Fear and Loathing in the Siting of Hazardous and Radioactive Waste Facilities: A Comprehensive Approach to a Misperceived Crisis

Michael B. Gerrard
Columbia Law School, michael.gerrard@law.columbia.edu

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FEAR AND LOATHING IN THE SITING OF HAZARDOUS AND RADIOACTIVE WASTE FACILITIES: A COMPREHENSIVE APPROACH TO A MISPERCEIVED CRISIS

MICHAEL B. GERRARD*

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I. INTRODUCTION

Few laws have failed so completely as the federal and state statutes designed to create new facilities for the disposal of hazardous and radioactive waste. Despite scores of siting attempts and the expenditure of several billion dollars since the mid-1970s, the federal government has spent $1.26 billion on the effort to site a repository for high-level radioactive waste at Yucca Mountain, Nevada, Projected HLW Program Budget Down by $200 Million, RADIOACTIVE EXCHANGE, Nov. 16, 1992, at 14, $1.3 billion on the Waste Isolation Pilot Project for transuranic waste in New Mexico, Keith Schneider, Wasting Away, N.Y. TIMES, Aug. 30, 1992, § 6 (Magazine), at 42, 43, and more than $100 million on its effort (abandoned in 1971) to site a high-level radioactive waste repository in Lyons, Kansas, id. at 56. Illinois spent $85 million in an abortive effort to site a low-level radioactive waste (LLRW) facility in Martinsville, Illinois. Conference Notes, RADIOACTIVE EXCHANGE, Dec. 14, 1992, at 14, 15. New York State has spent $37 million trying to site an LLRW facility. Herbert Inhaber, Of NIMBYs, LULUs, and NIMTOOs, 107 PUB. INTEREST 52, 62 (1992). California, Nebraska, and Pennsylvania have each spent about $30 million trying to site LLRW facilities, and North Carolina has spent $45 million. Jorge Contreras, In the Village Square: Risk Misperception and Decisionmaking in the Regulation of Low-Level Radioactive Waste, 19 ECOLOGY L.Q. 481, 528 (1992). As reported by an official of a large chemical manufacturing company, the typical cost of obtaining federal and state permits for hazardous waste facilities is $3 million. U.S. GENERAL ACCTG. OFFICE (GAO), PUB. No. GAO/RCED-88-95, HAZARDOUS WASTE: FUTURE AVAILABILITY OF AND NEED FOR TREATMENT CAPACITY ARE UNCERTAIN 22 (1988). However, some attempts have been much more expensive. For example, CECOS International spent at least $7 million in a failed attempt to expand a hazardous waste facility in Niagara Falls, New York. Paul MacClennan, The Stakes Are High in the CECOS Hearings, BUFFALO NEWS, Sept. 18, 1988, at H16. Clean Harbors of Braintree, Inc. spent $16 million on its unsuccessful effort to site a hazardous waste incinerator in Massachusetts. DENIS J. BRION, ESSENTIAL INDUSTRY AND THE NIMBY PHENOMENON 13-14 (1991). In Canada, one ongoing permitting proceeding has already cost approximately $100 million. Mary Lou Garr, Ontario Waste Management Corporation (OWMC) Proposal.
only one radioactive waste disposal facility,\textsuperscript{3} only one hazardous waste landfill (in the aptly named Last Chance, Colorado),\textsuperscript{4} and merely a handful of hazardous waste treatment and incineration units\textsuperscript{5} are operating on new sites in the United States today.

In 1981, a leading member of Congress, relying on data from the U.S. Environmental Protection Agency (EPA), predicted that by 1985 the country would need between 50 and 125 new off-site hazardous waste disposal facilities.\textsuperscript{6} Numerous legal commentators also stressed that many more facilities were desperately needed if the nation was to avert an environmental crisis.\textsuperscript{7} These


3. \textit{See infra} text accompanying note 296.


7. \textit{See Bacow & Milkey, supra note 6, at 266 n.9 (noting that the EPA projects major shortfall in disposal capacity); Susan Caskey, Alternative Dispute Resolution and Siting of Hazardous Waste Facilities: The Pennsylvania Proposal in Light of the Wisconsin and Massachusetts Statutes, 5 Temp. Envtl. L. & Tech. J. 58, 58 (1986) ("Few people who are well informed on the subject of hazardous waste generation and disposal will deny that there is an urgent need, throughout the United States, for the establishment of safe and efficient waste treatment, storage, and disposal facilities."); Kenneth A. DiMuzio, The Siting and Operation of Hazardous Waste Disposal Facilities, in Current Municipal Problems 506, 506-07 (Byron S. Matthews ed., 1982) ("The most serious political and moral problem facing New Jersey today is the safe disposal of hazardous wastes."); Daniel Mazmanian & David Morell, The "NIMBY" Syndrome: Facility Siting and the Failure of Democratic Discourse, in Environmental Policy in the 1990s at 125, 126 (Norman J. Vig & Michael B. Kraft eds., 1990) ("One of the most important questions of the 1990s is how to move beyond the current gridlock created by NIMBYism. . . . A workable answer is central to realizing the nation's environmental goals."); Stephen Sussna, Remediying Hazardous Waste Facility Siting Mala-}
facilities have not been built, yet no such crisis exists. The shortage of disposal facilities is actually far less severe and more localized than is usually portrayed. Its principal adverse environmental impact is that old, substandard, leaking disposal units stay open because there are no replacements. But there is a genuine political crisis—hundreds of battles have raged around the country, some dethroning elected officials, and some verging on violence—over the efforts of the federal and state governments to force hated facilities on terrified communities.

In this Article, I propose an approach to resolve the impasse in siting disposal facilities for hazardous wastes (HWs) and radioactive wastes (RWs). In doing so, I argue that the siting laws are based on a fundamental conceptual error, as well as several factual mistakes and policy blunders.

The conceptual error stems from the way the siting question is posed, which is usually framed as how to find the best locations for new facilities to dispose of HW/RW. But the fulfillment of this
dies by Considering Zoning and Other Devices, 16 Urb. L. 29, 32 (1984) (observing that “there is a desperate need for soundly designed treatment and disposal facilities”).

8. See infra part III.C.

9. E.g., Robert D. Benford et al., In Whose Backyard? Concern About Siting a Nuclear Waste Facility, 63 Soc. Inquiry 30, 31 (1993) (noting that in the Nebraska gubernatorial race, the incumbent was replaced by a candidate who opposed locating a low-level radioactive waste facility in the state); Howard Kunreuther et al., Public Attitudes Toward Siting a High-Level Nuclear Waste Repository in Nevada, 10 Risk Analysis 469, 469 (1990) (noting that Richard Bryan defeated incumbent Senator Chic Hecht of Nevada for Hecht’s seat in the U.S. Senate in 1988 largely as a result of Hecht’s allegedly equivocal stand on the siting of a high-level radioactive waste repository in that state).


task through government power over land use in effect subsidizes the disposal, and hence encourages the creation, of HW/RW by aggressively ignoring negative externalities and distorting the economics of production. Instead, the task should be posed as how to find the system of HW/RW management that maximizes social welfare, takes full account of social and environmental costs, and still achieves fairness. Viewing the problem this way leads to market solutions that reduce the generation of HW/RW rather than encouraging waste production which results in disposal nightmares.

The most important factual mistakes are the following widespread (and erroneous) assumptions:

1. A shortage of disposal facilities increases illegal dumping (when in fact illegal dumping has little to do with disposal capacity, and can be addressed through targeted enforcement);\(^{12}\)

2. States will cooperate with siting efforts, while willing local communities cannot be found (although the opposite is more often true);\(^{13}\) and

3. Monetary compensation can gain acceptance of HW/RW facilities in places that do not want them (although the evidence is that this seldom works).\(^{14}\)

Three policy blunders also have helped doom siting efforts. The first is separate regulation of all the different kinds of hazardous and radioactive waste streams, thereby dividing the states into victims (those with disposal facilities) and free riders (those without) for each waste stream and inhibiting regional cooperation.

The second policy blunder is insistence on technically perfect sites. Because such sites do not exist, old facilities remain open in some of the worst possible locations. The third blunder is the allowing of higher levels of government to preempt the authority of lower levels in imposing sites on unwilling communities—a method that not only always fails but is wildly counterproductive.\(^{15}\)

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12. See infra part IV.C.2.


14. See infra part V.A.1.

15. Addressing these problems requires delving into the literatures of law, economics, sociology, political science, psychology, and several of the physical sciences. I also have drawn heavily on my 16 years of experience litigating siting controversies on behalf of both facility opponents and applicants. I should disclose here that, primarily on behalf of several municipalities in New York and Connecticut, I have litigated against several companies named in this Article: Browning Ferris Industries, Inc. and its subsidiary CECOS International, Inc;
This Article is divided into five substantive parts. Part II lays out the foundation by arraying the different kinds of hazardous and radioactive wastes and describing the generation and disposal of each kind. Part III explains how past and present siting decisions have been made under federal and state laws and how old substandard facilities remain open under grandfather clauses. Part IV considers the effects of the current mechanisms for making siting decisions. It analyzes whether new HW/RW facilities are really "needed"; shows the irrelevance of illegal dumping to the question of need; assesses the fairness of the current system for various regions, economic classes, races, and generations; and erects a framework that strives to explain why certain facilities are so vehemently opposed, but others are accepted. Some of the hidden economics and psychology of the siting process are explored here. Although facility opposition is often trivialized with acronyms like NIMBY ("Not In My Backyard"), LULU ("Locally Undesirable Land Use"), or BANANA ("Build Absolutely Nothing Anywhere Near Anything"), this section will show how even new, "state-of-the-art" facilities pose real environmental hazards.

Part V discusses the prior proposals for addressing the siting dilemma. These proposals are divided into those based on efforts to achieve the consent of local communities to new sites; those that rely on governmental coercion; and those that seek to avoid the problem by minimizing waste production, exporting the waste to other jurisdictions, or avoiding the problem by reducing it to legal or linguistic nonexistence. This section also examines the frequent failures and rare successes of experiments with each of these proposals.

Finally, Part VI proposes a new alternative drawn from the many lessons of past siting attempts. The proposal is based on concepts of local control, state responsibility and national allocation. Under this scheme, all of the different types of hazardous and radioactive waste streams would be considered together, thereby eliminating much unnecessary regional conflict. The federal gov-

ernment would determine overall national disposal needs and allocate the burdens among the fifty states. The states would then ask communities to volunteer to host facilities—a method that, experience surprisingly shows, can attract numerous offers. The federal government would also make available the multitude of highly, and possibly permanently, contaminated sites that were used for military purposes and nuclear weapons production but have now been rendered obsolete by the end of the Cold War. Part VI also measures this proposed alternative against the criteria used in Part IV to assess existing siting mechanisms.

II. THE ORIGINS AND DISPOSAL OF HAZARDOUS AND RADIOACTIVE WASTES

This section reviews the different types of waste streams that are regulated under the HW/RW laws. For each type, the origins, quantities, regulation, and applicable disposal techniques are discussed. In an effort to devise a comprehensive approach, I have included here several types of wastes that are not conventionally discussed in this context but nevertheless form an important part of the overall disposal picture.

As will become clear, domestic and international politics and economics are as important as chemistry and physics in defining what substances are closely regulated.

A. Nonradioactive Wastes

1. RCRA-Regulated Hazardous Wastes

The transportation, storage, and disposal of hazardous waste are regulated primarily by the Resource Conservation and Recovery Act (RCRA), although other federal statutes govern particular disposal methods. RCRA defines "hazardous waste" with general references to threats to health or the environment. The stat-
ute also establishes an intricate system for the EPA to list the chemicals or types of chemicals that fit within this definition.22

The chemical industry generates 88% of all the HW in the United States.23 Industries involved in producing primary and fabricated metals and the petroleum refining industry rank just behind the chemical industry in HW generation.24 A small number of sites account for most of the HW. Just 1% of all generators create 97% of the HW,25 and three plants—operated by DuPont, Dow Chemical, and Eastman Kodak—generate 57% of all HW nationwide.26

Despite considerable uncertainty,27 most estimates of RCRA hazardous waste generated by the civilian sector during the 1980s are around 250 million tons per year, which is the equivalent of just under one ton for every person in the United States.28 This figure greatly overstates the burden on disposal facilities, because about 96% of this waste is disposed of at the point of generation;29 the great bulk of it is water mixed with wastes that are treated and then released into rivers, lakes, and oceans.30 Some of this 96% is injected underground, and some is burned in 154 on-site "captive"

22. 42 U.S.C. § 6921 (1988). A large body of judicial and regulatory authority has arisen around this system of definitions. For information on judicial and regulatory definitions of hazardous waste, see generally JOHN-MARK STENSVAAK, HAZARDOUS WASTE LAW AND PRACTICE (1989); David R. Case, Identifying Hazardous Materials and Hazardous Wastes, in 3 ENVIRONMENTAL LAW PRACTICE GUIDE 26-1, 26-5 to 26-21 (Michael B. Gerrard ed., 1992); see also infra text accompanying notes 100-24.


26. Id. at 2-14.


30. Id. at 4; Doug MacMillan, Interstate Movement of Hazardous Waste, WASTE AGE, May 1993, at 29, 32.
hazardous waste incinerators. The remaining RCRA hazardous waste, approximately 4%, is mostly solid and is sent to a variety of privately owned, off-site hazardous waste landfills, incinerators, and treatment facilities. Landfills get 26.4% of the HW disposed off-site and incinerators get 4.5%.

The commercial, off-site hazardous waste facilities now operating in the United States consist of 103 chemical treatment plants, 95 solvent recovery plants, 60 physical treatment plants, 30 kilns that burn hazardous waste as fuel, 24 landfills, 20 incinerators, and 8 deep injection wells. These 24 landfills and 20 incinerators, and the efforts to increase their number, are at the vortex of the current controversy over hazardous waste facility siting; there is ample excess capacity at the other types of facilities, although some regional shortfalls and deficits in some specialized forms of treatment may exist.

New laws that discourage the landfiling of untreated hazardous wastes increase the demand for incineration capacity. Other factors, such as waste reduction and on-site treatment,
reduce the demand; the net effect is uncertain.\textsuperscript{38} Several new commercial incinerators are now winding their way through the permit process.\textsuperscript{39} Incineration capacity is growing faster than demand,\textsuperscript{40} and aggregate projections show no significant capacity shortfalls.\textsuperscript{41} In 1993, a trade press report stated, "Today, there is an over-capacity of offsite hazardous waste treatment facilities and services, especially incineration."\textsuperscript{42} In fact, the nation's commercial HW incinerators were running at only about half their capacity.\textsuperscript{43} Acknowledging this excess capacity in May 1993, the EPA announced an eighteen-month "capacity freeze" on HW incinerators while it launched a "national dialogue" on HW management.\textsuperscript{44} In the subsequent months several plans for HW incinerators were cancelled due to lack of demand.\textsuperscript{45}

\textsuperscript{38} Karin Schreifels & Lisa Nelowet, Opportunities and Dilemmas of Transportable Hazardous Waste Management Facilities, in PROCEEDINGS, AN INTERNATIONAL SYMPOSIUM, HAZARDOUS MATERIALS/WASTES: SOCIAL ASPECTS OF FACILITY PLANNING AND MANAGEMENT 62 (1992) [hereinafter PROCEEDINGS].

\textsuperscript{39} William Gruber, Siting Efforts for Hazardous Waste Incinerators, EL DIGEST, May 1990, at 18; Paul Kemezis, Among the States: Free Trade—High Court Opens the Doors for Waste Imports, CHEMICAL WK., Aug. 19, 1992, at 50.

\textsuperscript{40} Paul Harris, Spotlight on TSD: Where Did the Business Go?, ENV'T TIMES, Oct. 1992, at 33.

\textsuperscript{41} OFFICE OF POLICY ANALYSIS, U.S. EPA, 1986-1987 SURVEY OF SELECTED FIRMS IN THE COMMERCIAL HAZARDOUS WASTE MANAGEMENT INDUSTRY: FINAL REPORT at iv (1988) (concluding that commercial incineration capacity is adequate); FREDERIC M. IANNAZZI & CHRISTINE A. O'SHAUGHNESSY, HAZARDOUS WASTE INCINERATION, PART 2: LEADING PARTICIPANTS (1991) (projecting incineration market to become increasingly competitive); Kristi Highum, The Incineration Picture Based on the Capacity Assurance Plans, EL DIGEST, Apr. 1990, at 16, 26-28 (showing total annual capacity at commercial hazardous waste incinerators to be over 1,000,000 tons/year, while demand is 670,000 tons/year).

\textsuperscript{42} Mary Melody, Hazwaste Treatment Services Weather Challenges, HAZMAT WORLD, June 1993, at 30, 32; see also Ray Pospisil, Radical Change for Hazardous Waste Services, CHEMICAL WK., Aug. 18, 1993, at 26 (noting that "incinerator overcapacity could be exacerbated by the debut of several new units").


In 1990, a leading trade journal concluded that no national shortage in hazardous waste landfill capacity existed. Since then, landfill demand has declined sharply. Considering all types of commercial hazardous waste disposal capacity, a vice president of the largest company in the field, Waste Management, Inc., wrote in 1991, "Though some sites will shut down while others add technologies, we are close to a capacity equilibrium unless local political restrictions limit that capacity." In 1993, the largest HW landfill in the country, located in Emelle, Alabama, was operating at less than half the rate it did before 1990. A leading financial analyst, Hugh F. Holman, wrote: "We are currently awash in commercial land disposal capacity," and he added, "[T]he business of commercial hazardous waste management is, in many ways, inherently self-limiting: it is a rare customer indeed that wants to do more business with you." Holman said that trends for more on-site remediation, for treatment rather than disposal, and for waste minimization will continue to erode the market for off-site commercial disposal. A few months later, Standard & Poor's Corp. put Chemical Waste Management, Inc. on its "Credit Watch" list because of declining waste volumes, due largely to waste minimization and recycling.

In sum, most legal commentators and some politicians have decried a critical national shortage of hazardous waste dispo-

51. Alex. Brown & Sons, Chemical Waste Management, Inc. and Rollins Environmental Services, Inc.: Why We Recently Downgraded These Stocks to "Source of Funds" 17 (1993).
52. Id. at 4.
53. Id. at 15, 20; see also Haz Waste Market Growth Fueled by Remediation; Disposal & Services Flat, Env'tl. Bus. J., June 1993, at 1, 1 [hereinafter Haz Waste Market]. A differing view is taken in Freedonia Group, Commercially Managed Wastes Grow at Twice the Rate of Total Generation, New Freedonia Study 1 (1993).
55. See sources cited supra note 7.
56. See sources cited supra note 6.
sal capacity to attempt to impose facilities on unwilling communities. The waste management industry, the trade press that covers the industry, and the financial analysts that study it, however, paint a very different picture.

2. Civilian Inactive Hazardous Waste Disposal Sites

The explosion of public consciousness concerning hazardous waste essentially dates to August 2, 1978, when New York State declared the Love Canal neighborhood of the City of Niagara Falls a public health emergency. In the 1930s and early 1940s, the Hooker Chemicals & Plastics Corp. had dumped 21,800 tons of liquid hazardous waste into a large ditch. The ditch was covered over, and a residential neighborhood and a school were later built on top of the ditch. When residents began complaining of illness, officials performed studies that ultimately led to the evacuation of the entire neighborhood.\(^{57}\)

The EPA, which for some time had been advocating a new statute to control inactive hazardous waste disposal sites, used the massive publicity generated by the Love Canal incident to push through Congress\(^{58}\) the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, also known as the Superfund law).\(^{59}\) CERCLA requires the use of a hazard-ranking system to establish the National Priorities List (NPL), which lists the hazardous waste sites\(^{60}\) that pose the greatest dangers.\(^{61}\) These sites must undergo an elaborate process of investigation and remediation.\(^{62}\)

The NPL now contains about 1200 sites nationwide.\(^{63}\) The congressional Office of Technology Assessment has estimated that

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\(^{58}\) Marc K. Landy et al., The Environmental Protection Agency: Asking the Wrong Questions 133-71 (1990).


\(^{60}\) Technically, these are hazardous substance sites, because CERCLA regulates hazardous substances, a broad category which incorporates by reference all RCRA hazardous wastes as well as several other lists of materials. See 42 U.S.C. § 9601(14) (1988).


the list could readily exceed 10,000. Additionally, many states have their own "mini-Superfund" lists, on which more than 19,000 sites have been placed. The average cost of investigating and cleaning up these sites is roughly $30 million each. Cleanup involves a broad range of possible actions, ranging from excavating the contaminated material and hauling it to a RCRA hazardous waste landfill or incinerator, to cleaning it up in place using such esoteric techniques as soil gas extraction or bioremediation. Although the practice has now been banned, for several years waste was simply dug up, hauled to another leaky landfill, and dumped without further treatment; several of these receiving landfills later became CERCLA sites themselves. NPL sites will require the removal of about twenty-six million cubic yards of soil, sludge, and sediment.

3. RCRA Corrective Action Sites

All hazardous waste facilities with permits under RCRA must undertake "corrective action" to clean up contamination on their sites, including any that has spread beyond the facility boundary. This program, which is still in its infancy, is very similar to CERCLA's NPL program but addresses contamination at operating facilities rather than at inactive sites. It may ultimately involve between 1500 and 3500 sites. Under some estimates, the cost of the RCRA corrective action program will grow to dwarf that of the NPL program.

Comprehensive figures are hard to come by, but it appears that, in the early 1990s, approximately eighty percent of the waste received by off-site commercial HW landfills and incinerators was "livestream," which means from ongoing industrial production, with the rest coming from CERCLA, RCRA, and other remedial projects.

64. Id. at 11.
66. Id. at 179.
67. See infra part V.C.5.
68. Mazmanian & Morell, supra note 7, at 13, 43, 47.
69. EPA, supra note 65, at 4.
71. EPA, supra note 65, at 5.
73. ALEX. BROWN & SONS, supra note 51, at 8.
4. Military Facilities

The U.S. military generates approximately 750,000 tons of hazardous wastes annually, including such substances as paint thinner, spilled solvents, hydraulic fuel, aviation fuel, fuel tank and sewage sludges, and herbicides.\(^7\) The Department of Defense traditionally was lax in the use and disposal of such wastes, and defense contractors had little incentive to be careful, because they could charge the cost of cleaning up their own messes back to the military.\(^7\) President Carter ordered federal facilities to comply with federal pollution control standards in 1978,\(^7\) but not until 1992 was a statute enacted that allowed the EPA and the states to penalize federal agencies for violating federal or state hazardous waste laws.\(^7\) With the end of the Cold War and the retrenchment of the military, the cleanup of former defense facilities has become a major growth sector.\(^7\)

The Department of Defense has two major cleanup programs for domestic facilities. The Installation Restoration Program covers facilities still in use, and it has targeted 1877 installations for cleanup at an estimated cost of $24.5 billion.\(^7\) The Formerly Used Defense Sites Program covers 6786 former facilities, such as arsenals, ammunition plants, equipment manufacturing plants, depots, bases, proving grounds, shipyards, forts, and camps; more than half of the former facilities will likely require significant remediation at unknown cost.\(^8\)

Although housekeeping was no better at the U.S. military's nearly 400 overseas bases, there is no integrated program to clean


\(^{80}\) Id. at 10; see also Seth Shulman, *The Threat At Home: Confronting the Toxic Legacy of the U.S. Military* 105-06 (1992).
them up. After the U.S. General Accounting Office surveyed some of these bases in 1986, the Pentagon classified the findings.

Various civilian federal agencies have also identified about 350 sites requiring remediation, but that number seems destined to climb considerably. These include research laboratories, prisons, power plants, properties acquired through foreclosure, and many other facilities.

5. Chemical Weapons

Although it claims never to have used them in war, the United States has been manufacturing and stockpiling chemical weapons for decades. President Nixon halted U.S. production in 1969 in the wake of a nerve gas leak in Utah that killed 4300 sheep. Congress has insisted that most of the older chemical weapons be destroyed by 1994, a deadline that has been pushed back several times—most recently to 2004.

In 1992, in the face of domestic protests, Congress cut off funding for much of the incineration of these old weapons. Much of the local opposition was based on the fear that, once the chemical weapons had been destroyed, the government would use the incinerators to destroy other defense or commercial waste. Congress also directed the Army to explore technological alternatives.

82. Satchell, supra note 74, at 21.
83. See EPA, supra note 65, at 7.
84. Id. at 89-90.
85. Unless otherwise noted, this subsection is based on John W. Birks, Weapons Forsworn: Chemical and Biological Weapons, in Hidden Dangers: Environmental Consequences of Preparing for War 161 (Anne E. Ehrlich & John W. Birks eds., 1990) [hereinafter Hidden Dangers]; Vicki Kemper, Deadly Debris: How the Army Plans to Rid the World of Chemical Weapons, Common Cause Mag., July-Aug. 1990, at 20 (examining the Army's plan to remove chemical weapons and the organized resistance of such disposal plans); Eugene L. Meyer, Toxic Fallout: Citizens Are Up in Arms over Plans to Incinerate the Nation's Chemical Weapons, Audubon, Sept.-Oct. 1992, at 16 (examining the politics surrounding the disposal of chemical weapons).
86. Seymour M. Hersh, Chemical and Biological Warfare: America's Hidden Arsenal 22-41 (1968).
to incineration. The overall program to destroy chemical weapons is estimated to cost nearly $8 billion.

Before 1970, the federal government buried old chemical warfare materiel at an additional seventy-five locations around the country. Most, but not all, of these locations are on military installations. The Army is now deciding what to do about these sites.


Some materials that were used for many years in construction are now recognized as hazardous. The three most prominent examples are asbestos, lead, and polychlorinated biphenyls (PCBs). A federal statute requires the inspection of all school buildings for asbestos and the performance of abatement where needed. The EPA has estimated that more than 44,000 schools may require asbestos abatement and that 300,000 to 400,000 public and commercial buildings have asbestos that may have to be removed, although no law requires such removal. An unknown number of residential buildings are also contaminated. National


96. Id.
expenditures for asbestos abatement have been running at three to four billion dollars per year.97

Several federal statutes recognize the dangers of lead98 (until recently a common component of paint and plumbing fixtures), but no comprehensive regulatory program is currently in place. In several recent incidents, lead released by the sandblasting or scraping of large structures, such as bridges and water towers has contaminated surrounding neighborhoods.99 PCBs are often present in old transformers and in the ballasts of fluorescent light bulbs.

Each of these substances require special disposal. Lead is a RCRA hazardous waste,100 and certain debris from its remediation must go to RCRA-licensed facilities.101 Asbestos, although not a RCRA hazardous waste,102 is regulated under CERCLA.103 As a result, many ordinary solid waste landfills, fearful of liability for later clean-up costs, refuse to accept it. PCBs are regulated under the Toxic Substances Control Act (TSCA)104 and must go to TSCA-licensed landfills or incinerators.105

Thus, the demolition or rehabilitation of buildings and structures, when performed properly, adds to the demand for hazardous waste disposal facilities.106 In all, some thirty-one million tons of "construction and demolition debris"—both hazardous and non-

99. See, e.g., Steven Lee Myers, Sandblasting Halted Again on Bridge, N.Y. TIMES, Oct. 27, 1992, at B1 (concerning the Williamsburg Bridge in New York City); Marcia Willhite, Sandblasting of Lead Paint Contaminates Residential Area, NATICH Newsl. (National Air Toxics Information Clearinghouse), Sept. 1991, at 5, 5-6 (concerning a water tower in Cedar Park, Texas).
106. Cf. State, Los Angeles Officials Grapple with Cleanup of Ruins Caused by Rioting, 23 Env't Rep. (BNA) No. 2, at 284, 284-85 (May 8, 1992) (noting concern over presence of asbestos and other hazardous materials in many of the buildings gutted by fire during the riots that followed the acquittal of the police officers accused of beating Rodney King).
hazardous—is generated every year.\(^{107}\) It is typically dumped in unlined landfills constructed for this purpose, even though it often contains hazardous contaminants.\(^{108}\)

7. Industrial/Special/Orphan Wastes

Much industrial waste does not fit within the RCRA definition of hazardous waste or would but for particular exemptions.\(^{109}\) Under one estimate, 430 million tons of industrial waste—much of it containing high levels of heavy metals and organic compounds—is discharged each year into waste ponds, waste piles, landfills, and other non-RCRA facilities.\(^{110}\) Most of these facilities lack even the most rudimentary liners or other groundwater protections, and they are barely regulated by either the federal or state governments.\(^{111}\) A few states—notably California, Illinois, New Jersey, Pennsylvania, and Wisconsin—require groundwater protection and other controls, but the federal government has no coherent program for these industrial wastes, the volume of which overwhelms that of RCRA hazardous waste and municipal solid waste.\(^{112}\)

8. Mining and Oil and Gas Wastes

Some 1.3 billion metric tons of mining wastes are produced each year.\(^{113}\) This material comes from the extraction, beneficiation,\(^{114}\) and processing of ores and minerals. This waste material is

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108. See also Bridgeport’s Plan to Burn Mountain of Trash Draws Threat of Lawsuit, N.Y. Times, Nov. 12, 1992, at B7 (reporting on the controversy over a plan to incinerate contents of an illegal construction and demolition debris landfill, including lead, creosote, and asbestos).


111. Orphans, supra note 107, at 1-2.


113. Incineration of Hazardous Waste at Sea, supra note 110, at 214.

114. Beneficiation is the process during which the ore is crushed and ground and minerals are recovered by physical or chemical techniques. T.S. Ary, The Importance of Waste Management Regulations to the Minerals Industry, in Proceedings of the First International Conference on Environmental Issues and Waste Management in Energy and Materials Production 5-6 (T.M. Yegulalp & Kunsoo Kim eds., 1992) [hereinafter Proceedings].
WASTE FACILITY SITING

typically placed in a slurry and dumped in tailings impoundments that average 500 acres in size, with the largest exceeding 10,000 acres. More than 24,000 mining waste ponds are in active use, and another 22,300 abandoned mines and processing facilities are expected to require cleanup, at a total cost of $55 billion.

Much mining waste would be considered hazardous waste; however, in 1980—shortly before the RCRA regulations were to take effect—Congress enacted the Bevill Amendment, which temporarily excluded mining wastes from RCRA regulation pending an EPA study and a subsequent rulemaking. The resulting EPA regulations have engendered a considerable amount of litigation; however, much mining waste remains exempt from RCRA despite clear evidence of serious health and environmental risks.

In the oil and gas industry, an estimated 8.6 billion metric tons of brines and drilling muds are discharged each year into some 125,000 oil and gas waste ponds. These wastes have high concentrations of chlorides, barium, and other contaminants but are also exempt from RCRA under the Bevill Amendment.

9. Pollution Control Residue

Pollution control devices typically capture the offending material before it can exit the smoke stack or drain pipe. Indeed, certain elements of the two main pollution control laws, the Clean

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115. Id.
117. Office of Tech. Assessment, supra note 63, at 100, 194; see also Mineral Pol'y Ctr., The Burden of Gilt (1993) (estimating that there are 557,650 hardrock mines in the United States, of which 14,950 contaminate ground or surface waters); Keith Schneider, New Approach to Old Peril: Abandoned Mines in West, N.Y. Times, Apr. 27, 1993, at A1, B17 (reporting that there are at least 500,000 abandoned mines in the western United States).
122. Incineration of Hazardous Waste at Sea, supra note 110, at 214.
123. Id.
Air Act and the Clean Water Act, have not so much eliminated pollution as consolidated it in residues that require their own disposal.\textsuperscript{125}

One prominent example is sewage sludge, which is a by-product of sewage treatment plants. In 1990, the nation's approximately 15,000 sewage treatment plants produced some 8.5 million dry tons of sewage sludge.\textsuperscript{126} Land application for fertilizer or soil conditioner is the preferred disposal method, but because certain contaminants can make sewage sludge unsuitable for this use, the EPA regulates sludge disposal.\textsuperscript{127}

Sludge disposal is especially difficult for metropolitan areas with little nearby agricultural land. New York City, for example, historically dumped its sewage sludge into the Atlantic Ocean. In 1988, a year when needles and other medical waste washed onto beaches in New York and New Jersey, Congress banned ocean dumping of sewage sludge after December 31, 1991.\textsuperscript{128} The ban increased New York City's annual sludge disposal costs from $20 million to $250 million\textsuperscript{129} and led to plans to build five sludge-burning incinerators in New York City and six in New Jersey,\textsuperscript{130} despite local opposition.\textsuperscript{131} Meanwhile, New York City is exporting much of its sewage sludge, and some regions have willingly

\begin{itemize}
  \item \textsuperscript{125} In enacting RCRA, Congress made a formal finding that "as a result of the Clean Air Act . . . the Water Pollution Control Act . . . and other Federal and State laws respecting public health and the environment, greater amounts of solid waste (in the form of sludge and other pollution treatment residues) have been created." \textit{Id.} § 6901(b)(3).
  \item \textsuperscript{126} Of this amount, 41.9% was land applied (used, after processing, as a soil conditioner or fertilizer, or as a fill material in land reclamation projects); 22.2% was landfilled; 13.6% was incinerated; 5.8% was processed, distributed, and marketed for compost and other uses; 9.2% was spread on vacant land; 4.8% was dumped in the ocean; and 2.5% was disposed of by other means. George A. Ravenscroft, \textit{Managing a Special Waste: Sewage Sludge}, \textit{SOLID WASTE & POWER}, Nov.-Dec. 1992, at 50.
  \item \textsuperscript{131} \textit{See} Jonathan Rabinovitz, \textit{Nassau's New Sludge Plan Is to Dump It Elsewhere}, \textit{N.Y. TIMES}, Nov. 24, 1992, at B5; Jonathan Rabinovitz, \textit{Nassau Given Time to Explore Sites for Sludge}, \textit{N.Y. TIMES}, Dec. 5, 1992, at 25 (reporting that Nassau County, New York decided, one week before it was to award a $200 million contract to build two plants to process sewage
\end{itemize}
accepted this material. However, other regions, which claim that the sludge is contaminated, have gone to court to try to stop the exports.

Ash is another residue of certain kinds of pollution control. For every 100 tons of municipal solid waste (MSW) that is incinerated, for example, there remain about 3 tons of fly ash (the material captured by the air pollution control equipment) and 27 tons of bottom ash. As much as 5.5 million tons of ash is created by MSW incineration each year in the United States. Much is so contaminated with organic chemicals and heavy metals that it fits within the RCRA definition of hazardous waste. Because the ash is derived primarily from household trash, however, it may be exempt from regulation under RCRA’s exemption for household hazardous waste. The circuits have split on this issue, and the U.S. Supreme Court recently agreed to address the question.

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137. Id. at 250.


10. Medical Waste

Approximately 500,000 tons of regulated medical waste are generated each year by about 380,000 generators, such as hospitals, clinics, and physicians' offices. The quantity of regulated medical waste is expected to increase considerably, because many states are requiring much hospital waste—whether or not it is infectious—to be handled specially and because of the increase in in-home health care.

The Medical Waste Tracking Act of 1988 was enacted in the wake of the summer of beach washups noted above. The special legal attention afforded medical waste seems based more on the fear of AIDS than on any clear evidence that medical waste poses greater dangers in the environmental setting—as opposed to the occupational setting—than does MSW. Nonetheless, the siting of facilities to incinerate or otherwise dispose of medical waste is enormously controversial, in part because of the psychology surrounding medical waste and in part because medical incinerators and municipal incinerators tend to have much higher dioxin and furan emissions than hazardous waste incinerators. Existing medical waste incinerators have the capacity to burn about ten times the amount of such waste actually generated, but most of the

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141. For a listing of some items that fit within this term, see 42 U.S.C. § 6992a(a) (1988). Wastes containing genetically engineered microorganisms have thus far escaped much regulatory attention and are usually treated as municipal solid waste. Shawna Vogel, Biotech Wastes, TECH. REV., Feb.-Mar. 1988, at 13, 13-14.


143. Id. at E.9; Sue Darcy, State Laws Boost Medical Waste Handling, WORLD WASTES, Nov. 1992, at 44, 44-45.


146. See, e.g., BFI Medical Waste Systems v. Whatcom County, 983 F.2d 911, 913-14 (9th Cir. 1993); Oklahoma Court Revokes Incinerator Permit, 22 Env't Rep. (BNA) No. 10, at 571 (July 5, 1991); Ian Fisher, Builders and Foes Using Bronx Incinerator as Test, N.Y. TIMES, Sept. 8, 1992, at B3; Frances F. Marcus, Medical Waste Divides Mississippi Cities, N.Y. TIMES, June 24, 1992, at A16.

147. See infra text accompanying notes 594-98.

148. E. Malone Steverson, Provoking a Firestorm: Waste Incineration, 25 ENVTL. SCI. TECH. 1808, 1810-11 (1991). The higher amount of these emissions is largely the result of the far more stringent regulation of HW incinerators.
excess capacity is in hospital incinerators that are used only intermittently.\textsuperscript{149}

11. Municipal Solid Waste (MSW)

Although this Article focuses on hazardous and radioactive wastes, ordinary MSW is so tied in law, politics, and regulation to HW/RW that it must be discussed as well. Approximately 180 million tons of MSW is generated annually, of which 40% is paper; 18% is yard wastes; 8% is metals; 8% is plastics; and 7% is food wastes.\textsuperscript{150} Of all this MSW, 72.7% is landfilled, 14.2% is incinerated, and 13.1% is recycled or otherwise recovered.\textsuperscript{151}

The number of MSW landfills declined from about 20,000 in the early 1970s to about 7000 in 1991.\textsuperscript{152} The number may fall to only about 1600 in 2003.\textsuperscript{153} Strict environmental regulations\textsuperscript{154} are leading to the closure of many small landfills and open dumps and to the opening of large new landfills.\textsuperscript{155} Old landfills present severe environmental hazards; 21% of all hazardous waste sites on the National Priorities List are municipal landfills,\textsuperscript{156} and municipalities have been held liable under CERCLA for MSW containing hazardous substances that they have sent to their own and to others' landfills.\textsuperscript{157} The leachate from even modern MSW landfills is just as toxic as that from HW landfills, although HW landfills are more rigorously regulated.\textsuperscript{158}
Even though the number of landfills is sharply falling, the new landfills—364 of which opened between 1986 and 1991\textsuperscript{159}—are so large that total capacity has actually increased,\textsuperscript{160} and a bidding war has erupted among landfills looking for more garbage.\textsuperscript{161} The EPA has concluded that the nation has adequate MSW landfill capacity, although there are some regional shortages.\textsuperscript{162}

The siting of MSW-burning incinerators (also called resource recovery plants or waste-to-energy plants) has been very controversial,\textsuperscript{163} and many proposed plants have been cancelled in the face of public opposition.\textsuperscript{164} An average of twelve new plants opened each year in the late 1980s; however, only nine were opened in 1991,\textsuperscript{165} and by 1992 there were 190 operating MSW incinerators in the United States. The portion of MSW that is incinerated has steadily increased.\textsuperscript{166} Nonetheless, there is a good deal of unused incinerator capacity nationwide,\textsuperscript{167} and several municipalities are losing so much money on new but under-utilized incinerators that they have imposed special taxes on their residents\textsuperscript{168} and passed "flow control" laws to prohibit export of their

\textsuperscript{159} Nat'l S.W.M. Ass'n, supra note 152, at 4 (1992).
\textsuperscript{162} Capacity Assurance Program, supra note 27, at 194-95 (statement of Sylvia Lowrance, Director, Office of Solid Waste & Emergency Response, EPA).
\textsuperscript{164} Office of Tech. Assessment, supra note 136, at 343.
\textsuperscript{167} See Stevenson, supra note 148, at 1808.
garbage. \textsuperscript{169} Two states, West Virginia and Rhode Island, have banned the construction of new MSW incinerators, and several others have imposed temporary moratoria. \textsuperscript{170}

12. Dredge Spoil

Many bodies of water used for shipping must be dredged periodically to maintain their required depth. Especially near major urban areas, this dredged material is often tainted with PCBs, heavy metals, and other toxins. It is usually dumped at sea. From the New York harbor alone, eight to ten million cubic yards of dredged material are dumped at sea annually, despite concern by some environmentalists that this practice degrades the ocean. \textsuperscript{171}

Some sediments at the bottom of rivers and other bodies of water are so contaminated that dredging and upland disposal in special facilities are necessary. For example, General Electric dumped about 1.1 million tons of PCBs from one of its factories into the Hudson River between the 1940s and 1977. New York State decided that much of the nearby river bottom should be dredged out, but so far the state has been unable to find a place to dispose of this material. \textsuperscript{172}

13. Storage Tank Remediation

In 1984, Congress recognized the threat to groundwater posed by leaking underground storage tanks (USTs), especially those containing gasoline and other petroleum products. As a result, Congress enacted a statute that requires the upgrading or replacement of many USTs. \textsuperscript{173} There are approximately 295,000 contaminated UST sites in the United States, containing at least fifty-six


million cubic yards of soil and debris requiring cleanup.\textsuperscript{174} Whether this soil must be treated as a hazardous waste depends largely on the unresolved regulatory status of used oil.\textsuperscript{175}

B. Radioactive Wastes

As just shown, hazardous wastes—and materials with hazardous characteristics, regardless of their regulatory status—are produced by virtually every sector of the economy and every type of human activity. In contrast, almost all man-made radioactive wastes come from just two enterprises: the generation of electricity by nuclear power plants and the manufacture of nuclear weapons.\textsuperscript{176} Both of these activities are on the decline. No new nuclear power plant has been ordered in the United States since 1973 without subsequently being cancelled.\textsuperscript{177} The general trend around the world today, except in parts of Asia, is away from nuclear power.\textsuperscript{178} The production of nuclear weapons has also all but stopped.\textsuperscript{179}

Virtually all radioactive wastes start with one substance: uranium ore. To fuel a typical nuclear power plant for one year, about 125,000 tons of uranium ore must be mined, yielding 175 tons of uranium.\textsuperscript{180} In a year, the plant will fission about one ton of uranium and convert 1.9 pounds of matter to energy, generating about 7 billion kilowatt hours of electricity. It will also leave about 45 tons of spent fuel and 500 tons of low-level radioactive waste.'\textsuperscript{181} Eventually, the plant will have to be dismantled and will itself become radioactive waste.

\textsuperscript{174} EPA, supra note 65, at 5. The cost of this cleanup is estimated at $30 billion. \textit{Id.} at 6; \textit{see also Cost of Cleaning Up Leaking UST Sites Could Exceed $41 Billion, Report Says}, 23 Env't Rep. (BNA) No. 35, at 2091 (Dec. 25, 1992). Another estimate is $67 billion. \textit{See Russell et al., supra} note 72, at 16.


\textsuperscript{176} All other sources, such as medical and industrial uses, account for only a tiny fraction of all radioactive wastes.


\textsuperscript{181} Sidamon-Eristoff, \textit{supra} note 120, at 19, 67.
1. High-Level Radioactive Waste (HLW)

There are two main kinds of HLW.\textsuperscript{182} The first is the residue, mostly liquid, from the manufacture of plutonium for warheads. In the United States most of this residue is now stored in 177 underground tanks at the Hanford Reservation of the U.S. Department of Energy (DOE) in southern Washington State and in fifty-one tanks at the DOE's Savannah River plant in South Carolina. The rest is located at the Idaho National Engineering Laboratories and at the West Valley site in New York State. In 1957, a tank holding similar wastes exploded in Kyshtym, the Soviet equivalent of Hanford, spreading radioactive contamination over hundreds of square miles.\textsuperscript{183} In 1993, a similar but much smaller explosion occurred in a radioactive waste tank in the Siberian city of Tomsk.\textsuperscript{184} There is considerable concern that the U.S. tanks may also explode from the chemical and radioactive reactions that constantly occur within them. Several of the tanks are leaking, and on sixteen occasions between 1987 and 1991, they released toxic gases, often injuring workers.\textsuperscript{185}

The second kind of HLW is spent fuel from nuclear power plants. When the uranium fuel is first loaded into a reactor, it is only mildly radioactive, but after one or more years it becomes too radioactive to use, and it also creates plutonium.\textsuperscript{186} When commercial nuclear power began in the 1950s, it was assumed that this spent fuel would be reprocessed through in a series of physical and chemical operations that separate the uranium and plutonium for reuse.\textsuperscript{187} However, reprocessing became an economic and environmental disaster. Only three commercial reprocessing plants were ever built in the United States. One plant, located in Morris,

\textsuperscript{182} 10 C.F.R. § 60.2(19) (1993). Additionally, nuclear submarines and experimental reactors both produce HLW and low-level radioactive waste, although in much smaller quantities than do weapons production and power generation reactors.

\textsuperscript{183} Keith Schneider, The Soviets Show Scars from Nuclear Arms Production, N.Y. Times, July 16, 1989, at D2.


\textsuperscript{186} Marvin Resnikoff, Living Without Landfills: Confronting the "Low-Level" Radioactive Waste Crisis 10 (1987).

\textsuperscript{187} Donald L. Barlett & James B. Steele, Forevermore: Nuclear Waste in America 74 (1985).
Illinois, did not work and therefore never opened. The second, located in Barnwell, South Carolina (near the Savannah River plant), experienced such cost overruns that it was never finished. The third, located in West Valley, New York, operated for six years but shut down in 1972, leaving behind hundreds of thousands of gallons of highly radioactive liquid waste and a legacy of fires and accidents.\footnote{Reprocessing suffered an enormous political setback in 1974 when India detonated an atomic bomb made with plutonium that was reprocessed from the fuel rods of a nuclear power plant. On October 28, 1976, five days before the presidential election, President Ford, trailing Jimmy Carter in the polls and concerned about the dangers of nuclear proliferation, ordered a temporary ban on commercial reprocessing. After the election, President Carter extended the ban.} President Reagan tried to revive reprocessing, but its economics were so unfavorable (partly because of its high cost relative to fresh uranium) that it never resumed.\footnote{Virtually all the spent fuel rods ever generated by commercial reactors in the United States—24,000 metric tons through 1991—are stored on site at the reactors where they were used. After removal from the reactor, the fuel is initially so hot that it must be kept underwater in spent fuel pools, with the water circulating constantly to cool it. The cancelling of reprocessing greatly increased the need for on-site storage capacity, but the utilities have crammed more rods into their existing pools, and it now appears that virtually all the power plants can store their wastes on-}

\footnote{Id. at 75-87. For a much more sanguine view of the hazards at West Valley, see generally John M. Matuszek, Safer than Sleeping with Your Spouse—The West Valley Experience, in Low-Level Radioactive Waste Regulation: Science, Politics and Fear 261 (Michael E. Burns ed., 1988) [hereinafter Low-Level Radioactive Waste Regulation].}

\footnote{Barlett & Steele, supra note 187, at 90-94.}

\footnote{Id. at 94-99. Spent nuclear fuels for military purposes are still reprocessed at three facilities: Hanford, Savannah River, and the Idaho Chemical Processing Plant in Idaho Falls. Tang & Saling, supra note 185, at 103. Great Britain and France still do commercial reprocessing. Glen Zorpette & Gary Stix, Nuclear Waste: The Challenge Is Global, IEEE Spectrum, July 1990, at 18, 20. The Soviet Union formerly took spent fuel from nuclear power plants in Czechoslovakia for reprocessing. That practice stopped with the collapse of the Soviet Union, and the new Czech and Slovak republics have been forced to store the spent fuel from their nuclear plants until a solution is devised. Malcolm W. Browne, Post-Czecho-}

\footnote{Id. at 10.}

\footnote{Id. at 124.}
site through the remainder of their forty-year operating licenses and perhaps 100 years or longer.

With no commercial reprocessing, spent fuel rods are a waste, not a resource. The nuclear utilities, no more eager than anyone else to have nuclear waste stored in their backyard, began pressing for a long-term disposal solution. The Nuclear Waste Policy Act of 1982 (NWPA) required the DOE to establish a system of "long term" or "permanent" deep geologic disposal facilities for both kinds of HLW, waste from bomb production and spent fuel rods. The DOE was told to recommend to the President three sites to be studied in depth. Accordingly, the DOE recommended Yucca Mountain, Nevada; Deaf Smith County, Texas; and Hanford, Washington; and in 1986 President Reagan approved these three sites for study. Just as the studies were about to begin, however, Congress stepped in and ordered the DOE to halt any investigations of the Texas and Washington sites and to put the HLW facility at Yucca Mountain. This location is near the Nevada Nuclear Test Site, 110 miles west of Las Vegas, with its nearest neighbor a legal brothel eighteen miles away. Nevada then began a long campaign of litigation, raising many serious technical questions about the site and considerably delaying the project, so that opening is not projected until 2010 at the earliest.

201. Fred C. Shapiro, Yucca Mountain, NEW YORKER, May 23, 1988, at 61, 62.
202. See Nevada v. Watkins, 939 F.2d 710, 711 (9th Cir. 1991); Nevada v. Burford, 918 F.2d 854, 855 (9th Cir.), cert. denied, 111 S. Ct. 2052 (1991); Nevada v. Watkins, 914 F.2d 1545, 1549 (9th Cir. 1990), cert. denied, 111 S. Ct. 1105 (1991); Nevada v. Herrington, 827 F.2d 1394, 1395 (9th Cir. 1987).
204. U.S. GAO, PUB. NO. GAO/RCED-92-73, NUCLEAR WASTE: DOE'S REPOSITORY SITE INVESTIGATIONS, A LONG AND DIFFICULT TASK 4 (1992); see also ENERGY POLICY ACT OF
and may well not occur until after 2020. The sense of procedural fairness that the DOE sought to cultivate has utterly evaporated and residents call the statute designating Yucca Mountain as the facility site the "Screw Nevada Bill." Sensitivities are further heightened by the diseases some residents of this area have suffered as a result of open-air testing of nuclear weapons in the 1950s and early 1960s.

The Nuclear Waste Policy Act also calls for establishment of a Monitored Retrievable Storage (MRS) facility, which would prepare spent fuel for emplacement in the geologic repository and act as a central receiving station. This proposal has also sparked considerable controversy, especially in Tennessee, which was initially targeted for the facility. In late 1992, it appeared that the DOE had become discouraged in the search for a volunteer site for an MRS facility and was focusing on interim storage at nuclear weapons facilities or other federal sites. By mid-1993, however,


211. Richard P. Mauro, Note, Tennessee v. Herrington: An End Run Around State Participation in Nuclear Waste Siting Decisions, 9 J. ENERGY L. & POL'Y 113, 127-28 (1988). One of the concerns was that the MRS facility would become a permanent resting place for HLW because of the difficulties in siting the geologic repository. In 1987, however, Congress provided that construction of the MRS may not begin until after a license for the construction of the geologic repository has been issued. 42 U.S.C. § 10,168(d)(1) (1988).

the nuclear industry was pressing for the construction of an MRS facility, and two tribes—the Mescalero Apaches in New Mexico and the Skull Valley Band of Goshute Indians in Utah—stood ready to negotiate a compensation package.\textsuperscript{213}

2. Transuranic Waste (TRU)

Another variety of radioactive waste is TRU: material, such as plutonium, that has an atomic number greater than that of uranium.\textsuperscript{214} Although most TRU has a relatively low level of radioactivity, it is long-lived and highly toxic.\textsuperscript{215} Almost all TRU comes from military activities.\textsuperscript{216}

To dispose of TRU, the federal government has built, but so far has been unable to open, a facility it calls the Waste Isolation Pilot Plant (WIPP), located twenty-six miles east of Carlsbad, New Mexico. When the project was first proposed in the early 1970s, it was enthusiastically endorsed by local officials, who saw it as a way to replace jobs lost in the declining mining industry.\textsuperscript{217} Congress authorized WIPP in 1979.\textsuperscript{218} Disposal would be in excavated salt formations 2150 feet underground.\textsuperscript{219} The first rooms were mined in the early 1980s, but in 1990 alarmed workers found lumps of rubble lying on the floor and discovered that some of the older rooms were collapsing.\textsuperscript{220} With this development and with attitudes toward nuclear power changing in New Mexico, the state switched to active opposition to the opening of WIPP. The District of Columbia Court of Appeals agreed with New Mexico that explicit congressional authorization was required before the property could be transferred to the DOE and shipments begun.\textsuperscript{221} However, Idaho, where much of the TRU is being stored until

\begin{itemize}
  \item between Minnesota utility and Mescalero Apache tribe for storage of utility’s spent fuel at Mescalero reservation).
  \item 213. Radioactive Waste: Mescalero Apache Tribe Renews Efforts to Site MRS on New Mexico Reservation, 24 Env’t Rep. (BNA) No. 6, at 274 (June 11, 1993); Matthew L. Wald, Nuclear Industry Seeks Interim Site to Receive Waste, N.Y. TIMES, Aug. 27, 1993, at 1, 1.
  \item 215. MAKHIANI & SALESKA, supra note 191, at 94; TANG & SALING, supra note 185, at 6.
  \item 216. TANG & SALING, supra note 185, at 14, 176.
  \item 220. Schneider, supra note 2, at 58.
  \item 221. New Mexico v. Watkins, 969 F.2d 1122, 1135 (D.C. Cir. 1992).
\end{itemize}
WIPP opens,\textsuperscript{222} brought counterpressures, and Congress promptly supplied the needed authorization.\textsuperscript{223} WIPP remains very controversial and it is not expected to start receiving waste before 1998.\textsuperscript{224}

For all its size and controversy, WIPP will receive only about twenty percent of DOE's TRU. Much of the rest lies in shallow burial grounds at nuclear weapons facilities around the country, and there are no clear plans for its final disposal.\textsuperscript{225}

3. **Low-Level Radioactive Waste (LLRW)**

LLRW is all radioactive waste that is not defined as HLW, TRU, or uranium mill tailings.\textsuperscript{226} In the civilian sector, ninety-nine percent of the radioactivity and half the volume in LLRW is produced by nuclear power plants, principally the ion-exchange resins that filter radioactivity from reactor cooling water.\textsuperscript{227} Other sources include industrial, medical, and research applications.\textsuperscript{228} The volume of civilian LLRW generated has been declining rapidly. It dropped by about half between 1980 and 1989, largely due to disposal surcharges that have given generators a strong incentive to produce less LLRW.\textsuperscript{229} This reduction occurred despite an


\textsuperscript{227} Resnikoff, supra note 186, at 4, 11; Tang & Saling, supra note 185, at 197.


\textsuperscript{229} Office of Tech. Assessment, supra note 226, at 1, 8.
increase in the amount of nuclear power generated during the same period.\textsuperscript{230}

The amount of LLRW generated in nuclear weapons production is unclear, but much of it (about 1.5 million cubic yards) is simply buried in shallow trenches at the production plants.\textsuperscript{231} Prior to 1970, the U.S. military dumped its LLRW into the sea.\textsuperscript{232} Most civilian LLRW has gone to the six commercial LLRW disposal facilities that were built in the United States after the government banned burial of civilian LLRW at federal facilities in 1962.\textsuperscript{233} Three of the six facilities—those located in West Valley, New York; Maxey Flats, Kentucky; and Sheffield, Illinois—have been permanently closed because of water infiltration into the waste trenches and other environmental problems.\textsuperscript{234} The three facilities still operating in 1992 were located in Barnwell, South Carolina (opened in 1971, near the Savannah River facility); Beatty, Nevada (opened in 1962); and Richland, Washington (opened in 1965, near the Hanford facility).\textsuperscript{235}

In 1979, both the Washington and Nevada sites were forced to shut down temporarily.\textsuperscript{236} In that year of the Three Mile Island accident, South Carolina was unhappy at being forced to take the entire nation's LLRW and ordered a fifty percent reduction in the volume of waste accepted by Barnwell, leading Washington and Nevada to announce that they would shut their facilities permanently. This precipitated a national crisis in LLRW disposal. To resolve it, Congress enacted the Low-Level Radioactive Waste Policy Act of 1980, which declared that the states, acting alone or in compacts with other states, were responsible for disposing of their own LLRW.\textsuperscript{237} The Act gave South Carolina, Nevada, and Washington the power to exclude other states' waste after 1986. By 1985, however, little progress had been made in siting new LLRW facilities, and Congress extended the deadlines, imposed


\textsuperscript{231} Office of Tech. Assessment, \textit{supra} note 219, at 24, 45.

\textsuperscript{232} See infra text accompanying notes 864-66.

\textsuperscript{233} Barlett \& Steele, \textit{supra} note 187, at 255.

\textsuperscript{234} Resnikoff, \textit{supra} note 186, at 33.

\textsuperscript{235} Colglazier \& English, \textit{supra} note 10, at 627.

\textsuperscript{236} The account in this paragraph is drawn from New York v. United States, 112 S. Ct. 2408, 2415-16 (1992); Colglazier \& English, \textit{supra} note 10, at 622-24; Timothy J. Peckinpaugh, \textit{The Politics of Low-Level Radioactive Waste Disposal, in LOW-LEVEL RADIOACTIVE WASTE REGULATION, supra note 188, at 45.}

interim milestones, and allowed the three sited states to exclude waste from states that missed the deadlines.\textsuperscript{238} Congress also provided that, in 1993, states that had not made provision for disposing of the LLRW generated within their borders would have to "take title" to it, thereby assuming liability for damage it causes.\textsuperscript{239} In 1990 New York State, acting with (and under pressure by) the two counties tentatively designated as the location for its LLRW facility, challenged the constitutionality of the 1986 amendments.\textsuperscript{240} In 1992, the U.S. Supreme Court invalidated the "take title" provision as a violation of states' rights under the Tenth Amendment but upheld the balance of the statute.\textsuperscript{241}

The federal requirement that states site LLRW facilities has sparked enormous debate all over the country.\textsuperscript{242} The three states that were furthest along in developing sites when the Supreme Court ruled were Illinois, California, and Nebraska.\textsuperscript{243} However, in 1992 the Illinois siting commission rejected the selected site because of geological problems and other deficiencies.\textsuperscript{244} In 1993, a federal court enjoined certain work at the California site because of potential impacts on an endangered species, the desert tortoise,\textsuperscript{245} and the Nebraska health and environment departments announced they were denying permits for that state's facility.\textsuperscript{246} An elected judge in Texas also rejected that state's chosen site in

\begin{itemize}
  \item \textsuperscript{239} 42 U.S.C. § 2021e(d)(2)(C) (1988).
  \item \textsuperscript{240} The author was counsel of record for Cortland County in this litigation.
  \item \textsuperscript{241} New York v. United States, 112 S. Ct. 2408, 2428-29 (1992).
  \item \textsuperscript{242} \textit{See generally} Paul Puriga, \textit{Hot Stuff}, GOVERNING, Nov. 1989, at 50 (observing that citizens' emotions make it even harder for states to decide what to do with low-level radioactive wastes).
  \item \textsuperscript{244} \textit{Martinsville Rejected for Central Midwest LLRW Facility}, RADIOACTIVE EXCHANGE, Oct. 21, 1992, at 1 [hereinafter \textit{Martinsville}].
  \item \textsuperscript{246} Letter from Randolph Wood, Nebraska Dept. of Env't. Quality and Mark B. Horton, Nebraska Dep't of Health, to Richard F. Paton, US Ecology, Inc., Jan. 22, 1993; \textit{see also} Concerned Citizens v. NRC, 970 F.2d 421, 426-27 (8th Cir. 1992) (affirming dismissal of
Hudspeth County.\textsuperscript{247} North Carolina plans to open a new facility in 1996 to replace Barnwell; it selected a site in 1993 but was immediately met with threats of lawsuits.\textsuperscript{248}

In January 1993, the Nevada facility shut down completely and the Washington site closed its doors to all but six western states. This left only Barnwell, which is scheduled to be closed to states outside its compact in July 1994 and to be shut down altogether by 1996. Meanwhile, medical, research, and industrial LLRW generators have been left scrambling for temporary storage.\textsuperscript{249}

4. Remedial Waste from Nuclear Weapons Production

The sites where the United States manufactured nuclear weapons are, collectively, called the Nuclear Weapons Complex (NWC). The NWC includes 14 major facilities in 13 states, on military reservations covering 3350 square miles and employing more than 100,000 people.\textsuperscript{250} The NWC originated with the Manhattan Project in World War II and was greatly expanded in the early 1950s. Among the largest facilities are the Rocky Flats plant in Colorado, which produced plutonium “triggers” for bombs; the Hanford Reservation in Washington, which produced weapons-grade plutonium; the Savannah River site in South Carolina, which made tritium for hydrogen bombs and plutonium; the Feed Materials Production Center in Fernald, Ohio, which produced uranium metal for weapons; the Oak Ridge Reservation in Tennessee, which fabricated weapons components; and the Idaho National
Engineering Laboratory, where fuel from military reactors is reprocessed. The NWC is rapidly phasing down its active operations, many of its units are inactive, and some plans for new units have been cancelled. The United States stopped producing highly enriched uranium in 1964 and plutonium in 1988 and has manufactured no nuclear warheads since July 1990.

The NWC has left behind an environmental horror. At every facility, the groundwater is contaminated with radionuclides, and pollution of surface waters, sediment, and soil is extensive. The immensity of the resultant cleanup task has necessitated the development by the DOE of a National Priority System (NPS) to better facilitate the allocation of resources. The NWC stores large volumes of HLW, TRU, and LLRW. The Secretary of Energy has blamed this contamination on "a 40-year culture cloaked in secrecy and imbued with a dedication to the production of nuclear weapons without a real sensitivity for protecting the environment."

Cleaning up the NWC will be one of the largest public works projects in history. In 1992, the DOE estimated that the work will cost $160 billion and take twenty to thirty years; another recent estimate placed the cost at $240 billion. Included in these costs are some very large waste treatment facilities. For example,

251. Cochran et. al. Supra note 250, at 3, 5. All the facilities are listed, and their status given, in Oversight of Cleanup and Modernization Proposals for DOE's Weapons Production Complex: Hearings before the Senate Comm. on Govt. Affairs, 101st Cong., 1st Sess. 390-431 (1989) [hereinafter Hearings].


253. See, e.g., Keith Schneider, U.S. Drops a Plan to Build a Reactor, N.Y. TIMES, Sept. 12, 1992, at 5 (reporting government's decision decides not to build a new nuclear reactor to produce tritium at the Savannah River Plant).

254. Renner, supra note 179, at 12.


256. Nuclear Weapons Complex, supra note 255, at 41-42.


261. See Russell et al., supra note 72, at 16; see also Energy Department Lacks Valid Cost Figures for Cleanup of Weapons Complex, GAO Reports, 24 Env't Rep. (BNA) No. 13, at 553 (July 30, 1993) (noting that although the DOE will not estimate cleanup costs, its informal predictions have quoted costs as high as $600 billion).
the DOE plans to spend four billion dollars building a factory to transform the thirty-four million gallons of HLW in tanks at Savannah River into a glass form for eventual disposal, presumably at Yucca Mountain. Similar plants are planned for Hanford Reservation and the Idaho laboratory.

5. Nuclear Weapons

At the peak of the arms race in the mid-1980s, the Soviet Union had roughly 33,000 nuclear warheads and the United States had about 24,000. The United States has produced nearly 70,000 nuclear warheads since 1945, more than 50,000 of which have now been retired and disassembled. Between them, the United States and the republics comprising the former Soviet Union possess more than 200 tons of weapons-grade plutonium and more than 1000 tons of highly enriched uranium, either assembled in warheads or held in storage.

The START II agreement and earlier treaties portend a drastic reduction in the number of deployed weapons but do not specify what is to be done with the decommissioned warheads. There is no coherent policy on what is to become of the nuclear material contained in these warheads. It can be recycled into new warheads; diluted and used as fuel for nuclear power plants; stored and guarded; or converted into a relatively irretrievable form, such as ceramic or glass blocks, and sent to a repository like Yucca Moun-

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tain or WIPP. The United States has committed to help the Russian republics destroy their nuclear weapons and has arranged to buy some of the material from Russia for dilution into reactor fuel. Meanwhile, great concern exists that terrorists or rogue nations might acquire some of the materials, especially those held by the four republics with Soviet weapons—Russia, Ukraine, Belarus and Kazakhstan. Already, radioactive materials and bomb parts from these countries have been found trading in the black market.

6. Decommissioned Nuclear Plants

There are approximately 112 nuclear power plants, 22 nuclear fuel cycle plants (mostly in the NWC), and 54 research and industrial reactors in the United States. All will eventually have to be decommissioned. Nuclear power plants were anticipated to have a forty-year life span, but some are now being shut down much earlier, largely because alternative power sources, especially natural gas, are cheaper. The world's first commercial nuclear power plant, a small unit in Shippingport, Pennsylvania, opened in 1957 and was dismantled in 1989. The reactor vessel was sent whole by barge, via the Panama Canal, to the Hanford Reservation in Wash-

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ingston State for disposal.\textsuperscript{274} No large commercial plant has yet been dismantled, however. Several have been retired, but they remain intact and their spent fuel pools must be continually monitored, with ongoing security, testing, and training, at an annual cost of several million dollars each.\textsuperscript{275} Completely dismantling a large power plant may cost more than one billion dollars\textsuperscript{276} and will leave wastes approximately one hundred times more radioactive than the combined total of all the LLRW generated during the reactor's operation.\textsuperscript{277} Another option is "entombment": the plant is encased in a massive structure of concrete and steel having a structural lifetime of perhaps two hundred years—leaving the task of dismantling a somewhat cooler plant to a distant generation.\textsuperscript{278} The twenty-five year practice at the Nuclear Regulatory Commission (NRC),\textsuperscript{279} which allowed licensees to bury LLRW on-site without prior NRC approval,\textsuperscript{280} complicates decommissioning. In one case, at a Westinghouse plutonium processing plant in Cheswick, Pennsylvania, radioactive waste was found under an employee softball field.\textsuperscript{281}

7. Uranium Mill Tailings

Uranium ore is the basic raw material of both nuclear power plant fuel and nuclear warheads. After the usable uranium is extracted from the ore, finely ground radioactive tailings remain whose radioactivity is reduced to about six percent of its initial value after four half-lives, or 300,000 years.\textsuperscript{282} More than 230 million tons of uranium mill tailings have accumulated in the United States, representing over ninety-five percent of the volume of all RW generated in this country.\textsuperscript{283} The largest number of adverse

\begin{itemize}
\item \textsuperscript{274} ENGLISH, supra note 10, at 4.
\item \textsuperscript{275} Matthew L. Wald, As Nuclear Plants Close, Costs Don't Shut Down, N.Y. TIMES, Sept. 20, 1992, at E18.
\item \textsuperscript{277} RESNIKOFF, supra note 186, at 14.
\item \textsuperscript{278} TANG & SALING, supra note 185, at 348.
\item \textsuperscript{279} The Decommissioning and Decontamination Requirements for Closing Nuclear Facilities: Hearings Before the Subcomm. for Env't, Energy, and Natural Resources of the House Comm. on Gov't Operations, 101st Cong., 1st Sess. 126-30 (1989) (written submission of Kenneth M. Carr, Chairman, NRC); GAO, supra note 272, at 4.
\item \textsuperscript{280} See 10 C.F.R. § 20.302 (1993).
\item \textsuperscript{281} GAO, supra note 272, at 4.
\item \textsuperscript{282} Goble, supra note 180, at 139, 157.
\item \textsuperscript{283} MAKHILANI & SALESKA, supra note 191, at 21.
\end{itemize}
health effects from all nuclear-related activities in the United States arise from the mining and milling of uranium.284

Historically, these tailings were carelessly managed. Until 1966 they were often used as fill material in building construction, leading to the contamination of thousands of buildings285 and, years later, to litigation brought by property owners.286 The great bulk of the tailings, however, were dumped in enormous piles or ponds.287 Contamination from these piles is spread above the surface by wind and below it by groundwater.288

In 1978, Congress enacted the Uranium Mill Tailings Radiation Control Act289 (UMTRA), with a mandate to clean up twenty-four inactive uranium processing sites, containing twenty-four million tons of tailings.290 This leaves another twenty-six sites with a total of more than 200 million tons of tailings.291 Although some of this material will be moved to new disposal sites, the volumes are so great that most will have to be managed in place.292


287. In 1979 a tailings dam collapsed at a uranium mill near Churchrock, New Mexico. This collapse released 100 million gallons of tailings solution that contaminated at least 60 miles of the Rio Puerco along its course through lands in New Mexico and Arizona used by Navajo for watering stock. TANG & SALING, supra note 185, at 277-78.


291. John L. Russell, Health Risks from Uranium Mill Tailings, in PROCEEDINGS, supra note 114, at 236. Even greater problems seem to have been left behind in the uranium mining and processing industry of former East Germany, which supplied the Soviet Union's nuclear weapons program. Patricia Kahn, A Grisley Archive of Key Cancer Data, 259 SCIENCE 448, 448-49 (1993).

292. Portillo, supra note 290, at 284-85; see also Colorado NPL Site to Be Uranium Waste Dump, SUPERFUND WK., Mar. 26, 1993, at 4 (reporting that a remediated uranium mill site may be utilized for off-site disposal of waste from other UMTRA sites).
8. Naturally Occurring Radioactive Material\textsuperscript{293} (NORM)

Numerous activities in such industries as oil and gas extraction, water treatment, mining, and fossil-fired power generation produce NORM: radiation present in nature but brought into contact with humans by these processes. Tens of billions of tons of NORM-containing wastes are generated each year, a volume dwarfing all other hazardous and radioactive wastes combined. Where NORM is produced, workers are often exposed to far higher levels of radiation than would be permitted for workers at a nuclear power plant. However, NORM is virtually unregulated. The EPA has released draft regulations aimed at some NORM wastes,\textsuperscript{294} but it has not promulgated them. One state, Louisiana, has its own regulations on the subject.\textsuperscript{295}

The only disposal site for NORM in this country is located near Clive, Utah and was established in the mid-1980s to take uranium mill tailings.\textsuperscript{296} Recent attempts to site another facility in Texas were defeated by local opposition.\textsuperscript{297} The vast majority of all NORM is simply buried or stored onsite, without any regulatory oversight at all. Its enormous volume, its multiple sources, and confusion over what to do with it have led essentially to regulatory paralysis.

9. Mixed Waste

Mixed waste is material that is both RCRA hazardous waste and radioactive waste. An example is a solvent-containing rag that was used to clean a radioactively contaminated pump at a nuclear power plant. Over ninety percent of all mixed waste produced in


\textsuperscript{295} \textit{LA. ADMIN. CODE tit. 33, § 15:1401-:1420}.


the United States is generated by the DOE. Mixed waste is simultaneously regulated as radioactive waste by the NRC and as hazardous waste by the EPA. However, these two schemes of regulation are incompatible. For instance, under RCRA, the operator of a disposal facility must verify the contents of a waste package by opening it and sending a representative sample for testing. However, this procedure could subject facility workers to doses of radiation that would violate NRC standards. Partly because of such contradictions, no disposal facility, offsite storage, or treatment facility for commercial mixed waste exists in the United States. The material is simply stored; in 1993 an estimated 589,481 cubic meters of mixed waste were in storage. As a result the EPA has been forced to grant variances from the RCRA rules for disposal of mixed waste. Even so, the D.C. Circuit has ruled that, under RCRA, electric utilities cannot store mixed waste on site indefinitely while waiting for the EPA to develop disposal guidelines. The court conceded that its decision puts the utilities “in the unenviable position of having no choice but to violate the law.”

III. How Siting Decisions Are Made

A. Siting in the Absence of Government Regulation

Unlike the practice in most of Europe and Canada, the U.S. private sector has been primarily responsible for the disposal of hazardous waste and commercial LLRW in the United States. Prior to the onset of modern environmental legislation in the early 1970s, the siting of private disposal facilities was relatively unfet-

300. OFFICE OF TECH. ASSESSMENT, supra note 226, at 17.
301. Id. at 15. A minor exception is a facility in Utah that accepts mixed waste that is only slightly radioactive. Richard Zuercher, NRC, States Prod DOE to Accept Commercial Mixed Waste, INSIDE NRC, Oct. 5, 1992, at 3.
305. Id.
306. GREEN, supra note 37, at 2.
tered by environmental constraints. Decisions on where to site disposal facilities were made the same way as decisions on where to put any heavy industry: by companies seeking the best combination of such key factors as proximity to markets and materials, availability of labor, transportation, utilities and infrastructure, and low land and development costs. Because heavy industry generates most of the HW, disposal facilities tended to be built near industrial concentrations, which in turn tended to be in or near cities. They were also often put on wetlands—then known as swamps—and floodplains, where land was cheap.

In contrast, the facilities in the nuclear weapons complex, where cost was never a controlling factor, tended to be sited more for expediency and sometimes even caprice. For example, in 1942 J. Robert Oppenheimer personally selected the site of what became the Los Alamos National Laboratory largely on the basis of its grand scenic view and his childhood memories of attending a boys' school there. The same year, General Leslie Groves, military head of the Manhattan Project, sent two men scouting for a site for a plutonium production facility. He told them he wanted a place that was remote from population and had ample water and electricity. They found a large spot on the Columbia River in Washington, just 100 miles from the newly completed Grand Coulee Dam. Groves swiftly bought it, and it became the Hanford Reserva-

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307. John V. Winter & David A. Conner, Power Plant Siting 61-63 (1978); William G. Murray, Jr. & Carl J. Senker II, Industrial Siting: Allocating the Burden of Pollution, 30 Hastings L.J. 301, 304 (1978); Suren S. Singhvi, A Quantitative Approach to Site Selection, Mgmt. Rev., Apr. 1987, at 47. Even after most environmental regulations took effect, they played only a secondary role in industrial location decisions, with the more traditional factors retaining primacy. Howard A. Stafford, Environmental Protection and Industrial Location, 75 Annals Ass'n Am. Geographers 227, 231-32 (1985); see also Craig N. Oren, Prevention of Significant Deterioration: Control-Compelling Versus Site-Shifting, 74 Iowa L. Rev. 1, 36 (1988) (arguing that prevention of significant deterioration requirements under the Clean Air Act have had little impact on facility siting; underlying economics of projects are far more important in siting decisions).

308. See supra part II.A.7.


310. Bernstein, supra note 32, at 83, 84.

Almost immediately, concerns were raised about the project's impacts on the Columbia River—concerns that were soon borne out—but wartime exigencies preempted any reconsideration of the site selection. In 1942 as well, General Groves personally selected a site in eastern Tennessee for uranium production, based on its remoteness from metropolitan areas, its cheap land, and its abundant water and power; this site is now known as Oak Ridge. In 1950, with scarcely more study, the bank of the Savannah River in South Carolina was selected for the manufacture of tritium for hydrogen bombs, even though the site sits atop a prolific aquifer, and in 1951, Rocky Flats, Colorado was chosen for plutonium fabrication with similar inattention to geologic conditions.

Individual entrepreneurs also have played a key role. The most important by far was Frederick P. Beierle, who began his career as a reactor operator at Hanford and who is personally responsible for siting three of the nation's six LLRW facilities and two hazardous waste landfills. In 1963, Beierle and two other men leased a parcel near Hanford for a LLRW landfill; this became the Richland facility, which is still operating. In 1966, Beierle moved to Sheffield, Illinois and persuaded its citizens to let him build a LLRW facility, which he sold to a company that became US Ecology. (The LLRW facility is now closed, but US Ecology still operates a hazardous waste landfill in Sheffield.) In 1968 he formed a new company, soon renamed Chem-Nuclear Services, and he built what is now the Barnwell LLRW facility near the Savannah River plant with the active support of the local community and the State of South Carolina. In 1976, Beierle opened a hazardous waste landfill in Livingston Parish, Louisiana, which he later sold to Browning-Ferris Industries. Beierle also

312. Michele S. Gerber, On the Home Front: The Cold War Legacy of the Hanford Nuclear Site 11-12, 22-23 (1992); Rhodes, supra note 311, at 496-97; Shulman, supra note 80, at 96.


317. This account is based on Barlett & Steele, supra note 187, at 250-96; Carol Bradley, "Environmentalist" is Father of Low-Level, Gannett News Service, Nov. 25, 1990, available in Lexis, Nexis Library, GNS File.

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was behind an unsuccessful attempt to build a HLW repository in salt caverns located in Lyons, Kansas.

These siting decisions, swift and sure but often environmentally disastrous, stand in marked contrast to the current siting process, which is governed by federal and state environmental agencies and regulations.

B. Siting Under Government Regulation

1. Federal Siting Processes

I have already mentioned four federal efforts to site federally owned disposal facilities for HW/RW: Yucca Mountain, WIPP, Lyons, and the incinerators for chemical weapons. Thus far, only the last has led to the disposal of a single pound of waste. A fifth effort occurred two decades ago and went nowhere. There have also been two federal attempts to require the states to site facilities. The first was the Low-Level Radioactive Waste Policy Act, which has not yet brought about any new facilities. The second effort has, so far, been similarly unproductive. It arose in the Superfund Amendments and Reauthorization Act of 1986 (SARA). Congress was concerned that most states were making little progress in siting new HW disposal facilities and that “Superfund money should not be spent in States that are taking insufficient steps to avoid the creation of future Superfund sites.” In an effort “to solve the ‘NIMBY’ . . . problems that arose because of political pressure and public opposition,” Congress provided that, after October 17, 1989, no state could receive Superfund assistance for remedial actions unless it assured “the availability of hazardous

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322. Superfund Improvement Act of 1985, S. REP. No. 11, 99th Cong., 1st Sess. 22 (1985); see also 132 CONG. REC. S14,924 (daily ed. Oct. 3, 1986) (statement of Senator Chafee) (stating that the states are not moving to avoid creation of future superfund sites and that they must give assurances of effort to obtain funding).

waste treatment or disposal facilities which . . . have adequate capacity for the destruction, treatment, or secure disposition of all hazardous wastes that are reasonably expected to be generated within the State” during the next twenty years. These facilities could be within the state, or outside the state if an interstate agreement for the facilities’ use is in place.

Acting under this authority, the EPA required every state to submit a “capacity assurance plan,” detailing the sources, quantities, and characteristics of the hazardous wastes generated within its borders and explaining how these wastes would be handled. The National Governors Association had recommended that, after preparation of the plans, the states negotiate between themselves to allocate waste disposal responsibilities between them and accept an EPA resolution if they could not agree; however, the EPA did not adopt this suggestion. Every state submitted a plan and the EPA approved almost every one, even when states relied on new facilities that were later rejected or on facilities in other states that opposed importation. There is no evidence that this process has led to the initiation or approval of any new hazardous waste facilities. New York State, which has a large HW landfill on which other states are relying, sued the EPA in 1992 over its refusal to sanction states that are not creating their own facilities.

325. Id. § 9604(c)(9)(B).
328. Green, supra note 37, at 96.
329. See Capacity Assurance Program, supra note 27, at 281 (statement of Sylvia K. Lowrance, Director, Office of Solid Waste & Emergency Response, EPA) (noting that the only plans not approved were those pending from Georgia, Mississippi, Arizona, Missouri, and the District of Columbia); see also Mississippi: Capacity Assurance Plan Nullified; Environmental Council Ruled Unconstitutional, 24 Env’t Rep. (BNA) No. 7, at 331 (June 18, 1993) (reporting the ruling of a state judge that the Mississippi submission violates the state constitution, because it requires state legislators to serve on an administrative board).
331. Green, supra note 37, at xxiii.
332. New York v. EPA, 35 Env’t Rep. Cas. (BNA) 1959, 1960 (N.D.N.Y. 1992). The author’s law firm represents the Town of Porter, the Town of Lewiston, and Niagara County, New York, which are plaintiff/intervenors in this action. No decision on the merits of the action has been rendered. See also Hazardous Waste Treatment Council v. South Carolina, 945 F.2d 781, 782 (4th Cir. 1991).
In 1993, the EPA changed its approach. Each state was directed to submit data on its HW disposal capacity and demand. Based on this information, the EPA will determine if there are any national shortfalls. If there are, states whose demand exceeds supply in national shortfall categories will be required to submit waste minimization plans and other data. If shortfalls are still projected after that, further measures may be invoked.333

2. State Siting Processes

The federal government’s unsuccessful attempts to site its own HW/RW disposal facilities and to require the states to site facilities have been mirrored by the states’ efforts. Many states have tried and failed to build state-owned facilities and to encourage private companies to create privately owned facilities.

The two states that came closest to creating their own facilities were Maryland and Arizona. In 1984, the State of Maryland actually built an industrial waste landfill at Hawkins Point in Baltimore Harbor, on the site of an existing chrome ore treatment facility. The state had to close the landfill after four months of operation, however, because it could not compete financially with commercial facilities in other states that charged lower fees.334 In 1981, the Arizona Legislature mandated the creation of an integrated hazardous waste treatment facility, including an incinerator and a landfill, in Maricopa County.335 The state contracted with EnSCO, Inc. to build the facility.336 In 1991, when the plant was nearly complete, the state government, facing rising opposition, cancelled the project and paid EnSCO forty-four million dollars for

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333. OFFICE OF SOLID WASTE & EMERGENCY RESPONSE, U.S. EPA, OSWER DIRECTIVE No. 9010.02, GUIDANCE FOR CAPACITY ASSURANCE PLANNING: CAPACITY PLANNING PERSPECTIVE TO CERCLA § 104(c)(9), at 1-2 to 1-3 (1993).

334. GREEN, supra note 37, at 75, 78; ANNE S. RYAN, A REPORT TO MASSACHUSETTS HAZARDOUS WASTE FACILITY SITE SAFETY COUNCIL, APPROACHES TO HAZARDOUS WASTE FACILITY SITING IN THE UNITED STATES at A11 (1984); THOMAS D. MCKEWN & ANNE C. SLOAN, A SUCCESSFUL HAZARDOUS WASTE LANDFILL SITTING—MARYLAND'S EXPERIENCE, in PROCEEDINGS OF THE NATIONAL CONFERENCE ON HAZARDOUS WASTES AND HAZARDOUS MATERIALS 247, 250 (HAZARDOUS MATERIALS CONTROL RESEARCH INST. 1987).


its trouble; the state raised the money by selling two state prisons and leasing them back.\textsuperscript{337}

Efforts by states to encourage private firms to locate HW/RW facilities within their borders have fared little better. In the late 1960s and early 1970s, many states adopted legislation that centralized the permitting of power plants and other heavy industrial facilities.\textsuperscript{338} With this as precedent, and under the prodding of the EPA,\textsuperscript{339} at least thirty-six states enacted hazardous waste facility siting laws, mostly between 1979 and 1984.\textsuperscript{340}

No two of these state laws are alike. They have been analyzed and compared many times,\textsuperscript{341} and that analysis need not be repeated here. Suffice it to say that most of these laws provide for enhanced public participation and for technical siting criteria. They often create special siting boards to act on facility proposals. The laws vary considerably in the degree of state initiative in the siting process, from aggressively proactive to passively reactive. Some allow the states to preempt local authority, and some preserve local approval power.

Technical siting criteria, especially when combined with siting boards, advance the notion that an objectively "best" site exists


340. HAZARDOUS WASTE FACILITY SITING, supra note 1, at 9.

only people with enough data, expertise, and wisdom can find it. This idea is implicit in many of the state statutes and has been made explicit by some commentators, several of whom see this search as the means to achieving public acceptance of unwanted facilities. The siting criteria most commonly concern depth to groundwater; proximity to wells, surface waters, residences, property lines, and recreational areas; and avoidance of wetlands and endangered species habitats. \(^{343}\) Elaborate multistage techniques have been devised under which the number of possible sites is progressively reduced by the application of successive "filters" or "constraints."\(^{344}\)

As shown by the dismal record of siting attempts, these multistage techniques can be counterproductive. Michael O'Hare and colleagues have correctly pointed out that

[the general rule seems to be that rationalistic site selection by successive exclusionary judgments serves only to focus political opposition in the relatively small part of the state remaining after the exclusion process, while the broad consensus agreement on the particular criteria being used seems impossible to maintain after its implications become known.\(^{345}\)]

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345. O'Hare et al., supra note 11, at 56; see also Frank J. Dodd, Siting Hazardous Waste Facilities in New Jersey: Keeping the Debate Open, 9 SETON HALL LEGIS. J. 423, 433 (1986); Tarlock, supra note 338, at 457-58.
Moreover, the criteria themselves, far from being objective, are necessarily laden with value judgments. How close may a waste facility be to an elementary school: 500 feet or 5000 feet? Can a scenic vista be destroyed, and what precisely is a scenic vista? How much numerical weight should be given to impacts on drinking water versus impacts on endangered species? Experts are of little help in answering these questions.346 Even when siting criteria are agreed on in advance, their application in particular cases can often be seriously questioned.347

The perfect site is a mirage, because the definition of perfection embodies so many contradictions. The perfect site would be far from any population centers so as to reduce the risk of health effects, but it would be near a highway and close to where the waste is generated in order to reduce transportation accidents. The perfect site would also be in an area with no development, but it would not be within a wilderness area, a park, an agricultural region, or the habitat of rare species; it would have a high and deep clay layer, but no water trapped on the top. Finally, it would be in a region that benefitted from the production of the waste to be disposed of, even though the most isolated and dry places in the United States, the western deserts, tend to be in states that generate little nuclear and hazardous waste.

C. Continuation and Expansion of Existing Facilities

It is a great irony that, at least so far, the principal environmental impact of stringent siting rules, ineffective siting strategies, and the illusionary search for the perfect site has been to continue the life of old, substandard, poorly sited HW/RW facilities, so that most of this waste still goes to places picked by Leslie Groves, Frederick A. Beierle, and their counterparts. Of the twenty-one commercial HW landfills operating today, for example, only one is

346. See generally Joseph B. Rose, Planning for "Fairness:" Wrestling with Criteria for the Location of City Facilities, Assessor, Feb. 1991, at 1, 2-3 (showing how seemingly objective siting criteria can be readily manipulated).

347. For example, serious technical flaws were discovered in the studies leading to the selection of an LLRW site in Martinsville, Illinois. ENGLISH, supra note 10, at 64; MARTINSVILLE, supra note 244, at 1. Major questions have been raised as well about the application of siting criteria in locating an LLRW facility in New York State, see generally U.S. GAO, PUB. NO. GAO/RCED-92-172, NUCLEAR WASTE: NEW YORK'S ADHERENCE TO SITE SELECTION PROCEDURES IS UNCLEAR 1-2 (1992) (examining New York low-level radioactive waste management), in siting an industrial liquid waste disposal facility in Ontario, see Edward J. Farkas, The Nimby Syndrome, 10 ALTERNATIVES 47, 47 (1981), as well as the selection of Yucca Mountain, see supra text accompanying notes 196-208.
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on a site selected since the enactment of RCRA in 1976. The EPA found that about seventy percent of all land-based HW treatment, storage, and disposal facilities would fail the EPA’s current siting criteria for protecting groundwater. One sample found potential releases of hazardous wastes from about ninety percent of such facilities. Some old facilities still operate in locations that would be inconceivable under current rules. For example, Radiac Research Corp. operates a commercial hazardous and radioactive waste storage facility in a row building in Brooklyn, New York.

When the waste management industry wants to add new capacity, it is much more likely to seek to expand existing sites than to move to new sites. Both anecdotal experience and formal public opinion research confirm that communities are much more likely to accept expansions of existing HW/RW facilities than the introduction of new ones.

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348. See infra note 659 and accompanying text.
349. Guidelines, supra note 343, at 48 (statement of Marcia E. Williams, Director, Office of Solid Waste & Emergency Response, EPA). Within this sample, on-site facilities tended to be in somewhat worse locations than commercial facilities. Id.
352. See generally Regina Austin & Michael Schill, Black, Brown, Poor & Poisoned: Minority Grassroots Environmentalism and the Quest for Eco-Justice, 1 KAN. J.L. & PUB. POL’Y 69, 70 (1991) (reporting on the proposed construction of hazardous waste incinerators in Kettleman City, California, at the site of an existing hazardous waste landfill); Reg Lang, Fair Siting in Waste Management, in PROCEEDINGS, supra note 38, at 237 (reporting the expansion of landfill sites in Ontario); Pat Medige, No More Waste, CWM Told, NIAGARA GAZETTE, June 15, 1990, at 1 (discussing a proposal, since abandoned, for construction of a hazardous waste incinerator in Porter, New York, at the site of an existing hazardous waste landfill).
353. See generally JACOB, supra note 203, at 161 (explaining that “a legacy of externalities already evident in the environments of Hanford and Yucca Mountain lowered political opposition to additional increments of environmental degradation”); McKewen & Sloan, supra note 334, at 249 (discussing the successful siting of a hazardous waste landfill in an area of Baltimore surrounded by existing landfills); Gretchen D. Monti, “All Politics Is Local”: Integrating Local Concerns into Facility Site Selection, in PROCEEDINGS, supra note 38, at 36, 38 (observing that a study of experience in Illinois shows that “[i]t is much easier to expand a waste facility that a community has become accustomed to”).
354. MICHAEL R. EDELSTEIN, CONTAMINATED COMMUNITIES: THE SOCIAL AND PSYCHOLOGICAL IMPACTS OF RESIDENTIAL TOXIC EXPOSURE 17 (1988); Barry G. Rabe, Low-Level Radioactive Waste Disposal and the Revival of Environmental Regionalism in the United States, 7 ENVTL. & PLAN. L.J. 171, 177 (1990) ("Survey research has demonstrated that public trust of power generation and waste disposal facilities increases with greater proximity to and familiarity with such facilities.” (citing evidence from areas of Beatty, Richland, and Barnwell LLRW facilities)).
The law makes it immensely easier for companies to continue and expand existing facilities than to create new ones,\textsuperscript{355} and much harder for opponents to shut down existing facilities than to block new ones.\textsuperscript{356} In an extension of the doctrine in zoning law that "prior nonconforming uses" may continue,\textsuperscript{357} hazardous waste facilities have been held to have vested rights to continue their operations,\textsuperscript{358} and in some states, the "natural expansion doctrine" even requires municipalities to allow landfills and similar facilities to expand.\textsuperscript{359}

When Congress enacted RCRA in 1976, it decided not to require existing facilities to meet the new siting and technology standards, for fear that most of them would have to shut down, leaving hazardous waste with no place to go.\textsuperscript{360} Instead, facilities that filed a short form, called a Part A application, and met certain minimal requirements were granted "interim status," which allowed them to continue to operate.\textsuperscript{361} A far more elaborate Part B application, typically running many volumes, had to be filed...
By 1984, when Congress reauthorized RCRA, this process was moving so slowly that Congress grew impatient, requiring landfills to file Part B applications and meet certain groundwater monitoring and financial responsibility requirements by November 8, 1985 or lose their interim status. Only about one-quarter of all the then-existing HW landfills—and fifty of the fifty-nine largest commercial facilities—met this deadline. As a result, most of the smaller landfills shut down, but the larger ones stayed open. Most of the facilities in the Nuclear Weapons Complex are also under interim status. The old landfills still operating under interim status are subject to far laxer rules than are new units. For example, many have no liners to protect the groundwater, because the EPA determined that retrofitting them might do more harm than good. Old hazardous waste incinerators under interim status are also subject to far laxer standards than are those with new permits. Certain facilities are also allowed to expand their capacity considerably while still under interim status.

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366. OFFICE OF TECH. ASSESSMENT, supra note 219, at 28.
D. The Overlay of Permits and Other Regulatory Obstacles

The federal and state statutes designed to find sites for HW/RW facilities have received considerable commentary. Much less attention has been devoted to the dense overlay of permits that must be obtained and other legal strictures that must be met by HW/RW facility operators. This focus on the siting laws has somewhat misdirected the academic inquiry, because practitioners know that the highest hurdles faced by project proponents arise in the permit laws, not the siting laws. To build a facility, a developer must obtain each and every required permit; to stop a project, opponents must merely block one. As Benjamin Walter and Malcolm Getz have pointed out, "[d]ispersing authority among independent veto points strikingly resembles a string of bulbs on a Christmas tree that have been wired in series. When one goes out, so do all the others." In examining these laws, it is remarkable how many of the strongest ones—those with the most absolute prohibitions—are aimed at preserving wildernesses, endangered species, wetlands, parks, and historic buildings. These irreplaceable resources are preserved for future generations in a strong expression of society's moral and aesthetic values, and current community concerns are largely relegated to the political process. Health impacts, the primary basis for most opposition, are implicit in the laws protecting groundwater, air quality, and the like, but they tend not to enjoy the same favored status as does protection of natural areas. Lawyers for project opponents are thus forced to focus on grounds that are often well removed from their original clients' basic concerns, a paradox exemplified by the snail darter that stopped the Tellico Dam and the striped bass that stopped the Westway

372. See sources cited supra note 341.
376. See infra text accompanying notes 590-606.
highway.\textsuperscript{378} Only limited overlap exists between the subjects discussed in the permit hearings and lawsuits about a project, on the one hand, and the community and political meetings about the project, on the other.\textsuperscript{379}

Given the often decisive role of legislatures in selecting sites, the legal processes can be effective at stopping projects by causing one of the "Christmas tree lights" of the permit process to go out, but they can do little to help build facilities.

IV. EVALUATING THE CURRENT SITING PROCESSES

At the outset of this Article, I framed the HW/RW siting problem as how to find the system of HW/RW management that maximizes social welfare, takes full account of social and environmental costs, and still achieves fairness. The purpose of Part IV is to evaluate the current system by this measure. This requires addressing five questions:

1. Does the system allow the sound remediation of waste that has already been created but still lingers, while also providing sufficient disposal capacity for waste that, despite efforts at waste minimization, will be created in the future?
2. Does the system ensure that the full costs of disposal facilities are borne by the users of the facilities?
3. Does the system protect human health and the environment?
4. Is the system fair?
5. Is the system politically viable?

In the course of this discussion, I will also explore some of the hidden economic forces and psychological factors at play in the siting process.

A. Needed Disposal Capacity

Federal and state governments are taking extraordinarily intrusive steps to site HW/RW facilities. The federal government is trying to force facilities on the states and states are trying to force facilities on municipalities through incursions on the normal

\textsuperscript{378} Sierra Club v. United States Army Corps of Eng'rs, 772 F.2d 1043, 1047 (2d Cir. 1985).

\textsuperscript{379} Idaho Governor Cecil Andrus expressed a comparable idea when he blocked a shipment of HLW: "The legal grounds are not near as important as the moral and political grounds, and I can use the courts till you can step on my beard." Fox Butterfield, \textit{Idaho Firm on Barring Atomic Waste}, N.Y. TIMES, Oct. 23, 1988, at A32.
concepts of sovereignty and home rule. There must be some compelling rationale to justify these steps.

The explanations vary between hazardous waste and radioactive waste. For HW, the usual reasons given are that there is a serious shortage of disposal facilities, that illegal dumping will be rampant without more facilities, and that a shortage of facilities will harm the economy. For RW, the usual reasons offered are that government control is necessary to prevent fissile materials from falling into the wrong hands, that anything less than permanent disposal is unsafe, and that the peaceful uses of nuclear energy require more facilities.

1. Hazardous Waste

A severe shortage of HW facilities is usually assumed. A long history exists of crying wolf about pressing demands, both for waste disposal facilities and for large unwanted installations in general. It is therefore necessary to look more closely to see if the wolf is really at the door. The question is so difficult that one state siting board conducted a week-long trial to determine whether a new hazardous waste landfill was needed and in the end threw up its hands and said it could not decide. Many agencies examining the issue take a private company’s interest in building a facility as

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380. See infra part V.B.1.
381. Noble, supra note 344, at 17; Emile Schmeidler & Peter M. Sandman, Getting to Maybe: Decisions on the Road to Negotiation in Hazardous Waste Facility Siting 22 (1988); Audrey M. Armour, The Siting of Locally Unwanted Land Uses: Towards a Cooperative Approach, 35 PROGRESS PLAN. 1, 7 (1991); see also supra note 7 and accompanying text.
382. See generally 42 U.S.C. § 6901(b)(8) (1988) (preamble to RCRA, enacted in 1976) (stating that “many of the cities in the United States will be running out of suitable solid waste disposal sites within five years unless immediate action is taken”); Harvey Alter, The Myths of Municipal Solid Waste, SOLID WASTE & POWER, July-Aug. 1992, at 46 (asserting that government officials have consistently proclaimed an imminent crisis in garbage disposal since the turn of the century).
383. For example, Western LNG Terminal Co. waged a ten-year battle to site a liquified natural gas (LNG) terminal in California, claiming dire need. However, the company withdrew the application when deregulation of domestic natural gas prices in 1978 destroyed the market for imported LNG. Howard Kunreuther et al., A Decision-Process Perspective on Risk and Policy Analysis, in Resolving Locational Conflict, supra note 17, at 260, 261-63; Lawrence E. Susskind & Stephen R. Cassella, The Dangers of Preemptive Legislation: The Case of LNG Facility Siting in California, in Resolving Locational Conflict, supra note 17, at 408, 411-12. Similarly, at least twenty-four attempts between 1970 and 1980 to site a new oil refinery somewhere along the eastern seaboard have failed. Piller, supra note 315, at 161. Yet, it is unclear whether a pressing need exists for these facilities.
384. In re CECOS Int’l, Inc., Application No. 90-85-0551, at *7-*10 (N.Y. Dep’t. of Envtl. Conserv., Mar. 13, 1990), available in LEXIS, ENVIRN library, NYENV file. The Board denied the landfill permit, because it found the site to be geologically unsuitable. Id.
prima facie proof of need, reasoning that the company would not otherwise risk its own capital. But this merely proves that the company believes the facility can turn a profit, not that society desperately needs it—the fact that Chrysler still wants to sell cars does not prove there is a shortage of cars. The need for new facilities is also justified by the argument that, without them, illegal dumping will increase. As shown below, this too has no basis in fact.

Central to ascertaining need is determining whether people seeking to dispose of hazardous waste can consistently find a lawful place to send it; the answer seems to be yes, as evidenced by the national estimates of an adequate or even excessive supply of disposal capacity. By simple reference to the Yellow Pages—typically under the heading “Waste Reduction, Disposal, & Recycling Services”—one can find hazardous waste brokers that will gladly connect waste generators with waste transporters and disposal facilities. Other brokers arrange for the pickup of LLRW for shipment to licensed facilities.

To be sure, prices have soared. Between 1976 and 1991—a period during which producer prices doubled—average waste disposal costs increased from less than $10 to more than $250 per metric ton for landfilling and from about $50 to more than $2600 per metric ton for sludge incineration. It seems likely that the


386. See supra part IV.C.2.

387. See supra notes 34-55 and accompanying text. The one major exception appears to be mixed hazardous and radioactive waste. See supra text accompanying note 301.


limited number of disposal facilities caused much of this price increase by enabling the few remaining facilities to charge more for their services. It is clear, as discussed below,\textsuperscript{391} that rising prices for waste disposal significantly reduce waste generation. Given the variability of price and the elasticity of demand, there is no "shortage" of HW disposal facilities in strict economic terms, as quantity demanded does not exceed quantity supplied.

2. Radioactive Waste

The federal government has assumed—though not yet fulfilled—responsibility for off-site disposal of HLW and TRU, for the compelling reason that plutonium must be held securely. Because LLRW is not useful to putative bomb makers, its disposal is a commercial enterprise. There is plainly no surplus of radioactive waste disposal capacity; Yucca Mountain has not been built, WIPP is built but not open, and only two or three LLRW disposal facilities remain operating. Whether the paucity of most kinds of RW facilities has major adverse impacts, however, is debatable.

The NWPA statutorily determined the need for the Yucca Mountain facility.\textsuperscript{392} Critics claim that no pressing need exists for a repository, because HLW can be safely stored at reactor sites for many decades. They argue that the principal impetus behind the Yucca Mountain project was that "[t]he lack of a disposal solution had long been a political albatross around the neck of the nuclear industry."\textsuperscript{393} In 1989, the NRC determined that no significant safety or environmental impacts would result from a delay in the

\textsuperscript{391} See infra part IV.B.

\textsuperscript{392} 42 U.S.C. § 10,131(a)(1)-(2) (1988). Note that the NWPA also provides that the EIS for Yucca Mountain need not consider the need for the facility, id. § 10,134(f)(6), and that the NRC may not consider the need for the monitored retrievable storage facility in licensing it, leaving that decision to DOE and Congress, id. §§ 10,161(d), 10,168(c).

\textsuperscript{393} \textsc{Makhijani & Saleska, supra} note 191, at 39; \textit{see also Jacob, supra} note 203, at 40, 182 (explaining how nuclear utilities capitalized on fear of financial disaster and nuclear waste disposal crisis to force federal relief); Roger E. Kasperson et al., \textit{Confronting Equity in Radioactive Waste Management: Modest Proposals for a Socially Just and Acceptable Program}, in \textsc{Equity Issues, supra} note 180, at 351, 352; Elliot Marshall, \textit{Thirty Ways to Temporize on Waste}, 237 \textsc{Science} 591, 591 (1987); Carol Polsgrove, \textit{Where Will We Dump the Nuclear Trash?}, \textsc{Progressive}, Mar. 1983, at 22, 25-26.
availability of Yucca Mountain until 2025, and in 1990 the National Academy of Science concluded that continued at-reactor storage of spent fuel should be safe for at least 100 years.

The absence of facilities—namely, Yucca Mountain and WIPP—for the disposal of waste from nuclear weapons production poses greater problems. Much of the waste destined for these facilities is kept in crude conditions, posing a significant threat to the environment.

The economics of LLRW resemble those of hazardous waste, except that LLRW appears to be even more price elastic. Nationwide LLRW volumes declined by about half between 1981 and 1989. These quantities are expected to drop still further as the remaining LLRW repositories increase their disposal charges to almost $300 per cubic foot and waste generators learn that materials substitution and better operational practices can reduce the amount of LLRW created. Temporary shutdowns of disposal facilities have, however, briefly disrupted the operations of some LLRW generators.

B. Internalization of Costs

Waste disposal costs significantly affect the demand for facilities for commercial HW/RW disposal. Under classical economic theory, the market is distorted if the price of a good or service does not fully reflect its social cost. Given the demand elasticity of waste disposal, if the price of waste disposal is artificially low, then the amount of waste generated will be inefficiently high.

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395. BOARD ON RADIOACTIVE WASTE MGMT., supra note 195, at 8-9.
396. See supra text accompanying notes 182-85.
397. OFFICE OF TECH. ASSESSMENT, supra note 226, at 7-8; Radioactive Waste: States Outside Southeast Compact Face Sharply Higher Fees to Use Barnwell, 23 Envtl Rep. (BNA) No. 19, at 1313 (Sept. 4, 1992); Reinhold, supra note 249, at 1, 8. The average cost of disposing of one cubic foot of Class A LLRW, which is the least radioactive, rose from $1 in 1975 to $42 in 1988. Contreras, supra note 2, at 529.
398. Contreras, supra note 2, at 520-21.
399. See infra text accompanying notes 791-94. Waste generation from nuclear weapons production does not seem sensitive to disposal costs.
If it succeeded in siting facilities, the current system of HW/RW facility siting would keep the price of waste disposal artificially low in two important ways. First, the cost of building facilities, which is ultimately reflected in disposal prices, would be lowered by federal and state override of local zoning controls. Second, under prevailing tort doctrines, facility operators would be—and indeed are—able to escape payment for many of the external costs they impose on their neighbors. These two market distortions are examined below.  

1. Zoning Override

One of the favorite legislative techniques in siting HW/RW disposal facilities is to override local zoning and other land use controls. Removing a zoning restriction from a piece of land ordinarily provides a financial benefit to the property owner. Every developer knows that securing the consent of local officials to a project with hostile neighbors is an arduous, expensive process that often requires community compensation, reductions in project size, and changes in design. Eliminating the issue of consent would be a tremendous benefit to the developer. Assuming a competitive market for waste disposal, a zoning override at disposal facilities might well be reflected in lower disposal prices. Although in practice, zoning overrides have been unsuccessful in HW/RW siting, this analysis suggests that, even if they worked, they would be economically inefficient.  

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403. See infra part V.B.1.


405. See infra notes 751-56 and accompanying text.


Allowing economic bargaining between the waste facility industry and the communities involved would, within the logic of the economic system, establish a market where the value of a particular site could be weighed relative to other sites and relative to the feelings of the local population. Prices established in this way would
2. External Costs

If HW/RW facilities are able to inflict costs on their neighbors without compensating them—in economists' jargon, if the negative externalities are not internalized—then the neighbors are, in effect, subsidizing the waste generators.407

The state of the art in quantifying the externalities from waste disposal facilities is extremely crude.408 In recent years numerous studies have been performed, however, on the impact of such facilities on one useful measure of externalities: property values.409 Most of these studies show a strong negative correlation between proximity to a HW/RW disposal site and property values,410 especially after publicity concerning the site411 or concerning other

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407. Id. at 122.

408. For one attempt, see JOHN SCHALL, DOES THE SOLID WASTE MANAGEMENT HIERARCHY MAKE SENSE? A TECHNICAL, ECONOMIC AND ENVIRONMENTAL JUSTIFICATION FOR THE PRIORITY OF SOURCE REDUCTION AND RECYCLING (School of Forestry and Envtl. Studies, Yale Univ. 1992). For pertinent information (relevant especially to the externalities of incinerators), see generally PACE UNIV., supra note 276.


contamination incidents. A strong negative effect can result from the mere announcement that a facility will be built. A few studies found no negative impacts, and several studies examined theoretical or practical issues without determining the effects. Overall, evidence exists that in at least some communities HW/RW facilities are lowering property values.

Compensation for these losses is quite limited. The NWPA provides for compensation to state and local governments and Indian tribes for their financial losses in the development of HLW repositories and storage facilities, but it does not provide for compensation to private parties. The other major federal siting statutes do not provide for compensation at all. CERCLA allows private parties to recover the "response costs" they suffer in investigating and cleaning up hazardous substances, but this does not include personal injury or property damage. A few state statutes provide for damage awards against HW facilities for property damages, but other state statutes arguably preclude such awards.


413. Smolen et al., supra note 410, at 4, 4-6 (discussing a proposed LLRW facility). But see William C. Metz, Perceived Risk and Nuclear Waste in Nevada: A Mixture Leading to Economic Doom?, 10 Impact Assessment Bull. 23, 23-32 (1992) (arguing that the proposed siting of an HLW facility near Las Vegas has not had discernable impact on the gaming-related tourist industry in Nevada).


416. See Greiner v. New Jersey Dep't of Envtl. Protection & Energy, OAL No. ECA 5401-92 (A.L.J. Apr. 26, 1993) (awarding $6,500 on behalf of NJDEPE for loss in value of home approximately one mile from NPL site); New York: Sludge Landfill Would Lower Values of Nearby Homes, Solid Waste Dig. (Northeast ed.), May 1993, at 5 (discussing a report which states that a proposed landfill for paper mill sludge would cause bordering properties to lose 12% of their value, with the effect diminishing over distance for a two-mile radius).


418. Id. § 9607(a)(4) (1988).


420. See Duffy, supra note 341, at 788 (discussing Utah Code Ann. § 26-14a-7 (Supp. 1981)).

In general, neighbors must resort to common-law tort remedies.\textsuperscript{422} Although RCRA does not preempt such remedies,\textsuperscript{423} both practical and doctrinal problems accompany their use. Among the practical problems are the multiple sources of contamination that are likely to make proof of causation difficult, the long latency periods for most toxic injuries, the resemblance of the illnesses caused by toxic substances to diseases stemming from other causes, and the high costs of litigation.\textsuperscript{424} The principal doctrinal problem is that most applicable tort remedies, such as nuisance, look not only to the injury suffered by the plaintiff but also to the social utility of the actions of the defendant, thereby denying redress to many people injured by activities deemed by the courts to be socially necessary.\textsuperscript{425} Although plaintiffs may occasionally prevail under a nuisance theory,\textsuperscript{426} more often they are defeated.\textsuperscript{427} The barriers to recovery become even higher when the damage is anticipated but has not yet occurred; the harm must generally be both imminent and highly probable before plaintiffs can suc-

\textsuperscript{422} In one case, the plaintiff sought the remedy of rescission. Smith v. Clark, No. 28019 (N.Y. Sup. Ct. Cortland County Mar. 23, 1990) (dismissing the complaint of parties who had contracted to buy land and then attempted to rescind when a LLRW site was proposed nearby).


\textsuperscript{424} See Stewart, supra note 360, at 1263-64, 1337-38 (1981).


\textsuperscript{426} See Village of Wilsonville v. SCA Servs. Inc., 426 N.E.2d 824, 831 (Ill. 1981) (ordering the shutdown of a hazardous waste facility after a lengthy trial based on the nuisance doctrine); see also Warner v. Waste Mgmt., Inc., 521 N.E.2d 1091, 1092 (Ohio 1988) (certifying class in action against HW facility for negligence, trespass, strict liability, and nuisance).

ceed. Similarly, efforts to stop or to obtain compensation on-site investigations before final siting decisions are made have been unavailing.

As discussed in detail below, among the most common and severe impacts of the HW/RW siting process is the emotional anguish suffered by the neighbors of planned facilities. A few courts have awarded damages for such fears, but these cases are

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431. See infra text accompanying notes 590-606.

432. See, e.g., City of Santa Fe v. Komis, 845 P.2d 753, 757 (N.M. 1992) (awarding land owner damages because highway through his property would carry nuclear waste to Waste Isolation Pilot Project, diminishing value of land due to fear of the waste); Lunda v. Matthews, 613 P.2d 63, 67-68 (Or. Ct. App. 1980) (allowing emotional distress damages for air emissions from cement plant); Heddin v. Delhi Gas Pipeline Co., 522 S.W.2d 886, 888 (Tex. 1975) (awarding damages to landowner who feared that pipeline on adjoining land would explode); Texas Elec. Serv. Co. v. Nelson, 546 S.W.2d 864, 871 (Tex. Civ. App. 1977) (allowing landowner to recover for fear of land adjacent to railroad through which nuclear wastes were transported); see also Federal Court in Ohio Certifies Class of Workers, Family Members with Cancer Fear, 7 TOXICS L. REP. (BNA) No. 13, at 371 (Aug. 26, 1992) (reporting on a class action against a nuclear fuel facility in Fernald, Ohio).
the exception, not the rule.\textsuperscript{433} One state statute calls on the HW facility licensing agency to consider "community perceptions and other psychic costs,"\textsuperscript{434} but the DOE has taken the opposite stance and advised that, in siting a HLW repository, "[p]erceived risk . . . is not an appropriate topic for general repository-siting guidelines; it is a subjective condition that cannot be fairly compared among sites."\textsuperscript{435} A West Virginia statute allowed the state to deny a permit for a solid waste facility that was "significantly adverse to the public sentiment."\textsuperscript{436} However, the Fourth Circuit declared the statute unconstitutional because it bore no substantial relationship to the state's legitimate interests.\textsuperscript{437} In a hearing on the expansion of a hazardous waste landfill in Niagara Falls, New York, five days of testimony was taken on the facility's psychological impact on a community that was, the opponents argued, already scarred by Love Canal. The state environmental commissioner ruled,

As a public policy matter, if the Department were to deny an application for a facility after concluding that it met all regulatory criteria and that the risk of its construction and operation was within acceptable limits merely because of fears in the host community, the agency would be abdicating its responsibility . . . . Therefore, I conclude that any psychological impact caused by this facility cannot, standing alone, be grounds for denial of the applications.\textsuperscript{438}


\textsuperscript{434} KY. REV. STAT. ANN. § 224.46-830(2)(a) (Baldwin 1992).


\textsuperscript{436} Geo-Tech Reclamation Indus. v. Hamrick, 886 F.2d 662, 663 (4th Cir. 1989) (citing W. VA. CODE § 20-5F-4(b) (1989)).

\textsuperscript{437} Id. at 666-67; \textit{see also} City of Cleburne v. Cleburne Living Ctr., Inc., 473 U.S. 432, 440 (1985) (prohibiting a city from zoning out a home for the mentally retarded based on impermissible motives); \textit{In re Combined Air & Solid Waste Permit No. 2211-91-OT-1}, 489 N.W.2d 811, 812 (Minn. Ct. App. 1992) (holding that generalized concern over possible adverse effects is insufficient to support permit denial). Cases concerning the courts' shifting attitudes toward the ability of local governments to prohibit feared land uses are reviewed in David Bernstein, \textit{From Pesthouses to AIDS Hospices: Neighbors' Irrational Fears of Treatment Facilities for Contagious Diseases}, 22 COLUM. HUM. RTS. L. REV. 1, 2-6 (1990); Harold A. Ellis, \textit{Neighborhood Opposition and the Permissible Purposes of Zoning}, 7 J. LAND USE & ENVT'L. L. 275, 276-97 (1992).

\textsuperscript{438} \textit{In re CECOS Int'l, Inc., Application No. 90-85-0551}, at *3 (N.Y. Dep't. of Envtl. Conserv., Mar. 13, 1990), \textit{available in} LEXIS, ENVIRN library, NYENV file. This hearing is
After reviewing the law on recovery for psychic distress, Roger A. Bohrer aptly summarized the issue:

At the very least, the issue of emotional distress recovery in the face of technological risk and uncertainty may be seen for what it is—a social choice between subsidy and compensation. A decision to impose liability and to require the internalization of "psychic costs" would not stop progress altogether, but it would simply make the products of new technology cost more in the marketplace. By forcing the market to recognize the social costs of technology, a more socially desirable level of consumption of technological products is achieved.439

The foregoing shows that the legal system, by denying recovery to many of those injured by HW/RW facilities, subsidizes the generation of hazardous and radioactive waste and would therefore encourage more than the socially optimal number of disposal facilities.440 The political system, however, acts as a safety valve, for it does reflect psychic costs and largely counteracts this encouragement by stymieing virtually all new facilities, although allowing many old units to stay open.

C. Protecting Health and the Environment

Does the current system of HW/RW facility siting protect health and the environment? Much of the pertinent information has already been presented. At this point, I will address two additional points. First, because the current siting system perpetuates the life of old facilities while sites are sought for modern new ones, I will look at the widespread notion that new, modern facilities can operate with few environmental impacts. Second, I will test one of the key assumptions underlying current siting laws: that a shortage of facilities increases illegal dumping.


440. This does not mean that exclusive reliance on a liability system guarantees optimal economic efficiency. For example, if living near a facility caused an individual $10,000 worth of psychic damage but the person could move for $6000, the socially optimal rule might limit payment to moving costs plus, perhaps, some increment for the psychic costs of moving.
1. Impacts of New Facilities

Much of the siting literature assumes that new HW/RW disposal facilities can be built and operated with a high degree of health and environmental safety. The environmental impact statements and health risk assessments for these facilities, which are typically prepared by their proponents, usually predict that the risks will be trivial. However, the actual evidence is far less clear. Because there are so few new HW facilities and no new RW facilities, it is hard to answer confidently whether new facilities will offer much greater protections than old ones. Nevertheless, actual operating experience is illuminating. The hundreds of civil and criminal enforcement cases brought by the EPA under RCRA every year attest to the fact that many current hazardous waste operations still violate the law. These statistics unfortunately do not differentiate old from new units.

Most indicative of the likely performance of new HW/RW facilities is the experience of those most units recently built (usually on existing sites) in the 1970s and 1980s. The largest hazard-

441. See, e.g., Greenberg & Anderson, supra note 309, at 207; Schmeidler & Sandman, supra note 381, at 29; Caskey, supra note 7, at 58; Letty G. Lutzker, Making the World Safe for Chicken Little, or the Risks of Risk Aversion, in LOW-LEVEL RADIOACTIVE WASTE REGULATION, supra note 188, at 175, 178-79; Paul Slovic et al., Perceived Risk, Trust, and the Politics of Nuclear Waste, 254 SCIENCE 1603, 1603 (1991); Tarlock, supra note 338, at 432-33.


444. This is in part because of the enormous uncertainty in the practice of risk assessment, requiring risk assessors to make scores of subjective judgments from inconclusive data. See Mary L. Lyndon, Risk Assessment, Risk Communication and Legitimacy: An Introduction to the Symposium, 14 COLUM. J. ENVTL. L. 289, 291 (1989). In one not uncommon incident, the opponents and proponents of a proposed LNG terminal prepared risk assessments that differed by three orders of magnitude. Howard Kunreuther et al., Decision-Process Perspective on Risk and Policy Analysis, in RESOLVING LOCATIONAL CONFLICT, supra note 17, at 260, 261.

ous waste landfill in the country is the Emelle, Alabama facility of Waste Management, Inc., the largest company in the industry. In a recent lawsuit, the Emelle facility was found to have released hazardous substances and noxious fumes into the environment on several occasions.\textsuperscript{446} Waste Management's large HW landfill in Niagara County, New York has had similar experiences,\textsuperscript{447} as have several HW landfills operated by the second-largest company, Browning Ferris Industries.\textsuperscript{448}

Events at incinerators have proven even more troubling. In 1992, regulators closed the largest commercial HW incinerator in the country, located in Chicago, after finding improper operating practices such as disconnected pollution monitoring devices, the burning of unpermitted wastes, and false labelling of waste barrels.\textsuperscript{449} The experience at many other commercial incinerators is not much better.\textsuperscript{450} A court ordered another large incinerator, in North Carolina, to shut down in 1989 following ten years of trouble-filled operations.\textsuperscript{451} A brand new hazardous waste incinerator in New York, built after years of permit proceedings, encountered significant technical problems in 1987 during trial burns and never opened.\textsuperscript{452} Elevated levels of PCBs have been detected in rodents captured near a new HW incineration/treatment/landfill facility in Swan Hills, Alberta, Canada and in the blood of about half a dozen waste handlers at the plant.\textsuperscript{453} Unannounced inspections by the EPA and the Office of Safety and Health Administration of twenty-nine HW incinerators in 1991 found 395 violations of standards, two-thirds of which the agencies considered "seri-


\textsuperscript{447} New York State Dep't of Envtl. Conserv., Report of On-Site Monitoring Activity at CWM Chemical Services, Inc. by NYS DEC Region 9 (quarterly reports).


\textsuperscript{449} Jeff Bailey, Environment: Concerns Mount over Operating Methods of Plants that Incinerate Toxic Waste, WALL ST. J., Mar. 20, 1992, at B1.


\textsuperscript{452} New York State Legislative Comm'n on Toxic Substances & Hazardous Wastes: The Evolution of a Promising Public Policy 9 (1989).

Several epidemiological studies have found elevated levels of respiratory and other disorders near commercial HW incinerators. In 1992, the EPA expressed concern that even well-operated incinerators were having difficulty meeting permit limits for dioxin. At a controversial new HW incinerator in Ohio, dioxin emissions during the test burn were up to five times greater than the level used in the risk assessment. Examinations of the results of trial burns of several other hazardous waste incinerators show that emissions of certain heavy metals, particularly cadmium and chromium, may pose significant risk to public health. In sum, even state-of-the-art disposal facilities can, and do, fail in a multitude of ways.

Occupational, as opposed to public, health risk has been well established. Numerous instances of occupational diseases among workers at nuclear weapons complex facilities and in the hazardous and solid waste industries have been documented. Although the above incidents did not necessarily involve injury to public health, they certainly challenge the commentators' assumptions of assured safety. They also suggest that new facilities will be no panacea and that reducing the creation of HW/RW...
will still deserve high priority. This conclusion is reinforced by the fact that the federal regulations governing the design and operation of HW/RW facilities clearly allow even new units to pose a residual, though slight, health risk.463 Moreover, environmental risks in the transportation of hazardous wastes are at least as great as those in storage and disposal.464

2. Illegal Dumping

A major impetus behind facility siting legislation and the pre-emption of local authority over siting has been the fear of illegal dumping of hazardous wastes. Congress,465 the courts,466 administrative agencies,467 and many commentators on facility siting468


465. GREEN, supra note 37, at xviii (noting that the fear of illegal dumping resulting from capacity shortfalls was one of the reasons Congress enacted the capacity assurance provisions of CERCLA).


have uncritically adopted the idea that a shortage of disposal facilities leads to illegal dumping. In all the siting literature, I have found only one statement questioning this view.\textsuperscript{469} Fear of encouraging illegal dumping also prompted Congress to reject proposals for a tax on the generation of HW,\textsuperscript{470} and it is one reason why old grandfathered landfills have been allowed to remain open.\textsuperscript{471} When the available data are examined, however, it becomes apparent that illegal dumping has almost no relationship to inadequate disposal capacity and would not be reduced by building more capacity.\textsuperscript{472}

As noted above, HW and RW brokers will, for a price, arrange for the shipment of virtually any waste stream to a licensed disposal facility.\textsuperscript{473} The price can be extremely high; the cost of legitimate disposal of hazardous waste is in the hundreds or thousands of dollars per ton, depending on the method used.\textsuperscript{474} The price of illegal disposal, on the other hand, is dramatically lower. Information about these prices can be gleaned from past criminal prosecutions. An illegal landfill in Kentucky, known as the Valley of the Drums, accepted up to 100,000 drums between 1976 and 1978 for 75 cents each.\textsuperscript{475} An illegal dump in Plainfield, Connecticut, which was closed in 1978, charged $1.50 per drum.\textsuperscript{476}
An illegal operation near Philadelphia also accepted drums for $1.50 each.\(^\text{477}\)

A government investigation in New York provides more dramatic evidence of the underground market. In 1992, the district attorney's office in Suffolk County, New York set up a "sting" operation to catch businesses that were willing to dispose of their HW illegally. Undercover investigators approached businesses and offered plainly unlawful disposal services. They found themselves being forced to reduce their prices to as low as twenty dollars a ton to meet the competition from genuine illegal dumpers.\(^\text{478}\)

One court has noted the existence of a "vast, unmonitored secondary toxic disposal market—one which . . . weaves across state lines and reaches to every corner of this nation."\(^\text{479}\)

A survey in the San Francisco area further evidences the extremely low prices in this underground market. The surveyors asked small businesses how much they would be willing to pay for legal HW disposal services. Thirty-four percent said they would pay nothing, and another eighteen percent indicated they would pay no more than twenty-five dollars per month. The authors concluded that, "[i]f the firms are not willing to pay anything, or are unwilling to pay more than twenty-five dollars per month, their present disposal costs must be very small. The very small amounts they will pay for waste disposal indicates that they are probably using illegal methods."\(^\text{480}\)

Limitations on HW/RW disposal capacity do greatly increase the price of legal disposal, and real capacity shortages would drive the price still higher. It does not follow, however, that this will lead to more illegal dumping. If a four-star restaurant raises its dinner prices from $100 to $120, that will not increase the business at McDonald's; the two establishments serve entirely different markets. The same holds true for HW disposal: There are very distinct legal and illegal markets. If the price of a licensed landfill goes from $250 to $300 per ton, not many of its customers will

\(^{477}\) Id. at 250.


switch to the twenty dollars method; conversely, a drop from $250 to $200 will not lure the twenty dollar crowd.\textsuperscript{481}

Several recent studies have revealed the nature of the legal and illegal markets. Of all the HW generated in the United States, 99.6\% comes from large quantity generators, and 0.4\% comes from small quantity generators\textsuperscript{482}—those that generate less than 1000 kilograms of hazardous waste per month.\textsuperscript{483} The large quantity generators are overwhelmingly concentrated in a few industries, particularly chemical manufacturing, primary and fabricated metals, and petroleum refining.\textsuperscript{484} These companies have much to lose if they are caught in illegal dumping, and they also tend to have sophisticated compliance staffs to advise them on legal requirements.\textsuperscript{485} Thus, it is not surprising that several studies have shown that the great bulk of illegal dumping comes from small quantity generators, and particularly from dry cleaners, auto repair shops, metal cleaners or platers, printers, and pest exterminators.\textsuperscript{486} Some estimates indicate that only about half of all small quantity generators dispose of their HW properly.\textsuperscript{487} According to several investigations, organized crime is responsible for much of the illegal HW hauling and disposal.\textsuperscript{488}

\textsuperscript{481} The restaurant analogy is not perfect, because many intermediate choices are available between a four-star restaurant and McDonald's. However, the huge gap between the prices of legal and illegal disposal—$250/ton versus $20/ton—suggests that price shifts of much less than an order of magnitude will not swing many waste generators from the illegal to the legal market or vice versa. Significant changes in the probability of being caught are likely to have a much more decisive effect on which businesses go to which market.

\textsuperscript{482} McCARTY & REISCH, supra note 28, at CRS-16; see also OFFICE OF SOLID WASTE & EMERGENCY RESPONSE, supra note 23, at 1.

\textsuperscript{483} 40 C.F.R. § 260.10 (1992).

\textsuperscript{484} See supra text accompanying notes 23-26.

\textsuperscript{485} Bruce W. Piatecki &Gary A. Davis, Restructuring Toxic Waste Controls: Intrinsic Difficulties and Historical Trends, in America's Future, supra note 35, at 1, 1-8.


\textsuperscript{487} HAMMITT & REUTER, supra note 486, at 18.

The HW that is most susceptible to illegal dumping is the 0.4% from small quantity generators. It makes no sense, in my view, to distort HW policy and create potentially excess HW disposal capacity for the 99.6% of the waste created by large generators in the hopes of luring the small generators. This is especially true when, given the extraordinary discrepancies between legal and illegal prices, this lure is unlikely to be taken. The solution to illegal dumping lies instead in enforcement. On a nationwide basis, very few resources are devoted to inspecting small quantity generators. More frequent and thorough inspections of small quantity generators, more crosschecking of toxic release filings, sting operations, and other techniques hold great promise of reducing illegal dumping.

The current system of HW/RW facility siting does not harm the environment by creating a shortage of facilities that encourages illegal dumping. The prevalence of illegal dumping is a failure of the enforcement system, not of the siting system. However, the current siting system does harm the environment by perpetuating old, substandard facilities. The promise of new facilities unfortunately offers no panacea for this harm.

D. Affording Fairness

Fairness is an essential consideration in evaluating the current system of HW/RW facility siting. Other commentators have explored the meanings of the concepts of "fairness," "justice," and "equity" in facility siting, and I will not step into that philosophical debate here. The discussion below is limited to allocative fair-

Scarpitti work should be cautioned that its publisher, William Morrow & Co., was sued for libel after the book's publication; the suit was settled under terms that were to be kept confidential, but the book was allowed to go out of print and the publisher has no plans to reprint it. Telephone Interview with Robert Hawley, Law Department, William Morrow & Co. (Oct. 28, 1992).


491. ENGLISH, supra note 10, at 117-60; Peter S. Wenz, Environmental Justice 5-21, 5-21 (1988); Vicki Been, Locally Undesirable Land Uses in Minority Neighborhoods: Disproportionate Siting or Market Dynamics?, 103 YALE L.J. 1383 (1994); Kasperon et al., supra note 393, at 331; Ted F. Peters, Ethical Considerations Surrounding Nuclear Waste Repository Siting and Mitigation, in NUCLEAR WASTE: SOCIOECONOMIC DIMENSIONS OF LONG-TERM STORAGE 41, 41 (Steve H. Murdock et al. eds., 1983) [hereinafter NUCLEAR WASTE].
ness and specifically to the distribution of benefits and burdens among geographical areas, classes and races, and generations.

1. Fairness Between Geographical Areas

Fairness between regions is a central theme in siting legislation. The Nuclear Waste Policy Act, written in 1982, contemplated both an eastern and a western HLW repository—although this plan was abandoned in 1987 when the eastern states politically overwhelmed Nevada—\textsuperscript{492}—and a monitored retrievable storage facility in a third state.\textsuperscript{493} The Low-Level Radioactive Waste Policy Act was designed to relieve the burden on the three states with LLRW repositories: South Carolina, Nevada, and Washington.\textsuperscript{494} The capacity assurance provisions of CERCLA aimed to assure that every state made provisions to dispose of its own HW.\textsuperscript{495} Several states have their own statutes calling for geographic equity.\textsuperscript{496}

There are three generally accepted principles in achieving regional fairness:

1. The benefits and burdens of waste disposal should be correlated. An area that enjoys the fruits of waste generation should bear the costs of waste disposal.\textsuperscript{497}

2. No place should bear a disproportionate share of the region’s (or the country’s) environmental hazards.\textsuperscript{498}

3. Facilities should be placed in the technically best locations in order to minimize adverse health and environmental impacts.\textsuperscript{499}

Unfortunately, these three principles are irreconcilable with each other and with other important values. The first and second principles are incompatible, because if the first is observed, then disposal facilities will be located near the polluting industries—the chemical waste landfill will be next to the chemical plant, the radi-

\textsuperscript{492} Jacob, supra note 203, at 169-70.
\textsuperscript{493} 42 U.S.C. §§ 10,161(g), 10,165(g) (1988).
\textsuperscript{494} English, supra note 10, at 127; Contreras, supra note 2, at 517-19.
\textsuperscript{495} See supra text accompanying note 324.
\textsuperscript{498} E.g., Edelstein, supra note 354, at 186; Kasperson, supra note 285, at 24, 50.
\textsuperscript{499} See supra note 342 and accompanying text.
Active waste repository will be next to the nuclear power plant—thereby creating a disproportionate burden on these communities, in violation of the second principle. The first and third principles are incompatible, because the technically best locations are usually remote from people and water and, therefore, unlikely to generate much waste or to enjoy the benefits of its creation. Observing both the second and third principles would proliferate small waste disposal sites throughout rural America, since each county with suitably dry and remote land would receive a little bit, not much, of the country's waste.

Because of these contradictions, it is perhaps inevitable that all three principles are infringed by aspects of the current siting system. The first principle, correlation of burdens and benefits, is badly violated, for example, by the planned location of the nation's repository for spent nuclear fuel in Nevada—a state that has no nuclear power plants—and by the location of the nation's largest HW landfill in rural Alabama, where little HW is generated. The second principle is violated because some communities, like Niagara Falls, New York, the adjacent Illinois communities of East St. Louis and Sauget, Vernon, California, and Toole County, Utah, voluntarily or not, have major concentrations of disposal facilities, polluting industries, CERCLA sites, or a combination thereof. The third principle is violated because many of the older waste disposal facilities, which continue in operation while the sitting of new units is paralyzed, are in technically inferior locations.

These tensions are likely to remain in any siting system, because it is not apparent which of these three principles should trump the others. These tensions can, however, be significantly reduced in a system that comprehensively addresses all different

500. See Tom Anderson, Residents Plead: Reject Sludge Plan, REPORTER-DISPATCH (Westchester County, N.Y.), Jan. 22, 1993, at 5B ("Yonkers residents who said they were already burdened by a sewage treatment plant in their neighborhood beseeched county officials last night to reject a proposal for a sludge-processing facility next to the sewage plant.").


505. See supra text accompanying notes 348-51.
kinds of HW/RW and requires all states to bear some burdens, as discussed in Part VI.

2. Fairness Between Classes and Races

The hottest issue in facility siting today is whether HW/RW facilities are intentionally placed in minority communities.\(^{506}\) Over the years, numerous studies have demonstrated that poor people are disproportionately exposed to pollution,\(^{507}\) and a 1983 study revealed that three of the four commercial HW landfills in the southeast are in minority communities.\(^{508}\) However, the racial issue did not come to the forefront until 1987, with the publication of *Toxic Wastes and Race in the United States* by the Commission for Racial Justice of the United Church of Christ.\(^{509}\) This study examined the location of "uncontrolled toxic waste sites"—those on the EPA's "CERCLIS"\(^{510}\) list of sites with known or suspected contamination—and commercial HW treatment, storage, and disposal facilities. It searched for correlations between the location of commercial facilities and five variables in the community (defined as a five-digit zip code area): minority percentage, mean household income, mean home value, number of CERCLIS sites per...
1,000 persons, and pounds of hazardous waste generated per person. The study found that "race proved to be the most significant factor among variables, tested in association with the location of commercial hazardous waste facilities. This represented a consistent national pattern." The study further determined that in communities with one operating commercial facility, the mean minority percentage in the zip code area was approximately twice that of areas without such facilities (twenty-four versus twelve percent). The mean white percentage in such communities was not revealed nor was there any discussion of the racial composition at the time the facility was first built.

The study was less conclusive about the correlation between race and CERCLIS sites, finding that 57.11% of the nation's black population, 56.63% of its hispanic population, and 53.6% of its white population lived in a zip-code area with at least one CERCLIS site. No correlations with income or wealth variables were presented.

Other studies have demonstrated a strong racial correlation in the siting of MSW landfills and incinerators in Houston, commercial hazardous waste facilities in Detroit, and hazardous waste incinerators nationwide. A 1984 study found that National Priorities List sites in New Jersey were in communities with high percentages of blacks, low-income people, foreign-born people, and very young and very old people, but it did not compare the strength of the racial and income correlations. A 1992 study found some correlation between community racial composition and the presence of NPL sites.

511. COMMISSION FOR RACIAL JUSTICE, UNITED CHURCH OF CHRIST, TOXIC WASTES AND RACE IN THE UNITED STATES 10 (1987).
512. Id. at xiii.
513. Id. at 13.
514. Id. at 53.
516. Mohai & Bryant, supra note 507, at 927.
518. GREENBERG & ANDERSON, supra note 309, at 158-59.
519. The study found only slight differences in average community racial composition in communities with NPL sites when compared to their geographic regions or to the nation as a whole, on an aggregate basis—which means adding up the minority populations in the communities with NPL sites and then dividing by the total population of those same communities. However, the percentage of blacks and hispanics in communities with NPL sites was found to be greater than the nationwide average. No comparable pattern was found for persons below the poverty line. RAE ZIMMERMAN, EXECUTIVE SUMMARY TO RISK AND PUBLIC CONTROVERSY
Additional work has focused on enforcement and cleanup efforts. A 1990 study found that CERCLIS sites in low-income rural communities are being evaluated as quickly as sites nationally but that disproportionately few are placed on the NPL, probably because the size of the affected population lowers the hazard-ranking score. A 1992 analysis concluded that penalties against polluters are lower when the violation occurs in a minority area, that EPA takes longer to investigate and clean up NPL sites in minority areas, and that EPA accepts less stringent remedial efforts.

The impacts of any disproportionate exposure to pollutants would be worsened by the already substandard health status of many minority communities, which stems from such influences as inferior health care, poor eating habits, hazardous occupations, and high consumption of cigarettes, alcohol, and illicit drugs.

Some have concluded that government and corporations make a conscious effort to place HW facilities in minority communities. More prevalent, and more persuasive, explanations for the

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521. Id. at ix.


523. U.S. EPA, Environmental Equity: Reducing Risk for All Communities 11 (1992); Austin & Schill, supra note 352, at 76-77; see Memorandum from Philip W. Johnston, Secretary, Executive Office of Human Services, Commonwealth of Massachusetts to John DeVillars, Secretary, Executive Office of Environmental Affairs 12-13 (Sept. 14, 1990) (on file with the Tulane Law Review) (disapproving site in Braintree for new hazardous waste incinerator, largely because the nearest communities have high rates of respiratory disease due in part to large elderly populations). This finding was criticized by the facility's proponents as the result of a simple statistical error. See Michael O'Hare & Debra Sanderson, Facility Siting and Compensation: Lessons from the Massachusetts Experience, 12 J. Pol'y Analysis & Mgmt. 364, 374 (1993).

location of HW sites in minority areas relate to land use patterns and to political power.

According to the land use explanation, factories formerly tended to be sited in center cities, often accompanied by working class housing. With suburbanization and the decline of central cities after World War II, housing values declined and low-income people, including minorities, were attracted. Most HW is disposed at the factory where it is generated, and when the factory shuts down, a Superfund site is often left behind. Grandfathered HW disposal facilities often persist in these areas, but poor minorities, with limited mobility options, are unable to flee.

The political explanation, which is not at all inconsistent with the land use explanation, points out that facility siting decisions are often made by government and that minority communities traditionally are underrepresented in government, which was the reason, of course, for the Voting Rights Act. Low-income and minority groups have long had low participation rates in political activity in general and in environmental politics in particular. Studies evaluating whether a statistical correlation exists between political power and siting decisions have been inconclusive, but several particular siting outcomes were blatantly political.
(although they did not involve minority areas). The bypassing of
the normal siting studies and the placement of the nation's HLW
repository in a state with little political power, Nevada, is one
obvious example.533 Another illustration presented itself in 1981,
when the Arizona legislature designated a spot for the state's HW
facility, bypassing the home counties of the state senate's majority
and minority leaders.534 As one proponent of the political explana-
tion has written:

Environmental laws, and the siting of polluting facilities, are
products of a political process which has historically excluded
poor people, and in which poor people are grossly under-repre-
sented. . . . Because siting decisions are political decisions, the
outcome—more facilities in poor communities—is neither sur-
prising nor unpredictable.535

Several lawsuits have challenged disposal facility siting in
minority communities on equal protection grounds. All the suits
that have been decided have been dismissed,536 primarily because
the plaintiffs could not meet their burden of proving discriminatory
intent or purpose.537 Several commentators have urged alternative
approaches to challenging discrimination in HW facility siting,
such as use of Title VI of the Civil Rights Act, use of equal protection clauses in state constitutions, and enactment of a new statute creating a "disparate impact" model for discrimination. Other, more cynical commentators have said that "civil rights law has so far miserably failed to combat racism, so why should we think that it will be better able to combat environmental racism?"

Apart from the probably insurmountable obstacle of proving intent to discriminate racially, those challenging proposed sitings on equal protection grounds have another formidable hurdle. A new HW facility will not receive a permit without an administrative finding that it is safe and poses no undue health threat. The plaintiffs will have a very difficult time persuading the court to disregard that finding and to conclude that the proposed facility will endanger the population. By the time the facility is built and its dangers become concrete, it will have achieved grandfathered status and will be very difficult to shut down.

Moreover, the theory that race accounts for many siting decisions requires much more factual development. Several groups are now working to replicate the United Church of Christ study to correct some of its acknowledged methodological shortcomings, especially its inattention to timing questions, for example, when facilities were sited and when current racial patterns came into being, and to geographic patterns. Most of the anecdotes and much of the data concerning discriminatory siting come from the southeastern United States. That, however, is a region where, for obvious historic reasons, rural areas have large black populations; in the Northeast, where the rural areas are mostly white, most proposed sites have been in white areas. The three sites that are most

542. In 1992, Waste Management, Inc. (WMI) circulated an analysis showing that 76% of its disposal facilities nationwide are located in five-digit zip code areas with a white population equal to or greater than the host-state average. Letter from Charles J. McDermott, WMI, to Luke Cole 1 (Sept. 8, 1992) (letter on file with the Tulane Law Review). However, this analysis counted white Latinos as white and did not adjust for facility size or type. WMI has commissioned a follow-up study from the University of Massachussetts at Amherst. Ronald Begley & Elisabeth Kirschner, The Demand for Environmental Justice, CHEMICAL WK., Sept. 15, 1993, at 27, 28.
often pointed to as examples of environmental racism are the HW landfills in Emelle, Alabama; Warren County, North Carolina; and Kettleman Hills, California; but at least facially plausible explanations have been offered why all three sites were technically superior.  

Returning again to our evaluation of the fairness of the current siting system, more work needs to be done to establish whether current efforts to site new HW facilities are racially or economically unfair. There have been few such charges against the proposed new radioactive waste facilities, most of which would be placed in lightly populated areas anyway. One fact does seem clear: to the extent that the current siting system perpetuates "grandfathered" facilities and does not allow new sites to open, much HW disposal will continue to take place in poor and minority areas.

3. Fairness Between Generations

A just society will consider the effects of its actions on its descendants. The Constitution states that one of its purposes is to "secure the Blessings of Liberty to ourselves and our Posterity." Few current human activities will have more impact on distant future generations than the disposal of hazardous and radioactive wastes that may remain dangerous for millenia. Iodine-129, for example, has a half-life of 15.7 million years. A theologian, Ted F. Peters, has asked the question starkly:

[How can we morally justify the bequeathal on the part of the present generation of risks and responsibilities that might gravely endanger the health and safety of future generations? How morally appropriate is it for one group to satisfy its own consumptive desires for a few decades and then exact payment from countless as yet to be born civilizations for hundreds of thousands of years?]

543. See GAO, supra note 508, at 9 (concerning Warren County); Bernstein, supra note 32, at 86 (concerning Emelle); Lawrence J. Straw, Jr., Environmental Equity: A Controversial Catchphrase Confronts Environmentally Sensitive Projects, 1992 CAL. ENVTL. L. REP. 507, 510 (concerning Kettleman Hills). But see Bullard, supra note 528, at 35-38, 70.


545. U.S. Const. pmbl.

546. Makhijani & Saleska, supra note 191, at 41.

As shown earlier, environmental law affords the highest degree of protection to preserving for future generations such items as endangered species, wilderness areas, and historic buildings. Doctrines from completely separate areas of law, such as limitations on the public debt and the rules against perpetuities and against restraints on alienation of property, are also designed to prevent the dead hand of the past from restricting the choices of the present and the future. These principles of protecting the future are constantly violated by today’s choices in HW/RW disposal.

The best way, of course, to protect future generations from HW/RW is to not create it in the first place. If that is not possible, disposal is necessary. The principal disposal options can be arrayed in a spectrum from most to least permanent: destruction, irretrievable disposal, retrievable disposal, long-term containment, and storage. These options are discussed in turn below.

a. Destruction

The primary destruction technique is incineration, although bioremediation and other alternative technologies are now being introduced. Incineration works for certain kinds of HW, but not, for others (such as heavy metals) and not for RW. Unfortunately, incineration of certain wastes creates byproducts such as dioxins and furans that, if released into the environment, can create their own problems for future generations. Thus, although incineration is a permanent remedy in theory, the reality is more complicated.

b. Irretrievable Disposal

Permanent shielding of exceptional items has been an aspiration of many civilizations, from the builders of the pyramids, who relied on secret passageways and the curses of the gods to keep out

548. See Harold P. Green, Legal Aspects of Intergenerational Equity Issues, in Equity Issues, supra note 180, at 189.

549. See infra part V.C.5.


551. Gore, supra note 509, at 157. Then-Senator Gore stated:

The principal consequence of incineration is . . . the transporting of the community’s garbage—in gaseous form, through the air—to neighboring communities, across state lines, and, indeed, to the atmosphere of the entire globe, where it will linger for many years to come. In effect, we have discovered yet another group of powerless people upon whom we can dump the consequences of our own waste: those who live in the future and cannot hold us accountable.

Id.
trespassers, to the believers in the legend of the Holy Grail, who looked to a race of knights to guard the cup. Geological repositories for radioactive waste, such as Yucca Mountain and WIPP, continue that hope. Recognizing the danger that some future society might forget about these facilities and inadvertently drill for oil or water there, DOE has spent several million dollars designing a “keep out” sign for WIPP that would be effective for 10,000 years and recognizable by any future earthling.552 A perpetual care fund is also being established for WIPP, with the theory that the income from a permanent endowment will allow DOE to pay for the monitoring and security for, say, the life of the sign.553 Perpetual care funds are a well-established feature of cemetery finance,554 and have been set up for some HW landfills as well.555 The Uranium Mill Tailings Radiation Control Act requires perpetual surveillance of tailings disposal facilities,556 which EPA expects will be designed to last at least 1000 years.557 Although good intentions may underlie these plans, no great cynicism is required to scoff at the notion of maintaining a sign, or a bank account, or a federal department for 10,000 years. (After all, the oldest continually operating organization in the western world, the Catholic Church, is less than 2000 years old.)

c. Retrievable Disposal

The idea behind retrievable disposal is that waste would be kept just as environmentally secure as in irretrievable disposal but that a future generation could obtain access in the event the material can later be used or treated differently. One example of this approach was discussed before the signing of the Antarctic Treaty. During talks, a proposal was made to place a radioactive waste canister in a shallow hole in the Antarctic ice sheet and allow the canister to melt its own way to the bottom; under one variation of the proposal, a cable would be attached to the canister that would

553. Kneese et al., supra note 224, at 203.
555. E.g., NEW YORK STATE DEP’T OF ENVTL. CONSERV., PERPETUAL MONITORING, MAINTENANCE, AND CARE (1989) (containing Module II of permit for SLF-12 hazardous waste landfill in Model City, N.Y.) see also Ray Pospisil, Radical Change for Hazardous Waste Services, CHEMICAL WK., Aug. 18, 1993, at 26, 28 (observing that “perpetual post-closure monitoring” was imposed on HW landfill in Ohio).
allow its retrieval.\textsuperscript{558} Earth-mounded bunkers, which are increasingly used for LLRW worldwide, present a less exotic example. The principal negative aspect of retrievable disposal for RW is that the wrong people might do the retrieving. Fears of this escalated after workers at the West Valley, New York facility stole radioactive tools and sold them at a public auction a few miles away. A similar incident occurred at the Beatty, Nevada LLRW facility.\textsuperscript{559} Retrievable disposal is disfavored for HLW and TRU for fear of plutonium theft.

d. Long-Term Containment

Underlying proposals for geologic disposal is the assumption that the waste will remain isolated from the environment, so that if future generations somehow forget about the facility, the odds are that nothing bad will happen. Conversely, with long-term containment, it is assumed that, some day, the waste will reach the environment. The most common waste disposal method in place today—the landfill—is the principal example of long-term containment. The EPA has repeatedly stated that, regardless of sound construction and operation, all landfill liner systems will eventually fail, resulting in the migration of the hazardous constituents of the waste into the broader environment.\textsuperscript{560} This is the principal reason why the geology of sites selected for landfills is so important.

The remedy selected in many CERCLA cleanups offers another important example of long-term containment.\textsuperscript{561} At many sites, especially those being cleaned up by their owners rather than by the EPA, the contamination is left in the ground but is enclosed in a liner and a cap, much like a landfill. Eventually, possibly decades or centuries later, the site may have to be cleaned up all


\textsuperscript{559} RESNIKOFF, supra note 186, at 50.


The methods used to address leaking underground storage tanks are also often temporary, requiring later cleanup. Most of the cleanups now underway at the nuclear weapons complex involve either containment of the contamination in place or excavation and storage of the waste in containers, often under “marginal conditions.” Landfills and containment remedies are the waste disposal equivalent of timed release capsules. Such “containment” remedies have been used in about half of the NPL sites where the cleanup work has been completed.

e. Storage

The least permanent method of disposal, and the one that most clearly shifts the burden to future generations, is storage. There is every sign that storage is becoming the de facto method of dealing with radioactive waste and some hazardous waste. The TRU destined for WIPP has long been sitting in barrels and boxes in Idaho and elsewhere awaiting shipment. The civilian HLW waiting for Yucca Mountain is stored at the nuclear power plants. The HLW from nuclear weapons manufacture is stored in large, leaking tanks at Hanford and Savannah River. The proposed monitored retrievable storage facility may store the waste
for a very long time. Some leading commentators have advocated leaving much of this material in storage for another 100 years or so, awaiting improvements in technology and changes in the public attitudes toward permanent repositories such as Yucca Mountain.\footnote{571} Other nations have also, more or less explicitly, adopted a de facto policy of long-term storage of HLW.\footnote{572}

The siting of LLRW facilities is equally problematic. Many nuclear power plants are building storage facilities for LLRW until repositories open. These facilities are often little more than steel-frame, metal-siding buildings on a concrete slab, sometimes with poured or precast concrete walls.\footnote{573} Many environmental groups advocate storage of LLRW (medical and industrial, as well as utility) at the nuclear power plants.\footnote{574}

Congress has prohibited the extended storage of HW that is banned from land disposal.\footnote{575} Such storage poses real hazards beyond the ever-present, and often-realized, danger of leakage. In 1984, a fire at a HW storage facility in Jacksonville, Florida destroyed several tanks containing PCBs and other organic chemical wastes and spread oily droplets of HW onto nearby homes, cars, and vegetation.\footnote{576} Nonetheless, several environmental groups have called for above-ground storage of HW until better disposal or destruction technologies are developed.\footnote{577} The Dutch, who can-

\footnote{571. See, e.g., \textit{Makhijani \& Saleska}, \textit{supra} note 191, at 108; Slovic et al., \textit{supra} note 441, at 1607; see also International Physicians for the Prevention of Nuclear War \& Institute for Energy \& Environmental Research, \textit{Plutonium: Deadly Gold of the Nuclear Age} 152 (1992); Kai Erickson, \textit{Out of Sight, Out of Mind}, \textit{N.Y. Times}, Mar. 6, 1994, Magazine, at 34 (arguing against permanent disposal of HLW because that removes the choice from future generations).}

\footnote{572. \textit{Frans Berkhout, Radioactive Waste: Politics and Technology} 177-78 (1991); Zorpette \& Stix, \textit{supra} note 190, at 20.}


\footnote{577. \textit{Citizens Clearinghouse for Hazardous Waste, Inc., How to Deal With a Proposed Facility} 5 (1986) [hereinafter Citizens Clearinghouse]; Samuel S. Epstein et al., \textit{Hazardous Waste in America} 337-78 (1982) (Sierra Club publication); see also Kenezi, \textit{supra} note 89, at 14 (reporting the opposition of citizens to the incineration of old
not build landfills because of their high water table, have already largely adopted this approach for HW treatment residues.\textsuperscript{578}

The above discussion should make it clear that the current system of RW/HW disposal is unfairly pushing many costs onto future generations.\textsuperscript{579} Moreover, by imposing many of the costs of final disposal on our distant descendants, the current system is also further depressing the cost of HW/RW disposal today and thus subsidizing the creation of waste.

\textbf{E. Political Viability}

The final question in evaluating the current HW/RW facility siting system is whether it is politically viable; that is, whether it can achieve enough political and public consensus for facilities actually to be built. One clear lesson of the past two decades is that adamant, sustained citizen opposition, when backed by local government, almost always wins.\textsuperscript{580} Since the passage of RCRA in 1976, not a single hazardous or radioactive waste disposal facility has opened, and stayed open, on a new site in the United States in violation of this principle. Because public opposition is so decisive, its nature must be explored.

\textbf{1. What Creates Public Opposition?}

Several public opinion polls have shown that nuclear power plants, RW facilities, and HW facilities are all lumped together as the most feared land uses. These are far more feared than, for example, chemical plants, oil refineries, or coal-fired power plants.\textsuperscript{581} In some of the surveys, people said they would not want chemical weapons at a depot in Alabama, even though the Centers for Disease Control said that the health risk from continued storage of the weapons at the depot were greater than those from incineration).


\textsuperscript{579} But see Dan M. Berkovitz, \textit{Pariahs and Prophets: Nuclear Energy, Global Warming, and Intergenerational Justice}, 17 COLUM. J. ENVTL. L. 245, 296-319 (1992) (arguing that the transmittal of risk to future generations is inevitable and that the dangers of RW/HW disposal are possibly lower than those associated with the continued use of fossil fuels).

\textsuperscript{580} Morell \& Magorian, supra note 10, at 188; see Brion, supra note 2, at 14; Murray \& Seneker, supra note 307, at 323.

\textsuperscript{581} See Owen J. Furuseth, \textit{Community Sensitivity to a Hazardous Waste Facility}, 17 LANDSCAPE \& URB. PLAN. 357, 364 (1989) (largely replicating a U.S. Council on Environmental Quality (CEQ) study in Charlotte, N.C.); Popper, supra note 17, at 1, 5 (reporting on a 1980 survey taken by Resources for the Future for the CEQ); Slovic et al., supra note 441 (observing that a 1989 survey showed nuclear power plants to be more acceptable than HW/RW facilities); Smith \& Desvousges, supra note 410, at 294 (noting a 1984 survey in suburban Boston).
a nuclear power plant or a HW/RW facility closer than 100 miles from their homes;\textsuperscript{582} in others, ten miles was an acceptable distance.\textsuperscript{583}

This opposition has not always existed. In the first third of this century, radium-laced patent medicines were hawked as cures for rheumatism, diabetes, and lagging sexual powers; a toothpaste containing radium was sold to "brighten the teeth," and tap water was bubbled through radium.\textsuperscript{584} In 1975, sixty percent of Americans told pollsters they favored the construction of new nuclear power plants; by 1983, sixty percent were opposed.\textsuperscript{585} Years of polling showed that concern over RW was imperceptible until 1973, when a leak of liquid HLW at Hanford received wide publicity.\textsuperscript{586} HW was also a matter of little public concern; a 1973 survey for EPA found that most people had positive attitudes about HW facilities and would accept one in their county.\textsuperscript{587} Public opinion took a dramatic swing in the late 1970s, however. Love Canal came to light in 1978.\textsuperscript{588} In March 1979, the movie The China Syndrome appeared, and two weeks later its warnings were eerily confirmed at Three Mile Island. Since then public opposition to nuclear power and to HW/RW facilities has solidified.\textsuperscript{589}

Many theories have been offered for the widespread public opposition to HW/RW facilities, but I believe that the reasons can be summed up with two words: \textit{dread} and \textit{intrusion}. These have important implications for the siting dilemma.

\textsuperscript{582} Popper, supra note 17, at 5; Slovic et al., supra note 441.

\textsuperscript{583} Lyons et al., supra note 1, at 89, 91-92; Smith & Desvousges, supra note 410, at 294. Other surveys are reported in Easterling, supra note 342, at 442; Christopher J. Smith & Robert Q. Hanham, Any Place but Here! Mental Health Facilities as Noxious Neighbors, 33 Prof. Geographer 326 passim (1981). For discussions of the inconsistent roles of proximity in shaping public opinion about facilities, see National Resource Council, supra note 497, at 101-02; William Hallman & Abraham Wandersman, Perception of Risk and Toxic Hazards, in Psychosocial Effects, supra note 438, at 31, 45-47.

\textsuperscript{584} Michael E. Burns & William H. Briner, Setting the Stage, in Low-Level Radioactive Waste Regulation, supra note 188, at 1, 24.

\textsuperscript{585} Jacob, supra note 203, at 47.


\textsuperscript{587} B.S. Forcade, Public Participation in Siting, in Politics, supra note 341, at 111, 111.

\textsuperscript{588} See supra note 57 and accompanying text.

a. Dread

Polls confirm that by far the most important reason behind opposition to HW/RW facilities is concern over the impact on health, particularly the health of one's children. Apprehension about health effects is also at the root of the emergence, since about 1980, of thousands of grassroots organizations of facility opponents and “toxic victims.” These groups are organized into two nationwide coalitions: the Citizens Clearinghouse for Hazardous Wastes (CCHW), based in Arlington, Virginia, and the National Toxics Campaign, based in Boston.

Each issue of CCHW’s newsletter, Everyone’s Backyard, contains reports from regional correspondents about successful efforts to stop HW/RW facilities. These groups differ markedly in style, agenda, and constituencies from the mainstream national environmental organizations.

Every era has had its own dreads. The Israelites cast out Moses’s sister Miriam when she contracted leprosy. Successive


592. Edelstein, supra note 354, at 158-167; Pillier, supra note 315, at 165; Michael Heiman, From 'Not in My Backyard' to 'Not in Anybody's Backyard!', 56 J. Am. Plan. Ass'n 359 (1990); see also Campaigning for Environmental Justice, Everyone's Backyard, Feb. 1993, at 6, 10 (“Perhaps the most common denominator in grassroots fights for environmental justice is the issue of health effects. More people get involved in this movement because their children or other members of their family are ill from exposure to toxic chemicals than any other reason.”); Walter A. Rosenbaum, The Politics of Public Participation in Hazardous Waste Management, in Politics, supra note 341, at 176, 191-92 (noting the explosion of citizen activism on hazardous waste issues at both national and local levels in the early 1980s).

593. William Greider, Who Will Tell the People 213-21 (1992). Lois Gibbs, who founded CCHW after being evicted from her home near Love Canal, tells a story (possibly apocryphal) that dramatically illustrates these differences. At a hearing in Louisiana concerning a hazardous waste site, she recounts, citizens set up an aquarium filled with contaminated drinking water from their wells. They loudly announced that the fish they were about to place in the tank would be dead by the end of the hearing. When the government officials and traditional environmentalists in the room protested, the crowd began to chant “kill the fish.” Gibbs said, “If we have to kill the fish to make the point, we’ll do it. We’re sacrificing our children.” Edelstein, supra note 354, at 167.

civilizations have had ample reason to be terrified of plague, smallpox, and polio, until each was eradicated or controlled. These horrors have manifested themselves in disputes over siting; Louis Pasteur’s effort to find a laboratory to develop a rabies vaccine was hampered by residents of Paris who feared they would contract the disease. Cancer and AIDS offer us contemporary medical phobias. Often people who have been exposed to agents that might cause these diseases, or that simply fear such exposure, become preoccupied with health problems. When wastes are the source of these agents, a further layer of revulsion is added, at least in the view of Freudians. When the waste is burned, as in incinerators, the complex psychological reaction to fire comes into play. Yet another layer of horror accrues when the waste is radioactive. Since Hiroshima and Nagasaki, fear of nuclear war has become embedded in the culture. People over forty well remember the fallout shelter craze of the 1950s, the Cuban Missile Crisis of 1962, films like On the Beach (1959), Fail Safe (1964), Dr. Strangelove (1964), and any number of Grade B movies about post-nuclear-war-mutants. These horrible images of nuclear war have become melded in the public mind with nuclear waste. Polls conducted around the world during the 1980s showed that nuclear power and nuclear waste were regarded at the extreme negative end of almost every attribute of risk perception, such as dread, lethality (likelihood that a mishap would prove fatal), potential for catastrophe (multiple fatalities), involuntariness, and uncontrollability. The mental linkage of nuclear weapons and radioactive waste greatly impedes the siting of RW facilities. Although most

595. Seley, supra note 217, at 5.
601. See, e.g., Slovic, supra note 589, at 192-93; Slovic et al., supra note 441, at 1603.
RW is not prone to atomic explosion, many members of the public may not draw that distinction.

The sociologist Kai Erikson has written that "[m]aybe we should understand radioactive and other toxic substances as naturally loathsome, inherently insidious—horrors, like poison gas, that draw on something deeper in the human mind." He says that toxic emergencies possess two distinguishing characteristics that add to the dread they induce. First, they are unbounded and have no frame or end; the "all clear" is never sounded. Second, they are without form. You cannot apprehend them through the unaided senses; you cannot taste, touch, smell, or see them. That makes them especially ghostlike and terrifying. Moreover, they invert the process by which disasters normally inflict harm. They do not charge in from outside and batter like a gust of wind or a wall of water. They slink in without warning, do no immediate damage so far as one can tell, and begin their deadly work from within—the very embodiment, it would seem, of stealth and treachery.

An invisible, ambiguous threat tends to induce what Irving Janis calls hypervigilance: a complete, sometimes even obsessive attention to possible risks and ways to avoid them. There can be no less fertile soil for a proposal to site a HW/RW facility.

b. Intrusion

The insidiousness of their threat is closely related to the second major reason why HW/RW facilities are so hated. The facilities themselves are seen as imposed on communities without

602. But see Nuclear Weapons Complex, supra note 255, at 117 (finding that eight "criticality accidents" have occurred in the NWC, when critical mass was achieved with plutonium or uranium solutions, with several fatalities resulting); see also supra notes 183-184 (concerning explosions at Soviet nuclear waste facilities in 1957 and 1993).


604. Kai Erikson, Toxic Reckoning: Business Faces a New Kind of Fear, HARV. BUS. REV., Jan.-Feb. 1990, at 118, 121; cf. RHODES, supra note 311, at 594 (recalling that President Franklin Roosevelt refused to authorize use of poison gas over Iwo Jima before American invasion, even though it might have saved the lives of thousands of Allied soldiers, presumably because he remembered the world outcry that followed the German use of poison gas in World War I).


consent, and once they arrive, they do their damage silently. When forced on unwilling localities, the facilities are seen as colossal intrusions. Attempts to override local siting authority almost invariably backfire and increase local opposition, partly by intensifying the community’s perception of risk. Some studies have shown that people will accept voluntary risks approximately 1000 times more hazardous than risks they perceive as involuntarily imposed—they will parachute out of an airplane or smoke a cigarette, but they don’t want anyone to build a waste plant near their house. The Constitution places a high value on guarding against intrusions in people’s homes; the Third Amendment states that “[n]o soldier shall . . . be quartered in any house, without the consent of the owner . . .” and the Fourth Amendment guarantees “[t]he right of the people to be secure in their . . . houses . . .” An unwanted facility is another kind of intrusion. As Michael R. Edelstein has written in his study of communities that had experienced toxic accidents:

Rather than a place to escape to, with the contamination home had become a place that residents could not escape from. Parents particularly feared the consequences of continued residence for themselves and their children. Thus, home was inverted in the sense that it now was accompanied by a strong sense of fear and insecurity. Rather than buffering the family from the dangers of the outside world, home embodies these dangers.

This sense of intrusion is magnified when the waste is imported from other areas. The EPA has acknowledged that public opposition is greater when the facilities would accept out-of-state waste. This poses an especially difficult problem, because all fifty states export some HW to out-of-state treatment facilities, and

607. O’HARE ET AL., supra note 11, at 58; SCHMEIDLER & SANDMAN, supra note 381, at 54; Richard N.L. Andrews & Terrence K. Pierson, Local Control or State Override: Experiences and Lessons to Date, 14 POL’Y STUD. J. 90, 97 (1985); Daniel Burchard & Robert Hughes, Beyond Capacity: Addressing the Concerns of Local Opposition in the Siting Process, 6 STAN. ENVTL. L.J. 145, 151 (1986-87).

608. MORELL & MAGORIAN, supra note 10, at 63.

609. Inhaber, supra note 2, at 55 (observing that many opposed to the siting of a monitored retrievable storage facility in Tennessee drove to the hearing without wearing seat belts and smoked during the hearing).

610. U.S. CONST. amend. III.

611. Id. amend. IV.

612. EDELSTEN, supra note 354, at 64.

613. OFFICE OF SOLID WASTE & EMERGENCY RESPONSE, supra note 326, at 3. The same phenomenon has been observed abroad. See Stephen Tromans & Kathy Mylrea, Siting Hazardous Waste Facilities in the United Kingdom, NATURAL RESOURCES & ENV’T, Winter 1993, at 29, 29.
forty-eight states—all but Alaska and Montana—import such waste.\footnote{614} Approximately eight million tons of HW is shipped off-site every year, and about half of that crosses state lines.\footnote{615} The Supreme Court has made clear that the Commerce Clause precludes states and localities from excluding or discriminating against out-of-state waste.\footnote{616} Yet, the fear or the reality of importing waste from other areas has been a major impetus behind public opposition to HW landfills,\footnote{617} HW incinerators,\footnote{618} sewage sludge landspreading,\footnote{619} and MSW landfills.\footnote{620} This is a major reason why several states refused to enter into compacts with others for regional disposal facilities for LLRW\footnote{621} and HW.\footnote{622} Opposition has also been raised to acceptance of waste from elsewhere in the same state,\footnote{623} county,\footnote{624} and city.\footnote{625} In several celebrated inci-
dents, barges or trainloads of waste (one of which, bearing Baltimore sewage sludge, came to be known as the "Poo-poo Choo-choo") were forced to wander aimlessly after their intended destinations refused to take them, and no one else would accept them. A centerpiece of Daniel R. Coats' successful bid for the Senate seat vacated by Dan Quayle was opposition to MSW imports, especially from New Jersey. One of his television ads featured a fat, cigar-chomping man wearing a Yankees cap and a Cape May T-shirt littering the steps of the Indiana State Capitol. After his election, Senator Coats sponsored a bill, which passed the Senate but not the House, allowing states to ban or tax out-of-state shipments of MSW.

The EPA has promulgated a regulation under RCRA targeted against any state action "which unreasonably restricts, impedes, or operates as a ban on the free movement across the State border of hazardous wastes . . . ." Nonetheless, many states have attempted to restrict imports. There has been extensive litigation in both the federal and state courts challenging, and usually striking down, these attempts.


632. Many of these attempts are recounted in Capacity Assurance Program, supra note 27, at 153 (statement of Richard C. Fortuna, Hazardous Waste Treatment Council); W. Victoria Becker, Legal Issues Affecting Interstate Disposal 13-24 (1989); Piller, supra note 315, at 73-74.

633. See, e.g., Northern States Power Co. v. Prairie Island Mdewakanton Sioux Indian Community, 991 F.2d 458, 462 (8th Cir. 1993); In re Southeast Ark. Landfill, Inc., 981 F.2d 372, 373 (8th Cir. 1992); Government Suppliers Consolidating Servs., Inc. v. Bayh, 975 F.2d 1267, 1277 (7th Cir. 1992), cert. denied, 113 S. Ct. 977 (1993); Chemical Waste Mgmt., Inc. v. Templet, 967 F.2d 1058, 1059 (5th Cir. 1992), cert. denied, 113 S. Ct. 1048 (1993); National Solid Wastes Mgmt. Ass'n v. Voinovich, 959 F.2d 590, 592 (6th Cir. 1992); Hazardous Waste Treatment Council v. South Carolina, 945 F.2d 781, 790 (4th Cir. 1991); Diamond Waste, Inc. v. Monroe County, 939 F.2d 941, 944 (11th Cir. 1991); National Solid Wastes
Another concept closely related to intrusion is trust. Opposition is magnified when the community does not trust the people or institutions seeking to place HW/RW in their midst. The political prospects for several proposed HW facilities were severely damaged when it became known that their proposed developers had histories of environmental or other violations. Especially since Three Mile Island, large segments of the public mistrust the entire nuclear industry, adding serious difficulty to siting RW facilities. The DOE faces widespread distrust in its cleanup of the Nuclear Weapons Complex. This distrust can expand from individual companies or agencies to entire industries and even to the technological society. In the words of Professor Erikson:

If science and technology have become the source of risk . . . it is because toxic peril has moved people so far up the scale of suspicion that they come to distrust not only public officials and experts, not only the social order and the natural world, but also the very ethos of science and technology.

Mistrust is often accompanied by despair. The forces behind hazardous facilities are seen not only as evil but also as invincible. As Peter Sandman has said, "[i]ronically, nearly everyone is impressed by the community's power of opposition—except the community, which sees itself as fighting a difficult, even desperate
uphill battle to stop the siting juggernaut." During this battle, residents feel themselves trapped because the threat of the facility often makes it impossible for them to sell their homes at full price—an injury for which there is no legal remedy.

2. What Reduces Public Opposition?

Although a complex of reasons, which can be grouped together under the headings "dread" and "intrusion," intensify public opposition to HW/RW facilities, several other factors reduce opposition. These are discussed below.

a. Local Waste and Local Jobs

Although waste importation is mightily resisted, storage or disposal of waste at the point of generation often proceeds smoothly. Nuclear power plants around the country have expanded their capacity for storing spent fuel, for example, with very little public opposition. Many companies have been able to build on-site storage or disposal capacity with little or no controversy. This lack of opposition is attributable to the influence of several factors. First, no importation of waste, and thus no intrusion into the community, is involved. Second, the waste generators are often industries that create many local jobs. Third, inertia and familiarity blunt opposition to what could be seen as just more of the same. Finally, transportation risk is eliminated.

639. Sandman, supra note 468, at 444; see also Bachrach & Zautra, supra note 534, at 85 (explaining that many neighbors of proposed HW facility in Arizona believed they were powerless to stop it, and "[a]s a consequence, the psychologically most fragile and vulnerable residents were underrepresented in community activities and thus less visible to government officials attempting to 'take the pulse' and assess the impact of the HWF on the local population").

640. See supra part IV.B.2.

641. Walter, supra note 598, at 260.

642. See, e.g., Greenberg & Anderson, supra note 309, at 167 (concerning a facility in Logan Township, New Jersey); Gail Bingham & Daniel S. Miller, Prospects for Resolving Hazardous Waste Siting Disputes Through Negotiation, 17 Nat. Resources Law. 473, 485 (1984) (concerning a facility in Providence, Rhode Island); Paul Slovic & Baruch Fischoff, How Safe Is Safe Enough? Determinants of Perceived and Acceptable Risk, in Too Hot to Handle, supra note 586, at 112, 116 (concerning a facility in Oregon); Walter & Getz, supra note 374, at 240-41 (concerning facilities in Montana and Texas); see also Lyons et al., supra note 1, at 93 (noting that a public opinion poll shows a strong preference for on-site disposal); Zimmerman, supra note 623, at 197, 219, 225 (noting that a survey of newspaper coverage of siting controversies shows a high degree of public acceptance of on-site disposal); supra notes 352-360 (concerning a relative ease in expanding existing facilities); Holman, supra note 166, at 3 (statistical analysis showing much higher success rates for siting noncommercial (typically on-site) HW facilities than for commercial facilities).

643. See Morell & Magorian, supra note 10, at 38, 41, 55.
Some of the largest chemical companies employ on-site disposal as a matter of policy. Even Lois Gibbs' CCHW has advocated on-site disposal. When faced with the continuation of a polluting industry or the loss of many local jobs, communities have often agreed to keep the jobs and sacrifice the environment, even at discernable risk to public health.

Unfortunately for the waste disposal industry, off-site facilities tend not to create many jobs. The nation’s largest LLRW facility, located at Barnwell, has fewer than 200 employees. The West Valley nuclear facility at its peak had an operating staff of 170. A new HW incinerator in Ohio would employ only 104 people. An integrated waste management facility in Alberta, Canada operates with 94 employees. These numbers are not trivial, but unlike an automobile assembly plant, for example, they are hardly so overwhelming that they can overcome intense local opposition.

In several instances, the prospect of large numbers of local jobs did succeed in mobilizing local support for HW/RW facilities, although this local support did not always last. At one time, the Yucca Mountain facility in Nevada enjoyed local support, in part because the community believed that many of the 6800 jobs at the Nevada Test Site, one of the state’s largest employers, would be jeopardized by a nuclear test ban treaty. When WIPP was first conceived in the early 1970s, the nearby city of Carlsbad, New Mexico, which was facing major layoffs in the local potash industry, strongly supported the facility. The West Valley nuclear

644. Goodbaum & Rotman, supra note 390, at 18.
645. Citizens CLEARINGHOUSE, supra note 577, at 3.
647. Walter & Getz, supra note 374, at 241. An exception is a HLW repository, which is expected to create 870 to 1000 operation jobs. John K. Thomas et al., The Socioeconomic Impacts of Repositories, in NUCLEAR WASTE, supra note 491, at 103, 106.
648. ENGLISH, supra note 10, at 85.
652. CARTER, supra note 224, at 424.
653. Reith & Fischer, supra note 222, at 303, 308; Schneider, supra note 2, at 56.
project, which began in the early 1960s, received strong support from local residents, who were promised that it would lead to strong growth in the local economy. It is important to note, however, that both WIPP and West Valley were initiated before the onset of major opposition to nuclear power and RW.

Another reason for the favorable reception of on-site disposal is its strong appeal to fairness. There is an obvious equity in having each location take care of its own waste—an equity that has a major impact on public reaction to siting proposals.

b. Local Control

The opposite of intrusion is invitation. When a community invites a facility into its midst, the risk is voluntary, not involuntary. Voluntary siting elicits a far different psychological response, as the discussion later concerning the Canadian experience in facility siting will evidence.

Regardless of whether the facility comes to town by invitation, local control over the facility's operations has a powerful impact on local reaction. Numerous public opinion studies have shown that the ability of a municipality to monitor a facility, to participate in its management, and to shut it down if necessary, has a far greater impact on local acceptance than any other measure—considerably greater than financial compensation, for example. Some grassroots activists share this view.

654. Seley, supra note 217, at 93.
656. See infra part V.A.4.
658. See Fred Setterberg & Lonny Shavelson, Toxic Nation: The Fight to Save Our Communities from Chemical Contamination 236 (1993); Austin & Schill, supra note 352, at 76.
This finding was empirically confirmed by the success of Browning-Ferris Industries (BFI) in siting a HW landfill and treatment facility in Last Chance, Colorado—the only HW landfill sitting success since the passage of RCRA in 1976. BFI initially applied for county approvals in November 1980. The county denied the permits in June 1982. In early 1983, the state amended the sitting law to confirm that local governments could veto facilities but also that, if no locality approved a site within two years, the state could step in and site one. The county then extracted several concessions from BFI, including a reduction in volume, prohibitions on certain types of wastes, specified engineering techniques, and county determination of haul routes. The county also secured the right to inspect the facility, to receive $100,000 per year from BFI to pay for inspectors plus two percent of gross revenues to review and approve detailed engineering and construction drawings, and to require county approval of all fee schedules and proposed hours of operation. Having obtained this degree of local control and compensation, the county approved the project in August 1983. Opposition from some environmental groups and neighboring counties continued, but the state granted the necessary permits in 1987, and the facility finally opened in 1991, although by then BFI had sold it to another company.

c. Local Culture

As Mary Douglas and Aaron Wildavsky have written, "each culture, each set of shared values and supporting social institutions, is biased toward highlighting certain risks and downplaying others." Some communities have cultures that are not averse to HW/RW facilities. Survey research has demonstrated that public trust of power generation and waste disposal facilities increases with greater proximity to and familiarity with such facilities.

Experience confirms this.

A prime example is Richland, Washington, a city near the Hanford Reservation, which dominates the local economy. The


661. Rabe, supra note 354, at 177.
local high school basketball squad, "the Bombers," plays on a gym floor inscribed with a mushroom cloud; local residents can bowl at the Atomic Lanes or have a massage at the Atomic Health Center. There is strong local support for RW management, and the community is now turning into an environmental boom town (no pun intended) with thousands of new jobs devoted to cleaning up the mess from weapons production.662 Similar local cultures strongly supportive of RW or HW facilities have been described in Barnwell, South Carolina, home of the Barnwell LLRW facility and near the Savannah River Reservation;663 in Nye County, Nevada, the home of Yucca Mountain, the Nuclear Test Site, and the Beatty LLRW facility;664 in Oak Ridge, Tennessee, whose economy is based on nuclear technology and whose local government volunteered for the monitored retrievable storage facility for HLW;665 in Los Alamos, New Mexico, a community dominated by a nuclear weapons laboratory;666 in Fall River County, South Dakota, an area with extensive uranium mining, which indicated it would welcome an LLRW facility;667 in Hermiston, Oregon, site of an army depot where munitions and toxic chemicals had long been stored, which was amenable to receiving nerve gas from Okinawa;668 in Pinawa, Manitoba, the site of Canada's Whiteshell Nuclear Research Establishment, where the local government volunteered for Manitoba's HW facility;669 in the Bruce and Chalk River areas of Canada, which have nuclear facilities;670 and in Swan Hills, Alberta, a com-


663. ENGLISH, supra note 10, at 110-11.


665. See generally E. Brent Sigmon, Achieving a Negotiated Compensation Agreement in Siting: The MRS Case, 6 J. POLICY ANALYSIS & MGMT. 170 (1987); Dick Thompson, Living Happily near a Nuclear Trash Heap, TIME, May 11, 1992, at 53 (reporting that a local doctor who warned a community about risks from nuclear waste in Oak Ridge, Tennessee was disciplined by his employer and largely ignored by the city).


667. Colglazier & English, supra note 10, at 647 n.27.

668. Slovic & Fischhoff, supra note 642, at 126; see also Ronald Smothers, Plan to Destroy Toxic Weapons Polarizes a City, N.Y. TIMES, Sept. 24, 1992, at A16 (reporting that some residents in Anniston, Alabama support a plan to destroy chemical weapons at a local Army depot, while others oppose the plan).


WASTE FACILITY SITING

3. Implications

As the above discussion has shown, much opposition to HW/RW disposal facilities is caused by some combination of dread (an emotion largely derived from the nature and physical origin of the waste) and intrusion (a concept that considers whether the facility is imposed or invited, whether the waste is local or imported, and whether the facility’s builders are trusted). A number of factors, however, increase public acceptance of such facilities: the treatment of local waste, the provision or protection of local jobs, the degree of local control, and the nature of the local culture.

This framework helps explains a number of apparent anomalies:

1. There have been few, if any, siting successes with new commercial HW incinerators, because they are both dreaded (the byproducts of incineration, such as dioxin, are greatly feared) and intrusive (they import waste from a wide area). MSW incinerators attract much public opposition because their emissions are still dreaded. Nonetheless, many MSW facilities have been successfully established, because they are not so intrusive—they are usually built by municipalities to burn local garbage.

2. Although experts proclaim their safety, medical waste incinerators have met with ferocious local opposition largely because of their psychological association with today’s most dreaded disease, AIDS.

3. Radon, a naturally occurring radioactive gas emitted by many rock formations, has stirred relatively little public concern, largely because it is not at all intrusive; that is, it comes from nature, rather than being imposed by some outside, mistrusted human agency. Furthermore, if it gets into a house, it is eminently controllable.

4. Some activities that statistically pose a far greater risk of injury than HW/RW disposal, such as the trucking of gasoline around the country,\(^\text{672}\) stir little concern because they are neither

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\(^{671}\) J. McQuaid-Cook, *Siting a Fully Integrated Hazardous Waste Management Facility with Incinerator and Landfill, Swan Hills, Alberta, Canada*, in *INNOVATIVE APPROACHES*, supra note 2, at 123, 129.

dreaded nor intrusive and also because their risks are spread over a larger population.

5. To obtain gratification or other benefits, individuals engage in personal activities such as smoking and car racing that subject them to considerably greater risks than do HW/RW disposal facilities, but those activities are voluntary and therefore not intrusive.

6. On-site disposal of HW/RW is generally accepted, because it is not intrusive.\(^6\)

The above discussion of public opinion also has important implications for the siting process. Most importantly, it shows that the widespread practice of trying to preempt local control and force disposal facilities on unwilling communities is much like the medieval practice of bleeding the sick: it is exquisitely counterproductive. Not only does it never work, it actually increases opposition exponentially by turning what might be a voluntary risk into an involuntary, highly intrusive risk. Moreover, as previously demonstrated, preemption (if it worked) would also amount to a hidden subsidy for the creation of hazardous and radioactive waste. Unfortunately, preemption is deeply embedded in national siting policy and law.

A second implication is the flip side of the first: the search for volunteer sites should be central to a sound siting policy. It should be possible to find communities whose cultures will induce them to volunteer. In Part V, prior successful attempts to find volunteer communities are examined.

A third implication is that the opposition to importation, and the relative ease of on-site disposal, are likely to lead to a proliferation of a very large number of very small disposal facilities. This situation presents its own environmental hazards, and my proposed solution to that dilemma is stated in Part VI.

Finally, to address the opening question of this section: The current system of HW/RW facility siting is not politically viable. It is based on a lack of understanding of the psychological and sociological dynamics of siting, and it fosters public opposition that is almost always fatal to siting attempts.

V. PRIOR PROPOSALS FOR REFORM

This Section describes and assesses prior proposals to reform the siting process. I have divided them into three categories: those that seek to achieve local consent to build a facility (consensual); those that seek to impose a facility (coercive); and those that seek to avoid local siting altogether by eliminating, redefining, or exporting the waste (avoidance).

A. Consensual

1. Compensation

Michael O'Hare published the seminal paper on compensation in HW/RW facility siting in 1977, and many writers have since embraced and embellished his idea. The basic notion is that “[s]iting of noxious facilities tends to concentrate costs within an area proximate to the site while providing diffuse benefits over a wide area. Compensation measures can rearrange this distribution of costs and benefits.” Under this theory, compensation serves three purposes: it induces localities to accept facilities; it makes the victims whole; and, by internalizing the external costs of these facilities, it increases economic efficiency.

674. Strictly speaking, three separate concepts are involved. “Compensation” aims to recreate the status quo, and make communities whole, by paying for actual damages. “Mitigation” prevents, reduces, or eliminates adverse impacts before they occur. “Incentives” or “rewards” are positive inducements, beyond any actual or predicted damages, to reward communities for accepting risk. See MORELL & MAGORIAN, supra note 10, at 173; S.A. Carnes et al., Incentives and Nuclear Waste Siting: Prospects and Constraints, in RESOLVING LOCAL CONFLICT, supra note 17, at 359. In the discussion that follows, the term “compensation” is used generically to cover all three concepts.

675. O'Hare, supra note 525; see also O'HARE ET AL., supra note 11. O'Hare draws on the work of Frank I. Michelman, Property, Utility and Fairness: Comments on the Ethical Foundations of Just Compensation Law, 80 HARV. L. REV. 1165 (1967). An earlier, less detailed exposition of the idea articulated in O'Hare’s article may be found in Anthony J. Mumphrey et al., A Decision Model for Locating Controversial Facilities, 37 AM. INST. PLANNERS J. 397 (1971).

676. E.g., Bacow & Milkey, supra note 6, at 265; Bingham & Miller, supra note 642; Carnes et al., supra note 674, at 353; Herbert Inhaber, Can We Find a Volunteer Nuclear Waste Community?, PUB. UTIL. FORT., July 15, 1991, at 19; Miller, supra note 401, at 918; Ronald Pushchak & Ian Burton, Risk and Prior Compensation in Siting Low-Level Nuclear Waste Facilities: Dealing with the NIMBY Syndrome, 23 PLAN CAN. 68 (1983).

677. MORELL & MAGORIAN, supra note 10, at 167. In many ways this is the inverse of state land-use laws protecting environmentally fragile “critical areas,” such as coastal zones, shorelands, and wetlands. “These are areas where the benefits of development, in terms of new jobs or an expanded tax base, will be enjoyed by local residents, while the environmental losses will be felt statewide.” Richard Briffault, Our Localism: Part I—The Structure of Local Government Law, 90 COLUM. L. REV. 1, 65 (1990).
The idea of compensation has been widely embraced in HW/RW siting legislation. The HW siting statutes of at least thirteen states mandate some kind of compensation or economic incentive.\(^{678}\) Twelve states offer compensation packages for communities getting LLRW facilities.\(^{679}\) The NWPA provides for payments of twenty million dollars per year to the host state (or Indian tribe) for the HLW repository, and ten million dollars per year to the host of the monitored retrievable storage facility,\(^{680}\) with additional "impact aid" to the state and affected local governments.\(^{681}\) The state or tribe can also receive several million dollars per year prior to the opening of the facilities but only if it waives its rights to object to the siting.\(^{682}\)

Despite all this support, compensation has never been used successfully in siting a HW/RW disposal facility in the United States.\(^{683}\) The reason is clear: the opposition to these facilities stems mainly from concern over their impact on health, particularly children's health,\(^{684}\) and people will not accept any amount of money that will allow others to endanger their children.\(^{685}\) Individuals that perceive these facilities as dangerous will not change these perceptions when offered money,\(^{686}\) and they view the offer

\(^{678}\) Green, supra note 37, at 93. Under some of these laws, the communities near existing facilities receive a gross receipts tax. See Teresa H. Sharp, Tax Windfall Didn't Set Off a Spending Spree, NIAGARA GAZETTE, Nov. 28, 1992, at 1 (reporting that the towns of Lewiston and Porter, New York each received $1 million in 1992 from Chemical Waste Management in compensation for its operation of hazardous waste landfills; the towns used a portion of those funds for legal and expert fees to oppose the company's plans to build two HW incinerators on the site).


\(^{682}\) 42 U.S.C. § 10,173a(b) (1988).


\(^{684}\) See supra notes 590-97 and accompanying text.

\(^{685}\) That is not to say that people will not often endanger their own children, through everything from passive smoking to nonuse of car seats to overt abuse. But these dangers are imposed by parents, not by an intrusive outside force.

itself as immoral,\textsuperscript{687} "bribery,"\textsuperscript{688} or "blood money."\textsuperscript{689} The moral problems are amplified when money is offered to low income communities.\textsuperscript{690} The closest that compensation has come to siting successfully a HW/RW facility was in 1981, when the City of Baltimore agreed to locate a HW landfill in an industrial neighborhood surrounded by other landfills. Under this proposal, the City would receive a redeveloped park and five dollars per ton of waste, and the twenty-two nearby families would be relocated. However, the city also insisted on a ban on out-of-state wastes—a condition that helped doom the project economically.\textsuperscript{691} As noted above, compensation also contributed to the successful siting of the HW landfill in Last Chance, Colorado. Local control, however, seems to have played a much more decisive role there.

In conclusion, compensation works when, and only when, the community does not believe the proposed facility poses an undue hazard.\textsuperscript{692} Compensation has accordingly been quite successful in siting MSW landfills and incinerators, which have much lower perceived risks than HW/RW facilities.\textsuperscript{693}

\textsuperscript{687} Some of the moral issues are discussed in \textsc{Douglas \& Wildavsky}, \textit{supra} note 589, at 67; \textsc{Mark Sagoff}, \textit{The Economy of the Earth} 68-69 (1988); \textsc{Been}, \textit{supra} note 491; \textsc{Peters}, \textit{supra} note 491, at 50.

\textsuperscript{688} \textsc{Carnes et al.}, \textit{supra} note 674, at 362; \textsc{Bradford C. Mank}, \textit{The Two-Headed Dragon of Siting and Cleaning Up Hazardous Waste Dumps: Can Economic Incentives or Mediation Slay the Monster?}, \textit{19 Envtl. Aff.} 239, 275 (1991).

\textsuperscript{689} \textsc{Godsil}, \textit{supra} note 540, at 408; \textsc{Lisa Aug}, \textit{We’re Selling Our Souls to Polluters, Niagara Gazette}, June 30, 1993, at 11A.

\textsuperscript{690} \textit{See Bullard, supra} note 528, at 91; \textsc{Schmeidler \& Sandman}, \textit{supra} note 381, at 111-12; \textsc{Walker}, \textit{supra} note 598, at 249-50; \textit{see also} \textsc{Austin \& Schill}, \textit{supra} note 352, at 70; \textsc{Lynette Holloway}, \textit{28 Acres of Roof and a Place to Play in West Harlem}, \textsc{N.Y. Times}, Sept. 1, 1992, at B1 (reporting on a controversy over a park that is on the roof of a new sewage treatment plant in minority community in New York City); \textsc{Elizabeth Royte}, \textit{Other People’s Garbage: The New Politics of Trash: A Case Study}, \textsc{Harper’s}, June 1992, at 54, 60 ("Garbage tends to concentrate in depressions: it rolls downhill until it hits those places most desperate to deal.").

\textsuperscript{691} \textsc{McKewen \& Sloan}, \textit{supra} note 334, at 250.

\textsuperscript{692} Respondents to a few public opinion surveys have said that they would be more willing to accept HW facilities if they received compensation. These surveys are discussed in a 1993 unpublished manuscript by Professor Vicki Been (on file with author). However, such results do not seem to have been translated into actual behavior.

2. Negotiation and Mediation

Many commentators have urged that siting disputes be resolved through negotiation, usually with the assistance of a mediator.\(^6\)\(^9\)\(^4\) Several handbooks have been written to guide the process.\(^6\)\(^9\)\(^5\) Nineteen states have procedures for negotiation or mediation between facility developers and proposed host communities.\(^6\)\(^9\)\(^6\) The NWPA established a presidentially appointed position, the Nuclear Waste Negotiator, whose job is to "attempt to find a State or Indian tribe willing to host a repository or monitored retrievable storage facility at a technically qualified site on reasonable terms . . . ."\(^6\)\(^9\)\(^7\)

Massachusetts pioneered mediation in HW siting disputes. In 1980, that state enacted a siting law which was conceived by three scholars from MIT and Harvard, Michael O'Hare, Lawrence Bacow, and Debra Sanderson, who had written widely on compensation mechanisms.\(^6\)\(^9\)\(^8\) The statute involved a formal process of mediator-aided negotiations between the state, the locality, and the facility developer, leading to a compensation agreement; if no agreement could be achieved, one would be decreed by an arbitrator. This statute served as the model for laws soon enacted in Rhode Island, Connecticut, Wisconsin, and Virginia, and it received extensive scholarly commentary.\(^6\)\(^9\)\(^9\) By now, however, it

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\(^{696}\) HAZARDOUS WASTE FACILITY SITING, supra note 1, at 16.


\(^{698}\) Mank, supra note 688, at 274 n.199.

\(^{699}\) See, e.g., BRION, supra note 2, at 7-29; SCHMEIDLER & SANDMAN, supra note 381, at 276-92. See generally Bacow & Milkey, supra note 6 (discussing the innovative Massachusetts siting statute that requires developers to negotiate compensation agreements with host communities); Bingham & Miller, supra note 642, at 479-80 (reporting that Massachusetts, Wisconsin, and Rhode Island have passed siting statutes that incorporate negotiation between
is clear that the law has not succeeded. There have been six serious siting attempts under the Massachusetts law since 1980, the most recent one ending in 1992; every one of them failed. Nor have any new HW disposal sites been created in the other states that adopted the Massachusetts model, although an on-site wastewater treatment facility was permitted in Providence, Rhode Island.

Negotiation suffers from precisely the same shortcoming as does compensation: outside threats to the health of one's children are nonnegotiable. Negotiation and compensation both work when the community does not fear for its children's health. Indeed, the principal purpose of the mediation process is to negotiate a compensation package. In Wisconsin, thirty-four solid waste facilities, but not a single new hazardous waste disposal facility, have been sited using negotiation. Negotiation does little to address the usual underlying causes of public opposition, and citizen activists warn against even entering into the process; "industries already have the battle more than half won when they can get their citizen opponents to sit down with them and speak their language." Low-income communities are also concerned that they do not have sufficient bargaining power to extract necessary concessions.

the local community and developers); Caskey, supra note 7, at 64-66 (comparing Pennsylvania's statute to comparable laws in Wisconsin and Massachusetts); Bernd Holznagel, Negotiation and Mediation: The Newest Approach to Hazardous Waste Facility Siting, 13 ENVTL. AFF. 329, 354-68 (1986) (discussing statutes in Massachusetts, Wisconsin, Rhode Island, and Connecticut that authorize, or even require, negotiation and mediation of waste facility siting disputes).


701. Bingham & Miller, supra note 642, at 484. At least two storage, as opposed to disposal, facilities have been sited in Wisconsin. Another mediation process, known as the Keystone Process, has been tested in Texas, with no greater success. Thomas O. McGarity, Public Participation in Risk Regulation, 1 RISK—ISSUES IN HEALTH & SAFETY 103, 125-28 (1990).

702. Bingham & Miller, supra note 642, at 479.


704. Heiman, supra note 592, at 361.

3. Public Participation and Public Information

Public participation is an important element of most environmental permit processes. Sherry Arnstein has formulated a "ladder of citizen participation," ranging (top to bottom) from citizen control to delegated power, partnership, placation, consultation, informing, therapy, and manipulation. Participation methods currently used in HW/RW siting run the shortened gamut from placation (negotiated concessions) to manipulation (public relations campaigns). The most common forms are public hearings, citizen advisory committees, and membership on state siting boards. Eleven states also give technical assistance grants.

A strong undercurrent running through much of the facility siting literature hints that public ignorance is at the root of opposition and that the mission of citizen participation and public information is to correct or neutralize this ignorance. Not much evidence exists, however, that public participation serves this purpose, and it appears that public participation, especially when poorly handled, can actually increase public opposition. Moreover, the undercurrent seems based on a false assumption; facility opponents have been found to be just as knowledgeable, on average, as proponents.


707. Sherry Arnstein, A Ladder of Citizen Participation, in THE POLITICS OF TECHNOLOGY 243 (Godfrey Boyle et al. eds., 1977); see also MORELL & MAGORIAN, supra note 10, at 119. A different spectrum is presented in McGarity, supra note 701, at 113-30.

708. HAZARDOUS WASTE FACILITY SITING, supra note 1, at 16. For a description of a process in Ontario in which intervenors were given several million dollars to hire lawyers and experts for adjudicatory hearings, see Gait, supra note 2.

709. See, e.g., MORELL & MAGORIAN, supra note 10, at 23, 65, 117, 120; Bacow & Milkey, supra note 6, at 269; "[F]inding sites for the safe disposal and processing of hazardous materials is largely a problem of managing local opposition."); Hazardous Waste: Education Seen as Key to Overcoming Public Resistance to Incinerator Siting, 23 Env't Rep. (BNA) No. 52, at 3196 (Apr. 23, 1993); Matheny & Williams, supra note 341, at 73.


Overall, public information campaigns have failed in their purpose. Although such campaigns can increase perception of risk, there is little or no evidence that they can reduce this perception.

4. Volunteers

The usual practice in siting has been called "decide, announce, defend" (often followed by "surrender"). The opposite approach entails requesting communities to volunteer to host facilities. This method has three principal advantages and four principal disadvantages. The advantages are: (1) it decreases intrusion—by making the risk voluntary, it reduces the perception of risk; (2) it draws out those communities with cultures that will accept these facilities; and (3) it usually leads to payment of the full social costs of a facility, because the hidden subsidies of pre-emption are eliminated. The disadvantages are: (1) it would be coincidental if volunteering communities also happened to have favorable geology and other physical conditions; (2) equity problems can arise, because low income communities may be more prone to volunteering; (3) it is difficult to define the borders of the relevant community, and people just beyond the borders may object; and (4) it is generally assumed that few communities will volunteer.

Several Canadian provinces have managed to avoid all the disadvantages and successfully site HW facilities in volunteer communities. The methods they used are instructive. In 1982, Alberta established a Crown (government-owned) corporation, the Alberta Special Waste Management Corp. (ASWMC), to build a centralized facility with HW incineration, treatment, landfilling,

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712. V. Kerry Smith & F. Reed Johnson, How Do Risk Perceptions Respond to Information? The Case of Radon, 70 REV. ECON. & STAT. 1, 8 (1988).

713. See Portney, supra note 531, at 39, 41, 46; Kasperson, supra note 285, at 58; Michael L.P. Elliott, Improving Community Acceptance of Hazardous Waste Facilities Through Alternative Systems for Mitigating and Managing Risk, 1 HAZARDOUS WASTE 397 (1984); see also R.W. Lake & L. Disch, Structural Constraints and Pluralist Contradictions in Hazardous Waste Regulation, 24 ENVT & PLAN. A 653, 665 (1992) (arguing that the hazardous waste management system narrows the frame of debate so that public participation "can only be expressed in terms of self-interested local opposition to facility siting," rather than in a more meaningful discussion about whether facilities are needed).

714. Morell & Magorian, supra note 10, at 128.

and deep-well injection. In 1984 the ASWMC asked all the municipalities in the province if any would like to be considered for the facility; seventy percent responded positively. After a series of information presentations and community meetings, several towns dropped out as they were free to do. The ASWMC selected five finalists based on technical criteria. Referenda were then held in the five towns to ensure that local support existed. The ASWMC chose the town of Swan Hills, a community founded in the 1950s as a camp for rig hands for the oil drilling companies that still dominate its economy, where the referendum had passed by a seventy-nine percent margin. The town hosted a champagne celebration after the selection, and one of the losing communities protested with newspaper ads. The facility, which is owned sixty percent by a private company and forty percent by ASWMC, opened in 1987. In 1990, it received local support for quadrupling its capacity.716

The Manitoba Hazardous Waste Management Corporation (MHWMC) was established in 1986. It underwent a very similar process. About fifty municipalities expressed interest in a HW facility, and thirty-five open houses were held to determine initial community support. Five communities became actively involved in the siting process, four rural towns plus the City of Winnipeg. Two of the towns dropped out after referenda, and one was disqualified on technical and economic grounds. That left one rural town, Montcalm, and Winnipeg. Montcalm is an agricultural area with a population of about 1700. A major north-south highway to the United States runs through it, accustoming the community to truck traffic. Several neighboring communities have supported Montcalm’s efforts. Winnipeg, which has 625,000 of the province’s 1.1 million people, planned to locate the facility adjacent to its MSW landfill, about three kilometers from the nearest residential area. In 1992, the MHWMC chose Montcalm and issued a construction permit.717

716. AUDREY ARMOUR, SOCIAL IMPACT ASSESSMENT OF NEW HAZARDOUS WASTE FACILITIES: CONTRASTING PROCESSES IN ALBERTA AND ONTARIO ILLUSTRATE PRACTICAL VALUE OF SOCIAL CONSIDERATIONS 18-24 (1986); SCHMEIDLER & SANDMAN, supra note 381, at 268-275; Jennifer McQuaid-Cook, Siting a Fully Integrated Hazardous Waste Management Facility with Incinerator and Landfill, Swan Hills, Alberta, Canada, in INNOVATIVE APPROACHES, supra note 2, at 123; Dave Wenger, Siting the Alberta Special Waste Treatment Centre: A Public Consensus—An Alberta Success, in PROCEEDINGS, supra note 38, at 124; Tomsho, supra note 453, at Al.

717. Ed Brethour, The Attempted Siting of a Physical-Chemical Hazardous Waste Treatment Facility in Hamiota, Manitoba, in INNOVATIVE APPROACHES, supra note 2, at 43; Alun Richards, Implementing a Voluntary and Responsive Siting Process in Rural and Urban Set-
One place that has been particularly receptive to new facilities is Tooele County, Utah. The county covers 7000 square miles, roughly the size of Connecticut, but has only 28,000 residents. The Tooele Army Depot stores large quantities of chemical weapons. The county has set aside a one hundred square mile hazardous-waste-disposal district for a new hazardous waste incinerator and a uranium mill tailings landfill. This district has created about 500 new jobs and brings in $2 million in annual "mitigation fees," which have allowed the county to freeze its property taxes.\(^7\)

A new hazardous waste facility has also been sited in a willing community in Quebec,\(^7\) and Ontario is now attempting to site a LLRW facility using the same process as Alberta and Manitoba, with similarly positive responses.\(^7\)\(^2\)\)

Other than Last Chance, Colorado; Tooele County, Utah; and Baltimore, Maryland, there have been no similar, locally desired HW/RW sittings in the United States since 1976. This is largely the result of state, rather than local, opposition. Martinsville, Illinois, a rural town of about 1200, volunteered to host the LLRW facility for the midwestern states, and sixty-eight percent of its residents voted in favor in a 1988 referendum. Nonetheless, a state board refused to issue a permit.\(^7\)\(^2\)\(^1\) One town in Michigan and two in Wisconsin had also volunteered for this facility.\(^7\)\(^2\)\(^2\) Many residents of Nye County, Nevada, the home of Yucca Mountain, support the construction of a HLW repository there, but the state has


\(^{721}\) ENGLJSH, supra note 10, at 55-57; Gretchen D. Monti, "All Politics Is Local": Integrating Local Concerns into Facility Site Selection, in PROCEEDINGS, supra note 38, at 36; Martinsville, supra note 244, at 1.

vigorously fought the proposal. The voters of Fall River County, South Dakota, a uranium mining region, voted in favor of a LLRW facility in 1985, but the state rejected the proposal. Fremont County, Wyoming expressed interest in a HLW storage facility in 1992, but the governor vetoed the idea; the same thing happened the same year in Apache County, Arizona. In 1969, ninety-five percent of the residents of Hermiston, Oregon favored an Army nerve gas storage facility, but ninety percent of the state’s residents were opposed. Other communities have supported HLW or LLRW facilities, only to be thwarted by state opposition: Naturita, Colorado; San Juan County, Utah; Edgemont, South Dakota; Nye County, Nevada; Barnwell, South Carolina; Oak Ridge, Tennessee; and Richland, Washington. Some other communities initially volunteered but later changed their minds. This occurred in Boyd County, Nebraska, which first supported and then opposed a LLRW facility; Woodland, North Carolina, which changed its mind about a hazardous waste incinerator; and Carlsbad, New Mexico, which initially invited the WIPP project. The town of Ashford, New York, the location of the West Valley nuclear facility, had a referendum in 1991 on hosting New York’s LLRW repository. The vote was 702 opposed to 533 in favor, but the Town Board soon thereafter voted to approve the

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723. Flynn et al., supra note 664, at 418.
724. English, supra note 10, at 104.
727. Contreras, supra note 2, at 536 n.329.
731. Carter, supra note 224, at 177-78.
facilities anyway. The following November the Town Board was reelected. The ultimate outcome in Ashford remains to be seen.\textsuperscript{732}

Several MSW facilities have been sited after calls for volunteers,\textsuperscript{733} sometimes after favorable votes in local referenda.\textsuperscript{734} Some fights have arisen between volunteer communities and their neighbors,\textsuperscript{735} but this is an unusual result.

5. Risk Substitution

In 1991, two commentators independently suggested the approach of risk substitution, that is, allowing a new HW facility to be built if a corresponding reduction in the risk results from some other nearby facility.

Kent E. Portney, after reviewing the public opinion evidence, posited that most siting schemes had failed because they attempted to reduce risk perceptions, an approach, he soundly concluded, that is all but futile. To address this problem, he suggested searching for existing facilities, such as chemical plants, ammunition factories, and nuclear power plants, that neighbors regard as dangerous; buying the old factory and shutting it down; and building the new HW facility on the same site or nearby. This, Portney reasoned, would be acceptable to the neighbors, because there would be no net change in the risks to which they were exposed.\textsuperscript{736}

Bradford C. Mank had a similar notion but focused on just one type of old facility: contaminated sites such as orphaned Superfund sites or MSW landfills. He suggested that waste man-


\textsuperscript{736} PORTNEY, supra note 531, at 137-59. Peter Huber had earlier discussed risk substitution in the products liability context. Huber, supra note 356, at 1073.
agement companies be allowed to build new disposal facilities in exchange for remediating an existing contaminated site in the community. 737

These proposals, although innovative, miss two important psychological dynamics. First, as discussed earlier,738 people react differently to old risks than to new ones. An existing facility, next to where a person has been living for years, may appear less threatening than a new one, even if objectively the latter poses far less risk. Second, if people are really concerned about an existing risk, they may demand that it be abated regardless of any plans for new facilities. People may consider it unjust to be forced to accept a new risk in order to eliminate an old one, especially because once they have the new facility, they will never be rid of it.

B. Coercive

1. Preemption

Part IV demonstrated that preemption of local authority is counterproductive as a HW/RW siting strategy, because it greatly increases perception of risk by making siting involuntary (intrusive), and it in effect would subsidize the creation of HW/RW. Moreover, it has also never succeeded in actually siting a new HW/RW facility. 739 Nevertheless, preemption remains a common feature in federal and state siting law and policy. 740

RCRA provides that nothing in it "shall be construed to prohibit any State or political subdivision thereof from imposing any requirements, including those for site selection, which are more stringent than those imposed" under the EPA's regulations. 741 Nonetheless, the EPA announced in 1980 that "the process of site

737. Mank, supra note 688, at 282-85. It was reported in 1990 that the New Jersey Legislature was considering a bill with similar features. W.B. Clapham, Jr., Some Approaches to Assessing Environmental Risk in Siting Hazardous Waste Facilities, 12 Env'tl. Prof. 32, 37 (1990). Additionally, a citizens' task force in Oak Ridge, Tennessee proposed that the siting of the monitored retrievable storage facility for HLW in that area be linked to a schedule for DOE cleanup of existing contamination in the area. C.P. Wolf, The NIMBY Syndrome: Its Cause and Cure, 502 Annals N.Y. Acad. Sci. 216, 223 (1987).

738. See supra text accompanying notes 661-71.


selection [should] not be hampered by blanket vetoes" and, in 1983, promulgated a regulation disapproving "[a]ny aspect of State law or of the State program [under RCRA] which has no basis in human health or environmental protection and which acts as a prohibition on the treatment, storage or disposal of hazardous waste in the State . . . ." In 1985, during consideration of what became the capacity assurance provisions of CERCLA, a Senate committee declared that "the process of site selection should find a way to transcend blanket local vetoes. No community should be able to remove itself from consideration on political grounds alone. Everyone must take responsibility for assuring that adequate sites are available." In 1986, the Eighth Circuit held that a county ordinance which prohibited the storage, treatment, or disposal of HW conflicted with RCRA because the ordinance did not allow the wastes to be handled in the manner deemed safest by Congress and the EPA. In 1988, after North Carolina enacted a law inhibiting the siting of a particular HW facility, the EPA began proceedings to revoke the state's authority to implement RCRA. Although some environmentalists claimed at the time that the EPA's proceedings were motivated by improper influences from the waste management industry, the EPA ultimately found that North Carolina's actions were legal because they did not amount to a statewide prohibition on HW facilities.

For obvious reasons of national security, federal primacy in the disposal of radioactive waste is well established, although

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742. EPA, supra note 706, at 7.
746. Green, supra note 37, at 6.
the states have been given the responsibility to find sites for LLRW.\footnote{750}{See supra text accompanying notes 237-41.}

Meanwhile, at least twenty-four states specifically reserve state override authority of local zoning laws in the siting of HW facilities,\footnote{751}{HAZARDOUS WASTE FACILITY SITING, supra note 1, at 12; see also Illinois Low-Level Waste Facility Law Eliminates Local Veto of Siting Decisions, 23 Env't Rep. (BNA) No. 47, at 3028 (Mar. 19, 1993).} and very few states leave facility siting decisions entirely in the hands of localities.\footnote{752}{See Godsil, supra note 540, at 406 (only California and Florida); Tsao, supra note 539, at 371.} Judicial decisions present a broad range of views on the degree of authority remaining to local government.\footnote{753}{The cases are reviewed in Melissa Thorme, Local to Global: Citizen's Legal Rights and Remedies Relating to Toxic Waste Dumps, 5 Tul. Envtl. L.J. 101, 104-22 (1991); McCabe, supra note 468, at 179-86; William B. Johnson, Annotation, Validity of Local Regulation of Hazardous Waste, 67 A.L.R.4th 822, 825-30 (1992).}

Several commentators have argued that local authorities should be overridden when they unduly restrict HW facility siting,\footnote{754}{See, e.g., Andreen, supra note 10, at 823; Davidson, supra note 341, at 550; A. Dan Tarlock, State Siting Laws, Local Land Use Laws, and Their Interplay, 15 Envl. L. Rep. (Envtl. L. Inst.) 10,236, 10,238 (1985); see also Laurie Reynolds, The Failure of Local Landfill Siting Control in Illinois, 17 S. Ill. U. L.J. 1, 41-49 (1992) (arguing that excessive control has been given to municipalities in siting MSW landfills in Illinois).} but others recognize that this is futile.\footnote{755}{See, e.g., O'HARE ET AL., supra note 11, at 24; Andrews, supra note 336, at 117, 121-22; Colglazier & English, supra note 10, at 641. See generally Robert W. Lake & Rebecca A. Johns, Legitimation Conflicts: The Politics of Hazardous Waste Siting Law, 11 Urb. Geography 488 (1990); Daniel A. Spitzer, Maybe in My Backyard: Strategies for Local Regulation of Private Solid Waste Facilities in New York, 1 Buff. Envtl. L.J. 87 (1993).} As Gail Bingham and Daniel S. Miller have written, "[s]imply preempting local controls . . . is unlikely to resolve the siting dilemma because it does not address the causes of opposition. Rather than disappearing, the opposition just surfaces somewhere else—in administrative challenges that complicate permit proceedings or in lawsuits that tie permits up in court."\footnote{756}{Bingham & Miller, supra note 642, at 477.}

2. Penalties

Orlando E. Delogu has proposed federal legislation requiring states to site HW/RW facilities, with a provision that "any state that will not fashion an effective siting mechanism will lose all forms of direct and indirect federal financial support . . . in those program areas in which NIMBY-type activities [preclude] needed
sites.\textsuperscript{757} The Low-Level Radioactive Waste Policy Amendments Act (LLRWPA) imposes financial penalties on states that do not make provisions for disposal of LLRW, and it originally required such states to take title to the LLRW.\textsuperscript{758} Although mechanisms of this sort require states to site facilities, they do not dictate any particular sites.

3. Governmental Facilities

The federal government, with requisite congressional authorization, theoretically could pick a site, take it by eminent domain if necessary, and build a facility on it. As we have seen, a comparable approach was taken at Yucca Mountain and has been stymied at every turn. States could do the same, but all such attempts to date have failed.\textsuperscript{759}

In addition to the obvious political problems, states may be reluctant to build their own HW/RW facilities, because doing so would make them liable under CERCLA for contamination caused by the facilities.\textsuperscript{760} The states would, in effect, take title to the waste, which is the same consequence that the Supreme Court held was unduly intrusive when imposed by Congress under the LLRWPA.

C. Avoidance

1. Waste Reduction

Few would disagree that the ideal way to solve the HW/RW siting dilemma would be to avoid generating the waste in the first place, assuming this could be done with acceptable economic consequences. Reducing generation of HW/RW has numerous benefits in addition to reducing the need for, and the environmental impact of, disposal sites: it increases the efficiency of raw materials utilization; it reduces the potential liability of generators; it reduces accidents in the transportation of the waste; it reduces leakage of waste at the locations of production, storage, transportation, and disposal; and depending on the technology used, it can...
reduce worker exposure to hazardous materials and reduce the presence of such materials in consumer products. Moreover, facility opponents consistently demand greater waste reduction.\footnote{761}{See Cole, supra note 443, at 1996; Heiman, supra note 592; Lillie C. Trimble, \textit{What Do Citizens Want in Siting of Waste Management Facilities?}, 8 \textit{RISK ANALYSIS} 375, 376 (1988).}

Despite these undisputed advantages, the law is strikingly weak on waste reduction. The Clean Air Act and the Clean Water Act are full of command and control mechanisms to reduce the production of air and water pollutants, and the Clean Air Act contains explicit marketplace incentives to reduce pollution. But the laws governing hazardous waste and radioactive waste have no comparable provisions.\footnote{762}{Clifford S. Russell, \textit{Economic Incentives in the Management of Hazardous Wastes}, 13 \textit{COLUM. J. ENVTL. L.} 257, 262 (1988).} Some HW statutes urge waste reduction, but none of the provisions have any teeth. The RW statutes offer nothing at all that requires or even encourages waste reduction.

RCRA declared one of its objectives to be “minimizing the generation of hazardous waste and the land disposal of hazardous waste by encouraging process substitution, materials recovery, properly conducted recycling and reuse, and treatment”\footnote{763}{42 U.S.C. § 6902(a)(6) (1988).} and announced a national policy “that, wherever feasible, the generation of hazardous waste is to be reduced or eliminated as expeditiously as possible.”\footnote{764}{42 U.S.C. § 6902(b)(2) (1988); see Robert F. Blomquist, \textit{Developing a Long-Term Waste Management Strategy: Beyond the EPA and OTA Reports: Toward a Comprehensive Theory and Approach to Hazardous Waste Reduction in America}, 18 \textit{ENVTL. L.} 817, 823 (1988).} The only enforcement mechanism, added by the Hazardous and Solid Waste Amendments of 1984\footnote{765}{Pub. L. No. 98-616, 98 Stat. 3221 (1984) (codified at scattered sections of 42 U.S.C.).} (HSWA), is that each generator must certify, in the manifests that accompany all shipments of HW, that it “has a program in place to reduce the volume or quantity and toxicity of such waste to the degree determined by the generator to be economically practicable.”\footnote{766}{42 U.S.C. § 6922(b)(2) (1988).} A small quantity generator must merely certify, in fine print on the standard manifest form, that “I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can
afford." A lawyer would be hard pressed to find anywhere else such a short sentence with so many loopholes. The biennial reports each generator must file with the EPA must also state "the efforts undertaken during the year to reduce the volume and toxicity of waste generated." It does not appear that any generator has ever been sanctioned for inadequate or false certification of waste minimization efforts. In mid-1993, the EPA published guidelines on the elements of a waste minimization plan that would allow a generator to issue a proper certification; the results remain to be seen. President Clinton also directed all federal agencies to develop and implement pollution prevention plans.

Despite the name of the statute, the Resource Conservation and Recovery Act, the EPA devoted such little funding and so little priority to conservation and recovery that one disgruntled official said RCRA should more aptly be called DRIP, the Dump Regulatory and Investigatory Planning Act. CERCLA contains no provisions concerning waste minimization at all. The EPA's directives to the states concerning capacity assurance reports stated that waste reduction was the preferred method of addressing hazardous waste problems; but again, no enforcement mechanism exists.

In 1990 Congress enacted the Pollution Prevention Act, declaring in even stronger rhetoric the national policy of reducing pollution at the source. This enactment calls on the EPA to develop and implement a strategy to promote source reduction, to give grants to the states, and to collect data and establish an infor-


771. Sidney M. Wolf, Public Opposition to Hazardous Waste Sites: The Self-Defeating Approach to National Hazardous Waste Control Under Subtitle C of the Resource Conservation and Recovery Act of 1976, 8 ENVTL. AFF. 463, 525 (1980); see also LANDY et al., supra note 58, at 125 (arguing that in writing the RCRA regulations in the late 1970s, "EPA could have looked for ways to encourage product and process redesign and recycling in order to lower the volume of waste requiring disposal. As public opposition to all disposal options has built, one is struck by how little attention this approach received from EPA during the Carter years").


information clearinghouse, but it has no regulatory punch whatsoever.774 Congress authorized sixteen million dollars per year775 to implement the act. This amounts to half the cost of cleaning up an average National Priorities List site.776 Several states have enacted their own pollution prevention statutes, but few of these laws are any stronger than the federal laws.777

The environmental impact statement (EIS) process is ordinarily an important mechanism for examining alternatives, but the builders of waste-generating facilities (such as chemical plants) are not required to discuss waste minimization in their EISs.778 EISs for waste disposal facilities, such as landfills, typically devote a page or two to waste minimization, compared to dozens of pages on recycling and hundreds on technological alternatives.

Many industries are working to reduce the hazardous waste they generate not because of the above toothless laws but because of the high price of waste disposal779 and because of fears of liability at disposal sites.780 Because waste generators have been held jointly and severally liable under CERCLA for cleanup of landfills to which they sent waste,781 large generators have become very skittish about using landfills. This has led to an increased prefer-


776. See supra note 66 and accompanying text.

777. See Johnson, supra note 774, at 203; see also Stephen L. Kass & Michael B. Gerrard, New York's Requirements for Reducing Hazardous Waste, N.Y. L.J., Nov. 21, 1990, at 3. One exception is the New Jersey Pollution Prevention Act of 1991, N.J. STAT. ANN. §§ 13:1D-35 to -50 (West 1991), which requires firms within the state to reduce their use of hazardous materials and reduce their production of HW by fifty percent over five years. Id. § 13:1D-40. This statute was enacted in partial response to protests against proposals to site HW incinerators in the state. Lake, supra note 10, at 90-91.

778. But see N.Y. ENVTL. CONSERV. L. § 8-0109(2)(i) (McKinney Supp. 1993) (requiring EISs prepared under New York State Environmental Quality Review Act to discuss "effects of proposed action on solid waste management where applicable and significant").

779. See supra text accompanying notes 389-391; see also OFFICE OF TOXIC SUBSTANCES, U.S. EPA, THE TOXICS RELEASE INVENTORY: A NATIONAL PERSPECTIVE, 1987, at 266 (1989) (noting that many reporting companies are attempting to reduce waste generation because of high treatment or disposal costs).

780. Goodbaum & Rotman, supra note 390, at 18.

ence for HW incineration\textsuperscript{782} and to the formation of consortia to inspect disposal facilities.\textsuperscript{783} Fear of liability has also led to a degree of overcompliance; many risk-averse companies send to HW landfills, rather than to ordinary solid waste landfills, material that technically may not be RCRA hazardous waste but that (it is feared) may one day be listed as such or might be contaminated with some HW, or material whose regulatory status is uncertain.\textsuperscript{784} New York State has estimated that forty to sixty percent of the waste disposed at its hazardous waste landfills is not legally hazardous.\textsuperscript{785} Whatever the reason, the amount of HW reduction and recycling is reported to be steadily rising.\textsuperscript{786}

Many estimates of the potential for waste reduction exist. Because the various studies to offer these estimates employed different methods and terms, they are not comparable. Several of them, however, calculated that more than half of all the hazardous waste generated in the country could be eliminated through technological measures.\textsuperscript{787} Such measures are not without precedent. In the 1970s, comparable efforts enabled industry to reduce its energy consumption significantly in the face of the oil crisis. In 1973, oil prices soared in the wake of the first OPEC oil embargo, forcing many industries to rethink their production methods. In just over a decade—between 1973 and 1984—American industry cut energy

\textsuperscript{782} ALEX. BROWN \& SONS, supra note 51, at 9-10; CAROL DANSEREAU, SMOKESCREEN: THE MYTH OF INCINERATOR NEED 18 (1992); DAVID J. SAROKIN ET AL., CUTTING CHEMICAL WASTE: WHAT 29 ORGANIC CHEMICAL PLANTS ARE DOING TO REDUCE HAZARDOUS WASTES 140, 142 (1985).

\textsuperscript{783} Goodbaum \& Rotman, supra note 390, at 21; Letter from Edgar Berkey, Chemical Hazardous Waste Management Evaluation Group, to Author (July 31, 1989) (on file with the Tulane Law Review).


\textsuperscript{785} N.Y. STATE DEP'T OF ENVTL. CONSERV., NEW YORK STATE HAZARDOUS WASTE FACILITY SITING PLAN AND ENVIRONMENTAL IMPACT STATEMENT 4-22 (1989) (revised draft). New York State attempted to prohibit nonhazardous waste from being sent to its hazardous waste landfills, but this effort was struck down on procedural grounds. CWM Chemical Servs., Inc. v. Jorling, Index No. 70,900 (N.Y. Sup. Ct. Niagara County July 23, 1991).


\textsuperscript{787} Warren, supra note 28, at 15.
requirements per unit of output by thirty percent. As Ronald T. McHugh wrote:

[T]he economics of waste minimization has frequently been the driving force in process engineering evolving from the early time-and-motion studies, through material shortages in World War II, to the energy crisis of the 1970s, and finally to today's emphasis on compliance and materials cost savings tied to the direct and indirect costs of environmental requirements.

Among the methods available for reducing generation of hazardous waste are changes to process inputs, improved plant management or housekeeping, changes in process equipment or technology, recycling and reuse of materials within a process, and changes in the design of end products.

The amount of hazardous waste generated depends critically on the price of waste disposal. This has been demonstrated both theoretically and through extensive interviews with plant operators. The experience at Borden Chemical Plant in Richmond, California illustrates this dynamic. The plant formerly generated approximately 350 cubic yards of phenolic resin sludge per year. When the cost of landfilling the sludge increased from $50 to $150 per yard, the plant changed its procedures for rinsing filters, rinsing reactor vessels, and increasing employee awareness of how to prevent small but significant losses of materials. These measures reduced the amount of sludge produced by ninety-three percent.

Conversely, low waste disposal costs can discourage waste minimization. USS Chemicals disposes of its liquid wastes through deep-well injection. Although it could recover phenol from the wastewater prior to injection, or reduce phenol wastes at the


792. Sarokin et al., supra note 782; see also Rick Mullin, New Direction on Hazwaste, CHEMICAL WK., Jan. 20, 1993, at 26.

source, the company continues to use injection because it is cheaper. 794

Waste minimization efforts can greatly affect the need for disposal facilities. For example, plans to build a new HW incinerator in Washington State have been called into question as a result of the vigorous waste minimization program of Boeing, without whose waste the incinerator would not be economically viable. 795 DuPont's waste reduction efforts allowed it to cancel an agreement to supply one-third of the waste that was to feed a new HW incinerator in Ohio. 796 Large chemical and petrochemical plants are rebuilt on a rolling ten to fifteen year cycle. As new plants, designed after waste minimization became a major issue, are developed, waste generation at these facilities—which are by far the largest generators of HW—can be expected to decline significantly. 797

The United States lags far behind Europe in the use of waste minimization technologies. Bruce Piasecki and Gary Davis, who have compared waste management on the two continents, attribute this not only to the relative scarcity of land and materials in Europe but also to the contrasting dominance of chemical engineers in the European waste management industry, in comparison to the former landfill operators in the United States. Piasecki and Davis write: "The evolution of hazardous waste management from garbage collection also helps explain America's peculiarly long reliance on landfill disposal. Both the practitioners and regulators had long experience with landfill disposal; thus both parties were slow to address hazardous waste management as a chemical engineering problem instead of a dirt-moving one." 798

2. Taxes and Charges

Much current discussion about reforming environmental law centers on economic incentives that would use such mechanisms as marketable permits and effluent charges. 799 Reducing the generation of MSW by use of disposal charges has often been pro-

794. Id. at 124-25.
795. DANSEREAU, supra note 782, at 109.
797. ALEX. BROWN & SONS, supra note 51, at 11.
posed,\textsuperscript{800} and numerous municipalities have actually adopted similar approaches.\textsuperscript{801}

The notion of financing the Superfund through a tax on waste generation or disposal of hazardous waste, which is called a "waste-end tax," was discussed when CERCLA was first enacted in 1980 and also during the reauthorizations of RCRA in 1984 and CERCLA in 1986. In each case the idea was rejected, largely because of concern that such a tax would increase illegal dumping.\textsuperscript{802} As shown above, this concern was misplaced.\textsuperscript{803} Instead, the Superfund is financed largely through a fee on chemical feedstocks,\textsuperscript{804} plus a surcharge on corporate income taxes.\textsuperscript{805} This method creates little or no incentive to reduce waste generation.\textsuperscript{806} However, several states have adopted waste-end taxes.\textsuperscript{807}

Some commentators have described an intricate system in which waste taxes or charges are fine-tuned to the external costs of

\begin{itemize}
\item \textsuperscript{803} See supra part IV.C.2.
\item \textsuperscript{804} I.R.C. §§ 4661-4662.
\item \textsuperscript{805} I.R.C. § 59A.
\item \textsuperscript{807} Gordon, supra note 401, at 829.
\end{itemize}
the disposal methods used.808 However, these systems require quantification of external costs in a way that is simply beyond the current state of the art.809 Any lawyer who has tried a toxic tort case knows that it can take weeks of testimony to prove that a particular incident of waste disposal led to a particular illness. Quantifying the future adverse health and environmental effects of numerous methods of disposal of thousands of different kinds of wastes, and then defending that quantification in front of some tribunal (for the taxed industries will surely demand a due process right to challenge their assessments), would create a litigation industry rivaling that which has arisen around CERCLA.

There is, however, another way to use economic incentives to reduce hazardous waste generation: rather than create artificial market mechanisms, eliminate the hidden subsidies and allow the market itself to create those incentives. This proposal is explored further in Part VI.

3. Recycling810

In the public image, recycling involves such environmentally benign activities as bundling newspapers and separating cans and bottles. At the plants where those newspapers, cans and bottles are actually processed into new products, however, considerable pollution is created.811 For certain materials, it is not clear whether secondary manufacturing (making products from recycled material) produces less pollution per ton of material processed than does primary manufacturing.812 Proposed facilities to recycle and compost ordinary MSW have attracted considerable community opposi-

808. See, e.g., Congressional Budget Office, supra note 800, at 5; Menell, supra note 390, at 659, 727; see also Molly K. MacAuley et al., Using Economic Incentives to Regulate Toxic Substances passim (1992); Bradford C. Mank, Preventing Bhopal: "Dead Zones" and Toxic Death Risk Index Taxes, 53 Ohio St. L.J. 761, 762 (1992). A much simpler system of waste taxes is proposed in Hirschlhorn & Oldenburg, supra note 800, at 346-50.

809. See Applegate, supra note 463, at 261; Cinti, supra note 463, at 158.

810. The term "recycling" is used here in its colloquial sense and not in the technical meaning provided by RCRA's exclusion of recycled materials from the definition of "solid waste." See American Mining Congress v. EPA, 907 F.2d 1179, 1185-87 (D.C. Cir. 1990); Stephen Johnson, Recyclable Materials and RCRA's Complicated, Confusing, and Costly Definition of Solid Waste, 15 Envtl. L. Rep. (Envtl. L. Inst.), at 10,357 (1985).


812. Id. at 191. But see Schall, supra note 408 (arguing that secondary materials production has considerably lower environmental impact than primary production for most materials).
The benefits of solid waste recycling lie, instead, in preserving virgin materials, conserving landfill space, saving energy, and reducing the need for incineration.

When the material to be recycled is hazardous waste, the problems are considerably more severe. Some HW/RW recycling operations, such as smelting of lead from automobile batteries, reprocessing waste oil, and reprocessing spent nuclear fuel, although often worthwhile, are highly polluting. A hazardous waste recycling facility is not much more desirable as a neighbor than any other kind of hazardous waste treatment plant. Thus, off-site recycling offers little solution to the HW/RW facility siting dilemma.

4. On-Site Treatment and Disposal

As discussed earlier, there are both legal and psychological advantages to the treatment and disposal of HW at the point of generation, if that is feasible. The use of mobile incinerators has allowed exploration of these advantages. These units travel in a convoy of several large trailers and are set up at Superfund sites for a few months at a time to destroy on-site wastes. They are then disassembled and moved to another location. These units attract less opposition than commercial incinerators, because they do not involve intrusion of waste from other regions and they are seen as temporary. They are far from universally accepted, however,
and some areas have expressed concern that, after installation, the mobile unit will become permanent and will accept off-site wastes. This concern is not entirely without basis. Congress initially directed that the on-site incinerators for destroying old chemical weapons be dismantled after all the material had been burned. Later, however, Congress rescinded this requirement, and the military is reportedly studying the possible use of these incinerators to destroy remedial waste from other sites. On-site incineration at NPL sites peaked in 1988 and has been declining ever since.

On-site disposal is still in growing favor for waste from ongoing production processes. For remedial waste, however, on-site disposal has the disadvantage of preventing the property from obtaining a "clean bill of health," thereby scaring away potential purchasers that are concerned about future liability.

5. Alternative Treatment Technologies

Few communities look favorably on hazardous waste landfills and incinerators. New treatment technologies currently being developed have not, at least so far, acquired the same negative image. Consequently, they do not attract the same opposition.

These alternative technologies are typically used on-site to treat remedial wastes. One prime example is bioremediation, which is the use of bacteria or fungi to destroy waste. A similar
approach is used in most sewage treatment plants. Bioremediation is a young technology, and its effectiveness and environmental consequences are still unclear. Genetically engineered organisms are being created to attack particular kinds of wastes. Some commentators have expressed concern over the release of these organisms into the environment. Others have suggested that, if the wrong methods are used, certain carcinogens could be created.

Another newly fashionable technology is thermal desorption, in which organic-contaminated soils, sludges, and sediments are heated (but not burned) in a chamber that volatilizes the organics and collects them for further treatment or recycling. Between 1990 and 1992, thermal desorption in hazardous waste cleanups doubled, while the use of mobile incinerators at HW sites lost popularity. This reversal of fortune has been attributed to the stigma attached to incineration. It is not clear, however, whether thermal desorption involves lower risks to the community.

Further technological advances in the coming years may decrease the need for off-site facilities for the disposal of remedial wastes, but it is impossible to predict the magnitude of the impact of future developments.

6. Deregulation

One common but seldom-discussed way to avoid the HW/RW siting problem is to define the material as nonhazardous. This

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831. Technological innovation in waste management has a long history. During the cholera epidemic of 1891, Hamburg’s neighbors refused to accept waste from the city. Because there was no space for a landfill, Hamburg built what became the first solid waste-burning incinerator in Europe. Rainer Funke, Cleanup and Recycling of a Dioxin Contaminated Area: Glasnost—the Way to Acceptance, in INNOVATIVE APPROACHES, supra note 2, at 89, 89. The relationship between regulation and technological development in hazardous waste treatment is discussed in Richard C. Fortuna, Same Wastes, New Solutions: The Market for Treatment Alternatives, in BEYOND DUMPING, supra note 560, at 199, 202-06.
form of deregulation has allowed many kinds of wastes to avoid the rigors of the RCRA program and to be disposed of as ordinary garbage, burned as fuel, flushed down the sewer or kept on-site indefinitely. The EPA has a formal procedure for generators to petition to have a particular waste stream "delisted" under RCRA. The principal application and impacts of deregulation, however, have taken place beyond the scope of this relatively narrow provision.

Government exemptions have placed some large waste streams beyond the pale of hazardous waste regulations. For example, the 1980 Bevill Amendment exempted huge volumes of mining waste and other materials from RCRA. RCRA’s exemption for hazardous waste used as fuel presents another significant example. Such exemptions invite manipulation of waste categorization. RCRA’s fuel exemption, for instance, led to a practice known as “sham recycling,” in which cement kilns, lime kilns, blast furnaces, and the like burned huge quantities of liquid hazardous waste at prices far below those charged by the better regulated HW incinerators. Until the EPA finally closed the loophole in 1991 by imposing stringent air pollution regulations, these units were burning nearly twice as much HW as were HW incinerators. Even now these units, which were often sited many years ago in what are now residential areas, account for a significant portion of the nation’s HW incineration capacity.

Another example of attempted deregulation occurred in the wake of the D.C. Circuit’s decision in late 1991 to invalidate, on procedural grounds, aspects of the EPA’s definition of HW. The EPA, under the prodding of Vice President Dan Quayle and his Council on Competitiveness, took that opportunity to propose an

833. See supra notes 118-21 and accompanying text.
entirely new set of definitions that would have had the effect of exempting broad groups of materials from RCRA.\textsuperscript{837} By September of 1992, this proposal had become an issue in the presidential campaign, and the White House Chief of Staff, James A. Baker III, ordered its withdrawal.\textsuperscript{838} Similarly controversial was a 1990 proposal by the NRC to declare certain radioactive materials as "below regulatory concern," so that they could go to ordinary MSW landfills rather than to LLRW facilities. This proposal drew storms of protest, and NRC withdrew it in 1991.\textsuperscript{839}

There are many other examples of controversial exemptions, or attempted exemptions, from the definitions of regulated materials in an effort to save money for generators and to reduce the demand on HW/RW disposal facilities.\textsuperscript{840} In many cases, both the proposals and the outcomes are driven more by politics than by science.

The regulatory ax swings both ways, and legal or political developments will often render a given substance subject to the HW/RW laws. For example, the enactment of the Clean Air Act Amendments of 1990 had the effect of adding forty new chemicals to the list of hazardous substances that are regulated under CERCLA.\textsuperscript{841} The abandonment of commercial reprocessing caused spent fuel rods kept at nuclear power plants to be converted from a resource into a radioactive waste. Current discussions between the


\textsuperscript{838} Keith Schneider, Campaign Concerns Prompt White House to Drop Waste Plan, N.Y. TIMES, Sept. 30, 1992, at A1.


\textsuperscript{840} See, e.g., New Debris Rule to Reduce Treatment Needed for Disposal, Lower Costs, EPA Says, 23 Env't Rep. (BNA) No. 17, at 1257 (Aug. 21, 1992) (concerning rule on debris contaminated with HW); New EPA Rules Aid Planned Disposal Site, Enc"g's News-Rec., Nov. 25, 1991, at 10 (observing that the EPA's redefinition of waste, coupled with rule on expedited permitting for facilities accepting such waste, will allow planned landfill in Houston to open much more quickly); Perspectives: Beneficial Reuse, Solid Waste & Power, Industry Sourcebook 1993, at 10 (discussing a proposal by New York State to grant "beneficial use determinations" for ash and other solid wastes, exempting them from usual regulatory requirements).

United States and the Russian republics will determine how much of the fissile material inside old Soviet warheads becomes “waste.”

7. Remote Siting

Transportation of waste to some desolate, unpopulated area, where a leak will injure no one, is a common aspiration for waste disposal. As has been amply demonstrated by the Yucca Mountain controversy, such plans have no guarantee of political acceptance. Moreover, deserts, which frequently offer an appropriate environment under this criterion, have their own special environmental problems, despite their advantages of remoteness and aridity. They are subject to strange wind effects, such as tornados and “dust devils”; they are often in places that are tectonically active; and they typically have corrosive salts in their upper layers. The U.S. Bureau of Land Management has supported the construction of a commercial hazardous waste treatment facility and landfill in the Broadwell Dry Lake basin in San Bernardino County, California, an area bounded by several wilderness areas, but the EPA has objected, largely because of impacts on wetlands and air quality, even though there are no neighbors for many miles. Moreover, reliance on remote areas raises serious questions of geographic equity. Accordingly, deserts provide no easy remedy.

One form of remote siting is prevalent, however: locating a facility near a border so that many of its neighbors will be in some other jurisdiction. An uncanny number of actual or proposed facilities are very close to a state or municipal border. Sometimes this arguably occurs because the borders are formed by bodies of water that attract heavy industry, but often this justification does not apply. Examples include California’s proposed LLRW facility in Ward Valley, near the Arizona border; Michigan’s proposed LLRW facility in rural Riga Township, across the Ohio border from the suburbs of Toledo; a proposed LLRW facility in North

844. For a discussion of geographical equity, see supra part IV.D.1.
846. Smolen et al., supra note 410, at 4.
Carolina two miles from the South Carolina border; the new hazardous waste incinerator in East Liverpool, Ohio, on the Ohio River across from West Virginia; the Model City hazardous waste complex in the extreme northwestern corner of New York State, near Canada; New Jersey's plan to put a hazardous waste incinerator on a narrow body of water called the Arthur Kill, directly across from Staten Island, New York; several facilities in Hudspeth County, wedged in the western panhandle of Texas between New Mexico and Mexico; and the effort of Pascagoula, Mississippi, to burn medical waste in an incinerator right across the city line from Moss Point, Mississippi. Additionally, plans are underway to build several hazardous waste facilities in Texas near the Mexican border.

8. Export

Remote siting refers to locations within the same jurisdiction. Even more attractive to most politicians is export: sending waste to a different jurisdiction. This approach includes sending waste to other cities or states, shipping it to other nations, disposing of it in the oceans, and shooting it into outer space. The idea is typified by a Saturday Night Live "commercial" for a fantastic new device, the Yard-a-Pult, which allows suburbanites to dispose of their garbage by catapulting it over the back fence into the yards of their neighbors.

848. Olsen, supra note 309, at 491-93.
a. Other Cities and States

The massive political and legal wars recounted earlier over the interstate transportation of waste all involve efforts of one jurisdiction to transfer its waste to another. Sometimes export of residue is an explicit part of a siting deal. For example, to secure approval by his city council for the construction of a large MSW incinerator, New York City Mayor David Dinkins cancelled plans to dispose of the ash at the city’s landfill in Staten Island and instead promised to export it, to Virginia, as it developed. On other occasions, a community will demand that an entire landfill be exhumed and its contents shipped elsewhere, even though the process of exhumation may well release gases into the neighborhood that could cause considerably greater health risks than leaving the landfill in place.

b. Other Nations

A huge international trade exists in hazardous waste, with waste travelling mostly from north to south. The West African nations of Benin, Guinea, and Guinea-Bissau have been among the most active importers. Guinea-Bissau once negotiated a contract of $120 million per year—more than the country’s annual budget—to store HW from other countries, but public outcry forced the government to rescind the deal. Unscrupulous waste merchants are known or suspected to have dumped numerous loads of HW at sea.

RCRA bars the international export of HW unless the United States and the receiving country have a waste exchange agreement, and the receiving country has agreed to accept the shipment. In

859. MOYERS, supra note 626, at 5.
August 1992, the U.S. Senate ratified the Basel Convention on the Control of Transboundary Movements of Hazardous Waste and Their Disposal, which establishes broad international controls, although not as broad as some would have liked. However, Congress has not yet enacted implementing legislation. The net result of these and related international controls is that it is unlikely that U.S. waste generators will lawfully be able to export large quantities of HW. However, stringent enforcement will be required to guard against illegal exports.

c. Oceans

The oceans have long been used for the disposal of HW/RW. The United States began dumping radioactive waste at sea in 1946. By the time the practice stopped in 1970, the United States had dumped an estimated 107,000 containers of RW—mostly concrete-capped fifty-five-gallon drums—at twenty-eight sites in the Atlantic and Pacific Oceans and the Gulf of Mexico. Until the early 1970s, the near-shore areas were commonly used as dumping sites for several types of HW. The United States also formerly dumped obsolete nerve gas and other chemical weapons in the ocean. Most of this stopped with the passage of the Marine Protection, Research and Sanctuaries Act of 1972, but dumping of acid wastes, contaminated dredge spoils, sewage sludge, and treated municipal and industrial waste waters continued until most of those practices, in turn, were barred by the Ocean Dumping Ban Act of 1988, effective at the end of 1991. One illegal practice persists off the Atlantic and Gulf coasts: filling barges with HW and abandoning them. The London Dumping Conven-
tion of 1972\textsuperscript{870} has also governed waste disposal at sea since 1975, together with a complex of other international agreements.\textsuperscript{871}

Ocean incineration of hazardous waste has received considerable attention. Four sets of research or interim burns occurred under the EPA's authority between 1974 and 1982, all using a ship called the Volcanus \textsuperscript{J.872} In 1983 the EPA held a public hearing concerning ocean incineration in Brownsville, Texas, which was proposed as an embarkation port. More than 6200 people attended, the overwhelming majority of whom were opposed to the incineration, making it the largest hearing in the EPA history.\textsuperscript{873} The EPA proposed regulations concerning ocean incineration in 1985,\textsuperscript{874} but never finalized them. Several companies wishing to burn at sea failed to persuade the EPA to grant them permits.\textsuperscript{875}

Even if the regulatory climate for ocean incineration improved,\textsuperscript{876} it could not have much of an impact on the overall HW disposal picture. For technical reasons, only about eight percent of all hazardous wastes (mostly liquid chlorinated wastes) is suitable for ocean incineration,\textsuperscript{877} and even the most ardent proponents foresee an incineration fleet of no more than a few ships, together burning only a tiny fraction of all the nation's HW.\textsuperscript{878} Ocean incineration began on a commercial basis in Europe in 1969 and peaked at 108,000 tons per year in 1980. It has been declining


\textsuperscript{872} OFFICE OF TECH. ASSESSMENT, supra note 28, at 179.


\textsuperscript{877} Incineration of Hazardous Waste at Sea, supra note 110, at 221.

\textsuperscript{878} OCEAN INCINERATION: ITS ROLE IN MANAGING HAZARDOUS WASTE, supra note 28, at 517.
ever since, plagued by technical problems (including discovery of
dioxin in the exhaust gases), market failures, and political
protests.\textsuperscript{879}

Proposals occasionally arise to build offshore islands for
deep-sea ports, refineries, waste disposal, and the like.\textsuperscript{880} The
Deepwater Port Act authorizes licenses for artificial ports that han-
dle oil and not for those handling other commodities.\textsuperscript{881} The fed-
eral government has jurisdiction over the seabed from the three-
mile limit to the edge of the continental shelf,\textsuperscript{882} and it is likely that
an offshore island for any other purpose would require explicit
congressional authorization.\textsuperscript{883}

Proposals for disposal of HW/RW under the deep sea floor
still arise from time to time.\textsuperscript{884} In 1987, when Congress designated
Yucca Mountain, a provision was inserted into the NWPA, as a
concession to the Nevada congressional delegation,\textsuperscript{885} calling for a
study of sub-seabed disposal of HLW.\textsuperscript{886} Scientists at the Woods
Hole Oceanographic Institution have suggested dropping torpedo-
shaped canisters of HLW into the sea floor's sediments,\textsuperscript{887} but this
proposal, like all the others, does not seem to be going anywhere.

d. Outer Space

Disposing of high-level radioactive waste or plutonium by
projecting it into outer space has been seriously
discussed.\textsuperscript{888} The
concept entails using a space shuttle to carry a waste package to a
low-level earth orbit, and then transferring the waste to another

\begin{itemize}
\item \textsuperscript{879} Bruce W. Piasecki & Hans Sutter, Alternatives to Ocean Incineration in Europe, in
\textit{America’s Future}, \textit{supra} note 35, at 67.
\item \textsuperscript{880} See, e.g., \textit{James Ehmann, Chatty’s Island passim} (1982).
\item \textsuperscript{881} 33 U.S.C. §§ 1501-1524 (1988).
\item \textsuperscript{882} Outer Continental Shelf Lands Act, 43 U.S.C. §§ 1331-1356 (1988).
\item \textsuperscript{883} See United States v. Ray, 423 F.2d 16, 20 (5th Cir. 1970).
\item \textsuperscript{884} See, e.g., A. Aristides Yayanos, \textit{Ocean Engineering: Sea-Burial of Toxic Wastes},
25 \textit{Cal. Bus.} 105 (1990); Keith Schneider, \textit{Scientists Suggest Dumping Sludge on Vast, Barren
Ocean Dumping}, 260 \textit{Science} 423 passim (1993) (reporting that the Woods Hole Oceano-
graphic Institute argues that deep-sea dumping would be a waste of money).
\item \textsuperscript{885} Shapiro, \textit{supra} note 201, at 64.
\item \textsuperscript{886} 42 U.S.C. § 10,204 (1988).
\item \textsuperscript{888} \textit{Jacob, supra} note 203, at 36 (noting that James Schlesinger had advocated space
disposal when he was chairman of the Atomic Energy Commission); \textit{Tang & Salting, supra}
note 185, at 383; Charles D. Hollister & Harry W. Smedes, \textit{Selecting Sites for Radioactive
Waste Repositories, in Hazardous Waste Management}, \textit{supra} note 344, at 63, 63; William
A2.
\end{itemize}
rocket for insertion into a solar orbit, where it would be expected to remain for at least one million years.\textsuperscript{889} This approach would not be entirely unprecedented; already orbiting the earth is the detritus of thirty years of space flight, ranging from large objects, such as discarded rocket bodies and derelict satellites, to smaller items, such as trash bags discarded from previous missions; clouds of urine ice crystals; and a lost Hasselblad camera.\textsuperscript{890} Approximately forty nuclear-powered devices are currently in space, carrying about a ton of radioactive material.\textsuperscript{891} One of these devices, a Soviet satellite containing Uranium-235, fell back to earth in 1978 and landed in Canada. The U.S.S.R. paid three million dollars to reimburse Canada for the cost of finding and cleaning up after the satellite.\textsuperscript{892}

Five international treaties have been cited that arguably would prohibit waste disposal in space, although their effect is not clear.\textsuperscript{893} Wholly apart from the very troubling ethical issues, outer-space disposal has serious practical problems. It currently costs about $10,000 per kilogram to put materials into space;\textsuperscript{894} rockets sometimes crash; the manufacture of rocket fuel has occasionally involved fatal accidents,\textsuperscript{895} is highly polluting, and creates its own hazardous wastes;\textsuperscript{896} and the burning of rocket fuel is so polluting that it has its own subsection in the Clean Air Act.\textsuperscript{897} In fact, the test firing and actual use of rockets is claimed to be a major cause of stratospheric ozone depletion.\textsuperscript{898}

\begin{itemize}
\item \textsuperscript{891} \textit{Id.} at 4.
\item \textsuperscript{892} \textit{Id.} at 24-25.
\item \textsuperscript{893} \textit{Id.} at 11.
\item \textsuperscript{894} \textit{Id.} at 10.
\item \textsuperscript{895} \textit{Benjamin A. Goldman, \textit{The Truth About Where You Live: An Atlas for Action on Toxins and Mortality} 128-29 (1991).}
\item \textsuperscript{897} 42 U.S.C. § 7503(e) (1988).
\end{itemize}
9. Do Nothing

The final alternative that has been seriously offered to building new disposal facilities is simply to stop building them. Several states have stopped even entertaining permit applications. One environmental advocate has called for a “progressive not-in-anybody’s-backyard solidarity [that is] required for a democratic challenge to a socially unjust and an environmentally unstable production process.” This approach is founded on the idea that if no more disposal capacity is provided, companies will be forced to stop generating the waste.

Robert W. Lake, adopting a similar viewpoint, has called for reframing the entire siting question:

Siting hazardous waste incinerators, for example, constitutes a locational solution to an industrial production problem (hazardous waste generation). But the incinerator siting solution is only one of a number of possible strategies for hazardous waste management. The facility siting strategy concentrates costs on host communities, as compared to the alternative strategy of restructuring production so as to produce less waste, which concentrates costs on capital.

In the words of Lois Gibbs of the Citizens Clearinghouse for Hazardous Wastes, grass-roots groups “are doing some terrific stuff. People are following the strategy. They’re stopping landfills, stopping incinerators, and backing up the wastes. They’re plugging up the toilet.”

VI. A Proposed Solution: Local Control, State Responsibility, National Allocation

A. Reprise: The Lessons of Experience

The reader by now has endured a detailed discussion of the many things that have gone wrong, and the few things that have...
gone right, in HW/RW facility siting. I will now try to summarize the lessons of this experience as a prelude to proposing an alternative approach based on those lessons.

The current siting impasse has led to the perpetuation of old, poorly sited, environmentally unsound on-site and off-site disposal facilities, which are disproportionately located in low-income and minority communities. The neighbors endure the externalities of these old facilities without recompense, and thus, they effectively subsidize the creation of HW/RW. An even more powerless group, our descendants, provides a further subsidy because the siting impasse has left HW/RW contained in impermanent vessels, such as landfills and capped Superfund sites, that will have to be cleaned up in the more or less distant future. These vessels proliferate around the country because most places do not want to accept waste from any other place.

Partly as a result of the siting impasse, the price of waste disposal has greatly increased. This is both good and bad. It is good in that the creation of hazardous waste and LLRW (although probably not HLW and TRU) is highly price elastic, and the high price of disposal sparks the development of alternative, waste-reducing production techniques. These techniques may drastically reduce creation of hazardous waste: generation of LLRW has already been cut by more than half.\textsuperscript{904} The high price is bad because it increases the cost of cleaning up the waste that has already been created, leading to delayed and impermanent remedies.

There is no "out of sight, out of mind" solution to HW/RW. International law and politics prevent reliance on third world countries, the oceans, and outer space. Domestic law and politics preclude shipping all the waste to remote deserts and wilderness. HW/RW recycling is environmentally problematic. New techniques for treating (as opposed to preventing) HW/RW show promise, but some of them present their own environmental problems, and it is too early to know if they will make much of a contribution. Thus accomplishing our task—finding the system of HW/RW management that maximizes social welfare, takes full account of social and economic costs, and still achieves fairness—must focus on two methods: minimizing the creation of new HW/RW; and finding a limited number of sites for new disposal facilities to replace the old, poorly sited units and to handle the remedial waste that already exists. Although these new facilities will be far

\textsuperscript{904} See supra text accompanying note 397.
superior environmentally to the old ones they replace, they will not be benign. Accordingly, their numbers should be minimized.

The determinative issues in the success or failure of facility siting attempts seem to be (1) the culture of the local community and (2) the host state's sense of national fairness. Preemption of local control magnifies the sense of incursion and never works in the face of determined opposition backed by the local government. In those communities which fear that the facilities will endanger their children's health, offers of compensation and negotiation are ineffective and offensive. On the other hand, there are some communities whose culture of risk perception does not lead them to fear (or at least to loathe) HW/RW facilities. In these communities, compensation and negotiation, as well as some degree of local control, can achieve local acceptance. It appears possible to reduce or eliminate a sense of incursion, though not a preexisting dread. But even if the community is willing to host a facility, the state will often veto the idea, at least partly because the state feels that a disproportionate share of the nation's waste disposal burden is being hoisted on it. The compartmentalization of disposal programs and laws fosters this sense of geographic inequity: one state may feel it handles an unfair share of the nation's hazardous waste disposal, for instance, although forgetting that other states may be taking its radioactive waste or medical waste or sewage sludge.

This understanding of what kills siting attempts should lead to a way out of the thicket. Communities with cultures that are congenial to HW/RW disposal facilities can be found by offering compensation and asking for volunteers; places that fear those facilities can just say no. To obtain acceptance at the state level, it will be necessary to have a comprehensive national program that considers all the different kinds of wastes and allocates the burdens equitably between the states.

Drawing on these lessons of experience, I will now propose a system that minimizes the creation of HW/RW and, for the waste

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905. Professor Vicki Been, a former resident of one of the volunteer communities cited earlier (Naturita, Colorado), has written to the author, "I would argue that 'culture of risk' is just a euphemism for 'lack of alternatives.' The residents of Naturita certainly fear HW/RW facilities, but they fear having their kids go hungry even more. . . . The 'cultural' factors . . . are inseparable from those towns' economic dependence upon risky activities." Letter from Vicki Been, Assoc. Prof., N.Y.U., to Author (Feb. 18, 1993) (on file with the Tulane Law Review). This comment illuminates the reasons, and level of enthusiasm, behind Naturita's willingness to accept such a facility, but it does not refute the observation that many other equally needy communities have rejected such facilities, based at least in part on the depth of their fears.
that still must be disposed of, identifies willing communities and gives the states reason to agree as well. After making this proposal, I will then evaluate it by the same criteria that I used to assess the current siting system.

B. Description of the Proposed Alternative

1. Centralized Facilities

Part II of this Article discussed the numerous sources and types of hazardous and radioactive wastes. These wastes are all regulated separately and are generally disposed of separately in a multitude of different sorts of facilities, even though the same kinds of physical characteristics, such as geological setting and transportation access, are desirable for most disposal facilities. The congressional Office of Technology Assessment has proposed the establishment of a National Cleanup List to track the cleanup of all chemically contaminated sites, but this has not occurred. Nor does any coordinated national effort exist to site disposal facilities for these varying waste streams. This fragmentation fosters a sense of inequity in the siting of each type of facility.

A national program for allocating waste disposal facilities would have several advantages. If every state had at least one facility and the larger states had the larger facilities, the states would have much less of a sense of regional unfairness. The larger states might have centralized facilities, taking a variety of waste streams and subjecting them to several different kinds of processes; a physical-chemical treatment plant, an incinerator, a landfill, an aqueous treatment plant, and a liquid organics recovery facility might all be located on the same site. Each kind of waste would be more likely to find its ideal treatment process. Sometimes one kind of waste can be used to treat another; a caustic could treat an acid, for example, or the oily waste can be used as fuel to burn other organic waste. Such a comprehensive approach would realize considerable economies of scale.

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908. See Davis, supra note 578, at 44.

909. See Office of Tech. Assessment, supra note 226, at 14 (noting that the development of efficient treatment technologies for LLRW may stall because of small waste volumes at decentralized LLRW disposal facilities); Contreras, supra note 2, at 522-23 (promoting economies of scale in LLRW facilities); Hahn, supra note 468, at 208 (giving estimates of costs per ton of facilities of different sizes); John F. Williams & Daniel D. Costello, Orphan
Several European nations have successfully established centralized waste disposal facilities. For example, Denmark sends nearly all of its hazardous waste to a central facility on the island of Funen in the city of Nyborg, via a network of twenty-one transfer stations. The facility, operated by a public corporation, houses an incinerator, a waste oil recovery plant, a physical-chemical treatment unit, and (twelve miles away) a landfill for treatment residuals. Similar systems are working well in Finland, Sweden, and the German states of Bavaria and Hessen. In most cases, on-site treatment at industrial plants is discouraged.910 As described by Gary Davis, Joanne Linnerooth, and Bruce Piasecki, these European systems all

have built technologically advanced, integrated facilities for the storage, treatment and disposal of hazardous waste with significant investment of public funds, placed a high priority on relatively expensive treatment and incineration technologies with little direct land disposal, have required generators to use the publicly owned management facilities in a monopolistic fashion, and have shared the cost of hazardous waste management between industry and the taxpayer.911

As discussed earlier, several Canadian provinces have adopted a similar approach.912

2. Sites

Any site selected for a waste disposal facility would have to meet minimum technical criteria. Beyond that threshold, however, certain factors would make some sites more appropriate than others.

For the last decade the tendency in siting new disposal facilities, and new industrial operations in general, has been to look for "green fields": farms or other lands with no prior industrial use. The two main reasons for this approach are: (1) to avoid the possibility of assuming a prior owner's CERCLA liability for contamination of the ground;913 and (2) to avoid the greater difficulty of monitoring leaks from a facility where the groundwater is already

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910. Gary Davis et al., Government Ownership of Risk: Guaranteeing a Treatment Infrastructure, in AMERICA'S FUTURE, supra note 35, at 95, 122.
911. Id. at 113.
912. See supra text accompanying notes 716-17.
contaminated from prior uses. However, this approach also increases social conflict by attempting to impose waste disposal on pristine areas, and it leads to the spoiling of ever larger swatches of American soil.

A growing body of scientific evidence suggests that once the groundwater is contaminated in certain ways, it will never be clean again, at least with current technology. No matter how much money is spent, many badly contaminated sites will always be dirty. Off-site waste migration must be halted, but it makes little sense to spend huge sums in futile attempts to make badly contaminated sites suitable for residential use, while productive farmland is seized for fresh waste disposal sites. Here, what is perfect is the enemy of the good: by insisting on total cleanup, we pour billions of dollars into a few unproductive holes and allow many other sites to go unaddressed. Instead, the waste should go to places that are already contaminated and unlikely ever to be thoroughly clean.

Many sites around the country are available using this approach. The Pentagon is closing thirty-five major and ninety-five minor domestic military bases, most of which have serious contamination problems. As noted before, the military's inventory includes several thousand smaller contaminated sites. In addition, the NWC contains seventeen major facilities, all contami-

914. See McKewen & Sloan, supra note 334, at 251 (discussing difficulties "in actually developing a site [near existing contamination] under real-world regulatory conditions in which the greatest imperative seems to be to prove you didn't cause degradation"); cf. 10 C.F.R. § 61.50(a)(2) (1992) (stressing the importance of the ability to characterize, model, and monitor in selection of LLRW disposal sites).


916. OFFICE OF TECH. ASSESSMENT, supra note 219, at 6-7.


920. See supra text accompanying notes 79-84.
nated, and several of them are likely to cease all production. The closing facilities, and the surrounding civilian communities that relied on them as their economic foundation, are desperately seeking a new mission. Fort Dix in New Jersey may be converted into a large federal prison, and officials at many military research facilities aspire to convert them to environmental research. Congress has eased the sale of military property for civilian uses.

Some work of this sort is already underway. Waste Management, Inc. has announced plans to build a large HW incineration and treatment complex at Hanford, in the hopes of attracting much of the remedial waste from the cleanup there. The Army plans to incinerate hazardous wastes from chemical weapons and pesticide production at the Rocky Mountain Arsenal in Colorado. The NRC is considering proposals to allow the disposal of LLRW at uranium mill tailings sites. In late 1992, the DOE revealed it was considering using NWC facilities for interim HLW storage. Waste Management's HW complex in Niagara County, New York was formerly a defense installation, the Lake Ontario Ordinance

921. See supra part II.B.4.
924. Environmental Technology Seen as Possible New Focus for Labs That Developed Weapons, 23 Env't Rep. (BNA) No. 23, at 1514 (Oct. 2, 1992); see also Kevin D. Murphy, Making the Most of a Base Closing, GOVERNING, Sept. 1993, at 22 (reporting on community efforts to convert closed bases for economically productive purposes).
927. Army Set to Burn Wastes at Arsenal, 23 Env't Rep. (BNA) No. 31, at 1925 (Nov. 27, 1992). For a discussion of incineration of obsolete chemical weapons at the depots where they are stored, see supra text accompanying notes 86-93, 813.
928. In the NRC, RADIOACTIVE EXCHANGE, Nov. 2, 1992, at 8.
929. DOE Looks to Federal Facilities, supra note 212, at 1.
Works. On a much smaller scale, in 1973 and again in 1979, a private company built small HW disposal facilities on two abandoned Titan missile sites in Idaho.

Many civilian sites might also be suitable. Some former Superfund sites are being reused for purposes such as transportation centers, industrial parks, and shopping centers, but that is the exception rather than the rule. The taint of contamination has killed development on many sites. In the 1970s, a few small hazardous waste treatment facilities were built at vacated industrial plants, but this does not seem to have occurred since the enactment of CERCLA, except at sites already used for waste management.

The idea that some places will always be contaminated, and will become "sacrifice zones," has been widely attacked. However, the permanent physical alteration of large areas of land is hardly a novel human activity. Lake Mead, the reservoir created by Hoover Dam on the Colorado River, is 175 square miles, and if the area were drained the land would still be covered by many feet

930. TERA CORP., PART 361 CERTIFICATE OF ENVIRONMENTAL SAFETY AND PUBLIC NECESSITY AND SUPPLEMENTAL DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE ARC PYROLYSIS PROJECT, MODEL CITY, NIAGARA COUNTY, NEW YORK 2-5 (1985).

931. O'HARE ET AL., supra note 11, at 144-46.


933. See Mank, supra note 688, at 255-56 (regulatory impediments to redevelopment of contaminated property); Elizabeth S. Kiesche, A Smaller Role for the Chemical Industry in New Jersey, CHEMICAL WK., July 22, 1991, at 7 (observing that New Jersey's Environmental Cleanup Responsibility Act (ECRA), NJ. STAT. ANN. §§ 13:1K-6 to -17 (West 1991), has reportedly resulted in the abandonment of several industrial sites); Keith Schneider, Rules Easing for Urban Toxic Cleanups, N.Y. TIMES, Sept. 20, 1993, at A12; Matthew L. Wald, Trenton Acts to Loosen Industrial Cleanup Law, N.Y. TIMES, June 7, 1993, at B1 (asserting that the New Jersey State Legislature weakens ECRA because of concerns about its negative effect on economic development).

934. Farkas, supra note 347, at 453 & n.8.

of sediment.\(^{936}\) The artificial Lake Volta in Ghana, formed by the Akosombo Dam in 1965, inundated 3275 square miles of land.\(^{937}\) A decade of hydrogen bomb tests seems to have made the coral island of Bikini, in the Marshall Islands, permanently uninhabitable, despite massive cleanup efforts.\(^{938}\) Many sites contaminated by nuclear weapons production and other military and civilian activities will never be completely clean.\(^{939}\) Although we must regret the initial loss of land, the past cannot be undone. We should focus now on minimizing the risks at existing sites and avoiding the contamination of new sites. Building a limited number of centralized HW/RW treatment and disposal facilities on already contaminated land seems to be the way to achieve this goal.

3. Finding Volunteer Communities

Under my proposal, a site for a centralized disposal facility would not merely have to be physically suitable; it would also have to be acceptable to the neighboring community. As noted above, numerous communities in the United States have volunteered for HW/RW facilities.\(^{940}\) How does one find such communities and secure their consent?

In 1984, a consulting firm hired by the California Waste Management Board said that disposal facilities were more likely to be successfully sited in rural areas where the residents were older, had an educational level of high school or lower, were low-income, Catholic, politically conservative with a free-market orientation, and had occupations such as farmer, rancher, or other jobs the report called "nature exploitative."\(^{941}\) This characterization gener-


\(^{937}\) \textit{NEW COLUMBIA ENCYCLOPEDIA} 2910 (William H. Harris & Judith S. Levy eds., 1975).

\(^{938}\) \textit{BARTLETT & STEELE, supra} note 187, at 331-33. A 1958 nuclear waste accident in Kyshtym, Soviet Union seems to have had the same effect. \textit{Id.} at 72.

\(^{939}\) In fact, the only hope these sites would ever have of complete purity would be to excavate huge quantities of soil (a task with unknown health and safety impacts) and replace it with clean fill. The removed soil would, of course, have to go to some other disposal facility. \textit{See Safety, supra} note 225, at 169 (remarks of Sen. Glenn); \textit{see also id.} at 345 (statement of Keith O. Fultz, GAO) ("[S]ome sites may be irreversibly contaminated, and DOE may have to place them in long-term institutional care . . . .").

\(^{940}\) \textit{See supra text accompanying notes 721-35.} The World Health Organization is currently considering a proposed "code of practice" for HW facility site selection that recommends a voluntary siting process.

ated considerable outrage, particularly in the Catholic press. A few years later, Lawrence Summers, chief economist of the World Bank, suggested in a memo that it made some sense to encourage the migration of dirty industries to Third World countries, where people were more complacent and needed the money. This so annoyed the incoming Clinton administration that the memo may have cost Summers the job of chairman of the Council of Economic Advisers. The lesson here is that it is neither possible nor wise to characterize the communities that might accept HW/RW facilities. Some communities have cultures that make them eager to attract defense-related industries, and other communities (perhaps some of the same) are amenable to HW/RW. Predicting which communities these will be is very difficult, although some have suggested that areas with heavy industry already are likely candidates. A better approach to finding volunteer communities is simply to ask.

Herbert Inhaber has suggested a procedure he calls a “reverse Dutch auction,” which would presumably be carried out through the newspapers. The auctioneer would propose a compensation amount that would be paid to a volunteer community. Any county that thought it might be willing to accept the facility for that amount would bid. For example, the auctioneer might declare a bid of ten million dollars and keep it open for a month. If no bids were received, the bid amount would be raised to twenty million dollars the second month, thirty million dollars the third month, and so on until a bid was received. (This is similar to the auction sometimes conducted by airlines seeking volunteers to give up their seats on overbooked flights.) A bid would have to specify a proposed site. Once a bid was received, the auction would stop until the site was studied to determine if it was physically acceptable. During this study period, bidding communities would receive funds from the state to hire their own consultants to do their own

942. Crim, supra note 619, at 132. Another study found that neighborhoods which accepted mental health facilities “are those in which residents have few children, are well-educated, and predominantly English-speaking; where the population is relatively transient, the population density relatively high; and where there is a mixture of land uses with commercial development and public open space in addition to residential areas”. Armour, supra note 381, at 20-21.


studies, and the communities could withdraw their bids at any time. Communities that did not want the facility under any circumstances would simply not bid.946

This procedure raises several questions:

1. What mechanism would ensure that the facility is endorsed by the whole community, and not just a (biased/unrepresentative/corrupt) governing body? The best procedure, and the one actually used in seeking volunteers for several solid waste facilities,947 is a referendum of the entire electorate after the detailed studies but before the final decision.

2. What is the geographic extent of the electorate? Inhaber suggests a county. The county should consent, but sometimes there will be a politically isolated municipality within the county; for instance, the county could be dominated by one party but the municipality by another. Thus, the referendum should be required to succeed in both the county and the municipality where the proposed site is located. If the proposed site is near a border, people in the adjoining jurisdiction need a voice as well. One method to provide this might be to include in the electorate all voters outside the voting jurisdiction but within a certain radius of the facility.

3. What considerations should be given to close neighbors of the proposed site who are adamantly opposed to the facility but lose the referendum? People within a close radius of the site should not be trapped; they should be offered the preproposal value of their property, plus relocation costs. This would follow the experience of several chemical plants that have bought out all the homes around their plants to create buffer zones.948 One small

community of twenty-two homes in Baltimore was voluntarily bought out and relocated to make way for a new HW landfill nearby. To be sure, forced relocation from a home can impose serious psychic costs above and beyond any purely financial costs, especially when the residents consider themselves part of a community, or when the residents have a limited range of job opportunities and housing alternatives. Perhaps some premium above fair market value should be offered.

4. What would be done with the compensation money? Those neighbors that want to move should have a priority claim to being bought out. Beyond that, the governing bodies of the county and the municipality should initially determine the intended uses of the compensation (for example, tax relief, new schools and hospitals, and more police and teachers) and then include the proposed uses in the referendum question. Unless the money is spent on capital facilities, it should probably be made available over a period of years to prevent current residents from receiving all the benefits, because the facility will affect future residents for many years to come.

4. Needs Assessment

The facility siting process will require specific information on the nature, quantities, and generation patterns of waste. This assessment should address all RCRA hazardous waste, all regulated radioactive waste, and other categories of non-RCRA or RCRA-exempt waste for which a national disposal market and significant interstate siting conflicts exist. Examples include incinera-

950. See BRION, supra note 2, at 175, 181, 198; EDELSTEIN, supra note 354, at 62; John E. Seley & Julian Wolpert, Equity and Location, in Equity Issues, supra note 180, at 69, 80.
tor ash, PCBs, medical waste, and asbestos waste. Those waste streams that are usually handled locally, for instance municipal solid waste, sewage sludge, and dredge spoil, would be excluded at this stage, even if there are occasional interstate conflicts.

For the waste streams included in the process, the next step would be to prepare a disposal needs assessment. The EPA would take the lead in assessing non-radioactive wastes, and the NRC would assess radioactive wastes. The needs assessment would have these elements:

a. *Current Generation Patterns:* The assessment would describe the quantities of wastes generated, where the generation occurs geographically, and the physical form of the wastes when they leave the site of generation. Waste streams disposed of on-site would not be the concern of the federal allocation process if, in the view of the state environmental agency, the on-site methods are environmentally satisfactory. Similarly, if the waste is treated on-site before being shipped off-site for disposal, then the form of the material as it leaves the site is what is relevant to the assessment, subject to the same proviso.

b. *Future Generation Projections:* The assessment should include projections of how much of this waste will be generated in the future. This will require predictions of future patterns of economic growth and technological development. Although this is a complex undertaking, it is hardly novel. Waste disposal companies engaged in long-term planning, and financial analysts assessing the stock of those companies, perform such analyses routinely. Similar work is also performed in preparing permit applications and environmental impact statements for disposal facilities. Many states have their own hazardous waste planning processes that have addressed these questions. Thus, there is a large body of existing research and analysis on which these projections could be based. The projections would include not only recurrent waste streams, such as waste from ongoing industrial processes, but also remedial waste from the cleanup of past contamination.

c. *Future Waste Generation Targets:* The assessment would also establish goals for waste reduction by adjusting future waste generation projections downward to reflect waste minimization, recycling, and other methods to reduce the amount of waste requiring disposal. An important goal of the process is to provide for the sound disposal of the waste that must be disposed, but not to create so much disposal capacity that waste generation will be encouraged. Industry-by-industry analyses of opportunities for
waste minimization will be necessary in calculating these targets. This is similar to the processes used by the EPA in formulating technology-based effluent limitations under the Clean Water Act,\textsuperscript{553} land disposal restrictions under RCRA,\textsuperscript{554} and new source performance standards\textsuperscript{555} and air toxics limitations\textsuperscript{556} under the Clean Air Act—processes that have already given the EPA a large data base about the production techniques used in virtually every major industry. Congress would have to determine the degree of technological stringency that will be required for the waste minimization technology adopted. The federal pollution control statutes have a large grab bag of concepts using combinations of "reasonably," "best" or "maximum" and "available," "achievable," "practicable" or "demonstrated" (or similar words) to modify "technology." The planning efforts now underway pursuant to the Pollution Prevention Act\textsuperscript{557} will help answer this question and will provide much of the required industry-specific information. In particular, the EPA’s Source Reduction Review Project is initially focusing its study on seventeen industrial categories.\textsuperscript{558}

\textit{d. Current disposal facilities}: It will be necessary to inventory the nation’s waste disposal facilities, their present and future capacity, and their regulatory status; for example, whether they are under orders to close. EPA’s RCRA data base and commercially produced directories already contain most of this information.\textsuperscript{559} Facilities operating under RCRA interim status and unable to obtain full RCRA Part B permits should be excluded from future capacity projections, because they should ordinarily be presumed to be environmentally unsatisfactory. Facilities under construction or in the permit application stage should be inventoried, with an assessment of the likelihood that they will come into operation and, if so, when.

\textit{e. Future disposal needs}: The inventory of current and proposed disposal facilities will allow a projection of future disposal

\textsuperscript{553} 33 U.S.C. § 1314(b) (1988).
\textsuperscript{554} 42 U.S.C. § 6924(g) (1988).
\textsuperscript{555} Id. § 7411 (1988).
\textsuperscript{556} Id. § 7412(d) (1988).
\textsuperscript{557} Id. §§ 13,101-13,109 (1988).
capacity. A comparison to the future generation targets will allow a projection of future capacity shortfall: the deficit (if any), per type of waste, of future waste disposal capacity under future waste generation, even after the use of waste minimization. The deficit projections should specify the type of facilities necessary, for instance incinerator, landfill, or aqueous treatment. This determination will require knowledge about the treatment technology involved with each type of waste; the EPA has already compiled such information for most RCRA wastes as part of preparing its land disposal restrictions under HSWA.

The draft needs assessments from the EPA and the NRC should be distributed for public comment. This will ensure that all the affected industries and localities will be able to check the accuracy of the data and assumptions. The final needs assessments, prepared by EPA and NRC after receiving the public comments, will reveal what new waste disposal capacity needs to be created.

A somewhat similar process, limited to recurrent streams of RCRA hazardous waste, is now underway pursuant to the capacity assurance provision of SARA. In May 1993, the EPA released its Guidance for Capacity Assurance Planning, requiring each state to submit base-year (1991) data and projections of commercial hazardous waste capacity and demand for the applicable waste streams generated within that state. This information is due from the states by May 1, 1994. Based on this data, EPA will project, to the year 2013, whether national shortfalls in disposal capacity will exist. If national shortfalls are projected, then states with demand exceeding supply in the national shortfall categories will be required to proceed to Phase II: the submission of waste minimization plans and information on permitted but not-yet-built facilities. If, after this information is assessed, national shortfalls are still projected, then the states will be required to go to Phase III: submission of plans to eliminate the gap between supply and demand by added waste minimization, new disposal capacity, or interstate agreements. The timing of Phases II and III has not yet been determined. The data developed during this process will go a long way toward providing the information on RCRA hazardous wastes needed for the federal allocation process. Furthermore, the statistical methodologies used will be helpful for non-RCRA

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wastes as well. A similar assessment has already been prepared for California.961

5. Federal Allocation

The needs assessment prepared by the EPA and the NRC will reveal how much new disposal capacity will be required. This determination will certainly address capacity for high-level and low-level radioactive waste, and perhaps for other categories of RCRA and non-RCRA wastes. Once the capacity needs are known, the process of allocating the satisfaction of those needs between the states should be assigned to an independent federal entity, perhaps called the Federal Waste Disposal Commission (FWDC).962 The FWDC would have a thankless task: allocating hated facilities between reluctant states. To avoid unending, fruitless debate and rampant political interference, the FWDC should be a politically independent commission whose recommendations are subject only to approval or rejection of the entire package by Congress, under the model of the Defense Base Closure and Realignment Act.963 The Defense Base Closure Commission created by this Act has performed admirably in carrying out a similarly unpopular mission. Composed of distinguished people with no future political aspirations, this Commission has been able to make base closure decisions on the merits, grounded on detailed information provided by the Department of Defense, and its recommendations have been accepted by Congress, despite the predictably outraged speeches on the floor of the House and Senate by members whose districts lost bases.964

The FWDC would have the job of determining what needed capacity should be provided by what states.965 Although it would

961. Mazmanian & Morell, supra note 7, at 196-97.
965. See Green, supra note 37, at 91-93 (suggests various possible mechanisms for allocating among the states the obligation to create various amounts of disposal capacity for RCRA HW, largely proportionate to the amounts generated).
announce its decisions all in one package, it should go about its internal deliberations in a step-by-step fashion. Because Congress has already decided, as matters of national policy, that HLW should go to Yucca Mountain in Nevada and TRU should go to WIPP in New Mexico, this should serve as the starting point for state allocation, and no further capacity should be allocated to either of those states. If the NRC believes that a separate repository should be established for the remains of decommissioned nuclear power plants, the FWDC would have to find a state where that repository would go. The NRC would specify the minimum physical conditions that would be necessary for such a repository, and the FWDC would have to allocate the repository to a state that had an ample supply of land meeting those conditions. The NRC could also be asked to specify an optimal general location: that is, the region of the country where the facility should go, determined on the basis of safety and cost, without reference to politics. As noted below, sophisticated computer programs have been developed to include transport risk in this kind of calculation.66 This specification would play heavily in the FWDC’s decision. For example, inasmuch as most commercial nuclear power plants are located east of the Mississippi,67 this repository would probably be located in an eastern state that contains such plants.

In next allocating repositories for LLRW, the FWDC should again look to the NRC for guidance on the physically optimal number and general location of LLRW facilities. I suspect the optimal number will be either two or three. If it is two, then there should be one in the East and one in the West; if three, there should also be one close to the center of the country. As it happens, California, North Carolina and Texas are all well along in the process of selecting LLRW sites,68 so the FWDC’s task here may be fairly simple.

The process of finding a site for a monitored retrievable storage facility for HLW is already underway.69 If a site has been selected by the time the FWDC gets to work, that state should be spared further allocations. Once the permanent HLW repository is opened and the MRS facility has been emptied, decades from now, the MRS state might again be eligible for a future allocation. If no

666. See infra text accompanying notes 995-96.
668. See supra text accompanying notes 245-48.
669. See supra text accompanying note 558.
site has been selected, and it appears that the initial volunteer process is not going to work, then the FWDC would allocate this facility to a state, again looking to the NRC for guidance on physically optimal location.

Uranium mill tailings sites should be addressed next. These wastes are extremely voluminous. Thus, unlike arrangements for HLW and LLRW, long-distance transport is not feasible. Once again, the NRC would designate the optimal number of facilities and their general locations. It is virtually certain that these facilities should be allocated to the western states in which the largest mill tailing piles are located. For this physical reason, a mill tailing repository for in-state waste might be located in a state that already has a HLW, TRU, or MRS facility, as an exception to the rule that those states would be exempt from future allocation. If a national policy decision has been made by then to develop repositories for naturally occurring radioactive material, such sites would be allocated on a similar basis.

By now all the major radioactive waste streams will have been allocated. The next subject of the FWDC’s deliberations would be the nonradioactive waste streams, including RCRA hazardous waste; PCBs, which by historical accident are regulated under TSCA rather than RCRA; asbestos; medical waste; and any other waste streams under FWDC’s jurisdiction, as well as mixed radioactive and hazardous waste. The EPA will have declared whether there are any nationwide capacity shortages. If there are, the EPA should also reveal whether there are any unique geological or other physical characteristics that must be met by a site for the required facility. It is unlikely that this will disqualify any states; the EPA has already promulgated location standards for RCRA and TSCA disposal facilities, and on their face they do not require, for example, an arid climate that would only be found in the West.

Based on the estimates of future waste generation and future waste disposal capacity calculated earlier by the EPA, the FWDC would determine which of the states still eligible for allocations (those without a radioactive waste disposal facility) are projected to become net exporters of nonradioactive FWDC waste streams, which primarily covers RCRA hazardous waste. The largest net exporters would receive the first allocations of new disposal capac-

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970. 40 C.F.R. § 264.18 (1992) (RCRA standards); id. § 761.75(b) (1992) (TSCA standards).
ity. The FWDC would allocate the largest new facility, measured in terms of tons per year, to the largest projected exporter; the second largest new facility to the second-largest projected exporter; and so on down the list, until every needed facility had been allocated to a state.

Under this allocative method, large centralized facilities would likely go to the largest exporting states; small transfer stations might go to importing states. In the following circumstances, however, the FWDC could vary from this otherwise mechanical process:

— if EPA advised that special physical characteristics were needed for a particular kind of facility, and the presumptively designated state for that facility lacked those characteristics;

— if most of a particular waste stream is projected to be generated in places so distant from the target state that it would be clearly unsafe or inefficient to send it to that state; or

— if it is unfair to assess exports purely on a tonnage basis, because some of the wastes involved have high volume but low toxicity, or vice versa.

It is also possible that the rule against allocation of nonradioactive facilities to states with RW facilities would be breached in one other circumstance. As noted, California and Texas might get LLRW disposal facilities. Both of these are large states in which a great deal of HW is generated. If they are also projected to be significant HW exporters, it might be fair to allocate to them some HW facilities if doing so offered clear safety or efficiency advantages.

Once all the needed facilities had been allocated to states, the FWDC would issue its comprehensive report on where all the RW and HW facilities would go. The report would be submitted to Congress, which would be required to vote yes or no on the entire package. The statute establishing the FWDC would mandate that Congress must consider the package as a whole and may not modify the FWDC's recommendations.

Because every state generates HW and because every state exports HW to other states, every state should have some disposal obligations; no state should think it can get a free ride. The possibility of a free ride—the knowledge that only one state in a compact region would probably have to host a facility—is one of

the major reasons for the failure of the federal siting efforts for LLRW.\footnote{972} States would be given credit in this allocation process for existing private HW/RW disposal facilities within their borders, such as Emelle and Barnwell, inasmuch as such facilities will tend to make these states importers rather than exporters.

After Congress has acted, states should then be able to trade allocations among themselves.\footnote{973} The National Governors Association or a similar group could establish a trading mechanism.\footnote{974} States might also want to trade disposal rights for waste streams not within the FWDC's jurisdiction, such as MSW; if New Jersey, for instance, wanted to export municipal trash to Indiana, then Indiana might agree if it could send some of its hazardous waste back to New Jersey.

Once the state-by-state allocations are established, each state should have the responsibility to find the necessary sites for any newly required facilities. Perhaps the state would look for volunteer communities using Inhaber's bidding process. Land on federal facilities would be made available to the extent it was physically suitable.\footnote{975} In any state that shirked its responsibility, the FWDC could step in and find sites itself. This resembles the process under the Clean Air Act in which a federal implementation plan can be prepared for any state that fails to submit a satisfactory state implementation plan.\footnote{976} Such a role for the FWDC would involve a limited violation of the antipreemption principle, but that may be necessary in order to induce states to provide sufficient incentives

\footnote{972}{See generally Rabe, supra note 354.}

\footnote{973}{Frank J. Popper has suggested allowing communities to trade all kinds of locally undesirable land uses; for example, a neighborhood that agreed to accept a HW facility could decline the next three halfway houses. Frank J. Popper, \textit{LULUs and Their Blockage: The Nature of the Problem, The Outline of the Solutions, in Confronting Regional Challenges: Approaches to LULUs, Growth, and Other Vexing Governance Problems} 13, 24 (Joseph F. DiMento & LeRoy Graymer eds., 1991).}

\footnote{974}{Some evidence exists that, in a few instances, states have informally allocated burdens among themselves. See Colglazier & English, supra note 10, at 647 n.28 (discussing the tacit agreement between Washington and Oregon by which Washington will continue to host an LLRW facility for the region, and Oregon will continue to host an HW facility). On the other hand, in meetings of the Southeast Compact (Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia) to pick a host state for an LLRW facility, Alabama contended that, because it had the Emelle HW landfill, it should not have to receive LLRW. The other states rejected this argument, in part because considering Emelle would require consideration of then existing or proposed large-scale waste facilities in the other states as well. See English, supra note 10, at 121.}

\footnote{975}{Such land should be sold or leased to the state or the new facility operator at the prevailing price for comparable industrial land, so as not to create a hidden subsidy.}

\footnote{976}{See 42 U.S.C. § 7410(c)(1) (1988).}
for volunteer communities to step forward. Additionally, the FWDC might set caps on how much waste each facility could accept to avoid the creation of excess capacity that might encourage waste generation.

Once sites were selected, the states would be responsible for overseeing the detailed characterization studies and the permitting and construction of the facilities, all under the applicable guidelines of the EPA or the NRC. Local communities should be given technical assistance grants to participate in the process. Perhaps each facility would have its own board of visitors, with federal, state, and local representation. This board should have full access to the site and its records and could conduct inspections at will to ensure that all environmental standards are met. It would also regularly meet with facility management to discuss mutual concerns, and it could make public these discussions if its recommendations were not followed.

State compliance with the FWDC's allocation would be ensured largely by the structure of the national system. A state's failure to meet its FWDC-set allocation of waste disposal would be penalized by other states, which could exclude its waste from their FWDC-allocated facilities. A similar sanction for states failing to site facilities was upheld under the LLRW PA.979

To advance the goal of closing existing older facilities, private companies should be able to relocate to FWDC-allocated sites if they (or someone from whom they bought capacity rights) shut down older, environmentally deficient disposal units. The receiving state and locality first have to consent to this move. This idea of disposal capacity trading is based on the emissions offset trading program under the Clean Air Act.980 Many disposal companies are currently in constant conflict with their neighbors and would probably embrace this option of new, preselected sites. To encourage these moves, perhaps the older facilities with the greatest environmental problems should be required to move after a few years, such as when their existing permits expire.

977. Perhaps FDWC-selected sites would have to be on land already owned by the federal government, if any such land is physically suitable for this purpose.
978. HLW and TRU repositories would be an exception to the rule of state oversight; they would have to be in federal hands because they will contain fissile materials.
Actual construction and operation of facilities could well be contracted to the private sector. Private companies could also attempt to site and construct new commercial facilities above and beyond those found necessary by the FWDC. In such cases, however, the firms would be on their own and would not be able to rely on any preemption of local land use controls.

C. Evaluating the Proposed Siting Process

1. Needed Disposal Capacity

In evaluating the existing siting processes, I have shown that, despite some regional disparities, no major national shortage of hazardous waste disposal capacity exists, although some old facilities should be replaced with new ones. My proposed alternative of local control, state responsibility, and national allocation is designed to eliminate any remaining shortages of capacity, anticipate future ones, and replace aging units. The FWDC would identify shortages and allocate between the states the responsibility to site facilities to meet these needs. Because it ordinarily takes five to eight years to site and build a new waste disposal facility, the task should begin soon.

Without such hidden subsidies as zoning overrides, those wishing to site new facilities will have to negotiate with local governments in volunteer communities for siting approvals. These local governments, to secure support from their constituents, might well require the disposal companies to guarantee neighboring property values and to compensate otherwise for any injury, thereby internalizing many of the externalities of such facilities. This is a natural market mechanism, not an artificial one with its attendant transaction costs and uncertainties. The proposed approach will increase the cost of building new facilities. However, much of the cost will be passed along to waste generators in the form of higher disposal prices and will lead to decreased waste production.

982. See Margaret A. Walls & Barbra L. Marcus, Should Congress Allow States to Restrict Waste Imports?, RESOURCES (RESOURCES FOR THE FUTURE), Winter 1993, at 7 (arguing that host community fees internalize the external costs of siting waste facilities).
983. There is a greater societal interest in high disposal prices for production wastes than for remedial wastes (i.e., waste that already exists, often lying dormant in the ground), because the cleanup and disposal of remedial wastes should be encouraged. One possible approach would be to impose a tax on the production of HW and LLRW and use the proceeds to subsidize the cleanup and disposal of remedial waste. However, this would have high transaction costs and would invite many disputes over whether a given waste stream is production or remedial waste.
Any threat that higher prices will cause more illegal dumping, a concern that was shown above to be largely misplaced,\textsuperscript{984} would be addressed through heightened enforcement. Hidden subsidies from inadequate tort remedies would be reduced, to the extent that the older facilities, which cause most of the nuisances, are shut down and their capacity traded to new FWDC sites. One important uncompensated cost, psychic injury, should decline greatly, because the new facilities would be in volunteer communities and any neighbors that still opposed the siting would be fully compensated for moving.

To encourage further the replacement of old facilities with new ones, consideration should be given to creating a tort-like remedy for facility neighbors, so that external costs cannot be so readily ignored. Expanding the definition of recoverable "response costs" under CERCLA is one possible approach.\textsuperscript{985}

2. Protecting Health and the Environment

The proposed system's method of capacity trading will reduce the number of old facilities, which tend to have the worst health and environmental impacts. To the extent that the new facilities are located on already contaminated land, such as military, NWC, or uranium mill tailings sites, agricultural and virgin land will be spared degradation. The aesthetic impact of these facilities will also be reduced, because they will be located in settings that are already industrial.

The allocations assigned by the FWDC are likely to lead to the creation of centralized, integrated waste management facilities based on the Scandinavian and German model.\textsuperscript{986} A state given the responsibility to handle waste streams requiring five different kinds of processes will have an easier time siting one big rather than five small facilities. Such centralized facilities have several advantages for health and the environment over a much larger number of smaller, decentralized facilities:

- the available sites with the best physical characteristics could be used for multiple purposes;
- specialized forms of waste treatment can be provided, making it more likely that each load of waste will be optimally treated;

\textsuperscript{984} See supra part IV.C.2.  
\textsuperscript{986} See supra notes 910-11 and accompanying text.
— with the much higher revenues per site, a higher caliber of management and technical staff can be provided;
— employees can enjoy better on-site medical care and receive better training and supervision in safe work practices;
— treatment residues are more likely to find an on-site use, rather than requiring landfilling;
— each centralized facility can be assigned a full-time staff of governmental monitors, some with specialized functions and some accountable to the local community;
— public exposure to contamination will be reduced, because ordinarily one large facility will have fewer neighbors within a given radius than will multiple small facilities;
— a larger buffer zone around the facility will be economically feasible; and
— only one site, as opposed to several, would be subjected to possible groundwater contamination.

Persons living near existing contamination, such as CERCLA sites, would also benefit, because the proposed system, by ensuring adequate disposal capacity for remedial wastes, should expedite cleanup. Similarly, the centralized facilities might reduce the amount of on-site disposal at factories, thereby benefitting the factory neighbors.

Transportation poses the biggest problem with a centralized system. The risk of transportation accidents is a very controversial issue, both legally and politically. Accidents are an inevitable feature of any system of transportation. On average, trucks are involved in accidents once every 400,000 miles of travel.


989. OFFICE OF TECH. ASSESSMENT, U.S. CONG., PUB. NO. OTA-SET-304, TRANSPORTATION OF HAZARDOUS MATERIALS 103 (1986). The EPA has devised formulae for the fraction of the annual quantity of liquids expected to be released in transportation mishaps. For
Between 1971 and 1985, there were 167 transportation accidents (mostly on highways) involving 2602 packages of radioactive materials; a total of 67 packages experienced some release of their contents. The three worst accidents all involved the rupture of fifty-five-gallon drums of yellowcake, the product of uranium mills. To put this in perspective, of all hazardous materials shipments annually (numerically, not by volume), about one percent involve RCRA hazardous waste and about two percent contain radioactive materials; the most shipments by far involve gasoline, with chemical products or intermediates a distant second.

Hazardous waste transportation is a big business. The cost is about $0.23 per ton per mile, and this adds up very quickly. More than half of the six billion dollars spent on hazardous waste services in 1990 went to transportation. Sophisticated models have been developed to determine the least costly and least risky routes to a given set of disposal facilities. Some models go further and also identify ideal facility locations, as well as transportation routes. Unfortunately, all these models rely on a very large

bulk liquids carried in tanker trucks, the fraction released is predicted to be $(9.5 \times 10^{-8} \times D) + (7.6 \times 10^{-6})$; for liquids contained in drums on flatbed trucks, the fraction is $(2.4 \times 10^{-6} \times D) + (2.9 \times 10^{-4})$ (where D is the distance, in miles, to the treatment or disposal facility). Office of Policy, Planning & Evaluation & Office of Solid Waste & Emergency Response, U.S. EPA, Pollution Prevention Benefits Manual C-2 (1989).


991. Id. at 274.


number of assumptions. One of the models, for example, in considering the optimal location for a LLRW facility in Pennsylvania, performed three different computer runs, depending on whether a life is valued at $300,000, $18 million, or $300 million. This modelling literature does not lend itself to a generalization as to whether, considering transportation risks, centralized or dispersed HW/RW facilities are better. Moreover, the prior work generally focuses on just one type of waste at a time, and it does not reflect the lower transportation risks of a centralized facility that result from eliminating the need for external shipment of wastes that would be handled internally, for example, ash or sludge from on-site treatment units that would go to an on-site landfill.

To a considerable extent, however, the question posed by transportation risks is moot. The experience of the past fifteen years shows that, at least under present siting procedures, a large number of new, dispersed facilities is not an option. The nation already possesses a large number of old, dispersed facilities, plus a great deal of "temporary" on-site storage and other substandard management techniques; finding new sites will, under any scheme, be sufficiently difficult that a centralized system is likely to be necessary.

3. Affording Fairness

The third factor in evaluating the proposed siting system is whether it affords fairness to locations, to classes and races, and to generations. The national allocation process to be conducted by the FWDC would be designed to provide a high degree of fairness between regions and states. When each waste stream is considered separately, the results are lumpy: a few states bear the burdens while everyone else gets a free ride. The lumpiness can be eliminated by considering together all the many kinds of hazardous and radioactive waste. The FWDC would have the task of making sure that each state bears a fair share of the cumulative national burdens; there should be no clear winners or losers. Any state that failed to carry its fair load would then be penalized by being unable to export its HW/RW—a serious penalty, since no state is self-sufficient in waste disposal.

Within states, some localities would inevitably bear a very high burden. However, these would be the volunteers. As Mark Sagoff has written, in the context of the voluntariness of risk, "[t]here is an ethical difference between jumping and being pushed—even if the risks and benefits are the same." No one would be forced to bear a disproportionate risk; dissenting individuals in volunteer communities could move away at no economic cost. The new facilities would be subject to strict environmental regulation and local, as well as state and federal, oversight. The facilities will not be without hazard, but they will still be less risky than such unpleasant but necessary neighbors as petrochemical plants, oil refineries, and steel mills, which society has deemed to pose acceptable risks. There is usually little immoral about informed consent to risk, unless the consent is obtained under conditions of coercion.

One form of coercion could be a poverty that forces a community to trade a case of cancer tomorrow for a loaf of bread today. There is concededly some danger of this under my proposal, but it is not at all clear that the volunteer communities will have low income profiles. As seen earlier, the chief factors in whether communities volunteer appear to be cultural rather than demographic. Many of the municipalities that have offered to receive HW/RW facilities have had well-educated populations, although newly hard times, such as the closure of a major employer, certainly contribute to willingness to accept a facility.

To the extent that the suggestions made here are followed, the centralized facilities are likely to be located at old military, nuclear weapons production or uranium mining sites, which—unlike old industrial areas—do not tend to be surrounded by minority communities.

Thus, fairness between classes and races would be improved by the proposed system. The system would aim to close down, and certainly prevent expansion of, old grandfathered facilities, which tend to be located in low-income, high-minority areas, and to open new facilities in places with less skewed demographic profiles. More fully internalizing the external costs of HW/RW disposal will tend to reduce the aggregate social costs of disposal (because it will drive up the price of, and therefore lower the demand for, waste disposal) and shift the remaining social costs away from

998. Sagoff, supra note 687, at 46.
999. See supra notes 652-54 and accompanying text.
1000. See Markusen et al., supra note 944, at 239-42.
facility neighbors and toward those that benefit: the shareholders, employees, suppliers, and consumers of hazardous waste generating companies. 1001

Future generations should also benefit significantly from this proposal. Higher disposal prices would lower HW/RW production. The availability of new disposal facilities would divert waste from temporary storage units to the more permanent new centers and would encourage permanent rather than containment remedies at CERCLA sites and other contaminated locations. The HLW stored in leaking tanks in Hanford and Savannah River could be properly entombed in the near, rather than distant, future. The use of already contaminated land would preserve more agricultural and virgin land for posterity. 1002

Aside from allocative equity, this proposal also offers an important element of procedural justice. Many activities that cause a great deal of anguish in large segments of the population are allowed by the law (such as flag burning, abortion, and marches by hate groups) or even required (for example, busing to achieve racial integration). But each of these activities invokes important constitutional values, at least as the Supreme Court now construes those values. The forced siting of a hazardous or radioactive waste facility in an unwilling community causes no less anguish, but it serves no fundamental constitutional value. As shown throughout this Article, ramming these dreaded facilities down the throats of unwilling communities is neither necessary nor effective, and the power of government should not be invoked in the attempt.

4. Political Viability

Success in finding volunteer communities is necessary to the success of my proposal. As shown above, many communities have already volunteered, typically with only minor financial induce-

1001. The demographics of these beneficiaries of hazardous waste generation are unknown. I am unaware of any studies concerning the income distribution impacts of higher hazardous waste disposal prices, for example. Such work has been done for the costs of air pollution and water pollution control. See Elizabeth E. Lake et al., Who Pays for Clean Water? The Distribution of Water Pollution Control Costs passim (1979); A. Myrick Freeman III, The Incidence of the Costs of Controlling Automotive Air Pollution, in The Distribution of Economic Well-Being 163, 165-67 (F. Thomas Juster ed., 1977).

1002. This is not, of course, a solution for all time. Presumably, after some years, new waste streams will be created that were not accounted for in the initial national allocation. It is hoped that, by then, at least one of the volunteer communities would volunteer to accept this new waste stream; if not, then the federal government would have to step in again. If in the intervening years the wastes going to one of the states declined, that state might be a prime candidate for this new stream.
If offers of serious compensation were forthcoming, still more localities with compatible cultures of risk perception should also come forward. To be appropriate, volunteer areas would also have to be physically suitable; land that sits atop a productive aquifer, for example, would have to be rejected for land disposal units. Could enough sites be found where both the sociology and the geology are suitable? I believe so, but I cannot say for sure.

This proposal requires the consent of the states as well as the localities. Here, I am more confident of success. A major reason for state opposition to locally acceptable waste disposal projects is the fear of being exploited, being stigmatized, and becoming the national patsy. A slight variation of a recurring phrase, "nation’s dumping ground," permeates state declarations of opposition to proposed HW/RW facilities. The national allocations provided by the FWDC should go a long way toward eliminating that sentiment. The map that the newspapers will print the day after the FWDC announces its proposed allocations will show that every state is bearing a piece, but only a piece, of the national disposal burden.

VII. CONCLUSION

The task I set at the beginning of this Article was to find a system of hazardous and radioactive waste management that maximizes social welfare, takes full account of social and environment-

1003. See supra notes 721-35 and accompanying text.


1005. On several occasions various mayors of New York City have tried to site simultaneously multiple incinerators, homeless shelters, or other unpopular facilities in different communities. The resulting newspaper maps did not achieve community acceptance of these proposals, and in each case the attempt failed politically. However, that experience differs greatly from the current proposal. In New York City, the mayor named specific sites, leaving no choice to the affected communities. Under my proposal, the FWDC would allocate facilities among states; the states would be left to pick sites for the facilities (or to trade allocations with other states). The New York City experience suggests that central allocation is ineffective if not accompanied by decentralized site selection and local control.
tal costs, and still achieves fairness. I believe that my proposed system of local control, state responsibility, and national allocation can fulfill this task.

Social welfare would be maximized by reducing waste disposal requirements to a minimum, primarily through price incentives and elimination of hidden subsidies for waste generation, and then determining how much disposal capacity is still required. This capacity would be allocated between the fifty states, based primarily on how much waste they generate, what disposal facilities they already have, and their geological and other physical attributes. Volunteer communities would be sought in each state to handle that state's allocation. Social and economic costs would be minimized through a sound siting process, and those that remained would be compensated. The national allocation process would achieve fairness between states; the search for volunteer communities would achieve fairness within states; the closure of antiquated facilities would reduce the disproportionate burden on the poor and minorities; and the construction of centralized destruction and disposal units, especially on already-contaminated federal land, would reduce the number of affected neighbors, preserve now-clean land for posterity, and help relieve future generations of the burden of caring for our waste.

This system would face many practical, political, and economic obstacles, but it is superior to the current regime of impasse, conflict, fragmentation, and futile attempts at coercion.