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September 2016

SUPERFUND SEDIMENT SITES

EPA Considers Risk Management Principles but Could Clarify Certain Procedures

GAO-16-777

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GAO Highlights

Highlights of GAO-16-777, a report to congressional requesters

September 2016

SUPERFUND SEDIMENT SITES

EPA Considers Risk Management Principles but Could Clarify Certain Procedures

Why GAO Did This Study

Water bodies in the United States, including rivers and harbors, may contain contaminated sediments that pose risks to ecosystems and human health. The federal government's principal program to clean up hazardous waste sites, including sediment sites, is EPA's Superfund program, authorized by the Comprehensive Environmental Response, Compensation, and Liability Act. Recently estimated costs for cleanups of some large Superfund sediment sites have ranged from about $500 million to $1.4 billion, according to EPA documents.

GAO was asked to review issues related to Superfund sediment sites. This report examines: (1) the steps EPA has taken to help provide national consistency in its management of Superfund sediment sites; (2) the extent to which EPA followed these steps at selected Superfund sediment sites; and (3) the challenges EPA officials said the agency faced in managing cleanups of Superfund sediment sites. GAO reviewed applicable laws, regulations, and guidance; a nonprobability sample of 6 of the 71 Tier 1 and 12 of the 17 Tier 2 Superfund sediment sites; and EPA documents from selected sites. GAO interviewed EPA officials and representatives of two stakeholder groups.

What GAO Recommends

GAO recommends that EPA clarify CSTAG's operating procedures for the type of information and documentation, if any, that should be prepared for CSTAG in advance of update meetings. EPA agreed with GAO's recommendation.

View GAO-16-777. For more information, contact J. Alfredo Gómez at (202) 512-3841 or gomezj@gao.gov.

What GAO Found

The Environmental Protection Agency (EPA) established risk management principles and a consultation process to help provide national consistency in its management of Superfund sediment sites. Specifically, EPA developed a framework of 11 risk management principles, including assessing sources of contamination and ways to control them early in the cleanup process, that EPA regional officials are to consider in developing a site's cleanup remedy. EPA also established a consultation process between EPA's headquarters and 10 regions for two tiers of sediment sites—Tier 1 sites, those with proposed cleanups of 10,000 cubic yards or more of contaminated sediment, and Tier 2 sites, those that are large, complex, or controversial. As part of the consultation process for Tier 1 and Tier 2 sites, regional officials are to prepare and submit consideration memorandums to headquarters to document how the 11 principles are being considered as the region develops a cleanup remedy for each site. Additionally, for Tier 2 sites, EPA established the Contaminated Sediments Technical Advisory Group (CSTAG) to monitor the progress of and provide advice on sites throughout the cleanup process. The CSTAG is to review the consideration memorandums for Tier 2 sites and meets with regional staff as part of the consultation process. CSTAG is to provide recommendations to regions on their proposed cleanup approach, and regional staff are to provide written responses to CSTAG recommendations.

EPA generally followed its steps for providing national consistency in its management of Superfund sediment sites at selected Tier 1 and Tier 2 sites GAO reviewed. At 5 of 6 Tier 1 sites reviewed, regional officials submitted memorandums explaining how the 11 principles were considered in developing the cleanup remedy. At 11 of 12 Tier 2 sites reviewed, officials submitted consideration memorandums prior to their initial meeting with CSTAG; CSTAG provided recommendations on the regions' consideration of the principles, and regional officials provided written responses, as required in CSTAG's operating procedures. At 5 of the 12 Tier 2 sites where CSTAG held additional meetings, or update meetings, consideration memorandums were not submitted to CSTAG. CSTAG's operating procedures do not clearly describe what type of information and documentation, if any, should be prepared by regional officials and provided to CSTAG in advance of these meetings. Under federal standards for internal controls, agencies are to clearly document internal controls, such as in operating manuals. Clarifying, in the operating procedures, the types of information and documentation, if any, that should be prepared for CSTAG before update meetings would help to ensure that CSTAG was getting information needed to inform its reviews and meetings.

EPA faces two main challenges in managing cleanups of Superfund sediment sites—technical complexities and stakeholder involvement—according to EPA officials. Technical complexities include site characteristics and the use of sampling and modeling in developing a cleanup remedy. Challenges with stakeholder involvement include the differing opinions and competing interests of stakeholders—such as communities, local governments, and industry—and the varying levels of knowledge among these stakeholders about the Superfund process, which officials said can take EPA time and resources to address.

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Abbreviations

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CSTAG	Contaminated Sediments Technical Advisory Group
DDT	dichlorodiphenyltrichloroethane
EPA	Environmental Protection Agency
NPL	National Priorities List
NRRB	National Remedy Review Board
OSRTI	Office of Superfund Remediation and Technology Innovation
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyls
PRP	potentially responsible party
ROD	Record of Decision

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U.S. GOVERNMENT ACCOUNTABILITY OFFICE
441 G St. N.W.
Washington, DC 20548

September 22, 2016

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

The Honorable M. Michael Rounds
Chairman
Subcommittee on Superfund, Waste Management,
and Regulatory Oversight
Committee on Environment and Public Works
United States Senate

Water bodies in the United States—including rivers, lakes, and harbors—may contain contaminated sediments that pose risks to aquatic ecosystems and human health. Contaminated sediments are toxic or hazardous substances contained in soil, sand, organic matter, or other materials accumulating on the bottom of water bodies at levels that may adversely affect human health or the environment, or both. These substances include polychlorinated biphenyls, or PCBs,[1] and metals, such as mercury, many of which persist for years or decades because they do not degrade or degrade very slowly in aquatic environments. Contaminants in sediments can directly harm aquatic organisms or accumulate in their tissues, which can then be consumed by humans or wildlife. As a result, contaminated sediments are often a contributing factor to the over 4,800 fish consumption advisories issued nationwide as

[1]PCBs are a group of man-made organic chemicals consisting of carbon, hydrogen, and chlorine atoms. The number of chlorine atoms and their location in a PCB molecule determine many of its physical and chemical properties. PCBs have no known taste or smell, and range in consistency from an oil to a waxy solid. Health effects that have been associated with exposure to PCBs, according to the Environmental Protection Agency, include neurobehavioral and immunological effects. PCBs are probable human carcinogens, according to the Environmental Protection Agency.

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of 2011.[2] They can also impair the navigational and recreational uses of water bodies, according to the National Research Council.[3]

Congress enacted the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in 1980, to protect human health and the environment from the effects of hazardous substances, including those in contaminated media such as groundwater, soil, or sediments.[4] CERCLA established the Superfund program, which is the federal government's principal program to clean up the nation's most contaminated hazardous waste sites, and the Environmental Protection Agency (EPA) is the agency responsible for administering the program. Two basic types of cleanups, or response actions, are conducted under the Superfund program: (1) remedial actions and (2) removal actions. Remedial actions are generally long-term cleanups—consisting of one or more remedial action projects—that aim to permanently and significantly reduce contamination and that can take a considerable amount of time and money, depending on the nature of the contamination and other site-specific factors. Removal actions are usually short-term cleanups for sites that pose immediate threats to human health or the environment. The authority for selecting response actions has been delegated from the EPA Administrator to the agency's 10 Regional Administrators.[5] Cleanup of Superfund sites is generally performed by or paid for by potentially responsible parties (PRP)—which include current or former owners and operators of a site or the generator or transporters of the hazardous

[2]Environmental Protection Agency, *2011 National Listing of Fish Advisories,* EPA-820-F-13-058 (Washington, D.C.: December 2013). A fish consumption advisory is not a regulation, but rather a recommendation issued to help protect public health. These advisories may include recommendations to limit or avoid eating certain fish and wildlife species caught from specific water bodies or from water body types (e.g., all lakes) due to contaminants. An advisory may be issued for the general public, including recreational and subsistence fishers, or it may be issued specifically for sensitive populations, such as pregnant women, nursing mothers, and children.

[3]National Research Council, *A Risk-Management Strategy for PCB-Contaminated Sediments* (Washington, D.C.: 2001), and National Research Council, *Sediment Dredging at Superfund Megasites: Assessing the Effectiveness* (Washington, D.C.: 2007). As of May 2016, the National Research Council is known as the National Academies of Sciences, Engineering, and Medicine.

[4]Pub. L. No. 96-510 (1980) (codified as amended at 42 U.S.C. §§ 9601 – 9675).

[5]EPA Delegation of Authority, 14-2 Response, 1200 TN 531. Regional Administrators may further delegate this authority to the regional branch chief level or equivalent.

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substances—and overseen by EPA.[6] Where PRPs cannot be identified or are financially unable to perform the cleanup, CERCLA established the Hazardous Substance Superfund Trust Fund to pay for cleanups at sites. EPA's Office of Land and Emergency Management's Office of Superfund Remediation and Technology Innovation (OSRTI) administers the Superfund program and, among other things, provides regional offices with site-specific support to help ensure that remedy decision documents comply with statutory and regulatory requirements and consider EPA policy.

According to both EPA and the National Research Council documents, Superfund sediment sites can be complex to clean up for a number of reasons. For example, these sites may have several sources of contamination, one or more of which can be difficult to control. In addition, cleaning up contamination in an aquatic environment is often difficult from an engineering perspective compared to land-based sites due to the dynamic nature of water bodies. As a result, the cost to cleanup Superfund sites with contaminated sediments can be more expensive than cleanups in other media. According to EPA documents, estimated costs to clean up some of the more complex sediment sites range from about $500 million to $1.4 billion each. In recognition of these complexities, EPA designated two tiers of Superfund sediment sites for the purpose of monitoring progress in their cleanup, among other things. Tier 1 sites are those for which the proposed cleanup involves more than 10,000 cubic yards, or 5 acres, of contaminated sediments. Tier 2 sites are those that are large, complex, or controversial. As of July 2015, EPA had designated 71 sites in 9 regions as Tier 1 sites, and 17 sites in 7 regions as Tier 2 sites.[7] See appendix I for a list of these sites.

You asked us to review issues related to Superfund sediment sites. This report examines: (1) what steps EPA has taken to help provide national

[6]Under CERCLA, PRPs are responsible for conducting or paying for site cleanup of hazardous substances. EPA has the authority to enter into agreements with PRPs for them to conduct the cleanup at hazardous waste sites, to compel PRPs to clean up sites, or to recover reimbursements for trust fund expenditures from PRPs.

[7]Region 7 did not have either Tier 1 or Tier 2 sediment sites at the time of our review. Four Tier 2 sites are also designated as Tier 1 sites and are included in the count of 71 Tier 1 sites. According to EPA officials, once a cleanup decision has been finalized for a Tier 2 site, the site is added to the list of Tier 1 sites.

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consistency in its management of Superfund sediment sites; (2) the extent to which EPA followed these steps at selected Superfund sediment sites; and (3) EPA officials' views on any challenges faced by the agency in managing cleanups of Superfund sediment sites.

To examine the steps EPA has taken to help provide national consistency in its management of Superfund sediment sites, we reviewed relevant federal laws, regulations, and EPA's policies and guidance related to the management of sediment sites. We also interviewed agency officials from EPA headquarters offices, including from OSRTI and Office of General Counsel, and regional offices. Specifically, we interviewed officials from the nine EPA regions with Tier 1 or Tier 2 sites. We reviewed an EPA list of Tier 1 sites with signed remedy decision documents and an EPA website with a list of Tier 2 sites to identify these nine regions as well as the one region with no sites.[8] In addition, we interviewed headquarters and regional officials responsible for providing technical advice and consultations on Superfund sites, including Superfund sediment sites.

To examine the extent to which EPA followed these steps to help provide national consistency at selected Superfund sediment sites, we reviewed a nonprobability sample of Tier 1 and Tier 2 sites.[9] To select this sample, we generated a randomly ordered list of Tier 1 and Tier 2 sites for each region, where applicable,[10] and selected one Tier 1 site and two Tier 2 sites in each region for inclusion in our review, starting with the first site on the list. Going down the list, we excluded any sites for which the cleanup decision document was issued prior to 2006, for the purpose of focusing on more recent cleanup decisions, or if there was relevant, ongoing litigation at the site and EPA was listed as the defendant. This resulted in the selection of 6 Tier 1 sites from 6 regions and 12 Tier 2 sites from 7 regions.[11] See appendix II for a list of the selected Tier 1 and

[8]Some of the Tier 2 sites on EPA's list are being addressed through removal actions or other cleanup authorities.

[9]Because this was a nonprobability sample, it is not generalizeable to all Tier 1 and Tier 2 sediment sites but provides illustrative examples of such sites.

[10]EPA Region 7 did not have any Superfund sediment sites designated as Tier 1, and Regions 6, 7, and 8 did not have any Superfund sediment sites designated as Tier 2 at the time of our review.

[11]Regions 3 and 4 each had only one Tier 2 site at the time of our review.

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Tier 2 sediment sites included in our review. We reviewed documents from the selected sites, including memorandums describing how the sites were addressing aspects of their sediment cleanup. In reviewing these memorandums, which are referred to as "consideration memorandums" by EPA, we did not evaluate the technical information included or the quality of these memorandums. We also interviewed officials from the 18 selected sites to identify examples of how the regions have implemented EPA's process for Superfund sediment sites. In reviewing these selected sites, we focused on EPA's process for managing Superfund sediment sites, and did not assess a region's selection of a proposed or final cleanup remedy at the selected sites or technical aspects of the cleanup.

To examine any challenges faced by EPA in managing cleanups of Superfund sediment sites, we interviewed officials from EPA headquarters and the nine regional offices with Tier 1 or Tier 2 sites, as well as regional officials responsible for the 6 selected Tier 1 sites and 12 selected Tier 2 sites. We also interviewed representatives from two groups representing PRPs—the Sediment Management Work Group and the Alliance to Restore Our Waterways—to gather their perspectives on the challenges faced by EPA in managing cleanups of Superfund sediment sites.[12] We selected these groups because they offered a national perspective on these issues.[13] Through an analysis of these officials' and representatives' views, we qualitatively grouped challenges into two themes that were most frequently mentioned about the types of challenges faced by EPA in managing cleanups of Superfund sediment sites. In addition, in the design phase of our review we conducted a site visit to two Tier 2 sites in EPA's Region 2 to increase our understanding

[12]The Sediment Management Work Group is an ad-hoc group with representatives from industry and government parties with responsibility for management of contaminated sediment that promotes the use of sound science and risk-based evaluation of contaminated sediment management options, according to a Group document. The Alliance to Restore Our Waterways is a coalition of 10 companies that promotes more expeditious and cost-effective cleanups of sediment sites through sound national contaminated sediment remediation policy, according to an Alliance document and representatives.

[13]We also attempted to obtain a national perspective from environmental groups and contacted representatives from the National Resources Defense Council and the Sierra Club; however, representatives of these groups told us that they either did not have ongoing work in this area or did not conduct work at a national level.

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of Superfund sediment sites,[14] and information on these sites, including challenges faced by EPA in managing these sites, is summarized in appendix III.[15]

We conducted this performance audit from August 2015 to September 2016, in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

This section discusses: contaminated sediments; EPA's process for remedial cleanup of Superfund sites, including sediment sites; and consultation on remedy selection.

Contaminated Sediments

Water bodies in which contaminated sediments can be found include wetlands, coastal tidal flats, ocean basins, lakes, rivers, and streams. In some cases, contamination is relatively contained in small, localized areas; in other cases, contaminated sediment exists throughout a watershed or covers miles of river or harbor bottoms and may have multiple sources of contamination. According to an EPA document, potential sources of contaminants in sediment include:

- discharges into a body of water from industrial facilities, wastewater treatment plants, or combined sewer overflows;[16]

[14]We selected EPA Region 2 for such a site visit because it is the region with the most Tier 1 and Tier 2 sediment sites. We selected the two sites in order to visit and obtain perspectives on a site with a signed Record of Decision—the Gowanus Canal Superfund site in Brooklyn, New York—and on a site still in the process of selecting a remedial decision—the Lower Passaic River site around Newark, New Jersey. At the time of our site visit, Region 2 had developed a proposed remedy for the lower 8-mile section of the Lower Passaic River; in March 2016 the Region issued a Record of Decision for this area.

[15]This information is reported separately because the two sites were not part of our nonprobability sample of Tier 1 and Tier 2 Superfund sediment sites.

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- chemical spills into a body of water; and
- surface runoff or erosion of soil from floodplains and other contaminated sources on land, such as waste dumps, chemical storage facilities, and agricultural or urban areas.

Contaminants can persist for years or decades either because a contaminant does not degrade or degrades very slowly in aquatic environments. Metals, for example, do not degrade, and PCBs and some polycyclic aromatic hydrocarbons, or PAHs,[17] degrade very slowly. Contaminated sediment can be buried by successive layers of sediments; however, if sediments are disturbed, contaminants can be resuspended, and can settle back onto the sediment surface.

Exposure to contaminants in sediment can occur by several routes, including direct contact with the sediment and indirect contact through the consumption of organisms that have accumulated contaminants from sediments, according to the National Research Council and EPA documents. Some bottom-dwelling organisms ingest contaminated sediment, and in shallow water environments, humans may also come into direct contact with contaminated sediment. In addition, some activities, such as fishing and clam digging, may bring individuals into contact with contaminated sediment through skin exposures to sediment on nets or other equipment. Some contaminants, such as most metals, are hazardous because they are directly toxic to a species.

Other contaminants—such as PCBs, dioxins, and pesticides—pose concerns because they accumulate in the environment—a process referred to as "bioaccumulation"—and increase in concentration as they are passed up the food chain and accumulate in various species—a process referred to as "biomagnification." As a result, concentrations of

[16]Combined sewer systems collect rainwater runoff, domestic sewage, and industrial wastewater in the same pipe. During periods of heavy rainfall or snowmelt the wastewater volume in a combined sewer system can exceed the capacity of the sewer system or treatment plant, resulting in an overflow and discharge of untreated wastewater directly to nearby streams, rivers, or other water bodies. According to EPA, these overflows are a major pollution concern for the approximately 860 municipalities that have combined sewer systems.

[17]PAHs are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture containing two or more of these compounds, such as soot. EPA has determined that some PAHs are probable human carcinogens.

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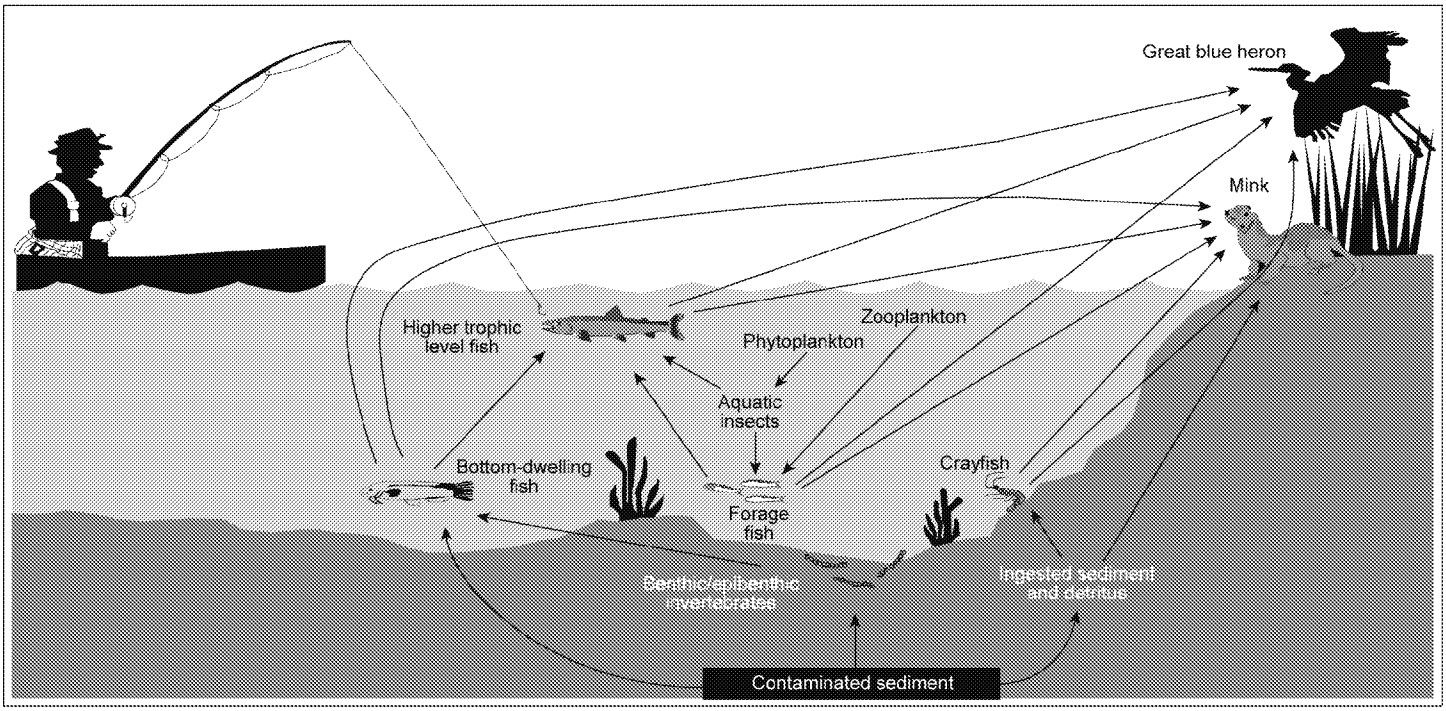
these types of contaminants in fish and shellfish may endanger the humans and wildlife that eat them. When humans consume these, a possibility exists that the contaminants will bioaccumulate in their tissues and, at a certain level, exert toxic effects. According to EPA, PCBs and some PAHs, for example, are probable human carcinogens, while heavy metals—mercury, cadmium, and lead—frequently found in contaminated sediment can cause damage to the central nervous system and kidneys. Women of childbearing age, young children, people who derive much of their diet from fish and shellfish, and people with impaired immune systems may especially be at risk to these types of exposures, according to EPA. Figure 1 illustrates potential sources of exposure to humans and the environment in an example of a Superfund sediment site.

Figure 1: Potential Sources of Exposure to Humans and the Environment at a Superfund Sediment Site



Source: EPA. | GAO-16-777

EPA's Process for Remedial Cleanup of Superfund Sites

EPA's process for cleaning up Superfund sites involves the selection of a cleanup remedy to protect human health and the environment from hazardous substances. The national goal of the remedy selection process is to select remedies that are protective of human health and the environment, maintain protection over time, and minimize untreated

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waste. Management of Superfund sites, including sediment sites, has historically been the responsibility of the EPA region in which a site was located. EPA has 10 regional offices, and each one is responsible for the execution of EPA programs within several states and, in some regions, territories. Figure 2 illustrates EPA's 10 regions.

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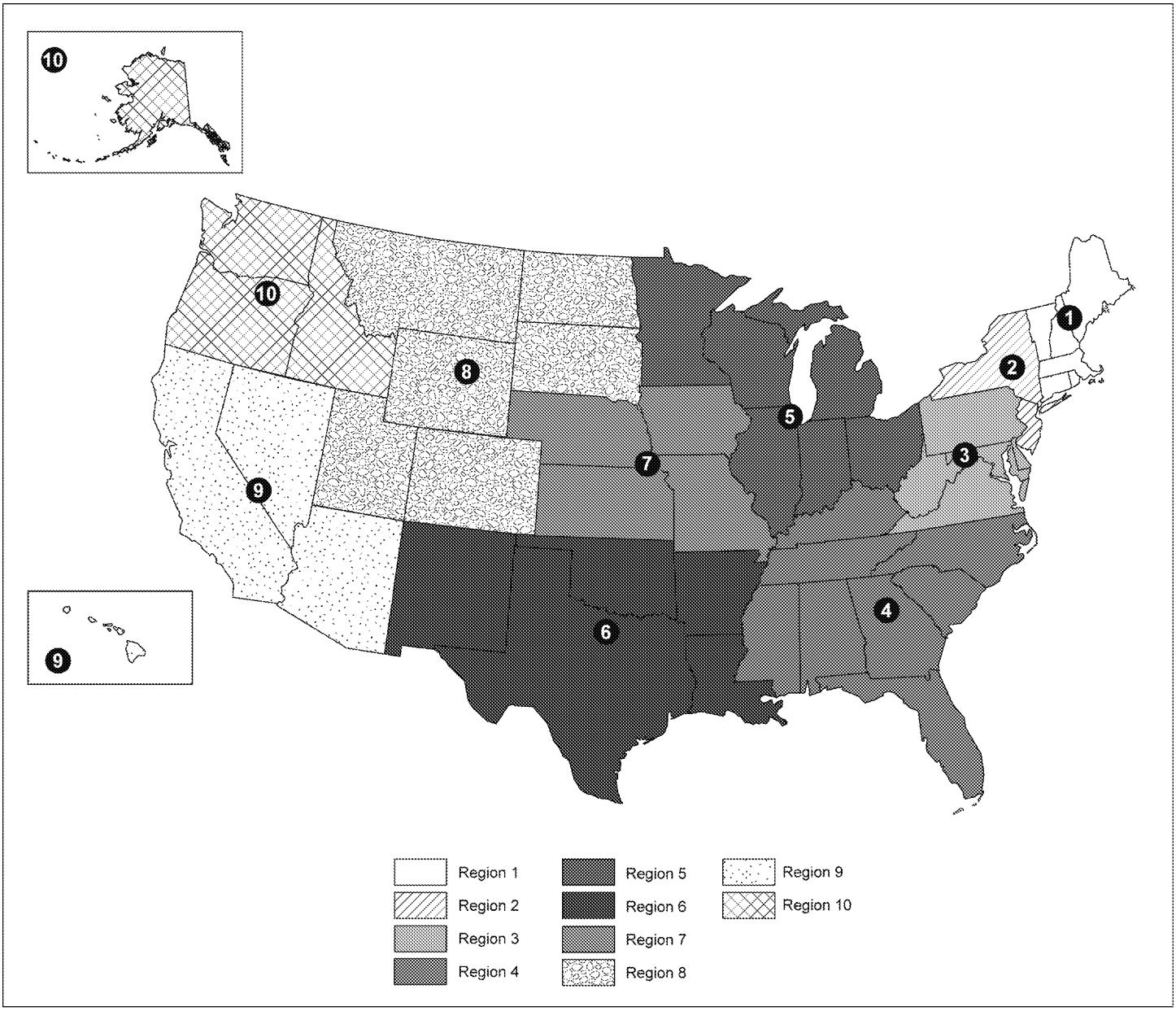
Figure 2: EPA's 10 Regions



Sources: GAO analysis of EPA information; Map Resources (map). | GAO-16-777

Note: Region 2 includes Puerto Rico and the U.S. Virgin Islands. Region 9 includes Guam, American Samoa, the Northern Mariana Islands, and the Trust Territories.

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The Superfund remedial cleanup process begins with site discovery or notification to EPA of possible releases of hazardous substances. Sites can be discovered by various parties, including citizens, state agencies, and EPA regional offices. The pre-remedial process involves the preliminary identification of site hazards and evaluation of the need for action under the Superfund remedial program. Information about the site collected in the pre-remedial process helps EPA to evaluate the risks posed by the site using its Hazard Ranking System.[18] Sites that score at or above an established level qualify for cleanup under the Superfund program and are proposed for listing on the National Priorities List (NPL), a list of the most serious sites identified for long-term cleanup.

EPA may enter into agreements with PRPs for those parties to conduct cleanups, compel site cleanups by PRPs, or conduct cleanups itself and seek reimbursement for its costs from those parties. EPA's enforcement of environmental cleanup at Superfund sites begins with the identification of PRPs, usually early in the cleanup process; continues throughout site cleanup; and often does not conclude until after the site is declared construction complete. EPA may begin a cleanup process before it has identified PRPs. However, according to EPA, once it identifies PRPs, EPA typically seeks to reach a settlement regarding the cleanup responsibilities and/or their payment for cleanup costs that EPA incurs. These negotiations generally may take place at any time throughout the site cleanup process. EPA identifies PRPs by, among other actions: reviewing documentation related to the site; conducting interviews with government officials or other knowledgeable parties; performing historical research on the site; and conducting sampling at the site to determine the nature and extent of contamination. In addition to identifying PRPs, EPA attempts to obtain information on the type and amount of hazardous

[18]The Hazard Ranking System is a numerically based screening system that uses available information—such as from initial, limited investigations—to assess the relative potential for releases of hazardous substances at sites that pose a threat to human health or the environment.

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substances shipped to a site by each party and any financial constraints faced by the identified parties, according to EPA.[19]

EPA or a PRP are to begin 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 actions, and
2. a feasibility study to evaluate various options to address the problems identified through the remedial investigation.

In the case of sediment sites, sources of and potential exposures to contaminated sediments are typically identified during the remedial investigation phase through the process of site characterization. According to an EPA document, environmental sampling is performed in conducting site characterization to determine the nature and extent of contamination, to develop the information necessary to assess risks to human health and the environment, and to assess the feasibility of cleanup alternatives. Models—including mathematical ones and others—are also used at many sediment sites to complement environmental sampling and address gaps that exist in observed data. According to EPA, such models can help fill gaps in knowledge and allow an investigation of relationships and processes at sites that are not fully understood. For example, a model could be used to predict the fate and transport of contaminants over long periods of time or during episodic, high-energy events, such as tropical storms or low-frequency flooding events.

Based on the results of the feasibility study, EPA develops a proposed plan for cleaning up the site and presents this plan to the public through a

[19]Courts have held responsible party liability under CERCLA to be strict, joint and several, and retroactive. Under strict liability, a party may be liable for cleanup even though its actions were not considered negligent. Because liability is joint and several, when the harm done is indivisible, one party can be held responsible for the full cost of the remedy even though other parties may have contributed to the release of hazardous substances at the site. Retroactive liability means that liability applies to actions that took place before CERCLA was enacted.

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comment period.[20] The proposed plan briefly summarizes the alternatives studied in the detailed analysis of the feasibility study phase, highlighting the key factors that led to identifying the preferred cleanup. The three major cleanup approaches for contaminated sediment are, according to EPA, monitored natural recovery, in-situ capping, and removal through dredging or excavation. Monitored natural recovery uses ongoing, naturally occurring processes to contain, destroy, or reduce the toxicity of contaminants in sediment. In-situ capping involves the placement of a subaqueous covering, or cap, of clean material over contaminated sediment that remains in place.[21] In dredging, contaminated sediment is removed from a water body while it is submerged, and in excavation, such sediment is removed after water has been diverted or drained. Both methods typically require transporting the sediment to a location for treatment or disposal. See appendix IV for information on these three approaches, including advantages and limitations of each, and the planned use of these approaches at selected Tier 1 and Tier 2 sediment sites included in our review.

Following the receipt of public comments and any final comments from supporting agencies, which may include states or other federal agencies, EPA selects a remedy and documents it in a Record of Decision (ROD).[22] The ROD identifies the selected remedy for addressing the site's contamination and a cost estimate for implementing the remedy, among other things. The method of implementation for the selected remedy is then developed during remedial design and implemented during the remedial action phase, when actual cleanup of the site occurs.

When all construction of the cleanup remedy at a site is finished, all immediate threats have been addressed, and all long-term threats are under control, EPA generally considers the site to be "construction

[20]The proposed plan is made available for public comment in the site's administrative record file. In addition, EPA must provide the opportunity for a public meeting to be held to discuss the plan.

[21]Caps are generally constructed of granular material, such as clean sediment, sand, or gravel.

[22]If changes to a ROD are necessary, EPA will develop a proposed ROD amendment, issue a public notice to notify the community, and hold a public meeting to discuss proposed changes and to take comments.

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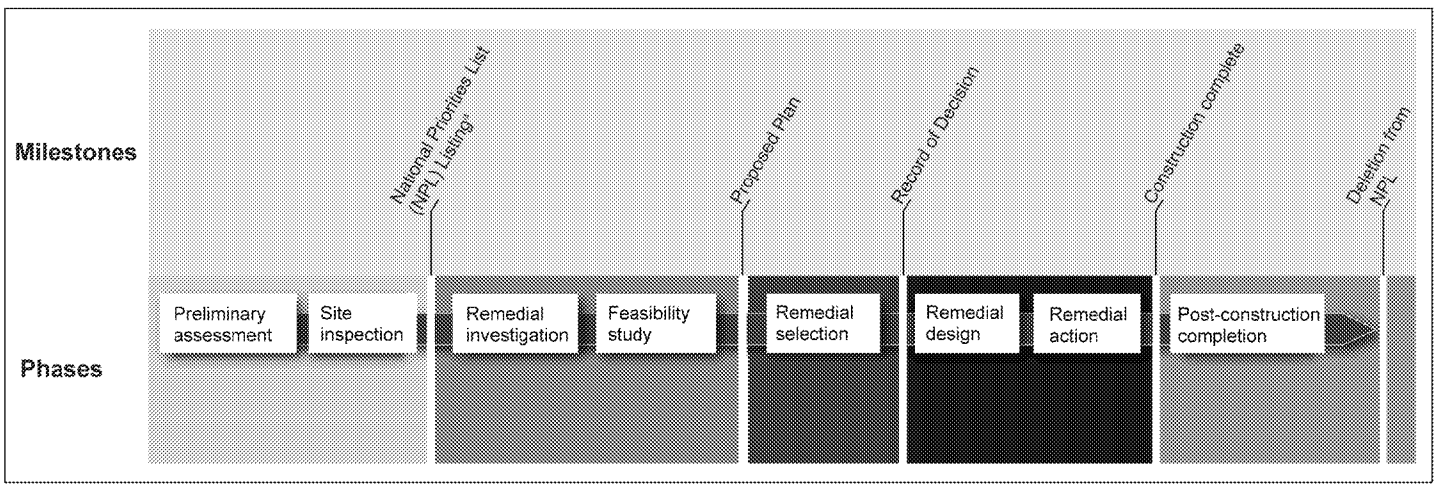
complete." Sites where additional work is required after construction is completed then enter into the post-construction phase, which includes actions such as operation and maintenance and conducting 5-year reviews.[23] When EPA in consultation with the state determines that no further site response is appropriate, then EPA may delete the site from the NPL. Figure 3 illustrates the typical Superfund process for cleaning up a site.

Figure 3: Phases and Milestones in the Superfund Cleanup Process



Source: GAO analysis of EPA information | GAO-16-777

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

[a]The NPL is a list of the most serious sites identified by the Environmental Protection Agency (EPA) for long-term cleanup.

Consultation on Remedy Selection

As previously noted, the authority for selecting response actions for Superfund sites, including sediment sites, has been delegated from the EPA Administrator to the agency's 10 Regional Administrators, who may further delegate this authority to regional Superfund branch chiefs. EPA has developed consultation procedures between headquarters and the regional offices to help ensure that national remedy selection policies and

[23]CERCLA regulations require reviews every 5 years of the integrity of the remedy at a site where hazardous substances remain on-site above levels that permit unrestricted use and unlimited exposure, even after deletion from the NPL.

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procedures are being implemented in a reasonable and appropriately consistent matter. Under these procedures, drafts of proposed plans are reviewed by staff in OSRTI, and regional staff are encouraged to use headquarters staff as a resource that can provide assistance in working through issues as early as possible during the development of site cleanup strategies and drafts of proposed plans.[24] Furthermore, OSRTI has identified specific categories of sites where the regions are directed to consult with headquarters-chaired entities on these sites prior to a proposed cleanup action. For example, the National Remedy Review Board (NRRB)—a peer review group that understands both the EPA regional and headquarters perspectives in the remedy selection process—reviews proposed cleanup actions that meet a certain cost-threshold to help evaluate whether they are consistent with current law, regulations, and EPA policy and guidance.[25] The board is chaired by OSRTI, and members include senior managers and technical experts from each of the 10 EPA regions, and senior technical and policy experts from other EPA offices. NRRB is to review proposed Superfund remedy decisions at both NPL and non-NPL sites where the remedial action will cost more than $25 million.[26, 27] Cleanup strategies are to be reviewed by

[24]See EPA, *Transmittal of "Consolidated Guide to Consultation Procedures for Superfund Response Decisions" and FY97 Focus Areas for OERR Regional Coordination Support,* (Washington, D.C.: 1997). In some cases, OSRTI may also request the review of drafts of remedy decision documents such as RODs and ROD amendments, according to EPA's consultation procedures.

[25]According to EPA's website, EPA created the NRRB as part of a comprehensive package of reforms designed to make the Superfund program faster, fairer, and more efficient. The NRRB was established by an EPA memorandum in November 1995, to begin its review of sites in January 1996. See EPA, *Formation of National Remedy Superfund Review Board* (Washington, D.C.: November 1995).

[26]NRRB also reviews non-time critical removal actions, at sites other than a federal facility, that are estimated to cost more than $25 million, and NPL and non-NPL sites where there have been significant changes after the release of the proposed plan.

[27]In October 2014, NRRB initiated a pilot changing the dollar threshold for requiring a review of a Superfund cleanup action. The pilot will increase the cost threshold for review by the board to $50 million, and implement a regional remedy review process to evaluate response actions costing from $25 million to $50 million. The regional remedy review process will include senior regional Superfund staff and will be independent of the site team. According to EPA, the increase to $50 million reflects inflation since 1995 and keeps NRRB reviewing its target of 10 percent of the non-federal facility Superfund cleanup actions each year. See EPA, *National Remedy Review Board Criteria Revision and Operational Changes*, OSWER Directive 9285.6-21 (Washington, D.C.: September 2014).

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NRRB after the remedial investigation and feasibility study phases have been completed, and before the region releases the proposed plan for comment. Following its review, NRRB is to issue written recommendations to the region, and the region is to respond in writing to the board to describe how it has or will address the recommendations. Both NRRB's recommendations and regional response are made available to the public on EPA's website.

EPA Established Risk Management Principles and a Consultation Process to Help Provide National Consistency in Its Management of Superfund Sediment Sites

To help EPA regions make nationally consistent and scientifically sound decisions at Superfund sediment sites, EPA issued a policy establishing a framework of risk management principles to be considered in managing these sites. For the two tiers of sediment sites, the agency also established a consultation process in which headquarters' officials and sediment experts are to help ensure that regional officials appropriately consider the principles before making site-specific risk management decisions.

EPA Issued a Policy Establishing a Framework of Risk Management Principles to Help Guide Sediment Site Cleanup Decisions

EPA issued a policy establishing a framework of 11 risk management principles to be considered at hazardous waste sites with contaminated sediment to help EPA regions make nationally consistent and scientifically sound decisions. The principles, developed in 2002, apply to all contaminants at sediment sites under CERCLA, including federal facilities, and are to be considered as regional officials plan and conduct site investigations, involve site stakeholders, and select and implement cleanup remedies.[28] EPA identified these principles in response to a National Research Council report that recommended EPA use a risk-

[28]EPA's policy also applies to all contaminants at sediment sites addressed under the Resource Conservation and Recovery Act. See EPA, *Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites,* (Washington, D.C.: 2002).

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based framework for managing contaminated sediments.[29] EPA's policy that establishes the principles states that the implementation of the principles should be tailored to the size and complexity of the site, the magnitude of site risks, and the types of cleanup actions under consideration. (See text box, below, for a list of EPA's 11 principles for managing contaminated sediment risks and app. V for additional information on the principles).

EPA's Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites

1. Control sources early
2. Involve the community early and often
3. Coordinate with states, local governments, tribes, and natural resource trustees[a]
4. Develop and refine a conceptual site model that considers sediment stability
5. Use an iterative approach in a risk-based framework
6. Carefully evaluate the assumptions and uncertainties associated with site characterization data and site models
7. Select site-specific, project-specific, and sediment-specific risk management approaches that will achieve risk-based goals
8. Ensure that sediment cleanup levels are clearly tied to risk management goals
9. Maximize the effectiveness of institutional controls and recognize their limitations[b]
10. Design remedies to minimize short-term risks while achieving long-term protection
11. Monitor during and after sediment remediation to assess and document remedy effectiveness

Source: EPA. | GAO-16-777

[a]Under CERCLA, a party responsible for the release of a hazardous substance is liable for injuries to natural resources resulting from the release. The regulations implementing the act designate certain federal agencies, state governments, and tribal authorities as natural resource trustees and authorize them to make claims against the parties responsible for the injuries. The federal trustees include the Department of the Interior, the Department of Commerce's National Oceanic and Atmospheric Administration, and the Department of Agriculture's Forest Service.

[b]Institutional controls are legal or administrative restrictions on land or water used to protect against exposure to the residual contamination.

Following the establishment of the 11 principles, EPA developed more specific guidance on the process that EPA project managers should

[29]See National Research Council, *A Risk-Management Strategy for PCB-Contaminated Sediments* (Washington, D.C.: 2001). According to an EPA document, although the National Research Council report focused primarily on the assessment and remediation of PCB-contaminated sediments, much of the information in the report is applicable to other contaminants found in sediment.

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follow in making remedy decisions at contaminated sediment sites.[30] The guidance is primarily intended for those project managers considering remedial response actions or non-time critical removal actions at Superfund sites, and can be used to evaluate the cleanup of contaminated sediment in a wide variety of aquatic ecosystems, such as rivers, wetlands, and coastal ocean areas. The guidance provides information on potential cleanup approaches for sediment management, including monitored natural recovery, in-situ capping, and dredging and excavation. According to EPA officials, the guidance is intentionally broad and flexible, as it recognizes that due to site-specific characteristics, regions may take different approaches to remediation for individual sites. Officials we interviewed from eight of the nine regional offices told us that the guidance is beneficial to approaching Superfund sediment sites from a consistent perspective, but that site-specific characteristics generally shape how they will approach sites.

EPA Also Developed a Consultation Process to Help Ensure National Consistency in Managing Two Tiers of Superfund Sediment Sites

To help ensure that the regions appropriately consider the 11 principles before making site-specific risk management decisions, EPA established a two-tiered consultation process for Superfund sediment sites.[31] This process applies to Tier 1 sites, those sites where the cleanup action will address more than 10,000 cubic yards, or 5 acres, of contaminated sediment, and Tier 2 sites, Superfund sites with contaminated sediment that are large, complex, or controversial. For Tier 1 sites, sediment experts in EPA headquarters are to provide consultation on the sediment cleanup when the region undertakes developing a proposed cleanup plan. Specifically, when regional officials submit a draft of a proposed

[30]See EPA, *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites,* (Washington, D.C.: 2005). In addition, EPA has also developed a variety of guidance and fact sheets related to specific technical issues at sediment sites, such as monitored natural recovery and fish tissues sampling. See EPA, *Superfund Contaminated Sediments: Guidance Documents, Fact Sheets, and Policies*, accessed May 6, 2016, https://www.epa.gov/superfund/superfund-contaminated-sediments-guidance-documents-fact-sheets-and-policies.

[31]EPA's consultation process for Superfund sediment sites applies to all proposed or listed NPL sites, all non-time critical removal actions, and all "NPL-equivalent" sites with an EPA-enforceable agreement. It does not apply to time-critical or emergency removal actions, or to sites with only sediment-like materials in wastewater lagoons, tanks, storage or containment facilities, or drainage ditches. See EPA, *Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites*, (Washington, D.C.: 2002).

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plan to headquarters as part of the standard Superfund decision document review process, they are to also provide a memorandum that describes how the region considered the 11 risk management principles in conducting the site investigation and evaluating cleanup alternatives and remedy selection for the site (i.e., a consideration memorandum). According to headquarters officials, the memorandum and the proposed cleanup plan are then reviewed by headquarters' sediment experts to assess whether the principles were considered in the remedy decision and any feedback is provided to the region.[32] According to EPA's policy, this consultation is intended to promote nationally consistent EPA approaches to evaluating, selecting, and implementing protective, scientifically sound, and cost-effective sediment site remedies. For those Tier 1 sites that meet the cost-threshold for review by NRRB, OSRTI is to review the region's consideration memorandum for the site and provide comments to the NRRB, according to a directive issued to supplement EPA's consultative process.[33] The directive also states that as part of the region's response to NRRB recommendations, the region should include a revised Tier 1 consideration memorandum addressing the NRRB comments. If the NRRB chair and OSTRI sediment team leader believe that their comments were not appropriately addressed, regional officials may be asked to make additional revisions to the consideration memorandum.

For Tier 2 sites, EPA established a technical advisory group—the Contaminated Sediments Technical Advisory Group (CSTAG)—to monitor the progress of and provide advice on these sites. Membership includes one representative from each of EPA's 10 regions, two representatives each from EPA's Office of Research and Development and OSRTI, and two representatives from the U.S. Army Corps of

[32]To assist EPA headquarters officials in their review of consideration memorandums and regional officials in determining what information to include in the memorandums, EPA developed guidelines for headquarters officials to use in evaluating how well regional officials have documented their consideration of the 11 principles. According to these guidelines, the Tier 1 consideration memorandum should be no longer than 10 pages, but the length could vary with the complexity of the site.

[33]EPA, *OSRTI Sediment Team and NRRB Coordination at Large Sediment Sites*, OSWER Directive 9285.6-11 (Washington, D.C.: Mar. 5, 2004).

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Engineers' Engineer Research and Development Center.[34] CSTAG is chaired by an official from OSRTI. CSTAG's formal consultations on Tier 2 sites begin early in the remedial investigation and feasibility study phase to provide technical advice on the cleanup. EPA established operating procedures for CSTAG that describe how the group is to review sites, among other things.[35] According to these procedures, CSTAG generally holds the following types of meetings with Tier 2 sites as part of this consultative process:

- **Initial Meetings:** CSTAG's consultation on a site begins with an initial meeting, in which regional officials present site data and describe how the region will address the 11 principles. At least 2 weeks before meeting, regional officials are to submit a consideration memorandum to the CSTAG stating how each of the principles is to be addressed, according to CSTAG's operating procedures. CSTAG's initial meeting also involves a site visit and an opportunity for key stakeholder groups, such as the lead state agency or lead PRP, to present how they think EPA is or should be addressing the 11 principles at the site. Following its site review and meeting, the CSTAG develops and submits, within 6 weeks, written recommendations to the region on ways to better address the principles, and regional officials are to prepare and submit a written response addressing each of CSTAG's recommendations within 2 months of receiving them. Both CSTAG's recommendations and the regional office's response are made available to the public on EPA's website.
- **Update Meetings:** CSTAG may hold additional update meetings to monitor the progress of the site in addressing the principles. According to CSTAG's operating procedures, these subsequent

[34]As the research organization of the U.S. Army Corps of Engineers, the Engineer Research and Development Center conducts research and development in support of the soldier, military installations, and civil works projects, as well as for other federal agencies, and state and municipal authorities, and with U.S. industry through innovative work agreements. The center's primary technical areas include the environment, focusing on issues such as remediation and restoration, and water resources, focusing on issues such as navigation and flood control. According to the CSTAG chair, officials from the center are included on the CSTAG because they provide expert advice on sediment sites that is not available within EPA.

[35]See EPA, *Operating Procedures for EPA's Contaminated Sediments Technical Advisory Group (CSTAG)*, accessed July 5, 2016, https://www.epa.gov/superfund/contaminated-sediments-technical-advisory-group-operating-procedures.

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meetings could take place before the remedial investigation and feasibility study has been finalized, before the proposed plan was sent out for public review, and before the first 5-year review or site completion report has been completed. The operating procedures do not state what, if any, documentation should be submitted to CSTAG prior to the meetings held in connection with any update meetings.

- **Proposed Remedy Review Meetings:** According to EPA documents, most of the Tier 2 sites being reviewed by the CSTAG will also meet the cost-threshold for review by NRRB. In these cases, joint remedy review meetings are held by NRRB and CSTAG. Specifically, a subset of CSTAG members participate in the NRRB meeting for the purpose of evaluating the sediment portion of the proposed remedy, and regional officials are to submit a revised or updated consideration memorandum as part of the site information packet to the groups in advance of the meeting. The chairs of NRRB and CSTAG jointly sign the recommendations memorandum to the region, and regional officials are to submit a written response to these recommendations.

Officials from CSTAG told us that the group's recommendations to regions about specific Tier 2 sites are generally considered to be advisory in nature, and therefore, there is no requirement that they be addressed in a specific manner. However, the headquarters-based CSTAG chair told us that in his role as a headquarters sediment expert, he reviews drafts of remedy decision documents from Tier 2 sites to ensure that CSTAG's comments have been addressed in the remedial decision.[36] Specifically, if a CSTAG recommendation was not sufficiently addressed, headquarters and the region will discuss it, and any areas where they cannot come to a mutual agreement for a solution are elevated through regional and headquarters management chains for discussion.

[36]The headquarters-based chair of the NRRB also told us that the board serves as a form of peer review and that its recommendations are advisory in nature. Like the CSTAG chair, the NRRB chair said that she reviews drafts of remedy decision documents from sites reviewed by NRRB to ensure that NRRB's recommendations have been addressed by the region as it described in the regions written response to NRRB's recommendations.

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EPA Generally Followed Its Steps for National Consistency at Selected Sites, but Documentation Requirements for Certain Meetings Are Not Clear

EPA generally followed its steps for providing national consistency in its management of Superfund sediment sites at the 6 Tier 1 sites and 12 Tier 2 sites we reviewed by submitting consideration memorandums explaining how the 11 risk management principles for contaminated sediment were considered in developing a cleanup remedy. However, regional offices did not submit consideration memorandums for the 5 Tier 2 sites that had update meetings, and the procedures are not clear as to what should be documented for such meetings. Regional officials consulted with headquarters on the development and selection of cleanup decisions at all of the selected sites we reviewed.

Regional Offices Submitted Consideration Memorandums for Most of the Selected Sites, but Requirements for Submitting These Memorandums for Update Meetings Are Unclear

Based on our review of 6 Tier 1 sites and 12 Tier 2 sites, EPA generally followed its steps for providing national consistency in its management of Superfund sediment sites at the regions by submitting consideration memorandums to headquarters for most of the Tier 1 and Tier 2 sites and responding to recommendations from CSTAG for Tier 2 sites.[37] However, requirements for submitting documentation for update meetings of Tier 2 sites are not clearly described in EPA's operating procedures for these reviews.

Most Selected Tier 1 Sites Submitted Consideration Memorandums for Headquarters' Review

At 5 of the 6 Tier 1 sites we reviewed, regional officials submitted consideration memorandums to headquarters explaining how they considered the 11 risk management principles for managing contaminated sediment in developing a cleanup remedy. According to EPA's policy, a consideration memorandum should be submitted by regional offices to headquarters at the point in the process when a draft proposed plan is provided to headquarters for review. The five consideration memorandums from the selected Tier 1 sites differed in the level of detail they contained, but all five discussed the 11 principles. For example, in discussing the fifth principle—use an iterative approach in a

[37] In reviewing consideration memorandums, we did not evaluate the technical information included or the quality of these memorandums. Specifically, we focused on EPA's process for managing Superfund sediment sites and did not assess a region's selection of a proposed or final cleanup remedy at selected sites or technical aspects of the cleanup.

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risk-based framework—two Regions provided the following discussions of their implementation of this principle at their respective sites:

- Region 3 described in its consideration memorandum for the Atlantic Wood Industries Inc. site in Portsmouth, Virginia, that an iterative approach was used to develop sampling plan designs and during data collection for its remedial investigation of the Elizabeth River. During the process of sampling sediment from the river, after a small number of samples were completed at pre-set locations, the region stated in its memorandum that it made decisions at the end of the day as to where to locate its sampling the following day to maximize the utility of the samples.
- Region 5 described in its consideration memorandum for the Outboard Marine Corporation site in Waukegan, Illinois, that it addressed the principle by identifying that additional cleanup work was needed to achieve a sufficient level of protectiveness that was not met in a previous cleanup at the site. The region stated in its memorandum that it was evaluating potential cleanup options under consideration to meet the desired level of protectiveness, including taking no action, capping, or environmental dredging of residual PCBs in the sediment.

In the one case where a consideration memorandum was not submitted, a headquarters official responsible for reviewing Tier 1 consideration memorandums stated that not submitting this memorandum was an oversight by both the region and headquarters.

Selected Tier 2 Sites Generally Submitted Consideration Memorandums for Initial and Proposed Plan Reviews, but Documentation Requirements for Update Meetings Are Unclear

Regions responsible for the 12 Tier 2 sites we reviewed generally submitted consideration memorandums to CSTAG for initial and proposed remedy review meetings, and provided written responses to recommendations from these meetings.[38] All 12 Tier 2 sites included in our sample had at least an initial meeting with CSTAG. At 11 of 12 Tier 2 sites we reviewed, regional officials documented their consideration of the 11 principles in a consideration memorandum for their sites' initial meeting with CSTAG, as required by CSTAG's operating procedures. One site did not submit a consideration memorandum for an initial review.

[38]In reviewing CSTAG's recommendations to the regions' responses, we did not assess each of the recommendations and the extent to which they were or were not incorporated into the remedy, due to the technical nature of the material.

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These memorandums varied in terms of their length—ranging from 5 to 50 pages—and level of detail, but all 11 memorandums we reviewed discussed all 11 principles. For example, Region 2 described in its consideration memorandum for the initial meeting of Newtown Creek, in Brooklyn and Queens, New York, that it addressed the eighth principle—ensure that sediment cleanup levels are clearly tied to risk management goals—and that it had not yet established sediment cleanup levels and risk management goals because it was still early in the project lifecycle. However, the memorandum noted that risk assessment would be used to develop sediment cleanup levels that are protective of human health and the environment and meet or exceed the required levels of risk reduction. In the one case where EPA did not provide a consideration memorandum, headquarters officials told us that a consideration memorandum was likely prepared by the region for this site, but that it was not identified in the region's or headquarters' files because the regional official who led the site at the time of the memorandum's preparation was no longer with the agency.[39] Following CSTAG's review of these 12 sites, CSTAG provided each of the regions with written recommendations. These recommendations included conducting additional sampling to further understand the nature or source of the contamination and increasing coordination with stakeholder groups on habitat restoration plans for the site. In all 12 cases, the regions provided a written response to CSTAG's recommendations, explaining how they planned to address the comments or providing a rationale for their approach to a specific area of recommendation, as is required by CSTAG's operating procedures.

For 6 of the 12 Tier 2 sites we reviewed, either CSTAG and NRRB jointly led review meetings of regions' proposed remedies, or CSTAG solely led a meeting if the sites did not meet the cost-threshold for a NRRB review.[40] For these meetings, the regions submitted consideration memorandums for each of the six sites to CSTAG and NRRB, or solely to CSTAG, documenting how the 11 principles were considered at the site and in the development of the proposed remedy, as is required by EPA

[39]Specifically, the site that was not able to identify an initial consideration memorandum was Region 9's Montrose/Palos Verdes Shelf site.

[40]The other six sites included in our selection had not yet developed proposed remedies at the time of our review, and therefore have not yet had this type of meeting.

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policy. Following these meetings, CSTAG and NRRB, or solely CSTAG, provided recommendations to the regions for these sites, and the regions provided written responses to these recommendations consistent with EPA's procedures.

For 5 of the 12 Tier 2 sites we reviewed, the regions responsible for these sites had at least one update meeting with CSTAG to discuss their progress at the site and to further discuss how the region was addressing the 11 principles. These meetings were held at different intervals in the sites' remedial response process, with the first update meeting generally occurring 2 to 3 years after the initial site meeting. For 2 of the 5 Tier 2 sites we reviewed, the regions had a second update meeting with CSTAG, with these meetings occurring 7 and 12 years following the initial meeting, respectively. We found that regional offices for the 5 sites we reviewed did not submit a revised or updated consideration memorandum to CSTAG in advance of these meetings. Regional officials responsible for managing these sites told us that such memorandums were not submitted because they did not believe such memorandums were required by CSTAG for update meetings, or because similar information was provided to CSTAG in an alternate format, such as in a PowerPoint presentation. However, according to the headquarters-based CSTAG Chair, a consideration memorandum should be submitted for update meetings with CSTAG where the group is going to issue recommendations to the region regarding a site.[41] The Chair also noted that CSTAG's approach was flexible given that the group's original design for holding update meetings had changed in the current budget environment and given the potential administrative burden on the regions in preparing a consideration memorandum.[42] The CSTAG chair also told us that some CSTAG representatives would prefer if the regions submitted a consideration memorandum for update meetings. EPA has documented its operating procedures for CSTAG; however, these

[41]At all five of the selected Tier 2 sites that had update meetings with CSTAG, CSTAG provided the regions with written recommendations on how to better address the 11 principles and in all five cases the respective regions provided a written response to the group.

[42]According to the CSTAG chair, CSTAG originally planned to hold multiple update meetings with the regions on Tier 2 sites as their sites progressed through the remedial response process, but due to the resources required for travel, CSTAG has been unable to take that approach in recent years.

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procedures are not clear about the requirements for submitting documentation for update meetings with CSTAG. Specifically, the operating procedures do not describe what type of information and documentation, if any, should be prepared by regional officials and provided to CSTAG members in advance of these meetings. Examples of PowerPoint presentations and a written summary we reviewed from update meetings differed in terms of the information they provided and the extent to which they discussed the implementation of the 11 principles. Under federal standards for internal controls, agencies are to clearly document internal controls, and the documentation is to appear in management directives, administrative policies, or operating manuals.[43] CSTAG's chair told us that revised operating procedures were drafted nearly 2 years ago, but never finalized, and that CSTAG did not have a time frame for when they would be updated. Clarifying in its operating procedures the types of information and documentation, if any, that should be prepared for CSTAG members in advance of update meetings would help to ensure that the regions are providing CSTAG with the information needed to inform its reviews and meetings and to monitor the progress of Tier 2 sites. The CSTAG chair told us that the group is still planning on making changes to its operating procedures and that adding information on the types of information and documentation, if any, that should be prepared for CSTAG members in advance of update meetings would be reasonable.

Regional Officials Consulted with Headquarters on the Development and Selection of Cleanup Decisions at All of the Selected Sites Reviewed

Regional officials responsible for the 6 Tier 1 and 12 Tier 2 Superfund sediment sites we reviewed told us they consulted with headquarters on the development and selection of remedy decisions, such as by receiving technical assistance, site-specific support, and comments from headquarters on drafts of remedy decision documents. The type and extent of the consultation varied based on a site's complexity. With regard to technical assistance, regional officials responsible for 2 of the Tier 1 sites and 7 of the Tier 2 sites we reviewed told us that they had received this type of support from headquarters officials or entities, in addition to the support provided from CSTAG meetings with the sites, for example:

[43]GAO, *Standards for Internal Control in the Federal Government*, GAO/AIMD-00-21.3.1 (Washington, D.C.: November 1999). GAO has revised and reissued *Standards for Internal Control in the Federal Government*, with the new revision effective as of October 1, 2015. See GAO-14-704G (Washington, D.C.: September 2014).

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- **Environmental Response Team:** Regional officials responsible for 2 of the 18 sites we reviewed stated that they used the expertise of OSRTI's Environmental Response Team, which provides assistance to EPA regional and headquarters offices on the characterization and cleanup of hazardous waste sites, among other things. For example, Region 3 officials from the Kanawha River site near Nitro, West Virginia, told us that they worked with the team to design methods for sampling fish tissue to determine if there were statistically significant differences in contamination in the river over time.
- **Office of Research and Development:** Regional officials responsible for 2 of the 18 sites we reviewed told us that they worked with staff in EPA's Office of Research and Development—the scientific research arm of EPA—to develop models of their sites. For example, Region 1 officials from the Nyanza Chemical Waste Dump site near Ashland, Massachusetts, told us that they worked with the office to develop a site-specific model for mercury contamination.

Regional officials responsible for 2 of the sites we reviewed told us that they also received technical support through EPA's relationship with the Army Corps of Engineers (Corps), which has technical expertise in water bodies and sediment. According to a headquarters official, through an interagency agreement between EPA and the Corps, regional officials may request, through headquarters, the support of the Corps for up to 40 hours, or $10,000, of technical support. For example, Region 1 officials from the Callahan Mining Corporation site near Brooksville, Maine, told us that they have received technical assistance from the Corps to determine whether dredging would be an appropriate and efficient approach at the site and whether dredged materials could be pumped into a confined aquatic disposal cell at the site.[44]

Regional officials responsible for two of the selected Tier 2 sites we interviewed—Portland Harbor and GE-Housatonic/Rest of River—told us that they have engaged in extensive consultation with headquarters to receive site-specific support. Officials at both of these sites told us that consultation occurred between regional and headquarters officials at both the staff and management levels and that the EPA Administrator's office

[44]Confined aquatic disposal cells are constructed to reduce the risk from unacceptably contaminated sediments by storing them in a depression in the bottom of an aquatic system and providing a means to store and cap the sediments.

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has also been involved in these sites. Specifically, at the Portland Harbor site—in the vicinity of Portland, Oregon—Region 10 officials told us that headquarters was directly involved in the development of the remedy and the EPA Administrator will sign the ROD.[45] This increased level of involvement by headquarters is unique and reflects the importance and political sensitivity of the site, according to regional officials. Four headquarters staff are members of the project team, according to a headquarters official, and regional staff met regularly with EPA leadership to discuss the region's progress on developing the proposed remedy, which was issued in June 2016. Region 1 officials responsible for managing the GE-Housatonic/Rest of River site—in the vicinity of Pittsfield, Massachusetts—told us that they have had regular consultation with headquarters on the site and that headquarters provided the region with specific assistance in building consensus on the selected remedy with the responsible state. Specifically, regional officials told us that the state of Massachusetts identified concerns with the preferred remedy, and EPA determined that the region should work with the state to build consensus on the remedy before issuing a proposed plan. The region and the state developed a working group to work collaboratively—with a representative from headquarters also participating in this process—a process that resulted in the region and the state reaching mutual agreement on a remedy.

Regional officials responsible for 5 of the Tier 1 sites and 6 of the Tier 2 sites we reviewed provided examples of how they consulted with EPA headquarters officials on remedy decisions or received headquarters' review and comment on drafts of remedy decision documents. For example, regional officials responsible for the Callahan Mining Corporation site near Brooksville, Maine, told us that they involved officials from headquarters in the regional management review meeting for the site's remedy decision. As previously discussed, headquarters reviews all Superfund drafts of proposed plans and some draft RODs prior to their public issuance, and for Tier 1 and Tier 2 sediment sites, drafts of remedy decision documents are also reviewed by headquarters sediment experts and the CSTAG chair, respectively. Regional officials told us that headquarters' comments touched on multiple areas, such as

[45]In July 2013, EPA committed to the Administrator's signing the ROD to address concerns raised by the Oregon congressional delegation about the progress and accountability of EPA and the parties responsible for the cleanup.

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technical issues related to sampling or the need to clearly document the regions' rationale for its decisions. In some cases, regional officials told us that they received limited comments from headquarters on drafts of remedy decision documents due to previous comments they had addressed through the Tier 2 review process.

Representatives we interviewed from two stakeholders groups that represent PRPs at Superfund sediment sites expressed concerns that regions are making remedy decisions without sufficiently addressing comments from headquarters' review process, resulting in regions making decisions that are not nationally consistent and without the oversight of EPA headquarters. Several regional officials responsible for selected sites, however, told us that they do not move forward with making a remedial decision until reaching agreement with headquarters on the remedy described in the drafts of remedy decision documents. EPA officials told us that the process for reviewing Tier 1 and Tier 2 sediment sites is intended to provide a nationally consistent level of review at these sites, but that site-specific factors and the regions' authority to make response decisions ultimately dictate individual remedial decisions.

EPA Officials Identified Two Main Challenges in EPA's Management of Cleanups of Superfund Sediment Sites—Technical Complexities and Stakeholder Involvement

EPA faces challenges in managing the cleanup of Superfund sediment sites, according to EPA headquarters and regional officials. The challenges officials cited generally fell into two primary areas—(1) the technical complexities of sediment sites, including the sampling and modeling needed to assess the environmental and health risks and develop the proposed cleanup remedy, and (2) stakeholders' involvement, including stakeholders' sometimes competing interests.

Challenges Related to Technical Complexities

EPA headquarters and regional officials cited challenges related to technical complexities with managing the cleanup of Superfund sediment sites, including the characteristics of the sediment sites themselves, the sampling used to determine the nature and extent of contamination, and the modeling used to better understand risks.

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Site Characteristics

EPA headquarters and regional officials we interviewed most frequently cited the characteristics of the sediment sites themselves as technically challenging. Sediment sites can be large and complex, according to EPA officials. For example, according to EPA documents and interviews, the GE-Housatonic/Rest of River site is located along a nearly 125-mile river system that runs through Connecticut and Massachusetts; the Portland Harbor site is located in Portland, Oregon, along a 10-mile stretch of the Lower Willamette River; and the Lower Duwamish Waterway Superfund site is a 5-mile stretch of the Duwamish River that flows into Elliott Bay in Seattle, Washington. Representatives from a stakeholder group representing PRPs described the complexity of large contaminated sediment sites as unparalleled in the Superfund program because the sites can consist of 10 to 30 river miles or large lakes or harbors associated with expansive watersheds. The location of sediment sites can also present technical challenges for the cleanup. For example, Region 9 officials discussed the challenges of designing a remedy for the Montrose Chemical/Palos Verdes Shelf site, a 17-square-mile site in the ocean off the coast of Palos Verdes near Los Angeles, California. The primary contaminants, including PCBs, are mostly located under about 200 feet of water. Region 9 officials also cited the Pearl Harbor site in Pearl Harbor, Hawaii, which is located on an active naval facility that is home to nuclear submarines. This location creates difficulties for entering the site from land, given the high security around the facility. Moreover, because dredging is part of the cleanup remedy, screening of the area to be dredged to detect any unexploded munitions that might remain from the Pearl Harbor attack in 1941 is required before beginning work.

Some sites are also challenging, according to EPA officials, because they are affected by tidal influences. For example, Region 2 officials involved with the cleanup of the Raritan Bay Slag site in New Jersey explained that the site presents a challenge because the tidal factor has a large impact on how the cleanup remedy is designed and implemented in terms of timing and logistics. Sites can also have multiple sources of contamination. For example, sediments at the Lower Duwamish Waterway site are contaminated with toxic chemicals from many sources, including a century of heavy industrial use along the banks of the Duwamish River, as well as storm water pipes and runoff from upland activities, streets, and roads. Representatives from one stakeholder group representing PRPs noted that these large sediment sites frequently involve comingled contaminants from multiple sources, which may result in impacts to human health via fish consumption, but the sources of risk are not easily identified and are often difficult to quantify. According to EPA headquarters officials, many sites are located in urban waterways

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where there are ongoing releases of contaminants, such as from combined sewer overflow and industrial discharges, some of which are upstream and not part of the site.

Sampling

Regional officials involved in cleaning up sites noted that there can be challenges to conducting the necessary sampling, such as samples of sediments and fish, to characterize the site and measure progress. For example, Region 9 officials working on the Montrose Chemical/Palos Verdes Shelf site near Los Angeles, California, said that although samples should be collected from the same area, the El Nino weather pattern has led to changes in the number and types of fish available for sampling. Officials added that technology limitations impact their ability to collect samples from the same location over time impairing their ability to precisely measure progress in reaching cleanup goals, since the level of contamination can vary from location to location on a site. Officials added that inconsistencies in sampling can later add to uncertainties in the modeling process. Region 3 officials working on the Kanawha River site in West Virginia noted that it can be challenging to schedule and complete fish sampling at the right time of the year to collect the proper data, that is, to catch the intended species of fish. Regional officials cited a case where, working with the region's Biological Technical Assistance Group, they were instead able to use samples from an alternative fish species that were plentiful at that time of year. The amount of data that needs to be collected for proper sampling can be very large, according to headquarters officials, in part due to the large size of some sites, and data collection can take a number of years. Regional officials explained that there may also be multiple sources of contamination that have to be evaluated as well.

Modeling

Models—which are tools used at many sediment sites when characterizing site conditions, assessing risks, and evaluating remedial alternatives—also add technical complexities, according to EPA headquarters and regional officials. Officials from one region said that modeling for sediment sites is very challenging, in part due to the dynamic nature of some sediment sites. Officials added that it is very hard to predict the future for these sites with a model, including how long it will take to achieve the cleanup and how much certainty there will be that the selected remedy meets cleanup goals. Officials from another region explained that in the case of sediment contamination, modeling is used in part to determine the effects that sediment contamination has on the food chain, such as in fish tissue, and then modeling is done to predict the risk involved to humans through the consumption of fish. Other regional officials said that there can be an unclear relationship between the level

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of sediment contamination and the level of contamination present in fish. As a result, decisions on what a safe level of sediment contamination is for cleanup purposes may not necessarily result in improvements in the level of contamination in fish tissue or the response in fish tissue concentrations may not be seen for several years. Headquarters officials noted that although some type of a predictive model needs to be used, there remains uncertainty in model outcomes and that there will be different opinions about whether a model is accurate or the correct model. A headquarters official expressed concerns that although there is a lot of uncertainty in the model outcomes, some officials and others will use modeling results as if they can accurately predict the future. According to regional officials, these challenges with models and uncertainty often result in EPA having disagreements with PRPs about a proposed cleanup remedy.

Regional officials also stated that modeling is a time-consuming process. Officials from one region explained that one nuanced change in a model can take months to run and interpret, but subtle changes made to the model are important and need to be tested. Moreover, they said that one has to gather and use a tremendous amount of data to model how a body of water, such as a river, might react over time. Officials added that the models are also sometimes peer-reviewed, which takes time. Representatives we interviewed from two stakeholder groups representing PRPs expressed concerns about the length and cost of the remedial investigation and the feasibility study phase overall. They noted that at some sites this phase can run from 10 to 20 years and can cost over $100 million. Representatives from one of the groups also expressed concerns about the disagreements among experts over the models used. Representatives for one group also acknowledged, however, that the remedial investigation and feasibility study phase can take longer due to PRPs' disagreement with EPA's initial considerations of the best remedy, such as the use of bank-to-bank dredging.[46] EPA regional officials said that it is a challenge to explain to critics, such as some PRPs who want decisions made more quickly, why this important step of evaluating and adjusting these models takes time.

[46]Dredging is the removal of contaminated sediment while the sediments remain submerged. Dredging may target "hotspots"—specific areas of elevated contamination—or address larger areas through "bank-to-bank" dredging.

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Challenges Related to Stakeholder Involvement

EPA recognizes the importance of stakeholder involvement in its 11 principles for managing contaminated sediment sites, but EPA officials also cited two primary challenges related to this involvement—(1) the differing opinions and competing interests among various stakeholders related to the cleanup decisions, including which stakeholders bear responsibility for cleaning up and preventing recontamination, and (2) the varying levels of knowledge among stakeholders about the Superfund process.

Competing interests

EPA officials said that among stakeholders there can be varied opinions and competing interests related to the cleanup, including the extent of cleanup needed and concerns about the effects of the cleanup. For example, Region 1 officials discussed the Nyanza Chemical Waste Dump site—a 35-acre area in Ashland, Massachusetts—that runs through six towns and includes a significant number of residential properties located along the river. Region 1 officials said that they held multiple meetings with town officials and residents to share information about the site and possible cleanup remedies. According to regional officials, the local governments of each of these towns had different perspectives about what the cleanup remedy should be, and EPA officials recognized that it would not be possible to select a remedy that would satisfy all the stakeholders. In another case in Region 1, officials stated that at the GE-Housatonic/Rest of River site, members of the public had a variety of opinions about how rigorous the cleanup remedy should be. Local governments also had concerns related to the impacts of the remedy, including the effects on property values and traffic during the cleanup period. The state governments for the two affected states in that case—Connecticut and Massachusetts—also had different concerns and goals for the cleanup. For example, according to EPA officials, officials from Massachusetts were very concerned about selecting a cleanup remedy that also focused on maintaining and restoring habitat. Officials from the state of Connecticut on the other hand were very concerned about taking the necessary steps to prevent PCBs from migrating downstream from Massachusetts and less focused on habitat issues.

Another challenge cited by EPA officials and one stakeholder group representing PRPs is determining which stakeholders bear responsibility for cleaning up the site. Specifically, regional officials told us that ownership issues at sites result in challenges. For example, a federal entity could “own” the river bottom, a PRP could be responsible for the contamination in the river, and another PRP could be contributing to the contamination of the water body due to discharges from combined sewer overflows. This type of situation can make it very challenging to determine

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who is responsible for paying for the cleanup remedy. Region 4 officials working on the Ward Transformer site in Raleigh, North Carolina, noted that there are a large number of PRPs with widely different opinions about the responsibility they bear for the site's contamination. Likewise, the Portland Harbor and the Lower Duwamish sites in Region 10—both projected to be costly cleanups—each have a large number of PRPs with different opinions about the extent of each PRP's responsibility for the cleanup needed, according to Region 10 officials.

According to EPA headquarters officials, there is ongoing tension among various parties and stakeholders over proposed remedies and costs at some sediment sites. Moreover, differences of opinion among stakeholders about the sampling and modeling used add a level of uncertainty that contributes to stakeholders questioning the proposed remedy based on their particular interests, according to EPA officials. Representatives from both stakeholder groups representing PRPs have expressed concerns about some proposed or selected cleanup remedies and their high costs, particularly for the largest sediment sites. Specifically, the representatives we interviewed stated that EPA seems to favor more costly remedies that focus on excavating more sediment but that PRPs do not believe significantly reduce risks more than using less costly alternatives. Headquarters officials stated that among many stakeholders and in some regions, there is a preference for more aggressive remedies, such as dredging, in contrast to PRP preferences for less expensive remedies, such as monitored natural recovery.[47] EPA's sediment guidance states that an advantage of dredging is that removal of contaminated sediment can minimize the uncertainty about the long-term effectiveness of the cleanup. The guidance also notes that while implementation costs for monitored natural recovery are relatively low, risk reduction can be slower in comparison to more active cleanup approaches. Representatives for one stakeholder group representing PRPs also expressed concerns about controlling sources of contamination stating that they believe that at some sites, EPA does not adequately identify potential ongoing sources of contamination, which, if not properly addressed, could lead to recontamination of the remedy. A Headquarters official told us that while there were issues in the past with

[47]According to EPA's contaminated sediment guidance, monitored natural recovery uses ongoing, naturally occurring processes to contain, destroy, or reduce the toxicity of contaminants in sediment.

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source control, the agency's performance in this area has improved due to increased emphasis on assessing and addressing sources of contamination. He cited the Lower Duwamish Waterway as an example of this. The ROD for the Lower Duwamish Waterway states that the selected remedy will be implemented after source control measures sufficient to minimize recontamination have been implemented, that additional sampling and analysis has been conducted, and that the design of the remedy has been completed. EPA guidance also provides information to assist EPA officials in assessing and addressing sources of contamination at sediment sites. In addition, in 2015, the agency issued a memorandum to encourage improvements in coordination so that EPA's Water, Superfund, and Enforcement programs can better address issues related to sources of contamination.[48]

Varying Levels of Knowledge about the Superfund Process

Working with stakeholders that have varying levels of knowledge about the Superfund process can be challenging, as it takes additional time and resources to educate stakeholders, according to EPA officials. For example, according to headquarters officials, PRPs have varying levels of sophistication related to their knowledge and understanding of the Superfund process. Some PRPs are well versed in CERCLA and the Superfund process, whereas others are novices. In a large coalition of PRPs for a site, for example, there can be disparate levels of understanding, and EPA can spend a lot of time educating PRPs about the Superfund process. This in turn can lengthen the negotiation process for cleanups, according to EPA officials. EPA regional officials said that many PRPs and states are often not familiar with the CERCLA process, and so EPA regional and headquarters officials meet with these parties during the process to help them understand it. According to officials, it can be a burden to educate all of the stakeholders, particularly at a large, complex site. According to EPA officials and documents, EPA takes steps to inform communities through meetings and other sources of information. EPA regional officials stated that they periodically survey the community affected by a site to see if officials need to enhance their outreach efforts.

[48]See EPA, *Promoting Water, Superfund, and Enforcement Collaboration on Contaminated Sediments,* (Washington, D.C.: 2015).

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Conclusions

EPA has recognized that addressing Superfund sites with contaminated sediments is challenging, due in part to sites' large size and oftentimes high cleanup costs, and has issued risk management principles and guidance to help EPA regions make nationally consistent and scientifically sound decisions at these sites. EPA also established a consultation process for two tiers of Superfund sediment sites—Tier 1, involving more than 10,000 cubic yards of contaminated sediments and Tier 2, which are large, complex, or controversial—to help ensure that regions appropriately consider these principles before making site-specific risk management decisions. EPA has developed operating procedures for its consultation on Tier 2 sites, including what information the regions should be providing in advance of initial and proposed plan review meetings by CSTAG. These procedures do not, however, clearly describe what type of information and documentation, if any, regions should prepare and provide to CSTAG members in advance of additional meetings, called update meetings. Clarifying, in the operating procedures, the types of information and documentation, if any, that should be prepared for CSTAG members in advance of update meetings would help to ensure that the regions are providing CSTAG members with the types of information needed to inform and facilitate their reviews and meetings and help monitor the oversight of progress at Tier 2 sites.

Recommendation for Executive Action

To ensure that CSTAG's information needs are met for update meetings, we recommend that the EPA Administrator direct CSTAG to clarify, in its operating procedures, what type of information and documentation, if any, should be prepared by regional offices and provided to CSTAG members in advance of these meetings.

Agency Comments

We provided a draft of this report to EPA for review and comment. In written comments provided by EPA (reproduced in app. VI), EPA generally agreed with our findings and concurred with our recommendation, stating that it will revise the CSTAG operating procedures to clearly describe the types of information and data that regional offices need to provide before update meetings. EPA also provided technical comments that were incorporated, as appropriate.

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As agreed with your offices, unless you publicly announce the contents of this report earlier, we plan no further distribution until 30 days from the report date. At that time, we will send copies to the appropriate congressional committees, the EPA Administrator, and other interested parties. In addition, the report will be available at no charge on the GAO website at http://www.gao.gov.

If you or your staff have any questions about this report, please contact J. Alfredo Gómez at (202) 512-3841 or gomezj@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix VII.

J. Alfredo Gómez
Director, Natural Resources and Environment

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Appendix I: List of Environmental Protection Agency's Tier 1 and Tier 2 Sediment Sites

Table 1: List of Environmental Protection Agency's (EPA) Tier 1 Sediment Sites

Region	Site name	State
Region 1		
	Callahan Mining Corp	Maine
	Centredale Manor Restoration Project[a]	Rhode Island
	Loring Air Force Base	Maine
	New Bedford	Massachusetts
	Newport Naval Education & Training Center	Rhode Island
	Nyanza Chemical Waste Dump[a]	Massachusetts
	Pine Street Canal	Vermont
	Sullivan's Ledge	Massachusetts
Region 2		
	Batavia Landfill	New York
	Bridgeport Rental & Oil Services	New Jersey
	Burnt Fly Bog	New Jersey
	General Motors (Central Foundry Division)	New York
	Gowanus Canal[a]	New York
	Grasse River Superfund Site (Alcoa Aggregation Site)	New York
	Hooker (102nd Street)	New York
	Hudson River PCBS	New York
	Lipari Landfill	New Jersey
	Love Canal	New York
	Marathon Battery Corp.	New York
	Onondaga Lake	New York
	Raritan Bay Slag	New Jersey
	Reynolds Metals Co.	New York
	Richardson Hill Road Landfill/Pond	New York
	Roebling Steel Co.	New Jersey
	Vineland Chemical Co. Inc.	New Jersey
	York Oil Co.	New York
Region 3		
	Atlantic Wood Industries Inc.	Virginia
	E.I. DuPont De Nemours & Co. Inc. (Newport Pigment Plant Landfill)	Delaware
	Koppers Co. Inc. (Newport Plant)	Delaware
	Metal Banks	Pennsylvania
Region 4		
	American Brass Inc.	Alabama

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Region	Site name	State
	American Creosote Works Inc.	Mississippi
	Copper Basin Mining District Site	Tennessee
	Domtar Corporation	North Carolina
	Koppers Co. Inc. (Charleston Plant)	South Carolina
	Sangamo Weston Inc./Twelve-Mile Creek/Lake Hartwell PCB Contamination	South Carolina
	Tennessee Products	Tennessee
	Triana/Tennessee River	Alabama
	Ward Transformer	North Carolina
Region 5		
	Continental Steel	Indiana
	Fox River NRDA/PCB Releases	Wisconsin
	Kerr-McGee (Kress Creek/West Branch of Dupage River)	Illinois
	Little Mississinewa River	Indiana
	Outboard Marine Corp.	Illinois
	Sangamo Electric Dump/Crab Orchard National Wildlife Refuge (US DOI)	Illinois
	Sheboygan Harbor & River	Wisconsin
	Torch Lake	Michigan
	Velsicol Chemical Corp (Michigan)	Michigan
Region 6		
	Alcoa (Point Comfort/Lavaca Bay)	Texas
	Bailey Waste Disposal	Texas
	Bayou Bonfouca	Louisiana
Region 8		
	Milltown Reservoir Sediments	Montana
	Rocky Mountain Arsenal (US Army)	Colorado
	Sharon Steel Corp. (Midvale Tailings)	Utah
	Silverbow Creek/Butte Area	Montana
Region 9		
	Iron Mountain Mine	California
	McCormick & Baxter Creosoting Co.	California
	Moffett Naval Air Station	California
	Montrose Chemical Corp.[a]	California
	United Heckathorn Co.	California
Region 10		
	Bunker Hill Mining and Metallurgical	Idaho
	Commencement Bay, Nearshore/Tide Flats	Washington

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Region	Site name	State
	Harbor Island (Lead)	Washington
	Ketchikan Pulp Company	Alaska
	Lockheed West Seattle	Washington
	McCormick & Baxter Creosoting Co. (Portland Plant)	Oregon
	Old Navy Dump/Manchester Laboratory (USEPA/NOAA)	Washington
	Pacific Sound Resources	Washington
	Puget Sound Naval Shipyard Complex	Washington
	St. Maries Creosote	Idaho
	Wyckoff Co./Eagle Harbor	Washington

Source: EPA. | GAO-16-777

Note: EPA defines Tier 1 sites as those where the proposed cleanup involves more than 10,000 cubic yards of contaminated sediments, or 5 acres.

[a]These sites, or sections of these sites, are also included on EPA's list of Tier 2 sediment sites, which are reviewed by the agency's Contaminated Sediments Technical Advisory Group. According to EPA officials, Superfund sediment sites that are large, complex, or complicated (i.e., a Tier 2 site) are added to the list of Tier 1 sites when a Record of Decision has been signed, if the Tier 2 sites meet the Tier 1 criteria.

Table 2: List of Environmental Protection Agency's (EPA) Tier 2 Sediment Sites

Region	Site name	State
Region 1		
	Centredale Manor Restoration Project[a]	Rhode Island
	GE-Housatonic/Rest of River	Massachusetts and Connecticut
	Nyanza Chemical Waste Dump[a]	Massachusetts
Region 2		
	Berry's Creek Study Area	New Jersey
	Gowanus Canala	New York
	Lower Passaic River	New Jersey
	Newtown Creek	New York
Region 3		
	Kanawha River	West Virginia
Region 4		
	Anniston PCB Site	Alabama
Region 5		
	Allied Paper, Inc./Portage Creek/Kalamazoo River	Michigan
	Ashland/Northern States Power Lakefront	Wisconsin
	Tittabawassee River, Saginaw River and Bay	Michigan
Region 9		
	Montrose/Palos Verdes Shelf[a]	California

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Region	Site name	State
	Pearl Harbor Naval Complex	Hawaii
Region 10		
	Lower Duwamish Waterway	Washington
	Portland Harbor	Oregon
	Upper Columbia River	Washington

Source: EPA. | GAO-16-777

Note: EPA defines Tier 2 sites as those sediment sites that are large, complex, or controversial.

[a]These sites are also included on EPA's list of Tier 1 sediment sites. According to EPA officials, Tier 2 sites are added to the list of Tier 1 sites when a Record of Decision has been signed, if the Tier 2 sites meet the criteria for a Tier 1 site. EPA defines Tier 1 sites as those where the proposed cleanup involves more than 10,000 cubic yards of contaminated sediments, or 5 acres.

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Appendix II: Selected Tier 1 and Tier 2 Sediment Sites Included in Our Review

To examine the extent to which EPA follows its process to help provide national consistency at selected Superfund sediment sites, we reviewed selected documents and interviewed regional officials for a non-generalizable sample of Tier 1 and Tier 2 sites. We reviewed EPA lists of these sites to identify the nine regions with Tier 1 and Tier 2 sediment sites, as well as the one region with no sites.[1] To select this sample, we generated a randomly ordered list of Tier 1 and Tier 2 sites for each region, if applicable,[2] and selected one Tier 1 site and two Tier 2 sites in each region for inclusion in our review, starting with the first site on the list. Going down the list, we excluded any sites for which the proposed cleanup decision document was issued prior to fiscal year 2006, for the purpose of focusing on more recent cleanup decisions, or if there was relevant, ongoing litigation at the site and EPA was listed as the defendant. This process resulted in the selection of 6 Tier 1 sites from 6 regions and 12 Tier 2 sites from 7 regions.[3] See table 3 for a list of the Tier 1 and Tier 2 sites included in our review.

Table 3: Selected Tier 1 and Tier 2 Sediment Sites Included in Our Review

Region	Site name	State
Tier 1 Sites		
1	Callahan Mining Corp	Maine
2	Raritan Bay Slag	New Jersey
3	Atlantic Wood Industries Inc.	Virginia
4	Ward Transformer	North Carolina
5	Outboard Marine Corp.	Illinois
10	Lockheed West Seattle	Washington
Tier 2 Sites		
1	GE-Housatonic/Rest of River	Massachusetts and Connecticut
1	Nyanza Chemical Waste Dump	Massachusetts
2	Berry's Creek Study Area	New Jersey

[1]EPA's Region 7 did not have any Tier 1 or Tier 2 sites at the time of our review.

[2]EPA Region 7 did not have any Superfund sediment sites designated as Tier 1 and Regions 6, 7, and 8 did not have any Superfund sediment sites designated as Tier 2 at the time of our review.

[3]Regions 3 and 4 both had one Tier 2 site at the time of our review.

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Region	Site name	State
2	Newtown Creek	New York
3	Kanawha River	West Virginia
4	Anniston PCB Site	Alabama
5	Allied Paper, Inc./Portage Creek/Kalamazoo River	Michigan
5	Tittabawassee River, Saginaw River and Bay	Michigan
9	Montrose/Palos Verdes Shelf	California
9	Pearl Harbor Naval Complex	Hawaii
10	Lower Duwamish Waterway	Washington
10	Portland Harbor	Oregon

Source: GAO selection from EPA information. | GAO-16-777

Note: EPA defines Tier 1 sites as those where the proposed cleanup involves more than 10,000 cubic yards of contaminated sediments, or 5 acres. EPA defines Tier 2 sites as those sediment sites that are large, complex, or controversial.

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Appendix III: Information on the Lower Passaic River and Gowanus Canal Superfund Sediment Sites

In the design phase of our review, we conducted two site visits in EPA Region 2 to increase our understanding of Superfund sediment sites. Specifically, we visited the Gowanus Canal site in Brooklyn, New York, and the Lower Passaic River site in Newark, New Jersey. Both sites are designated as Tier 2 sediment sites by EPA. In conducting these visits, we reviewed site-specific documents and spoke with EPA Region 2 officials, including the sites' Remedial Project Managers and Community Involvement Coordinators; representatives from the sites' Community Advisory Group; and officials representing some of the sites' potentially responsible parties (PRP).

Gowanus Canal

Background

The Gowanus Canal is a 1.8-mile-long, man-made canal located in a mixed residential-commercial-industrial area in the Borough of Brooklyn in New York City. (See figure 4.) The canal was constructed in the mid-1800s and was once a major industrial transportation route. Manufactured gas plants, paper mills, tanneries, and chemical plants are among the many facilities that operated along the canal. Although the level of industrial activity along the canal declined over the years as industry moved away from the canal, high levels of hazardous substances remain in the sediments and upland sources. In addition, contamination flows into the canal from New York City's combined sewer overflow system that carries sewage from homes and rainwater from storm drains, which can include industrial pollutants. More than a dozen contaminants, including polycyclic aromatic hydrocarbons, or PAHs; polychlorinated biphenyls, or PCBs; and heavy metals, including mercury, lead, and copper are found at high levels in the sediment of the Gowanus Canal.

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Figure 4: View of the Upper Section of the Gowanus Canal in Brooklyn, NY

Source: GAO. | GAO-16-777

EPA's Cleanup Process and Decision

The Gowanus Canal was listed on the National Priorities List (NPL) in 2010, with EPA Region 2 serving as the lead on the cleanup of the site. EPA has identified numerous parties that are potentially responsible for the contamination, including National Grid, the City of New York, and other private and federal government entities. As a Tier 2 site, the Gowanus Canal site was reviewed by EPA's Contaminated Sediment Technical Advisory Group (CSTAG)—together with the National Remedy Review Board (NRRB)—as EPA investigated the site and developed a cleanup action. In November 2011, EPA Region 2 provided CSTAG with a consideration memorandum—which discussed how EPA's 11 risk management principles would be addressed for the site—and drafts of executive summaries of the remedial investigation and the feasibility study. For example, for the first principle—control sources early—EPA stated that it intends to eliminate sources as part of the remedy for canal sediments and that it was actively engaged with both New York State's Department of Environmental Conservation and New York City's Department of Environmental Protection in the development and implementation of the source control measures to ensure that they address the requirements of a sustainable canal remedy. In addition, EPA

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stated that source control measures were being or would be developed by the PRPs in consultation with EPA and that the relative timing of source control actions and sediment response actions were also the subject of ongoing discussions. In January 2012, CSTAG responded with recommendations to Region 2, and the Region formally provided its response to the recommendations in May 2012. In November 2012, CSTAG and NRRB provided joint comments on the Region's proposed remedy. For example, regarding source controls, CSTAG and NRRB recommended to EPA that all continuing contamination sources be identified and evaluated to determine which ones can be controlled. CSTAG and NRRB further recommended that the Region determine to what degree contaminant releases should be controlled, inclusive of combined sewer overflows, for the remedy to remain protective. EPA released a proposed plan for the cleanup for public comment in December 2012.

EPA issued its Record of Decision (ROD) for the site in September 2013, with an estimated site cleanup cost of $506 million. The cleanup remedy for the canal is divided into three segments. The first and second segments are the upper and middle areas of the canal, respectively, which have the most heavily contaminated sediment. The third segment or lower area has less contaminated sediment than the others. For the first and second segments of the canal, EPA's plan includes dredging of approximately 307,000 cubic yards of highly contaminated sediment. For the third segment of the canal, the EPA requires the dredging of approximately 280,000 cubic yards of contaminated sediment. In dredged areas of the canal, EPA will cap with multiple layers of material, including sand and gravel, designed to absorb and isolate contamination. For the first and second segments of the canal where the deep sediment is contaminated with liquid coal tar, the EPA will first stabilize that sediment by mixing it with portland cement or similar materials and then place a cap. EPA's ROD also requires controls to significantly reduce the flow of contaminated sewage solids from combined sewer overflow into the upper canal. According to the ROD, these overflows are not being addressed by current New York State's Department of Environmental Protection's upgrades to the sewer system. Without these controls, contaminated sewage's solid discharges would result in recontamination of the canal after its cleanup. EPA is requiring that combined sewer overflow discharges from two major outfalls in the upper portion of the canal be outfitted with retention tanks to reduce the volume of contaminated sewage's solid discharges. Contaminated land sites along the canal, including three former manufactured gas plants, are also being addressed by PRPs, in coordination with the EPA. In addition, other

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potential sources of continuing contaminant discharges to the canal have been referred to the State of New York and will be investigated and addressed as necessary. According to the ROD, to prevent recontamination of the canal following the implementation of the above-described remedial actions, the upland sources of hazardous substances must also be addressed prior to the commencement of, or in phased coordination with, the implementation of the remedy. According to Region 2 officials, the site cleanup is in the remedial design phase.

Challenges Regarding the Cleanup of the Gowanus Canal

EPA officials in Region 2, including the Remedial Project Manager and the Community Involvement Coordinator; members of the Community Advisory Group; and one of the site's PRPs commented on challenges in the cleanup of the Gowanus Canal site. According to the EPA Remedial Project Manager, there have been challenges related to the construction of retention tanks to control combined sewer overflow discharges into the canal due to disagreements between EPA and the City of New York on the design and location of the tanks. For example, according to the official, the City of New York disagreed with EPA on the size of the tanks called for in the ROD, arguing that the tank volumes had to be considerably smaller. More than a year after EPA issued a Unilateral Administrative Order to New York City for the design of the retention tanks, the City of New York submitted preliminary design reports for the two combined sewer overflow tanks with the tank size volumes that were originally called for in the ROD, according to the Remedial Project Manager.[1] In addition, with regard to the larger of the two tanks, in the ROD EPA proposed a location for the site of the tank that it determined was the preferred option based on the cleanup schedule and cost. The City of New York disagreed with this location, and negotiated with EPA to enter into an "administrative order of consent" that would allow New York

[1]A "unilateral administrative order" may require responsible parties to conduct site work, among other things.

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City to build the tank in the city's preferred location.[2] According to the Remedial Project Manager, this decision will result in lengthening of the schedule for the combined sewer overflow portion of the remedy and will result in significant higher costs to New York City than had been included by EPA in the ROD. In addition, Region 2's Community Involvement Coordinator for this site stated that there are challenges at Superfund sites when dealing with different factions in the community that want different outcomes from the cleanup. For example, the coordinator said that since EPA's role at the site is to oversee the cleanup of the Canal, EPA has not been able to address the community's concerns about zoning and redevelopment.

According to Gowanus Canal Community Advisory Group's representatives, EPA has coordinated very well with the community and has been very transparent. Community Advisory Group representatives stated that the group functions as an outlet for the community to express opinions on the Gowanus Canal cleanup. One challenge, according to these representatives, is that members of the Group have competing interests on various subjects relating to the direction of the cleanup, such as the use of the land surrounding the canal. In addition, they said that sometimes the community wants to bring in other issues for EPA to address, such as land ownership issues and potential recontamination of the canal from contaminated sewer overflows. However, because of legal limitations, EPA needs to have the city and state address these type of issues.

Officials from National Grid, one of the site's major PRPs, told us that there are challenges to the cleanup related to EPA's ambitious schedule and time frame for completing the remedial response process and cleanup of this site. Specifically, officials told us that more information is

[2]According to the Remedial Project Manager, the administrative order of consent, among other things, involves the acquisition by New York City of three private properties along the eastern bank of the canal by eminent domain. This acquisition will result in the associated displacement of business operating at these properties. The order also includes the cooperation and coordination with the other major PRP at the site, National Grid, for excavation, contamination removal, and construction of the retention tank. EPA made the administrative order of consent available for public comment, with the public comment period ending on May 31, 2016. According to the Remedial Project Manager, comments received to date reflect the public's concern with the project delays caused as a result of New York City's selection of the location of the retention tank.

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needed related to the flow and movement of groundwater, sediment movement, and how to address 4.5 miles of bulkheads that needed to be stabilized along the canal while coordinating with the respective property owners. Officials stated that EPA's efforts to move quickly on this project could limit its cost-effectiveness. Furthermore, officials expressed concerns about EPA's plans to move ahead with the design and implementation of National Grid's portion of the remedy before the completion of the design of the contaminated sewer overflow's holding tanks.

Lower Passaic River

Background

The Passaic River was one of the major centers of the American industrial revolution beginning in the early 19th century. Industries, such as pharmaceutical and chemical manufacturers, and municipalities often discharged wastewater directly into the river. To date, more than 100 industrial facilities have been identified by EPA as potentially responsible for discharging a number of contaminants into the river, including, but not limited to, dioxins and furans; PCBs; PAHs; dichlorodiphenyltrichloroethane, or DDT, and other pesticides; and mercury, lead, and other metals. The Lower Passaic River is a section of the Passaic River that spans 17 miles from Newark Bay to the Dundee Dam in Garfield, New Jersey. According to EPA, contaminated sediment of the Lower Passaic River poses a significant threat to people's health and the health of wildlife that live in and along the river. The primary risks are from eating contaminated fish and shellfish from the river.

EPA's Cleanup Process and Decision

The Lower Passaic River cleanup effort is part of the EPA's cleanup of the Diamond Alkali Superfund site, a former manufacturing facility located in Newark, New Jersey, which began producing DDT and other products

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in the 1940s.[3] In 2004, EPA signed a settlement agreement with a group of eventually 70 PRPs at the site—the Cooperating Parties Group—in which the group agreed to pay for EPA to conduct the remedial investigation/feasibility study for the 17-mile area. In conducting these studies, EPA concluded that expediting the Superfund process for the lower 8.3 miles of the Lower Passaic River—which EPA refers to as the "lower eight miles"— would best support the overall protection of human health and the environment due to this area's containing the bulk of the contaminated sediment. As a result, EPA undertook a focused feasibility study to evaluate taking action to address the contamination in this area, while the study of the 17-mile area is ongoing. The proposed plan for the lower eight miles was released in April 2014, and a ROD was issued in March 2016. See figure 5 for a photo of a portion of the Lower Passaic River adjacent to the Diamond Alkali Superfund site.

[3]From the 1950s to 1960s, the facility was operated by the Diamond Alkali Company (later purchased by and merged into Occidental Chemical Corporation), which used the facility for the manufacture of the defoliant chemical known as "Agent Orange," among other products. After investigations by the state of New Jersey and the EPA, the site was listed on the EPA Superfund program's NPL in 1984. A cleanup plan for containment of the dioxin contamination at the land-based site was selected in 1987, which included a variety of strategies including capping, subsurface slurry walls to keep the contaminated material from moving, and a ground water treatment system. In 2001, the interim cleanup of the land-based site was completed.

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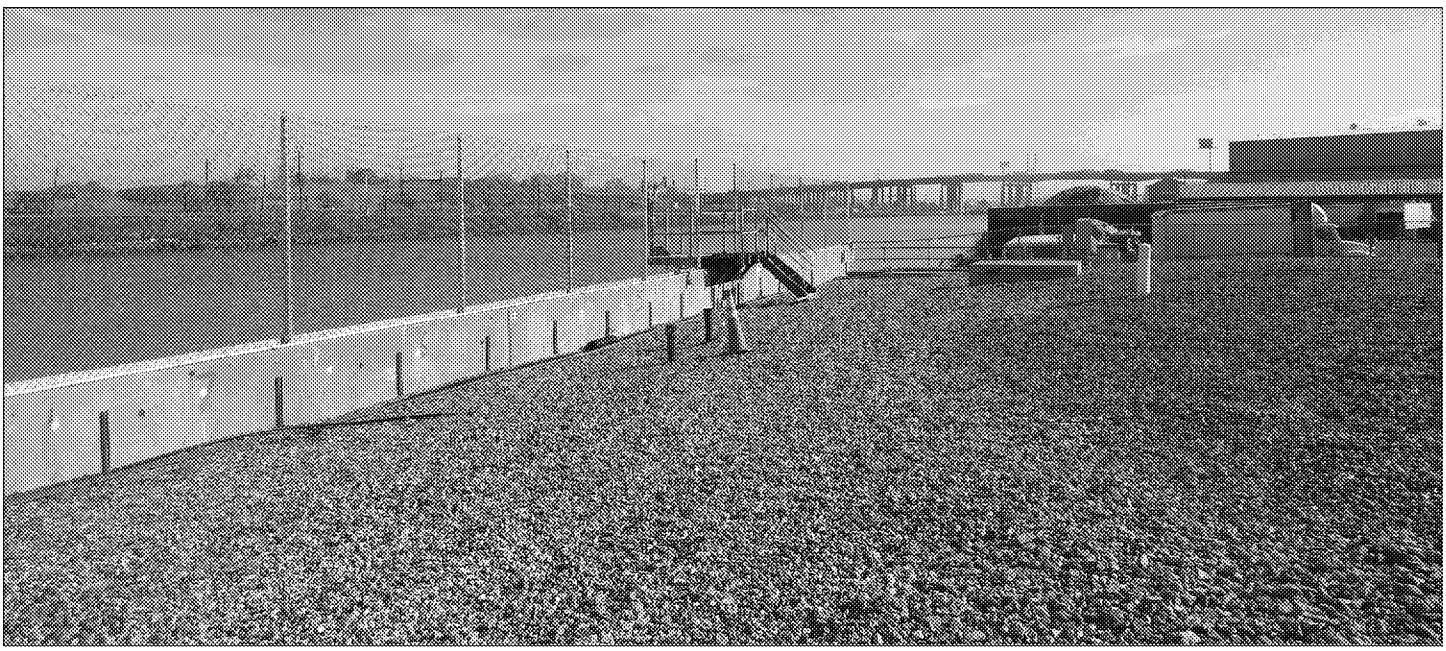
Figure 5: View of the Passaic River from the Diamond Alkali Superfund Site in Newark, NJ



Source: GAO. | GAO-16-777

CSTAG conducted its initial meeting at the site in February 2008, focusing on the remedial alternatives developed for the draft focused feasibility study, and made recommendations to Region 2 concerning how it addressed the 11 principles in developing and evaluating potential cleanup alternatives for the lower 8 miles. For example, CSTAG recommended that additional data be collected to better characterize the contaminant loads that enter the lower 8-mile area so that the region could more accurately estimate the long-term risk reduction in the lower 8 miles in conducting a focused cleanup of this area. A Region 2 official told us that as a result of CSTAG's recommendations, additional sampling was conducted in the river and delayed the Region's initial time frame for developing a proposed plan, but enhanced the quality of the information available for decision making. The Region responded to CSTAG's comments in May 2008. In December 2012, CSTAG and NRRB jointly reviewed Region 2's proposed remedy for the focused feasibility study area and provided formal recommendations to the Region in April 2014. For example, regarding the cost of the remedy, CSTAG and NRRB recommended that the Region reconsider the use of a less costly confined aquatic disposal cell—instead of the Region's preferred off-site disposal scenario. The Region responded in its formal comments to the groups in April 2014 that it did not find the selection of a confined aquatic

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disposal cell appropriate, despite its lower cost, given that the State of New Jersey was opposed to its use. Representatives from the site's Community Advisory Group also told us that they did not support the use of a confined aquatic disposal cell.

EPA's selected remedy for the lower eight miles of the Lower Passaic River involves the removal of 3.5-million cubic yards of contaminated sediment through bank-to-bank dredging of the river bottom. This remedy will involve the dredging of approximately 5 to 15 feet of contaminated sediment in the navigation channel in the 1.7 miles of the river closet to Newark Bay and approximately 2.5 feet everywhere else in the lower eight mile section. Following the removal of the sediment, a bank-to-bank cap will be placed over the dredged areas to isolate any potential remaining contaminated sediment. Removed sediment will be dewatered locally and transported off-site for disposal. Based on comments received in its proposed cleanup, EPA made modifications to its April 2014 proposal to bring the final cleanup plan in line with current and reasonably anticipated future commercial uses of the Lower Passaic River, while maintaining the level of protectiveness of the earlier cleanup proposal, according to an EPA document. The final plan will remove 0.8-million cubic yards less material from the river, due to a reduction in the amount of dredging that will be performed in the federal navigation channel. As a result, the final cleanup plan estimate is $350 million less than the April 2014 proposed plan, bringing the estimated cleanup costs from $1.73 billion to $1.38 billion.

Challenges Regarding the Cleanup of the Lower Passaic River Site

EPA officials in Region 2, including the Remedial Project Manager and the Community Involvement Coordinator; members of the Community Advisory Group; and representatives from the site's two groups of PRPs commented on challenges in the cleanup of the Lower Passaic River site. According to the EPA Remedial Project Manager, the 17-mile Lower Passaic River area is challenging from a technical perspective, given the extent of the contamination, and due to stakeholder involvement. With specific regard to stakeholder involvement, the official said that EPA's role in coordinating stakeholder involvement is challenging due to the number of involved stakeholders and interests. Furthermore, the official said there has been a need for stakeholder education on the part of EPA to inform interested parties on why the process to study and cleanup the site has taken so many years and to demonstrate that EPA's decision-making process on the site has been based in the framework of the remedial process. The site's Community Involvement Coordinator also stated that it is challenging to communicate to the community how EPA's

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use of models at this site fits into its plan for decision making, including why modeling is important and why modeling takes time. To improve EPA's dissemination of information to the community, EPA has provided the Community Advisory Group with a Technical Assistance Grant to hire an independent technical advisor to help the group understand the information provided by EPA to the group.

According to Lower Passaic Community Advisory Group's representatives, EPA has been transparent and inclusionary of the community when discussing the site, and the Group has benefited from the Technical Assistance Grant provided by EPA to allow the Group to examine critical aspects of the proposed plan and focused feasibility study to more effectively disseminate information to the community. Representatives told us that one challenge in addressing the site is involving a multi-lingual community in the remedial response process. EPA has helped to address this challenge by providing translation services at community meetings for speakers of Spanish and Portuguese.

Representatives from two groups of PRPs at the Lower Passaic site—Occidental/Tierra/Maxus and the Cooperating Parties Group—also stated that there have been challenges related to addressing the contamination at the site. For example, officials representing Occidental/Tierra/Maxus told us that there are challenges in the cleanup related to the control of sources. Specifically, PRP officials cited concerns that upland sources over the Dundee Dam—or the upper boundary of the 17-mile area—and sediments above and below EPA's lower eight mile section will re-contaminate the lower eight mile cleanup after capping.[4] In addition, these representatives expressed concerns that the focused feasibility study for the lower eight mile area underestimates the risk that a major storm event during remedy construction will spread currently buried sediments throughout the area, significantly increasing the risk relative to current exposures. Officials representing the Cooperating Parties Group also told us that a challenge to addressing the cleanup is that EPA has

[4]EPA Region 2 described in its Responsiveness Summary for the lower eight mile ROD that it addressed issues related to recontamination by developing a model to predict post-cleanup sediment concentrations. Based on the results of the model, EPA concluded that remediating the lower 8.3 miles first would result in less recontamination of the remediated portion of the river from the unremediated upper 9 miles than remediating the upper section first.

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set remediation goals lower than background concentrations that will not be able to be achieved due to the potential for recontamination from other sources. Both groups also expressed concerns related to the cleanup's cost, time frames, and consistency with other remedial decisions, among other things.

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Appendix IV: Major Cleanup Approaches for Sediment Cleanup and the Proposed or Planned Uses of these Approaches at Selected Sites Included in Our Review

There are three major cleanup approaches for managing sites with contaminated sediment, according to EPA's contaminated sediment guidance: monitored natural recovery, in-situ capping, and removal through dredging and excavation. Table 4 describes the characteristics of these approaches, including examples of their advantages and limitations, according to an EPA document. Table 5 provides information on the planned use of these cleanup approaches, as described in RODs, at Tier 1 sites included in our review. Table 6 provides information on the proposed or planned use of these approaches at Tier 2 sites included in our review, as described in proposed plans or RODs.[1] In addition to using these approaches, regions with Tier 1 or Tier 2 sites included in our review also described using additional approaches to address contamination in their proposed plans or RODs, such as a hybrid approach involving the thin layer placement of sand or other material to enhance recovery via natural deposition, or the use of institutional controls.[2] According to EPA, a final sediment remedy frequently combines more than one type of cleanup approach. At sites with multiple water bodies or sections of water bodies with different characteristics or uses, alternatives that combine a variety of cleanup approaches are frequently the most promising. The use of the three approaches may also range in their implementation based on site-specific characteristics, for example, removal of contaminated sediment through dredging may target "hotspots"—specific areas of elevated contamination—or address larger areas through bank-to-bank dredging. According to the National Research Council, no two Superfund sediment sites are identical and therefore the cleanup and risk-management strategy will vary from site to site.

[1]Regions responsible for 6 of the 12 Tier 2 sites included in our review had not issued proposed plans or RODs for these sites at the time of our review—Region 1's GE-Housatonic/Rest of River, Region 2's Berry's Creek Study Area and Newtown Creek, Region 3's Kanawha River, Region 4's Anniston PCB Site, and Region 5's Tittabawassee River, Saginaw River and Bay.

[2]Institutional controls are legal or administrative restrictions on land or water use to protect against exposure to the residual contamination.

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Table 4: Environmental Protection Agency's (EPA) Information on Major Cleanup Approaches for Contaminated Sediment, Including Characteristics, Advantages, and Limitations

Approach	Characteristics, advantages, and limitations
Monitored natural recovery	Uses ongoing, naturally occurring processes to contain, destroy, or reduce the toxicity of contaminants in sediment. • Advantages: relatively low implementation costs and non-invasive disruption to the existing environment. • Limitations: generally leaves contaminants in place and can be slow in reducing risks in comparison to more active cleanup approaches. Common community concerns include the long time frame for recovery and doubts about the effectiveness.
In-situ capping	Involves the placement of a subaqueous covering, or cap, of clean material over contaminated sediment that remains in place. Caps are generally constructed of granular material, such as clean sediment, sand, or gravel. • Advantages: quickly reduces the exposure of fish and other biota to contaminated sediment. Requires less infrastructure than dredging in terms of material handling, treatment, and disposal, among other things. • Limitations: contaminated sediment remains in the aquatic environment where contaminants could become exposed or dispersed if the cap is significantly disturbed. Common community concerns include the potential for increased flooding and the disturbance of aquatic habitats.
Dredging and excavation	Removes contaminated sediment from a water body either while it is submerged (dredging) or after water has been diverted or drained (excavation). Both methods typically require transporting the sediment to a location for treatment or disposal. • Advantages: removal of contaminated sediment can minimize the uncertainty about the long-term effectiveness of the cleanup, and can provide greater flexibility regarding the future use of the water body
	compared to other approaches. • Limitations: implementation is typically more complex and costly than other approaches because of high cost removal technologies and infrastructure needed for transport and disposal, among other things. Common community concerns include the potential for impacts on recreation and tourism, and noise, emissions, and lights from the treatment and disposal facilities.

Source: GAO summary of EPA information. | GAO-16-777

Note: See EPA, Contaminated Sediment Remediation Guidance for Hazardous Waste Sites, (Washington, D.C., 2005). According to EPA, at sites with multiple water bodies, sections of water bodies with different characteristics or uses, or differing levels of contamination, alternatives that combine a variety of approaches are frequently the most promising.

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Table 5: Major Cleanup Approaches Planned by Tier 1 Sediment Sites Included in Our Review

Region	Site name	Operable unit or section (if applicable)[a]	Major cleanup approaches		
			Monitored natural recovery	In-situ capping	Dredging or excavation
1	Callahan Mining Corporation	3			✓
2	Raritan Bay Slag	0			✓
3	Atlantic Wood Industries Inc.	3	✓		✓
4	Ward Transformer	1, Reach B, C, D, and Lower Brier Creek			✓
		1, Brier Creek Reservoir, Lake Crabtree and Lower Crabtree Creek	✓		
5	Outboard Marine Corporation	1		✓	✓
10	Lockheed West Seattle	1			✓

Source: GAO summary of EPA information. | GAO-16-777

Note: Other approaches, in addition to those noted in the table above, may be used by Superfund sediment sites to address contamination.

[a]Superfund sites may be divided into smaller parts, known as operable units.

Table 6: Major Cleanup Approaches Proposed or Planned by Tier 2 Sediment Sites Included in Our Review, with Proposed Plans or Records of Decision

Region	Site name	Operable unit or section (if applicable)[a]	Proposed or selected remedy	Major cleanup approaches		
				Monitored natural recovery	In-situ capping	Dredging or excavation
1	Nyanza Chemical Waste Dump	3	Selected			✓
		4	Selected	✓		
5	Allied Paper, Inc./Portage Creek/Kalamazoo River	5, Area 1	Selected	✓		✓
9	Montrose/Palos Verdes Shelf	5	Selected	✓	✓	
9	Pearl Harbor Naval Complex	Pearl Harbor sediment site	Proposed	✓		✓
10	Lower Duwamish Waterway		Selected	✓	✓	✓
10	Portland Harbor		Proposed	✓	✓	✓

Source: GAO summary of EPA information. | GAO-16-777

Note: Other approaches, in addition to those noted in the table above, may be used by Superfund sediment sites to address contamination.

[a]Superfund sites may be divided into smaller parts, known as operable units.

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Appendix V: EPA's 11 Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites

EPA issued a policy establishing a framework of 11 risk management principles to be considered at hazardous waste sites with contaminated sediment to help EPA regions make nationally consistent and scientifically sound decisions. The principles, developed in 2002, apply to all contaminants at sediment sites under CERCLA, including federal facilities, and are to be considered as the remedial project manager's plan and conduct site investigations, involve site stakeholders, and select and implement cleanup remedies.[1] EPA's policy setting forth the principles recognizes that the implementation of the principles should be tailored to the size and complexity of the site, the magnitude of site risks, and the types of cleanup actions under consideration. EPA's 11 principles include:

1. **Control Sources Early**—Identify all direct and indirect continuing sources of significant contamination to the sediments early in the cleanup process, assess which continuing sources can be controlled and by what mechanisms, and evaluate the potential for future recontamination of sediments when selecting a cleanup action.
2. **Involve the Community Early and Often**—Ensure early and meaningful community involvement by providing community members with appropriate technical information. While EPA has the responsibility to make final cleanup decisions at Superfund sites, early and frequent community involvement can facilitate the acceptance of the agency's decisions.
3. **Coordinate with States, Local Governments, Tribes, and Natural Resource Trustees**[2]—Communicate and coordinate early with states, local governments, tribes, and all Natural Resource Trustees to ensure that their perspectives are considered in the remedy selection process.

[1]EPA's policy also applies to all contaminants at sediment sites addressed under the Resource Conservation and Recovery Act. See EPA, *Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites,* (Washington, D.C.: 2002).

[2]Under CERCLA, a party responsible for the release of a hazardous substance is liable for injuries to natural resources resulting from the release. The regulations implementing the act designate certain federal agencies, state governments, and tribal authorities as Natural Resource Trustees, and the regulations authorize them to make claims against the parties responsible for the injuries. The federal trustees include the Department of the Interior, the Department of Commerce's National Oceanic and Atmospheric Administration, and the Department of Agriculture's Forest Service.

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4. **Develop and Refine a Conceptual Site Model That Considers Sediment Stability**—Develop a conceptual site model that identifies, among other things, all known and suspected sources of contamination, the types of contaminants and affected media, and the known or potential human and ecological endpoints that may be at risk. A conceptual site model can be in pictorial or graphical form and should be periodically updated with new information.
5. **Use an Iterative Approach in a Risk-Based Framework**—An iterative approach is defined broadly to include cleanup approaches that incorporate testing of hypotheses and conclusions and foster re-evaluation of site assumptions as new information is gathered.
6. **Carefully Evaluate the Assumptions and Uncertainties Associated with Site Characterization Data and Site Models**—Evaluate and describe the uncertainties and limitations of site characterization data and qualitative or quantitative models to extrapolate site data to future conditions, and describe the basis for all models used and their uncertainties when using predicted results to make site decisions.
7. **Select Site-Specific, Project-Specific, and Sediment-Specific Risk Management Approaches That Will Achieve Risk-Based Goals**—EPA has no assumed remedy for any contaminated sediment site, regardless of the contaminant or level of risk; therefore, at many sites a combination of remedy options will likely be the most effective way to manage the site's risk.
8. **Ensure That Sediment Cleanup Levels Are Clearly Tied to Risk Management Goals**—Use measurable indicators of exposure to ensure that human health or ecological risk-reduction goals are being met, such as direct measurements of indigenous fish tissue concentrations or estimates of wildlife reproduction.
9. **Maximize the Effectiveness of Institutional Controls and Recognize Their Limitations**—Institutional controls, such as fish consumption advisories and waterway use restrictions, may be used to limit human exposures to a site; however, site managers should ensure that complementary tools, such as public education campaigns, are also used to address potential limitations.
10. **Design Remedies to Minimize Short-term Risks while Achieving Long-term Protection**—While some increase in short-term risks may be necessary to achieve a long-lasting, protective solution, remedies should be designed to minimize short and long-term impacts related to risk or societal and cultural practices.

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11. **Monitor during and after Sediment Remediation to Assess and Document Remedy Effectiveness**—Establish a physical, chemical, or biological monitoring program to determine if short-term and long-term health and ecological risks are being adequately addressed at the site and to evaluate whether cleanup objectives are being met.

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Appendix VI: Comments from the Environmental Protection Agency

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

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OFFICE OF
SOLID WASTE AND
EMERGENCY RESPONSE

NOW THE
OFFICE OF LAND AND
EMERGENCY MANAGEMENT

Mr. Alfredo Gomez
Director
Natural Resources and Environment
U.S. Government Accountability Office
Washington, DC 20548

Dear Mr. Gomez:

Thank you for the opportunity to review and comment on the U.S. Government Accountability Office's (GAO) draft report, *Superfund Sediment Sites: EPA Considers Risk Management but Could Clarify Certain Procedures*. This letter provides the U.S. Environmental Protection Agency's (EPA) response to GAO's draft report findings, conclusions and sole recommendation.

The GAO found that EPA generally follows Agency steps for providing national consistency in its contaminated sediment site managment activities. The draft report contains an acknowledgment that EPA faces two main challenges in managing those activities: (1) technical complexities, including the use of sampling techniques and modeling, and (2) stakeholder involvement, including differing opinions, competing interests and varying levels of knowledge of the Superfund process. These challenges are consistent with those identified by EPA officials during GAO interviews. An additional GAO finding was that the Agency's Contaminated Sediments Technical Advisory Group's (CSTAG) operating procedures do not clearly describe what type of information EPA regional offices should provide to the CSTAG prior to Tier 2 site update meetings. EPA concurs with this recommendation and outlines below the Agency's proposed actions to implement it.

Although EPA has no significant comments on the GAO findings and conclusions, the Agency suggests that the GAO make the following corrections to the draft report:

P 11, line 12: change to: "... in the detailed analysis of the ~~remedial investigation and~~ feasibility study phase..."

P. 16, line 6: change to: "...or 5 acres of *contaminated* ~~contained~~ sediment..."

P. 18, line 4: change to: "... documentation *should* ~~must~~ be submitted..."

P. 22, line 2: change to: "... where the group *is going to issue* ~~has issued~~ recommendations....."

P. 28, line 12: change to: "Headquarters officials note that although *some type of predictive model needs to* ~~a model must~~ be used..."

P. 41, line 19: change to: "... by mixing with *portland cement* ~~concrete~~ or similar materials..."

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GAO Recommendation for Executive Action

To ensure that CSTAG's information needs are met for update meetings, we recommend that the EPA Administrator direct CSTAG to clarify in its operating procedures what type of information and documentation, if any, should be prepared by regional offices and provided to CSTAG members in advance of these meetings.

EPA Response

EPA agrees with this recommendation and will revise the CSTAG operating procedures to clearly describe the types of information and data that the regional offices need to provide the CSTAG before the Tier 2 site update meetings. The depth of information the CSTAG requires will vary depending on when during a site's remedial investigation/feasibility study process an update meeting occurs; but for each update meeting, the CSTAG will communicate to the region its specific information needs.

Thank you for the opportunity to review the draft report. If you have any questions or need additional information, please contact Stephen Elis at 703 603-8822.

Sincerely,

Mathy Stanislaus
Assistant Administrator
Office of Land and Emergency Management

cc: EPA GAO Liaison Team

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Appendix VII: GAO Contact and Staff Acknowledgments

GAO Contact

J. Alfredo Gómez, (202) 512-3841 or gomezj@gao.gov.

Staff Acknowledgments

In addition to the contact named above, Janet Frisch (Assistant Director), Richard Burkard, Greg Carroll, John Delicath, Cindy Gilbert, Armetha Liles, Emily Ryan, and Kiki Theodoropoulos made key contributions to this report.

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