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THE POTENTIAL IMPACT OF A FEDERAL SUBSIDY PROGRAM ON THE PACE OF CLEANING UP SUPERFUND SITES

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ABSTRACT

The Superfund program was established by Congress in 1980 to clean up the worst inactive hazardous waste sites in the nation. The doctrine of strict, joint and several, and retroactive liability is the legal basis for enforcing the Superfund regulations. The liability allocation system has become very contentious, generating considerable transaction costs and leading to cleanup delays. In spite of several regulatory reforms aimed at improving the pace of cleanup and reducing the transaction costs, cleanup durations have not improved. The major objective of this study is to explore the effectiveness of creating Federal subsidies to pay for a fraction of cleanup costs contingent upon the expeditious settlement of Superfund liability disputes. The distribution of total cleanup costs from USEPA Region V (Midwest) suggests that the introduction of a fixed subsidy aimed at settling liability disputes at smaller sites may be effective in speeding up the pace of cleanup. The value of analysis presented in the study is in the identification of a defined target market for subsidies and the exploration of conditions under which such a market might be successful in improving the effectiveness of the Superfund program.

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I. INTRODUCTION

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, also known as Superfund, was established in order to clean up the nation's worst inactive waste sites. Superfund provides the Federal Environmental Protection Agency the authority to conduct site removal actions to eliminate immediate risks to human health, and to develop long-term solutions to clean up the most serious of hazardous waste sites. The facilities and sites that appear to present the most significant long-term threat to public health or the environment are placed on a National Priority List (NPL).

Superfund establishes a financing scheme that holds the parties involved in the release of the hazardous substances liable for the cost of clean up. The potentially responsible parties (PRPs) are the past and present generators and transporters of the hazardous materials at a site or those who owned or operated a site. Under the Superfund financing scheme potentially responsible parties are subject to retroactive, strict, and joint and several liability. Retroactive liability means the PRPs are liable for actions that occurred before CERCLA was passed in 1980. Strict liability holds the responsible parties liable for clean up even when their actions were in compliance with the regulations at the time of disposal. Under joint and several liability, a PRP can be held liable for the total clean up bill even if he was only responsible for a small share of the waste. In practice, the EPA usually names only a subset of the PRPs at a site. The named PRPs must search for the remaining PRPs and collect all relevant data that will be used to allocate liability among themselves and agree to a division of the cost of cleaning up the site.

Not surprisingly, the liability allocation process has become very contentious, leading to long cleanup delays and high administrative and transaction costs. At the end of 1993, 1320 sites were on or had been on the Superfund NPL in all ten EPA regions. Actual cleanup activities were underway at only 30 percent of the sites. Only 4 percent of the nationwide NPL sites had been completely cleaned up and deleted from the list. Estimates by EPA show that it takes an average of twelve years nationally from the beginning of site studies to the completion of remedial actions at the site. The Congressional Budget Office estimates that the cleaning up of all current and future sites will cost the EPA and potentially responsible parties about $230 billion dollars from the 1993 through the year 2070 [1]. Probst [2] has estimated that 25 percent of this cost will be expended on transaction costs. The level of these costs is closely related to the administrative complexity of the process.

There have been several attempts since 1986 to improve the performance of the Superfund program. CERCLA was amended in 1986 by the Superfund Amendment and Reauthorization Act (SARA). SARA authorizes EPA to release from liability those PRPs contributing insignificant proportions of the waste at the NPL sites and establishes time schedules for the EPA to start cleanup activities. EPA introduced the Superfund Accelerated Cleanup Model (SACM) in 1989 in order

to accelerate the initial site screening process. In the same year, EPA announced the enforcement-first policy under which the agency would order responsible parties to undertake some cleanup activities prior to the completion of the liability allocation process [3]. In spite of these attempts to improve the pace of cleanup, evidence shows that the costs and duration of cleanup have been increasing over the years [3].

The most recent attempts to reform the process are embodied in the proposed Superfund Reform Act of 1994. The proposal creates a mechanism whereby the EPA could set up arbitration procedures in order to allocate the liability among the PRPs at a site [4]. The PRPs could accept the arbitration settlement or if they disagree with it, continue to contest with other PRPs the extent of their liability for cleanup costs. Despite the regulatory reforms aimed at speeding up the pace of cleanup, the basic structure of Superfund administration and liability allocation still provides positive incentives to contest the allocation of costs among the PRPs thereby slowing the pace of cleanup at the Superfund sites.

The major objective of the study presented in this article is to explore the effectiveness of creating Federal subsidies to pay for a fraction of cleanup costs contingent upon the expeditious settlement of Superfund liability disputes. Such subsidies would be given if PRPs accepted an EPA specified allocation of liability, thereby promoting the settlement of liability issues and accelerating the cleanup process. The degree to which such a subsidy would accelerate the cleanup process depends upon the relative duration of time spent in the initial planning and cleanup phases at Superfund sites, the existing level of benefits in contesting liability allocations, and the relative percentage of sites that are now in different phases of planning and remediation.

In order to assess the impact of a subsidy program, data were used from the Region V WASTELAN database, the Superfund information system for sites in the Midwestern region. This database contains information on the activities related to 274 sites (approximately 20% of the national activity). Data on the status of remedial response activity, the duration of cleanup phases, and the cost of completing site studies, remedial designs and remedial actions are contained in the WASTELAN database.

In section two of the article the sources of delay and litigation in the cleanup process are discussed. The objectives, structure, and potential impact of a Superfund subsidy program are discussed in section three. Section four presents the summary and conclusions.

II. SOURCES OF DELAY IN SUPERFUND CLEANUP ACTIVITIES

A great deal of the delays caused in the Superfund program have been due to the complex web of interactions the program creates among the responsible parties, providing opportunity for litigation rather than cooperation. There are two major

sources of delays, namely 1) the assignment of liability among various parties and 2) the selection and approval of site cleanup remedies.

Under current practice, EPA only negotiates with PRP committees, not individuals. This strategy allows EPA to transfer a substantial portion of its transaction costs to the PRPs. The PRP/PRP interactions generate substantial delays because the PRPs must locate each other, form a negotiating committee, and design a common negotiating strategy in order to reduce their joint liability. Members must attend PRP committee meetings with enough data to win concessions regarding liability. The PRPs must agree among themselves about what each member's share of the joint liability should be.

Under current practice, EPA releases the demicromis parties from liability altogether, offers settlements to deminimis parties and municipal operators and pays for the cleanup costs of all orphan sites. Deminimis parties are those responsible for only a small percentage, often less than 1 percent by volume or toxicity of the hazardous waste at a site. Demicromis parties are defined as the truly small contributors to a site (< .1%). Orphan shares are the cleanup bills of those responsible parties who are insolvent or cannot be found. Municipal and industrial solid waste sites, also called co-disposal landfill sites, are among the NPL sites where cost allocation is most contentious. These sites are more likely to have a large number of responsible parties and thus will find it difficult linking specific responsible parties to specific waste. It has been estimated that orphan shares at multiparty sites (mostly municipal and industrial co-disposal sites) constitutes between 15 and 18 percent of the cleanup cost [5, 6].

A second source of delay involves the selection of remediation technologies at the site. The lack of specific technology selection introduces a certain degree of subjectivity into the process and encourages litigations and delays by the PRPs. PRPs would naturally prefer less expensive remedial alternatives while the Agency, under pressure from the public, would prefer more expensive and permanent treatment technologies. Milton et al. have shown that, on the average, the difference between a potentially acceptable low cost remedy that satisfies the short term effectiveness conditions of remediation for Superfund sites versus a remedy that is effective over a long term can vary by a factor of four [7]. Hence, the cost savings can be substantial if the PRPs can convince the EPA to approve a low cost remedial technology.

The incentives created by the administration of Superfund to slow down the processes for cleanup effect the early planning phases more than the actual remediation activities. The relative duration of the phases of cleanup must be considered in assessing any policies to reduce the incentive for litigation or delays. The initial phase of the Superfund process involves a preliminary assessment of any site that may pose a potential threat to human health or the environment. The preliminary assessment is a multi-step process that begins with the review of existing information at the site and ends with documentation of all data needed to

provide a first approximation of a threat posed by the site to human health or the environment. The result of these steps is the placement of the site on the National Priority List of Superfund.

The first stage of the remediation process after a site has been listed on the NPL is the remedial investigation/feasibility study phase (RIFS). The RIFS phase characterizes the nature and extent of risk posed by the hazardous substances at the sites and further evaluates the potential remedial response technologies that might be used to clean the site. The RIFS phase is followed by the engineering phase of the remedial process, known as remedial design and construction phase (RD). The remedial design activities will be either EPA directed or directed by the PRPs if the PRPs have been identified and have accepted the allocation of liability. For EPA managed sites the EPA may use outside contractors to design and implement the project. EPA provides only oversight for PRP-lead sites and bills the participating responsible parties for this oversight service.

Actual cleanup activities (removal, containment, incineration, erosion control, chemical, and biological remediation, etc.) occur during the remedial action (RA) phase. A site may be deleted from the National Priority List when all necessary remedial activities have been properly implemented.

Table 1 presents the average durations of these remedial activities in Region V for EPA-managed sites after 1987 (the passage of SARA). There were few remedial activities before the passage of SARA. With respect to the potential impact of incentives to accelerate the cleanup program, it is significant that over half of the average of 10.6 years to complete all phases of the cleanup are spent in the completion of the initial planning phases. It is during these phases that delays due to PRP liability issues and the disagreements regarding appropriate technologies would occur.

Figure 1 shows the status of clean-up activities in the region by 1994. The total number of sites represented is 274. The Congressional Budget Office, in developing their cost estimates, assumes that seventy-five sites will be added to the NPL nationally per year through 2058 [1]. If the relation between the Superfund

Table 1. Mean Durations of Superfund Cleanup Phases in Region V[a]

Activity	Duration in Years [Number of Sites]
Site Study (RIFS)	5.2 [180]
Remedial Design (RD)	2.5 [117]
Remedial Action (RA)	2.9 [71]

[a]Site study and remedial design constitute the planning phase of the cleanup process.

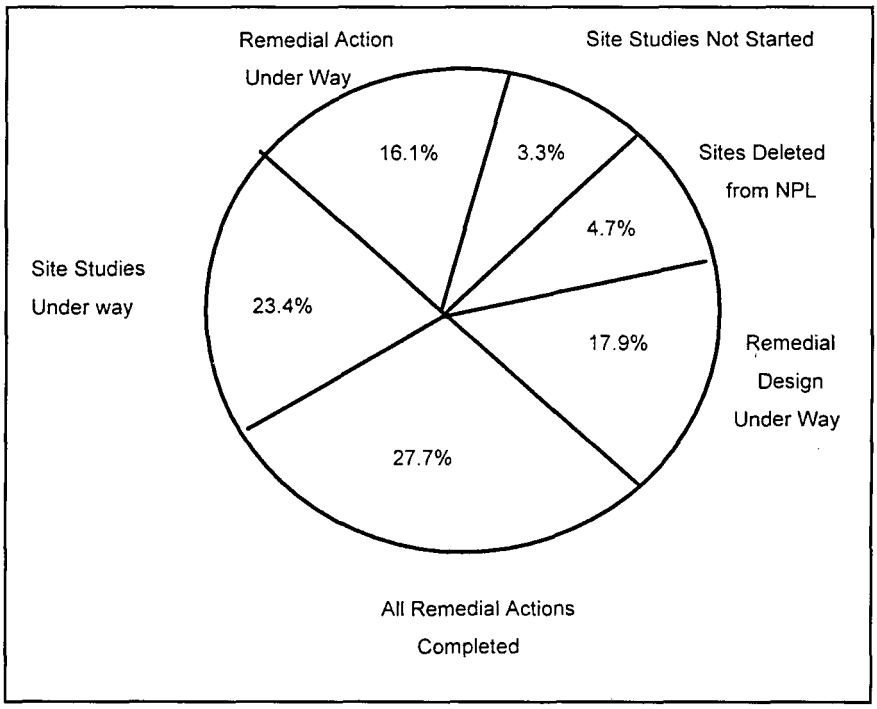

Figure 1. Status of cleanup activities at NPL sites in Region 5, 1994.

activities nationally and in Region V remains comparable to past experience, Region V could expect about fifteen sites to be added to the NPL for the Midwest each year for this period.

The number of sites that might be affected by a subsidy program (i.e., those in the planning phase) over the next decade can be estimated approximately from status of existing sites, the duration of the planning phase and the number of new sites being added to the NPL. Based upon WASTELAN data, the average duration for the planning phase (RIFS) is assumed to be five years. If the approximately seventy-five sites presently in the pre-RIFs or RIFS stage in Region V are uniformly distributed in terms of their progress through this stage, one fifth of the sites should be moved to the design phase each year. Thus for Region V, the number of sites moving out of the RIFS phase (approximately 15) will equal the number of new sites entering the NPL list in the Region. We conclude that the number of sites in the RIFS stage would remain roughly constant under these conditions until the number of sites introduced into the NPL declines in the next decade.

III. OBJECTIVES, STRUCTURE AND POTENTIAL IMPACT OF A SUPERFUND SUBSIDY PROGRAM

The objective of a subsidy program is to provide incentives to PRPs to accept EPA-defined allocations of liability. When viewed as a governmental investment problem, the central question in developing a subsidy program is how to obtain the maximum amount of reduction in the time taken for the preliminary phases of the Superfund cleanup process for a given level of government expenditures for the subsidy. The level of required government subsidy per site to obtain a settlement depends in large part upon the total costs of remediation. If the level of subsidy is high in relation to total costs, there is a higher probability that the PRP would forego the potential benefits of contesting the EPA liability allocation in favor of the certain benefits of receiving the subsidy.

Given these considerations, there is evidence, based upon the examination of the WASTELAN data, that offering a fixed dollar subsidy per site (the acceptance of which requires the PRPs to concur with EPA's liability allocation) would be the most effective approach. The data show that the durations of the RIFS and RD phases are almost independent of the remediation costs at a site. The correlation coefficients are 0.32 and 0.29 for the RIFS time/cost relationship and the RD time/cost relationship, respectively for Region V sites. Thus the planning phase times and therefore the potential time savings in the RIFS and RD phases due to the acceptance of negotiated settlements may be as large for the less costly sites as the more expensive sites. A fixed subsidy would represent a higher proportion of total costs for smaller cost sites and therefore a stronger incentive to settle for such sites than for the more expensive sites.

The impact of a fixed price subsidy depends on the distribution of site remediation costs. For the low cost sites, the fixed subsidy represents a stronger incentive; therefore, for the program to be successful, one would hope for a high percentage of low costs sites. The average remediation cost per site in Region V is $25.5 million for EPA-lead sites and $20.8 million for PRP lead-sites. Figure 2 shows that the distribution of sites by costs is Chi squared. Approximately 50 percent of the sites have total costs of less than ten million dollars. It is these smaller sites with significant planning phase times that would be the target of a fixed subsidy incentive program.

The benefits to the small sites of accepting the subsidy and a negotiated settlement are actually greater than the value of the subsidy alone. The PRPs involved would also avoid some of the significant transaction costs presently involved in the cleanup process. Under the present procedures, PRPs are more likely to conduct excessive and overly defensive site studies in order to generate "quality data" they can use in court. EPA assumes that 32 percent of the cost of site studies is unnecessary [8].

Extensive evidence on the relationship of transaction costs to total site cost does not exist. If transaction cost were constant with respect to total site costs, it would

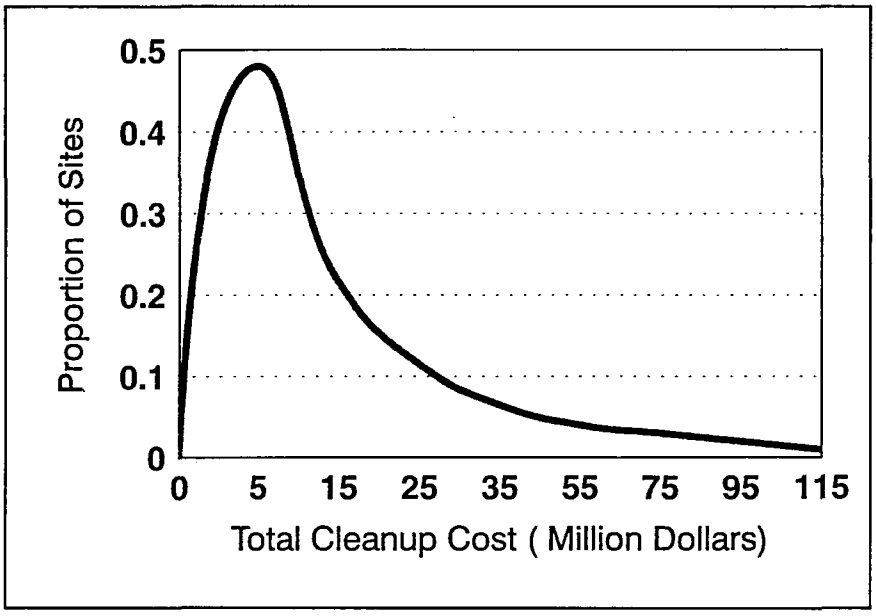

Figure 2. Distribution of total cleanup cost.

reinforce the advantages of an incentive strategy aimed at sites with smaller total costs. The fixed transaction cost saving together with a fixed subsidy for accepting a negotiated settlement would represent a relatively higher proportion of the total site cost. Probst has reported that transaction costs vary from 5 percent to 30 percent depending on the number of PRPs involved in the site [2]. At sites with between two and ten PRPs, 20 percent of the total costs are transaction costs that presumably would be reduced if a negotiated settlement were accepted. At sites with more than fifty participating PRPs, transaction costs represent over 30 percent of the total costs. In order to assess more clearly the effects of the reduction of transaction costs on the acceptance of negotiated settlements, more evidence is needed regarding the behavior of these costs.

The ambiguity regarding the selection of appropriate remediation technologies for the cleanup of Superfund sites could potentially reduce the impact of any subsidy program. The wide variance in potential remediation costs that can result from PRP/EPA negotiations provides strong incentives to contest the EPA specification of the remediation strategy even if the allocation of liability has been settled. The development of more specific guidelines by EPA with respect to technology selection would reduce the benefits of contesting the choice of technologies, but the development of highly specific guidelines that would cover all technologies and site situations is itself a time consuming task. Evidence from the

Region V data indicate that two remedial strategies presently account for over half of the measures selected in the region. These are incineration and stabilization/solidification/erosion control. The widespread use of a limited number of technologies suggests that the initial development of more explicit guidelines for the use of frequently used technologies, in conjunction with a subsidy program aimed at smaller sites, would be a cost-effective approach to reducing the time spent in the planning phase of the clean-up program.

Any estimates of the impact of the subsidy program on the pace of clean-up activities must be speculative. There are some studies to suggest that the planning phase could be reduced by two to three years. In an attempt to estimate how many man-years of effort it takes to conduct remedial response activities in Region V, the EPA measured the actual hours of work involved in thirty-four site studies, twenty-two remedial designs and twelve remedial actions. The actual work involved on the sites involved only a total of 7.5 years. This is approximately three years less than the present average duration of site clean-ups in Region V. Approximately two-thirds of this discrepancy occurred in the planning phases. If a subsidy aimed at promoting the settlement of liability disputes at the smaller sites (i.e., those in the lower 50% by site cost) was instituted and its effect was to reduce planning phase times by two years, the long-term effect would be to gradually reduce the number of sites in the planning phase. In such a scenario the average RIFS duration for Region V (averaging the RIFS durations of small and large cost sites) would drop from five years to four years. This change would increase the rate of sites moving from the planning to the design phase from fifteen sites per year to twenty sites per year. Instead of a constant seventy-five sites in the RIFS stage over the next decade (based upon a 5 year planning duration and 15 sites entering the NPL annually), the number of sites in the planning phase would gradually drop over the next five years from seventy-five to sixty.

The specification of the appropriate level of subsidy is complicated by the beneficial influence of the reduced transaction costs caused by acceptance of the subsidy and the uncertain benefits of contesting the selection of remedial technologies. These factors will affect the PRPs' judgments when weighing whether to accept the subsidy. If we assume for illustrative purposes that the smaller sites (those with total costs of less than 10 million dollars) would require a subsidy representing 20 percent of the total site costs, the cost of the program can be estimated. The 20 percent subsidy implies a site subsidy of two million dollars. As stated earlier, sites with total costs less than ten million dollars constitute 50 percent of all sites. Assuming a uniform distribution of the seventy-five sites that are presently in the planning phase in Region V, the number of sites moving through the RIFs stage in each year is fifteen. If we only gave subsidies to the smaller sites in year one of the planning phase, 7.5 sites (50% of 15) out of the current seventy-five sites will require subsidies. Therefore, for the current sites, the subsidy cost would be fifteen million dollars. In addition, half the estimated

fifteen sites that will be added to the Midwest Superfund sites each year would be given the subsidy. The total cost of the subsidy for the next five years would be ninety million dollars.

IV. SUMMARY AND CONCLUSION

One of the original objectives in the structuring of the Superfund program was to place the burden of both transaction and actual remediation costs on PRPs. The result of this approach was the development of a program that has inherent incentives to PRPs to contest the allocation of liability and the selection of remediation strategies. The experience of the last decade would indicate that PRPs have responded to these incentives by slowing the pace of cleanup and, as an unforeseen by-product, raising the transaction cost of the program to a level in which such costs become a major fraction of total costs. The concept of providing Federal subsidies to pay for a fraction of the cost of cleanup would at first seem to contradict both the original intent of the legislation and the present trend toward reducing the role of the Federal government.

The questions raised by the analysis of a subsidy program in this article admittedly skirt the larger question of the intent of the legislation (Society should not pay for the past actions of a polluter) or the validity of the basic objective of Superfund (Should society expend the effort to cleanup these sites?). We raise a much more modest question of efficiency. Given the objectives of Superfund, the inherent incentives in its present structure for PRPs to adopt delaying tactics and the past failure of administrative "fixers" to overcome such incentives, would a subsidy program be a cost-effective approach to overcoming the incentive delay cleanup activities?

Given the present level of transaction cost both to PRPs and the EPA, the actual net costs of the subsidy may be considerably less than the actual dollar amount of the subsidy. The potential reduction in transaction cost to PRPs together with the subsidy might make it cost-effective for the affected industries to support the financing of a subsidy program. The present structure of the program is creating significant transaction costs in the public as well as private sector. Nationally, EPA currently spends 1.6 billion dollars annually in cleanup expenditures while the PRPs collectively spend $1.3 billion annually [1]. EPA is presently authorized to recover the mitigation costs it incurs for which there is a set of PRPs that have been determined to be liable. Due to prolonged litigations, EPA's total revenues from cost recovery and fines have accounted for only 5 percent of the Agency's cleanup expenditure recently [5]. Given such a low cost recovery record and the long delays caused by the current Superfund structure, it may be time for EPA to change the Superfund management strategy. The estimates of the effects and costs of a subsidy in a hypothetical "market" which assigns liability shares to PRPs must be highly speculative. The value of the analysis is presented above, based upon Region V data, is not in the cost and duration estimates derived but rather in

the identification of a defined target market (the smaller cost sites) for the subsidies and at least some indication that if this market sector responded, there is a potential for substantial reductions of the number of sites residing in the planning phase of the clean-up process.

REFERENCES

1. Congressional Budget Office, *The Total Costs of Cleaning Up Non-Federal Superfund Sites 94-015039*, p. 17, January 1994.
2. N. Probst, D. Fullerton, R. E. Litau, and P. R. Portney, *Footing the Bill for Superfund Cleanups: Who Pays and How?*, The Brookings Institute and Resources for the Future, p. 37, 1995.
3. General Accounting Office Report to Congressional Requesters, *Superfund: Status, Cost, and Timeliness of Hazardous Waste Site Cleanups*, GAO/RCED 94-256, p. 2, September 1994.
4. L. S. Dixon, *Fixing Superfund: Effects of the Proposed Superfund Reform Act of 1994 on Transaction Costs*, RAND, pp. 9-10, 1994.
5. Office of Solid Waste and Emergency Response, *Mixed Funding Evaluation Report: The Potential Cost of Orphan Shares (USEPA)*, p. 5, September 1993.
6. J. P. Acton, *Oversight of the Superfund Program*, Hearing before the House Committee on Energy and Commerce Subcommittee on Transportation and Hazardous Materials, 103rd Congress, 1993.
7. E. R. Milton, W. E. Colglazier, and R. M. English, *Hazardous Waste Remediation: The Task Ahead*, University of Tennessee, Waste Management Research and Education Institute, pp. 6-11, December 1991.
8. Office of Technology Assessment, *Coming Clean: Superfund Problems Can be Solved, OTA-ITE-433*, Washington, D.C., p. 29, 1989.

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