Project in Development and the Environment

A Proposal for a Regulatory Impact Assessment Procedure for Pollution Control in Central America

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The objective of the Project in Development and the Environment (PRIDE) is to help the U.S. Agency for International Development (AID) design and implement programs that foster the agency's environmental and natural resources strategy for sustainable economic growth in the Near East and Eastern Europe.

PRIDE provides AID and participating countries with advisory assistance, training, and information services in four program areas: (1) strategic planning, (2) environmental policy analysis, (3) private sector initiatives, and (4) environmental information, education, communication, and institutional strengthening.

The project is being implemented by a consortium selected through open competition in 1991. Chemonics International is the prime contractor; subcontractors include RCG/Hagler, Bailly, Inc.; Science Applications International Corporation; Capital Systems Group, Inc.; Environomics, Inc.; Industrial Economics, Inc.; Lincoln University; and Resource Management International, Inc. In addition, AID has entered into a cooperative agreement with the World Environment Center to support implementation of PRIDE.

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August 1996

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ACRONYMS

ASIES	Asociación de Investigaciones y Estudios Económicos y Sociales
AVANCSO	Asociación para el Avance de las Ciencias Sociales
CCAD	Comisión Centroamericana Ambiente y Desarrollo
CICAD	Comisión Interparlamentaria Centroamericana de Ambiente y Desarrollo
CIEL	Centro de Investigaciones y Estudios Legislativos
CIEN	Centro de Investigaciones Económicas Nacionales
CONCAUSA	Conjunta Centroamericana-USA
FLACSO	Facultad Latinoamericana de Ciéncias Sociales
PRIDE	Project in Development and the Environment
PRISMA	Programa de Investigaciones Salvadoreñas de Desarrollo y Medio Ambiente
PROARCA	Proyecto Ambiental Regional para Centro América
PRODEL	Programa para el Desarrollo Legislativo
RIA	Regulatory Impact Assessment
USAID	United States Agency for International Development
USEPA	United States Environmental Protection Agency

SECTION I
REGULATORY ANALYSIS IN CENTRAL AMERICA

At the "Summit of the Americas" held in Miami, Florida, in December 1994, the United States and the Central American governments signed the Conjunta Centroamericana-USA (CONCAUSA) agreement. CONCAUSA expresses the political will of the countries in Central America to strengthen environmental legislation and harmonize legal frameworks. The governments of these countries, assisted by the Projecto Ambietal Regional para Centro America (PROARCA), are embarking upon an ambitious program to improve and harmonize their environmental protection policies, laws, and regulations. The purpose of the program is to improve environmental protection in the region while allowing for sustainable economic growth and promoting hemispheric free trade.

Depite the program's purpose, new policies, laws, and regulations could have adverse environmental impacts along with negative social, cultural, economic, and institutional consequences. In many cases, more than one legal or regulatory approach is available to address a pollution problem; and the magnitude and extent of environmental, social, cultural, economic, and institutional impacts will vary with each approach. The decision makers and the public need to assess impacts and take them into consideration to ensure that new policies, laws, and regulations achieve their purpose or narrow objective, but not at the expense of other, unrecognized sectors of the economy or society. By the same token, opportunities for maximizing secondary benefits or synergies, such as encouraging the use of green technologies, could go unrecognized.

A. Environmental Guidelines

The PROARCA Environmental Protection Component assists Central American countries to develop and harmonize environmental policies, laws, and regulations. To acknowledge the potential of such activities for adverse environmental impacts, an Environmental Threshold Decision for PROARCA issued a Negative Determination "with the condition that environmental guidelines be developed and approved by the LAC Chief Environmental Officer (CEO)."

This report is an initial effort to prepare such guidelines. The Project in Development and the Environment (PRIDE), a centrally funded project that provides technical assistance in environmental management to USAID missions and host-country institutions, proposes a framework for developing a Regulatory Impact Assessment (RIA) procedure for use in implementing the PROARCA Environmental Protection Component.

The United States has extensive experience in developing environmental regulations, including assessing the potential impacts of alternative regulatory strategies. The U.S. Environmental Protection Agency (USEPA) has developed Regulatory Impact Analysis, a procedure to develop and assess alternative regulatory strategies. The analysis includes assessments of environmental, social, cultural, economic, and institutional impacts.

The PRIDE framework draws upon the regulatory impact analysis experiences of USEPA as well as the principles of environmental impact assessment. In addition to meeting the needs of the Environmental Protection Component of PROARCA, the framework can be useful to the governments of Central America and regional institutions in developing their own procedures to assess the impacts of proposed environmental policies, laws, and regulations.

B. Existing Environmental Analysis

Most Central American countries have not routinely analyzed potential environmental, social, cultural, economic, and institutional impacts of proposed policies prior to passing environmental laws or promulgating regulations. The analysis they do conduct is seldom comprehensive and often focuses on an assessment of the current situation rather than future impacts. As a result, many existing environmental standards and regulations are not implementable.

By-in-large, executive agencies do not have policy analysis offices, and those that exist do not conduct regulatory impact assessment. Some private organizations in the region conduct policy analysis—though not regulatory impact assessment. They have analytic capabilities, however, that could contribute to assessment. For instance, in Guatemala, four private institutions conduct analysis of environmental and social policies. The Asociación de Investigaciones y Estudios Económicos y Sociales (ASIES) has prepared assessments of economic and social impacts of proposed legislation for the Guatemalan Congress. The Facultad Latinoamericana de Ciéncias Sociales (FLACSO) has analyzed environmental policies and helped develop the National Environmental Action Plan. The Centro de Investigaciones Económicas Nacionales (CIEN), which has close ties to the industrial sector, has conducted studies on the costs of compliance with environmental regulations. The Asociación para el Avance de las Ciencias Sociales (AVANCSO) has experience in assessing social impacts of policies and programs. Other institutions with the capacity for policy analysis and involvement in regulatory impact assessment are the Programa de Investigaciones Salvadoreñas de Desarrollo y Medio Ambiente (PRISMA) in El Salvador, the Programa para el Desarrollo Legislativo (PRODEL) in Costa Rica, and the Centro de Investigaciones y Estudios Legislativos (CIEL) in Honduras.

To help meet the need for environmental policy analysis in Central America, USAID supported development of *The Green Book*, a publication that presents a participatory methodology for identifying and assessing the impacts of government policies on the environment. It also provides participants in the process with background information on potential cross-sectoral impacts of policies. The methodology focuses on assessing the impacts of existing policies. Although much of the information in the Environment section of *The Green Book* would be useful in regulatory impact assessment, this methodology is not directly applicable to assessing potential impacts of legislative or regulatory alternatives. Portions of the policy inventory methodology presented in Volume 2 of *The Green Book* are applicable to regulatory impact assessment, particularly to assessing the current situation.

SECTION II
REGULATORY IMPACT ASSESSMENT PROCESS

PRIDE proposes a six-step process for regulatory impact assessment (RIA) in Central America:

- Identifying the problem
- Describing the existing situation
- Identifying feasible alternatives
- Assessing the impacts of each alternative
- Comparing alternatives
- Selecting an alternative

The first five steps require implementation by an interdisciplinary team with staff from the promulgating institution as well as representatives from other private and public institutions. USAID is committed to a transparent, participatory process for developing environmental policies, laws, and regulations. RIA is not a substitute for such a process, but rather a means of providing participants in the process with the information they will need to assess alternatives.

The sixth step is the responsibility of the decision maker. The RIA process can provide the decision maker with information and comparisons of alternatives. The ultimate decision, however, remains with the decision maker.

Some of the reviewers of earlier drafts of this report (Annex D) expressed concern that the RIA process would be too complex to apply in the developing countries of Central America. Particularly, they were concerned with the lack of data and trained personnel to assess the data. Although an RIA can be a long, time-consuming process using volumes of data and computer modeling, it can also take the form of a focus-group meeting relying upon known data and professional judgment. The purpose of RIA is to improve environmental policies, laws, and regulations. Its value lies in explicit consideration of environmental, social, cultural, economic, and institutional factors that may affect implementation and reduce potential environmental improvements. Lack of data and expertise may affect the level of detail in an RIA but need not preclude its use.

General descriptions follow on each step in the RIA process. A checklist of specific questions for participants to address in steps 1 through 4 appears in Section III.

A. Step 1. Identifying the Problem

The RIA process, designed to assess the ability of alternatives to achieve an environmental purpose, requires clear identification of the problem to be addressed and definition of the purpose of a policy, law, or regulation. That purpose will guide the development of alternatives and the assessment of their impacts. For instance, if the purpose of an action is to reduce emissions from vehicles in a metropolitan area, the regulatory options and impacts may be quite different from those whose purpose is to improve air quality in the same metropolitan area.

B. Step 2. Describing the Existing Situation

To assess the impacts of alternatives, participants need to understand the existing situation as a baseline against which to measure alternatives. This description needs to include environmental, social, cultural, economic, and institutional components. For instance, environmental information on an emissions problem would include sources of pollution, emission levels, and impacts of emissions on human health, quality of life, and ecosystems.

Descriptions of existing social and cultural situations need to include information on those being impacted by the pollution problem and on how they are impacted. This includes the identification of stakeholders—those who will be positively or negatively impacted by the proposed action. Descriptions also need to identify any specific cultural activities, behaviors, or artifacts that may be impacted by a proposed policy, law, or regulation.

The economic description will contain information on the distribution of emissions among polluters and on the economic conditions of the polluters.

Analysis of existing institutional structures requires information on existing policies, laws, and regulations that deal with or affect the pollution problem; an assessment of their effectiveness; and an analysis of the capabilities of the responsible institutions. The institutional analysis also will identify policies in other sectors that affect the current pollution problem or may affect the viability of alternatives.[1]

To the extent possible, description of the existing environment will include a prediction of the state of the future environment in the absence of the policy, law, or regulation.

C. Step 3. Identifying Feasible Alternatives

For RIA to become a decision-making tool, participants will need to apply it to alternatives and not just to one way of addressing a pollution problem. Feasible alternatives are those:

- With the potential to achieve the purpose of a policy, law, or regulation
- For which a known technology exists at a reasonable cost
- For which a country has the potential institutional capacity for implementation

Each feasible alternative can provide the decision maker with a different means of meeting the purpose of the policy, law, or regulation.

Alternatives may include standards (emission standards, ambient standards, and technical standards) or economic incentives (fees, taxes, subsidies, technical assistance, and changes in liability). They may also include alternative levels for standards, varying standards for different sources, and alternative implementation schedules. The Environment Section in Volume 1 of *The Green Book* (Annex A of this report) provides a discussion of the pros and cons of several regulatory alternatives.

[1] *The Green Book* methodology can help identify cross-sectoral policy impacts.

D. Step 4. Assessing the Impacts of Each Alternative

This step involves assessing the environmental, social, cultural, economic, and institutional impacts of each alternative. Participants need to measure these impacts as changes from the existing situation. Among the techniques available for assessing the potential impacts of alternatives are habitat evaluations, ecological indices, mathematical modeling, simulation modeling, statistical analyses, graphical overlays, risk assessment, benefit/cost analysis, delphi techniques, and professional judgment. The techniques used will depend upon the type of environmental problem and its impacts as well as the size of the budget available for the assessment. No matter what techniques are used, participants will need to apply them equally to all alternatives.

D1. Environmental Impacts

An assessment of environmental impacts requires consideration of positive and negative impacts. By their very nature, the alternatives will have positive environmental impacts such as reductions in emissions. To the extent possible, participants need to quantify reductions in pollution. They also need to estimate the impacts of such reductions on human health and ecosystems for each alternative—even if the estimation can only be qualitative.

The assessment needs to address the potential for cross-media contamination–the transfer of pollution from one media (water, air, or soil) to another. For example, a regulation requiring the use of "scrubbers" on industrial smoke stacks can result in increased contamination from disposal of the "scrubbed" pollutants in dumps. Cross-media contamination can also occur if compliance with an alternative results in changes in production processes that reduce emissions to one media while increasing them to another.

D2. Social Impacts

The social assessment addresses changes in quality of life created by each alternative. Impacts on quality of life can be aesthetic, such as odor and visual contamination. They can take the form of material damage, health care costs associated with the pollution problem, or lost income from work absences caused by health problems. The alternatives are likely to improve quality of life by such measures as improved visibility and reduced odors and health care costs. Participants will need to quantify these improvements where possible.

The social assessment also addresses changes in social equity associated with each alternative. It identifies how the benefits and costs of each alternative will be distributed among social classes and ethnic groups. If the alternatives require waste disposal or allow for varying levels of emission control, the assessment can determine if one social class or ethnic group is likely to be impacted by the location of disposal sites or facilities with higher emission levels.

D3. Cultural Impacts

The cultural assessment focuses on both living culture and archaeological resources. It identifies and assesses changes in cultural behavior that may be caused by each alternative. The assessment also identifies traditional activities that could hinder implementation of each alternative or that could encourage developments to foster implementation. The cultural assessment should identify and assess impacts on archaeological resources.

D4. Economic Impacts

An economic assessment focuses on the economic impacts of each alternative on the regulated community—those who will have to change their behavior because of the policy, law, or regulation. Participants need to address social and institutional costs in respective sections of the assessment. An economic assessment estimates costs of compliance and analyzes impacts on small businesses, employment, and trade. It also identifies potential adverse economic incentives that could be created by an alternative.

Compliance cost estimates should include capital, operation, and maintenance costs of equipment; costs of monitoring and reporting; and labor costs. An assessment identifies individual facility costs as well as aggregate costs for an affected population. An assessment should clearly state the assumptions used for making cost estimates. If the assessment is for a performance standard or economic incentive, participants will need to make assumptions about the technologies used by the regulated community to meet the standards or respond to the incentives.

An assessment of impacts on small businesses identifies the number of small businesses that will be impacted and the percentage they represent of the total regulated community. An assessment compares compliance costs for small businesses with such operating characteristics of businesses as annual sales, annual operating costs, and net worth. Participants can use these comparisons to estimate the potential for small business closures as a result of implementing each alternative.

To the extent possible, an assessment identifies shifts in employment and trade associated with each alternative. Employment and trade may decline, if increased costs result in reduced production, or if businesses close in response to an environmental policy, law, or regulation. Employment may rise, if implementation requires application of new technologies and the employment of specialized labor. Trade may increase if the quality of products produced by regulated industries improves, or if their production processes are brought into line with international standards, thus opening new markets. Alternatives may also cause shifts in employment from one sector of the market to another (for instance, from less efficient to more efficient companies, from small to large companies, or from one location to another). In assessing shifts in employment, participants need to identify those market sectors likely to lose employment and those likely to gain.

An economic assessment identifies potential perverse or inadequate economic incentives associated with each alternative. Perverse incentives are those that stimulate behavior resulting in greater environmental impacts than the status quo or that remove incentives to reduce pollution. An example of stimulating perverse behavior would be an alternative which replaces three open dumps with one properly operated sanitary landfill but, in so doing, creates such a high cost of transporting solid wastes that illegal dumps proliferate. An example of removing incentives would be subsidies for end-of-the-pipe pollution control equipment which reduce the economic benefits of changing production processes to reduce pollution. Inadequate economic incentives are those designed to reduce pollution (via fees, penalties, taxes, or subsidies) but which are set too low to generate pollution reduction.

D5. Institutional Impacts

In Central America, institutional analysis could be the key component of regulatory impact assessment. Many governments in the region are not enforcing environmental laws and regulations because they lack institutional capability. Institutional analysis includes analysis of ability to enforce and monitor as well as identify information, training, and resource needs for implementation.

Analysis of ability to enforce and monitor includes identifying the types of enforcement and monitoring needed, technical requirements, costs of implementation, and the institutions which will be responsible. For each institution responsible for enforcement or monitoring, participants need to assess technical and financial ability to fulfill these responsibilities. They also should estimate staffing and budget needs. This portion of the analysis identifies other institutions that could be involved in implementation, identifying opportunities and constraints for coordination among implementing institutions and these other institutions.

If implementing institutions are to collect fees or emission charges, participants need to determine the ability of the institution to collect and manage the revenues and whether revenues will remain with the enforcement and monitoring institution or will go into the general treasury.

An institutional analysis addresses information and training needs as well. It identifies the types of information necessary for implementation and assesses their availability. This analysis also identifies training needs and mechanisms for providing training.

E. Step 5. Comparing Alternatives

Proper presentation of assessment results can facilitate comparison of alternatives. Although some assessments may lend themselves to risk assessment or benefit/cost techniques, in most cases participants can present results in matrices with the alternatives on one axis and environmental, social, cultural, economic, and institutional impacts on the other axis.

F. Step 6. Selecting an Alternative

Participants in a regulatory impact assessment may recommend an alternative, but the ultimate decision will rest with the decision maker. RIA will not guarantee that the best decision is made, but it will ensure that the decision maker has the best information available on the potential impacts of a decision.

SECTION III
IMPLEMENTING A REGULATORY IMPACT ASSESSMENT

A. Handbook and Training

For PROARCA to implement a regulatory impact assessment effectively, participating institutions will need a detailed description of the process that could be prepared in the form of a handbook. Such a handbook, produced in both English and Spanish, could include examples from Central America.

RIA training would support handbook use. Some training activities will need to focus on introducing RIA principles, and others can address specific methodologies for conducting environmental, social, cultural, economic, and institutional analyses. USEPA has developed training programs that may be applicable for these purposes.

For the RIA process to reach beyond PROARCA efforts to become a common practice in the region, development of an RIA handbook and training by Central Americans is critical. Institutional advocates of the process also are essential. At a regional level, the Comisión Centroamericana Ambiente y Desarrollo (CCAD) or the Comisión Interparlamentaria Centroamericana de Ambiente y Desarrollo (CICAD) may be potential institutional RIA sponsors. CCAD, however, may already be overextended, and CCAD is still new and growing. At the national level, some of the private institutions involved in policy analysis in the region may be potential supporters. These include ASIES, FLACSO, CIEN, and AVANCSO in Guatemala, PRISMA in El Salvador, PRODEL in Costa Rica, and CIEL in Honduras.

B. An RIA Checklist

This checklist presents questions or regulatory approaches which participants should consider during the first four steps of the RIA process:

☐ **Step 1. Identifying the Problem**

What problem will the proposed policy, law, or regulation address?

What is the purpose of the proposed policy, law, or regulation?

☐ **Step 2. Describing the Existing Situation**

What are the current levels of emissions for the pollution problem and/or status of existing facilities (wastewater treatment plants, solid waste disposal sites, etc.)?

What are the current impacts of the pollution problem on human health, quality of life, and ecosystems?

Do the impacts vary depending upon the location of the sources? How?

How are the emissions and impacts distributed among the sources of the problem?

Are some sources of emissions causing greater impacts than others?
Are there a few big sources causing most of the impact?
Are many small sources equally contributing to the impacts?

What national or local laws, regulations, standards, or activities (taxes, subsidies, provision of services, etc.) currently address or impact the pollution problem? How effective are they? *The Green Book* can help identify policies in other sectors that are impacting the problem.

If laws or regulations directed at the problem already exist, consider:

Are they targeted at specific types or locations of polluters?
Are they discharge or ambient standards?
Do they require the use of specific technologies?
Do they impose penalties, taxes, fees, or charges?
Do they provide subsidies?
What institutions manage these laws, regulations, standards, or activities?
What strengths or constraints (technical capability, funding, etc.) do these institutions have for implementing, enforcing, and monitoring existing laws or regulations?

Which individuals, groups, cultural activities, archaeological resources, and institutions are negatively impacted by the current situation?

Which individuals, groups, cultural activities, and institutions benefit from the current situation?

☐ **Step 3. Identifying Feasible Alternatives**

Alternatives may include the following components:

- Technology-based standards—equipment requirements
- Performance-based standards—emission standards
- Ambient standards
- Alternative levels of stringency—alternative technologies or alternative quantitative standards
- Phased standards—phased in over time
- Tailored standards—different levels of stringency based on risk, location, size of company, etc.
- Economic incentives—taxes, fees, subsidies, tradeable permits, changes in liability
- Education, information, and technical assistance
- Monitoring and reporting procedures—government, self, third-party

Does the technology exist in the country, or is it readily available to allow for compliance with the alternative?

Are the compliance, monitoring, and enforcement costs reasonable?

Does institutional capacity exist to implement the alternative? If not, is it reasonable to assume that the capacity could be created?

☐ **Step 4. Assessing Impacts of Each Alternative**

- **Environmental Impacts**

  To what extent will the alternative reduce emissions?

  To what extent will the alternative reduce impacts on human health and ecosystems?

  If the alternative will rely upon some form of removal of pollutants from a waste stream (such as an end-of-the-pipe treatment process), how will the pollutants so removed be disposed of?

  If the alternative will create some changes in production to reduce emissions, will the changes result in an increase in emissions of pollutants to another media?

- **Social Impacts**

  To what extent will the alternative reduce impacts on quality of life? What impacts will it reduce?

  Other than reducing current impacts of the pollution problem, will the alternative create benefits to quality of life? How so?

  Which individuals, social classes, and ethnic groups will be affected by the alternative?

  Who will benefit? How?
  Who will pay?

  Does the incidence of who benefits and who pays fall primarily on one social class or ethnic group?

- **Cultural Impacts**

  Will the alternative impact cultural behavior or activities? How?

  Will the alternative impact archaeological resources? How?

  Could traditional activities hinder implementation of the alternative?

Could traditional activities foster implementation of the alternative? How could implementing institutions encourage such activities?

- **Economic Impacts**

  How much will it cost each establishment to comply with the alternative? (Include capital, operation and maintenance, and reporting costs.)

  What will be the total cost to the country of compliance?

  What percentage of the total establishments to be regulated are small businesses?

  How do the compliance costs compare to the operating characteristics of the small businesses (such as annual sales, annual operating costs, net worth)?

  Will compliance result in closure of no/some/many/most/all small businesses?

  Will the alternative create or reduce employment? How so and by how much?

  Will the alternative cause a shift in employment from one sector of the market to another? If so, what shift is expected (for instance, from less efficient to more efficient companies, from small to large companies, from one location to another)?

  Will the regulation have a positive/negative/no impact on trade? How?

  Is it likely that the costs of compliance will create an incentive for illegal or undesirable behavior that could result in more contamination? If so, how? Are sufficient regulations and enforcement capability in place to prevent this behavior?

  Are proposed fees, penalties, taxes, or subsidies sufficient to deter noncompliance and achieve the desired levels of pollution reduction?

  Are proposed subsidies sufficient to create incentives for pollution prevention, or do they encourage only the use of end-of-the-pipe cleanup technologies?

- **Institutional Impacts**

  What type of enforcement and monitoring does the alternative require? What will they cost?

  Which institutions will be responsible for enforcement and monitoring?

  Do the institutions have (or have access to) the necessary technical staff and equipment to enforce and monitor the alternative? Are they equipped to analyze and interpret the results of monitoring?

  Will the institutions have sufficient budgets to pay for enforcement and monitoring?

Will proposed fees or penalties go towards enforcement and monitoring or into the general budget?

Does the collection agency have the necessary personnel and administrative structure to collect and administer proposed fees or penalties?

Do other institutions exist which, although not responsible for implementation, could assist in implementation, enforcement, and monitoring?

How will these institutions be involved?

If their involvement increases their costs, will these costs be reimbursed? How?

What types of information will responsible institutions need to enforce and monitor an environmental policy, law, or regulation?

How will this information be collected and compiled?

What types of training will be necessary for implementation of an environmental policy, law, or regulation?

How will this training be provided?

Who will be responsible for training?

How will it be funded?

ANNEX A

ENVIRONMENT SECTION, *THE GREEN BOOK*, VOL. 1

Environment

PROTECTION OF ENVIRONMENTAL QUALITY

KEY POINTS

- The demand for environmental management policies increases as the scale of waste generation exceeds assimilative capacity and environmental and health damages become apparent.
- Contrary to conventional wisdom that environmental regulation has a negative economic effect, analysis of available empirical evidence finds no data supporting a negative relationship between environmental regulation and economic growth.

A large class of environmental problems results from the free disposal of wastes into the air, surface water, groundwater, or on the land. At early stages of development, it may be feasible to allow unregulated accumulation of waste emissions because the assimilative capacity of the environment exceeds the level of waste generation. As development progresses, however, the scale of waste generation increases correspondingly, disposal exceeds the assimilative capacity, and environmental and health damages follow. At this stage of development it is necessary to implement environmental management policies.

Policies can be directed at the source of the waste or at the environmental or human endpoint where the damage occurs. In the first case, environmental management focuses on limiting free disposal, such as through policies that change the generation, emission, storage, treatment, and recycling of wastes. These policies may intervene directly in how activities are carried out through regulations or indirectly through policies that address the contributing factors. Examples of indirect policy intervention are pricing and taxation policies for raw material inputs.

Source: Johnston, George, and Hilary Lorraine, "Environment," pages 1-32 in *The Green Book*, Volume. 1, RENARM and DESFIL, USAID/G-CAP, USAID/G/EG/EID, Guatemala City, 1994.

Likely Impacts of Environmental Protection

Growth

- Growth in the environmental technologies sector.
- Savings from increased efficiency available for investment.
- Positive growth and job formation, although at a slower rate in the short term.

Welfare

- Transfer of wealth from polluters to pollution controllers and abaters and to less polluting firms.
- Improved health in the general population, especially among poor and marginalized groups who traditionally have been the most affected by declining environmental quality.

Conservation

- Improved water and air quality.
- Decreased loss in biodiversity.

Alternately, environmental management can focus on mitigating exposure once wastes get into the environment. Such policies are necessary because environmental capacity constraints are seldom acknowledged until after damages have begun to manifest themselves. An example is environmental cleanup of uncontrolled hazardous waste sites. When remediation costs are high, insulating the environment or humans from contamination may be the next best alternative. This option is typically used when large-scale contamination occurs, such as at Love Canal, New York, and Times Beach, Missouri, where hazardous waste contamination eventually forced residents to move out of these areas.

What is the net impact of environmental protection on jobs and the economy? Roger Bezdek (1993) reviewed the evidence drawn from theoretical, anecdotal, econometric/simulation, and empirical/statistical sources. His review is summarized below. The standard argument that environmental policies have negative economic effects is as follows: "Businesses invest capital goods and services for a profit. Each firm seeks to minimize capital and operating expenses and to maximize sales and profits. As more environmental restrictions on production are enacted, the cost of production increases. This increase raises the price of the product

and, depending on the product's price elasticity, reduces its sales. Reduced sales decrease employment. When regional or international considerations are taken into account, it is argued, economic activities, pollution, and jobs are exported to those regions and nations with relatively lax environmental standards ("pollution havens"). Thus, environmental regulations and standards impose nonproductive expenses on the economy that reduce economic growth and eliminate jobs.

"However, does the empirical evidence available indicate a negative or positive relationship between environmental protection and economic growth?" (Bezdek 1993)

Stephen Meyer (1992) of the Massachusetts Institute of Technology, in the most comprehensive recent study tested the "hypothesis that pursuit of environmental quality hinders economic growth and job creation by ranking the 50 U.S. states on the basis of the stringency of their environmental laws and then comparing the rankings with measures of economic growth and job creation between 1973 and 1989. His findings are striking: Not only did Meyer find no evidence to support a negative relationship between environmental regulation and economic growth, but his results showed just the opposite. States with the most ambitious envionmental programs had the highest levels of economic growth and job creation over the period. Although Meyer's study does not necessarily prove that environmental regulations cause economic growth or create jobs, it does repudiate the hypothesis that environmental regulations reduce economic growth and job creation" (Bezdek 1993).

The empirical evidence cited by Bezdek questions the hypothesis that industries will relocate to nations with the least stringent environmental policies to minimize compliance costs.

- H. Jeffrey Leonard (1988) of Cambridge University, in a case study of trade and investment flows, found little evidence that polution control measures have exerted any systematic effect on international trade.

- James A. Tobey (1990) at the University of Maryland, in an ecnometric study of international trade patterns in "pollution-intensive" goods, also could not identify any negative effects of stringent domestic environmental policies.

- Michael Porter (1990), a professor of economics at Harvard University, contributes even more surprising evidence. His seminal study of the comparative advantage of nations found not only that environmental protection does not hamper

economic competitiveness but also that those nations with the most stringent environmental laws also have the highest rates of economic growth and job creation.

- Maureen L. Cropper and Wallace E. Oates (1993), both of the University of Maryland and Resources for the Future in Washington, D.C., in the most extensive recent reveiw of the literature, report that "in short, domestic environmental policies at least to this point in time (June 1992) do not appear to have had significant effects on patterns of international trade."

Indicators: Improved Environmental Protection

Problem Indicators

- Quality of air, water, and land resources.
- Degree of biodiversity.
- Health of people, represented by mortality and morbidity.
- Rate of resource usage and efficiency

Policy/Process Indicators

- Movement toward market-based policy instruments.
- Growth of environmental protection spending and jobs.
- Economic benefits from investment in environmental and conservation programs.
- Efficiency of industries with stringent environmental regulations compared with the efficiency of those without.
- Rate of job growth in environment-related technologies compared with that in other sectors.

WATER QUALITY

KEY POINTS

- Technology-based standards may not be a cost-effective means of pursuing water quality goals.
- Ambient standards accommodate the circumstances of a given location's water quality needs better than uniform, technology-based standards. They do not, however, provide adequate guidance on which point sources should be controlled when tolerances are exceeded.
- Standards that are customized to the environmental and economic circumstances of individual point sources may be the most efficient. But the high transaction costs for establishing such a system may put such an approach beyond the reach of governments with limited resources.
- Setting priorities for the most important point sources that can be controlled cost effectively could be the best starting point for improving water quality.
- Effluent charges provide polluters with monetary signals that can lead to changes in wastewater disposal practices. Imposing charges rather than direct regulation allows polluters to decide how to most efficiently reduce their level of pollution.
- It is difficult to determine the level of effluent charge that will send the right monetary signal to achieve a water quality target.
- It is also difficult to set an administratively feasible charge that is not so high as to cause financial burden and not so low as to be disregarded.
- Rather than serve as the key element of a program to improve water quality, effluent charges may best be used initially to supplement a program of standards, but oriented more toward raising revenue for a water quality authority than as an incentive to change behavior.
- Subsidies redistribute the burden of pollution control from polluters to society.
- Although subsidies may facilitate the adoption of better pollution control by individual facilities, pollution control will not be accomplished at cost-minimizing levels.
- Tax exemptions, a special form of subsidy, may benefit most the polluters who are in the best position to pay for pollution control themselves (i.e., the most profitable firms).

Likely Impacts of Adoption and Enforcement of Water Quality Standards

GROWTH

- Increased costs and decreased employment in polluting industry in short term.
- Increased employment in environmental protection, and in firms specializing in environmental technology.
- Increased costs of government and increase in government employment.
- Long-term improvement in economic competitiveness.

WELFARE

- Improved water quality.
- Improved health of population.
- Transfer of wealth and jobs from polluting industries to other sectors.

CONSERVATION

- Decrease in loss of biodiversity.
- Sustainable long-term resource use.

Direct Regulation

Regulations to protect surface waters initially tend to target the effluent from a finite number of point sources. Such end-of-the-pipe regulation is a common, but not cost-effective, means of pursuing water quality goals, in part because it is implemented in many circumstances through uniform, technology-based standards. Such standards restrict emissions to the levels achievable under the "best available" or "best practicable" pollution control technology. In the case of municipal and industrial discharges, the inefficiency results from failure to consider the levels of control needed to achieve a given level of quality in the receiving water body.

End-of-pipe standards that are customized to the discharger's circumstances can reduce the cost of pollution control without sacrificing environmental protection. This can be achieved by setting performance standards on the basis of water quality needs of the receiving water body. This ambient standard approach

requires more complete monitoring of each point source than is required under a technology-based approach, where visual inspection may be sufficient to ensure that the technology is operating properly.

Although ambient standards may also be uniform, they at least recognize that variations in local conditions can affect the capability of a water body to assimilate wastes. Consequently, the pollution control requirements can be set at the levels necessary to attain ambient conditions for specific locales. When ambient standards are exceeded, however, it is uncertain if government authorities have the capability to identify the responsible individual point sources. Uniform requirements have an advantage in that they relieve the authorities of proving that an individual polluter must carry out additional control efforts.

Focusing on one environmental objective, such as water quality targets, may create other environmental problems because many pollution control technologies transform rather than destroy pollutants. For example, treating wastewater to reduce the concentration of a toxic substance is likely to generate sludges with higher concentrations of this toxic. Because these sludges must also be managed, a more integrated view of management must include more than the water quality problem alone.

Limited budgets limit government oversight capabilities and the degree to which regulations can be established and implemented for individual point sources. Consequently, authorities may rely on command-and-control approaches to regulatory standards based on technologies used in industrialized countries. For some developing countries, however, such standards are overly ambitious and cannot be enforced.

Effluent Charges

Environmental economics points to the existence of socially optimal levels of pollution. Assuming that the social damages (in terms of negative impacts on the environment and human health) can be estimated, imposing a tax equivalent to this damage on polluters will give the polluter the ideal incentive to mitigate the damage.

Typically, polluters are given little financial incentive to change their wastewater disposal practices. To dispose of wastewater an industrial facility need only invest in conduits to the nearest

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water body. Households have limited access to sewage infrastructure in terms of hookups or handling capacity, and municipal sewage systems, to the extent they exist, serve merely as a means to collect domestic and other wastewater that eventually is dumped untreated into surface water bodies. Although these industrial, household, and municipal practices are tolerable on a small scale given the environment's assimilative capacity, wastewater increases from urban and industrial growth have long exceeded such a scale.

In theory, a charge on wastewater effluent could be structured to provide an incentive for polluters to alter waste disposal practices. To set this charge at an optimal level, a government authority must have extensive information: pollution emissions by point source, resulting concentrations of each pollutant in the environment, physical damages that result from these increases in concentration, and the monetary value of the damage.

Given these requirements, it is not surprising that few countries have used such charges as the primary means to control wastewater effluent. Still, several countries have used effluent charges to raise revenues to provide wastewater treatment facilities, oversee water quality protection, and subsidize industrial investments in wastewater treatment

Although intended primarily to raise revenue, these charges do provide incentives for polluters to change disposal practices even though they are poorly targeted and their effects tend to be small because charges are set low to lessen opposition from industry and households. Effluent charges can be coupled with a system of standards and are analogous to fines if the charges are triggered when standards are exceeded.

Using effluent charges exclusively in place of direct regulation is unlikely. Achieving specific environmental targets with behavioral instruments, such as an effluent charge, would require extensive monitoring of effluent sources and the resulting water quality. Charges would have to be frequently adjusted to reflect changes in effluent discharges and environmental conditions in order to send the right behavioral signals to polluters.

Subsidies and Tax Exemptions

Subsidies appear to fit the circumstances of developing countries better than direct regulation or effluent charges. Subsidies lower the financial burden that pollution control imposes and possibly encourage faster adoption of new technologies. Furthermore, subsidies have a certain logic in that the cost of retrofitting manufacturing facilities with end-of-pipe treatment should be borne by the government because it is generally the public that benefits from pollution control, not the polluter.

Subsidies, however, have been criticized on both economic and environmental grounds. Even if subsidies are one of the best uses of limited government funds, unless conditions are adequately imposed on awarding subsidies, they will not provide correct incentives to minimize pollution control costs. The environmental argument against subsidies is that they may encourage expansion of the industry receiving them, which can actually increase the aggregate level of pollution.

Tax exemptions, a special form of subsidy, are intended to encourage investment in environmental protection by granting accelerated depreciation for the pollution control equipment needed to meet water quality objectives. These tax incentives favor profitable firms, which may not be the class of polluters needing the greatest inducement to invest in pollution control. Polluters of marginal profitability may need greater support before they will choose voluntarily to invest in greater pollution control.

Experience with one large-scale subsidy program for public wastewater treatment facilities indicates that the high subsidy share in investment costs (30% to 75%) led to capital-intensive solutions with excess capacity. Because subsidy shares increased over time, wastewater treatment plant operators may have delayed investment. Economies of scale may make wastewater treatment unaffordable for smaller communities, which are unable to build wastewater treatment plants without financial assistance.

Indicators: Water Quality

Problem Indicators

- The quality of surface and groundwater sources.
- Quality of point source discharges into water bodies.
- Amount and type of contaminants from non-point sources.
- The number of environmental and sanitary health problems related to contaminated water.

Policy/Process Indicators

- Increase in the level of treatment provided to water supply systems.
- Establishment of water quality standards with emphasis on the water quality needs of the receiving body of water.
- Establishment of water quality standards for drinking water.
- Increased budgets and personnel dedicated to oversight and enforcement of water quality regulations.
- Creation of incentives to promote the construction of water treatment facilities, but within certain guidelines to prevent overcapacity.
- Establishment of effluent charges or taxes to promote the construction of water treatment facilities and monitoring.
- Establishment and enforcement of effluent discharge standards.
- Creation of regulations, combined with fiscal incentives, to curb the discharge of untreated effluent..

AIR QUALITY

KEY POINTS

- Technical standards for stationary and mobile sources tend to be set nationally, but those standards can vary by region and source. Many standards force the adoption of certain technologies, which raises the costs of air pollution reduction.

- Ambient standards typically are uniform and established nationally, but are implemented at the subnational level. Delegating regulatory authority to the local level increases the ability to adjust standards to local needs and therefore to keep overall protection costs down. Local authorities, however, may be inclined to compromise more with vested interests who oppose more stringent requirements.

- Many air pollution problems are extra-jurisdictional, and thus local, regional, and state authorities may not adequately address what are basically national problems.

- Putting less emphasis on rigid command-and-control regulatory practices and more emphasis on flexible approaches such as market-based instruments can lower overall control costs.

- Emission charges are a relatively simple way to influence the behavior of polluters. In theory, emission changes can be designed to achieve target levels of pollution reduction while avoiding the inflexibility of direct regulation. In practice, their use has been oriented toward raising revenue, with little emphasis on providing incentives to polluters.

- Other financial instruments can be used to change air polluting activities. General fuel taxes are a common but not well-targeted means for achieving pollution reduction, except in cases of differential taxes, such as those for leaded and unleaded gasoline.

- Other taxes such as vehicle taxes can be structured to influence consumers' choices of cars, with different pollution implications.

- Trading pollution rights approaches offer regulatory authorities the opportunity to retain greater control over the final environmental outcome than emission charges do while still drawing upon the power of economic incentives to reduce costs of control.

- Despite these advantages, the number of trading schemes actually implemented has been limited. Policy uncertainty, high transaction costs, and institutional resistance have seriously impeded air pollution emissions trading.

- More experience with this approach could reduce some of the impediments. The United States is about to implement a major emissions trading program that could open up new possibilities.

Direct Regulation

In many countries, air quality regulations focus on major stationary sources of air pollution, especially electric power generation and industrial facilities. Only as automotive traffic has increased significantly have countries begun to address air pollution from mobile sources

Standards are set nationally and tend to be uniform, but they can be allowed to vary by region or, especially where agreements are negotiated, by point sources with individual polluters. The more that standards can be customized to local environmental and economic circumstances, the more cost effective air pollution regulations are likely to be. However, local environmental and public health considerations do not always provide a comprehensive basis for setting standards because many air pollution problems cross local, regional, and state boundaries.

Likely Impacts of Air Pollution Regulations

GROWTH

- Short-term costs associated with technology adoption that are generally small but can be significant for dirty industries.
- Long-term increase in efficiency and competitiveness.

WELFARE

- Improved air quality.
- Reduced morbidity and mortality and other health effects.
- Welfare transfers away from polluting industry.

CONSERVATION

- Possible increases in other forms of pollution such as solid wastes.
- Decrease in resource deterioration, both flora and fauna, caused by air pollution.

Technical standards take the form of emission limits for mobile and stationary sources, as well as reduction requirements for stationary sources. Existing sources tend to be treated more leniently than new sources, which protects existing polluters from higher costs (for equivalent control) but discourages the adoption of technologies that may be more efficient.

The technical standards for automobiles typically imply a specific technology (e.g., catalytic converters) to control pollution, or imply wholesale design changes, such as those necessitated by fuel efficiency standards. As currently structured, mobile source standards limit pollutant emissions per unit of travel. Although each car may pollute less, total air pollution continues to increase as the number of cars increases.

Ambient air quality standards are concerned with such common pollutants as carbon monoxide, sulfur dioxide, nitrogen oxides, total suspended particulates, ozone (from emissions of volatile organic compounds and nitrogen oxides), and lead. When these standards are implemented by subnational governmental authorities, a greater degree of flexibility and accommodation to local environmental and economic conditions can be achieved than under a program administered at the national level. In regions

where these standards are not met, radical restrictions have been established. For example, construction of new plants might be prohibited until existing plants reduce their emissions enough to offset any additional emissions from the new facilities. In some cases, radical steps have been taken at the national level, such as dramatic restrictions on lead additives to gasoline.

Although noncompliance with air quality standards provides the basis for national authorities to mandate more stringent steps, this does not guarantee action. Delays in addressing significant air pollution may persist in large, growing urban areas unless authorities at the regional, state, or national level can apply sanctions. Withholding national funds for large construction projects in regions that do not meet emissions standards has provided leverage in some instances.

Air pollution problems must be addressed in the context of other related environmental issues. For example scrubbers to reduce sulfur dioxide emissions also generate solid wastes that must be disposed of. As toxic air emissions are controlled to a greater degree, the retention of toxic wastes formerly emitted to the air may instead contaminate surface waters in wastewater effluent.

Air pollution regulations are often perceived by regulated industries as imposing undue costs on their operations. In practice, industrialized countries have found that pollution control and abatement expenditures add only a small amount to total costs of production. There are exceptions to this with particularly "dirty" industries, such as arsenic smelting and steel production, where high capital expenditures are necessary if old facilities are to meet current standards. In developing countries, this can be avoided if new capital investment takes advantage of environmental protection technologies.

Placing less emphasis on rigid command-and-control regulatory practices and more attention to market-based instruments can lower the overall costs of air pollution control.

Emission Charges and Environmental Taxes/Tax Differentials

Emission charges can be used to create incentives to reduce air pollution emissions and to provide a source of revenue, especially for environmental programs.

Some countries are considering substituting emission charges for other revenue sources (e.g., income taxes) in a revenue-neutral fashion. This would reorient taxation away from a focus on desirable commodities (e.g., labor) and toward a focus on undesirable by-products of economic activity (e.g., pollution). It may reduce the "excess burden" imposed on society by suboptimal taxation, as welfare economics points out.

Charges on emissions of air pollutants have been used in few countries. Because these charges are usually too small to have an incentive effect, they function primarily as a revenue source. One program, now suspended, used the revenue from charges on sulfur dioxide emissions to compensate victims of illnesses related to these emissions. These charges were highest in the most-polluted regions.

A tax on fuel is a price incentive that government authorities can use where fossil fuel–based energy consumption is involved. This serves as an implicit environmental tax, although it is not well targeted because it focuses on energy use rather than on pollution generation. In some countries, gasoline taxes double the price to consumers.

In several European countries, taxes differentiated for leaded and unleaded automobile fuel are used to encourage the use of unleaded gas. Also, a few countries apply differential vehicle taxes based upon the air pollution characteristics of different cars. These tax differentials may be transitional instruments because direct regulations also exist.

Revenues from emission charges can be used to provide a wide range of incentives. For example, Sweden is planning to institute a nitrogen oxide charge applied to emissions from large furnaces. The charge will be rebated to the facilities on the basis of differences in emissions per unit of electricity generated, thus rewarding more efficient electricity generators.

Despite the ease of implementing a charge-based system relative to a regulatory or a marketable permits approach, emission

charges are used infrequently, and if used, are primarily for revenue purposes. By keeping the charges low, authorities can create a reliable and substantial source of revenues without encountering serious opposition from the regulated community.

Other Economic Instruments

Economic instruments attempt to provide a signal to polluters, constraining their options enough so that they have an incentive to change behavior while at the same time leaving enough room to achieve the most cost-effective means for change. By raising the price of pollution disposal (via an emissions charge for pollution), an environmental agency induces polluters to find their own cost-minimizing amounts of pollution. By limiting the number of emission permits and allowing polluters to trade permits, the agency allows polluters to determine the price of pollution disposal.

Using either method, it should be possible to reduce pollution to a specified target level. However, the environmental agency is likely to prefer the marketable permit approach because it allows direct control over the quality of emissions.

A few quantity-based emissions trading approaches have been implemented. One, known as the "bubble" concept, allows a plant with several air pollution sources that would otherwise be subject to emissions limits to meet an overall aggregate limit, consistent with those limits. This provision gives the plant the flexibility to choose which sources to control and to what extent, as long as the aggregate requirement is met, and creates the possibility of saving costs relative to the source-by-source approach.

An extension of this approach allows emissions from new sources at a plant as long as emissions from other sources are reduced. Another trading approach, "offsets," allows trades between emissions from a new source and those from an existing source, even though the two sets of sources are not internal to the same plant; the two sources must, however, be in the same air quality nonattainment area. The "banking" approach allows firms to earn credits for controlling emissions more than is called for under required emissions limits.

Although the above are called market-based approaches, the true market experience embodied in them has been very limited. Most of the trades have been internal to plants with multiple sources.

In this sense, these trading programs have been relatively small, but they nonetheless have generated notable cost savings. Also, it has been noted that policy uncertainty, high transaction costs, and institutional resistance have seriously impeded air pollution emissions trading. Whether a major emissions trading scheme can have comparable success remains to be seen.

Experience with another environmental trading program provides insights into how well a market for newly created rights can develop. During the phasedown of lead in gasoline in the United States, refiners were allowed to trade the restricted rights to lead additives in gasoline. By the end of the program, about 50 percent of all lead additives in gasoline was obtained through the trade of lead rights. This program was successful because it was nearly free of government intervention and because well-established markets in refinery inputs already existed, so refinery personnel began the lead trading process with considerable experience in similar transactions.

Trading approaches attempt to reduce the social and private costs of reducing pollution. They supplement rather than substitute for direct regulation and take environmental goals as given. Although they are economic instruments, it does not mean that they are used to achieve economically efficient outcomes. Setting the level of total emission reductions implicit in trading programs is the domain of decision makers who may variously consider or ignore economic factors.

Mini-Case

In 1993, the largest application of a market-based approach to environmental protection took effect. At that time, the trading of SO_2 emission allowances began. After more than two decades of trying to regulate these emissions through "command-and-control" approaches that set emissions standards for individual pollutant sources, the United States Environmental Protection Agency (EPA) is implementing a more flexible approach that will save costs while still reducing overall emissions.

The trading scheme derives from the latest U.S. initiative to tighten controls on pollution from fossil-fuel electric power generation, as called for in the 1990 Amendments to the Clean Air Act. This step will cap national emissions of SO_2 at 8.95 million tons per year by the year 2000, which is 10 million tons below 1980 levels.

Through the market-based allowance trading system, the utilities rather than a governing agency decide the most cost-effective way to comply with the acid rain requirements of the Clean Air Act. An allowance authorizes a power generation unit within a utility to emit one ton of SO_2 during or following a given year. At the end of each year, the utility must hold at least as many allowances as there were tons of SO_2 emitted from the unit.

The initial allocation of allowances will be calculated in part on the basis of each utility's average fossil fuel consumption in the period 1985–1987. Additional allowances will be made available to selected units in the three states most affected by SO_2 restrictions (Illinois, Indiana, and Ohio) employing demand-side energy conservation measures, and additional units will be made for auctions and sales by EPA. First priority in sales will go to independent power producers. The total number of allowances nationwide will be limited to 8.95 million in the year 2000.

The allowances can be bought, sold, traded, or banked for use in future years. In theory, anyone is entitled to buy, sell, or trade allowances, including brokers, municipalities, environmental groups, and private citizens. Utilities that are able to reduce their emissions relatively inexpensively can sell their surplus allowances to other utilities that otherwise would have to take more expensive steps to comply with the emission allowances they are allocated.

EPA estimates that the allowance trading program will produce cost savings of about 50 percent ($10–$14 billion) above the conventional "command-and-control" approach.

Indicators: Air Quality

Problem Indicators

- Levels of environmental pollutants in the air.
- Levels of morbidity resulting from air contamination.
- Air quality effects on flora and fauna.

Policy/Process Indicators

- Number of industries and vehicles not subject to pollution.
- Creation of emission charges or other disincentives to pollution.
- Establishment of environmental tax schemes differentiated on the basis of the overall environmental impact.
- Systems in place whereby revenue from taxes and charges is directly investigated in greater pollution control and monitoring.

LAND DISPOSAL

KEY POINTS

- Land disposal policies need two interlinked components: one to remediate past contamination and one to prevent future contamination.
- Management practices for hazardous wastes that seem appropriate at a particular time can lead to substantial and serious contamination when conducted over many years. Waste regulations that increase in stringency over time could avoid this outcome.
- Stringent waste regulations provide incentives for minimizing wastes, but they may leave too little leeway for waste generators to adopt waste minimizing practices.
- Economic instruments are not used as significant alternatives to direct regulation of hazardous waste management. Rather, they are typically used to reinforce direct regulations or provide a source of public revenue.

Direct Regulation

Policies aimed at addressing contamination from the disposal of hazardous wastes on land have two interlinked components: one remedial and one preventive. In the last decade, industrialized countries have initiated large-scale efforts to clean up contamination that resulted from past management practices and to implement policies to prevent future contamination. In developing countries, hazardous wastes present a growing problem not only because industrial wastes increase as manufacturing increases, but also because these countries accept and handle wastes exported from industrialized countries.

The sites that are the focus of remediation tend to be the most flagrant examples. Many of the practices that led to contamination were considered acceptable at the time they took place. In some cases waste management practices are tolerable on a small scale but are not tolerable if they are continued for several years. In other cases, such as those dealing with concentrated PCB- or dioxin-tainted wastes, even small-scale land disposal practices are not acceptable.

Likely Impacts of Policies to Regulate Hazardous Waste Disposal

GROWTH

- Increased costs and decreased employment in polluting industries.
- Increased costs to government to implement and monitor regulations.
- Long-term increase in efficiency and competitiveness.

WELFARE

- Decrease in incidence of off-site health problems.
- Employment decreases in polluting industry and employment increases in pollution prevention industries.

CONSERVATION

- Decrease in loss of biodiversity.
- Long-term improvement in resource management.
- Reduction in potentially irreversible environmental losses associated with land contamination.

The new policies to prevent contamination tend to mandate very specific measures. In several industrialized countries, any facility managing hazardous wastes must be issued a permit that may include explicit technical requirements for the design and operation of each unit handling hazardous wastes. This approach is complicated because the waste stream is heterogeneous; it may be solid or liquid, and may contain one or more of hundreds of chemical constituents. The waste can be managed in different ways: it can be disposed of in landfills and in surface impoundments, stored in containers, incinerated, injected into deep wells, treated, or recycled. It can be managed on-site, where the wastes are generated, or off-site, in some cases out of state and even out of country. Tracking wastes "from cradle to grave" with a manifest system has been used to try to prevent hazardous wastes from escaping regulation.

Stringent regulation of hazardous wastes, adopted in several countries over the past decade, encourages waste generators to minimize their wastes. Although direct regulations are not

economic instruments per se, they do translate into higher costs, which waste generators would rather avoid.

Higher waste management costs can be avoided by capturing usable products in the waste stream, recycling and reusing inputs, and substituting inputs that generate less hazardous wastes. Some waste regulations are so broad that they preclude important opportunities for waste minimization and recycling, the very things the regulatory program should encourage.

The disposal of municipal solid wastes in landfills has traditionally been the responsibility of local governments, even though county or state authorities set the standards. This was a logical procedure because municipal wastes were managed locally. Municipal waste landfills, however, have been poorly managed, and federal standards in the United States now regulate the design and operation of municipal solid waste facilities.

This example illustrates the trade-off between the increased flexibility achieved from local responsibility for environmental management and the need for ensuring consistency (especially minimum levels of protection) achieved by centralizing responsibility at the national level. Flexibility provided by local control may compromise environmental protection if vested interests prevail. Consistency provided by national control may be too heavy-handed, setting uniform standards that impose high costs.

Another example from the United States shows that the evolution of waste management regulations is far from complete. The U.S. Environmental Protection Agency has found that funding priorities do not correspond with priorities based upon risks. For example, programs to remedy hazardous waste contamination and to prevent future contamination impose relatively high costs for relatively small aggregate risks (although there may be local "hot spots" that present significant risks).

The funding priorities reflect at least partially the relative ranking that the public gives to environmental problems. The public is concerned about hazardous wastes, and these concerns have been translated into major programs. The task for the future is to realign these programs by eliminating poorly targeted regulations while still addressing well-identified sources of significant risks.

Economic Instruments

Land disposal in industrialized countries is addressed by a large number of economic instruments. Policies for the disposal of hazardous wastes in these countries include several features:

Financial accountability. A requirement that a company show financial viability can be imposed in anticipation of potential liabilities from the operation of a hazardous waste facility. This financial test may not be carried out rigorously, however, especially when the facilities are subsidiaries of large companies with significant assets. The effectiveness of this requirement may be limited further by the fact that injured parties may have difficulty proving economic damage, thereby reducing the likelihood that the hazardous waste facility would actually be held financially accountable.

Fees. Waste generators face higher waste management costs the more stringent hazardous waste regulations are. In some cases, additional licensing or operations fees may be imposed for the hazardous waste management facility, and fees can vary with the degree of hazard of the waste handled. Unless such fees vary with quantities, they may provide only limited incentive to change hazardous waste generation and management practices. Fees per unit of waste do exist, but they are often too small to provide an economic incentive, and act primarily as a source of public revenue.

There is at least one instance in the United States where a hazardous waste fee has been designed like an import tariff and is meant to curb wastes destined for disposal. One state, trying to stem the influx of wastes from other states, imposed a fee that varied with origin in an attempt to reduce the economic gain that came from disposal within its borders rather than in the state of origin. This fee was implemented explicitly because direct regulation of imported wastes (such as a ban) was prohibited by the U.S. Constitution.

For developing countries, prohibiting waste imports might be allowed under GATT because there are provisions for countries to take the necessary steps to protect human health and resources Plus, an international agreement on transboundary movement of hazardous wastes under discussion is intended to restrict waste imports where these may damage the environment.

Product charges. In the United States, a tax on chemical feedstocks and petroleum was created to fund the cleanup of existing contamination from hazardous wastes. Too small to provide an incentive effect, the charge also suffers from a poor linkage to the problem of concern—improper management of hazardous wastes—although the taxed substances may eventually be improperly disposed of. This tax effectively treats all uses of the taxed substances equally, regardless of their environmental implications. Attempts to replace this product charge with a waste end tax have failed.

Liability. In addition to the financial accountability that can be imposed on hazardous waste management facilities, all entities that generate, handle, or transport hazardous wastes, and even banks that are substantially involved in the management of these entities, can be held liable for any past, present, or future contamination, even if it arises in waste practices that were allowed at the time. This blanket liability has induced firms to clean up existing contamination, to make waste management practices more thorough, and to reduce waste generation—all on a "voluntary" basis (i.e., without explicit regulatory requirements).

Whether liability creates a significant incentive is unclear; the evidence is more anecdotal than conclusive. Furthermore, it is possible that the threat of liability may cause excessive steps to be taken, especially in view of the U.S. experience that firms and municipalities are being held liable for the cleanup of contamination that, in several cases, does not pose significant risks.

Whether the cumulative effect of these various economic instruments influences hazardous waste generation, management, and cleanup is unclear, partly because each instrument influences only a small portion of the problem and partly because these instruments coexist with large programs of direct regulation.

For consumer waste destined for land disposal, other economic instruments have been tried, but they generally are used only on a small scale. For example, deposit-refund systems for bottles, batteries, and tires have been implemented in a few countries and are under consideration in others.

Mini-Case

The Mochito mining operations in the northwest sector of the Lake Yojoa watershed in Honduras, managed now by the American Pacific Mining Company, has since 1972 disposed of the mine's solid and liquid wastes in large settling ponds. The condition of the retaining walls of the lagoons has been unsatisfactory and in heavy rains mine wastes have spilled into local streams, many of which drain into Lake Yojoa. Both the streams and Lake Yojoa provide drinking and irrigation water to rural families downstream and along the lakeshore. A significant percentage of the population in this area have blood lead levels above the recommended minimum of the World Health Organization.

Claiming imminent bankruptcy, the Rosario Mining Company, which has operated the Mochito Mines since 1947, withdrew in 1986, leaving thousands of residents of the Lake Yojoa watershed unemployed. This became a great political concern of the congressmen from this region, who became active in the search for solutions to the socioeconomic problems created by the company's withdrawal.

A buyer was eventually found for the interests in the mine, the American Pacific Mining Company, and the transaction was aided by a debt-for-equity swap. However, significant economic concessions had to be worked out with the company in order to make their investment attractive. These concessions consist of significant economic reforms to the Mining Code that substantially reduce the land concession fees, sales taxes, and other fees established previously for the other mining companies. These concessions have made it very attractive for the company to continue mineral exploitation and exploration and provide employment to approximately 1,000 workers. The contract, which was agreed upon by the company and the Ministry of Natural Resources through the General Directorate of Mines and Hydrocarbons, indicates the responsibilities of the two parties.

While consideration of contamination problems are covered in the contract with fines of up to 10,000 Lempiras for the company if it is proven that it discards toxic or poisonous substances into the water resources, no specific consideration is given as to how the land that is exploited under the concession's terms will be left after the exploitation or exploration is finished. If the General Directorate of Mines and Hydrocarbons does not dictate specific means for environmental protection, the topic is not considered. The General Directorate of Renewable Natural Resources has the power to demand such protection measures, but they must be specific and must be capable of enforcement; so far this has not been the case. The Fisheries Law has given the ministry the power to assess fines up to 300 Lempiras when habitat contamination is proved, yet this fine, which has always been paid by the Rosario Mining Company, is so small that there is no real economic incentive to mitigate or eliminate environmental contamination.

Indicators: Land Disposal

Problem Indicators

- Amount of hazardous waste entering landfills, waterways, and land in general from unauthorized dumping.
- Levels of overall land and water contamination.
- Morbidity and mortality.

Policy/Process Indicators

- Establishment of risk assessment analysis procedures at the national and regional levels for planning and economic and analysis purposes.
- Increase in the number of special hazardous waste disposal sites established.
- Establishment of appropriate incentives and sanctions to induce companies to recycle and to adopt processes to minimize wastes.
- Adoption and enforcement of strict hazardous waste regulations and sanctions in conjunction with effective sanctions to limit the dumping of hazardous wastes.
- Establishment of systems that track waste from cradle to grave.
- Creation of consumer education programs on the dangers of hazardous waste disposal and offer alternatives to unsafe disposal practices.

RESEARCH QUESTIONS

Which level of government (national or local) should establish water quality and drinking water regulations? Which level should implement and enforce them? Which authority within a level of government should have responsibility for water quality protection?

What is the best point of intervention?

Can priority water quality needs be established, especially in terms of location within the country?

What information is available that would allow an initial review of potential water quality improvement priorities, especially with regard to identifying point sources that can be controlled cost effectively?

Are there any charges for the disposal of domestic or industrial sewage? If so, who collects these charges?

What is the current financial basis for existing investment in and operation of public and private wastewater treatment? Are they funded from general revenues or bond sources?

In cases where little or no wastewater treatment exists, what institutions are best suited to establishing and administering a system of effluent charges?

To what extent are fines currently used to enforce existing systems of water quality standards?

Are there explicit or implicit subsidies for controlling wastewater discharges? How large are they? Are they directed at economic agents who otherwise would not invest in pollution control? Has the use of subsidies been rationalized? Do the subsidies come with conditions, or are they merely distributed until funds are depleted?

Are there tax exemptions or allowances to encourage wastewater treatment control? How large are they? Which polluters take advantage of the exemptions? Are these polluters the ones whose behavior it is most important to change?

What institutional mechanisms exist for evaluating environmental impacts from potential policy decisions targeted primarily at socioeconomic issues other than environmental management?

What mechanisms exist for integrating environmental concerns into actual decision making?

How can the linkages between economic, population, and other important social policies and the environment be quantified in a way that can realistically support policy analysis? For example, should larger models be developed (such as one that adapts pollution coefficients to economic input-output models to predict the pollution consequences of different output configurations) or should these linkages be examined on a case-by-case basis as important policies are considered?

What are the relative environmental and public health risks associated with water quality deficiencies? Can these be assessed in a common unit of measure, such as through monetary valuation?

What are the likely economic impacts from different levels of effluent charges? For households? For industry?

What behavioral responses can be expected from different levels of effluent charges? By households? By industry?

Can a subsidy scheme be effectively coupled with an effluent charge mechanism to provide adequate financing? What are the incentive effects for investing in wastewater generation and management?

How much information is there about the relative seriousness of different air pollution problems? What additional research is needed to establish a relative ranking among air pollution problems so that regulatory priorities can be risk-based? Can these problems be assessed in a common unit of measure, such as through monetary valuation?

What are the behavioral responses by polluters to different levels of emission charges for alternative air pollutants? How reliable are they as a revenue source? What are the economic impacts from different levels of charges? What are the likely environmental impacts? What are the ideal uses of the revenues from these charges?

What range of pollution control options is appropriate for addressing air pollution problems in the country? How much can be learned from the experience of industrialized countries, such as the costs of controls and the array of technological alternatives? How much must be customized for the circumstances of the country?

How effective might a market-based approach be in a given country, in light of the state of market development and the adequacy of public and private institutions that would be called upon to implement such an approach? Are the transaction costs likely to be too high to warrant experimenting with a market-based approach? Is there adequate oversight and monitoring to ensure the approach is operating as anticipated?

What are the proximate causes of the most important air pollution problems? What policies are connected to these proximate causes? Can a screening analysis be constructed to identify alternatives to the current policies that meet current policy objectives but with less environmental damage? What additional information is needed to evaluate the feasibility of these alternatives, and what does it take to obtain this information?

How can developing countries avoid the pattern of mistakes that has characterized industrialized countries' approaches to hazardous waste regulation (i.e., to allow lax handling of wastes until very serious contamination makes expensive remediation a necessity)?

Is it possible to have regulatory stringency and oversight increase as the scale of hazardous waste generation and management increases?

Would establishing better information on hazardous waste generation and management now place developing countries in a better position to regulate more stringently as necessary? What kind of information would be collected and how?

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