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Chapter 2

Understanding Marine Waste Disposal: The Broader Context

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Understanding Marine Disposal: The Broader Context

INTRODUCTION

Decisions about marine waste disposal are affected by many ecological, economic, and social factors that extend beyond purely technical considerations. These other important factors include the economic and aesthetic value of marine resources, philosophical perspectives on the use of marine environments for waste disposal, and the nature of public concerns over such disposal. Looking at this range of considerations can help define a broad context within which decisions can be made about using marine environments for the disposal of wastes.

Marine waters have enormous value. They are home to a tremendous diversity of marine organisms and play a critical role in nutrient and energy cycles. From an economic perspective, they harbor food species that provide sustenance to people, primarily from commercial and recreational fishing, but also from hunting coastal waterfowl, harvesting marine plants, and aquaculture and mariculture operations. Fishing supports numerous other commercial activities, such as shipbuilding, fish processing, and retailing. Marine resources are also important sources of products such as pharmaceutical chemicals and many common consumer goods (e. g., the base for toothpaste).

From an aesthetic perspective, marine waters afford the value of a relatively unspoiled and mysterious frontier, as well as numerous recreational opportunities. The sights, smells, and sounds of the sea and its life provide countless people with feelings of pleasure and well-being. Fishermen, mariners, poets, and beachcombers all recount the irresistible attractions of the sea. Commercial fishermen cling tenaciously to their way of life despite economic and physical hardships; recreational fishermen frequently continue to fish for pleasure even when advised not to consume fish due to high con-

tamination levels.¹ Although difficult to fully quantify, it is clear that marine resources are of substantial importance to a wide range of Americans.

Public interest in marine resources heightened in recent decades because of several marine pollution incidents. These include the detection of DDT residues and PCBs in parts of the deep ocean, closures of beaches and shellfish beds in the United States because of bacterial contamination, and a lethal incident in Japan that involved the consumption of mercury-contaminated fish. In addition, problems arising from waste disposal on land (e. g., the discovery of many toxic waste sites and increasing groundwater contamination) generally stimulated public concern about the impacts of wastes in all environments.

The images left after these and other pollution incidents have combined with aesthetic considerations to confer a special status on marine waters. The ocean is viewed by many in the general public as a unique and precious resource requiring careful stewardship because of its vital importance to the earth's ecosystem and the potential for rendering irreversible harm to it. In addition, in recent years the international community has begun to recognize marine waters in general as a global resource.

¹ A recent study of recreational fishermen in New Jersey found that 40 percent of the fishermen surveyed were aware that the fish they caught had unacceptable levels of contaminant ion and refrained from eating them (31). A survey by the U.S. Department of the Interior in 1982-83 found that fishermen most frequently cite relaxation and enjoying nature as the reasons why fishing is a favored outdoor activity; the prospect of catching or consuming fish is cited much less frequently (626).

For these reasons, any discussion of the use of marine waters for waste disposal must consider not only the technical and economic feasibility of a disposal option, but also its political acceptability. Thus, it is increasingly important to consider marine disposal alternatives in the context of broader issues. In particular, the aesthetic and economic value of marine waters should be considered relative to land-based resources and marine waste disposal should be seen as one part of a more comprehensive strategy of waste management.

This chapter examines various perspectives toward marine waters, including their economic and social value from a recreational and commercial viewpoint, and the broad philosophical positions that affect use of these waters, ranging from

a protectionist view to managerial stances. These differing philosophical perspectives are reflected in current statutes and could be obstacles to comprehensive marine waste management. Next, two elements of a more comprehensive waste management strategy are examined: a general waste management hierarchy and the use of "multi-media assessment. Finally, recognizing that credibility is crucial to the public acceptability of any waste management decisions, several specific public concerns about marine disposal are discussed: 1) questions of equity; 2) opportunities for public participation; and 3) risk acceptability.²

²These public concerns were selected to illustrate the range of such concerns, but are only a sample of the various types of issues important to the public.

PERSPECTIVES ON MARINE WATERS

The Value of Marine Resources

It is impossible to accurately and meaningfully quantify the full value of all marine resources to all people. Thus, the following discussion focuses on marine resources that are directly important to large numbers of people or are economically significant, and in addition are especially vulnerable to changes induced by waste disposal. These resources include organisms dependent on marine waters, such as fish, birds, mammals and vegetation, and waters used for swimming and other recreational purposes.

These marine resources support commercial and recreational fishing, beach-going, and other activities generated by the tourist trade in coastal areas. The activities tend to be concentrated in estuaries and coastal areas, although a significant amount of fishing occurs in the open ocean. Marine resources are of substantial and direct importance to tens of millions of Americans and they generate annual expenditures of billions of dollars.

Fishing and beach-going are among the principal recreational uses. Almost 12 million Americans aged 16 or over fished recreationally in U.S. marine waters in 1980 and spent approximately \$2.4 billion on food, lodging, transportation, equipment, licenses, tags, and permits (628). Approximately

30 percent of all U.S. finfish landings used for human food (as opposed to uses such as pet food or fish meal) in 1985 were caught by marine recreational fishermen (614).³ About three-fourths of these fish were caught within 3 miles of shore (605,606).

Although the nationwide significance of beach-going has not been studied in detail, its importance is suggested by a study conducted in Florida (27). Over 13 million adults used the State's beaches in 1984, and direct and indirect beach-related sales amounted to \$4.6 billion—nearly 3 percent of the State's gross sales. These sales generated about 180,000 jobs, with a payroll of about \$1.1 billion, and over \$164 million in revenues for the State.

The same study also attempted to quantify the social value of Florida's beaches. Based on extrapolations from a survey that asked people in Florida how much they would be willing to pay to use the beaches, the investigators estimated a social value ranging between \$2 billion and \$28 billion. This large range illustrates the uncertainty associated with such an estimate. Nevertheless, it draws attention to the enormous economic significance of recreational activities, and beach-going in particular, to some coastal economies.

³This figure refers to fish landed in all U. S. marine ports, regardless of where they were caught.



Photo credit: Division of Tourism, Florida Department of Commerce

Almost 12 million Americans aged 16 or over fished for recreation in U.S. marine waters in 1980.

In addition to being drawn to marine waters for recreational fishing and bathing, people travel to or live near these waters for other recreational purposes, ranging from waterfowl hunting to whale and bird watching. The degree to which wildlife draws people to marine waters for these other activities is not known, but large numbers of people are involved. For example, National Park Service lands that include marine waters recorded more than 60 million recreational visits in 1985; over 22 million of these visits were recorded at National Seashores (627). A government survey found that wildlife *alone* attracted at least 5 million people to ocean-side areas in 1980 (628).

Besides their recreational uses, wildlife resources are also of tremendous commercial value, primar-

ily to commercial fishermen.⁴ About 231,000 commercial fishermen were employed in the United States in 1984. Total commercial landings of fish and shellfish from all U.S. marine waters had a dockside value in 1985 of about \$2.3 billion (table 1), and a retail value several times greater. About one-half of the total commercial value was generated by fish and shellfish harvested within 3 miles of shore. These figures do not include the value of support services, such as shipbuilding and fish processing. For example, nearly 110,000 people were seasonally employed in 1984 as processors and

⁴Other uses, while not discussed here, are locally important. These include activities such as the commercial harvesting of aquatic vegetation (e. g., kelp) and commercial exploitation of fur-bearing mammals.

Table I.—Commercial Fish Landings in the United States, 1985

Coastal region	Million pounds	Million dollars
Northern Pacific	1,454	\$ 730
California and Hawaii	380	155
Gulf of Mexico	2,412	597
Southern Atlantic	311	156
Northern Atlantic	1,556	644
Maryland, Virginia	(815)	(124)
Delaware, New Jersey, New York	(151)	(101)
New England States	(590)	(419)
Total	6,113	\$2,282

SOURCE: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, *Fishery Statistics of the United States, 1985*, Current Fishery Statistics No. 8380 (Washington, DC: April 1988).

wholesalers for the commercial fishing industry (614).

Recreational and commercial activities have been affected by waste disposal activities in numerous instances. The effects are not always detrimental, and may in fact at times be beneficial. For example, wastes discharged from small fish-processing firms, if properly managed, can increase the food supply for local fish and improve nearby recreational fishing.

Unfortunately, in many cases the impacts are not advantageous. The nationwide magnitude of impacts certainly is very large, although its exact

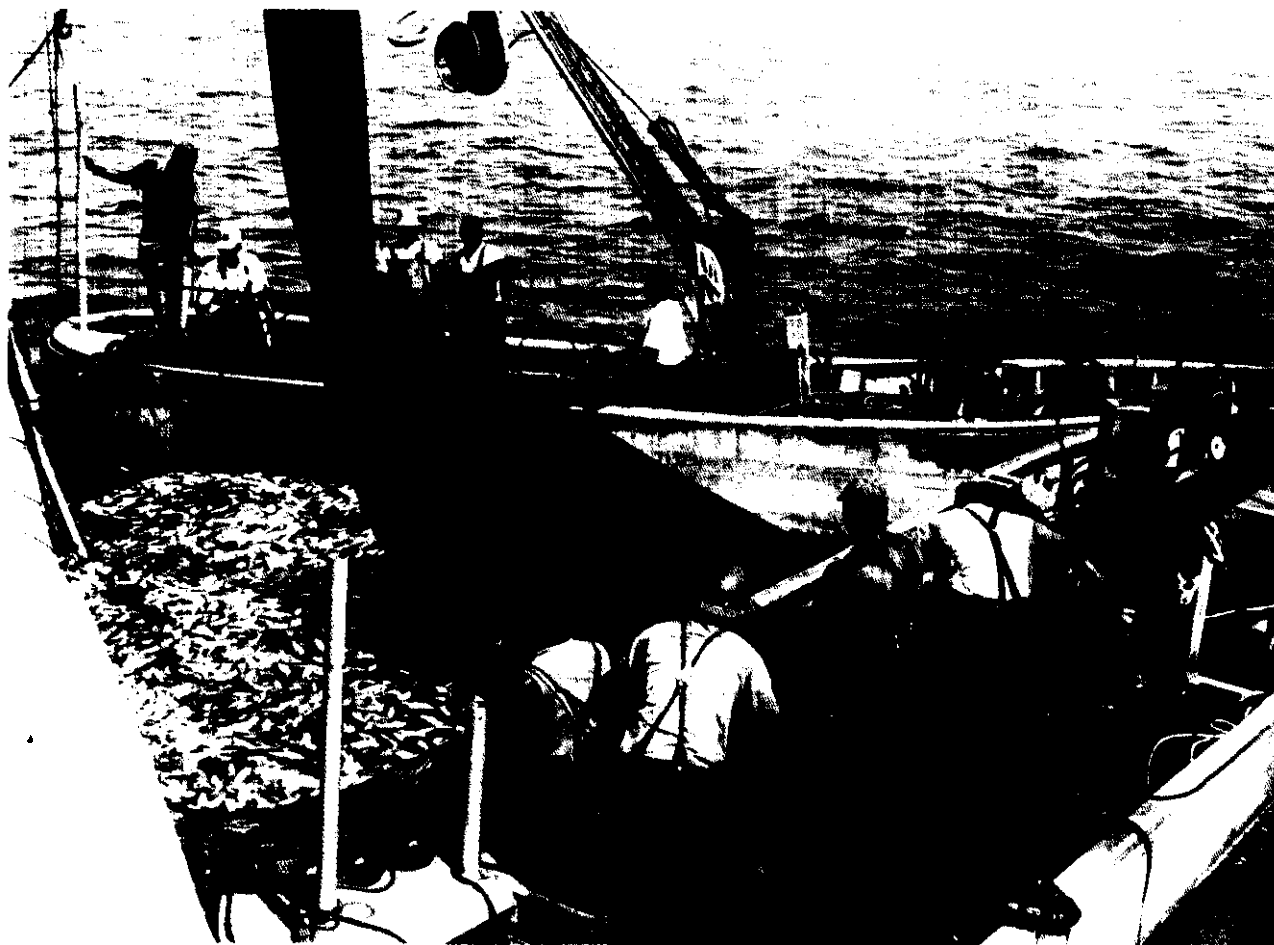


Photo credit: U.S. National Oceanic and Atmospheric Administration

In 1985, marine fisheries supported well over 200,000 U.S. fishermen, and U.S. landings were valued at \$2.3 billion. The single most important commercial marine species was menhaden, shown here being hauled aboard a fishing vessel. Some menhaden being caught along the Atlantic coast, from North Carolina south, exhibit skin ulcers that may be linked to pollutants, but a clear explanation for the affliction has yet to be found.

spective, the ocean is considered a common resource that requires special protection to prevent its exploitation. The basic concern is to prevent a ‘tragedy of the commons, i.e., the overexploitation of the common resource of the oceans for individual gain (222). Special protection of marine waters by the government is considered justified on grounds similar to those used to argue for protection of national forests and other precious common resources.

The protectionist position argues further that the level of scientific uncertainty about marine environments requires extreme caution when considering their use for waste disposal. Given the potential irreversibility of negative impacts that might result from waste disposal activities or accidents, this view gives special weight to the effects of actions by today’s society on future generations. As Jacques Cousteau explained:

To fulfill a moral obligation that the legacy of the oceans be continued, our first concern must be directed to the future. Risks for our progeny must be weighed against anticipated short-term provincial benefits. Our responsibility toward them is overwhelming . . . Poisoning the sea will inevitably poison us. Let us act with wisdom, foresight, and prudence (117).

Most proponents of the protectionist perspective maintain that the first management priority is to reduce the generation of a waste at its source. When wastes must be disposed of, protectionists argue that marine waters should only be used as a last resort or at least not be considered equally along with other potential disposal media. One reason given for this strict stand is that whenever marine waters are considered as an option for waste disposal, they are chosen because marine disposal is often the least socially objectionable alternative (i. e., because it satisfies people’s desire to have waste disposal occur at a distance). Marine disposal is also often the least costly disposal alternative for some wastes. For some coastal municipalities, for example, marine disposal of sewage sludge costs less than land-based treatment or disposal. Some observers, however, advocate changing this by having the costs associated with marine disposal (e. g., site selection and monitoring) be borne more directly by waste disposers rather than by the government.

An additional concern is that since ‘nothing in the sea is provincial, a global perspective must be maintained regarding marine waters. In particular, the United States has been considered a leader in environmental protection, so there is concern that if the United States increases its marine disposal activities, other nations will follow.

Even many strong proponents of protection, however, acknowledge that disposal in marine waters may be appropriate for certain wastes. For example, marine disposal of acid wastes might be considered acceptable in some instances, if properly managed and monitored. At the same time, there is general consensus that certain highly toxic wastes are probably never appropriate for such disposal. Most protectionists would argue that marine disposal should only be chosen after a comparison with land-based treatment and disposal methods (i. e., after conducting a multi-media assessment) (121).

The Managerial View

The managerial position contends that marine waters can be viewed in many ways, and ‘one of the uses of the oceans is that [of] a receptacle for wastes. If used properly, it should serve as a renewable resource’ (189). This perspective is rooted in the conservation movement of the Progressive era; the movement emphasized wise and multiple use of natural resources. From the managerial perspective, many factors need to be balanced in deciding how to use marine waters. These factors include: environmental and human health considerations, technological feasibility, economic costs, and the availability of other disposal options. Depending on how these different factors are weighted, the managerial perspective can support a range of positions from strong protection to maximum use of marine waters.

A basic distinction between the protectionist and managerial perspectives is that the latter is a *human-centered* approach which views the environment, including marine waters, as a resource to be used for society’s benefit. In contrast, the protectionist position places primary emphasis on the environment itself, treating anthropological concerns as peripheral in any policy decisions. It considers the environment for its own value, however

difficult to quantify, rather than its value only in terms of its use for humans (558). Thus, the severity of the same impact can be interpreted differently.

When marine waters are viewed as a resource (i.e., from the managerial perspective), they are not necessarily used by society in the most beneficial or environmentally sound way. This problem is related to the “tragedy of the commons” argument: for any resource for which there are no individual property rights (i.e., a common resource), it is in each individual’s interest to use the resource to his/her fullest advantage regardless of any long-term consequences. Ultimately, since all resources have the potential to be exhausted, disaster can result.

A managerial perspective can use several different approaches to encourage better management of such resources. The approach commonly used in the United States is a standard-setting regulatory approach, which delineates the allowable amount of resource degradation or use. Standard-setting can be based on environmental and human health considerations, as well as technological and economic factors; it is used extensively, for example, in the Clean Water Act. Another approach relies more on the use of economic mechanisms to control degradation. For example, a society could use fees or taxes to adjust the degree of resource use to a desired level, or it could use transferable property rights or tradable permits to allocate the rights to use the resource (172).

It is possible that an economic fee or charge approach and a standard-setting system might be integrated to better provide incentives for reduction and more efficient control of certain pollutants; the combination of a permit system with an economic charge system might be better than either system alone in providing the flexibility needed for responding adequately to changing circumstances (56).

Comparing the Marine Protection, Research, and Sanctuaries Act and the Clean Water Act

Currently, the two major statutes regulating marine waste disposal—the Clean Water Act (CWA) and the Marine Protection, Research, and Sanctuaries Act (MPRSA)—embody somewhat different expressions of these basic philosophical perspec-

tives. MPRSA includes protectionist provisions (e. g., establishment of marine sanctuaries), but allows managed use through a permit process for marine dumping. The permit system could also be used to increase or decrease protection. An assessment of all relevant factors, such as alternative options, potential effects, and economics is required before a dumping permit can be granted.

Under MPRSA, disposal of some wastes is absolutely prohibited (e. g., warfare substances and high-level radioactive waste). Other wastes such as some industrial wastes, sewage sludge, and dredged material can be disposed of under regulated conditions.

CWA is more consistently managerial in its orientation, and it stresses a ‘ ‘best available technology, economically achievable’ and ‘ ‘best management practices’ approach. Under CWA, permits include standards for allowable discharges, but do not require consideration of the full range of factors required for an MPRSA permit.

As a result, and because the two statutes also differ in their jurisdiction over marine environments (ch. 7), different marine environments have received varying degrees of protection from and use for waste disposal. In open ocean environments, dumping activities have generally been strictly controlled or reduced under the guidelines set forth by MPRSA. In estuaries and coastal waters, however, disposal activities regulated under CWA and MPRSA are much more frequent, and in general these waters have borne the brunt of marine disposal activities.

The basic orientation of a law, however, can evolve and change. In the case of MPRSA, Congress embodied a protective attitude in the law a decade ago by setting a 1981 deadline for terminating the disposal of sewage sludge which might ‘ ‘unreasonably degrade or endanger’ human health, welfare, or the environment.’⁷ In a landmark case, *City of New York v. United States Environmental Protection Agency* (EPA) (543 F. Supp. at 1084, 1099 (S. D.N.Y. 1981)), the court held that not all dumping of sludge was necessarily prohibited by

⁷Congressional intent has been a source of confusion in the Environmental Protection Agency’s implementation of this provision: Congress apparently imposed an absolute deadline, but also included language that can be interpreted to allow the dumping of “reasonable sludge” (12,291,531).

the 1981 deadline.⁸ EPA decided not to appeal the case and currently interprets it to: 1) allow sludge dumping if it does not cause “unreasonable” harm, and 2) require development of criteria for comparing land-based and ocean alternatives to determine

⁸New York City had been dumping sludge under interim permits granted by EPA and was exploring alternative disposal options. It concluded that land-based alternatives would be more costly and potentially more environmentally harmful than marine disposal. EPA maintained that the 1981 deadline absolutely prohibited the dumping and denied the City's petition to continue ocean dumping. The City then sued, arguing that EPA was required to consider all of the statutory criteria listed in MPRSA (Sec. 102(a)) when evaluating permit applications. These criteria require EPA to take into account—beyond environmental criteria—such factors as the need for ocean dumping and the costs of land-based alternatives. The Court further held that MPRSA requires EPA to balance these statutory factors when evaluating permit applications (ch. 7). Some observers have raised the concern that this decision could reduce incentives to find land-based alternatives for sludge treatment or disposal, especially in light of the difficulties associated with siting land-based alternatives and their frequently higher cost (155,650).

when ocean dumping can be allowed. Several cities, including Philadelphia and Washington, have indicated that they would consider the ocean disposal option for sludge if it were to become available.

Although Congress has not officially removed the ban on dumping harmful sludge, it has allowed the 1981 deadline to pass. The law's originally protective attitude thus may be evolving into a more managerial approach to marine waste disposal, but the final policy direction is not yet clear. Specific deadlines for eliminating dumping at the 12-Mile Sewage Sludge Dump Site have been set by EPA and some dumping activity has already shifted to the Deepwater Municipal Sludge Site in open ocean waters. The House of Representatives has supported this shift (ch. 7). The extent to which sludge dumping activities should continue under MPRSA, however, has not yet been clarified by Congress.

COMPREHENSIVE WASTE MANAGEMENT

It is increasingly recognized that the existing suite of pollution control laws, each primarily focused on abating pollution in one particular medium (air, water, or land), has sometimes resulted in the shifting of wastes from one environmental medium to another and that long-term environmental and human health risks may not have been substantially reduced (1 10,11 1,263,378,382). As a result, there is a need for greater incentives to reduce or avoid the generation of wastes as the best means of reducing waste disposal-related risks (144,263,377, 586,587). As our understanding has grown, it has become clear that a highly protective policy toward the open ocean may be counterproductive and that, for particular wastes and situations, marine disposal should be carefully considered in context with land-based alternatives.

Thus, consensus is developing about the need for a more comprehensive waste management strategy in this country. Two key elements of such a strategy would be: 1) a hierarchical approach to waste management, and 2) multi-media assessment. A hierarchical approach ranks waste management methods according to their ability to reduce risk; for example, the highest tiers include methods that avoid the generation of waste (586). Multi-media assessment can be used as a tool to determine which

treatment or disposal method, in which environment, would most minimize risk.

Waste Management Hierarchy

The idea of a waste management hierarchy was developed originally for wastes classified as hazardous according to the legal definition in the Resource Conservation and Recovery Act (RCRA), but its principles are equally applicable to all wastes which can cause harm to the environment or human health (144,263). Tiers in the waste management hierarchy include:

- reduced generation of waste, with respect to both volume and toxicity (using techniques such as product or input substitution and process modification);
- recovery of waste for recycling or reuse of materials for energy (including the use of waste exchanges, shared central facilities, and third-party recycles);
- destruction or treatment of wastes to reduce toxicity (using techniques such as land-based or ocean incineration);
- stabilization of waste through physical or chemical means (e. g., including neutralization and evaporation);

- isolation or containment (e. g., in surface impoundments or landfills); and
- dispersion in the environment (e. g., by dumping or discharge) (586).⁹

With regard to marine destruction and disposal methods, for example, methods such as ocean incineration, which has the potential to destroy 99 percent of certain hazardous wastes, occupy a middle position in such a waste hierarchy. Other methods such as sewage sludge dumping occupy a lower tier.

Waste minimization was declared to be a national policy in the 1984 amendments to RCRA, but incentives to ensure its implementation are not yet sufficient (587). Strong incentives for reduction, recovery, and treatment of wastes prior to disposal, and for selecting the best available disposal options or improving disposal technology, could be made a more integral part of many environmental statutes (263,586,587). Some companies that have voluntarily implemented waste reduction strategies have found that they not only reduce the amount of waste generated, but also save money (279,490,587).¹¹

It is important to note, however, that even when waste reduction does occur large quantities of wastes may still result. Within a waste management hierarchy, the next objective would be to reduce the levels of toxic pollutants in the wastes, by recovering or recycling materials when possible, and then to select the best disposal option for any remaining wastes. The particular characteristics of a waste and the feasibility or availability of potential disposal media would determine the number

and nature of options available, as well as their economy. In general, additional encouragement by Congress of a hierarchical approach for waste management could help facilitate the move toward more comprehensive environmental management.

Multi-Media Assessment

Multi-media assessment as an approach to waste management has gained considerable popularity. This procedure involves comparing the impacts of different treatment and disposal options, including impacts on environmental media other than the one directly used, and then selecting an option on the basis of the greatest reduction in overall environmental risk. Other social and economic factors can also be considered in the process.

Multi-media assessment can be difficult to implement, partly because the amount of information needed to perform such an analysis is large and expensive to obtain, and partly because estimating risks is difficult. Thus, this approach may be most useful as a qualitative gauging method for comparing options, rather than as a rigorous, exclusive, or formal basis for decisions.

The need for multimedia assessment arises in part because disposal in each environmental medium is generally regulated by separate statutes. Although possibilities exist for incorporating multi-media considerations into current statutes, to date waste management programs have operated quite independently. For municipal sludge, for example, MPRSA and CWA place strict limits on (and in some cases effectively prohibit) disposal of sludge in marine and surface waters generally. RCRA limits land-based disposal and land application options, and the Clean Air Act sets extensive technological requirements for sludge incineration operations. Each environmental medium may in theory be protected, but factors such as the cross-media transfer of wastes among the media and the effects of one regulatory program on another are not taken into account (49,283). Moreover, since the sludge must go somewhere, it commonly ends up in the least regulated medium. (EPA is developing comprehensive regulations for sewage sludge management to address these problems; see ch. 9.)

This lack of coordination arises in part because most major environmental statutes were developed

⁹Certain technologies may actually involve more than one tier of the hierarchy and more than one environmental medium. Ocean incineration of wastes entails the destruction of most of the wastes (and for this reason is considered to be in a middle tier of the hierarchy), but a small amount of the unburned wastes is dispersed into the air and the surface water of the ocean and any residues are contained in land-fills (586).

¹⁰Although in many cases the preferred strategy may be to eliminate or reduce the generation of a waste, it cannot automatically be assumed that this option will always best reduce overall risk. For example, process modifications can lead to a reduction in the *quantity* of a waste produced or change its composition, without necessarily reducing the *degree of hazard* of any remaining waste (586). Moreover, certain wastes may not be able to be reduced to any great extent (e. g., sewage sludge and dredged material).

¹¹The 3M Co. estimates that it saved close to \$300 million since 1975 as a result of its "pollution prevention pays" strategy (279).

independently, by different combinations of congressional committees and subcommittees, and are administered by different EPA offices and programs. Differences exist among the statutes with respect to their philosophy and intent, as well as their designation of management authority, and no mechanism provides for development of a comprehensive approach to waste management.

The use of multi-media assessment and a hierarchical approach to waste management could conceivably be integrated into current regulatory programs as a way to promote comprehensive waste management.¹² This would be an enormous under-

¹²A number of options are possible to further promote the use of multi-media assessment including: 1) using Sec. 304 of CWA, which

taking and almost surely would require Federal guidance. Yet, a general consensus is emerging both inside and outside of government that this is a necessary policy direction to ensure more efficient and effective environmental protection. It is increasingly essential that marine waste disposal options be viewed within the context of this general policy debate.

requires that guidelines on discharges into surface water include information on "non-water quality environmental impacts," as a model for provisions in other statutes; 2) requiring the preparation of a multi-media impact statement for all disposal activities; and 3) requiring the development of more consistent criteria for assessing disposal options (where appropriate) among statutes, i.e., a common set of general criteria—perhaps focused on public health and environmental risk reduction—could be included in MPRSA, CWA, and RCRA to be used in comparisons of land-based and marine disposal options.

PUBLIC CONCERNS ABOUT THE USE OF MARINE ENVIRONMENTS

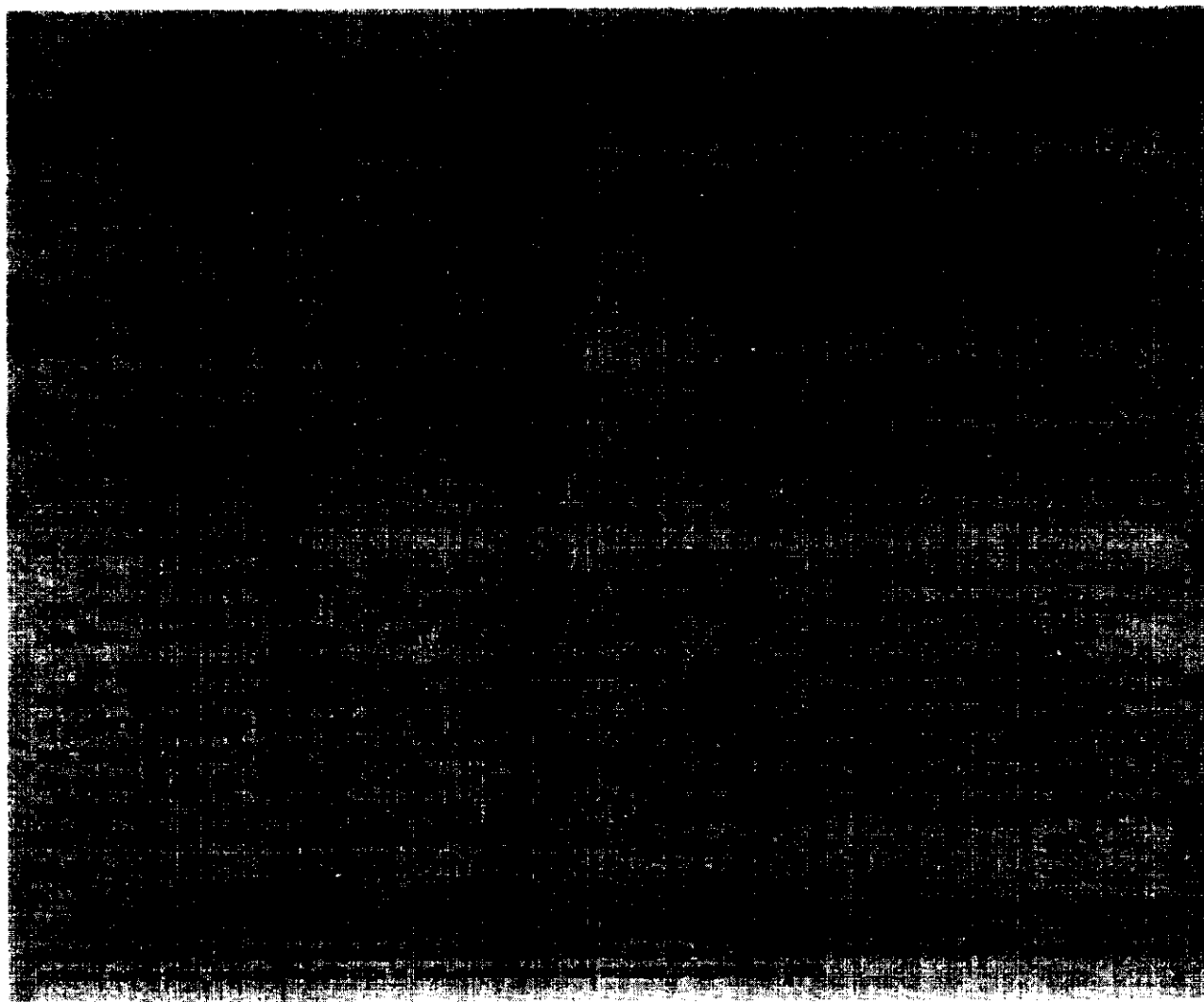
A critical component of all decisions regarding waste disposal in marine waters is the public acceptability of disposal alternatives. A wide range of factors influence whether an individual or the public at large will accept a particular option, but this discussion only highlights several of the most important ones. One fundamental factor is the level of trust the public has for decisionmakers. While any government action is dependent on public trust for its legitimacy, such trust can be elusive.

EPA's credibility, for example, eroded in the early 1980s when several scandals involving the Agency and its dealings with some industries were uncovered (360). Efforts are underway to improve this situation, but rebuilding trust is a slow process. In addition, past violations of environmental regulations (that resulted, for example, in the creation of Superfund sites) have led industry and waste management companies to lose credibility. Given these problems, technical assessments about disposal options often hold little sway with the public, especially when such assessments are unclear about the risks of environmental degradation. Building credibility is closely linked to: 1) how equity issues are resolved during the decisionmaking proc-

ess, 2) how the public is allowed to participate; and 3) how risks and other public concerns are addressed.

Equity

Equity issues arise every time a waste disposal alternative is discussed because residents near a proposed facility or area of disposal fear that their health or property values will be disproportionately jeopardized (see box F). As a consequence, the public often believes that the generator of a waste not only should treat and dispose of it but also should be held liable for any impacts (see box G). One of the most frequently voiced objections at public hearings—whether about the siting of hazardous waste facilities or land disposal of sludge, or permitting for ocean incineration—is that one community should not have to bear the economic burden and potential health and environmental risks of another community's wastes. Although this is not an easy issue to resolve, several techniques to deal with these concerns are being attempted; when siting hazardous waste treatment facilities, for example, the use of risk-mitigating proposals (e. g., regular safety inspections by public officials and rep-



representatives) appears to be more attractive to communities than risk compensation proposals (e. g., lowering property taxes) (450).

Public Participation

The right of citizens to participate in decisions that directly affect their interests is a fundamental component of our form of government. Certainly one way to increase the credibility of a waste disposal decision is to involve the public early and throughout the decisionmaking process. The scientific and technical issues surrounding waste disposal options (e. g., the risks of siting a facility or disposing of waste in a certain location) are impor-

tant factors, but the way they are communicated to and discussed in the community is equally critical. For example, one of the most significant obstacles to the ocean incineration program proposed by EPA is public opposition, which stems in part from poor communication. In this case, the public was excluded from participating in decisions made early in the process (586,667).

Risk Acceptability

If information about a disposal option is highly uncertain, then risks associated with the option are likely to be perceived as high and its acceptance is less likely. Effective communication with the pub-

Box C.—The Liability Issue

The question of who is liable for effects on the environment or human health is a common issue in waste management today, and its implications extend to both developed and developing countries. Liability can be incurred not just from spectacular land-based events such as the Bhopal gas tragedy in India, but also from less apparent hazards—for example, leachate from landfills or effluents from sewage treatment plants; discharges that, although permitted, cause adverse effects on the environment; and current disposal methods that may not meet future standards.

In general, two major areas of concern exist with respect to current liability practices: 1) the availability and cost of liability insurance; and 2) the lack of compensation mechanisms for third parties (i.e., those people who have been injured in some way as a result of waste management activities). Two types of liability insurance cover environmental risks—general comprehensive liability (GCL) for releases, accidental releases, and environmental impairment liability (EIL) for gradual releases and contamination.

For land-based disposal activities, EIL insurance has been available for waste impoundments, landfills, or treatment facilities since 1982 (40 C.F.R. Part 301.103). The cost of this insurance has increased since January 1986, when all new GCL insurances contracts were required to contain a pollution exclusion, which virtually eliminated the availability of such coverage for waste generators (134). Only three companies currently sell EIL insurance for land-based activities. At the same time, the price of liability insurance has increased dramatically during recent years, at the same time that its coverage has become more restricted.

Several statutory provisions address liability for activities in marine environments. Provisions applicable to Superfund sites (CERCLA Sec. 107) in aquatic environments establish a liability limit of \$50 million plus cleanup response costs. Liability can also be incurred by generators from releases that occur during the transportation of hazardous wastes (CERCLA Sec. 308). Under the Marine Protection, Research, and Sanctuaries Act (MPRSA), an ocean vessel knowingly or recklessly discharging wastes is liable for civil penalties or criminal fines (Sec. 105), but not for any damages. The Clean Water Act liability provision for oil and hazardous substances (Sec. 311) applies to vessels and to any discharge at offshore facilities; the provision establishes civil penalties up to \$250,000, a liability limit of \$150 million for oil pollution damages, and compensation for remedial actions. The American Shipowners' Convention Act of 1966, which addresses pollution-related liability of vessel owners, also has provisions in other laws such as the Trans-Alaska Pipeline Authorization Act, the Outer Continental Shelf Lands Act Amendments, and the Deep Water Ports Act.

In the past, it has been difficult for third parties to press liability claims. The Superfund Amendments and Reauthorization Act of 1986 overruled several cases, including *Illinois v. City of Milwaukee* (101 S.Ct. 1784), *Missouri County Sewerage Authority v. National Sea Clammers Association* (453 U.S. 1)) and clarified that MPRSA does not preempt any person's right to: 1) seek damages or enforcement of any standard or limitation under State law, including State common law; or 2) seek damages resulting from non-compliance with any permit or requirement under MPRSA or under other Federal law, including maritime tort law.

lic regarding the nature of risks associated with a disposal option is an important aspect of building credibility, addressing equity issues, and encouraging effective public participation in helping to solve problems. Given that access to information influences an individual's perception of risk, efforts have been made recently to improve communication between government, industry, and citizens about

risks (11 2). Public involvement has been encouraged by EPA, for example, to help make decisions about how to balance risks and other ethical, social, and economic considerations (652). Various States also are developing strategies for involving the public. The New Jersey Department of Environmental Protection, for example, is restructuring risk assessment activities so that information



Photo credit: Gilles Press

“In haul-seining, a net-filled dory is launched through the open surf, an enterprise that, on a rough Atlantic day, demands nerve and experience as well as skill. Without the striped bass, haul-seining is unlikely to survive, and the end of this fishery will mean the end of a surfboat tradition that began when the Atlantic coast was still the American frontier.”
—Matthiesen, P., *Men's Lives: The Surfmén and Baymen of the South Fork* (New York: Random House, 1986).

about risks is communicated more effectively to the public.¹³

A number of factors influence risk acceptability (316). Two of the most crucial, especially with respect to marine disposal, are the controllability and irreversibility of potential risks. One of the primary reasons why the public has a protective attitude toward the oceans is a perception that any harm incurred as a result of waste disposal activities in marine waters may be irreversible. The public genuinely believes that the oceans are a resource requiring careful stewardship and that they should not be damaged perhaps irrevocably. As one fisherman noted:

I've seen bluefish come and go in my lifetime, and striped bass, too. The bluefish is a wild fish and a hardy fish, and because he don't go up in them dirty rivers, he'll survive where the striped bass will go down. All the fish around here come and go in cycles, and years back, you could anticipate the cycles, but today, with the pollution the way it is, you can 't be so sure that a fish that's gone will ever come back at all (342).

The logical conclusion drawn by most fishermen, then, is that some stewardship of marine resources is necessary (342).

This sentiment is generally shared by the public which—judging by its high level of recreational use of coastal areas—highly values marine environments. An observation frequently heard when discussing marine waste disposal options—that ‘ ‘fish don't vote’ —is literally true, but not completely accurate. Marine waters and organisms do have a constituency that attempts to represent their interests. A number of public interest groups are highly attentive to any decisions regarding the uses of marine waters and the potential impacts of waste disposal. At the same time, most groups would agree that decisions regarding the disposal of wastes in marine waters should be considered in the broader context of comprehensive waste management.

¹³One strategy is to involve citizen groups in the decisionmaking process *before* an issue becomes a news media event. For example, a New Jersey Department of Environmental Protection study recently found toxic contamination with dioxin in New York Bight lobsters; *before* any policy determinations were made, the agency invited representatives from the fishery cooperatives in New Jersey and the U. S. Army Corps of Engineers to meet with its staff. The Corps of Engineers was invited because lobstermen maintain that the marine disposal of dredged material is the primary source of the dioxin contamination. The involvement of both groups is intended to ensure that human health and economic issues will be adequately considered, that credibility in the process can be maintained, and that information will be effectively communicated to the broader public (29).

¹⁴Marine waters appear to be able to receive certain wastes (e.g., acids) in controlled and monitored quantities without suffering significant adverse impacts; water and sediment quality may be altered for a time, but long-term ecological change appears unlikely (see chs. 5 and 11). Certain land-based disposal methods also can lead to irreversible environmental effects (e.g., contamination of groundwater). There is a general perception, however, that these effects tend to be relatively localized compared to the more global contamination that might occur in the ocean. This perception is not always correct.