



Citizen's Guide to the implementation of the Stockholm Convention

Fernando Bejarano González

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Citizen's
Guide to the

STOCKHOLM CONVENTION



IPEN[®]
International POPs Elimination Network



Swiss Agency for
Development
and Cooperation
SDC



Swiss Agency for
the Environment,
Forests and
Landscape SAEFL

Fernando Bejarano
González

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Fernando Bejarano González

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Foreword

by Klaus Toepfer
Executive Director
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Revelations about the contamination of marine mammals by persistent organic pollutants (POPs), and thus their presence in the human food chain, were among the first alarm bells that woke the world to the threats of these long-lived and highly toxic chemicals to environmental and human health. Among the chief bell ringers was Sheila Watt-Cloutier. The Stockholm Convention on POPs is, in large part, testament to her tireless campaign on behalf of the Inuit people and the world to get POPs banned. It is a tribute to the power of civil society.

Civil society participation has been a hallmark of the Stockholm Convention on POPs since negotiations for the treaty began in June 1998. Environmental, public interest and industry groups worked alongside governments and intergovernmental organizations, often late into the night, to reach an agreement that all sectors of society applaud and support.

This spirit of partnership lies at the heart of all our development goals. The environment movement rides on the energy, input and commitment of civil society. Repeatedly, we have seen champions of environmental protection, such as Rachel Carson, Theo Colburn and Sheila Watt-Cloutier, compelling governments and the international community to look honestly at environmental problems caused by human activity and persuading them to take action to solve them.

The United Nations Environment Programme (UNEP) recognizes the importance of involving civil society at all levels of environmental decision making. We have the responsibility within the United Nations system of providing leadership and encouraging partnership in protecting the environmental base of sustainable development. Our work with civil society is central to that effort.

The spirit of cooperation embodied in negotiating the Stockholm Convention must, and I believe certainly will, continue in its implementation. All stakeholders must contribute. The International POPs Elimination Network (IPEN), which represents more than 360 non-governmental organizations around the world, is a highly constructive contribution to the global movement to protect ourselves, our descendants and our environment from POPs.

The message of IPEN's Citizen's Guide to the Stockholm Convention is that everyone has a role to play. Only through meaningful and open collaboration between international organizations, governments, non-governmental groups, communities and individuals can we hope to rid the world of POPs.

About the International POPs Elimination Project

On May 1, 2004, the International POPs Elimination Network (IPEN <http://www.ipen.org>) began a global NGO project called the International POPs Elimination Project (IPEP) in partnership with the United Nations Industrial Development Organization (UNIDO) and the United Nations Environment Program (UNEP). The Global Environment Facility (GEF) provided core funding for the project.

IPEP has three principal objectives:

- Encourage and enable NGOs in 40 developing and transitional countries to engage in activities that provide concrete and immediate contributions to country efforts in preparing for the implementation of the Stockholm Convention;
- Enhance the skills and knowledge of NGOs to help build their capacity as effective stakeholders in the Convention implementation process;
- Help establish regional and national NGO coordination and capacity in all regions of the world in support of longer term efforts to achieve chemical safety.

IPEP will support preparation of reports on country situation, hotspots, policy briefs, and regional activities. Three principal types of activities will be supported by IPEP: participation in the National Implementation Plan, training and awareness workshops, and public information and awareness campaigns.

For more information, please see <http://www.ipen.org>

IPEN gratefully acknowledges the financial support of the Global Environment Facility, Swiss Agency for Development and Cooperation, Swiss Agency for the Environment Forests and Landscape, and the Panta Rhea Foundation.

The views expressed in this report are those of the authors and not necessarily the views of the institutions providing management and/or financial support.

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I would like to express my gratitude to the International POPs Elimination Network, better known by its acronym, IPEN, for its support in preparing this document, as well as to the Action Network on Pesticides and their Alternatives in Latin America (RAP-AL), the New World Foundation, and the International Project for the Elimination of Persistent Organic Pollutants (IPEP), which receives assistance from the Global Environmental Facility (GEF), the United Nations Industrial Development Organization (UNIDO), and the United Nations Environment Program (UNEP). The ideas and opinions expressed in this book are exclusively those of the author, and do not necessarily reflect those of the organizations that provided financial or administrative support.

Through IPEN, I had the opportunity to participate as an observer in the intergovernmental negotiations for the Stockholm Convention, and consequently had direct access to information provided by various United Nations agencies, to meetings for discussion among government delegates, and to the exchange of experiences and dialogue with other citizen organizations.

It is always an enriching experience to collaborate with persons of such professionalism and social commitment as those who work with IPEN, including Pat Costner, whose scientific and political analysis is a constant source of inspiration and consultation; and Jack Weinberg, Sharyle Patton and many others who participate in the working groups created by this international network on pesticides, dioxins-furans-PCBs, and community monitoring. I especially want to express my appreciation to Joseph Di Gangi for his valuable suggestions and comments on the final draft of this book; to Cecilia Allen for her suggestions related to incineration; and to María Elena Rozas and María Eugenia Acosta for their general support during these years. Finally, although the data and arguments used in writing this book were based on a search for sources and authors with extensive experience in this field, any errors that may have been made in this text are solely my responsibility.

Fernando Bejarano González
La Purificación Tepetitla, state of México, México

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ABBREVIATIONS AND ACRONYMS

| | |
|--------|--|
| DDT | Dichloro-diphenyl-trichloroethane |
| EPA | Environmental Protection Agency |
| FAO | United Nations Food and Agriculture Organization |
| GAIA | Global Alliance for Incineration Alternatives |
| GEF | Global Environmental Facility |
| HCB | Hexachlorobenzene |
| IFCS | Intergovernmental Forum on Chemical Safety |
| ILO | International Labor Organization |
| IOMC | Inter-Organization Program for the Sound Management of Chemicals, a cooperative agreement among UNEP, ILO, FAO, WHO, UNIDO, UNITAR and OECD. |
| IPEN | International POPs Elimination Network |
| LRTAP | Convention on Long-Range Transboundary Air Pollution |
| OECD | Organization for Economic Cooperation and Development |
| PAN | Pesticide Action Network |
| PCB | Polychlorobiphenyl or polychlorinated biphenyl |
| PCDD | Dioxins (Polychlorinated dibenzo-p-dioxins) |
| PCDF | Furans (Polychlorinated dibenzo-p-furans) |
| PIC | Prior Informed Consent, included in the Rotterdam Convention |
| POP | Persistent Organic Pollutant |
| PRTR | Pollutant Release and Transfer Register |
| PVC | Polyvinyl chloride |
| RAP-AL | Action Network on Pesticides and their Alternatives in Latin America (Red de Acción en Plaguicidas y sus Alternativas para América Latina) |
| TCDD | Tetrachloro-dibenzodioxin |
| TEF | Toxicity Equivalence Factor |
| TEQ | Toxicity Equivalence |
| UN | United Nations |
| UNDP | United Nations Development Program |
| UNEP | United Nations Environment Program |
| UNIDO | United Nations Industrial Development Organization |
| UNITAR | United Nations Institute for Training and Research |
| WHO | World Health Organization |

UNITS OF MEASUREMENT AND CONVERSION

| | | | |
|-----------|----|--|-----------------|
| Kilogram | Kg | 1 X 10 ³ g | 1,000g |
| Gram | g | 1g | 1g |
| Milligram | mg | 10 ⁻³ g One thousandth of a gram | 0.001g |
| Microgram | ug | 10 ⁻⁶ g One millionth of a gram | 0.000001g |
| Nanogram | ng | 10 ⁻⁹ g One billionth of a gram | 0.000000001g |
| Picogram* | pg | 10 ⁻¹² g One trillionth of a gram | 0.000000000001g |

Equivalences

| | | | | | |
|-------------------|-----|-------|------|------|-------|
| Part per million | ppm | mg/kg | ug/g | mg/l | ug/ml |
| Part per billion | ppb | ug/kg | ng/g | ug/l | ng/ml |
| Part per trillion | ppt | ng/kg | pg/g | ng/l | pg/ml |

* One picogram per gram (pg/g) is equivalent to one part per trillion (ppt). The amount of dioxins in food and in human fat is often measured in ppt.

Introduction

This Citizens Guide is designed to give a general explanation of the obligations of the member countries of the Stockholm Convention on Persistent Organic Pollutants (POPs); to identify the effects of these pollutants on health and the environment; and to highlight the opportunities for citizen participation in developing the national implementation plans for this Convention.

The Stockholm Convention establishes measures for the control and elimination of twelve persistent organic pollutants (POPs): nine of them are pesticides (aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex and toxaphene), and the others include industrial products referred to as polychlorinated biphenyls or PCBs (insulating oils used primarily in the electrical industry) and substances, particularly dioxins and furans, that are unintentionally produced during combustion and the manufacture of chemical compounds containing primarily chlorine.

POPs are a worldwide problem, due to their toxic characteristics, the way they persist in the environment, and their capacity for bioaccumulating in food chains and traveling long distances. They can be found not only in the most remote areas of the planet, affecting polar bears, whales and other mammals, but also in rural areas and in cities. POPs contaminate food, accumulating in the milk products, meat and fish we eat. Consequently, for decades human beings have been accumulating organochlorinated pesticides, PCBs, dioxins and furans in the fatty tissues of their bodies. POPs are part of the body burden of pollutants, and can pass through the placenta and affect fetal development; they are also excreted in breast milk and have even been found in the semen of animals and humans. There are some POPs that can provoke numerous chronic effects, including cancer, hormonal disruptions and alterations in reproductive development, in the immunological system and child development.

The Stockholm Convention represents a step forward in international agreements for protecting the environment and human health, however the benefits and achievements it can obtain will depend on us, as citizens, becoming aware of its contents and demanding that our governments sign, ratify and fully comply with the Convention.

The Convention on POPs was signed in Stockholm, Sweden on May 23, 2001 and went into effect, or became legally binding for signatory countries, on May 17, 2004, after being ratified by the first 50 countries. The corresponding governments have a period of two years, from the latter date, to develop their National Implementation Plans. To that end, developing countries and countries with economies in transition may request financial assistance from the Global Environmental Facility (GEF). In fact, more than a hundred governments are in the progress of developing their plans. The guidelines developed for implementing the Convention recommend that governments establish institutional processes for citizen participation, to include groups dedicated to protecting the environment, health, and the rights of women, children and workers.

The Guide is made up of five chapters. The first chapter reviews the history of antecedents leading up to the Stockholm Convention, particularly emphasizing citizen struggles waged against pollutants over the past fifty years, as well as prior international and regional agreements within the United Nations system, and the associations formed by transnational corporations that have been involved in discussions regarding the elimination of POPs. The second chapter describes the effects generated by the POPs included in the Convention on human health and the environment. The third chapter presents an analysis of the

commitments acquired by governments, as specified in the articles of the Convention, and the fourth chapter gives a description of the phases involved in developing National Implementation Plans and the role of citizen participation in each of those phases. The fifth chapter characterizes citizen demands for the right to health and to a clean environment as part of the human rights struggle. It emphasizes the importance of the right to know and the right to public access to information, and establishes the fundamental elements of public policies that will guarantee those rights and effectively comply with Stockholm Convention commitments. Finally, at the end of this document the reader will find some Annexes with detailed information and a list of web pages for seeking further information.

We hope reading this book will stimulate the critical awareness of citizens regarding the need for eliminating persistent organic pollutants, and contributing toward formulating environmental public policies that are preventative and democratic in nature, and that will better protect the health and environment of present and future generations.

Chapter One



Antecedents of the Stockholm Convention: the international struggle against Persistent Organic Pollutants

- 1.1 The fight against pesticides: From Silent Spring to Circle of Poison
- 1.2 PCBs, the polluting legacy of chlorinated benzene
- 1.3 Dioxins, Seveso, Vietnam and corporate interests
- 1.4 The fight against incineration
- 1.5 Alternative proposals for zero waste, clean production and extended producer responsibility
- 1.6 POPs discussion in the United Nations and other international conventions
- 1.7 Business associations involved in discussions on eliminating POPs
- 1.8 The creation of the International POPs Elimination Network (IPEN)

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Chapter One

Antecedents of the
Stockholm Convention:
The international struggle
against Persistent
Organic Pollutants

The signing of the Stockholm Convention is not only the result of governments' political will and the accumulation of scientific evidence documenting health and environmental risks provoked by Persistent Organic Pollutants around the world, but it is also due to an increase in citizen awareness and citizen-based struggle involving communities, workers, mothers, environmental groups, indigenous peoples and farmers. For decades, these individuals and groups have suffered the consequences of these pollutants at local, regional and international levels, and have insisted that the industries producing them and the governments tolerating them recognize their right to health and to a clean environment.

1.1 The fight against pesticides: From Silent Spring to Circle of Poison

The nine pesticides prioritized in the Stockholm Convention for global elimination were introduced on the market in many countries after the Second World War, in the 1940s and 1950s, and were used with a wide variety of crops (see Table 1). DDT was the pesticide that became the most widely known around the world. Before its civilian use and its expansion throughout the world, it was used by the US Army—as a result of research by the Chemical Warfare Department—to protect US troops from attack by malaria-transmitting mosquitoes and lice in Southeast Asia, and also the typhus epidemics affecting refugees.

The Persistent Organic Pesticides (POPs) selected by the Stockholm Convention belong to the group known as *organochlorine* pesticides, since their carbon-based chemical structure (explaining why they are referred to as organic) also includes several atoms of chlorine, which provides them with greater stability and persistence in the environment. Because of their persistence and the fact that they are fat soluble and accumulate in food chains many of these pesticides were severely restricted and prohibited since the end of the 1960s in Nordic countries such as Norway, Sweden and Finland, and in eastern European countries such as Hungary and the former Yugoslavia, and later in the United States in the 1970s, and finally in most of the world (Table 1).

The international public became aware of the problems of the persistence and bioaccumulation, as well as the biocide effects, of organochlorine pesticides, because of a book entitled *Silent Spring* and written by Rachel Carson, a zoologist and marine biologist. A selection of her writing was initially published in a series of three articles in *The New Yorker* magazine in June 1962, and then, the entire book was published in September of that same year. Written in beautiful poetic prose and backed by extensive scientific inquiry,

Silent Spring warned of the serious effects from organochlorinated pesticides such as aldrin, endrin, dieldrin, DDT, heptachlor, toxaphene and chlordane—all currently included in the Stockholm Convention—and she also pointed to problems caused by other organochlorinated pesticides that continue to be used today, such as lindane and pentachlorophenol, as well as organophosphorous pesticides such as parathion, and herbicides such as 2,4-D and 2,4,5-T.

Table 1
Pesticides for global elimination in the Stockholm Convention

| Name of active ingredient | Introduced on the market | Cancellation or suspension of registration | Uses |
|---------------------------|--------------------------|--|---|
| Aldrin | 1949 | 1965 Norway 1970 Sweden 1974 agricultural uses and (1987) as a termiticide, for moth control, with livestock, US (*) | Insecticide often formulated to protect seed, and used against soil pests in corn, cotton and potato fields. Later restricted as a termiticide, for moth control, and against livestock parasites, and was finally cancelled or no longer used in many countries. |
| Chlordane | 1945 | 1968 Norway 1970 Finland 1975 most uses (1995) termiticide, US (**) | Insecticide used extensively on crops, in gardening and in forests. Was restricted exclusively to termite control in some countries, until it was definitively cancelled. Technical chlordane can contain up to 11 compounds. |
| DDT | 1942 | 1970 Norway 1970 Cuba 1972 agricultural use, US | Insecticide used extensively in the past. Currently its use is restricted to only the control of mosquitoes that transmit malaria in some countries. |
| Dieldrin | 1948 | 1968 Hungary 1969 Sweden 1968 ectoparasite control in livestock, and (1969) in food in Argentina 1970 Finland 1974 most uses and in (1987) as termiticide, moth control, with livestock, US (**) | Insecticide used in fruit orchards, for soil pests in corn, potato and cotton crops, and ectoparasite control in livestock; later restricted for use only as termiticide and for moth control, until it was definitively banned. |
| Endrin | 1951 | 1963 Belgium 1966 Sweden 1966 Norway 1971 Food use, Canada | Rodenticide and insecticide used on cotton, rice and corn crops, and for ectoparasite control in livestock. |
| Heptachlor | 1945 | 1968 Hungary 1976 Yugoslavia 1973 Netherlands | Fungicide. Also a polluting by-product resulting from the production of other chlorine pesticides and compounds. |
| Mirex | 1959 | 1977 US 1978 Canada | Insecticide used in various agricultural crops, and in ant and termite control; also as a flame retardant. |
| Toxaphene(cam phechlor) | 1948 | 1970 Finland 1974 Israel in food 1990 US | Insecticide used in the past primarily for cotton, corn and cereal crops and vegetable growing, and later restricted to use only in bathrooms, to control ticks and acarids in livestock in some countries. It is a complex mixture of 670 chemical substances. |

(*) Although the use of chlordane was banned in the United States, it was exported to other countries, including Mexico, until 1977, when the manufacturer, Velsicol, stopped producing and exporting this pesticide.

(**) Technically, the United States did not ban the use of aldrin, but rather discontinued its use, as in the cases of dieldrin and endrin.

Sources: Anne Platt McGinn, *Why Poison Ourselves? A precautionary approach to synthetic chemicals*. World Watch Paper 153, November 2000, p. 9. In the information regarding the banning and cancellation of pesticides, the first dates and countries were selected from: United Nations, Department for Policy Coordination and Sustainable Development, *Consolidated List of Products Whose Consumption and/or Sale Have Been Banned, Withdrawn, Severely Restricted or not Approved by Governments*, fifth issue, New York, 1994. The dates for cancellation of registration and the past uses in the United States were obtained from Ruth Stringer and Paul Johnston, *Chlorine and the environment*, London, Kluwer Academic Publishers, Ch. 10, "Chlorine pesticides."

The book *Silent Spring* was harshly attacked by the chemical pesticide industry. Some say Rachel Carson's work was the target of the first anti-environment public relations campaign. After her articles were published in *The New Yorker*, the Velsicol company tried to block the book's publication, and sent a letter to the publishing company, insinuating that it would file a legal suit against the company for discrediting chlordane and heptachlor —Velsicol was the exclusive producer of these pesticides— and accusing the publisher of participating in "sinister influences." Monsanto's president, Peter Rothberg, called Rachel Carson a "fanatic defender of the cult of the balance of nature" and his company developed a sarcastic parody of her book, publishing it in a paid ad in numerous publications in the country. American Cyanamid financed propagandistic campaigns in several US states to reaffirm the need for pesticide use. The National Agricultural Chemical Association doubled its budget for its public relations department, and contracted E. Bruce Harrison, a young man at that time, as its "manager of environmental information." He worked with public relations directors at DuPont, Dow, Monsanto and Shell to coordinate a furious media campaign in which hundreds of letters attacking *Silent Spring* were sent to public opinion leaders who wrote in magazines, newspapers and bulletins.

Rachel Carson was labeled as emotional, hysterical and alarmist, and her work was described as based on exaggerations lacking sufficient scientific foundations. She was accused of promoting world hunger by seeking to eliminate pesticides. In fact, biographer Linda Lear, a former US Secretary of Agriculture, wrote in a letter to Dwight Eisenhower that she was probably a "communist" —in the old McCarthyism style. This accusation was repeated in various ways in the campaign launched against her, and it was even suggested that she was involved in a conspiracy to ruin US agriculture. Nevertheless, despite the attacks against this US biologist, later scientific research backed her claims.⁽¹⁾

Despite the banning of organochlorinated pesticides beginning at the end of the 1960s and into the next decade, transnational companies such as Dow, Bayer, Ciba-Geigy, Monsanto, ICI, Dupont and Velsicol continued to produce these pesticides in the United States and European countries where their headquarters were located, to then export them to their subsidiaries in Latin America, Asia and Africa. In 1979, US government reports calculated that at least 25% of all US pesticide exports were products that had been banned or had never been registered for use within the country.⁽²⁾

In 1992, Greenpeace denounced the exporting of pesticides not registered in the United States, specifically: butachlor ("Machete," "Lambast"), by Monsanto; carbosulfan ("Posse," "Advantage," "Marshall," "Sheriff," "FMC 350") by FMC; haloxyfop-methyl and haloxyfop-ethoxyethyl ("Gallant," "Verdict," "Dowco 453 M") by Dow Elanco; nuarimol ("Gauntlet," "Trimidal," "Triminal") by Dow Elanco; and prothiofos ("Tokuthion") by Miles (previously Mobay Corp.). In three of these cases, applications for national registration were rejected by the EPA, due to suspicion that the products could cause cancer and other chronic effects. The requested tolerable limits on wastes generated were also rejected, based on the possibility that they could cause cancer,

birth defects and other long-term health problems.⁽³⁾ During the 1995-96 period, 21 million pounds (10.5 tons) of pesticides whose use was banned in the United States were exported to other countries. These exports, averaging about 14 tons a day, included both products that had been banned as well as those not registered for national use.⁽⁴⁾

The exporting of banned pesticides from industrialized countries to the so-called “Third World” was denounced in articles published in magazines such as the *Rolling Stone*, in 1975, and *Mother Jones*, in 1979. The authors of these articles, David Weir and Mark Schapiro, described what they called the *Circle of Poison*. In effect, pesticides prohibited in Europe and the United States, but exported to other countries, were used on export crops and returned to the countries of origin as residue on imported food products. The denouncement caused world indignation and motivated a group of citizen organizations from Asia, Africa and the United States—at the initiative of the International Organization of Consumers Unions, based in Penang, Malaysia—to create a new citizen network to confront the problem. Consequently, in 1982 the Pesticide Action Network (better known by its acronym, PAN) was founded. On June 5, 1985, this network began an international campaign to eliminate pesticides labeled as the “Dirty Dozen,” including most of those currently selected by the Stockholm Convention, and which, after an immense amount of pressure, have been banned or restricted in much of the world (see Tables 1 and 2).⁽⁵⁾

Table 2
Pesticides included in the Pesticide Action Network’s international campaign against the “Dirty Dozen”

| |
|---|
| <ul style="list-style-type: none"> • The “drins” (aldrin, dieldrin, endrin) • Chlordane / Heptachlor • Chlordimeform • Toxaphene (camphechlor) • DBCP • DDT • EDB • HCH and lindane • Paraquat • Ethyl and methyl parathion • Pentachlorophenol • 2,4,5-T <p>(*) In 1986, Aldicarb (Temik) was added.</p> |
|---|

Source: Pesticide Action Network–North America (www.panna.org).

The Pesticide Action Network has five regional offices: Asia/Pacific, Africa, Latin America, Europe and North America. It brings together 400 member organizations from a total of 60 countries, and continues to provide support for the elimination of the most hazardous pesticides and the promotion of lower-risk alternatives for pest control.

The vast majority of organochlorinated pesticides have been banned or are no longer used in numerous countries, however due to their persistent quality, they can still be present in river and lake sediments, and in contaminated sites where they were manufactured or developed. They have accumulated in food chains and can be found in the body burden of a significant portion of the world population that grew up between the 1940s and 1970s. In fact, in the United States, some organochlorinated pesticides such as dieldrin, DDE (DDT metabolite), endrin, heptachlor, hexachlorobenzene and toxaphene have been found —although in small amounts— in common food such as butter, cantaloupe, cucumbers, peanuts, radishes, spinach and squash, according to 1999 information.⁽⁶⁾

During the 1960s, 1970s, and 1980s, Africa received thousands of tons of organochlorinated and organophosphorous pesticides donated by European and US bilateral and international aid organizations for controlling pests such as locusts and grasshoppers, among other uses. This has created a serious problem of accumulation. The FAO estimates there are 50,000 tons of obsolete pesticides and tens of thousands of tons of contaminated soil, affecting most of the 53 countries in the region and threatening the health of communities and the environment. It has been estimated that there are another 80,000 tons in Asia and Latin America, and in Eastern European countries, estimates were calculated at 150,000 tons as of March 2000. Since 1994, the FAO has been working with developing countries in the identification and treatment of accumulated, obsolete pesticides. In general, the intention is for these pesticides to be returned to their place of origin, or incinerated in Holland and Great Britain. Nevertheless, even the FAO estimated that only 5% of the total identified obsolete pesticides had been taken out of Africa by 1999. During the process of the Stockholm Convention negotiations, the Africa Stockpiles Program was created in December 2000. This program is a multi-sector initiative and participants include the pesticide industry, represented by Crop Life, plus the African Development Bank, the World Bank, the Secretariat of the Basilea Convention, and various United Nations organizations and environmental organizations, such as PAN-Africa, PAN-UK and the World Wildlife Fund (WWF).⁽⁷⁾

1.2 PCBs, the polluting legacy of chlorinated benzene

For more than 47 years, PCBs, a type of isolating oil, were used around the world, primarily by the electrical industry. In Latin America PCBs are commonly known by their brand names, such as *askareles*. Although the chemical characteristics of PCBs were discovered in the 19th century (1881), they were industrially manufactured beginning in 1929 by the St. Louis, Missouri company of Swan Corporation, which was later obtained by Monsanto (in 1935). They were produced in Germany beginning in 1930, and after the Second World War, production was expanded to other countries, including England, Russia, Japan (in 1954, by a Japanese company, and beginning in 1969, by Monsanto, with co-investment by Mitsubishi), France, Austria, Italy, Spain, Belgium, Czechoslovakia (1959) and China.⁽⁸⁾

Monsanto was the only US company that produced PCBs, and it was also the world's largest producer of PCBs, until it ceased production at its Illinois and Alabama plants at the end of 1976. It is estimated that more than 1.5 million tons of PCBs were produced in the world (not including totals from Russia and China), and the United States was the primary producer, with a total of 600,000 tons.⁽⁹⁾ Part of Monsanto's PCB production in the United States was exported to Latin American countries and other regions of the world.

The industrial production of PCBs was a result of the expanding petrochemical industry, and the demand on the part of the electrical industry. With an increase in the demand for gasoline extracted from crude petroleum, large amounts of other chemicals, such as benzene, were produced as by-products. The chemical

industry began to experiment with benzene, and also with chlorine, to see what other compounds could be useful. When benzene was heated under the right conditions, two benzene rings were joined, forming biphenyls.

When these biphenyls are exposed to chlorine gas (Cl_2) in the presence of a catalyzer, a chemical reaction is produced—some of the hydrogen atoms are substituted with chlorine atoms—and this creates a mixture of polychlorinated biphenyls. Depending on the time of the reaction, the amount of chlorine initially present and the temperature, different types of PCBs are produced, according to the number and position of the chlorine atoms in their chemical structure.⁽¹⁰⁾ The primary users of PCBs were the large companies that produced electrical capacitors and transformers, including Westinghouse and General Electric in the United States, and AEG and Siemens in Germany.⁽¹¹⁾ During the 1980s, it was estimated that 40% of all US electrical equipment contained PCBs.⁽¹²⁾

In the mid and late 1970s, the banning or withdrawal of PCBs began around the world: in Japan (1974), the United States (1976), Canada and Sweden. In the early 1980s, these initial countries were followed by France, Germany (Bayer in 1983), Spain, the United Kingdom and Czechoslovakia (1983). The industrial production of PCBs continued in Russia until 1990.⁽¹³⁾

Although a great number of countries have ceased to produce PCBs, the problem has not been resolved, since an estimated 70% of what was produced around the world is still currently in use, located in a large number of electrical equipment and consumer items. PCBs are also still present in old equipment and contaminated appliances that have been thrown away and remain in warehouses, municipal trash dumps and military installations. These are the latent reserves of contamination, together with sediments and mud in the areas where they were dumped over the years.⁽¹⁴⁾

Within only a few years after PCB production began, Monsanto and the electrical companies that used these compounds were aware of the problems they caused in workers' health. However, there was no substitute on the market, so these companies preferred to continue with their lucrative business. In effect, in 1937—only eight years after PCB production began—the Harvard School of Public Health organized a meeting to discuss problems related to the systemic effects from certain chlorinated hydrocarbons, including PCBs. The meeting was attended by representatives from Monsanto, General Electric, the US Public Health Service, and the Halowax Corporation, among others.⁽¹⁵⁾ Presented at that meeting were severe cases of chloracne—a very painful skin disorder causing eruptions, cysts and acne—and also reports of the deaths of workers who had been exposed to PCBs in the process of producing these chemical compounds, or who had used them as isolating fluids in the manufacturing of electrical transformers in Halowax Corporation and General Electric industrial plants. Also reported at that meeting were results from experiments with laboratory rats and from some experiments with humans at Monsanto's PCB production plants. At the end of 1971, Westinghouse representatives confirmed that PCBs had been concentrated in the food chain, however it was recommended that they continue to be used.

In the 1980s researchers began to prove that workers exposed to PCBs were dying of skin cancer and probably brain cancer as well.⁽¹⁶⁾ Publicly, Westinghouse and Monsanto stated that they always fully informed their workers regarding the dangers of PCBs, however during the 1990s, more than a thousand workers demanded compensation from Westinghouse for damages to their health and the lies they were told by the company. While Monsanto ceased PCB production in Alabama in 1976, it was not until August of 2003—after decades of litigation—that Monsanto and Solutia, Inc. finally agreed to pay 700 million dollars to develop a

program for cleaning up the location, among other actions, and to respond to the complaints made by 20,000 residents of Anniston, Alabama in relation to the contamination caused by PCB production.⁽¹⁷⁾

1.3 Dioxins, Seveso, Vietnam and corporate interests

The effects of dioxins on the environment and human health have led to intense research and debate since the end of the 1970s in the United States, Europe and Japan —the countries where most of the scientific research on these pollutants has been conducted.

Many of the initial studies on dioxins were conducted by analyzing the effects caused by serious industrial accidents in the production of chlorinated compounds. These accidents caused severe contamination by dioxins, as in the case of Seveso, Italy (1976) —a case widely publicized, although it was not the first accident of its kind to occur. It was preceded by similar events in the industrial plants of Monsanto (United States, 1949), BASF (Germany, 1953), Dow Chemical (United States, 1960), Phillips Duphar (Holland, 1963), and Coalite (United Kingdom, 1968).⁽¹⁸⁾ As extensively documented in the United States, research on the effects from dioxins constitutes a social and political history immersed in conflict, and during which powerful chemical companies have even manipulated scientific research and have exercised their power to influence decisions made by environmental agencies and to defend their interests in response to the demands and protests by workers, communities and war veterans who have been affected by exposure to these toxic substances.

The accident in Seveso, Italy

The international public became aware of dioxins and their effects because of the industrial accident that seriously affected the population of the Seveso urban area, located to the north of Milan, Italy. On July³ 10, 1976, in the town of Meda, there was an explosion in a reactor where 2,4,5-trichlorophenyl (TCP) —used as an intermediary in the production of herbicides (hexachloropropene and 2,4,5-T)— was produced at the ICMESA company, owned by the gigantic Swiss pharmaceutical company, Givaudan-Hoffman-LaRoche. Permission for the functioning of this reactor could not have been obtained in Switzerland. The explosion provoked the release of nearly three tons of chemical substances, including more than 600 kilos of chlorophenyls and the formation of new pollutants: dioxins. The resulting toxic cloud reached a height of 50 meters, and was dispersed across neighboring Seveso and the surrounding area, affecting an area six kilometers to the south of the plant in less than two hours. It is estimated that 37,000 persons living in the neighboring residential zones were exposed. The contamination seriously affected the soil, plants, wildlife and domestic animals in the affected area. Later, dioxins were measured in the tissues of individuals living in nearby neighborhoods, and the levels found were between 5 and 20 times higher than those in the environment. Thousands of animals died in the two months following the accident, and the exposed Seveso population has experienced severe, short-term and long-term health problems. In addition to chloracne, the cases of liver cancer, lymphomas, multiple myelomas, leukemia and cardiac illnesses have increased.⁽¹⁹⁾

Catastrophes like the one that occurred in Seveso are not the only episodes during which dioxins are released into the environment. Every day —at a smaller scale, and resulting from diverse industrial activities, generally involving the production or combustion of chlorinated compounds— dioxins are released into the air, water and soil, leading to their accumulation in the environment, in food chains and in the population's body burden. Annexes 2, 3 and 4 list chemical substances that may generate dioxins and furans during their production.

Manipulation of dioxin studies by Monsanto and BASF

For many years, the chemical industry accepted the claim that severe exposure to dioxins could cause chloracne, but rejected claims of any other chronic effects on human health. And it insisted that there was no evidence that humans suffered the same effects —especially cancer— seen in experiments with animals. Studies conducted by Monsanto, BASF and Dow, and published in scientific journals, were repeatedly used by these companies to support their arguments, and defend their viewpoints in response to the demands of affected workers and communities.

In 1980, Monsanto published the first of three epidemiological studies of workers exposed to dioxins generated by an explosion during the production of 2,4,5-T in Nitro, West Virginia —occurring decades earlier, in 1949. Monsanto concluded that workers did not suffer any secondary effects other than chloracne, and that there was no evidence that exposure to dioxins caused cancer or other long-term effects. Further studies conducted by Monsanto in 1980 and 1984 supported this conclusion. Likewise, in 1980 the BASF company presented an epidemiological study that concluded that workers and communities did not present significant levels of cancer cases after exposure to dioxins resulting from an accident that occurred during the production of 2,4,5-Trichlorophenyl in Ludwigshafen, Germany in November 1953. Based on these conclusions, the Insurance Association of the Chemical Industry rejected a demand for compensation filed by BASF workers. The Monsanto and BASF studies were presented shortly after Dow Chemical Co. researchers found that very low levels of exposure to dioxins caused cancer in rats, although they argued that these results could not be extrapolated to humans.⁽²⁰⁾ In 1965 and 1966, Dow even conducted experiments on prisoners in the Holmesburg prison in Pennsylvania, applying dioxin to their skin, and confirming that chloracne developed, but no other effects were observed —although no follow-up medical exams were performed. The EPA ignored complaints by prisoners who, when released from prison, sought assistance for illnesses they were experiencing.⁽²¹⁾

These Monsanto and BASF studies were cited in numerous articles and editorials as proof that exposure to dioxins had no long-term effects on health except for chloracne. The studies were also used to question efforts by the US Environmental Protection Agency (EPA) to classify dioxins as a probable human carcinogen. It was discovered years later, however, that these “classic” studies conducted by Monsanto and BASF were manipulated. During the Kemmer et al. vs. Monsanto court case pursued in 1985 by citizens of Sturgeon, Missouri, lawyers discovered and confirmed through testimonies that data was manipulated when classifying the exposed population, for the purpose of extracting the conclusion that the number of deaths from cancer was insignificant. It was also proven that information regarding illnesses other than chloracne was deliberately disregarded. In 1990 Cate Jenkins, an EPA official with a Ph.D. in chemistry, analyzed the Monsanto information and concluded that the company deliberately used false information and manipulated the results. She requested that the EPA’s criminal investigation office conduct a more extensive investigation of Monsanto, however the investigation was filed away, and she was removed from her position in 1992 and given other responsibilities at the EPA. She was prohibited from having contact with the public, and was not authorized to participate in new regulations. In the case of the BASF study, a review conducted by an independent epidemiologist appointed by a German court in 1989 revealed that information was manipulated. When errors were corrected, the epidemiologist found significant statistical proof related to an increase in various types of cancer in workers exposed to the accident at the plant where trichlorophenyl was produced.⁽²²⁾

The Dow corporation's influence on the EPA was revealed when a report on dioxin contamination in the food chain in the Great Lakes region was published in 1981. EPA officials edited the final version of the report, and eliminated references that could point to Dow and its Midland plant (where 2,4,5-T was produced) as one of the primary sources of dioxins. They also failed to include a recommendation for prohibiting the consumption of fish from the Tittabawasee River and Saginaw Bay located near the plant. It was not until 1983 that a Congressional investigation discovered this manipulation, leading to the forced resignation of high EPA officials.⁽²³⁾

2,4,5-T, Agent Orange and Dow

The herbicide known as 2,4,5-T (2,4,5-trichlorophenoxyacetic acid) is prohibited in many countries, since during its chemical synthesis process, the most toxic dioxin known —2,3,7,8, TCDD— is involuntarily produced and contaminates the product. The 50%-50% mixture of two herbicides —2,4,5-T and 2,4-D (2,4-dichlorophenoxyacetic acid)— came to be known as *Agent Orange*, a name derived from the orange color-coded bands on the drums in which it was transported. It was one of the main defoliants used as a chemical agent by the US army during the Vietnam War.⁽²⁴⁾

Tens of thousands of US veterans from that war, in addition to three generations of Vietnamese, have pointed to *Agent Orange* as the possible cause of numerous cases of cancer and congenital malformations in their children and grandchildren, among other chronic effects on their health. In addition to napalm, 80 million liters of herbicides, of which 43 million were *Agent Orange*, were sprayed by the US army on the forests of South Vietnam near the Laos border over a nine-year period, from 1962 to 1970. These covert actions under the code name of "Operation Ranch Hand" have been described as the "largest chemical warfare campaign in history."⁽²⁵⁾ Although 2,4,5-T and 2,4-D were used as herbicides for controlling broad leaf weeds in agriculture, the concentration of TCDD found in the 2,4,5-T used in *Agent Orange* was as much as a thousand times higher than that reported for agricultural use (50 ppm. compared with 0.05 ppm. of TCDD, respectively). It is estimated that 4,000 kg of dioxins were sprayed on three million hectares of forests and crops, constituting nearly 10% of Vietnam's total territory.⁽²⁶⁾

Aerial spraying of *Agent Orange* was used in an attempt to prevent the Viet Cong communist guerrillas from finding protection in the forests along what was known as the Ho Chi Min Trail. Consequently, millions of Vietnamese plus thousands of US pilots, soldiers and Marines came into contact with the mixture of dioxin-contaminated herbicides. In 1975, almost immediately following the Vietnam War, US veterans began to report chronic skin problems, asthma, gastrointestinal ulcers and cancers, and also reported that their babies were born with malformations. In 1979, 15,000 veterans initiated a collective lawsuit against Dow Chemicals, Monsanto, Diamond Shamrock, Uniroyal, Hercules, Thomson Chemical and TH Agriculture —all were 2,4,5-T and *Agent Orange* producers that had received lucrative Pentagon contracts during the war.⁽²⁷⁾ The case never reached court, and lawyers arrived at a settlement in 1984 in which the companies agreed to pay US \$240 million, signifying that plaintiffs received US \$12,000 if the veteran was still alive, and no more than US \$3,500 if no longer alive. Many veterans and their families did not agree with the settlement, and continued to pursue individual lawsuits.⁽²⁸⁾

In late 1979, US President Carter signed a law that ordered the Department of Veteran Affairs to conduct an investigation into the impact from *Agent Orange* on veterans' health. After three years the protocol was still under discussion and research had not yet begun, so in 1983 responsibility for conducting the investigation

was passed to the Center for Disease Control (CDC). CDC conducted various studies, including a study of chronic effects from herbicide exposure entitled “the *Agent Orange* study,” however it announced in 1986 that it was impossible to identify who had been exposed and who had not, and the study was cancelled in 1987. In 1988 the CDC concluded in other studies that there was no proof of chronic health effects from exposure to dioxins.

Years later, the US Congress ordered the National Academy of Sciences (NAS) to conduct an extensive investigation that reached the conclusion in 1993 that CDC studies as well as other studies conducted by the Armed Forces were modified and manipulated due to political pressure from the White House during President Ronald Reagan’s administration. The NAS report indicated that there was sufficient scientific evidence to link *Agent Orange* exposure to various types of cancer, such as soft tissue sarcomas and non-Hodgkin’s lymphomas, and with Hodgkin’s disease, chloracne and other metabolic and cardiovascular disorders, such as porphyria cutanea tarda (affecting areas of the body exposed to light, causing hirsutism, hyperpigmentation and skin fragility). Limited, but suggestive, evidence was found in relation to other cancers of the respiratory system, prostate cancer and multiple myeloma. It is suggested that there are other possible effects still to be confirmed among veterans, given the long period of latency with other types of cancer. The National Academy of Sciences report made it possible for the Veterans Administration to approve compensation granted for nine illnesses derived from *Agent Orange* exposure during the Vietnam War. Some critics argue, however, that there is evidence of 28 illnesses linked to exposure to this toxic.⁽²⁹⁾ In January 2003, the Department of Veterans Affairs granted extra compensation benefits to veterans suffering from a type of leukemia, after proof from scientific research of its link to *Agent Orange* exposure.⁽³⁰⁾

As a result of the fight waged by US veterans from the Vietnam War suffering from illnesses related to *Agent Orange*, they receive a monthly compensation (of up to US \$1,500). However, no compensation from the US government or the corporations that produced this chemical weapon is offered to the millions of Vietnamese victims. Vietnamese families affected by *Agent Orange* receive only US \$5 a month from their government. The Vietnam Association of Agent Orange Victims estimates that three million persons were exposed to this herbicide during the war, and according to Vietnam Red Cross records, at least a million suffer from serious health problems. Other estimates indicate 500,000 children born with deformities. Twenty-nine years have passed since the war with the United States ended, however dioxins are still found in high concentrations in soil, and even worse, these substances have been dispersed in sediments and in rivers, and they have accumulated in food chains and the body burden of men and women, to be passed on to future generations through breast milk. The grandchildren of the Vietnamese men and women exposed to *Agent Orange* continue to suffer the consequences. More than 50 sectors with high levels of dioxin contamination have been identified.

In January 2004 the Vietnam Association of *Agent Orange* Victims presented a legal complaint before a US Federal Court, against 37 US chemical corporations that produced and distributed this toxic, and charging them with war crimes. The civil suit began in March of the same year in the Brooklyn District Federal Court in the state of New York. A strong legal battle is expected, since it affects powerful corporations such as Dow Chemical and Monsanto. Hundreds of victims have joined the legal battle, and thousands more are expected to do the same. The International Association of Democratic Lawyers has expressed its solidarity, and support has been provided by organizations that have conducted investigations in affected communities in the Asian country. The United States and the corporations should pay their debt to the Vietnamese people.⁽³¹⁾

Other legal proceedings in the United States, according to documents made public in the Federal Court and summarized in an extensive New York Times article in 1983, revealed that Dow Chemical had been aware

since 1964 of dioxin contamination occurring in the production of 2,4,5-T in its industrial plant in Midland, Michigan, since there was an outbreak of chloracne among its workers during that year. As the primary producer of 2,4,5-T, Dow invited other companies that produced this herbicide, including Monsanto and Hooker Chemical (later Occidental), to discuss the political and scientific implications of dioxin contamination in their *Agent Orange* production lines, however it did not report this discovery to the US government until 1970. In the interim, it continued to produce and sell this herbicide to the US army for use in Vietnam. Dow and Monsanto were the primary producers of *Agent Orange*.⁽³²⁾

Even after 1970 when the Pentagon ordered an end to the use of *Agent Orange*, 2,4,5-T continued to be used as an herbicide in the United States for another nine years. In 1973, the EPA attempted to cancel its registration, however under pressure from the chemical industry, it postponed the decision in order to conduct new studies. As a result of a lawsuit filed by citizens and a later EPA study—that linked the occurrence of miscarriages to federal forestry programs with aerial application of 2,4,5-T in Alsea, along the Oregon coast—the EPA issued an emergency order in 1979 to suspend the application of this herbicide on US forests, roads and grazing lands. Dow challenged the decision and the validity of the EPA study, and maintained a legal battle for another six years, during which time it continued to export 2,4,5-T to the Third World—until all uses of this product were cancelled in December 1984. Nevertheless, Dow continued to produce 2,4,5-T with an associated company in New Zealand until 1987. Currently, 2,4,5-T has been banned and/or it is no longer used in most of the world.

Another component of *Agent Orange*, the herbicide referred to as 2,4-D (2,4-dichlorophenoxyacetic acid), can also be contaminated with dioxins, however since most of the latter are not the most toxic type—2,3,7,8 TCDD—the toxicity of this herbicide was less than that of 2,4,5-T. It is inevitable that dioxins are produced during the production of 2,4-D, as has been verified in the discharge effluents and atmospheric emissions of the primary manufacturer of this product, Nufarm Ltd, in Melbourne, Australia. Nevertheless, the industry argues that such contamination can be reduced with control measures.⁽³³⁾ Analysis of 2,4-D in samples taken in the United States, Israel and Russia in 1997 indicates the presence of dioxins and furans.⁽³⁴⁾ The 2,4-D herbicide continues to be used extensively around the world.⁽³⁵⁾

The torturous path of dioxin assessment in the United States

The US government's study of unintentional dioxin generation and related health risks has been a long, slow process covering a period of more than 20 years, and it is still unfinished, subject to intense pressures from the powerful interests of corporations in the chemical industry.

In 1982 the National Toxicological Program of the Department of Health and Human Services completed a study on the carcinogenicity of dioxins, and found cancer in both rats and mice exposed to levels of dioxins similar to those found in previous studies published in 1978 by Dow scientists. In 1985 the US Environmental Protection Agency (EPA) published a scientific review of the health effects from dioxins. This review served as the basis for the first assessment of the risks from dioxins, and it defined an acceptable daily dose (ADD) of exposure at a lower limit than that established at that time by other governmental agencies and in other countries (0.006 picograms per kg of body weight per day). A short time later, in 1987, the EPA reported in its National Dioxins Study that it had found these pollutants in the effluents of paper-producing companies in various locations around the country. This provoked intense pressure from the chlorine chemical industry and the paper industry, which demanded that the EPA reconsider its risk estimates from 1985. The pressure

brought results. In 1988, the EPA formed an internal working group for initiating what would be the first reassessment of dioxins in relation to the 1985 document. However, its proposals for increasing the risk values were criticized by the EPA Scientific Advisory Council (made up of scientists not holding government positions), which did not see any grounds for changing the values established in 1985. In April 1991, the EPA began its second reassessment —under pressure from the Chlorine Institute (later known as the Chlorine Chemistry Council), which brings together the major producers and commercial users of chlorine compounds —with the idea of seeking a safe threshold of exposure, and with the industry expecting it would prove that dioxin was less toxic than had been thought.⁽³⁶⁾

In September 1994, the EPA reported the results of its second dioxin reassessment, presented as a rough draft, for receiving comments from the public. Contrary to what the industry expected, the EPA found that health problems related to dioxins were worse than had been thought. The EPA determined that the new level of acceptable risk for contracting cancer was between 100 to 1,000 times higher than one in a million, which had been considered acceptable up until that time. It acknowledged other chronic effects caused by dioxins at levels very close to the population's environmental exposure, and warned that dioxins accumulate in the body over time, primarily through diet, forming a body burden of pollutants. The industry once again exerted pressure through a report by scientists who were at its service, criticizing various chapters of the rough draft. Consequently, in December 1994, the EPA was forced to ask its Scientific Advisory Council to review parts of the report on dioxin reassessment, and to this end, an ad hoc committee of scientists was created. In September 1995 this committee presented its report which, in general terms, backed the 1994 report. Meanwhile, both state and local level agencies asked that there be more guidance with regard to exposure and risk, and once again, the presentation of the final report was postponed.⁽³⁷⁾

In June 2000, the EPA presented a review of the 1994 report on dioxin reassessment, and once again, to the industry's displeasure, it reported even stronger links between dioxin exposure and severe impacts on health. The Scientific Advisory Council once again reviewed the report in Fall-Winter of 2000-2001 in a process that was controlled by the industry and questioned due to its lack of neutrality, and in June 2001, the Council sent a letter to the EPA expressing the urgency of completing the process and presenting it to the public. To the contrary, the EPA announced during that same month the creation of a new Inter-Agency Working Group for yet another review, however it did not send the document for that review until January 2003, 18 months after the Group had been created. The Inter-Agency Working Group is made up of representatives from all federal and state agencies, and is charged with commenting on the report and developing a strategy for its presentation to the public. It is coordinated by the Department of Health and Human Services and the Department of Agriculture, the latter of which has great interest in minimizing the impact from dioxin regulations on the industrial food sector, and especially on livestock and milk products. The Inter-Agency Working Group asked the National Academy of Sciences (NAS) to evaluate the scientific consistency of the dioxin reassessment report. However, in June 2004, internal sources revealed that the NAS had not yet received funds for conducting its review, and that it had been given the task of finding anything that could be defined as less than perfect in the dioxin report presented in 2003, in another effort to postpone the public presentation of the report until after the presidential elections in November 2004 or as far ahead into the future as possible.⁽³⁸⁾

Various citizen organizations in the United States have denounced the pressure exerted by business associations representing the chemical industry in order to influence the dioxin reassessment process conducted by the EPA —which has succeeded in delaying the public presentation of the final report. Among the corporate tactics used by the American Chemical Council (ACC) and the Chlorine Chemistry Council

(CCC) is lobbying aimed at positioning scientists who lean toward their interests in key positions on the review panels of the EPA's Scientific Advisory Council. The ACC and CCC have also proposed legislative reforms that limit public participation, and they have threatened to sue the EPA if it classifies dioxins as a known human carcinogen. These business organizations made generous financial contributions to the campaigns of President Bush and Christine Todd Whitman —EPA director in 2003— when she ran for New Jersey governor. At the same time, the industry has pressured local governments to prevent the approval of ordinances that would regulate the sources that generate dioxins. This has taken place in San Francisco and Marin Counties, and in the cities of Oakland, Berkeley, San Francisco and Palo Alto, in California. All of the above has led to denouncements that business associations in the Chlorine Chemistry Council represent a powerful pressure group that impedes the exercise of democratic public policy that protects the population's health and environment. This is the position of organizations such as the Center for Environmental Health and Justice (CEHJ), an institution providing services to a broad-based coalition made up of hundreds of communities organizations in the United States.⁽³⁹⁾

Efforts by the chlorine chemical industry to pressure US environmental authorities are nothing new. In 1994, when the EPA proposed studying the viability of a national strategy for “prohibiting, substituting or reducing” the use of chlorinated compounds in four of the primary user sectors (PVC, solvents, paper pulp bleaching and water treatment), the Vinilo Institute called the proposal “a declaration of war against modern society” and the Chlorine Chemistry Council launched an aggressive counter-campaign, with intense lobbying in Congress, in the press and with other public officials, until the White House withdrew the proposal.⁽⁴⁰⁾

In view of the enormous delay in the public presentation of the final version of the dioxin reassessment, the Center for Environmental Health and Justice convoked a group of scientists to review available scientific information on the health impact from dioxin exposure, and published its own report in November 1999, including proposals for alternatives and for changes in public policy for each of the sources identified as generators of dioxins.⁽⁴¹⁾

1.4 The fight against incineration

The citizens movement against the waste incineration industry has been an important component in the fight against POPs, and it has become international in scope.

Defined broadly, incineration includes a process of combustion or thermal oxidation of wastes, for the purpose of reducing them to gases and ashes. The burning of trash in incinerators was first practiced in Europe during the 19th century. In the 1930s the inexpensive method of burying wastes led to an increase in underground deposit sites (sanitary landfills), which were made more “sophisticated” to receive hazardous industrial wastes —by adding filters, impermeable layers, and systems for monitoring and collection of leaching (hazardous waste confinement). However, in the 1970s, as a result of inadequate space for building new sanitary landfills or hazardous waste confinements, together with an enormous increase in the volume of municipal and hazardous wastes, and the rejection by communities and local governments unwilling to receive trash from other places and watch their own soil and water becoming polluted, the waste management industry began to promote incineration technologies as a solution to the “trash crisis.”⁽⁴²⁾

Companies promote incineration as a form of recycling or “recuperating resources” when energy is obtained from burning wastes. However, the amount of energy recuperated is not only insignificant, but is frequently

notably less than the energy that could be saved if —instead of burning the products— they would be repaired, reused, recycled or composted, thus avoiding the need to reproduce them with brand new materials. In addition, the very process of incineration creates wastes that are frequently more toxic than the original materials.

The different types of incinerators include those used for the combustion of municipal wastes and those used for incinerating hazardous wastes. Among the hazardous wastes that are incinerated are various types of industrial wastes in solid, liquid and mud forms, and also infectious biological wastes from hospitals. Since incinerators have been identified as a source of the generation of dioxin and other pollutants, citizen opposition has increased. In the United States alone, between 1985 and 1994, approximately 280 proposals for installing municipal waste incinerators were rejected or abandoned. Also, dozens of governments around the world have banned or restricted waste incineration, in response to evidence of the dangers represented by this technology, and prompted by citizen pressure.⁽⁴³⁾

Given the opposition to incinerators, the cement industry has recently expanded its practice of burning hazardous and non-hazardous wastes as alternative fuel for their rotary ovens used in cement production. This practice is promoted by transnational corporations controlling the world cement market, as a “sustainable cement initiative.” In this way, they manage to conduct a “double business,” obtaining profits from both treating wastes and producing cement. In the process, they “paint” themselves “green,” presenting this practice as a way of saving energy and a solution to the problem of wastes, as we will see in greater detail on page 31.

Incineration represents an advantage for those who generate hazardous wastes. This is especially true since the legal responsibility linked to wastes disappears as soon as they enter the incinerator. Incinerating wastes avoids the legal problems created when wastes are dumped or when leaching occurs in confinements, since there are no labels left on barrels identifying those responsible for generating the wastes. The original wastes are transformed into atmospheric gases and ashes, and can no longer be traced. Responsibility is transferred from the company that generated the wastes, to the company operating the incinerator.⁽⁴⁴⁾

Release of POPs and other hazardous substances by incinerators ⁽⁴⁵⁾

All types of incinerators release hazardous wastes, including flue gases and ashes that may contain heavy metals and products of incomplete combustion (PICs), involuntarily forming new POPs such as dioxins and furans. Even the EPA acknowledges that hazardous waste incinerators release thousands of incomplete combustion products during the incineration process. These particles are released in flue gases, and are also deposited in waste ash and liquids in hazardous waste incinerators.

Flue gases: These gases emit persistent organic pollutants, such as dioxins, furans, PCBs, and hexachlorobenzene —all of which, as we will be studying in more detail, are highly toxic, persistent and bioaccumulative in food chains. Other organic compounds are also released, including greenhouse effect gases; heavy metals such as lead and cadmium; acid gases; and ultra-fine particles (2.5 micron) that escape filters and emission control equipment, and may remain suspended in the atmosphere for long periods of time or deposited in lungs, and may also carry dioxins and heavy metals. POPs released into the atmosphere can be carried long distances, and affect communities and the environment.

Ash: Incineration processes generate two types of ash: bottom ash that remains after incineration, and fly ash, some of which is captured by control equipment, and some of which is emitted into the atmosphere. Ash can be contaminated with PICs and heavy metals.

Fugitive emissions: These are wastes that are accidentally released during transportation and handling operations, sometimes in amounts equal to or greater than atmospheric emissions from flues.

Heavy metals contained in wastes that are burned are not destroyed, but are rather redistributed and their physical form is changed. Sometimes they become more toxic, and become easier to inhale and ingest, with leaching more likely in the case of ash in incinerators. At least 19 metals have been identified in flue gases, ash and other incinerator waste. The metals commonly released are mercury, lead, cadmium, chromium, arsenic and beryllium—all known to be possible carcinogens. Mercury is released from incinerators in a gaseous form, as elemental mercury; it is a strong neurotoxin and it biomagnifies in the food chain.

In the fourth chapter of this book we will address the limitations of methods used in measuring dioxins and furans, when we look at dioxin inventories in Stockholm Convention national implementation plans. For now, we will comment that current measuring methods underestimate the actual release of dioxins, since they do not include a continuous method of measurement that covers several days, and instead typically measure only a few hours. Also, reports on the release of dioxins should be complete, and include not only the release through flue gases, but also in ash and other liquid and solid wastes. Control measures for dioxins and furans established by governments are very weak. Measurements are taken only once or twice a year, with prior notification given, and consequently cannot reflect the real average conditions for operations, characterized by frequent lighting, extinguishing and malfunctioning.

Impacts from incineration on health and the environment

Research on human and environmental exposure resulting from releases from incinerators is limited, however there is now accumulated evidence verifying that incinerators—both the more modern and older installations—contribute to local contamination of soil and vegetation by dioxins and heavy metals. The evidence also confirms negative effects on the health of exposed workers and local residents.

Members of communities located near incinerators are exposed to hazardous chemical substances, by inhaling polluted air, consuming contaminated local agricultural products (vegetables, eggs and milk), and through direct contact with contaminated soil. Individuals living near incinerators have higher levels of dioxins and other compounds with similar toxicity in their tissues, and even in children's blood and breast milk.

Although limited in nature, various studies have documented the following impacts for workers at solid urban waste incinerators: elevated levels of mutagens (capable of damaging DNA in cells) in urine; increased levels of hydroxypyrene in urine (an indicator of exposition to polyaromatic hydrocarbons); 3.5 times higher probability of death from lung cancer; 1.5 times higher probability of death from esophagus cancer; 2.79 higher probability of death from stomach cancer; increased allergies; decreased liver functioning; hyperlipidemia; coronary ischemia (insufficient blood flow to heart, causing angina pectoris) and chloracne.⁽⁴⁶⁾

Other studies on the health of communities located near incinerators have documented the following impacts: chromosomal damage; thioether concentrations in urine; an increase in various cancers (44% increase in soft tissue sarcomas, and 27% in non-Hodgkin lymphomas, that do not include lymphatic tissues); mortality from

lung cancer and larynx cancer; a 37% increase in mortality from liver cancer; and a doubling of the probability for childhood cancer. Respiratory problems and lung illnesses have been observed near cement-producing plants (breathing difficulties, persistent coughs, bronchitis). Also observed are congenital malformations such as harelip, spina bifida and hypospadias (when testicles fail to descend). There are contradictory studies on a possible increase in multiple births, and finally, low levels of thyroid hormones have been found in children.⁽⁴⁷⁾

The connection between chlorine content in wastes and dioxin formation during incineration

One of the controversial aspects of opposition to incineration is the relationship between the chlorine content found in wastes, and an increase or decrease in dioxin generation. The Chlorine Chemistry Council states that, according to some studies, the way incinerators are designed and the conditions for their operation are the critical factors determining any increase in dioxins and furans as a result of combustion. The Council contends there is no relationship between such an increase and an increase in chlorinated wastes.⁽⁴⁸⁾ This is the industry's way of attempting to prevent the use of restrictions or policies that could limit or question the use of their products.

Despite the arguments used by the chlorine industry, there is a significant body of scientific evidence demonstrating the opposite: specifically, that dioxin formation diminishes when the amount of chlorinated compounds is decreased. In effect, Greenpeace International's scientific unit conducted a comprehensive review of the scientific literature published up to the end of 2001, and based on its findings, argues the following: that since each molecule of dioxin contains two or more atoms of chlorine, chlorine is absolutely necessary for the formation of dioxins, and therefore, if chlorine is not present, dioxins will not be formed. There are three types of studies that have proven the relationship between a low chlorine content and a reduction in dioxin formation: studies conducted with pilot-level combustion systems in laboratories; with small-scale combustion systems; and with full-scale combustion systems.⁽⁴⁹⁾

In the specific case of full-scale incinerators, some studies have demonstrated a reduction in dioxin formation when chlorine content is reduced, while other studies have not found these same results. This has been interpreted by some regulators as an indication that for this particular category of combustion systems, chlorine input has little or no influence on dioxin formation. No scientific explanation has been given for why or how the chlorine-dioxin relationship would be different in full-scale incinerators than in other combustion systems. Nevertheless, a practical explanation for the inconsistency in results obtained by studies of full-scale waste incinerators can be found in the difficulties characterizing this type of study, including: study design errors; sampling and analysis methods with a high degree of uncertainty; delayed emission of dioxins (when dioxins are absorbed in the walls of flues and then released gradually); the high degree of variability in waste content; and finally, the uncertainty of measurements of hydrogen chloride in flue gases, as an indicator of chlorine content.⁽⁵⁰⁾

The correlation between chlorine content in wastes and dioxin formation has led some governments to impose restrictions on the chlorine content of fuel used or wastes burned in incinerators, as well as to propose the substitution of chlorinated materials. For example, the Swedish government has promoted the substitution of polyvinyl chloride plastic (PVC) by the year 2007. PVC is composed of 57% chlorine and has been identified as the primary substance containing chlorinated compounds found in incinerators. It has also been found to be a primary contributor to dioxin formation in fires occurring in trash dumps.⁽⁵¹⁾

International opposition to incineration

During recent years, the incineration industry has expanded in countries in the South, backed by arguments pointing to improved efficiency in combustion and in devices for trapping pollution. It is claimed that these measures reduce and control hazardous emissions. However, while the generation of pollutants may be reduced through these controls, it is not eliminated. Furthermore, the costs of equipment for filtering or controlling pollution may represent as much as a third or even half of installation costs. This is found primarily in industrialized countries that increasingly impose stricter demands on emissions control. For countries in the South, the option of incinerating hazardous wastes is too onerous —unless they permit incinerators to operate with control measures that are not as strict, however this would create an unacceptable double standard.⁽⁵²⁾

Another case of problems that are more intense in Southern countries can be observed in the greater difficulties and costs involved in monitoring pollutants generated by incineration, due to the following: the lack of specialized laboratories and trained technical personnel; limitations in the area of hazardous waste confinement that is adequate for depositing ash; maintenance problems; differences in waste composition, which can affect the operation of incinerators; corrupt practices; and finally, financial problems caused by receiving fewer tons of wastes than planned. The incineration of municipal wastes requires a high cost in capital investment, however only minimal use of the labor force. In addition to wasting resources, this option does not create sources of employment, as operations for recycling materials do.⁽⁵³⁾

In 2000, the Global Alliance for Incineration Alternatives (GAIA) was created, forming a network of more than 400 institutions and individuals from 70 countries in Europe, the United States, Asia, Africa and Latin America. GAIA supports citizen resistance to incinerators, and promotes projects for clean production and reduced generation of wastes, with the final goal of “zero waste.”⁽⁵⁴⁾

Incinerators for municipal, hospital and hazardous wastes, and cement ovens that burn chlorinated wastes for fuel are all part of a dirty technology that can be replaced by prevention and management systems designed to reduce the generation of wastes at the source. Wastes that cannot be reduced should be treated with appropriate technology that does not generate new pollutants. In the section dedicated to Best Environmental Techniques, we will develop this topic further.

In the specific case of alternatives to hospital waste incinerators, there is an international campaign and network, *Health Care Without Harm*, that brings together hospitals, consultants, nurses, health professionals, and service-providing companies to promote not only alternatives to incinerators, but also the elimination of mercury, PVC and other toxic substances, with the aim of reducing health risks to workers and patients through efficient systems of reduction, segregation and treatment of hospital wastes.⁽⁵⁵⁾

At the fourth meeting of the Intergovernmental Negotiating Committee of the Stockholm Convention held in Bonn, Germany in March 2000, more than 36 social and environmental organizations belonging to IPEN declared their opposition to the transfer of incinerators from the United States and Europe to the rest of the world. They also called for the Convention to establish mechanisms for technical and financial assistance for promoting alternative non-combustion technologies, so the existing stockpiles of POPs can be treated without producing dioxins and furans.

1.5 Alternative proposals for zero waste, clean production and extended producer responsibility

As an alternative to the final disposal of wastes (in sanitary landfills or hazardous waste confinement) and to toxic technologies for waste treatment—which, like incineration, generate new pollutants—many citizens and companies are proposing a new paradigm in waste management that emphasizes prevention (more than control) of wastes and pollutants generated by industrial production. One proposal that is increasingly gaining momentum is to work toward *zero waste* systems. The goal is to aspire beyond activities for separating trash, recuperating organic material for composting, and recycling glass, plastics and cardboard. Instead, the focus is to not only impact waste recycling and management at the end of a product's life cycle, but rather to modify the entire cycle of production and consumption (extraction of raw materials, product design, production practices, mode of transportation, the way consumers make their choices, and more). All of this is aimed at building a system in which materials are returned to nature or to the market without generating wastes.⁽⁵⁶⁾

The philosophy and principle of zero waste proposals extend beyond the prevailing linear management throughout the life cycle of products, or the “cradle-to-grave” management (extraction-production-consumption-final disposal). Rather, the idea is to create a circular vision that allows for “cradle-to-cradle” management. This proposal seeks the transformation of industrial processes and their products to make the flow of materials increasingly circular, similar to what we see in natural systems (see Figure 1).

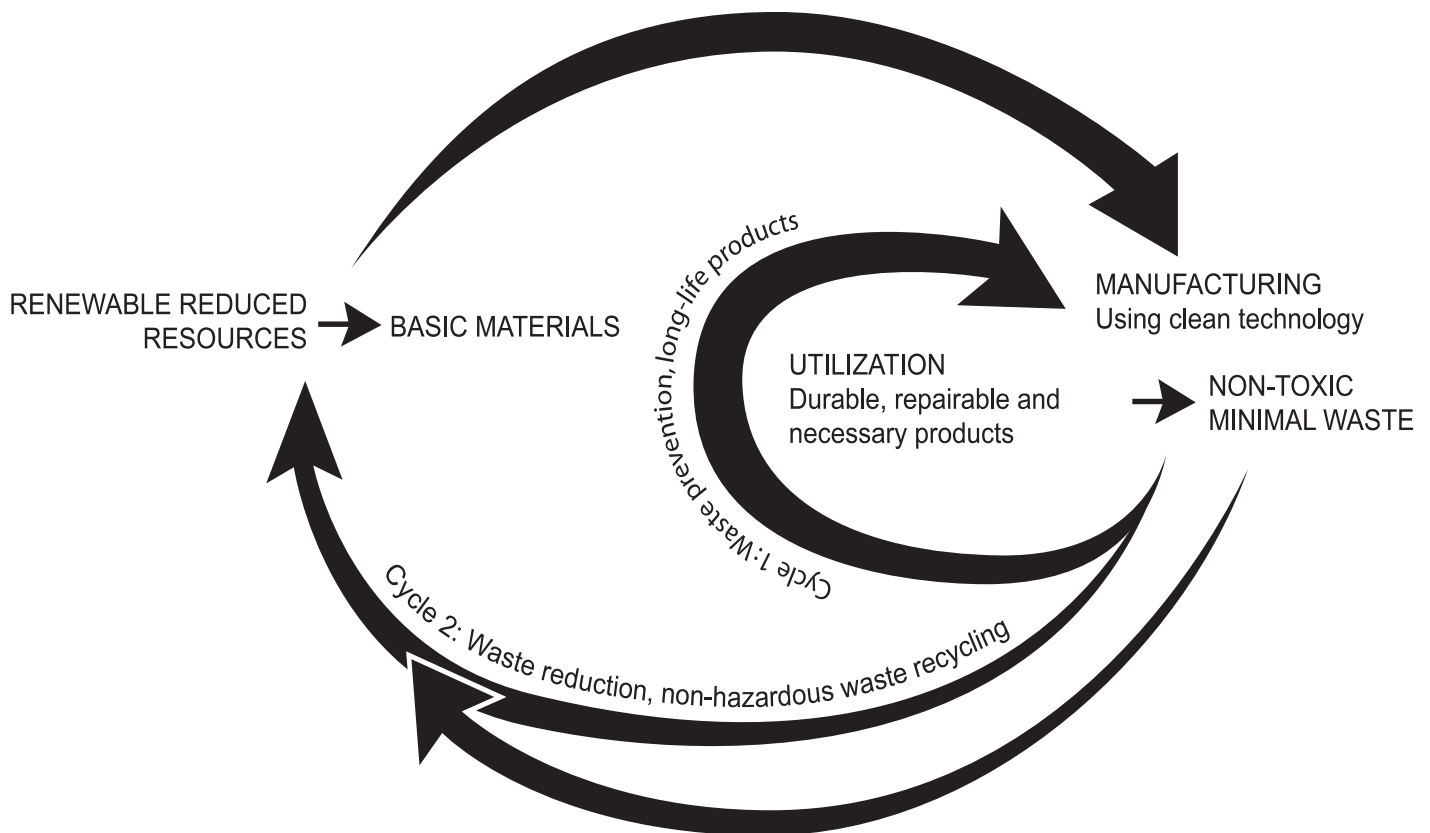


Figure 1

Circular Structure of a Sustainable Economy

Source: Iza Kruszewska and Beverly Thorpe, 4. *Extended Producer Responsibility: Strategies for promoting Clean Production*, Greenpeace Report, 1995, p. 9.

In order to attack the root of the problem of waste generation, changes must take place at the source where wastes are generated, and even during production. “End-of-pipe” solutions through better filters and better pollution control equipment are not enough. And this is where actions for attaining *Clean Production* come in. These include the application of techniques for increasingly reducing and finally eliminating the use of toxic substances in products and production processes. Strategies for reducing the use of toxics involve changing inputs and materials, with redesigning of products and processes; plus reducing the volume of toxics through improvements in the efficiency or output of production processes, improvements in maintenance operations, and internal recycling in closed processes. The clean production strategy also includes the conservation of natural resources and efficient use of energy.⁽⁵⁷⁾

The focus of clean production is different from the concept of “eco-efficiency” or “industrial ecology,” as generally applied. The goal of industrial ecology is for the wastes from one factory to become the inputs for another, thus creating industrial circuits with more efficient use of resources and energy, and an analysis of the life cycle of products. This strategy has a significant limitation, however, since it does not emphasize promoting the use of cleaner, less toxic materials. This explains why many “ecological” industrial parks only manage to exchange their toxic wastes as inputs, without promoting the transformation or redesigning of the overall system.⁽⁵⁸⁾

Another necessary tool for achieving the goals of zero waste and clean production is what has been termed “*Extended Producer Responsibility*” (EPR), also sometimes referred to as producer “take-back.” EPR guarantees that manufacturers take responsibility for their products and the packaging for their products during their entire life cycles. If a product and its packaging cannot be reused, recycled or composted, the producer must assume the costs for collecting and eliminating them in the safest way possible.⁽⁵⁹⁾ Examples of EPR programs are the systems for returning beverage bottles, programs for returning toxic products to the producers—including batteries, paints, medicines, pesticides, used vehicles (European End-of-Life Vehicle Directive), computers and other electrical equipment—for their recycling or safe treatment. EPR is a principle that focuses on producers taking responsibility for the environmental impacts of their products, in order for the use of toxic substances to be increasingly reduced in product design and production, and in order for these products to be used for longer periods of time, and to be safely reused or recycled, thus decreasing the consumption of resources. The goal is for the producer to assume the costs and responsibility for collecting its products after they have been thrown away, instead of these costs falling on taxpayers or local governments, as is currently the case.⁽⁶⁰⁾

Policies for implementing the Extended Producer Responsibility principle may use regulatory, economic and consumer information instruments, as specified in the following Table.

Table 3
Policies for implementing Extended Producer Responsibility (EPR) principle

| |
|---|
| <p><u>Regulatory instruments:</u></p> <p>Mandatory take-back</p> <p>Minimum recycled content standards for products</p> <p>Secondary materials utilization rate requirements</p> <p>Energy-efficiency standards</p> |
|---|

Bans and restrictions on final disposal
Bans and restrictions on specific materials
Bans and restrictions on specific products

Economic instruments:

Advance payment of product's final cost
Taxes on use of materials

Removing subsidies that favor use of virgin materials
Deposit/refund systems
Government purchase of cleaner products

Informative instruments:

Seal-of-approval type environmental labeling on products (Green Seal, Blue Angel)
Environmental information labeling (energy efficiency, CFC use, etc.)
Product hazard warnings
Product durability labeling

The primary responsibility for informing is placed on producers, whether voluntarily knowing they will receive market advantages, or through regulatory requirements.

Source: Mariana Walter, reviewed by Veronica Odriozola, *Basta de Basura*, Greenpeace-Argentina Report, Buenos Aires, Argentina, November 2003, p. 20.

The barriers to making progress in building systems based on the zero waste goal can be found: in government subsidies for extracting raw materials and for the waste management industry; in efforts to conceal the costs involved in these activities, both for the environment and for public health; in the lack of responsibility on the part of industries in relation to wastes generated by their products; in the inertia generated by cultural practices and the perception of “trash”; in the environmental regulatory model that prioritizes “end-of-pipe” solutions; in the defense of economic groups interested in perpetuating the lucrative business of management and final disposition of wastes; and in neoliberal economic policies in Southern countries that are promoted by international financial centers, that encourage technological dependence and favor the interests of foreign investment, while sacrificing health and the environment.

1.6 POPs discussion in the United Nations and other international agreements

Discussion on POPs in the United Nations can be traced back to 1992, the year of the UN *Conference on the Environment and Development, known as the Earth Summit*. At that meeting, *Agenda 21* was approved, and in its Chapter 17, it recommended that the United Nations Environment Program (UNEP) call for an intergovernmental meeting on protecting the marine environment from pollution resulting from land-based sources. At that meeting there was discussion on the possibility of eliminating the emission or discharge of

organohalogen compounds (organic compounds that contain chlorine, fluorine, bromine, iodine or astatine) and to reducing the emission or discharge of other synthetic organic compounds that threaten to accumulate to dangerous levels in the marine environment.

To follow up on the commitment made in *Agenda 21*, UNEP organized several meetings and established a list of 12 POPs. The proposal was later supported by the Intergovernmental Forum on Chemical Safety (IFCS) —in which representatives of the government, industry and environmental groups participate— and then UNEP organized an intergovernmental negotiating committee to establish an international convention with legal obligations linked to these pollutants. The process of negotiating the Convention on POPs took four years. After the initial meeting held in Montreal, Canada in June 1998, there were meetings in Nairobi, Kenya (1999), Geneva, Switzerland (1999), Bonn, Germany (2000) and Johannesburg, South Africa (2000). At this last meeting the final text of the Convention was agreed upon, and it was later signed according to protocol in May 2001 in the Swedish city of Stockholm, from which it received its name.

Before the signing of the Stockholm Convention, other international conventions had recommended the elimination or progressive reduction of the 12 POPs, especially in relation to protecting the marine environment and specific ecosystems in various regions. Nevertheless, the Stockholm Convention is the first that established a mechanism for technical and financial assistance available to developing countries or those with economies in transition.

Of the conventions prior to the Stockholm Convention, we would especially mention, because of their importance, the recommendations by the International Commission for the Great Lakes area, the Convention on Long-Range Transboundary Air Pollution (LRTAP) and the OSPAR Convention.⁽⁶¹⁾

a) *The International Joint Commission between the United States and Canada*. This Commission was originally created by the *Border Waters Treaty* that was signed in 1909 between the two countries, and to which the *Great Lakes Water Quality Agreement* was added in 1978. The general purpose of this agreement is to “restore and maintain the chemical, physical and biological integrity of the waters of the Great Lakes Basin Ecosystem” (Article II). It includes a commitment to adopt a policy for “the discharge of toxic substances in toxic amounts to be prohibited and the discharge of any or all persistent toxic substances to be *virtually eliminated*” (emphasis added by author).⁽⁶²⁾

In March 1992, in its sixth biennial report, the International Commission analyzed the problem of persistent toxic substances and indicated, among other things, that the necessary and reasonable way to implement the strategy of *virtual elimination* is to adopt the goal of zero discharge of persistent toxic substances. From the Commission’s viewpoint, *zero discharge* does not signify being satisfied with achieving non-detectable levels, or the use of controls based on the best available technology or the best management practices, which allow for the continued release of these substances. Instead, zero discharge is defined as ending the manufacture, use, transport and disposal of persistent toxic substances resulting from human activity.⁽⁶³⁾ In order to achieve this goal, it would be necessary to identify and virtually eliminate persistent toxic substances; to progressively eliminate PCBs, DDT, dieldrin, toxaphene, mirex and HCB; to seek an international ban on their production, use and storage (the sixth report also acknowledged the endocrine disruption effect on wildlife caused by these substances); to modify production processes and chemical inputs, in order to avoid the unintentional production of dioxins, furans and HCB; to establish dates for an end to the use of chlorine and chlorinated compounds as basic materials in the Great Lakes area; and to establish a specific date after which no point of release of persistent toxic substances would be permitted in Lake Superior and its tributaries. These

recommendations by the Commission have not been fully implemented in the Great Lakes region due to the industry's strong opposition and its considerable influence on the US and Canadian governments.⁽⁶⁴⁾

b) After six years of investigation and negotiations, the *Convention on Long-Term Transboundary Air Pollution* (LRTAP) was approved in 1979, and entered into effect in 1983. This convention addresses the air pollution problems in the United Nations Economic Commission for Europe (ECE) region. All of Europe, Central Asian republics, the former Soviet Union, Israel, Canada and the United States are members of the UNECE region, and most of these countries are parties to the LRTAP Convention.

In June 1998, the LRTAP Convention adopted the *Protocol on Persistent Organic Compounds*, which will enter into effect when it is ratified by 16 countries. This protocol is aimed at controlling, reducing or eliminating discharges, emissions and losses of POPs. In addition to the 12 POPs later included in the Stockholm Convention, the following were also included: an insecticide known as chlordecone (Kepone), hexabromobiphenyls, polyaromatic hydrocarbons and another insecticide known as lindane —as part of the controls on technical HCH (hexachlorocyclohexane). It was proposed that short-chained chlorinated paraffins and pentachlorophenol also be added, however since an agreement was not reached, they did not enter into the protocol. The LRTAP Convention includes another seven protocols on substances with transboundary impact.⁽⁶⁵⁾ The provisions in these protocols greatly influenced the contents of the Stockholm Convention.⁽⁶⁶⁾

c) The OSPAR Convention, or the *Convention for the Protection of the Marine Environment of the North-East Atlantic*. This convention was created through the fusion of the *Oslo Convention for the Prevention of Marine Pollution by Dumping from Ships and Aircraft*, of 1972, and the *Paris Convention for the Prevention of Marine Pollution from Land-Based Sources*, of 1974. The acronym OSPAR was formed by joining “Oslo” and “Paris.” This convention was signed in 1992, it went into effect in 1998, and it currently includes 15 member countries from the European Union (Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Luxembourg, Holland, Norway, Portugal, Sweden, Switzerland, the United Kingdom and Spain).⁽⁶⁷⁾ The ocean area covered by the agreement is the North Sea and part of the North East Atlantic and the Arctic Ocean.

At the ministerial meeting held in Sintra, Portugal in July 1998, the member countries of the OSPAR Convention issued the *Sintra Declaration*, which includes specific commitments regarding hazardous substances, radioactive substances, eutrophication and the offshore oil and gas industry. The agreement also addresses the protection of biological diversity. With regard to hazardous substances, the countries agreed to “preventing pollution of the maritime area by continuously reducing discharges, emissions and losses of hazardous substances (that is, substances that are toxic, persistent and liable to bioaccumulate or which give rise to an equivalent level of concern), with the ultimate aim of achieving concentrations in the marine environment near background values for naturally occurring substances and close to zero for man-made synthetic substances.” Even more importantly, they agreed to “move towards the target of cessation of discharges, emissions and losses of hazardous substances by the year 2020” in the maritime area covered by the Convention. This has been referred to as the goal to be attained “within a generation,” or the “generational goal” and it includes various POPs and other substances. The text signed by the ministers meeting in Sintra specified that: “We emphasize the importance of the precautionary principle in this work.”

⁽⁶⁷⁾

As a first step toward implementing the goal “within a generation,” OSPAR member countries agreed in 1998 to select a priority list of 15 substances, including PCBs, dioxins and furans, in addition to polyaromatic hydrocarbons (PAHs), pentachlorophenol, short-chain chlorinated paraffins, mercury and organic mercury

compounds, cadmium, hexachlorocyclohexane isomers (HCHs), lead and organic lead compounds, organic tin compounds, nonylphenol/ethoxylates and related substances, musk xylene, brominated flame retardants, and certain phthalates (dibutylphthalate and diethylhexylphthalate). Organohalogens will be considered as a group in the Convention's implementation.⁽⁶⁸⁾

The *Sintra* Declaration emphasizes the commitment to apply the precautionary principle, the polluter pays principle, and the identification of *Best Available Techniques* (BAT) and *Best Environmental Practices* (BEP), including clean technology.

As you can see, this European regional commitment contains many more progressive elements than the LRTAP Convention, and it constituted a frame of reference for various positions taken by the European Union during the Stockholm Convention negotiations. The European Union's proposals were met with strong opposition by countries such as the United States, Canada, Japan, Australia and New Zealand, which in this and other conventions have opposed the inclusion of the precautionary principle and commitments for eliminating substances, especially dioxins and furans, since the governments of those countries are greatly influenced by the interests of corporations in the chemical industry.⁽⁶⁹⁾ As we will see in the third chapter of this book, the Stockholm Convention reached a compromise between these two positions.

1.7 Business associations involved in discussions on eliminating POPs

In response to the fight waged by citizens and regulations established by governments to control environmental pollution, transnational corporations have —throughout decades of conflict— developed strategies for transforming their images, and exerting more influence on public opinion, on science and national and international regulatory agencies. In short, they have attempted to influence the terms in which environmental issues and their solutions are defined.

It has been extensively documented by a number of analysts that there is a growing tendency among transnational corporations to contract public relations firms or establish their own public relations department. The area of public relations has become a specialized services-oriented industry that is dedicated to manipulating public perception, shaping reality and fabricating consensus.⁽⁶⁹⁾ These public relations firms launch campaigns that include paid publicity; however their activities are primarily dedicated to sending information directly to influential public opinion leaders. Public relations firms are now an important source of news, for both the most prestigious communication media as well as common newspapers.⁽⁶⁹⁾ One of the strategies used in this form of public relations work is the “third party technique,” through participation by “independent experts” who talk about all the good qualities of a product, create doubts about the alleged risks of certain activities, and respond to criticisms provoked by company practices. Now we find nonprofit institutions dedicated to scientific research and dissemination that have been created with perspectives that are convenient for the interests of industries. Also, techniques traditionally used by environmental activist groups, such as sending mass mailings and creating citizen support groups, have been appropriated by the industry. A common practice among corporations is to combine public relations strategies with lobbying in Congress to block laws contrary to their interests and pass laws in their favor.

What has been termed “corporate environmentalism” is a complex phenomenon, since on the one hand we can find examples of changes in pollution-generating industrial practices. However, there is also extensive documentation of how these efforts are actually part of a “greenwash” strategy, through public relations campaigns, and the promotion of voluntary codes of conduct and self-regulation programs, such as the

“Responsible Care” campaign launched by the chemical industry. Corporations have used the concept of “sustainable development” to their advantage, influencing the way it is interpreted and implemented. They create the impression that promoting free trade, economic growth, and industry’s self-regulation is compatible with environmental protection and the fight against poverty.⁽⁷⁰⁾

In the negotiations and preparatory activities for the Stockholm Convention on POPs, various international business associations participated actively as observers and members of government delegations, while lobbying and exerting pressure to best serve their own interests. In this section we will present the groups headed by powerful transnational corporations that were especially active in this process and that continue to exert their influence on the Conferences of Parties to the Convention and the corresponding National Implementation Plans.

World Chlorine Council

The World Chlorine Council (WCC) brings together national and regional commercial associations in the chlorine industry, and is the “global voice” for this sector. Members of WCC are chemical and chlorine industry associations in countries including the United States (Chlorine Chemistry Council), Europe, Japan, Korea, Russia, Australia and Mexico, as well as sector-based producer associations, especially manufacturers of vinyl or PVC and halogenated solvents, and also associations in China and Taiwan.⁽⁷¹⁾

During the Stockholm Convention negotiations, the World Chlorine Council —under the leadership of the US Chlorine Chemistry Council— lobbied openly against including the precautionary principle; against including the principle of replacing inputs, processes and products that form or release dioxins; and in favor of instead including general references to prevention. It was opposed to including language in the Convention that could lead to the banning of incineration in waste management; it was against including explicit references to dioxin-generating sources; it proposed general instead of specific exceptions; and it advocated including strictly scientific criteria for including new POPs.⁽⁷²⁾ The Chlorine Chemistry Council also spreads the notion that the chlorine industry is not a significant source of dioxins and furans released into the environment; it states that perfecting combustion practices is the best way to reduce environmental levels of dioxins; and it describes dioxins and furans as by-products of both natural and industrial products.⁽⁷³⁾

In 1994, the World Chlorine Council promoted the creation of a group called the “Chlorophiles,” which defines itself as “independent, non-for-profit.” It is made up of workers in the chlorine and PVC industries, and its purpose is to counteract the environmental campaigns of groups like Greenpeace. The “Chlorophiles” have stated that they “work responsibly and carefully in the manufacture of products for the well-being of the human race. Humanity cannot be deprived of the benefits from chlorine because of false or erroneous prejudices and information.” They claim to have 1,800 members who are primarily workers in the chlorine and PVC industries in Belgium and Holland.⁽⁷⁴⁾ This group is a clear example of the “third party technique” used in the public relations strategy mentioned above. In this case, there is also an attempt to present a false contradiction between workers’ interests and environmental protection. The Greenpeace campaign proposes replacing chlorinated compounds and prohibiting PVC, since they generate dioxins, furans and other pollutants when they are produced, and also because they are the main contributors to the forming of these pollutants in wastes that are incinerated. Groups of workers who support the Greenpeace campaign ask for a fair transition, in which the need to relocate workers to other, lower-risk productive sectors is recognized.⁽⁷⁵⁾

The Chlorine Chemistry Council (CCC) was created in the United States in 1993 by the Chemical Manufacturers Association (CMA), also of the United States (now known as the American Chemistry Council or ACC). The objective of the CCC was to maintain a strong presence in public relations, political lobbying, and “scientific initiatives” in all topics related to the chlorine industry. The CCC’s creation was the political response to the report and recommendations made by the International Joint Commission between the United States and Canada for the Great Lakes region, for the elimination of the use of chlorinated compounds, as mentioned earlier in this chapter.⁽⁷⁶⁾

The transnational corporation, Dow Chemical, played a fundamental role in creating the US Chlorine Chemistry Council, whose first director was Brad Lienhardt, a Dow employee for much of his career. In effect, Dow is one of the most influential ACC members, and is the world’s largest producer of chlorine since the Second World War, with industrial facilities in the United States, Canada, Germany and Brazil.⁽⁷⁷⁾

Dow, together with the Chlorine Chemistry Council, the Chlorine Institute, the Vinyl Institute, ACC and the US Chamber of Commerce, all make up a common front that contracts public relations firms to influence government regulatory agencies, Congress, and communication media in the United States and other countries, in the defense of their interests. The targets of their attacks are the precautionary principle and environmental groups, and what they promote is the notion of sound science that supports their interests.⁽⁷⁸⁾

The Chlorine Chemistry Council is supported in its public relations work by various corporate groups, such as the American Council on Science and Health, and conservative think tanks such as Competitive Enterprise Institute and Heartland Institute, as well as the so-called “Wise Use Movement,” a broad-based, conservative coalition created in opposition to the environmental movement, and which, since 1988, has been advocating for fewer environmental regulations.⁽⁷⁹⁾

The World Chlorine Council, according to its own information, has been very active in awareness-raising workshops on management and destruction of PCBs. Through Euro Chlor, and by invitation from UNEP, it has sent various industrial experts to participate in workshops in Mali, the United Arab Emirates, Slovenia, Zambia, Russia, Croatia and Iran.⁽⁸⁰⁾

Chlorine production is primarily for manufacturing other chlorinated compounds, including plastics (primarily PVC, representing 34% of the world’s use of chlorine), solvents, pesticides and intermediate chemical substances. Many of these compounds have been identified as sources of dioxin generation during their manufacturing, use and final disposal.

International Council of Chemicals Associations (ICCA)

The ICCA is a council of important commercial associations representing chemical manufacturers around the world. ICCA members are from North America, with the American Chemistry Council (formerly Chemical Manufacturers Association), the Canadian Chemical Producers’ Association and the Mexican National Association of the Chemical Industry (ANIQ); from South America, with Conselho das Associações da Indústria Química do Mercosul (CIQUIM, Brazil and Argentina); from Japan, with the Chemical Industrial Association of Japan; from Australia and New Zealand; and from Europe, with the European Chemical Industry Council (CEFIC), through which national commercial associations from 22 European countries participate in the ICCA.⁽⁸¹⁾

Delegations from the American Chemistry Council of the United States, as well as members from Canada, Australia and Sweden participated aggressively in the POPs negotiations. A representative from ICCA and another from the Chlorine Chemical Council (CCC) participate in the Experts Committee that will develop BAT and BEP guidelines, to be subjected to approval at the first Conference of Parties to the Stockholm Convention.

The ICCA expressed its particular satisfaction for the adoption of the Stockholm Convention, and the establishment of criteria for selecting new POPs based on the LRTAP Convention.

World Business Council for Sustainable Development (WBCSD)

This organization was previously named the Business Council for Sustainable Development (BCSD) and was originally formed by a group of 50 leaders from major transnational corporations (including DuPont, 3M, Dow) in the chemical, energy and pesticide industries and the forestry sector, as well as others. The Council was created at the end of 1990 by Stephan Schmidheiny, a multimillionaire Swiss businessman, after he was invited to serve as the primary Commerce and Industry advisor by Maurice Strong, another multimillionaire businessman who was the Secretary General of the UN Conference on the Environment and Development, held in June 1992 in Rio de Janeiro, Brazil. Maurice Strong provided important support for the presentation of the Council's proposals and the publishing of the book "Changing Course: A Global Business Perspective on Development and the Environment," which was the first expression of the Council's vision on Rio Summit topics. Since that time, he has published various reports.⁽⁸²⁾

The Council participated actively in preparations for the UN Conference, and had an influence on the results from negotiations. It contracted the services of one of the world's most important public relations firms, Burson-Marsteller, and together with other business organizations, promoted the idea that free trade, industrial self-regulation, simplification of regulatory mechanisms, eco-efficiency of production systems under the leadership of transnational corporations, and adequate cooperation in technology will lead to sustainable development. In theory, *Changing the Course* accepts the idea of using cleaner materials, technology and products as a strategy for preventing pollution, however in practice this is not apparent in any specific program, and it is not consistent with the position of Council members, such as those from the chlorine industry.

After the Earth Summit, the BCSD established national and regional affiliates in Latin America and Asia, and a binational entity in the Gulf of Mexico, with its headquarters located in the Texas state government offices. At the end of 1994, the BCSD agreed to a fusion with another industrial group, the World Industry Council for the Environment (WICE), which was initiated by the International Chamber of Commerce in 1993. Eighty-five members participated in WICE, including Royal Dutch/Shell, ICI, Ciba, Sandoz, Rhone-Poulenc, Mitsubishi and Mobil. With the fusion, the new organization took on the name of the World Business Council for Sustainable Development (WBCSD).⁽⁸³⁾ Belonging to the World Council are 160 of the world's major transnational corporations from 30 countries, in the 20 main industrial sectors. It has formed a network of 38 national and regional business councils in developing countries and countries with economies in transition, and in which more than 1,000 business leaders participate, according to its 2002 publications.

Both the World Chlorine Council (WCC) and the International Council of Chemicals Associations (ICCA) participate in the WBCSD.

In relation to POPs, something especially noteworthy within the WBCSD is the Sustainable Cement Initiative, created in 1999 by the ten primary transnational corporations in the cement industry, representing a third of total world production. This initiative, which seeks to guarantee the sustainable development of the cement industry for the next 20 years, contracted the Batelle Memorial Institute, a US consulting firm, to conduct an initial assessment. One of the objectives of the study was identified as an increase in the productivity of resources used, including the use of energy and the recuperation and reuse of wastes. In July 2002, the ten corporations presented an Agenda for Action, which identified six strategic areas and included among its projects the development of guidelines for the “responsible use” of raw materials, conventional fuels (coal, fuel oil, gas) and “alternative” fuels for cement ovens. “Alternative fuels” refer to the burning of wastes such as old tires and hazardous wastes in cement ovens. In the area of emissions reduction, the Agenda has a project designed to develop an industrial protocol for measurement, monitoring and notification of emissions, and to seek ways of more quickly assessing dioxins, furans and volatile organic compounds. The Agenda for Action will report on its progress in 2005 and 2007.⁽⁸³⁾

The *Sustainable Cement* project is coordinated by high-level executives at the following companies: Cimpor (Portugal), Holcim (formerly Holderbank, Switzerland), and Lafarge (France), making up the Working Group, together with Cemex (Mexico), Heidelberger Zement (Germany), Italcementi (Italy), RMC Group (United Kingdom), Siam Cement Industry (Thailand), Ssangyong Cement (South Korea), Taiheiyo Cement (Japan) and Votorantim (Brazil). The initiative includes a small Assurance Group, which has the function of reviewing the approach, quality and balance in the process, and to act as an arbitrator if differences arise. Dr. Mustafá Tolba, former director of UNEP coordinates the group.

One of the stated reasons for promoting the *Agenda* is to create new market opportunities through a process of innovation that achieves greater efficiency in resources, energy, and savings in the long term; innovations in services and products to reduce environmental impacts; and efforts with other industries on new uses of secondary products and wastes from cement production.⁽⁸⁴⁾ The practice of burning hazardous and other wastes in cement ovens saves the cement industry the costs of conventional fuel and represents an additional source of income, by linking up with other sectors in the hazardous waste management industry that charge for their services. However, this does not reduce environmental impact, and instead it creates new risks to the environment and to public health, due to the involuntary generation of dioxins and furans.

The cement industry has demonstrated its capacities in promoting and *greenwashing* its image and financing environmental programs, while at the same time defending the practice of incineration in its cement ovens — which it presents as a service to the community. The cement industry contends that this is a way to prevent old tires from ending up in sanitary landfills, or hazardous wastes from ending up in confinements or final disposal. However, it conceals or minimizes the impacts caused from the POPs generated.

CropLife International

CropLife International represents, in its own words, the “Plant Science Industry.” With its headquarters located in Brussels, Belgium, this federation has members from 87 countries, through regional associations established in the United States, Europe, Latin America, Africa and the Middle East, Asia and Japan, in addition to national associations in Canada and Israel.⁽⁸⁴⁾

CropLife’s history can be traced back to the creation of the European Group of Pesticide Manufacturers, which after the United States and other countries had joined, was given the name of International Group of

National Associations of Agrochemical Manufacturers (GIFAP) in 1960.⁽⁸⁵⁾ Later its name was changed to Global Crop Protection Federation, and in 1991, it changed once again, to CropLife International. This last change was a result of its international restructuring and its interest in consolidating its position in the area of agricultural biotechnology, especially with the commercialization of genetically-modified organisms.

This federation is headed by transnational corporations such as Syngenta, Bayer (now also the owner of Aventis CropScience), Monsanto, Dow AgroSciences, DuPont, FMC, BASF and Sumitomo. These corporations control the world market in pesticides, and have invested in other sectors of the chemical industry such as plastics and the pharmaceutical sector. During recent decades they have acquired seed-producing companies and biotechnological laboratories, in order to promote genetically-modified crops. CropLife supports free trade and the reduction of tariffs for importing pesticides.

According to CropLife, its members do not produce any of the nine POP pesticides selected in the Stockholm Convention as high priority for elimination,⁽⁸⁶⁾ and consequently, its interest in the negotiation process was focused on the discussion on eliminating expired pesticides and the criteria for selecting new POPs for elimination, since some of them may be pesticides. CropLife supports the incineration of obsolete pesticides as a treatment method, and has cooperated with government development agencies such as GTZ of Germany, Cooperation for Development of Switzerland, the US Development Agency (USAID), the respective agency in the Netherlands, Cooperation for Development in the United Kingdom, and various national governments in projects for final waste disposal.

According to a March 2004 report, CropLife has participated in 25 projects for eliminating expired pesticides, many of them POP pesticides, by obtaining bilateral financial donations, organizing projects or reformulating usable stock when considered appropriate. In 2001, it reported having contributed to the destruction of 3,000 tons of obsolete pesticides, including 800 tons of POP pesticides.⁽⁸⁷⁾ In March 2004 it reported this figure had increased to 3,400 tons of obsolete pesticides in developing countries, especially Africa. In Latin America it has carried out elimination projects in Brazil, Colombia, Ecuador and El Salvador. For example, 1,200 tons of obsolete pesticides were incinerated in 2000, through a joint industry-government project. Other projects it reported correspond to Australia, Canada, India, Nepal, Pakistan and Sudan.⁽⁸⁸⁾

Participation by business associations has not been limited to the negotiations period for the Stockholm Convention. Rather, it continues today through committees of experts created by the Convention, particularly the Committee of Experts for defining guidelines for Best Environmental Practices (BEP) and Best Available Technology (BAT). Participating are representatives from the World Chlorine Council (WCC), International Council of Chemicals Associations (ICCA) and the European cement industry participating in the *Sustainable Cement Initiative*.

1.8 The creation of the International POPs Elimination Network (IPEN)

The International POPs Elimination Network (IPEN) was formed at the beginning of the first meeting of the Stockholm Convention's International Negotiating Committee held in Montreal in 1998. The objective of this network is to eliminate POPs and other persistent toxic substances. Currently, more than 350 citizen organizations in 65 countries on six continents participate in the network. These groups include national and local environmental groups, as well as groups defending the right to health and women's rights, plus indigenous groups, workers' labor unions, independent scientists, specialists in environmental law, and

international environment groups such as Greenpeace, Pesticide Action Network (PAN), Physicians for Social Responsibility (PSR), and at the beginning, the World Wildlife Fund, and others.

In the IPEN platform it was proposed from the beginning that the Stockholm Convention would face the challenge of establishing clear goals: the elimination of POPs —acknowledging the temporary exception of DDT use in controlling malaria; the application of the precautionary principle; prevention of POP-generating sources, by promoting cleaner forms of production; promoting alternatives to incineration for treatment of wastes and stockpiles of obsolete POPs; as well as clear measures for technical and financial assistance for developing countries and those with economies in transition. During the negotiations process, IPEN organized parallel events and made statements regarding the key issues under negotiation.

IPEN has established a Secretariat that plays a facilitating role, while the network carries out its activities in a decentralized manner, through three working groups: one on pesticides, a second on dioxins and PCBs, and a third on community monitoring of POPs.⁽⁸⁹⁾ In the course of these years, IPEN has developed a high-level dialogue with UNEP on the Stockholm Convention, and has received recognition for its work in the Intergovernmental Forum on Chemical Safety (IFCS). Currently, IPEN is working toward the effective implementation of the Stockholm Convention, and to open up channels for participation by civil society in the corresponding national implementation plans. To this end, it has developed a project for carrying out activities in at least 40 countries, through eight regional facilitators. This project was approved by the Global Environmental Facility (GEF), with support from the United Nations Industrial Development Organization (UNIDO) and the United Nations Environment Program (UNEP), and it will be carried out during a period of two years, beginning in May 2004.

IPEN members participate in the Group of Experts that will develop proposals for BAT/BEP guidelines, and some of its members have been incorporated into the committees for developing Stockholm Convention national implementation plans. IPEN is also participating in IFCS, and in the meetings organized by the United Nations to discuss a new Strategic Approach to International Chemicals Management (SAICM).

NOTES – CHAPTER ONE

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72. According to a study by Scott Cutlip, 40% of the news content of a typical newspaper in the United States originates from press bulletins released by public relations firms, memos on histories, or suggestions from these firms. Sheldon Rampton and John Stauber, 2001, *op. cit.*, p. 23.
73. For a critique of *greenwashing* and corporate environmentalism, see Jed Greer and Kenny Bruno, *Greenwash: the reality behind corporate environmentalism*, Penang, Malaysia, Third World Network 1996; Joshua Karliner, *The Corporate Planet: Ecology and politics in the age of globalization*. San Francisco, Sierra Club, 1997; and Kenny Bruno and Joshua Karliner, *Earth summit.biz, The corporate take over of sustainable development*, USA, Food First Books, 2002.
74. www.worldchlorine.com
75. www.pops-info.org Most of these arguments can still be consulted in this informative web page on POPs that was specifically created during the Stockholm Convention negotiations in December 2000.
76. Informative folder "What are the facts about dioxins and furans?" Chlorine Chemistry Council www.c3.org, and especially www.dioxinfacts.org
77. <http://www.ping.be>
78. www.greenpeace.org See report entitled "PVC-Free Future: A Review of Restrictions and PVC free Policies Worldwide."
79. Sheldon Rampton and John Stauber, 2001, *op. cit.* In relation to the Chlorine Chemistry Council and the chlorine industry, especially see Chapter 6 on "Preventing Precaution," pp. 120-152.
80. Jack Weinberg, editor (Dow, etc.), *op. cit.*, p. 6.
81. Sheldon Rampton and John Stauber, 2001, *op. cit.*
82. Sharon Beder, *Global Spin: The corporate assault on environmentalism*. USA-UK Green books and Chelsea Green Publishing Company, 1998, p. 151. Regarding "Wise Use Movement," see Chapter 3 dedicated to analyzing this movement, pp. 47-62.
83. World Chlorine Council, *The World Chlorine Council and Sustainable Development*, April 2002, p. 16 www.eurochlor.org
84. International Council of Chemical Associations (ICCA). Article on Persistent Organic Pollutants (POPs), ICCA, 2/6/98.
85. See www.wbcds.org and "Cambiando el Rumbo. Una perspectiva global del empresariado para el desarrollo y el medio ambiente," Mexico, Fondo de Cultura Económica, 1992.
86. Jed Greer and Kenny Bruno, 1996, *op. cit.*, p. 29.
87. The Agenda report can be consulted at www.wbcdcement.org/agenda.asp Other strategic areas identified, in addition to Fuels and Raw Materials and Emissions Reduction, are Climate Protection, Employee Health and Safety, Local Impacts and Internal Business Processes.
88. See for update www.croplife.org y www.africastockpiles.org
89. See more details in www.ipen.org

Chapter Two



Effects from POPs on health and the environment

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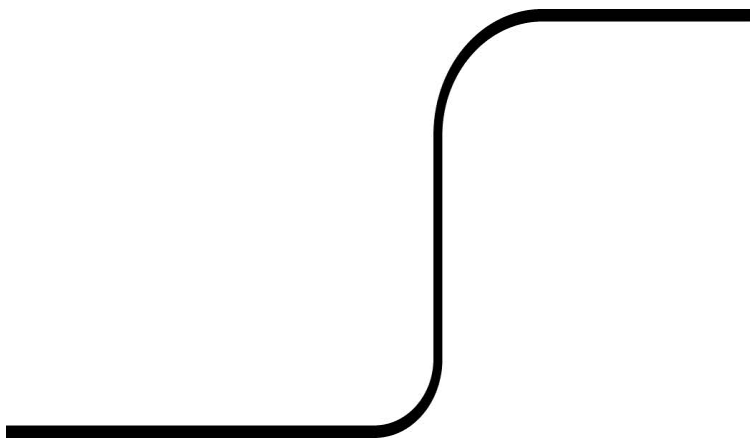
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Chapter Two

Effects from POPs
on health and the environment

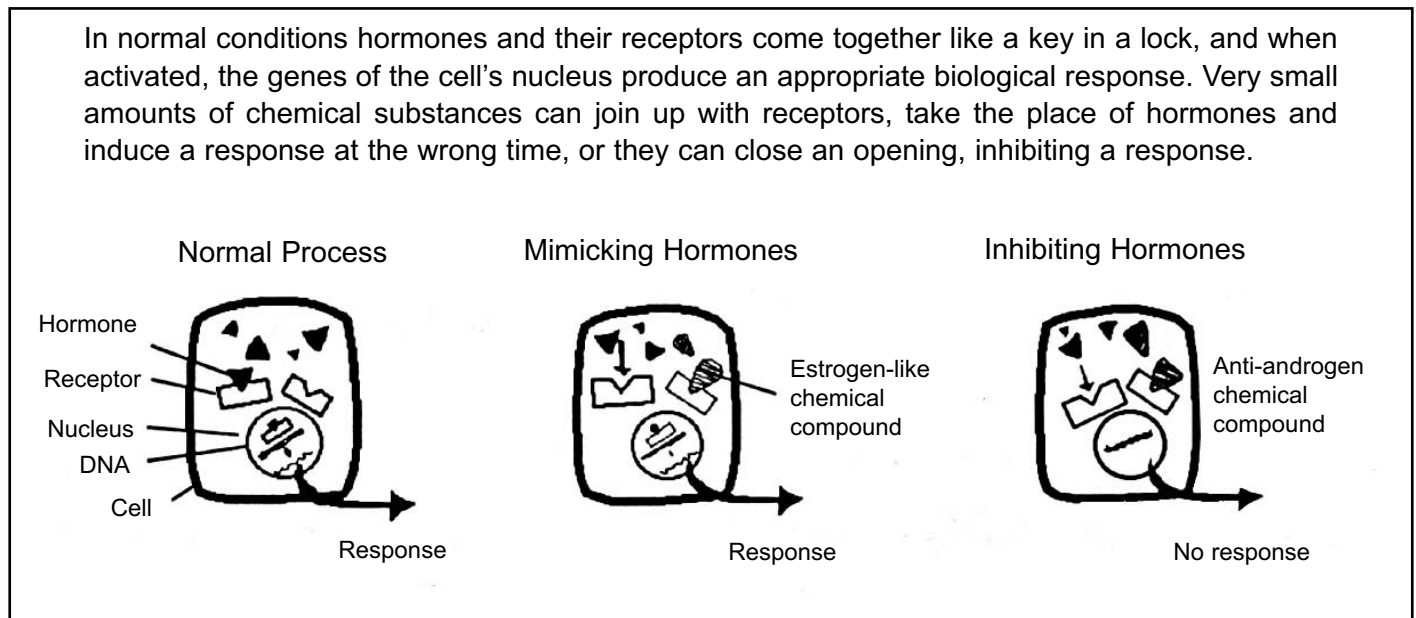
2.1 General characteristics of POPs

The Persistent Organic Pollutants (POPs) included in the Stockholm Convention are a group of chemical substances that have four basic characteristics in common: first, they are toxic for human and animal health, and they pollute the environment; second, they are “organic” since their chemical structure includes carbon, which makes them fat soluble and means they can bioaccumulate and biomagnify throughout food chains; third, they are persistent, with the potential to last for years or decades before degrading; and fourth, they can travel long distances. These intrinsic properties of POPs create a dangerous combination that makes it practically impossible to effectively control them, once they are released into the environment. In this section we will look at each one of these general characteristics in more detail.

POPs are toxic chemical substances. They function in many different ways and interfere with biological processes that are fundamental for living beings. They are capable of affecting the health of human beings and other living organisms, even in tiny amounts, measured in parts per million or even parts per trillion. Health effects can be immediate or may not be manifested until later —when they are known as chronic effects. The chronic effects caused by POPs include cancer, reproductive problems (fetal death, miscarriages, fertility disorders), disruptions in the immunological system (which lower the body’s defenses and make it more likely that other illnesses will be contracted), hormonal disruptions, behavior disorders and decreased intelligence.

Like other chemical substances, the POPs included in the Stockholm Convention are endocrine disruptors, or in other words, they cause hormonal imbalances. This is because even in very low concentrations, they are capable of mimicking, substituting or inhibiting the actions of hormones, provoking numerous uncontrolled biochemical reactions, especially in embryonic development. Hormones are produced by endocrine glands (testicles, ovaries, thyroid and suprarenal glands, and others), and are released in the bloodstream, carrying a very precise chemical message to the cells. In the embryo and the fetus, hormones guide the development of sexual organs, the nervous and immunological systems, and the formation of organs and tissues, including the liver, blood, kidneys, muscles and the brain. The lack or excess of a hormone can produce serious disturbances.

Table 4
Endocrine disruption mechanisms



Source: Adapted from Theo Colborn, John Peterson Myers and Dianne Dumanoski, *Nuestro Futuro Robado*, Madrid, Ecoespaña publishers, 1997, p. 89.

The presence of endocrine disruptors in wildlife has caused disruptions in reproductive development (panthers without testosterone, alligators with very small penises or with testicles but without penises, infertile eagles), changes in sexual behavior (feminization of males and masculinization of females), birth defects and depressed immunological systems. Since there are no significant differences between the endocrine system of most animals and human beings, it is highly probable that similar effects will take place in humans. In the most recent studies on reduced sperm count, loss of fertility, increased breast, prostate and testicle cancer, and increased hyperactivity and learning problems in children, the actions of endocrine disruptors such as dioxins, furans and PCBs are considered to be a possible cause. ⁽¹⁾

The specific effects provoked by POPs depend on the intrinsic danger-related characteristics of each one of them, plus the way in which they enter the organism. The latter includes the conditions of exposure, the amount of the pollutant received, and for how long, plus the characteristics of the organism that received the pollutant (for example, age and sex), and the moment within its development when the pollutant was received (children are the most vulnerable).

POPs are characterized as “organic” since their basic chemical structure is formed by various carbon atoms, and this means that they tend to be soluble in oils and fats (a characteristic referred to as lipid solubility). The twelve POPs prioritized in the Stockholm Convention also have various chlorine atoms linked to the carbon structure, making them even more fat soluble.

POPs are capable of “bioaccumulating.” When they are released into the environment, they are absorbed by the fatty tissues of plants and animals, and they become increasingly concentrated in those tissues, through a process called bioaccumulation. This concentration biomagnifies, or increases by hundreds and even

millions of times, as organisms exposed to POPs are eaten by their predators, and this allows the pollutants to move through the different links in food chains. In this way, POPs become more highly concentrated in species that are at higher levels in food chains, such as fish, predator birds and mammals, including polar bears, otters, seals, dolphins, whales and human beings (see Figure 2).

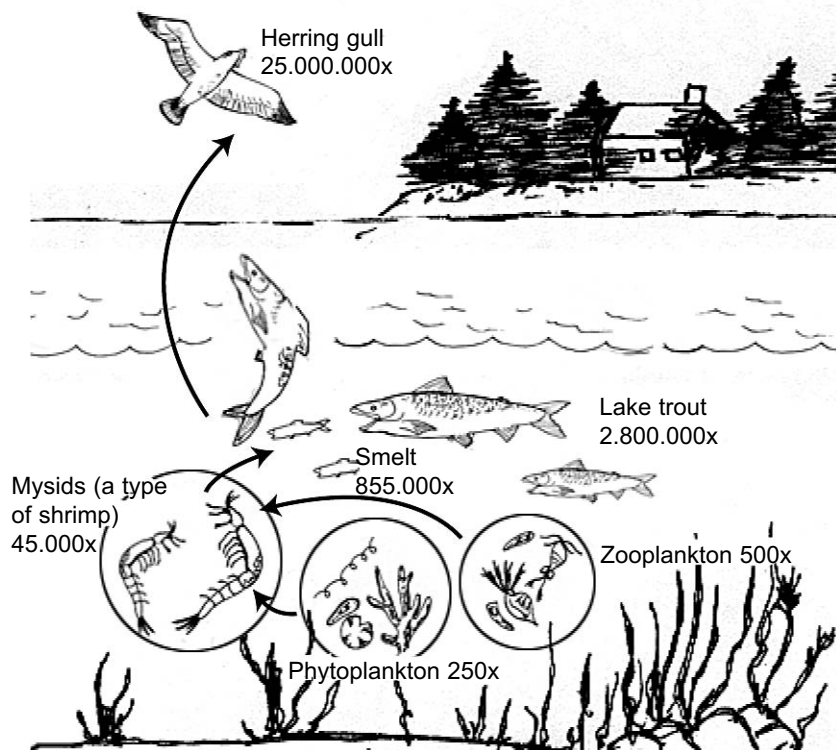


Figure 2

Biomagnification of PCBs in food chains, adapted from Theo Colborn, John Peterson Myers and Dianna Dumanoski, *Nuestro Futuro Robado*, Madrid, Ecoespaña publishers, 1997, p. 33.

POPs are persistent, or in other words, they last for a long time in the environment—for years and even decades—since they resist degradation caused by the sun, chemical transformation and decomposition provoked by microorganisms. This is because POPs have a chemical structure with very strong bonds that resist decomposition caused by normal biochemical and biophysical processes. Few organisms have enough enzymes to break down the molecules of POPs and excrete them in water soluble compounds. Also, as we have already pointed out, because they are also fat soluble, they accumulate for a longer period of time.

The more persistent a substance, the more hazardous it is, since it is more likely to travel through the environment and affect living organisms before degrading. It is estimated that when there are more atoms of chlorine or bromine in the molecule of a POP substance, its lipid solubility, its tendency to bioaccumulate and its persistence also increase. ⁽²⁾ In the case of organochlorinated POPs, when they degrade, they become other organochlorines, and these can be even more dangerous and persistent than the original substance.

POPs can travel long distances. The persistence of these substances, combined with their semi-volatility, means they have great environmental mobility. Once they have been released into the atmosphere, they evaporate slowly in warm climates; they can be carried by air currents, and will condense and deposit into soil when the temperature drops, and then re-volatilize and repeat the cycle. In this way, POPs travel from the warmer areas to the colder areas of the planet, all the way to the Arctic and the Antarctica. They can also be transported by fresh and sea water currents. Other less volatile POPs can accumulate in sediments and

from there, penetrate food chains. We might say that POPs are unaware of national borders, since they can affect populations and sectors far away from the original location where they were released. Because of their persistence and mobility, POPs can literally be found anywhere in the world. They have been found in places and in organisms far from the industrial sources of pollution, such as in polar bears in Alaska, Canada and Norway, in the Arctic, and penguins in the Antarctica and the remote Pacific islands —affecting the communities living in those places. ⁽³⁾

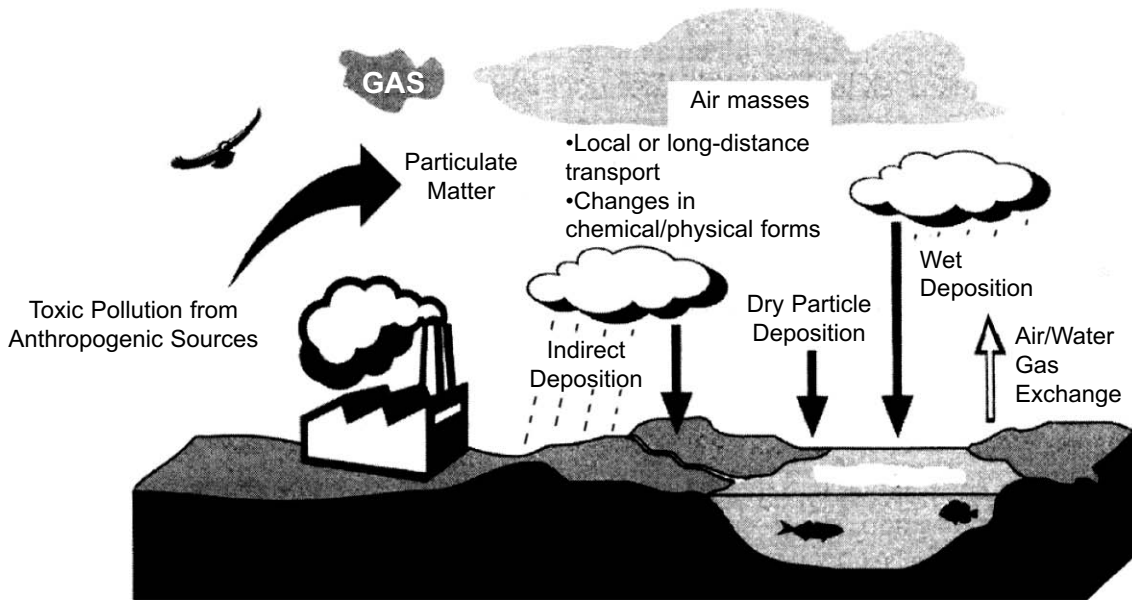


Figure 3
Release and dispersion of POPs in the environment

POPs can be released into the environment, transported, and redeposited in water and on land far from their sources.

Source: Adaptation from *Deposition of air pollutants to the Great Lakes* (First Report to Congress), EPA, 1994. Included in the World Federation of Public Health Associations, *Persistent Organic Pollutants and Human Health*, Washington, May 2000, p. 8.

POPs have a transgenerational effect. Exposure to these substances begins at conception; PCBs have been found in semen. POPs that accumulate in fatty tissues can pass into the blood and can pass through the placenta during embryonic and fetal development. They can be excreted in breast milk and thus transferred to breastfed babies. Consequently, we find that human beings and other mammals are exposed to the highest levels of these pollutants during the period of life when they are the most vulnerable —in the uterus and as babies, when their bodies, brains, nervous systems and immunological systems are in the delicate process of being developed.



Figure 4

POPs contaminate breast milk, affecting new generations.

POPs enter the human body primarily through the food we eat. POPs can accumulate in milk products, fish and meat—in very small amounts that cannot be perceived through the senses. We cannot see them, smell them or feel them. POPs released into the atmosphere enter into the food chain when it rains, contaminating pastures and crops used to feed livestock., POPs discharged into water bodies accumulate in soil or sediments and contaminate fish, and subsequently reach human beings. Even though food is the primary way in which humans are exposed to POPs, the levels of these substances in food are not monitored in most countries—not even dioxins, furans or PCBs. In the United States, exposure to dioxins through food occurs at levels that are near or above the levels that cause adverse effects in tests with laboratory animals.

The World Health Organization has established acceptable daily intake limits for some POPs, such as dioxins, furans and PCBs. These are based on risk assessments in accordance with an average diet (from 1 to 4 pg. TEQ per kg body weight per day). A normal diet in industrialized countries frequently contains dioxins in amounts that are greater than these limits. In addition, it is certainly questionable whether these “tolerable” limits actually represent protective measures, since there is no “safe dose” for endocrine disruptors, nor is there a “safe dose” for cancer-causing substances, such as POPs. Research on endocrine disruptors demonstrates that some effects are found with very low concentrations instead of with high doses, as normally occurs with toxicological assessment procedures. Furthermore, studies indicate that the moment when exposure occurs is just as or more important than the amount, especially if exposure takes place during the embryonic period of development. ⁽⁴⁾

POPs form part of the toxic body burden that is passed on to future generations. The term “body burden” refers to the total amount of chemical substances present in the human body at a given point in time. Some scientists estimate that everyone alive today carries at least 700 pollutants in his/her body, and these include POPs, as well as many other chemical substances that have not yet been the subject of thorough study. Toxic

chemical substances enter the human body when they are inhaled, or when contaminated food or water is ingested, and in fact, they can be absorbed through our skin. A pregnant woman can pass toxic substances to her developing fetus through the placenta, and a woman who nurses her child can pass these substances through breast milk. Chemical substances can have different effects on humans and on wildlife, depending on the intrinsic toxic properties of the specific substance and the amount, timing, duration and pattern of exposure. Nevertheless, the effects of the combination of this “cocktail” of chemical substances found in the human body have not been studied, and government regulations that establish “tolerable limits” for some of these particular substances in food and in the environment do not take into consideration this multiple, accumulated nature of exposure. ⁽⁵⁾

Chemical substances and their transformation products (metabolites) remain in organisms for only a certain amount of time before they are excreted through urine or perspiration, as occurs with some organophosphate pesticides. However, continuous exposure can create a persistent body burden. Some persistent, bioaccumulative chemical substances, such as POPs, are not easily discharged by the body, and may remain for years in our blood, fatty tissue, semen, muscles, bones, brain tissue and other organs. DDT, for example, can remain in the body for 50 years, and PCBs can remain in fatty tissues for 25 to 75 years, since they are resistant to metabolic transformation. ⁽⁶⁾

Thus, just as we have the right to know what pollutants are present in the air, water and soil, we also have the right to know what pollutants form part of our body burden, and to demand that authorities and the industrial producers of these substances adopt measures that prevent their formation and release into the environment. The body burden of persistent toxic substances such as POPs should not be accepted as a natural, irreversible fact, since it violates the fundamental right to a quality of life characterized by human dignity. In particular, the presence of these substances in the human body violates the reproductive rights of women, their right to pregnancy and breastfeeding free from pollutants, and the rights of children to a healthy diet and to conditions that will permit their full development. Women’s groups and organizations created to defend children’s rights have an opportunity to play a significant role in the fight to eliminate POPs. The Stockholm Convention explicitly mentions that governments must report to and consult with these groups during the process of developing National Implementation Plans.

Table 5

“Biomonitoring” of the body burden of toxic, bioaccumulative chemical substances

“Biomonitoring” or analyzing the body burden of pollutants in human samples measures the levels of these compounds, usually in blood and urine, and reflects the actual amount of chemical compounds present in the environment and inhaled, ingested or absorbed by the human body.

In the United States, two national reports on human exposure to chemical substances in the environment have been prepared by the US Centers for Disease Control and Prevention (CDC). The first report, released in March 2001, included the measurement of 27 substances. The second report stated that its analysis of blood and urine from a selected population focused on 116 chemical substances, and 89 of them were found, including POPs such as dioxins, PCBs and organochlorine pesticides; and other substances such as polyaromatic hydrocarbons; carbamate and organophosphate pesticides; herbicides; phytoestrogens; insect repellants and disinfectants; heavy

metals such as lead mercury and cadmium, among others; cotinine (tobacco smoke); and phthalates. This second report presents information regarding the exposure of the US population on the basis of a national sample of 9,282 individuals, categorized according to age, gender, and ethnic group or race, for the 1999-2000 period.

A more detailed analysis of the data on 34 pesticides contained in the CDC's second report — conducted by Pesticide Action Network-North America (PANNA)— revealed in May 2004 that a large number of California residents carry a burden of toxic pesticides in their bodies that is above the “acceptable” levels established by government authorities (such as the insecticide known as chlorpyrifos, for example). This analysis also indicated that the largest body burden was found in women, children and the Mexican American population, and among the components found were pesticides such as DDT, lindane and methyl parathion.

A similar study conducted previously by the Environmental Working Group, in conjunction with the Mount Sinai School of Medicine in New York, and published in January 2003, indicates that of 210 chemical substances measured in the body burden of nine volunteers, an average of 91 compounds were found. Of the total substances found, 76 are chemical substances that can cause cancer in humans or animals, 94 are toxic for the brain and nervous system, and 79 can cause birth defects or abnormal development. Among these substances detected, there were 48 different PCB congeners, dioxins and furans; organochlorine pesticides such as DDT and chlordane, among others; heavy metals such as lead, mercury, arsenic and cadmium; phthalates originating from personal-care cosmetic products and from PVC plastic packaging of food products; and volatile and semi-volatile organic compounds derived from petroleum.

Similar efforts have been carried out in Alaska, Australia and other parts of the United States and Europe. Community organization directed at monitoring the body burden of PCBs was a determining factor in forcing Monsanto to grant compensation to residents of Anniston, a community located near Monsanto's PCB production plant in Alabama. ⁽⁷⁾

Sources consulted:

- “What is body burden” in www.chemicalbodyburden.org
- Center for Disease Control and Prevention (CDC), *Second National Report on Human Exposure to Environmental Chemicals*, United States, February 2003, in <http://www.cdc.gov/exposurereport> (CDC plans to release reports every two years).
- Environmental Working Group, *Body Burden: The Pollution in People report*, in <http://www.ewg.org/reports/bodyburden/>
- Pesticide Action Network–North America, *Chemical Trespass: Pesticides in Our Bodies and Corporate Accountability report*, in www.panna.org

Identifying POPs within the universe of chemical substances

The 12 POPs prioritized in the Stockholm Convention can be identified as within the extensive universe of organic chemical substances, since they are compounds that contain carbon in their structure. Within that universe, they belong to the group of organohalogens, and in particular, to two subgroups: first,

organochlorines, since they are organic compounds that have a number of chlorine atoms, and second, polyaromatic hydrocarbons, since each has a benzene ring that serves as a building block in their molecular structure. They can therefore be characterized as chlorinated polyaromatic hydrocarbons.

Nevertheless, other organic compounds not included in these two subgroups may also be classified as POPs, due to their persistence and capacity for bioaccumulating. These include other organohalogens, especially brominated compounds such as polybrominated flame retardants. And there are other chemical substances that enter into the classification of POPs, such as certain organometals used in paint for boats. Figure 5 gives a more graphic idea of this classification.

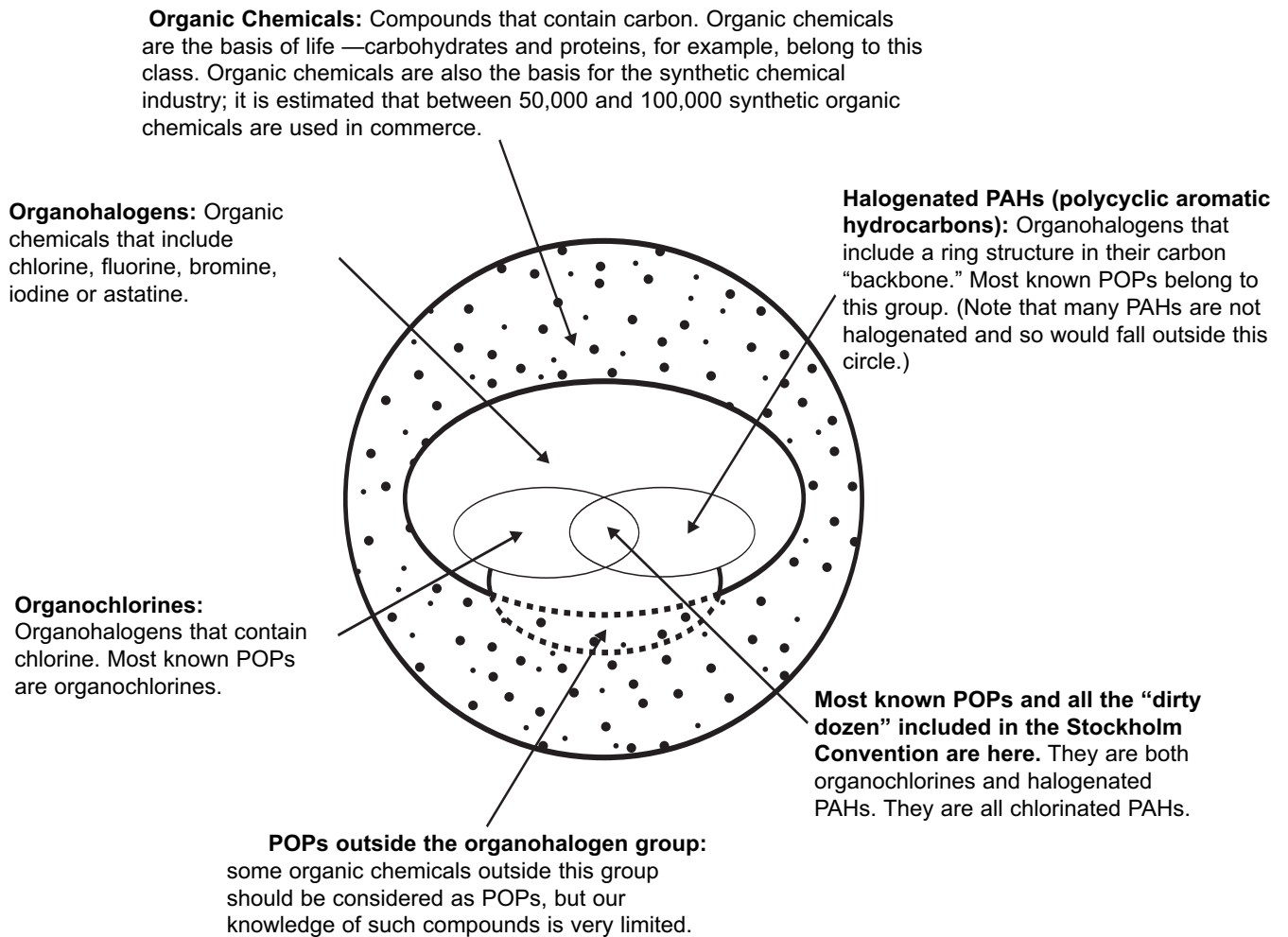


Figure 5
Identifying POPs within the universe of chemical substances

Source: adapted from Anne Platt McGinn, *Why poison ourselves? A precautionary approach to synthetic chemicals*, MA, United States, World Watch Paper No. 153, November 2000, p. 15.

2.2 Pesticides included in the Stockholm Convention

Effects on health and the environment from pesticides included in the Stockholm Convention

Chemical pesticides are toxic substances by definition, and can affect pests as well as human beings. Pesticides affect the central nervous system and can provoke acute poisoning, manifested as malaise, headache, nausea, vomiting, dizziness, tremors, excitation, recurrent convulsions, severe depression of the respiratory system and the central nervous system, coma, and even death, if prompt medical attention is not received.

There are other effects from exposure to pesticides that can appear over the long term. These are referred to as chronic effects, and generally they are a result of repeated exposure, in small amounts, over a prolonged period of time. Some of the chronic effects caused by the pesticides included in the Stockholm Convention correspond to different types of cancer, malformations, fertility disorders, and endocrine disruption (see the next table).

From a biological viewpoint, pesticides are biocides, and are rarely selective, killing not only the organisms that become pests, but also beneficial insects, such as predators, parasitoids, pollinators, birds, fish and other animals. Pesticides interfere with fundamental biological and physiological processes that are common to a wide variety of organisms. The intensive use of pesticides also creates resistance in insects, plants and fungus, which are subsequently able to survive at doses that previously caused death. Resistance is a hereditary mechanism of genetic selection that permits only the strongest to survive. In the case of resistance to organochlorinated insecticides, insects can also develop resistance to some pyrethroids, in what is known as crossed resistance. ⁽⁸⁾

The indiscriminate use of pesticides provokes contamination of soil, air and water, and alters ecological equilibrium. The problems of environmental contamination caused by chemical pesticides are accentuated in the case of organochlorine pesticides—the group to which pesticides included in the Stockholm Convention belong—because of their great persistence and capacity to accumulate and magnify in food chains. The persistence of a substance is expressed by its half-life. This corresponds to the time required for half of the substance to disappear under normal circumstances. For example, if a half-life is 100 days, this means that half of the substance will still be present 100 days after its application, a fourth of the substance will still be present after 200 days, and an eighth of the substance will still be present after 300 days.

There are other organochlorinated pesticides that are not included in the Stockholm Convention, such as lindane, pentachlorophenol and endosulfan, however it has been proposed that they also be included. And a large number of other organochlorine pesticides can be contaminated with dioxins and furans, however we will address that issue in the section of this document dedicated to dioxins.

Dioxins—also known as polychlorinated dibenzo-p-dioxins (PCDD)—is the generic name to refer to a group of 75 compounds that are formed by two benzene rings joined by a five-sided ring with two oxygen atoms and several chlorine atoms in the periphery.

Furans, or polychlorinated dibenzofurans (PCDF), consist of a group of 135 compounds with a structural similar to that of dioxins. And, another category that also has a similar structure is composed of PCBs, which we will address in the following chapter.

Table 6
Effects from POP pesticides included in the Stockholm Convention

| Name of active ingredient | CAS No. | Health effects | Environmental effects and persistence |
|---------------------------|----------|--|--|
| Organochlorines | | <p>General acute effects from exposure to organochlorine pesticides: Central nervous system disorders. Malaise, headache, nausea, vomiting, dizziness, tremors, excitation, recurrent convulsions, severe depression of respiratory and central nervous systems, and coma.</p> | <p>They are very persistent and accumulate in fatty tissues in food chains, and are excreted in breast milk.</p> |
| Aldrin (*) | 309-00-2 | <p>Acute. Same as those mentioned for exposure to organochlorines (see above). Chronic. Prolonged exposure can lead to excitation of central nervous system. Abnormalities in electroencephalogram and convulsions. Classified by IARC in Group 3 (possible human carcinogen). Is fetotoxic in experimental animals. Aldrin is metabolized and converted to dieldrin. Endocrine disruption (1).</p> | <p>High potential for bioaccumulation and biomagnification. Extreme toxicity for fish and crustaceans; average toxicity for birds and bees. Highly persistent in soil: 50% disappears after 4 to 7 years.</p> |
| Chlordane (**) | 57-74-9 | <p>Acute. Same as those mentioned for exposure to organochlorines (see above). Chronic. Prolonged exposure can lead to excitation of central nervous system, abnormalities in electroencephalogram and convulsions. Classified by IARC in Group 3 (possible human carcinogen). In laboratory mice, it has been found to reduce fertility by nearly 50% (22 mg/kg injected once a week for 3 weeks) Endocrine disruption (1).</p> | <p>High potential for bioaccumulation and biomagnification. Extreme toxicity for fish, crustaceans, birds, bees and earthworms. Highly persistent in soil. Soil half-life is 4 years, however may remain in soil for as long as 20 years. Relatively immobile in the environment, and binds to soil particles.</p> |

| Name of active ingredient | CAS No. | Health effects | Environmental effects and persistence |
|---------------------------|---------|---|--|
| DDT | 50-29-3 | <p>Acute. Same as those mentioned for exposure to organochlorines (see above).</p> <p>Chronic. Abnormalities in electroencephalogram and convulsions. Classified by IARC in Group 2B (possibly carcinogenic for humans). In laboratory tests, it has been shown to be mutagenic (moderate mitotic inhibition and chromosomal aberrations and damage). Suppresses immunological system, causes sterility and is fetotoxic, teratogenic and carcinogenic (liver, lungs, thyroid, leukemia) in laboratory animals. Endocrine disruption (1).</p> | <p>High potential for bioaccumulation and biomagnification. Extreme acute toxicity for fish and crustaceans. Acute toxicity is low for bees and birds, although in the latter, prolonged exposure produces severe effects in reproduction, with weakened eggshells and reduced viability of embryos.</p> <p>Highly persistent in soil: 50% disappears after 2 to 15 years. Is a pollutant of superficial water bodies.</p> |
| Dieldrin (*) | 60-57-1 | <p>Acute. Same as those mentioned for exposure to organochlorines (see above). Persistent sleep disturbances for periods of days or weeks have been reported.</p> <p>Chronic. Prolonged exposure can lead to excitation of the central nervous system, abnormalities in electroencephalogram and convulsions. Dieldrin (a metabolic derivative of aldrin) suppresses the immunological system and causes liver cancer in mice. Classified by IARC in Group 3 (possible human carcinogen). In experimental animals, it is fetotoxic and can provoke fertility disturbances in males and females. Endocrine disruption (1).</p> | <p>High potential for bioaccumulation and biomagnification. Extreme toxicity for fish and crustaceans; average toxicity for birds and bees.</p> <p>Highly persistent in soil: 50% disappears after 4 to 7 years.</p> |
| Endrin (***) | 72-20-8 | <p>Acute. Same as those mentioned for exposure to organochlorines (see above).</p> <p>Chronic. Prolonged exposure can lead to excitation of the central nervous system, abnormalities in electroencephalogram and convulsions. Classified by IARC in Group 3 (possible human carcinogen). In experimental animals it is fetotoxic and embryotoxic, and it alters spermatogenesis in rats. It can produce chromosomal damage in the germinal tissue in men and women. Endocrine disruption (1).</p> | <p>High potential for bioaccumulation and biomagnification. Extreme toxicity for fish, birds and bees.</p> <p>Highly persistent in soil, with a half-life up to 12 years.</p> |

| Name of active ingredient | CAS No. | Health effects | Environmental effects and persistence |
|---------------------------|-----------|--|---|
| Heptachlor | 76-44-8 | <p>Acute. Same as those mentioned for exposure to organochlorines (see above).</p> <p>Chronic. Prolonged exposure can lead to excitation of the central nervous system, abnormalities in electroencephalogram and convulsions. Classified by IARC in Group 2B (possible human carcinogen). Has been associated with infertility and inadequate development of litters in experimental animals. Produces an increase in the incidence of liver cancer in rats. Endocrine disruption (1).</p> | <p>High bioaccumulation and biomagnification. Extreme toxicity in fish; average in crustaceans; low in birds.</p> <p>Extreme persistence in soil. Minimally susceptible to biodegradation. Soil half-life ranges from 6 months to 3.5 years, however traces have been found up to 16 years after its application. No mobility in soil. Less persistent in water (sediment).</p> |
| Hexachlorobenzene | 118-74-1 | <p>Acute. Same as those mentioned for exposure to organochlorines (see above).</p> <p>Chronic. Prolonged exposure can lead to excitation of the central nervous system, abnormalities in electroencephalogram and convulsions. Classified by IARC in Group 2B (possible human carcinogen). Children exposed to contaminated bread were found to have low height, atrophied hands and fingers, osteoporosis and arthritic changes. It is teratogenic in experimental animals. Tests with animals indicate the substance to be associated with reproductive problems in males, and negative effects in fetuses and in offspring. Endocrine disruption (1).</p> | <p>Moderate and high toxicity for fish. Not considered toxic for bees. Is a strongly bioaccumulative substance.</p> <p>Is very persistent. Binds strongly to soil particles and sediments. Its soil half-life is estimated at 3 to 6 years. Does not easily leach into water.</p> |
| Mirex | | <p>Acute. Same as those mentioned for exposure to organochlorines (see above).</p> | |
| Toxaphene (camphechlor) | 8001-35-2 | <p>Acute. Same as those mentioned for exposure to organochlorines (see above).</p> <p>Chronic. Classified by IARC in Group 2B (possible human carcinogen). Endocrine disruption (1).</p> | <p>A highly bioaccumulative compound. High toxicity for fish and aquatic invertebrates, with average toxicity for birds and low toxicity for bees. When released in superficial water bodies, it is vigorously absorbed into sediment. Is extremely persistent.</p> |

Source: *Fichas técnicas de plaguicidas a prohibir o restringir. Incluidos en el Acuerdo No. 9 de la XVI Reunión del Sector Salud de Centro América y República Dominicana (RESSCAD)*. OPS, OMS. Programa Medio Ambiente y Salud en el Istmo Centroamericano. Proyecto Aspectos Ocupacionales y Ambientales de la Exposición a Plaguicidas en el Istmo Centroamericano (PLAGSALUD). San Jose, Costa Rica, 2001.

2.3 Unintentional POPs: dioxins, furans, PCBs and HCB

Dioxins, furans and compounds with similar toxicity⁽⁹⁾

Dioxins and furans —unlike other POPs, such as pesticides— are not actually products and do not even have any useful purpose. They are pollutants that are unintentionally formed and released from thermal processes involving organic matter and chlorine-containing substances, as a result of incomplete combustion or complex chemical reactions.

The unintentionally produced POPs included in the Stockholm Convention are the following: dioxins, furans, polychlorobiphenyls (PCBs) and hexachlorobenzene (HCB). PCBs and HCB are industrial products, but they are also generated involuntarily.

Not all dioxins, furans and PCBs have the same level of toxicity. Only 7 dioxins, 10 furans and 13 PCBs have a toxicity level similar to the level of the most toxic dioxin known, which is 2,3,7,8 TCDD. The toxicity of dioxins and similar compounds depends on their ability to bind with and activate a complex protein known as the Ah (aryl hydrocarbon) receptor. Only molecules with the right form can enter this receptor, just as only the right key can open a lock. The most toxic dioxin and the one that mostly strongly binds to this receptor is 2,3,7,8 TCDD.

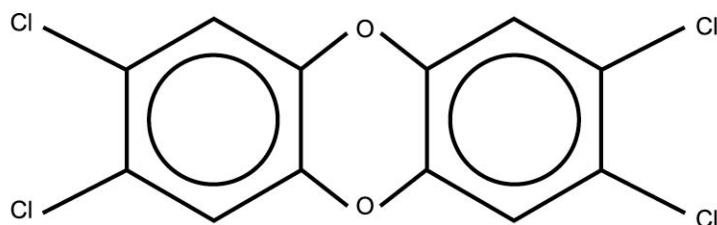


Figure 6

Molecular structure of the dioxin, TCDD

In order to be able to make comparisons among the various dioxins, furans and PCBs, the World Health Organization (WHO) established a measurement of equivalency with the most toxic dioxin, 2,3,7,8 TCDD. If we analyze food, blood, breast milk, sediments or the atmosphere, we can find many different types of dioxins and furans with varying levels of toxicity. In order to quantify and compare the total toxicity of this mixture of compounds, we use 2,3,7,8-TCDD (or simply TCDD) as the measurement, granting a toxic equivalency factor (TEQ) to the other compounds, in relation to TCDD, which is given the value of 1. Thus, if a compound receives a TEQ of 0.5, it means that it is half as toxic as TCDD. When animals are exposed to dioxins in laboratory tests, TCDD is generally the dioxin used. When we speak of the population's exposure to dioxins, we are referring to exposure to a complex mixture of dioxins and similar compounds. In the real world, TCDD is not found isolated.⁽¹⁰⁾

Table 7 Basic chemical structure of dioxins, furans and PCBs

Carbon exists as an element (graphite and diamonds) and as a compound (joined with other elements). There are more carbon compounds (more than 2.5 million) than compounds of any other element. Carbon compounds can be joined with hydrogen compounds in thousands of ways, sometimes in long chains that form plastics. At other times, carbon and hydrogen compounds form rings such as benzene rings.

The basic block of the chemical structure of dioxins, furans and PCBs is the benzene molecule, which contains six carbon atoms (abbreviated as C) and six hydrogen atoms (abbreviated as H) joined together in a ring (Figure 1). In the interest of abbreviating, the carbon and hydrogen atoms are normally omitted and the benzene ring is represented as a ring within a hexagon, as demonstrated in Figure 1.

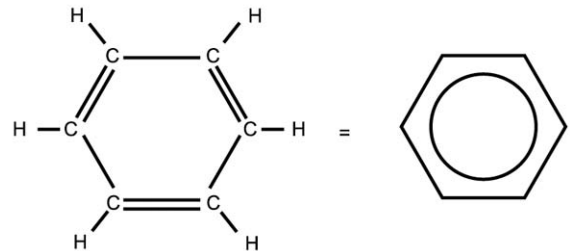


Figure 1: Benzene

Benzene rings have two important properties: a) two or more benzene rings can be joined together; and b) chlorine atoms can take the place of hydrogen atoms outside the ring. These properties explain the formation of PCBs, dioxins and furans.

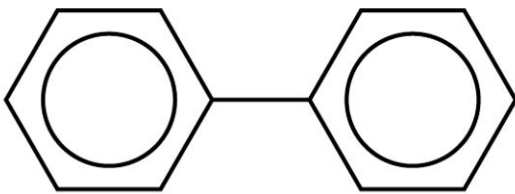


Figure 2: Biphenyls

Dioxins and similar compounds are made up of two benzene rings joined together in three different ways:

a) When two benzene rings are directly joined together, they are called biphenyls, and when a number of hydrogen atoms are replaced in benzene with chlorine atoms, polychlorobiphenyls or PCBs are formed (see Figure 2).

b) when two benzene rings are joined together by a five-sided ring that contains an oxygen atom (abbreviated as "O," the hexagonal figure), furans are formed (see Figure 3).

c) when two benzene rings are hooked together by a six-sided ring that contains two oxygen atoms, the substance belongs to the family of dibenzodioxins (di –for two, benzo –for benzene, di –for two, oxin –for oxygen). When the hydrogen atoms are replaced with various chlorine atoms, they are called polychlorodibenzodioxins, or PCDD. Dioxins can have between one and eight chlorine atoms. There are 75 possible types of dioxins, determined by the position where the chlorine atoms are attached. Chemists use numbers to describe the positions where the chlorine

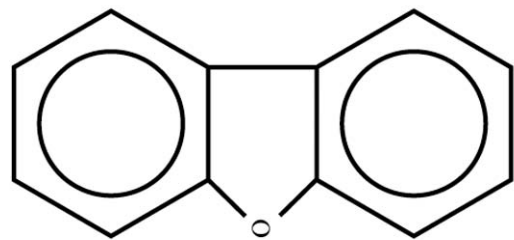


Figure 3: Furans

atoms are located. The most toxic type of dioxin we know of is the one that has the chlorine atoms at positions 2, 3, 7 and 8 (see Figure 4). The chemical name for this dioxin is “2, 3, 7, 8 tetrachlorodibenzodioxin, or 2, 3, 7, 8 TCDD (in this case, tetra, the Greek word for four, is used).

Each one of the hydrogen atoms in the benzene rings of dioxins, furans and PCBs can be chemically replaced by chlorine atoms. The many substances belonging to each of these groups, or congeners, are identified by the varying numbers and positions of the chlorine atoms on each molecule. Bromine, an element similar to chlorine, can also replace the hydrogen atoms, forming similar compounds. Bromine and chlorine congeners can exist together.

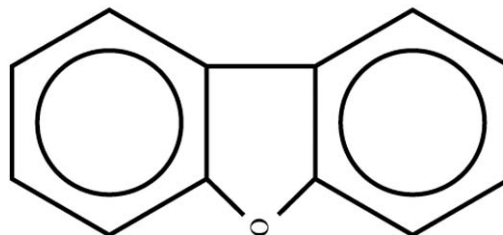


Figure 4: 2, 3, 7, 8 TCDD

Source: Summary of text by Beverly Paige, “Dioxin and Dioxin-like Chemicals,” in *Pesticides, People and Nature*, 1(1): 33-52 (1999), Begell House, Inc.; and “What are Dioxins?” in *Dioxin: The Orange Resource Book*, Synthesis / Regeneration 7/8. Summer 1995. A Magazine of Green Social Thought, St. Louis, Missouri, p. 12.

Sources of unintentional POPs

The Stockholm Convention identifies 20 of the types of anthropogenic sources that can generate unintentional POPs (dioxins, furans, PCBs and HCB), and divides them into two categories: first, the sources having a strong potential for forming and releasing these POPs into the environment, and secondly, other sources (see Table 8).

Table 8

Sources that can generate unintentional POPs (dioxins, furans, PCBs and HCB), according to the Stockholm Convention

Industrial sources that have the potential for comparatively high formation and release of these chemicals into the environment (Annex C, Part II):

- a) Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge;
- b) Cement kilns firing hazardous waste;
- c) Production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching; (*)

d) The following thermal processes in the metallurgical industry:

- Secondary copper production;
- Sinter plants in the iron and steel industry;
- Secondary aluminium production;
- Secondary zinc production

Other sources that can generate unintentional POPs (Annex C, Part III):

- a) Open burning of waste, including burning of landfill sites;
- b) Thermal processes in the metallurgical industry not mentioned in Part II;
- c) Residential combustion sources;
- d) Fossil fuel-fired utility and industrial boilers;
- e) Firing installations for wood and other biomass fuels;
- f) Specific chemical production processes releasing unintentionally formed persistent organic pollutants, especially production of chlorophenols and chloranil;
- g) Crematories;
- h) Motor vehicles, particularly those burning leaded gasoline;
- i) Destruction of animal carcasses;
- j) Textile and leather dyeing (with chloranil) and finishing (with alkaline extraction);
- k) Shredder plants for the treatment of end of life vehicles;
- l) Smoldering of copper cables;
- m) Waste oil refineries.

Source: UNEP *Stockholm Convention*, Annex C, Unintentional Production.

(*) Elemental chlorine refers to the use of chlorine gas, Cl_2 , and hypochlorite. It does not include chlorine dioxide (ClO_2).

This list of sources is not exhaustive, and the Convention indicates that it may be updated by the Conference of the Parties. In the Annexes to the present document, we have included three tables with a selection of sources of dioxins and furans, as well as a list of chemical substances and pesticides of which it is known or suspected that during their manufacture, dioxins and furans are generated, but are not listed in the Stockholm Convention.

Health effects from dioxins and furans

As we pointed out in the first chapter of this book, the only health effect from exposure to dioxins that the chlorine industry accepted—for many years—was chloracne, which is a serious skin ailment. We currently know, however, that dioxin exposure can cause numerous acute and chronic effects that are irreversible. This is why dioxins are considered to be the most toxic chemicals known to science.

The dioxin TCDD and similar compounds are capable of altering physiological processes in humans, at levels of exposure that are so low that highly sophisticated processes are needed for their identification and measurement. Adverse health effects have been reported from exposure to dioxin at levels in the range of

nanograms (ng)/ kilogram (kg) (a nanogram is a billionth of a gram). The ng/kg measurement is equivalent to parts per trillion. One part per trillion is the equivalent of a grain of salt dissolved in an Olympic-sized swimming pool. It is calculated that the average US citizen carries a body burden of 13 parts per trillion. ⁽¹¹⁾

Dioxins are capable of causing cancer and are classified as a “known human carcinogen” by the WHO and the International Agency for Research on Cancer (IARC). In the United States, according to the EPA’s preliminary report on dioxin assessment in 2000, the average levels of dioxins and similar compounds to which the population is exposed represent a risk of provoking one case of cancer per every 1,000 persons. This is 1,000 times higher than the “acceptable” risk of one case of cancer per every million. Epidemiological evidence from studies on exposed workers and the population affected by accidents indicates that exposure to dioxins and similar compounds increases the risk of contracting cancer in soft tissues —lungs, stomach— and non-Hodgkin lymphoma (malignant tumor in lymphatic ganglions), and increases the rate of mortality from soft-tissue sarcomas (malignant tumors originating in connective tissue) in exposed workers. ⁽¹²⁾

Dioxin exposure in laboratory animals reduces fertility, increases endometriosis, causes birth defects, damages the liver, disrupts genital development, slows down growth, disrupts thyroid functioning, provokes learning deficiencies, and diminishes the response from cells in the immunological system. Effects from dioxins on human health include heart ailments and disruptions in male and female reproductive systems (endometriosis, for example). There is also evidence that such exposure affects the thyroid gland, depresses the immunological system, causes birth defects and interferes with glucose metabolism, thus contributing to diabetes. Dioxins mimic or block the action of hormones and disrupt every hormonal system that has been studied. Exposure before birth can have an impact on determining the sex of the fetus (see Table 9). ⁽¹³⁾

Dioxins and similar compounds —like other POPs— bioaccumulate and biomagnify along the food chains. Dioxins and furans have been found in cow’s milk, cheese, butter and in animals; as well as in blood, fatty tissue and breast milk. All of this contributes to the toxic body burden passed on to future generations. The World Health Organization conducted two studies in 19 countries, in which samples of milk taken in 1987-88 and in 1992-993 were analyzed to determine levels of dioxins, furans and PCBs. Other similar studies have been conducted in Holland, Germany, the Nordic countries, the United Kingdom, France, Spain, Japan, New Zealand and the United States. Studies have also been conducted in some Asian and Middle East countries, and only a few in Africa and Latin America. ⁽¹⁴⁾ Do we want to mention the IPEN egg study here?

Table 9
Health effects from dioxins and compounds with similar toxicity

| | |
|---|---|
| <p><i>Cancer</i></p> <ul style="list-style-type: none"> • In soft tissues, lungs, stomach and non-Hodgkin’s lymphoma • Increases mortality from cancer in soft tissues <p><i>Masculine reproductive effects</i></p> <ul style="list-style-type: none"> • Reduced sperm count • Diminished size of testicles • Diminished testosterone (the masculine hormone) • Feminization of hormonal sexual responses and behaviors • Hormonal and metabolic changes | <p><i>Hormonal and metabolic changes</i></p> <ul style="list-style-type: none"> • Altered glucose tolerance and decreased insulin levels, increasing the risk of diabetes • Altered fat metabolism leading to elevated cholesterol and triglycerides, with the consequent increase in the risk of heart attack • Weight loss • Changes in thyroid hormones |
|---|---|

| | |
|--|--|
| <p><i>Feminine reproductive effects</i></p> <ul style="list-style-type: none"> • Hormonal changes • Decreased fertility • Adverse pregnancy outcomes, difficulty maintaining pregnancy • Ovarian dysfunction • Endometriosis | <p><i>Damage to central and peripheral nervous system</i></p> <ul style="list-style-type: none"> • Increase in irritability and nervousness • Cognitive deficits |
| <p><i>Effects on fetus</i></p> <ul style="list-style-type: none"> • Birth defects, cleft palate • Alterations in reproductive system | <p><i>Damage to liver</i></p> <ul style="list-style-type: none"> • Elevated liver enzymes • Cirrhosis |
| <p><i>Effects in childhood and adolescence</i></p> <ul style="list-style-type: none"> • IQ deficiency problems • Delayed puberty • Delayed psychomotor development and neurodevelopment • Behavior disorders and hyperactivity | <p><i>Damage to immunological system</i></p> <ul style="list-style-type: none"> • Reduction in size of thymus • Increased susceptibility to infectious diseases and increased risk of cancer. |

Source: US EPA, 1994; De Vito, 1994, in Center for Health Environment and Justice, *Dying from Dioxin*, US, 1995, Table 9-2, p. 138.

Since the primary way that dioxins enter the human body is through food, the US Institute of Medicine recommends that the population reduce its exposure through consumption of food with fewer saturated fats and only moderate consumption of meat fats and milk products that may contain dioxins and similar compounds. It also places priority on reducing dioxin contamination of feed and forage used in animal production systems, and to establish mechanisms for monitoring levels of dioxins and similar compounds in these systems, with subsequent information accessible to the public. It also recommends reducing or eliminating animal fat content in livestock feed. In addition, it recommends that efforts to reduce saturated fats in the diet be focused on female adolescents and youth, prior to their childbearing years, in order to have an impact on reducing the dioxins that may affect fetus development and the development of breastfed babies. Dioxins have a half-life of 7 to 12 years in the human body. ⁽¹⁵⁾

Changes in eating habits aimed at maintaining the recommended low-fat diet is not sufficient, if not also accompanied by a program for eliminating dioxins and similar compounds in the industrial and urban sources where they originate. This signifies changes in industrial processes and practices that generate POPs, since the responsibility cannot be placed on consumers alone, but should rather be placed on the companies that generate these substances, even if unintentionally. Replacing chlorinated inputs in industrial processes and prohibiting waste incineration in its many forms are some of the necessary measures in a program for preventing and eliminating dioxins —designed to attack the roots of the problem and not only attempt to control effects on consumer health.

2.4 Polychlorinated biphenyls (PCBs)

Characteristics of PCBs

Polychlorinated biphenyls (PCBs) are industrial products used primarily as oils in electrical transformers and equipment. Commercially, they are known as *askarels*, among other names. They are a family of chlorinated compounds derived from the petrochemical industry (chlorinated aromatic hydrocarbons), and they have a basic chemical structure composed of two benzene rings joined together (thus, biphenyls), to which from 1 to 10 chlorine atoms are linked (thus, polychlorinated). Depending on the varying positions of the different chlorine atoms in the chemical structure of PCBs, there are a total of 209 different types or congeners, of which 13 are particularly toxic, similar to the toxicity of the dioxin TCDD. The substances in this latter group are referred to as coplanar PCBs since they can have a planar configuration, with the benzene rings in the same plane. This does not mean that other PCB congeners are not toxic or do not cause health damage, but rather, that they have been studied less.

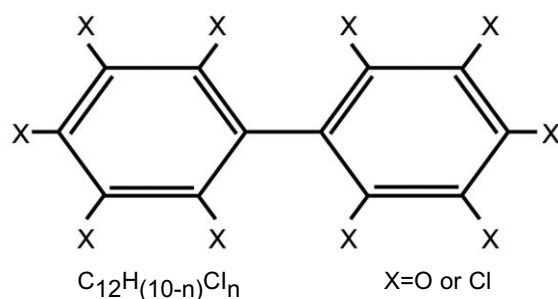


Figure 7

Molecular structure of PCBs

Chemical formula: $C_{12}H_{(10-n)}Cl_n$, where n is a number within the range of 1-10.

The CAS No. varies according to number of congeners (for example, Aroclor 1242 has CAS No. 53469-21-9; Aroclor 1254 has CAS No. 11097-69-1).

Source: *Directrices para la identificación de PCB y materiales que contengan PCB*. UNEP Chemicals, August 1999, p. 2.

The physical appearance of PCBs varies according to the number of chlorine atoms in their molecular structure. They can appear as oily liquids, white crystalline solids, or waxy resins. The color ranges from light yellow, in the case of lightweight, less chlorinated oils, to a honey color in the case of heavier oils. PCBs have no odor or taste. ⁽¹⁶⁾

Uses of PCBs

PCBs are excellent heat conductors, but not good conductors of electricity. They do not burn easily, and do not degrade from use. They are not water soluble and not very soluble in oil, however they are very soluble in solvents and very stable chemically. These physical characteristics made them a dielectric fluid (a fluid that

does not conduct electricity) that was ideal for use in the electrical industry, primarily in transformers and capacitors, but also in many other applications, including oils for surface coatings such as paint, ink solvents in carbon-less copy paper, adhesives and plasticizers (see Table 10). Later, PCB use was expanded, to replace the old mineral insulating oils that were flammable, thus reducing the risk of fires in electrical installations in public buildings, hospitals, schools and industries. The use of PCBs in electrical installations was required by insurance companies and by local ordinances in some cities.

Table 10
Uses of PCBs

| | |
|--|---|
| <p>Closed Systems</p> <ul style="list-style-type: none"> Electrical transformers Electrical capacitors Electrical motors Electromagnets | <p>Other uses</p> <ul style="list-style-type: none"> Insulating materials Pesticides (b) |
| <p>Partially Closed Systems</p> <ul style="list-style-type: none"> Heat transfer fluids Hydraulic fluids Switches (a) Voltage regulators (a) Liquid-filled electrical cables (a) Liquid-filled circuit breakers (a) | <p>(a) These applications were not designed to contain PCBs, however they may have been contaminated during their operations and maintenance.</p> <p>(b) Scrap transfer fluid has been used as an ingredient in pesticide formulas.</p> |
| <p>Open Systems</p> <p>Lubricants</p> <ul style="list-style-type: none"> Immersion oils for microscopes Cutting oils Brake linings Lubricating oils (natural gas air compressors) | |
| <p>Surface coatings</p> <ul style="list-style-type: none"> Paints Textile treatment Carbon-less copy paper Flame retardants | <p>Plasticizers</p> <ul style="list-style-type: none"> Gasket sealers Filling material in joints of concrete PVC Rubber seals |
| <p>Adhesives</p> <ul style="list-style-type: none"> Special adhesives Adhesives for waterproof wall coatings | <p>Inks</p> <ul style="list-style-type: none"> Dyes Printing inks |

Sources: UNEP and IOMC, *Directrices para la identificación de PCB y materiales que contenga PCB*. First issue, August 1999. Also, Dolores Romano and Estefanía Blount, *Guía sindical para la eliminación de PCB. Disruptores endocrinos: un nuevo riesgo tóxico*. Madrid, Instituto Sindical del Trabajo, Ambiente y Salud (ISTAS), Confederación Sindical de Comisiones Obreras (CCOO), 2003, p. 11.

Most PCBs were used by the electrical industry as dielectric fluids in closed-system transformers and capacitors in electric motors and electromagnets. However, they were also used in industrial installations, and in mining and military operations, and even in various electric items and electrical appliances for everyday use, such as in motor start capacitors in refrigerators, heating systems, air conditioners, hair dryers and water well motors. They were also used in capacitors in televisions and microwave ovens, and even in the ballasts in fluorescent lamps and neon lights manufactured in the United States before 1978. Even though ballasts are classified as a closed system, studies in Japan have demonstrated that PCBs can volatilize with the heat from these lamps. ⁽¹⁷⁾

PCBs were sold as a part of technical mixtures, more than as individual chemicals. In the case of transformer oils, PCBs were diluted with chlorobenzene solvents. Of the 58 commercial names for PCBs in the world, those commercialized by Monsanto were the most used. One dielectric fluid that was used, under the name of *askarel*, contained between 60 and 80% PCB, with the remaining 20 to 40% corresponding to tri- and tetrachlorobenzene. Not all high-concentration PCB liquids are *askarels*, however this name is used as a matter of convenience. Other names of PCBs commercialized by Monsanto were Pyroclor and Aroclor, with different variations. (Generally a number was added, usually referring to the carbon atoms in the molecular structure and the percentage of chlorine in the total weight. For example, the name Aroclor 1254 meant that it had 12 carbon atoms and 54% chlorine. There were exceptions, however.) PCB mixtures may also contain other pollutants, including dioxins and furans. ⁽¹⁸⁾

PCBs were also used in partially closed systems, such as heat-transfer fluids, refrigerant fluids, hydraulic fluids and vacuum pumps. And, they could contaminate other electrical equipment during their operation and maintenance, as in the case of switches and voltage regulators or liquid-filled electrical cables, even though they were not originally designed to contain these oils.

In open applications, PCBs were used primarily as plasticizers in the manufacture of PVC, neoprene, rubber seals, filling material in joints of concrete, and gaskets. They were also used as lubricants in immersion oils for microscopes, brake linings in the automotive industry and cutting oils; as waxes and smelting additives; as flame retardants in paints and plastics; as surface coatings in paints for the bottoms of ships, in textiles and carbon-less copy paper; as special adhesives for waterproof wall coatings; and in other uses as insulating material.

PCBs are not only industrial products, but are also produced unintentionally in various industrial processes, including the manufacture of PVC and magnesium; the incineration of hazardous, hospital and municipal wastes; the burning of contaminated oils and other chlorinated wastes in cement ovens; in accidental fires in which electrical equipment is burned; in marine traffic emissions, in the burning of tires, in plants for sewage water treatment, and other processes. ⁽¹⁹⁾

Atmospheric dispersion of PCBs and ways of entering the human body

PCBs have been dispersed in the environment in a number of ways: when they escape from electrical equipment and consumer items that have been thrown into municipal trash dumps; when they were dumped as wastes during the industrial production of PCBs; when they were generated unintentionally in the atmospheric emissions resulting from their burning or incineration; as well as from the wastes and accidents produced in the maintenance and cleaning of electrical equipment.

Regular monitoring of PCB-containing equipment is part of a sound management plan for identifying PCB leaks and preventing accidents. During the maintenance and disposal of PCB-containing electrical equipment, there may be mechanical and electrical accidents or fires that can expose workers and release these pollutants into the environment. It is therefore necessary to establish appropriate safety and hygiene standards, in addition to emergency plans for responding quickly when necessary.

Like other POPs, PCBs are very persistent, they bioaccumulate in food chains and can be transported long distances, and thus are contaminating the planet. PCBs have been found in air and rain, in various kinds of fish, in meat and milk products, in human sperm, in breast milk, and even in penguins in the Antarctica and in native Arctic populations, such as the Inuits in Quebec, Canada. ⁽²⁰⁾

PCBs bioaccumulate in food chains since they are fat soluble and very persistent. Once they have entered rivers, PCBs —sooner or later— reach the oceans and accumulate in the bodies of fish, and in the birds and mammals that feed on them. Marine mammals —whales, dolphins, sea lions— are at the top of the food chain in oceans, and up to 10 million times more PCBs can concentrate in their body fat than the level found in the ocean where they live. ⁽²¹⁾ PCBs pass from generation to generation through eggs, in birds and fish, and through the placenta and breast milk, in mammals —including humans.

The first scientific evidence that PCBs bioaccumulate in food chains came from Swiss studies published in 1966. Soren Jensen, a Swedish analytical chemist at the University of Stockholm, identified PCBs in each one of 200 fresh water fish (*Esox lucius*) originating in various parts of Switzerland. ⁽²²⁾ Concerned by these results, he continued his investigation and found PCBs in nearly every living being he studied. They were in fish eggs, and even in an eagle in the Swedish Archipelago. He even found them in eagle feathers he obtained from the Swedish Museum of Natural History, collected since 1944. There were also in the needles of conifers. He even found them in his own hair, in his wife's hair and even in the hair of his five-month-old daughter, which made him think that she probably received her PCB dose through breast milk. In 1966 he published his results in the *New Scientist* journal in an article entitled "Report of a new chemical hazard," in which he also reported having found PCBs in the air in London and Hamburg, and in seals along the coast of Scotland, and he stated his hypothesis that it could be dispersed throughout the entire world. ⁽²³⁾ Subsequent studies confirmed the presence of PCBs in the eggs of the peregrine falcon and in eagles in Sweden.

PCBs can be absorbed through the skin, through the nose or mouth. For most of the population, the primary route for its introduction into the human body is from eating food with very small amounts of this pollutant that cannot be perceived through the senses.

Effects from PCBs on human health and the environment

The danger from human exposure to PCBs was revealed to the international public as a result of the attention received by two accidents involving mass poisoning: the case of Yusho in Japan, and Yu-Cheng in Taiwan. In both cases, eating food cooked with rice oil that had been accidentally contaminated with PCBs and other pollutants caused a teratogenic, neurotoxic effect in children, in addition to effects on sperm and reduced fertility (see Table 11). The effects publicized in the Yusho and Yu-Cheng cases were found in women and children exposed to high concentrations of PCBs, however other studies in the United States (Lake Michigan, Lake Ontario, in New York and North Carolina) have also found problems in neurological development in

children exposed to much lower concentrations, from environmental exposure, for example, from mothers who ate PCB-contaminated fish, or in children who were breastfed with milk contaminated with PCBs. (24)

Table 11
Mass PCB poisoning accidents in Yusho and Yu-Cheng

The Yusho case occurred in 1968, when it was reported that 1,700 residents of Kyushu, Japan became ill after eating food prepared with rice oil that was accidentally contaminated with PCBs. The case of Yu-Cheng, located in the Taichung province in central Taiwan, took place over an eight-month period (December 1978 to September 1979), when just over 2,000 individuals —according to official figures— ate food prepared with rice oil contaminated with PCBs that were converted into dioxins, furans and other chlorinated compounds.

In both cases, the initial symptoms included serious skin abnormalities, such as acne and patches of black pigmentation; vision and respiratory problems; neurological disorders, fatigue and anorexia. There was a higher rate of mortality in the exposed population in Yu-Cheng, resulting from various illnesses. However, particularly children exposed while still in the uterus were severely affected, and not all of them survived. The children of Yu-Cheng who were born to exposed mothers were under observation for several years, and many of them were born with congenital defects (low birth weight, hyperpigmentation of facial skin and genitals, abnormal fingernails, often dark in color, and reduced penis size (although this last effect should be further studied). In addition, many of the children responded more slowly in various learning tests, and were found to have lower intelligence scores, hyperactivity or other behavior problems. Among children who suffered the most exposure, there were cases of mental retardation.

Recently, it has been revealed that Yu-Cheng men under the age of 20 years who were exposed to PCBs and furans were found to have deformed sperm with impaired mobility, as well as reduced fertility. These incidents were publicized internationally, and subsequently more assessments of health effects from PCB exposure were conducted, leading to the gradual withdrawal of these substances from the world market.

Sources: Ruth Stringer and Paul Johnston, *Chlorine and the environment*, London, Kluwer Academic Publishers, pp. 285-7; *Rachel Hazardous Waste News*, No. 372; Mammi Nida, "Country Report by Japan," and "Country report from Taiwan," in the CD from Japan Offspring Fund, *Toxic PCB is around you. The present situation and the need for solutions*. Tokyo, Japan, March 2003.

(**) See "Sperm abnormalities in men exposed to PCBs and PCFDs," which comments on the study by Hsu PC, Huang W, Yao WJ, Wu MH, Guo YL, Lambert GH. 2003. "Sperm changes in men exposed to polychlorinated biphenyls and dibenzofurans." *JAMA* 289: 2943-2944, in *Environmental Health Perspectives*, Vol. 11, No. 12, September 2003, p. A 639.

Cancer and hormonal disruptions

It has been proven that PCBs cause cancer in animals, and they are considered to be probable carcinogens in humans by the WHO's International Agency for Research on Cancer (IARC). Exposure to PCBs has been particularly associated with breast cancer.

Epidemiological studies have been conducted with PCB-exposed workers at factories where transformers are made for the electrical sector, and at urban waste incinerators. These studies have shown an increase in the incidence of brain, liver and bile duct cancer, as well as other malignant tumors in exposed workers. An increase in mortality resulting from these tumors has also been observed. ⁽²⁵⁾

It has been found in laboratory tests that some specific PCB congeners disrupt hormonal functions. These are "endocrine disruptors," particularly affecting the action of estrogens and androgens, the thyroid hormone, retinoid and other hormones.

PCBs do not remain inert in the human body, as they do in electrical transformers, and rather, provoke a biological response. The effects from PCBs on women's reproductive health give reason for serious concern. PCBs damage the brain development of the fetus, especially affecting the thyroid hormones. Exposure to PCBs in the uterus in amounts slightly above those found in environmental exposure (in food, for example) can have long-term negative impacts on intellectual functioning during childhood, and can cause problems in psychomotor coordination, memory and visual recognition. Exposure to PCBs during pregnancy has also been associated with low birth weight and miscarriages. ⁽²⁶⁾

Once they have been introduced into the human body, PCBs can remain in fatty tissue for 25 to 75 years, since they resist metabolic transformation. Of all mammals, humans are the slowest to excrete PCBs, and there is no known method for accelerating this process. ⁽²⁷⁾

Contamination of breast milk

PCBs accumulate in mothers' fatty tissue and are excreted through breast milk, representing a danger for future generations.

The health effects for children who are breastfed with milk contaminated with low concentrations of PCBs are worrisome. In an experiment with monkeys who were fed a mixture and concentration of PCBs similar to the average levels found in human breast milk (from birth to 20 weeks of age), learning and behavior problems were found in tests conducted at 2.5 and 5 years of age. The levels of PCB in the blood of these monkeys were 2 to 3 ppb, similar to the average levels found in human populations. Other experiments with monkeys who were exposed to PCBs after birth revealed similar effects, including hyperactivity. ⁽²⁸⁾

2.5 Hexachlorobenzene (HCB)

Characteristics of HCB

HCB is a chlorinated organic compound that has six carbon atoms and six chlorine atoms, with the following formula and molecular structure:

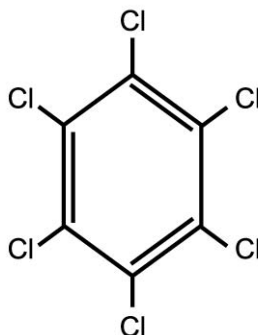


Figure 8

Molecular structure of HCB

Chemical formula: (C₆Cl₆)

CAS No. 118-74-1

Uses of HCB

HCB was used as a pesticide and as an intermediate or additive in industrial production. It is also an unintentionally produced POP.

HCB was used as a wood preservative and fungicide for seed treatment for cereals such as wheat, barley, oats and rye. It was also used as an intermediate or additive in various manufacturing processes, including the production of synthetic rubber, dyes, and pentachlorophenol (a pesticide used as a wood preservative). HCB is also a byproduct of various industrial processes, specifically: the production of numerous chlorinated compounds, including pesticides (it can be produced as impurities in chlorothalonil, propanil (DCPA), picloram, pentachloronitrobenzene (PCNB), pentachlorophenol, dacthal, simazine and atrazine); the production of magnesium; the synthesis of vinyl chloride monomer (VCM) for producing PVC plastic; productive processes in the metallurgical industry; chlorine production; the production of chlorobenzenes, chlorophenols and their derivatives; and the production of chlorinated solvents, such as tetrachloroethylene, perchloroethylene and trichloroethane. It is produced unintentionally as a result of the incineration of chlorinated compounds, in its various forms, including the burning of hazardous wastes in cement ovens, the incineration of sewage sludge, of municipal, hazardous and medical wastes, and in carbon combustion. ⁽²⁹⁾

Effects of HCB on health and the environment

The UN European Commission identifies HCB within substances having a level of toxicity similar to that of dioxins and furans, and secondly, within the category of polyaromatic hydrocarbons, as the most significant POP released from a stationary source, especially through emissions from incinerators, from the metallurgical industry and the burning of chlorinated compounds.

The acute toxicity of HCB is low in birds, aquatic biota and mammals, including humans, however if exposure is prolonged, it can have very toxic, chronic effects, even at low concentrations.

The accidental exposure of 3,000-5,000 persons in Turkey who ate breads made from HCB-treated grains, between 1955 and 1959, provided more in-depth knowledge —although tragic— of HCB's effects on health. More than 600 persons experienced an illness called porphyria turcica, which is manifested through skin lesions and disruptions in the metabolism of red blood cell pigment (porphyrin) in the liver. The children of exposed mothers had skin lesions, and 95% of them died in less than a year's time. ⁽³⁰⁾

HCB is classified by IARC in Group 2B, as a possible human carcinogen, and it may also promote tumors. HCB can damage fetal development, the liver, immunological system, thyroid gland, kidneys and the central nervous system. The liver and the nervous system are especially sensitive to its effects, and porphyria is a common symptom from HCB toxicity. High or repeated exposure can damage the nervous system and cause irritability, difficulty in walking and in coordination, muscular weakness, tremors and a prickly sensation in the skin. There are reports that repeated exposure can lead to permanent changes in the skin, provoked by its hardening, and that wrinkles are more likely to appear, as well as increased hair growth, especially in the face and forearms. ⁽³¹⁾ Recent experiments in rats exposed to HCB —using genetic toxicology models that analyze the profiles of gene expression— confirmed the known effects from HCB on the immunological system, provoking an inflammatory response in the liver, kidneys and spleen, and other new mechanisms for disrupting the immunological system. ⁽³²⁾

HCB is persistent in the environment; it has a soil half-life of up to six years, and it has been measured in the atmosphere, in potable water, in food and breast milk. ⁽³³⁾ If HCB is included when measuring dioxins in breast milk, the total Toxic Equivalency (TEQ) levels found are higher than those obtained if only dioxins and PCBs are included in the measurement.

High concentrations of HCB have been found in the air near factories where chlorine and organochlorinated compounds are produced in Flix, Tarragona, Spain, and these concentrations were also found in blood samples from workers and local residents. ⁽³⁴⁾

In the United States and Canada, regulations have been established for maintaining better controls over the production of organic chemicals, and it is hoped that this will reduce HCB emissions from the production of chlorinated solvents. Also, standards for water quality have been established, due to possible emissions from industries such as electroplating and metal finishing industries, and from wastewater pre-treatment, effluent discharges and chemical processing. ⁽³⁵⁾

The Stockholm Convention includes HCB within the subgroup of unintentional POPs, together with dioxins, furans and PCBs. The Convention permits countries to request a specific, temporary exception to the elimination of HCB as an industrial product, if it is used as a solvent in pesticide formulas, if it is produced or used as a closed-system site-limited intermediate, or if it is chemically transformed during the manufacture of other chemical products that do not exhibit the characteristics of POPs (Stockholm Convention, Annex A, Part I, note iii).

NOTES — CHAPTER TWO

1. For a general overview of the problems caused by endocrine disruptors, the author recommends reading the book by Theo Colborn, John Peterson Myers and Dianne Dumanoski, *Our Stolen Future* (Dutton, Penguin Books, New York, 1996), which has been translated into 14 languages. See www.ourstolenfuture.org for updated information on this topic.
2. Dr. Lilia Albert, editor, *Introducción a la toxicología ambiental*. Centro Panamericano de Ecología Humana y Salud, State of Mexico Government, Department of Ecology, Metepec, State of Mexico, 1997, pp. 111 and 330.
3. UNEP, IOMC, GEF, *Global Report 2003. Regionally Based Assessment of Persistent Toxic Substances*, Geneva, Switzerland.
4. Theo Colborn, John Peterson Myers and Dianna Dumanoski, op. cit., Chapter 10. Regarding the lack of evidence for a safe threshold of dioxin exposure, with a review of US EPA studies, see: David Mackie, Junfeng Liu, Yeong-Shang Loh, and Valerie Thomas, “No Evidence of Dioxin Threshold,” *Environmental Health Perspective* 5730, November.

5. "What is body burden?" in www.chemicalbodyburden.org
6. Steingraber, Sandra. *Having Faith: An Ecologist's Journey to Motherhood*. Cambridge, Massachusetts, Perseus Publishing, 2001, p. 1436.
7. See more information on these results in the web page of IPEN's Community POPs Monitoring Group at <http://www.edc.org>. With regard to the Anniston case, see Community Against Pollution, Anniston, Alabama, <http://www.communityagainstpollution.org>
8. Fernando Bejarano González, *La Espiral del Veneno, Guía Crítica Ciudadana sobre plaguicidas*, Mexico, Red de Acción sobre Plaguicidas y Alternativas en México (RAPAM), 2002.
9. See *America's Choice: Children's Health or Corporate Profit. The American People's Dioxin Report*. Technical Support Document, Chapter 2, "The Chemistry and Environmental Fate of Dioxin," Center for Health, Environment and Justice, pp. 5-6.
10. *America's Choice*, *op. cit.*, p. 6. The total TEQ is equal to the sum of the concentration of the congener multiplied by the TEF assigned to the congener, in comparison to TCDD, in a complex sample. Also see the formula presented by William H. Farland, EPA, Power Point presentation.
11. The comparisons were taken from Marvin Legator, Ph.D., Environmental Toxicologist, University of Texas, in the article "Surviving in a Chemical World," published in the *Galveston County Daily News*, March 16, 1996.
12. See a summary of the sources of these studies in "What is Dioxin" in the web page of Alliance for Safe Alternatives, previously the Center for Health, Environment and Justice, and with more detail, in the CHEJ report, *America's Choice: Children's Health or Corporate Profit. The American People's Dioxin Report*, USA, 2000 (various scientists participated in the review).
13. Sandra Steingraber, *op. cit.*, p. 257.
14. See references to these studies in Michelle Allsopp, Ruth Stringer and Paul Johnston, Greenpeace Research Laboratories, *Unseen Poisons: Levels of organochlorine chemicals in human tissues*, Exeter UK, June 1998, pp. 2-3, 15-18, in the Annexes and the extensive bibliography.
15. Institute of Medicine, *Dioxins and dioxin-like compounds in the food supply: strategies to decrease exposure* (2003), USA, National Academy of Sciences, Executive Summary. Also, Charles W. Schmidt, "Diet and dioxins: the need to cut back," in *Environmental Health Perspectives*, Vol. 12, No. 1, January 2004, pp. A40-A43.
16. Presentation by Dr. Jacques Ehretzman, "Overview: polychlorinated byphenyls (PCBs)," in UNEP-IOMC, *Proceedings of the subregional workshop on identification and management of PCBs and dioxins and furans*, Habana, Cuba, April 23-26, 2001, pp. 33-47. Also, Lilia Albert, *Curso básico de toxicología ambiental*. OPS-OMS, Mexico, Editorial Limusa, p. 272.
17. Study by Japan Offspring Fund.
18. Ruth Stringer et al., *op. cit.*, p. 280.
19. Ruth Stringer et al., *op. cit.*, p. 281-282.
20. Sandra Steingraber, *op. cit.*, pp. 137-152.
21. *Rachel's Hazardous Wastes News*, No. 295, July 22, 1992, Environmental Research Foundation, edited by Peter Montague, Washington, D.C.
22. Deborah Cadbury, *Feminization of Nature: Our Future at Risk*, London, 1977, p. 72.
23. *Ibid*, p. 72.
24. Ted Schettler et al., *In Harm's Way: toxic threats to child development*, a report by Greater Boston Physicians for Social Responsibility, 2000, pp. 78-79.
25. Dolores Romano and Estefanía Blount, *op. cit.*, p. 13.
26. Sandra Steingraber, *op. cit.*, pp. 144-149.
27. Sandra Steingraber, *op. cit.*, 2001, p. 143.
28. Ted Schettler, *op. cit.*, p. 76.
29. Ruth Stringer et al., *op. cit.*, pp. 347-348; Joe Thornton, 2000, *op. cit.*, pp. 261, 266, 271-273; *Expediente de nominación sobre hexaclorobenceno*, presented by Canada to the Working Group on the Sound Management of Chemicals, Commission for Environmental Cooperation (CEC), April 22, 1998, internal document.

30. Ruth Stringer, *et al.*, *op. cit.*, p. 347.
31. Ruth Stringer, *et al.*, *op. cit.*, p. 347.
32. Janine Ezendam et al., "Toxicogenomics of subchronic hexachlorobenzene exposure in brown norway rats," *Environmental Health Perspectives*, Vol. 112, No. 7, May 2004, pp. 782-791.
33. Ruth Stringer, *et al.*, *op. cit.*, p. 347.
34. Ruth Stringer, *ibid.*
35. CEC, *Expediente de Nominación del HCB*, *op. cit.*, p. 8.

Chapter Three



Government commitments in the Stockholm Convention

- 3.1 Elimination of pesticides with POP characteristics
 - Elimination of organochlorinated pesticides in the Stockholm Convention
 - Temporary, specific exemptions to elimination of POP pesticides
 - Elimination of DDT and control of malaria
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Chapter Three

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3.1 Elimination of pesticides with POPs characteristics

Elimination of organochlorine pesticides in the Stockholm Convention

The provisions in the Stockholm Convention that address pesticides are stipulated in Article 3 and in Annex A.

Signatory countries must eliminate the production and use of the eight organochlorine pesticides included in Annex A of the Convention: aldrin, chlordane, dieldrin, endrin, heptachlor, mirex, toxaphene and hexachlorobenzene (HCB), the latter of which is also unintentionally produced, and thus also included in Annex C. Certain specific and temporary exemptions to eliminating the production and use of these pesticides are, however, permitted. To qualify, governments must notify the Convention Secretariat in writing, in order to be registered for specific exemptions that are stipulated in Annex A of the Convention (Article 4). These specific exemptions depend on the particular pesticide and include: use for controlling termites and ectoparasites such as lice and ticks; use as an intermediate in the production of another substance; or as a solvent in pesticides.

Waste stockpiles and POPs-contaminated sites are addressed in Article 6 of the Convention, and will be discussed in 3.5 of this Citizen's Guide.

Temporary, specific exemptions to elimination of POPs pesticides

The Stockholm Convention establishes exemptions to the elimination of the production, use, import and export of POPs pesticides, however they are specific and temporary in nature, as stipulated in Annex A.

The exemptions correspond to: aldrin, in its use as a local insecticide and ectoparasiticide (against lice and ticks, for example); chlordane, as a local ectoparasiticide, insecticide and termiticide and as an additive in plywood adhesives; dieldrin, for agricultural uses; heptachlor, as a termiticide, for treating wood and for use in underground cable boxes; hexachlorobenzene, as a solvent in pesticides and as an intermediate, as long as the process takes place in a closed, site-limited system, and it is not used to produce another POP; and finally, mirex, as a termiticide (see Table 12).

According to the Convention, countries that obtain a specific exemption: "...shall take appropriate measures to ensure that any production or use under such exemption or purpose is carried out in a manner that

prevents or minimizes human exposure and release into the environment. For exempted uses or acceptable purposes that involve intentional release into the environment under conditions of normal use, such release shall be to the minimum extent necessary, taking into account any applicable standards and guidelines.” (Article 3, paragraph 6)

In the case of pesticides, the use of these substances represents precisely an intentional release into the environment. Because of their very nature, chemical pesticides are the only type of chemical substances that, because they are toxic, are released intentionally into the environment, to kill pests or fight against disease-transmitting insects. In this context, the Convention is very clear, requiring these releases occur “to the minimum extent necessary.” In our opinion, this implies first of all, that the practice of aerial spraying of POP pesticides must be discontinued, and secondly, that any exception is only justifiable after other chemical and non-chemical alternatives to the POPs pesticide have been evaluated. In fact, there are alternatives to using POPs pesticides that have been documented in every case, and therefore, the use of these pesticides in certain countries through these exceptions can only be viewed as an extreme, temporary measure.

limination of DDT and control of malaria

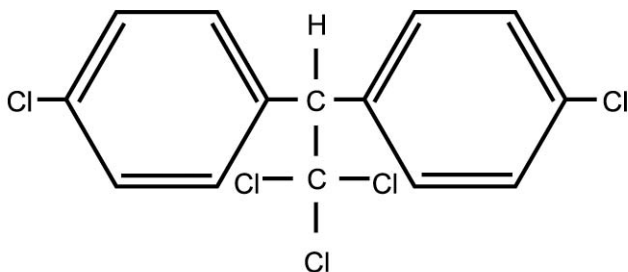


Figure 9

Molecular structure of DDT (1,1,1-trichloro-2,2-bis(4 chlorophenyl) ethane). CAS No. 50-29-3.

Table 12
Exemptions permitted for the 12 POPs included in the Stockholm Convention

| Chemical product | Activity | Specific exemption |
|----------------------------|------------|---|
| Aldrin* CAS: 309-00-2 | Production | None |
| | Use | Local ectoparasiticide Insecticide |
| Chlordane* CAS: 57-74-9 | Production | As allowed for the Parties listed in the Register |

| | | |
|--|------------|--|
| | Use | Local ectoparasiticide Insecticide Termiticide (to control termites) Termiticide in buildings and dams Additive in plywood adhesives |
| Dieldrin* CAS: 60-57-1 | Production | None |
| | Use | In agricultural operations |
| Endrin CAS: 72-20-8 | Production | None |
| | Use | None |
| Heptachlor* CAS: 76-44-8 | Production | None |
| | Use | Termiticide Termiticide in structures of houses Termiticide (subterranean) Wood treatment In use in underground cable boxes |
| Hexachlorobenzene CAS: 118-74-1 | Production | As allowed for the Parties listed in the Register |
| | Use | Intermediate Solvent in pesticides Closed-system site-limited intermediate |
| Mirex* CAS: 2385-85-5 | Production | As allowed for the Parties listed in the Register |
| | Use | Termiticide |
| Toxaphene* CAS: 8001-35-2 | Production | None |
| | Use | None |
| Polychlorinated biphenyls (PCB) (1) | Production | None |
| | Use | Articles in use in accordance with the provisions in Annex III. |

Source: UNEP, *Stockholm Convention on Persistent Organic Pollutants*, Annex A, Part I.

CAS: Chemical Abstract Service.

(1) Government commitments in the area of PCBs are addressed in later chapters.

The worldwide elimination of DDT provoked heated discussions during the Stockholm Convention negotiations, since DDT is primarily used to fight the mosquito that transmits the pathogen that causes malaria. This illness causes more than a million deaths a year, most of them in south Saharan Africa. During the negotiations, some individuals even attempted to pose a false dilemma, stating that either DDT use be continued and human lives will be saved, (although the environment will be polluted) or that it be prohibited and the environment will be protected but the population's protection against malaria will be jeopardized. This dilemma is false, since it presents DDT as the only chemical tool that can control malaria, or as the most effective and most inexpensive., In reality there is a diversity of successful experiences in various countries, including Mexico, in varied regions of the world, where DDT has been eliminated and malaria has been effectively controlled. Comprehensive strategies include not only controlling the vector mosquito of the parasite that transmits the illness, but also include habitat management, timely diagnosis and treatment of patients, and improved housing and hygiene conditions (Table 13).

For years the World Health Organization (WHO) recommended using DDT to control malaria, until authorities became aware of the resistance that mosquitoes were developing to the insecticide. Currently, the WHO is promoting a new world initiative, *Rollback Malaria*, that seeks to reduce the number of deaths from malaria by half by the year 2010, through participation by governments, development agencies, research groups, and civil society organizations. Some of the elements that serve as the engine for this initiative are the following: decisions based on scientific tests, timely diagnostic assessment, and effective treatment; increasing community awareness; multiple prevention, with the use of treated mosquito nets, environmental health and reduced risks during pregnancies; research studies on new medicines, vaccinations and insecticides, and support for epidemiological monitoring activities. In countries with huge public debts, the initiative supports actions aimed at minimizing the debt burden, in order to increase resources that can be allocated to programs for fighting poverty. ⁽¹⁾ With assistance from this WHO initiative, Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua and Panama have mobilized US \$770,000 —as of December 2000— to eliminate DDT use. ⁽²⁾

Table 13
Mexico's success in controlling malaria and eliminating DDT

Mexico eliminated the use of DDT in the year 2000, and is effectively controlling malaria through a comprehensive strategy for controlling the vector mosquito and the parasite that transmits the disease. The strategy allows for a focused treatment, made up of the following elements:

- A national epidemiological monitoring system with strong community participation, through which trained volunteers to detect cases of malaria, draw blood samples, and report the cases to health centers, where the transmitting parasite is identified through microscopic examination.
- Epidemiological and entomological stratification, in order to learn more about the model of transmission and the biology and behavior of vector mosquitoes, respectively.
- Elimination of reservoirs of parasites in humans, through the Single Dose Treatment (SDT) with two medicines, chloroquine and primaquine, on a monthly basis for three consecutive months, followed by a two-month break, and then repeating the treatment during a period of three years (SDT3x3x3).

- Elimination of the breeding areas for the anopheles mosquitoes, with community participation. Filamentous green algae are cleaned up in rivers and ravines, where these mosquitoes breed, thus preventing them from hatching and significantly reducing their numbers. This measure was originally recommended by Hoffman in 1936, and with its use, it is no longer necessary to spray inside homes, thus reducing program costs. Using insecticides is no longer the program's strategic alternative.
- Increasingly active participation by the community and municipal authorities is promoted, in order to promote good hygiene practices, cleaning up yards, housing improvements, and cleaning up the sites where mosquitoes breed.
- When necessary, a pyrethroid insecticide is applied inside homes (deltamethrine is the first choice).

Source: *Programa de Acción: Enfermedades Transmitidas por Vector*. Mexican Health Department, 2001, pp. 17-28; and Mexican Official Norm NOM 032-SSA2-2002, www.ssa.gob.mx

Government commitments to eliminating DDT

In Article 3 and Annex B of the Convention, the following government commitments are established in relation to DDT:

- All governments shall eliminate the production and use of DDT, with only two exceptions: for use in programs for disease vector control—for diseases such as malaria—and as an intermediate in the production of dicofol (another insecticide) in a closed, site-limited system. (Article 3, and Annex B (iii))
- Countries that wish to continue producing or using DDT for disease vector control shall notify the Stockholm Convention Secretariat, which will establish a special registration that will be open to public consultation, and they shall also notify the World Health Organization (WHO).
- Each country that produces or uses DDT for disease vector control must do so “in accordance with the World Health Organization recommendations and guidelines on the use of DDT and when locally safe, effective and affordable alternatives are not available.” (Annex B, Part II, paragraph 2)
- Each country that uses DDT shall report to the Convention Secretariat and the World Health Organization (WHO) every three years with regard to the amount used, the conditions of such use and its importance for that country's disease control strategy, according to a format to be determined by the Conference of the Parties in consultation with the WHO. (Annex B, Part II, paragraph 4)
- Develop and implement a DDT Action Plan in accordance with Article 7 of the Convention, with the goal of reducing and ultimately eliminating DDT use. This plan should include:
 - The development of regulatory and other types of mechanisms for ensuring that DDT use be restricted to disease vector control;

- The implementation of alternative products, methods and strategies, including resistance management strategies for ensuring the ongoing effectiveness of these alternatives.
- Measures for strengthening health care and reducing the incidence of the disease. (Annex B, Part II, paragraph 5 (a))
- Signatory countries are encouraged to promote research and development of chemical and non-chemical products, methods and strategies that are alternatives to DDT (Annex B, Part II, paragraph 5 (b))
- The Convention indicates that alternatives or combinations of viable alternatives to DDT *shall pose less risk to human health and the environment*, adequate for disease control according to the existing conditions in member countries, and supported with monitoring data (Annex B, Part II, paragraph 5 (b))
- The Conference of the Parties to the Convention will determine, during its first meeting and the following meetings at least every three years, whether DDT continues to be necessary to fight against vector diseases. In consultation with the WHO and based on available scientific, technical, environmental and economic information, including information on the production and use of DDT, *the availability, suitability and implementation of the alternatives to DDT; and progress in strengthening the capacity of countries to transfer safely to reliance on such alternatives* (Annex B, Part II, paragraph 6).

Preventing the production and use of new pesticides and industrial products exhibiting POPs characteristics

In Article 3, paragraph 3 of the Convention, it is recommended that governments adopt regulatory measures to prevent the production and use of new pesticides or new industrial chemicals that exhibit the characteristics of persistent organic pesticides, in line with the criteria specified in the first paragraph of Annex D (specifically, the properties of persistence, bioaccumulation, long-range transport, and toxic potential for causing damage to health and the environment).

Also, in paragraph 4 of Article 3, it is established that this same criteria should also be taken into account when conducting risk assessments of pesticides and industrial chemicals currently in use.

Environmental organizations have emphasized the need to prohibit all organochlorine pesticides still on the market, including lindane, endosulfan, pentachlorophenol and 2,4-D, due to their intrinsic toxic characteristics and the high-risk conditions accompanying their use, especially in developing countries and countries with economies in transition.

3.2 Elimination of PCBs

The governments of the Convention's signatory countries make a commitment to achieve the following objectives:

To end the production of PCBs

1) The Convention stipulates that PCB production must end (Article 3, paragraph 1), and it does not offer any exceptions. With regard to the use of PCBs, however, it does specify exceptions for PCB-containing products and equipment, subject to a series of conditions and restrictions for their gradual elimination, as specified in Part II of Annex A, and mentioned later in this document.

Also not included for elimination are amounts of PCBs that occur as unintentional trace contaminants in products and articles, as indicated in the first note (i) under Annex A.

To gradually eliminate PCB-containing equipment in use, by 2025

2) Governments shall eliminate the use of PCBs in equipment (for example, in transformers, electrical capacitors, ballasts, etc.) by 2025. To achieve this goal, they shall make efforts in line with the following priorities:

- I. Identify, label and remove from use all equipment that contains more than 10% PCBs and volumes greater than 5 liters;
- II. Identify, label and remove from use all equipment that contains more than 0.05% PCBs and volumes greater than 5 liters;
- III. Identify and remove from use all equipment containing more than 0.005% (50 ppm) of PCBs and volumes greater than 0.05 liters.

To reduce the risk of PCB exposure for the population and the environment

3) Governments shall also promote the following measures for reducing the risk of exposure for the population and the environment:

- a) Use PCBs only in intact and non-leaking equipment and in areas where the risk of these substances being released into the environment can be minimized, and if this were to occur, where decontamination can take place rapidly;
- b) Eliminate the use of PCBs in areas where food for human or animal consumption is produced or processed;
- c) When PCBs are used in densely population areas, including schools and hospitals, that reasonable measures be adopted for protection against electric failure that could lead to fires, and that such equipment be regularly inspected to detect any leaks.

To treat PCB-containing hazardous wastes

- d) Prohibit the import or export of PCB-containing equipment, except for the purpose of “environmentally sound waste management,”
- e) Prohibit the recovery of liquids contaminated with PCBs at concentrations above 0.005% (50 ppm), to be reused in other equipment, except for maintenance and repair operations.

- f) Achieve the elimination of PCB-containing liquid wastes and equipment contaminated with concentrations above 0.005% (50 ppm) as soon as possible, and by 2028 at the latest.
- g) Identify other articles containing more than 0.005% PCBs (for example, cable-sheaths, cured caulk and painted objects) and treat them appropriately, in accordance with the provisions in the first paragraph of Article 6.

To report advances made to the Conference of the Parties

- h) Prepare a report every five years for the Conference of the Parties to the Convention, regarding the progress made in eliminating PCBs from equipment in use and destroying PCB wastes by 2025 and 2028, respectively, in line with the stipulations in Article 15.

3.3 Unintentionally produced POPs: dioxins, furans, PCBs and HCB

Continuous minimization and where feasible ultimate elimination of unintentional POPs: goals established by the Convention

Article 5 and Annex C of the Stockholm Convention specify the commitments that governments must fulfill with regard to unintentionally produced POPs (dioxins, furans, PCBs and HCB), and establishes the overall goal of continuing minimization and where feasible, ultimate elimination of the total anthropogenic releases of unintentional POPs (see Table 14).

Table 14
Article 5 of the Stockholm Convention

| |
|--|
| <p><i>Measures to reduce or eliminate releases from unintentional production</i></p> <p><i>“Each Party shall at a minimum take the following measures to reduce the total releases derived from anthropogenic sources of each of the chemicals listed in Annex C, with the goal of their continuing minimization and, where feasible, ultimate elimination.”</i> (Stockholm Convention, Article 5, first paragraph)</p> <p>Annex C includes dioxins, furans, PCBs and HCB as unintentionally produced POPs.</p> |
|--|

The Convention is very clear in relation to unintentional POPs. The ultimate goal is to eliminate the sources of these substances, and when this is not viable, all Parties must seek the *continuing minimization* of these substances. Therefore, it is expected first of all, that governments seek alternatives in order to eliminate dioxins and other unintentional POPs, and if this is not possible, that they minimally seek measures that will permit their gradual reduction.

The continuing minimization of dioxins and other unintentional POPs essentially means that the levels of these POPs should be lower next year than this year, as pointed out by John Buccini, coordinator of the

Intergovernmental Negotiating Committee of the Stockholm Convention. ⁽³⁾ Consequently, governments have an ongoing responsibility to establish a monitoring system for measuring progress made to this end. And this does not imply only measuring levels, but rather, verifying that the levels of the release and discharge of these pollutants into the environment are actually being reduced. The Convention specifies that one of the measures that governments must minimally implement is to conduct national inventories of sources and estimates of releases, and that Best Available Techniques (BAT) and Best Environmental Practices (BEP) are applied, as we will see later in this document.

It is important to emphasize that the continuing minimization and ultimate *elimination of unintentional* POPs refers to total releases. This means that inventories must not only include atmospheric releases, but must also consider releases into the environment as a whole, including discharges into water and soil.

The Stockholm Convention adopted the term releases, to refer to total environmental impact. It is more inclusive than emissions, which only refers to releases into the atmosphere, according to the definition by the Convention of Long-Range Transboundary Air Pollution (LRTAP).

The Stockholm Convention identifies a partial list of 20 of the types of sources having the potential to form and release unintentional POPs into the environment (Annex C, Parts II and III), and it divides them into first, industrial sources with a strong potential for release, and secondly, other sources (the list of these sources is presented in Table 8 in Chapter Two, but is not complete other sources identified in scientific literature or other inventories are listed in Annexes 2-4 of this Guide).

Minimum measures that must be adopted to fulfill the ultimate goal of eliminating unintentional POPs

Article 5 of the Convention establishes that governments must adopt, at a minimum, a set of specified measures to fulfill the objective of *continuing minimization, and where feasible, ultimate elimination* of unintentional POPs. These measures should be included in the National Action Plans, and should be reviewed every five years.

One of these measures is what some refer to as the “principle of substitution,” or the commitment to “*promote the development and, where it deems appropriate, require the use of substitute or modified materials, products and processes to prevent the formation and release*” of unintentional POPs. (Article 5, paragraph c). Applying these measures can lead to the development of a policy for selecting materials that will avoid the formation and release of dioxins and similar compounds, and thus fulfill the Convention’s ultimate goal. The principle of substitution is part of a management strategy that focuses on prevention, directly addresses production processes, leads to a reduction in the use of toxic materials and substances, and can even lead to cleaner forms of production.

The minimal measures that should be adopted, according to Article 5 of the Stockholm Convention, are the following:

- Develop an Action Plan, regional or sub-regional in nature, within two years of the date when the Convention enters into effect, and subsequently implement this plan, which should include:
 - Preparing and updating a National Inventory that identifies the sources of the unintentional formation of dioxin and similar compounds, and the current and projected assessment of total releases;

- Evaluating the efficacy of the laws and policies of the country or region, relative to the management of these releases;
 - Strategies for fulfilling the obligations mentioned above;
 - Measures for promoting education and training regarding these strategies
 - A review of the success of the strategies for fulfilling these obligations, conducted every five years;
 - A schedule for implementing the Action Plan, including for the strategies and measures included in this plan.
- Promote the application of available, feasible and practical measures that can expeditiously achieve a realistic, significant level of release reduction or source elimination.
 - Promote the development and use of substitute or modified materials, products and processes to prevent the formation and release of dioxins and similar compounds included in Annex C, taking into consideration the general guidelines for prevention and reduction of releases in Annex C, and guidelines approved by the Conference of the Parties.
 - Promote and, in accordance with the implementation schedule for the Action Plan, require the gradual use of Best Available Techniques (BAT) for new sources, initially focusing on sources identified as having a strong potential for forming unintentional POPs (Annex C, Part II), and within a period of four years after the Convention enters into effect for each government.
 - Promote the use of Best Environmental Practices (BEP) with respect to existing and new sources.
 - When applying BAT and BEP, governments should take into consideration the general prevention measures specified in Annex C, Part V, Section A (see Table 22), and guidelines adopted by decision of the Conference of the Parties.

Development of Guidelines for Best Available Techniques (BAT) and Best Environmental Practices (BEP) in the Stockholm Convention

Signatory countries to the Stockholm Convention must require the use of Best Available Techniques for new sources, and the promotion of Best Environmental Practices for existing and new sources. A new source is understood as "...any source of which the construction or substantial modification is commenced at least one year after the date of entry into force of this Convention for the Party concerned..." or the entry into force of an amendment that includes the source in question.(Art 5. (f) (vi)

Annex C of the Convention includes a special section dedicated to providing general guidelines on best available techniques and best environmental practices, listing a series of general prevention measures for both, and specifying the factors that should be generally considered in order to determine the best available techniques (Tables 15 and 16). In the case of best environmental practices, the Convention only indicates that the Conference of the Parties may develop guidelines in this respect.

Table 15
General prevention measures relating to best available techniques and best environmental practices

Priority should be given to the consideration of approaches to prevent the formation and release of chemicals listed in Part 1 (Annex C, Part I : dioxin, furans, PCBs and HCB, note of the author).

Useful measures could include:

- (a) The use of low-waste technology;*
- (b) The use of less hazardous substances;*
- (c) The promotion of the recovery and recycling of waste and of substances generated and used in a process;*
- (d) Replacement of feed materials which are persistent organic pollutants or where there is a direct link between the materials and releases of persistent organic pollutants from the source;*
- (e) Good housekeeping and preventive maintenance programs;*
- (f) Improvements in waste management with the aim of the cessation of open and other uncontrolled burning of wastes, including the burning of landfill sites. When considering proposals to construct new waste disposal facilities, consideration should be given to alternatives such as activities to minimize the generation of municipal and medical waste, including resource recovery, reuse, recycling, waste separation and promoting products that generate less waste. Under this approach, public health concerns should be carefully considered;*
- (g) Minimization of these chemicals as contaminants in products;*
- (h) Avoiding elemental chlorine or chemicals generating elemental chlorine for bleaching.*

Source: UNEP Stockholm Convention, Annex C, Part V, Section A.

Table 16
Best Available Techniques: General Considerations

a) General considerations:

- (i) The nature, effects and mass of the releases concerned: techniques may vary depending on source size;*
- (ii) The commissioning dates for new or existing installations;*
- (iii) The time needed to introduce the best available technique;*
- (iv) The consumption and nature of raw materials used in the process and its energy efficiency;*
- (v) The need to prevent or reduce to a minimum the overall impact of the releases to the environment and the risks to it;*
- (vi) The need to prevent accidents and to minimize their consequences for the environment;*
- (vii) The need to ensure occupational health and safety at workplaces;*
- (viii) Comparable processes, facilities or methods of operation which have been tried with success on an industrial scale;*
- (ix) Technological advances and changes in scientific knowledge and understanding.*

(b) General release reduction measures: When considering proposals to construct new facilities or significantly modify existing facilities using processes that release chemicals listed in this Annex, priority consideration should be given to alternative processes, techniques or practices

that have similar usefulness but which avoid the formation and release of such chemicals. In cases where such facilities will be constructed or significantly modified, in addition to the prevention measures outlined in Section A of Part V the following reduction measures could also be considered in determining best available techniques:

- (i) Use of improved methods for flue-gas cleaning such as thermal or catalytic oxidation, dust precipitation, or adsorption;*
- (ii) Treatment of residuals, wastewater, wastes and sewage sludge by, for example, thermal treatment or rendering them inert or chemical processes that detoxify them;*
- (iii) Process changes that lead to the reduction or elimination of releases, such as moving to closed systems;*
- (iv) Modification of process designs to improve combustion and prevent formation of the chemicals listed in this Annex, through the control of parameters such as incineration temperature or residence time.*

Source: UNEP Stockholm Convention, Article 5, Annex C, Part V, Section B “Best Available Techniques.”

The concept of Best Available Techniques, according to the Stockholm Convention, “...is not aimed at the prescription of a specific technique or technology, but rather at taking into account the technical characteristics of the installation concerned, its geographic location and the local environmental conditions.” In order to determine the best available techniques, special consideration should be given to a set of factors, while “...bearing in mind the likely costs and benefits of a measure and consideration of precaution and prevention...” (Annex C, Part V, Section B “Best Available Techniques,” first paragraph). Included among the general factors to be considered are the need to safeguard occupational health and safety at workplaces, technological advances, and new scientific knowledge and understandings (see Table 17).

It is important to emphasize that even the Convention, in its general guidelines for Best Available Techniques, recommends that when studying proposals for building new facilities or modifying existing facilities that use processes known to release dioxins or similar compounds, that priority should be placed on considering “...alternative processes, techniques or practices that have similar usefulness but which avoid the formation and release of such chemicals...” (Annex C, Part V, Section B, paragraph b).

A group of experts has been created to develop guidelines for BAT and BEP for all sources of unintentional POPs identified in Annex C. It was expected that the group will meet on three occasions and that these guidelines will be ready for comment or approval by the first Conference of the Parties (COP1) in May 2005, to take place in Uruguay. ⁽⁴⁾ (At COP1 however, no decision was made and the group of experts will meet again during 2005 – 2006 to present the guidelines at COP3, note from the author for the English edition)

The group of experts is formed by 36 government delegates, with 15 designated by developing countries (Algeria, Argentina, Chile, Dominican Republic, Fiji, Iran, Kenya, Mexico, Mongolia, Singapore, Venezuela and Zambia); three named by countries with economies in transition (Serbia and Kazakhstan), and 18 experts representing developed countries (Germany, Australia, Austria, Canada, Finland, Italy, Japan, Switzerland and the United States). Also participating are members of UN entities, such as the UNEP Chemicals Program and UNIDO; representatives from the industrial sector, such as the International Council of Chemical

Associations, World Chlorine Council, International Council on Metals and Mining, and the European Cement Association. Finally, representing citizen organizations are members of Greenpeace International, World Wildlife Fund (WWF) and the International POPs Elimination Network (IPEN).

It should be expected and demanded that the guidelines for best available techniques (BAT) for each source of unintentional POPs (to be developed by the group of experts) prioritize recommendations or criteria for seeking alternatives, and not only propose measures for reducing emissions by improving combustion processes, for example. If the consideration of alternatives is not included as a substantial part of the BAT guidelines, this will have a very negative impact on the financial assistance mechanisms for implementing the Stockholm Convention, since in practice, it will give priority to assistance for dioxin-reducing equipment and actions, instead of alternatives for preventing the formation of these substances.

The countries in the Global South should decide what type of investments they want to promote in their National Implementation Plans: those aimed at only expanding pro-incineration technologies with expensive control equipment and difficult monitoring, or those focused more on preventing the generation and release of dioxins, applying the principle of substitution and using technologies that present alternatives to incineration.

Especially in the case of incinerators of medical, municipal and hazardous wastes, there are alternatives for managing these wastes and other treatment technologies that do not generate dioxins and furans, and that are used commercially in many countries (see Table 17).

Table 17
Alternatives for some sources of dioxins and furans

| Source | Alternatives |
|--|---|
| Incineration of medical wastes | System for separation and reduction of medical wastes with technologies for treating infectious biological wastes that do not include incineration: autoclave, trituration and chemical disinfection; cremation only for anatomical parts. |
| Incineration of municipal wastes | Intensive programs for separation, reuse and recycling of materials in municipal trash dump. Elimination of PVC in consumer articles and their packaging. Encouraging the use of reusable and recyclable materials in packaging materials. Extended Producer Responsibility measures. |
| Incineration of hazardous wastes in cement kilns | Avoid burning chlorinated wastes (including tires). Use of other energy sources, such as gas (most recommendable), fuel oil or coal, with adequate control equipment. |
| Chlorinated solvents | Water-based solvents; wet cleaning systems for use in drycleaners. |

Source: Fernando Bejarano. *Amenaza Global, Cuaderno Ciudadano sobre contaminantes orgánicos persistentes*. RAPAM. Mexico. 2000. Also, Pat Costner, *Criteria for the Destruction of Stockpiled Persistent Organic Pollutants*. Greenpeace, USA, October, 1998.

In the first chapter of this Guide, we mention the different citizen networks that oppose incineration in its various forms. We also refer to alternative proposals, especially in Zero Waste projects, that promote not only recycling, but also measures oriented toward extended producer responsibility, in order to impact product design and not only the final disposal of products after their useful life is over. In the Annexes of this document, we also include the web pages of institutions and groups that are promoting alternatives to hospital waste incinerators and promoting clean production strategies.

The following list can serve as an assessment guide when considering alternatives that can lead to the implementation of Best Environmental Practices in new facilities or in the modification of existing facilities (that generate dioxins and other unintentional POPs):

- a) Review proposals for new facilities in the context of sustainable development. This means reviewing the proposal or project and its intended usefulness, in relation to the economic, social and environmental context, and to policies for promoting sustainable development.
- b) Identify possible and viable alternatives. This consists of identifying alternative processes, techniques and practices that have a similar usefulness, but avoid the formation and release of unintentional POPs into the environment. To this end, there is a proposal to establish an information center on alternatives to various processes, with consideration for regional differences and the particular conditions found in developing countries and countries with economies in transition.
- c) Conduct a comparative assessment of the proposed project and identify possible, viable alternatives. The list of socioeconomic considerations included in Annex F and in the relevant criteria in Annex C, Part V, Sections A and B should be considered in the comparative assessment (Table 18).

Table 18
Information on socioeconomic considerations for assessing alternative products and processes

| |
|--|
| <ol style="list-style-type: none">a) Technical viabilityb) Costs, including environmental and health-related costsc) Efficiencyd) Riske) Availabilityf) Accessibility |
|--|

Source: UNEP Stockholm Convention, selection from Annex F.

- d) Prioritized consideration of alternatives. Alternatives should be prioritized above and beyond the original proposal only if —taking into account the aspects specified previously— they avoid the formation and release of unintentional POPs, they have a similar usefulness, and they are consistent with the sustainable development policies defined by developing countries and countries with economies in transition. ⁽⁵⁾

Exceptions to elimination of dioxins

The Convention indicates that the POPs classified as unintentional polluting residues in products and articles will not be included in Annex A and therefore will not be subject to elimination or to the mechanism for requesting an exception. This is a “window left open” in the Convention negotiations, and permits a lack of attention to the problem of pollution from dioxins, furans and PCBs when they are exhibited as “impurities” in various organochlorine pesticides. In effect, there is scientific evidence of this contamination by dioxins, furans and PCBs in the cases of pentachlorophenol, chloronitrophenol, nitrophenol, chlorothalonil, MCP (1-methylcyclopropene) and 2,4-D (2,4-dichlorophenoxyacetic acid).⁽⁶⁾ There are also reports in the United States on pesticides contaminated by BHC (lindane) impurities, including atrazine, picloram and simazine, and the fungicides chlorothalonil and pentachlorophenol. Use of the pesticides mentioned here is authorized in many developing countries.

Contamination from impurities in formulated pesticides indicates the unintentional production of dioxins and similar compounds during the manufacture of organochlorine pesticides. The US Environmental Protection Agency (EPA) has identified 161 active ingredients in pesticides of which it is known or suspected that dioxins and furans are produced during their chemical synthesis. In addition to those active ingredients the following are also present: chlorfenvinphos, diflubenzuron, fenvalerate, fenarimol, diclofop, diuron, linuron, metribuzin, oxadiazon, oxyfluorfen, endosulfan, bromoxynil and dicamba—all of which are authorized for use in various developing countries.⁽⁷⁾ Pesticide production represents 30% of the total release of dioxins and furans into the air and soil in the European Union, according to data from its official inventories in 1997 and 1999. (8)

Dioxin contamination during the production of certain pesticides and the presence of dioxins as impurities in products are additional reasons to work toward the elimination of pesticides from the market, and instead promote forms of agroecological control of pests, using lower-risk alternative products.

3.4 Restrictions on the import and export of POPs, and cooperation with other environmental conventions

The import and export of organochlorinated pesticides and PCBs (included in Annex A) and DDT (Annex B) will only be permitted if their destination corresponds to the exceptions permitted by the Convention, or to their “*environmentally sound disposal*” (Article 3, paragraph 2 (b)), or if they will be used in very small amounts “*for laboratory-scale research or as a reference standard*” (Article 3, paragraph 5). The cross-border movement of products, stockpiles and POP wastes must be subject to the relevant international provisions for prior informed consent (Article 3, paragraph 3) (Rotterdam Convention), and those indicated in the Basel Convention, according to Article 6, paragraph 1 (d).

The Stockholm Convention permits the export of POPs included in Annex A and B to countries that are not Parties to this international agreement, if they provide an annual certification to the exporting Party (Article 3, paragraph 2 (b) (iii)). This certification shall specify the intended use of the chemical, and the commitment by the importing country to protect human health and the environment, taking the necessary measures to reduce releases to the minimum possible or avoid them completely, and to appropriately manage wastes, according to specifications in Article 6, paragraph 1, and in the case of DDT, to use it only for malaria control, according to WHO guidelines.

Links with the Rotterdam Convention

The prior informed consent procedures that must be complied with in order to export the POPs mentioned in Article 3 is part of the Rotterdam Convention, which entered into effect on February 24, 2004, 90 days after it was signed and ratified by 50 countries.

The Rotterdam Convention establishes the requirement of the Prior Informed Consent (PIC) procedure for the international trade of certain chemical products that have been prohibited or rigorously restricted, as well as extremely hazardous pesticide formulations. Through PIC, countries must receive notification by the exporting country of its intention to introduce into the receiving country's territory a prohibited or restricted product that has been included in the PIC list. This procedure allows the importing country to make a better informed decision as to whether it will permit the entrance of such a product, and if will impose special restrictions. ⁽⁹⁾

The complete list of substances subject to the PIC procedure includes not only most of the POPs selected for the Stockholm Convention, but a total of 37 chemical products, including 22 pesticides, nine industrial chemical products and six extremely hazardous pesticide formulations (see Table 19).

Table 19
List of chemicals in Rotterdam Convention subject to the PIC procedure

| | |
|---|---|
| <ul style="list-style-type: none"> • Aldrin • Binapacril • Captafol • Chlordane • Chlordimeform • Chlorobenzilate • DDT • Dieldrin • Dinoseb and dinoseb salts • DNOC and its salts • 1,2 dibromoethane (EDB) • Ethylene dichloride • Ethylene oxide • Fluoroacetamide • HCH (mixed isomers) • Heptachlor • Hexachlorobenzene • Lindane • Mercury in different compounds • Pentachlorophenol • 2,4,5-T • Toxaphene • Dustable powder formulations containing benomyl at or above 7%, carbofuran at or above 10%, thiram at or above 15% • Methamidophos (in soluble liquid formulations of the substance that exceed 600 g active ingredient/l) • Methyl-parathion (emulsifiable concentrates with 19.5%, 40%, 50% and 60% active ingredient and dusts containing 1.5%, 2% and 3% active ingredient) • Monocrotophos (all formulations) • Parathion (all formulations except capsule suspensions) • Phosphamidon (soluble liquid formulations of the substance that exceed 1,000 g active ingredient/l) | <ul style="list-style-type: none"> • Asbestos • Polychlorinated biphenyls (PCB) • Polybrominated biphenyls (PBB) • Polychlorinated terphenyls (PCT) • Tris (2,3-dibromopropyl) phosphate |
|---|---|

Source: Rotterdam Convention, www.pic.int

Basel Convention

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal was adopted on March 22, 1989. This Convention was prompted by the numerous international scandals related to the trafficking of hazardous wastes at the end of the 1980s. The Convention entered into effect on May 5, 1992, and its Secretariat has been located in Geneva, Switzerland since that time.

Many countries and environmental NGOs criticized the Convention at its inception, since it legitimated the export of hazardous wastes from wealthy countries to poor countries. As a result, various regional conventions were created as protection measures, and prohibited the import of hazardous wastes. Specifically, the Lomé Convention was signed in 1989 among Asian Pacific countries, the Bamako Convention in 1991 among African countries, and the Central American Agreement in 1992. These regional agreements—together with a strong international campaign directed by Greenpeace, which documented and actively opposed the export operations from Europe and the United States—created the momentum necessary for worldwide prohibition.⁽¹⁰⁾

At the Second Conference of the Parties on March 25, 1994, a proposal made by the Group of 77 was approved, with support from the European Union and objection by the United States, Australia and Canada. This Decision II/12 immediately prohibited the export of hazardous wastes from member countries of the Organization for Economic Cooperation and Development (OECD) to non-OECD members for their final disposal, and it also prohibited, beginning on January 1, 1998, exports for the purpose of recovery or recycling. Later, this proposal became an amendment to the Convention. Therefore, at the Third Conference of the Parties of the Basel Convention, held on September 22, 1995, the amendment to the Basel Convention (Decision III/1) was approved, prohibiting all exports of hazardous wastes from countries listed in Annex VII (OECD countries, European Union countries and Liechtenstein) to countries not on that list, whether for final disposal or for recovery and recycling. Although this amendment has only been ratified by 56 countries (April 2005), and 67 ratifications are needed in order for it to enter into effect, 43 countries have already incorporated it into their national legislation.

In 1999 the assembly of parties to the Basel Convention adopted a protocol on responsibility and compensation for damages resulting from transboundary movements of hazardous wastes and their elimination, although it has only been signed by 13 countries and has not yet entered into effect.⁽¹¹⁾

The purpose of the Basel Convention is not only to establish control over the transboundary movement of hazardous wastes, but it also commits signatory countries to reduce the generation of hazardous and other wastes (Article 4, paragraph 2 (a)); and it also establishes the obligation to achieve as much self-sufficiency as possible in managing wastes (Article 4, paragraph 2 (b)) and to reduce transboundary movements to a minimum (Article 4, paragraph 2 (d)).⁽¹²⁾

Countries should sign and ratify not only the Stockholm Convention but also the Rotterdam and Basel Conventions, including the amendment to the latter, in order to enhance the synergy among these three conventions and achieve greater control and transparency in the export and import of POPs.

3.5 Identification and treatment of stockpiles and wastes, and clean-up of POP-contaminated sites

Article 6 of the Stockholm Convention specifies government commitments to identify and provide an environmentally sound treatment to stockpiles of POPs, POP wastes, and articles still in use that are contaminated with POPs or will become POP-contaminated wastes. The goal is to establish a management program that protects health and the environment, through a set of measures that reduce or eliminate POP releases into the environment.

According to Article 6, paragraph 1, governments must develop and implement strategies to:

- (6 (a,b)) Identify stockpiles, products, articles in use and wastes that contain POPs. This includes stockpiles of obsolete POP pesticides, PCB-containing equipment still in use, POP-containing wastes, and products contaminated by dioxins and similar compounds.
- (6 (c)) Manage POP stockpiles....*in a safe, efficient and environmentally sound manner.*" (13)
- (6 (d) (i)) Collect, handle, transport and store POP-contaminated wastes (including products and articles, upon becoming wastes) in an *environmentally sound manner*.
- (6 (d) (ii)) Dispose POPs waste "*..in such a way that the persistent organic pollutant content is destroyed or irreversibly transformed so that they do not exhibit the characteristics of persistent organic pollutants or otherwise dispose of in an environmentally sound manner when destruction or irreversible transformation does not represent the environmentally preferable option or the persistent organic pollutant content is low, taking into account international rules, standards and guidelines..*" "*..and relevant global and regional regimes governing the management of hazardous wastes;*" (in particular, the Basel Convention; see below).
- (6 (d) (iii)) *Not permitted to be subjected to disposal operations that may lead to recovery, recycling, reclamation, direct reuse or alternative uses of POPs.*
- (6 (d) (iv)) *Not transported across international boundaries without taking into account relevant international rules, standards and guidelines.*

Paragraph 6 (d) (ii) is especially important, since while the Convention does not prohibit incineration, it encourages the use of alternative technologies, so that wastes will be destroyed or transformed irreversibly, and so they will no longer exhibit the characteristics of POPs —since it is known that when chlorinated wastes are burned, incinerators produce dioxins and furans with POP characteristics, which is counter to the preference stipulated in the Convention. Then, the same paragraph opens up the possibility that governments also consider the disposal of wastes "in an environmentally sound manner," while keeping international regulations in mind, especially the Basel Convention. Consequently, the Parties to the Convention will have to approve specific technical guidelines, as we will see below.

Clean-up of contaminated sites

Signatory countries made a commitment to work toward developing appropriate strategies for identifying sites contaminated with the top-priority twelve POPs included in Annexes A, B and C of the Convention, and if there is a clean-up process, that it be carried out in an environmentally sound manner (Article 6, paragraph 1 (e)).

In this sense, it is important to evaluate the legacy of environmental pollution and the effects on the health of workers and neighboring communities of factories where organochlorine pesticides and PCBs have been historically produced, as well as the impact from releases into the air, water and soil of unintentionally produced dioxins and similar compounds, originating from sources including industrial plants for producing chlorinated compounds in their various uses.

Elimination of POP wastes in collaboration with the Basel Convention

According to Article 6, paragraph 2 of the Stockholm Convention, the Conference of the Parties will closely cooperate with the appropriate bodies of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, to carry out the following:

- (6, 2 (a)) *“Establish levels of destruction and irreversible transformation necessary to guarantee that characteristics of POPs as specified in the first paragraph of Annex D are not exhibited;”* (characteristics including their persistence, bioaccumulation, potential to be transported long distances, and adverse effects for human health and the environment), unless this option is not the preferred option due to environmental reasons or low POP content.
- (6, 2, (b)) Determine the methods that constitute environmentally sound disposal referred to above.
- (6, 2, (c)) Establish, as appropriate, the concentration levels in order to define the low POPs content for environmentally sound disposal, when these substances are not disposed of in such a way that the POPs content is destroyed or irreversibly transformed.

The Conference of Plenipotentiaries for the Stockholm Convention invited entities of the Basel Convention to prepare appropriate technical guidelines for the environmentally sound management of POP wastes. In June 2002, consultants contracted by the Secretariat of the Basel Convention presented their first proposal for the technical guidelines. In October 2002 and January 2003 the second and third proposals, respectively, for these guidelines were distributed, and they have been included, together with corresponding observations, in the Basel Convention’s web page (www.basel.int). It is hoped that the definitive version of the guidelines will be approved and adopted at the First Conference of the Parties to the Stockholm Convention in 2005.

The future of incineration

Nongovernmental organizations such as the Basel Action Network, which has followed the emergence and development of the Basel Convention since its inception, warn that this Convention is strong in the area of transboundary movement of hazardous wastes, however weak in terms of the voluntary guidelines developed for the management, treatment and final disposal of hazardous wastes. The guidelines developed by the Basel Convention should be reviewed and adapted to the goals of the Stockholm Convention, since they were developed without considering the impacts caused by POPs on health and the environment.⁽¹⁴⁾

Levels of destruction. Experts from Greenpeace and IPEN have specified that the level of destruction and irreversible transformation of POP wastes should be 100%, since each molecule of persistent organic pollutants exhibits characteristics such as persistence, toxicity and bioaccumulation—which the Convention establishes should not be exhibited (Article 6, paragraph 2 (a)). Therefore, the guidelines to be developed in cooperation with the Basel Convention should consider sampling and analysis methods that will guarantee 100% effective destruction.

These same experts have also proposed that when POPs are not destroyed or irreversibly transformed, minimal concentration levels and “*low POP content*” should be attained for each one of them within a two-step process that, first of all, establishes limits based on health data; the results of a long-term evaluation of its adverse effects, including the means of environmental exposure for each one; the factors of bioaccumulation; and all the sources of exposure (including prenatal exposure and exposure through breast milk); and related information. Secondly, after these health limits have been established, sampling and analysis techniques should be determined, to assure that the levels will be established by universal methods, with sufficient precision and exactness, and following the highest and not the lowest standards. Once these standards are agreed upon and established, technical and financial assistance should be provided to developing countries and countries with economies in transition, in the interest of building capacities and infrastructure for sampling, analysis and treatment of POP wastes. ⁽¹⁵⁾

Approval of the guidelines that the Stockholm Convention will adopt for treating stockpiles of obsolete POPs and contaminated soil is particularly significant for determining the future role of incineration—which has been the most frequently chosen option within the context of the Basel Convention—with respect to exporting hazardous wastes to Europe and the United States, or justifying the export of incinerators to countries in the South. The guidelines to be adopted by the Stockholm Convention can serve as the trigger for further development of non-combustion, alternative technologies. Developing countries and countries with economies in transition should decide whether they want to continue to be part of the incineration business, and accept this dirty technology, or rather receive assistance for non combustion technologies.

It is important to remember that countries such as Australia have managed to develop various non-combustion technologies for treating POPs, since incineration was prohibited there.

The research and commercialization of technologies that offer alternatives to incineration constitute a tendency in the world market. In January 2004 the UNEP-established Scientific and Technical Advisory Panel of the Global Environmental Facility, released its final report, in which it reviewed 50 non-combustion technologies for the destruction and decontamination of POPs, especially for use by developing countries. ⁽¹⁶⁾

This report identified six non-combustion technologies that are currently on the market, have already accumulated considerable experience, and have a license for destroying high concentrations of obsolete POP stockpiles, including contaminated soil; two technologies that are about to be introduced on the market; and five promising technologies that have proven their efficiency in pilot plants or laboratory tests, however require further research. The report recommends further evaluation of the five technologies identified as promising, emerging and innovative, for the purpose of obtaining financial support for introducing them on the market in the near future. It also recommends developing a system of support for users, to help them determine which technologies are most appropriate for treating POP wastes and contaminated soil in developing countries.

Table 20
Non-combustion technologies for the destruction and decontamination of POPs

| |
|---|
| <p>Commercial technologies with considerable experience:</p> <ul style="list-style-type: none"> Gas-Phase Chemical Reduction (GPCR) Base Catalyzed Decomposition (BCD) Sodium Reduction Super-Critical Water Oxidation (SCWO) Plasm Arc (PLASCON)(*) <p>Technologies near or at the start of commercialization:</p> <ul style="list-style-type: none"> Molten Salt Oxidation Solvated Electron Technology <p>Promising technologies:</p> <ul style="list-style-type: none"> Ball Milling Geoi Melt Process Mediated Electrochemical Oxidation (CeOx) Mediated Electrochemical Oxidation (AEA Silver II) Catalytic Hydrogenation <p>Technologies not applicable to the destruction of POPs stockpiles:</p> <ul style="list-style-type: none"> MnOx/TiO2-A1203 Catalyst Degradation TiO2-based V2O5/WO3 Catalysis Fe (III) Photocatalyst Degradation Pzonation / Electrical Discharged Destruction Molten Metal Molten Slag Process Photochemical Enhanced Microbial Degradation Biodegradation / Fenton's Reaction White Rot Fungi Biodegradation Enzyme Degradation In situ bioremediation of soils DARAMEND Bioremediation Phytoremediation |
|---|

Source: Ron McDowall, Carol Boyle, Bruce Graham, International Center for Sustainability Engineering and Science. Faculty of Engineering, University of Auckland, New Zealand. The Scientific and Technical Advisory Panel of the GEF. UNEP. *Review of emerging, innovative technologies for the destruction and decontamination of POPs and the identification of promising technologies for use in developing countries.* GF/800-02-02-2205, January 2004.

(*) Note from the author: The definition of non-combustion technologies used in the report is a broad definition that includes processes that operate in a reduced content oxygen atmosphere, such as pyrolysis and Plasm Arc (PLASCON). Such technologies still produce dioxins or furans, but they require less technology for removing these pollutants than an oxidation process, like in a high-temperature rotary kiln. A stricter definition would not consider pyrolysis and Plasm Arc as non-combustion technologies.

3.6 Incorporation of new chemicals in the Stockholm Convention

Article 8 of the Stockholm Convention and Annexes D, E and F address the incorporation of new chemicals in the list of POPs to be eliminated or reduced around the world.

Annex D establishes the requirements for information and the criteria for selection in the process of incorporating a new chemical on the list of POPs. Any country can make a proposal to the Convention Secretariat to include a new chemical, as long as it meets the requirements established in Annex D. These requirements include information regarding the brand names, Chemical Abstract Service (CAS) registration number, the name in the International Union of Pure and Applied Chemistry (IUPAC), the molecular structure of the chemical and manufactured products, as well as their persistence, bioaccumulation, potential for long-range transport in the environment, and their adverse effects on human health or the environment.

If the Convention Secretariat verifies that the information is sufficiently complete, it will send the proposal to the POPs Review Committee. This committee should establish whether it will proceed, at the first meeting of the Conference of the Parties, which it is anticipated will be held in April 2005, and based on an equitable geographic distribution, approving its recommendations by consensus or by two-thirds majority vote.

On the basis of a risk profile prepared in accordance with Annex E, the Review Committee will evaluate whether the chemical, as a result of its long-range environmental transport, is likely to lead to adverse effects on human health and/or the environment of such a magnitude that the adoption of global measures is justified. The Convention indicates in Article 8, paragraph 7 (a) that “*..Lack of full scientific certainty shall not prevent the proposal from proceeding.*” which in other words, signifies the application of the precautionary principle.

The Committee should also prepare a risk management evaluation that includes an analysis of control measures, in accordance with Annex F. This Annex indicates the necessary information for a socioeconomic analysis that evaluates possible control measures, including management and elimination of the product. The Committee is responsible for evaluating: the efficiency of possible control measures in achieving the risk reduction goals, alternatives to the new POPs proposed (products and processes), technical feasibility, costs (including environmental and health costs), efficacy, risk, availability and accessibility, positive and/or negative effects from implementing possible control measures, consequences of wastes and their disposal, access to information and public education, the status of control and monitoring capacity, and any control measures adopted at the national or regional level, including information on alternatives.

Finally, the Committee will make a recommendation to the Conference of the Parties as to whether or not the chemical should be considered for inclusion in Annexes A, B and/or C. The Conference of the Parties, taking into consideration the recommendation from the Review Committee and including any scientific uncertainty, “shall decide, in a precautionary manner”⁽¹⁷⁾ whether the proposed chemical should be included in the list of POPs, and it should also specify control and/or disposal measures (see Figure 10 next page).

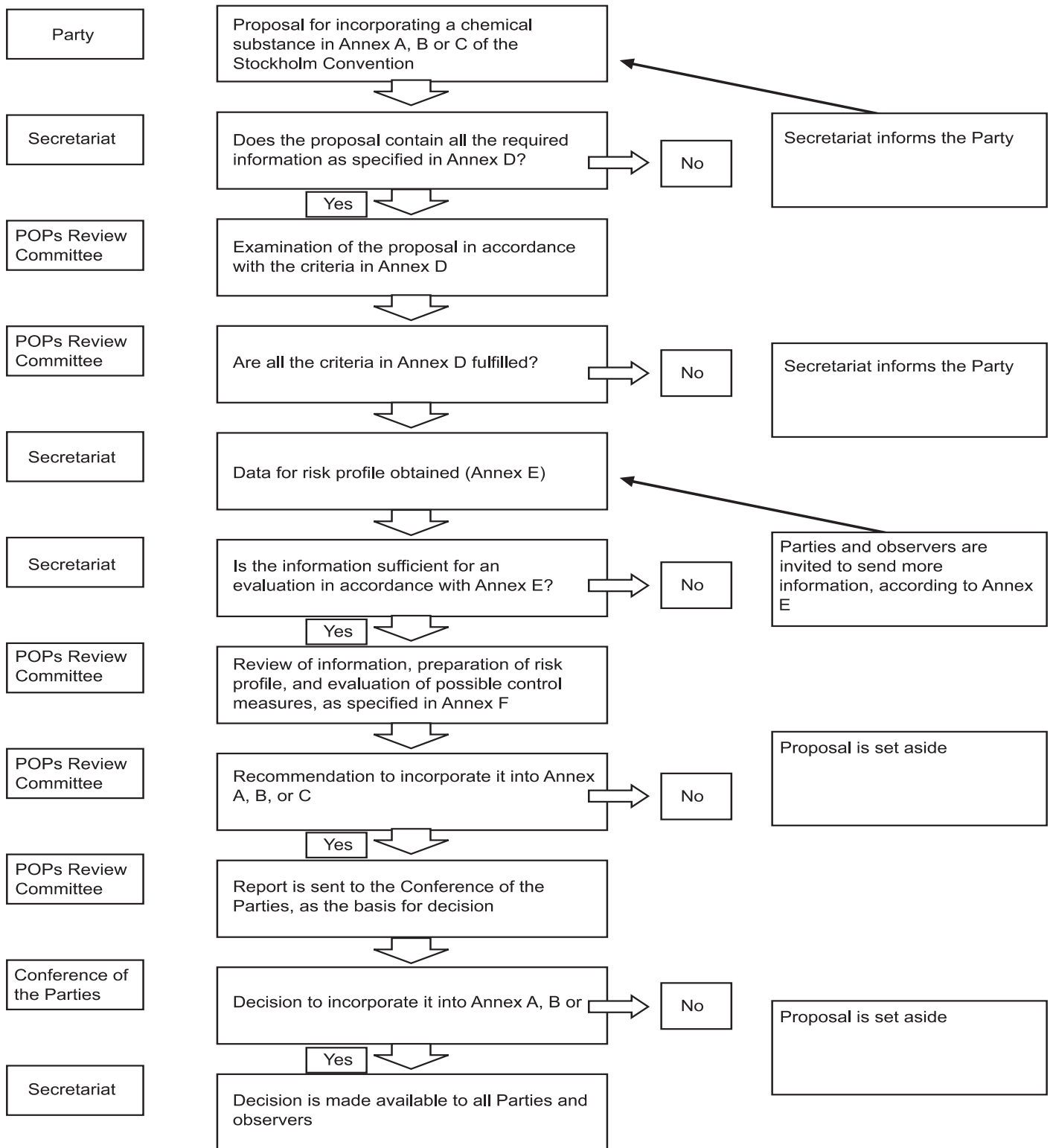


Figure 10

Scheme of procedures for incorporating new substances in the Stockholm Convention list

Source: Carina Weber, *The Stockholm Convention (POPs Convention). An international legally binding regulation for the global elimination of extremely dangerous pollutants*. PAN Germany, Hamburg, October 2001, p. 7.

Various environmental groups have made the observation that if the intention is to confront the POPs crisis in an adequate way, not only individual chemicals should be included, but also groups and sub-groups of chemical products. Analysis by substance could take too long, risking greater deterioration in the environment and in public health, and therefore governments should adopt preventative measures. ⁽¹⁸⁾

As some scientists have pointed out, identification/evaluation of new POP candidates for inclusion in the Stockholm Convention is limited by the fact that information regarding the characteristics of persistence, toxicity, bioaccumulation and long-range transport is only available for a limited number of chemicals.

The European Commission has declared in Brussels that at least nine chemicals should be added to the Stockholm Convention, and they have already been identified as POPs in the Protocol on POPs of the United Nations Economic Commission for Europe (UNECE). These substances include organochlorine insecticides such as lindane, and brominated flame retardants and chemical substances for industrial use (see Table 21). ⁽¹⁹⁾

Table 21
New chemicals proposed by the European Union to be included in the Stockholm Convention

| Chemical | Uses |
|---|--|
| Chlordecone (Kepone)* | Insecticide |
| Hexabromobiphenyl Hexa-BB) | flame retardant prohibited in Europe and the United States |
| Octabromodiphenyl ether* | Flame retardant |
| Hexachlorocyclohexane* (HCH, including gamma isomer (lindane))* | Lindane is used as an insecticide, in pharmaceutical use, against lice and scabies, as a seed protector, with livestock and pets. |
| Hexachlorobutadiene* (HCBD) | Industrial chemical substance and fumigant. |
| Polychlorinated naphthalenes (PCN)* | Primarily used for cable insulation, wood preservation, and also as engine oil additives, and feed stocks for dye production. Was used before PCBs as a dielectric fluid |
| Short-chained chlorinated paraffins | Primarily used in metal working fluids, but also in leather finishing products |
| Pentachlorobenzene* | Dielectric fluid, fungicide, flame retardant |

(*) Also included as POPs in the Protocol for the United Nations Economic Commission for Europe (UNECE). Source: Developed from a press release entitled "Chemical Pollution: Commission wants to rid the world of more nasty substances," Brussels, August 11, 2004.

In addition to these nine chemical substances, experts have identified eleven more substances that merit research to determine whether they should be included in the Stockholm Convention, due to their toxicity and since they were detected far from where they were originally released. These are: polycyclic aromatic

hydrocarbons (PAHs), which make up a group of chemical substances produced during the incomplete combustion of oil, gas and other organic materials, and have been identified as POPs in the Protocol for the UNECE; organochlorine insecticides, specifically endosulfan, dicofol, pentachlorophenol and methoxychlor; tetrachlorobenzene (Tetra-CB), used directly or as a degraded product of pentachlorobenzene or hexachlorobenzene, that has been used as an insecticide or an intermediate in the production of herbicides; hexabromocyclododecane (HBCD), used as an additive in flame retardants, primarily in polystyrene; octachlorostyrene (OCS), which is an unintentional product from various industrial processes, such as the production of chlorine, magnesium and chlorinated solvents; perfluorooctanyl acid and its salts (PFOA) and perfluorooctanyl sulfonate (PFOS), used in various industrial applications such as foams and cleaners.⁽²⁰⁾

(Note for the english edition. At August 2005, three substances had officially been submitted to the Stockholm Secretariat: pentabromodiphenyl ether by Norway, chlordecone and hexabromobifenyl by the European Community, lindane by Mexico and perfluorooctaine sulfonate (PFOS) by Sweden . Se update in http://www.pops.int/documents/meetings/cop_1/chemlisting/Default.htm

The chemical industry is particularly opposed to new restrictions and elimination of products recently introduced on the world market. In fact, for the US chemical industry, the mechanism for accepting or not accepting recommendations from an international agreement such as the Stockholm Convention and modifying national legislation to implement restrictions or prohibitions of new substances is one of the crucial aspects in the discussion around the US Senate's approval of this Convention. As of April 2004, discussion on the proposal for modifying the Toxic Substances Control Act (TSCA) and the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) was still underway, and the proposal had not yet been approved in the four legislative committees responsible for analyzing the proposal. Modifications to legislation also include those necessary for signing and ratifying the Rotterdam Convention. The proposals include a period for public comments in three stages, prior to adding new chemicals to the list of POPs, which in the eyes of US environmental groups, will excessively prolong the procedure. In practice, this would tie the EPA's hands, and keep it from accepting commitments for restricting or eliminating new chemicals.⁽²¹⁾

3.7 Public Information, Awareness and Education

The entire Article 10 of the Stockholm Convention is dedicated to defining what every signatory country should do —within its possibilities— to promote and facilitate public information, awareness and education (Article 10 is reproduced in Table 22).

As we can see, Article 10 is very comprehensive and precise, however it is worth making some comments regarding some of the points.

Article 10 indicates that every country should make efforts to promote and facilitate awareness among those who formulate public policies on POPs. This implies an educational task to be carried out by the executive branch and to be directed at the members of both legislative bodies as well as state and municipal authorities. This task is important, since full compliance of the Stockholm Convention must be reinforced by environmental and public health policies that are in accordance with the commitments in the Convention.

In addition, governments should promote and facilitate public access to all information regarding POPs. This includes information regarding health, safety and environmental aspects that cannot be considered to be confidential information. Public access to POPs-related information is an obligation of the governments

participating in the Stockholm Convention, but it is also a fundamental right of citizens. This is the basic nucleus of Article 10, and it includes disseminating information through public education campaigns, training programs, the creation of national and regional information centers, and the development of Pollutant and Transfer Registers (PRTRs)

Table 22
Stockholm Convention: Public information, awareness and education (Article 10)

| |
|---|
| <p>1. Each Party shall, within its capabilities, promote and facilitate:</p> <ul style="list-style-type: none">(a) Awareness among its policy and decision makers with regard to persistent organic pollutants;(b) Provision to the public of all available information on persistent organic pollutants, taking into account paragraph 5 of Article 9;*(c) Development and implementation, especially for women, children and the least educated, of educational and public awareness programs on persistent organic pollutants, as well as on their health and environmental effects and on their alternatives;(d) Public participation in addressing persistent organic pollutants and their health and environmental effects and in developing adequate responses, including opportunities for providing input at the national level regarding implementation of this Convention;(e) Training of workers, scientists, educators and technical and managerial personnel;(f) Development and exchange of educational and public awareness materials at the national and international levels; and(g) Development and implementation of education and training programs at the national and international levels. <p>2. Each Party shall, within its capabilities, ensure that the public has access to the public information referred to in paragraph 1 and that the information is kept up-to-date.</p> <p>3. Each Party shall, within its capabilities, encourage industry and professional users to promote and facilitate the provision of the information referred to in paragraph 1 at the national level and, as appropriate, subregional, regional and global levels.</p> <p>4. In providing information on persistent organic pollutants and their alternatives, Parties may use safety data sheets, reports, mass media and other means of communication, and may establish information centers at national and regional levels.</p> <p>5. Each Party shall give sympathetic consideration to developing mechanisms, such as pollutant release and transfer registers, for the collection and dissemination of information on estimates of the annual quantities of the chemicals listed in Annex A, B or C that are released or disposed of."</p> <p>* (Health, safety and environmental aspects cannot be considered to be confidential, according to Article 9, paragraph 5.)</p> |
|---|

Source: UNEP, *Stockholm Convention*, Article 10.

With regard to the public education and awareness programs that governments should promote and facilitate, Article 10 indicates they should be especially directed at women, children and the least educated. It adds that these programs should include information on the environmental and public health effects from POPs and

their alternatives. As we saw in Chapter 2 of this book, the effects of POPs are especially concerning for child development and during pregnancies, since these harmful substances can accumulate in the food chains, and can pass across the placenta and be excreted through breast milk. Children and women of reproductive age are high-risk sectors of the population, and there should be programs especially designed for them. In order to protect children from exposure to hazardous chemicals, it is important to refer to the recommendations from the Intergovernmental Forum on Chemical Safety (IFCS).⁽²²⁾

When the Convention indicates that the least educated are also a special sector to which public awareness programs on POPs should be directed, it is asserting that information cannot be reserved for only a small group of experts, technicians or government representatives who generally already have access to the contents of international environmental negotiations. Instead, this information should be widely disseminated and made accessible to the sectors making up the majority of the population —precisely the sectors with the least access to education.

Training workers and technical personnel regarding the risks of POPs and their alternatives should also be part of this policy of making information available, for example, through safety data sheets. This right to be informed and to prevent POPs-related risks on the job is particularly important for workers in the electrical industry who are still operating PCB-containing equipment, as well as for workers in various industries where dioxins and other unintentional POPs are generated, in sectors such as the paper, solvent and steel industries as well as industries promoting waste incineration, including the cement industry that uses hazardous wastes as alternative fuel.⁽²³⁾

In the fourth paragraph of Article 10, the Convention suggests that in order to provide information on POPs and their alternatives, governments can make use of safety data sheets and reports as well as the mass media (press, radio, television) and other means of communication, and can also create national and regional information centers.

As we can see throughout Article 10, as well as in other Convention Articles, the need to provide information regarding alternatives to POPs is mentioned repeatedly. This is particularly important for promoting the substitution of inputs, processes and products that generate POPs and for promoting clean production strategies.

The Convention indicates that governments should promote and facilitate public participation, including in the process of implementing the Convention. As we will see in Chapter 4 of this document, the guidelines for developing National Implementation Plans —prepared by the Global Environmental Facility (GEF)— reinforce this idea and recommend that such participation takes place early on, during the initial phases of public consultation for developing the implementation plan —specifically by creating a multistakeholder national committee.

Pollutant Release and Transfer Register (PRTR)

The Stockholm Convention calls on each government to develop a Pollutant Release and Transfer Register (PRTR), as a mechanism for obtaining and disseminating information regarding the amounts of POPs generated and eliminated each year. The development of these Registers on toxic chemicals is one of the commitments adopted by governments in Chapter 19 of *Agenda 21* from the UN Conference on the

Environment and Development. PRTRs are reporting instruments that have been used in industrialized countries since the mid-1980s, and are now being promoted in Southern countries.

Among the international guidelines for developing PRTRs, we would especially mention the following:

- a) A resolution approved by the Intergovernmental Forum on Chemical Safety (IFCS), recommending that PRTRs be established around the world;
- b) The creation of a coordinating group for developing PRTRs, an effort by the Inter-Organization Program for the Sound Management of Chemicals (IOMC), a cooperative agreement among UNEP, ILO, FAO, WHO, UNIDO, UNITAR and OECD;
- c) The OECD has developed a manual on PRTRs for governments, and has a Task Group on Techniques for Release Estimations;⁽²⁴⁾
- d) The European Polluting Emissions Register (EPER) includes 50 chemicals measured in European Union countries, and it will be compiled every three years, beginning in 2003. This register includes releases into air and/or water, but not soil, and will be available in February 2004;⁽²⁵⁾
- e) The Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice on Environmental Matters has created a working group on PRTRs. At the May 2003 meeting of this Convention, an international protocol for developing PRTRs was approved. All countries, whether or not they are signatory countries for this Convention, may sign the protocol. By late 2003,⁽²⁶⁾ it had been signed by European Union countries.
- f) A coalition of European citizen groups called Ecoforum has developed a guide on the right to information on pollution sources, and it serves as a brief introduction to the Protocol for PRTRs.⁽²⁷⁾

The United Nations Institute for Training and Research (UNITAR) has a program for disseminating information on PRTRs and working with other UN agencies to organize training workshops in developing countries. PRTRs generally include several hundred toxic chemicals, and it is important to assure that efforts to carry out these processes in Southern countries prioritize POPs.⁽²⁸⁾ In Latin America, Mexico has a PRTR which includes a report on dioxins and furans, but it has not yet been presented to the public.

In general, an effective PRTR should first specify the name, type of industry and geographic location of the industry or activity that is generating POPs. In short, the entity responsible for the contamination should be identified. Secondly, a PRTR should include an annual report of toxic substances, or POPs in this case, that are released into the air, water and soil. In other words, the second characteristic of a PRTR is that it should be a comprehensive multimedia report of POPs. Thirdly, a PRTR should also include the transfers made of POP-contaminated wastes for their treatment or final disposal, including recovery activities within the factory as well as shipments to outside the factory. Fourth, this report should be obligatory and should be maintained and updated every year. Fifth and last, all this information should be accessible to the public. Information from PRTRs can be incorporated into national systems of databases and in geographic information systems.⁽²⁹⁾ In the case of the most extensive versions of PRTRs, they can become registers documenting use, to also include information regarding the use of water, energy and materials and substances that enter into production processes, as indicated by the Aarhus Convention on the access to information, public

participation in decision-making and access to environmental justice (Article 5, paragraph 9), which makes it possible to have a more comprehensive evaluation of a product's life cycle.

PRTRs can be conceived of as tools for promoting reductions in the use of toxic chemicals, and in the case of POPs, for promoting cleaner forms of production, with the substitution of these chemicals for others. In the case of organochlorine pesticides still in use, PRTRs can be used as tools for promoting agroecological strategies for controlling pests; and in the case of DDT, for promoting integral forms of vector control and malaria control; and finally, for promoting cleaner forms of industrial production that make it possible to substitute inputs, products and processes, and thus eliminate the generation of dioxins and furans.

In the case of POPs not produced in a given country, but rather imported under the conditions of the specific exceptions allowed in the Stockholm Convention, the PRTRs should—in our opinion— be complemented by an inventory of POP uses to be carried out in a coordinated manner with responsible customs authorities.

In the case of the registry or inventory of unintentional POPs such as dioxins, furans, PCBs and HCB, it should include releases into the air, water and soil, the presence of these POPs in wastes and products, and sites contaminated with these substances. We will address this matter again, when we comment on the second phase of developing National Implementation Plans for the Stockholm Convention in the fourth chapter of this book.

3.8 Research, development and monitoring of POPs

Article 11 of the Convention addresses activities in research, development and monitoring of POPs.

It specifies that governments should “encourage and /or undertake appropriate research, development, monitoring and cooperation” pertaining to POPs and when relevant, also to their alternatives and to potential POPs, with the following aspects included:

- (a) Sources and releases into the environment;
- (b) Presence, levels and trends in humans and the environment;
- (c) Environmental transport, fate and transformation;
- (d) Effects on human health and the environment;
- (e) Socio-economic and cultural impacts;
- (f) Release reduction and/or elimination; and
- (g) Harmonized methodologies for making inventories of generating sources and analytical techniques for the measurement of releases.

To carry out these activities, countries should support and further develop international programs, networks and organizations dedicated to the tasks of research, data collection, and monitoring, while remembering the importance of avoiding the duplication of efforts. Governments should support actions aimed at strengthening national capacities in scientific and technical research, especially in developing countries and countries with economies in transition, and should promote access to and exchange of data and analysis. To this end, they should take into account the problems and needs of those countries, in terms of financial and technical resources, and should cooperate in efforts to improve their capacities.

Article 11 makes special mention of carrying out research aimed at “alleviating the effects of persistent organic pollutants on reproductive health” (Article 11, paragraph 2 (d)). This opens the way to research on

the impact from POPs on the health of parents and children, particularly in the reproductive process, including conception, pregnancy, childbirth and breastfeeding, and to assure that mothers and fathers and their children have the necessary material, physical, mental and social conditions. The World Health Organization (WHO) defines reproductive health as a state of complete physical, mental and social well-being, and not only the absence of illness during the reproduction process. ⁽³⁰⁾

The results from research, development and monitoring activities should be made accessible to the public on a regular, timely basis (Article 11, paragraph 2 (e)).

Monitoring the presence of POPs in humans is referred to as measuring the body burden of these substances among the various sectors of the population. As we pointed out in the second chapter of this guide, because of the persistence of POPs and their capacity to accumulate in fatty tissues, they are among the persistent toxic substances that can become stored in our bodies. Contamination of breast milk by persistent organic pollutants is particularly concerning, since while breast milk is necessary and indispensable to guaranteeing the maximum development of infants, it can become contaminated with dioxins, furans, PCBs and organochlorine pesticides. There have been reports from industrialized countries of the presence of 350 different synthetic chemical substances in breast milk.

It is recommended that measuring the body burden of POPs—which takes place in the United States and some European countries, as described in the second chapter of this guide—also take place in less industrialized countries in Latin America, Asia and Africa. This is part of citizens' right to information. Such measurements should be viewed as a way to measure progress made through actions to continually reduce and finally eliminate the generating sources of POPs.

It is also important that efforts to monitor POPs also focus on food, and especially milk products, meat and fish, since we know that POPs bioaccumulate in food chains, and since eating food contaminated with POPs is the primary way in which humans are exposed to these toxic substances.

It is necessary that government policies aimed at reducing and eliminating POPs are reflected in a decrease of their presence in the body burden of the population and in food.

These commitments established in Article 11 should be taken into account when developing the National Implementation Plans for the Stockholm Convention. Technical and financial capacities should be strengthened, in order to comply with these commitments, through resources granted by the Global Environmental Facility, and other funding sources. Governments should also consider applying the "polluter pays principle" and developing ways in which those responsible for generating POPs contribute funds for research, monitoring and prevention of the generation of POPs.

3.9 Technical and financial assistance to developing countries and countries with economies in transition

Article 12 of the Stockholm Convention addresses technical assistance, and Article 13, financial resources and mechanisms.

The Stockholm Convention recognizes that timely, appropriate technical assistance for developing countries and countries with economies in transition is essential to effectively implementing the Convention (Article 12,

paragraph 1). The purpose of technical assistance is to develop capacities for complying with the obligations established by the Convention (Article 12, paragraphs 2 and 3).

Furthermore, the Convention specifies that:

- Regional and subregional centers will be established for capacity building and technology transfer (Article 12, paragraph 4).
- The specific needs of the least developed countries and small island developing states will be taken fully into account, in relation to this assistance (Article 12, paragraph 5).
- Developed countries that are Parties to the Convention “..shall provide new and additional financial resources, to enable developing countries Parties and Parties with economies in transition to meet the agreed full incremental costs of implementing measures which fulfill their obligations under this Convention..”, as agreed between a recipient country and a financing entity (Article 13, paragraph 2).
- The Global Environmental Facility (GEF) will, on an interim basis, be the primary entity entrusted with financial assistance operations, until the first meeting of the Conference of the Parties, or until the Conference adopts a decision regarding the definitive institutional structure (Article 14).

In general terms, “*incremental costs*” consist of the difference between the cost of necessary measures to comply with the obligations for implementing the Stockholm Convention, and what the country would need to spend to achieve the same or similar goal in the absence of Convention obligations.

GEF has four implementing agencies: the World Bank, the United Nations Environment Program (UNEP), the United Nations Industrial Development Organization (UNIDO), and the United Nations Development Program (UNDP). Each country can choose through which one of these four it wishes to request financial assistance for designing and carrying out its plan for implementing the Stockholm Convention

Developing countries and countries with economies in transition that are Parties to the Convention can also take advantage of financial resources from other bilateral, regional or multilateral sources, in line with the plans of the involved parties (Article 13, paragraph 3).

GEF divides requests for assistance submitted by governments into two major categories: the first, for developing and strengthening capacities that will allow the countries to comply with obligations in the Stockholm Convention —what are referred to as “enabling activities”— and secondly, for financing specific interventions in prohibiting or cleaning up pollutants at a national or regional level, or specific components of capacity building, which might lead to more extensive projects. (31) At October 2004, only a guide for supporting the development of National Implementation Plans for the Convention has been developed, and a rough draft of guidelines for financing specific interventions has been published. Primary areas of GEF assistance are in capacity building, institutional strengthening and technical assistance.

IPEN has commented on the rough draft version of a Guide to the Stockholm Convention’s Financial Mechanism, and has proposed that priorities for funding include: support for measures focused on consulting and cooperating with stakeholders in civil society, that facilitate developing and carrying out the national implementation plans, that promote public information, awareness and education on POPs, as established in

Article 10 of the Convention; and those that promote technological cooperation and development, especially important for developing alternatives to the generation of POPs. Financial support for these types of activities can be found through other international environmental conventions, such as the Climatic Change Convention and the Biodiversity Convention. ⁽³²⁾

As of September 2003, 125 countries had received GEF funding to develop their national implementation plans. Sixty of those countries (14 in America, 18 in Africa, 6 in Europe, 13 in Asia, and 9 in Oceania) selected UNEP as their implementing agency, ⁽³³⁾ and the rest selected UNIDO or UNDP. The Canadian government created the Fund for Persistent Organic Pollutants, administered by the World Bank, to provide financial support, technical knowledge and access to technologies for capacity building in developing countries and countries with economies in transition. Support activities have a ceiling limit of US \$250,000. Two Latin American countries, Colombia and Mexico, selected the World Bank as their financing agency, for developing their national plans. Also intervening in the case of Mexico is the North American Commission for Environmental Cooperation (CEC), in which environmental ministers from Mexico, the United States and Canada participate.

NOTES – CHAPTER THREE

1. For more details on the *Rollback Malaria* initiative, see www.rbm.who.int In addition to the WHO, other participants in this initiative are the World Bank, UNICEF, UNDP and bilateral donors.
2. WHO, *RBM News*, Switzerland, Issue 2, December 2000.
3. BAT/BEP Expert Group, Opening Remarks by John Buccini, Chairman, INC of the Stockholm Convention on POPs. BAT/BEP Expert Group meeting in Chile, March 11, 2003.
4. The author participates in this group of experts as a member of IPEN. The rough draft of these guides prepared by the group of experts can be consulted at www.pops.int
5. IPEN, “*Consideration of Alternatives*,” a key element in the *BAT/BEP Expert Group’s Recommendations to the Stockholm Convention POP1*. Jack Weinberg, paper prepared for discussion at the Second Meeting of the Stockholm Convention BAT/BAP Expert Group, Villarica, Chile, 2003. UNEP, *Guidelines on BAT and Guidance on BEP*. Draft 29-07-0, UNEP/POP/EGB.3/2, July 27, 2004, “Section II Consideration of Alternatives in the application of BAT,” pp. 9-11.
6. See, for example, the studies conducted in Japan by S. Masunaga, T. Tasakuga and J. Nakanshi, 2001, “Dioxin and dioxin-like PCB impurities in some Japanese agrochemical formulations.” *Chemosphere*, 44:873-875. The author expresses his appreciation to Pat Costner of Greenpeace, for sending this reference.
7. See the “Plaguicidas y dioxinas” chapter in Fernando Bejarano, *Amenaza Global, Cuaderno Ciudadano sobre contaminantes orgánicos persistentes*. Texcoco, Mexico, RAPAM, pp. 32-35. Also, EPA, 1998, *The Inventory of Sources of Dioxin in the United States*. EPA/600/P-98/002Aa, Washington, D.C., April 1998. The complete list is included in Pat Costner, “Greenpeace comments on UNEP Chemicals’ Standardized Toolkit for identification and quantification of dioxin and furan releases,” Greenpeace International, January 10, 2003, “Compilation of views on measures to reduce or eliminate releases from unintentional production” (Article 5 and Annex C) and “Evaluation of current and projected releases of chemicals” listed in Annex C. UNEP/POPS/INC.7/INF/17, May 5, 2003, pp. 136-140.
8. The quote is from Pat Costner, op. cit., UNEP/POPS/INC.7/INF/17, May 5, 2003, pp. 75-77, distributed during the seventh session of the Intergovernmental Negotiating Committee of the Stockholm Convention, in Geneva, Switzerland, July 14-18, 2003.
9. See the web page for the Rotterdam Convention, <http://www.pic.int>
10. Greenpeace, *The Basel ban. The pride of the Basel Convention. An update on implementation and amendment*, Netherlands, September 1995.

11. See www.basel.int of the International Secretariat of the Basel Convention, and www.deschospeligrosos.org of the Coordinating Center for Latin America and the Caribbean. As of April 2005, the Convention had 165 signatory countries. For a critical view of the Convention, see the Basel Action Network (BAN) web page: www.ban.org
12. Jim Puckett, *The Basel Ban Amendment: the first step toward environmental sound management of hazardous waste*. Prepared by the Basel Action Network (BAN) for the 16th Session of the Technical Working Group and the 1st Session of the Legal Working Group of the Basel Convention, Geneva, Switzerland, April 3-9, 2000. See www.ban.org
13. The English version of the Convention uses this term “environmentally sound,” which is translated in the Spanish version as “ambientalmente racional (environmentally rational),” and which is also commonly translated as “ambientalmente adecuado (environmentally adequate).” Later in this chapter, there is a call for working together with the Basel Convention to establish environmentally acceptable technical levels for this treatment.
14. Basel Action Network. *Briefing Paper*, No. 5, December 2000, www.ban.org
15. Pat Costner, Information relevant to the Basel Convention’s hazardous H1-Toxic (delayed chronic) characteristics, for example “de minimis” concentrations in waste and the Stockholm Convention’s “low POPs content,” IPEN, 2003, memo.
16. GEF Scientific and Technical Advisory Panel, UNEP, *Review of emerging, innovative technologies for the destruction and decontamination of POPs and the identification of promising technologies for use in developing countries. Final*. GF/8000-02-02.2005. International Center for Sustainable Engineering and Science, Faculty of Engineering, University of Auckland, Auckland, New Zealand, January 15, 2004.
17. Other way for the Spanish translation of “shall decide, in a precautionary manner,” as in the original English version, would be “deberá decidir, en una manera precautoria,” instead of “adoptará a título preventivo,” as translated in the official Spanish version of the Stockholm Convention.
18. Greenpeace, *Una guía y un análisis para ayudar a los países en la aplicación del Convenio de Estocolmo sobre Contaminantes Orgánicos Persistentes*. Holland, undated, p. 2718.
19. Reuters. “EU wants to Expand Dirty Dozen Chemicals List.” August 11, 2004. <http://www.reuters.com/newsArticle.jhtml?type=scienceNews&storyID=5941468>
20. WWF. *Stockholm Convention: “New Pops”. Screening additional POPs candidates*. April 2005, see report <http://panda.org/downloads/toxics/newpopsfinal.pdf>
21. See article by Cheryl Louge, “US vote at treaty meetings threatened,” in *Chemical Engineering News*, March 23, 2004, and “White House Jeopardizing US role in Global Toxics Treaty,” Bush Green Watch, February 25, 2004, www.bushgreenwatch.org which cites WWF opinions and press bulletins.
22. IFCS, www.ifcs.ch IV Forum, November 2003, Bangkok, Thailand.
23. The author recommends visiting the web page for the *Instituto Sindical de Trabajo, Ambiente y Salud (ISTAS)*, which is part of the *Confederación Sindical de Comisiones Obreras (CC.OO)* in Spain. It has designed various courses for workers on PCBs and other endocrine disruptors. See www.istas.ccoo.es
24. OECD (1996): *Pollutant Release and Transfer Registers: Guidance Manual for Governments* (OCDE/GD(96)32 at [http://www.oalis.oecd.org/oalis/1996doc.nsf/LinkTo/ocde-gd\(96\)32](http://www.oalis.oecd.org/oalis/1996doc.nsf/LinkTo/ocde-gd(96)32)
25. <http://www.eper.cec.eu.int/eper>
26. Greenpeace Comments on UNEP Chemicals’ “Standardized Toolkit for identification and quantification of dioxin and furan releases,” January 10, 2003, p. 10. IPEN Comments on the Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases. April 2004, p. 10-14. UNITAR and IOMC have compiled a set of documents on PRTRs around the world on a CD, entitled “Designing and implementing national pollutant release and transfer registers. A compilation of PRTR Resource Documents, 2nd edition, 2003, see <http://www.unitar.org/cwm/prtrcd/index.htm> Also, see <http://www.unece.org/env/pp/prtr.htm>
27. <http://www.eeb.org> and <http://www.participate.org>
28. See www.unitar.org For example, the US Toxic Substances Registry includes 579 substances, and the registry for Canada includes 245.

29. See, for example, *The Right to Know: The promise of low cost public inventories of toxic chemicals*, WWF, Washington, D.C., 1994. Also, Martha Delgado, Coordinator, *Manual para el acceso y uso de información sobre emisiones contaminantes*. Mexico, 1999. And also, Olinca Marino, Marisa Jacott and Azucena Franco (coords), *¿Un tóxico nos ataca. Carpeta informativa sobre sustancias tóxicas y derecho a la información ambiental en México*. Proyecto Emisiones: Espacio virtual, Mexico, April 2001, www.laneta.apc.org
30. I. Daniel Gutiérrez, M.D., M.P.H., *Salud reproductiva: concepto e importancia*. PALTEX series for Health Program implementers, No. 39, OPS, OMS, Washington, 1996, p. 5.
31. See GEF/C.16/September 6, 2000, in UNDP, GEF Persistent Organic Pollutants Resource Kit, UNDP-GEF, at www.undp.org/gef
32. IPEN, Open Ended Working Group: Comments on the Draft to the Financial Mechanism, 2003.
33. UNEP Chemicals, *Boletín informativo*, Vol. 7, No. 2, October 2003, p. 3.

Chapter Four



The National Implementation Plan of the Stockholm Convention, and Citizen Participation

- 4.1 The commitment to public consultation in developing Stockholm Convention National Implementation Plans
 - Global Environmental Facility (GEF) assistance and guidelines for developing NIPs
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Chapter Four

The National Implementation Plan
of the Stockholm Convention,
and Citizen Participation

4.1 The commitment to public consultation in developing Stockholm Convention National Implementation Plans

The Stockholm Convention requires, as specified in Article 7, that each signatory country develop a National Implementation Plan (NIP) to indicate how it will comply with the obligations in the Convention. These NIPs should be reviewed and updated at periodic intervals and in a manner to be determined by the Conference of Parties to the Convention. ⁽¹⁾

The Stockholm Convention went into effect on May 17, 2004, and the 50 original signatory countries have two years from that date to present their NIPs. Any country joining the Convention at a later date will have the same time period, beginning 90 days after it has presented its ratification instrument.

The Convention clearly establishes the following in Article 7, paragraph 2: *“The Parties shall, where appropriate, cooperate directly or through global, regional and subregional organizations, and consult their national stakeholders, including women’s groups and groups involved in the health of children, in order to facilitate the development, implementation and updating of their implementation plans.”* Thus, consultation with civil society and especially with women’s groups and those dedicated to protecting children’s health is an obligation of governments when developing, implementing and updating their NIPs.

Global Environmental Facility (GEF) assistance and guidelines for developing NIPs

GEF assistance in the area of enabling activities encompasses two components:

- a) Preparation of a National Implementation Plan (NIP). This refers to initial support for developing the national plan in a systematic, participative process.
- b) Support for capacity building for carrying out support activities. Assistance will be provided for efforts to strengthen the capacities of countries to fulfill their commitments to the Stockholm Convention.

Initial GEF guidelines on support activities for the Stockholm Convention indicate that the NIP will provide the framework in which a country, in a systematic and participative way, will develop and implement the prioritized reform of policies and regulations, capacity building, and investment programs. The GEF will provide up to US \$500,000 per country for preparing the NIP. ⁽²⁾

As of May 2001, the GEF Council adopted a set of initial guidelines linked to the request for financial support that are recommended for use by governments when developing their Stockholm Convention NIPs. ⁽³⁾ The

guidelines were prepared by the GEF Secretariat in consultation with a special Working Group on POPs, which includes the three GEF implementing agencies: the World Bank, the United Nations Development Program (UNDP) and the United Nations Environment Program (UNEP), in addition to the United Nations Food and Agriculture Organization (FAO), the United Nations Industrial Development Organization (UNIDO) and UNEP Chemicals, the latter of which serves as the Provisional Secretariat for the Convention. Based on said guidelines, UNEP Chemicals and the World Bank subsequently developed a complementary, more detailed guide, which was used in a GEF-financed project to support 12 countries in the development of their NIPs. These include: Barbados, Bulgaria, Chile, Ecuador, Guinea Conakry, Lebanon, Malaysia, Micronesia, Papua New Guinea, Slovenia, and Zambia. (4)

The GEF's general guidelines do not offer detailed descriptions of how any particular activity should be carried out, and they are not prescriptive in nature. They may be used in their entirety or in part, as determined by each government. In fact, the Convention establishes that NIPs should be developed in relation to the specific needs of each member country.

Since POPs have an impact on broad and diverse citizen, industrial, and governmental sectors, the GEF guidelines specify that an effective and successful NIP requires participation by a broad-based range of "interest groups," from the start of the NIP development process.

These so-called "interest groups" include:

- Secretaries of State or Ministers who will assure that political priority and adequate resources will be designated to the POPs issue,
- governmental officials and key staff from all agencies and departments, capable of coordinating and assuming responsibility for actions included in the NIP, and
- nongovernmental organizations (NGOs) such as relevant environmental, academic, social, women's, and child protection organizations, and organizations from the industrial, commercial, agricultural and labor sectors.

4.2 Phases for developing the National Implementation Plan (NIP)

The NIP development phases, presented schematically, are the following:

1. ***Establishing a mechanism for coordination and organizational structure to guide the NIP development process.***

A national institution or government department should be designated as the national lead agency, which will be the legal entity responsible for carrying out the project. Also, a National Project Director should be named and will be the official link with the GEF implementing agency. The national lead agency will establish a Project Coordination Unit (PCU) with a National Coordinator, and will form a National Coordination Committee (NCC) —with pluralistic participation by interest groups— which will review the results of the process.

2. ***Taking POP inventories and assessing national infrastructure and capacity.***

This phase involves preparing a National Profile of Chemical Management and taking inventories of POP pesticides, PCBs, dioxins and furans, obsolete POPs, and contaminated sites.

3. *Assessing priorities and defining objectives.*

Includes developing action plans for POPs pesticides (including DDT), PCBs, dioxins and similar substances, wastes, and accumulated stockpiles.

4. *Formulating National Implementation Plans.*

Involves reviewing the various options for POPs elimination and management, as well as identifying requirements for technical and financial support.

5. *Broad-based endorsement of the NIP and its submission to the Conference of Parties to the Stockholm Convention.*

Includes a broad-based public consultation for receiving and incorporating observations and securing greater political support, and submitting the Plan to the Conference of Parties.

6. *Carrying out the Stockholm Convention NIP.*

Involves implementing the various action plans and the mechanisms for updating, reviewing, and informing the Conference of Parties, in accordance with Article 7 of the Convention.

It is important to point out that, according to guideline recommendations, civil society groups dedicated to environmental and public health protection, as well as community representatives and women's groups, should be considered among the interest groups from the start of the process—in other words within the National Coordination Committee and not only in the final phase of public consultation (see Figure 11).

FIRST PHASE. Establishing a mechanism for coordination and organizational structure to guide the NIP development process.

A successful National Implementation Plan requires a planning process and an appropriate organizational structure, which is suggested in Figure 12. In this first phase, it is recommended that the national government designate the following:

- A national lead agency and a General Project Director, which will be the legal entity and certified official for signing the Convention with the GEF implementing agency and submitting the corresponding reports. This entity is not necessarily the one that will coordinate the NIP, and therefore it is recommended that the following be established:
 - A National Coordination Committee (NCC), with pluralistic participation by diverse stakeholders. The GEF recommends that this committee include members from various governmental departments in the areas of the environment, health, agriculture, labor, finance, industry, commerce, transportation and customs, among others, and also representatives from industry and civil society (environment, environmental health, women's and academic groups, and unions). (5) This Committee will facilitate coordination of project activities among the different national stakeholders and will provide guidance and support for project execution. Individual members of the Committee may be responsible for supervising specific components of NIP development. The Committee will contribute to the NIP's final review, and in particular, it will sign the detailed work plan and calendar for NIP development;

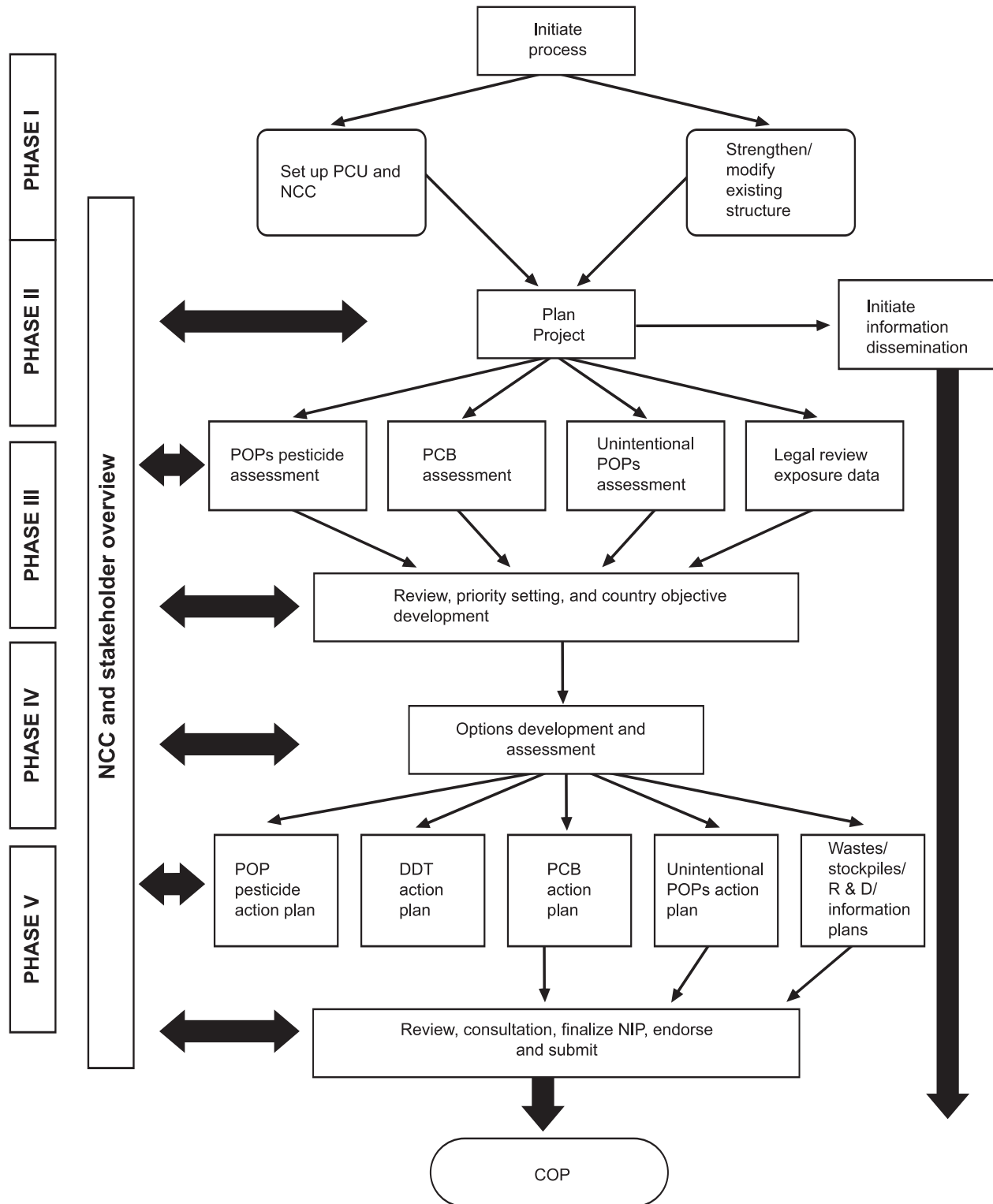


Figure 11

Diagram illustrating Phases of the National Implementation Plan for the Stockholm Convention
 Source: *Guidance for developing a National Implementation Plan for the Stockholm Convention*.
 UNEP. World Bank.

identify and recommend activities for increasing public awareness and public information; review and provide observations on the action plans for the task teams for each POP, the National Profile of Chemical Management and improvements in existing regulations, in addition to providing recommendations on aspects of public policy. The GEF recommends that this Committee be constituted by a maximum of 15 members, and that it meet regularly every three months, holding extraordinary meetings when necessary.

- The Project Coordination Unit (PCU) and the National Project Coordinator (NPC). The National Project Coordinator will act as Secretary of the National Coordination Committee, will organize the PCU, and supervise the overall execution of the project and coordination with the GEF implementing agency. The PCU will work with technical experts and ad-hoc topic-based task groups (for example on pesticides, PCBs and dioxins) to complete its work. It is recommended that greater national capacities be promoted by working with existing expert groups in specialized departments or institutions, although contracting international experts is also permitted.
- It is recommended that responsibilities in the diverse aspects of POP management be defined and assigned among government departments and other interested actors.

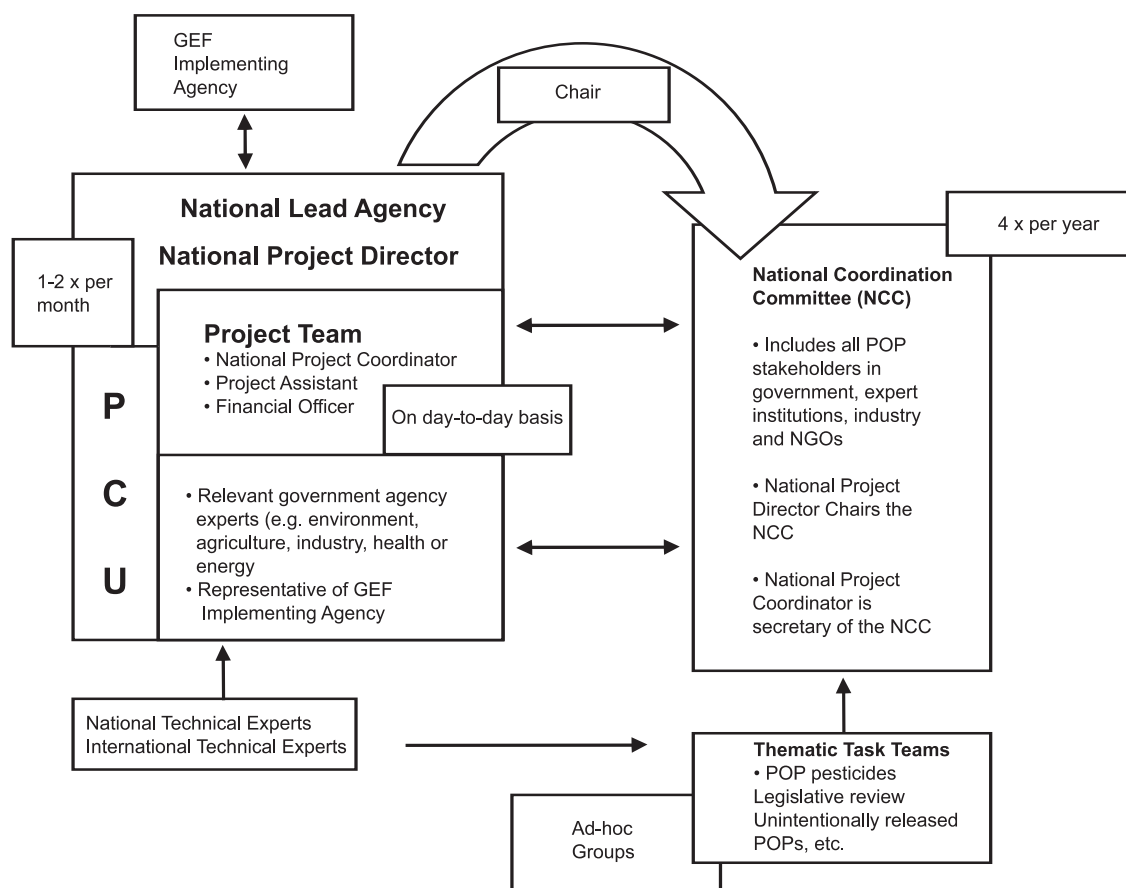


Figure 12

Scheme for the Organizational Structure of the National Implementation Plan, as suggested by GEF

Source: UNEP, World Bank, *Guidance for developing a National Implementation Plan for the Stockholm Convention*. Draft 200??.

SECOND PHASE. Taking POP inventories and assessing national infrastructure and capacity.

The expectation for this phase is to carry out specific assessments, collect existing information and generate new information, identifying needs and gaps in relation to resources, capacities and knowledge, and defining priorities, all with the objective of compiling a thorough assessment of the country's POP status. The results from this phase should include the following:

- A newly prepared or updated National Profile to evaluate the national infrastructure for chemical products management, in the section corresponding to POPs. The United Nations Institute for Training and Research (UNITAR) and the Inter-Organization Program for the Sound Management of Chemicals (IOMC) have developed a guide for said purpose. ⁽⁶⁾ In the Intergovernmental Forum on Chemical Safety, most of the nations committed to completing their national profiles on chemical products management by the year 2002. Part of this National Profile consists of the POPs inventories, and an assessment of the necessary infrastructure and resources, as listed and described further below. The guide includes a diagnosis on access to and quality and quantity of information for management of chemical substances, including the existence of a Pollutant Release and Transfer Registry (PRTR) or its equivalent, in order to create and update a reliable inventory. It is recommended that all stakeholders linked to the sound management of chemical products be involved. Part of the evaluation includes identifying the NGOs and public interest groups that play or can play a role in POPs management. The guide highlights IPEN's important role, and invites the reader to consult the list of participating organizations.
- A preliminary inventory of POP pesticides, including their historic and current use, production, purpose, importation and exportation, and information on environmental monitoring of these pesticides and their health impacts.
- A preliminary inventory of equipment and articles that contain PCBs. Commitments specified in Annex A, part II.
- A preliminary inventory of the estimated release of unintentional POPs (dioxins, furans, HCB and coplanar PCBs) for each identified source. This inventory should be comprehensive, and include releases into the air, water and soil; the presence of these POPs in wastes and in products; and indicators of contaminated sites. This will be commented in detail further below.
- A preliminary inventory of POP stockpiles, wastes, and POP-contaminated sites and products, including information on the magnitude, location, relevant regulations, and clean-up measures, as well as an assessment of existing opportunities for the elimination of obsolete POPs.
- Evaluation of the capacities of existing infrastructure and institutions to carry out adequate POP management, including prevention, control, and monitoring measures. In reference to the latter, chemical laboratories of analytical reference should be evaluated, as well as the needs and options for strengthening capacities in this area.
- Description and assessment of public policies, legislation, regulations and norms related to POP management, and national capacities in guaranteeing their enforcement.
- Compilation and summary of known human-health and environmental impacts related to POPs, including potential releases into the environment and the dimensions of the exposed population. The sectors of the population at greatest risk should be mentioned here, with special emphasis on occupational, children's and women's health. Research and monitoring needs should also be identified here.
- Assessment and description of mechanisms (legal options, and related programs, policies and activities) to build awareness, disseminate information, and educate workers and the public on POPs, as recommended by the UNITAR-IOMC and UNEP guide. Another chapter should be included on NGO activities, encompassing the work of public interest groups, industrial-sector organizations and research

entities. ⁽⁷⁾ This involves developing and updating PRTRs for each POP, as indicated in Article 10, paragraph 5 of the Stockholm Convention.

- Assessment of infrastructure and capacity for research and development of alternatives that avoid POP formation and release. This activity includes developing preventative aspects in accordance with the commitments acquired in the Stockholm Convention, especially Article 5 (c) (d), Article 9, section 1, (b), and Article 11, section 1, and which are not sufficiently specified in the guide for developing the National Profile for chemical products management.

Inventories of dioxins and other unintentional POPs, and limitations of the UNEP Toolkit.

As acknowledged by UNEP, only a small number of countries in the world have undertaken a national inventory that reports on releases from dioxins and furans. By January 2001, only 16 national inventories had been identified, almost all of them carried out in countries in the North (primarily Europe and the United States). UNEP also affirmed that most of these inventories were incomplete, obsolete, or lacked a uniform structure. Furthermore, only a few inventories addressed releases other than atmospheric emissions, or in other words, they did not cover total environmental releases, which also include releases into soil and water, with the residues generated in the production of or the end of the useful lifetime of the product. ⁽⁸⁾ Environmental experts coincide with these observations and add that very few inventories or monitoring programs currently include information on total TEQ values for dioxins, furans, HCB and coplanar PCBs, as indicated by the Stockholm Convention. ⁽⁹⁾

Conducting inventories of dioxins and other unintentional POPs is an important aspect of governmental commitments derived from Article 5 of the Stockholm Convention, as we will see in the third chapter of this Citizen Guide. These inventories should include identification of the sources generating POPs and an estimation of total environmental releases.

UNEP has elaborated a document, still in draft form, to assist countries in preparing dioxin and furan inventories: the “Standardized Toolkit for the Identification and Quantification of Dioxin and Furan Releases,” better known as simply the “Toolkit.” It includes four components: a) a methodology for identifying the industrial and non-industrial processes that release dioxins and furans into five components or media: air, water, land, in products, and in residues, and identifying which of them are the most important; b) guidance on gathering information for classifying the pertinent processes, through questionnaires aimed at compiling specific plant or process data; c) a detailed database available in Excel files on emission factors for each representative activity and area, and d) guidelines on the assembly and preparation of inventories to facilitate comparison of results.

The basic objective of the Toolkit is to facilitate an estimation of average annual releases of dioxins and furans into each medium (air, water and land, in products and residues) for each of the activities identified as a generating source. The estimation is obtained by multiplying the activity level or rate by the emission factor. For example, the activity level or rate may be the amount of product produced or input material or waste generated per year (expressed in tons or liters), by a specific facility or by all facilities in a country or region. The emission factor refers to the amount of dioxins or furans released into each medium per unit of activity (wastes or products produced), expressed in micrograms of toxicity equivalents (ug TEQ) per year. For example, for the incineration of municipal solid wastes, an emission factor is established for the atmospheric emissions and in residues (which vary according to the type of pollution-control technology), and this is multiplied by the volume of wastes burned per year.

There are various basic methods for calculating emission factors: a) the releases measured in each individual medium from each individual source per unit of activity (starting at the bottom and working upward); b) the estimated releases for each medium based on the range of values measured for the releases from one source category per unit of activity (from the top and working downward); c) the emission factors proposed by the UNEP Toolkit, by inventories in other countries, or in the scientific literature.

The Toolkit proposes a five-stage methodology to conduct the inventory: 1) apply a screening matrix (Table 23) to identify the main categories of existing dioxin and furan-generating sources in the country; 2) review the subcategories to identify existing activities and sources; 3) gather detailed information on the processes and classify processes in similar groups, applying the standard questionnaire; 4) quantify the identified sources, making use of the default emission factors for each medium, and 5) apply nation-wide to establish the full inventory, and report results using the guidelines provided in the standard form.

Table 23
Screening matrix – Main source categories in dioxin inventories

| No. | Main source category | Air | Water | Land | Product | Residue |
|-----|--|--|-------|------|---------|---------|
| 1 | Waste incineration | X | | | | X |
| 2 | Ferrous and non-ferrous metal production | X | | | | X |
| 3 | Power generation and heating | X | | X | | X |
| 4 | Production of mineral products | X | | | | X |
| 5 | Transport | X | | | | X |
| 6 | Uncontrolled combustion processes | X | | X | | X |
| 7 | Production and use of chemicals and consumer goods | X | | | | X |
| 8 | Miscellaneous | X | | X | X | X |
| 9 | Disposal | X | | X | | X |
| 10 | Identification of possible hotspots | Probably registration only to be followed by site-specific evaluation. | | | | |

Source: UNEP Chemicals. *Standardized Toolkit for identification and quantification of dioxin and furan releases*. Draft. January 2001. Geneva, Switzerland, Table 1.

The categories are sufficiently broad and cover a wide variety of industries, processes and activities known to potentially cause dioxin and furan releases.

(X) Primary route of dioxin and furan release in each category. It is recommended that “hotspots” be identified for posterior specific evaluation, since they have the potential to release dioxins and furans in the future. These hotspots may be locations where products contaminated with dioxins and furans are being or have been manufactured.

Despite the UNEP Toolkit's promise to offer a "complete" methodology to carry out dioxin and furan inventories, it has important limitations which have been pointed out by groups such as Greenpeace and IPEN, and which are summarized in Table 24.

Table 24
Limitations of UNEP Toolkit for taking inventories of unintentional POPs

| |
|---|
| <ul style="list-style-type: none"> • The manual only covers dioxins, and does not include the identification and quantification of PCBs and HCBs when they are produced unintentionally. Considering that the majority of dioxin and furan-generating sources are also sources that generate PCBs and HCBs, resources and time would be saved by conducting a comprehensive inventory instead of first a dioxin and furan inventory and later another inventory to cover the remaining unintentional POPs. • The Toolkit does not include a complete list of dioxin-generating sources, even though they have been identified by other inventories and in the scientific literature. The unconsidered sources include the production of numerous industrial compounds containing chlorine and of pesticides, the burning of tires, and municipal water treatment. Nor does the Toolkit consider emission factors from sanitary landfills as part of unintentional POP releases into the soil, despite their inclusion in other inventories. (*) • The Toolkit does not offer a strategy to identify the sources that generate dioxins and furans, thus leaving unidentified sources out of inventories and out of national or regional action plans. The consequence is that economic assistance cannot be received from the Stockholm Convention to carry out continuing minimization and possible elimination of these unidentified sources, signifying lost opportunities for assistance and even higher environmental and public health costs. • The emission factors included in the Toolkit are insufficient. A large number of unintentional POP-generating activities are absent, and this makes it impossible to adequately estimate releases into all the physical media at each generating source. • The emission factors included in the Toolkit are unreliable, inadequately representing the range of releases for each medium, measured at the various generating sources. The factors included are even lower than those recognized in the dioxin inventories in more industrialized regions and in the scientific literature. • The emission factors included in the Toolkit are not applicable to dioxin and furan-generating sources outside of Western Europe and the United States because they do not adequately reflect the range of releases for each environmental medium that has been reported at the generating sources in developing countries and countries with economies in transition. |
|---|

(*) In the Annexes the reader will find a list of dioxin and furan sources not included in the Toolkit, as well as a list of pesticides and chemical substances that may also generate dioxins and furans during their production.

Sources: Adapted from Pat Costner, Senior Scientist, Greenpeace International: *Comments on UNEP Chemical's "Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases."* UNEP/POPS/INC.7/INF.17, pp. 74-148, and by the same author: *Inventories of dioxins and other by-products POPs. The myths and realities.* Presentation in Power Point at the Conference on "Persistent Organic Pollutants and Waste and Chemicals Policy," Czech Republic, May 6, 2004. Also, IPEN Dioxin, PCB and Waste Working Group, *Comments on the Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases.* April 2004. www.ipen.org

According to its critics, most if not all of the emission factors contained in the Toolkit are derived from values measured in the sources located in a few countries: Germany, Holland, the United Kingdom and the United States. In fact, numerous examples can be found of activities in which the emission factors provided by the Toolkit are not representative of even those countries and are underestimated (for example, in reference to municipal and hazardous waste incinerators), or no emission factor is provided (for example, for primary production of aluminum, or cement ovens that burn hazardous residues).

The atmospheric emission factors for dioxins and furans in the Toolkit, and most if not all the sources, are based on conventional sampling methods, and the resulting analysis may greatly underestimate real dioxin emissions. The conventional sampling method consists of capturing flue gases for a six-hour period for their posterior analysis. This method may lead to very high calculation errors, up to 30 or even 50 times, compared with the results of the analysis of an almost continuous sampling carried out over several days. This type of almost continuous sampling is carried out in some European countries and the measuring equipment may be commercially acquired. A second factor which may contribute to significant calculation errors in atmospheric emission factors is the so-called “memory effect” in which dioxins are released very slowly, once formed in the post-combustion area of incinerators and other combustion systems. ⁽¹⁰⁾

Application of the Toolkit does not require measuring the emissions, and therefore it does not offer exact results, as recognized by the draft UNEP document. Rather, the Toolkit facilitates rapid identification of the primary sources and provides a general panorama, to assist governments in prioritizing and directing their efforts to comply with the Stockholm Convention.

Also very worrisome is the enormous overestimation of the dioxin and furan emission factors for firewood and coal burning in household stoves, and the burning of household garbage in barrels and piles, as well as the emissions produced by forest fires —especially if used as reference values in the elaboration of inventories in developing countries and those with economies in transition, as can be appreciated in Table 25, next page.

Table 25
Comparison of atmospheric emission factors in the Toolkit for dioxin inventories and other sources

| Primary Category | Toolkit on dioxins | Other sources |
|---|--|--|
| Burning of clean wood in household stoves | 0.2 – 4.7 ng TEQ / kg 1.5 ng TEQ/kg | 0.2- 0.9 TEQ/kg ⁽¹⁾ 0.5 ng TEQ/kg |
| Burning of coal in household stoves | 1 – 7 ng TEQ / kg 2 ng TEQ/kg | 108.5 to 663.9 ng TEQ/kg ⁽²⁾ 386.2 ng TEQ/kg |
| Burning of household garbage in barrels and piles | 300 ng TEQ/kg | 5 ng TEQ/kg per yard of wastes 35 ng TEQ/kg of household garbage ⁽³⁾ |
| Forest fires | 5 ng TEQ/kg | 0.08 – 0.17 ng TEQ/kg ⁽⁴⁾ |

1 Environment Canada and the Hearth Products Association of Canada, 2000. *Characterization of Organic Compounds from Selected Residential Wood Stoves and Fuels*. ERMD Report 2000-01. Canada.

- 2 Moche, W., Thanner, G. 1998. PCCD/ F-emissions from coal combustion in small residential plants. *Organohalogen Cpd.* 36:329-332.
- 3 Wevers, M., De Fre, R., Desmedt, M., 2004. Effect of backyard burning on dioxin disposition and air concentrations. *Chemosphere* 54: 1351-1356.
- 4 Prange, J., Gaus, C., Weber, R., Papke, O., Muller, J., 2003 Assessing forest fire as a potential PCCD/ F source in Queensland, Australia. *Environ. Sci. Technol.* 37:4325-4329.

Source: Pat Costner, Greenpeace International. Scientific Unit. Personal communication.

If we add up the underestimation of emission factors from incineration and diverse industrial activities or their complete absence in the tally, we find that governments could mistakenly conclude that their primary problems are diffuse sources such as backyard burning or biomass burning or forest fires, located primarily in rural areas and among the population, and diminish the importance of contributions from industrial activities.

Given the current limitations of the draft version of the Toolkit, developing or transition-economy countries in particular cannot mechanically apply the emission factors proposed in the activities included in the manual. This would lead to a partial and distorted view of reality, making it impossible to design action plans for establishing reliable priorities for effectively complying with the objective of continually minimizing and where feasible, ultimately eliminating the generation of POPs.

Countries should review the Toolkit and add to the lists of generating sources of dioxins and other unintentional POPs, and develop a strategy for their identification. The UNEP Chemicals Unit should consider the criticisms made of the Toolkit draft, correct it, and present a new version that will implement comprehensive inventories, responding more adequately to the particular needs of developing countries and those with transition economies. ⁽¹¹⁾ (Note for the English edition: UNEP Chemicals has released a 2nd Edition, in February 2005 of the Toolkit but unfortunately still with the main deficiencies we already pointed out in our previous paragraphs)

As a strategy for identifying sources that generate unintentional POPs, Greenpeace recommends working from the assumption that all chemical industrial processes and activities in which any form of chlorine is involved should be suspected as producers of dioxins and other unintentional POPs, unless proven otherwise, while leaving those processes and activities that do not involve chlorine use pending for future consideration. The availability of chlorine in any form —elemental, organic or inorganic— is a definitive characteristic of all processes and activities that generate dioxins and furans. Once chlorine presence is established as part of the basis of the strategy, it is possible to then: a) evaluate the presence of other materials —such as catalyzing metals— and the conditions —such as temperatures— which are favorable to formation of dioxins and furans, and b) supervise the gas emissions into the atmosphere, discharges into water, and solid wastes and products suspected to be sources of PCDD/F.

Denmark used the strategy of especially focusing on the use of chlorine and chlorine-containing materials in chemical production facilities, for the purpose of identifying potential sources of dioxins and furans in the preparation of its inventory. Similarly, the European Union's inventory noted that thermal processes involving oxygen and materials with carbon and chlorine are generally suspected to be capable of producing dioxins and furans. ⁽¹²⁾

Beyond preliminary inventories and statistical calculations, the truth is that the only methodology that will provide a clear idea of dioxin emissions is the actual measurement of the individual facilities of each generating source. Measuring dioxin is an expensive activity, if the goal is to accurately measure all the generating sources through mass spectrometry and high-resolution gas chromatography (GC/MS). For an initial “scan” of dioxin levels, various researchers use bioassays such as the ELISA or CALUX tests. These rapid screening assays facilitate general quantification of the TCDD dioxin and compounds of similar toxicity. With this strategy, positive results obtained from the screening assays can be corroborated with high-resolution gas chromatography, which is a more precise, but slower and more expensive method. Rapid screening assays also allow analysis of foods (eggs, fish, cattle feed), biological samples (blood and breast milk) and contaminated soil. ⁽¹³⁾

THIRD PHASE. Assessing priorities and defining objectives.

The objective of this phase is to develop criteria to facilitate establishing national priorities for actions to be carried out, and to define the short and long-term objectives of the NIP, in accordance with the commitments in the Stockholm Convention.

- Information obtained from the partial assessments conducted in the previous phase should be reviewed.
- Criteria established should consider health and environmental impacts, socioeconomic aspects, and access to alternatives. The legal requirements of the Stockholm Convention and those derived from relevant national, regional or international agreements, such as the Basel and Rotterdam Conventions, for example, should be taken into account.
- The guidelines emphasize that the National Coordination Committee should work extensively with the various stakeholders, either brought together in one group or in workshops, to discuss short and long-term objectives.

FOURTH PHASE. Formulating National Implementation Plans.

This phase involves reviewing the available options and measurements for complying with the obligations established in the Stockholm Convention and with nationally-established priorities. The National Implementation Plan should contain the action plans for the various types of POPs, in accordance with the Convention, and the identification of needs for technical and financial assistance.

- It is suggested that for each POP group, the necessary steps be outlined to determine needs for resources, their implications, and cost-benefit and cost-effectiveness assessments. The GEF guidelines suggest the use of a holistic focus in this review of options. ⁽¹⁴⁾
- The action plans and proposed measures should be coordinated with existing sustainable development programs and with particular programs on chemical management, comprehensive pest management, comprehensive vector management, appropriate waste management, and control of industrial pollution. It is suggested that performance indicators be included in the NIP to determine the effectiveness of the measures adopted.
- The NIP should include a national strategy for information, awareness-raising, and citizen education, in response to all the commitments derived from Article 10 of the Stockholm Convention. This includes the designing of broad, mass education campaigns, using different media to inform, create awareness, and educate the public on the environmental and health effects caused by POPs, especially among women, children and the less-educated sectors of the population, and also on alternatives to POPs. There should be training programs for workers, technical personnel, scientists, and educators, and also a

strategy guaranteeing regular public access to all this information, with appropriate updating. The Convention suggests establishing national and regional information centers for said purpose.

- The NIP should also include a strategy for complying with the information-exchange commitments outlined in Article 9 of the Convention, especially on alternatives to POPs, as well as on options for their reduction/elimination, which as pointed out in the GEF guidelines, are fundamental for the Convention's long-term success. The Parties have the obligation to designate a national coordination center to facilitate this information exchange, within the country as well as abroad. Public access to this information is necessary to guarantee broad citizen participation in the implementation of the National Plan.
- The NIP should include a strategy to maximize capacities for researching and monitoring POPs and their health and environmental impacts. The strategy should especially consider the Stockholm Convention recommendation on the effects of POPs on reproductive health (Art. 11, section 2, d), the need for an institutional review mechanism, and national consultation as a way of participating in the discussion to incorporate new POP substances into the Stockholm Convention.

FIFTH PHASE. Broad-based endorsement of the NIP and its submission to the Conference of Parties to the Stockholm Convention.

- The objective of this phase is to clearly communicate the scope, need for, purpose and value of the NIP. This includes developing communication materials and broad-based national consultation for receiving and incorporating observations, and hopefully to secure broad public support for the NIP. Finally, support for the NIP and the commitment to fulfill it are required from the different government departments involved (Secretaries, Ministries, etc.). A mechanism should be devised for continual updates, review, and reporting on the NIP. The final result of this phase is its submission to the Conference of Parties to the Stockholm Convention.

SIXTH PHASE. Carrying out the Stockholm Convention NIP.

- This phase includes implementing the various action plans and mechanisms for NIP updating, review and reporting to the Conference of Parties, in accordance with Article 7 of the Convention. The calendar for the review and submission of reports will be established by the Conference. However, in the case of PCBs, reports should be submitted every five years on progress made in their elimination, as described in Annex 1, part II of the Convention. In addition, Article 5 calls for a five-year review of achievements in the strategies designed to progressively minimize and where possible eliminate unintentionally-produced dioxins, furans, HCB and PCBs.
- Participation by the various stakeholders, including women's and children's health groups, should be guaranteed in the reviewing and updating of the NIP.

NOTES – CHAPTER FOUR

1. A "Party" may be a State or regional economic integration organization that has consented to be bound to the obligations established in the Convention, and for which the Convention is in force. "(Article 2, Stockholm Convention)
2. Global Environment Facility (GEF). *Directrices iniciales relativos del GEF sobre las actividades de apoyo para el Convenio de Estocolmo sobre Contaminantes Orgánicos Persistentes*. GEF/C.17/April 4, 6, 2001, p. 8.

3. GEF Council, *Directrices iniciales sobre actividades de apoyo para el Convenio de Estocolmo sobre contaminantes orgánicos persistentes*. GEF document/C.17/4. GEF Council, May 9-11, 2001. As of May 2002, the GEF had approved, based on these guidelines, proposals from 55 developing countries or countries with economies in transition.
4. *Guidance for Developing a National Implementation Plan for the Stockholm Convention* (Draft). UNEP, World Bank. This Guide was developed with financial support from DANCED, and was reviewed by a panel composed of representatives from UNEP, UNITAR, UNDP, FAO, UNIDO, World Bank, World Wildlife Fund (WWF), World Chlorine Council (WCC), CHECAR, Chile, Denmark, Switzerland, Sweden and Zambia.
5. The guide states that because the National Coordinating Committee is composed exclusively of government representatives, it is necessary to create a forum for representatives from NGOs, labor sectors, academics, and research and industrial groups, in order to be informed, to monitor the process for developing NIPs, and to make an appropriate contribution to the process. GEF, *op. cit.*, p. 22, Annex entitled "Responsibilities of the NCC."
6. UNITAR-IOMC-UNEP. *Preparando/Actualizando un Perfil Nacional como parte del Plan Nacional de Aplicación del Convenio de Estocolmo*. Working Draft. January 2003. <http://www.pops.int/documents/meetings/inc6/englishonly/INF.8.pdf> This document is complementary to the UNITAR/IOMC document entitled *Preparación de un Perfil Nacional para Evaluar la Infraestructura Nacional para la Gestión de los Productos Químicos: un Documento Guía*, 1996. www.unitar.org/cwn/publications
7. UNITAR/IOMC/UNEP, *op. cit.*, 2003, recommends developing this in Chapter 6 and 11.
8. UNEP Chemicals, *Instrumental normalizado para la identificación y cuantificación de liberaciones de dioxinas y furanos*, Draft, January 2001, Geneva, Switzerland, Executive Summary, p. 1.
9. Darryl Luscombe and Pat Costner, *Zero toxics: sources of byproduct POPs and their elimination*, Greenpeace International, Netherlands, May 2001, p. 9-11.
10. Presentation by Pat Costner, *op. cit.*, citing articles by R. De Fre and M. Wevers, 1998, "Underestimation in dioxin emission inventories," *Organohalogen Cpds* 36:17-120; M. Chang, J. Lin, 2001, "Memory effect on dioxin emissions from municipal waste incinerator in Taiwan," *Chemosphere* 45:1151-1157; and R. Zimmermann, M. Bluemenstroch, H. Heger, K. Schraman, A. Kettrup, 2001, "Emission of nonchlorinated and chlorinated aromatics in the flue gas of incineration plants during and after transient disturbances of combustion conditions: Delayed emission effects," *Environ. Scie. Technol.* 35:1019-1030.
11. Pat Costner, Senior Scientist, *Greenpeace International Comments on UNEP Chemicals' "Standardized Toolkit for identification and quantification of dioxin and furan releases,"* UNEP/POP/INC.7/INF.17, p. 74-148. Also, see IPEN, *Dioxin, PCB and Waste Working Group Comments on the Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases,* April 2004, www.ipen.org
12. UNEP/POPS/INC.7/INF.17. Pat Costner, *op. cit.*, p. 76.
13. ELISA is the abbreviation for "Enzyme-Linked Inmunosorbent Assay." And, CALUX stands for "Chemically Activated Luficarese Expression." ELISA uses an anti-TCDD antibody, while the CALUX bioassay is based on the activity of the cytoplasmic receptor Ah, and is specific to any compound that activates the receptor; it is based on a cell to which a gene is inserted and when the receptor is activated, the gene will fluoresce, and the fluorescence is quantified. The use of CALUX is particularly recommended for developing countries and countries with economies in transition. The author expresses his gratitude to Dr. Fernando D. Barriga and Pat Costner for their comments on this point.
14. The GEF guidelines refers to the Environmental Assessment of Technologies and a framework of reference for assessing environmental risks in "Technical Workbook on Environmental Management Tools for Decision Analysis," *International Environment Technology Center*, Technical publications, Series 14, Japan.

Chapter Five



Citizen rights and demands

- 5.1 The human right to health and a healthy environment
- 5.2 The right to citizen participation and to information in the Stockholm Convention NIPs
- 5.3 Access to justice and compensation for damages
- 5.4 In favor of prevention-oriented, democratic environmental policy

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Chapter Five

Citizen Rights and Demands

5.1 The human right to health and a healthy environment

The production and release of persistent organic pollutants (POPs) into the environment violates fundamental human rights, such as health rights, women's and children's rights, and the right to healthy food that is free from pollutants and an environment that is suitable for human dignity and development.

Human rights constitute the grounds for legitimizing the modern rule of law, to the extent that this form of rule emerged precisely to protect what was previously referred to as the “natural rights” of citizens in relation to constituted powers. These rights are currently known as “first generation” rights, or basic liberties — specifically civil and political rights, such as the recognition that all human beings are, by their very nature, equally free and independent; and that their physical integrity; freedom of expression, of the press, and of association; and the political right to popular participation in government, as well as other fundamental rights and freedoms must be respected. As a result of the struggles waged by workers and citizens, State intervention was demanded in order to guarantee individuals a “second generation” of rights —the rights of equality, or economic, social, and cultural rights (such as access to education, housing, health, jobs, social security). In recent decades, the so-called “third generation rights” have now been recognized. Their fundamental value is solidarity-oriented: the right to peace and the right to a healthy environment. ⁽¹⁾

Recognition of human rights has emanated from the political struggle for human dignity throughout history. These rights cannot be viewed as concessions made by the State. In fact, neoliberal governments are looking to disown their political obligations in relation to human rights, in terms of social services and a healthy environment, to allow the “free play” of the market to better assign resources and access to collective goods.

The rights of all individuals to health and to an environment suitable to their full physical and spiritual well-being are human rights that are universally valid. They constitute expressions of the fundamental right to quality of life, with respect for the dignity of individuals. In other words, these are rights that should be respected for all individuals, in recognition of their intrinsic dignity, without regard to their race, religion, sex, level of schooling or income level. These rights express a consciousness of unity, of belonging and of the interdependence that each human being has with respect to all other human beings, and to nature, to their cultural past, and to future generations. Human rights should be considered as an integrated whole, as universal, indivisible and interdependent, as they are acknowledged in international agreements on human rights, such as the Universal Declaration of Human Rights adopted by the United Nations, and the Additional Protocol to the American Convention on Human Rights in the Area of Economic, Social and Cultural Rights, or the San Salvador Protocol. ⁽²⁾

Health does not signify an absence of illness, but rather, a state of complete physical, mental and social well-being —as recognized by the World Health Organization. The right to health does not mean the right to not fall ill, but rather for such well-being to be guaranteed and protected by the actions of those who govern us. It is impossible to attain physical well-being, a healthy body and a healthy mind, if the environment that surrounds us is contaminated and if it violates our well-being, as in the case of POPs, which are introduced into our bodies from the moment of conception and during fetal development. The struggle of women for reproductive health that is free from pollutants, the struggle of workers for safe and hygienic conditions in the workplace, the actions of communities to keep their soil and water free from industrial pollutants, the demand by consumers for uncontaminated products —these are among the multiple expressions of an individual and collective aspiration to fully exercise these rights to life.

Many governments have explicitly acknowledged the rights of those governed to health and a healthy environment in their National Constitutions, which represent the supreme laws in these countries —at the top of the hierarchical order, above other laws and regulations, the latter of which cannot be contrary to what is contained in National Constitutions. In this sense, it is the legal obligation of those who govern to guarantee that these rights of the governed are respected and fulfilled, and to design institutions, laws, regulations and policies that guarantee the full exercise of these rights.

International environmental agreements can —through the rights and obligations they establish between governments— contribute toward improving the protection of human health and the environment, in favor of the full exercise of these individual and collective rights. We must not forget that even the Stockholm Convention establishes the overall goal of protecting human health and the environment from the effects of persistent organic pollutants. The fact that governments have signed and ratified international agreements means that the corresponding commitments become part of their legal obligations at the national level, between those who govern and those governed, and thus, governments must contribute to the full enforcement of such human rights.

5.2 The right to citizen participation and to information in the Stockholm Convention NIPs

The harmful effects from POPs on human health and the environment make these pollutants a problem that is not only individual but also collective in nature. These pollutants have negative repercussions for public health, and they disrupt ecological integrity and equilibrium. The decisions made by governments to control or eliminate the formation of these pollutants and their release into the environment are decisions that affect all of us —men and women, sooner or later. The right to participate in POPs-related decisions is a legitimate right of citizens to ensure that their human rights to health and a healthy environment are effectively protected.

The particular interests that have benefited from the industrial production or unintentional production of POPs cannot prevail over collective interests, when it comes to decisions made by governments if the goal is allegedly to strengthen democratic environmental policies.

In 1992, governments recognized in the Rio Declaration on the Environment and Development, in Principle 10, that the best way to address environmental issues is through the participation of all citizens, and that this participation should be facilitated and encouraged, making environmental information that is available to public authorities accessible to citizens. Principle 10 especially mentions public participation in decisions related to materials and activities that represent a hazard to communities.

Public access to government information is an indispensable condition for lending transparency to the decisions made by public servants, and it is one of the mechanisms for assuring the accountability of those who govern in democratic societies. Access to environmental information is indispensable to increasing awareness regarding environmental problems and enhancing participation by the population in public policies.

A well-informed civil society will be able to more fully participate in discussions on the problems it is confronting. Citizen participation is also an additional source of information and knowledge for those responsible for making decisions, in addition to the technical and scientific knowledge that can be offered by specialists.

Especially noteworthy within international environmental law is the UN *Convention on access to environmental information, public participation in environmental decision-making, and access to justice in environmental matters*, adopted in Aarhus, Denmark on June 25, 1998. This Convention was agreed upon by the 55 nations that, together with the United States, form the UN Commission for Europe.⁽³⁾ The Convention establishes that it is the obligation of governments to guarantee access to information on the environment, as well as public participation in decision-making and access to justice in environmental matters, with the goal of contributing to protecting the right of each individual —of present and future generations— to live in an environment that guarantees health and well-being.

The European Union and the United States, together with other governments, have acknowledged —through general laws— the right to public access to government information and/or environmental information. In Latin America, Mexico and Argentina have very recently approved laws on public access to environmental information.

As we pointed out in the third chapter of this book, the Stockholm Convention dedicates the entire Article 10 to the topic of public information, awareness and education; and the GEF guide to developing national implementation plans for the Convention recommends public consultation and participation from the very first phase of developing these plans.

According to Article 10, governments should promote and facilitate public access to:

- All available information regarding POPs, taking into account that “...*information on health and safety of humans and the environment shall not be regarded as confidential.*”
- Information regarding the effects from POPs on health and the environment. There is particular mention that governments should develop programs for public education and awareness, and especially for women, children and those with the lowest levels of schooling.
- Information and research on alternatives to POPs, with the creation of national and regional information centers.

In addition, the public will have the right to:

- All of this information being kept up-to-date, timely and provided on a regular basis.

- That this information be provided through safety data sheets, reports and through the mass media and other means of communication.
- That the possibility of establishing Pollutant Release and Transfer Registers (PRTRs) be analyzed, since this would mean that those responsible for pollution would be required to report each year the amounts of POPs they released into the environment and transferred for their elimination or treatment.
- Be informed of the results from research and monitoring with respect to the levels of POPs in the environment and in human beings, and their impact on reproductive health, in a timely and regular manner. (Article 11)

All of these information-related commitments require a comprehensive communication policy and coordination among government authorities in the areas of the environment, public health, education, and scientific and technological research and promotion. Coordination is also needed between federal and state-level authorities.

5.3 Access to justice and compensation for damages

There are aspects that are not covered in the Stockholm Convention, and governments must take responsibility for them, such as those related to access to justice in environmental matters, and compensation for damages to health and the environment that are provoked by intentional or unintentional production of POPs. There is no doubt that the industrial production of POPs has created an environmental debt over the course of time, leaving a mark on the environments where they have been generated, and an impact on the health of communities located nearby and beyond. The impact from activities such as the formulation and production of organochlorinated pesticides, the use of chlorine and its derivatives for bleaching paper in cellulose factories, and other generating sources of dioxins and furans should be evaluated, to establish priorities in clean-up activities and granting compensation for damages.

The Convention establishes that inventories should be taken at POPs-contaminated sites, especially those known as “hot spots,” and clean-up efforts should be included in National Implementation Plans. Who will pay for these environment clean-up programs? Who will cover the costs of assessing the damage to the health of residents living in exposed communities? Not everything can be resolved through outside financial and technical assistance. Different mechanisms for internal financing must be evaluated. It will be necessary to apply the “polluter pays principle,” in order for those responsible for generating POPs to contribute to covering the resulting costs, and it will be necessary to study different economic instruments for this purpose.

Citizens should demand that corporations fully assume their responsibilities —that extend beyond establishing codes of conduct and volunteer initiatives. It is necessary to create mechanisms for corporate accountability that will oblige corporations to pay for the damage they cause. ⁽⁴⁾

To achieve these objectives, it will be necessary to evaluate various economic instruments and learn from the experiences in other countries, to then adapt them to the specific conditions in each country. A number of economic instruments have been proposed for financing the elimination of POPs, including an ecological tax on emissions and discharges, and a tax on the use of chlorine in the production of certain products that are known generators of dioxins and furans. These could be complementary measures to prohibitions and to the goals of reducing the use of products and materials that can generate POPs.

5.4 In favor of prevention-oriented, democratic environmental policy

The implementation of the Stockholm Convention can make it possible for governments to strengthen prevention-oriented, democratic public policies. But first, governments must abandon neoliberal policies that rely on the market to make the primary decisions in the areas of the environment, public health and industrial development. Some of the measures imposed by neoliberal policies are: an indiscriminate trade opening, cutbacks in public spending, privileged treatment of foreign investors, the relaxing of environmental protection requirements, and industrial self-regulation of control measures. These measures constitute an obstacle to promoting public policies committed to protecting health and the environment.

Resolving environmental and public health problems created by the production of POPs is not a primarily technical matter. Instead, this is a fundamentally political matter, since it requires public discussion and new forms of social control over the decisions that are currently being made exclusively in the offices of private businessmen. If the intentional production of chemical substances and products contaminates the environment, due to their intrinsic characteristics of persistence and bioaccumulation, and they irreversibly damage the health of the population, then it is the right of the population to participate in discussions on how to resolve this problem. The focus of discussion should be on how to change what is produced and the way in which it is produced, so such production is not the source of pollution and damaging effects on health. This is the argument posed by a new citizen environment movement that questions the regulatory model that places the population at risk, without prior consultation, and demands sacrifices to maintain economic growth that only benefits a small minority. ⁽⁵⁾

As we saw in the third chapter of this book, Article 5 of the Stockholm Convention establishes that governments should, at a minimum and as part of their national implementation plans, promote the development of and require the use of substitutes or modified materials, products and processes to prevent the forming and releasing of unintentional POPs —for the purpose of reducing to a minimum, and when possible, eliminating the sources of dioxin and furan generation. This is a political commitment that means governments must promote the identification and evaluation of alternatives for each one of the sources that generate dioxins, and open up opportunities for citizen participation, and for incorporating national and international experiences. The application of this principle of substitution should be part of the strategies defined in national implementation plans.

Applying the principle of substitution is part of a prevention-oriented policy that seeks to avoid damages before they are produced. The philosophy is that there is nothing worth risking, if it can be avoided. Decisions on how to resolve the problem of POPs contamination cannot be delegated to only a few “experts,” who carry out risk assessments or cost-benefit analyses. These experts tend to define the problem in quantitative terms, establishing “tolerable limits” for certain physical environments, or admissible daily intake amounts of hazardous substances in the food we eat. This approach, within the paradigm of establishing control over chemicals, has serious limitations: it does not consider the total accumulated impact from the pollution released from various sources, affecting an ecosystem or a region, nor does it evaluate the interaction among various toxic substances present in the human body at the same time, nor does it consider the particularly vulnerable moments in life, whether during the early weeks of gestation, during adolescence or in old age. The control paradigm functions on the notion that the dose is what makes a substance dangerous, when studies on POPs and other [“hormonal disruptors” indicate that not only the dose, but also the moment when exposure takes place, defines the risk of a given substance. ⁽⁶⁾

Given the crisis in the paradigm focused on controlling chemical substances, there is a need to develop a new regulatory model based on prevention and on the acknowledgement that defining and accepting risks requires a process of political discussion and definition, in addition to the application of scientific methodologies. A prevention-based model would be based on various elements, including the application of the precautionary principle in cases of scientific uncertainty; the right of citizens to be informed regarding the uses and emissions of toxic substances; the principle of substituting hazardous substances and materials when there are feasible, lower-risk alternatives; and the promotion of clean forms of production and mechanisms for extending the responsibilities of producers, as we described at the end of the first chapter of this guide. ⁽⁷⁾

Citizens around the world are demanding that alternatives be sought to the incineration of municipal, hazardous and hospital wastes, and burning of wastes in cement kilns. This demand should be part of a prevention-oriented environmental policy that seeks alternatives to the sources that generate dioxins and other unintentionally produced POPs. As we saw in the first chapter, current regulations for controlling dioxins and furans in incinerators have serious limitations. Requirements to measure levels of releases only once or twice a year are inadequate; conventional measuring methods underestimate the actual release of dioxins; and equipment for controlling and capturing dioxins and other pollutants is increasingly expensive. We pointed out in the third chapter that alternative non-combustion technologies for treating POP stockpiles and other wastes are already operating commercially in a number of countries. Evaluations of these systems have already been conducted, and other alternatives are also emerging. Developing countries and countries with economies in transition should consult their citizens whether they want to continue to be the recipients of “dirty” technologies such as incinerators, or rather aspire to cleaner technologies, with appropriate programs and initiatives for technical assistance. Furthermore, the incineration of hospital and municipal wastes is totally unnecessary and avoidable, when appropriate systems for waste reduction, segregation and treatment are implemented.

If governments are to fully implement the Stockholm Convention, they will need citizens to participate and help with monitoring, through institutional mechanisms and comprehensive, transparent, democratic procedures. Citizen participation cannot be limited to quick consultations designed to legitimize decisions that have already been made. These simulated forms of participation should be replaced by mechanisms for consultation and participation through a broad-based, multi-sector committee, involving not only environmental groups, but also those working to protect the health and rights of women, children, workers and indigenous populations, as we indicated when we analyzed Article 10 of the Convention and the phases of developing national implementation plans.

Governments should inform citizens and open up discussions to define postures on the pending issues to be resolved by the Conference of the Parties to the Stockholm Convention, beginning with its first meeting scheduled for May 2005. These issues include: a) reviewing and incorporating new POPs into the Convention, and the corresponding measures needed to reduce and eliminate these substances around the world; and b) discussion on and approval of guides for Best Environmental Practices and Best Available Techniques, for continually reducing and when possible, eliminating the sources that are unintentionally generating dioxins and other POPs. In this discussion, it is extremely important that a central role is given to alternatives that avoid—not only reduce—the generation of POPs.

A qualitative leap in public control over the expansion of the chemicals market is needed. So far, most chemical substances have been introduced on the market without sufficient information on their health and

environmental effects, to indicate that they are safe substances. According to US EPA estimates, there is basic information available regarding the hazards of less than 10% of the 2,800 chemical substances produced in large volumes in the United States. And in Europe, it is estimated that there is complete information for only 14%. Even less is known about chemical substances produced in small amounts, or regarding mixtures of different chemical substances. This lack of evidence regarding the toxicity of chemical substances is often misinterpreted as evidence of their safety. ⁽⁸⁾ All of humanity and the planet have already paid the consequences of this immense social experiment, and it is time to reverse this tendency.

The World Summit on Sustainable Development (WSSD), held in September 2002 in Johannesburg to review progress made on *Agenda 21*, approved the following objective in their implementation plan: “...aiming to achieve, by 2020, that chemicals are used and produced in ways that lead to the minimization of significant adverse effects on human health and the environment...” With this antecedent, the United Nations called on the international community to discuss the Strategic Approach to International Chemicals Management (SAICM), which had its first preparatory committee meeting in November 2003 in Bangkok, Thailand, and will finalize the agreement at the International Conference on Chemicals Management in February 2006 in Dubai.. An important element to consider in these discussions are the recommendations from the Intergovernmental Forum on Chemical Safety (IFCS) —in which governments, citizen organizations and the industry participate on an equal playing field— which proposes a concept of chemical safety based on the prevention of damage. IFCS defines “chemical safety” as the prevention of adverse effects, both long and short-term, for humans and the environment, resulting from the manufacture, storage, transport, use and elimination of chemical products. ⁽⁹⁾

In this context it is important to point out that the European Union Commission presented a proposal in February 2001 and an initial legislative draft in May 2003, for a new strategy and framework for sound management of chemicals called REACH, for the purpose of registration, evaluation and authorization of chemicals. After it is discussed and approved, this proposal will go on to the European Parliament and the Council of Ministers, to complete the process in 2006 and likely enter into effect in 2007. ⁽¹⁰⁾ This initiative requires companies to assume the burden of proof, to pay and submit basic information for all chemicals on the market, including information on risks throughout the life cycle of each of them, and to conduct a quick evaluation of chemical risks and replace substances of greatest concern. If the required information is not submitted, the corresponding chemicals will not be allowed to be used or sold on the market. All information should be available to the public, and if not, the company must provide a justification. The initiative includes a restriction on chemicals that can cause cancer, mutagenesis, reproductive effects and that are persistent. While European labor unions have proposed measures to improve the initiative, and the legislative proposal of 2003 weakens some of the original aspects presented in 2001, REACH represents a step forward in establishing an international regulatory model for chemicals. ⁽¹¹⁾ The REACH initiative was and will continue to be the object of strong pressure from the US government, for fear that it could affect US interests in Europe, and for the momentum it could provide to updating the US regulatory system and international discussions on the matter. The United States is even lobbying in developing countries, to urge them to express their concern regarding this issue. ⁽¹²⁾

Citizens of countries in the South, together with workers and citizen groups in North American and European countries, should be informed of the discussions on the future of international policies for controlling chemicals —especially chemicals that are toxic, persistent and bioaccumulative— and develop forms of participation for expressing their concern and presenting proposals in SAICM discussions. Members of IPEN will continue to participate in these discussions. ⁽¹³⁾

Opposition to neoliberal corporative globalization has led to the emergence of a citizen movement that declares that “another world is possible”; an alternative to the world of interests seeking to make quick profits and in which the accumulation of capital is viewed as a measure of economic success. In this alternative vision, new forms of economic cooperation and fair trade are being explored. Within this international struggle to create production systems with healthy food and clean industrial production, its necessary to add the global elimination of POPs, in order to prevent the poisoning of workers and communities, and the contamination of the planet.

NOTES – CHAPTER FIVE

1. See Adela Cortina, “Derechos Humanos y discurso político,” in Graciano González R. Arnaiz (coord.), *La condición humana en la sociedad tecnológica*, Madrid, Spain, Editorial Tecnos, 1999.
2. See, for example, Asociación para las Naciones Unidas en España, *La Declaración Universal de los Derechos Humanos*, commentary on each article, Barcelona, Spain, Editorial Icaria, 1998. Also, Comisión Nacional de Derechos Humanos (CNDH), *Los sistemas internacionales de protección de los derechos humanos*, Mexico, 1996.
3. See the Convention text in www.unece.org/env/europe/ppconven.htm
4. Regarding the differences between “corporate responsibility” —more akin to the public relations and *greenwashing* strategy used by corporations— and “corporate accountability,” see Kenny Bruno and Joshua Karliner, in *earthsummit.biz. The corporate takeover of sustainable development*, Oakland, CA, Food First Books, Chapter 4, pp. 60-73.
5. See, for example, a critique by Barry Commoner of the US environmental regulation model and the new grassroots movement for environmental justice, *Making Peace with the Planet*, The New Press, 1992, (Spanish translation published in 1992, Barcelona, Editorial Crítica), Chapter 8.
6. For a critique of the control-based model, see Fernando Bejarano G., “Residuos Peligrosos,” in Regina Barba Pirez (coord./editor), *La Guía Ambiental, 58 ensayos de expertos acerca del medio ambiente*, Mexico, UGAM, 1998. Also, David Santillo, Paul Johnston and Axel Singhofen, *The way forward out of the chemical crisis. An alternative approach, based in the precautionary principle, to the regulation of the manufacturing, marketing and use of chemicals in Europe*. Greenpeace International, Netherlands, May 1999. For a critique of risk assessment and the need to develop a process for assessing alternatives, see Mary O’Brien, *Making better environmental decisions. An Alternative Risk Assessment*. Cambridge, Massachusetts / London, England, MIT Press, 2000.
7. See Jorge Reichman and Joel Tickner (coords.), *El principio de precaución en medio ambiente y salud pública: de las definiciones a la práctica*, Barcelona, Spain, Editorial Icaria, 2002. Also, Beverly Thorpe, *Citizens’ Guide to Clean Production*, USA, Clean Production Network, January 2000 www.cleanproduction.org and publications from the International Chemical Secretariat, an NGO, at www.chemsec.org
8. Lowell Center for Sustainable Production, *Integrated Chemicals Policy. Seeking New Direction in Chemicals Management*, University of Massachusetts, October 2003, p.2. Also, WWF, *An introduction to REACH, a new regulatory system for chemicals in Europe. EU Toxics Briefing*. September 2003, www.panda.org/toxics
9. See report from the SAICM meeting at <http://www.chem.unep.ch/saicm/> and the IFCS report at www.ifcs.ch
10. <http://europe.eu.int/comm/environment/chemicals/whitepaper.htm>
11. See an analysis on REACH, *New chemicals policy in the EU, good or bad for companies. International Chemical Secretariat*, May 2003, Sweden; and Lowell Center Chemicals Policy Initiative at www.chemicalspolicy.org For a critical viewpoint from European labor unions, see the analysis by ISTAS at www.istas.ccoo.es
12. See Joseph DiGangi, Ph.D., *US intervention in EU Chemical Policy*, MA Environmental Health Fund, September 2003.
13. See the Bangkok Resolution for SAICM from IPEN, November 10, 2003, and the IPEN document entitled “Elements of a strategic approach to international chemicals management,” November 2003, prepared for the SAICM meeting in Bangkok. www.ipen.org

Annexes



- 1. Countries that have signed and are Parties to the Stockholm Convention
- 2. Selection of identified dioxin sources not included in the UNEP Toolkit
- 3. Pesticides which, during their production, are known to or suspected of generating dioxins or furans
- 4. Chemical substances which, during their production, are known to or suspected of generating dioxins and furans

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Anexo 1
Countries that have signed and are Parties to the Stockholm Convention

| Participant | Signature | Ratification, Acceptance (A), Approval (AA), Accession (a) |
|------------------------|-------------|--|
| Albania | 5 Dec 2001 | 4 Oct 2004 |
| Algeria | 5 Sep 2001 | |
| Antigua and Barbuda | 23 May 2001 | 10 Sep 2003 |
| Argentina | 23 May 2001 | 25 Jan 2005 |
| Armenia | 23 May 2001 | 26 Nov 2003 |
| Australia | 23 May 2001 | 20 May 2004 |
| Austria | 23 May 2001 | 27 Aug 2002 |
| Azerbaijan | | 13 Jan 2004 a |
| Bahamas | 20 Mar 2002 | |
| Bahrain | 22 May 2002 | |
| Bangladesh | 23 May 2001 | |
| Barbados | | 7 Jun 2004 a |
| Belarus | | 3 Feb 2004 a |
| Belgium | 23 May 2001 | |
| Belize | 14 May 2002 | |
| Benin | 23 May 2001 | 5 Jan 2004 |
| Bolivia | 23 May 2001 | 3 Jun 2003 |
| Bosnia and Herzegovina | 23 May 2001 | |
| Botswana | | 28 Oct 2002 a |
| Brazil | 23 May 2001 | 16 Jun 2004 |
| Brunei Darussalam | 21 May 2002 | |
| Bulgaria | 23 May 2001 | 20 Dec 2004 |
| Burkina Faso | 23 May 2001 | 31 Dec 2004 |
| Burundi | 2 Apr 2002 | 2 Aug 2005 |

| Participant | Signature | Ratification, Acceptance (A), Approval (AA), Accession (a) |
|---------------------------------------|-------------|--|
| Cambodia | 23 May 2001 | |
| Cameroon | 5 Oct 2001 | |
| Canada | 23 May 2001 | 23 May 2001 |
| Central African Republic | 9 May 2002 | |
| Chad | 16 May 2002 | 10 Mar 2004 |
| Chile | 23 May 2001 | 20 Jan 2005 |
| China | 23 May 2001 | 13 Aug 2004 |
| Colombia | 23 May 2001 | |
| Comoros | 23 May 2001 | |
| Congo | 4 Dec 2001 | |
| Cook Islands | | 29 Jun 2004 a |
| Costa Rica | 16 Apr 2002 | |
| Côte d'Ivoire | 23 May 2001 | 20 Jan 2004 |
| Croatia | 23 May 2001 | |
| Cuba | 23 May 2001 | |
| Cyprus | | 7 Mar 2005 a |
| Czech Republic | 23 May 2001 | 6 Aug 2002 |
| Democratic People's Republic of Korea | | 26 Aug 2002 a |
| Democratic Republic of the Congo | | 23 Mar 2005 a |
| Denmark ³ | 23 May 2001 | 17 Dec 2003 |
| Djibouti | 15 Nov 2001 | 11 Mar 2004 |
| Dominica | | 8 Aug 2003 a |
| Dominican Republic | 23 May 2001 | |
| Ecuador | 28 Aug 2001 | 7 Jun 2004 |

| Participant | Signature | Ratification, Acceptance (A), Approval (AA), Accession (a) |
|----------------------------|-------------|--|
| Egypt | 17 May 2002 | 2 May 2003 |
| El Salvador | 30 Jul 2001 | |
| Eritrea | | 10 Mar 2005 a |
| Ethiopia | 17 May 2002 | 9 Jan 2003 |
| European Community | 23 May 2001 | 16 Nov 2004 AA |
| Fiji | 14 Jun 2001 | 20 Jun 2001 |
| Finland | 23 May 2001 | 3 Sep 2002 A |
| France | 23 May 2001 | 17 Feb 2004 AA |
| Gabon | 21 May 2002 | |
| Gambia | 23 May 2001 | |
| Georgia | 23 May 2001 | |
| Germany | 23 May 2001 | 25 Apr 2002 |
| Ghana | 23 May 2001 | 30 May 2003 |
| Greece | 23 May 2001 | |
| Guatemala | 29 Jan 2002 | |
| Guinea | 23 May 2001 | |
| Guinea-Bissau | 24 Apr 2002 | |
| Haiti | 23 May 2001 | |
| Honduras | 17 May 2002 | 23 May 2005 |
| Hungary | 23 May 2001 | |
| Iceland | 23 May 2001 | 29 May 2002 |
| India | 14 May 2002 | |
| Indonesia | 23 May 2001 | |
| Iran (Islamic Republic of) | 23 May 2001 | |

| Participant | Signature | Ratification, Acceptance (A), Approval (AA), Accession (a) |
|----------------------------------|-------------|--|
| Ireland | 23 May 2001 | |
| Israel | 30 Jul 2001 | |
| Italy | 23 May 2001 | |
| Jamaica | 23 May 2001 | |
| Japan | | 30 Aug 2002 a |
| Jordan | 18 Jan 2002 | 8 Nov 2004 |
| Kazakhstan | 23 May 2001 | |
| Kenya | 23 May 2001 | 24 Sep 2004 |
| Kiribati | 4 Apr 2002 | 7 Sep 2004 |
| Kuwait | 23 May 2001 | |
| Kyrgyzstan | 16 May 2002 | |
| Lao People's Democratic Republic | 5 Mar 2002 | |
| Latvia | 23 May 2001 | 28 Oct 2004 |
| Lebanon | 23 May 2001 | 3 Jan 2003 |
| Lesotho | 23 Jan 2002 | 23 Jan 2002 |
| Liberia | | 23 May 2002 a |
| Libyan Arab Jamahiriya | | 14 Jun 2005 a |
| Liechtenstein | 23 May 2001 | 3 Dec 2004 |
| Lithuania | 17 May 2002 | |
| Luxembourg | 23 May 2001 | 7 Feb 2003 |
| Madagascar | 24 Sep 2001 | |
| Malawi | 22 May 2002 | |
| Malaysia | 16 May 2002 | |
| Mali | 23 May 2001 | 5 Sep 2003 |

| Participant | Signature | Ratification, Acceptance (A), Approval (AA), Accession (a) |
|----------------------------------|-------------|--|
| Malta | 23 May 2001 | |
| Marshall Islands | | 27 Jan 2003 a |
| Mauritania | 8 Aug 2001 | 22 Jul 2005 |
| Mauritius | 23 May 2001 | 13 Jul 2004 |
| Mexico | 23 May 2001 | 10 Feb 2003 |
| Micronesia (Federated States of) | 31 Jul 2001 | 15 Jul 2005 |
| Monaco | 23 May 2001 | 20 Oct 2004 |
| Mongolia | 17 May 2002 | 30 Apr 2004 |
| Morocco | 23 May 2001 | 15 Jun 2004 |
| Mozambique | 23 May 2001 | |
| Myanmar | | 19 Apr 2004 a |
| Namibia | | 24 Jun 2005 a |
| Nauru | 9 May 2002 | 9 May 2002 |
| Nepal | 5 Apr 2002 | |
| Netherlands | 23 May 2001 | 28 Jan 2002 A |
| New Zealand | 23 May 2001 | 24 Sep 2004 |
| Nicaragua | 23 May 2001 | |
| Niger | 12 Oct 2001 | |
| Nigeria | 23 May 2001 | 24 May 2004 |
| Niue | 12 Mar 2002 | |
| Norway | 23 May 2001 | 11 Jul 2002 |
| Oman | 4 Mar 2002 | 19 Jan 2005 |
| Pakistan | 6 Dec 2001 | |
| Palau | 28 Mar 2002 | |

| Participant | Signature | Ratification, Acceptance (A), Approval (AA), Accession (a) |
|-----------------------|-------------|--|
| Panama | 23 May 2001 | 5 Mar 2003 |
| Papua New Guinea | 23 May 2001 | 7 Oct 2003 |
| Paraguay | 12 Oct 2001 | 1 Apr 2004 |
| Peru | 23 May 2001 | |
| Philippines | 23 May 2001 | 27 Feb 2004 |
| Poland | 23 May 2001 | |
| Portugal | 23 May 2001 | 15 Jul 2004 A |
| Qatar | | 10 Dec 2004 a |
| Republic of Korea | 4 Oct 2001 | |
| Republic of Moldova | 23 May 2001 | 7 Apr 2004 |
| Romania | 23 May 2001 | 28 Oct 2004 |
| Russian Federation | 22 May 2002 | |
| Rwanda | | 5 Jun 2002 a |
| Saint Kitts and Nevis | | 21 May 2004 a |
| Saint Lucia | | 4 Oct 2002 a |
| Samoa | 23 May 2001 | 4 Feb 2002 |
| Sao Tome and Principe | 3 Apr 2002 | |
| Saudi Arabia | 14 Mar 2002 | |
| Senegal | 23 May 2001 | 8 Oct 2003 |
| Serbia and Montenegro | 2 May 2002 | |
| Seychelles | 25 Mar 2002 | |
| Sierra Leone | | 26 Sep 2003 a |
| Singapore | 23 May 2001 | 24 May 2005 |
| Slovakia | 23 May 2001 | 5 Aug 2002 |

| Participant | Signature | Ratification, Acceptance (A), Approval (AA), Accession (a) |
|--|-------------|--|
| Slovenia | 23 May 2001 | 4 May 2004 |
| Solomon Islands | | 28 Jul 2004 a |
| South Africa | 23 May 2001 | 4 Sep 2002 |
| Spain | 23 May 2001 | 28 May 2004 |
| Sri Lanka | 5 Sep 2001 | |
| Sudan | 23 May 2001 | |
| Suriname | 22 May 2002 | |
| Sweden | 23 May 2001 | 8 May 2002 |
| Switzerland | 23 May 2001 | 30 Jul 2003 |
| Syrian Arab Republic | 15 Feb 2002 | |
| Tajikistan | 21 May 2002 | |
| Thailand | 22 May 2002 | 31 Jan 2005 |
| The Former Yugoslav Republic of Macedonia | 23 May 2001 | 27 May 2004 |
| Togo | 23 May 2001 | 22 Jul 2004 |
| Tonga | 21 May 2002 | |
| Trinidad and Tobago | | 13 Dec 2002 a |
| Tunisia | 23 May 2001 | 17 Jun 2004 |
| Turkey | 23 May 2001 | |
| Tuvalu | | 19 Jan 2004 a |
| Uganda | | 20 Jul 2004 a |
| Ukraine | 23 May 2001 | |
| United Arab Emirates | 23 May 2001 | 11 Jul 2002 |
| United Kingdom of Great Britain and Northern Ireland | 11 Dec 2001 | 17 Jan 2005 |
| United Republic of Tanzania | 23 May 2001 | 30 Apr 2004 |

| Participant | Signature | Ratification, Acceptance (A), Approval (AA), Accession (a) |
|------------------------------------|-----------------------|--|
| United States of America | 23 May 2001 | |
| Uruguay | 23 May 2001 | 9 Feb 2004 |
| Vanuatu | 21 May 2002 | |
| Venezuela (Bolivarian Republic of) | 23 May 2001 | 19 Apr 2005 |
| Viet Nam | 23 May 2001 | 22 Jul 2002 |
| Yemen | 5 Dec 2001 | 9 Jan 2004 |
| Zambia | 23 May 2001 | |
| Zimbabwe | 23 May 2001 | |
| Total | 151 Signatures | 106 Parties |

Source : www.pops.int August 2005

ANNEX 2**Selection of identified dioxin sources not included in the UNEP Toolkit**

| Selection of Identified Dioxin Sources Not Included in the Toolkit's List of Sources | | | |
|--|-----------|---|-----------|
| Source | Reference | Source | Reference |
| Tire combustion | i | Accidental fires involving stockpiles of PVC | ii |
| Petroleum refining catalyst regenerators (1) | | Run-off from roads | iii |
| Tetrachlorobisphenol-A manufacture | | Thermal stabilization of sewage sludge | iv |
| Primary aluminum production | | Fireworks | v |
| Primary copper production | | Oil and gas exploration – well testing | vi |
| Drum and barrel reclamation | | Hog fuel boilers (1) | vii |
| Iron chloride manufacture | | Accidental fires involving stockpiles of tires | viii |
| Aluminum chloride manufacture | | Thermal stabilization of sewage sludge | ix |
| Copper chloride manufacture | | Rubber manufacture, vulcanization process | x |
| Phthalocyanine dyes and pigments manufacture | | Elemental chlorine manufacture, titanium electrodes (2) | xi |
| Printing inks manufacture and/or formulation | | Trichloroethylene and perchloroethylene manufacture (3) | xii |
| Carbon reactivation furnaces (industrial spent carbon and spent carbon from municipal water treatment) | | Caprolactam manufacture (intermediate for manufacture of nylon) | xiii |
| Alkylamine tetrachlorophenate manufacture | | Titanium dioxide manufacture | xiv , xv |
| Candle burning | | | |
| Municipal waste water treatment | | | |

Source: IPEN Dioxin, PCB and Waste Working Group. *Comments on the Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases*

- (1) While it is acknowledged that this process has been otherwise identified as a dioxin source, it is not included in the Toolkit's list of sources and no data are given on dioxin releases
 - (2) While this process may be assumed to be included in the subcategory, "Biomass Power Plants", it has been specifically identified in the scientific literature as well as in at least one national inventory as an important source due to high dioxin releases attributed to the high chlorine content of 'hog fuel.'
 - (3) In the text of the Toolkit, manufacture of elemental chlorine using titanium electrodes is acknowledged to be a dioxin source. However, the Toolkit's list of sources includes only chlorine production with graphite anodes.
 - (4) Manufacture of these chemicals is acknowledged as a dioxin source in the Toolkit and an emission factor is given in the text. However, these are not included in the Toolkit's list of sources
- i U.S. Environmental Protection Agency, 2000. "Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds. Part I: Estimating Exposure to Dioxin-Like Compounds, Volume 2: Sources of Dioxin-Like Compounds in the United States," and in "Part III: Integrated Summary and Risk Characterization for 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds": Final Draft. EPA/600/P-00/001Bb, September 2000.
 - ii Socha, A., Abernethy, S., Birmingham, B., Bloxam, R., Fleming, S., McLaughlin, D., Spry, D., Dobroff, F., Cornaccio, L-A., 1997. Plastimet Inc. Fire, Hamilton, Ontario. July 9-12, 1997, Ottawa, Canada: Ontario Ministry of Environment and Energy, October 1997.
 - iii Dyke, P., Foan, C., 1997. A review of dioxin releases to land and water in the UK.. *Organohalogen Cpds.* 32: 411-416.
 - iv Balzer, W., Pluschke, P. 1994. Secondary formation of PCDD/F during the thermal stabilization of sewage sludge. *Chemosphere* 29: 1889-21902.
 - v Fleischer, O., Wichmann, H., Lorenz, W., 1999. Release of polychlorinated dibenzo-p-dioxins and dibenzofurans by setting off fireworks. *Chemosphere* 39: :925-932
 - vi Nowegian Oil Industry Association, 1997. Emissions to Air and Discharges to Sea from the Norwegian Offshore. Petroleum Activities. <http://www.olf.no/en/rapporter/miljorap/1997/6.2.html>
 - vii Pandompatam, B., Kuman, Y., Guo, I., Liem, A.J. 1997. Comparison of PCDD and PCDF emissions from hog fuel boilers and hospital waste incinerators. *Chemosphere* 34:1065-1073.
 - viii Buser, H.-R., Dolezai, I.S., Wolfensberger, M., Rappe, C., 1991. Polychlorodibenzothiophenes, the sulfur analogues of the polychlorodibenzofurans identified in incineration samples. *Environ. Sci. Technol.* 25: 1637-1643.
 - ix Balzer, W., Pluschke, P. 1994. Secondary formation of PCDD/F during the thermal stabilization of sewage sludge. *Chemosphere* 29: 1889-1902.
 - x Lexen, K., de Wit, C., Jansson, B., Kjeller, L-O., Kulp, S.E., Ljung, K., Soderstorm, G., Rappe, C., 1993. Polychlorinated dibenzo-p-dioxin and dibenzofuran levels and patterns in samples from different Swedish industries analyzed within the Swedish Dioxin Survey. *Chemosphere* 27: 163-170.
 - xi Environment Ministry of Lower Saxony., Press Release., March 22 1994., No 77/94.
 - xii Wenborn, M., King, K., Buckley-Golder, D., Gascon, J., 1999. Releases of Dioxins and Furans to Land and Water in Europe. Final Report. Report produced for Landesumweltamt Nordrhein-Westfalen, Germany on behalf of European Commission DG Environment. September 1999.
 - xiii Kawamoto, K., 2002. New sources of dioxins in industrial processes and their influences on water quality. *Organohalogen Cpds.* 56: 229-232.
 - xiv U.S. Environmental Protection Agency, 2001, Final Titanium Dioxide Listing Background Document for the Inorganic Chemical Listing Determination. U.S. Environmental Protection Agency, Washington, D.C.
 - xv Wenborn, M., King, K., Buckley-Golder, D., Gascon, J., 1999. Releases of Dioxins and Furans to Land and Water in Europe. Final Report. Report produced for Landesumweltamt Nordrhein-Westfalen, Germany on behalf of European Commission DG Environment. September 1999.

ANNEX 3
Pesticides Known or Suspected to be Accompanied by PCDD/F Formation During Manufacture

| Common Name | Pesticide | Chemical Abstract Service Number | Source |
|--------------------------|---|----------------------------------|--------|
| | Dichlorodifluoromethane | 75-71-8 1 | 1 |
| Bromophos | O-(4- Bromo- 2,5- dichlorophenyl) O, O- dimethyl phosphorothioate | 2104-96-3 | 1 |
| | Dimethylamine 2,3,5- triiodobenzoate | 17601-49-9 | 1 |
| Neburon | | 555-37-3 | 1 |
| Crufomate | | 299-86-5 | 1 |
| | MCPB, 4- butyric acid [4-(2- Methyl- 4- chlorophenoxy) butyric acid] | 94-81-5 | 1 |
| | MCPB, Na salt [Sodium 4-(2- methyl- 4- chlorophenoxy) butyrate] | 6062- 26- 6 | 1 |
| | 4- Chlorophenoxyacetic acid | 122- 88- 3 | 1 |
| Chloroxuron | | 1982- 47- 4 | 1 |
| Dichlobenil | | 1194- 65- 6 | 1 |
| Propanil | 3', 4'- Dichloropropionanilide | 709- 98- 8 | 1 |
| Dichlofenthion | O-(2,4- Dichlorophenyl) O, O- diethyl phosphorothioate) | 97- 17- 6 | 1 |
| DDT | Dichloro diphenyl trichloroethane | 50- 29- 3 | 1 |
| Dichlone | 2,3- dichloro- 1,4- naphthoquinone | 117- 80- 6 | 1 |
| Ammonium chloramben | 3- amino- 2,5- dichlorobenzoic acid | 1076- 46- 6 | 1 |
| Sodium chloramben | 3- amino- 2,5- dichlorobenzoic acid | 1954- 81- 0 | 1 |
| Disul | Sodium 2-(2,4-dichlorophenoxy) ethyl sulfate | 136- 78- 7 | 1 |
| DCNA | 2,6- Dichloro- 4- nitroaniline | 99- 30- 9 | 1 |
| | Potassium 2-(2- methyl-4-chlorophenoxy) propionate | 1929- 86- 8 | 1 |
| MCPP, DEA Salt | Diethanolamine 2-(2- methyl- 4- chlorophenoxy) propionate | 1432- 14- 0 | 1 |
| MCPP, IOE | Isooctyl 2-(2- methyl- 4- chlorophenoxy) propionate | 28473- 03- 2 | 1 |
| Dicaphthon | O-(2- chloro- 4- nitrophenyl) O, O- dimethyl phosphorothioate | 2463- 84- 5 | 1 |
| Monuron trichloroacetate | 3-(4- chlorophenyl)- 1,1- dimethylurea trichloroacetate | 140- 41- 0 | 1 |
| Diuron | 3-(3,4- dichlorophenyl)- 1,1- dimethylurea | 330- 54- 1 | 1 |

| Common Name | Pesticide | Chemical Abstract Service Number | Source |
|----------------------------|---|----------------------------------|--------|
| Linuron | 3-(3,4- dichlorophenyl)- 1- methoxy- 1- methylurea | 330- 55- 2 | 1 |
| Metobromuron | 3-(p- bromophenyl)- 1- methoxy- 1- methylurea | 3060- 89- 7 | 1 |
| Methyl parathion | O, O- Dimethyl O- p- nitrophenyl phosphorothioate | 298- 00- 0 | 1 |
| Dichlorophene | Sodium 2,2'- methylenebis(4- chlorophenate) | 97- 23- 4 | 1 |
| Dichlorophene, sodium salt | Sodium 2,2'- methylenebis(4- chlorophenate) | 10254- 48- 5 | 1 |
| | 1,2,4,5- Tetrachloro- 3- nitrobenzene | 117- 18- 0 | 1 |
| Ethyl parathion | O, O- diethyl O- p- nitrophenyl phosphorothioate | 56- 38- 2 | 1 |
| Carbophenothion | S-(((p- chlorophenyl) thio) methyl) O, O- diethyl phosphorodithioate | 786- 19- 6 | 1 |
| Ronnel | O, O- dimethyl O-(2,4,5- trichlorophenyl) phosphorothioate | 229- 84- 3 | 1 |
| Mitin FF | Sodium 5- chloro- 2-(4- chloro- 2-(3-(3,4- dichlorophenyl) ureido) phenoxy) benzenesulfonate | 3567- 25- 7 | 1 |
| | Orthodichlorobenzene | 95- 50- 1 | 1 |
| | Paradichlorobenzene | 106- 46- 7 | 1 |
| Chlorophene | 2- Benzyl- 4- chlorophenol | 120- 32- 1 | 1 |
| | Potassium 2- benzyl- 4- chlorophenate | 35471- 49- 9 | 1 |
| | Sodium 2- benzyl- 4- chlorophenate | 3184- 65- 4 | 1 |
| | Chlorophenol | 95- 57- 8 | 1 |
| | 2- Chloro- 4- phenylphenol | 92- 04- 6 | 1 |
| | Potassium 2- chloro- 4- phenylphenate | 18128- 16- 0 | 1 |
| | 4- Chloro- 2- phenylphenol | not available | 1 |
| | 4- Chloro- 2- phenylphenol, potassium salt | 53404- 21 | 1 |
| | 6- Chloro- 2- phenylphenol | 85- 97- 2 | 1 |
| | 6- Chloro- 2- phenylphenol, potassium salt | 18128- 17- 1 | 1 |
| | 4- Chloro- 2- phenylphenol, sodium salt | 10605- 10- 4 | 1 |
| | 6- Chloro- 2- phenylphenol, sodium salt | 10605- 11- 5 | 1 |

| Common Name | Pesticide | Chemical Abstract Service Number | Source |
|-------------------|---|----------------------------------|--------|
| | 4 and 6- Chloro- 2- phenylphenol, diethanolamine salt | 53537- 63- 6 | 1 |
| | 2- Chloro- 4- phenylphenol, sodium salt | 31366- 97- 9 | 1 |
| | 4- Chloro- 2- cyclopentylphenol | 13347- 42- 7 | 1 |
| Fentichlor | 2,2'- Thiobis(4- chloro- 6- methylphenol) | 4418- 66- 0 | 1 |
| Fentichlor | 2,2'- Thiobis(4- chlorophenol)] 5 | 97- 24- | 1 |
| | 4- Chloro- 2- cyclopentylphenol, potassium salt of | 35471- 38- 6 | 1 |
| | 4- Chloro- 2- cyclopentylphenol, sodium salt | 53404- 20- 9 | 1 |
| Chlorophacinone | | 3691- 35- 8 | 1 |
| ADBAC | Alkyl* dimethyl benzyl ammonium chloride *(50% C14, 40% C12, 10% C16) | 68424- 85- 1 | 1 |
| ADBAC | Alkyl* dimethyl 3,4- dichlorobenzyl ammonium chloride *(61% C12, 23% C14, 11% C16, 5% C18) | not available | 1 |
| Niclosamide | 2- Aminoethanol salt of 2', 5- dichloro- 4'- nitrosalicylanilide | 1420- 04- 8 | 1 |
| | 5- Chlorosalicylanilide | 4638- 48- 6 | 1 |
| | 2- Methyl- 4- isothiazolin- 3- one | not available | 1 |
| Tetradifon | 4- chlorophenyl 2,4,5- trichlorophenyl sulfone | 116- 29- 0 | 1 |
| Chloranil | tetrachloro- p- benzoquinone | 118- 75- 2 | 1 |
| | 6- Chlorothymol | 89- 68- 9 | 1 |
| Anilazine | 2,4- Dichloro- 6-(o- chloroanilino)- s- triazine | 101- 05- 3 | 1 |
| Chlorothalonil | Tetrachloroisophthalonitrile | 1897- 45- 6 | 1 |
| Fenac, Chlorfenac | Sodium 2,3,6- Trichlorophenylacetate | 2439- 00- 1 | 1 |
| Chlorfenvinphos | | 470- 90- 6 | 1 |
| | O-(2- Chloro- 1-(2,5- dichlorophenyl) vinyl) O, O- diethyl phosphorothioate | 1757- 18- 2 | 1 |
| PCMX | 4- Chloro- 3,5- xlenol | 88- 04- 0 | 1 |
| Piperalin | 3-(2- Methylpiperidino) propyl 3,4- dichlorobenzoate | 3478- 94- 2 | 1 |
| Fenamiphos | | not available | 1 |

| Common Name | Pesticide | Chemical Abstract Service Number | Source |
|--------------------------------|---|----------------------------------|--------|
| | p- Chlorophenyl diiodomethyl sulfone | 20018- 12- 6 | 1 |
| Metribuzin | | 21087- 64- 9 | 1 |
| Bifenox | methyl 5-(2,4- dichlorophenoxy)- 2- nitrobenzoate | 42576- 02- 3 | 1 |
| Methazole | 2-(3,4- dichlorophenyl)- 4- methyl- 1,2,4- oxadiazolidine- 3,5- dione | 20354- 26- 1 | 1 |
| Diflubenzuron | N-(((4- chlorophenyl) amino) carbonyl)- 2,6- difluorobenzamide | 35367- 38- 5 | 1 |
| Oxadiazon | 2-Tert- butyl- 4-(2,4- dichloro- 5- isopropoxyphenyl)- delta 2 - 1,3,4- oxadiazoline- 5- one] | 19666- 30- 9 | 1 |
| Fenvalerate | | 51630- 58- 1 | 1 |
| Fluvalinate | N- 2- Chloro- 4- trifluoromethyl) phenyl- DL- valine (+)- cyano(3- phenoxy- phenyl) methyl ester | 69409- 94- 5 | 1 |
| Iprodione | 3-(3,5- Dichlorophenyl)- N-(1- methylethyl)- 2,4- dioxo- 1- | | |
| imidazolidinecarboxamide (9CA) | | 36734- 19- 7 | 1 |
| Triadimefon | 1-(4- Chlorophenoxy)-3,3-dimethyl-1-(1H-1,2,4-triazol-1-yl)- 2- butanone | 43121- 43- 3 | 1 |
| Diclofop - methyl | Methyl 2-(4-(2,4- dichlorophenoxy) phenoxy) propanoate | 51338- 27- 3 | 1 |
| Profenofos | O-(4- Bromo- 2- chlorophenyl)- O- ethyl S- propyl phosphorothioate | 41198- 08- 7 | 1 |
| Oxyfluorfen | 2- chloro- 1-(3- ethoxy- 4- nitrophenoxy)- 4-(trifluoromethyl) benzene | 42874- 03- 3 | 1 |
| Imazalil | 1-(2-(2,4- Dichlorophenyl)- 2-(2- propenyloxy) ethyl)- 1H- imidazole | 35554- 44- 0 | 1 |
| Bromothalin | N- Methyl- 2,4- dinitro- n-(2,4,6- tribromophenyl)- 6- | | |
| (trifluoromethyl) benzenamine | | 63333- 35- 7 | 1 |
| Vinclozolin | 3-(3,5- Dichlorophenyl)- 5- ethenyl- 5- methyl- 2,4- oxazolidinedione (9CA) | 50471- 44- 8 | 1 |
| Fenridazon | Potassium 1-(p- chlorophenyl)- 1,4- dihydro- 6- methyl- 4- oxo- pyridazine- 3- carboxylate | 83588- 43- 6 | 1 |
| Tridiphane | 2-(3,5- Dichlorophenyl)- 2-(2,2,2- trichloroethyl) oxirane | 58138- 08- 2 | 1 |
| Paclbutrazol | | 76738- 62- 0 | 1 |
| Linalool | | 78- 70- 6 | 1 |
| | [a-(2- chlorophenyl)- a-(4- chlorophenyl)- 5- pyrimidinemethanol] | 60168- 88- 9 | 1 |
| Dicamba dimethylamine | [3,6- dichloro- o- anisic acid] | 2300- 66- 5 | 1 |

| Common Name | Pesticide | Chemical Abstract Service Number | Source |
|------------------------|--|----------------------------------|--------|
| Diethanolamine dicamba | [3,6- dichloro- 2- anisic acid] | 25059- 78- 3 | 1 |
| 2,4-D | 2,4- Dichlorophenoxyacetic acid | 94- 75- 7 | 1 |
| | Lithium 2,4- dichlorophenoxyacetate | 3766- 27- 6 | 1 |
| | Potassium 2,4- dichlorophenoxyacetate | 14214- 89- 2 | 1 |
| | Sodium 2,4- dichlorophenoxyacetate | 2702- 72- 9 | 1 |
| | Ammonium 2,4- dichlorophenoxyacetate | 2307- 55- 3 | 1 |
| | Alkanol* amine 2,4- dichlorophenoxyacetate *(salts of the ethanol and isopropanol series) | not available | 1 |
| | Alkyl* amine 2,4- dichlorophenoxyacetate *(100% C12) | 2212- 54- 6 | 1 |
| | Alkyl* amine 2,4- dichlorophenoxyacetate *(100% C14) | 28685- 18- 9 | 1 |
| | Alkyl* amine 2,4- dichlorophenoxyacetate *(as in fatty acids of tall oil) | not available | 1 |
| | Diethanolamine 2,4- dichlorophenoxyacetate | 5742- 19- 8 | 1 |
| | Diethylamine 2,4- dichlorophenoxyacetate | 20940- 37- 8 | 1 |
| | Dimethylamine 2,4- dichlorophenoxyacetate | 2008- 39- 1 | 1 |
| | N, N- Dimethyleylamine 2,4- dichlorophenoxyacetate | 53535- 36- 7 | 1 |
| | Ethanolamine 2,4- dichlorophenoxyacetate | 3599- 58- 4 | 1 |
| | Heptylamine 2,4- dichlorophenoxyacetate | 37102- 63- 9 | 1 |
| | Isopropanolamine 2,4- dichlorophenoxyacetate | 6365- 72- 6 | 1 |
| | Isopropylamine 2,4- dichlorophenoxyacetate | 5742- 17- 6 | 1 |
| | Morpholine 2,4- dichlorophenoxyacetate | 6365- 73- 7 | 1 |
| | N- Oleyl- 1,3- propylenediamine 2,4- dichlorophenoxyacetate | 2212- 59- 1 | 1 |
| | Octylamine 2,4- dichlorophenoxyacetate | 2212- 53- 5 | 1 |
| | Triethanolamine 2,4- dichlorophenoxyacetate | 2569- 01- 9 | 1 |
| | Triethylamine 2,4- dichlorophenoxyacetate | 2646- 78- 8 | 1 |
| | Triisopropanolamine 2,4- dichlorophenoxyacetate | 32341- 80- 3 | 1 |

| Common Name | Pesticide | Chemical Abstract Service Number | Source |
|-------------|--|----------------------------------|--------|
| | N, N- Dimethyl oleyl- linoleyl amine 2,4- dichlorophenoxyacetate | 55256- 32- 1 | 1 |
| | Butoxyethoxypropyl 2,4- dichlorophenoxyacetate | 1928- 57- 0 | 1 |
| | Butoxyethyl 2,4- dichlorophenoxyacetate | 1929- 73- 3 | 1 |
| | Butoxypropyl 2,4- dichlorophenoxyacetate | 1928- 45- 6 | 1 |
| | Butyl 2,4- dichlorophenoxyacetate | 94- 80- 4 | 1 |
| | Isobutyl 2,4- dichlorophenoxyacetate | 1713- 15- 1 | 1 |
| | Isooctyl(2- ethylhexyl) 2,4- dichlorophenoxyacetate | 1928- 43- 4 | 1 |
| | Isooctyl(2- ethyl- 4- methylpentyl) 2,4- dichlorophenoxyacetate | 25168- 26- 7 | 1 |
| | Isooctyl(2- octyl) 2,4- dichlorophenoxyacetate | 1917- 97- 1 | 1 |
| | Isopropyl 2,4- dichlorophenoxyacetate | 94- 11- 1 | 1 |
| | Propylene glycol butyl ether 2,4- dichlorophenoxyacetate | 1320- 18- 9 | 1 |
| | 4-(2,4- Dichlorophenoxy) butyric acid | 94- 82- 6 | 1 |
| | Sodium 4-(2,4- dichlorophenoxy) butyrate | 10433- 59- 7 | 1 |
| | Dimethylamine 4-(2,4- dichlorophenoxy) butyrate | 2758- 42- 1 | 1 |
| | Butoxyethanol 4-(2,4- dichlorophenoxy) butyrate | 32357- 46- 3 | 1 |
| | Butyl 4-(2,4- dichlorophenoxy) butyrate | 6753- 24- 8 | 1 |
| | Isooctyl 4-(2,4- dichlorophenoxy) butyrate | 1320- 15- 6 | 1 |
| | 2-(2,4- Dichlorophenoxy) propionic acid (Dichlorprop, 2,4-DP) | 120- 36- 5 | 1 |
| | Dimethylamine 2-(2,4- dichlorophenoxy) propionate | 53404- 32- 3 | 1 |
| | Butoxyethyl 2-(2,4- dichlorophenoxy) propionate | 53404- 31- 2 | 1 |
| | Isooctyl 2-(2,4- dichlorophenoxy) propionate | 28631- 35- 8 | 1 |
| | [2-(2- Methyl- 4- chlorophenoxy) propionic acid] | 7085- 19- 0 | 1 |
| MCPPP, DMA | Dimethylamine 2-(2- methyl- 4- chlorophenoxy) propionate | 32351- 70- 5 | 1 |
| Bromoxynil | 3,5- Dibromo- 4- hydroxybenzoxynil | 1689- 84- 5 | 1 |

| Common Name | Pesticide | Chemical Abstract Service Number | Source |
|---------------------------------|---|----------------------------------|--------|
| Hexachlorophene | 2,2'- Methylenebis(3,4,6- trichlorophenol) | 70- 30- 4 | 1 |
| Hexachlorophene, sodium salt | Monosodium 2,2'- methylenebis(3,4,6- trichlorophenate) | 5736- 15- 2 | 1 |
| Hexachlorophene, potassium salt | Potassium 2,2'- methylenebis(3,4,6- trichlorophenate) | 67923- 62- 0 | 1 |
| Irgasan | 5- Chloro- 2-(2,4- dichlorophenoxy) phenol | 3380- 34- 5 | 1 |
| | Tetrachlorophenols | 25167- 83- 3 | 1 |
| | Tetrachlorophenols, sodium salt | 25567- 55- 9 | 1 |
| | Tetrachlorophenols, alkyl* amine salt*(as in fatty acids of coconut oil) | not available | 1 |
| | Tetrachlorophenols, potassium salt | 53535- 27- 6 | 1 |
| Bithionolate sodium | Disodium 2,2'- thiobis(4,6- dichlorophenate) | 6385- 58- 6 | 1 |
| Phenachlor | 2,4,6- Trichlorophenol | 88- 06- 2 | 1 |
| | Potassium 2,4,6- trichlorophenate | 2591- 21- 1 | 1 |
| | 2,4,6- Trichlorophenol, sodium salt | 3784- 03- 0 | 1 |
| Phenothiazine | | 92- 84- 2 | 1 |
| Dacthal- DCPA | Dimethyl tetrachloroterephthalate | 1861- 32- 1 | 1 |
| Endosulfan | Hexachlorohexahydromethano- 2,4,3- benzodioxathiepin- 3- oxide | 115- 29- 7 | 1 |
| Silvex | 2-(2,4,5-Trichlorophenoxy) propionic acid | 93- 72- 1 | 1 |
| Tetrachlorvinphos | 2- Chloro- 1-(2,4,5- trichlorophenyl) vinyl dimethyl phosphate | 961- 11- 5 | 1 |
| Edolan | Sodium 1,4', 5'- trichloro- 2'-(2,4,5- trichlorophenoxy) | | |
| methanesulfonaniilide | | 69462- 14- 2 | 1 |
| 2,4-DB | 4-(2,4-Dichlorophenoxy)butanoic acid and its salts | | 2 |
| 2,4,5-T | 2,4,5-Trichlorophenoxyacetic acid, its esters and salts | | 2 |
| | Dimethyl-(2,3,5,6-tetrachloro-1,4-benzodicarbonate) | | 2 |
| MCPA | 4-Chloro-2-methylphenoxy acetic acid | | 2 |
| Chloroneb | 1,4-Dichloro-2,5-dimethoxybenzene | | 2 |

| Common Name | Pesticide | Chemical Abstract Service Number | Source |
|-------------|---|----------------------------------|--------|
| Erbone | 2(2,4,5-Trichlorophenoxy)-ethyl-2,2,-dichloropropionate | | 2 |
| Daconil | 1,3-dicyano-2,4,5,6-tetrachlorobenzene | | 2 |

Sources:

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2. Bretthauer, E., Kraus, H., di Domenico, A. 1991. *Dioxin Perspectives: A Pilot Study on International Exchange on Dioxins and Related Compounds*. New York: Plenum Press.

ANNEX 4
Commercial Chemicals Known or Suspected to be Accompanied by Dioxin Formation During Their Manufacture

| Chemical | Reference |
|--|-----------|
| Dioxins are Known By-Products During Manufacture | |
| Chlorine | (1) |
| Sodium hypochlorite (bleach) | (2) |
| Ethylene dichloride (1,2-dichloroethane; vinyl chloride monomer) | (3) |
| Epichlorohydrin | (4) |
| Trichloroethylene | (5) |
| Perchloroethylene (tetrachloroethylene) | |
| Hexachlorobutadiene | (6) |
| Chlorobenzenes | |
| Dichlorobenzene | |
| Trichlorobenzene | |
| 1,2,4,5-Tetrachlorobenzene | |
| Pentachlorobenzene | |
| Hexachlorobenzene | |
| Chlorophenols | |
| 2,4,5-Trichlorophenol | (7) |
| 2,4,5-Trichlorophenol, sodium salt | (8) |
| 2,4,6-Trichlorophenol | (9) |
| 2,4,6-Trichlorophenol, sodium salt | (10) |
| 2,3,4,6-Tetrachlorophenol | (11) |
| 2,3,4,6-Tetrachlorophenol, sodium salt | (12) |
| Pentachlorophenol | (13) |
| Polychlorinated biphenyls (PCBs) | (14) |
| 4-Chlorotoluene | (15) |

| Chemical | Reference |
|--|-----------|
| Chloranil (2,3,5,6-tetrachloro-2,5-cyclohexadiene-1,4-dione) | (16) |
| Dioxazine dyes (Direct Blue 106, Direct Blue 108, and Violet 23) | (17) |
| Ni-phthalocyanine dye | (18) |
| Printing inks (unidentified) | (19) |
| Metal Chlorides | |
| Aluminum chloride | (20) |
| Ferric chloride | |
| Cuprous chloride | |
| Cupric chloride | |
| High Probability of Dioxin Formation During Manufacture | |
| Chlorophenols | |
| o-Chlorophenol | (21) |
| 2,3-Dichlorophenol | |
| 2,4-Dichlorophenol | |
| 2,5-Dichlorophenol | |
| 2,6-Dichlorophenol | |
| 3,4-Dichlorophenol | |
| 4-Chlororesorcinol | |
| 4-Bromo-2,5-dichlorophenol | |
| 2-Chloro-4-fluorophenol | |
| 2-Chloro-4-phenylphenol | |
| Chlorohydroquinone | |
| 2-Chloro-1,4-diethoxy-5-nitrobenzene | |
| 5-Chloro-2,4-dimethoxyaniline | |
| 3,5-Dichlorosalicylic acid | |

| Chemical | Reference |
|---|-----------|
| Possible or Likely Dioxin Formation During Manufacture | |
| Chlorobenzenes | |
| o-Dichlorobenzene | (22) |
| 1,2,4-Trichlorobenzene | |
| 1,2,4,5-Tetrachlorobenzene | |
| Hexachlorobenzene | |
| o-Chlorofluorobenzene | |
| 3-Chloro-4-fluoronitrobenzene | |
| Chloropentafluorobenzene | |
| 1,2-Dichloro-4-nitrobenzene | |
| Chlorophenols | |
| 3-Chloro-4-fluorophenol | (23) |
| 4-Chloro-2-nitrophenol | |
| o-Benzyl-p-chlorophenol | (24) |
| 2,3,6-Trichlorobenzoic acid | |
| 2,3,6-Trichlorophenylacetic acid, and sodium salt | |
| 3,4-Dichloroaniline | (25) |
| 3,4-Dichlorobenzaldehyde | (26) |
| 3,4-Dichlorobenzotrichloride | |
| 3,4-Dichlorobenzotrifluoride | |
| 3,4-Dichlorophenylisocyanate | |
| Pentachlorocyclohexane | |
| Pentachloroaniline | |
| Pentabromochlorocyclohexane | |
| Tetrachlorophthalic anhydride | |
| *Phenol (from chlorobenzene) | |

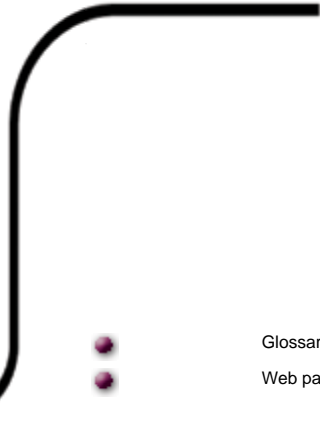
| Chemical | Reference |
|--|-----------|
| *1,2-Dihydroxybenzene-3,5-disulfonic acid, disodium salt | |
| *2,5-Dihydroxybenzenesulfonic acid | |
| *2,5-Dihydroxybenzenesulfonic acid, potassium salt | |
| *2,4-Dinitrophenol | |
| *2,4-Dinitrophenoxyethanol | |
| *3,5-Dinitrosalicylic acid | |
| *o-Nitroanisole | |
| *2-Nitro-p-cresol | |
| *o-Nitrophenol | |
| *2,4,6-Trinitroresorcinol | |
| *Fumaric acid | |
| *Maleic acid | |
| *Maleic anhydride | |
| *o-Phenetidine | |
| *Phenyl ether | |
| *Phthalic anhydride | |
| *Picric acid | |
| *Sodium picrate | |

*Non-chlorinated chemicals produced via routes involving chlorinated chemicals.

- 1) Strandell, M., Lexen, K., deWit, C., Jamberg, U., Jansson, B., Kjeller, L., Kulp, E. Ljung, K., Soderstrom, G., Rappe, C. 1994. The Swedish Dioxin Survey: Summary of results from PCDD/F and coplanar PCB analyses in source-related samples. *Organohalogen Cpd*s 20: 363-366.
- 2) Rappe, C., Andersson, R., Lundstrom, K., Wiberg, K. 1990. Levels of polychlorinated dioxins and dibenzofurans in commercial detergents and related products. *Chemosphere* 21: 43-50.
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- 5) Environment Agency. 1997. *Regulation of dioxin releases from the Runcorn operations of ICI and EVC. Information report.* United Kingdom, January 1997.
- 6) Hutzinger, O., Fiedler, H. 1991. *op cit.*
- 7) U.S. Environmental Protection Agency. 1998. *op cit.*
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- 9) Firestone, D., Ress, J., Brown, N., Barron, R., Damico, J. 1972. *op. cit.*
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- 11) Firestone, D., Ress, J., Brown, N., Barron, R., Damico, J. 1972. *op. cit.*
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- 14) Hutzinger, O., Fiedler, H. 1991. *op.cit.*
- 15) Bretthauer, E., Kraus, H., di Domenico, A. 1991. *Dioxin Perspectives: A Pilot Study on International Exchange on Dioxins and Related Compounds.* New York: Plenum Press.
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- 18) Hutzinger, O., Fiedler, H. 1991. *op. cit.*
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- 20) Hutzinger, O., Fiedler, H. 1991. *op. cit.*
- 21) Esposito, M., Tiernan, T., Dryden, F. 1980. *Dioxins.* EPA-600/2-80-197, Washington, D.C.: U.S. Environmental Protection Agency.
- 22) Esposito, M., Tiernan, T., Dryden, F. 1980. *op. cit.*
- 23) *Ibid.*
- 24) Anonymous. 1985. Pesticides 'Possibly Contaminated with Dioxins' List Compiled in OPP," *Pesticide and Toxic Chemical News*, pp. 34-38, February 20, 1985.
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Glossary



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GLOSSARY

Bioaccumulation

The process through which a substance accumulates in the tissues of living organisms over time. When POP-contaminated food is ingested, the toxic substance is not easily degraded or excreted by the organism and thus accumulates over the years.

Biomagnification

The process that results in higher concentrations of toxic substances in organisms at higher levels in the food chain or at higher trophic levels.

Persistent Organic Pollutants (POPs)

Chemical substances with the following characteristics: they are toxic in small amounts, provoking a wide range of irreversible harmful effects on health; they remain in the environment for a long period of time; they often accumulate and biomagnify in living organisms; and they can travel long distances. Because of these characteristics, they can be found in the tissues of human beings and wildlife around the world.

Congeners

This term refers to the diverse variants or configurations, in number and position, of a group of compounds with the same chemical structure. For example, PCBs occur in 209 different forms or congeners. Each congener has two or more atoms of chlorine located at specific sites on the PCB molecule.

Dioxins

This is the short name for a class of 75 chemical substances referred to as polychlorinated dibenzo-p-dioxins, of which seven are highly toxic and the most toxic is 2,3,7,8-tetrachlorodibenzo-p-dioxin, abbreviated as TCDD. Dioxins are not produced as commercial products, but are rather unintentionally formed through the combustion of chlorinated compounds and through diverse industrial processes. When reference is made to dioxins and other compounds with similar toxicity, furans and PCBs are also included. Dioxins and dioxin-like compounds can cause cancer in humans and have been linked to a wide variety of illnesses, since they are endocrine disruptors and they affect the development of intelligence, the immunological system, and reproduction, as well as other aspects of health.

Endocrine disruptors

This term refers to chemical substances that mimic or block hormones in cell receptors. Hormones are chemical messengers that are segregated according to type of endocrine gland (thyroid, testicles, suprarenal gland, and others) and travel in the blood to highly subtle and precise cell receptors. Endocrine disruption can lead to serious reproductive problems, nervous system disturbances, a depressed immunological system, and changes in sexual conduct. Most of the POPs included in the Stockholm Convention are endocrine disruptors.

Furans

This is the short name for a group of 135 substances referred to as polychlorinated dibenzo-furans (PCDF), of which ten have a similar toxicity as dioxins (see Dioxins).

Lipid

This is a biological molecule that does not dissolve in water. A lipid is generally known as a fat or fatty substance. A substance is referred to as "liposoluble" if it dissolves more easily in fat than in water, and such a substance tends to accumulate in organisms. POPs are generally liposoluble (see bioaccumulation).

Organic

Chemical substances are labeled as organic if they have carbon or hydrogen atoms in their molecular structure. One or more of the hydrogen atoms in their chemical structure can be replaced by other elements such as chlorine, oxygen, nitrogen and various metals.

Organochlorine

Any organic chemical substance that contains chlorine atoms in its molecule.

Organohalogen

An organic chemical substance that contains halogen atoms in its molecule. Halogen is a type of nonmetallic chemical element that includes chlorine, bromine, iodine, fluorine and astatine.

PCBs or polychlorinated biphenyls

PCBs refer to a family of 209 congeners with a similar chemical structure, of which 13 have a level of toxicity similar to the TCDD dioxin. These are industrial products that were previously used as insulating oils, primarily in transformers and other electrical equipment.

PCDD

Polychlorinated dibenzo-p-dioxins (see Dioxins).

PCDF

Polychlorinated dibenzo-furans (see Furans).

TCDD or tetrachlorodibenzo-p-dioxin

TCDD or 2,3,7,8-tetrachlorodibenzo-p-dioxin is a dioxin variant or congener that has four chlorine atoms on each molecule. TCDD is the most toxic of all dioxins, and serves as a point of reference for comparing the toxicity of other congeners and similar substances.

TEF or Toxic Equivalency Factor

This is a numeric index used to compare the toxicity of the various dioxin congeners and dioxin-like substances. TCDD, the most toxic of all dioxins, is used as a point of reference and is assigned the value of 1 TEF. Substances with similar toxicity as a dioxin are assigned a fractioned value of TEF. For example, a substance with a value of 0.5 TEF is half as toxic as TCDD.

TEQ or Toxic Equivalence

This is the measurement of dioxin-like toxicity in a complex combination of dioxin-like substances. TEQ is calculated by first measuring the amount of each congener or substance present in the sample. The amount measured is multiplied by the Toxic Equivalency Factor (TEF) of each congener or substance, and the results are added together. The sum is expressed as an amount of TEQ. This amount is a general approximation of the amount of 2,3,7,8 TCDD that could present the same dioxin-like toxicity. The measurement is only an approximation since TEFs are not precise. Combinations do not always present the same toxicity as the sum of its parts, and all the dioxin-like substances found in the combination are not always measured.

Half-life

This refers to the time necessary for half of the substance analyzed to degrade in a specific substrate, whether water, soil or sediment. For example, when we say that DDT has a soil half-life of more than 15 years, this means that half of the total substance will remain for this period of time; that 25% will still be present for twice as much time, or 30 years; and that 12.25% of the DDT will still be present in the soil for three times as much time, or 45 years.

Source: adapted from *The Greenpeace Guide to Persistent Organic Pollutants USA n/d*; Fernando Bejarano, Amenaza Global, Cuaderno Ciudadano sobre Contaminantes Orgánicos Persistentes, Mexico, RAPAM, 2000.

Web pages

International Conventions:

Aarhus Convention (Convention on Access to Information, Public Participation in Decision-making, and Access to Justice in Environmental Matters). United Nations Economic Commission for Europe (ECE).
<http://www.unece.org/env/pp/welcome.html>

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes
<http://www.basel.int>

Stockholm Convention on Persistent Organic Pollutants (POPs)
<http://www.pops.int>

Stockholm Convention, National Implementation Plans approved by GEF
<http://www.gefonline.org/home.cfm>

Rotterdam Convention
<http://www.pic.int>

International Entities

Africa Stockpiles Program
<http://www.africastockpiles.org>

Commission for Environmental Cooperation (CEC)
See regional management plans for the United States, Canada and Mexico on DDT, PCBs, dioxins and furans
<http://www.cec.org>

United Nations Food and Agriculture Organization (FAO)
Guidelines for the elimination of obsolete pesticides in developing countries:
<http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGP/AGPP/Pesticid/Disposal/default.htm>

Global Environmental Facility (GEF)
<http://www.unep.org/gef>

Intergovernmental Forum on Chemical Safety (IFCS)
<http://www.ifcs.ch>

Global Harmonized System (GHS) for Labeling and Classifying Chemical Substances
<http://www.unece.org/trans/dabger/publi/ghs.html>

UNIDO, United Nations Industrial Development Organization
<http://www.unido.org>

UNIDO, Cleaner Production Systems
<http://www.unido.org/cp>

UNEP, United Nations Environment Program, Chemicals Division. Information on POPs. Inventories of Dioxin and Furan Releases.

<http://www.chem.unep.ch/pops>

Pollutant Release and Transfer Register. European Union. Contains emissions inventories in 16 European countries.

<http://www.eper.cec.eu.int/eper/>

SAICM, Report on first United Nations meeting to discuss the Strategic Approach to International Chemicals Management (SAICM)

<http://www.chem.unep.ch/saicm/>

UNITAR, United Nations Institute for Training and Research

<http://www.unitar.org>

UNDP, United Nations Development Program

<http://www.undp.org>

Environmental and health organizations linked to POPs

Global Alliance for Incineration Alternatives (GAIA)

<http://www.no-burn.org>

Basel Action Network

Citizen organization that monitors the Basel Convention.

<http://www.ban.org>

Chemical Body Burden

<http://www.chemicalbodyburden.org>

Center for Health, Environment and Justice (CHEJ)

Conducts the "Be Safe" campaign for preventing contamination.

<http://www.chej.org>

CHEJ. People's report on dioxins, including a technical report, can be downloaded at no cost from <http://www.safealternatives.org/peoplesreport.html>

Clean Production Action

Group that promotes Clean Production. The web page explains its components in simple terms, and offers examples of public policies and companies that implement Clean Production.

<http://www.cleanproduction.org>

Grassroots Recycling Network, USA

Has produced a "Citizens Guide for Zero Waste" based on experience in the United States and Canada.

<http://www.grrn.org/zerowaste/community>

Greenpeace International
<http://www.greenpeace.org>

Greenpeace, United States
See reports on dioxins, PVC, incineration.
<http://www.greenpeace.org/-usa>

Greenpeace Argentina
Has reports on impacts from incineration and landfills.
<http://www.greenpeace.org.ar/>

Greenpeace Mexico
www.greenpeace.org.mx

Health Care Without Harm (HCWH)
Medical waste management and alternatives to incineration.
<http://www.no-harm.org>

Instituto Sindical de Trabajo, Ambiente y Salud (ISTAS, or the Labor Union Institute on Work, the Environment and Health). Autonomous foundation promoted by the *Confederación Sindical de Comisiones Obreras* (Labor Union Confederation of Workers' Commissions) in Spain.
Provides courses and brochures on PCBs, endocrine disruptors and the application of the precautionary principle.
<http://www.istas.ccoo.es>

Lowell Center for Sustainable Production
<http://www.sustainableproduction.org> and www.chemicalspolicy.org

Our Stolen Future
Information on endocrine disruptors.
<http://www.ourstolenfuture.org>

Pesticide Action Network
Contains links to the regional centers participating in this network in Africa, Asia Pacific, Europe, Latin America and North America.
<http://www.pan-international.org>

Pesticide Action Network in North America (PANNA)
Database on pesticides.
<http://www.pesticideinfo.org>

Pesticide Action Network in Latin America (RAP-AL)
<http://www.rap-al.org>

International POPs Elimination Network (IPEN)
<http://www.ipen.org>

IPEN Community Monitoring Handbook
<http://www.oztoxics.org/cmwg/index.html>

World Wildlife Fund. Toxic Chemicals Program
<http://www.worldwildlife.org/toxics>