2-12-2007

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Recommended Citation
David A. Wirth. "Hazardous Substances and Activities." In *Oxford handbook of International Environmental Law.* Daniel Bodansky, Jutta Brunée, Ellen Hey, eds., Oxford: Oxford University Press, 2007.

CHAPTER 17

HAZARDOUS SUBSTANCES AND ACTIVITIES

DAVID A. WIRTH

1 Introduction

THE modern world is awash in synthetic and naturally occurring chemicals deployed with an intent to improve our quality of life. Nearly 26 million different chemicals are currently catalogued, and approximately 4,000 new substances are identified every day. While this ingenuity in manipulating the basic building blocks of matter accounts for many of the accomplishments of our industrial society, some of those chemicals may have unanticipated or undesirable consequences for human health and the environment.

1.1 Public Policies for Addressing Toxics

Toxics originate from highly diverse sources, including a wide variety of manufacturing processes that employ hazardous substances. Human beings experience

Preparation of this chapter was supported by a generous grant from the Boston College Law School Fund and draws on some of the author's previously published work.

exposure to toxics in numerous settings, and the ultimate environmental fate of hazardous substances is enormous in its scope. Toxic substances are used in consumer products, as industrial chemicals, and as pesticides. Hazardous chemicals are found in waste from manufacturing plants and households, in the workplace, and also may be transported over long distances through air and water.

Hazardous substances may have effects on human health or on the integrity of natural ecosystems or both. In addition to their intended uses, chemicals to which human beings are exposed may present risks of carcinogenicity (cancer), teratogenicity (birth defects), mutagenicity (genetic mutations), neurotoxicity (nerve damage), and a wide array of other adverse health effects. Concern for previously underappreciated health effects such as endocrine (hormone) disruption has recently increased dramatically.

Poisons such as pesticides purposely released into the environment can have unintended consequences, such as species loss through concentration at higher levels in the food chain. Pollution or chemical waste discharged into the environment as by-products of industrial manufacturing processes can disrupt terrestrial and aquatic ecosystems—some of them of considerable economic importance. Synthetic chemicals such as chlorofluorocarbons, which were once thought to be environmentally benign, can turn out to have near-catastrophic consequences of global proportions, such as the destruction of the stratospheric ozone layer.

The goals of policy interventions to combat the risks presented by toxic substances demonstrate a wide variation. Some regulatory approaches are designed to establish minimum common standards to protect health and the environment from unacceptable levels of harm. Others are intended to reduce competitive distortions that arise from divergent policy goals or approaches. Alternatively, public policies may attempt to create incentives for industry to reduce emissions of toxics or the use of hazardous substances in manufacturing processes. Finally, public policy may address toxic risks by leaving them to a system of liability, with harm from toxic exposures being addressed through general principles of compensation rather than through government regulation.

The range of options in terms of the point of policy intervention is similarly broad. Public policy may seek to reduce the use or production of toxics in favour of less hazardous substances or processes. Governmental regulation, instead or in addition, may address the removal of toxics from waste streams that pollute air, water, or soil. After harm has occurred, public policies establish criteria for determining whether compensation is appropriate and, if so, in what amount.

Further complicating the complexity of the situation is the vast spectrum of policy strategies, instruments, and tools for responding to the problems created by toxics. Governments may require public authorities to evaluate and approve potentially hazardous substances as a condition for market entry. Alternatively, regulatory interventions may be required to remedy existing situations in which risks from toxic substances are present, including the removal of existing products from the market or establishing conditions of use or disposal.

1.2 International Dimensions of Regulating Toxics: Hard and Soft Law

It is increasingly apparent that the environmental and public health hazards presented by many toxic substances transcend national borders and may even be global in scope. The form of public policy interventions at the international level is significantly different from the regulatory tools typically employed by national governments. Coordinated multilateral responses often involve binding international agreements or non-binding, hortatory instruments of a kind different from the regulatory tools routinely encountered at the national level. Supranational authorities such as the European Union (EU), which exercise some but not all of the regulatory powers ordinarily associated with sovereign states, create additional analytical complexities (→ Chapter 37 'Regional Economic Integration Organizations'). Last, in recent years, industry self-regulation in the form of private voluntary standards has attracted increasing attention as a public policy strategy (→ Chapter 21 'Private and Quasi-Private Standard Setting').

Sovereign states have the authority to regulate private parties under their jurisdiction (→ Chapter 31 'Changing Role of the State'). On occasion, states may coordinate or harmonize their policies in binding international agreements. Such an approach has considerable advantages, including enhancing the environmental efficacy of individual national responses through coordinated multilateral action; minimizing distortions in competitiveness that arise from disparate national policies; and providing a mechanism for holding other states parties to the agreement accountable through the creation of binding international obligations.

Binding treaties, however, also have drawbacks (→ Chapter 20 'Treaty Making and Treaty Evolution'). Initiating a multilateral negotiation on a major new treaty or convention typically requires mustering considerable political will. Negotiations on an international agreement may take many years, and the results may represent a disappointing 'least common denominator' result, which is responsive to the needs of the least, rather than the most, ambitious positions taken in the negotiations. Even then, an international compact binds only those states that have formally accepted the obligations in it.

In response to considerations such as these, states and international institutions have often relied on less formal, non-binding instruments for situations that do not necessarily require obligations that are enforceable under international law (→ Chapter 6 'Formality and Informality'). The texts of non-binding instruments, which have been widely employed in the field of international regulation of toxics, consequently are typically phrased in terms of 'shoulds' rather than the obligatory 'shalls' characteristic of binding obligations, which are more frequently found in the 'hard' law created by treaties and international agreements. One important function of this category of 'soft' instruments is consciously to establish normative expectations, which often function as standards of good practice.

In contrast to a 'hard' international agreement, a non-binding 'soft' instrument may allow states to gain experience with more ambitious, aspirational goals in a milieu that is perceived as being less risky. By contrast, under such circumstances states might commit to binding or 'hard' treaty obligations only of a modest character, if at all. Alternatively, non-binding instruments may also be appropriate for circumstances in which consensus is elusive or illusory, while, nonetheless, supporting more aggressive policy action by those states that are prepared to do so. Non-binding instruments may be attractive alternatives to a downward spiral towards a least common denominator—a result characteristic of many multilateral efforts.

A 'soft' instrument may be particularly useful for establishing normative, albeit non-binding, expectations for private parties. To accomplish this goal through a formal treaty negotiation is cumbersome at best. Since non-state actors such as private industry are not subjects of international law (→ Chapter 35 'Business'), an international agreement cannot create obligations for private entities except through the intermediary of states parties to the agreement. Governmental authorities must then prescribe rules for regulated private entities within their jurisdiction. A non-binding instrument can bypass this unwieldy and time-consuming structure with exhortations addressed directly to private parties, presumably for implementation on a voluntary basis. On occasion, soft law can coalesce into binding customary law, although this is by no means necessary to ensure the efficacy of a non-binding instrument.

The concept of 'principles' is of particular importance in modern international environmental law. Although they have an analytical significance beyond any one international instrument, many of these principles are collected and codified in the Rio Declaration on Environment and Development from the UN Conference on Environment and Development. Unlike some other non-binding authorities, principles of international environmental law are not primarily intended expressly to establish normative standards. Rather, these principles are overarching aspirational precepts identified as part of a comprehensive and unifying architecture that identifies the direction in which international law should progressively evolve. Principles of international environmental law consequently are equally relevant to the development of treaties, customary law, and non-binding norms. Among the more salient principles in the field of toxics regulation are the exhortation to engage in precautionary decision-making (Principle 15 of the Rio Declaration) and the polluter pays principle (Principle 16 of the Rio Declaration).

This chapter analyzes the enormous scope of international instruments addressing hazardous substances and activities by segmenting strategies for regulating toxic substances into a typology of specific junctures and regulatory theories that have been or might be employed to inform governmental interventions, whether at the national or international level. This approach offers a template for organizing and categorizing public policy responses to discrete aspects of the problem of controlling risks from toxic substances. Accordingly, this chapter begins by addressing policies designed to identify hazardous substances through testing and then progresses to

treat more substantive public policy interventions designed to reduce or eliminate risks to public health and the environment from toxics.[1]

International law governing toxic substances and activities inevitably evolves in tandem with policy, legislation, and regulation at the national and (in the case of the EU) supranational level—strategies that serve as a backdrop against which multilateral efforts are negotiated and coordinated. For this reason, many multilateral instruments in the area of toxic substances and processes are designed to harmonize or extend diverse and sometimes divergent domestic regulatory approaches. Consequently, the topics below are framed by a brief discussion of domestic approaches in countries such as the United States or at the supranational level within the EU, both of which have been at the forefront of identifying public policy strategies for addressing this complex challenge. The examples, both international and domestic, have been chosen to illustrate various theories of regulation and do not aim to be comprehensive. Many national and international approaches, moreover, represent an amalgam of two or more public policy approaches and cannot necessarily be strictly compartmentalized.

2 Hazard Identification and Testing

One of the first questions inevitably encountered in crafting public policies for toxic substances, and a logical starting place for discussion, is that of identification and definition. Among the universe of elements and compounds encountered in the world, and especially those that are synthetically manufactured, some raise concern about adverse effects on human health or to the environment, while others present less cause for alarm or none at all. The level of risk that justifies a policy intervention is largely a social policy determination involving the application of judgment and values. Nonetheless, in making the distinction between 'toxic' or 'hazardous'[2] chemicals that warrant policy interventions and the remainder that do not, it is essential to have basic empirical toxicity data.

Of the tens of millions of different chemical substances known, about 100,000 are utilized in industrial processes. Of those, very few have been thoroughly tested for human toxicity or adverse environmental impacts. National legislation in the United

[1] Certain aspects of toxic substance regulation are addressed in other chapters, such as liability and cleanup (→ Chapter 44 'International Responsibility and Liability') and private voluntary approaches (→ Chapter 21 'Private and Quasi-Private Standard Setting' and Chapter 35 'Business').

[2] For the purposes of this chapter, the terms 'toxic' and 'hazardous' are used interchangeably in a non-technical sense to identify situations characterized by a heightened risk of injury, disease, or death from exposure to synthetic or extractive chemicals or substances.

States addresses the need for testing of existing chemicals and screening of new substances.[3] The Commission has formally proposed new legislation to the Council and the European Parliament consisting of a comprehensive new regulatory framework for registration, evaluation, and authorization of chemicals (REACH), which would systematize and strengthen chemical regulation by requiring the registration of existing and new chemicals.[4] As of this writing, a first reading of the proposal had been completed in both the Council and the Parliament, and formal adoption of the new system is expected by the end of 2006. The proposed registration process would require the production of basic toxicological data, including studies of ecotoxicity, if they are not already available.

2.1 Organisation for Economic Cooperation and Development (OECD) Harmonization Initiatives

Coordinating national test protocol and data requirements at the international level has significant benefits, particularly by reducing redundant or contradictory requirements from one country to another. Similarly, divergent national testing requirements can have unintended adverse consequences that can impede trade. Based on these considerations, the OECD has been actively involved for several decades in harmonizing national policies for testing chemicals.

Since 1989, a 'screening information data set' program set out in a Decision-Recommendation on the Co-operative Investigation and Risk Reduction of Existing Chemicals has operated under the auspices of the OECD to develop basic information concerning about 600 poorly characterized international high production volume chemicals.[5] The base set of data includes the results of tests for physico-chemical properties, environmental fate, environmental effects, and health effects. As with other testing programs, the principal goal is to assure adequate characterization of a substance to determine appropriate substantive regulatory policy for that chemical. Since the 1980s, the OECD has also had a program to encourage the mutual recognition of test data by OECD member states—an initiative that has now extended to non-members as well.[6]

[3] Toxic Substances Control Act, 15 U.S.C., secs. 2601–92.

[4] See Proposal for a Regulation of the European Parliament and of the Council Concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH), Establishing a European Chemicals Agency and Amending EC Directive 1999/45 and Regulation (EC); and Proposal for a Directive of the European Parliament and of the Council Amending EEC Directive 67/548 in Order to Adapt It to Regulation (EC) of the European Parliament and of the Council Concerning the Registration, Evaluation, Authorization and Restriction of Chemicals, Doc. COM(2003)644 final.

[5] Organisation for Economic Co-operation and Development (OECD), Doc. C(90)163.

[6] See Decision Concerning the Mutual Acceptance of Data in the Assessment of Chemicals, OECD Doc. C(81)30, as amended by OECD Doc. C(97)186; Decision-Recommendation on Compliance with Principles of Good Laboratory Practice, OECD Doc. C(89)87, as amended by OECD Doc. C(95)8; and

The choice of forum for, and form of, multilateral cooperation for exchanging toxicity testing data is revealing. First, these efforts have taken place within the thirty-member OECD, which is an international organization that is not part of the UN system, whose members are generally states with industrialized, market-oriented economies, and which is generally perceived as representing the interests of wealthier countries. Although developing countries may be invited to participate in OECD work, as in the case of certain of the OECD's efforts on the mutual acceptance of data, the OECD is not broadly representative of the interests of all countries. Second, the multilateral response has been limited to sharing those data that have been produced through existing national regulatory approaches in a largely voluntary setting, with only limited attempts to craft a harmonized system of testing at the international level. An additional reason for this relatively modest, voluntary approach may well be concerns over the confidentiality of data.[7]

2.2 Initiatives in the United Nations System

Building on a recommendation in Chapter 19 of Agenda 21, the Intergovernmental Forum on Chemical Safety (IFCS) was established in 1994. The IFCS meets approximately every three years and serves as a setting for communication among more than 150 governments, intergovernmental organizations, and non-governmental groups—including business, labour, environmental, and scientific organizations—concerned with chemicals management. The forum identifies priorities for cooperative action; recommends coordinated international strategies; facilitates the development of national regulatory infrastructure; identifies gaps in scientific knowledge related to chemicals; promotes information exchange and technical cooperation with respect to chemicals; advises governments with respect to chemical safety; and promotes cooperation between governments and non-governmental organizations (NGOs). The 2000 session of the forum (Forum III) adopted the Bahia Declaration on Chemical Safety, a statement that drew attention to the need for further action and established concrete goals for chemicals management in such areas as hazard assessments, the exchange of information, labelling, harmonized standards, infrastructure development, and the control of illegal trade.

Decision Concerning the Adherence of Non-Member Countries to the Council Acts Related to the Mutual Acceptance of Data in the Assessment of Chemicals, OECD Doc. C(97)114.

[7] The International Agency for Research on Cancer (IARC), a component of the World Health Organization located in Lyon, France, publishes a series of monographs, now covering more than 860 environmental agents, designed to relate exposure to environmental factors to the development of human cancer. The IARC ranks carcinogenic risks, and its work product may be useful to national and international authorities in evaluating risks of cancer and formulating public policies to reduce them. Unlike the OECD, the IARC is primarily a scientific research organization and not a forum for harmonizing national policies.

In 1995, also following a recommendation in Agenda 21, several intergovernmental organizations entered into a memorandum of understanding establishing an Inter-Organization Program for the Sound Management of Chemicals (IOMC). The UN World Health Organization provides secretariat services for the IOMC's activities, which include participation by the OECD, the UN Food and Agriculture Organization (FAO), the International Labour Organization (ILO), the United Nations Environment Programme (UNEP), the United Nations Industrial Development Organization, and the United Nations Institute for Training and Research. The United Nations Development Program and the World Bank participate as observers. Unlike the OECD's work on chemicals, the efforts of the IOMC are potentially global in reach.

The IOMC coordinates the international assessment of chemical risks; the harmonization of classification and labelling of chemicals; information exchange on chemicals and chemical risks; the establishment of risk reduction programs; the strengthening of national capabilities and capacities for the management of chemicals; and the prevention of illegal international traffic in toxic and dangerous products. Among other things, the IOMC has facilitated the establishment of a globally harmonized system for the classification and labelling of chemicals. The IOMC implemented a voluntary prior informed consent procedure that preceded the legally binding Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides (PIC Convention) (section 6.2) and has assisted countries to develop national implementation plans under the Stockholm Convention on Persistent Organic Pollutants (Stockholm Convention) (section 3.1).

Building on the IFCS Bahia Declaration and the 2002 Johannesburg Plan of Implementation at the World Summit on Sustainable Development (WSSD), the IOMC organizations and the IFCS have embarked on a strategic approach to international chemicals management (SAICM), which culminated in an International Conference on Chemicals Management held in Dubai in February 2006. The outputs from this meeting include a high-level declaration expressing a commitment to SAICM by governments, representatives of civil society, and the private sector; an overarching policy strategy describing governmental expectations from SAICM in such areas as risk reduction, knowledge and information, governance, capacity building and technical cooperation, and illegal international traffic; and a global plan of action containing a menu of 'work areas and activities', in the form of voluntary national and international actions, for implementation of the Strategic Approach. The meeting also served as a vehicle for achieving the WSSD's goal of assuring that by the year 2020 chemicals are produced and used in ways that minimize significant adverse impacts on the environment and human health. The SAICM will also address the promotion of national regulatory infrastructure, technology transfer, and improved chemicals management. An additional benefit is expected to be enhanced implementation of the major global treaties on chemicals, including the PIC and Stockholm Conventions.

3 Conditions of Production and Use

Public authorities may respond to the risks presented by hazardous substances, products, or processes by establishing conditions under which these substances or products may safely be used or hazardous activities conducted in a safe manner. Alternatively, if some risks are deemed to be acceptable, a governmental regulatory authority may be charged with setting out allowable conditions of use or operation. This approach may, but need not necessarily, be employed together with a requirement for governmental approval, after a governmental authority has determined that the product or substance meets a regulatory standard but nonetheless must be used or deployed under limited circumstances to meet this standard. For instance, conditions of use are contemplated by the EU's REACH proposal, as well as existing EU and US chemicals legislation (section 2). The EC Directive 96/82 on the Control of Major-Accident Hazards Involving Dangerous Substances (Seveso II Directive) (section 5) is likewise an application of this regulatory approach to hazardous activities.

3.1 Stockholm Convention

Beyond the local risks posed by their toxicity, persistent organic chemicals (POPs) such as polychlorinated biphenyls (PCBs) are a global threat because they are stable and, hence, persist in the environment for long periods; because they consequently end up widely distributed geographically, oftentimes far from the place of manufacture or release; and because they accumulate in the fatty tissue of living organisms and therefore concentrate at higher levels of the food chain. The 2001 Stockholm Convention builds on years of work by international NGOs to target a 'dirty dozen' list of pesticides and industrial chemicals.

The Stockholm Convention goes farther than prior universal agreements addressing international trade in hazardous wastes, industrial chemicals, and pesticides (section 6) by directly limiting the production and release of certain chemicals at the domestic level, whether these substances are involved in international trade or not. The Stockholm Convention consequently is an example of harmonizing national policies on conditions of use, in some cases by eliminating the use of a substance altogether, at a potentially universal, global level. The Stockholm Convention, which entered into force in 2004, targets nine chemicals and categories of chemicals for elimination: the pesticides aldrin, chlordane, dieldrin, endrin, heptachlor, mirex, and toxaphene and the chemicals hexachlorobenzene and PCBs. The agreement also strictly limits the use of DDT to control disease-carrying insects and requires governments to limit unintentional releases of PCBs, hexachlorobenzene, dioxins, and furans.

As a dynamic instrument designed to be responsive to the needs of the future as well as the present, the Stockholm Convention contains a mechanism by which the parties can apply the stringent conditions of the convention to new substances as the need arises. This mechanism expressly states that decisions to list new chemicals should be taken on the basis of a precautionary approach. Many of the original dirty dozen chemicals had already been banned in major industrialized countries under domestic law, which explains the widespread support for the treaty. More opposition is expected to the banning or restriction of new substances under the treaty, which may impinge upon profitable industries in the developed world.

The Global Environment Facility serves as the funding mechanism under the convention and has financed pilot programs for the development of national implementation plans for the management of POPs, as required by the convention, by developing and newly industrialized countries. The convention also includes an important information-exchange component, including a clearinghouse function for sharing information provided by governments, intergovernmental organizations, and NGOs, which complements similar efforts coordinated by the IOMC.

3.2 Multilaterally Agreed Standards for Pesticides and Other Toxics

Since 1985, the voluntary FAO Code of Conduct on the Distribution and Use of Pesticides, which was newly revised in 2002, has been the internationally accepted standard for labelling, packaging, storage, and disposal, and pesticide management. Similarly, the OECD's Guidelines for Multinational Enterprises, originally adopted in 1976, were subsequently amended to include a section devoted entirely to standards addressed directly to multinational corporations in the area of the environment.[8] Both of these instruments apply not only to potentially toxic materials but also to operations involving hazardous substances or processes. Each of these efforts, consistent with its non-binding character, is addressed not only to national governments but also directly to a variety of public and private actors, including local officials, industry, workers, consumers, NGOs, and the public generally.

Alternatives to formal treaties may be particularly well suited to certain institutional settings. For example, through the process of negotiating loan agreements with sovereign states on a case-by-case basis, the World Bank is uniquely positioned to influence policies in those states, principally developing countries, which borrow from the bank. The bank's loan preparation process is governed by a series of instruments known as 'operational policies', 'bank procedures', and 'good practices' in such areas as pest management and environmental assessment (section 9.2). In principle,

[8] OECD, *Guidelines for Multinational Enterprises* (Paris: OECD, 2000).

the first two categories are internally binding on bank personnel and the third advisory, but the force of the instruments may vary depending on their terms.

4 Regulation of Pollutant Releases

Establishing conditions of use, as discussed in the previous section, is a public policy strategy that can be usefully employed in certain cases to reduce the risk presented by a hazardous substance or product. Such an approach may be particularly appropriate for reducing workplace risks from toxic substances or to protect those who use them, such as pesticide applicators or consumers. There may also be concern for environmental exposures to, for example, a toxic pollutant that may have adverse consequences for public health or the environment or both. While establishing conditions of use may reduce some risks resulting from exposures to toxic substances, this approach may not be sufficient to protect the public and the environment from harmful levels of exposure to pollutants released as by-products of industrial, manufacturing, or other activities.

Public policies for limiting exposures to toxic or hazardous materials may be articulated in a number of ways. One approach is to limit emissions as such—a strategy that may be expressed in a regulatory sense as an upper bound on acceptable levels of releases of the substance in question. This may be a particularly attractive option if policymakers choose to control releases based on available technology, in which case the emissions limitations may reflect the level of technology chosen, often by reference to an adjective standard such as 'best' technology or 'maximum' control. One drawback to emissions limitations phrased by reference to available technologies is that it may be difficult to correlate the regulatory standard to real-world exposures. In other words, if there are enough sources, then even stringent emissions limitations may still result in unacceptable ambient concentrations of a toxic pollutant.

Another approach is to establish limitations on environmental exposures as such, a strategy that is typically articulated as an upper limit on ambient concentrations of the substance in question. While this approach may be more directly linked to exposures, it is also not free of conceptual and practical difficulties. A regulatory authority must establish an 'acceptable' concentration or level of exposure, which may be politically controversial or scientifically difficult. Ultimately, the ambient exposure limitation must be implemented by reductions in emissions from sources, necessitating sometimes complicated extrapolations or modeling to correlate source emissions with environmental concentrations. Empirical monitoring, moreover, is necessary to assure that the regulatory targets in the form of maximum ambient concentrations have been achieved.

National and supranational regulatory approaches contain examples of each of these strategies—emissions limitations and control of ambient concentrations—with both

often employed simultaneously. For example, United States law and policy for addressing air pollutants relies on an ambient approach to protecting public health and the environment from harmful concentrations of most air pollutants, including at least one toxic substance, lead.[9] Technology-based controls apply to a list of 189 other toxic chemicals pursuant to a statutorily specified schedule. The EU's air pollution legislation reflects a similar range of approaches to emissions limitations. A framework directive was adopted in 1996 with the goal of controlling ambient environmental exposures to air pollutants and monitoring their concentrations in the air.[10] By contrast, a directive adopted in 2000 addressing waste incineration requires the establishment of emissions limitations for a variety of conventional pollutants as well as toxics such as heavy metals.[11]

Likewise, United States policy with respect to water pollution includes both technology-based emissions limitations for hazardous substances as a primary approach, with limitations on ambient concentrations of toxic water pollutants as a secondary, residual strategy.[12] Similarly, under a framework directive in the field of water policy, the EU requires the attainment of basin-wide water quality objectives.[13] Pursuant to an instruction in the framework directive, the EU has established a list of 33 toxic chemicals and categories of chemicals for priority consideration, with the goal of eliminating emissions and discharges of those hazardous substances within twenty years.[14]

4.1 UN Economic Commission for Europe (UNECE) Protocols on Air Pollution

The UNECE, whose membership includes all states of both eastern and western Europe as well as Canada and the United States, has been working for several decades on questions of air pollution. A Convention on Long-Range Transboundary Air Pollution (LRTAP Convention) was concluded in 1979 under UNECE auspices (→ Chapter 14 'Atmosphere and Outer Space'). The LRTAP Convention was one of the first international environmental agreements to be structured as a 'framework' convention, consciously designed to serve as a vehicle for ongoing multilateral cooperation (→ Chapter 20 'Treaty Making and Treaty Evolution'). The convention

[9] Clean Air Act, 42 U.S.C., secs. 7401–7671q.

[10] EC Directive 96/62 on Ambient Air Quality Assessment and Management, [1996] O.J. L296/55.

[11] EC Directive 2000/76 on the Incineration of Waste, [2000] O.J. L332/91.

[12] Clean Water Act, 33 U.S.C., secs. 1251–387.

[13] EC Directive 2000/60 Establishing a Framework for Community Action in the Field of Water Policy, [2000] O.J. L327/1.

[14] EC Commission Decision 2455/2001 Establishing the List of Priority Substances in the Field of Water Policy and amending EC Directive 2000/60, [2001] O.J. L331/1. As of this writing, no specific control measures for any of these substances have yet been proposed by the Commission.

consequently articulates no more than a general commitment to 'limit and, as far as possible, gradually reduce and prevent air pollution.'

Ancillary agreements, or 'protocols,' containing substantive regulatory measures were subsequently appended to the convention. A 1998 Protocol to the LRTAP Convention on Persistent Organic Pollutants (POPs Protocol) addresses this category of toxics in the context of regional air pollution in a manner complementary to the globally applicable Stockholm Convention (section 3.1). The POPs Protocol, which governs 16 POPs—a wider coverage than the Stockholm Convention—eliminates the production and use of some substances, restricts the uses of others, establishes emissions limitations, and specifies waste management practices.

A second Protocol to the LRTAP Convention on Heavy Metals, which was adopted in 1998, addresses three toxics: cadmium, lead, and mercury. This instrument relies primarily on an emissions reduction strategy for achieving its policy goals. The agreement requires parties to it to reduce emissions of those three heavy metals by reference to a base year—an international regulatory technique frequently encountered in the regulation of toxics. The instrument also specifies numerical technology-based emissions limitations and target dates for new and existing stationary sources in eleven enumerated categories. The agreement likewise sets out technology- and process-based emissions limitations for major industrial categories, including iron and steel, non-ferrous metals, power generation, road transport, and waste incineration.

4.2 Multilateral Agreements on Land-Based Sources of Marine Pollution

Part XII of the 1982 United Nations Convention on the Law of the Sea articulates obligations for states to regulate pollutant releases on land, including toxics, that may contaminate the marine environment. In 1995, following a mandate in Chapter 17 of Agenda 21, more than 100 states participated in drafting the Washington Declaration on Protection of the Marine Environment from Land-Based Activities. The declaration launched a new initiative under UNEP auspices, the Global Program of Action for the Protection of the Marine Environment from Land-Based Activities (GPA). Among the goals of the GPA are the reduction of emissions of such toxic substances as POPs, radioactive substances, heavy metals, and hydrocarbons including oil.

Both before and after the adoption of the Washington Declaration, regional multilateral agreements addressing the environment in particular marine areas have been a principal vehicle for addressing environmental hazards from land-based sources. As of this writing, the UNEP regional seas program, initiated in 1974 as a result of the 1972 Stockholm Conference on the Human Environment, covers thirteen geographic regions. Ancillary protocols on land-based sources of marine pollution (LBS protocols) have been adopted under the auspices of many of these regional

seas conventions, including those for the Mediterranean, the southeast Pacific, the Persian Gulf (ROPME Sea Area), the Black Sea, and the wider Caribbean. The post-1995 protocols, including those for the Mediterranean and the wider Caribbean—neither of which is in force as of this writing—have adopted a comprehensive basin-wide approach to sources of water pollution, including toxics, that may adversely affect the marine environment. As in the case of the ECE LRTAP regime, to the extent that the regional LBS protocols govern substances such as POPs, these agreements are complementary to global regulatory instruments such as the Stockholm Convention (section 3.1).

In addition to requirements that parties adopt national plans and programs, the UNEP LBS protocols contain specific regulatory requirements designed to address land-based pollution. For example, in addition to the toxics enumerated in the GPA, both the Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources and Activities and the Protocol Concerning Pollution from Land-Based Sources and Activities in the Wider Caribbean Region identify organophosphorous compounds, organotin compounds, cyanides, and fluorides as substances to be addressed under the agreements. Other regional agreements addressing toxic water pollution of onshore origin that are not part of the UNEP regional seas program include the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention), and the Convention on the Protection of the Marine Environment of the Baltic Sea Area (Helsinki Convention).

5 Hazardous Processes and Industrial Accidents

Several major industrial accidents in the latter part of the twentieth century alerted governments and the public to the potential not only for hazardous substances but also for manufacturing processes employing them to present risks to the environment and public health. In 1976, an industrial installation in the Italian town of Seveso released a cloud of dioxin, requiring the evacuation of more than 600 people and the treatment of several times that many for dioxin poisoning. In 1984, methyl isocyanate escaped from a US-owned pesticide plant in Bhopal, India, and killed 2,000 people. In 1986, water used to combat a fire in the Sandoz Chemical Company's industrial compound near Basel, Switzerland, resulted in the release of mercury compounds, pesticides, and other agricultural chemicals into the Rhine River, which transported the pollution downstream to Germany, France, and the Netherlands, causing a massive fish die-off.

These events, as well as others less well publicized, have focused attention on manufacturing processes as a potential juncture for regulation. One obvious goal of regulatory interventions in this area is to reduce the risks of accidents such as those at Seveso and Bhopal. Addressing manufacturing processes also provides another, perhaps less apparent, opportunity to encourage shifts towards less polluting, more sustainable manufacturing practices. As illustrated by the Bhopal catastrophe, which involved foreign investment, and the Sandoz spill, a case of transboundary pollution, there is also an important international dimension to this issue.

The EEC Directive 82/501 on the Major-Accident Hazards of Certain Industrial Activities, the first and most influential instrument in the field, was adopted in 1982, amended after the Bhopal and Sandoz incidents, and overhauled and replaced by a new directive (Seveso II Directive) in 1996.[15] The Seveso II Directive addresses not only hazardous substances in industrial installations, including the storage of toxic chemicals, but also hazardous processes themselves. Under the directive, operators of industrial establishments governed by the instrument must notify the competent national authority and establish a major accident prevention policy. Operators at the most rigorous regulatory tier in addition must file a safety report, a safety management system, and an emergency plan. Unlike in the EU, no single instrument in the United States governs emergency preparedness and chemical accidents. Federal legislation nonetheless requires that public authorities, including state and local governments, must craft an emergency response plan, review it at least annually, and inform the public about chemicals in the community. Industrial installations must adopt a facility-specific risk management program and notify public authorities of emergency releases of any of 364 extremely hazardous substances.[16]

5.1 ECE Convention on the Transboundary Effects of Industrial Accidents

The Convention on the Transboundary Effects of Industrial Accidents, negotiated and adopted in 1992 under the auspices of the ECE, is a multilateral effort along the lines of the Seveso Directives but addressed more generally to Europe and North America. Like the Seveso Directives, the convention, which entered into force in 2000, aims at protecting public health and the environment by reducing the likelihood of such events, along with measures designed to mitigate the effects of those that do occur. The convention promotes international cooperation among the parties to it before, during, and after an industrial accident.

[15] EC Directive 96/82 on the Control of Major-Accident Hazards, [1997] O.J. L10/13.

[16] Emergency Planning and Community Right-to-Know Act of 1986, 42 U.S.C., secs. 11001–11050; and Clean Air Act, 42 U.S.C., sec. 112(r) and sec. 7412(r).

The convention obliges parties first to identify hazardous operations within their borders that could have transboundary effects in the event of an accident. After identification, parties must inform the other parties that could be affected and consult with them. The convention directs that new installations be sited in areas where the risks are minimized, and that potential transboundary effects be disclosed and analyzed in advance. In the area of preparedness, hazardous operations must have both on-site and off-site contingency plans. In situations in which several parties to the convention might be affected by a hazardous operation, the convention specifies that they work together. The convention additionally articulates standards for informing and consulting with the public, including administrative and judicial remedies.

In the event of an accident, the convention requires early notification to other parties and calls on the parties to establish special notification systems for this purpose, the UNECE Industrial Accident Notification System. Additionally, parties must take action to minimize transboundary effects, in cooperation with other parties to the extent required by the situation. Each party to the convention must designate a competent authority as a focal point for communication and action with respect to the convention's obligations.[17]

5.2 Multilaterally Agreed Good Practice Standards for Industrial Accidents

As in other areas covered by this chapter, industrial accidents have been addressed through non-binding approaches, and other indirect leverage points in the international system. The OECD Working Group on Chemical Accidents has adopted *Guiding Principles for Chemical Accident Prevention, Preparedness, and Response*.[18] The principles address planning, construction, management, operation, and review of the safety performance of industrial installations employing hazardous processes. The guidelines, consistent with their non-binding character, are not confined to the role of national governments but instead are addressed directly to public authorities, industry, employees, NGOs, and the public generally.

The OECD *Guidelines for Multinational Enterprises* (section 3.2) specify that private entities addressed by that instrument should maintain contingency plans to prevent and control accidents and emergencies; should report accidents immediately to public authorities; and should educate workers in the proper handling of hazardous materials so as to avoid accidents. A companion *Guidance on Safety Performance Indicators* is intended to help facilities engaged in hazardous activities,

[17] International Labour Organization (ILO) Convention no. 174 on the Prevention of Major Industrial Accidents adopts an analogous approach at the global level.

[18] OECD, *Guiding Principles for Chemical Accident Prevention, Preparedness, and Response* (Paris: OECD, 2003).

governmental authorities, and the local public assess the efficacy of efforts to reduce the risk of industrial accidents and their effects should an incident nonetheless occur.[19]

Development assistance administered through the World Bank or bilateral aid agencies, and external financing of private projects through sources such as the World Bank's International Finance Corporation, are also occasions to influence public policy and private behaviour in the area of industrial accidents. The World Bank's 1998 *Pollution Prevention and Abatement Handbook* emphasizes opportunities for investment in less-polluting technologies and processes and sound management techniques in key mining and manufacturing sectors such as pesticide production and oil and gas development. Additionally, the handbook, which is intended to be applied in connection with the bank's environmental assessment policy (section 3.2), specifies the need for contingency plans to minimize accidental releases and emergency response procedures to manage accidents when they occur.

6 International Trade in Hazardous Substances, Products, and Waste

All of the regulatory strategies identified so far can be, and have been, applied within national jurisdictions and by the supranational EU to intervene in what otherwise would be unregulated markets. At the national and supranational level, those regulatory interventions typically involve imposing obligations on private parties such as businesses and industries that produce products or engage in activities that may, at least under some circumstances, pose unacceptable risks to public health or the environment.

In the international arena, analogous interventions that make use of governmental regulatory authorities or national police powers may not be possible. In a world of co-equal sovereign states whose governmental powers are generally limited by the extent of each country's territorial jurisdiction, it may be difficult or impossible for structural or legal reasons for governments to take action to abate risks that emanate from abroad. Multilateral cooperation of necessity tends to rely on consent and consensus, which may be difficult or impossible to secure so as to respond to risks from hazardous substances or activities that have a transnational dimension, leading governments and non-state actors alike to look to unilateral self-help as an alternative to concerted international action.

Internationally, the point at which something—a bulk shipment of a substance, a finished product, a service, capital, or know-how—crosses a national border consequently assumes commensurately greater importance as a potential juncture at

[19] OECD, *Guidance on Safety Performance Indicators* (Paris: OECD, 2005).

which regulatory requirements designed to reduce risks from toxics might be applied. Transboundary movements of hazardous substances such as industrial chemicals, pesticides, or toxic waste may also themselves present risks. For reasons such as these, the regulation of transboundary trade in hazardous substances has received considerable attention on the international level. There has also been a great deal of interest in the relationship between the agreements discussed in this section, which regulate trade in discrete categories of toxic substances through prescriptive governmental action, and the negative disciplines contained in free trade agreements such as World Trade Organization rules (→ Chapter 7 'Relationship between International Environmental Law and Other Branches of International Law').

International trade in hazardous substances and products also raises significant North-South issues. After banning or severely restricting substances to protect health and the environment within their territories, industrialized countries have in some cases continued to allow those same substances to be exported. Developing countries in response have objected to a 'double standard' in which private enterprises in the industrialized world may profit at the expense of poorer countries, which may not have the technical capacity, the resources, or the governmental infrastructure to control the entry of these substances into their territory or to regulate their domestic use. Multilateral treatment of trade in hazardous substances consequently has been a vehicle for addressing the broader needs of developing countries in such areas as regulatory infrastructure, capacity building, technical cooperation, and development assistance. Negotiations on these instruments have also been permeated by delicate considerations of equity and morality.

6.1 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (Basel Convention) and the Convention on the Ban of the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa (Bamako Convention)

The Basel Convention, which was adopted in 1989 and entered into force in 1992, was the first potentially universal, binding instrument addressing international trade in wastes, including both hazardous wastes and municipal trash. With respect to states not party to this instrument, the convention establishes a 'limited ban'. Specifically, the Basel Convention prohibits exportation from parties to non-parties and limits transboundary movements of wastes, both imports and exports, only to those states that are parties to the convention unless a party has entered into a bilateral agreement on waste shipments that satisfies Article 11 of the convention (section 8.1).

Among parties to the agreement, the core regulatory approach of the Basel Convention is the establishment of a 'prior informed consent' (PIC) regime. Accordingly, every state party to the convention may choose to ban the importation of hazardous or other wastes. With respect to other states party to the convention that have not prohibited waste imports, the government of the country of export must assure prior notification to the governments of the receiving state and any transit states in advance of a waste shipment. The shipment may not commence until the government of the proposed state of import has given its consent in writing. Based on the written consent of relevant states of import, states of export may allow exporters to use a 'general' notification procedure for up to one year for multiple shipments of the same types of wastes.

The third Conference of the Parties to the Basel Convention, which was held in Geneva in September 1995, adopted an amendment to the agreement intended to ban North-South shipments of hazardous waste intended for disposal, as defined roughly along OECD–non-OECD lines, among parties to the amendment. The amendment also phases out shipments of hazardous wastes from the same group of primarily OECD countries intended for recovery or recycling to other states outside this group. The adoption of the North-South ban amendment, which has been criticized in some quarters as paternalistic and environmentally counterproductive, is indicative of substantial continued concern about the environmental integrity of shipments from developed to developing countries.

Even before the Basel Convention was adopted, there were pressures to strengthen the rigour and intensity with which this instrument controls international trade in wastes. African states expressed concern over the Basel Convention's failure fully to ban transboundary movements of hazardous and other wastes, and no sub-Saharan African country signed the convention at the time of its adoption. Under the auspices of the Organization of African Unity (now the African Union), those countries in 1991 adopted a stronger regional agreement, the Bamako Convention. The Bamako Convention bans imports of hazardous waste into Africa and creates a PIC procedure for trade within Africa.[20]

6.2 PIC Convention

Like the Basel Convention, the PIC Convention, which was concluded in 1998 and entered into force in 2004, establishes a legally binding regime for applying PIC

[20] Other regional agreements include the 1996 Izmir Protocol to the Barcelona Convention for the Protection of the Mediterranean Sea against Pollution (section 4.2); the 1995 Waigani Convention to Ban the Importation into Forum Island Countries of Hazardous and Radioactive Wastes and to Control the Transboundary Movement and Management of Hazardous Wastes within the South Pacific Region; and the 1992 Central American Regional Agreement on Transboundary Movements of Hazardous Wastes.

principles to international shipments of hazardous chemicals and pesticides. The PIC Convention applies to goods in the form of chemicals in international commerce, in contrast to the Basel Convention, which applies to presumptively harmful detritus or 'bads.' As with the Basel Convention, the principal motivation for the agreement was to assist developing countries that might have limited regulatory capacity or difficulty controlling imports to implement their own domestic environmental and public health policies.

The PIC Convention addresses pesticides and industrial chemicals that have been banned or severely restricted for health or environmental reasons by parties, and which have been notified by parties for inclusion in the PIC procedure. The agreement requires that any import ban be universal and non-discriminatory. That is, a party cannot refuse to import a chemical from another party while continuing to permit domestic production or allowing imports from other parties or from non-parties. At the time it was adopted, the convention's requirements applied to twenty-two pesticides and five industrial chemicals. The convention also contains provisions for exchange of information concerning potentially hazardous chemicals in international trade, and channels for providing technical assistance to developing countries to improve their domestic capabilities to manage toxic chemicals and pesticides.

With respect to the covered substances, the convention requires the formal, written consent of the government of the state of import before exportation may take place. In response to a notification from the Convention secretariat, a state of import that is a party to the convention may decide to allow importation of the chemical, to prohibit importation, or to allow importation subject to specified conditions. Alternatively, the convention provides that states of import may provide an interim response. Like the Stockholm Convention (section 3.1), the PIC Convention contains a mechanism for subsequent additions to the list of covered substances.

6.3 Cartagena Protocol on Biosafety (Cartagena Protocol)

The Cartagena Protocol, an ancillary instrument to the 1992 United Nations Convention on Biological Diversity, was adopted in January 2000 and entered into force in September 2003. The protocol governs genetically modified food and crops, which strictly speaking are not toxic substances. Its public policy approach, however, is similar to those in the Basel and PIC Conventions. The Cartagena Protocol expressly articulates a public policy of precaution, and the instrument as a whole can be seen as an embodiment of this approach.

The principal regulatory vehicle in the protocol is the requirement for 'advanced informed agreement' (AIA), which is analogous to the PIC requirements established for hazardous wastes under the Basel Convention and for chemicals and pesticides in

the PIC Convention. The protocol requires as a first step in the AIA process advance notice to the state of import before the first exportation of a living modified organism (LMO). The state of import then has a right to permit, deny, or impose conditions on the importation of the LMO in question and must ensure that a risk assessment has been performed. The other principal substantive aspect of the Cartagena Protocol concerns the establishment of a biosafety clearinghouse designed to facilitate the exchange of scientific, technical, environmental, and legal information on, and experience with, living modified organisms, with particular attention to the needs of developing countries.

LMOs as defined in the protocol include those intended for release into the environment, such as seeds, as well as those intended for human food or animal feed, but does not as a general matter include pharmaceuticals. LMOs intended for direct use as food or feed are not covered by the AIA procedure. As to LMOs intended for food, feed, or processing, the biosafety clearinghouse must be notified within fifteen days of a decision regarding domestic use, including domestic marketing with a potential for exportation.

7 Disposal of Toxic Waste

The lifecycle of a hazardous substance may result in release into the environment, typically to the media of air or water, at which juncture regulatory requirements, typically in the form of emissions limitations, may apply (section 4). Alternatively, a particular toxic substance may ultimately find its way into industrial waste as a component of the detritus remaining at the conclusion of a manufacturing process. Similarly, household or consumer products consisting of or containing hazardous materials may enter the waste stream. As with releases of toxics to the environment, the treatment, storage, and disposal of hazardous waste presents risks to public health and the environment that have been addressed by regulatory policies.

In the United States, statutory requirements establish minimum technical and scientific standards for hazardous waste.[21] For instance, hazardous waste landfills must have double liners, leachate collection systems, and groundwater monitoring facilities. The principal mechanism for implementing the statute is a requirement that existing and new facilities obtain a federal operating permit. The statute also establishes the so-called 'cradle-to-grave' manifest or tracking system to ensure that waste ultimately arrives at a permitted facility. EU legislation is similar in establishing technical requirements for waste and its treatment with the goal of reducing

[21] Resource Conservation and Recovery Act of 1976, 42 U.S.C., secs. 6901–6992k.

adverse impacts on public health and the environment.[22] The legislation identifies a variety of categories of waste—municipal waste, hazardous waste, non-hazardous waste, and inert waste—and specifies requirements for landfills that may accept each category. Like the US legislation, the directive sets up a system of operating permits for landfill sites.

The binding obligations contained in the Basel Convention (sections 6.1 and 8.1) address the ultimate fate of waste governed by the agreement as part of its strategy of regulating trade in this hazardous commodity. Other international regimes target disposal more directly by attempting to harmonize national regulatory approaches.

7.1 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention)

The London Convention, for which the International Maritime Organization serves as Secretariat, is a multilateral agreement of potentially global scope designed to address one component of the disposal problem, namely dumping at sea (→ Chapter 15 'Ocean and Freshwater Resources'). The London Convention, like a number of regional agreements adopted after it, adopts a listing approach. A 'black list' identifies substances, including compounds containing the toxic heavy metals mercury and cadmium, and organohalogen pesticides, whose dumping is prohibited altogether. A second 'grey list' includes substances such as wastes containing other heavy metals, which require a special permit in advance. Since its adoption in 1972, the London Convention has been amended several times, most notably to ban ocean incineration of wastes and the disposal at sea of low-level radioactive waste.

The Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and other Matter, which entered into force in March 2006, supersedes the 1972 instrument for parties to both agreements. The protocol is based on a precautionary theory of regulation expressly articulated in the text and consequently is much more restrictive than the earlier instrument. To this end, the protocol, in a regulatory approach that is in direct contrast to the 1972 London Convention, prohibits ocean dumping altogether unless the activity is specifically authorized by the new agreement. Among the very restricted categories of waste for which ocean disposal is allowed are dredged material; sewage sludge; waste from fishing operations; vessels, platforms, and other man-made structures; inert, inorganic geological material; and organic material of natural origin. The protocol also prohibits ocean incineration and the exportation of wastes to other states for dumping at sea.

[22] EC Directive 99/31 on the Landfill of Waste, [1999] O.J. L182/1.

7.2 International Atomic Energy Agency's (IAEA) Agreements and Standards

Nuclear safety, along with technology transfer and verification, is one of the three pillars of the IAEA's program. After the Chernobyl accident, four binding multilateral agreements in the area of nuclear safety were adopted under IAEA auspices. One of these agreements, the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention), which was adopted in 1997 and entered into force 2001, is the first binding international agreement to address the management and storage of radioactive waste and spent fuel in countries that do and do not have nuclear programs. The Joint Convention builds on the earlier IAEA Principles of Radioactive Waste Management, which were published in 1995.

The goal of the Joint Convention is to assure that individuals, society, and the environment are adequately protected against radiological hazards. The convention requires states parties to establish and maintain a legislative and regulatory framework to govern the safety of spent fuel and radioactive waste management through a system of licensing of facilities by a national regulatory body. The agreement sets out standards for the siting, design, construction, operation, closure, and safety assessment of spent fuel management and radioactive waste management facilities. Both existing and proposed facilities are covered by the Joint Convention, which also articulates general requirements for safe operation. Additionally, the Joint Convention sets out a regime of notification and consent for transboundary movements of radioactive waste based on the 1990 IAEA Code of Practice on the International Transboundary Movement of Radioactive Waste.

Other IAEA agreements are also designed to further the goal of nuclear safety. The Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of Nuclear Accident or Radiological Emergency are intended to facilitate international preparedness for, and responses to, nuclear and radiological emergencies. The Convention on Nuclear Safety obliges states parties to operate nuclear power plants in a manner consistent with high standards of safety. The Convention on Nuclear Safety requires each party to develop and enforce safety standards, but it does not itself prescribe the standards. Consequently, there is no internationally binding instrument that sets minimum safety standards for nuclear reactors.

The IAEA has also adopted hundreds of safety standards, which are not binding on IAEA member countries, intended in part to serve as models of good practice for states in crafting their own legislation and regulations. These safety standards are further categorized as fundamental principles, mandatory requirements, and recommended guidance. Published IAEA standards in the area of radioactive waste management include those addressing the classification of radioactive waste, the predisposal management of radioactive waste, and the management of radioactive waste from medicine, industry, research, agriculture, and education.

8 Integrated Approaches to Pollution Prevention

As a result of the difficulty of managing hazardous substances and products once they have been produced, attention in recent years has shifted to a more comprehensive approach that focuses on minimizing the likelihood of adverse effects for the environment and public health—'pollution prevention'. In the area of hazardous substances and products, the emphasis has been on minimizing the need for toxic substances either in manufacturing processes or finished products—'toxics use reduction'.

For example, legislation adopted by Massachusetts, a subnational unit in the United States, is an effort at implementing precautionary perspectives underlying a toxics use reduction approach.[23] The statute does not regulate based on risk or 'safe' levels of exposure or emission but, instead, encourages reductions in the use of about 1,400 enumerated industrial chemicals by setting out specific, numerical reduction targets by comparison with a reference baseline. The EU's volatile organic chemicals (VOC) solvents directives adopt a similar approach by permitting Member States to adopt use reduction plans as an alternative to command-and-control end-of-pipe emissions limitations.[24]

8.1 Basel Convention

Few binding international agreements address pollution prevention as a regulatory tool, presumably because the approach is still crystallizing as a public policy option at the domestic level. One exception is the Basel Convention (section 6.1), whose overall strategy is to limit the transboundary shipments of wastes. Accordingly, the convention encourages the generation of wastes to be reduced to a minimum—a requirement that can be seen as a particularized expression of the precautionary and polluter-pays principles. In part to reduce the need for international shipments of wastes, parties to the convention are to assure the availability of facilities for sound management of wastes within their territories. Wastes may be exported only under certain conditions, including the unavailability of suitable disposal facilities in the country of generation and the need for wastes as a raw material for recycling or recovery operations in the state of import.

Other provisions of the Basel Convention indirectly encourage waste reduction. Notwithstanding the consent of the proposed state of import, the convention requires that states of export prohibit shipments of hazardous and other wastes if

[23] Toxic Use Reduction Act of 1989, Mass. Gen. L. ch. 21I, secs. 1–23.

[24] EC Directive 93/13 on the Limitation of Emissions of Volatile Organic Compounds Due to the Use of Organic Solvents in Certain Activities and Installations, [1993] O.J. L85/1.

there is reason to believe that the wastes will not be managed in an environmentally sound manner in the country of import. The convention also articulates an obligation for states of export to ensure that international shipments of wastes are accepted for re-import if those shipments do not conform to the terms of export. Article 11 of the Basel Convention specifies that the requirements of the convention will not apply to transboundary movements between parties and non-parties that are governed by bilateral or regional arrangements that meet certain standards. In particular, Article 11 agreements concluded after the entry into force of the Basel Convention must contain provisions that are 'not less environmentally sound' than those in the convention.

8.2 OECD Recommendation on Pollution Prevention

The OECD in 1990 adopted a non-binding recommendation on integrated pollution prevention and control.[25] The recommendation contains an appendix entitled 'Guidance on Integrated Pollution Prevention and Control', which identifies basic principles, including the consideration of the entire lifecycle of substances and products; the anticipation of environmental effects in a variety of environmental media, including consideration of multiple pathways to exposure and movement through the environment; the minimization of waste; and the application of a precautionary decision-making approach. The recommendation also identifies the desirability of zero- or low-waste technology, recycling, and alternative manufacturing strategies designed to reduce the use of toxic substances. The form of this instrument, a non-binding recommendation adopted by wealthier industrialized countries, is perhaps indicative of the emerging nature of pollution prevention as a regulatory strategy on the international level.

9 Other Related Policies

Several fundamental approaches of international environmental law of a more procedural nature may also come into play in addressing public policies related to hazardous substances or processes. While not confined to situations involving toxics, these regulatory approaches have particular utility in this area.

9.1 Right to Know

One public policy approach to reducing risks from hazardous substances and activities is to inform the public of releases of potentially toxic substances, of the presence

[25] OECD Doc. C(90)164.

of potentially dangerous activities, or of the nature or magnitude of associated risks. Public information approaches can complement other substantive regulatory approaches, such as those related to industrial accidents (section 5). Provision of information can also comprise a complete public policy in itself, which is designed to allow consumers, workers, and members of the public to make informed choices about the risks associated with the products they purchase, the quality of the environment where they live, and potential hazards in the workplace.

As suggested by the catchphrase 'knowledge is power', information about the nature of the local environment can catalyze community activism to address appropriate responses to toxic hazards by holding local businesses and municipal governments accountable. Indeed, the anticipated release of potentially anxiety-provoking information may encourage those who have control over the situation, such as polluting industries, voluntarily to reduce risks or even to incorporate risk-reduction strategies into their ordinary business plans. Last, information disclosure is among the least intrusive forms of governmental intervention. In certain situations in which proposals for substantive prescriptive regulation may encounter political opposition, labelling and public reporting may be an effective alternative that can be expected to achieve similar or identical results.

The ECE Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Aarhus Convention), which was adopted in 1998, articulates an express link between governmental provision of information to the public and environmental protection (→ Chapter 29 'Public Participation). To this extent, the Aarhus Convention addresses principles of democratic accountability and good government more generally. The convention, which entered into force in 2001, creates rights to information on the part of the public and obligations for public authorities regarding access to this information. An extraordinary meeting of the parties held in Kiev, Ukraine in 2003 adopted a Protocol on Pollutant Release and Transfer Registers—an approach employed at the domestic level involving the collection and dissemination of toxic emissions released into the environment.

9.2 Environmental Impact Assessment (EIA)

EIA is a component of a planning process by which environmental considerations are integrated into decision-making procedures for activities that may have adverse environmental effects. The emphasis in EIA is on the collection and analysis of information relating to the environmental consequences of a proposed action. EIA is a process-oriented analytical technique distinct from substantive environmental standards and requirements. The principal purpose of EIA is to facilitate informed decision-making through a thorough scrutiny of anticipated environmental effects.

With the assistance of this analysis, an informed decision-maker should be able to assess the advisability of proceeding with proposed actions and to modify proposals to eliminate or mitigate their adverse environmental effects.

While not confined to the field of toxics, EIA is useful for identifying and analyzing potential adverse effects from hazardous substances and activities. An EIA would be expected to project the likely and potential effects of toxic substances or dangerous activities on the environment and public health. Application of the EIA methodology would likely provide an opportunity to consider less hazardous or environmentally preferable alternatives to the proposed action. The EIA would also be expected to consider mitigating measures to reduce risks from hazardous substances and activities and contingency plans in the event of a mishap.

A wide variety of international instruments encourage or mandate the application of the EIA methodology at the national level by reference to internationally harmonized criteria, to cases of actual or potential pollution of the territory of other states or of areas beyond national jurisdiction, and in the development assistance projects, policies, and programs. Any or all of these instruments could apply to a hazardous substance or process. Some agreements, such as the 1991 ECE Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention), apply to EIA as such. Others, like the IAEA Joint Convention (section 7.2) employ EIA as a procedural tool to achieve public policy purposes related to the substantive goals of the agreement.

10 Conclusion

There is at present no single, overarching international institutional framework for addressing environmental and public health risks from hazardous substances and activities. Public policy has been implemented at the national, supranational, regional, and global levels, sometimes simultaneously, with considerable interaction among various settings. Like-minded countries, such as members of the OECD, may coordinate policies among themselves, or a universal strategy such as that found in the Stockholm Convention may be adopted. International instruments, as in the case of the Basel and PIC Conventions, may be consciously targeted to address North-South issues.

In almost every situation, there are also choices to be made between non-binding 'soft' instruments and binding international agreements, with advantages and drawbacks accompanying either choice of the form of instrument. And this is before even contemplating the variety of regulatory tools available to address a particular problem, ranging from modest requirements, such as access to information, to bans on particular substances or rigorous requirements for governmental approval.

While the broader picture is far from systematic or neat, this outlook is perhaps all to the good from the perspective of international policy. The difficulties in effectively reducing risks from hazardous substances and activities are varied and multifaceted at the domestic and supranational levels, and the impediments are even more imposing internationally. The wider the array of options, the greater the potential for creatively meeting new challenges. Given the scope of the problem, we can hardly afford to ignore any realistic options among this exceedingly broad array.

Recommended Reading

C. Bail, R. Falkner, and H. Marquard, eds., *Reconciling Trade in Biotechnology with Environment and Development? The Cartagena Protocol on Biosafety* (London: Royal Institute of International Affairs, 2002).

R. Brickman, S. Jasanoff, and T. Ilgen, *Controlling Chemicals: The Politics of Regulation in Europe and the United States* (Ithaca: Cornell University Press, 1985).

J. Clapp, *Toxic Exports: The Transfer of Hazardous Wastes from Rich to Poor Countries* (Ithaca: Cornell University Press, 2001).

D. Hunter, J. Salzman, and D. Zaelke, *International Environmental Law and Policy*, 2nd edition (New York: Foundation Press, 2002).

S. Jasanoff, ed., *Learning from Disaster: Risk Management after Bhopal* (Philadelphia: University of Pennsylvania Press, 1994).

K. Kummer, *International Management of Hazardous Wastes: The Basel Convention and Related Legal Rules* (Oxford: Oxford University Press, 1995).

M.A. Olsen, *Analysis of the Stockholm Convention on Persistent Organic Pollutants* (Dobbs Ferry, NY: Oceana, 2003).

M. Pallemaerts, *Toxics and Transnational Law: International and European Regulation of Toxic Substances as Legal Symbolism* (Oxford: Hart Publishing, 2003).