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RESEARCH REPORT

Pollution Prevention and Mining: A Proposed Framework For The Americas

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**POLLUTION PREVENTION AND MINING:
A Proposed Framework For The Americas**

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Towards A Regional Framework for Pollution Prevention in the Mining Sector
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Table of Contents

Page No.

EXECUTIVE SUMMARY

I.	INTRODUCTION	1
A.	The Environmental Impacts of Mining	1
B.	The Need for a Hemispheric Approach	1
C.	Developing a Framework for a Hemispheric Approach	3
II.	POLLUTION PREVENTION AND EXISTING NATIONAL LAWS	5
A.	Legal Tools	7
1.	Environmental Impact Assessment	7
2.	Planning	11
3.	Permits	15
4.	Concessions	16
5.	Regulatory Standards and Best Practices	18
6.	Monitoring and Disclosure Requirements for Toxic Substances	21
7.	Financial Assurances	23
8.	Land Use Restrictions	24
B.	Cross-cutting Policies	26
1.	Public Participation	26
2.	Management Systems	30
3.	Financial and Other Incentives	33
4.	Remining and Privatization	35
5.	Liability	36
III.	A PROPOSED HEMISPHERIC FRAMEWORK	39
A.	Defining Pollution Prevention	39
B.	Integrating Legal Tools into a Pollution Prevention Strategy	41
1.	Exploration	41
2.	Active Mining Operations	43
3.	Closure	47
C.	Specific Areas of Concern	50
1.	Common Problems	50
2.	Recommendations	50

IV.	CONCLUSION	55
A.	Towards Effective Pollution Prevention Laws	55
B.	Next Steps	55

Annex I: Contributors to the Studies of National Frameworks

Annex II: List of Acronyms

Tables

Table 1:	Legal Tools and Policies	5
Table 2:	Pollution Prevention Concepts	41
Table 3a:	Integrating Legal Tools Into a Pollution Prevention Strategy (Exploration)	43
Table 3b:	Integrating Legal Tools Into a Pollution Prevention Strategy (Active Mining Operations)	46
Table 3c:	Integrating Legal Tools Into a Pollution Prevention Strategy (Closure)	49
Table 4:	Recommendations for Establishing a Regional Framework	52

Executive Summary

The environmental impacts of hard rock mining can be highly adverse if the proper pollution prevention technology and regulatory framework are not in place and properly functioning. Pollution prevention as a strategic management principle offers the opportunity to avoid or minimize significant environmental impacts of hard rock mining while also identifying and promoting economy and efficiency in the design and operation.

There are compelling reasons for Inter-American collaboration in developing a hemispheric framework for pollution prevention in hard rock mining. Trade and investment in this sector are expanding. Many of the natural resources potentially threatened by mining have common characteristics or are shared by countries. Mining companies are operating as multinationals. An Inter-American approach to environmental regulation helps to set a common playing field as well as avoids the complexity of having different standards in different regions.

To address this need, the Environmental Law Institute, in cooperation with its partners, *Fundación Ambiente y Recursos Naturales* (Argentina), *Centro Especializado de Derecho y Política* (Bolivia), *Instituto Socioambiental* (Brazil), Canadian Institute for Environmental Law and Policy (Canada), *Comité Nacional Pro Defensa de la Fauna y Flora* (Chile), *Centro Mexicano de Derecho Ambiental* (Mexico), and *Sociedad Peruana de Derecho Ambiental* (Peru), conducted studies of the national legal frameworks for pollution prevention in the mining sector. Traditional legal tools such as permitting, environmental impact assessment and regulatory standards were examined as well as policy approaches such as public participation and economic incentives.

In Section II of this report, select tools and policies for promoting pollution prevention discussed in the national reports are described and analyzed, focusing on innovative aspects as well as design limitations. In Section III, a preliminary hemispheric framework for promoting pollution prevention is presented. This framework first defines what pollution prevention means in the context of mining operations. Next, the report briefly identifies for each of the three major phases of mining (exploration, active mining operations, and closure): (i) the potential sources of pollution prevention, (ii) opportunities for pollution prevention, and (iii) the specific legal, policy and management tools that can be used to address relevant pollution problems. Special issues of concern to be taken into consideration in the formulation of the framework are also discussed.

The next step in developing an Inter-American framework is launching a dialogue on this topic in the appropriate arena. In Section IV, the following potential fora for this dialogue are identified: the Mining Ministries of the

Americas Conference, and meetings of the Partnership for Pollution Prevention, the Cleaner Production Roundtable of the Americas and the working group of the Inter-Agency Task Force on cleaner production organized by the Organization of American States. In this section, opportunities for national and local action on pollution prevention are also described. Finally, the need for additional research on issues related to implementation and enforcement of laws and policies in the region is highlighted.

This report is one of the three complementary studies supported by USAID's "Partnership to Promote Clean Technology in the Mining Sector in Latin America and the Caribbean." The goal of the Partnership is to identify the policy, technical, and financial options for promoting pollution prevention in the mining sector. ELI's report provides an overview of the legal and policy options. A second report, prepared by Hagler Bailly, pursuant to the EP3 Project and entitled "*Best Management Practices in Nonferrous Metals Mining and Processing*," addresses the technical issues. A third report, providing information on financial mechanisms, is being prepared by SAIC.

I. Introduction

A. The Environmental Impacts of Mining

The environmental impacts of hard rock mining can be highly adverse if the proper pollution prevention technology and regulatory framework are not in place and properly functioning. Groundwater and surface water supplies can be permanently or temporarily contaminated by improper use of chemicals in the ore extraction process or by uncontrolled runoff from poorly placed mining waste, creating a hazard for the local community, wildlife, and other biological resources. Specific pollutants, such as acid mine drainage or introduced toxics, can have particularly devastating and long-term negative impacts on the environment, as exemplified by the use of mercury for gold mining in sensitive ecosystems such as the Amazon basin. Strip and underground mining practices may destroy soils and vegetation, leading to erosion, loss of habitat and other negative environmental consequences. Furthermore, ore smelters can emit hazardous air pollutants that are especially harmful.

The costs of not addressing environmental impacts at the inception of a mining project can be quite high. Clean up costs for contaminated groundwater and soil for large operations alone may run into the millions of dollars. In the United States, for example, it is estimated that the cost for cleaning up the Summitville mine site in Colorado could be as high as \$120 million. Other countries in the Americas face similar challenges as they begin to discover the pollution legacy of years of contamination. In Canada, estimates for the cleanup of arsenic contamination from Royal Oak's Giant Gold Mine in the Northwest Territories range from \$250 million to \$1 billion. In Peru, estimates for cleaning up the pollution legacy from Centromin start at \$500 million.

Pollution prevention should be a strategic management principle for the hard rock mining industry. It offers the opportunity to avoid or minimize significant environmental impacts of hard rock mining while also identifying and promoting economy and efficiency in the design and operation. It enhances recovery of minerals while at the same time helping to minimize impacts on the surrounding environment and prevent the creation of long-term environmental hazards and risks.

B. The Need for a Hemispheric Approach

The current realities of economics and free trade in the region emphasize the critical and timely need for Inter-American collaboration on regulating the environmental impacts of mining. Latin American countries are vigorously seeking to expand their mining operations in order to attract foreign investment, create local jobs, and increase exports. "Between 1996 and 2000, Latin America

will receive through direct investment and exploration – some \$35 billion."¹ Over the next ten years, for example, Peru estimates \$8 billion dollars of investment in this sector.² Argentina expects to receive \$1 billion of investment in mining over the next five years.³ In 1997 alone, \$1 billion was invested in the mining industry in Mexico, with about 45 percent of the investment coming from abroad.⁴ At the same time, U.S. and Canadian companies are looking to Latin American countries for opportunities to expand their operations and to transfer clean mining technology.

The case for addressing the environmental issues connected with mining on a hemispheric basis is compelling. First, many of the natural resources potentially threatened by mining have common characteristics or may be shared by countries in the region. Second, many of the mining companies are operating as multinationals. Latin American countries currently establishing or considering raising standards may be hesitant to act alone for fear of creating an incentive for these businesses to locate in a country with less stringent regulation. In addition, the federal government and state governments in the United States, as well as the federal and provincial governments in Canada, are also experiencing pressure for decreasing domestic environmental regulation of mining to avoid creating competitive disadvantages for local mining industries vis-à-vis Latin American mining operations. A hemispheric approach helps to set a common playing field as well as avoids the complexity of having different standards in different regions.

Moreover, several countries in the region have already had the opportunity to explore different policy and technology options for promoting pollution prevention and protecting common ecosystems or natural resources; others can learn from these experiences through Inter-American dialogue. As will be discussed below, there exist numerous potential fora for these dialogues. The environmental laws of most countries – especially those regulating mining and promoting a pollution prevention approach – are still in the formative stages. Now is the time to initiate hemispheric policymaking initiatives in this area.

¹ LATINO MINERÍA (January 1997)

² Center for Business Intelligence, Latin American Mining Conference Materials, January 26-27, 1998.

³ *Id.*

⁴ Dora Delgado, "Mining Sector Wants Clear-cut Standards to Outline Foreign Investors' Responsibilities," *Intl. Env'tl. Rep. (BNA)* (January 7, 1998), 12-13.

C. Developing a Framework for a Hemispheric Approach

Critical to the development of a hemispheric framework for promoting pollution prevention is an understanding of the national frameworks already in place for regulating the environmental impacts of mining and promoting pollution prevention. Since 1997, the Environmental Law Institute (ELI) has worked in partnership with a number of national environmental law centers throughout the Americas to develop studies of these national frameworks. ELI's national partners include: *Fundación Ambiente y Recursos Naturales* (FARN) in Argentina, *Centro Especializado de Derecho y Política Ambiental* (CEDPA) in Bolivia, *Instituto Socioambiental* (ISA) in Brazil, Canadian Institute for Environmental Law and Policy (CIELAP) in Canada, *Comité Nacional Pro Defensa de la Fauna y Flora* (CODEFF) in Chile, *Centro Mexicano de Derecho Ambiental* (CEMDA) in Mexico, and *Sociedad Peruana de Derecho Ambiental* (SPDA) in Peru.

Each partner conducted a study identifying and analyzing legal and policy tools for pollution prevention in the mining sector in their respective countries. Traditional legal tools such as permitting, environmental impact assessment and regulatory standards were examined as well as innovative policy approaches, such as economic incentives, to promote the development and transfer of "state of the art" pollution prevention technology and services. The national studies also identified gaps or inadequate mechanisms in these regulatory frameworks for promoting and enforcing a pollution prevention approach. The national studies did not, however, examine the actual implementation and enforcement of the legal frameworks. Thus, important issues such as the use and availability of technical, financial and personnel resources, administrative capacity, corruption, and federalism were not addressed. An examination of these issues would enhance the development of a hemispheric framework and be critical to effective implementation and enforcement.

In **Section II** of this report select tools and cross-cutting policies for promoting pollution prevention discussed in the national studies are described and analyzed, focusing on innovative aspects and design limitations. Based on the information in the national studies, a preliminary hemispheric framework for promoting pollution prevention is presented in **Section III**. Finally, in **Section IV** opportunities for initiating an Inter-American dialogue as well as additional issues that need to be examined to develop and implement a hemispheric framework are identified.

II. Pollution Prevention and Existing National Laws

Environmental laws, policies, and management techniques are fundamental to making pollution prevention a key component of sustainable mining operations. A variety of legal and policy approaches can require the identification and integration of pollution prevention into metallic mineral mining operations. In this section the universe of tools and policies that can be used to promote pollution prevention are identified and the various functions that each kind of legal instrument, if properly designed, can carry out in support of a pollution prevention program are explained. **Table 1** below provides a summary explanation of these tools and policies.

Selected examples of the legal tools and cross-cutting policies that have been identified in the national studies are presented. The discussion highlights some of the innovative aspects of these tools and policies, as well as some of the problems associated with their use in the context of pollution prevention. The ways in which countries prioritize and integrate the use of these tools into their overall approach to pollution prevention is also addressed.

Table 1 LEGAL TOOLS AND POLICIES	
Environmental Impact Assessment (EIA)	A procedure that helps the project proponent, government regulators and the public identify the potential environmental impacts of a project before it proceeds. An EIA process may be used to 1) allow environmental controls to be established for the project and 2) identify alternatives and mitigation measures.
Planning	A process to identify future activities associated with mining and reclamation, closure and post-closure to manage a mining operation in order to achieve goals by a preferable means.
Permits	A written authorization to conduct the operation of an activity. Granting of a permit may depend on the applicant meeting certain conditions required in advance of the authorization.
Concessions	Legal agreements between governmental owners of mineral rights and the mining companies who want to extract the minerals. While concessions typically address financial issues (such as royalty rates, lease rates, taxation, and similar economic concerns), they also may require pollution prevention measures in connection with planning, operating and closing the mine, as well as the provision of financial guarantees for the performance of environmental obligations.
Regulatory Standards Best Practices	A <i>regulation</i> is a written statement of a government agency that establishes rights, imposes obligations, or sets procedures. A <i>regulatory standard</i> prescribes either the design of an activity or the performance level that the activity must meet. <i>Best practices</i> are suggested methods for successfully achieving performance standards.

Table 1 (continued)
LEGAL TOOLS AND POLICIES

<p>Monitoring</p> <p>Disclosure Requirements</p>	<p><i>Monitoring</i> is the systematic collection of information and data related to ongoing operations, discharges and emissions, and the effects of the operation on the environment.</p> <p><i>Disclosure requirements</i> refer to the reporting of such information to the government and the public. These requirements allow both mine operators and governments to adjust management practices as needed in order to prevent pollution. Public accountability provided by such practices may help encourage the adoption of pollution-preventing methods of mining, beneficiation, and closure.</p>
<p>Financial Assurances</p>	<p>Mechanisms that require a mining operator to provide a financial guarantee of performance before undertaking a regulated activity. If the operator fails to comply with the required standards, the government can collect the amount of the guarantee. Common forms of financial assurances include bonds, letters of credit and negotiable securities.</p>
<p>Land Use Restrictions</p>	<p>Regulations that designate areas and provide information and conditions on activities within these areas in order to protect environmentally or culturally sensitive resources or public welfare.</p>
<p>Public Participation</p>	<p>Refers to opportunities for citizens and non-governmental organizations to participate in environmental decision-making processes and enforcement activities, including the opportunity to have access to relevant environmental information.</p>
<p>Environmental Management Systems</p>	<p>An environmental management system (EMS) provides a framework for an organization to manage itself in order to achieve both environmental and economic goals. Management systems, such as the ISO 14000 standard, offer a structured approach for organizations to more effectively manage their environmental obligations by not only complying with environmental laws and regulations, but also moving beyond compliance, improving overall environmental performance, and making greater use of pollution prevention approaches. From a business standpoint, EMSs can help organizations meet their environmental obligations more efficiently, thus maintaining their competitive position in various markets.</p>
<p>Economic and Other Incentives</p>	<p>Laws, policies or programs that provide financial or other advantages to organizations adopting pollution prevention techniques. Incentives may include preferential tax treatment for pollution prevention equipment, programs for rebates or credits against royalties for successful pollution prevention, and other approaches.</p>
<p>Remining Privatization</p>	<p><i>Remining</i> is conducting mining activities in a previously mined area, providing opportunities to structure new mining activities to remedy environmental problems caused by previous mining activities. <i>Privatization</i> is the sale of government-owned mining operations and provides opportunities for remining.</p>
<p>Liability</p>	<p>The legal assignment of responsibility to remedy harm. Liability standards can serve as significant incentives for mining operations to undertake their pollution prevention obligations. Common forms of liability standards include: administrative, civil and criminal penalties, corrective orders, and natural resource and tort damages.</p>

A. Legal Tools

1. *Environmental Impact Assessment*

Environmental impact assessment (EIA), can require the mining operation (or the approving governmental agency) to identify potential sources of pollution and ways to avoid or minimize them through alternative designs for a project. Critical to the effectiveness of the EIA is the requirement for the process to be completed before the proposed activity proceeds. It can require the examination of cumulative impacts on the environment and social impacts by projecting both direct and indirect impacts of the mining operations and the impacts of other existing and foreseeable projects (and environmental stressors) in the same vicinity. It can require the evaluation of alternative methods of excavation, beneficiation of ore, and treatment and disposal of tailings, as well as alternatives to the undertaking. It can be used to identify monitoring requirements and mitigation measures to be implemented during and after the mining process. It can be used to identify closure requirements, post-closure care, and contingency plans. It can also engage the public by allowing them to identify issues of significance to them that might otherwise not be studied; and by affording an opportunity for affected persons or agencies or local governments to identify needs for additional data on points of particular concern, as well as to suggest alternative mining or disposal methods, timing of activities, or monitoring approaches. Financial support for public participation is important for such participation to be effective. All of these can help improve the quality of mining operations and increase the confidence of governments and local citizens that pollution prevention is integrated into the entire mining process from beginning to end.

The EIA is gaining great popularity in the Americas as a tool for preventing the environmental impacts of mining. In some countries, such as Chile and Bolivia, the EIA is the linchpin of the program. The countries studied vary in their use of EIAs for mining operations and as a tool to promote pollution prevention. In general, EIA laws in the region do not set pollution prevention as a goal. One additional common problem is that guidance and regulations concerning preparation of the EIAs rarely recommend or require specific measures and techniques for pollution prevention, even though the company may be subject to a general requirement to describe the steps it would take to prevent pollution.

In **Chile** the most important tool for environmental management and pollution prevention is the environmental impact evaluation system. The system, which applies to all productive sectors, became mandatory in April 1997, although many mining operations were already preparing EIAs pursuant to requirements imposed in connection with the financing of their operations. In accordance with Law 19300 (Art. 10, LBMA) and its regulations, mining

development projects, including prospecting activities susceptible to causing environmental impacts in any of their phases, must be submitted to the EIA system. A detailed study of environmental impacts (*Estudio de Impacto Ambiental*) is required for projects with certain significant impacts and characteristics as specified in the law. A less detailed and more descriptive Statement of Environmental Impact (*Declaración de Impacto Ambiental*), sufficient to permit the regulatory authorities to determine compliance with applicable environmental standards, is also contemplated for activities which do not present known health risks or adversely affect renewable natural resources.

Chile's EIA System requires the project proponent to develop broad pollution prevention measures. The environmental impact study must include a Plan of Mitigation Measures to address the actions undertaken to reduce or counteract the risks and harms to the environment from a given project, and must also specifically state what measures are being adopted for environmental risk prevention and accident control. Chile's regulations, however, do not go so far as to specify what mitigation or monitoring activities will be required. One drawback to the Chilean system is that a Study or Statement of Environmental Impacts may be automatically approved if the environmental authority does not respond within the prescribed terms. The environmental authority in Chile has 60 days to review a Statement of Environmental Impact, and 120 days for the more detailed Study of Environmental Impacts. These limits may be extended one time for qualified cases. There are no exceptions to the automatic approval provision.

Argentina also relies on the EIA process as the primary mechanism for pollution prevention. An EIA is generally mandatory for all commercial exploration activities. Owner-prospectors who do not require permits to explore or engage in common-use operations, such as river or metal sands mining, do not require an EIA in Argentina (§4, UMC). There are no provisions for automatic approval of an EIA in Argentina. Express action by the federal or provincial authority with jurisdiction is necessary for an EIA to be approved (§254, UMC). General administrative law in Argentina also calls for administrative silence to be interpreted as a negative response (Art. 10, Ley de Procedimientos Administrativos).

Argentina requires separate assessments for evaluating the environmental impact of each phase of a mining operation: exploration, discovery, and mining. The EIA for the activity proposed at each phase is reviewed separately for approval. An EIA sets forth the mitigation measures that, if approved, are the basis for control and monitoring of the operation. Significantly, the initial EIA must include reports of acid mine drainage and possible treatment and neutralization measures. Argentina's law, however, does not provide specific standards or best practices to address acid mine drainage. Since the Mining Plan, presented with the EIA at the outset of operations, must include post-closure

monitoring, long term measures for pollution prevention are necessarily a consideration from the initial impact assessment. However, at closure, an operator is still required to file a new EIA, or update and amend the existing EIA to account for any changes in the mining activity not contemplated in the original plan.

Bolivia's Law on the Environment requires that the type of EIA that must be performed for all projects and public or private activities must be identified prior to the investment phase. (Art. 25). Projects are assigned to one of four categories: i) the project requires a complete EIA analysis; ii) the project requires only a specific EIA analysis; iii) the project does not require a specific EIA analysis, but could benefit from a conceptual EIA review; and iv) the project does not require an EIA. For new projects, an environmental category is assigned by the environmental authority who reviews the initial file or application (*ficha ambiental*), depending on the scope of the proposed activity, the extent of the possible impact on the environment, proximity to protected areas, severity with which the environment may be modified or risks to human health, among other factors.

To promote investments in the mining sector, the Environmental Regulations for Mining Activities stipulate that prospecting and exploration activities be classified under category IV, and require only the filing of a mining prospecting form with the corresponding regional authority, the Departmental Prefecture. The Mining Code in general states that an EIA is not necessary in unprotected areas (Art. 90). However, this exemption may conflict with the requirements of Law on the Environment regarding the type of EIA that is required for a particular activity.

In **Brazil**, an EIA may be required as a condition of approving an environmental license for a mining activity. Although all mining activities require an environmental license, an EIA is required only for certain categories of minerals, including metal minerals. In the exploration stage, an environmental license is required when mineral substances are extracted for research. The environmental agency may then require an EIA if it determines on a case-by-case basis that this extraction may cause significant environmental damage. Also, if the proposed mining operations will not have a significant impact, other environmental studies may be substituted for the EIA.

Brazil's EIA law has some unique features. When required, the EIA is prepared by an interdisciplinary group of experts, selected and paid by the project proponent. The group of experts and project proponent are responsible for the veracity and accuracy of all the technical information in the EIA. Review of the EIA includes an analysis of possible alternatives including an analysis of the possibility of not executing the project. Under no circumstances are projects to proceed prior to the approval of the EIA and environmental license.

In **Canada**, the federal or a provincial government, or both, may require an environmental impact assessment of proposed mining projects. Federal assessments, under the Canadian Environmental Assessment Act (CEAA) are triggered if there is a requirement for federal approval for a mining activity to proceed or if the undertaking is on federal lands, or receives federal funding. Provincial environmental impact assessment requirements vary widely. In British Columbia, for example, environmental assessments are required for major mining projects; in Ontario, environmental assessments are only required for public sector undertakings, unless a project is specifically designated for review by the provincial cabinet. The scope and content of the provincial assessments are largely at the discretion of the provincial Minister of the Environment.

Various administrative agreements have been established in Canada between the federal government and individual provinces to integrate the federal government and individual processes where an EIA is required by both entities. These arrangements have been controversial because they are seen by aboriginal and environmental groups as providing the framework for the effective withdrawal of the federal government from the assessment process.

In **Mexico**, an environmental impact statement (*Manifestación de Impacto Ambiental*) is generally required prior to commencing exploration and mining activities (LGEEPA Art. 28, Para. III). However, there may be some exceptions to this requirement in the future. Mexico's general environmental law (LGEEPA) provides that the implementing regulations (currently under development) may identify works or activities which are exempt from an environmental evaluation because their location, size, characteristics or reach cannot cause significant environmental impacts, nor exceed the limits and conditions established in the legal norms about preservation of the ecological equilibrium and the protection of the environment (Art. 28). Mexican law also only requires a preventive report (*Informe Preventivo*) to be filed instead of an environmental impact statement where there are Mexican official norms or other dispositions that regulate emissions, discharges, natural resources use and, in general, all relevant environmental impacts that the work or activity might cause. As Mexico is in the process of studying several official norms for the Mining Sector, it is possible that in the future activities subject to these norms may only need to prepare a preventive report instead of the more comprehensive environmental impact statement.

If required, the environmental impact statement in Mexico must include a description of the possible effects on the ecosystems, prevention and mitigation measures, and other measures necessary to avoid or minimize negative effects over the environment. Likewise, when high risk activities are being developed, a Risk Study (*Estudio de Riesgo*) must be included. The specific content and characteristics of the environmental impact statement and the risk studies will be

established by a future regulation, currently in draft form. Under Mexican law there is no automatic approval of an EIA.

In 1993, **Peru** adopted a unique system for promoting pollution prevention in the mining sector through a combination of legal instruments. EIAs are required for new operations or modifications of 50% or more. Significant exploration activities, however, are only required to present an "Environmental Evaluation" rather than an "Environmental Impact Study." The "Environmental Evaluation" differs from the "Environmental Impact Study" in the issues that must be addressed, the periods for approval and the requirement for conducting a public hearing. As a result, opportunities for promoting pollution prevention may be lost. In addition, even in the case of operations subject to preparation of an "Environmental Impact Study," the focus is on controlling and mitigating environmental impacts, rather than preventing them in the first place. This is because the applicable environmental standards are oriented towards control of contamination at the end of the process and compliance with maximum permissible limits. In contrast to regulations applicable to the mining sector, Peru's environmental laws for the manufacturing and fishing sector now incorporate methods promoting pollution prevention.

Hard rock mining operations on federal lands in the **United States**, as well as operations on private lands that require a federal permit to proceed, are subject to an EIA. A full environmental impact statement (EIS) must be prepared for any project with the potential to significantly affect the environment. The requirement for scoping under the regulations for the National Environmental Policy Act (NEPA) significantly enhances environmental protection. Scoping involves identifying the issues and alternatives to the proposed action that should be part of the study to be addressed in the EIS. NEPA's regulations require that the scoping process include a public meeting where citizens express their views on these topics. This public process may improve the EIA by identifying alternatives not developed by the project proponent, or anticipated by the governmental agency. Following scoping, a draft EIS is prepared, and subjected to public comment and review by other agencies. Following public comment, a final EIS is prepared, and a record of decision follows.

2. Planning

Planning, too, can serve to increase the efficacy of pollution prevention. Often the preparation of plans is integrated with environmental impact assessment. However, regardless of whether the two tools are integrated, preparation of exploration plans (where there is to be significant disturbance of land or water), mining plans, closure plans, and contingency plans, can help assure that operations do not produce unintended pollution, even if conditions change. Various legal regimes require different plans and have different timing requirements for the preparation and submission of plans. While these need not

follow the same pattern, planning for each phase of the mining operation nevertheless is important if pollution prevention techniques for the mine are to be properly designed and implemented. Requirements for the development of management plans, which are a common and important requirement in many countries, can emphasize pollution prevention as a goal.

Closure Planning, can be a critical tool for preventing and minimizing long-term negative environmental impacts, such as acid mine drainage or problems arising from tailings dams. It is important to design an operation so that it can be safely closed. If closure planning is postponed until the middle or end of the mineral extraction phase, it may be too late to use certain pollution-preventing approaches. Moreover, given the volatility of markets for metallic minerals, such issues as perpetual care and secure disposal cannot be left unaddressed until a time when revenues may be insufficient to allow them to be properly carried out.

As a tool for pollution prevention, planning plays a significant role in many of the countries studied. Plans may be required in connection with the different phases of operations (exploration, operations and closure) or to address specific environmental problems. Planning may also be required as part of the EIA or permitting process. Again, although many countries have the regulatory structure in place to use planning as a tool for pollution prevention, the substantive planning requirements necessary to meet this goal are missing in most cases.

Planning for closure at the inception of operations is particularly vital to a successful long-term pollution prevention strategy. As the discussion below will show, many countries either lack a closure planning requirement or fail to require pollution prevention to be addressed in the closure plan.

Bolivia has one of the most comprehensive closure planning systems in the region. The Environmental Regulation for Mining Activities in Bolivia requires the preparation of closure plans as part of the application for approval of an environmental license (*licencia ambiental*) (Art. 67), and stipulates that any area affected by an operator's mining activity (whether inside or outside the perimeter of his operations) must be rehabilitated when the mining activities have been abandoned for a period of more than three years. Closure plans are evaluated as part of the EIA review process in the granting of an environmental license, and must specify the program for the control of pollution streams, the physical and chemical stabilization of waste, rehabilitation of the area, surface draining and erosion control. The plan must also include post-closure actions such as stabilizing structures for accumulated waste and monitoring of drainage flows and bacteria in monitoring wells.

Mining operations are additionally required to record and report on post-closure activities during a three-year period. These reports must show that emissions and discharges were within the regulatory limits, and that there was no instability of accumulated waste at the closed sites. Post-closure reports are independently evaluated by an auditor approved by the Ministry of Sustainable Development and Environment.

The prevention of acid mine drainage is specifically required in the Environmental Regulations for Mining Activities, which state that acid mine drainage, as well as certain other effluents are to be directed into channels and treated prior to discharge into bodies of water. (Art. 67). Bolivia's approach to the environmental aspects of the closure phase of mining operations has necessarily been twofold; first, to mandate closure plans for new activities which fall under the planning provisions of the Law on the Environment, and second, to control or contain existing pollution levels from mining activities which originated prior to the promulgation of the current laws.

Exploration activities and minor mining activities with insignificant environmental impacts are also required to undertake measures for closure and rehabilitation and report on the actions taken.

As noted above, in 1993 **Peru** adopted a unique system for promoting pollution prevention in the mining sector through a combination of legal instruments. The key legal tool for existing operations is the Environmental Compliance and Management Program or PAMA (*Programa de Adecuación y Manejo Ambiental*). The PAMA is, in effect, a plan which lays out the actions and investments necessary for incorporating the technologies and alternative measures for reducing or eliminating emissions in order to comply with applicable standards. PAMAs must be carried out in five years, with an exception for certain operations such as smelting, for which the deadline is 10 years. Mining operations are required to make an annual investment towards carrying out the program, fixed at no less than 1% of annual sales. The authorities have four months to approve the PAMA; inaction by the authority is interpreted as approval. There are no opportunities for public participation in its elaboration or approval.

Closure plans are required in Peru as part of the EIA or PAMA. However, the recommendations in the environmental management guides for these plans focus on treatment and disposal of wastes and do not require any prevention measures. There is guidance on predicting the potential for acid-mine drainage based on the type of rock.

Specific terms and conditions may be included in the approvals granted to mines in **Canada** through federal and provincial environmental assessment and environmental protection legislation. Mine planning requirements *per se* in

Canada tend to focus on the closure aspects of mine operations. These requirements are usually established through provincial mining legislation, such as the Ontario Mining Act (Part VII). The British Columbia Waste Management Act also allows the Minister to require the preparation of spill prevention, reporting, and contingency plans for polluting substances.

Chile's regulations do not call for the submission of exploration plans or closure plans *per se*. Instead, it is only through the EIA mechanism that the exploration phases of a project are evaluated. Mining operations in Chile must submit a mining plan for approval to the Director of the National Service of Geology and Mining prior to commencing operations. While there is no explicit requirement for the identification of toxic substances, the plan must consider the health risks to mine personnel, and the environmental safety of the workplace. Likewise, while there are no particular requirements for closure plans, the law can be construed to require that the accumulated environmental impact and adverse effects of an operation at the closure phase be considered in the EIA process.

In **Argentina**, an Environmental Management Plan is presented with the EIA at the outset of operations. Since this plan must include measures for post-closure monitoring, project proponents are required to identify the environmental impacts associated with closure and consider pollution prevention approaches at the inception of their operations. If the operator later changes the plans for closure, the EIS must be updated accordingly.

Mines on federal lands in the **United States** are required to have plans of operations that generally require a conceptual approach to closure. States with significant mining operations require submittal and approval of closure plans. In the case of mines on lands regulated by the Bureau of Land Management, formal review and approval of an actual closure plan does not occur until close to the time of closure, with the closure plan being treated as a minor amplification of the original plan of operations (and thus not subject to formal public processes or an EIA). Contingency plans are required for the handling of hazardous substances such as cyanides and acids.

Although **Brazil's** Constitution (Art. 225, second paragraph) requires that anyone who develops mineral resources is obligated to restore the environment, there is no explicit requirement for closure plans. A Plan for the Recovery of Degraded Areas is submitted prior to the commencement of operations in connection with the application for an environmental license. This plan, however, does not require pollution prevention measures.

3. *Permits*

Permits are used under some legal regimes to assure governments' ability to review proposed operations and to take enforcement action against operations that do not carry out their legal commitments. For purposes of this discussion, the term "permit" includes licensing requirements. In many countries, the permit and the EIA approval are the same thing. In others, they are distinct (or a permit may even be required in some instances where an EIA is not). Many of the potentially pollution-preventing functions of permits have been discussed above under EIA and planning -- identification of alternatives, pollution control measures, monitoring, and mitigation. But permits also present opportunities to address enforcement and evaluation of an operator's fitness to operate the proposed mine (*viz.* does the operator have a bad record in the past, does the operator have sufficient financial resources to carry out the commitments identified in the plan, permit, or EIA?). In addition, permit review and renewal processes may provide the public with an opportunity to submit comments and insist upon appropriate monitoring and satisfaction of operator commitments. Permits often require the submission of financial assurance guarantees (performance bonds, reclamation bonds, insurance, letters of credit, *etc.*) to assure that the mine is closed and reclaimed in accordance with the permit conditions even if the financial condition of the mine or parent company is impaired.

A wide range of permits or licenses are currently being used by several of the countries studied to address pollution prevention. Permits or licenses may be required for the different phases of mining, for different sizes of mining operations or for different types of minerals. In addition, general and media-specific environmental permits or licenses may be required. In some cases, a single license requirement is in place or under consideration that covers all of the sectoral, environmental, and/or other permit requirements (health, agriculture). Again, as with EIA processes and planning, the national case studies reveal that few substantive requirements for addressing pollution prevention are part of the permitting process.

Brazil requires permits for exploration and mining operations, as well as authorization of nonmechanized mining, and a special license for certain mineral substances. Exploration or mining permits may be canceled in the case of environmental violations. As part of the environmental licensing process, the environmental agency has authority to require the project proponent to prepare pollution prevention plans and to identify the existence or use of toxic substances as well as methods for the control and disposal of tailings. In addition to an EIA, the agency also requires an Environmental Control Plan and a Plan for the Recovery of Degraded Areas. This plan must describe measures that will eliminate or mitigate the impacts of mining activities, such as noise, vibration, quality of the surface and underground water, safety of the site, stability of the slopes and visual impact.

Chile has a number of environmental permit requirements that may be applicable to exploration and mining operations. Its EIA law specifically lists several environmental permits that may be required. These include permits for operations located in certain protected areas, within city limits or watershed zones, in cemeteries, military zones, etc. There are also sectoral permits required to develop mining activities. Environmental emissions, such as emissions of particulate matter, may also be subject to prior authorization by the health authorities.

Mining operations in the **United States** may also be required to obtain a number of media specific permits, including water pollution discharge permits, stormwater permits, permits for dredging or filling wetlands, air pollution permits and hazardous and solid waste permits. States may require additional permits to those necessary under federal law. Few of these federal or state permits require pollution prevention measures. For example, even though stormwater permit applicants must develop a pollution plan, these plans are not required to be approved as a condition of permit approval.

A mining operation in **Canada** typically requires a number of specific permits under federal and provincial legislation, in addition to environmental assessment approvals. At the federal level this can include requirements for permits to alter or destroy fish habitat under the Fisheries Act. At the provincial level, specific permits are usually required under mining legislation. Waste management and closure planning have been a major focus of these requirements. Further specific approvals may be required with respect to water use, and air and water pollution. In the case of major undertakings, like mines, efforts are usually made to integrate all of the approval requirements through the environmental assessment process.

4. Concessions

Concessions are legal agreements between governmental owners of mineral rights and the mining companies who want to extract them. While the terms of concessions typically address financial issues such as royalty rates, lease rates, taxation, and similar economic concerns, they also may require pollution prevention measures to be taken in connection with planning, operating, and closing the mine, as well as the provision of financial guarantees for the performance of environmental obligations.

Of the countries studied, many did not even require concessions to be granted in connection with mining operations. Even in those countries requiring concessions, measures for environmental management and pollution prevention were not required as a condition for approval of the concession, nor could violation of environmental requirements be grounds for revocation of the concession.

In **Chile**, for example, the legal regime for mining concessions does not explicitly authorize any environmental conditions for the approval of the concession. A concession may be terminated only for noncompliance with administrative requirements or upon the expiration of a set term. The failure to comply with environmental laws is not grounds for termination of the concession.

In **Brazil**, concession contracts are only used in connection with petroleum natural gas and nuclear minerals operations. The concession for these operations could be terminated if the grantee breaches the law, including environmental law.

Similarly, the **United States** does not grant concessions for mining activities on public lands. There are two ways by which an individual or company may secure exclusive rights to hard rock minerals on federal lands: (i) simply marking and working the claim, or (ii) purchasing the land from the government after establishing the presence of valuable minerals. There are no mechanisms for imposing any environmental conditions in connection with either of these processes.

While pollution prevention measures may not be required as a condition for the granting of mining concessions in **Mexico**, concession holders are obligated to comply with the general environmental protection and safety regulations of the Mining Law (Art. 27, 37, 39). The Federal Environmental Prosecutor's Office (*PROFEPA*) may inspect the concession sites to monitor compliance with environmental regulations, and in the case of serious violations, the Secretariat may request that the concession be terminated (Art. 172, *LGEEPA*).

Bolivian law does not require mining operations to comply with environmental conditions in order to obtain a mining concession. The concession is granted to the operator prior to participation in the EIA process. However, since a concession holder must obtain approval of an environmental license to perform mining activities, and is required to comply with any applicable regulations and orders so as to maintain that license for as long as the mining activities are underway. Therefore, in the event a concession holder's environmental license is revoked, an operation will be temporarily closed until compliance is demonstrated, and an environmental audit will be performed to determine if the environmental noncompliance rises to the level of a violation or crime. In Bolivia, the liability of an operator for environmental violations does not end after a concession is terminated either partially or wholly (Art. 68, Mining Code).

Mining concessions in **Argentina** are not subject to revocation because of environmental violations.

5. *Regulatory Standards and Best Practices*

Regulatory standards – which may be incorporated into permits, plans or an EIA, or may directly apply to operators – can prescribe the use of pollution prevention techniques. These techniques may include limitations on the use or handling of toxic substances introduced into the mine site (such as cyanides, acids, flocculents, and oils). Standards may also address construction and maintenance of ore beneficiation units (mills, heap leach pads, ponds, *etc.*) to prevent releases of introduced substances; and they may address the handling of ores and waste rocks to avoid or minimize the release of naturally occurring toxic substances (such as acid, metals, and arsenic). Standards may impose requirements for treatment, disposal, and management of tailings, and for management of storm water and ground water. Regulatory standards requiring operators to justify the use of mining and beneficiation methods that may produce pollutants, and to minimize such uses and provide for clean production, may help promote pollution prevention in the metallic mineral mining sector.

While several countries have general pollution control standards that could be interpreted to promote pollution prevention, only very limited progress in the region has been made towards establishing standards specifically promoting this objective. Existing environmental standards tend to establish general limits on emissions or on environmental concentrations rather than promote specific pollution prevention practices, such as source reduction or recycling.

Several countries rely heavily on discharge limitations, which may only indirectly, if at all, promote pollution prevention. **Peru**, for example, has maximum permissible limits for liquid effluents that regulate pH, suspended solids, lead, copper, zinc, iron, arsenic and cyanide, as well as maximum permissible levels for certain air contaminants, including lead, arsenic and particulates. In addition, Peru has prepared a number of environmental management guides that contain suggested practices on topics such as water in mining operations, acid mine drainage and tailings management. Other than measurements for the prediction of acid mine drainage, these guides do not promote any specific pollution prevention practices.

The most important recent regulatory standard-setting program for metal mining in **Canada** has been Ontario's Municipal Industrial Strategy for Abatement Program (MISA). The MISA program established discharge standards for both controversial pollutants (*e.g.*, biological and chemical oxygen demand, total suspended solids and nutrients) and approximately 350 toxic substances. The MISA regulations also specify that facility effluents not be acutely toxic to fish and daphnia, and require chronic toxicity monitoring. Specific requirements were developed for each of the 190 industrial facilities regulated through the program.

Under Canada's Federal Fisheries Act, there is a strict prohibition of the deposit of any "deleterious" substance that degrades or alters the quality of water frequented by fish. To achieve this goal, Metal Mining Liquid Effluent Regulations (MMLERs) under the Act regulate arsenic, copper, lead, nickel, zinc, total suspended solids, and radium 226. There are several significant limitations to the application of these regulations. First the MMLERs do not apply to gold mines. In addition, emissions of toxic effluent from mines established prior to the promulgation of the MMLER's in 1977 are not subject to these regulations. Finally, the regulations do not apply to discharges into a tailing pond, into which effluent can be dumped at full concentration and at any quantity, as long as the Minister has approved the tailings facility in writing. The regulations are currently under review by the government.

The federal Canadian Environmental Protection Act (CEPA) provides the federal government the authority to regulate the import, export, use, storage, processing, sale, release into the environment and disposal of substances designated as "toxic" for the purposes of the Act. Forty-four substances, including asbestos, mercury, lead, cadmium, chromium, arsenic, and nickel and their compounds have been declared "toxic" for the purposes of CEPA. However, with respect to the mining industry, the Canadian federal government has established only regulations for air releases of asbestos mines and mills, and lead from secondary lead smelters. These regulations date from the 1970s.

Provincial regulations in Canada have attempted to promote prevention over control. British Columbia's Acid Rock Drainage Policy, which guides its approval of reclamation and closure plans, provides that "The primary objective of a Metal Leaching and Acid Rock Drainage program is prevention. This will be achieved through prediction, design and effective implementation of appropriate mitigation strategies." It further provides that "Where ARD or significant metal leaching cannot be prevented, mines are required to reduce discharges to levels that assure long-term protection of the receiving environment. An important secondary objective is to minimize the alienation of on-site land and water resources from future productive use."

Mexico's regulatory system also emphasizes emissions and discharge limits. Mining operations in Mexico are subject to official Mexican standards setting maximum permissible limits for pollutants in wastewater discharges (NOM-001-ECOL-1996) and for particulate emissions from fixed sources (NOM-043-ECOL-1993) as well as hazardous waste regulations (NOM-052-ECOL-1993). Mexico is in the process of developing an official norm for the construction of tailings.

In the **United States**, federal water pollution regulations (which establish permit limits for operations on federal lands and state or private lands) may result in pollution prevention with respect to introduced toxic substances insofar

as prevention is driven by the establishment of discharge limits. These regulations provide the discharge limits for copper, lead, zinc, gold, silver, and molybdenum mines, for example. The limits are set on the basis of best practicable technology, best available technology, or new source performance standards, depending upon when the operation was permitted. In addition to the numerical limits, which may produce some pollution prevention indirectly by setting discharge limits, the regulations specifically provide that (with a limited exception based on water balance) "there shall be *no discharge* of process wastewater to navigable waters from mines and mills which employ dump, heap, in situ leach or vat leach processes for the extraction of copper from ores or ore waste materials" and "there shall be *no discharge* of process wastewater to navigable waters from mills which extract gold or silver by use of the cyanidation process (40 Code of Federal Regulations 440.102(c), (d); 440.103(c), (d); 440.104(c), (d))." New sources are also prohibited from discharging any process wastewater "from mills that use the froth-flotation process alone, or in conjunction with other processes, for the beneficiation of copper, lead, zinc, gold, silver, or molybdenum ores (40 Code of Federal Regulations 440.104(b))."

Virtually all state mining laws and regulations in the U.S. require the disposal of tailings in engineered units, with varying levels of specificity in the design and performance standards such units must meet. Some states (e.g., Colorado and Montana) rely heavily on performance standards in dealing with construction and maintenance of engineered tailings disposal units. In Arizona, all mining facilities are generally required to "be designed, constructed and operated so as to ensure the greatest degree of discharge reduction achievable through application of best available demonstrated control technology (BADCT), processes, operating methods or other alternatives, including where practicable, a technology permitting no discharge of pollutants (Ariz. Rev. Stat. Ann. § 49-243 (Supp. 1994-1995). Facilities must submit a proposal of BADCT, using either "prescriptive BADCT" (a preapproved design independent of site specific conditions) or "individual BADCT" (a performance-based approach with design tailored to a specific facility and site). Prescriptive BADCT requires diversion or retention structures to convey at least the 100 year, 24 hour storm event. Liner requirements for nonwater impoundments, process solution impoundments, heap leach pads and lined tailings impoundments are also specified. Individual BADCT requires the applicant to follow a six step process: site selection, development of a reference design, estimation of aquifer pollution loading with the reference design, selection of alternative designs, estimation of aquifer pollution loading with each alternative design, and, finally, selection of the BADCT. The applicant must select the design resulting in the lowest estimated pollution loading. If two designs produce similar pollution loadings, the applicant may select the less costly design.

Concerns over the adequacy of existing regulatory approaches in addressing pollution in the U.S. have led to some controversial developments.

For example, in 1998 the citizens of the State of Montana in the United States voted in a referendum enacting a law to prohibit the establishment of any new surface mining operations using cyanide. Likewise, the State of Wisconsin adopted a moratorium on the mining of sulfide ores until companies could present evidence of successfully closed mines that did not generate acid. The U.S. Bureau of Land Management has proposed regulations that would require operators to "minimize water pollution (source control) in preference to water treatment" and to "handle earth materials and water in a manner that minimizes the formation of acidic, toxic, or other deleterious pollutants of surface water systems". Operators must also manage excavations and other disturbances to "prevent or control the discharge of pollutants into surface waters" among other pollution prevention requirements including "minimiz[ing] the likelihood of acid formation and toxic and other deleterious leachate generation." The controversy surrounding each of these developments suggests that the process of setting and communicating standards for pollution prevention objectives deserves more attention.

6. *Monitoring and Disclosure Requirements for Toxic Substances*

Monitoring and disclosure requirements can provide information that allows both mine operators and governments to adjust management practices as needed in order to prevent pollution. In addition, the public accountability provided by such disclosure may help encourage the adoption of pollution-preventing methods of mining, beneficiation, and closure.

The countries studied have a wide range of legal tools in place for monitoring, reporting and disclosing information on the use, management and release of toxic substances. Reporting requirements for processes that may promote pollution prevention, such as source reduction and recycling, appear to be limited. Information from monitoring operations is critical for governments in their effort to develop and enforce appropriate regulations. The generation and widespread public availability of this information also ensures effective public participation.

The **United States** has one of the most advanced systems for reporting information on the use of toxic substances. The Emergency Planning and Community Right-to-Know Act (EPCRA), Section §313, requires certain facilities manufacturing, processing, or using listed toxic chemicals to report specific information about these chemicals, including the annual quantities of those chemicals entering each environmental medium. In 1997, EPA added the metal mining industry to the list of facilities subject to the EPCRA reporting requirements.

EPCRA establishes a threshold for reporting based on the amount of the chemical that is released, but the Administrator of the Environmental Protection Agency (EPA) has the capacity to alter the threshold based on classes of chemicals or categories of facilities. If a toxic chemical that is a constituent of overburden is processed or used by a covered facility, it is not included when determining whether the applicable threshold for reporting has been met. The Pollution Prevention Act of 1990 expanded the type of information that facilities must report to include information on source reduction, recycling and treatment.

The **Canadian** National Pollutant Release Inventory (NPRI), is a program similar to the Toxic Release Inventory in the U.S. The extractive phase of mining operations is exempted from the NPRI reporting requirements. However, processing and smelting operations are subject to the reporting requirements under the program. The program requires that facilities that manufacture, process or otherwise use more than 10 tonnes per year of 249 designated substances, and have the equivalent of 10 or more full time employees, report their releases of those substances to the air, land or water, or their transfers in waste for treatment, disposal or recycling, to the federal government. The data is made available to the public on an annual basis. The most recent year for which NPRI data has been released in 1996.

In **Mexico**, pursuant to the environmental impact statement, mining operations must report on the toxic wastes that will be generated or managed in connection with their operations, as well as the quantities of these wastes. Mexican law also provides for concession operators to obtain a single environmental license (*licencia ambiental única*) through which the operator processes the EIA, performs the required risk analysis, and reports on air emissions, toxic waste, and water (LGEEPA, Art. 109b). Additionally, the operator must annually report air, water, and soil pollution discharge levels, disposal and transport of pollutants, and monitoring and prevention activities and projections for the following year. These reports are obligatory for the issuance by the Secretariat of an annual operating certificate (*cédula de operacion anual*). If a concession operator undertakes an environmental audit, the results are to be made available to anyone directly affected by the preventive and correction components of the audit (LGEEPA , Art. 38b(1)).

Argentina has a limited number of reporting requirements. In connection with the application for an exploration permit from the appropriate provincial authority, the applicant must detail the chemical and fuel supplies used for the project. The Complementary Rules that are the implementing regulations of national legislation at the provincial level require that discharges be reported in the environmental impact statement. Any new information regarding toxic discharges to the environment must be reported to the enforcement authority (§56, U.M.C.).

Peru involves third parties in verifying monitoring information. Monitoring systems must be established to verify compliance with applicable air, water and other environmental regulations in connection with the EIA or PAMA. Mining concession holders are required to present an annual report signed by an environmental auditor registered with the Ministry of Energy and Mines. The report includes information on atmospheric emissions and discharges, including information on acid mine drainage and on the treatment and final disposal of solid and liquid wastes.

In **Bolivia**, Article 22 of the General Regulation on Environmental Management, as well as the Hazardous Substances Regulations, mandate the disclosure of any pollution activity or accidents in written form to the appropriate environmental authorities. There are likewise affirmative obligations to disclose the introduction and handling of any toxic substances in connection with the environmental license application. Accidental discharges must also be reported in order to control adverse consequences. Any such disclosures, as well as reported monitoring or mitigation activities, are considered under Bolivian law to be public information, available for consultation and public comment.

7. *Financial Assurances*

Financial assurance mechanisms require the operator to provide a financial guarantee of performance before undertaking a regulated activity. If the operator fails to comply with the required standards, the government can collect the amount of the guarantee. Common forms of financial assurance mechanisms include bonds, letters of credit and negotiable securities. In addition to simplifying the collection process for the government in the event of a violation, financial assurance mechanisms can provide a strong incentive for mines to be in compliance with pollution prevention requirements.

Many of the countries studied have some form of financial assurance mechanism in place. However, there are several problems associated with these existing mechanisms, including the inadequacy of the amount and form of assurance required. Some countries do not have any mandatory financial assurance requirements.

In **Canada**, financial assurance is generally only required at the provincial level in connection with closure plans, but the terms and conditions vary. In 1996, Ontario passed legislation that allows mining companies to demonstrate their financial viability in lieu of posting actual financial instruments. Regulations to implement this system were proposed in 1999. In addition, all information related to the financial assurances for mine closures provided by mining companies is now exempt from the province's freedom of information

legislation. In contrast, British Columbia, under its Mining Act has a "mine reclamation fund" which holds funds placed by the operators to assure reclamation; these are refunded upon successful completion of reclamation. Manitoba has similar provisions in its law.

Mining operations in the **United States** are required to provide financial assurance under state and federal reclamation laws (with the exception of mines under five acres in size in certain western states). The financial assurance guarantees the performance of reclamation in the event of a default by the operator. In a few states, financial assurance must also be posted to guarantee the long-term treatment and maintenance of water quality where there is any residual risk of potential pollution continuing after reclamation. Some states also allow the public to comment on the release of the financial assurance.

In **Brazil**, mining operations are required to include one percent of the project's budget for measures to prevent and mitigate negative environmental, cultural and social impacts that are identified as part of the EIA. In addition, the mining plan required in connection with obtaining a mining permit must have a budget and timetable for its execution and the applicant must prove the availability of resources or commitments from financing entities necessary to carry out the plan.

Chile does not require financial assurances to guarantee performance of obligations proposed in an EIA or agreed to in the course of monitoring activities by a government authority. In a unique approach, **Argentina** allows mining companies to voluntarily register for a program that allows them to create a special reserve for pollution prevention and environmental restoration. Funds set aside for the reserve may be deducted from the company's taxable income for that year, up to an amount equal to five percent of aggregate operational costs.

In **Mexico**, SEMARNAP must require an assurance or guarantee of compliance with the requirements or conditions established in the environmental impact authorization.

8. *Land Use Restrictions*

Land-use restrictions can serve to prevent pollution in specifically targeted areas. These may include, for example, areas of particular ecological value, high biodiversity and fragility, areas in close proximity to human settlements, or areas where other forms of economic activities inconsistent with mining (such as farming and fishing) may be designated "unsuitable" for mining or for certain mining methods. Similarly, areas with high concentrations of sulfide ores may be designated off-limits to mining under most circumstances because of their high potential for the generation of acid mine drainage – with

mining allowed only under the strictest, best-capitalized, technologically advanced methods and conditions.

Countries in the region have a wide range of mechanisms restricting mining in the different types of protected areas. These mechanisms vary in the degree of restriction of mining activities. In some cases, there may be a conflict between these provisions and other mining laws.

Under **United States** law, many areas are off limits to metallic mineral mining in order to protect wilderness values, wildlife, parks, or for uses incompatible with mining. However, apart from these federal land areas "withdrawn" from mineral entry and location, most areas are available for mining.

In **Chile**, special permits from the regional governmental authorities are required to carry out any mining activities in national parks, reserves, or national monuments (Mining Code, No.2). There is an outright prohibition of all commercial activities in Virgin Region Reserves (*Reservas de Región Virgen*). The Forestry Law and other laws impose specific restrictions and conditions on commercial operations in woodlands. For example, any cutting of native forest must be done in accordance with a previously approved management plan. There are also requirements concerning reforestation. In areas preferably suited for forests, commercial operators must undertake the reforestation of an equal or greater amount of land, under the supervision of the national agency of forests. Also, if native trees are cut, the area must be reforested.

Argentina expressly prohibits exploration and development activities in national parks but not in national reserves. Mining is also prohibited in special "strict" national reserves (areas that contain great biological value and which represent typical ecosystems) of the country, although the law does not address whether this includes exploration activities. Private lands within a specific category of protected areas may be subject to the restrictions applicable to that category.

Although **Bolivia's** Regulation on Protected Areas does not permit any mining activities in areas so designated, the Mining Code (Art. 89) provides that, so long as the EIA process has determined that the activity will not interfere with the purposes of legal protection, these activities may go forward under the regulatory restrictions of the Law on the Environment. This apparent conflict has not yet been addressed by the courts in Bolivia. National parks are strictly protected from any mining activity, absent the promulgation of an express law to the contrary.

Mining in national parks in **Canada** is prohibited through the National Parks Act. The level of protection through provincial parks legislation is less certain, and typically mining may be permitted within provincial parks with the approval of the provincial cabinet. Mining activities are typically granted overriding priority in provincial land-use planning processes for both public and private lands. The situation with respect to mining activities on lands which are held by aboriginal peoples through treaties or land-claims settlement agreements is complex, and varies with the particular treaty or settlement agreement. The situation with respect to lands that are subject to aboriginal land claims (*i.e.*, lands which are not covered by treaty, and over which aboriginal people make a claim of ownership) is even more difficult. Mineral claims or tenure on such lands may not be considered secure, and their status may become part of settlement agreement negotiations.

B. Cross-cutting Policies

1. Public Participation

Public information and participation requirements may be a part of the other legal tools discussed, or exist as independent requirements. Required disclosures by mining operations, and opportunities for members of the public (and local governments) to participate in evaluation and regulation of mining approaches, can improve the responsiveness of mining operations to local environmental and social concerns.

National laws are beginning to incorporate mechanisms for public participation at a variety of stages of review and regulation of mining operations. As the availability of information on the environmental impacts of mining is critical to effective public participation, countries have also launched requirements in this area. However, many limitations and exceptions to the right of participation and access to information continue to limit the effectiveness of this tool in engaging citizens in the goal of promoting pollution prevention.

A wide variety of mechanisms providing for public participation in the EIA process exist across the region. **Peru**, for example, requires a public hearing to be held prior to approval of the environmental impact assessment for mining operations. However, the effectiveness of this mechanism may be limited because individuals are not guaranteed participation in the hearing, questions may only be posed in written format, the hearings are held only in the central headquarters of the Ministry of Energy and Mines in Lima. The authorities are not required to consider the contributions made in the hearing.

Although **Argentina's** federal mining law does not expressly provide for public hearings to be held in connection with an EIA for mining, at the provincial

level there are general environmental laws that do provide for public hearings. As a result, in the province of Mendoza, for example, a conflict has arisen as to whether the Mining Code's environmental provisions, which do not call for public hearings (Law 24.585), or the terms of Mendoza's environmental laws, which do call generally for public hearings in connection with an EIA, are applicable. The Environment Minister wants to require such hearings, while the Secretary of Mining is opposed. There is no jurisprudence which resolves the different interpretations by the two entities.

Brazil has several important provisions promoting public participation. The public may participate in the environmental licensing process in Brazil (which includes review and approval of the EIA during the comment period and during the public hearing. The entire EIA and the RIMA (the environmental impact report which summarizes the conclusions of the EIA so that the advantages and disadvantages of the project are easily understood by the public) are available to the public for review (subject to protection for industrial secrets), usually at public libraries. A summary of the EIA must be published in the official register along with the request for an environmental license. Comments made during the comment period and hearing must be considered by the environmental agency when determining whether to approve the EIA. A public hearing must be held if requested by a non-governmental organization, the Public Prosecutors Office, or a group of 50 or more citizens. Non-governmental organizations may also have the opportunity to participate on a State Environmental Council (a deliberative and standard-setting body which makes and proposes environmental rules and reviews EIAs as part of the environmental licensing process). There are no provisions, however, for public participation in the initial stages of the EIA process (such as scoping). The right of citizens to information of public interest is guaranteed in the Brazilian Constitution (Art. 5, XXXIII) and may be enforced in court through a writ of mandamus.

Canada's federal EIA law contains some unique provisions on funding to support public participation in the federal EIA process. Under the Canada Environmental Assessment Act, mining proponents must provide funding to support public participation in panel reviews and mediations associated with the EIA process. The funding is used to cover professional fees of experts and other expenses designed to enhance the quality of the public input into the review process. The amount of funding varies in accordance with the magnitude of the project, with no precise formula currently in use. The question has been raised as to the adequacy of intervenor funding. In one case involving an eight volume EIS that cost \$14 million to produce and was subject to EIA hearings which took 18 months to conclude, the public intervenors received only \$250,000.

The following criteria are often used by the Canadian Environmental Assessment Agency in assessing public applications for funding: (i) is the

participant directly affected by the project? (ii) does the participant have a special interest in the project's potential environmental, health or socio-economic effects? (iii) does the participant raise a legitimate public interest; (iv) does the participant demonstrate a commitment to contributing time and resources? (v) will the presentation be unique and original? (vi) can the participant cooperate with other persons or groups in presenting a point of view; (vii) does the participant request funds for studies or materials which duplicate other requests?

On the provincial level, Ontario had an Intervenor Funding Project Act in effect from 1989 to 1996 which provided funding to support public interest organizations and communities participating in the provincial EIA process, but the law expired and has not been renewed. To qualify for funding, intervenors had to demonstrate that the issues they intended to address during the hearing reflected significant public, not private, interests. One of the more interesting aspects of the law was that the proponent, or any other party that would financially benefit from the law, could be required by the funding panel to compensate the government for some of the funding granted to the intervenors. British Columbia provides funding for First Nation (indigenous) groups to participate where a demonstrated need exists, but there are no funding provisions for other types of participants.

Chile's EIA systems allows citizen organizations and individuals to comment on the environmental impact studies during the 60 days following the publication of the EIA application in the official government record and in newspapers of general circulation. The regional or national environmental councils charged with evaluating and responding to the EIA must take into account the interventions of citizen groups or public interest NGOs and notify them by certified mail of their observations. If their observations are not duly considered in the final resolution for the EIA, citizen groups may bring an action challenging the resolution.

The public information and participation provisions for the EIA process in **Mexico** are extensive and mandate information disclosure and opportunities for citizen participation at the various phases. The environmental impact statement is made available for public consultation at the offices of the National Institute of Ecology. Also, the environmental impact assessment files are also publicly available at these offices and may be copied at a person's request and expense. The project proponent is required to publish at its cost an extract of the project in a local newspaper of general circulation. Any citizen within 10 days of the publication of the project extract can request that the environmental impact statement be made available in the local office of SEMARNAP.

Mexico allows any person to comment on the project's negative impacts and suggest possible mitigation measures in a public consultation or hearing

procedure. Citizens can also participate in the EIA process through the review and complaint procedures described below.

United States law contains a number of provisions that may enhance the contribution of the public to environmental protection. In the EIA process, as well as in the approval of certain permits, written comments may be solicited and a public hearing may be required. The agency receiving such written or oral comments is generally required to consider such comments in its responses. Public participation in the U.S. is also enhanced by the existence of several mechanisms to generate and make available information on environmental regulations (see discussion in Monitoring and Disclosure Requirements Section II.A.6 above).

National laws around the region also now provide a number of ways for citizens to appeal administrative decisions and participate in the enforcement process. Notably, under **Mexican** law, citizens from the affected communities have the right to an administrative review of an EIA if they are able to prove their own standing as affected parties, and substantiate that the governmental actions would violate environmental protection statutes and regulations (Articles 176-181 of the General Ecological Law). In addition, Mexican laws allow any person to file an administrative complaint (*denuncia popular*). A similar criminal complaint (*denuncia penal*) may be filed for potential criminal violations.

While **Bolivian** law does not provide explicitly for citizen initiatives which would trigger investigations regarding pollution prevention activities, Article 101 of the Law on the Environment provides a mechanism and time schedule for investigations of violations in response to a citizen complaint of environmental violations. These provisions mandate the environmental authority to investigate and issue a report following the timely review of any evidence presented on the alleged violations. An affirmative finding of a violation would result in administrative sanctions and the prospect of criminal sanctions by the public attorney general's office (*Ministerio Publico*).

In the **United States** a number of major environmental statutes allow citizens to bring suit to enforce legal provisions. Citizens may not bring suit for failure to carry out an action identified only in an EIS.

In the United States, most of the major federal environmental statutes (including those governing air, water pollution, hazardous waste, and toxics, among others) allow citizens to bring suits to enforce their provisions against any person alleged to have violated the statute or to require the government to comply with a mandatory duty under the statute. In addition, under RCRA, citizens can sue for abatement of imminent and substantial endangerment to public health and the environment, which includes any significant, potential risk

of eventual environmental harm. Citizens may not initiate suit unless 60 days notice has been given to USEPA, the state, and the alleged violator. If EPA or the state has initiated and is diligently prosecuting an enforcement action, then a citizen suit may not be commenced. In a citizen suit, the court may award costs, including reasonable attorneys fees and expert witness fees, to a prevailing party. This provision has been critical to the success of US environmental NGOs in bringing citizen suits. State environmental laws in the U.S. also provide a variety of citizen suit mechanisms.

Under certain federal environmental legislation, **Canadian** citizens have the opportunity to request an investigation of an alleged offense and, if pollution prevention practices are substandard, also can file a petition through the newly constituted Commissioner of Environment and Sustainable Development with the responsible federal department. The Ontario Environmental Bill of Rights also permits members of the public to request reviews of existing laws, regulations and policies, and request investigations of alleged violations of environmental laws, regulations and approvals. The provincial government is required to respond to these requests within 60 days of their receipt. An Office of the Environmental Commission was established through the legislation to oversee its implementation and report annually to the public on the government's compliance with its requirements. The Commissioner is an Officer of the Provincial Legislature, similar to the Provincial Auditor and Ombudsman.

A number of interesting mechanisms to support public access to information exist around the region. In **Peru**, if an information request is denied by the different levels of the Mining Ministry, a "habeas data" action based on the constitutional guarantee access to information may be brought in court. The federal Freedom of Information Act in the **United States**, as well as several similar state and local laws, establish a presumption that any person may have access to any record held by a federal agency unless the record is exempt from disclosure. Individual U.S. environmental laws also provide access to government records.

2. Management Systems

Environmental management systems, while generally not required by law, can nevertheless serve to improve the efficiency of mining operations and, hence, their avoidance of unnecessary and wasteful pollution. In addition, such systems can give investors and purchasers of commodities confidence in the operations and thus benefit the company's operations. Adoption of ISO 14000 standards in a number of countries may drive mining companies toward greater pollution prevention in their operations.

The voluntary use by the mining sector of environmental management systems, such as ISO 14000, and other tools, such as environmental audits, is only just beginning in some countries. Few countries have formally incorporated environmental management tools into their regulatory structures.

Peru relies heavily on third-party environmental audits to monitor and enforce compliance with its environmental regulatory program for mining. Mining operations are subject to annual audit inspections conducted by a third-party inspector in accordance with surveys prepared by the General Office of Mining. The inspections may also be triggered by complaints. These surveys include questions concerning all environmental obligations, including practices in the environmental management guides that have been incorporated into the EIA or PAMA. Violations uncovered may be subject to sanctions.

The ISO 14000 management system is voluntary in Peru. The National Environmental Council (CONAM) has also created Club ISO 14000 to encourage businesses to obtain certification. One mining operation in Peru is a part of this Club (MILPO S.A.).

Although not required on the federal level, some states in **Brazil** have required mining operations to conduct environmental audits. The State of Maranhão requires that mining companies periodically monitor exploration and mining activities through auditing. The State of Espírito Santo requires that mining companies perform environmental audits at least once every three years.

Voluntary audit and environmental management programs are most common in the region. **Mexico**, for example, has a Voluntary Management Program in which the mining industry can participate, which then may qualify them for special economic incentives or recognition. If a concession operator undertakes an environmental audit, the results are to be made available to anyone directly affected by the preventive and correction components of the audit (LGEEPA, Art. 38b(1)). Some mining companies in Mexico have started to become involved in the ISO 14000 process. In November 1997, *Minera Carbonífera Río Escondido* (MICARE) was the first mining company in Mexico to be certified to the environmental quality norm ISO 14001.

The National Institute of Ecology in Mexico has developed two programs for the voluntary adoption of pollution prevention measures: the Program on Environmental Management of Toxic Substances Deserving Priority Attention, and the 1996-2000 Program for the Minimization and Integrated Management of Hazardous Industrial Waste in Mexico. As part of the initiative on toxic substances, the National Institute of Ecology, together with SEMARNAP, has signed an Agreement for Cooperation with the International Lead Management

Center to establish a voluntary pilot program on the reduction of risk from lead, as well as an agreement with the Mexican Mining Chamber.

Also noteworthy is the separate initiative of the Mexican Mining Chamber to adopt a "Declaration on Principles for Environmental Protection and Conservation." These principles include making environmental management a corporate priority, ensuring compliance with all applicable environmental laws, evaluating the environmental impact of exploration and mining activities, and planning the design, construction, and closure of mining operations in a way that minimizes negative environmental impacts.

Bolivian law requires operators to conduct environmental audits prior to applying for an environmental license (*licencia ambiental*), to determine the degree of pollution resulting from the activities. The audit is carried out by the regional Department Prefecture or by the national environmental authorities, depending on whether the project is regional or national in scope.

Certification to the Bolivian ISO norms (NB-ISO 14000 and NB-ISO 14010) is voluntary. No mining companies have yet been certified. Although there are incentives in Bolivia for certification to other ISO standards, such incentives do not yet exist for certification to the environmental standard.

The most significant voluntary environmental program in **Canada**, the Accelerated Reduction and Elimination of Toxics Program (ARET), includes as members 31 of the 34 members of the Mining Association of Canada. This voluntary program has companies make commitments to reduce their emissions of toxic substances from a designated base year (which must be a year after 1987). The goals (which were set in the form of a challenge issued by the federal Minister of Environment) include reductions of certain persistent and bioaccumulative substance emissions by 90 percent by the year 2000; certain other toxics must be reduced 50 percent by that year.

The ARET program has been the target of widespread criticism due to the absence of mechanisms for independent verification of claimed reductions, the focus on reducing releases of substances to the environment rather than on reducing their use and generation as waste, the inconsistent reporting methodologies and reporting timeframes, and lack of consequences for facilities that don't participate in the program (the "free rider" problem), or which fail to achieve the program's targets. There is also concern about the heavy reliance of Canadian governments on voluntary measures to improve the environmental performance of industrial facilities in general, especially due to the absence of evidence regarding the effectiveness of these programs. The loss of capacity, including law enforcement capacity suffered by Canadian federal and provincial

environmental agencies due to the major budgetary reductions over the past few years, has added to this concern.

Implementation of the ISO 14000 standard in **Argentina** is voluntary. Argentine mining enterprises have generally implemented environmental management systems and environmental auditing programs on their own. **Chile** has also approved ISO 14000 as the national standard, with voluntary implementation as well. Overall, Chilean companies have been slow to participate and very few mining operations have started implementing the standard.

The use of environmental management systems in the **United States**, including certification to the ISO 14000 standard and the use of environmental audits, is generally voluntary. In the U.S. and possibly other countries, one issue associated with the use of these environmental management systems is that potential liability under environmental laws may discourage some operators from disclosing operational problems or violations on a voluntary basis.

3. *Financial and Other Incentives*

Financial incentives may provide a means to encourage mining operations to adopt pollution prevention techniques. Such incentives may include preferential tax treatment for pollution prevention equipment, programs for rebates or credits against royalties for successful pollution prevention, and other approaches. While such incentives do not take the place of other legal tools, they may provide sufficient inducement to improve the functioning of these other tools in the protection of the environment and human health and safety. Other nonfinancial incentives that can be used include public recognition awards as well as technical assistance programs.

National laws have not focused significantly on economic and other forms of incentives as a tool for promoting pollution prevention in the mining sector. Some limited forms of assistance, including technical assistance and formal recognition programs (some of which are discussed in Section II.B.2 above), have been attempted. In part, the problem may lie in more general policies, such as exist in **Peru**, precluding the use of economic incentives such as tax credits, for this purpose.

One of the more common forms of incentives are tax benefits. **Argentina's** mining investment promotion law establishes certain accounting and tax benefits for certain costs that, in addition to establishing the operations, may also preserve the environment, such as costs involved in research and testing. **Bolivia's** Mining Code provides for the creation of tax or other financial inducements for operators to control pollution streams from operations which

existed prior to the enactment of Bolivia's Environment Law, and are unrelated to their own activities. Bolivia's environmental law also calls for mechanisms to promote public and private activities that incorporate technology and processes oriented towards environmental protection and sustainable development. Additionally, the Mining Tax Regulations provide for tax abatements amounting to as much as 33% of aggregate investments in development, exploration, and environmental protection. The government's *MEDMIN* program seeks to assist small and medium scale mining operations through the identification of environmental problems and practical solutions through the use of efficient and low cost technology.

Mexico's tax laws provide several incentives for pollution prevention by industry in general. Equipment for pollution prevention and control may be amortized up to 100%. In addition, investments in new assets such as equipment for pollution prevention and control may qualify for an immediate deduction.

Brazil has a number of notable economic incentives and disincentives that may be incorporated into a pollution prevention strategy. Its Green Protocol Program aims to stimulate official credit institutions to prioritize support (through public funds) for activities which respect environmental regulations and standards. Official financial agencies (banks, credit institutions, etc.) are required to only provide financial support for activities that comply with applicable environmental regulations. In addition, violators may be subject to the loss or restriction of general tax incentives and benefits, the loss or prohibition of access to official credits and a ban on contracting with the government for up to three years. Brazil also has a special legal mechanism that allows the owner of private land to create a conservation area on his property. The creation of this area allows the owner to obtain technical assistance and tax incentives. Exploration and mining operations on these areas need special authorization from the government which will include conditions and restrictions on these activities.

In response to the significant problem of acid mine drainage in **Canada**, the federal and provincial governments, in conjunction with the mining industry, developed the Mine Environment Neutral Drainage (MEND) program. The goal of MEND is to reduce the corporate and public liability resulting from acidic drainage through a cooperative research organization sponsored, financed and administered by a voluntary consortium consisting of the mining industry, the Government of Canada and eight provincial governments. MEND was implemented in 1990 to develop and apply new technologies to prevent and control acidic drainage. MEND has essentially developed a toolbox of technologies that is available to all stakeholders, including operators, regulators and consulting engineers for dealing with acid mine drainage. MEND is fundamentally a coordinated research initiative with no ties to the development

of new regulations for dealing with the problem of acid mine drainage in Canada.

4. *Remining and Privatization*

Rules for *remining of abandoned sites* and/or *privatization of existing government-owned mines* may provide some opportunities to remedy problems of the past while providing new jobs and more modern, pollution-preventing techniques.

In the countries studied, there is little in the way of specific laws or policies or financial incentives that promote the use of pollution prevention measures in connection with remining existing or abandoned mines or privatization of government-owned mines.

As discussed in Section II.B.3. above, **Bolivia's** Mining Code provides for the creation of tax or other financial inducements for operators to control pollution streams from operations which existed prior to the enactment of Bolivia's Environment Law, and are unrelated to their own activities. Many countries with a long history of mining operations such as **Chile, Peru, Brazil, and Mexico**, have no laws or policies on this topic.

The **United States**, however, has a number of regulatory programs applicable to remining. Subsequent owners or operators of a mine may be liable for environmental pollution or damage caused by historic mining activities at the site. Under CERCLA, responsible parties are liable to clean up hazardous waste at a site or to pay for cleanup actions conducted by the state, EPA or some other private party. Four potential classes of parties may be liable for cleanup costs under CERCLA: (i) current owners and operators; (ii) former owners and operators who were present at the time of the hazardous waste disposal; (iii) generators and parties responsible for the disposal of the waste; and (iv) transporters. Responsible parties may also be held liable for the cost of natural resource damages.⁵ Most likely, parties that become involved with exploration, operating or owning a site with historic environmental problems will be liable for the cleanup costs, even for conduct that occurred before enactment of CERCLA. However, natural resource damage claims may not be brought for pre-enactment releases.

CERCLA liability may act as a disincentive to remine previously mined areas with significant environmental hazards, as well as to the voluntary

⁵ See generally, Lynn M. Kornfeld, *Reclamation of Inactive and Abandoned Hardrock Mine Sites: Remining and Liability Under CERCLA and the CWA*, 69 U. COLO. L. REV. 597 (Spring 1998), on which this summary is based.

remediation of previously mined sites for which the volunteer (state, university, or mining company) currently has no liability. There are several possible ways that CERCLA could be used by EPA or private parties to promote remining with the use of pollution prevention measures. EPA can provide a prospective purchaser with a covenant not to sue under certain limited circumstances. EPA could also condition the granting of the covenant on the incorporation of pollution prevention measures into the remining plan. The State of Colorado has a policy allowing mining companies to negotiate a remining agreement to limit CERCLA liability. Colorado will agree not to hold the company liable for cleanup costs if the company complies with the remining plan approved by the state. The company may still be subject to a CERCLA natural resources damages suit and liability for cleanup costs in a CERCLA action brought by the federal government.

Remining operations may also be subject to liability under the Clean Water Act for acid mine drainage created by historic activities. Recent cases have found that preexisting acid mine drainage is a pollutant under the Act for which companies are subject to permitting requirements. The Western Governors Association (WGA) is currently trying to negotiate a "Good Samaritan" exemption to liability under the Clean Water Act for voluntary remedial actions on abandoned or inactive mined land. The WGA proposal would include entities other than governmental units, but would not include those with prior involvement at the site or those with current or prior legal responsibility for discharges at the site. Remining activities would not be permitted in connection with the proposed remediation activities. For these reasons, strong opposition from the environmental community exists to allowing such activity and the WGA has decided to postpone consideration of the issues connected with remining. Thus, nonremediation-development at the site would be subject to normal NPDES rules. The remediation plan must demonstrate with reasonable certainty that the actions to be taken will result in an improvement in water quality to the degree reasonably possible. Moreover, in order to assure that efforts were made first to identify parties with liability for cleaning up the site, the remediation plan would have to include a summary of efforts made to that end.

5. *Liability*

A.Liability standards can serve as significant incentives for mining operations to undertake their pollution prevention obligations. The countries studied rely on a range of forms of liability including: administrative, civil and criminal penalties, corrective orders, and natural resource damages. In many cases, the amount of the penalties authorized may not be correlated to the actual amount of damages or cost of cleanup, and thus may not be large enough to serve as an incentive for companies to act. In assessing the effectiveness of liability systems,

it is important to also examine the actual types and amounts of penalties imposed, and the reasons for such penalties, including issues of corruption, independence of the judiciary, etc. These issues were not addressed in the national studies.

Brazil's laws impose different forms of liability. Mining activities that violate environmental regulations may be subject to fines and the cancellation of permits and possible criminal sanctions including imprisonment. Official credits and loans granted by federal banks or institutions must also be suspended. Violators may also be sued by public agencies, non-governmental organizations and the Public Prosecutors Office, and, if they are found guilty, they are subject to paying for damages into a special fund (the Public Interest Defense Fund) used to repair the environmental damage. Operations may be inspected at any time without notice by the environmental agency.

Mexico has administrative, civil and criminal sanctions available for different types of environmental violations. Failure of a mining operation to comply with the measures provided for in its environmental impact resolution may subject the company to administrative sanctions (Art. 171, LGEEPA). If the operations result in damage or harm to third parties, the company may be subject to civil or criminal penalties (Art. 103, LGEEPA). Criminal penalties include terms of three months to six years of imprisonment and fines of 1,000 to 20,000 days of minimum salary (Art. 415-420, Código Penal). Additional sanctions include taking actions necessary to reestablish preexisting conditions, suspension, modification, or demolition of the responsible work or activities, reintroducing natural elements of flora and fauna, and return of hazardous materials or wastes to the country of origin.

Argentina also has a broad range of administrative sanctions available for noncompliance with the Environmental Management Plan. Violators may be subject to warnings, fines, revocation of the environmental quality certificate, environmental remediation requirements, and temporary or permanent shutdowns (after three shutdowns the mine is permanently closed). Contamination of drinking water in a manner hazardous to human health may result in a criminal penalty of three to ten years of imprisonment.

The **United States** also authorizes a wide range of penalties for environmental violations under federal and state laws. For example, violation of NPDES permits may be subject to administrative penalties, civil penalties of up to \$25,000 per day, injunctive relief or compliance orders. Criminal penalties – including fines and imprisonment – may also be available for negligent violations, knowing violations, knowing endangerment and false statements. Under CERCLA, responsible parties may be required to clean up hazardous waste at a site or pay for the cleanup activities conducted by the government. CERCLA also authorizes natural resources damage actions to be brought.

III. A Proposed Hemispheric Framework

An analysis of the tools and policies available in the national frameworks for pollution prevention provides considerable insight into the potential legal and policy tools that can be incorporated into a comprehensive hemispheric framework to promote pollution prevention at all stages of mining operations. By combining the best tools and policies the region has to offer, with ideas for new tools and policies to address the gaps or weaknesses in existing laws, ELI, in cooperation with its partners, has developed a preliminary framework for a hemispheric approach for promoting pollution prevention. This framework provides an overview of the elements that countries can incorporate into a strategy, policy or law on the Inter-American, national, regional or local level, taking into consideration the specific social, legal and economic context. It is not intended to be a model law.

This framework first defines what pollution prevention means in the context of mining operations. **Table 2** below provides a summary explanation of the key concepts incorporated in the definitions of pollution prevention. Next, the framework briefly identifies the range of legal and policy approaches that can be used for pollution prevention. The framework then identifies for each of the three major phases of mining (exploration, active mining operations, and closure): (i) the potential sources of pollution prevention; (ii) the opportunities for pollution prevention; and (iii) the specific legal, policy and management tools that can be used to address the relevant pollution problems. Finally, the issues of special concern to be taken into consideration in formulating and implementing the framework and presents policy recommendations for addressing these issues. It is worth restating that the proposed framework may be enhanced by additional research on issues related to implementation and enforcement of laws and policies in the region.

A. Defining Pollution Prevention

The primary goal of the proposed definition of pollution prevention is to incorporate all the measures necessary to avoid or minimize the creation of costly contamination, while at the same time create opportunities for economies and efficiencies in the use of resources. In other words, pollution prevention in the mining context under the proposed framework would emphasize source reduction. The definition of pollution prevention adopted by the federal government in Canada is a useful example: "The use of processes, practices, materials, products or energy that avoid or minimize the creation of pollutants and waste and reduce overall risk to human health and the environment."

Under the proposed framework, the term "source reduction" would have the following meaning:

Source reduction reduces or eliminates the quantity or hazardous nature of pollutants and waste at the point of generation. Source reduction includes strategies to predict the occurrence of acid-forming materials, arsenic, and toxic metals likely to be mobilized by mining activities and design operations to avoid or minimize contact with these materials and/or assure their isolation. Source reduction can also include such strategies as substitution of cleaner processes for more hazardous processes - such as prohibition of mercury processes.

As secondary objectives, the definition of pollution prevention would call for recycling materials and substances that might otherwise be released into the environment and treating and securely disposing hazardous substances, pollutants, and materials that could degrade the environment. Again, it is important to emphasize that source reduction should form the core of any pollution prevention strategy for the mining sector; recycling treatment and secure disposal are not adequate substitutes for a strong source reduction program.

Under the proposed framework, the terms recycling, treatment and secure disposal would be defined as follows:

Recycling provides for the use or reuse of wastes as a substitute for a commercial product or material in an industrial process. It can include strategies such as closed-loop processes for handling acids and cyanides, and maximizing the reclamation/reuse of tailings water.

Treatment is any method, technique, or process that changes the physical, chemical or biological characteristics of waste materials in a way that eliminates harmful characteristics, recovers energy or useful materials in the waste materials, leave them capable of being reused or safely contained, or reduces their volume. It can include such strategies as decontamination of tailings.

Secure disposal is any method, technique or process that prevents residual wastes from posing a threat to the environment. This includes use of designed disposal units to prevent sulfide materials from coming into contact with air and water and generating acid mine drainage. It may include placement of tailings in engineered structures with appropriate management and diversion of water to prevent mobilization and migration of pollutants.

Table 2
POLLUTION PREVENTION CONCEPTS

Source reduction reduces or eliminates the quantity or hazardous nature of pollutants and waste at the point of generation. Source reduction includes strategies to predict the occurrence of acid-forming materials, arsenic, and toxic metals likely to be mobilized by mining activities and design operations to avoid or minimize contact with these materials and/or assure their isolation. Source reduction can also include such strategies as substitution of cleaner processes for more hazardous processes - such as prohibition of mercury processes.

Recycling provides for the use or reuse of process materials and wastes as a substitute for a commercial product or material in an industrial process. It can include strategies such as closed-loop processes for handling acids and cyanides, and maximizing the reclamation/reuse of tailings water.

Treatment is any method, technique, or process that changes the physical, chemical or biological characteristics of waste materials in a way that eliminates harmful characteristics, recovers energy or useful materials in the waste materials, leaves them capable of being reused or safely contained, or reduces their volume. It can include such strategies as decontamination of tailings.

Secure disposal is any method, technique or process that prevents residual wastes from posing a threat to the environment. This includes use of designed disposal units to prevent sulfide materials from coming into contact with air and water and generating acid mine drainage. It may include placement of tailings in engineered structures with appropriate management and diversion of water to prevent mobilization and migration of pollutants.

B. Integrating Legal Tools into a Pollution Prevention Strategy

Mining operations have the potential to prevent pollution at three phases: exploration, active mining operations, and closure. The following discussion highlights how legal and policy tools can be integrated into a strategy for preventing pollution in each of these phases. **Tables 3a-3c** below provide a summary of this discussion. Under the proposed strategies, countries have the flexibility to choose among different tools that may serve the same objective. The key is to make sure that the tools incorporated in the strategy are designed to cover or address all the pollution prevention opportunities in each of the different phases of mining. In addition, priority attention should be given to those tools and policies that would avoid or minimize the creation of pollutants and waste.

1. Exploration

Potential sources and types of pollution

Exploration operations can result in disturbance of the land surface and creation of air or water pollution with naturally occurring materials as well as

with materials introduced to the exploration site during drilling and related activities. Drilling associated with exploration can lead to the contamination of groundwater, by creating new paths for the migration of contamination. Excavations associated with exploration can produce acid drainage and mobilize metals, as well as produce sediment and erosion. Finally, road building and clearing activities can directly cause pollution through sedimentation and erosion, but can also lead (in some remote forest areas) to secondary environmental impacts through induced development.

Pollution prevention opportunities

Pollution prevention during the exploration phase requires substantial attention to limiting the extent of disturbance. This may include minimizing the area disturbed to that needed for exploration, and taking particular care in likely acid-generating areas to limit exposure of acid-forming materials. Plugging of wells and drill holes is important. Plans and requirements for abandonment of roads and suitable reclamation and revegetation of drill sites and other disturbed areas are important as well to assure that introduced contaminants or naturally occurring pollutants are not permitted to migrate, as well as in order to prevent unwanted development or degradation of lands.

Legal, policy, and management tools

During the exploration phase, it is important to assure that disturbances are those needed to locate and characterize the ore body, while minimizing impacts on adjacent lands and waters. Standards and planning can help assure that undue degradation does not occur as a result of exploration, and reclamation requirements can help prevent contamination of ground water, erosion of drill sites and roads, and the formation of acid drainage. Requirements for financial assurance, such as bonding, can also help assure that exploration areas are not left to become pollution hazards. Environmental management systems can help exploration operations assure that materials are properly handled and accounted for, and that exploration is both efficient and environmentally sustainable. Land use restrictions may also be appropriate to use at this point, depending on the nature and existing use of the proposed exploration site. Because exploration operations establish the basis for future mining activities, it is important to assure that they are conducted in ways that facilitate future mining while not impairing areas that will not be mined or where mining may not occur for a significant length of time.

Table 3a
INTEGRATING LEGAL TOOLS INTO A POLLUTION
PREVENTION STRATEGY

"Exploration"

<p>Potential Sources and Types of Pollution</p>	<ul style="list-style-type: none"> •Disturbance of the land surface. •Creation of air or water pollution with naturally occurring materials as well as with materials introduced to the exploration site during drilling and related activities. •Contamination of groundwater by creating new paths for the migration of contamination. •Acid drainage and mobilization of metals. •Sedimentation and erosion through excavation and road building and clearing activities. •Secondary environmental impacts (in some remote forest areas) through induced development as a result of road building and clearing.
<p>Pollution Prevention Opportunities</p>	<ul style="list-style-type: none"> •Minimizing the area disturbed to that needed for exploration. •Taking particular care in likely acid-generating areas to limit exposure of acid-forming materials. •Plugging of wells and drill holes. •Plans and requirements for abandonment of roads, as well as suitable reclamation and revegetation of drill sites and other disturbed areas, to prevent migration of contaminants or naturally occurring pollutants and unwanted development or degradation of lands.
<p>Legal, Policy and Management Tools</p>	<ul style="list-style-type: none"> •Planning to assure that disturbances are those needed to locate and characterize the ore body, while minimizing impacts on adjacent lands and waters. •Standards and planning to help assure that undue degradation does not occur. •Reclamation requirements to help prevent contamination of ground water, erosion of drill sites and roads, and the formation of acid drainage. •Requirements for financial assurance, such as bonding, to help assure that exploration areas are not left to become pollution hazards. •Environmental management systems to help assure that materials are properly handled and accounted for, and that exploration is both efficient and environmentally sustainable. •Land use restrictions, depending on the nature and existing use of the proposed exploration site.

2. Active Mining Operations

Potential sources and types of pollution

Mining operations can cause the production of acid drainage. Such drainage can mobilize metals, making them water pollutants. Mining can mobilize other naturally occurring toxic substances such as arsenic, which may become air or water pollutants. Active mines (including zero discharge facilities

and those that recycle and reuse potential pollutants) also are subject to accidental releases of cyanides, acids, or other introduced materials used in the mining and beneficiation process. Such releases may be due to process upsets, failure of equipment, or to precipitation events not adequately contained or controlled by the engineered design of the systems. Mines may expose wildlife (particularly birds) to such substances even where releases from the mine site are prevented.

Active mines can generate substantial volumes of tailings and waste rock, which may produce air pollution and water pollution during the operation. They also produce large volumes of waste materials. These include mine tailings and spent ores that may be contaminated with cyanides, acids, or other introduced materials – leading to potential releases into the air, surface water, or ground water.

Pollution prevention opportunities

One of the keys to prevention of long-term water pollution is careful characterization of ore and waste rock characteristics to determine what to disturb and how to handle and dispose of the disturbed materials. Early and thorough understanding of the materials present at the site can lead to avoidance of acid-forming or toxic material, where feasible, and careful control of its disposal when it is disturbed.

Pollution prevention also involves use of cleaner processes. For example, it may require use of techniques that do not introduce cyanides, acids, or certain beneficiation reagents to the site; and that avoid use of mercury - still a problem in some countries. In addition, better design of processes can lead to use of a reduced amount of cyanides and acids in the beneficiation process – chiefly through use of closed loop, reuse, and recycling processes designed to minimize quantities used and released to the environment. These techniques make more efficient use of the materials and improve recovery of metals at the same time. Operations can also be designed to minimize the exposed area of process ponds, or to use closed loop recovery systems with no exposed ponds, in order to reduce exposure of wildlife and the surrounding environment to substances such as cyanide used in leaching operations.

Control of site drainage is critically important to minimize the contact of precipitation, surface water, and ground water on the site with contaminants or acid-generating materials. Acid drainage controls include designs of mining approaches that exclude water or air from contact with acid-generating materials, and control of the bacteria that promote acid generation; as well as the use of on-site and imported neutralizing materials to reduce acid generation. Mine operations should also use designs that separate clean drainage from

contaminated drainage in order to reduce the volume of water for which control and treatment is required. For example, pollution preventing designs separate storm water drainage from contact with materials in tailings impoundments. Such systems also recycle water used in beneficiation processes and from tailings slurries.

Pollution prevention during the mining phase also includes use of leak detection systems and monitoring of groundwater, water, and air. In addition, mines should provide for spill collection systems and containment structures for potential spills of hazardous substances. The mining plan should also include contingency planning, equipment, and training to enable operators to deal with foreseeable process upsets, leaks, and releases.

Pollution preventing techniques include the control of dust using nontoxic materials and with attention to the fate of dust suppressants. This may include recycling of water used as a dust suppressant.

Pollution prevention techniques useful during the active mining phase may include contemporaneous reclamation, where feasible, to reduce the "footprint" of the mine on the landscape and reduce exposure of a disturbed area to the elements – thus reducing the potential for air pollution and water pollution. In order to accomplish better reclamation, operators can segregate and stockpile topsoil early in the mining operation for later use.

Legal, policy, and management tools

Virtually all of the legal, policy, and management tools discussed in this report are applicable to the mining phase, and each may play some role in assuring that mining activities are efficient, clean, and produce impacts of limited duration on the surrounding environment. Important tools include environmental impact assessment, standards for the prediction of acid drainage and for characterization of wastes, environmental management systems to provide for the handling of toxic substances, financial incentives and financial assurances to assure complete reclamation, as well as planning for operation, closure, and post-closure. Land use restrictions may also be important depending on the nature and use of the site.

These tools can improve the efficiency of mining by integrating environmental concerns into the operation at each stage; this results in savings over attempting to do environmental protection after the fact, and can also reduce costs. Cost savings may be achieved through such measures as limiting the amount of material requiring special handling - due to early and accurate characterization of overburden and waste materials with acid-generating or toxic potential; through measures such as segregation of topsoil for reuse in

reclamation and revegetation; and through control and recycling of process waters and introduced substances. Mining plans and systems that account for all materials and that minimize the need for double-handling of rock and other materials can integrate efficient recovery of metals with environmental protection.

Table 3b
INTEGRATING LEGAL TOOLS INTO A POLLUTION PREVENTION STRATEGY

"Active Mining Operations"

<p>Potential Sources and Types of Pollution</p>	<ul style="list-style-type: none"> • Production of acid drainage and mobilization of metals. • Mobilization and release of other naturally occurring toxic substances such as arsenic, which may become air or water pollutants. • Accidental releases of cyanides, acids, or other introduced materials used in the mining and beneficiation process. • Exposure of wildlife (particularly birds) to toxic substances, even where releases from the mine site are prevented. • Generation of substantial volumes of tailings and waste rock, which may produce air and water pollution.
<p>Pollution Prevention Opportunities</p>	<ul style="list-style-type: none"> • Careful characterization of ore and waste rock characteristics to determine what to disturb and how to handle and dispose of the disturbed materials. • Early and thorough understanding of the materials present at the site to avoid acid-forming or toxic material where feasible, and careful control of its disposal when it is disturbed. • Use of cleaner processes (for example, techniques that do not introduce cyanides, acids, or certain beneficiation reagents to the site; and those that avoid use of mercury). • Better design of processes to reduce the quantity of toxic substances used in the beneficiation process. • Minimizing the exposed area of process ponds and using closed loop recovery systems with no exposed ponds in order to reduce exposure of wildlife and the surrounding environment to substances used in leaching operations. • Control of site drainage to minimize the contact of precipitation, surface water, and ground water on the site with contaminants or acid-generating materials. • Use of designs that separate clean drainage from contaminated drainage in order to reduce the volume of water for which control and treatment is required. • Use of leak detection systems and monitoring of groundwater, water, and air. • Provisions for spill collection systems and containment structures for potential spills of hazardous substances. • Contingency planning, equipment, and training to enable operators to deal with foreseeable process upsets, leaks, and releases. • Control of dust, using nontoxic materials and with attention to the fate of dust suppressants. • Contemporaneous reclamation, where stockpile of topsoil is feasible, to reduce the "footprint" of the mine on the landscape and reduce exposure of a disturbed area to the elements - thus reducing the potential for air pollution and water pollution.
<p>Legal, Policy and Management Tools</p>	<ul style="list-style-type: none"> • Environmental impact assessment to identify the potential impacts of a project before it proceeds. • Standards for the prediction of acid drainage and for characterization of wastes • Regulatory standards for construction and operation of process facilities and waste management units. • Regulatory standards for prevention. • Environmental management systems to provide for the handling of toxic substances. • Financial incentives and financial assurances to assure complete reclamation. • Planning for operation, closure, and post-closure. • Required monitoring and disclosure of releases. • Land use restrictions, depending on the nature and use of the site.

3. Closure

Potential sources and types of pollution

At closure, and for years beyond, mines can generate substantial pollution from the exposure of materials in the pits and the waste rock and tailings disposal areas that may require perpetual care. Acid drainage can occur after the conclusion of mining and can worsen over time. Similarly, contaminants contained in the tailings and spent ore from the beneficiation process may be released into the water and groundwater after closure of tailings disposal areas and heaps.

Impoundments remaining after mining may become contaminated with acid drainage, metals, and other pollutants, posing a hazard to wildlife and (if impoundments are hydrologically connected to surface or ground water) to other water users and the environment.

Dust particles from tailings and spent ore areas can cause air pollution after mining and closure has been completed, if they are not properly stabilized and/or covered.

Pollution prevention opportunities

Mining exploration and operation activities can be sited and conducted from inception in a way that avoids the creation in the first place of long term environmental problems. EIAs, planning and permitting requirements, as well as land use restrictions may assist in this effort by identifying, restricting or prohibiting mining on categories of land where the environmental problems created by mining ore may be in conflict with the existing use of the land or create a threat because of the sensitive ecosystem. These tools can also be designed to include a process for preventing mining on lands outside these categories where mining operations are suitable for these same reasons. Pollution prevention techniques relevant to closure include isolation and containment of acid-producing materials. Use of neutralizing and other materials to prevent acid mine drainage and metals transport in pits, impoundments, and other waters are important. Topsoil and revegetation can help stabilize and control waste areas in their post-mining configuration to limit movement and water infiltration.

Rinsing, decontamination, and covering of spent ores and tailings, coupled with drainage controls to prevent migration of contaminants remaining in place after closure, are important techniques. These measures may also include dewatering of mine tails and/or hydrologic controls for tailings impoundments to ensure long term stability. Such measures should generally be accompanied by monitoring and maintenance to assure hydrologic controls are working to control drainage and to prevent water from contacting and mobilizing contaminants of concern.

Changes in the post-mining configuration of the land can also reduce the threat of pollution. Such approaches may include filling of pits where feasible in order to reduce the potential for collection and contamination of pit water and to reduce the exposure of waste rock to oxygen and water, where it may contribute to possible acid

drainage. Plugging wells and adits can help prevent water pollution and the discharge of metal-laden mine site waters to surface and ground water.

Removal of introduced materials – including pollution control wastes, beneficiation chemicals and reagents, laboratory chemicals, oil, *etc.* – is also an important part of preventing pollution after mine closure.

Legal, policy, and management tools

Closure of mine waste units, such as tailings impoundments and spent ore dumps, is best accomplished if fully planned prior to the commencement of active mining. Tools such as EIAs and planning and permitting requirements can help avoid the creation of long-term environmental problems by assisting operators and regulators in identifying alternative sites and alternative means of operating and appropriate methods for disposal. Standards for closure, if incorporated into the project design, can provide a key benchmark by which to assess performance and impose liability for failure to perform. Environmental management systems can help operators carry out closure obligations. Financial assurance mechanisms can be designed for an amount that accurately reflects the cost of ongoing and future treatment and clean up obligations and be kept in place until these problems are resolved. This creates an incentive for operators to avoid creation of long term environmental problems in the first place as well as to seriously undertake ongoing treatment and cleanup obligations. In addition, public information and transparency can improve the effectiveness of post-mining controls – assuring that disposal areas remain undisturbed after closure and do not create any risks to local populations. Public participation in the process for releasing financial assurance mechanisms helps guarantee that the operation has complied with all its post-closing obligations.

Table 3c
INTEGRATING LEGAL TOOLS INTO A POLLUTION PREVENTION STRATEGY

"Closure"

Potential Sources and Types of Pollution	<ul style="list-style-type: none"> • Exposure of materials in the pits and the waste rock and tailings disposal areas that may require perpetual care. • Acid drainage after the conclusion of mining, which can worsen over time. • Release of contaminants contained in the tailings and spent ore from the beneficiation process into the water and ground water after closure of tailings disposal areas and heaps. • Contamination of impoundments remaining after mining with acid drainage, metals, and other pollutants, posing a hazard to wildlife and to other water users and the environment. • Air pollution after completion of mining and closure as a result of dust particles from tailings and spent ore areas that are not properly stabilized and/or covered.
Pollution Prevention Opportunities	<ul style="list-style-type: none"> • Isolation and containment of acid-producing materials. • Use of neutralizing and other materials to prevent acid mine drainage and metals transport in pits, impoundments, and other waters. • The stabilization and control of waste areas in their post-mining configuration using topsoil and revegetation to limit movement and water infiltration. • Rinsing, decontamination, and covering of spent ores and tailings, coupled with drainage controls to prevent migration of contaminants remaining in place after closure. • Dewatering of mine tails and/or hydrologic controls for tailings impoundments to ensure long term stability. • Monitoring and maintenance to assure hydrologic controls are working to control drainage and to prevent water from contacting and mobilizing contaminants of concern. • Filling of pits, where feasible, in order to reduce the potential for collection and contamination of pit water and to reduce the exposure of waste rock to oxygen and water, where it may contribute to possible acid drainage. • Plugging wells and adits to prevent water pollution and the discharge of metal-laden mine site waters to surface and ground water. • Removal of introduced materials, including pollution control wastes, beneficiation chemicals and reagents, laboratory chemicals, oil, <i>etc.</i> to prevent pollution after mine closure.
Legal, Policy and Management Tools	<ul style="list-style-type: none"> • Use of EIAs and planning and permitting requirements to help avoid the creation of long-term environmental problems by assisting in the identification of alternative sites, alternative means of operating and appropriate methods for disposal. • Incorporating standards for closure into the project design to provide a key benchmark by which to assess performance and impose liability for failure to perform. • Implementation of environmental management systems to help operators carry out closure obligations. • Designing financial assurance mechanisms to accurately reflect the cost of ongoing and future treatment and cleanup obligations and to remain in place until these problems are resolved (thereby creating an incentive for avoiding long term environmental problems in the first place and seriously undertaking ongoing treatment and cleanup obligations). • Use of public information and transparency to improve the effectiveness of post-mining controls, assuring that disposal areas remain undisturbed after closure and do not create any risks to local populations. • Guaranteeing compliance with all post-closing obligations through public participation in the process for releasing financial assurance mechanisms.

C. Specific Areas of Concern

1. Common Problems

Our examination of the national framework laws and policies for promoting pollution prevention in the mining sector identified several common problems. Special effort should be given to addressing these issues in the development of a hemispheric framework for pollution prevention. First, there is a lack of a broad definition of what pollution prevention for mining operations means in the overall context of environmental protection or sustainable development. Second, even where there are existing legal tools and policies that promote pollution prevention, there is an absence of specific goals, measures, and technical guidance for achieving pollution prevention in the different phases of mining (exploration, mining, and closure), as well as in the context of the specific pollution problems faced by the mining industry. Third, countries either lack or have inadequate legal tools or policies that support pollution prevention in the following critical areas: closure planning, financial assurance, re-mining and privatization, public participation, economic incentives, and liability.

2. Recommendations

In establishing a hemispheric framework, countries may want to consider the following recommendations that specifically target some of the key problems with existing national laws. **Table 4** below provides a summary of these recommendations.

- i. Incorporate a **broadly defined goal of pollution prevention** in a general environmental framework law or specific environmental media laws.

Pollution prevention needs to be identified as a specific goal in the policy objectives of the laws governing mining. This may include incorporation of pollution prevention in any general environmental framework law as well as environmental impact assessment and specific media laws. There is also a need to prioritize and differentiate this objective from pollution control.

- ii. Develop **specific goals, measures, and technical guidance** to achieve pollution prevention in the context of specific tools applicable to mining.

While many EIA, permitting and planning processes call for the development of pollution prevention measures, these provisions could be made more effective if specific goals, measures and technical guidance were set forth to achieve pollution prevention in the different phases of mining. In broad terms, these goals and methods include avoiding to the greatest extent possible the disturbance of acid or other toxic-generating areas in establishing mining operations; avoiding or minimizing the use of toxic substances in operations; minimizing the creation of large volumes of toxic wastes; and preventing future pollution from toxic substances and waste streams in connection with closure.

iii. Improve **planning tools** for pollution prevention, especially **closure planning requirements**.

EIA mechanisms and other legal tools can be designed to require mining operations to engage in planning with respect to environmental impacts. Prevention and performance can be improved by requiring contingency, spill and closure plans to address prevention issues, as well as response actions from the inception of operations. These tools help drive decisionmaking that strives to prevent pollution problems rather than assume that they can be dealt with later.

iv. Create effective and adequate **financial assurance mechanisms**.

Financial assurance mechanisms can serve as a strong incentive for companies to seriously undertake and carry out their pollution prevention mechanisms. These mechanisms can more effectively serve this purpose if they are linked to the levels of risk presented by operations. This can be achieved by requiring the company to establish financial assurance in an amount that realistically reflects their potential obligation. In order to minimize their exposure, companies will design operations to avoid unnecessary risks and improve self-monitoring to avoid liability. This approach can be strengthened by requiring that these commitments be met by independent mechanisms such as bonds or letters of credit, rather than an assessment of the company's financial situation. This engages third party issuers in an assessment of potential risks. Shared-risk pools could also be used to improve accountability across the mining sector by providing an incentive for the companies themselves to monitor compliance efforts. Finally, allowing the public to have an opportunity to comment on the release of the financial assurance puts the company on notice that its practices will be seriously examined before these obligations are released, thus increasing incentives for self-monitoring and documentation of operational practices.

v. Set policies and strategies for addressing pollution prevention in the context of **remining or privatization**.

Mining operations that involve remining of abandoned lands with preexisting environmental problems and private operations that will be taking over previously government-controlled mines with preexisting environmental problems present special challenges for regulators interested in promoting pollution prevention strategies. In both cases, a policy decision is needed to determine who will be responsible for cleanup of past problems as well as ongoing pollution prevention and control. Additional policy decisions are needed to determine both the level of prevention and control that will be required and the measures for monitoring and implementing these requirements.

Table 4

RECOMMENDATIONS FOR ESTABLISHING A REGIONAL FRAMEWORK

- Incorporate a **broadly defined goal of pollution prevention** in a general environmental framework law or specific environmental media laws.
- Develop **specific goals, measures, and technical guidance** to achieve pollution prevention in the context of specific tools applicable to mining.
- Improve **planning tools** for pollution prevention, especially **closure planning requirements**.
- Create effective and adequate **financial assurance mechanisms**.
- Set policies and strategies for addressing pollution prevention in the context of **remining or privatization**.
- Strengthen mechanisms for **public participation**.
- Create **economic and other incentives** for the development and use of pollution prevention technology.
- Implement strong **liability systems**.

vi. Strengthen mechanisms for **public participation**.

Effective public participation in environmental decisionmaking and enforcement is a key component of a pollution prevention strategy. There are a number of ways public participation could be improved. EIA laws could be revised to ensure that all mining activities that may have a significant impact on the environment are subject to an EIA process that provides for written and oral comments from the public. The public could also be involved at the scoping stage to help identify potential environmental impacts of concern to local communities that should be addressed in the EIA. This involvement can increase incentives for development of pollution prevention strategies and for monitoring the efficacy of these strategies. Improved mechanisms for developing and disseminating information on environmental impacts, as well as ongoing emissions and discharges to the environment (especially toxic emissions and discharges), should be established. Finally, governments may want to explore mechanisms for financially supporting public participation, including educational programs on pollution prevention, as a strategy.

vi. Create **economic and other incentives** for the development and use of pollution prevention technology.

Existing laws provide little or no economic incentives for the development and use of pollution prevention technology. Only a few countries even

provide tax benefits for capital expenditures for pollution equipment. Tax benefits and other forms of economic incentives could increase the development and use of new forms of pollution prevention technology. Certification and public recognition programs also provide a positive incentive for these actions. These types of incentives may be more attractive for us in countries which have fiscal policies that discourage or prohibit the use of economic incentives.

viii. Implement strong **liability systems**.

One of the strongest incentives for companies to undertake their pollution prevention obligations is the existence of a liability system that clearly identifies the environmental harms and actions for which a company will be held liable and impose penalties or require compensation for government clean-up actions in an amount commensurate with the cost of clean-up and the amount of natural damages. Environmental penalties rarely reflect these actual costs and thus may not be large enough to serve as an incentive for companies to seriously undertake their obligations. In addition, companies may be required to undertake or finance government actions to clean up the environmental harm. Criminal penalties, including imprisonment, create an incentive for high level management to pay serious attention to their pollution prevention obligations.

IV. Conclusion

A. Towards Effective Pollution Prevention Laws

With investment in the hardrock mining sector in the Americas on the rise, there is a critical and timely need to put in place a strong framework for pollution prevention. Pollution prevention as a strategic management principle offers the opportunity to address environmental concerns while at the same time promoting economy and efficiency in operations. This opportunity to save money while protecting the environment is very important to an industry that has increasingly narrow profit margins.

Many of the elements of this framework already exist, in many countries, if only on paper in some cases. As noted above, the concern of creating competitive disadvantages may be deterring countries from advancing laws on this topic on the national scale. The development of a regional framework will not only create a level playing field, but will also create a favorable political climate regionwide for these initiatives to be adopted at the national level and to be effectively implemented and enforced.

B. Next Steps

The next step in developing a hemispheric framework is to launch a dialogue on this topic in the appropriate regional arena. There are a number of existing policy-setting fora where governments can work together to set in place a hemispheric pollution prevention framework. At present, one of the most promising fora is the Mine Ministries of the Americas Conference. This annual conference brings together high level mining officials and their technical experts to address major issues in the industry. A number of issues related to pollution prevention, including closure planning, environmental law and policy, and technology transfer, have been under discussion in recent meetings and specific projects to study and develop policies on these issues are under consideration.

There are additional policy-setting fora in the region where these issues could be addressed. The Summit of the Americas process has launched a number of hemispheric initiatives, such as the Partnership for Pollution Prevention and the Cleaner Production Roundtable of the Americas. Pursuant to the Bolivia Summit, the Organization of American States has established the Inter-Agency Task Force for Summit Follow-up which includes a working group on cleaner production. In addition, the negotiations for the Free Trade Area of the Americas may provide an opportunity for discussion of these issues.

While hemispheric negotiations are underway, individual countries may proceed with improving their national frameworks for pollution prevention. The recommendations discussed can be implemented in a number of ways on the national level, including passing new legislation, adopting regulations, and developing technical

guidance and policy documents. Governments could also independently, or in cooperation with the private sector, launch education and recognition programs in this area. States, provinces and local government authorities may also want to proceed independently in these areas. However, without the safety net of a hemispheric framework, many national, state and local authorities may be hesitant to proceed with this agenda on the assumption that mining investment will flow to regions that do not have such measures in place.

Finally, there remains a critical need for a review and analysis of the actual implementation and enforcement of national laws on pollution prevention. This review could help identify and propose recommendations to address problems related to the availability and use of financial, technical and personnel resources, corruption, and decentralization, among others. The findings of this study would enhance the development of a hemispheric framework and prove critical to effective implementation and enforcement.

ANNEX I

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ANNEX II

LIST OF ACRONYMS

ARD	Acid Rock Drainage
ARET	Accelerated Reduction and Elimination of Toxics Program (Canada)
BADCT	Best Available Demonstrated Control Technology (Arizona)
CEAA	Canadian Environmental Assessment Act
CEDPA	<i>Centro Especializado de Derecho y Política Ambiental</i> (Bolivia)
CEMDA	<i>Centro Mexicano de Derecho Ambiental</i> (Mexico)
CEPA	Canadian Environmental Protection Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (United States)
CIELAP	Canadian Institute for Environmental Law and Policy (Canada)
CODEFF	<i>Comité Nacional Pro Defensa de la Fauna y Flora</i> (Chile)
CONAM	National Environmental Council (Peru)
ELI	Environmental Law Institute (United States)
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement (<i>Manifestación de Impacto Ambiental</i>)
EPA	United States Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act (United States)
FARN	<i>Fundación Ambiente y Recursos Naturales</i> (Argentina)
ISA	<i>Instituto Socioambiental</i> (Brazil)
LGEEPA	General Law on Ecological Balance and Environmental Protection
MEDMIN	<i>Programa Medio Ambiente y Minería</i> (Bolivia)
MEND	Mine Environment Neutral Drainage (Canada)
MICARE	<i>Minera Carbonífera Río Escondido</i> (Mexico)
MISA	Municipal Industrial Strategy for Abatement Program (Ontario)
MMLER	Metal Mining Liquid Effluent Regulations (Canada)
NEPA	National Environmental Policy Act (United States)
NPDES	National Pollutant Discharge Elimination System
NPRI	National Pollutant Release Inventory (Canada)
PAMA	<i>Programa de Adecuación y Manejo Ambiental</i> (Peru)
PROFEPA	Federal Environmental Prosecutor's Office (Mexico)
RIMA	Environmental Impact Report (summary of EIA) (Brazil)
SEMARNAP	Secretariat of Environment, Natural Resources, and Fish (Mexico)
SPDA	<i>Sociedad Peruana de Derecho Ambiental</i> (Peru)
USAID	United States Agency for International Development
WGA	Western Governors Association (United States)

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