

1990

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Susan E. Bromm

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### Recommended Citation

Bromm, Susan E. "Creating a Hazardous Waste Management Program in a Developing Country." American University International Law Review 5, no. 2 (1990): 325-350.

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# CREATING A HAZARDOUS WASTE MANAGEMENT PROGRAM IN A DEVELOPING COUNTRY

Susan E. Bromm\*

## INTRODUCTION

Considering the public and media attention focused on hazardous waste in the United States, the vast resources devoted to its management and control,<sup>1</sup> and the complex web of legislative and regulatory controls<sup>2</sup> governing every aspect of its handling, it is difficult to believe that many countries have no hazardous waste management control program. Contrast the complex facility permitting process in the United States that takes years to complete and produces permits thousands of pages in length, the prescriptive statutory and regulatory controls, such as the land disposal restrictions program<sup>3</sup> and the comprehensive clean-up programs under both the Comprehensive Environmental Response

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\* Director, Resource Conservation and Recovery Act (RCRA) Enforcement Division, United States Environmental Protection Agency.

The opinions and ideas presented in this article were formulated in large measure based on the papers presented and the discussions held at a workshop on "Adapting Hazardous Waste Management to the Needs of Developing Countries," sponsored by the Developing Country Program of the International Solid Waste and Public Cleansing Association (ISWA), on September 11-13, 1989, in Honolulu, Hawaii. For this reason, the author wishes to thank the workshop organizers and participants for their contribution to this article. In particular, the author thanks Dr. David Wilson, chairperson of Developing Country Program, for his expert assistance and guidance in the development of this article.

The views expressed in this article do not necessarily represent the policies or opinions of the Environmental Protection Agency, the ISWA, or any of the co-sponsors of the Workshop.

1. UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, JUSTIFICATION OF APPROPRIATION ESTIMATES FOR COMMITTEE ON APPROPRIATIONS SF-2, HW-2 (1989). For example, in 1988 Congress appropriated approximately one and a half billion dollars for the United States Environmental Protection Agency's (EPA) hazardous waste regulatory, research, and site clean-up programs. *Id.*

2. See 42 U.S.C. § 6901 (1982 & Supp. V 1987) (setting forth the Resource Conservation and Recovery Act of 1976 (RCRA)). RCRA regulates active waste generation and disposal and prescribes comprehensive regulation of hazardous waste. *Id.* at §§ 6921-6931. The Comprehensive Environmental Response Compensation and Liability Act (CERCLA), 42 U.S.C. §§ 9601-9675, prescribes a phased site evaluation program and imposes liability for site cleanup based on investigations and feasibility studies according to a "National Contingency Plan." *Id.* at §§ 9605, 9616. Hazardous waste management in the United States is also complicated because state governments operate individual hazardous waste regulatory programs, sometimes in lieu of, and other times in addition to, the federal regulatory program. *Id.* at § 6926.

3. Land Disposal Restrictions, 40 C.F.R. § 268 (1987).

Compensation and Liability Act (CERCLA)<sup>4</sup> and the Resource Conservation and Recovery Act (RCRA),<sup>5</sup> with the totally uncontrolled practices that exist in many developing countries. In Thailand, for example, as in many other countries, human scavengers roam uncovered and uncontrolled dumps containing municipal, infectious, and toxic wastes in search of food or recyclable materials such as metals or plastic.<sup>6</sup> In Hong Kong, liquid hazardous wastes originating in multi-storied factories are discharged directly into sewers or alleyways.<sup>7</sup>

Several factors may tend to compound the hazardous waste program in developing countries. It is believed that some newly industrialized countries may generate more hazardous waste per square kilometer than the United States.<sup>8</sup> Additionally, in some countries, hazardous waste generation is very geographically concentrated. In Mexico, for example, two-thirds of the national waste generation occurs within forty miles of Mexico City.<sup>9</sup> In Brazil, ninety percent of the hazardous waste is generated in three states: Sao Paulo, Rio de Janeiro, and Minas Gerais.<sup>10</sup> The combination of geographical concentration, relatively high generation rates, and generally poor management of hazardous waste may tend to cause high levels of exposure in some countries.<sup>11</sup>

### I. THE ISWA WORKSHOP

It is against this backdrop that the International Solid Wastes and Public Cleansing Association (ISWA) formed the Working Group on

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4. 42 U.S.C. §§ 9601-9675 (1982 & Supp. V 1987).

5. 42 U.S.C. §§ 6921-6939b (1982 & Supp. V 1987).

6. Nipapun Kungskulniti, Public Health Aspects of a Solid Waste Scavenger Community: A Case Study at On-Nooch, Bangkok 1, 3 (Sept. 12, 1989). Kungskulniti presented this paper at the International Solid Wastes and Public Cleansing Association's 1989 Workshop on Adapting Hazardous Waste Management to the Needs of Developing Countries, Honolulu, Hawaii, Sept. 11-13, 1989 [hereinafter ISWA Workshop].

Another infamous example of a scavenger community living on or adjacent to an uncontrolled dump site is Smokey Mountain, located outside of Manila, where 15,000 people reportedly live and work. Fallows, *A Damaged Culture*, ATLANTIC, Nov. 1987, at 49-54.

7. Adapting Hazardous Waste Management to the Needs of Developing Countries 62-63 (J. Nash ed. Sept. 11, 1989) (paper presented at the ISWA Workshop) [hereinafter Hong Kong Paper].

8. CONSERVATION FOUNDATION, STATE OF THE ENVIRONMENT: A VIEW TOWARDS THE NINETIES 161 (1987). Differing definitions of hazardous waste as well as variability in the quality of data on waste generation make direct comparisons of generation rates between countries difficult. *Id.*

9. *Id.*

10. *Id.*

11. *Id.*

Hazardous Waste (Working Group) in 1984.<sup>12</sup> ISWA is a nonpolitical, nongovernmental organization composed of twenty-seven national organizations of waste management professionals. These professionals represent a variety of sectors including federal and local government, private industry, trade associations, and academia. The Working Group is composed of representatives from twelve countries spanning four continents.<sup>13</sup>

The Working Group's first project, a survey of hazardous waste management activities in the represented countries, was published in 1987.<sup>14</sup> That same year, the Working Group created a Developing Country Program and appointed Dr. David Wilson as the chairperson. On September 11-13, 1989, in Honolulu, Hawaii, the Developing Country Program sponsored a workshop on "Adapting Hazardous Waste Management to the Needs of Developing Countries" (Workshop). Co-sponsors of the Workshop included the United States Environmental Protection Agency (EPA), the Pacific Basin Consortium for Hazardous Waste Research, the United Nations Environment Programme (UNEP), the United States Agency for International Development (AID), the World Environment Center (WEC), and the Conservation Foundation. Workshop participants presented papers, primarily in the form of case studies, on waste management practices in the twelve countries.<sup>15</sup> The opinions and premises presented in this article were formulated in large measure based on the papers presented, as well as the discussions held, at the Workshop.

## II. ADAPTATION

One of the major themes to emerge from the Workshop was the im-

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12. Forester, *Preface* to INTERNATIONAL PERSPECTIVES ON HAZARDOUS WASTE MANAGEMENT (W. Forester & J. Skinner eds. 1987) [hereinafter INT'L PERSPECTIVES].

13. *Id.* at 1. Members of the ISWA Hazardous Waste Working Group are John Skinner, United States EPA, Washington, D.C. (Chairman); William Forester, American Public Works Association, Washington, D.C. (Secretary); Kenneth Andersson, GRAAB-KEMI, Goteborg, Sweden; Tom de Bruin, Institute of Waste Management, Cape Town, South Africa; Daan den Ouden, AVR Chemie NV, the Netherlands; Claus Hansen, National Agency for Environmental Protection, Copenhagen, Denmark; Sachiho Naito, President of Kanto-Gakuin University, Yokohama, Japan; Alberto Piepoli, ISMES, Bergamo, Italy; Gerhard Sierig, Berliner Stadtreinigungsbetriebe, Berlin, Federal Republic of Germany; Gerhard Vogel, University of Economics, Vienna, Austria; and David Wilson, Environmental Resources Limited, London, England.

14. INT'L PERSPECTIVES, *supra* note 12, at 1.

15. ISWA Workshop, *supra* note 6. The papers examined waste management in Australia, Austria, Brazil, Hong Kong, Indonesia, Malaysia, the Netherlands, Pakistan, Peru, the Philippines, South Africa, and Thailand.

portance of adaptation—the premise that what works for one country will not necessarily work for another country, particularly when the transfer is attempted from an economically and industrially developed country to a developing one. Adaptation, as the developing country representatives repeatedly stressed, precludes the development of a rigid formula blindly applicable in any circumstance. Rather, it suggests that a hazardous waste program will only be successful when it is developed in consideration of the unique cultural, political, and economic circumstances of the individual country.

Even under the best circumstances, a country cannot create a comprehensive hazardous waste management program overnight.<sup>16</sup> Given the political and economic circumstances of many developing countries, the creation of such a program is necessarily an evolutionary process. In discussing the development of a waste management program, this article does not attempt to outline a cookbook formula but rather attempts to identify the major components of the process and the critical considerations for the completion of each component.

The framework presented in this article is intended for a country without an existing hazardous waste management program, but it is also suitable for countries in the earlier stages of program development. This analysis is not intended to represent a precise sequence of events, because timing and sequence of program development depend upon resource availability and the unique needs and circumstances of the specific country. Ideally, a country should implement many of the steps of the process concurrently; in reality, however, this is rarely possible.

### III. ELEMENTS OF PROGRAM DEVELOPMENT

The following elements are generally necessary for successful development of a waste management program and are described in more detail below:

- A. political commitment and a governmental infrastructure;
- B. personnel trained in the technical, legal, and policy aspects of hazardous waste management;

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16. In the United States, legislation directing the establishment of a hazardous waste regulatory program was initially passed in 1976. 42 U.S.C. § 6901 (1982). Thirteen years later, major pieces of the regulatory program are still being promulgated. See, e.g., 54 Fed. Reg. 43,718-63 (Oct. 26, 1989); 54 Fed. Reg. 48,372-528 (Nov. 22, 1989); see also Mangun, *A Comparative Analysis of Hazardous Waste Management Policy in Western Europe*, in DIMENSIONS OF HAZARDOUS WASTE POLITICS AND POLICY 205-21 (Davis & Lester eds. 1988) [hereinafter DIMENSIONS OF HAZARDOUS WASTE] (discussing the evolution of hazardous waste programs in western European nations).

C. adequate data to provide an understanding of the country's industrial processes, waste generation, and current waste management practices;

D. legislation adapted to the needs of the country;

E. a framework or strategy for management; and

F. development of waste management capacity.

A sequential progression through these steps is not necessary. Rather, a country can undertake the steps simultaneously.

#### A. POLITICAL COMMITMENT AND A GOVERNMENTAL INFRASTRUCTURE

Lack of political commitment and governmental and economic instability may seriously impede the initiation and maintenance of a successful hazardous waste management program.<sup>17</sup> Indeed, in a country suffering from severe economic hardship, it is more appropriate to focus limited governmental resources on basic human health protection needs, such as providing food, shelter, basic medical care, and basic solid waste/sewage management, rather than expending resources on the management of hazardous waste. Yet, once a country begins to industrialize, it becomes both desirable and cost-effective to begin a waste management control program. In some cases, however, the desire to encourage industrialization in an effort to foster the nation's economy outweighs the desire to protect human health and the environment from the risks of hazardous waste.

Significantly, in some countries the issue of waste importation has raised the public and political consciousness on the issue of waste management.<sup>18</sup> In Peru, for example, a proposal to import hazardous waste for use as fuel for an electrical generating plant in 1987 led the government to hastily enact a waste importation ban and to examine its domestic waste management situation.<sup>19</sup> Similarly, an incident of unwanted importation of batteries, ostensibly for the purpose of recycling, probably contributed to the introduction of a new comprehensive toxic waste bill in the Philippine House of Representatives in 1989.<sup>20</sup>

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17. Kiam Seng Goh, *Experiences in Developing Hazardous Waste Programmes-Establishing Strategies and Control Systems in Malaysia* 25 (Sept. 13, 1989) (paper presented at the ISWA Workshop) [hereinafter *Malaysia Paper*] (noting the importance of political will in enforcing regulations and obtaining funding and staffing); DIMENSIONS OF HAZARDOUS WASTE, *supra* note 16, at 219.

18. See Livia Benavides, *Case Study: Industrial Wastes Inventory in Lima, Peru* 2-4 (Sept. 11, 1989) (paper presented at the ISWA Workshop) [hereinafter *Peru Paper*] (discussing the development of waste management programs).

19. *Id.* at 2.

20. Oral statement of Amado Tolentino, Director, Environmental Management Bu-

Public awareness of hazardous waste issues varies from country to country. In the views of the Workshop representatives from Thailand and Malaysia, for example, public awareness evolved into the prevalence of the "NIMBY" (Not in My Backyard) syndrome when efforts were made to establish sites for waste management facilities.<sup>21</sup> In contrast, South Africa and Hong Kong Workshop representatives evaluated public awareness of hazardous waste as quite low in their respective countries. The Hong Kong representative cited low public awareness as contributing to that country's difficulties in establishing a waste management control program.<sup>22</sup> Although some believe that in developed countries such as the United States and the Western European nations, hazardous waste issues are overly politicized and that an acutely aware public has made waste management facility citing virtually impossible, a basic level of political and public knowledge and commitment is necessary for the successful initiation of a hazardous waste program.

Virtually all Workshop participants cited the creation of a governmental infrastructure as a fundamental element of a successful waste management program. Most stressed that countries ideally should create a centralized agency whose sole mission is environmental protection. Centralization helps avoid the parochialism that can occur at the local level,<sup>23</sup> as well as reduces the confusion that has persisted in some countries because of overlapping agency regulation. For example, until recently in the Philippines, as many as ten governmental agencies had jurisdiction over toxic waste and chemical disposal. These agencies included the Department of Health (food and drugs), the Department of Agriculture (pesticides and fertilizers), the Department of Natural Resources (mine tailings), the Philippine Coast Guard (ocean dumping and marine pollution), the Philippine Nuclear Research Institute (radioactive waste), and several environmental agencies including the National Pollution Control Commission (NPCC) (air and water quality) and the National Environmental Protection Council (NEPC)

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reau, Philippines Department of Environment and Natural Resources, at ISWA Workshop (Sept. 11, 1989); A. Brabante, M. David & A. Tolentino, *Toxic Chemicals and Hazardous Waste Management in the Philippines* 11 (Sept. 11, 1989) (paper presented at the ISWA Workshop) [hereinafter *Philippines Paper*].

21. Malaysia Paper, *supra* note 17, at 2, 20.

22. See Hong Kong Paper, *supra* note 7, at 9 (noting the effect of public awareness on pollution control and chemical waste management during the 1970s).

23. See, e.g., Anderton, *Waste Disposal Legislation in the United Kingdom*, in 3 *TOXIC AND HAZARDOUS WASTE DISPOSAL* 33 (R. Pojasek ed. 1980) (discussing the difficulties in a highly centralized system).

(policymaking).<sup>24</sup>

Indonesia provides another example where there is no centralized environmental agency. The roles and responsibilities of the various departments are still in the formulation stage. Responsibility for hazardous substance management is split among the Ministries of Agriculture, Environment, Forestry, Health, Home Affairs, and Manpower.<sup>25</sup> Such multi-institutional systems can be a significant impediment to an effective enforcement program. Government institutionalization is critical, although hopefully that institutionalization will involve centralization without unmanageable bureaucracy.

## B. TRAINED PERSONNEL

Although the need for trained personnel seems self-evident, the shortage of such personnel plagues even the most developed countries.<sup>26</sup> The Malaysian Workshop representative strongly emphasized the need for trained personnel for both industry and government.<sup>27</sup> Trained personnel are needed in technical fields as well as in legal and policy areas to assist developing countries create legislation and regulations.<sup>28</sup> National and international organizations, such as the World Health Organization, UNEP, and AID sponsor programs to bring expertise into developing countries. The Japanese International Cooperation Agency under Japan's Ministry of Foreign Affairs sponsors training programs for officials of developing countries that bring the officials to Japan for intensive eight to ten week training programs taught by national experts. Other developed countries offer similar programs.<sup>29</sup>

Assistance, however, need not always flow from a more developed to

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24. Philippines Paper, *supra* note 20, at 2. In 1987, the Department of Natural Resources became the cabinet level Department of Environment and Natural Resources, encompassing the Environmental Management Bureau. *Id.* The Environmental Management Bureau resulted from the merger of the NPCC and the NEPC. *Id.*

25. N. Makarim, Hazardous Waste Management in Indonesia 3 (Sept. 11, 1988) (paper presented at the ISWA Workshop) [hereinafter Indonesia Paper].

26. See *Hearing on Groundwater Monitoring at RCRA Land Disposal Facilities Before the Subcommittee on Oversight and Investigations of the House of Representatives Committee on Energy and Commerce*, 101st Cong., 1st Sess. 84 (1989) (statement of Jonathan Z. Cannon, Acting Assistant Administrator for Solid Waste and Emergency Response, EPA).

27. Malaysia Paper, *supra* note 17, at 4, 23-25.

28. *Id.* at 23.

29. Such foreign assistance efforts have been critical to Malaysia's progress in establishing a waste management program. These efforts include a 1981 study undertaken by the Australian Government Consultancy Service's Feasibility Study Fund Program, a 1984 study by a Danish consultant under the ASEAN-EEC Scientific and Technological Corporation Programme, and a 1987 study by an American consultant under the United States Trade Development Program. *Id.* at 5-9.



a less developed country. The Peruvian representative's paper recommended increased "horizontal cooperation mechanisms," based on her positive experience in the sharing of expertise among similarly situated countries.<sup>30</sup> Despite the usefulness of these foreign assistance programs, they are not a substitute for permanent, resident expertise in the developing countries. As in developed countries, most developing country personnel will have to rely on on-the-job training to develop relevant expertise.

### C. DATA

Data is critical for enacting meaningful legislation, developing a waste management strategy, establishing priorities, and developing needed waste management capacity. Developing countries must understand not only the types and quantities of waste generated within their borders and current waste management practices, but also the size and location of industrial development in the country, as well as the nature of the industrial processes. This latter information is particularly important for designing a waste management scheme and for exploring waste minimization and recycling opportunities. Data collection, however, has proven difficult for both developing and developed countries.<sup>31</sup>

The State of Victoria, Australia, the second most populous of the Australian states, with four million inhabitants, collected a basic initial data base as a preliminary step in developing its hazardous waste management strategy.<sup>32</sup> Using consultants they conducted a confidential survey of waste generators. Access to the raw data was available only to the consultants and was subsequently destroyed.<sup>33</sup> As a check, the

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30. Peru Paper, *supra* note 18, at 17.

31. See *id.* at 8, 16 (describing typical scenarios in which data collection is difficult); see also Dietrich, *Information Burdens and Difficulties in Conceptualizing the Crisis: A Reappraisal*, in BEYOND DUMPING (B. Piasecki ed. 1984); UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, 1985 BIENNIAL REPORT OF HAZARDOUS WASTE GENERATORS AND TREATMENT, STORAGE AND DISPOSAL FACILITIES REGULATED UNDER RCRA (1988) [hereinafter BIENNIAL REPORT] (describing data collection difficulties encountered in the United States); Schmitt-Tegge, *Treatment and Disposal of Industrial Wastes in the Federal Republic of Germany*, in 3 TOXIC AND HAZARDOUS WASTE DISPOSAL 38-40 (R. Pojasek ed. 1980) (describing data collection and waste generation estimation problems in FRG).

32. B. Robinson, *Experiences in Developing Hazardous Waste Programmes—Needs for Guidance for Those Embarking on the Process* (Sept. 11, 1989) (paper presented at the ISWA Workshop) [hereinafter Australia Paper]. Australia is a federation of states. *Id.* at 1. Under the Australian Constitution, responsibility for environmental matters lies primarily with the states. *Id.* A national council of environment ministers addresses issues of national significance and promotes consistency among the states. *Id.*

33. *Id.* at 3. In several instances the EPA has used consultants and prohibited gov-

collected information was compared to data from a simple existing manifest system and to existing estimates of per employee waste generation rates.<sup>34</sup>

In 1985, Malaysia conducted a similar survey, focusing on the most industrialized regions in the country including Klang Valley, Seberang Prai, Bayan Lepas in Penang, Pasir Gudang in Johore, and Ipoh in Perak.<sup>35</sup> The survey, undertaken in large measure to identify waste management facility needs, involved site visits to about seven hundred waste generators. The survey identified and quantified waste generation in the following categories: wastes to be incinerated or recycled, waste to be treated by chemical or physical methods, and wastes that must be disposed in a secure landfill.<sup>36</sup>

Recently, the Peruvian government attempted to conduct a waste survey in Lima. A consultant from the Sao Paulo, Brazil Environmental Protection Agency (CETESB) assisted in the design of the survey.<sup>37</sup> Because Peru has no legislative or regulatory programs and, consequently, no formal definition of hazardous waste, it adopted the Brazilian hazardous waste definition for the purpose of targeting its survey.<sup>38</sup>

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ernment personnel from access to the raw data, insuring confidentiality to survey respondents. For example, the EPA used this approach in the Small Quantity Generator Survey in 1986 and in the recently completed survey on owner/operator financial responsibility under RCRA. UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, REPORT TO CONGRESS ON SMALL QUANTITY GENERATORS OF HAZARDOUS WASTE (1986) (3 vols.); United States Environmental Protection Agency, RCRA Liability Coverage for Bodily Injury and Property Damage Survey Results (Sept. 1989 draft) (scheduled for publication in Nov. 1989). Confidentiality is a relatively effective technique, particularly when conducting a survey of a population not previously subject to regulation or when making particularly sensitive inquiries.

34. Australia Paper, *supra* note 32, at 3.

35. Malaysia Paper, *supra* note 17, at 8.

36. *Id.*

37. Peru Paper, *supra* note 18, at 2.

38. This serves to illustrate the "chicken and egg" problem that a country encounters in conducting a survey early in the course of program development. Initially, it seems entirely sensible to undertake a prior survey and develop data in order to provide a sound basis for drafting legislation or regulations. This course of action, however, leaves a country in the position of surveying "hazardous waste" generation before the term is defined and without any specific legislative authority to compel the submission of information. Peru's approach to this dilemma, adoption of the hazardous waste definition of a similarly situated country (Brazil), for purposes of the survey, seems to be the logical one. *Id.* at 7.

The first comprehensive survey on hazardous waste generation in the United States was not conducted by the EPA until 1984, eight years after the passage of RCRA and four years after the promulgation of regulations defining hazardous waste. See UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, NATIONAL SURVEY OF HAZARDOUS WASTE GENERATORS AND TREATMENT, STORAGE AND DISPOSAL FACILITIES REGULATED UNDER RCRA IN 1981 1-19 (1984). The hazardous waste generation survey took almost three years to complete, involved the mailing of approximately 15,000 questionnaires, and included extensive follow-up studies and data analysis. *Id.* at 21-37.

Peru's National Council for Environmental and Health Protection created a survey design based on questionnaires from CETESB, the "Technical Manual for the Safe Disposal of Hazardous Wastes with Special Emphasis on the Problems and Needs of Developing Countries,"<sup>39</sup> and an October 1986 industrial survey used in Mexico. The survey compiled data from industry on raw materials and manufactured products, production line flow sheets, waste types and sources, current waste management practices, and general plant information.<sup>40</sup> As part of the survey, environmental health technicians selected a non-statistical sample of 148 plants and hand-carried the surveys to the targeted plants.<sup>41</sup> The technicians received training in the survey form and basic industrial processes before going into the field. Their lack of a strong educational background in industrial processes and waste handling, however, arguably contributed to their failure to compare their observations at the plant with the respondent's survey form data.<sup>42</sup>

Despite the Peruvian representative's disappointment over the effectiveness of deploying personnel into the field to conduct the survey, other countries highly recommended using this technique over a mail-only survey. The reported advantages of deploying personnel include more accurate survey results, a higher response rate, and essential on-the-job training on industrial processes for environmental agency employees. Ultimately, Peru experienced a sixty-three percent response rate to its survey. Although the Peruvian workshop participant recommended additional survey work, these initial efforts produced a considerable amount of information.<sup>43</sup>

Rapid assessment techniques are useful tools in estimating waste quantities as a precursor to data collection through surveying. These assessments are also useful when economic circumstances of the country preclude survey techniques. Rapid assessment relies upon computer models to predict waste generation. These models include a large database of existing information on the types and quantities of waste

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Promulgation of the initial RCRA regulations was completed under a court ordered deadline, based primarily on existing data sources that had been developed by other environmental programs (e.g., water, air, and pesticides). In retrospect, it would have been preferable to have had more extensive data to support the development of the early RCRA regulations. Since the 1984 Hazardous Waste Generation Survey, the EPA has undertaken a number of additional surveys. This type of data collection has, however, proven to be time-consuming and expensive. BIENNIAL REPORT, *supra* note 31.

39. Peru Paper, *supra* note 18, at 5.

40. *Id.* at 5-6.

41. *Id.* at 7.

42. *Id.* at 7, 8.

43. *Id.* at 16, 17.

generation of a variety of different industrial sectors.<sup>44</sup> Standard and readily available data on the industrial presence in an area or a country (e.g., types and sizes of industry) are entered into the computer and the model generates area-wide predictions of waste types and total quantities. The value and validity of the model results are determined by the accuracy of the data contained and entered into the model. For example, if the data on waste generation contained in the model is based on modern industrial processes, the resulting outputs will have little validity in underdeveloped countries using older plants and outdated industrial processes.

Although data collection is time-consuming and expensive, it is critical in designing a meaningful and properly targeted program. Investing in at least some rudimentary level of data collection as an initial step results in economic savings. Specifically, the data assists a program in identifying and focusing on the most significant environmental concerns.

#### D. LEGISLATION

The most important theme in the area of creating new hazardous waste legislation in a developing country is that of adaptation. Not surprisingly, developing countries often look to existing legislation in more developed countries when constructing their initial legal authorities. Unless this existing legislation is adapted to the special needs and circumstances of the developing country, however, totally ineffective laws may result. For example, the only environmental legislation in Peru is a water law modeled on the Clean Water Act of the United States.<sup>45</sup> The Peruvian law has proven ineffective because its implementation relies on information on pollutant concentrations and there is virtually no laboratory capacity for measuring these concentrations in Peru.

It is also apparent that highly prescriptive and detailed legislation like the current RCRA, as amended by the Hazardous and Solid Waste Amendments of 1984,<sup>46</sup> is poorly suited for most developing countries. This legislation is clearly indicative of a mature program with an extensive existing regulatory scheme. The general, broad grant of authority in the original 1976 version of RCRA is probably far better suited to the needs of developing countries.

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44. See R. Barnard, *Rapid Assessment of Industrial Waste Arisings*, Based on Available Employment Statistics 1 (Sept. 11, 1989) (paper presented at the ISWA Workshop) (explaining the utility and function of models to better understand the types and quantities of industrial wastes that cities and industrial regions generate).

45. Clean Water Act of 1973, 33 U.S.C. §§ 1251-1387 (1982 & Supp. V 1987).

46. 42 U.S.C. §§ 6921-6939b (1982 & Supp. V 1987).

Several fundamental issues should be considered in even the most general of legislative constructs.<sup>47</sup> One of the most basic issues is formulating a definition of hazardous waste. Historically, developing countries have adopted versions of the industrialized countries' hazardous waste legislation resulting in a variety of hazardous waste definitions.<sup>48</sup> In the interest of moving toward a much needed internationally-consistent definition, developing countries should consider adopting the OECD definition of hazardous waste adopted by the Basel Convention.<sup>49</sup> This definition is, however, relatively broad and perhaps overly inclusive for a developing country with limited resources seeking to implement a program. An alternative approach is to adopt a broad statutory definition of hazardous waste while initially devoting limited resources on implementation for only high priority wastes.

Another fundamental issue that enabling legislation must address is the question of liability. In most countries, generators have fulfilled

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47. In its assessment of hazardous waste management practices conducted between 1973 and 1980, the NATO's Committee on the Challenges to Modern Society recommended that hazardous waste legislation contain the following elements:

1. definition of hazardous waste;
2. provision of binding hazardous waste management principles;
3. provisions for distribution of liability;
4. regulations on financing, including provisions for abandoned sites and long-term care and maintenance;
5. planning regulations;
6. legislation on control mechanisms regulating:
  - a) waste generation;
  - b) waste transportation;
  - c) importation of wastes;
  - d) waste disposal facilities including facilities for storage; and
  - e) waste stream control.

DIMENSIONS OF HAZARDOUS WASTE, *supra* note 16, at 207-08.

48. In the United States and the Federal Republic of Germany, for example, hundreds of specific wastes and processes are officially listed as hazardous waste. In addition to those hazardous wastes that appear on the officially promulgated list, both countries consider any waste hazardous if it meets specific criteria. The criteria include an evaluation of toxicity, ignitability, flammability, corrosiveness, and reactivity. INT'L PERSPECTIVES, *supra* note 12, at 29, 31-32 (table 5).

In contrast, Japanese law contains a much narrower definition of hazardous or "special" waste. First, the specified facility must generate the waste. *Id.* at 29. Such wastes are then considered hazardous only if they are a "cinder, sludge, waste acid, waste alkali, slag, or dust," and their extract (using a specified extraction procedure) contains one or more of nine toxic constituents at levels in excess of prescribed concentration levels. *Id.*

49. Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, *opened for signature* Mar. 22, 1989, art. I and Annexes I-III, XXVIII, *reprinted in* 28 I.L.M. 649, 657-58, 678-81, *also reprinted in* UNITED NATIONS ENVIRONMENTAL PROGRAMME, BASEL CONVENTION ON THE CONTROL OF TRANSBOUNDARY WASTES AND THEIR DISPOSAL: FINAL ACT (providing the Basel Convention definition for hazardous waste).

their obligations and, therefore, terminated their liability when they accurately disclose the composition of their waste and deliver it to a facility licensed to receive it.<sup>50</sup> In the United States, however, generators are subject to much broader liabilities. Under CERCLA, both fault and joint and several liabilities apply so that if a generator delivers waste to a properly licensed facility, and that facility later becomes a problem site, the generator is potentially liable for the clean-up.<sup>51</sup>

The advantages to the governmental enforcement authority of this sort of broad imposition of liabilities are clear. It is unlikely, however, that such a scheme will be effective in a developing country where generators have not previously been subject to any management controls. A developing country would be better advised to establish incentives for generators to use approved or licensed facilities. The traditional command and control approach to mandating the use of licensed facilities, coupled with potential liability if doing the "right" thing turns out wrong in the future, is likely to be unacceptable for generators unaccustomed to government control and may evoke far more noncompliance than compliance.

If not resolved in the federal constitution, the enabling legislation should address whether the federal, state, or local branch of government has responsibility and authority for waste management matters. In many countries, multiple levels of government share such responsibilities. Approaches to delegation range from the Australian and United Kingdom systems where virtually all control is vested in the state or local governments,<sup>52</sup> with the federal role almost exclusively advisory to the United States approach wherein the federal government develops and implements highly specific regulations, and control is passed to the states through a complex authorization process only if the states adopt equivalent regulations and demonstrate their capability to manage the program.<sup>53</sup> Many different considerations should enter into decisions on the appropriate governmental level for controlling wastes, including: the existing division of responsibility among tiers of government; country size (geographically and by population); diversity among

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50. INT'L PERSPECTIVES, *supra* note 12, at 19.

51. See Comprehensive Environmental Response Compensation and Liability Act of 1980, 42 U.S.C. §§ 9601(32), 9607; The Federal Water Pollution Control Act, 33 U.S.C. § 1251, 1321 (codifying liability sections that when read together impose absolute liability on the generator for proper transportation and disposal of its hazardous waste).

52. INT'L PERSPECTIVES, *supra* note 12, at 22; 3 TOXIC AND HAZARDOUS WASTE DISPOSAL 53 (R. Pojasek ed. 1980).

53. See 42 U.S.C. § 6926 (1982 and Supp. V 1987) (outlining the procedures for authorization of state hazardous waste programs).

the various states within the country (e.g., extent of industrialization, weather, hydrogeology); ability to develop and maintain expertise at the state or local level; and resources available to the different tiers of government.

Another important area for legislation is restrictions on waste importation and exportation. An exhaustive discussion of the myriad of social, political, and economic considerations involved in determining the necessary level of control over transfrontier movements of waste is beyond the scope of this article.<sup>54</sup> Many developing countries may find it necessary to export waste for proper management because they lack environmentally adequate management capacity. This is especially true during the initial periods before countries create appropriate facilities within their borders. Developing countries may also find it cost-effective as well as environmentally beneficial to enter into formal or informal regional cooperative agreements with neighboring countries for the provision of waste treatment facilities. Waste importation is a potentially volatile, politically sensitive issue, although it is likely to be more politically acceptable if it is part of a reciprocal arrangement seen as mutually beneficial. It is far preferable, however, to avoid a highly politicized and hasty response by legislatively addressing this issue prior to the development of a crisis situation.

There are a number of other areas that legislation should address. These areas include scope of control (cradle to grave or narrower), manifesting systems, permitting or licensing requirements, enforcement authorities, programs designed to clean-up old waste problems and minimize waste. These areas are discussed in more detail below under the heading Framework for Management.

#### E. FRAMEWORK FOR MANAGEMENT

In attempting to institute control over waste management, it is essen-

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54. In recent years, a number of articles and papers have discussed issues arising from hazardous waste export and import. See, e.g., EXPORT OF HAZARD (J. Ives ed. 1985); Industry and Environment Office, United Nations Environment Programme, Implementing the Basel Convention (Sept. 12, 1989) (paper presented at the ISWA Workshop); Nanda & Bailey, *Export of Hazardous Waste and Hazardous Technology: Challenge for International Environmental Law*, 17 DEN. J. INT'L & POL'Y 155 (1988); Halter, *Regulating Information Exchange and International Trade in Pesticides and Other Toxic Substances to Meet the Needs of Developing Countries*, 12 COLUM. J. ENVTL. L. 1, 36-37 (1987) (noting the need for industrial countries to assist developing countries in managing the movement of toxic substances); Note, *Hazardous Export to the Third World: The Need to Abolish the Double Standard*, 12 COLUM. J. ENVTL. L. 71 (1987) (emphasizing the importance of international cooperation in avoiding and correcting environmental problems).

tial to have a strategy of management framework. The design of this framework must meet the specific needs of the developing country and adhere to the existing legal system, political culture, economic conditions, unique environmental conditions, geographic and climatic considerations, and other factors that distinguish it from developed countries. In general, a regulatory control program will implement this framework.

Among countries with mature waste management control systems, a pattern has developed regarding the basic framework elements. Most of these countries have instituted a "cradle to grave" approach to controlling waste. A cradle to grave system generally contains, in some form, the following:

1. generator requirements;
2. a manifesting or tracking system;
3. treatment, storage, and disposal facility requirements implemented through a permitting or licensing system;
4. waste specific requirement;
5. an enforcement program to assure compliance;

This outline may serve as a useful starting point for developing countries. A cradle to grave system is most desirable in terms of providing the most comprehensive control. Developing countries must consider, however, whether they can afford such a system because it is expensive for the regulated community and the government to administer. Indonesia, for example, has chosen to focus on the "grave" end of the system in the implementation of its program. Its efforts have primarily focused on developing a suitable waste treatment and disposal facility, rather than regulating waste generators and waste transport.<sup>55</sup> Victoria, Australia<sup>56</sup> and Malaysia<sup>57</sup> have attempted to implement a more broad-based program from the start.

Within these basic elements of a waste management control framework there is a fair amount of deviation among those countries with existing programs. Opportunities exist for adaptation of these various elements in developing countries. In addition to this basic framework, some developed countries have also instituted programs to encourage and support waste minimization, source reduction and recycling, and to clean up releases from old, abandoned, and uncontrolled sites. These

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55. See Indonesia Paper, *supra* note 25, at 4-5.

56. See Australia Paper, *supra* note 32, at 7 (noting the existence of approval requirements for the handling, transportation, storage, and treatment of hazardous waste).

57. See Malaysia Paper, *supra* note 17, at 1, 23 (explaining the need for a program of waste reduction at the waste exchange site).



types of programs may also have some applicability to developing countries.

In designing a program, one of the most important considerations is the composition of the waste generating community. In some countries, with Hong Kong as perhaps the most extreme example, a wide variety of very small, privately-owned industrial or manufacturing companies characterize the industrial sector. In other developing countries, the industrial sector is composed primarily of very large and sophisticated multinational companies. The industrial sectors of other developing countries fall somewhere between these two extremes. An implementation and enforcement program aimed at a large number of very small waste generators must necessarily vary greatly from one aimed at a handful of multinational companies on whom it is practical to impose responsibility and liability to assure proper waste management. Large industrial generators can more adequately develop and maintain their own waste management facilities and are more likely to opt for on-site waste management rather than the shipment of waste to a commercial facility.<sup>58</sup> In countries characterized by numerous small waste generators, however, it may be necessary to begin moving in the direction of good waste management practices by providing waste treatment and disposal services to industry at a minimal cost through public subsidies and with reduced liabilities.<sup>59</sup>

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58. See Biennial Report, *supra* note 31, at 14, 15 (figure 8) (indicating that large treatment, storage, and disposal facilities in the United States conduct on-site waste management).

59. Thailand adopted this approach through a recently opened government-owned privately operated facility. Oral statement of Boonyong Lohwongwatana, Director, Office of Industrial Services and Waste Management, Thailand Industrial Works Department, at ISWA Workshop (Sept. 11, 1989). Charges at this facility are approximately 45 baht/ton (approximately \$1.80/ton) for waste water treatment with a 1 baht/kilometer/ton (approximately 4c/ton) charge for transportation. *Id.* The charge for landfill disposal of sludge is 100 baht/ton (approximately \$4/ton). *Id.* The per ton cost of landfilling hazardous waste at a commercial facility in the United States is \$250/ton. A. Cortese, Waste Minimization and its Role in Developing Countries 3 (Sept. 11, 1989) (paper presented at the ISWA Workshop) [hereinafter Cortese Paper].

Although the United States, which is accustomed to a command and control regulatory system and a strong "polluter pays" ethic, might question the appropriateness of a subsidized disposal system, such an approach is cost-effective for a developing country. INT'L PERSPECTIVES, *supra* note 12, at 100. This is particularly true where enforcement is constrained by economic, political, legal, or cultural factors. *Id.* at 112. The concept of government subsidies to encourage or support the development of waste management facilities, such as low or no interest loans, is fairly common in European countries, such as Austria, Denmark, Italy and Sweden. *Id.* at 155, 216.

### 1. Generator Requirements

In general, responsibilities placed on waste generators include: (1) determination of whether the waste meets the formal definition of hazardous waste; (2) notification and periodic reporting to governmental authorities; (3) packaging and labeling of waste; and (4) assuring that waste is properly managed on-site or delivered to a properly licensed off-site management facility.

### 2. Manifest System

Many of the developed countries have instituted a manifest or trip ticket system to track the transport of waste from the point of generation to the point of ultimate disposal.<sup>60</sup> These systems include some sort of paperwork that travels with the waste and identifies its composition, place of generation, and destination. In some cases, the tracking system includes reporting if the waste is not delivered in accordance with the manifest. Also, in some countries, copies of the manifest are sent to governmental authorities. In the United Kingdom, for instance, the authorities receive a copy of the manifest in advance of the shipment to allow them to monitor treatment or disposal of the waste if they desire.<sup>61</sup>

### 3. Facility Standards and Permitting

Most countries with hazardous waste programs have a system for issuing permits or licenses to hazardous waste storage, treatment, and disposal facilities.<sup>62</sup> These permits are used to impose site-specific engineering or performance standards on many aspects of the facility's design and operation.

Storage is a term that generally implies placement of a waste for some temporary period, prior to further treatment or ultimate disposal. At times, however, there is a blurred distinction between storage and disposal. For example, in the Federal Republic of Germany, waste in containers stored in underground salt mines is carefully charted to fa-

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60. INT'L PERSPECTIVES, *supra* note 12, at 45 (Table 9). Countries with manifest systems for the transport of hazardous waste include: Denmark, the Federal Republic of Germany, France, Italy, the Netherlands, the United Kingdom, and the United States. *Id.*

61. *Id.* at 44.

62. J. McLoughlin & M.J. Forster, THE LAW AND PRACTICE RELATING TO POLLUTION CONTROL IN THE MEMBER STATES OF THE EUROPEAN COMMUNITIES: A COMPARATIVE SURVEY 277-303 (1982).

cilitate later excavation for recycling.<sup>63</sup>

Treatment includes physical and chemical processes such as dewatering, neutralization, solidification/stabilization and precipitation, as well as thermal processes such as incineration. Many industrialized nations have incineration capacity within their borders, the most common types being liquid injection used only for liquids, or rotary kiln used to burn solids and containerized liquids.<sup>64</sup> Another technology being considered for use in some developing countries<sup>65</sup> and currently used in some developed countries such as the United States, is the burning of hazardous waste as fuel in cement kilns. There is some debate, however, over the effectiveness of this practice and the need for control.<sup>66</sup> The EPA has recently proposed a rule that would subject the burning of hazardous waste in cement kilns to standards similar to those applicable to incineration.<sup>67</sup>

Land disposal in many developed countries is limited to highly engineered and monitored landfills in carefully chosen locations. This has come about due to the many problems long-industrialized nations have faced with releases from prior uncontrolled land disposal sites. In some countries, including Australia, Hong Kong, South Africa, and the United Kingdom,<sup>68</sup> co-disposal of hazardous and municipal waste is practiced.<sup>69</sup> Other countries, however, have rejected this practice, based on concerns that municipal waste generates acidic leachate that mobilizes hazardous constituents, causing or accelerating their release into the environment.<sup>70</sup>

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63. *Id.* at 129.

64. *Id.* at 55. Commercial incineration facilities exist, for example, in Austria, Denmark, the Federal Republic of Germany, France, Japan, the Netherlands, Sweden, the United Kingdom, and the United States. *Id.*

65. See A. Marcil, Cement Kiln Incineration of Out-Dated Agricultural Chemicals in Pakistan 1-5 (Sept. 12, 1989) (paper presented at the ISWA Workshop) (noting that the AID and the WEC have sponsored a project to study options for the disposal of outdated agricultural chemicals in Pakistan). Test burns are under way because the study has identified the use of agricultural chemicals as a preferable source of fuel for kilns. *Id.* at 13.

66. See R. MOURNIGHAN & M. BRAQNSCOME, HAZARDOUS WASTE COMBUSTION IN INDUSTRIAL PROCESSES: CEMENT AND LIME KILNS 2 (1987); Cincinnati: Hazardous Waste Engineering Research Laboratory, Office of Research and Development, United States EPA.

67. BURNING OF HAZARDOUS WASTE IN BOILERS AND INDUSTRIAL FURNACES; SUPPLEMENT TO PROPOSED RULE, 54 Fed. Reg. 43,718-63 (1989) (to be codified at 40 C.F.R. §§ 260, 261, 264, 265, 266, 270, 271) (proposed Oct. 26, 1989).

68. INT'L PERSPECTIVES, *supra* note 12, at 60; Hong Kong Paper, *supra* note 7, at 20.

69. INT'L PERSPECTIVES, *supra* note 12, at 60. The theory underlying co-disposal is that proper control of the process will result in degradation of the hazardous waste.

70. In the late 1970s and early 1980s, significant research was conducted in the

#### 4. Waste Specific Requirements

In countries with mature waste management programs, there is an increasing trend toward limiting the choice of management options for certain wastes or limiting the use of landfills to the residuals of treatment. In the Netherlands, for example, waste is prohibited from landfills unless granted an exemption.<sup>71</sup> Virtually no waste is allowed in a landfill without pretreatment. The United States is in the process of implementing a land disposal restrictions program that imposes strict waste-specific, technology based treatment standards.<sup>72</sup> Other countries, such as Denmark, Japan, and Sweden also have some special requirements for managing specific wastes.<sup>73</sup> Based on the historical problems encountered by developed countries with land disposal, and to the extent it is economically feasible, developing countries should consider moving directly to waste specific treatment requirements, particularly for the most toxic and mobile wastes.

#### 5. Enforcement

Essential to an effective enforcement program is adequate legal authority to conduct investigations and inspections, compel compliance, and impose penalties.<sup>74</sup> In addition, an adequate number of trained legal and technical enforcement personnel, particularly inspectors, is important. As the experiences of the developed countries demonstrate, enforcement is potentially one of the most difficult problems facing the developing country.<sup>75</sup> One or more levels of government may exercise enforcement authority, depending on the existing legal arrangements within the country.

Victoria, Australia has implemented a system of "infringement notices" in addition to its normal system for penalty imposition. The infringement notices are citations for violations and are issues much like

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United States on the composition of municipal waste leachate and its effect on co-disposed hazardous waste. See, e.g., Kinman, Rickabaugh, Vogt & Walsh, *Long Term Impacts of Hazardous Waste Codisposal in Landfill Simulators*, in PROCEEDINGS OF THE NINTH ANNUAL RESEARCH SYMPOSIUM ON LAND DISPOSAL OF HAZARDOUS WASTE 219 (1983).

71. INT'L PERSPECTIVES, *supra* note 12, at 60-61.

72. 40 C.F.R. § 268 (1987).

73. INT'L PERSPECTIVES, *supra* note 12, at 24 (table 3).

74. See 42 U.S.C. § 6928d (Supp. 1989) (describing when the government will impose criminal and civil liability for the mismanagement of hazardous waste); see also J. McLoughlin and M.J. Forster, *supra* note 62, at 277-303 (indicating that in most European countries, authority exists to impose fines and imprisonment for the violation of waste management laws).

75. J. McLoughlin & M.J. Forster, *supra* note 62, at 26.

traffic tickets. If an inspector identifies one or more of 364 relatively minor, well-defined violations, he or she can immediately issue an infringement notice imposing fines of up to 400 dollars.<sup>76</sup>

## 6. *Waste Minimization*

Although waste minimization has recently become an extremely popular concept among countries with mature hazardous waste management programs, its role in a developing country with either no waste management system or an infant system is open to some debate. While some see it as an essential element of a developing country's new waste management program,<sup>77</sup> incentives that drive companies to seek waste minimization opportunities in developed countries may simply not exist in developing countries. In the United States and other developed countries, for example, the high cost of waste treatment and disposal is one of the major incentives for waste minimization. These high costs are primarily the result of stringent regulatory requirements. For a developing country in the process of establishing a control system, however, increased disposal costs may lead to illegal disposal rather than waste minimization, particularly in those countries lacking a strong enforcement program.<sup>78</sup> Without these incentives, therefore, waste minimization represents only a strategy for the future in developing countries.

Another impetus for waste minimization is created through community right-to-know requirements that force companies to report publicly the quantities of hazardous waste they release into the environment. Although these requirements are often a strong motivating factor in countries with a high level of public awareness of environmental issues, these requirements are not likely to be effective in countries with a less environmentally aware citizenry.

Again, the likelihood of success for a waste minimization program in a developing country depends upon the characteristics of the waste gen-

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76. Australia Paper, *supra* note 32, at 7. In the United States, no such citation system for hazardous waste violations currently exists at the federal level, although several states, such as California and West Virginia, are implementing pilot citation programs.

77. Cortese Paper, *supra* note 59, at 10.

78. See Hong Kong Paper, *supra* note 7, at 59-61 (noting the conclusion of a study that a subsidy is needed to encourage compliance with a new waste management program). The government of Hong Kong undertook a study of various systems of charges that it could implement to recover the cost of providing chemical waste treatment services. *Id.* The government analyzed fourteen direct and indirect charging systems against a variety of objectives, including both compliance and "good housekeeping/clean technology" (i.e., waste minimization) incentives. *Id.* The study found that enforcement costs for compliance can exceed any surplus revenue derived from charges on the hazardous waste. *Id.*

erators in the country. For large multinational companies, the incentives for waste minimization may already exist or may be easily created. The companies may already have investigated cost-saving opportunities through waste reduction or be more willing to look for them. A country with small industrial operations may warrant a different approach. For example, Victoria, Australia developed a successful waste minimization grant program for small and medium-sized industries.<sup>79</sup> Under the program, companies must agree to share new technologies regarding their waste minimization process with other companies.<sup>80</sup> The government also established a consulting group to provide technical assistance to small companies.<sup>81</sup>

Several developing countries have taken advantage of opportunities to increase recycling of waste products or decrease work generation.<sup>82</sup> Indeed, what some consider waste may be a viable economic commodity in economically depressed countries. Even if waste minimization does not prove viable as a short-term strategy, it is important to factor waste minimization into a developing country program as a long-term goal.

## 7. Clean-up Program

Most industrialized nations are experiencing the environmental degradation resulting from past waste mismanagement practices and the tremendous societal costs of waste clean-up. Unfortunately, many developing countries are also witnessing the effects of some level of pesticide or other toxic substance mismanagement.<sup>83</sup> The Netherlands and the United States have created special government funds to finance the clean-up of abandoned hazardous waste sites and other areas of environmental contaminations.<sup>84</sup> In other countries such as Denmark, Japan, and South Africa, government monies are used as needed.<sup>85</sup> In France, the chemical, oil, steel, and automotive industries, in conjunc-

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79. Australia Paper, *supra* note 32, at 5.

80. *Id.*

81. *Id.*

82. *Waste Minimization and Clean Technology: Moving Toward the 21st Century*, ISWA PROC. (May 29-June 1, 1989).

83. Not surprisingly, systematic inventories of contaminated sites do not exist for developing countries. One study, to date, has focused primarily on contamination caused by pesticides use. *See, e.g.*, PESTICIDES RESIDUES AND ENVIRONMENTAL POLLUTION (S. Goel ed. 1986; INTERNATIONAL ATOMIC ENERGY AGENCY TRACE CONTAMINANTS OF AGRICULTURE, FISHERIES AND FOOD IN DEVELOPING COUNTRIES (1976). Some information on other causes of contamination, however, does exist. *See* EXPORT OF HAZARD, *supra* note 54, 173-83.

84. INT'L PERSPECTIVES, *supra* note 12, at 72.

85. *Id.* at 73 (table 14).

tion with the government, are voluntarily creating a special fund to avoid the imposition of a special tax.<sup>86</sup> As part of their comprehensive waste control strategy, developing countries should establish programs for the location and clean-up of abandoned waste sites.

The first step for a developing country would be the gathering of information to establish an inventory of potentially contaminated sited to assess the need for, and expected breadth of, a clean-up program and a special clean-up fund. Given the potentially enormous expense of conducting such an inventory, this task appears to be a good candidate for funding by a developed country or international aid organization.

### 8. *Involving the Stakeholders*

Waste management program success stories will most assuredly contain one common element—an aggressive outreach effort to involve all effected sectors in the planning process. These sectors will probably include all of the following: the general public, the potentially regulated community, the politicians, the environmental groups, and the media. Good communication among the various levels of government involved in waste management is also an essential element for success.

A variety of mechanisms can achieve this outreach and participation, including developing special advisory committees composed of representatives from the affected sectors, holding public forums or meetings, or holding smaller meetings directly with interest groups. Written communications such as pamphlets, brochures, and fliers are often a useful supplement to oral communications. Again, selecting the right combination of mechanisms is primarily a matter of country-specific adaptation.

## F. DEVELOPMENT OF WASTE MANAGEMENT CAPACITY

Among the developed countries, the degree of governmental involvement in creating and administering waste management capacity varies widely. In the United States, development of waste management capacity is almost entirely the responsibility of the private sector and is left to the workings of free enterprise and market forces. Changes in the concept of private responsibility for capacity development, however, are rapidly evolving in the United States.<sup>87</sup> In the Netherlands the primary

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86. *Id.*

87. See 42 U.S.C. § 9604(c)(9)(A) (Supp. 1987) (explaining that states must adequately handle hazardous waste regulation to qualify for federal funds); see also 53 Fed. Reg. 5,004 (1988) (to be codified at 40 C.F.R. pt. 372)(proposed Feb. 19, 1988) (listing proposed rules to section 313 of Title III of the Superfund Amendments and

centralized waste treatment and disposal facility, AVR-Chemie CV, operates as a private enterprise although its shareholders are the national government, the city of Rotterdam, and eight multinational companies.<sup>88</sup> In Denmark, a quasi-public corporation, Kommunekemi A/S, was established by the federal government to provide sound waste management capacity. Kommunekemi A/S has developed central waste management collection points throughout the country. Danish companies must either treat wastes on-site or use the Kommunekemi A/S facility. While initially funded by the government, Kommunekemi A/S is now somewhat self-supporting through user fees.<sup>89</sup>

In most developing countries, leaving the development of environmentally sound waste management capacity entirely to the private sector will likely result in haphazard capacity development, at best, or no capacity development, at worst. Many national governments have found it necessary to actively participate in the development of a hazardous waste management capacity.<sup>90</sup> Sometimes this involvement is limited to locating suitable sites for facilities or providing initial capital, but it may extend to actually designing, constructing, and operating facilities.

Maintaining a good data base on current waste generation and management is critical to determining what capacity is needed and the priority of its development. In Thailand, for example, capacity development efforts coincide with a risk ranking which demonstrated that heavy metal bearing sludges and solids constituted the highest waste-related risk.<sup>91</sup> This type of information is critical to optimizing the use of scarce resources.

Important issues in developing capacity include the questions of private versus public ownership and operation, centralization versus decentralization of facilities, development of adequate capacity within the country for all domestically produced waste versus developing capacity regionally with neighboring countries, and exporting waste for manage-

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Reauthorization Act of 1986, regarding Toxic Chemical Reporting and Community Right-to-Know).

88. INT'L PERSPECTIVES, *supra* note 12, at 180. The national government has a 10% share, Rotterdam has a 45% share and the multinational companies have a 45% share. *Id.* Initial capital costs for AVR-Chemie CV, like many other European facilities, were paid for by the government. It is operated as a commercial facility required to make sufficient profit to pay for new investments but it is not required to make any principle or interest payments to the government on the initial investment costs.

89. DIMENSIONS OF HAZARDOUS WASTE, *supra* note 16, at 213.

90. Hong Kong Paper, *supra* note 7, at 20.

91. Boonyong Lohwongwatana, Planning and Implementation of Industrial Hazardous Waste Treatment Facilities in Thailand 8 (Sept. 11, 1989) (paper presented at the ISWA Workshop).



ment. In Thailand, for example, the government originally wanted to have fully privatized facility ownership with the government playing only a standard-setting and regulatory role.<sup>92</sup> Problems in attracting private investors occurred, however, due to factors such as the high investment risk of the project, the lack of a governmental loan guarantee program, and the general lack of corporate and governmental experience in the hazardous waste management area.<sup>93</sup> Ultimately, the government of Thailand not only used public funds for the initial capital necessary to construct a facility, but it also designed and built the facility.<sup>94</sup> After construction, the government relinquished the management and operation of the facility to a private company through a contractual agreement. Under the terms of the agreement, the private company has a five-year lease on the use of the facility in exchange for payment of a fixed monthly rental fee plus royalties based on the amount of waste it processes.<sup>95</sup> Collection, treatment, and landfilling of the hazardous waste is completed at the company's own risk because generators are released from liability when they send their wastes to this facility.<sup>96</sup>

Hong Kong has likewise decided that due to the nature of its industrial sector, (i.e., very small factories located in crowded conditions, often in multi-story factory blocks), it cannot rely on private industry to switch from sewer discharge of their hazardous wastes to collection and transport to a treatment facility, without some form of an incentive.<sup>97</sup> The government of Hong Kong, therefore, chose to provide a centralized treatment facility. Based on its data regarding waste generated in Hong Kong, the government determined the types of treatment processes that are necessary. Due to its desire to develop the facility quickly and its lack of experience in facility design, the government of Hong Kong decided to leave the construction and operation of the facility to the private sector.<sup>98</sup> After considering a number of possible contractual arrangements, the government decided upon a fifteen-year concession contract whereby the contractor would provide for financing the design, construction, and operation of the facility.<sup>99</sup> Under this contract, the government must provide the site for the facility, repay capi-

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92. *Id.* at 11.

93. *Id.*

94. *Id.* at 1, 11-14.

95. *Id.* at 14.

96. *Id.* at 15.

97. Hong Kong Paper, *supra* note 7, at 40.

98. *Id.* at 48.

99. *Id.*

tal costs over the fifteen-year contract period, and pay an operating fee with a guaranteed minimum based on the types and amounts of waste treated.<sup>100</sup>

Resolution of questions like centralization versus decentralization and regional cooperation among neighboring countries will depend on factors such as country size, volume and variety of waste generation, and transportation costs and risks. This is particularly true where roads and transportation systems are inadequate. In addition, the political climate with regard to cooperation among regional or local governments within the country as well as cooperation among national governments of neighboring countries are important considerations.

Experience illustrates that the NIMBY syndrome plagues developed countries as well as developing countries. This attitude, in combination with very real constraints such as land scarcity in countries like Japan and Hong Kong or unsuitability of available land for facility location based on hydrogeologic or climatic conditions, makes facility siting a major problem for both developed and developing countries.

### CONCLUSION

Creation of a waste management control program is not an easy endeavor for any developing country. Simply recognizing the need for a program can represent a major step forward for a country plagued by a variety of social, health, economic, and environmental problems. In view of the billions of dollars spent in some industrialized countries to clean up the mistakes of the past, it is important that developing countries establish a waste management program grounded in the philosophy that the polluter pays now, early in the industrialization process. Developing countries can learn much from the mistakes and successes of countries with more mature programs.

Perhaps one of the most important lessons, a lesson developing countries are just now learning, is that the best way to control waste is to control what goes into the waste stream. At one time the view that protecting the environment by controlling the raw materials of the production process was rejected as being outside the scope of an environmental regulatory program because it interfered with the industrial process. Waste minimization, however, is beginning to gain acceptance as the most favored approach to waste management. Thus, a developing country's best method of controlling waste is probably through con-

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100. *Id.*

trolling chemical and industrial technology importation.<sup>101</sup> Countries must determine the answers to the most difficult waste management questions before the waste is generated.

A variety of national and international institutions offer assistance to countries attempting to develop waste management systems. But in offering our help and experience to developing countries, developed countries must also heed their message encouraging us not to try to prescribe a solution for them, but rather to spend time with them, learn about their country, and work with them to create a solution to their problem.

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101. See EXPORT OF HAZARD, *supra* note 53, 172-91 (describing human health and environmental effects of technology importation into developing countries).