WATER POLLUTION CONTROL:
LESSONS FROM TRANSNATIONAL EXPERIENCE

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Water is fundamental to life, as reflected in space scientists' compulsive search for signs of its presence when scrutinizing other planets for possible life forms. Fortunately for our species, more than two-thirds of our planet is covered with water, creating an environment richly conducive to life. Humans have just begun to appreciate how precious earth's water resources are and how vulnerable they are to damage from human activity.

Efforts to protect earth's water resources from contamination have been among the most prominent catalysts for the development of environmental law throughout the world. After surveying this experience, this paper finds that water pollution control law has evolved in remarkably similar patterns around the world, despite enormous differences in local and regional conditions. The paper discusses lessons that can be learned from this transnational experience and how they can be applied to improve water pollution control programs around the world.

1. GLOBAL WATER POLLUTION PROBLEMS

Water pollution has become a serious problem throughout much of the world. Inadequate sewage treatment and industrial pollution have precluded a large portion of the world's inhabitants from having reliable access to safe drinking water, posing an enormous threat to human health. Industrial discharges, runoff from farms and urban developments, and acid mine drainage have severely degraded water quality in many rivers, lakes, estuaries and coastal areas. This pollution has contributed to the destruction of habitat of many aquatic species while escalating the costs of securing access to clean water. Overfishing and habitat degradation have contributed to the collapse of some global fisheries depriving certain coastal communities of their traditional sources of livelihood.

Protecting water resources from contamination is a multi-faceted challenge not only because of the number and diversity of sources of water pollution, but also due to variations in the natural conditions of waters. Weather, seasonal variations in climate, and geographic conditions can profoundly affect the availability of water supplies and their quality. Only 2.5 percent of the earth's water consists of freshwater and only about one-third of this is available for consumptive use at least
than extraordinary cost. (1) Only 0.1% of freshwater supplies are from renewable sources. In several parts of the world these are becoming depleted due to unsustainable rates of consumption.

The first and most basic priority of water resource protection policy should be to ensure that humans have access to safe drinking water. This was recognized by the United Nations in 1980 when it established as a global goal that clean water and adequate sanitation be provided for all the world's population by the year 1990. (2) But declaring the 1980s the "International Drinking Water Supply and Sanitation Decade" proved to be largely a symbolic gesture that fell far short of achieving its ambitious goals. As indicated in Table 1 on the following page, more than a billion people remained without access to safe water supplies in developing countries in 1994. This has had severe consequences for human health. Water-borne diseases account for 80 percent of human health problems in developing countries, causing the death of 4 million children per year. (3) Even with anticipated improvements in sanitation and water supply services, more than 750 million people will not have access to safe drinking water by the year 2000 and the number without access to sanitation will increase to more than three billion people by then.

Global population growth is outpacing investments in sewage treatment and pollution control technology. World population is expected to grow from less than six billion to 10 billion by the year 2050. Rapid urbanization is exacerbating water supply problems. Worldwide, it is estimated that 96 percent of population growth during the next three decades will occur in urban areas. By the year 2000, 77 percent of the population of South and Central America will live in urban areas; the region already has three of the world's ten largest cities (Mexico City, Sao Paulo and Buenos Aires). (4) For each million of their residents, cities consume 625,000 metric tons of water per day while generating 500,000 metric tons of wastewater. Chile and other South American countries are in the process of upgrading their environmental standards and investing in sewage treatment capacity. However, at present only a small percentage of all wastewater generated in these countries is treated prior to disposal. (5) Worldwide, despite improvements in water supply and sanitation services, the number of urban residents of developing countries without access to safe water supplies is expected to increase to more than 380 million by the year 2000 while more than 840 million people in these areas will lack access to sanitation services.

(2) UN General Assembly Resolution 35/18 (Nov. 10, 1980).
(4) LAWRENCE J. Jensen, Environmental Regulation in Latin America: A Rapidly Changing Legal Framework, 8 Nat. Res. & Env't 23 (Fall 1993).
(5) LAWRENCE J. Jensen, Environmental Regulation in Latin America: A Rapidly Changing Legal Framework, 8 Nat. Res. & Env't 24 (Fall 1993).
Table 1
Water supply and sanitation coverage, by developing country region, 1990-2000

<table>
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<th>1990</th>
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While there is no worldwide shortage of freshwater, severe regional imbalances exist in supply and demand. In countries that are developing rapidly, commercial demand for water is expected to increase ten-fold during the next three decades. The United Nations predicts that conditions of water scarcity will prevail in 30 countries by 2025 with 50 countries considered “water-stressed”. (6) Increased consumption is depleting water tables in parts of China, India, Mexico, the western United States, and Thailand. Water supply problems are becoming particularly acute in many Chinese cities.

The condition of global water resources is not uniformly grim. Great strides have been made in protecting some resources, particularly in countries that have invested heavily in sewage treatment capacity while adopting strong water pollution controls. However, even these countries are discovering that non-point source pollution remains a serious problem. Deforestation, urban development and destruction of wetlands have reduced the capacity of watersheds to filter pollutants. Nearly half of the wetlands formerly present in the United States have been destroyed. (7) Ninety percent of global drinking water comes from underground sources that often are severely threatened by pollution, particularly in urban areas and near feedlots and farms using agricultural chemicals. The construction of dams has destroyed fish habitat and damaged the environment of river deltas.

Degradation of water resources not only threatens human health, it also wreaks enormous economic damage that is not adequately considered in conventional national income accounts. Aquatic ecosystems do far more than simply supplying humans with drinking water, they also recycle nutrients, provide habitat for aquatic organisms, produce food, moderate natural disturbances, help regulate climate, and provide enormous cultural and recreational value. Environmental economists recently estimated that the value of the services provided by natural ecosystems is on the order of $33 trillion per year, almost twice the value of the global, man-made economy. (8) When the value of these services is considered, investments in water pollution controls may yield enormous net benefits to society.

2. PATTERNS IN THE EVOLUTION OF WATER POLLUTION CONTROL LAW

A review of transnational experience with water pollution control law reveals some striking patterns. Despite immense variations in local and regional circumstances, water pollution control policies have been evolving in a remarkably

similar progression in countries around the world. The pace of this evolution has not been uniform—some countries are much further along the path than others—but its general contours are clear.

First, the use of watercourses as cheap and convenient vehicles for waste disposal has been ubiquitous around the world. Efforts to regulate water pollution often have not been undertaken until waters became so highly contaminated as to pose visible threats to public health or welfare. In a few countries, early concern over the conditions of watercourses was spawned in part by the desire to prevent obstacles to navigation, particularly where water-borne commerce was economically significant. In a few countries, laws initially intended to protect water-borne commerce from obstruction subsequently proved to be adaptable for purposes of controlling pollution. This is illustrated by the experience with the Rivers and Harbors Act of 1899 in the United States, which was resuscitated as a pollution control statute in the early 1970s, creating political pressure to establish a comprehensive national water pollution control scheme. (9)

During the last three decades there has been a worldwide surge in the enactment of environmental laws. Water pollution control has been one of the most prominent objectives of this wave of regulatory legislation. Most countries now have laws specifically regulating water pollution. Virtually all of the water pollution control schemes created by these laws require dischargers to obtain some sort of permit before discharging pollutants to surface waters. (10) These permits generally are administered by an administrative agency which is directed to ensure that the discharges do not reduce water quality to unacceptable levels.

The growth of specialized administrative agencies with regulatory powers has been a consistent trend in recent years in both civil law and common law countries. These agencies often lack the resources to implement national pollution control programs in a comprehensive fashion. As a result, regulatory legislation may remain on the books for years in certain countries before regulations necessary to implement the laws are adopted.

In many countries water pollution control is the responsibility of state or local officials, though the recent trend has been toward the adoption of national legislation. As a practical matter, countries with national water pollution control standards often must rely heavily on state or local authorities for administration and enforcement of these standards. In some countries state or local authorities are authorized to adopt more stringent limits than the national standards if they so choose; in others, more stringent limits can be adopted only if necessary to achieve ambient water quality standards. The recent surge in global trade has created enormous pressure to harmonize environmental standards. This is contributing to

(9) See Comment, Discharging New Wine into Old Wineskins: The Metamorphosis of the Rivers and Harbors Act of 1899, 33 U. Pitt. L. Rev. 483 (1972). Many countries have similar statutes, often administered by non-environmental agencies.

the increasing federalization of water pollution regulations, particularly in the European Union, which is seeking to harmonize the environmental standards of its member countries. (11)

The comprehensiveness of water pollution control laws varies considerably from country to country. In the United States, national legislation since 1972 has required all point source dischargers to obtain a permit before discharging any pollutants into surface waters. In other countries, permits are necessary only for discharges into certain “classified waters”, (12) or for discharges of certain substances. Activities that contribute to non-point source pollution generally are not covered by permit requirements. A few countries and some states have separate programs to protect groundwater resources. (13)

For the most part, water pollution control has been addressed by separate legislation rather than as part of an integrated approach to environmental protection. Indeed, in most countries different laws address different aspects of water resources protection policy. Typically, protection of drinking water, which is often the responsibility of local water suppliers, is addressed by laws separate and distinct from general water pollution control laws. These laws may be administered by environmental agencies (as in the United States) or by other administrative agencies. (14) Coastal and ocean resources also are often the subject of separate regulatory legislation. Discharges to sewers generally are regulated separately from discharges to surface waters, though like the United States, many countries require pretreatment programs as part of the national water pollution control program.

This ad hoc approach is a prominent feature of environmental legislation throughout much of the world. Most countries have adopted medium-specific regulatory legislation to protect the environment. As a result, the laws that regulate water pollution often do not cover many activities that have enormous consequences for water resources, such as land-use planning, energy and transportation policies. These policies may be the responsibility of other agencies at different levels of government than the ones administering water pollution control laws. As non-point source pollution becomes a more significant cause of water quality problems, particularly in countries that have been successful in controlling point source discharges, the need for a more comprehensive approach to regulation has become more apparent.

(12) See, e.g., id. at 20 (Australia).
(13) See, e.g., the Netherlands Groundwater Act.
(14) For example, drinking water contamination is often regulated by the agency responsible for protection of health, as in Costa Rica where the Ministry of Health, rather than the Ministry of Environment and Energy, has responsibility for drinking water.
While truly integrated approaches are rare in national regulatory legislation, (15) most countries have adopted some form of framework environmental legislation that requires environmental impact assessment. Indeed, environmental impact statement requirements are the first and most universal elements of environmental law around the world, having been adopted by more than 130 countries. Chile's framework environmental law follows this pattern and creates a mechanism for assessing environmental effects when development projects are launched.

Effluent limits on point source dischargers have been a major type of water pollution control imposed by countries around the world. Many believe that these controls are the easiest to implement. The United States abandoned early efforts to use ambient water quality standards as the primary vehicle for controlling toxic water pollutants after they proved too difficult to implement because they were extraordinary data intensive in an area where good monitoring data were extremely scarce. (16) The European Community has employed a mix of strategies for controlling waste pollution. Effluent limits are imposed on what are considered to be the most dangerous water pollutants, while water-quality based limits, that can vary depending upon the condition of receiving waters, are employed in the permits of those discharging less dangerous substances. (17)

As countries have enacted and amended environmental legislation in recent years, they have been consistently strengthening the enforcement authorities contained in that legislation. Penalties for violations of the environmental laws have been increased substantially around the world. Government authorities are enforcing the environmental laws more aggressively, including criminal prosecutions for deliberate violations of the environmental laws. In the United States, citizen suits also have become a significant tool for ensuring that government officials implement the environmental laws and for taking enforcement action against companies who violate them. Strict civil liability for damages caused by water pollution is beginning to appear in the laws of several countries. (18) Countries that recently have revised their constitutions increasingly are incorporating environmental rights or duties into them, creating potential new avenues for legal action to protect water resources.

Finally, water pollution control has become a topic of growing international concern. International cooperation long has been important for developing effective water management policies for the 200 rivers that span international borders and

(15) Sweden is one of the rare exceptions, a country that requires industries to obtain integrated environmental permits covering discharges to land, air or water from a National Franchise Board for Environmental Protection.


(17) See, e.g., Directive 76/464/EEC.

(18) The Civil Code of the Czech Republic treats harm to the environment as a form of unfair competition and authorizes competing businesses to sue for damages.
the 40 percent of the world's population who depend on water that flows from another country. The 17 countries that use water from the Danube River have entered into more than 2,000 treaties governing the allocation of rights to this water. Thus, it is not surprising that a major case before the International Court of Justice involves a dispute between two of these countries -- Hungary and Slovakia -- over the construction of a dam that is having profound ecological consequences for the Danube watershed. The successful resolution of international disputes over water rights ultimately could become vital to preserving peace, particularly in the Middle East. International cooperation between the United States and Canada has resulted in a plan to eliminate toxic discharges into the Great Lakes that span their shared border by 2006.

3. LESSONS FROM TRANSNATIONAL EXPERIENCE

While environmental law remains a relatively young field, in many countries it has reached sufficient maturity that rich lessons can be derived from comparing the results different countries have achieved in responding to similar problems. The section that follows provides some tentative conclusions gleaned from transnational experience with water pollution control law. Before examining these lessons, it is important to caution against overly facile transnational generalizations given substantial differences between countries in environmental, economic and political conditions. Each country's situation is unique and the same environmental policies cannot be expected to achieve the same results in every country. Only someone intimately familiar with local conditions can be in a position to evaluate the relevance of other experience to a particular country's environmental policies.

Transnational experience illuminates some of the structural obstacles to the development of effective water pollution control policies. One of the first and most basic obstacles is that upstream dischargers have little incentive to be concerned about downstream water quality. If wastes can be cheaply discarded in a manner that imposes the environmental consequences entirely on someone else, dischargers have little incentive to control water pollution. As a result, policies that leave pollution control to local authorities generally have been ineffective. A crucial development in the early history of water pollution control in the United States was the national government's decision in 1956 to provide funding to local governments to construct sewage treatment plants. This program of massive federal financial assistance helped overcome the reluctance of local authorities to invest in sewage treatment capacity. Yet it still ultimately became necessary to adopt national regulatory standards to control other sources of water pollution.

In situations where multiple jurisdictions share common water resources, one clear lesson that emerges from the field of water pollution control law is the importance of intergovernmental cooperation to develop effective policies to protect such resources. How to mobilize that cooperation can be a difficult political challenge. A comparative study of how various nations were responding to pollution problems affecting shared coastal seas found that successful intergovernmental partnerships generally were mobilized only after some catalytic "event" that mobilized public opinion and made the importance of cooperation to
protect the resource politically salient. (19) The difficulties the nations of the world have encountered in seeking to halt depletion of global fisheries (20) suggests that in the absence of such a mobilizing event, resource depletion may have to approach extreme levels before an effective response can be crafted.

Intergovernmental cooperation is necessary even for protecting resources that do not transcend international boundaries. As the importance of non-point source pollution has come to be recognized, it is now apparent that successful water resource protection strategies may require policies that manage development on a watershed-wide basis. But the boundaries of political subdivisions do not neatly coincide with hydrologically-defined geographic areas (areas defined by their patterns of ground and surface water flow). For example, the watershed of the Chesapeake Bay, the world’s largest estuary, covers more than 64,000 square miles that overlaps six different states in the United States. Since 1983 a unique intergovernmental partnership between the federal Environmental Protection Agency and the states bordering the Bay has developed a coordinated strategy for reducing nutrient inflows into the Bay, which has substantially halted degradation of this important resource.

Based on the success of this model, which has been largely due to overwhelming public support for the resource, other projects are being launched to organize diverse interest groups to help develop consensus resource protection strategies. (21) Organizing these partnerships on the basis of watershed boundaries, rather than political boundaries, has considerable appeal to policymakers because it also may facilitate incorporation of water quality considerations into the long-range water supply planning process. (22) Such partnership also may create opportu-

(19) The Coastal Seas Governance Project compared policies for protecting three water bodies in North America (Chesapeake Bay, Great Lakes, Gulf of St. Lawrence), one in South America (Gulf of Guayaquil), four in Europe (Baltic Sea, North Sea, Adriatic Sea, and Black Sea), one in the Middle East (Persian Gulf), and five in Asia (Inland Sea of Japan, Gulf of Thailand, Pearl River Estuary, Gulf of Papua, and Bay of Bengal). Ian Morris & Wayne H. Bell, Coastal Seas Governance: An International Project for Management on Threatened Coastal Seas, 47 Md. L. Rev. 481, 487-88 (1988).


(22) See William E. Taylor and Mark Gerath, The Watershed Protection Approach: Is the Promise About to Be Realized?, 11 Nat. Res. & Env. 16 (Fall 1996).
cessful approaches to pollution control, such as watershed-based effluent trading, which is under development in the United States at present. (23)

It is important to integrate considerations of both water quality and water quantity into the long-range planning process. In many countries land use planning decisions are made in isolation from decisions relating to planning for future water supplies. (24) The nature and characteristics of water resources may dictate at which level of government this integration should occur. Provisions for environmental assessments of development projects, which are becoming nearly universal as countries adopt environment impact statement requirements, provide some opportunities for promoting more integrated long-range planning. Another vehicle for achieving more integrated planning is to create special intergovernmental partnerships organized around particular resources, as described above.

Obtaining funding can be a major obstacle for investments in pollution control technology in developing countries. While such investments can provide enormous net economic benefits, they can be quite costly. Growing recognition of the "polluter pays" principle as a fundamental principle of international environmental law suggests that user charges that help internalize environmental costs should be employed wherever possible. In former Soviet-bloc countries where the government has owned most production facilities, lack of funding has been a crucial obstacle to investment in pollution control technologies. As these industries are privatized, many countries are requiring that pollution control issues be addressed as part of privatization agreements, which provide financial incentives for environmental improvements. Environmental improvements also can be accomplished through policies that promote more efficient management of water resources, such as improved planning and pricing of water resources to ensure that they are used where they provide the greatest social benefits. In many jurisdictions, government subsidization of water supplies currently creates incentives for overconsumption. For example, it is estimated that the price of water from urban water supply projects financed by the World Bank is only approximately one-third the true cost of supplying it.

Experience has demonstrated that no single water pollution control strategy is optimal in all circumstances. Rather a combination of control measures offers the best hope for achieving environmental improvements. In the United States the use of uniform, technology-based effluent limits was criticized as inefficient, but it ultimately proved successful in accomplishing substantial reductions in pollutant discharges by large industrial point sources. Ambient water quality standards, which initially proved too difficult to implement as the primary means for controlling water pollution, are now assuming some importance as a backup strategy for


(24) See KEVIN M. O'Brien and BARBARA Markham, A Tale of Two Coasts: How Two States Link Water and Land Use Planning, 11 Nat. Res. & Env. 3 (Fall 1996).
imposing more stringent controls when effluent limits prove unsuccessful in obtaining desired levels of ambient water quality. (25) Strict liability for remediation and damages caused by the release of pollutants whose source is easy to trace has proven to be an effective strategy for reducing oil spills, particularly when coupled with preventative regulations to reduce the consequences of such spills. (26)

Experience implementing the first generation of environmental regulations can help environmental agencies acquire information and expertise that ultimately could be used to design more flexible and efficient regulatory strategies. Agencies often lack sufficient resources to implement comprehensive national regulatory programs. As a result, long delays have ensued in the issuance of regulations and in the United States citizen suits repeatedly have been necessary to force agencies to carry out their legal obligations. One approach for ensuring that agencies have sufficient resources to implement national regulatory programs is to use permit fees to help fund the agencies implementing such programs. In the United States this approach recently has been incorporated in the Clean Air Act's new national permit program which allows agencies to collect a per ton fee on certain air emissions to defray the costs of administering the permit program.

Regulatory decisions always must be made in the face of considerable uncertainty. The precautionary principle, which has become a fundamental premise of international environmental law, suggests that regulators should err on the side of the environment when environmental hazards have been identified, but their true scope remains uncertain. Decisions concerning water pollution control undoubtedly can be improved if an environmental monitoring network is constructed that regularly collects water quality data in a consistent form so that problems can be detected at an earlier stage and the success of pollution control strategies assessed and ultimately fine-tuned with greater confidence.

Experience with water pollution control programs in industrialized countries has demonstrated that even after industrial point source dischargers are controlled, atmospheric deposition of pollutants and non-point source pollution may have a substantial impact on water quality. In the United States it has been estimated that runoff from farms, mines, and urban areas accounts for nearly all the sediment, 82 percent of the nitrogen and 84 percent of the phosphorous reaching surface waters. (27) The realization that atmospheric deposition and non-point source pollution can have a significant effect on water quality makes it important to coordinate air pollution control and land use development policies with measures to protect water resources. While there has been considerable political resistance to efforts to impose greater land use controls, other regulatory policies have been


(26) In the United States there has been a substantial decline in oil spills since the enactment of the Oil Pollution Act of 1990, 33 U.S.C. §2701 et seq., which raises liability limits and requires the use of double hulls on oil tankers using U.S. waters.

dramatically successful. For example, the decision to eliminate lead additives from gasoline in the United States has produced a sharp decline in levels of lead in surface waters by reducing atmospheric deposition of this toxic pollutant.

Agencies implementing regulatory programs inevitably seem overwhelmed by the breadth of their responsibilities and the limits of their budgets. To enhance the effectiveness of pollution control programs it is important to mobilize citizens to participate actively in the process of implementing and enforcing regulatory standards. The environmental movement in the United States has been heavily dependent upon grassroots activism. (26) Citizen involvement has been facilitated by freedom of information laws that provide public access to information in the possession of government agencies and that allow citizens to comment on proposed regulations and to have access to the courts to challenge regulatory decisions. More countries are adopting this model as a means for ensuring that regulatory legislation is implemented and for supplementing government enforcement.

In the water pollution control area, voluntary citizen groups organized around specific water resources have played a useful role in collecting monitoring data and lobbying for resource protection measures. Australia's "water watch" program is an example of such a community-based program. The U.S. Environmental Protection Agency has compiled a catalog of such programs to demonstrate the potential for citizen participation to improve water resource protection policies. (29)

4. CONCLUSION

The problems of protecting water resources are primarily political rather than technological. Countries that are just now embarking on the development of water pollution controls can learn a great deal from the experience of other nations, as outlined above. While each country's situation is different, water pollution control law appears to be evolving in a remarkably similar progression around the world. Public investments in sewage treatment capacity coupled with comprehensive national regulatory programs for controlling water pollution have been a successful first generation strategy for slowing the degradation of aquatic resources. The challenge that remains is to broaden the scope of environmental decision-making to integrate water quality considerations into water supply, land use, and other development decisions, while designing a new generation of fairer and more efficient environmental regulations and mobilizing the power of citizen involvement in the development and enforcement of regulatory policy.
