Hazardous waste policies have evolved in response to urgent environmental and political challenges. The intensity of feelings and mistrust has eclipsed almost any other aspect of environmental policy. This has created a climate in which the prospect of improving public policies is overshadowed by fears that changes will reverse past accomplishments or make things even worse. As a result, the public policy debate about hazardous waste continues to focus on issues that should have been resolved many years ago.

Nonetheless, the nation’s hazardous waste challenge is changing and there are new questions to be discussed. The traditional focus on emergency response and “the polluter pays” is not sufficiently broad to consider the implementation issues that are beginning to dominate the effectiveness of our hazardous waste system. Information systems, priority-setting mechanisms, strategies for technology development, and managerial systems must be developed for solving problems in science, technology, engineering, and risk assessment, under conditions of limited financial resources. Systems analysis must be brought to the problem of hazardous waste management in order to rationalize policy and avoid unintended consequences. This must be done in a context where the federal government’s growing role as responsible party (as opposed to regulator) for hazardous waste should dramatically change our view of public and private responsibilities.

INTRODUCTION

Goals of the Paper

The nation’s hazardous waste laws are entering the reauthorization process. Ideally this would present an opportunity to consider broad issues and legislate an innovative and farsighted set of laws.1 Unfortunately, the unique evolution of hazardous waste policies may again preclude this opportunity. Hazardous waste policies are still being shaped—and misshaped—by the unusual circumstances of their origins: the national near-emergency at Love Canal occurring just before the election of a president who promised minimal regulatory oversight, the EPA scandal of the early 1980s, and the regulatory policy chasm between the early Reagan administration and Congress. History, combined with the intrinsic complexity of hazardous waste policy, has permitted a considerable number of questions to remain unresolved that should have been settled much earlier.

The purpose of this paper is to alert the policy community to critical new challenges that have recently emerged as well as the unfinished business that still

1The 1986 Superfund reauthorization resulted in several meaningful pieces of legislation, including “community right to know” and the extension of the law to federal facilities. It did not, however, attempt to restructure or reform policy.
needs resolution. Some new challenges involve existing issues that have been given new significance by recent events. Even nonspecialists are aware of the interest in Superfund reform, but few in the community seem engaged in addressing new challenges, or even recognizing them. A hopeful sign is the recent Clinton administration proposal to modify the nation’s hazardous waste cleanup laws, which along with the president’s five-point plan for military base closures not only considers unfinished business but also identifies a number of significant but infrequently discussed issues that fall in the new challenge category. Although the political momentum for the administration’s new proposal has oscillated rapidly, it nonetheless reflects a growing recognition of the need to address new challenges.

**The RAND Summer Institute**

This paper and the opinions and judgments it contains were heavily influenced by discussions held at a workshop of the 1993 RAND Summer Institute, where a small group of experts from industry, government, the environmental community, academia, the international community, and RAND met to discuss hazardous waste policy.

The Institute considered broad conceptual issues, including several that are given scant attention in discussions of hazardous waste policy that traditionally focus on Superfund reform. Participants discussed the unfinished business of Superfund reform, with its related topics of cleanup standards, financing, liability, equity, and administrative efficiency, as well as such new challenges as the explosive growth of federal facility cleanups and their associated multiple agendas; environmental technology and international competitiveness; the need to improve our ability to regulate, manage, and monitor large-scale remediation projects; the unclear relationship between hazardous waste and sustainability; and the value of rethinking the entire regulatory relationship between “old” and “new” waste, to rationalize incentives and encourage innovation. The participants also debated federalism and the proper balance between state and federal roles.

The opinions in this paper are those of the authors, not of the participants in the Summer Institute work-

---

2 A forthcoming RAND publication by Lloyd Dixon will provide a detailed examination of many aspects of this proposal.

3 President Clinton’s speech of July 2, 1993, outlines the five points as follows: (1) provide grants to communities affected by base closing, (2) establish a single federal coordinator at each base, (3) establish a fast-track cleanup program for environmental problems, (4) establish fast-track disposal of federal property, emphasizing uses likely to create new jobs, and (5) make a coordinated effort to pool federal resources for easier community access.

shop, and the paper is not intended to summarize the Institute’s activities. At times we have chosen to refer to a “consensus of the Institute,” both because we were heavily influenced by Institute discussions and because that consensus was consistent with judgments drawn from other sources. We have also used the discussions of the Summer Institute workshop to characterize differences in positions about particular issues.

**REEXAMINING THE GOALS OF HAZARDOUS WASTE POLICY**

Although major federal hazardous waste laws have been in existence for almost 15 years, it is still difficult to define long-term policy goals and objectives and to link program implementation to those goals. As noted above, policy formulation and legislation were influenced by Love Canal, EPA malfeasance and the ensuing congressional response, and Congress’ desire to limit any flexibility that EPA might have in implementation.

One consequence of this unusual evolution is that policies for managing wastes defined as hazardous by various pieces of legislation are unusually prescriptive, detailed, and complex. For example, details about the thickness of landfill liner are actually written into federal law, not dealt with at the rule or regulation level as in other regulatory areas. The intense debates over this specificity are obscuring policy goals. Such detail is not unusual in regulatory policy, but the lack of clarity and coherence is exceptional. The system seems to be influenced less by fundamental policy concerns than by mistrust, transitory events, media, politics, and the desire by some to preserve an obscure regulatory language.

**Four Guiding Principles**

The Summer Institute examined the reasons for societal interest in hazardous waste policy and listed four possible guiding principles for policy; they are shown in Table 1.

The order reflects our judgment of historical priorities and is not intended to be prescriptive. Despite a clear trend toward use of quantitative health risk assessment as an aid to technical and regulatory decisions, the primary policy goal has been to remedy the adverse effects of hazardous waste on the quality of

---

4 We are referring to the 1980 passage of CERCLA (Comprehensive Environmental Response Compensation and Liability Act). Other hazardous waste laws existed before 1980, but CERCLA dramatically changed the policy context for these laws. Superfund is a special fund for implementing part of CERCLA, specifically the provisions governing cleanup of waste sites on the National Priorities List (NPL). However, the law is often referred to as the Superfund law, and we will use Superfund and CERCLA interchangeably.
Table 1

Guiding Principles for Hazardous Waste Policy

1. To eliminate and/or limit adverse effects on the quality of life in affected or potentially affected communities
2. To eliminate and/or limit actual and potential effects on human health
3. To eliminate and/or limit actual and potential effects on local ecology
4. To promote resource conservation, sustainability, and eventually, industrial ecology

Life in local communities. These effects include noxious odors, unpleasant vistas, dropping real estate values, fear of potential health hazards, and health problems of unknown etiology. Such concerns produced the near national panic over Love Canal and Times Beach, and they continue to motivate congressional and executive agency responses and priority setting.

The need to incorporate objective expert assessments of health (and ecological risk) more fully into decision-making has been much discussed. Ultimately, this would shift focus from the first to the second principle listed in Table 1. This notion is often expressed in terms of a “risk-based priority system,” and is used to argue that hazardous waste risks should properly be compared with other environmental and nonenvironmental risks. We believe that current policy lacks this focus. But the formulation of a convincing rationale to expand priorities beyond “quality of life” is a daunting new challenge, and no one should underestimate its difficulty. Quality-of-life issues loom larger when data is preliminary and limited, and when scientists are divided and uncertain. Assessment of health and ecological risk—even by experts—is often subject to great uncertainty. Some at the Summer Institute even argued that risk assessment is little more than a quantitative surrogate for quality-of-life concerns. Conversely, others viewed quality of life as an unscientific basis for risk assessment. We agree with the viewpoint that both “quality of life” and “best scientific assessments” are valid and (somewhat) independent concepts that need to be integrated into the goals of future policies, particularly when the scientific foundations are highly uncertain.

This uncertainty may result in overlap between the first and second principles. The debate over “expert” versus “citizen” perception of risk has no clear-cut boundaries and should shift toward developing mechanisms to reduce the gap in perceptions. One Summer Institute participant suggested that an aggressive program of risk education could bridge the gap between what is known and what is unknown but feared. There is also no substitute for further research in toxicology and epidemiology, including research in molecular epidemiology and biomarkers in order to improve our understanding of human health effects associated with hazardous waste.

Regarding principle four, several at the Institute felt that the concepts of sustainability and industrial ecology could establish long-term objectives for hazardous waste policy. Some even expressed a need for a deeper philosophical statement of environmental principles to support highly complex decisionmaking. This need is influenced by an awareness of environmental risks that extend beyond exposure to hazardous waste. The very existence of hazardous wastes may signal serious upstream environmental hazards of known or unknown severity. Hazardous wastes may imply the use of hazardous materials, ecological damage due to resource extraction, upstream human exposure during extracting, processing, and distribution, and exposure during consumption and use. The long-term buildup of heavy metals in the environment illustrates a possible worst-case scenario. As in global climate change, the health and ecological consequences of such a buildup are still uncertain, but the situation may already be irreversible when the first serious adverse effects are detected.

The four guiding principles in Table 1 are not metaphysical or ivory-tower ideals. They could supply the needed foundations for policy and provide the basis for resource allocation, technology, rule writing, and protocol. We should also note that pure environmental concerns need not be the only basis for formulating policies. International competitiveness, technology

---

5Industrial ecology is a visionary concept that envisions our economic infrastructure as a set of interrelated elements in which the wastes from one process are the feedstocks for the next. The flow of resources and energy into and out of the “industrial ecosystem” are minimized. Kumar Patel defined six principles of industrial ecology: (1) reduced dependence on materials that produce ecological damage at resource extraction, (2) “just in time” materials flow, (3) reduction of toxic feedstocks, (4) process modification to remove toxic materials from the waste stream, (5) engineering control systems to insure robust and reliable processes, and (6) end of life recyclability. See Proceedings of the National Academy of Sciences, Vol. 89, No. 3, 1992.

6In practice, communities adopt using the political process have been better able to utilize the hazardous waste system to address urgent concerns.


development, environmental justice, and a broad range of other political and economic objectives could be secondary goals for policy. Having identified such objectives, we can then assess just how well they complement or conflict with achieving primary environmental goals.

“Old” and “New” Waste

For purposes of such analysis and further discussion of goals and principles, it is useful to distinguish between “old” and “new” waste. “Old” refers to waste generated in the past and now stored at a variety of sites. Remediating the effects of old waste is largely a matter of applying technically effective remedies at appropriate times during the cleanup process, and doing so in ways that are responsive to the concerns of affected communities. Programs for old waste include Superfund, federal cleanup programs, USTs, RCRA corrective actions, and state Superfund.9 In contrast, “new” waste is waste whose generation is occurring today or could occur in the future. Managing new waste involves a broader set of technology choices than managing old waste. It could ultimately entail reengineering and adapting industrial processes and consumption decisions to better balance economic and environmental costs and benefits. The design of policies for new waste is eventually tied to the value we ascribe to concepts of sustainability and industrial ecology in priority setting.

Present policies do not properly distinguish between old and new waste. The two are often linked for a variety of reasons, some purposeful and some not. Some linkages may have unintended side effects, and some may have outlived their usefulness. Some illustrations include:

- Standards and handling requirements for new waste, which are partially intended to raise the cost of new waste generation, are applied to remediation projects, raising their cost.10

- The siting of a facility for managing new waste will entail cleanups of old waste (RCRA corrective actions) that might not otherwise have been deemed necessary.

- Superfund, the program to clean up old waste, is used as a consciousness-raising tool to compel generators to recall the potential liabilities of new waste generation.

The nature and merits of these linkages deserve broader consideration as the hazardous waste policy debates unfold. For many years, fear of future Superfund involvement (Superfund phobia) among new waste generators has been claimed as a major benefit of CERCLA. The obvious question today is whether this is still a desirable way to influence behavior. To many generators, the message about the potential hazards and uncertain liability of generating new waste has been delivered. An alternative to Superfund phobia is to alert generators to the broader implications of new waste generation through more precise and direct policy instruments, including taxes, fees, enforcement, permitting standards, and penalties associated with new waste generation. Reducing certain linkages between old and new waste policy would facilitate more effective and innovative policy approaches.

OLD WASTE

Unfinished Business

Neither Superfund nor the current public policy debate about its reauthorization has yet adapted to the changed requirements for cleanup in the 1990s. Despite its critics, Superfund—originally passed in 1980—still exemplifies a form of federal responsiveness to grassroots concerns about hazardous waste sites. It is associated with the concepts of “the polluter pays,” direct government intervention with minimum federal outlays, and strict joint and several retroactive liability. If the program was intended to assure attention to the prompt mitigation of visible threats to health and quality of life, then it has been successful largely through emergency removals and as a mechanism for affected communities—sometimes even those with limited political influence—to voice concerns and draw attention to nearby hazardous waste sites. But there are serious controversies about virtually every other aspect of the program—financing, effectiveness, liability, incentives, cleanup standards, etc. Also, the scope and magnitude of the listed and unlisted inventory of hazardous waste sites suggests that Superfund has only scratched the surface of its eventual responsibility.

The administration’s current proposal raises new and important issues that suggest interest in broadening discussion beyond the bounds of Superfund reauthorization. Nevertheless, it seems likely that the debate will focus on two questions that form part of Superfund’s “unfinished business.”
• How should costs for cleanups be allocated? This focuses on the notion of "the polluter pays" and on the utility, equity, and efficiency of the retroactive strict joint and several liability system for recovering cleanup costs.

• How clean is clean? This focuses on the appropriate cleanup level that should be achieved at individual sites and ultimately relates to the feasibility of utilizing criteria set by land use planning as an alternative to absolute cleanup standards.

These questions were already recognized as significant during the 1986 CERCLA reauthorization, but the program was immature and still recovering from the EPA scandals of the early 1980s that derailed the logical evolution of cleanup policies. They remain profound issues for policy debate. But the emergence of the federal government as potentially responsible party (PRP) in the last five years, in contrast to its traditional role as regulator or arbiter for hazardous waste cleanup, has dramatically changed the policy context for addressing these two questions. It also raises several important questions that do not seem to be adequately considered by the policy community.

Federal Cleanups: Changing the Context for Policy

Federal facilities were added to the National Priorities List in 1986. Although many realized that the problem on federal sites was large, few realized the immense scope of the cleanup that would be required. As shown in Figure 1, federal (predominately Department of Defense and Department of Energy) cleanup programs have grown to approximately $10 billion annually (not including EPA's approximately $1.5 billion annual expenditures on Superfund), dominate National

Priorities List expenditures, and exceed the EPA's total agency budget. This dramatic growth has significantly changed the assumptions and issues that underlie the hazardous waste cleanup debate. One example is the effect on the "polluter pays" concept. This now means making federal agencies pay, but with a vastly different effect than on the private sector. "The polluter pays" implies a cost penalty for a private-sector PRP. For a federal agency, it may imply mandates for cleanup and appropriations to implement the process.

The two cases differ substantially in their impact upon the polluter. Even if there is inefficiency, slow and expensive CERCLA procedures—with painstaking quality assurance and quality control studies—may have the beneficial effect of penalizing the private polluter and guarding against future litigation. However, there are different effects on federal cleanups. Some in DoE see cleanup as an opportunity to preserve jobs, implement defense conversion, and build a new DoE mission. These same procedures slow cleanup on closing military bases and delay conversion of these facilities to civilian use.

The federal budget is also at stake. Having entered the process late, the federal government has not fought cleanup costs with the same vigor as the private sector. Figure 1 is a reflection of both a large federal problem and a federal willingness to attach resources to the problem. Thus, the federal government will be affected by CERCLA's inefficiencies to a far greater extent than the private sector will be. It may be socially and politically acceptable to burden a private polluter with demanding cleanup obligations, but the federal case is different. The government must continue to balance broad social, economic, environmental, and political goals. Although Superfund's original concept was to limit federal cleanup costs, hazardous waste cleanup has become a very large item on the federal budget, but one that is politically buried within DoD/DoE accounts.

The growth in federal cleanups also requires that we reexamine implementation strategy for a policy objective that is still in flux: that federal facilities should comply with federal, local, and state environmental laws. Many

---

11 Federal cleanup budgets include both NPL and non-NPL cleanups and other environmental activities. Although estimates of private NPL expenditures are extremely crude, such costs for DoD and DoE are comparable and probably larger than the combined total of EPA and private-sector costs on NPL cleanups. EPA's costs are approximately $1.5 billion a year, with funds raised primarily through special taxes rather than from the general budget. We also note that although federal cleanups are dominated by DoE and DoD projects, there is an unknown—but potentially large—cleanup obligation on Department of the Interior lands. See the National Research Council's Hazardous Materials on the Public Lands, National Academy Press, Washington, D.C., 1992.
political and legislative milestones along this path have been achieved, but the sheer size of the federal facility cleanup problem may block further progress. Federal Facility Cleanup Agreements are already beginning to exceed congressional budget allocations. Growing slippage and difficulty in meeting milestones specified in these agreements could be used to support the granting of special treatment to federal facilities.

Delay, cost growth, uncertainty, and other difficulties that could arise during federal site cleanups could also stimulate thinking about priority setting in a broader manner than "how clean is clean?" Cleanup standards must not be set only for individual sites; we must pay rigorous attention to the entire process of prioritization that establishes which, among the whole set of government and privately owned sites, should be selected for cleanup. Technology should also be a critical consideration, given its dynamic status, its relation to temporal trends in cleanup costs, and its differing benefits for different sites. These should influence the prioritization process.

Cleanup operations on some federal facilities could also provide important data related to "how clean is clean?" President Clinton's plan to accelerate cleanups on closing military bases incorporates dual—and perhaps even competing—objectives of achieving high cleanup standards while assuring that cleanup goals and timetables are responsive to community land-use plans. The closure process will test the practical feasibility of using land-use planning to establish cleanup levels and their relationship to traditional health and safety criteria. It will help illuminate the practical side of the "how clean is clean?" issue and give real-world insights into the neglected question of who should make such decisions.

Given the transformation of cleanup and the large inventory of listed and unlisted sites, Superfund should evolve from a program that is intended mainly to demonstrate government (and political) interest in responding to emergencies and managing the early stages of remediation to one that can organize, regulate, and manage large projects over the long term. Success in the longer term may require skills and knowledge in science, risk assessment, systems analysis, technology, engineering, field activities, and contracting that differ from those required under CERCLA. A new set of technical, economic, social, and political bases for policy may be needed for a successful transition.

**New and Old Questions in a New Policy Context**

A number of key policy questions—some already raised in the administration proposal and elsewhere—should now enter the policy debate. We should also recognize that even traditional questions are likely to gain significance in this new context.

1. **What goals are cleanups intended to achieve?**

   As mentioned earlier, urgent concerns about quality of life and visible health hazards influenced the early stages of policy and program implementation. Moreover, many visible threats were mitigated by emergency removals and other (so-called) nonpermanent remedies. For the future, we need to better understand when, how, and why soil and groundwater should be treated. Decisions to proceed with costly and long-term treatment are influenced by long-term health risks, ecological risk, and high levels of uncertainty. But we must also consider the principles in Table 1 as well as the ability of current technology to overcome difficult practical barriers. We must determine as well whether ARARs and an elaborate regulatory regime are the underlying rationale for decisionmaking, rather than potential impacts on health or ecology. We need to ask if maintaining regulatory momentum is more important than achieving fundamental progress in cleanup goals.

2. **How do we develop a priority-setting system that corresponds to these goals?**

   The broadened scope of national cleanup raises questions about site selection and priority setting. The appropriateness, consistency, and utility of EPA's Hazard Ranking System—which is used to select sites for the NPL—has been debated in the past and has often been characterized as arbitrary and subjective. Curiously, it has never become a defining aspect of the policy debate, despite private-sector fears about sites not yet discovered. The existing scoring system permitted EPA to select sites associated with significant political and community concerns, but it is being criticized for favoring the communities that do the best job of using ARARs.
the political process. Resource limitations, policy interest, and political visibility all play a role in selecting candidates for NPL listing. But the potential backlog of candidate sites is probably an order of magnitude greater than the current NPL inventory. A more transparent, systematic, internally consistent, and reproducible process for selecting sites is needed.15

3. What is the most effective and efficient way to insure consistent and equitable state and community participation in priority setting, remedy selection, and other aspects of the cleanup process?

Improved priority setting and “how clean is clean?” are closely linked with the proper roles of federal, state, local government, and affected communities. The current system for NPL cleanup involves a dominant federal role derived from political pressure for an urgent national response to Love Canal and the limited state capabilities that existed in the 1970s. But state activities have grown in unanticipated ways, due primarily to ARARs, linkage with state-regulated new waste policies, participation in federal facility compliance agreements, and an (ill-defined) ability to require permitting processes on NPL sites. States have also gained additional authority as EPA staffing constraints have limited the designation of NPL sites and oversight is shifted to state cleanup programs. Any new priority system should span both NPL and non-NPL sites if it is to reflect current realities.

4. What is the relationship between federal and private sites? Should the goals for cleanup be identical for both?

Despite near unanimity in the desire to hold federal facilities to the same environmental standards as the private sector, this is becoming increasingly difficult as federal cleanups escalate in cost. Difficulty is compounded by the multiple—and possibly divergent—objectives of federal facility cleanup programs. The agenda includes defense conversion, job preservation and creation, rapid military base transfer, environmental technology development for enhancing international competitiveness, and agency commitment to environmental responsibility and openness. It is useful to explicitly recognize these multiple purposes, to determine whether they complement or retard effective cleanup and influence standards, and to determine their proper roles in hazardous waste policy.

5. How do we stimulate the development of an effective and innovative private-sector cleanup industry?

The truly long-term nature of cleanup also poses questions about the private-sector cleanup industry, which serves both private and federal clients. The cleanup market ought to foster a competitive and innovative private-sector cleanup industry that offers the prospect of lower long-run costs. But the federal government is both regulator and major customer in this market. The dual federal role seems to be creating a poor climate for optimal industry and technology development, because the market is neither competitive nor directed according to a well-defined mission or goal.

6. How should the federal government be organized to meet the challenge?

Some federal agencies are responsive to cleanup obligations but may see little need to play an active role in building long-term public or private capabilities. Others see cleanup as a new mission. How should federal efforts be organized? The existing federal cleanup structure, with various responsibilities across the different military services, the Department of Energy, the EPA, the Department of the Interior, and the Army Corps of Engineers, reflects an earlier perception of the federal role that conflicts with current reality: the government as responsible party and manager of the largest cleanup projects. The current agency-by-agency piecemeal approach is too fragmented to properly motivate coherent research, development, technology applications, and evaluation. We do not suggest that a single organization should be in charge (although this should be considered), rather that the level of inter-agency coordination, planning, and mutual learning must be improved. Goals should be established and federal agencies should commit to those goals.

These questions emphasize the need to examine the old waste issue in a context broader than the National Priorities List. Changing the priority system, stimulating an effective private-sector cleanup industry, developing technology, revising state and local roles, and so forth will require us to assess virtually all large-scale cleanup programs. The answer will affect RCRA corrective actions, state programs, USTs, and other programs aimed at remediating the effects of old waste. Responding to these questions requires an ability to cross institutional and programmatic boundaries.

Our final comment about old waste is a reminder that private NPL sites represent only a small fraction of old waste sites. This is due to the scope and scale of cleanups on federal sites, the great diversity of non-NPL

---

15On May 6, 1994, the administration’s interagency Federal Facilities Policy Group published its mission statement that included priority setting as a major topic for analysis. The outcome of this process is likely to affect both public and private cleanups, yet there has been little attention to this in the Superfund community.
cleanup programs, and the large number of hazardous waste sites that are not yet completely characterized. Superfund reform may not directly influence cleanup at these sites. Thus, an additional new challenge is to broaden the context for considering old waste sites.

NEW WASTE

Defining the Challenge

The basis and goals of existing policy for new waste is perhaps equally obscure, although no single issue such as Superfund reform dominates. Detailed rules and regulations help reduce the probability of future Love Canals, but they are not comprehensive, they discourage efficiency, and they yield contradictory incentives for recycling and pollution prevention. As an example, engineering resource extraction models predict that many existing hazardous waste streams may contain valuable resources that could be efficiently extracted, and yet the streams are not viewed as a potential source of revenue.\(^{16}\) Also, regulations have created and defined a waste management market, but we understand little about this market and the factors that govern flows within the waste management system.

Some similarity exists in the incentive structures for addressing both new and old waste. Incentives for pollution prevention stem from the high costs of treating and disposing of wastes under RCRA regulations (costs measured broadly including financial cost, risk, uncertainty, adverse publicity, etc.). These costs are the result of stringent waste treatment requirements as well as RCRA complexities and inefficiencies. Inefficiency was not the intended goal of RCRA; it emerged as a byproduct of the 1984 amendments, which were written with overwhelming detail and rigidity to ensure that a scandal-ridden EPA could not abuse executive authority. Inadvertently, complexity alone has become a reason to avoid waste generation. As a result, we are in the unusual situation where program inefficiencies create environmental benefits. But they also give rise to such socially negative effects as midnight dumping, transferring to less-regulated media, the discouragement of recycling, etc. One possible strategy for RCRA reform is to preserve the high costs of waste disposal but remove nonconstructive incentives (eliminating inefficiencies without offsetting costs could reduce incentives for pollution prevention by lowering the cost of waste generation). The high cost of waste disposal could produce additional environmental or social benefits.

Workshop participants—particularly those with experience in regulating and managing new waste—felt that policies for managing and preventing new waste generation are so complex and politicized that the forthcoming RCRA reauthorization debate will be excruciatingly detailed. They believed that while details cannot be neglected, it is important to frame the discussion in terms of the desired configuration of our entire waste system. One participant with years of high-level regulatory experience suggested that the entire set of laws, rules, and regulations governing new waste should be discarded, and a new set formulated. The recent Supreme Court decision classifying incinerator fly ash as a hazardous waste—with all its financial and management implications for many communities—may generate further support for such a perspective. Although discarding RCRA may be neither constructive nor practical, the suggestion is indicative of frustration and difficulty in finding ways to reform it.

How to Rationalize New Waste Policy

One Summer Institute breakout group commented that the current system had evolved in response to piecemeal political and environmental concerns and recommended a multistep process for rationalizing it. In conceptual terms, the process will:

- Identify the universe of hazardous wastes without regard to whether wastes are categorized as hazardous in RCRA;
- Rank this universe according to a more systematic definition and ordering of their hazardous potential;
- Identify management practices and technology for achieving the preferred mix of the four guiding principles or goals;
- Identify strategies to maximize the extent to which a given expenditure will comply with different weightings of the four principles.

This new approach would enhance the prospect of introducing “systems analysis” to a process that is generally agreed to be overly politicized. But there is little data and less understanding to support policy and systems analysis. We need to better understand how and where hazardous wastes are generated, how they are processed, where they go, how they can harm human health and the environment, and how they can best be minimized. More than 50 percent of our wastes are categorized as “industrial nonhazardous,”\(^{17}\) a class of waste that is poorly understood and little regulated.


\(^{17}\) A collection of hazardous waste databases that documents our limited knowledge of material flows is presented in Hazardous Waste and Hazardous Materials, Vol. 9, No. 1, 1992.
An ongoing comprehensive data-gathering effort to characterize critical aspects of the new waste system would be extremely valuable. It would have the collateral effect of improving the performance of individual firms and industries, just as the Toxics Release Inventory motivated many firms to reduce air emissions.\footnote{18} It may upset conventional wisdom, but increasing the emphasis on corporate environmental disclosure and gathering data on waste and material flows, coupled with research and development in science, technology, and systems, could produce greater environmental benefits at lower costs than RCRA reauthorization. It would be useful to properly understand the entire system, including the relationship between hazardous waste, hazardous materials, resource extraction damage, and all aspects of their associated environmental impact. We could then estimate the near-term costs and benefits of embracing the long-term holistic goals of sustainability and industrial ecology.

Finally, we note that we need to expand the way we think about industrial ecology and sustainability. These concepts may provide an attractive vision of the future, but there is no roadmap to guide our journey into the 21st century. Concepts such as green accounting\footnote{19} need to be evaluated seriously as a means of motivating this change of direction and the eventual replacement of command and control regulations. \textit{Visions of sustainability and industrial ecology are likely to remain academic constructs with few implications for public policy unless there is increased attention to the managerial tools for transforming our economy.}

CONCLUSION AND SUMMARY

It is now time to review and rethink the full scope of the hazardous waste problem. Current policy protects the environment by hitting hard in both the right and the wrong places. History and events have pushed us toward these policies; but we have reached a time for fundamental reevaluation, both to deal with unfinished business and to confront new challenges. Hazardous waste policies need to be formulated for the future rather than for the past.

Reauthorization debates are significant parts of the political process. They will certainly define the range of issues and policy changes that can be considered in the short term, but they are unlikely settings for a fundamental rethinking of complex policy. There is a longer-range problem of finding ways to inject broad new issues and challenges into the political process.

Because existing policy is incoherent, fragmented, and often inconsistent, there is a need to reformulate hazardous waste policy without regard to existing organizational and legislative boundaries. Goals based on quality of life, human health, ecology, and sustainability need to be made more precise, and laws and institutions should be designed to better attain these goals for both old and new waste.

One mechanism for such rethinking—enthusiastically endorsed by Institute attendees—is the formation of a bipartisan national commission on hazardous waste policy with an independent research arm. Such a commission would not be constrained by particular program, agency, congressional committee, or other institutional boundaries. It could formulate a set of fundamental objectives for hazardous waste policy. It would lay out broad questions for objective policy research and systems analysis. The commission’s charter should be sufficiently broad to encompass old waste and new waste, and to consider both unfinished business and new challenges. (A broad charter may also be necessary to minimize potential conflict with Superfund reauthorization and to justify a fundamental and holistic exploration of the issues.)

It is not likely that a single new commission can change the entire course of hazardous waste policy. But the creation of such a commission would send an important signal that we are seeking to change the way in which policy is formulated; to move from an approach dominated by reaction to political events and detailed legislation, to a new, more rational approach based on systems analysis and the close linking of program design and implementation.

A bipartisan national commission and others would be well served by the following agenda of policy-relevant research:

- Continue national efforts to refine a vision of sustainability and industrial ecology that will serve as a long-term guidepost for hazardous waste policies. The President’s Council on Sustainable Development should manage the development of this vision and integrate it with the materials flow analyses described below. It should explicitly consider the relationship between a long-term vision and near-term policies.

- Conduct a systematic effort to gather data on material flows both before and after the generation of waste. The goal of the effort should be to increase our understanding of the relationship between the generation of hazardous waste and
upstream environmental impacts that are separately regulated and independent of hazardous waste consequences. We suspect that the data gathering itself will reveal new sources of pollution that will lead many to make voluntary reductions in waste generation.

- Begin a dedicated effort to understand the extent to which financial management tools such as environmental disclosure, reporting, accounting, life-cycle analysis, and "green" economics can be used to promote a long-term vision and introduce the managerial and human element into industrial ecology. We should also explore broader concepts of industrial efficiency to reflect what are sometimes treated as externalities.

- Pursue an integrated health-effects research agenda that will systematically improve our knowledge of the health consequences arising from environmental and occupational exposure to hazardous materials, old hazardous waste, and new hazardous waste.

In conclusion, the features of the hazardous waste landscape have been radically altered since the problem first attracted public and policy attention. It is now appropriate to reevaluate the foundations of hazardous waste policy, and to formulate new policies and regulatory approaches that better match this new landscape.