

# Superfund

## *A Half Century of Progress*



EPA Alumni Association

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## Preface

Former managers and staff of the U.S. Environmental Protection Agency (EPA) have formed an [EPA Alumni Association](#) (EPA AA). The Association has developed this and six other web-based environmental reports in support of our *Half Century of Progress* project. An integrated summary based on all of these reports, [Protecting the Environment: A Half Century of Progress](#), is available on the Association website. The Association has developed these materials to inform high school and college students and other members of the public about the major environmental problems and issues encountered in the United States in the 1960s and 70s and the actions taken and progress made in mitigating these problems over the last half-century. We also want to highlight continuing and emerging environmental challenges we face today. We hope that, besides summarizing the history of U.S. environmental programs, these reports might inspire some students and others to consider careers in the environmental field.

A number of retired EPA program managers and subject matter experts worked together to produce the first editions of these reports in 2016. Additional experts have updated these documents in 2020 in recognition of the 50th anniversary of Earth Day and the creation of the EPA. This updated report has been reviewed by relevant members the EPA AA Board of Directors and other alumni. We welcome comments on this document, which you may provide at this [EPA Alumni Association link](#).

The Association has also produced a *Teacher’s Guide* to facilitate the use of these materials by educators interested in including the *Half Century of Progress* in high school and college curricula. The *Guide* contains data interpretation and other questions related to the report topics, with answers. It also includes activities that challenge students to learn more about environmental issues in their communities, web-based resources for additional activities, and three lesson plans related to the HCP materials. These plans were designed and tested by three AP Environmental Science Teachers. Teachers may request a copy [here](#).



# History

In April 1978, residents of Niagara, New York, awoke to newspaper headlines about a former river diversion called Love Canal. Following practices typical of the time, a local chemical company had used the abandoned canal for years as a dump site for a variety of hazardous wastes. When high groundwater levels began pushing toxins to the surface at the then-closed site, the public became alarmed: an elementary school sat on a portion of the property, and a residential neighborhood was nearby. By August, both New York State and the federal government had declared states of emergency. Thus began the long saga of one of the most notable chapters in environmental cleanup history, which contributed significantly to the formation of the EPA Superfund Program.

Until the 1970s, there were few controls on the handling and disposal of hazardous waste. Generators of waste typically disposed of manufacturing, industrial, and other byproducts onsite—often in unlined pits—or arranged for companies to transport them offsite, usually to locations unknown to the generator. Once waste left the plant fence line, companies usually had no idea where it ended up. Unscrupulous transporters or disposers of such waste had little, if any, regulatory oversight, and many times the waste was disposed of in locations that caused significant harm to groundwater, surface waters, soils,

vegetation—even air quality. This resulted in a legacy of sites throughout the country where public health and the environment were being seriously harmed. In the late 1970s, the legacy of past hazardous waste disposal practices (e.g., [Love Canal](#) and Valley of the Drums ) sparked a growing awareness by policymakers and the public that something needed to be done.



Love Canal residents discuss revitalizing their neighborhood with EPA Administrator Lee Thomas in September 1985.





Superfund site in New Jersey, where soil, river sediments, and groundwater were contaminated by industrial practices from the late 1880s to the 1990s. *Photo: EPA*

The challenge was daunting; many highly contaminated sites needing cleanup posed significant health and environmental risks, and were characterized by complex remediation challenges. Moreover, at a large number of sites the parties who owned contaminated land were unknown, were not financially viable, or did not believe that they were responsible for the contamination. Often, waste generators who paid third parties to haul their wastes away were not aware of where the shipments ended up. Since there was no effluent discharge or regulated and reportable air emissions—and hazardous waste rules were still being developed—there was no apparent national-level control over the contamination or means or method to require cleanup.



In the days before the Superfund Program was created, the regulatory environment for industrial or municipal facilities depended on owner/operators to exercise the necessary environmental and public health precautions, and ensure long-term safety. However, policymakers recognized early on that some components for a comprehensive solution existed. In many cases, the businesses and facilities linked to contaminated waste sites were financially sound and functioning, so there was a cash stream that could be tapped for environmental cleanup. The Clean Water Act and Clean Air Act—strengthened versions of earlier, weaker environmental protection laws—were enacted by Congress in the early 1970s, and had already begun to implement regulatory safeguards for these facilities. The national hazardous waste management program developed under the federal Resource Conservation and Recovery Act (RCRA) had just been passed in 1976, and regulations—though not yet developed—were being considered. The purpose of RCRA was to manage the handling of currently generated/transported/disposed of hazardous waste, but was not focused on handling past contamination.

Although EPA attempted to use the developing RCRA program to deal with some hazardous waste sites using emergency authorities under Section 7003, it became apparent to many that a new law was necessary to deal with the complexities of older, highly contaminated sites with multiple responsible parties. As the 1970s waned, public interest in a comprehensive path forward for site cleanups further intensified.



[Shpack Landfill Superfund Site](#), Norton, Massachusetts.

Photo: Massachusetts Department of Environmental Protection

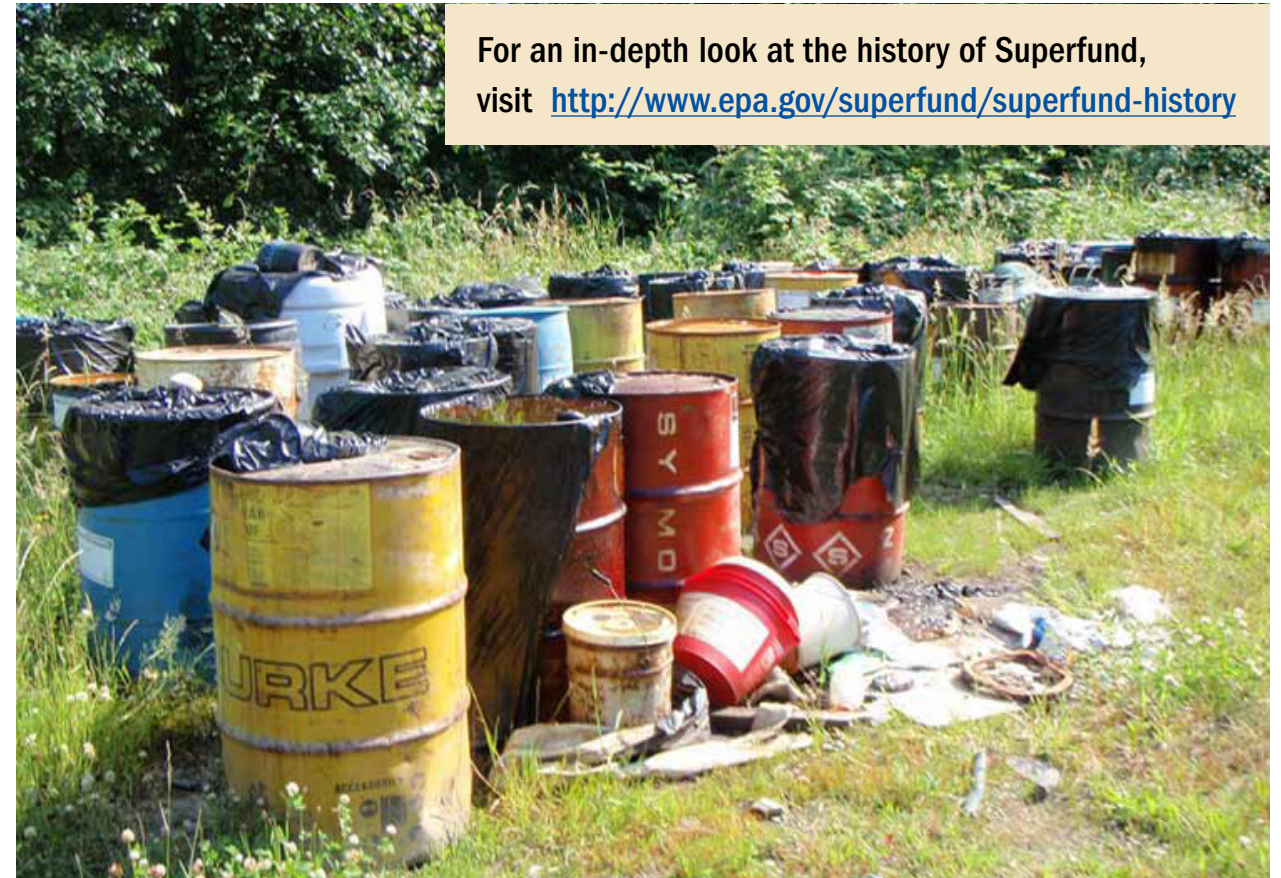


# Major Early Implementation Actions Taken

In December 1980, during a lame duck session of Congress, the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)—nicknamed “Superfund”—was passed by Congress and signed by the outgoing President, Jimmy Carter. Because many of the contaminated sites being discovered at that time were either “orphan” sites (i.e., without known or financially viable owners), or were caused by parties who did not have records to show where their waste went during past decades, it was clearly recognized that two approaches might be necessary:

- A different liability scheme from CERCLA, or
- A public works program for cleanup that would provide government funding for cleanup.

In the end, both concepts were included in the new law. Because of the difficulty in assigning responsibility for cleanups, it was recognized that there was a need for strict, joint, several (multi-party), and retroactive liability to secure financially viable parties who could and should pay for cleanup. Contrary to most environmental laws, which usually deal only with current owners/violators, Superfund casts a wider net for its responsible parties. These parties include past or present generators and transporters of hazardous materials to the site, as well as current—and with some exceptions, past—owners of the site in order to find enough responsible parties to pay for the cleanups.



For an in-depth look at the history of Superfund, visit <http://www.epa.gov/superfund/superfund-history>

The legislation recognized that resources were needed for EPA staffing of the program, as well as for site investigations and cleanups where responsible parties could not be easily found. As a result, the Superfund was established to provide public funding—financed by a taxing mechanism on certain industries—to build the program, manage it, and clean up “true” orphan sites. Funding started at \$1.6 billion, increasing later to \$8.5 billion.





**Valley of the Drums.** The A.L. Taylor Superfund site in Kentucky, also known as the Valley of the Drums, served as an open dump for thousands of barrels of hazardous and other wastes. Photo: EPA

During the early days of the Superfund program's implementation, comprehensive regulations to address releases of hazardous substances were developed and added to the already existing National Contingency Plan for oil spill responses and cleanup. The revised National Contingency Plan provided the framework for program implementation. EPA was required to develop a *National Priorities List* of sites needing attention. The agency also had to grapple with the question of how much cleanup to conduct at sites—i.e., to answer the question “how clean is clean enough” to adequately and appropriately protect human health and the environment. In some communities, like Love Canal in New York



and Times Beach, Missouri, which were close to areas of severe contamination or underlain by contaminated groundwater, EPA temporarily or permanently relocated residents. During this early period of program development, much of the Superfund was utilized for government staffing and contract funds to implement the program.

Early cleanup action focused on site cleanup studies, emergency responses to contain and stabilize immediate threats, and mechanisms to identify potentially responsible parties (PRPs) who would be liable for cleanup costs. During this time, there was significant public support for the program.



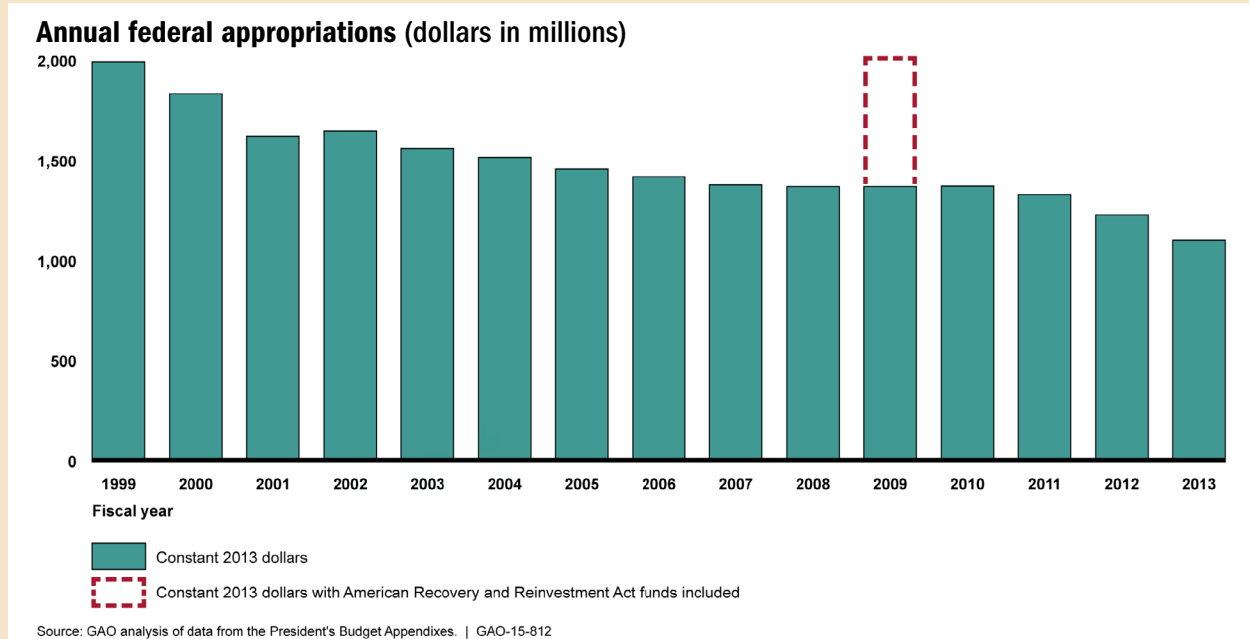
# The Program Overcomes Hurdles

Emergency response activities were highly successful in reducing immediate threats to human health and the environment throughout the years. Many Superfund sites were tens or hundreds of square miles in area and presented technical and logistical challenges—for example, at sites where river bottom sediments had been contaminated over decades before the Clean Water Act curtailed such toxic discharges. Former nuclear weapons sites and munitions depots, often encompassing hundreds or thousands of acres, added to the challenge of requiring federal agencies to undertake or fund remedial action. Because of the huge sums and long time frames that were required for the larger, more complex, and longer-term cleanup actions, many stakeholders began to criticize the program. They included potentially responsible parties (PRP) who may be liable for the contamination, states, Congress, and the public.

Early political concerns and criticism about program management resulted in senior staff changes in the early 1980s. In addition, EPA began to streamline cleanup administrative processes and developed a more robust enforcement program for PRPs to shoulder a larger load of site cleanups. Further, the continuing complexity of investigations and site characterizations meant progress on many cleanups was slow. Early results were disappointing to many critics. Groundwater cleanups were especially problematic, as more became known about

technological limitations and need for even longer cleanup times. Long-term “remedial” cleanup costs rose rapidly from the millions, to the tens of millions, to the hundreds of millions of dollars, fueling criticism from parties responsible for paying for the cleanups. EPA responded with a set of administrative reforms meant to speed up program implementation and increase fairness for PRPs. This led to some improvements in process and results.

The Superfund tax on industry expired in 1995, although the Bush Administration had recommended its renewal. Consequently funding for the program was required to come from general appropriations. As a result, significant limits were put on EPA’s ability to perform cleanup work itself, and an increasing

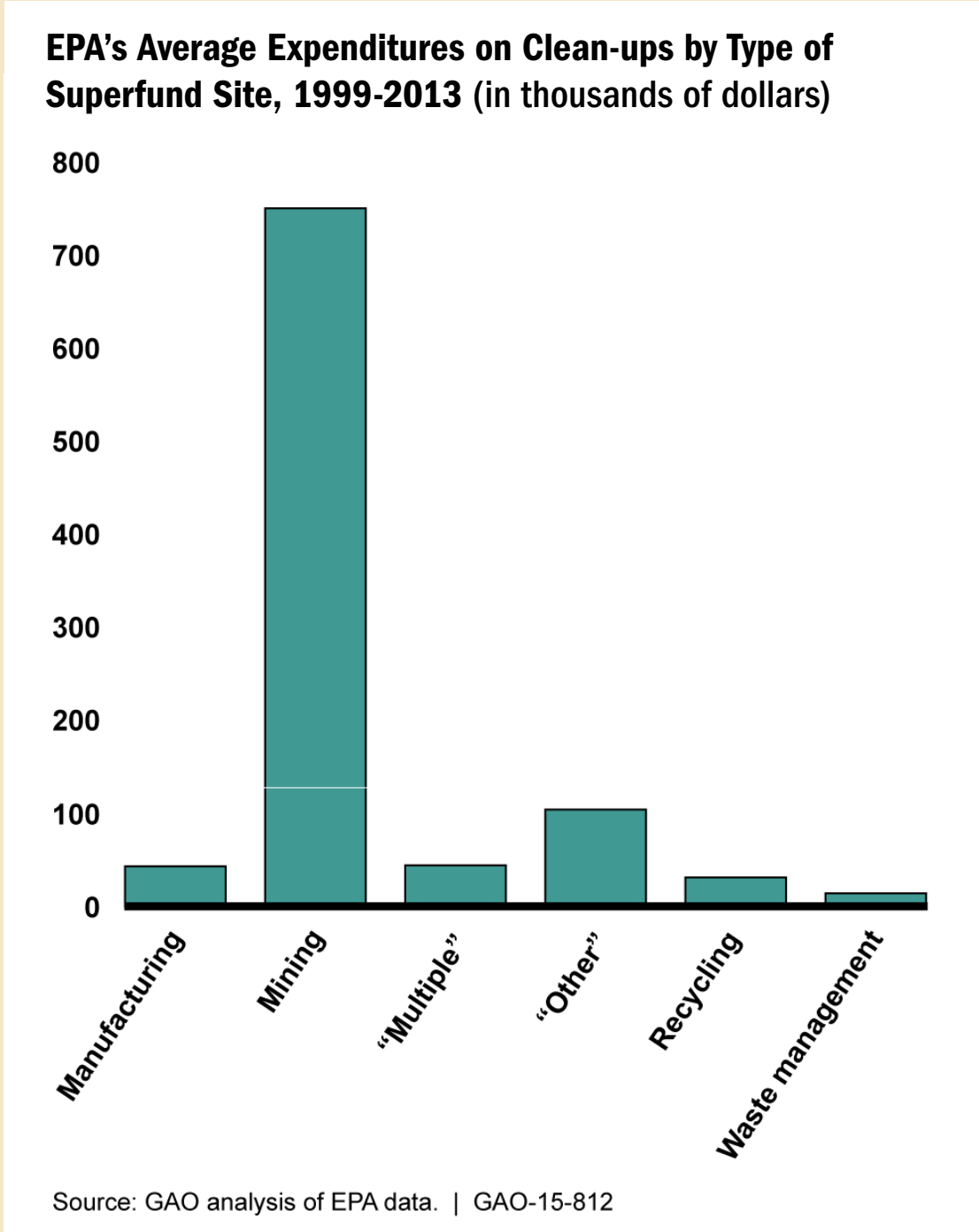


EPA's Superfund Program Annual Appropriations, Fiscal Years 1999 through 2013



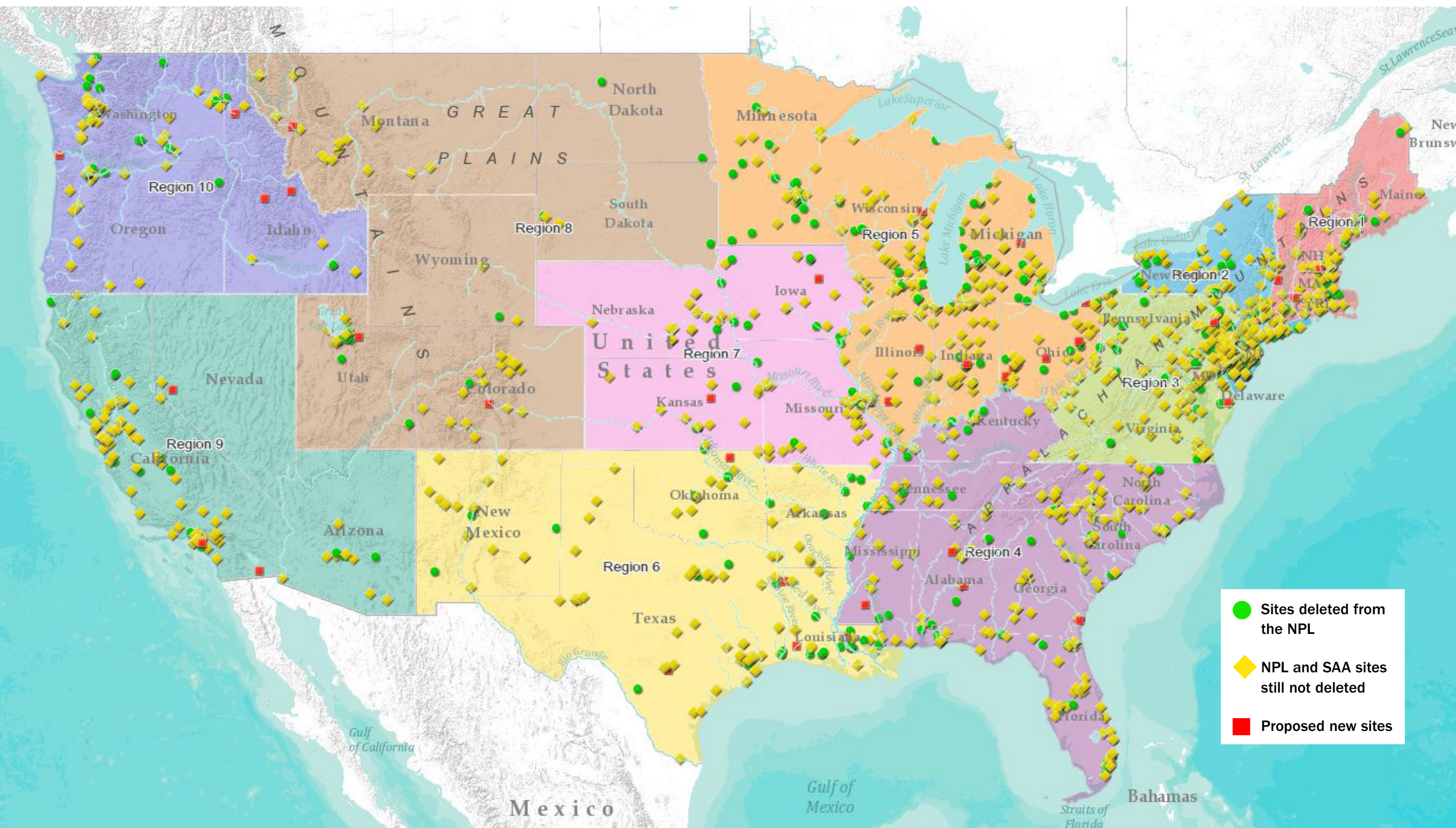
percentage of cleanups was being performed by PRPs and their contractors. EPA focused its regulatory activities during this period and onward on ensuring that PRPs perform most of the cleanups, thus saving dwindling public dollars for government oversight of private actions and emergency responses.

In the 21<sup>st</sup> century, the Superfund program has continued to remediate hazardous waste sites, albeit with more consistent implementation approaches and reduced budgets as responsible parties, state and local governments, Congress, and local citizens have recognized the difficulties of hazardous site cleanup. Most cleanup is done by responsible parties under the oversight of EPA and states that have set up parallel programs for less contaminated sites. Also, the federal government has reserved funding for cleaning up formerly or currently owned federal facility sites. Many of the smaller, less complex sites have been remediated, and a higher proportion of sites are large-area, difficult-to-remediate sites, such as mine tailing and sediment cleanups, as shown in the figure right.



Source: Government Accounting Office, 2015





[Map of Superfund National Priority List \(NPL\) and Superfund Alternative Approach \(SAA\) Sites in the Lower 48 States](#)

Click on the bold blue hyperlink for EPA's interactive map that provides details on the status of all sites, including all 50 states and U.S. territories.



# Current Status of Superfund and Progress Made

The map above shows all current, deleted, and proposed new Superfund and Superfund alternative sites. EPA estimates that as of 2016, about 53 million people, or roughly 16% of the U.S. population, live within three miles of listed and alternative Superfund sites.<sup>1</sup> EPA data show this population is, however, contains a higher percentage of minorities, is lower income, more linguistically isolated, and less likely to have a high school education than the overall U.S. population (see Table). Overall, these communities may have fewer resources with which to address concerns about their environment. EPA cautions that proximity to a site does not necessarily represent risk of health effects, as exposure to contamination varies significantly across all sites. As noted below, the majority of sites have completed construction of cleanup facilities.

Proportions of Key Demographics in the Total Near Site Population and the Total U.S. Population

	Population within 1 Mile of All Sites	Population within 3 Miles of All Sites	U.S. Population
Minority	49.3%	49.7%	38.4%
Below poverty level	16.7%	16.7%	14.7%
Linguistically isolated	8.4%	8.1%	5.2%
Less than a High School Education	16.3%	15.8%	13.5%

Since 1983, about 1,750 sites have been put on the National Priorities List. The following lists provides two measures for the status of NPL sites as of 2019:

- Number of sites cleaned up and removed from the cleanup list: 424
- Number of sites where construction of cleanup facilities is completed, but need to be operated into the future: 1,212
- Number of sites where human exposure is under control: 1,484<sup>a</sup>
- Number of sites where human exposure is not under control: 113
- Number of sites with insufficient data on exposure: 152

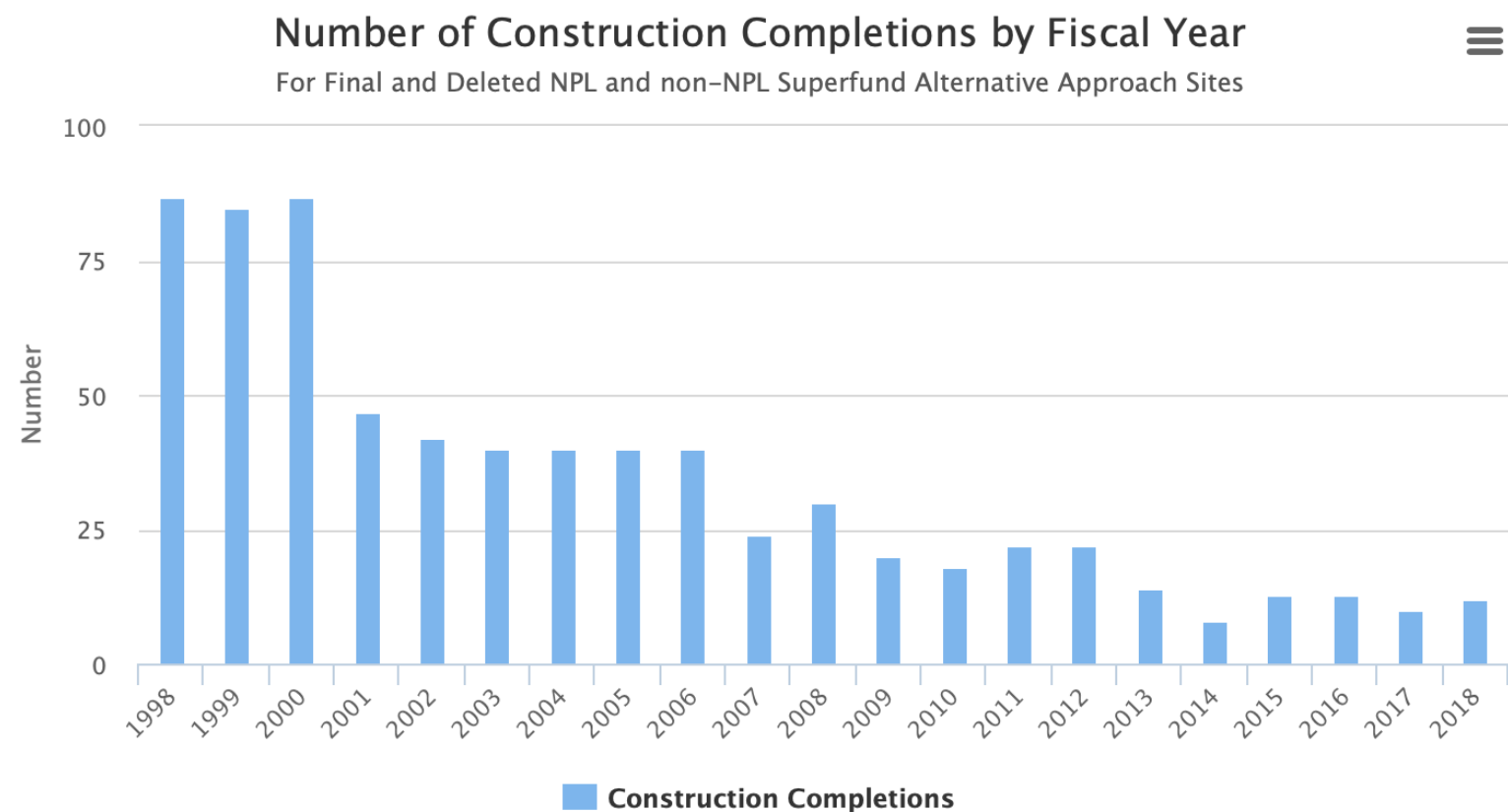
The first measure (top two bullets) includes sites delisted. The cleanup facilities are in place, but need to be maintained to ensure continued protection. This category has been used for decades. The second measure relating to human exposure (bottom three bullets) is new. EPA considers human exposure as “under control” where EPA assessments indicate there are currently no unacceptable human exposure pathways anywhere on site. The extent and nature of exposures can vary widely among sites; site specific summaries provided by EPA can be found [here](#).

<sup>a</sup> This includes NPL sites taken off the list.



One can look at these numbers from two perspectives. One reaction could be that only 424 sites have been fully remediated and removed from the list, and there is still much work that needs to be done to clean up all the sites on the list. This view does not consider the complexities of studying and remediating contamination that is underground, and thus very difficult to locate and remove, even with today’s technologies. Another view could be that over 90% of sites either have been fully cleaned up or are in the process of being cleaned up. The public’s reaction to the Superfund program tends to gravitate toward these two views. In fact, there has been a tremendous reduction in risk to the public from these cleanups, and most critics recognize that this work is important and needs to continue.

[The long record of cleanup completions](#) provides a measure of activity since the program began. A substantial jump in the annual number of cleanup completions began in 1992 (88/yr) and ranged between 61 and 88 per year through 2000. The EPA chart below shows the trend for 1998–2018. Cleanup completions dropped significantly after 2000, with further reductions after 2006 and beyond. Part of the drop may be related the elimination of the tax on industry in the 1995 and the need to focus more on responsible parties—but EPA’s administrative budget for Superfund also fell during this period. GAO reported annual appropriations for the Superfund program fell from about \$2 billion in 1999 to about \$1.1 billion in 2013.<sup>2</sup> EPA’s Superfund Cleanup budget was \$837 million in 2018 and estimated at \$785 million in 2019.<sup>3</sup>





## Other Benefits of Superfund Programs

The results above show the completions of facility cleanups that reduce exposures of the public to toxic materials contaminating water, soil, and air at or near Superfund sites. This is the primary objective of the program. A 2011 study examined the effect of site cleanups on infant health in areas within 5 km of 154 sites that were cleaned up between 1989 and 2003.<sup>4</sup> The results suggest that Superfund cleanups reduce the incidence of birth defects by roughly 20–25%.

An additional unquantifiable benefit of the Superfund program has been how the Superfund liability scheme has revolutionized the way commercial and industrial real estate is transferred. No longer can sellers of such property use the old adage “let the buyer beware” as a means to relieve themselves of liability for contamination from past activities. No conditions in a private contract of sale regarding past contamination can shield a party from Superfund liability. In addition, buyers of such properties have been much more conscious of potential liability. An entire industry has developed that deals with site investigations, characterizations, and potential Superfund liability in property transactions, thus ensuring that knowledge of contamination is clear to all parties during property transfers.

Another benefit of the Superfund program is the recognition that industrial development of remediated Superfund sites creates opportunities for industrial growth in formally blighted areas. The

“Brownfields” program was started in the 1990s and developed processes, procedures, and funding for local governments to convert formerly contaminated sites to productive industrial redevelopment. Prompted by a series of court cases in the early 1990s that essentially caused lenders to redline contaminated property for fear of potential liability, the first several rounds of Brownfields pilot projects provided local governments with financial assistance and tools to assess such properties in terms of the financial ramifications of any contamination, and also provided prospective lenders and purchasers with liability relief.

These early rounds of pilot projects in the mid-1990s became so politically and financially acclaimed that they led to widespread calls by labor unions, local governments, and financial entities for Congressional legislation to codify the program’s success. In January 2002, President George W. Bush signed into law the Small Business Liability Relief and Brownfields Revitalization Act (the “Brownfields Law”).

As of early 2020, EPA estimates that grants through the Brownfields program have cumulatively leveraged \$31.2 billion, 160,300 jobs, and led to over 92,000 acres of land made ready for reuse.<sup>5</sup> The program has also led to ancillary economic revitalization. A 2017 study<sup>6</sup> found that residential property values within 1.3 miles of an assessed or cleaned-up brownfields site increased by 5.1 to 12.8 percent.



# Superfund Emergency Response Program

The U.S. Coast Guard, which maintained an emergency response center to receive and respond to reported oil spills to waterways before Superfund was enacted, operates a National Response Center 7 days a week, 24 hours a day. The NRC receives as many as 25,000 reports of spills and other incidents annually. Where indications are that a spill in coastal waters and ports involves primarily oil, the USCG has responsibility to respond and avert or remediate environmental damage, or oversee efforts of private parties and local and state governments to do so. Where a spill or threatened release involves hazardous materials or oil in inland waters, EPA has that responsibility. EPA will designate an on-scene coordinator and emergency responders. Their job is to assess the severity of the situation and work with partners in federal, state, and local agencies to reduce human and environmental risk. EPA On-Scene Coordinators investigate instances of “midnight dumping” of containers of hazardous materials, respond to train derailments with tank cars of toxic chemicals substances, and address releases of toxic, corrosive, explosive, and radiological materials associated with natural disasters such as tornadoes and hurricanes.

Many large and complex NPL listed sites have involved imminent hazards that required emergency “removal” actions even while the site was under consideration for listing or after listing and while a permanent and comprehensive remedial action was being



In Cameron, Louisiana, EPA environmental specialists carefully dispose of chemicals spilled during Hurricane Rita. EPA was involved in a massive operation to identify and clean up any hazards so people would not be exposed. Photo: Marvin Nauman, FEMA

evaluated planned, or underway. The Valley of the Drums site, for example, mentioned at the beginning of this Report, required several removal actions before the final remedy was selected and implemented. One of these emergency actions occurred in September 1981. Prior to the final cleanup, Superfund provided \$400,000 in emergency support for removal of about 1,500 drums containing chemical waste. The drums—containing benzene, toluene, and methylmethacrylate—were deteriorating and leaking into Wilson Creek, and officials were concerned about elevated risks of a fire at the site.



## Anatomy of an Emergency Response

In late December 2015, a major weather system dropped approximately ten inches of rain over three days across much of the central United States. The Meramec River basin hit record flood stages in the St. Louis area, and 14 people died. More than 9,500 customers lost power. Many area roads and highways were closed, and several thousand homes and businesses were flooded in four counties in the St. Louis area.

A federal emergency disaster declaration was made for the flooded areas. The Federal

Emergency Management Agency tasked EPA Region 7 with curbside collection and disposal of household hazardous waste, freon-containing household appliances, electronic goods, and orphaned hazardous material containers. EPA also collected and disposed of all flood related demolition debris, sandbags, and wood debris from homes and public areas in the flood zone.<sup>7</sup>

From January to late February 2016, EPA's work resulted in the recycling, treatment or disposal of more than 2,200 dump truck loads of residential

flood debris. EPA's response teams collected more than:

- 300 drums,
- 20,000 assorted small containers,
- 100 large containers,
- 170 propane tanks,
- 260 compressed gas tanks,
- 1,000 major appliances such as refrigerators and stoves,
- 400 batteries,
- 170 small engines, and
- 6,000 other electronic items.

Field teams outfitted with mobile geographic information system (GIS) mobile device applications collected and updated target information while on collection runs. Geotagged photos, impacted areas, and waste target data were captured and streamed in near-real-time to a web site that was used by responding agencies. This enabled EPA and its federal and state partners get a better picture of response operations, direct response crews, and track progress.



View of Valley Park, Missouri, December 31, 2015. Photo: Missouri National Guard



## Emergency Response: The Anthrax Cleanup on Capitol Hill



On September 18, 2001, just one week after the terrorist attacks on the Twin Towers and the Pentagon, letters containing deadly anthrax spores were received by several

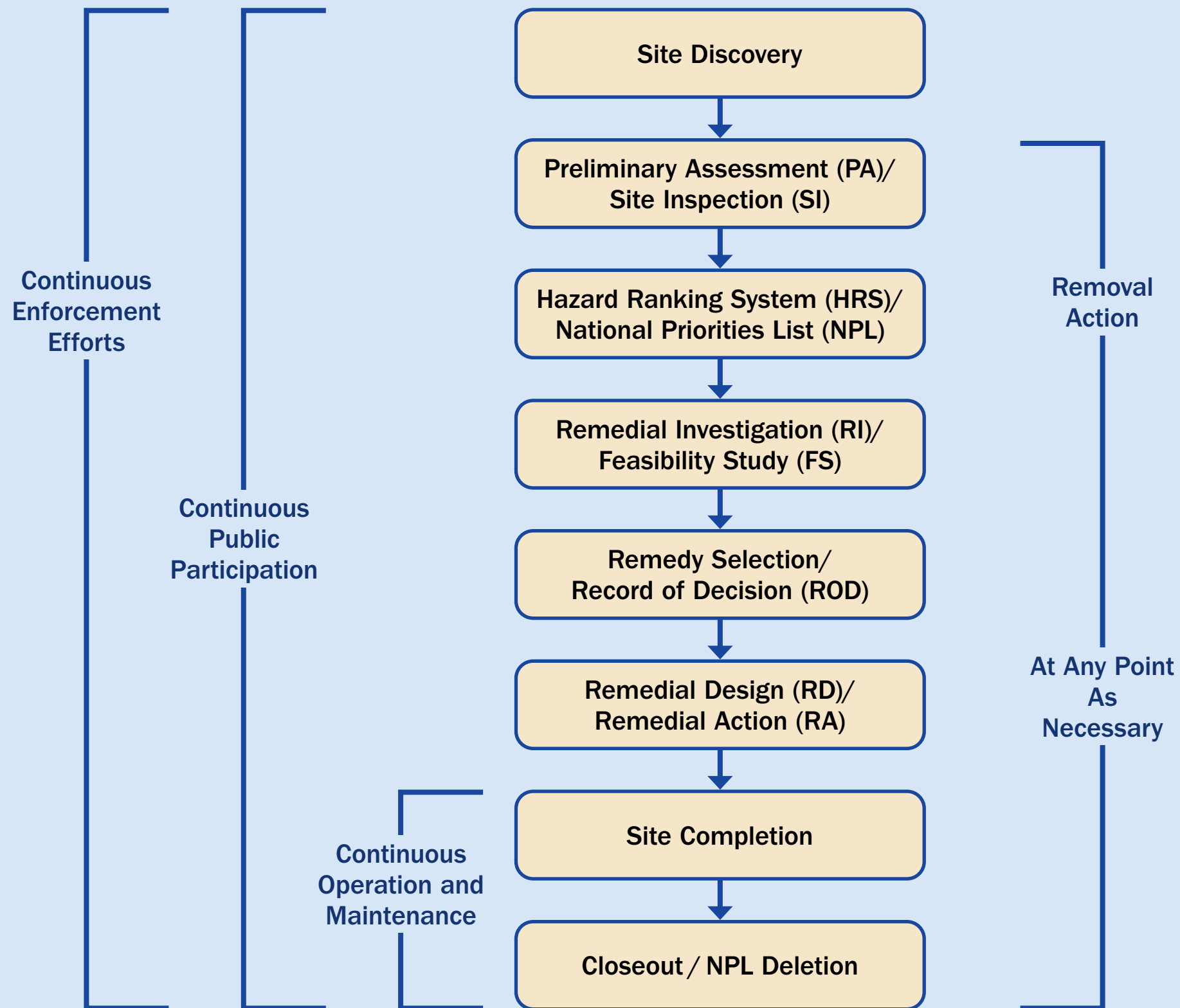
news media offices and then-Senate Majority Leader, Tom Daschle. A similar letter containing anthrax was addressed to Senator Patrick Leahy was misrouted and later found in a mail processing facility in Virginia. Five people died of inhalation anthrax in the incident and 16 others were sickened. The Hart Senate Office Building, other Senate facilities, and several mail processing facilities were contaminated and had to be evacuated. In this documentary, which can be viewed [here](#), participants in the clean-up effort describe how EPA, the National Institute for Occupational Safety and Health (NIOSH), the Center for Disease Control (CDC), and other agencies, collaborated to solve a scientific and engineering challenge never before faced—making an entire building contaminated with deadly anthrax spores safe. The mission had to be accomplished while working under severe time pressure and in the full glare of intensive media coverage.



A sample is inserted into a vial in the Hart Senate Office Building. Photo: EPA



## The Superfund Process





# Future Challenges

Significant future challenges continue as Superfund budgets decline. As the simple and relatively easy sites are cleaned up, a residual number of difficult and massive sites need to be addressed. Examples are large-area mining and sediment sites, with estimated costs in the hundreds of millions to billions of dollars for cleanup at each site. Currently, these few large sites dominate EPA funding capabilities, leading people who live near other unfunded sites to wonder: “Where is Superfund?”

Another challenge in the Superfund program comes from past or current federal facilities, which are also being remediated much more slowly. Among the reasons are the differences in EPA’s ability to require performance as compared with private sites, the sheer number of federal facility sites, and the difficulty of dealing with Department of Energy radioactive wastes. As a result, a significant number of federal facilities still need to be remediated.

Climate change also presents a significant challenge. A 2019 GAO report found that nearly 950 Superfund sites may be at risk from the impacts of climate change, including hurricane storm surges and flooding that could spread their toxic legacies into waterways, communities and farmlands.<sup>8</sup> The report made recommendations to improve planning to address the potential impacts.



Top: Nuclear reactors line the bank of the Columbia River in Washington at the Hanford Site in January 1960. Bottom left: Hanford site mid-cleanup, July 2012. Bottom right: A container of waste is excavated from a storage trench. Photos: U.S. Department of Energy



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## Endnotes

- <sup>1</sup> [U.S. EPA](#), Office of Land and Emergency Management Estimate. 2017. Data collected includes: (1) Superfund site information as of the end of FY2016; and (2) 20011-2015 American Community Survey (ACS) census data. Sites used in this analysis included 1,836 Superfund final, deleted, and proposed National Priorities List (NPL) sites, as well as non-NPL Superfund Alternative Agreement sites in the 50 U.S. states and Puerto Rico with accurate location data.
- <sup>2</sup> [GAO, 2015](#). SUPERFUND: Trends in Federal Funding and Cleanup of EPA's Nonfederal National Priorities List Sites GAO-15-812
- <sup>3</sup> [EPA Budget in Brief 2020](#). Superfund Cleanups and Infant Health. Janet Currie, Michael Greenstone, and Enrico Moretti NBER Working Paper No. 16844 March 2011. JEL No. H4,I1,Q5 GAO, 2019.  
[SUPERFUND: EPA Should Take Additional Actions to Manage Risks from Climate Change. October 2019.](#)
- <sup>4</sup> Superfund Cleanups and Infant Health. Janet Currie, Michael Greenstone, and Enrico Moretti NBER Working Paper No. 16844 March 2011. JEL No. H4,I1,Q5
- <sup>5</sup> EPA. 2020 Summary of Brownfields Program Accomplishments <https://www.epa.gov/brownfields/brownfields-program-accomplishments-and-benefits>
- <sup>6</sup> Haninger, K., L. Ma, and C. Timmins. 2017. [The Value of Brownfield Remediation](#). *Journal of the Association of Environmental and Resource Economists* 4(1): 197-24
- <sup>7</sup> <https://www.epa.gov/emergency-response/emergency-response-and-management-activities#regional%20newslettershttps://www.epa.gov/emergency-response/emergency-response-and-management-activities#regional%20newsletters>
- <sup>8</sup> GAO, 2019. [SUPERFUND: EPA Should Take Additional Actions to Manage Risks from Climate Change. October 2019.](#)