# Superfund 2017

## Cleanup Accomplishments and the Challenges Ahead

Katherine N. Probst

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This paper was commissioned by the American Council of Engineering Companies (ACEC). In the summer of 2016, members of the ACEC Superfund Study Work Group decided that they wanted to fund an independent white paper on the status of the Superfund remedial program and contacted me to see if I would be willing to undertake such a project. By contract, I was assured that I would have complete independence regarding the paper. I greatly appreciate the support of the members of the ACEC Superfund Study Work Group and their adherence to the terms of the contract. The analysis, conclusions, and recommendations in the paper are mine, and mine alone, and do not represent the views of ACEC nor of any other organization.

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Finally, any errors or omissions are those of the author.

Kate Probst

# Executive Summary

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), better known as "Superfund," is now in its 37th year. At the start of a new presidential administration it is timely, once again, to review the progress of the Superfund remedial program aimed at cleaning up sites on the National Priorities List (NPL). The NPL is the list of sites where federal funds can be used to pay for remedial actions or more colloquially, what are referred to as long-term cleanups. The NPL has become synonymous with those sites that are the highest priority in the country: contaminated areas warranting federal funding, federal enforcement action, or both.

The purpose of this paper is to provide information on the overall progress of the remedial program, looking at both the number and types of sites added to the NPL since FY 2000 as well as at key measures of program success. Program funding is also examined as one of the questions that has plagued the program for many years is whether Congress is appropriating adequate funds to ensure the timely cleanup of sites. This paper focuses on sites on the NPL that are not owned or operated by federal agencies (referred to as "non-federal" NPL sites) from FY 2000 through FY 2016; proposed NPL sites, federal facilities, and Superfund alternative sites are not addressed. Where appropriate, actual EPA expenditures and accomplishments are compared with the estimates that were presented in a 2001 Report to Congress, *Superfund's Future: What Will It Cost?,* published by Resources for the Future (RFF).[1] All dollar amounts are in constant 2016 dollars unless otherwise noted.

It is hoped that the information presented here will lead to a more informed debate about the future of the Superfund remedial program.

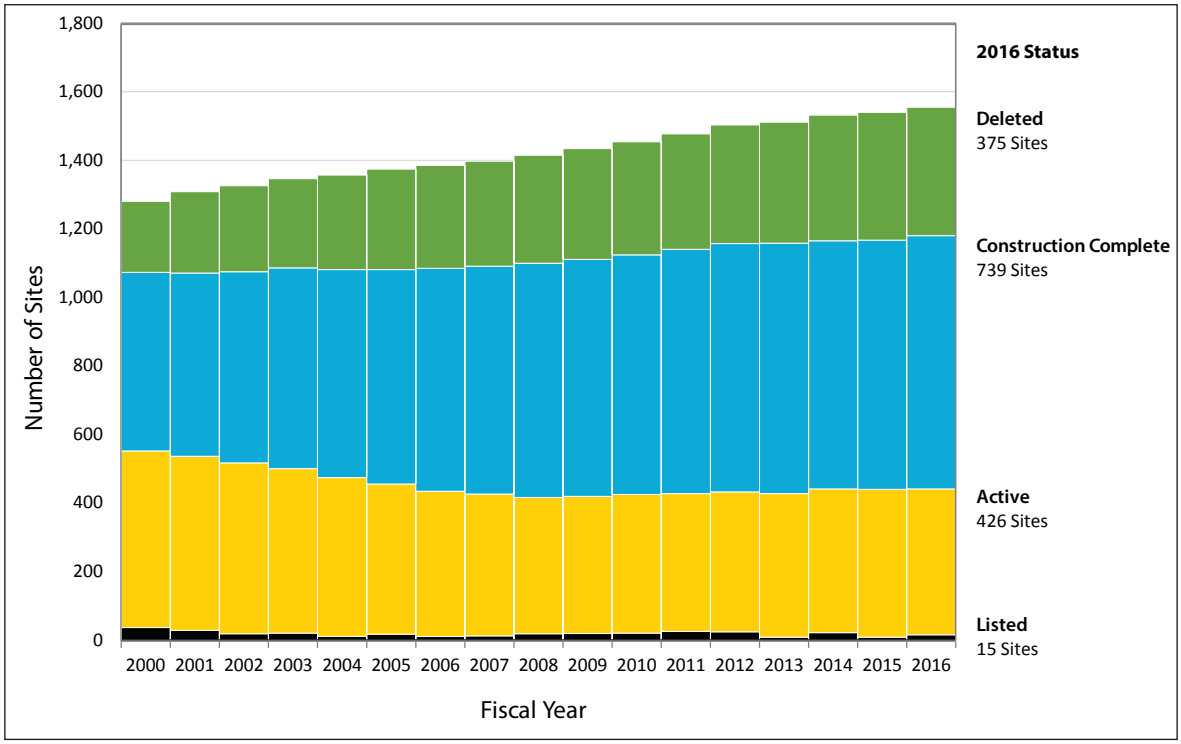
## Superfund Snapshot

1. **Over two-thirds of the 1,555 non-federal sites on the NPL at the end of FY 2016 either have been deleted from the NPL (meaning that all response actions are complete and all cleanup goals have been achieved) or are construction complete (meaning all remedies have been constructed).**

As of the end of FY 2016, 24% (375) of non-federal NPL sites had been deleted from the NPL and another 48% (739) were construction complete but not deleted, meaning that all remedies have been constructed but all cleanup objectives have not

1. *Superfund's Future: What Will It Cost? A Report to Congress*, Katherine Probst et al., Resources for the Future, 2001, Washington, DC.

Figure ES-1. **Cumulative Status of Non-Federal NPL Sites, FY 2000–FY 2016**




*Source*: U.S. EPA

been achieved (see Figure ES-1). The remaining 28% (441) of sites (those identified as "active" and "listed" in Figure ES-1) are in some stage of the remedial pipeline and require additional EPA work or oversight. More detailed information on the number and cost of future site actions—as well as whether the costs will be borne by EPA or PRPs—is needed to estimate future EPA workload and funding needs.

2. **There are some non-federal NPL sites where human exposure is not under control.**

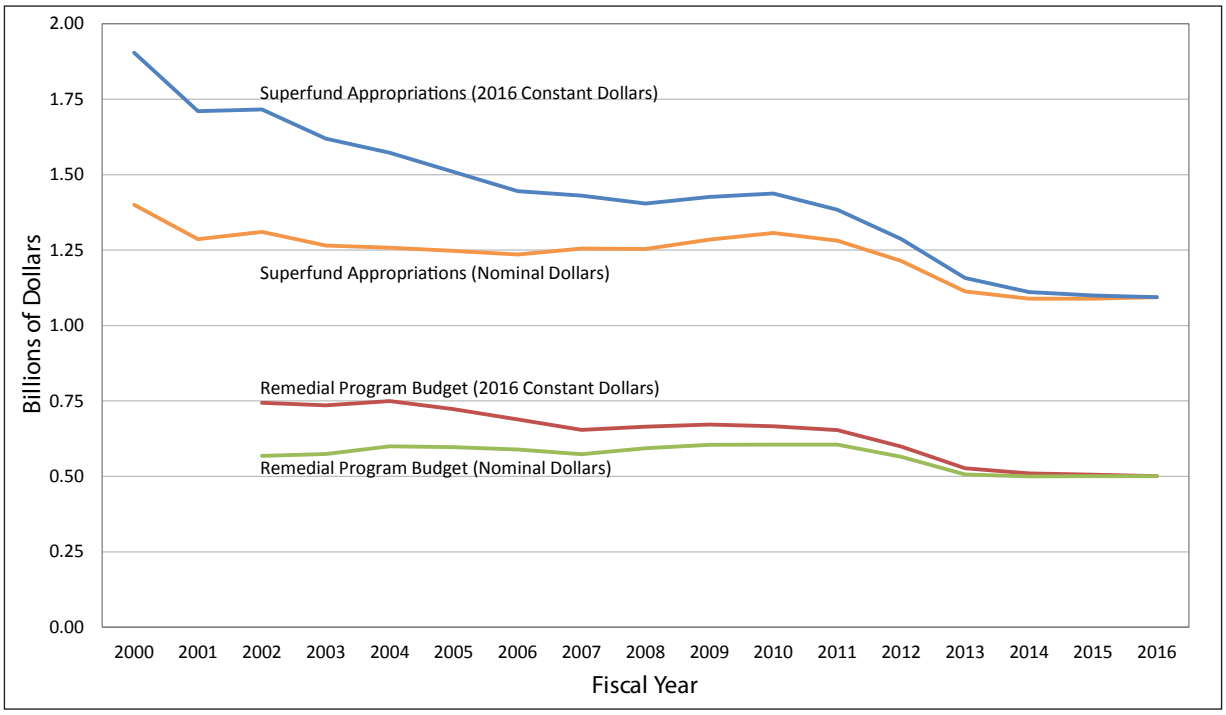
Seven percent of non-federal NPL sites were categorized by EPA as "human exposure not under control" at the end of FY 2016. At another 10% of these sites, there was insufficient data to determine whether human exposure was under control or not. This indicator is not precise because it is determined on a site-wide basis: Designating a site as having human exposure not under control could indicate that only a small portion of a site has contamination that is not under control, or it could mean that most of the site has uncontrolled contamination. Thus, more information is needed to determine the extent of concern at these sites.

## Conclusions

1. **Funding for the Superfund program has declined markedly since FY 2000, and it appears that the remedial program is facing a funding shortfall.**

In constant 2016 dollars, annual Superfund appropriations declined from a high of $1.9 billion in FY 2000 to a low of $1.09 billion in FY 2016, a decrease of 43% in real dollars, as shown in Figure ES-2 (next page). Not surprisingly, funding

Figure ES-2. **Superfund Appropriations and Remedial Program Budget in Constant and Nominal Dollars, FY 2000–FY 2016**




*Source*: U.S. EPA

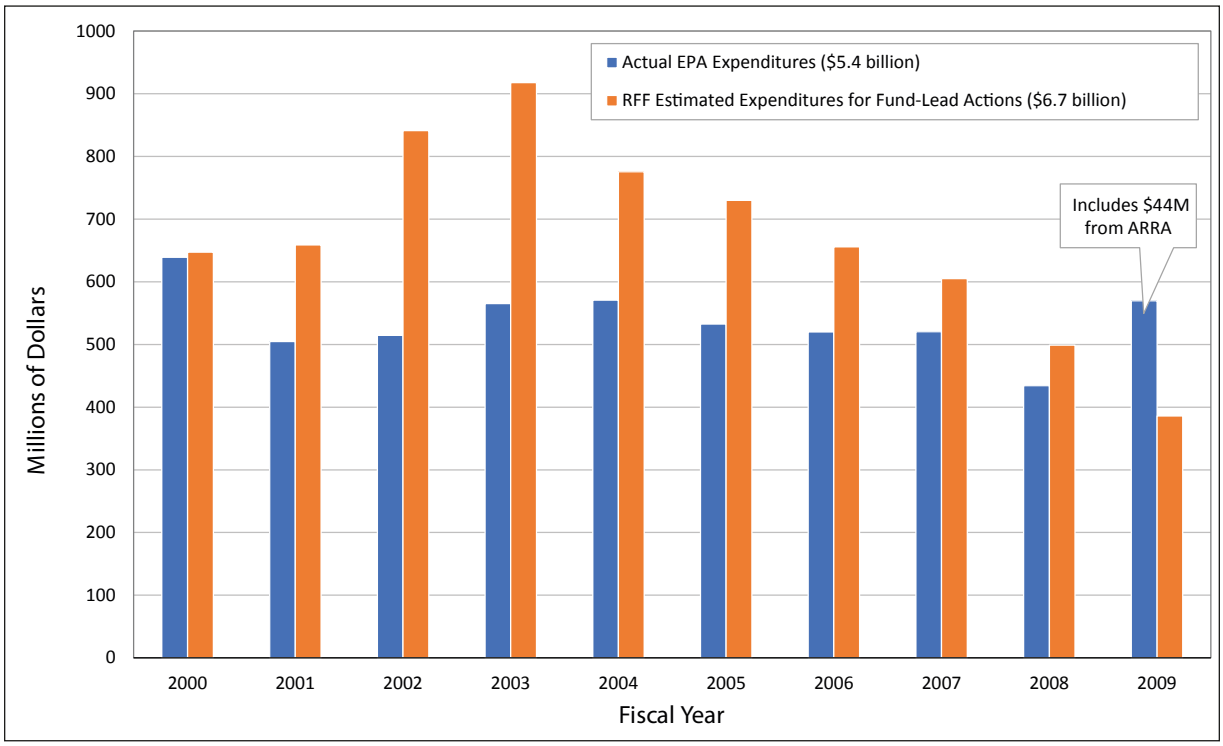
*Notes*: Funds from the American Recovery and Reinvestment Act (ARRA) of 2009 that were allocated to the Superfund program in FY 2009 are not included in the Superfund appropriations in this figure. Information on the remedial program budget is not available for FY 2000 and FY 2001.

for the remedial program declined as well, from a high of $749 million in FY 2004 to a low of $501 million in FY 2016, a decrease of 33% in constant dollars, as shown in Figure ES-2.

Due to lack of funding, EPA has had to delay the start of some cleanups for 14 out of the past 17 years. Over the past five years, the end-of-year funding shortfalls for remedial action projects have averaged $67 million in constant dollars. Most likely, this is only the tip of the iceberg in terms of underfunding as unfunded remedial action starts are among the easiest items to track. Much more difficult to quantify are more subtle results of funding constraints: sites not added to the NPL, site study and remedial projects spread out over a longer time-period, and other less visible actions not taken or delayed due to lack of resources.

A comparison of actual EPA expenditures with the estimates developed in the RFF model presented in *Superfund's Future* shows a major shortfall**.** Over the period from FY 2000 though FY 2009 (the period addressed in the RFF report), EPA expenditures for the cost of all EPA-lead actions at non-federal NPL sites were almost 20% lower than the estimates in the RFF model. Actual EPA expenditures over these 10 years were $5.4 billion in 2016 dollars while the RFF model estimated that EPA expenditures would total $6.7 billion. (See Figure ES-3, next page.)

Figure ES-3. **Actual EPA Remedial Expenditures vs. RFF Estimated Expenditures in Constant 2016 Dollars, FY 2000–FY 2009**




*Source*: Actual EPA expenditures are from, GAO-15-812 Report, Figure 5; RFF estimated expenditures are from *Superfund's Future*, Table H-1 (base case), p. 256, and Table H-5, (low case), p. 259, reduced by 22% to adjust for that fact that approximately 22% fewer sites were added to the NPL from FY 2000 through FY 2009 than was assumed in the low case.

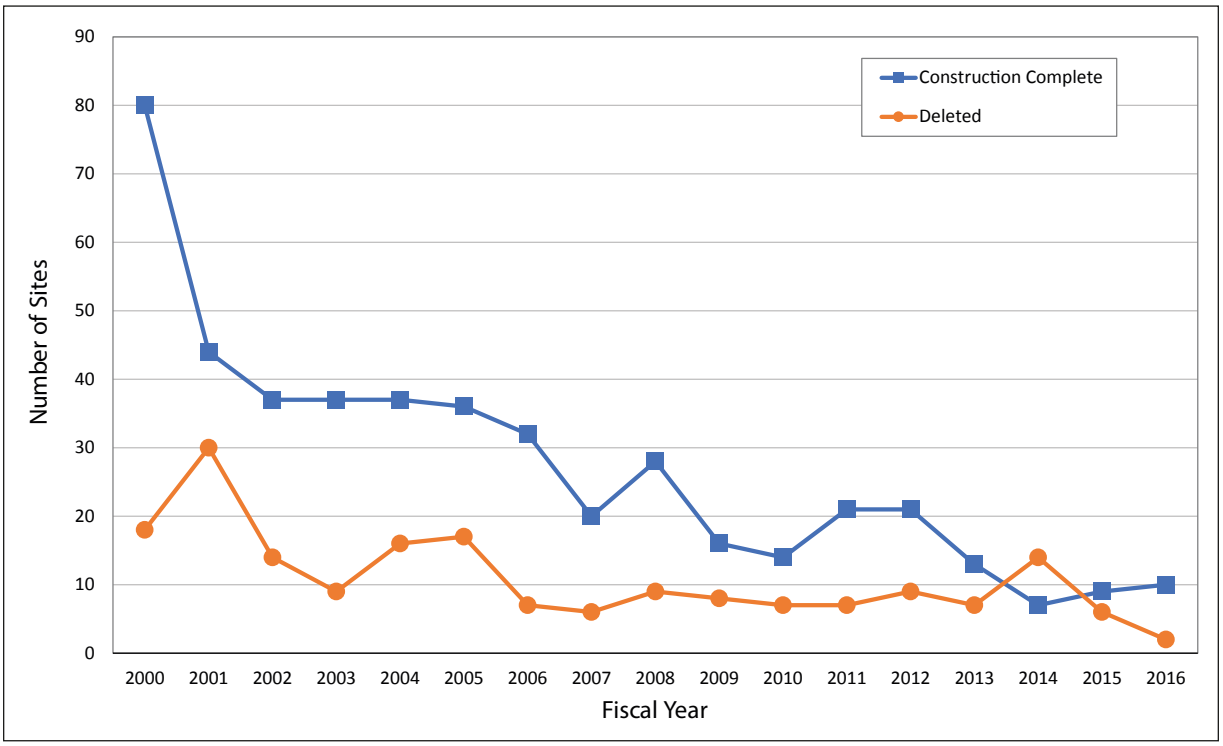
**2. Cleanup progress has slowed in recent years.**

Since the beginning of FY 2000, 462 non-federal NPL sites have achieved construction complete status, an average of 27 a year. The average dropped to 12 sites a year for the five years from FY 2012 through FY 2016, when only 60 sites were designated construction complete. Since the beginning of FY 2000, a total of 186 non-federal sites were deleted from the NPL, an average of just under 11 sites a year; since FY 2012, that average has decreased to eight deletions a year. (See Figure ES-4, next page.)

A comparison with the estimates in *Superfund's Future* again shows a shortfall. The actual number of non-federal NPL sites designated construction complete over the ten years from FY 2000 through FY 2009 was 367; the model in *Superfund's Future* predicted that 550 sites would achieve this measure over that same period. Thus, almost one-third fewer non-federal NPL sites achieved construction complete status from FY 2000 through FY 2009 than was predicted in the RFF model, which assumed that the remedial program was fully funded.

There is a pressing need to better understand what factors have led to the slowdown in cleanup progress and what steps could be taken to address this

Figure ES-4. **Number of Non-Federal NPL Sites Construction Complete and Deleted Each Year, FY 2000–FY 2016**




*Source*: U.S. EPA

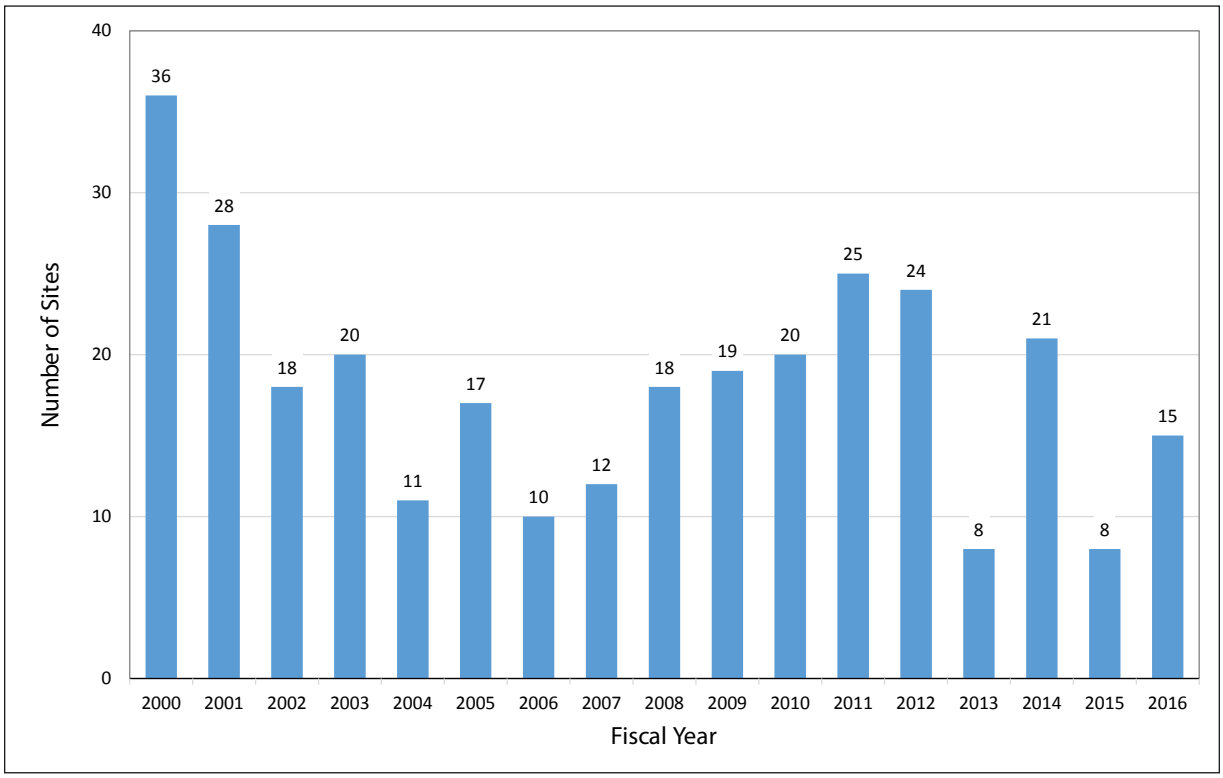
issue. While funding constraints are almost certainly a factor, there are other possible causes that should be evaluated, including whether there are more effective ways to deploy EPA staff and dollars, whether PRPs are implementing their cleanup obligations in a timely manner, and whether the technical challenges presented by certain types of sites and contamination make it impossible, at some sites, to speed action and achieve key program metrics.

3. **There is still a need for the federal Superfund program. Not only is there more work to be done to complete cleanup at current non-federal NPL sites, but new sites continue to be added to the NPL each year.**

There is still a sizeable amount of work to be done to complete cleanup at non-federal sites on the NPL. Four hundred and forty-one of the 1,555 non-federal sites on the NPL at the end of FY 2016 either have remedies underway that need to be completed, remedies yet to be started, or both. In addition, sites that are construction complete but not deleted from the NPL also require federal resources, which can be substantial for sites with long-term response actions.

In addition, new sites continue to be added to the NPL each year. Sites added to the NPL typically fall into one or more of the following categories: The site is complicated from a technical standpoint, cleanup is expected to be expensive, there are no financially viable or cooperating PRPs, the state does not

Figure ES-5. **Number of Non-Federal Sites Added to the NPL by Year, FY 2000–FY 2016**



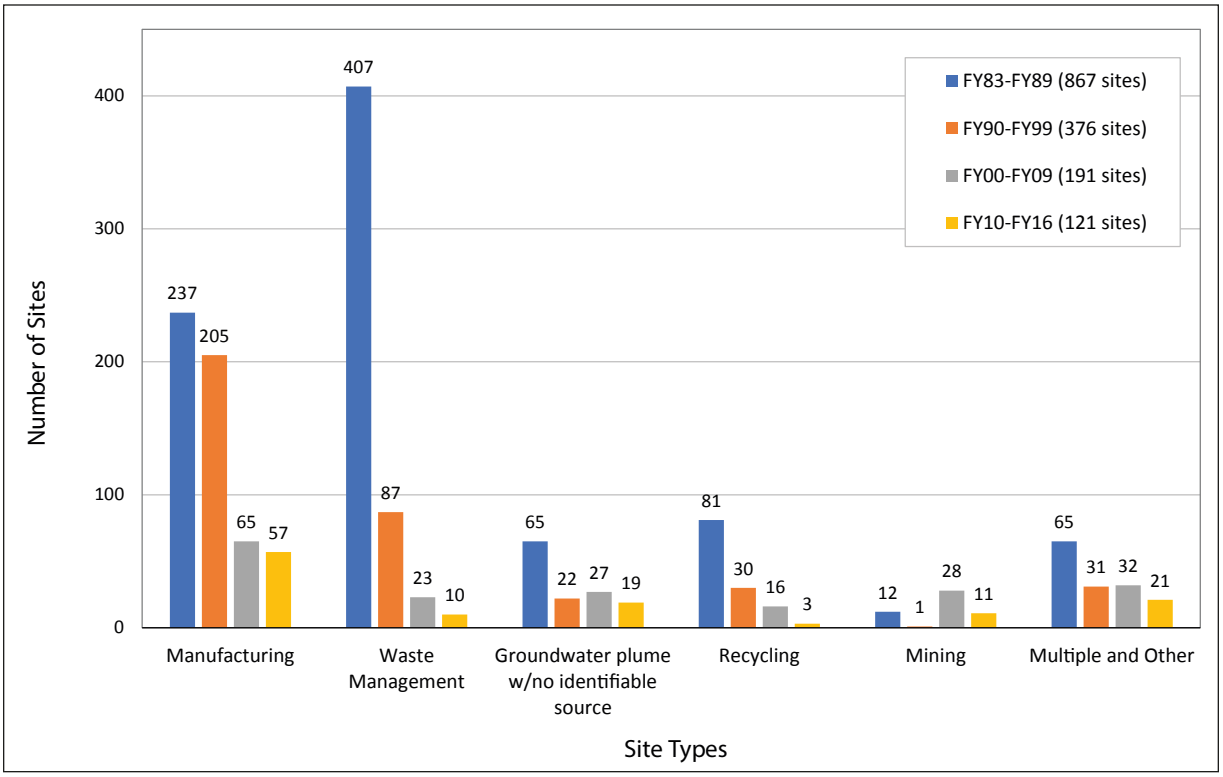

*Source*: U.S. EPA

have adequate funds to address the site, the site has recalcitrant PRPs and the state lacks the necessary resources and legal authority needed and seeks federal enforcement, or the site is high-profile and has hit the front page of the national newspapers.

Since FY 2000, a total of 310 non-federal sites were added to the NPL, an average of 18 per year. As shown in Figure ES-5, over the past 17 years the number of non-federal sites added to the NPL has ranged from a low of eight in FY 2013 and FY 2015 to a high of 36 in FY 2000. Over the last seven years, EPA added 121 sites to the NPL, an average of 17 sites per year. This is only a small decrease from the average number of non-federal sites (19) added to the NPL each year from FY 2000 through FY 2009.

EPA costs and workload are driven not only by the number of sites added to the NPL but also by the types of sites added, which have changed over time. As shown in Figure ES-6 (next page), before FY 1990, waste management facilities constituted the largest category of sites added to the NPL. From FY 1990 on, manufacturing sites were the largest single category of new NPL sites. Mining sites and contaminated sediment sites are among the most challenging and expensive sites to remediate. Of the 52 mining sites on the NPL at the end of FY 2016, more than half were added during the 10 years from FY 2000–FY 2009.

Figure ES-6. **Number of Non-Federal Sites Added to the NPL by Type: Comparison Over Time**




*Source*: U.S. EPA

4. **Better information on the basic building blocks of the Superfund remedial program is needed.**

There is a lack of publicly available information on the cost of cleanup for non-federal NPL sites, the cost and duration of each major phase of the remedial pipeline, the types of sites being added to the NPL, and many of the critical "building blocks" that would be needed to estimate EPA's future funding and staffing needs. In some cases, it appears EPA has not analyzed its own data to develop these estimates, and in other cases, EPA has not collected the kind of consistent and reliable information that is needed.

## Recommendations

Sound decisions about the future direction and funding of the Superfund remedial program require better information and data, and a commitment by EPA to analyze that data and make the results public. Below are a series of recommendations for specific studies and actions that should be implemented by EPA. In some cases, EPA should consider contracting out this work to ensure the independence and credibility of the results.

It should be noted that while the program may face staff and funding constraints, none of the recommendations below would require a large amount

of time or money to implement, and all would contribute to better-informed decisions within EPA, and a better-informed debate with Congress, states, and members of the public. More detail about each of the recommendations below can be found in the final section of this paper.

1. **EPA should estimate the future cost of completing work at all non-federal sites on the NPL.** This estimate, and the assumptions behind it, should be made public and should be updated on an annual basis.
2. **EPA should develop credible and robust data about the critical building blocks of the Superfund remedial program.** These data should include the average cost of each step of the remedial program for all sites and for individual site types, as well as the average duration of each step in the process and whether the duration differs when the action is implemented by EPA as compared to PRPs.
3. **EPA should develop better information on the types of sites listed on the NPL.** The agency should issue two reports describing:
    a. The types of sites that have been added to the NPL in the past five years and the specific attributes that led to these sites needing federal attention; and
    b. The types of sites most likely to be added to the NPL in the future, based on historical data, current trends, and interviews with regional EPA and state agency officials.
4. **In addition to reporting program accomplishments for all NPL sites as a group, EPA should report progress for specific subsets or categories of sites and actions.** For example, site progress should be reported separately for PRP-lead versus EPA-lead actions, for mega sites, and for mining and contaminated sediment sites.
5. **Better Superfund metrics are needed.** New metrics should be judged by whether they provide useful information that increases understanding of site progress and the obstacles to progress, not by whether they will result in a larger number of the items being counted ("more beans").
6. **EPA should issue a report detailing what actions are needed to reduce possible human exposure to contamination at non-federal NPL sites where a site is characterized as having human exposure or groundwater migration that is "not under control."**
7. **EPA should commission an independent analysis of the financial capacity and legal authorities of state Superfund programs.** This report should be conducted in coordination with the Association of State and Territorial Solid Waste Management Officials (ASTSWMO) and potentially with the Environmental Council of the States or the National Governors Association.

All the analyses and studies that are recommended should be made public and should be updated every few years, if not annually.

## Introduction

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), better known as "Superfund," is now in its 37th year. It was signed into law by President Jimmy Carter on December 11, 1980.[1] The goal of the act was to provide funding and authority for the U.S. Environmental Protection Agency (EPA) to clean up sites contaminated with hazardous substances. The law created a two-pronged approach to site cleanup. First, CERCLA created a powerful liability scheme to compel former and current owners and operators of contaminated sites (the "potentially responsible parties" or PRPs) to pay for and clean up sites themselves. Second, it created a designated trust fund to pay for site studies and cleanups where responsible parties could not, or would not, perform the work themselves. Authorization for the taxes that were the primary source of revenue for the trust fund expired at the end of 1995; since FY 2004, the vast majority of annual appropriations for the program has come from general revenues.[2] Federal funds may be used to pay for remedial actions (typically referred to as "cleanups") *only* at sites that are placed on EPA's National Priorities List (NPL).

At the start of a new presidential administration it is timely, once again, to review the progress of that part of the Superfund program aimed at cleaning up sites on the NPL—the remedial program. The purpose of this paper is to provide information on the overall progress of the remedial program, looking at both the number and types of sites added to the NPL since FY 2000 as well as at key measures of program success. Information on program funding for the past 17 years is also included, as one of the questions that has plagued the program for many years is whether Congress is appropriating adequate funds to ensure the timely cleanup of NPL sites. This paper focuses on the cleanup of sites on the NPL that are not owned or operated by federal agencies (referred to as "non-federal" NPL sites) from FY 2000 through FY 2016.[3]

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1. CERCLA was amended by the Superfund Amendments and Reauthorization Act in 1986.

2. After the funds are appropriated to EPA, no distinction is made between "trust fund monies" and "general revenues." Funds deposited in the Superfund Trust Fund include fines, penalties, cost recoveries from responsible parties, and interest accrued on the balance of the fund. In FY 2016, 74% of the annual appropriation of $1.09 billion came from general revenues and 26% came from the Trust Fund.

3. Federal facilities are sites that are owned or operated by a federal agency, such as the Department of Energy or Department of Defense. Cleanups at these sites are implemented and paid

The paper is organized into the following sections:

- Superfund Remedial Program Overview
- Superfund Snapshot: Status of Non-Federal NPL Sites at the End of FY 2016
- Trends in NPL Listing
- Cleanup Progress Over Time
- Funding Over Time
- Conclusions and Recommendations

Where relevant, the paper includes a comparison between actual EPA data and estimated future funding needs and program accomplishments that were forecast in Resources for the Future (RFF) report, *Superfund's Future: What Will It Cost? A Report to Congress*, which was issued in 2001.[4] This report was requested as part of the conference report that accompanied the FY 2000 Departments of Veterans Affairs and Housing and Urban Development, and Independent Agencies appropriations bill. The request asked the authors to estimate the amount of money EPA would need in order to implement the Superfund program for the 10 years from FY 2000 through FY 2009. As part of that work, the authors estimated annual total program costs, annual costs of actions taken by EPA at non-federal NPL sites, and the number of sites where the construction of the remedy would be completed each year. These estimates provide a useful point of comparison to EPA's actual accomplishments and funding over the same time period. The author of this paper was the lead author and project director of *Superfund's Future*.

A few aspects about the approach taken in this paper are worth noting:

- All data on the program are as of the end of FY 2016 unless otherwise noted; actions implemented since then are not included.
- All data are for non-federal final and deleted NPL sites; data on federal facilities, proposed NPL sites, and Superfund alternative sites are not included.
- All data on the program were either provided by EPA (the Superfund program), obtained from the EPA website, or are from published documents.
- All appropriations, budget, and cost data have been converted to 2016 constant dollars, for ease of comparison, unless otherwise noted.[5]

Due to time and resource constraints, three important elements of the Superfund program are not addressed:

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for by the agency responsible. The costs of remediating these sites are not part of the EPA Superfund budget, nor part of Congressional appropriations to EPA. The cost of EPA oversight of federal facility cleanups does come out of EPA appropriations.

4. Probst et al., *Superfund's Future: What Will It Cost? A Report to Congress* (Washington, DC: Resources for the Future, 2001).

5. The GDP deflator was used to convert 1999 through 2015 nominal dollars to constant 2016 dollars; see https://www.bea.gov/index.htm. Appendix A includes a table of the deflators used for each year.

1. The removal program, which allows EPA to address imminent threats by, for example, providing alternative drinking water, removing leaking barrels, or fencing off a site;[6]
2. The enforcement program, whereby EPA enters into a settlement agreement with PRPs who agree to pay for and implement site cleanup activities themselves, and also seeks to compel recalcitrant parties to pay for their share of cleanup costs; and
3. The role of state and tribal governments in NPL cleanups.

## Superfund Remedial Program Overview

The NPL is the list of sites where federal funds may be used to pay for remedial actions or what are referred to colloquially as long-term cleanups. The NPL has become synonymous with those sites that are the highest priority for cleanup in the country—contaminated areas warranting federal attention either for federal enforcement action, federal funding, or both. Since the beginning of FY 2001, EPA and state agencies have investigated more than 18,000 non-federal sites to assess whether they needed to be addressed either by states or by EPA.[7] At the end of FY 2016, there were 1,555 final and deleted non-federal sites on the NPL.[8]

Sites placed on the NPL are quite diverse in terms of industrial operations, historic uses, average cleanup cost, and who pays for cleanup. The types of sites commonly found on the NPL include: chemical manufacturing, metal fabrication, mining, wood preserving operations, as well as commercial and on-site recycling and waste management facilities, among others. Not surprisingly, the types of non-federal sites added to the NPL has changed over time. In the early years of the program, the largest category of sites on the NPL was waste management sites. Since then, manufacturing sites have become the largest single category. Very few mining sites were placed on the NPL before FY 2000. Some sites are defined more by the media that is contaminated—such as sediments or groundwater—than by the industrial operation, disposal practices, or other conditions that caused the contamination.

NPL sites are typically divided into multiple projects, referred to as operable units (OUs), and most sites have more than one OU. Each OU at a site goes through the same process, referred to as the remedial pipeline: site study (the remedial investigation/feasibility study); remedial design; remedial action; and,

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6. Removal actions are generally of shorter duration and lower cost than remedial actions, although this is not always the case. Many sites on the NPL are subject to removal actions before a longer-term remedial cleanup is implemented. Sites do *not* need to be on the NPL to obtain federally-funded removal actions

7. Data provided by U.S. EPA. The overwhelming majority of the sites assessed did not warrant any kind of federal action.

8. A small number of sites not on the NPL are addressed by EPA under the "Superfund Alternative" approach.

if needed, long-term response action (which is often groundwater pump and treat) as well as operation and maintenance activities. Many NPL sites have more than one OU, and thus most sites go through the remedial pipeline more than once. Only when *all* remedial actions at a site have been fully implemented is a site declared "construction complete," which is one of the two major progress milestones for NPL sites. "Construction complete" means that all remedies at the site have been constructed. The second major milestone occurs when a site is formally deleted from the NPL.[9] A site can only be deleted from the NPL when all the remedies have been constructed *and* all the cleanup objectives at the site have been achieved—a much more challenging metric.

The total time to reach the construction complete phase is a lengthy process. According to a 2009 U. S. Government Accountability Office (GAO) report, the median length of time from when a site was proposed to the NPL to when it was deemed construction complete was 10 years for all sites, and almost 15 years for sites with more expensive cleanups.[10] It is worth noting that there are several sites that were added to the NPL in 1983, with the first set of sites listed, that are yet to achieve construction complete status. Many sites require long-term operation and maintenance after the final remedy is constructed, and it could be decades before the cleanup objectives for a site are reached and it can then be deleted from the NPL. There may, in fact, be some sites with such intractable contamination that they may never be taken off the NPL, or at least, not for many decades.

Site investigations and cleanups can be implemented either by EPA or by potentially responsible parties, referred to as PRPs, or by a combination of the two. Typically, but not always, the party that is implementing the activity is the same party that is paying for it. At any individual site, some steps in the process might be implemented and/or paid for by EPA, and other steps by PRPs. The lead for remedial program activities can—and sometimes does—go back and forth between EPA and responsible parties. While information on the cost of EPA site studies and cleanups has been made public by EPA and in independent published reports, responsible parties are not required to disclose their costs at NPL sites and there is little publicly available information on the actual cost of PRP-lead actions. Thus, all information on the average cost of site cleanups is based on the cost of EPA activities.[11] Who pays for each stage of the remedial process at NPL sites determines how much money is needed for EPA's remedial program. If, for example, more of the sites added to the NPL are truly orphan sites—where the responsible parties either cannot be found or are not financially viable—then a larger share of cleanup costs will be borne by EPA; by the same token, if more sites

9. In some cases, EPA may designate a site as a "partial deletion" when a part of the site or operable unit at a site is deleted but the entire site is not deleted.

10. GAO, *Superfund: Litigation Has Decreased and EPA Needs Better Information on Site Cleanup and Cost Issues to Estimate Future Program Funding Requirements,* GAO-09-656, "Table 15, Construction Complete Nonfederal NPL by Site Type and Megasite Designation through Fiscal Year 2007," p. 70.

11. While PRPs sometimes disclose their estimated costs at a specific site, these estimates are rarely documented, and the information is anecdotal and completely voluntary.

listed on the NPL have financially viable and cooperating PRPs, the burden on EPA will be less.

States also play a role in paying for remedial actions at NPL sites. Under Section 104 of CERCLA, states must contribute 10% of the cost of remedial actions paid for by EPA at non-federal NPL sites within their borders. States are also responsible for 100% of the operations and maintenance costs at these sites. As more and more NPL sites enter the remedial action stage, states have raised concerns about their ability to finance their share of cleanup and long-term operations and maintenance costs.

Cleanup costs vary widely depending on the type of NPL site. Superfund sites are often lumped into two cost categories: "mega sites," that is, sites with expected total cleanup costs of $50 million or more, and "non-mega" sites. According to *Superfund's Future*, the average cost to clean up a mega site on the NPL was approximately $140 million ($195 million in constant 2016 dollars), more than ten times the average cost of a non-mega site, which had an average cleanup cost of $12 million ($17 million in 2016 dollars).[12] Unfortunately, more recent information on average site cleanup costs is not available.

Mining sites and contaminated sediment sites are generally considered among the most expensive to address due to the nature and extent of the contamination. Contamination at these kinds of sites is often measured in square miles rather than acres, and there can be hundreds of thousands of cubic yards of contaminated media. As an example, Tar Creek, a mining site in Oklahoma added to the NPL in 1983, is 40 square miles. The site has extensive lead contamination and has already cost EPA and the state of Oklahoma over $300 million.[13] Another very expensive site is the Hudson River PCB site in New York, where General Electric has spent over $1.5 billion on the project, and the work is not yet complete.[14] Most cleanups do not cost hundreds of millions of dollars, but when these costs are borne by EPA, this becomes a huge drain on limited federal cleanup funds.

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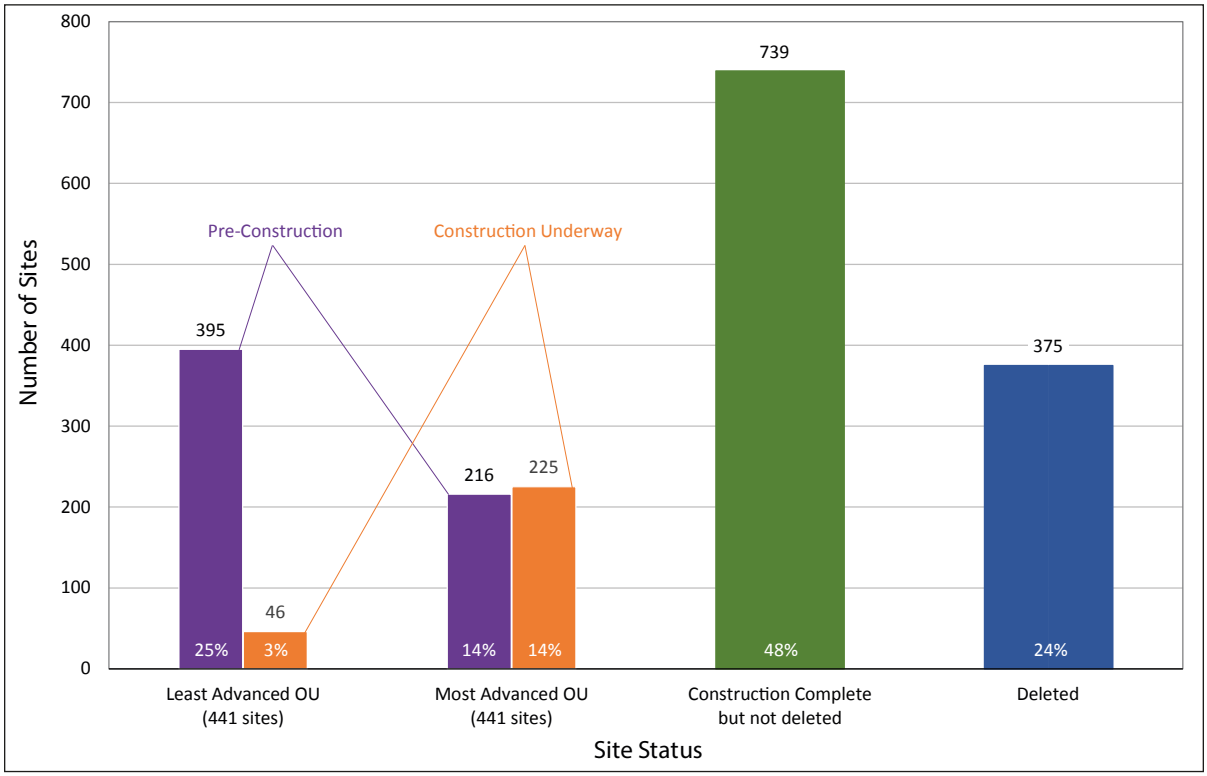
12. *Superfund's Future*, page xxv of the Executive Summary. This appears to be the most recent public information on the cost of cleanup for specific site types on a site basis. Data included in the *Superfund: Litigation Has Decreased and EPA Needs Better Information on Site Cleanup and Cost Issues to Estimate Future Program Funding Requirements*, GAO-09-656, are not average site cleanup costs as total expenditures for all sites are averaged over the total number of sites, regardless of whether they are EPA- or PRP-lead.

13. "$10 million Tar Creek settlement proposed," available online at http://www.tulsaworld.com/homepagelatest/million-tar-creek-settlement-proposed/article_107629cb-4f3c-5d6a-8a56-0af354d99433.html and "NPL Site Narrative for Tar Creek (Ottawa County)," available online at https://semspub.epa.gov/work/06/300355.pdf.

14. See "Hudson River PCBs Superfund Site," available online at https://www.epa.gov/superfund/superfund-35th-anniversary-region-2#hudson.

Figure 1. **Site Status of 1,555 Non-Federal NPL Sites at the End of FY 2016, Showing the Least Advanced and Most Advanced Operable Units (OUs)**




*Source:* U.S. EPA

## Superfund Snapshot: Status of Non-Federal NPL Sites at the End of FY 2016

From the inception of the Superfund program through the end of FY 2016, EPA has placed 1,555 non-federal sites on the NPL.[15]

As shown in Figure 1, at the end of FY 2016, 24% (375) of non-federal NPL sites had been deleted from the NPL, and another 48% (739) were construction complete but not deleted.[16] Thus, all elements of the cleanup remedies have been implemented at just over 70% of all non-federal sites on the NPL. The remaining 28% (441) of sites are at some stage in the remedial pipeline. Exactly how much work remains to be done at these 441 sites cannot be determined from readily available public information. At just over half (225) of these sites, construction of a remedy is underway for the most advanced operable unit. However, construction of the remedy has not yet begun at the least advanced operable unit

15. Data in this paper include only final and deleted non-federal NPL sites. Proposed NPL sites, "Superfund Alternative" sites, and federal facilities are not included.

16. Four of the deleted sites are not identified as construction complete because they were deferred to another authority for cleanup.

of 90% (395) of these sites. Thus, there are many sites that will require additional site studies and cleanup in the years to come.

In FY 2016, Congress appropriated $1.09 billion to the Superfund program; 46% of these funds ($501 million) were allocated to the remedial program. Funding for the remedial program covers all cleanup activities except removals[17] as well as the cost of remedial program staff, program management, and technical support functions in support of site cleanups. Staff who are funded under the remedial program include the remedial project managers in EPA's ten regional offices who oversee both EPA- and PRP-lead actions at NPL sites. Just under $300 million of the remedial program budget went to cleanup contractors and states to pay for what are called "extramural" costs, that is, the costs of pre-construction, construction, and post-construction activities at non-federal NPL sites. At the end of FY 2016, there was a shortfall in funding for remedial actions. EPA did not have the $61 million needed to begin new construction projects that were otherwise ready to go at 12 NPL sites. The $61 million represents only the amount of funds that would be needed to *begin* construction at these projects; EPA estimates the full cost of these construction projects to be $200 million or more.[18]

Although completing cleanup is a major focus of the remedial program, perhaps even more important is the task of ensuring that contamination at a site no longer presents a risk to the public. To assess current exposure to contamination and whether contaminated groundwater is effectively contained, EPA tracks two environmental indicators at all NPL sites:

- Sites at which *current human exposure* to contamination is under control or falls within the levels specified as safe by EPA; and
- Sites where *contaminated ground water migration* has been controlled to prevent further spread of contaminants and prevent unacceptable discharge levels to surface water, sediments, or ecosystems.[19]

It is important to note that each of these indicators is a site-wide determination. Thus, in some cases, a site with "human exposure not under control" may mean that contamination is not under control at a small portion of a site, while at another site, it might mean that most of the site has uncontrolled contamination.[20]

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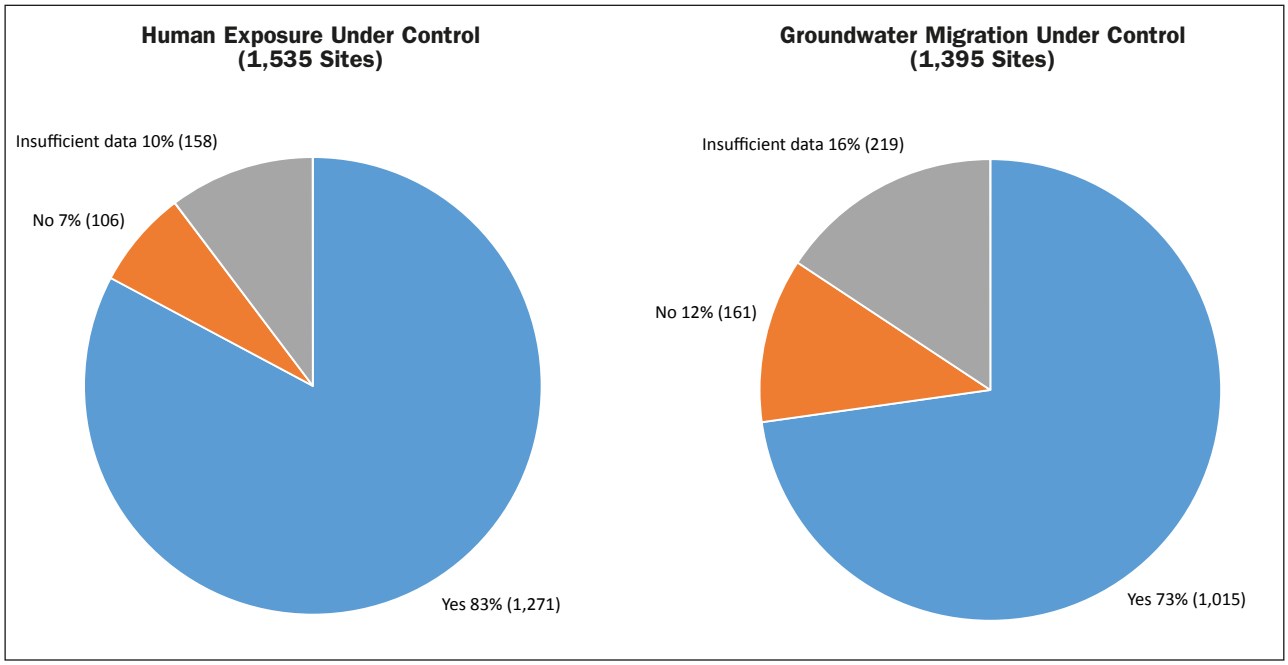
17. The budget for the removal program was $175 million in FY 2016; data provided by U.S. EPA.

18. Information provided by U.S. EPA.

19. Definitions are taken from "Superfund Remedial Performance Measures," available online at https://www.epa.gov/superfund/superfund-remedial-performance-measures#he_anchor, accessed on March 7, 2017.

20. GAO examined the specific issues at sites where human exposure is not under control in some detail. GAO, *Superfund: EPA's Estimated Costs to Remediate Existing Sites Exceed Current Funding Levels, and More Sites Are Expected to be Added to the National Priorities List*, GAO-10-380.

Figure 2. **Human Exposure and Groundwater Migration Under Control at Non-Federal NPL Sites, End of FY 2016**




*Source:* U.S. EPA

*Notes:* There are fewer total sites in the groundwater data than the human exposure data because some sites are classified as "groundwater migration not applicable."

Percentages may not add to 100% due to rounding.

As shown in Figure 2, at the end of FY 2016, human exposure was under control at 83% of non-federal NPL sites; at 7% of these sites, human exposure was not under control; and there were insufficient data to determine if human exposure is or is not under control at the remaining 10% of sites. Groundwater migration was under control at 73% of the sites, was not under control at 12% of sites, and there were insufficient data to make this determination for the remaining 16% of sites.

Some of the sites where human exposure is not under control may present situations where it is in fact technically difficult or impossible to prevent exposure or limit access to the contamination, such as at large sediment sites and mining sites. If this is the case, EPA should amend its performance measures to reflect this. A critical issue is to find out why human exposure is not under control at these sites and to identify what actions, either by EPA or PRPs, would address the concern.

The fact that there are insufficient data to determine whether human exposure is under control at 158 non-federal NPL sites also suggests the need for more nuanced information about these sites. In addition, there are also insufficient data to determine whether groundwater migration is under control for 219 non-federal NPL sites.

## Trends in NPL Listing

One of the most important indicators of the need for the Superfund program—and a key determinant of future funding requirements—is the number of sites that are added to the NPL annually. EPA has a statutory requirement to revise the NPL at least once each year.[21] The decision to add a site to the NPL is usually made jointly by EPA and the state or tribal government in which a site is located. Although there are specific criteria for NPL eligibility that are articulated in EPA regulations,[22] the decision to list a site (or not) is completely at EPA's discretion and the Agency has wide latitude in this matter. Thus, there is no objective way to determine whether the "right" number of sites are being added to the NPL or not.

Most states now have robust state cleanup programs. As a result, sites listed on the NPL tend to fall into one or more of the following categories: the site is complicated from a technical standpoint, cleanup is expected to be expensive, there are no financially viable or cooperating PRPs, the state does not have adequate funds to address the site, the site has recalcitrant PRPs and the state lacks the necessary resources and legal authority and seeks federal enforcement, or the site is high profile and has hit the front page of the national newspapers.

Since FY 2000, a total of 310 non-federal sites have been added to the NPL, an average of 18 per year. As shown in Figure 3 (next page), over the past 17 years the number of non-federal sites added to the NPL has ranged from a low of eight in FY 2013 and FY 2015 to a high of 36 in FY 2000. As part of the work that was conducted to estimate future EPA funding needs in *Superfund's Future*, the authors of that report interviewed the Superfund division directors in all ten EPA regional offices and Superfund officials in nine states to help inform estimates of the likely number of sites to be added to the NPL from FY 2000 though FY 2009.[23] Based on these interviews, as well as by looking at then-recent listing trends, the authors estimated that EPA was likely to list an average of from 23 (low case) to 49 (high case) non-federal NPL sites per year from FY 2001 through FY 2009.[24] The actual number of non-federal sites added to the NPL in FY 2000 was known (it was 36). The "base case" estimate assumed that 35 new non-federal sites would be added each year from FY 2001 through FY 2009. In fact, an average of only 17 new NPL sites were added per year over this time period. Thus, actual listings were significantly lower than the estimated "low case." The authors also concluded that future sites to be added were likely to be more expensive and more complicated to clean up than sites listed in the past, as many states had by this time developed their own state Superfund programs that could address the less difficult or expensive sites.

A more nuanced and robust description of what kinds of sites have been added to the NPL, and why, would be very useful for understanding the program's likely future scope and funding needs. EPA information on site types is based on what is

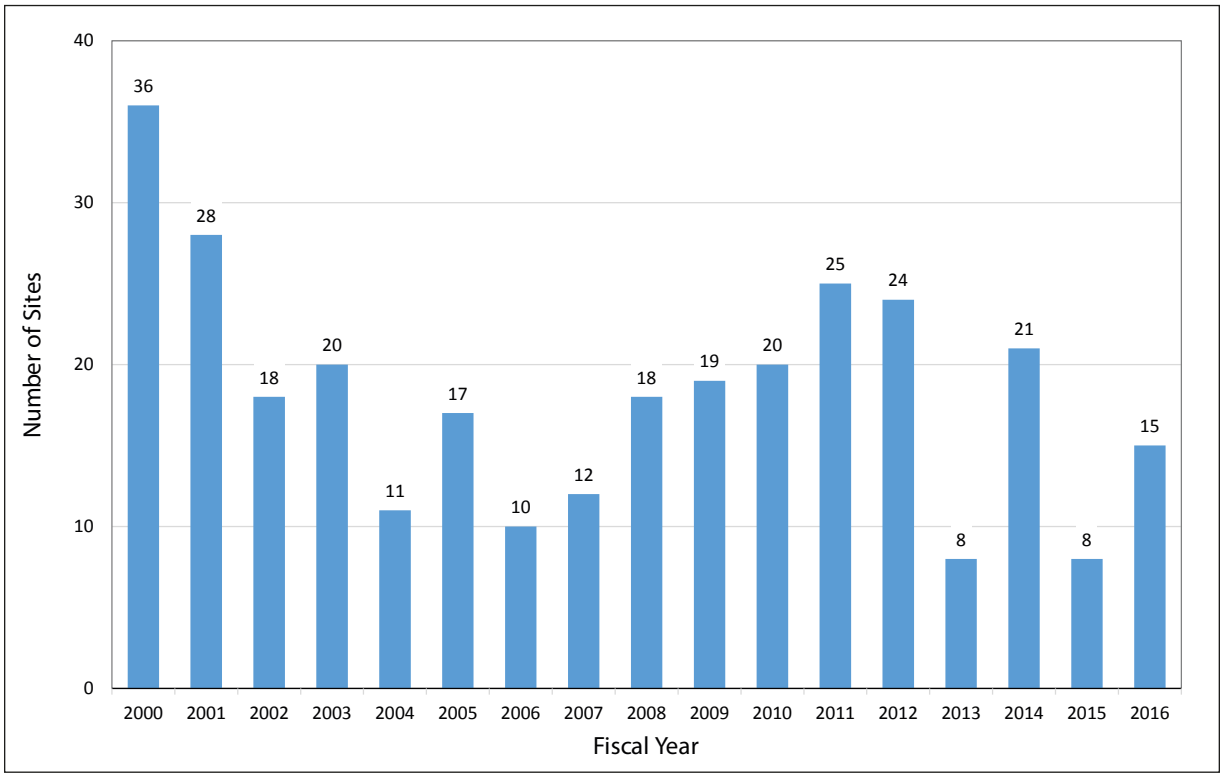
21. See Section 105(a)(8)(B) of CERCLA.

22. 40 CFR 300.425.

23. See *Superfund's Future*, Chapter 5 and Appendix E.

24. See *Superfund's Future*, p. 105, Table 5-4.

Figure 3. **Number of Non-Federal Sites Added to the NPL by Year, FY 2000–FY 2016**




*Source:* U.S. EPA

known at the time a site is proposed for the NPL and is typically not updated as more information becomes available later in the process.[25] Although EPA collects a great deal of information as part of the process to determine whether a site should be added to the NPL, information regarding site attributes not required for listing, such as whether a site has bankrupt PRPs or contaminated drinking water, may not be known or collected at the time of listing. EPA does maintain an internal analysis of listing trends, but the data are incomplete and not updated systematically. As a result, the data cannot be used to analyze trends over time.

It would also be useful for EPA to gather consistent information for all sites added to the NPL regarding key site attributes that relate to the nature and extent of contamination and likely cleanup costs, and to update the data as more information becomes available over time. The information should address the following questions about the attributes of each site:

- Are contaminated sediments a major issue at the site?
- Will it be difficult to control human exposure to contamination?
- Is the site likely to have cleanup costs of $50 million or more?
- Are there bankrupt PRPs associated with the site, and is this a major factor in why the site was added to the NPL?
- Is the site being listed because the state is seeking federal enforcement?

25. See Appendix B for EPA site type categories.

- Is the contamination the result of a gap in another regulatory program?
- Is the site being listed because of failed financial assurance under another program?
- Were there any demographic or land-use changes that led to listing?

Consistent information on these types of site attributes would allow EPA, Congress, and the public to have a better understanding of why sites continue to be added to the NPL. Absent this kind of information, it is difficult to paint a clear picture of the types of sites that have been listed in recent years and what factors drove their being added. It would also be helpful if EPA tagged NPL sites that are likely to be designated mega sites early in the process, as these sites typically demand more agency resources, both for cleanup dollars and for EPA program and enforcement staff, than do less costly sites.

According to EPA's staff, recent NPL listings have included sites with bankrupt PRPs; changing demographics leading to increasing exposure and risk; failed Resource Conservation and Recovery Act (RCRA) financial assurance; truly orphan sites where the cause of contamination is unknown; sites where a state had the lead for many years but then sought NPL listing when it determined it did not have the necessary funds to complete work at the site; and sites with what is referred to as an "emerging" contaminant, that is, a contaminant that was not previously a concern at NPL sites, such as perfluorooctanoic acid (PFOA). A few examples of sites recently added to the NPL are below.

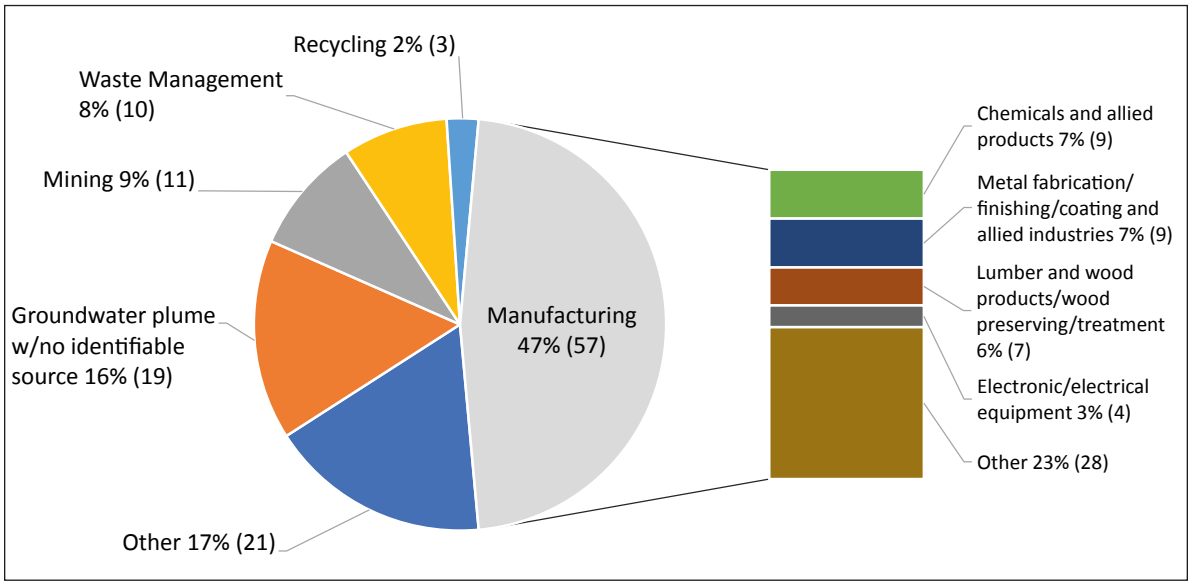
**Argonaut Mine, California—Bankrupt PRPs.** A former gold mining operation from the 1850s to 1942, 90 acres of the site were later sold and developed for residential use. The PRPs are bankrupt. There are arsenic, mercury, and lead in soil in the residential area. Some of the residences were built on top of or adjacent to the former mining operations.

**Dorado Ground Water Contamination, Puerto Rico—Changing demographics.** The site has a contaminated groundwater plume with no identifiable source of the contamination that is affecting a municipal drinking water source for over 100,000 people. The area has seen increasing numbers of residences in recent years. There is no alternative source of drinking water. Contaminants of concern include trichloroethylene (TCE), perchloroethylene (PCE or "perc"), and vinyl chloride.

**Eldorado Chemical Co., Inc., Texas—Orphan site.** The site was operated as a chemical manufacturer of cleaning products from 1978 to 2007, at which point it was abandoned. There are no known or viable PRPs, and there are high concentrations of volatile organic compounds, metals, and cyanide in the aquifer beneath the site that threaten 40 public supply wells serving nearly 1.5 million people.[26]

26. For brief descriptions of each of these three sites, see the site narratives at "National Priorities List (NPL) Sites—by Site Name," at https://www.epa.gov/superfund/national-priorities-list-npl-sites-site-name.

Figure 4. **Non-Federal Sites Added to the NPL by Type (121 sites), FY 2010–FY 2016**




*Source:* U.S. EPA

*Note:* Percentages may not add to 100% due to rounding.

One of the ways to examine the future trends of the Superfund program is to look at the types of sites being listed on the NPL. At the time a site is listed on the NPL, EPA places sites in one of five major categories to reflect the type of activity that led to site contamination:

- Manufacturing
- Mining[27]
- Recycling
- Waste management
- Other

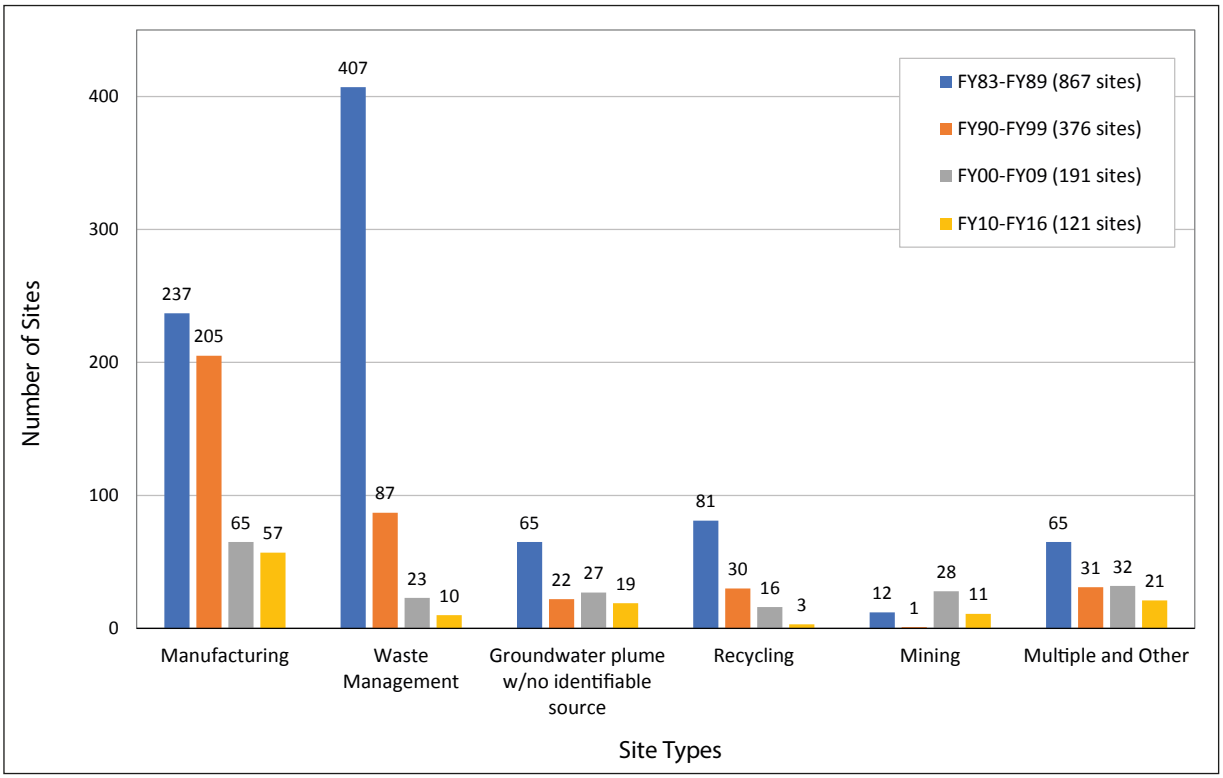
Figure 4 shows a breakdown of the 121 non-federal sites, by type, that were added to the NPL from FY 2010 through FY 2016, including the number of sites in the five major EPA categories and in the four largest sub-categories of manufacturing sites:

- Chemicals and allied products
- Electronic/electrical equipment
- Lumber and wood products/wood preserving/treatment
- Metal fabrication/finishing/coating and allied industries

Figure 4 also shows the number of sites categorized as "groundwater plume with no-identified source of contamination" (which is a subset of the "Other"

27. Mining sites are those sites where mining is the primary activity. There are additional NPL sites with mining-related activities that are included in the manufacturing and waste management categories.

Figure 5. **Number of Non-Federal Sites Added to the NPL by Type: Comparison Over Time**




*Source:* U.S. EPA

*Note:* Appendix D includes this information presented in percentages.

category noted earlier), as they comprise a relatively large percentage of the 121 sites listed over those seven years. It is important to note that these are *not* the only sites that have groundwater contamination on the NPL. They were put into a separate category because the source of the contamination was not known at the time of listing, and as a result, they do not fall under any of the other possible site type categories.

Manufacturing sites make up the largest category of sites listed, 47 percent. The next largest category of sites (not including "Other") are the 16% of sites with a groundwater plume with no identifiable source of contamination. Mining sites are the third largest group, with 11 sites (9%). Mining sites are of particular interest, as these sites are often among the most expensive sites to remediate.[28] In addition, some of the most expensive and notorious mining sites on the NPL have bankrupt PRPs, which means that the cleanup costs of these expensive sites are often borne by EPA.

Of the 121 sites added to the NPL over the last seven years, almost half (46%) are in eight states: California, Florida, Illinois, Indiana, New Jersey, New York, North Carolina, and Texas. These states have consistently had the most NPL sites

28. *Superfund's Future*, p. 203, Table F-1, and p. 216, Table F-10; and GAO-15-812, p. 24.

listed within their borders; in fact, six of them were in the "top 10" listing states for the period from October 1996 through February 2000.[29]

In addition to the types of sites added to the NPL in recent years, it is informative to look at whether the types of sites added to the NPL have changed since the program's inception and, if so, how? Figure 5 (see page 13) shows the number of sites in each of six categories: the five "major" EPA categories (manufacturing, mining, waste management, recycling, and other) and the subcategory of sites with groundwater plumes from an unknown source of contamination. Sites that qualify for multiple types have been grouped with "Other."

The first aspect of the data that stands out is the large number of sites (867, or 56%) that were listed before FY 1990. At that time, waste management facilities constituted the largest category of sites added to the NPL, but from FY 1990 on, manufacturing sites were the largest category.[30] Mining sites represent a small number of all non-federal NPL sites, and very few mining sites were placed on the NPL prior to FY 2000. Of the 52 mining sites on the NPL at the end of FY 2016, more than half were added during the 10 years from FY 2000–FY 2009.

One key trend to watch in estimating future cleanup costs is who is paying for the various phases of the remedial program: PRPs or EPA?

Figure 6 (next page) shows the relative percentage of remedial action projects (the most expensive phase of the cleanup process) started each year from FY 2000 through FY 2016 that were implemented by EPA compared to remedial action projects conducted by PRPs. From FY 2000 through FY 2004, more than 50% of remedial action projects were paid for by PRPs. Since then, however, the distribution between EPA and PRPs has bounced around. Over the last 10 years, there have only been three years where PRPs paid for more than half of the remedial action project starts (FY 2010, FY 2012, and FY 2013). These percentages reflect only the *number* of actions that were initiated by either PRPs or EPA; they provide *no* information on the relative amount of *dollars* paid by PRPs and EPA for site cleanups at NPL sites. Finer-grained data, ideally the total actual cleanup costs paid for by EPA and by PRPs—or, lacking that level of detail, an estimate of the total cost paid for by PRPs and EPA based on estimated remedial action costs for PRP and EPA actions—would provide information on whether EPA's share of cleanup costs for non-federal NPL sites has remained the same, is increasing, or is decreasing over time. There is very little information on the actual cost of PRP-implemented cleanups, because PRPs are not required to disclose their actual cleanup costs, and few voluntarily do so. In addition, EPA does not typically make public their annual cleanup expenditures. Expenditure data, rather than program budget information, provide information on how much EPA is *actually* spending as distinct from how it allocates funds at the beginning of the year.

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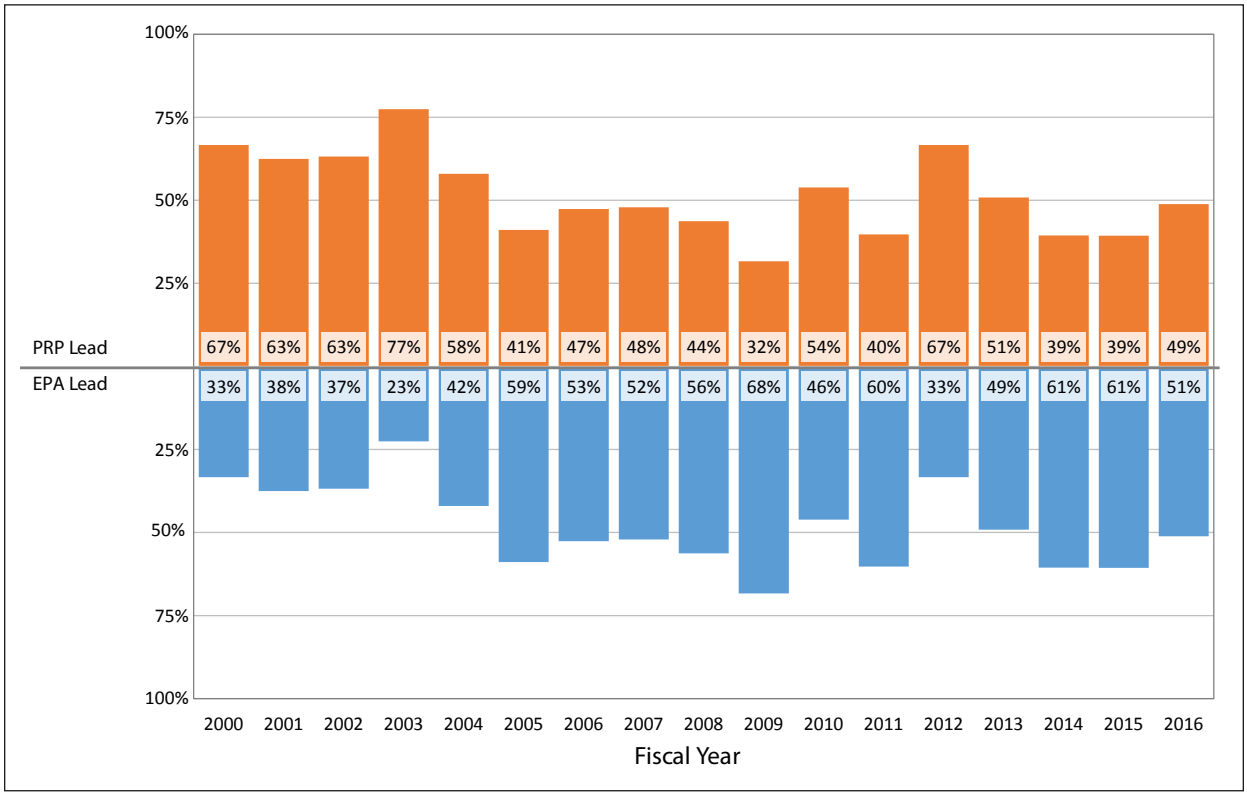
29. These states are: CA, FL, NJ, NY, NC, and TX; see *Superfund's Future*, Table E-1, pp. 186–187.

30. See Appendix C for a more detailed breakdown of types of manufacturing facilities added to the NPL over time.

Figure 6. **Percentage of Remedial Action Project Starts at Non-Federal NPL Sites that Were PRP and EPA Lead, FY 2000–FY 2016**




*Source:* U.S. EPA

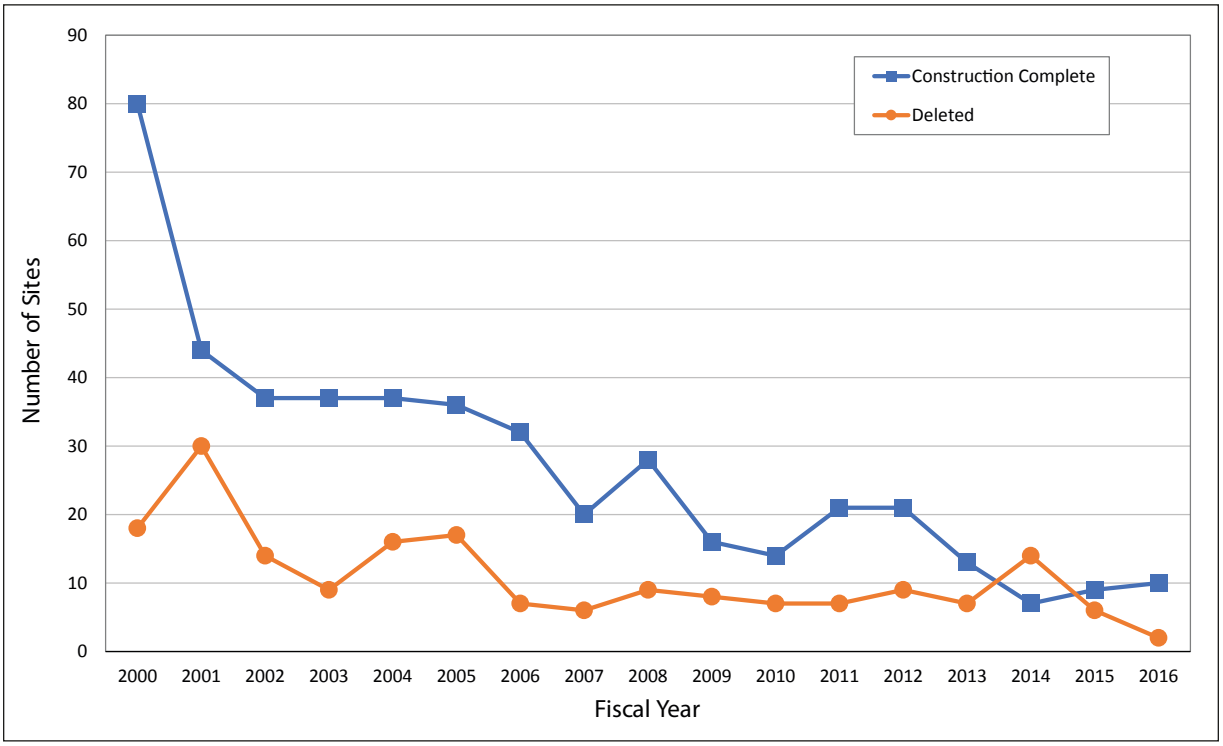
*Note:* Remedial actions starts are tracked at the project, not the operable unit, level.

## Cleanup Progress Over Time

EPA has developed several indicators of site cleanup progress over the course of the Superfund program. The oldest metric of program accomplishments is the number of NPL sites that have been "deleted" from the NPL. According to EPA guidance, a site can be deleted from the NPL when "no further response is required at the site, all cleanup levels have been achieved, and the site is deemed protective of human health and the environment."[31] In the early years of the program, this was the only measure of cleanup progress. It soon became clear, however, that at some sites it could take years, or even decades, to achieve the cleanup standards called for in the remedy. For this reason, in 1993, EPA established "construction complete" as a new measure of site progress. A site is designated construction complete when the physical construction of all remedies at the site is complete even if all cleanup goals at the site have not been achieved.

31. *Close Out Procedures for National Priorities List Sites*, OSWER Directive 9320.2-22, p. 8, May 2011, U.S. EPA.

Figure 7. **Number of Non-Federal NPL Sites Construction Complete and Deleted Each Year, FY 2000–FY 2016**



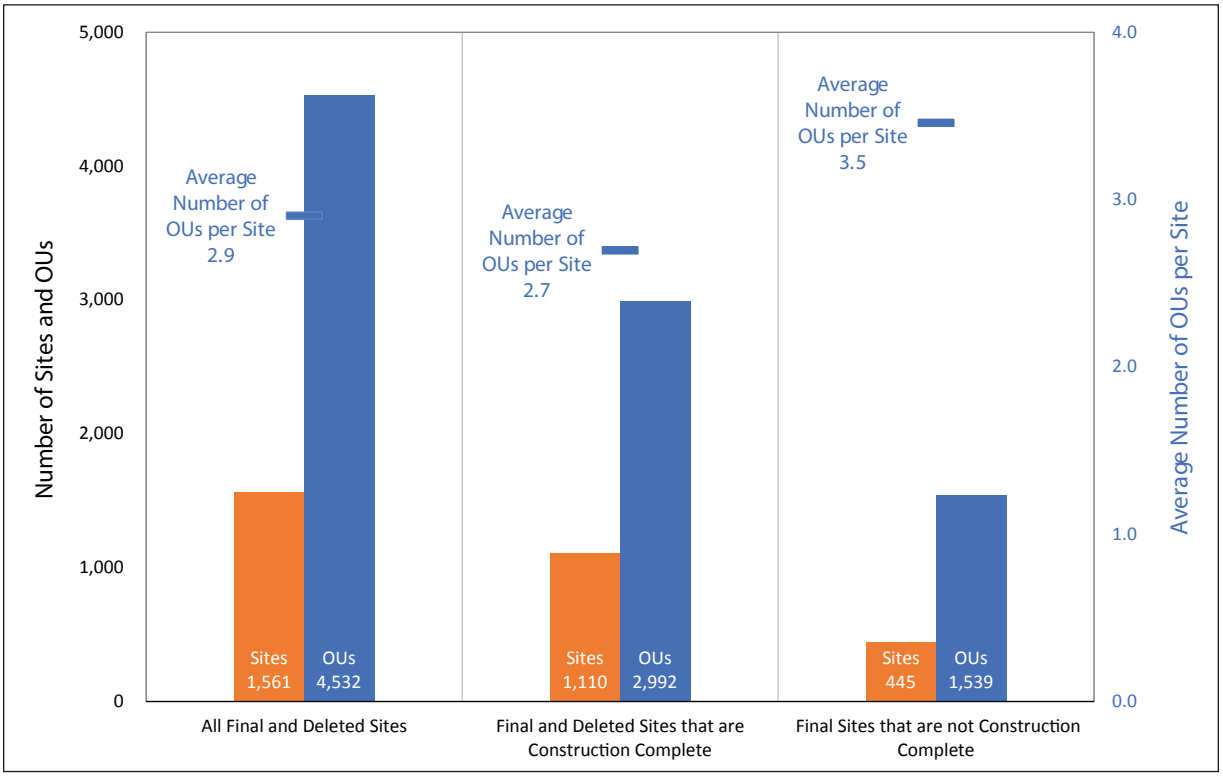

*Source:* U.S. EPA

One important note about data on site progress is that Superfund sites are *not* homogeneous. They can, and do, differ greatly in terms of complexity, cost, duration of cleanup, the type and extent of contamination, and who—EPA or the responsible parties—is implementing site actions. Most likely, those sites that are less complex, smaller, have fewer remedies to implement, and have contamination with proven cleanup technologies will be completed sooner than those that are more complex. EPA does not provide information on program accomplishments for different categories of sites, such as PRP and EPA remedial actions, mega sites vs. non-mega sites, large complex sites vs. smaller sites, etc. Thus, it is not possible, from public data, to determine whether certain types of sites take longer to clean up than others. Data on the duration of site cleanups do suggest that, not surprisingly, mega sites—those sites expected to cost $50 million or more to address—take longer to reach construction completion than less expensive sites.[32] Thus, it would be helpful if EPA tagged mega sites in their data systems so that progress and costs at these sites could be tracked separately from less expensive sites.

As shown in Figure 7, beginning in FY 2002, fewer than 20 non-federal sites have been deleted each year from the NPL, and for many years, that number was less than 10. From FY 2000 through FY 2016, a total of 186 non-federal sites were

32. See *Superfund's Future*, page 210, and GAO-09-656, page 70.

Figure 8. **Average Number of Operable Units (OUs) at Non-Federal NPL Sites at Different Stages in the Cleanup Process**



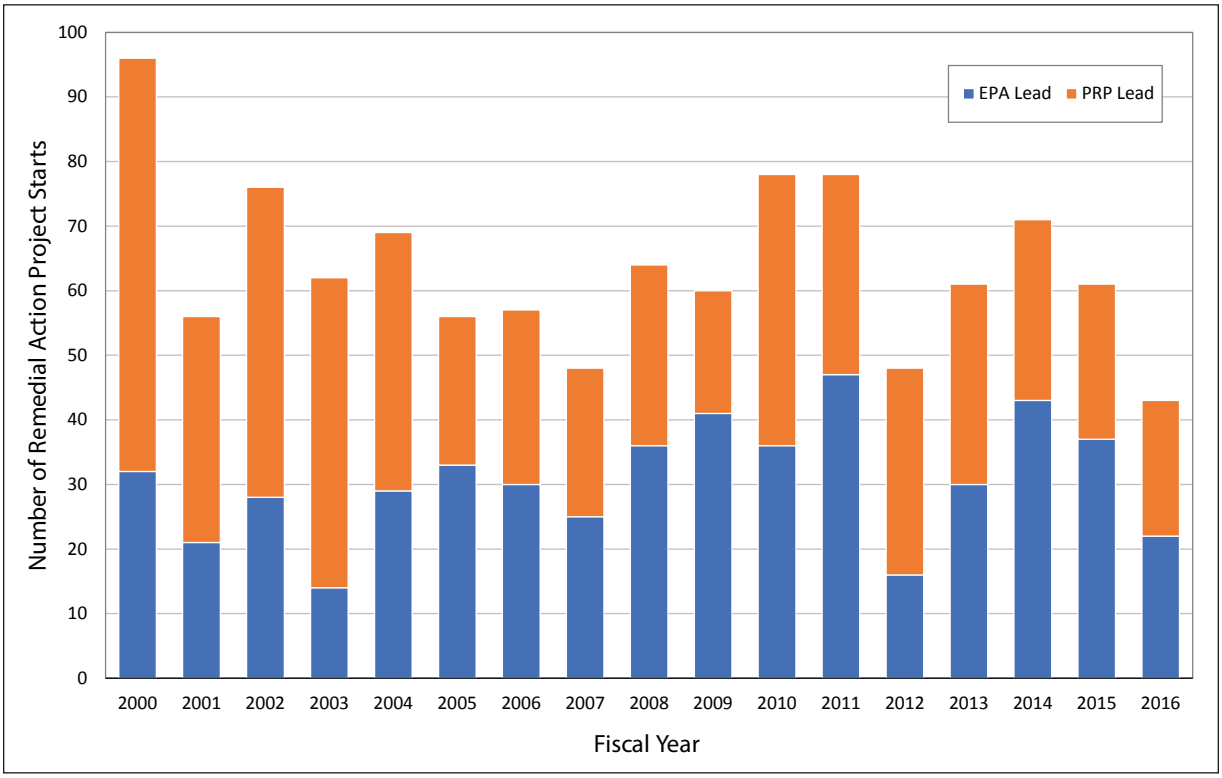

*Source*: U.S. EPA, data as of February 27, 2017.

deleted from the NPL, an average of 11 deletions each year. Looking at the last five years, from FY 2012 through FY 2016, this average dropped to fewer than eight deletions each year. Over this same time-period, 76 new non-federal sites were added to the NPL, an average of 15 sites a year. More sites are being added to the NPL each year than are being taken off.

From FY 2000 through FY 2016, a total of 462 non-federal NPL sites reached construction complete status, an average of 27 each year. In the five years FY 2012 through FY 2016, this number dropped by more than half, to an average of 12 sites designated as construction complete each year.

The fact that the number of sites being deleted and reaching construction complete status has decreased over time is not necessarily surprising. As noted earlier, sites that are more complex, with more remedies, are likely to take longer to reach these milestones than less complex sites. Data about the number of operable units at NPL sites that have or have not reached construction complete support this. As shown in Figure 8, sites that were construction complete at the end of FY 2016 had fewer operable units (and, therefore remedies to implement) than sites that were not designated construction complete. The average number of operable units for all final and deleted non-federal NPL sites was 2.9, but the average number of operable units for sites that were construction complete was 2.7, while

Figure 9. **Number of Remedial Action Project Starts at Non-Federal NPL Sites: EPA and PRP Lead, FY 2000–FY 2016**




*Source:* U.S. EPA

*Note:* Remedial actions starts are tracked at the project, not the operable unit, level.

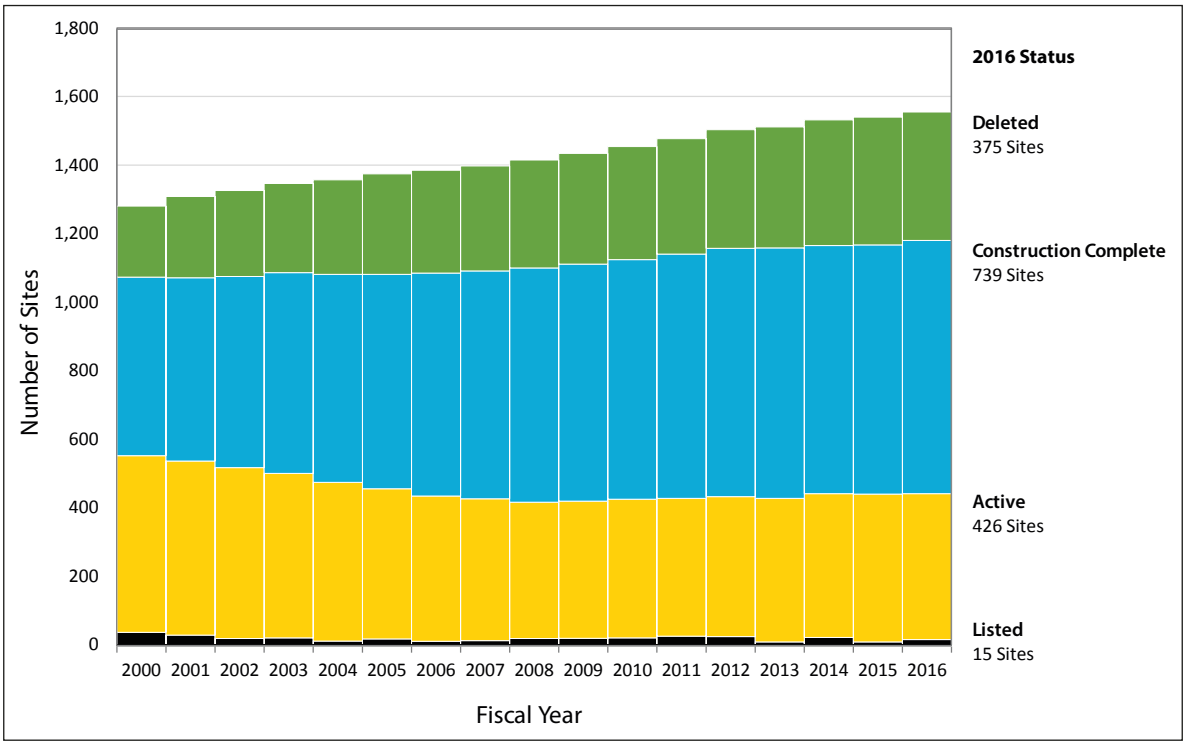
the average for sites that were not yet construction complete was 3.5. That said, it is worth noting that there are sites with only one operable unit that are extremely expensive. For example, the Portland Harbor site in Oregon has only one operable unit and is estimated to have cleanup costs of approximately $1 billion.[33]

The decreasing number of non-federal NPL sites being deleted and achieving construction complete raises two questions. First, why is this the case? Are the number of sites achieving these progress metrics decreasing because of technical challenges, funding constraints, EPA or PRP inaction, or some other reason? Second, are these, in fact, useful and important measures of program success, or would other metrics—perhaps yet to be developed—provide more useful indicators of both clean-up progress and benefits? These are important issues to address in order to identify ways to make the remedial program more successful and to better track progress.

With the slower pace of sites reaching construction complete, in FY 2011 EPA began tracking progress at the remedial project level, rather than on a site-wide or operable unit basis, tracking the number of remedial action project completions.

33. See "Portland Harbor Superfund Site," available online at https://yosemite.epa.gov/r10/cleanup.nsf/sites/ptldharbor.

Figure 10. **Cumulative Status of Non-Federal NPL Sites, FY 2000–FY 2016**




*Source:* U.S. EPA

Sixty-five remedial action projects were completed at non-federal NPL sites in FY 2015, and another 54 were completed in FY 2016.[34] Unfortunately, data for non-federal sites only are not available for prior years, so it is not possible to provide an historical perspective regarding completions.[35]

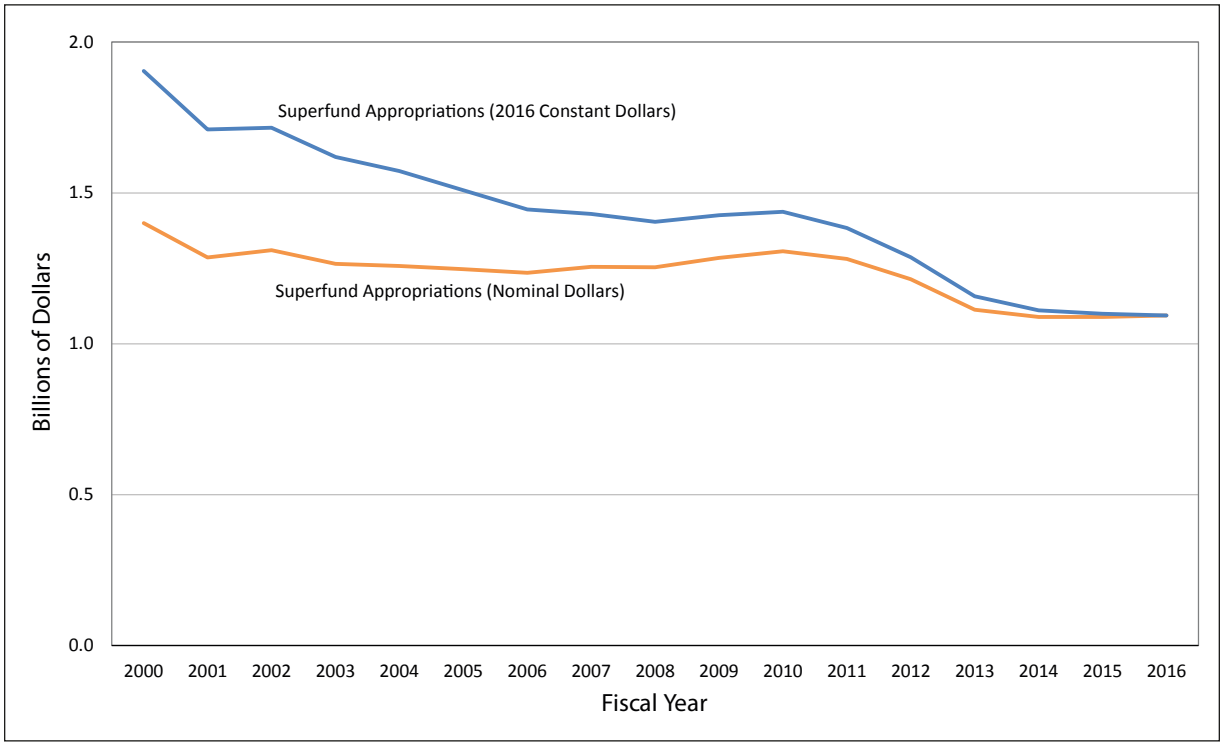
Figure 9 (page 18) shows remedial action project *starts* since FY 2000. The number of remedial action project starts has bounced around, with a high of 96 in FY 2000 and a low of 43 in FY 2016. Over the last five years, an average of 57 remedial action projects were started each year, which is somewhat lower than the average from FY 2000 through FY 2016, when remedial action project starts averaged 64 a year.

EPA's workload has remained relatively steady over recent years. Figure 10 shows the distribution of all non-federal NPL sites since FY 2000 among four categories: sites listed as final during that fiscal year, sites that are "active," sites that are construction complete but not deleted, and deleted sites. Together, the number of new sites added to the NPL and the number of active sites decreased from a high

34. Data provided by U.S. EPA.

35. For information on remedial project completions for all final NPL sites, both federal facilities and non-federal sites, see "Superfund Remedial Performance Measures," available online at https://www.epa.gov/superfund/superfund-remedial-performance-measures#ra_anchor. In FY 2015 and FY 2016, federal facilities accounted for 37% and 49%, respectively, of the RA project completions, according to data provided by U.S. EPA.

Figure 11. **Superfund Appropriations in Constant and Nominal Dollars, FY 2000–FY 2016**




*Source:* U.S. EPA

*Note:* Funds from ARRA that were allocated to the Superfund program in FY 2009 are not included.

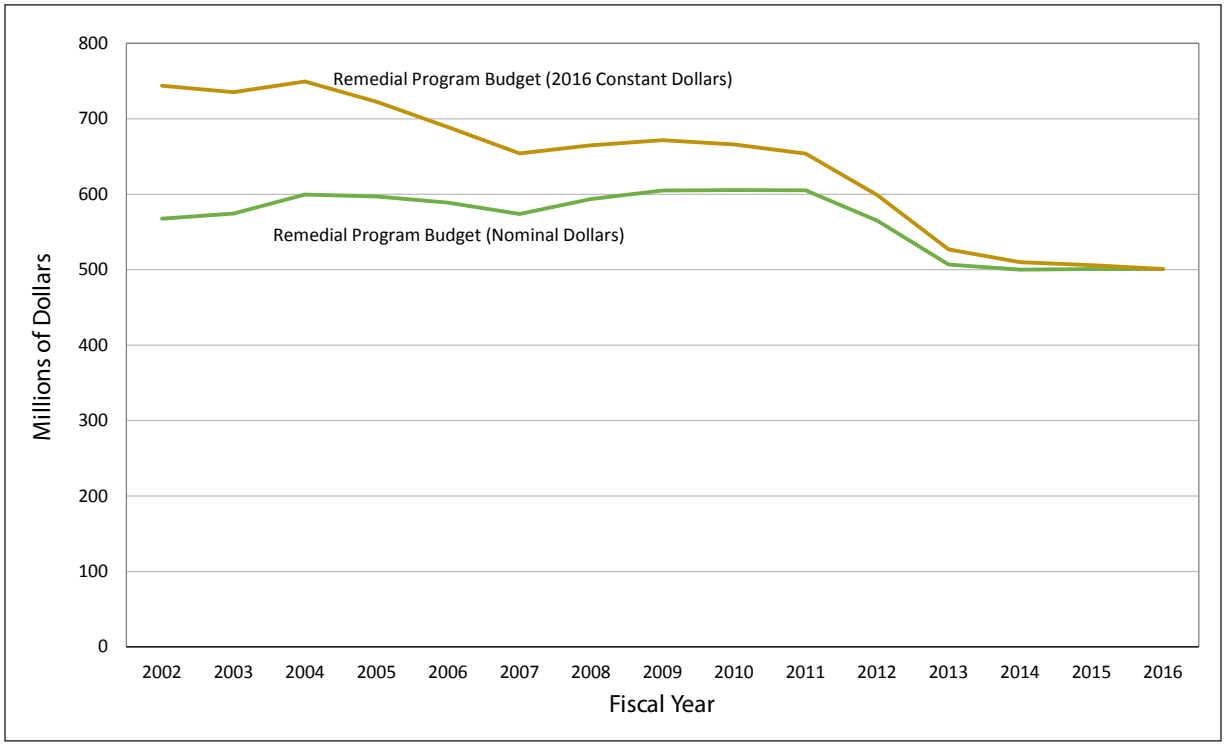
of 552 in FY 2000 to a low of 416 in FY 2008. Over the past five years, the number of sites in these two categories has hovered between 427 and 441 each year. The number of active sites in recent years has remained relatively steady, but more detailed information on the number and cost of future site actions—as well as whether the costs would be borne by EPA or PRPs—would be needed to estimate future funding needs. And it is worth noting that EPA (and PRPs and states) continue to expend staff and other resources on sites that are construction complete as well as on sites that have been deleted.

## Funding Over Time

When CERCLA was first enacted, Congress created a dedicated trust fund, the "Superfund," stocked with dedicated new taxes to generate the revenues to pay for the annual costs of the Superfund program. The authority for the Superfund taxes expired at the end of 1995, and the balance in the trust fund has dwindled over time.[36] Most annual Superfund appropriations now come

36. See Ramseur, Jonathan L., Reisch, Mark, and McCarthy, James E., *Superfund Taxes or General Revenues: Future Funding Issues for the Superfund Program*, CRS Report to Congress by Congressional Research Service February 4, 2008, Washington, DC.

Figure 12. **Superfund Remedial Program Budget in Constant and Nominal Dollars, FY 2002–FY 2016**




*Source*: U.S. EPA

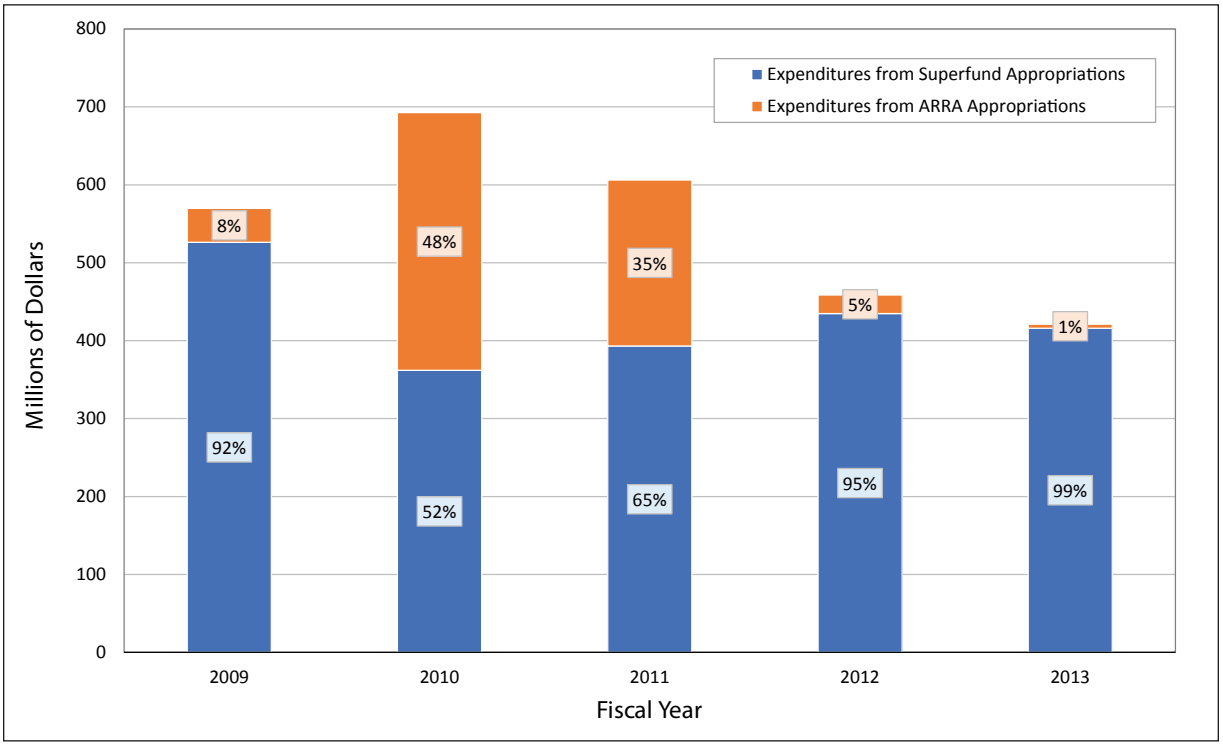
*Note:* Information on the remedial program budget is not available for FY 2000 and FY 2001.

from general revenues, not trust fund monies. Since then, while there have been periodic attempts to reinstate the taxes that stocked the trust fund, no administration—Democratic nor Republican—has made a serious effort to reinstate the Superfund taxes or some variation of them.

As shown in Figure 11 (previous page), in nominal terms, annual appropriations remained relatively steady from FY 2001 through FY 2011, hovering around $1.3 billion for most of these years. In FY 2013, annual appropriations in nominal dollars fell to under $1.2 billion for the first time. In nominal dollars, funding went from a high of $1.4 billion in FY 2000 to a low of $1.09 billion in FY 2014 (and FY 2015 and 2016), a decrease of 22 percent. In real terms the decrease in funding has been much more dramatic: annual funding has been cut over 40 percent. In constant 2016 dollars, appropriations dropped from a high of $1.9 billion in FY 2000 to a low of $1.09 billion in FY 2016, a decrease of 43 percent. In FY 2009, the program received a one-time increase in appropriations of $600 million ($666 million in 2016 dollars) from the American Recovery and Reinvestment Act of 2009 (ARRA), which is not shown in Figure 11.

Given the decrease in total annual Superfund appropriations, it is not surprising that funds allocated to the remedial program have declined as well, as shown in Figure 12. Expenses paid from the remedial program budget include:

Figure 13. **Impact of American Recovery and Reinvestment Act (ARRA) Funds on Remedial Expenditures in Constant 2016 Dollars, FY 2009–FY 2013**



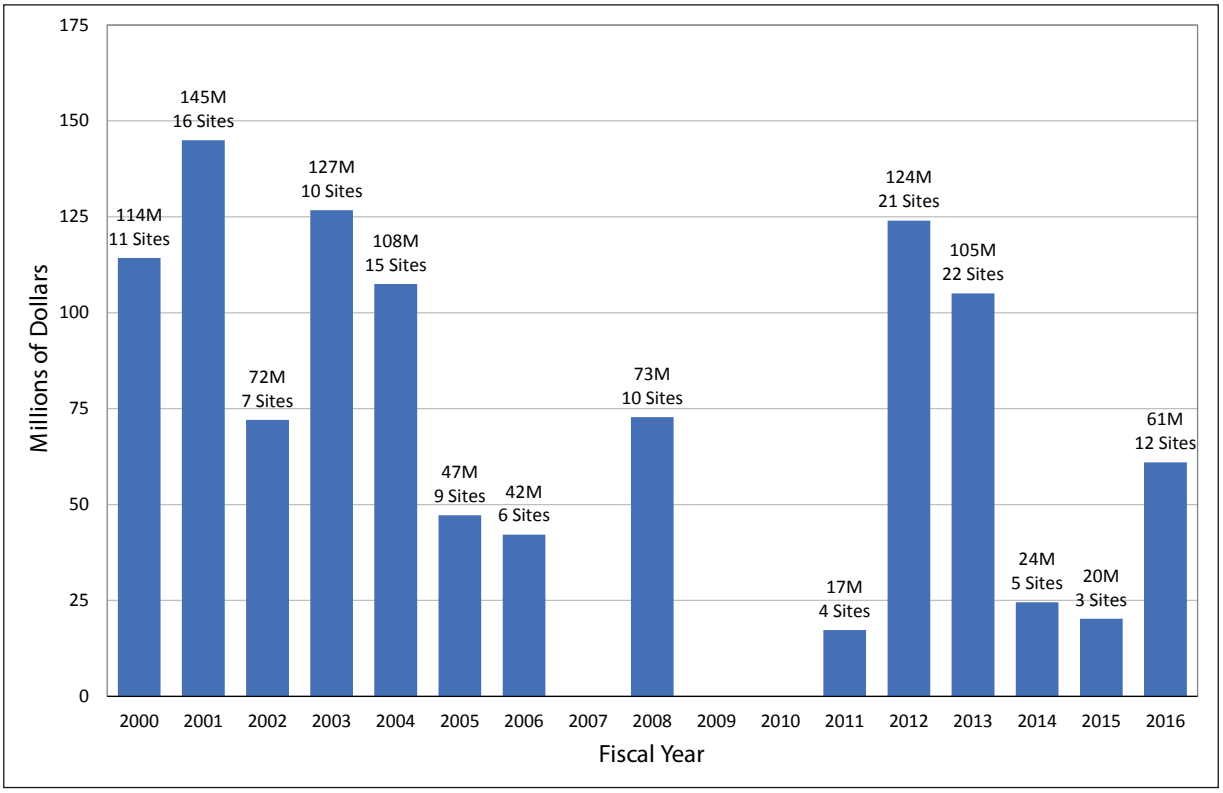

*Source:* GAO-15-812, Figure 5, p. 15. Actual data provided by U.S. EPA.

pre-construction, construction, and post-construction activities; associated staff (payroll) costs; and program management activities. In constant 2016 dollars, the annual budget for the remedial program has decreased by one-third from a high of $749 million in FY 2004 to a low of $501 million in FY 2016.

Not all funds for the program are spent in the same year they are appropriated due to the vagaries of the budget and spending process.[37] In their 2015 report, *Trends in Federal Funding and Cleanup of EPA's Nonfederal National Priorities List Sites*, GAO published information on actual EPA expenditures for remedial activities from FY 2009 through FY 2013 and included remedial expenditures paid for with funds from the American Recovery and Reinvestment Act (ARRA) as well as from Superfund appropriations. As shown in Figure 13 in constant 2016 dollars, overall spending on these activities decreased over this time from a high of $693 million in FY 2010, to a low of $421 million in FY 2013. The additional funds available from the ARRA boosted remedial spending in FY 2009, FY 2010, and FY 2011, almost doubling remedial expenditures in FY 2010 and increasing FY 2011 remedial expenditures by 54 percent. Looking only at expenditures on remedial activities paid from Superfund appropriations, there was a decrease of 21% in constant 2016

37. Program *expenditures* for remedial activities can differ greatly from the amount of funds allocated to the remedial program *budget*. For analysis of trends and costs, it is important to look at expenditure data.

Figure 14. **Number and Associated Cost of Unfunded Remedial Action Starts at Non-Federal NPL Sites in Constant 2016 Dollars, FY 2000–FY 2016**




*Source:* U.S. EPA

dollars from FY 2009 ($526 million) to FY 2013 ($416 million). Remedial expenditures from Superfund appropriations were even lower in FY 2010 and 2011, when they were $362 million and $393 million, respectively.

Based on annual reports issued by EPA since FY 2000, there has clearly been a funding shortfall for remedial actions paid for by EPA. As shown in Figure 14, in 14 of the past 17 years EPA has closed out the year unable to fund some remedial actions that were otherwise ready to be implemented. In constant 2016 dollars, the shortfall in funding needed to start these cleanup projects has ranged from a low of $17 million in FY 2011 to a high of $145 million in FY 2001. Over the past five years, the funding shortfall for remedial actions at the end of the year has averaged $67 million in constant 2016 dollars. In 2010 and 2015, GAO issued reports concluding that the cost to EPA to remediate existing sites exceeded current funding levels and documented trends in federal funding for non-federal NPL cleanups.[38]

Two of the three years when there were no unfunded remedial actions (FY 2009 and FY 2010) are two of the years when EPA received supplemental funding for remedial activities from the ARRA.

38. GAO-10-380, *Superfund: EPA's Estimated Costs to Remediate Existing Sites Exceed Current Funding Levels and More Sites are Expected to Be Added to the National Priorities List*, and GAO-15-812, *Superfund: Trends in Federal Funding and Cleanup of Nonfederal National Priorities List Sites.*

It is likely that the actual Superfund program shortfall exceeds these amounts. Unfunded remedial actions are easy to track as these are projects where the remedy has been designed and the cost of the remedy is part of the remedial design. It is much more difficult to assess whether funding constraints resulted in some sites not being added to the NPL at all or in a slowing down of sites moving through the pre-construction stages. Delays in these earlier stages of the remedial process due to lack of funds would almost certainly lead to a lower number of completed site studies, designs and, ultimately, remedial actions. These results, however, are harder to discern.

An interesting, though certainly not typical, example of the impact of funding constraints on the speed of cleanup is the New Bedford Harbor site in Massachusetts. The 18,000-acre site, which was added to the NPL in 1983, is expected to cost over $300 million to remediate. For many years, all site work was paid for out of Superfund appropriations, and due to budget constraints, EPA allocated approximately $15 million a year to the site. At that rate, EPA estimated that cleanup would take 30 to 40 years to complete. In October of 2012, EPA and the Commonwealth of Massachusetts reached a settlement with AVX Corp.—the main responsible party—for $366 million, which is estimated to cover 90% of the total cleanup costs.[39] At the time of the settlement, EPA estimated that with these funds in hand, the duration of cleanup could be reduced to five to seven years once the project is fully underway.[40]

Another way to examine whether remedial activities are experiencing a funding shortfall is to compare actual EPA expenditures and accomplishments with the estimates found in *Superfund's Future* as shown in Figure 15 (next page). The RFF model included site-specific information on the future actions and likely costs of the 1,245 final and deleted non-federal sites on the NPL as of the end of FY 1999 as well as an estimate of the cost of sites likely to be added to the NPL from FY 2000 through FY 2009. As fewer sites were added to the NPL over this time period than was estimated in *Superfund's Future*, the estimated expenditures for future sites included in Figure 15 has been reduced accordingly.

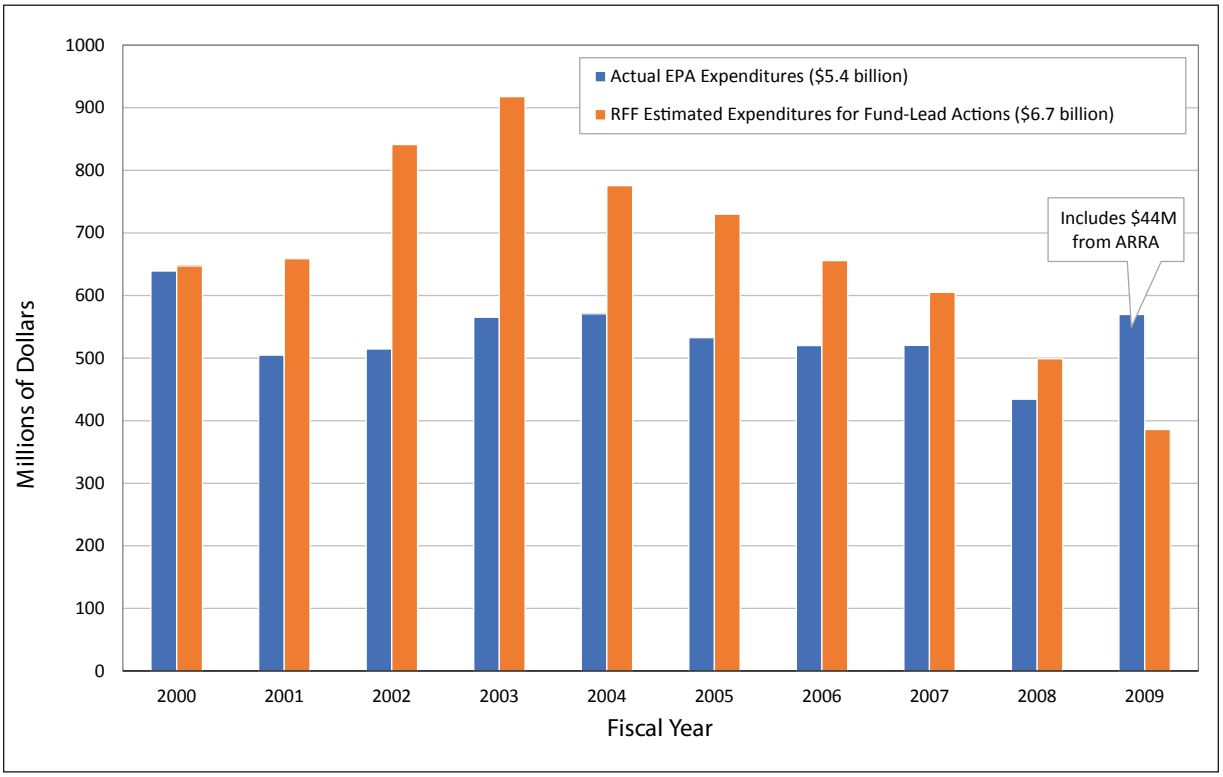
The comparison of EPA expenditures to the RFF estimates shows a funding shortfall. Over the 10-year period from FY 2000 through FY 2009, EPA expenditures for remedial activities totaled $5.4 billion in constant 2016 dollars; the RFF model suggested that a total of $6.7 billion would be needed, a funding gap of $1.3 billion. If the $44 million in ARRA dollars spent in FY 2009 is not included, this gap would be even larger. The RFF estimates assumed full funding of each phase of the remedial program when each phase was ready to begin.

A comparison of the actual number of non-federal NPL sites that were designated construction complete to the number predicted in the RFF model also reveals a dramatic shortfall as shown in Figure 16 (page 26). Actual construction comple-

39. All cost estimates for New Bedford Harbor are in nominal, not constant, dollars.

40. "Harbor Cleanup," available online at https://www.epa.gov/new-bedford-harbor/harbor-cleanup accessed 1/17/17; and *New Bedford Harbor Superfund Site, Supplemental Consent Decree with Defendant AVX Corporation, Additional Frequently Asked Questions*, October 25, 2012.

Figure 15. **Actual EPA Remedial Expenditures vs. RFF Estimated Expenditures in Constant 2016 Dollars, FY 2000–FY 2009**



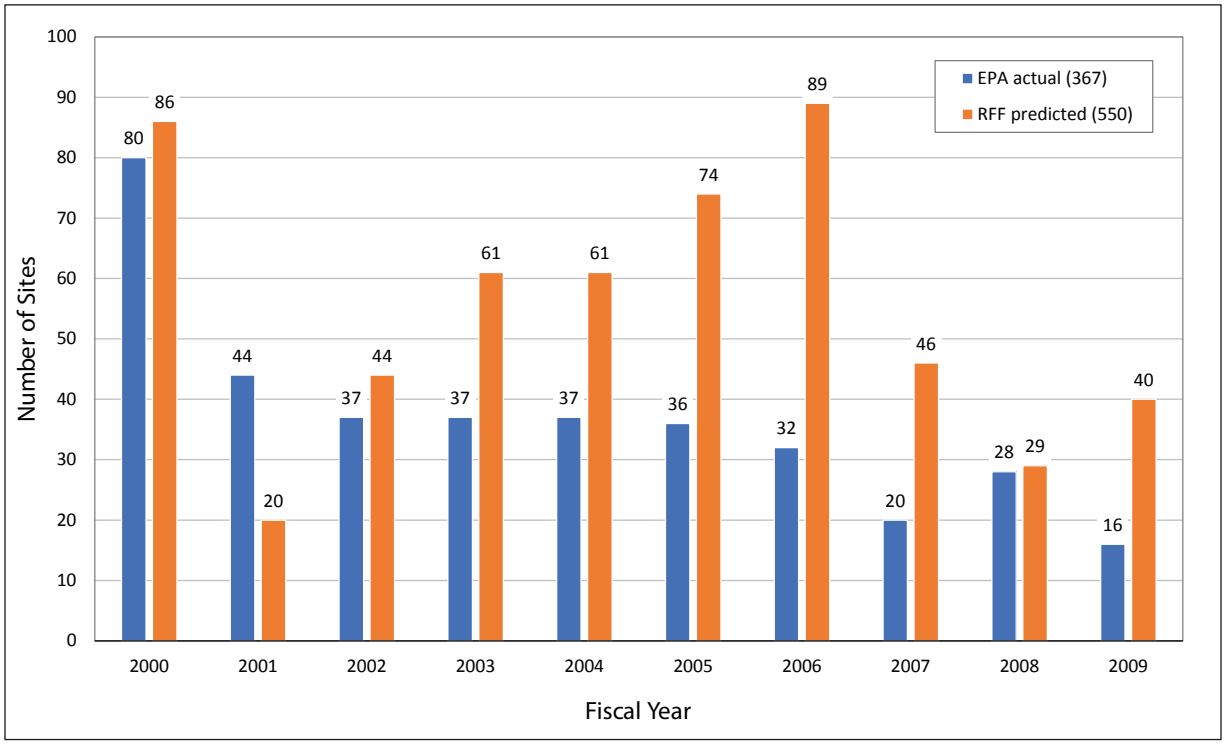

*Source:* Actual EPA expenditures are from GAO-15-812 Report, Figure 5; RFF estimated expenditures are from *Superfund's Future*, Table H-1 (base case), p. 256, and Table H-5 (low case), p. 259, reduced by 22% to adjust for that fact that approximately 22% fewer sites were added to the NPL from FY 2000 through FY 2009 than was assumed in the low case.

*Note:* Fund-lead actions are paid for by EPA.

tions over this 10-year period totaled 367; the RFF model, which assumed that all necessary funds for fund-lead (that is, EPA-financed) actions would be available and that all site activities, whether fund-lead or PRP-lead, would proceed at an "average" pace, predicted that 550 non-federal NPL sites would reach this stage. The RFF model predicted that almost 50% (183) more sites would reach construction complete than was achieved. Of course, without more detailed analysis there is no way to discern the relative role of PRP-lead actions in this discrepancy, but it is likely that lack of funding played some role. Based on this comparison, program accomplishments have clearly fallen behind what was predicted in the 2001 Report to Congress, *Superfund's Future*.

Estimating needed funding for the remedial cleanup program would require information on the Superfund program's workload, which is not publicly available. EPA has not issued an estimate of the remaining cost of cleaning up sites currently on the NPL for many years, yet this type of information is critical to evaluating whether annual appropriations are adequate. While this is a substantial undertaking, it can and should be done.

Figure 16. **Non-Federal NPL Sites Reaching Construction Complete: Actual EPA vs. RFF Predicted, FY 2000–FY 2009**




*Sources:* U.S. EPA, and *Superfund's Future*, Table H-2, p. 257.

## Conclusions and Recommendations

Improving the implementation of the Superfund cleanup program requires a frank assessment of its accomplishments thus far and an understanding of the challenges ahead. The conclusions and recommendations set forth below are intended to provide a starting point for that discussion.

1. **Funding for the Superfund program has declined markedly since FY 2000, and it appears that the remedial program is facing a funding shortfall.**

*Funding for the Superfund program, in general, and the remedial program, in particular, has decreased dramatically in recent years.* In constant 2016 dollars, annual Superfund appropriations declined from a high of $1.9 billion in FY 2000 to a low of $1.09 billion in FY 2016, a decrease of 43% in real dollars. Not surprisingly, funding for the remedial program declined as well, from a high of $749 million in FY 2004 to a low of $501 million in FY 2016, a decrease of 33 percent.[41]

*Due to lack of funding, EPA has had to delay the start of some number of cleanups for 14 of the past 17 years.* In FY 2016, EPA had to put 13 cleanup projects at 12 NPL

41. These figures do *not* include the additional $666 million, in constant 2016 dollars, of ARRA funds allocated to the program in FY 2009. The amount of the remedial program budget for FY 2000 and FY 2001 was not available from U.S. EPA.

sites on hold due to lack of funding. The estimated price tag to get the 13 projects started was $61 million. (EPA estimated the total cost of these 13 cleanup projects to be $200 million or more.) Over the past five years, the end-of-year funding shortfall for remedial action projects has averaged $67 million in constant 2016 dollars. Most likely, this is only the tip of the iceberg in terms of underfunding as unfunded remedial action starts are among the easiest items to track. Much more difficult to quantify are more subtle results of funding constraints: sites not added to the NPL, site study and remedial projects spread out over a longer time period, and other less visible actions not taken or delayed due to lack of resources.

*A comparison of actual EPA expenditures and accomplishments with the estimates in* Superfund's Future *shows a major shortfall.* Over the period from FY 2000 though FY 2009, EPA expenditures for the cost of all EPA-lead actions at non-federal NPL sites were almost 20% lower than the estimates in *Superfund's Future*, even after taking into account that fewer sites were added to the NPL than was assumed in the most conservative estimate. The number of sites that achieved construction complete status over this same 10-year period was almost one-third fewer than was estimated in the RFF model, which assumed that the remedial program would be fully funded. More detailed analysis is needed to confirm that the decrease in construction completions is due to fewer resources being allocated to these actions than was estimated in *Superfund's Future*, but it seems likely that lack of funding played a role.

2. **Cleanup progress has slowed in recent years.**

*The average number of non-federal NPL sites reaching construction complete status and being deleted each year is relatively small and has decreased in the last five years.* Since the beginning of FY 2000, 462 non-federal NPL sites achieved construction complete, an average of 27 a year. During the years from FY 2001 through FY 2006, the average number of sites reaching construction complete was 37 per year. However, the average dropped to 12 sites a year for the five years from FY 2012 through FY 2016, when only 60 sites were designated construction complete. Since the beginning of FY 2000, a total of 186 non-federal sites were deleted from the NPL, an average of just under 11 sites a year; since FY 2012, that average has decreased to eight deletions a year.

There is a pressing need to better understand what factors have led to the slowdown in cleanup progress and what steps could be taken to address this issue. While funding constraints are almost certainly a factor, there are other possible reasons that should be evaluated, including whether there are more effective ways to deploy EPA staff and dollars, whether PRPs are implementing their cleanup obligations in a timely manner, and whether the technical challenges presented by certain types of sites and contamination make it impossible, at some sites, to speed action.

3. **There is still a need for the federal Superfund program. Not only is there more work to be done to complete cleanup at current non-federal NPL sites, but new sites continue to be added to the NPL each year.**

*There is still a sizable amount of work to be done to complete cleanup at non-federal sites on the NPL.* Four hundred and forty-one (28%) of the 1,555 non-federal sites on

the NPL at the end of FY 2016 were "active" sites, that is sites that were neither deleted from the NPL nor construction complete. The number of active sites has remained relatively constant over the past five years, ranging from 427 to 441 active sites each year. The 441 active sites have more operable units per site than sites that have reached the construction complete stage, and thus they are likely more complex and possibly more expensive to remediate. More detailed analysis is needed to determine whether EPA's workload—which includes implementing EPA-lead actions and overseeing PRP-lead actions—has increased, decreased, or remained relatively constant.

In addition, the 48% (739) of non-federal NPL sites that are construction complete at the end of FY 2016 will continue to require some EPA resources either to implement EPA-funded long-term response actions or to oversee PRP-lead actions as well as to conduct periodic site reviews. While these costs likely will not be very substantial in terms of total expenditures, these activities may be expensive at some sites and will require EPA staff. States, who bear the burden of 100% of operations and maintenance for remedial actions paid for by EPA, are increasingly concerned about the long-term cost burden this presents.

There are still many non-federal NPL sites where human exposure and groundwater contamination either are not "under control," or there is insufficient information to make this determination.

More detailed information on the remaining work to be implemented at non-federal NPL sites, as well as whether EPA or PRPs are footing the bill for the various activities, is needed to determine EPA's future workload and funding needs. EPA staff are needed for both PRP and EPA-lead actions.

*New sites continue to be added to the NPL each year, and the number of non-federal sites added to the NPL in recent years has not declined much compared to earlier years.* Over the past seven years, 121 non-federal sites were added to the NPL, an average of 17 sites each year. This is only a small decrease from the average number of non-federal sites (19) added to the NPL each year from FY 2000 through FY 2009. NPL listing is required to obtain federal funding for remedial actions. Typically, sites are added to the NPL to obtain federal cleanup funds, federal enforcement, federal expertise, or all three, and this is done with state concurrence. Anecdotally, some believe that the sites now being added to the NPL are more complex from a technical standpoint (such as contaminated sediment sites) and are more likely to have bankrupt PRPs, although better information is needed to confirm that this is the case. More information is needed to be able to evaluate whether the types of sites being added to the NPL in recent years are different in any meaningful way from the sites added in earlier years and if they are, the implications this might have for future EPA staff and funding needs.

4. **Better information on the basic building blocks of the Superfund remedial program is needed.**

*There is a lack of public information on the cost of cleanup for non-federal NPL sites, the duration of each major phase of the remedial pipeline, the types of sites being added to the NPL, and many of the critical building blocks that would be needed to estimate*

*EPA's future funding and staffing needs.* In some cases, it appears EPA has not analyzed information it already has in its own database to develop these estimates, and, in other cases, EPA has not collected the kind of consistent and reliable information that is needed.

EPA has not issued an estimate of the future cost of cleanup for all non-federal NPL sites in many years. EPA used to issue an estimate of the future cost to EPA of completing cleanups at all non-federal NPL sites, referred to as the "out-year liability model," on an annual basis. While there may have been criticisms of the assumptions used, this model provided a baseline for other estimates and a point of comparison to annual appropriations. In addition, although EPA releases information on the value of PRP settlements at NPL sites and on the amount of funds held in site-specific "special accounts," the Agency has never issued an estimate of future costs to PRPs at NPL sites.

EPA has not made public basic information regarding the major components of remedial program costs, such as: the average cost of each phase of the remedial pipeline for all sites, and by individual site type; the number of sites that are expected to have cleanup costs of $50 million or more; what percentage of costs (rather than actions) are being paid for by PRPs, as compared to EPA; and whether PRP-lead actions take more time or less, on average, than EPA actions. These data points, as well as others, are needed to accurately forecast the future staffing and funding needs for the remedial program.

In addition, EPA does not collect consistent and reliable information on the types of sites that are added to the NPL and the attributes that may have contributed to the need for Superfund listing, such as bankrupt PRPs, complex contamination, or lack of state financial capacity. This kind of information would enable the Agency and others to examine trends in the types of sites warranting federal attention and to determine whether the nature of sites added to the NPL is changing over time. Finally, there is little or no consistent and reliable information on state financial capabilities, even though states are responsible for 10% of the cost of EPA-financed remedial actions and 100% of the operations and maintenance activities that follow.

### Recommendations

Sound decisions about the future direction and funding of the Superfund remedial program require better information and data and a commitment to analyzing that data and making it public. It will be very difficult to identify effective reforms to speed cleanup and to develop better metrics of program accomplishments for the Superfund program without analyzing data EPA already has and filling in critical data gaps. Below are recommendations for specific studies and actions EPA should implement and should make public. It should be noted that, although the program may face staff and funding constraints, none of the recommendations below would require a large amount of time or money.

**1. EPA should estimate the future cost of completing work at all non-federal sites on the NPL.** This estimate, and the assumptions behind it, should be made public and should be updated on an annual basis. Absent an annual estimate of the future cost of cleaning up non-federal sites on the NPL, it is difficult, if not impossible, to evaluate whether annual funding levels are adequate. To ensure the credibility of the effort, EPA should commission a small advisory panel of outside experts to review the approach, data used, assumptions, and results. This work does not have to be an expensive or time-consuming exercise, as the goal is to have a reasonable ballpark estimate of future costs, not a precise figure. A simple model with site-specific costs for all mega sites (cleanup cost of $50 million or more) and average unit costs by site type for all other sites, based on the total number of operable units at each site, would be sufficient as a starting point. Over time, the estimate can become more precise. The model should include the cost of future EPA actions and activities at all non-federal NPL sites and of long-term response actions paid for by EPA. The estimate should include both extramural (contract) and intramural (staff) costs and the staff costs to oversee PRP-lead actions.

**2. EPA should develop credible and robust data about the critical building blocks of the Superfund remedial program.** As noted repeatedly, there is a lack of robust data and information about the building blocks of the Superfund remedial program. EPA should analyze its own data and develop and make public information regarding: the range and average cost of cleanup at different types of sites, the range and average duration of the major steps in the remedial process for different types of sites, and the relative financial contribution of PRPs and EPA to cleanup costs**.** Without robust information on these critical building blocks of the program, it is difficult to assess whether current funding is adequate and how much future funding is needed, much less to hold EPA accountable for any lack of progress. Looking at the patterns among sites and examining trends and averages in site costs and cleanup duration could help senior management pinpoint anomalies, develop better metrics, evaluate progress, hold regions and PRPs accountable, and lead to a much more informed public debate about how to improve the Superfund program. This information should be updated at least every five years, if not annually.

**3. EPA should develop better information on the types of sites listed on the NPL.** Any effort to estimate future remedial program staff and funding needs requires a deeper understanding of the kind of sites that have been added to the NPL in recent years, what factors have led to the need for NPL listing, and what kinds of sites are likely to be added in the future. To fill this data gap, EPA should conduct or commission two studies, described below.

- **Analysis of NPL site types:** EPA should analyze the types of sites that have been added to the NPL over the past five years. This analysis should include information on the industrial operations at the site (if appropriate), the media contaminated, the extent or volume of contamination, the factors that led to its listing on the NPL (such as bankrupt PRPs, or lack of state funding or legal authority), whether each site is likely to cost $50 million or more to remediate (qualifying as a mega site), and whether the remedial actions are

likely to be paid for by EPA or PRPs, among other attributes. This analysis should be based on current information about the sites, not information collected at the time of listing.

- **Estimate of sites to be added to the NPL:** EPA should issue a report estimating the number and types of non-federal sites likely to be added to the NPL in the future. This report should be based on interviews with EPA's 10 regional offices and with state agency officials to find out what kinds of sites they think are likely to be added to the NPL over the next five years, and why. This analysis should focus on identifying emerging types of sites, contaminants, and situations that are likely to warrant federal enforcement, federal funding, or both.

Both studies should be updated every five years.

**4. In addition to reporting program accomplishments for all NPL sites as a group, EPA should report progress for specific subsets or categories of sites and actions.** Providing information only for all sites on the NPL as a group, as EPA now does, obscures the very real challenges presented by complex sites. EPA should amend the coding in its central data management system to enable it to easily cull different subsets of sites, such as mega sites, contaminated waterways, properties ripe for redevelopment, and sites where it is known that it will be 10 years or more before cleanup objectives are likely to be achieved. These categories of sites each present different challenges and opportunities, making it helpful to be able to examine cost and progress at each of these different types of sites as a group. For example, it is likely that it is difficult, if not impossible, to bring human exposure under control at a contaminated waterway such as the Hudson River or New Bedford sites. If the EPA data management system coded all contaminated waterways, then it would be easy to determine how many of the sites where human exposure is not under control are contaminated waterways, where this goal may not be achievable for many years. Similarly, some look to Superfund as an engine for redevelopment. Identifying that subset of NPL sites where the property is valuable and ripe for redevelopment, such as the Industri-Plex site in Woburn, Massachusetts, would provide a better gauge of the program's success in this area than tracking redevelopment at all NPL sites. These are just a few examples of ways in which the data management system could be improved to provide more nuanced information about the remedial program, its challenges, and successes.

In addition, EPA should present all program metrics and accomplishments separately for EPA- and PRP-lead actions and for non-federal and federal facility sites.

**5. Better Superfund metrics are needed.** The fact that so few non-federal NPL sites are being deleted and reaching construction complete each year suggests that the current array of metrics are no longer providing much useful information. As the Superfund program again faces external pressure to speed cleanup and show progress, it is likely EPA will seek to develop new metrics for documenting achievements. The incentive is to adopt measures that show larger numbers of program accomplishments. As an example, the original cleanup accomplishment measure

for the program was the number of sites deleted from the NPL, but when it became clear this was taking a long time, the program came up with the construction completion measure, then partial deletions, and more recently remedial action project starts and completions. Without a context—such as the number of total remedial actions that will be undertaken at all sites—the number of remedial actions started or completed is meaningless. Simply dividing site activities into smaller and smaller units does not show progress. Moreover, these kinds of measures may not even provide useful information about the real accomplishments at the site in terms of protecting public health and the environment.

The measures that are intended to document risks at the site—those indicating whether human exposure and groundwater contamination are under control—need improvement. These measures provide no indication of the severity of the risk, the likelihood of human exposure, or how long contamination has been uncontrolled. EPA should report each quarter the number of non-federal NPL sites that (1) were categorized as not under control in the previous quarter but are now under control, and (2) were categorized as under control in the previous quarter but are now not under control. While some of this information is available on a site-by-site basis, the rationale for program metrics is to provide comparable information across all sites.

New metrics should be judged by whether they provide useful information that increases understanding of site progress and the obstacles to progress, not by whether they will result in a larger number of the items being counted ("more beans"). EPA should seek to develop metrics that convey information about real program accomplishments, not simply steps in the remedial pipeline. The metrics should provide EPA senior management, Congress, and the public a more robust understanding of both the program's accomplishments and the challenges that lie ahead.

**6. EPA should issue a report detailing what actions are needed to reduce possible human exposure to contamination at non-federal NPL sites where a site is characterized as having human exposure or groundwater migration that is "not under control."** EPA should review all non-federal NPL sites where human exposure and groundwater migration (1) is not under control, or (2) where there are insufficient data to determine if it is under control, to determine what steps would be needed to resolve these issues. This assessment should identify the specific steps that are needed to bring human exposure and groundwater migration under control, as well as whether these actions would be paid for by PRPs or EPA and, if EPA, the associated cost. For those sites with insufficient data, the report should detail why this is the case, and what steps would be needed to make this determination. In addition, the assessment should examine whether there are technical obstacles to addressing these concerns and identify those specific sites where it is not technically possible to bring the measure under control in the next decade, and why. Based on this analysis, EPA should revise the current performance measures to make them more meaningful and create a new code for both metrics that indicates those sites where it is not technically feasible to bring

(1) human exposure, or (2) groundwater migration under control in the next 10 years (or some specified time period to be decided by EPA).

**7. EPA should commission an independent analysis of the financial capacity and legal authorities of state Superfund programs.** This report should be conducted in coordination with the Association of State and Territorial Solid Waste Management Officials, and potentially with the Environmental Council of the States or the National Governors Association. Some have suggested there is little or no need for a federal cleanup program and that the program should be delegated to the states. Yet few (if any) states have the financial resources to pay for the cleanup of an NPL-caliber site, much less a mega site. Under Section 104 of CERCLA, states must contribute to the cost of cleanup at non-federal NPL sites when the remedial action is paid for by EPA. At these sites, the law requires states to pay for 10% of the cost of the remedial action and 100% of all operation and maintenance costs. The report on state capacity should include information for all 50 states[42] on the number of non-federal NPL sites where the state is currently responsible for 10% of government-performed remedial actions and the associated cost burden, as well as the estimated annual cost of operation and maintenance for these sites. In addition, the study should include information on the total amount of monies, if any, in each state's cleanup fund (that is, funds that could be used to clean up contaminated sites similar to those listed on the NPL), whether these funds are replenished on an on-going basis, the average cost of any state-funded cleanups implemented over the past 10 years, and whether state Superfund laws have the same liability provisions as CERCLA. This kind of information was previously available for a number of years when EPA commissioned an in-depth analysis of state Superfund programs that was conducted by the Environmental Law Institute. The last of these reports was issued in 2002.[43]

42. Because of OMB information collection budget requirements, this might have to be limited to nine states, in which case we recommend that information on the nine states with the most non-federal sites added to the NPL in the last five years be included.

43. Go to https://www.eli.org/research-report/analysis-state-superfund-programs-50-state-study-2001-update to download *An Analysis of State Superfund Programs: 50-State Study, 2001 Update*, November 2002, Environmental Law Institute, Washington, DC.

# Appendix A

## Deflator Source and Factors Used to Convert Nominal 1999 Through 2015 Dollars to Constant 2016 Dollars

| Year | Deflator |
|---|---|
| 1999 | 1.39 |
| 2000 | 1.36 |
| 2001 | 1.33 |
| 2002 | 1.31 |
| 2003 | 1.28 |
| 2004 | 1.25 |
| 2005 | 1.21 |
| 2006 | 1.17 |
| 2007 | 1.14 |
| 2008 | 1.12 |
| 2009 | 1.11 |
| 2010 | 1.1 |
| 2011 | 1.08 |
| 2012 | 1.06 |
| 2013 | 1.04 |
| 2014 | 1.02 |
| 2015 | 1.01 |
| 2016 | 1 |

*Source:* The deflator used to convert 1999 through 2015 nominal dollars to constant 2016 dollars is from https://www.bea.gov/index.htm.

*Calculator:* http://stats.areppim.com/calc/calc_usdlrxdeflator.php

# Appendix B

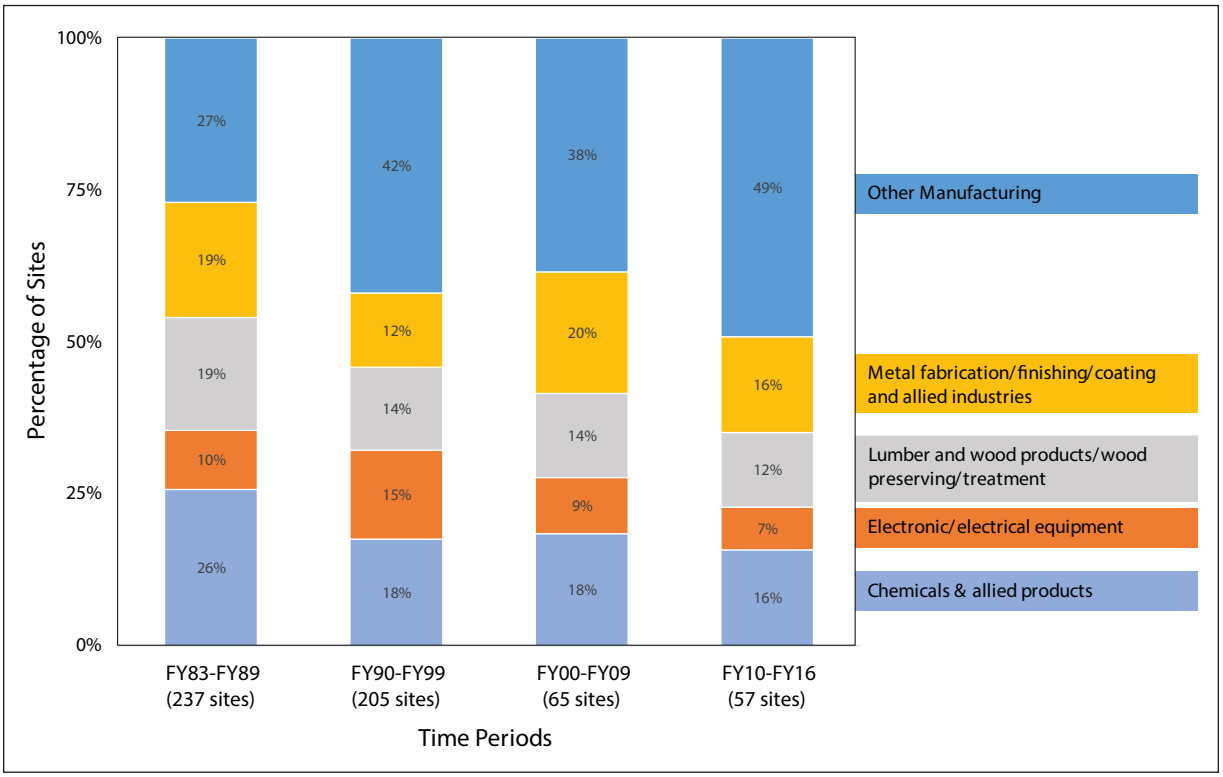
## U.S. EPA Matrix of Site Type Categories

| Site Type/Site Sub-Type Combinations | |
|---|---|
| **Site Type: Mining**<br>Coal<br>Metals<br>Mineral processing/smelting only<br>Mining only<br>Mining and mineral processing/smelting<br>Multiple<br>Non-metal minerals<br>Oil and gas<br>Uranium mining<br>Uranium processing<br>Other (enter other category name)<br>Unknown | **Site Type: Waste Management**<br>Co-disposal landfill (municipal and industrial)<br>Illegal disposal/open dump<br>Industrial waste facility (non-generator)<br>Industrial waste landfill<br>Mine tailings disposal<br>Multiple<br>Municipal solid waste landfill<br>Radioactive waste treatment, storage, disposal (non-generator)<br>Other (enter other category name)<br>Unknown |
| **Site Type: Manufacturing/Processing/ Maintenance**<br>Chemicals and allied products<br>Coal gasification<br>Coke production<br>Electric power generation and distribution<br>Electronic/electrical equipment<br>Fabrics/textiles<br>Lumber and wood products—pulp and paper<br>Lumber and wood products—wood preserving / treatment<br>Metal fabrication, finishing, coating and allied industries<br>Multiple<br>Oil and gas refining<br>Ordnance production<br>Plastics and rubber products<br>Primary metals/mineral processing<br>Radioactive products<br>Tanneries<br>Trucks, ships, trains, aircraft and related components<br>Other (enter other category name)<br>Unknown | **Site Type: Other**<br>Agricultural (e.g., grain elevator)<br>Contaminated sediment site with no identifiable source<br>Dry-cleaning operations<br>Dust control<br>Ground water plume site with no identifiable source<br>Lighthouse<br>Military—other ordinance<br>Multiple<br>Product storage / distribution<br>Ranger station<br>Research, development, and testing facility<br>Residential<br>Retail/commercial<br>School or daycare<br>Spill or other one-time event<br>Transportation (e.g., railroad yards, airport, barge docking site)<br>Treatment works, septic tanks, other sewage treatment<br>Unknown<br>Other (enter other category name)<br>Work Center |
| **Site Type: Recycling**<br>Automobiles and tires<br>Batteries, scrap metals, secondary smelting, precious metal recovery<br>Chemicals and chemical waste (e.g., solvent recovery)<br>Drums and tanks<br>Multiple<br>Waste, used oil<br>Other (enter other category name)<br>Unknown | |

*Source:* Pre-CERCLA Screening Guidance, U.S. EPA, Office of Land and Emergency Management, OLEM Directive 9200.3-107 December 2016.

# Appendix C

## Comparison of Different Types of Manufacturing Sites Added to the NPL Over Time by Percentage of Sites Listed

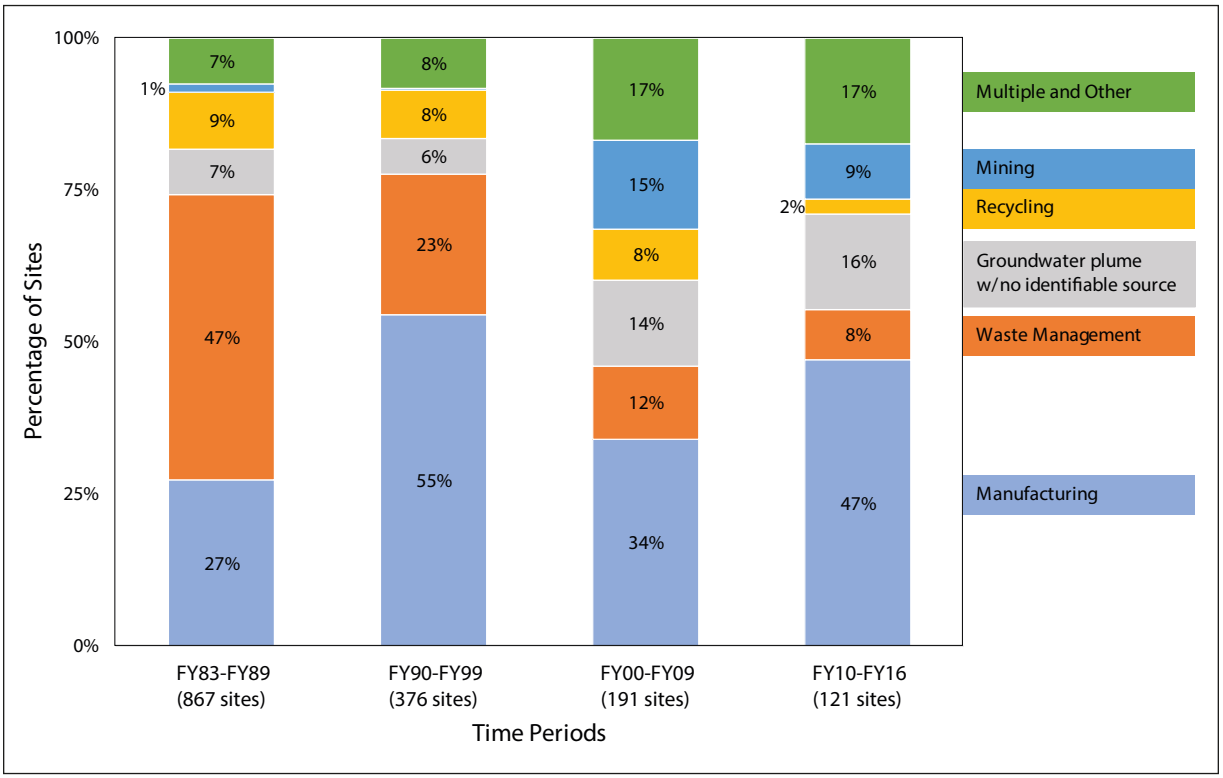



*Source:* U.S. EPA

*Note:* Percentages may not add to 100% due to rounding.

# Appendix D

## Non-Federal Sites Added to the NPL by Type: Comparison Over Time, by Percentage




*Source:* U.S. EPA

*Note:* Percentages may not add to 100% due to rounding.

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