
Comparisons with Other Estimates and Implications for Policy

Estimates by the Congressional Budget Office of future Superfund costs are very different from earlier estimates developed by the Environmental Protection Agency and the University of Tennessee. The main factors that explain the differences are CBO's broader coverage of costs and use of discounted dollars, different average cleanup costs per site, and different numbers of sites on the National Priorities List. The CBO estimates of average cleanup costs are lower than the EPA and Tennessee figures, primarily because of the assumed private-sector cost advantage and barrel-scraping effect.

The estimates presented here have four main implications for Superfund policy. First, future costs will remain highly uncertain until the ultimate number of sites to be cleaned up is known more precisely. Second, the cleanup job is far from over. Third, costs to the states will rise dramatically from current levels, though they will remain a relatively small share of total Superfund costs. Fourth, under the assumptions of the base case and high case, large increases in federal and private spending will be required over the next decade to avoid a growing backlog of sites awaiting cleanup.

CBO's analysis provides a baseline estimate that assumes no significant policy changes. Two administrative changes that are being carried out or discussed by EPA now are unlikely to have major effects on total costs. Many other policy changes have been proposed, some of which would have larger cost implications. Given adequate data, the

costs of these alternatives could be estimated using the same methods employed in Chapter 2.

Why Do the CBO, EPA, and Tennessee Estimates Differ?

The CBO, EPA, and University of Tennessee estimates of Superfund costs--\$74 billion, \$16 billion, and \$151 billion, respectively--are not directly comparable and rely on many different assumptions and analyses.¹ A handful of key factors explain most of the differences, however.

Two factors make direct comparisons of the estimates inappropriate. One is the different coverage of types of costs. The CBO figure includes all future public and private Superfund expenditures (including private transaction costs), but the EPA figure covers only costs to the federal government, and the Tennessee estimate covers public and private costs for study and cleanup at NPL sites--including costs before 1993--omitting administrative and legal expenses and the costs of screening and removals at non-NPL sites. The other comparability issue is that

1. See Environmental Protection Agency, Office of Emergency and Remedial Response, *Progress Toward Implementing Superfund: Fiscal Year 1990* (February 1992), pp. 33-38; and E. W. Colglazier, T. Cox, and K. Davis, *Estimating Resource Requirements for NPL Sites* (Knoxville, Tenn.: University of Tennessee, Waste Management Research and Education Institute, 1991).

the CBO estimate is in present-worth dollars, but the EPA and Tennessee figures are in undiscounted dollars.

The estimates also differ in their assumptions and analyses of the number of sites to be cleaned up, the average cleanup costs, and the costs of activities other than cleanup. For example, the CBO base case assumes 4,500 nonfederal NPL sites, the EPA figure covers only the 1,120 sites listed through 1990, and the Tennessee estimate assumes 3,000 sites. Average cleanup costs per NPL site, measured using a common 10 percent discount rate for operations and maintenance costs, are \$21 million in the CBO base case, \$29 million in the EPA estimate, and \$32 million in the Tennessee analysis.² The Tennessee study also assumes \$1 million per site in "pre-remedial costs"; the comparable figure in the CBO analysis, covering removal actions, remedial investigations/feasibility studies, and remedial designs, is roughly \$4 million.

The importance of each of these factors can be seen in a closer comparison of the CBO and Tennessee cost estimates. In undiscounted dollars, CBO's estimate is not \$74 billion but \$228 billion, reversing the apparent difference from Tennessee's figure of \$151 million. Scaling up the Tennessee estimate from 3,000 to 4,500 nonfederal NPL sites yields a cost of \$226 billion, almost entirely closing the gap. The story does not end there, however. The CBO estimate for only the site-specific costs, past and future, of studies and cleanup at NPL sites is \$161 billion (of which \$12 billion is costs before 1993). The difference between \$161 billion and \$226 billion is the result of the Tennessee study's higher remedial action costs and lower preremedial costs. In percentage terms, the discounting factor accounts for 200 percent of the original gap between the CBO and Tennessee estimates, the assumptions about NPL size for negative 97 percent, the cost-coverage factor for negative 87 percent, and the difference in average site costs--mostly remedial action costs--for 84 percent.

2. See *Federal Register*, June 23, 1992, p. 34022; and Colglazier, Cox, and Davis, *Estimating Resource Requirements*, Figure 4.13. The \$25 million figure for the CBO base case given in Chapter 2 discounted O&M costs at 7 percent.

This examination of the gap between the CBO and Tennessee estimates raises the question of why CBO's cleanup costs are lower. Assumptions about two factors--the efficiency of private-sector cleanups and future trends in the costliness of sites--explain most of the difference. Eliminating the 20 percent efficiency advantage assumed for private-sector cleanups would raise CBO's estimate of average costs per site, measured at a 10 percent discount rate, from \$21 million to \$24 million. Also eliminating the assumed downward trend in site costliness (the barrel-scraping effect) would bring the CBO estimate as high as \$31 million--between the EPA and Tennessee figures of \$29 million and \$32 million per site.³ The remaining gaps are attributable to differences in data on the costs of individual cleanup projects: all three studies combine cost estimates from records of decision with data on post-ROD cost overruns, but the sets of projects sampled in the three analyses, though overlapping, are not identical.

The key CBO assumption of a downward trend in site costliness receives some support from the fact that EPA has recently reduced its own estimate of average cleanup costs per site. The addition of data on recent cleanups, coupled with corrections to flawed older data, has led EPA to lower its estimate of average remedial action costs from \$29 million per site, the figure used in its projection of future federal costs, to \$26 million.⁴ This revised estimate is close to the \$24 million average estimated by CBO in the absence of private-sector cost savings--or equivalently, for cleanups funded by the federal government.

3. CBO's highest figure, \$30.6 million, is obtained under the strictest interpretation of "eliminating the downward trend." In this version, all sites are assumed to be distributed among the mega, major, and minor categories in the same proportions as were the first 711 sites proposed for the NPL. Alternatively, average costs for future cleanups could be assumed to equal those observed through 1992. This interpretation would yield a somewhat lower estimate, because the average through 1992 is already reduced by the lower incidence of mega-sites among sites listed in later cohorts.

4. Environmental Protection Agency, Office of Emergency and Remedial Response, "Overview of the Outyear Liability Model," fact sheet (December 1993).

Implications for Federal Cleanup Policy

Four main policy implications can be derived from CBO's estimates of future Superfund costs despite the significant uncertainty represented by the difference between the low and high scenarios. That uncertainty itself is the focus of the first implication.

Superfund Costs Depend on the Size of the Cleanup Problem, Which Remains Unknown

Some uncertainty is unavoidable in any attempt to estimate costs decades into the future. Given the unpredictability of changes in technology and policy, such estimates cannot be regarded as forecasts but at best as extrapolations based on currently observable trends.

In the case of Superfund, however, so little is known about the ultimate size of the problem that estimates of the remaining costs are conditional not only on technology and policy but also on the number of sites to be cleaned up. The assumed numbers of NPL sites in CBO's low and high cases range from 49 percent below the base-case assumption to 73 percent above it--and more extreme possibilities cannot be ruled out. This variation in numbers of NPL sites is the main reason why estimated present-worth costs range almost threefold between the low and high cases (and undiscounted costs more than fourfold).⁵ As noted in Chapter 2, applying the low-case or high-case NPL assumptions to the base case eliminates 80 percent of the respective differences in present-worth costs.

One key reason that the ultimate number of NPL-caliber cleanup problems is so uncertain is that EPA has not conducted a comprehensive site-

discovery effort. Instead, it has relied primarily on reports from state and local governments, site owners, and other individuals. Possible alternatives to this passive approach have been discussed by the Office of Technology Assessment, which suggested that historical aerial photographs could provide the cornerstone of an active federal site-discovery program.⁶ EPA's main argument for not making site discovery a higher priority has been that the passive approach is already bringing in enough cleanup work to absorb the current level of funding.

Does the ultimate number of sites matter for policy purposes? On the one hand, larger numbers of sites presumably increase the benefits of a cleanup program as well as the costs. Arguably, therefore, the uncertainty about ultimate NPL sites is less important for Superfund policymaking than is the level of average costs per site (including the appropriate share of overhead costs). On the other hand, the same inefficiency or inequity seen as regrettable but not worth the trouble to address in a small or short-lived program may be totally unacceptable at a larger scale. For example, setting priorities so that sites with the worst health effects do not languish at the back of the queue is presumably more important when the queue is longer.

Much of the Superfund Job Remains To Be Done

Despite the uncertainty in the number of sites to be cleaned up, there is good reason to believe that the end of the Superfund program is by no means around the corner. According to the CBO base case, public and private obligations incurred through 1992 represent less than 30 percent of the total economic value of Superfund costs, measured in present-worth dollars, and less than 10 percent of total inflation-adjusted but undiscounted dollars. The federal government's obligations through 1992 represent 35 percent of its share of cumulative costs in present-

5. Cost estimates in the three scenarios do not vary in strict proportion with the number of NPL sites because of assumed economies of scale in administrative costs, unit-cost assumptions that differ among scenarios (including assumptions about the barrel-scraping effect), and discounting.

6. Office of Technology Assessment, *Coming Clean: Superfund Problems Can Be Solved . . .* (1989), p. 94. The EPA region covering Alaska, Idaho, Oregon, and Washington has used historical business lists and geographic information systems in an active site-discovery effort; see Environmental Protection Agency, *The Superfund Program: Ten Years of Progress* (June 1991), p. 11.

worth dollars and 14 percent in undiscounted dollars.⁷

More optimistically, the low scenario suggests that the economy may be 40 percent of the way through Superfund's present-worth costs (though only 17 percent finished in undiscounted dollars). At the other end of the spectrum, the high scenario suggests that 19 percent of the present-worth costs (and less than 5 percent of the undiscounted costs) have so far been incurred.

The larger the amount of cleanup work yet to be done, the greater the potential benefits from improving Superfund policies, compared with the disruption costs that might be incurred in adopting new policies. The CBO estimates suggest that the end of the cleanup problem may be distant enough to justify some policy changes involving long-term benefits but short-term costs.

Costs to the States Will Rise Dramatically

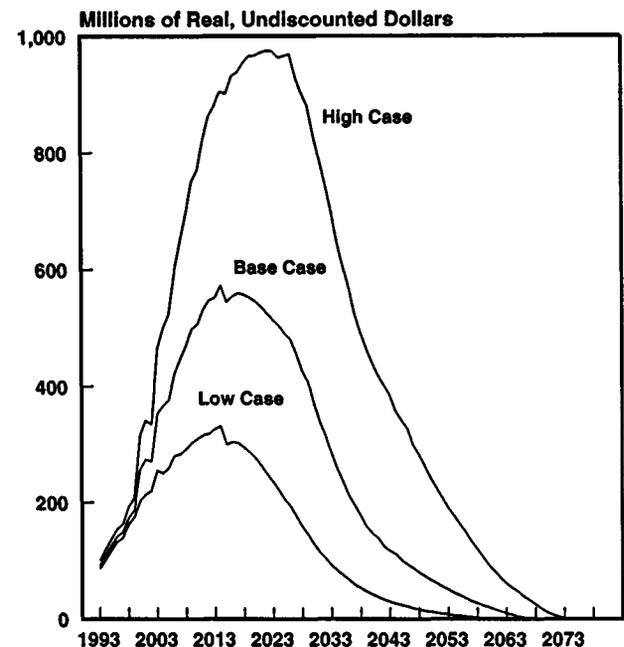
The finding that much of the Superfund job lies ahead is even more true for the required state contributions to fund-lead cleanups, which are concentrated at the back end of the cleanup process, than for total national spending. The low, base, and high estimates of \$2.1 billion, \$3.3 billion, and \$5.0 billion in future present-worth costs to the states imply that the obligations incurred through 1992 are 15 percent, 10 percent, and 7 percent of the total, respectively.⁸

The percentage of cumulative state costs that were incurred through 1992 is lower in undiscounted dollars--between 1 percent and 3 percent, given

7. Total obligations between 1981 and 1992 were \$19.9 billion in nominal dollars, \$21.7 billion in real 1991 dollars, and \$28.3 billion in 1991 dollars discounted forward to the start of 1993. (The use of 1991 rather than 1992 as the index year for real dollars allows a more accurate comparison between past and future costs because the data underlying CBO's estimates of future costs reflect a mix of prices from different years.) The federal obligations to date of \$10.3 billion in nominal dollars (excluding offsetting collections) are equivalent to \$11.4 billion in real dollars and \$15.1 billion in discounted dollars.

8. Including state commitments for capital costs not yet paid to EPA, obligations through 1992 are roughly \$0.3 billion in real 1991 dollars and \$0.4 billion in 1991 dollars discounted forward to the start of 1993.

Figure 4.
Required State Contributions to Superfund,
Fiscal Years 1993-2075



SOURCE: Congressional Budget Office.

NOTE: See Appendix A for the differences in assumptions underlying the three cases.

estimated future costs ranging from \$9.8 billion to \$36.8 billion. The contrast between the present-worth and undiscounted results is sharper for state costs than for total national spending, another consequence of the back-loading of the state contributions. Whereas yearly national costs reach their peak in 2003 in CBO's analysis (see Figure 2 on page 15), the state costs rise more gradually and do not peak until 2014 or 2022 (see Figure 4). The trajectories of state costs shown in Figure 4 should be considered illustrative; because of the importance of operations and maintenance costs in total state expenditures, a more detailed analysis would require better data on the average duration of groundwater and nongroundwater O&M efforts.⁹

9. In the absence of adequate data on the duration of O&M costs, CBO's analysis did not directly model the EPA policy of paying for the first 10 years of a groundwater pump-and-treat remedy, but instead assigned the agency a constant share of each year's costs for all fund-lead O&M. This simplification causes the state cost trajectory to peak a few years earlier than it would otherwise.

State costs for contributions to fund-lead cleanups are estimated to remain a modest share of the national total, despite their high growth in relative terms. These costs represent 4 percent to 5 percent of the present-worth total, and 8 percent to 9 percent of total undiscounted costs, in the CBO scenarios.

Current Funding Levels May Constrain the Pace of Cleanup

As noted in Chapter 2, the assumptions of the base and high cases imply that a substantial backlog of sites await placement on the NPL. Current levels of public and private Superfund spending are too low to simultaneously drain this backlog over the next 10 years, keep pace with new sites brought to EPA's attention, and move present sites expeditiously through the cleanup pipeline.

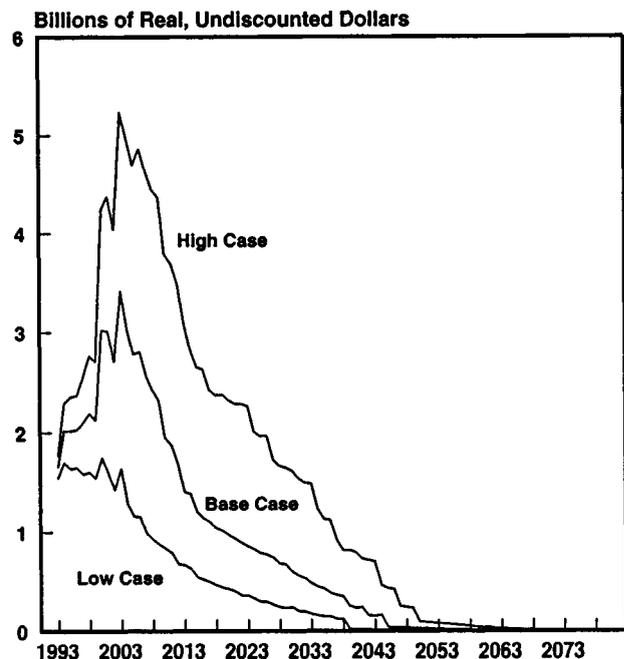
The growth in total spending necessary to keep pace with site work loads in the base and high cases is shown in Figure 2 on page 15; Figure 5 shows a similar pattern for the federal component of the total. Federal costs peak at \$3.4 billion in the base case and \$5.2 billion in the high case, roughly double or triple the highest level observed to date (\$1.7 billion in 1992). This growth in federal costs cannot be avoided by additional emphasis on enforcement-lead cleanups: since most new projects are already being undertaken by responsible parties, the potential for further cost shifting of this type is limited.

Of course, high growth in spending can always be avoided by stretching the costs out over more years; in the context of Superfund, a funding stretchout would have several effects on long-term costs. Natural dispersion and decay of hazardous substances would make some cleanups cheaper--or even unnecessary--and others more expensive. Total costs would probably rise in undiscounted dollars because a stretched-out program would have more years of overhead costs. Total present-worth costs, however, might fall because of the additional years of discounting.

Regardless of the impact on long-term costs, stretching out the program unambiguously delays cleanup and its attendant benefits. One way to illustrate the magnitude of the possible delays is to

contrast the results of CBO's low case, in which federal and total spending levels remain relatively flat over the next decade, with those of the base and high cases. The average annual number of remedial investigations/feasibility studies started from 1993 through the peak cost year of 2003 is 151 in the low case, 339 in the base case, and 490 in the high case. Over those 11 years, new remedial actions average 173, 243, and 291 per year in the low, base, and high cases. Consequently, applying the activity levels funded in the low case to the site work loads of the base case would allow only 45 percent of the ready RI/FS projects and 71 percent of the potential remedial cleanups to begin by 2003, leaving backlogs of more than 2,000 RI/FSs and close to 800 RAs. Similarly, only 31 percent of the RI/FS starts and 59 percent of the RA starts would occur if low-case activity levels were applied to high-case needs, and backlogs of roughly 3,700 RI/FSs and 1,300 RAs would accumulate by the end of 2003.

Figure 5.
Federal Superfund Expenditures,
Fiscal Years 1993-2075



SOURCE: Congressional Budget Office.

NOTE: See Appendix A for the differences in assumptions underlying the three cases.

Superfund Costs Under Alternative Policies

Given that the CBO estimates assume a static policy environment, it is useful to consider how changes in Superfund policies might affect future costs. Two current EPA initiatives are unlikely to have a major impact on total long-run costs but could shift their distribution by payer and over time. Other proposed changes could affect total costs as well as their distribution.

EPA's current initiatives are the Superfund Accelerated Cleanup Model (SACM) and state deferral of potential NPL sites. The SACM seeks to eliminate downtime in the screening process, institute presumptive remedies for common contamination problems, and speed risk reduction (as distinct from environmental restoration) at NPL sites as well as non-NPL removal sites. The state deferral policy, now being developed, would allow EPA to delegate to qualified states the responsibility for addressing certain "low- or medium-priority NPL-caliber sites, i.e., sites that EPA would not be able to address for several years."¹⁰

Although both of these initiatives may represent significant change in other respects, their impact on Superfund's total costs may be minor. The streamlining called for in the SACM could result in some cost savings, but the main effect will be to shift some of the existing costs forward in time (and perhaps to defer others) in order to speed up the benefits of reduced risks to health and the environment. Similarly, state deferral could conceivably reduce overall administrative costs--if the cooperating

state programs are more efficient than EPA's--but the primary emphasis of the initiative is on speeding up cleanup by spreading costs, not on reducing costs.

To the extent that either of these policy changes succeeds in increasing the pace of cleanup, present-worth costs could actually rise, since earlier expenditures have a higher economic value. A thorough cost-benefit analysis, however, would also show present-worth benefits rising as a result of the earlier cleanups. In the absence of enough data on benefits to allow such an analysis, undiscounted dollars may provide a more useful measure of the cost effects of alternative policies.

Other proposed changes in Superfund policies could have more significant cost implications. For example, changes in cleanup standards could raise or lower average cleanup costs (for one or more types of sites), with secondary effects on administrative and transaction costs. A shift from the present liability system to a public-works financing scheme would eliminate enforcement and transaction costs at many sites, but it would also eliminate the savings from any private-sector advantage in efficiency. The cost effects of these and other alternatives could be estimated using the framework employed in Chapter 2, given adequate data on the nature of the policy changes.

The nonfederal sites addressed under the Superfund program, which are the focus of this study, are only one component of the overall national effort to clean up hazardous wastes. The full universe of sites includes federally owned facilities, sites being addressed under the Resource Conservation and Recovery Act and other federal laws, and sites being cleaned up under state programs or voluntary private efforts. Ideally, attempts to maximize the net benefits of the nation's waste cleanups should take this broader context into account.

10. Environmental Protection Agency, "Superfund Administrative Improvements: Final Report" (June 23, 1993), p. 34.

Appendixes

A Summary of the Different Assumptions Used in the Three Scenarios

Table A-1 summarizes the differing assumptions that underlie the three Congressional Budget Office scenarios analyzed in this study. The table includes all of the primary assumptions--those not derived from more fundamental, underlying assumptions--and some of the key secondary (derivative) assumptions.

Table A-1.
Assumptions of the Three Cases

	Base Case	Low Case	High Case
Sites Added to the Screening Inventory	25,376	15,151	50,000
Percentage of Screening Sites Placed on the NPL	8	5	10
Total Nonfederal NPL Sites ^a	4,500	2,300	7,800
Percentage Distribution of Sites (Mega/major/minor)			
First 711 sites	6.5/18.7/74.8	6.5/14.0/79.5	6.5/23.3/70.2
Next 789 sites	4.0/13.0/83.0	4.0/10.0/86.0	5.0/20.0/75.0
Next 200 sites	4.0/13.0/83.0	2.0/6.0/92.0	5.0/20.0/75.0
Next 200 sites	2.0/8.0/90.0	2.0/6.0/92.0	5.0/20.0/75.0
Next 400 sites	2.0/8.0/90.0	2.0/6.0/92.0	3.5/16.5/80.0
Next 600 sites	2.0/8.0/90.0	n.a.	3.5/16.5/80.0
Next 600 sites	2.0/6.0/92.0	n.a.	3.5/16.5/80.0
Next 1,000 sites	2.0/6.0/92.0	n.a.	2.0/12.0/86.0
Next 3,300 sites	n.a.	n.a.	2.0/12.0/86.0
All sites	3.1/10.1/86.8	4.1/9.9/86.0	3.2/15.2/81.7
Default Cost-Scaling Factors Used for Sites with Cleanup Projects Not Yet Estimated (Percent)			
Mega-sites greater than \$150 million	120	110	130
All other mega-sites	135	110	160
Major sites	160	120	200
Costs per Site for Fund-Lead Cleanups (Millions of dollars) ^b			
Mega-sites			
Capital	107.6	102.6	112.7
Operations and maintenance	61.6	58.9	65.0
Total	169.2	161.5	177.7
Major sites			
Capital	33.0	28.9	37.0
Operations and maintenance	16.9	14.8	19.0
Total	49.9	43.7	56.0
Efficiency Advantage of Private Sector (Percent)	20	30	10
Average Cleanup Costs for All Sites (Millions of dollars) ^c	24.7	23.3	29.1
Federal Markup for General Administration, Research, and Non-EPA Costs (Percent)	22	20	24

SOURCE: Congressional Budget Office.

NOTES: NPL = National Priorities List; n.a. = not applicable; EPA = Environmental Protection Agency.

- Secondary assumption, derived from the total screening inventory (existing sites and assumed additions) and the assumed acceptance rate of the screening process. (See Chapter 2 for details.)
- Secondary assumption, derived from site-specific data and the assumed cost-scaling factors for incomplete sites. (Operations and maintenance costs are discounted at 7 percent per year.)
- Secondary assumption, derived from fund-lead costs by site type, the assumed distribution of sites, and the assumed private-sector efficiency advantage.

A Glossary of Superfund Terms

Many of the definitions given below are adapted from Environmental Protection Agency, *The Superfund Program: Ten Years of Progress* (June 1991).

cash-out settlement: An agreement in which a responsible party settles its liability by paying the Environmental Protection Agency (EPA) a certain amount toward cleanup work to be done later. It differs from a cost recovery, in which EPA collects money to reimburse the Superfund trust fund for previous expenditures.

enforcement-first policy: A policy introduced in 1989 under which EPA attempts to maximize the number of cleanups conducted by responsible parties.

enforcement-lead cleanup: A cleanup conducted by some or all of a site's responsible parties with EPA oversight; same as **RP-lead cleanup**. Compare with **fund-lead cleanup**.

fund-lead cleanup: A cleanup conducted by EPA using money from the trust fund.

Hazard Ranking System (HRS): The system EPA uses to score potential risks to human health and the environment from releases or threatened releases of hazardous substances. In general, a hazardous waste site must score at least 28.5 on the HRS to be placed on the National Priorities List for extensive cleanup.

joint-and-several liability: A legal rule under which any liable party may be held fully responsible for a situation resulting from the actions of multiple liable parties. In the context of Superfund, joint-and-several liability means that any subset of a site's responsible parties can be required to pay for the entire cleanup of the site (although such parties are free to seek contributions or reimbursement from the other liable parties).

major site: In the Congressional Budget Office's analysis, a site contaminated with hazardous substances whose total cleanup costs are expected to be between \$20 million and \$50 million, as estimated in one or more records of decision. Compare with **mega-site** and **minor site**.

mega-site: A site whose estimated cleanup costs exceed \$50 million.

minor site: A site with estimated cleanup costs of less than \$20 million.

National Priorities List (NPL): EPA's list of sites eligible for long-term remedial response using money from the trust fund.

operable unit: An element of an overall site cleanup. EPA may choose to divide a site into multiple operable units to be cleaned up separately or to treat it as a single unit. Multiple units generally correspond to different areas or media, such as soil and groundwater.

preliminary assessment (PA): The first stage of EPA's screening process for investigating suspected waste sites, generally involving review of available documents and site reconnaissance. Followed by a site inspection, when necessary.

record of decision (ROD): A public document in which EPA identifies the cleanup alternative to be used at an operable unit of a site on the National Priorities List.

remedial action (RA): The actual construction or implementation phase of cleanup at an operable unit of a site on the National Priorities List.

remedial design (RD): The engineering work that follows a record of decision to develop the technical drawings and specifications that will guide subsequent remedial action.

remedial investigation and feasibility study (RI/FS): Related studies that gather data to determine the type and extent of contamination at an NPL site (or operable unit), establish cleanup criteria, and analyze the feasibility and cost of alternative cleanup methods.

removal or removal action: An action of short duration (generally under one year) taken to control immediate threats to people or the environment from a release or threatened release of hazardous substances. Removals may be undertaken at sites not on the National Priorities List.

responsible party (RP): An individual, business, or other organization legally liable for cleaning up a site. The four types of responsible parties are a site's present owners and operators, its previous owners and operators from periods during which it received hazardous substances, the generators of such substances, and any waste transporters responsible for choosing the site. Because liability is often contested, the term "potentially responsible party" is also commonly used.

RP-lead cleanup: Same as **enforcement-lead cleanup**.

site inspection (SI): The second stage of EPA's screening process, which involves collecting and analyzing samples of soil and water, as appropriate.

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