

Executive Summary

The Evolution of Hazardous Waste Programs: Lessons from Eight Countries *Executive Summary*

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Executive Summary

In most countries, the development of environmental programs follows a similar pattern. Early efforts concentrate on direct threats to public health, such as contaminated drinking water and air pollution. Only after these problems are addressed does the issue of improving the day-to-day management of wastes deemed “hazardous” rise to the top of the nation’s environmental agenda.

In the past thirty years, many developed countries have established effective hazardous waste management programs. During the past decade, some developing countries—particularly those that have experienced rapid economic growth and industrialization—have begun to consider ways of developing and implementing programs to assure the proper disposal of hazardous waste. No two countries share identical circumstances in terms of political regime, industrial policy, major industries, geography, and the nature of their hazardous waste problem; an examination of the experiences of both developed and developing countries offers useful insights about the evolution of hazardous waste management programs to other countries embarking on a similar path.

Managing Hazardous Waste: A Difficult Challenge

Fundamentally, the goal of an effective hazardous waste management program is changing the behavior of those organizations (both public and private) that generate and manage hazardous wastes. The key components of meeting this goal are, first, building an effective regulatory program and, second, developing adequate treatment, storage, and disposal facilities. Both components present challenges to a country seeking to move from a situation in which there is little or no regulation of hazardous waste to one in which the majority of generators treat, store, and dispose of hazardous waste in an environmentally safe way.

In this report, we examine the lessons that can be learned from eight countries that have instituted (or have begun to institute) hazardous waste management programs during the last thirty years. We look at the experiences of four developed countries—Germany, Denmark, the United States, and Canada—and

four developing countries—Malaysia, Hong Kong, Thailand, and Indonesia. Each of these (and in that order) have tackled the hazardous waste management challenge. This report represents a first effort at a cross-country comparison of the evolution of hazardous waste management programs around the world. We look at a small sample of countries, from three regions of the globe. However, the countries studied employ a broad range of approaches, and their experiences highlight a number of important issues.

In many ways, the central challenge of developing a successful hazardous waste management program is creating incentives for proper hazardous waste treatment and disposal. To compel compliance, hazardous waste management programs typically rely on what can be called “negative incentives”—requirements that impose costs on the waste generator and carry with them the “stick” of permits, licenses, inspections, and enforcement. Many countries have chosen to make it easier to comply in the early years of a new regulatory regime by “ramping up” the stringency—and often the costs—of requirements over time. The first issue we address in this report is: *What are the major steps in the evolution of a successful hazardous waste management program, and how long does it take before new requirements result in improvements in the way that hazardous wastes are actually managed?*

Assuring adequate facilities for treating, storing, and disposing of hazardous wastes presents its own challenges. There are usually few high-quality waste management facilities in countries that are just beginning to institute hazardous waste management requirements. And, in the early years of a program, it is difficult to attract private-sector money to build needed facilities. Often, private investors cannot be assured that hazardous waste generators will be willing to pay the higher costs of proper waste treatment and disposal, rather than dumping hazardous wastes in back lots and rivers. When this is the case, some form of public-sector financing often is used to get needed treatment and disposal infrastructure on-line. Public-sector financing also allows governments to introduce the positive incentive of subsidized disposal fees that encourage waste generators to use high-quality waste management facilities at low (or no) cost. The second key question we address is: *What role, if any, does the public sector play in financing hazardous waste treatment and disposal facilities?*

Ultimately, the issues of regulatory program development and facility financing are inextricably linked. Absent a set of clear rules and adequate enforcement, industries have little incentive to pay for proper waste disposal;

this leaves government and private firms with little financial incentive to invest in expensive waste treatment and disposal. Without adequate facilities, however, it is very difficult (if not impossible) to hold the regulated community accountable for proper waste management.

Creating an Effective Hazardous Waste Management Program

The experiences of the eight countries in our study make one lesson clear: It takes a long time to develop an effective hazardous waste management program. Programs evolve through a complex process subject to the particular economic, political, legal, and cultural context of individual countries. As programs evolve, however, they typically pass through five major stages.

1. *Identifying the problem and enacting legislation*: recognizing that an environmental problem exists and enacting legislation to address it.
2. *Designating a lead agency*: giving authority to a specific agency, or agencies, to draft, implement, and enforce regulations.
3. *Promulgating rules and regulations*: establishing the legal basis for a regulatory program, including (a) identifying which wastes will be subject to regulation and (b) identifying specific technical, procedural, and information requirements for waste treatment, storage, and disposal facilities and for generators of hazardous wastes.
4. *Developing treatment and disposal capacity*: ensuring the construction and operation of hazardous waste management facilities using public funds, private investment, or a combination of the two.
5. *Creating a mature compliance and enforcement program*: influencing the behavior of generators and operators of hazardous waste management facilities to ensure that waste is properly managed. At this final stage, one can say that a “culture of compliance” exists. Once a program has matured to this point, renewed effort is usually focused on ways to reduce or recycle hazardous substances to decrease the need for expensive waste treatment and disposal.

Each of these stages takes a number of years, and, at each stage, there are many difficult issues to be resolved. Germany, Denmark, the United States, and Canada began the process of program development during the 1970s. For the

most part, their regulatory programs were fully operational by the end of the 1980s, and subsequent laws and policies have focused mainly on encouraging waste minimization and recycling. Malaysia, Thailand, Hong Kong, and Indonesia began focusing serious attention on hazardous waste management in the late 1980s and early 1990s (although some began initial efforts in the early 1980s). With the possible exception of Hong Kong, these developing countries are still some way from having what most would describe as fully operational programs. Table ES-1 presents a summary of the dates of each country's first major hazardous waste management laws or regulations.

A review of the evolution of hazardous waste management programs in the eight countries we examined suggests some general lessons that should prove useful to those countries contemplating the creation of their own hazardous waste management programs. Perhaps the most significant lesson, however, is one of humility about the enormity of the task.

1. It takes a long time—at least ten to fifteen years—to develop a fully operational hazardous waste regulatory system.

It took the United States, Germany, Canada, and Denmark ten to fifteen years to develop the laws, institutions, and procedures that resulted in widespread changes in the way firms handle, treat, and dispose of hazardous waste. These are all “rule of law” countries with strong legal and bureaucratic institutions. Hong Kong, Indonesia, Malaysia, and Thailand have been actively regulating hazardous waste for five to ten years and still have a long way to go before hazardous waste is properly managed in a comprehensive way.

Table ES-1. Dates of First Major Laws or Regulations Dealing With Hazardous Waste Management

Developed Countries	
Germany	1972 (law)
Denmark	1973 (laws)
United States	1976 (law)
Canada	1980 (law)
Developing Countries	
Malaysia	1989 (regulations)
Hong Kong	1991 (laws)
Thailand	1992 (laws)
Indonesia	1994 and 1995 (regulations)

2. Developing a culture of compliance is the crucial element of an effective hazardous waste management system.

No government has enough resources to inspect every hazardous waste management facility frequently enough to detect all violations of rules and regulations. Instead, the regulatory system must have enough public credibility—often established by making the threat of enforcement real—that most regulated entities comply with environmental requirements as a matter of course. Absent such a culture, it is extremely difficult to have an effective hazardous waste management program. The question of what, if anything, can be done to *create* a culture of compliance is far larger than simply building effective environmental programs. It raises fundamental issues of governance and the core legal and political culture of a country.

3. Clear lines of regulatory authority increase the chances of successful implementation of new regulatory programs.

A single *environmental* agency may not always be the best way to proceed, but having clear lines of regulatory authority vested in a single agency is important to program success. Simply having good laws and regulations on the books does not guarantee that a hazardous waste management program will be successful. What is needed are government institutions that are credible and that have the resources and expertise to implement regulatory requirements.

4. There are important consequences to the decision *not* to harmonize policy at the national level.

While most of the countries we studied had some form of shared responsibility between the national government and subnational jurisdictions, some delegated most of the responsibility for the design and implementation of programs to provinces and states. In these cases, decentralization resulted in differences in the quality and effectiveness of different state- and province-level programs, as well as differences in waste definitions, permitting requirements, and treatment and disposal standards. These countries have subsequently sought greater harmonization of their hazardous waste policies at the national level.

Bringing Needed Hazardous Waste Management Facilities On-Line

Ideally, once a regulatory system has been implemented, there would also be adequate capacity for the proper treatment and disposal of hazardous waste.

But hazardous waste management facilities do not come on-line overnight. They are expensive, and the market for hazardous waste treatment and disposal is highly uncertain, especially in the early years of a regulatory program. Often, private investors are unsure whether hazardous waste generators will be willing to pay disposal fees that are high enough to provide an adequate return on investment. This is especially true in countries with weak legal and enforcement regimes.

In many countries, in order to assure that needed hazardous waste management facilities *do* come on-line, the public sector has provided direct financial support to build and operate facilities or has offered incentives that reduce investors' financial risk. In some cases, government agencies build and operate hazardous waste management facilities themselves.

Partial or full public financing of hazardous waste facilities creates the option of subsidizing disposal fees. Subsidies are an important policy tool, as they help discourage illegal disposal by making proper hazardous waste management cheaper. Subsidies can be available to all, or they can be targeted to some generators, such as small businesses, with the least ability to pay for disposal. While subsidies can be effective in helping to control illegal disposal, they may also work against another important long-term hazardous waste management goal—getting generators to minimize their production of hazardous waste in the first place. However, preventing illegal disposal is typically a more urgent concern in the early years of regulatory programs. Attention to minimizing hazardous waste generation often comes later, as regulatory programs mature.

The countries we studied ran the gamut from a private-sector approach in the United States, Malaysia, and Indonesia to a public-sector approach in Denmark and parts of Germany. The remaining countries fell somewhere between, with shared public and private sector responsibilities. Table ES-2 presents a summary of the public—and private—sector financing approaches employed by the countries examined in this study.

Based on our examination of eight countries, we reached three important conclusions about facility financing.

1. There is no single “proper” approach to hazardous waste management facility financing that will work in every country.

No one financing approach—private, public, or a mix—was clearly superior to the others in all cases. Rather than adopting a standard approach, each country

Table ES-2. Summary of Public- and Private-Sector Financing of Hazardous Waste Management Facilities

Developed Countries	
Germany	public/private
Denmark	public
United States	private
Canada	public/private
Developing Countries	
Malaysia	private
Hong Kong	public/private
Thailand	public/private
Indonesia	private

should select a financing approach that is tailored to its circumstances (industrial profile, geography, government resources, and capacity), the effectiveness of its regulatory system, and its general policy objectives.

2. In countries where there is not yet a culture of compliance, the financing approach matters.

Although there is no standard approach to financing hazardous waste facilities, it is clear that where enforcement and compliance are weak—a situation typical of the early years of regulatory programs—subsidies are an important policy tool for encouraging generators to properly manage hazardous wastes. In this environment, treatment and disposal facilities usually “compete with the river,” where the cost of disposal is zero. When the regulatory stick is weak—as in all of the developing countries we examined—financing models that allow countries to offer the carrot of subsidized disposal fees are likely to be more effective than other approaches in encouraging a change in behavior.

3. Disposal fee subsidies are a viable transitional strategy for encouraging proper waste disposal.

Several countries we studied showed that transitions from a subsidized approach toward a more market-driven approach are possible. Subsidies can encourage early compliance, and getting generators in the habit of using hazardous waste management facilities is an important first step toward the long-term goal of building a culture of compliance. More stringent and costly hazardous waste management requirements can be phased in over time.

Other Important Issues and Areas for Further Research

In the course of our research, several issues arose that are not directly related to program evolution or facility financing but are, nonetheless, important elements in developing a hazardous waste management program. We briefly describe them here and then recommend issues warranting additional research.

Other Important Issues

1. One very important resource in a hazardous waste management program is *information*—about who is generating waste, what quantities and types are being generated, and where it is going.
2. Regardless of whether facilities are financed publicly or privately, accurately estimating needed future capacity is difficult.
3. Planning for hazardous waste infrastructure must account for the geography of hazardous waste generation and the cost of transportation from generators to treatment and disposal facilities.
4. There are a number of nonmarket approaches that can be (and have been) used to encourage waste reduction and recycling, including laws and policies to encourage waste minimization, public information, and subsidies or requirements for waste reduction equipment.
5. Siting hazardous waste facilities is always controversial.

Areas for Further Research

Several important issues warrant further study. Most important is the question of what can be done to create a culture of compliance. It is clear that such a culture plays an important role in hazardous waste management and other areas of environmental policy, yet the steps to building such a culture are poorly understood.

Also poorly understood are the specific elements of two financing issues. First, how should subsidies be structured to “get the incentives right” for hazardous waste generators, investors, and the government? And, second, given that public–private ventures are so prevalent in hazardous waste management facilities, how should such arrangements be structured in different situations?

Finally, our research has focused on eight countries in three regions of the globe. What have been the experiences in other parts of the world, such as Eastern Europe, Latin America, and Africa? It would be useful to learn whether the findings for countries in these regions are consistent with those reached in this report.

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