

## Hazardous Waste and the US-Mexico Border Region: Toward a Binational, University-Based Institution

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The United States-Mexico border region (Figure 1), like many international frontier zones, lies far from national decision-making centers. This separation impairs the ability of communities in the region to respond adequately to a host of problems. Environmental difficulties are especially evident and typically underaddressed (Ingram, Milich, and Varady, 1994).

Of environmental issues along the US-Mexico border, those involving management of hazardous waste are of particular interest because of their close association with human health. Hazardous waste in the border region, as elsewhere, is generated by a number of sectors—agriculture, mining, manufacturing, medical facilities, and energy-production. While the present paper argues for a new institution that would address hazardous-waste issues associated with all these sources, we draw heavily on examples from the manufacturing sector.

Hazardous-waste issues are of increasing concern given the continuing growth of industry and commerce on both sides of the border, and especially in Mexico. The border zone's manufacturing facilities, the *maquiladoras* (foreign-owned plants), bear special mention. These plants were stimulated by the adoption of the North American Free Trade Agreement (NAFTA) in late 1993 and are major producers of hazardous waste (USEPA, 1998; Jacott, Reed, and Villamar, 1999). (Appendix 1 illustrates one of the most pressing concerns in the region: the need for better tracking and accounting of maquila-generated hazardous waste.) In addition to the primary effects of maquila proliferation, urban growth induced by maquiladora expansion further threatens public health as local governments providing potable water and sewage disposal are unable to keep pace. In the past five years alone, population in the Mexican border cities has grown by 20 percent and will more than double in the next two decades if moderate growth continues (Mumme, 1999).

For decades the public sector in each nation has been searching for suitable means to address such problems. Yet the existing instruments to identify, remediate, and monitor potentially dangerous situations lie almost exclusively within official domains (see Appendix 2) while most officials are poorly equipped to understand or confront hazardous-waste issues. Furthermore, poor infrastructure and relative poverty magnify the gap between potential health problems

and the public sector's ability to respond. Therefore, we contend here that overlapping jurisdictions, information paucity, and insufficient resources have caused the governments to overlook what are arguably their most effective institutions, the universities.

In both Mexico and the United States, universities in the border region and elsewhere possess enormous intellectual capacity. In the realm of hazardous waste, they offer resources to analyze the sociopolitical and technical contexts of problems, pose relevant questions, develop new technologies, provide state-of-the-art laboratory facilities, train new scientists and cadres, disseminate new information, and help formulate appropriate public policies.

In summary, government infrastructure for the management and regulation of hazardous materials used or produced by maquila plants and other regional industries is largely missing. This leaves, at least temporarily, considerable room for abuse that may affect regional environmental quality for the foreseeable future. Because most of the border region lies within an arid-to-semiarid belt, the area is critically dependent on the preservation of scarce water resources and has a limited capacity for assimilating hazardous wastes or recovering from their introduction. As such, the situation challenges our collective will to preserve environmental values while pursuing economic efficiency and maintaining social cohesion. In short, there are practical reasons to establish sound regional hazardous-waste-management practices, ahead of the proliferation of environmental problems. The present article describes a seven-year process that is attempting to address these problems.

### First Steps in Addressing Binational Hazardous-Waste Problems

Beginning in the early 1990s, the National Institute of Environmental Health Sciences' (NIEHS) Superfund Hazardous Substances Basic Research Program, now known as the NIEHS Superfund Hazardous Substances Basic Research and Training Program, began to recognize the im-

#### Abbreviations

CONACyT—Consejo Nacional de Ciencias y Tecnología (National Council for Science and Technology)

INE—Instituto Nacional de Ecología (National Institute of Ecology)

IMP—Instituto Mexicano del Petróleo (Mexican Petroleum Institute)

NAFTA—North American Free Trade Agreement

NIEHS—National Institute of Environmental Health Sciences

PAHO—Pan American Health Organization

UA—The University of Arizona

UAM—Universidad Autónoma Metropolitana (Metropolitan Autonomous University)

UNAM—Universidad Nacional Autónoma de México (National Autonomous University of Mexico)

USEPA—United States Environmental Protection Agency



Figure 1. Map of the US-Mexico Border Region and Collaborating Universities.

portance and uniqueness of hazardous-waste issues linking Mexico and the United States. This view was occasioned by the long, 3,000-km border between the southwestern United States and northern Mexico, the perception of disparate standards of environmental regulation in the two countries, and the likelihood of increased manufacturing spawned by NAFTA.

Accordingly, NIEHS encouraged its only Superfund center in the region, at The University of Arizona, to establish linkages between US-based researchers and Mexican colleagues. Preliminary meetings among counterparts led to one of the first joint United States-Mexico conferences on toxic substances (specifically trace metals). The conference, "Fate, Transport and Interaction of Metals," was held in April 1993 in Tucson, Arizona, and was cosponsored by NIEHS, the National Autonomous University of Mexico (UNAM), and the Pan American Health Organization (PAHO) (Dieter, 1993).

To achieve maximum impact, the program combined attention to technical matters and a focus on policy and risk assessment (two key papers were Sánchez, 1993 and Catalán Martínez, 1993). Thus, designing appropriate public-policy responses to hazardous-waste problems was a central

feature of the conference. This orientation set the stage for subsequent attempts to draw attention to the special needs of the United States-Mexico environment.

In August 1994, prompted by the momentum gained at the 1993 conference, the organizers—again with NIEHS support—convened a workshop "Environmental Health and Hazardous Waste Issues Related to the US-Mexico Border," again held in Tucson. Instead of targeting a specific set of toxins, this workshop addressed larger issues, with a particular emphasis on public-health impacts of hazardous waste. Further, while the 1993 meeting preceded NAFTA, the 1994 session came just six months after its implementation. As a result, many of the presentations and much of the discussion centered on institutional developments in the United States and Mexico and on how NAFTA might influence the course of hazardous-waste decision making.

The strong presence of national and regional policymakers reaffirmed the necessity of public-sector involvement in hazardous-waste management. But the university-based venue of the meeting and the presentations by recognized researchers also underscored the potential contribution of academic institutions (Carter et al., 1996).

### Incubating an Idea: The 1998 US-Mexico Conference on Hazardous Waste Management and Technologies

To further promote joint US-Mexican university collaboration on hazardous waste, another conference was convened in June 1997. This time the event was held in Mexico at the Metropolitan Autonomous University (UAM-Iztapalapa) in Mexico City and was sponsored by UAM, the Instituto Mexicano del Petroleo (IMP), and NIEHS. The University of Arizona played a conspicuous role in motivating and participating in the conference. Objectives of the meeting included the establishment of communication among academic, bureaucratic and industrial hazardous-waste professionals in Mexico, and a relatively small number of their counterparts in the United States.

Participants at this meeting pointed to (i) the lack of an administrative framework for binational cooperation in the management of hazardous waste and related human or environmental health problems; (ii) the absence of an established route for informational exchange between US and Mexican investigators in the hazardous-waste arena; and (iii) the insufficient capacity for training professionals to plan

for or remedy future hazardous-waste-management challenges in northern Mexico. Subsequently, these participants recommended additional meetings for more focused discussion of these shortcomings.

A direct result of the 1997 event in Mexico City was another binational conference, the United States/Mexico conference on Hazardous Waste Management and Technologies.<sup>1</sup> This program was hosted by The University of Arizona Center for Toxicology, Superfund Basic Research Program, in Tucson, Arizona, on August 9–11, 1998. The conference was attended by more than 80 academics, practicing scientists, and representatives of institutions with oversight for the management of hazardous wastes.

#### *Objectives of 1998 Meeting*

Formal presentations and poster sessions by scientists from the United States and Mexico concentrated on five subject areas: (i) comprehensive discussion of existing hazardous-waste legislation and institutions with oversight responsibilities in Mexico, (ii) anecdotal descriptions of representative hazardous-waste problems in Mexico, (iii) summary information related to technologies that are more or less routinely applied for the remediation of hazardous-waste problems in the United States, (iv) examples of innovative, recently-developed technologies for the remediation of hazardous wastes in the United States and Mexico, and (v) descriptions of binational collaborations that have been successful in other, related contexts.

#### *Tentative Recommendation: Establishing a Regional Binational Center*

Seeking more than the obvious benefits of informational exchange, the 1998 conference was designed to discuss the merits of an as-yet hypothetical regional binational center for hazardous-waste studies. Responsibilities of such a center might include data management, information dissemination, training and education, and research. To that end, a steering committee composed of influential scientists and managers with hazardous-waste responsibilities in the United States and Mexico was

developed from among the conference participants.<sup>2</sup>

The steering committee commented on (i) the adequacy of informational and human resources in the southwestern United States and northern Mexico for supporting hazardous-waste-management activities, (ii) the need for applied research leading to the solution of hazardous-waste problems specific to the region, (iii) institutional formats that would facilitate or best serve regional needs for the management of hazardous waste, and (iv) funding for centralized, binational institutions for the management of regional hazardous-waste problems. They achieved consensus with respect to the following points:

- There exists no central repository for environmental data or central responsibility for data dissemination in the region (northern Mexico/southwestern United States).
- Efforts to collect environmental data in northern Mexico remain handicapped by inadequate numbers of trained personnel and limited funds.
- University participation is either missing or inadequate in regional institutions addressing environmental quality, infrastructure, public health, and hazardous-waste issues.

To remedy these shortcomings, the steering committee arrived at a critical conclusion: *There is a clear need for a binational, university-based center to manage environmental and hazardous-waste information, promote training and education in hazardous-waste management, and establish research ties between US and Mexican investigators in environmental science, health, engineering, and policy.* To be most effective, the committee suggested that the center's responsibilities and membership should be designed to avoid redundancy with those of extant institutions.

Committee members were particularly convinced that US-Mexico collaboration would offer a mechanism to help solve hazardous-waste problems and benefit both countries. Participants observed that such collaboration is not a primary function of any existing international institu-

tion. In short, there is room for great improvement in the area of hazardous wastes, and an academically-rooted binational center with organizational and leadership responsibilities would be useful if carefully configured.

#### **Beyond the 1998 Conference: Next Steps**

A primary purpose of the 1997 and 1998 meetings was to identify outstanding hazardous-waste issues affecting Mexico and the United States and to present examples of promising and appropriate remediative technologies and procedures. Some of the presentations outlined the institutional arrangements currently in place for addressing hazardous-waste problems and described infrastructural inadequacies, but participants did not discuss missing elements in the present configuration of institutions and there was little sense of how a new center would fit into the existing framework. Furthermore, the administrative configuration of an eventual center, its membership, and other structural issues were left entirely unaddressed. Neither did members of the steering committee explore opportunities for financial support of center activities. Therefore, to discuss these and other related matters in greater detail, follow-on planning meetings were scheduled for early 2000.

In the interim, in Mexico both the Undersecretary for Higher Education and the President of Instituto Nacional de Ecología (INE) expressed support for the creation of a binational center for the management of hazardous wastes. In November, 1998, six Mexican universities in the border region (the Universities of Ciudad Juárez, Sonora, Sinaloa, and Chihuahua; Technological Institute of Sonora; and Western University) formed a consortium whose mission is to encourage joint efforts in environmental science. Two additional institutions, the University of Baja California and the University of Baja California Sur, are expected to join the group.

#### **Existing Institutional Framework**

Within the United States and Mexico, there exist numerous ministries, agencies,

universities, research institutes, private-sector organizations, consortia (as in the burgeoning Mexican example above) and other institutions whose interests include research on the remediation of hazardous waste or related subjects. However, for reasons of national interest or national sovereignty, US institutions rarely concern themselves with problems in Mexico, and vice versa. Unless a *prima facie* case exists that the origins of a particular problem can be attributed to a source in the neighboring country, there is little reason to devote resources to studying or remediating external problems.

The area adjoining the US-Mexico border—the southwestern United States and northern Mexico—is, however, the large exception to the above “rule.” There, where national security issues, population growth, water scarcity, and environmental and public-health concerns of the two nations meet, a number of important governmental and quasi-governmental institutions have emerged over the past century and especially during the last two decades, precisely to address this convergence of issues. The result has been a maze of treaties, agreements, and organizations intended to improve environmental infrastructure, alleviate environmental problems, and improve public health on both sides of the border. A concise listing of institutions with responsibilities for regional environmental and human health is provided in Appendix 2 (see also Liverman et al., 1999).

While these existing institutional arrangements may fit the needs of the region, they also may impede efforts to produce a new institution for hazardous-waste management. To avoid duplication of institutional responsibilities, the proposed center’s activities will be defined with reasonable constraints, following attempts to understand the roles and activities of institutions already in place. The 1998 conference steering committee agreed that an important niche exists for the binational center as an instrument for consolidating and disseminating existing information, promoting binational education and training, facilitating the formation of research collaborations among investigators in US and Mexican

universities, and assisting in understanding and shaping environmental policies.

### Lacunae: What *Isn't* Being Done?

As Appendix 2 shows, many environmental issues are addressed in one or more of the extant agreements or fall within the purview of the active organizations. Hazardous-waste issues within the border region, however, have received less attention than other environmental and public-health concerns, and several important elements are missing from current management practices.

For one, the necessary scientific infrastructure to diagnose environmental problems ahead of costly or irreversible deterioration of the environment simply does not exist in northern Mexico. Comprehensive and reliable information bases and trained personnel for undertaking difficult remediation efforts are scarce and, with few exceptions, direction or assistance from the United States has been neither requested nor offered.

Access to technical information and resources for detecting and correcting problems are not the only missing elements. More fundamentally, the body of professionals to motivate effective environmental plans, monitor environmental health and, when necessary, provide remedies is lacking. The situation is not altogether different from that in the United States three decades ago. But by contrast, Mexico is not likely to find the resources for hazardous-waste management and environmental education programs at a scale similar to those made available in this country in the 1970s and 1980s. Consequently, a purely domestic “quick fix” to perceived shortcomings in hazardous-waste management—that which would occur on a time scale of years to decades—is improbable.

Yet there is still much to be gained by identifying acceptable, economically feasible avenues for destroying or isolating contemporary hazardous wastes, designing practical environmental monitoring programs for the region, accelerating the education and training of environmental profession-

als in Mexico, and encouraging the development of an adequate institutional framework for environmental management in northern Mexico. However, a glance at the existing institutional arrangements for regional environmental problems (Appendix 2) suggests that these objectives will not be satisfied without considerable adjustment. There exists, for example, neither a concerted effort among universities in the southwestern United States to facilitate and accelerate the education and training of Mexican students in environmental science and engineering, nor any consensus on how such an objective should be accomplished. There is very little collaborative environmental research among US and Mexican investigators—and even exchange of environmental data and technical information is limited. In the border region, months to years precede the release of results from the few tightly circumscribed joint environmental monitoring efforts that have been organized.

Most observers have little doubt that individuals and organizations in both countries can improve their collective performance in these areas, even without altering existing binational institutional frameworks or those in the United States and Mexico. But scientists and officials could much better apply limited available resources to the most pressing problems—environmental education, problem diagnosis, and informational exchange—by altering our institutional *approach* to regional hazardous-waste management. In an optimal situation, both countries will have complementary institutions to address cooperatively issues relating to regional hazardous waste. But at present, although numerous ministries, agencies, universities, research institutes, and private-sector laboratories are in place, efforts are rarely coordinated and brought to bear in unison. Instead, fragmentation and haphazardness characterize research, education, and outreach on toxics.

### Extending the Foundation to Other Universities

Border universities are natural partners for environmental and health-related studies

that are pertinent to the US-Mexico border region. In the United States, preliminary efforts by the proponents of the proposed center have generated considerable interest. A number of key toxicologists, environmental engineers, public-health researchers, and environmental-policy scholars from some of the border region's most important universities (The University of Arizona, UCLA, University of New Mexico, University of Texas at Austin, University of Texas at El Paso, Texas A&M University, and Texas Tech University) have agreed to continue discussing the establishment of a permanent multi-university collaboration on hazardous waste. In northern Mexico, the idea has been met with equal enthusiasm and even with initial action. Officials of the Mexican universities identified above expressed interest in creating a regional university consortium. The effort suggests that a regional center for the management of hazardous waste will be strongly supported by the universities of Mexico's border states and that their organization into a single administrative unit for that purpose is both feasible and natural.

Beyond the border region itself, in Mexico, unlike in the United States, much of the research capacity, most major universities, and the funding base reside in the center of the country, near Mexico City. To tap Mexican expertise and scientific capability, any binational center will need to include full participation by these key institutions.

## Conclusion

In the 1990s, economic relations between the United States and Mexico changed dramatically. These changes were driven by a number of factors: global economic forces and corresponding regional wishes to enhance commerce, a mid-decade financial crisis manifested in the devaluation of the Mexican peso, the restructuring of the Mexican political system, and heightened awareness in both countries of the importance of protecting the environment and public health (Liverman et al., 1999).

One of the responses to these changes has been the implementation of NAFTA, the world's first "green" trade treaty, between the United States, Mexico, and Canada. This accord brought with it a number of

new institutions charged with enhancing environmental conditions in the continent. Additionally, NAFTA has prompted greater collaboration among the environmental ministries of the three nations. For the infrastructure-poor US-Mexico border region, these developments included a new binational plan to ameliorate the environmental problems. This plan, known as Border XXI, represents an attempt by the governments of Mexico and the United States to consolidate in a single post-NAFTA plan, the various pre-existing agreements on environmental policy (Mumme, 1999). In the case of hazardous waste, Border XXI is the intended executor of the hazardous and solid-waste workgroup envisioned in the La Paz Accord. Border XXI includes provisions to confront environmental-health issues in general, and toxics and hazardous-waste issues in particular. The workgroup's annual implementation plans are well thought-out and ambitious, but actual progress depends optimistically on cooperation among a host of federal and state agencies in each country as well as on meaningful cross-border collaboration. Such a decentralized approach, relying as it does on harnessing ongoing programs, can be cost-effective but it may leave numerous needs unmet.

Clearly, most observers would agree that over the past decade the binational climate and resolve for addressing such matters has improved. But few would concur that this change in mood has translated into palpable efforts to strengthen environmental and health-related studies at academic institutions in Mexico and the United States. For the past dozen years, there have existed unilateral efforts such as those of the NIEHS-supported Superfund basic-research centers at US universities. But the new post-NAFTA US-Mexico institutions have implemented no provisions for better and more comprehensive measures addressing problems associated with hazardous waste—even while the problems themselves may be multiplying as a result of the growth in economic activity. Similarly, funding has been scarce to disseminate the results of those investigations that have been carried out. Finally, programs to train cadres of environmental-health and environmental-redemption professionals

for the management of border health and hazardous-waste issues have not materialized.

Paradoxically, then, at a time when the next decade promises more binational cooperation on environmental and public-health matters, it also looms as a period featuring more frequent and more intractable hazardous-waste problems. The universities in the two countries are the logical lead instruments for helping to resolve this paradox. A consortial arrangement via a binational center is the most sensible and most efficient way to achieve better research and training capabilities in the United States and Mexico. From recent events, it appears that many of these institutions are ready to initiate such an arrangement.

## Appendix 1. Accounting for Hazardous Waste in the US-Mexico Border Region

The process of hazardous-waste accounting among maquila industries provides arguably the best illustration of the need to improve hazardous-waste-management practices in the US-Mexico border region. Although Mexican law and the 1983 La Paz Agreement stipulate that maquiladoras must return industrial hazardous wastes to the country from which the source material was obtained, considerable disagreement exists with respect to the exact quantities of wastes shipped. The Instituto Nacional de Ecología (INE) indicated that in 1997 about 76,000 tons of hazardous waste—just two percent of the hazardous wastes generated in the border states—was returned from border maquilas (Wolf, 1998). Moreover the United States exports more than 200,000 tons of hazardous waste to Mexico each year for treatment and recycling (INE, 1999). Worse still, it appears that only one in nine tons of toxic waste generated by maquiladoras is properly treated.

The spectacular growth of the maquila industry during the past two decades, particularly in the border states, has emphasized the necessity of responsible regional hazardous-waste management. While numbers of employees in border maquiladora plants increased about 10-fold (at an annual rate of more than 12 percent) during the period 1978–1998, reaching a level of al-

**Table 1.** Summary of annual hazardous waste crossing the US-Mexico border during 1995–1997 (all figures in tons/yr)

	HAZTRAKS <sup>a</sup>	Border Maquilas <sup>b</sup>	Transport from US Industries to Mexico
1995	8,510	33,187	
1996	6,983	72,113	230,417
1997	11,057	76,808	284,921

<sup>a</sup> Source: (USEPA, 1999a)

<sup>b</sup> Source: (INE, 1999)

most one million by the 1990s, the value of raw materials imported from the United States by the same manufacturers increased by 24.4 percent annually during the same period, approximately an 80-fold increase (INEGI, 1999). However, the expected flood of returning hazardous waste has, at least by some accounts, not materialized.

To trace the expected flow of hazardous waste back to the United States, the US Environmental Protection Agency (USEPA) developed a computer-based system known as HAZTRAKS, which offers industry-specific data for wastes shipped from Mexico. Although HAZTRAKS provides a parallel accounting system to that maintained by INE, the Sistema de Rastreo de Residuos Peligrosos or SIRREP (Faulkner, 1999), the respective accounts are not comparable. There is great divergence between reported annual figures for the period 1995–1997 (see Table 1).

Figures representing United States-to-Mexico transport for hazardous-waste recycling indicate that maquila-generated hazardous materials form only a portion of the overall regional hazardous-waste-management picture. Procedural differences account for a portion of the disparate figures and further highlight the need for interagency cooperation in this area. Of the more than 2,000 maquilas located in border cities in 1997, fewer than 40 percent could be found in the HAZTRAKS 1997 database reflecting shipment of solid wastes (both non-hazardous and hazardous) to the United States (Jacott, Reed, and Villarreal, 1999). If Tijuana and Juárez are omitted from this list, the percentage of border maquilas reporting solid-waste shipments to the United States in 1997 was just 23 percent suggesting that compliance

with reporting requirements varies significantly from one region to another.

Finally, transborder hazardous-waste shipment statistics indicate that the origin of such waste material is concentrated among relatively few maquilas. In Tijuana in 1996, for example, two of almost 300 reporting industries accounted for more than 50 percent of hazardous waste returned to the US from that city. In Juárez the story is similar – three of more than 200 reporting industries accounted for 65 percent of the waste exported. The data suggest that major benefits will accrue from even a modest, coordinated, binational hazardous-waste-management effort. To be most effective such coordination should include joint efforts to acquire, archive, and disseminate information, and collaboration on research, training and remediation.

## Appendix 2. US-Mexico Environmental Institutions

*The institutional backdrop against which planning for a binational center for hazardous-waste management will be carried out (arranged by order of inception)*

**International Boundary and Water Commission (IBWC).** The IBWC, the traditional institution for managing transboundary US-Mexico water resources, was created in 1889 to resolve international boundary issues arising from meander changes of the Rio Grande/Río Bravo and Colorado River. Since then the IBWC's responsibility has enlarged to include all aspects of water-resources management such as allocating water from the Rio Grande, Colorado River, and other minor rivers and

associated tributaries; overseeing groundwater utilization in the Colorado River basin near the Arizona-California-Sonora border area; and monitoring the salinity levels of the Colorado River as it enters Mexico.

Although the IBWC has operated efficiently and effectively within the above focus areas, it has not responded to such major border-region resource problems as hazardous-waste disposal and transport, air pollution, water pollution, overpumping of groundwater, and threats to the natural biological resources (Liverman, et al., 1999).

**La Paz Agreement.** Concluded in 1983 by the presidents of Mexico and the United States, Miguel de la Madrid and Ronald Reagan, this accord established technical working groups to address such sensitive transboundary issues as water quality, air quality, natural resources, and solid and hazardous waste. Significantly, these groups reached beyond the diplomatic corps and included representatives of the environmental ministries and of the ten state governments. The La Paz Agreement, with its nine current task forces, remains the bedrock of official US-Mexico border environmental cooperation.

**Integrated Border Environment Plan (IBEP).** In 1991, the USEPA and Mexico's then-ministry of environmental affairs, SEDUE (Secretaría de Desarrollo Urbano y Ecología), drafted a new plan for continuing the charge and extending the scope of the La Paz Agreement. The resulting Integrated Border Environment Plan (IBEP) was strongly criticized from the outset because of its numerous omissions, its failure to acknowledge explicitly the impact of the then-proposed free trade agreement, and its lack of procedural and financial recommendations. In the end, the IBEP was doomed by its almost total absence of specificity.

**Border XXI Program.** Designed by the USEPA and SEDUE's successor, SEMARNAP (Secretaría de Medio Ambiente, Recursos Naturales y Pesca), to correct the flaws and oversights of the IBEP and guide cross-border environmental policy, this program came into effect in 1997. The for-

mal heir to the La Paz Agreement, the program defines nine areas of concern, each addressed through a binational technical working group: natural resources, water, air, hazardous and solid waste, contingency planning and emergency response, environmental information resources, pollution prevention, environmental health, and cooperative enforcement and compliance.

**North American Free Trade Agreement (NAFTA).** This accord, negotiated and signed in late 1993, was intended to promote and facilitate commerce among Canada, Mexico, and the United States. Simultaneously, however, the signatories agreed to charter three new environmental institutions to soften the potential environmental impact of the expected growth in trade and economic activity: the binational (US-Mexico) Border Environment Cooperation Commission (BECC) and North American Development Bank (NADB), and the trilateral Commission for Environmental Cooperation (CEC) (see below). This "greening" of a trade treaty was an entirely new idea in 1993 and it remains the only instance of such a procedure.

**Border Environment Cooperation Commission (BECC).** BECC and its sister organization, NADB, both born in January 1994, became operational in early 1995. Their aim is to improve environmental infrastructure in the border region. BECC, headquartered in Ciudad Juárez, Chihuahua, identifies projects that deal with water supply, water pollution, wastewater treatment, municipal solid waste, and "related matters" in needy border communities and certifies those it considers appropriate and likely successful. In the process, it has incorporated and retained a number of highly innovative design features: (1) binationality at all levels—policymaking by its board, community advising, and composition of its management, and staff; (2) preference for assisting disadvantaged communities; (3) openness and transparency; (4) bottom-up operation, with requirements for public participation at all levels; (5) avoidance of the regulatory or standard-driven approach—the norm for similar organizations elsewhere; and (6) emphasis on sustainability—economic and

environmental (Milich and Varady, 1998). The commission has fielded more than 150 draft proposals and, by late 1999, had certified 31 of these (12 in Mexico, 19 in the United States)

**North American Development Bank (NADB).** Mexico and the United States participate as equal partners in this bilaterally-funded, organization, based in San Antonio, Texas. The bank's role is to facilitate financing for the development, execution, and operation of environmental-infrastructure projects certified by BECC and thus it provides three primary services to border communities: it acts as: (1) an advisor and financial strategist, (2) an investment banker, and (3) a lender. Furthermore, according to the charter, ten percent of NADB's capital is designated for community adjustment and investment programs in both countries. Each government is responsible for developing its own program within this framework, independently from the bank. Since its creation, the bank has struggled to find sources for low-interest loans. Lately the pace has accelerated, but at the end of 1999, only 15 of the 31 BECC-certified projects had secured partial or full funding via NADB.

**Commission for Environmental Cooperation (CEC).** CEC's mission is "to address regional environmental concerns, help prevent potential trade and environmental conflicts, and promote effective enforcement of environmental law," in the North American continent, without special reference to either the Canada-US or the US-Mexico border. The CEC is mandated to (1) commission research reports on problem topics, (2) fund projects by community-based organizations through the North American Fund for Environmental Cooperation (NAFEC) program, (3) host meetings of the three nations' environmental ministers, and (4) respond to citizen complaints by considering submissions from "any nongovernmental organization or person asserting that a party to the North American Agreement on Environmental Cooperation (NAAEC) is failing to effectively enforce its environmental law."

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