PROGRAM ON NEGOTIATION AT HARVARD LAW SCHOOL
AN INTER-UNIVERSITY CONSORTIUM TO IMPROVE THE THEORY AND PRACTICE OF CONFLICT RESOLUTION

THE GLOBAL MANAGEMENT OF ORGANOCHLORINES

General Information for All Participants

UNEP WORKING GROUP ON MANAGING THE GLOBAL USE OF ORGANOCHLORINES

It is 1998. Recent studies have added new weight to the mounting evidence that some organochlorine compounds may pose serious risks to human health and the environment. Taking its cue from growing international concern about the impacts of organochlorines on the global environment, the United Nations Environment Programme (UNEP) has turned its full attention to this issue. The director of UNEP has called on nations to be proactive, that is, to negotiate and ratify an international treaty to phase out some of the most harmful organochlorines.

The Director of UNEP is eager to do this in a way that improves upon the typical convention-protocol process that takes ten years or more. Indeed, the director would like to initiate a treaty development process that provides a more efficacious model for generating sound global agreements, even in the face of scientific uncertainty. From the director's standpoint, one of the most important steps is to encourage both developed and developing countries to engage in informal dialogue before they lock into formal positions and each country's range of flexibility narrows. The director's hope is that this brainstorming period will produce a treaty draft that reflects the most important concerns of all parties, while taking account of the best scientific advice available.

In a recent speech, the director said, "I am committed to sparking an open international debate about chlorine before any formal treaty negotiations begin. This will educate the international community about the effects of any ban or phase out, advance our understanding of the key provisions that must be incorporated into any convention, and, perhaps, lead to more focused action, more quickly than might otherwise be the case. It will also better prepare all countries to participate in regional as well as multilateral negotiations when the time arises."

As the first step towards initiating the most constructive international dialogue, possible, UNEP will convene an international Working Group on Managing the Global Use of Organochlorines. The Working Group's charge will be to review and improve the text of a draft treaty drawn up by UNEP consultants and staff, particularly to identify areas of agreement and disagreement, and to advise UNEP on what the next steps in the treaty drafting process ought to be. Once UNEP has produced a revised version of the proposed treaty (based on the Working Group's comments), UNEP will circulate the new draft in the hope that it can serve as a springboard for regional

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meetings, and ultimately for a global conference of some sort.

UNEP has carefully selected eight countries to participate in the informal Working Group. All have agreed to participate. They include: the United States, China, India, Brazil, the Czech Republic, Germany, Norway, and Japan. Some countries have opted to send a senior official from their Ministry of Trade, while others are sending a representative from their Ministry of Environment. In addition, UNEP has decided to include representatives of non-governmental organizations (NGOs), which have been vocal in, and have expertise relevant to the ongoing debate over organochlorines. Four international organizations have agreed to send representatives to serve on the Working Group: Green Strategies, the International Business Roundtable, the International Council of Scientific Associations, and the International Union for the Conservation of the Environment.

Today, the Working Group will meet in the first of a series of scheduled sessions. Representatives of the eight countries and the four NGOs have received background briefing materials from UNEP to help them prepare for this meeting. These materials summarize various technical studies that have shaped the global debate thus far. They also characterize the potential risks associated with the use of various organochlorines, as well as some of the assumed benefits and costs of a phase-out or ban of certain compounds.

The agenda for the initial meeting of the Working Group has also been distributed. It focuses on four issues that are central to the preliminary treaty draft prepared by UNEP. These are: **the scope of the problem, possible national and global actions that might be taken, financing strategies, and governance of the treaty regime.**

SCOPE OF THE PROBLEM

There is substantial disagreement over the risks to human health and the environment posed by organochlorines of various kinds. On the one hand, there are those who say that the scientific evidence is inconclusive. Even if some of the risk assessments are correct, they argue, the potential human health impacts are not serious enough to warrant global action. Among those who think the problem might indeed be serious, some would like to see further studies (of various kinds), while others would endorse taking precautionary action as long as it involves minimal costs and disruption. There are a few environmental activists who are convinced that the problem is terribly serious and urge that everything possible should be done quickly to reduce the risks.

POSSIBLE ACTIONS

Additional scientific assessments could be undertaken. Economic impact assessments (of the various risk-reduction strategies) might also be encouraged. Some countries feel that specific targets and timetables should be set now. One group is calling for a 25 percent reduction of all organochlorines, but prefers to leave it up to each country to figure out the most cost-effective way of achieving this goal. Another group advocates a 50 percent reduction, naming specific substances to be banned or blacklisted. Monitoring arrangements and penalty systems, although controversial, are also under discussion.

FINANCING

There are three issues at stake under the heading of financing. First, there is the question of how much money to collect from some or all of the parties to the treaty to finance both the implementation of the regime, as well as the search for chlorine substitutes. Second, there is a debate over the appropriate means of raising such funds (i.e., taxes versus licensing fees). Finally, there is the question of whether to give the money out on the basis of need (i.e., the cost of adjusting to the requirements of the treaty) or on the basis of merit (e.g., to finance the most promising new technologies).

GOVERNANCE

Some of the stake-holding parties are quite concerned about the voting procedures that will be used by the signatories to make decisions. Will everyone have an equal vote? Will the majority rule? Is a weighted regional voting system preferable? Should votes be weighted according to the impact the treaty is likely to have?

A second governance issue concerns the participation of NGOs. While NGOs have been invited to sit on the Working Group, some national representatives feel that NGOs should have no official representation in the Conference of the Parties that finally emerges, once the treaty is signed. Others feel that the signatories should designate a limited number of (responsible) NGOs to participate as observers. The NGOs, if asked, would prefer to self-select representative organizations to participate as observers if they are not allowed to participate directly as co-equal partners in both debating and voting.

MEMORANDUM

TO: UNEP WORKING GROUP
ON MANAGING THE GLOBAL USE OF ORGANOCHLORINES
FROM: UNEP
RE: Background Briefing Materials

I. INTRODUCTION

Since World War I, the use of chemicals containing chlorine has grown exponentially. As many as 15,000 chlorinated compounds exist today, some by design, and others as the unintended byproducts of manufacturing or combustion. Chlorine applications are far ranging. Chlorine compounds are used to make plastics, refine petroleum, bleach pulp and paper, produce solvents, disinfectants, and flame retardants; to do dry cleaning, process food; make paints, refrigerants, and insulation; and to treat waste water. In the U.S. (one of the only countries for which comprehensive statistics are available) chlorine is in virtually all U.S. drinking water systems, in 85 percent of pharmaceuticals, and in 96 percent of crop-protection chemicals.

The ubiquitous use of chlorine both to facilitate industrial processes and to manufacture consumer products has made it a major contributor to the economies of both developed and developing nations. Again, statistics available in the United States hint at the scale of chlorine's use globally and its resulting economic importance. A report recently prepared for the Chlorine Institute by Charles River Associates regarding the economic benefits of chlorine in the U.S. economy estimates that 1.3 million U.S. jobs, generating more than $31 billion in annual wages and salaries, depend on the chlorine industry.

However, the last decade has witnessed a dramatic increase in concern about the known and suspected impacts of these compounds on the health of animal and human populations. Many new studies suggest that some chlorine-based "bad actors" may be responsible for a host of health problems in various animal species exposed to high levels of each pollutant. In addition, there is a growing body of laboratory research which documents the tendency of organochlorines to cause cancer, disrupt endocrine systems, cause developmental defects, and weaken immune systems in the organisms exposed to them.

The new research findings have catalyzed action among advocacy groups, governmental bodies in the United States, and in numerous European nations. These groups have issued a call for a global ban on chlorine (and all its applications and derivatives). They claim that there is enough scientific evidence regarding the harm done by organochlorine pesticides, PCBs, and dioxin to warrant adopting precautionary measures. Even though the majority of chlorinated compounds have never been studied for their toxicological effects (the task of studying 15,000 compounds clearly presents enormous logistical and financial obstacles), these groups maintain that the weight of evidence warrants making logical assumptions about their likely impacts and taking precautionary measures to ensure that animal and human populations are protected.

The international chemical industry, as well as a number of scientists and scientific organizations, has decried this call for a phase-out of all chlorine compounds. First, they point out that the benefits of chlorine use in modern industrial chemistry should not be underestimated. Second, they assert that treating all organochlorines as if they had the same properties and produce the same impacts is methodologically unsound. Third, they insist that even though there may be substitutes available for some chlorinated compounds, effecting a global switch to these substitutes would produce mammoth costs and economic dislocation that cannot be absorbed by many national economies around the world.

Following is background information on the global use and potential impacts of chlorine. Section II gives a brief history of the chlorine economy, and offers current statistics on the global production of chlorine and the number of chlorine compounds currently in use. Included is a Figure, which categorizes the range of chlorinated compounds by their use. Section III describes the principal properties of organochlorine compounds that raise concern among scientists, advocacy groups, and the public. Section IV details some recent national and international institutional initiatives calling for a ban, phase out or at least sharp restrictions on the use of chlorine.

II. BRIEF HISTORY OF THE GLOBAL USE OF CHLORINE

Chlorine was added to the periodic chart of elements in 1810. However, it wasn't until after World War I that the chemical industry began relying heavily on chlorine to develop new chemicals and consumer products. This trend accelerated after World War II, when a boom economy provided the impetus for discovering thousands of new uses and applications for chlorine, ranging from pharmaceuticals to more efficient building materials. Chlorine became the centerpiece of an emerging chemical revolution, which itself was seen as the underlying force behind a rising standard of living throughout the developed world.

One of the first applications of chlorine after World War I was in the manufacture of pesticides designed to protect crops and increase agricultural productivity. DDT, or dichlor-diphenyl-trichlor-ethane is perhaps the most well known of the pesticides introduced to the global economy during this period. This insecticide was originally synthesized in the late 1800s. It wasn't until 1937, however, that its efficiency in combating insects was discovered by a Swiss chemist, who received a Nobel Prize for his discovery. Other insecticides, fungicides, and herbicides were soon invented, and chlorinated compounds quickly gained currency throughout the world in fighting tropical diseases as well as controlling pest populations.

The post-World War I period also witnessed the emergence of industrial uses for chlorine. Two chemicals containing chlorine were particularly important in fueling economic development: polychlorinated biphenyls (PCBs) and chlorofluorocarbons (CFCs). These chemicals had properties that made them attractive candidates for extensive industrial and commercial use. PCBs were distinguished by their low flammability, making them ideal for use in transformers and capacitors, which had previously been highly flammable. They were also used in vacuum pump fluids, lubricating oils, heat transfer liquids, and other industrial chemicals that facilitated consumer product manufacturing. CFCs were similarly versatile. At the time of their entrance into the market, they were thought to be nontoxic and nonreactive and were widely used as refrigerants, propellants in spray cans, blowing agents in plastic foam products, and solvents for cleaning electric parts.

After World War II, the importance of chlorine in the chemical industry grew exponentially with the development of thousands of new chemicals that either contained chlorine or relied on chlorine for their manufacture. Perhaps the most well-known application developed after World War II is polyvinyl chloride, or PVC. The versatility of PVC has been rivaled by few compounds; it is used to produce consumer products as varied as floor tiles, shoe soles, electrical insulation, automobile components, and medical equipment. Other applications for chlorine included many industrial solvents (including methylene chloride), new forms of pesticides, epoxy resins, dyes and pigments, and pharmaceuticals.

Today, more than 25 percent of the approximately 60,000 chemicals in use either contain chlorine or rely on chlorine for their production, making this element one of the most widely used industrial feedstocks in existence. Global chlorine production has now reached 38 million tons a year.

The main uses of chlorine in the current global economy fall into three categories: direct uses of chlorine, chlorine-containing consumer products, and chlorine-facilitated products. Direct uses of chlorine include water purification and pulp bleaching to produce white paper. Chlorine-containing products include PVC, as well as other plastics with uses ranging from food packaging to automotive components. This category also includes pharmaceuticals, crop protection chemicals, dry-cleaning chemicals, and chlorinated solvents, which are used in a wide variety of industrial processes for cleaning parts, or as paint strippers, adhesives, and extractants. Finally, chlorine-facilitated products include consumer products that do not themselves contain the element chlorine, but which are manufactured via a process that depends on the use of chlorine as a catalyst. Many paints, paper, plastics, and other consumer goods are produced with the aid of chlorinated compounds.

III. ENVIRONMENTAL AND PUBLIC HEALTH IMPACTS

Until 30 years ago, little was known about the potential hazards that chlorinated compounds posed to human or animal health. DDT provides a good example. Now banned in most industrialized countries and heavily restricted in many developing countries, DDT once enjoyed a flawless reputation as a highly efficient, low-cost pesticide. It was manufactured in large quantities and used all over the world for crop protection and for halting the spread of tropical diseases such as malaria. As Scientific American described the global importance of DDT in the post-war period:

> The supply of the insecticide DDT, which in the space of six years has become one of the world's necessities, almost comparable to steel and fuel, has begun to give concern to health workers. The World Health Organization last month reported developing a shortage of the chemical so serious that it threatens the breakdown of the campaign against insect-born disease, which since the end of the war has wiped out malaria in many parts of the world.

Today, global concern about the impacts of organochlorines such as DDT on the health of human and wildlife populations is growing. The following section is an encapsulated summary of what is known and what is not known about these impacts. This section begins with a basic description of chlorine chemistry, focusing on the properties of chlorine compounds, which give scientists and policymakers reason to be concerned about their release into the environment. The second section sketches some of the results of recent field and laboratory studies exploring the mechanisms by which organochlorines may affect human and animal populations.

Chemical Properties of Organochlorines

In its elemental state, chlorine appears as a pale green gas. This gas is highly toxic to plants and animals. However, it rarely occurs in this form on Earth. Elemental chlorine is highly reactive and unstable, and it quickly combines with other molecules.

Three key properties of organochlorines raise concerns about their ubiquitous use in industry and agriculture. The first is *persistence*, or the length of time during which a chemical exists in its original form without being broken down or transformed. Due to its ability to attract electrons, chlorine forms strong bonds with other atoms or molecules so that they do not break down readily once released into the environment. It is precisely this characteristic that makes chlorine so industrially useful for synthesizing other chemicals. For example, chlorine readily reacts with carbon, making carbon and chlorine one of the most versatile combinations for synthesizing other compounds. However, the bonds that form between chlorine atoms and carbon atoms are so strong that many of the chemicals synthesized with these two elements tend to persist in the environment for long periods of time.

The second characteristic of organochlorines that creates concern is *bioaccumulation*. This is the tendency of certain chemicals to accumulate in greater concentrations in biota than in the surrounding environment. Organochlorines are "lipophillic," meaning that they tend to occur in greater concentrations in fat, or lipids. This is due to their low water solubility, which makes it difficult for the body of an animal or a human to eliminate them. Illustrations of the effects of bioaccumulation can be found in the many studies of fish and wildlife in the Great Lakes, an area heavily dosed by organochlorines from the effluent of nearby industries. The tissues of Great Lakes fish contain much higher concentrations of lipophillic contaminants than the water in which they live. When these fish are eaten by animals or humans, the contaminant loading is passed on to the consuming organisms, which have a similar biological inability to get rid of it. Organisms can thereby carry much greater concentrations of environmental pollutants than occur in the environment, an effect known as *bioconcentration.* It is the combined tendency of organochlorines to persist and to bioconcentrate that produces alarm in scientists studying their effects; some of these chemicals have been found to be so persistent in humans that their half-life exceeds ten years.

The third characteristic of organochlorines which is troublesome to those who are charting their health impacts is *toxicity*. Toxicity refers to the ability of a chemical to damage an organ system or to disrupt a biochemical process. Almost every chemical has a set of exposure conditions under which it is toxic, but there is an enormous range in the amount of a substance required to produce harm and also in the extent of the harm likely to be done. The worst environmental bad actors are those which produce harm at normal environmental exposure levels.

Scientists debate the relative toxicity of the class of organochlorines as a whole. The difficulty in making a determination about their toxicity lies in the paucity of testing that has been done on individual chemicals. Because of chlorine's ability to combine with innumerable varieties of organic compounds, the number of possible organochlorines exceeds the capacity of the scientific community for testing. For example, about 97 percent of the organochlorine species produced as industrial wastes and found in the Great Lakes have not been formally characterized; far fewer have actually been tested.

However, some organochlorines have been shown to be highly toxic. Dioxins, a subfamily of organochlorines, are perhaps the most well known of these. Dioxins have no known use; they are an unintended byproduct of certain industrial processes and combustion. Scientific evidence on the toxicity of dioxins suggests that they may be among the most potent toxicants ever studied. They have produced a variety of biological effects in experimental animals at dose levels hundreds or even thousands of times lower than many of the other chemicals of environmental interest. It is these findings that have propelled some environmental groups such as Greenpeace to declare a public health emergency and call for an immediate phase out of chlorine as an industrial feedstock. Since dioxin is an unintended byproduct of the industrial use of chlorine, the only way to ensure that no dioxin is produced is to stop using chlorine in industrial processes.

Summary of Research on the Health Effects of Organochlorines

Recent proposals by governmental and non-governmental organizations to restrict the use of the roughly 15,000 organochlorines in commerce have been driven by growing scientific evidence about the adverse impacts of these compounds on public health and wildlife.

Scientists in many countries have undertaken studies aimed at exploring the connection between exposure to organochlorines and a range of health effects. Much of this research has been focused on determining whether these substances cause cancer in humans. However, in recent years scientists have broadened their focus to include a host of other potential non-cancer health effects, including developmental disorders, endocrine disruption, and immunological problems in both humans and animals.

There are two broad scientific approaches that have been used to study organochlorines. The first, an epidemiological approach, involves observations of health trends in actual animal and human populations that may have been exposed to one or multiple organochlorine compounds. These studies are hindered by a large degree of uncertainty, due to the difficulty in establishing a causal relationship between observed health trends and exposure to particular chemicals. Scientists have confronted major methodological obstacles in their attempts to isolate exposures which may have contributed to observed health effects. Nevertheless, a number of scientists around the world who have conducted such studies point to possible connections between alarming health trends and the presence of various organochlorines in the environment.

The second broad approach, involving controlled laboratory studies, explores the effects of particular substances on lab animals such as mice and rats. Here the method is to administer high doses of such substances, document their health impacts, and then extrapolate findings to actual populations under non-laboratory conditions. These studies, too, are hindered by high levels of uncertainty associated with efforts to extrapolate across species, as well as from high dose levels used in controlled laboratory settings to lower doses likely to be experienced under non-laboratory conditions.

Following is a brief summary of the recent research on the health impacts of organochlorines. We have included examples of both kinds of research described above. While this is far from an exhaustive account of the studies that have been completed, it does give a broad overview of the major research findings on organochlorines over the past decade.

Increased Incidence of Cancer

Historically, cancer has received the most attention as a possible result of exposure to organochlorines. In part, this concern has developed because of some disturbing historical trends in cancer rates. In one study sponsored by the National Research Council in the U.S., scientists documented increasing cancer rates in 20 different countries around the world, even after accounting for the aging of the population. The study reported increased mortality from multiple myeloma, prostate cancer, breast cancer, brain cancer, non-Hodgkin's lymphoma, kidney cancer, and testicular cancer.

Increases in the rate of breast cancer have captured the attention of scientists and the public alike. In the U.S., the chances of a woman developing breast cancer have gone from one in 20 in 1960, to one in nine today. Scientists suggest that it is unlikely this increase can be explained by the usual factors associated with an increased probability of getting the disease. Only 30 percent of the women who contract cancer today display the best-known risk factors, including a family history of breast cancer, early menstruation, or a late-age first pregnancy.

While research examining the potential causes of this rise in breast cancer rates is in its infancy, several studies have suggested a connection between incidence of the disease and human exposure to organochlorines. Fat tissue in women with breast cancer has been shown to have higher levels of certain organochlorines than in healthy women. Industrial nations that use organochlorines more extensively and generate more pollution also have significantly higher rates of breast cancer than developing countries.

One team of scientists at Mount Sinai School of Medicine in New York found that among a sample of women, those women with the highest levels of the pesticide DDT in their blood were four times more likely to have breast cancer. The study was small and therefore not definitive, but its results do suggest that the upward trend in breast cancer could be linked to widespread pesticide use in the U.S. before 1940. This finding was echoed by another study done in Israel before and after a drastic reduction in the usage of organochlorine pesticides. When exposure to organochlorines dropped between 1976 and 1986, breast cancer rates fell eight percent.

Studies of cancer rates at the sites of industrial accidents also offer important data about the carcinogenic effects of organochlorines. Two accidents in Europe have been studied extensively. In Seveso, Italy, people living near an industrial plant were exposed to high levels of dioxin (a widespread group of organochlorine compounds which originate as by-products of industrial production or incineration) after an industrial accident. Similarly, in Germany workers in a chemical plant contaminated with dioxin experienced high-dose exposures. Research into the effects of both accidents revealed elevated rates of several forms of cancer.

Laboratory studies of some organochlorines have pointed to carcinogenic properties. For example, cancer has been induced in laboratory animals exposed to doses of dioxin, PCBs, and chloroform. However, some scientists assert that organochlorines as a class are not strong carcinogens. Many organochlorines tested in lab rodents do not produce elevated rates of cancer. Those organochlorines that do test positive for cancer in lab animals usually only produce modest elevations in tumors.

Endocrine Disruption

While the public and many scientists have focused on cancer as the main human health threat from exposure to organochlorines, recent research has revealed that some organochlorines may be even more debilitating to the endocrine systems of a wide range of organisms. Endocrine disruption is thought to lead to many other health problems, such as the feminization of males or the masculinization of females, failure to reproduce, and weakened immune systems.

New scientific attention to these noncancer effects of organochlorines was sparked at a meeting of 21 scientists sponsored by the World Wildlife Fund. Representing a cross-section of scientific disciplines including reproductive physiology, ecology, comparative endocrinology, immunology, and zoology, the group met to discuss its findings on the effects of organochlorines in many different species. At the end of the meeting, it concluded:

> A large number of man-made chemicals that have been released into the environment, as well as a few natural ones, have the potential to disrupt the endocrine systems of animals, including humans. Among these are the persistent bioaccumulative organohalogen compounds that include some pesticides (fungicides, herbicides, and insecticides) and industrial chemicals, other synthetic products, and some metals.
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> Many wildlife populations are already affected by these compounds. The impacts include thyroid disruption in birds and fish; decreased fertility in birds, fish, shellfish and mammals; defeminization and masculinization of female fish and birds; and compromised immune systems in birds and mammals.

In recent years, a number of studies have suggested that organochlorines may have very different effects on developing embryos or fetuses than they do on adult organisms of the same species.

This means that even when adult populations show no signs of having been affected by chlorinated compounds in the environment, their offspring may sustain serious impacts that inhibit functioning and ability to reproduce. Some scientists suggest that even very low doses can harm an embryo, especially if the exposure occurs at a critical point in fetal development. They note that the effects of such exposures may not appear until the organisms reach adulthood (and certain principal organ systems do not function properly).

Scientists have postulated some reasons why organochlorines (and other endocrine disrupters) might have such a serious effect on embryos. The physical properties of organochlorines cause them to collect in the fat tissue of a mother throughout her lifetime. From there they pass through the placenta into the fetus, or from birds and fish into their eggs. Once in the embryo, endocrine disrupters alter the normal hormonal interactions crucial to healthy adult development. For example, some mimic estrogen, upsetting a delicate balance between male and female hormones in a developing fetus. This can cause abnormalities and poor functioning in sex organs, and can even lead to feminization of a male or masculinization of a female. Interfering with the endocrine system in a developing fetus can also damage the immune and nervous systems. It can even make an organism more susceptible to toxic chemicals later on, thereby increasing the chances that it could contract some form of cancer. (Some scientists are exploring whether the potential of some organochlorines to disrupt the hormonal balance of a human fetus could be a contributing factor to the development of cancers during adult life.)

Wildlife Studies

Some of the potent warning signs about these noncancer effects of organochlorines have appeared in research on the health of fish and wildlife in the Great Lakes region of the United States, an area that has been heavily exposed to a range of organochlorine compounds including PCBs, dioxin, DDT, and other industrial solvents. Scientific reports document that at least 14 species, which depend on Great Lakes fish, are suffering severe health problems. For example, one study showed that 100 percent of sexually mature, pink Coho and Chinook salmon have vastly enlarged thyroids, a sign that their endocrine systems have been disturbed. Other studies show that the hatching rates of gulls on the shores of Lake Ontario have poor reproductive success: cormorants are giving birth to offspring with deformed beaks, minks have suffered a population decline, and beluga whales in the mouth of the St. Lawrence River are exhibiting immune system problems.

The Great Lakes area is not the only region in the world in which scientists are exploring the relationship between exposure to organochlorines and adverse health impacts on wildlife. Some of the strongest evidence comes from Florida's Lake Apopka, where there was a large DDT spill in 1980. Researchers found a 90 percent decline in the birth rate of alligators, which they attributed to abnormalities in their reproductive organs. In other locations, seals and fish in

PCB-contaminated environments have also experienced reproductive failure.

The difficulty with this population-based research lies in trying to substantiate causal relationships between health problems observed in wildlife, and specific chemicals that may be present in the environment. Scientists have sought to confirm suspicions about certain organochlorine compounds by testing them in the lab on proxy animals. For example, scientists have examined the effects of dioxin on male rodents. Their findings suggest that even very small amounts of dioxin can induce negative heath impacts. In one study, the lowest dose of dioxin necessary to cause reproductive problems in offspring was less than current average background levels that have accumulated in the tissue of humans.

Research on Human Effects

Less is known about the endocrine effects of different organochlorines on humans. Some scientists argue that useful conclusions about potential human impacts can be drawn from the various animal studies conducted in the lab or in the field. Specifically, they maintain that there is enough similarity between the mechanisms governing the development of the animal and human fetuses to merit extrapolating findings about deleterious effects from animal to human populations. They conclude it is likely that humans have been affected by exposure to organochlorines including DDT, as well as other pesticides still in use, such as dioxin and PCBs.

Other scientists emphasize the high degree of uncertainty involved in generalizing about human health based on the results of animal studies. They argue that animal populations have been exposed to extremely high doses of organochlorines relative to their weight. Human beings would be unlikely to experience comparable dosages. Furthermore, they point out that it is much easier to pinpoint causal links when investigating wildlife health in an area contaminated by a single pollutant, than it is when investigating the health of different species in areas where multiple pollutants are present in varying quantities.

Several studies have attempted to document the hormonal impacts of organochlorines in human beings. Two American researchers at Wayne State University sought to explore what happens when people eat fish from the Great Lakes, "bioaccumulating" toxic chlorine compounds in their tissues. Their research produced a striking finding about the potential developmental effects of organochlorines on human embryos. The study found that pregnant women who ate about one Lake Michigan fish per month were more likely to give birth to babies who are smaller, and who exhibited a range of behavioral problems from jerky movements and dull reflexes, to impaired learning abilities.

A European study postulated that a steady decline in global sperm counts over the last 50 years might be linked to a worldwide accumulation of hormone-disrupting chemicals in the environment. Conducted by two reproductive biologists from the National University Hospital in Copenhagen and the British Medical Research Council Reproductive Biology Unit in Scotland, the study involved a meta-analysis of 61 sperm count studies published between 1938 and 1990. While scientists don't dispute their finding that sperm counts have steadily decreased, many do not subscribe to the theory that this phenomenon is caused by environmental factors.

This emerging research on organochlorines is so new that it has not yet been a major factor compelling some groups to advocate a phase-out of chlorine. However, if additional studies verify some of the preliminary findings, the potential endocrine-disrupting effects of organochlorines are sure to play a more prominent role in discussions of possible global actions to reduce chlorine use. More than half the pesticides and a wide range of other industrial chemicals now in use are capable of causing endocrine disruption.

IV. RECENT INTERNATIONAL REGULATORY ACTION

A number of policies calling for a ban or phase out of various chlorine compounds have been adopted over the past several years. These include:

- European Community Directive 76/464/EEV. "Directive on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community." The directive includes a list of chemicals whose discharge into surface waters is to be eliminated.

- Paris Convention on the North Sea. Signed in the mid-1970s, this Convention contains wholesale restrictions on chlorine, in the form of a phase-out of emissions of persistent, toxic chemicals indicated on an attached blacklist. The list includes references to organochlorine chemicals as a class.

- The 1992 Convention and Ministerial Meeting of the Oslo and Paris Commissions on Prevention of Marine Pollution (OSPERCOM), representing 15 North Atlantic nations, and the 1993 Barcelona Convention on the Mediterranean Sea (BARCON), representing 24 Mediterranean nations. Both bodies concluded that persistent, bioaccumulative organochlorines should be phased out quickly.

- 1990 Bergen Joint Agenda for Action: "By 1992, Governments should have agreed on a regional timetable for the phasing out mercury, cadmium, and chlorinated compounds."

- 1990 Bergen/Danube International meeting of NGOs. "The family of organohalogens should be phased out by the year 1995."

- 1991 Scandinavian plan for the reduction and phase-out of chlorine from pulp and paper production. The Scandinavian countries have adopted a plan and timetable for phasing out chlorine use. Even in the absence of formal regulations, economic and market forces are accelerating the phase out of chlorine in this industrial sector.

In addition, a number of jurisdictions in Europe are reducing their use of PVC, a ubiquitous plastic whose manufacture and burning are widely believed to produce dioxin. In significant areas of Austria and Germany, use of PVC building materials is prohibited in the construction of new public buildings. In the German state of Lower Saxony any purchase of PVC products by the government is banned unless no substitutes are available. Meanwhile, the Swedish government continues to press for an international control regime for PCBs, motivated by impacts in Sweden from the long-range atmospheric transport of these chemicals. Sweden also supports the virtual elimination of the solvent perchloroethylene, which is widely used by dry cleaners. And in Canada, the New Democratic Party government of Ontario has ordered its paper industry to phase out the use of chlorine by 2002.

Several of the European environmental regimes listed above have taken a position on organochlorines as a class, something which the U.S. regulatory apparatus has been unwilling to do. Thus far, none of these regimes has been implemented as a broad-based ban, although their existence puts pressure on European industry to search for chlorine substitutes. While specific bans have so far been limited to chlorine in pulp paper bleaching and to the use of PVC, Europeans have a number of established regional forums in which to address chlorine issues. This is not the case in the developing world, where the chlorine issue has not reached prominence. In many regions organochlorine compounds that have been banned or restricted in North America and Western Europe, such as DDT, are used extensively.

THE GLOBAL MANAGEMENT OF ORGANOCHLORINES

BIOGRAPHICAL SKETCHES OF WORKING GROUP MEMBERS

The Chair of this working group, invited by the organizers of the meeting, is Costa Rica's former ambassador extraordinary and plenipotentiary at the Permanent Mission to the United Nations. The ambassador is very popular in UN diplomatic circles and has often played a conciliatory role between developing and industrialized countries in international negotiations. S(he) is also known for experimenting with innovative diplomatic techniques to improve the international negotiation system and has been a champion of more nongovernmental representation in international affairs. S(he) has served as the special representative of the U.N. secretary-general on numerous occasions and is known not only for her/his diplomatic skills and integrity but also for facilitative abilities, which have been demonstrated with distinction at various international conferences. The ambassador has chaired many important, sensitive, international negotiations including those on environment and trade. Having been trained in, and having taught, both international law and international politics, the ambassador has received many international awards including the UNEP 500 Award for Environmental Excellence, and is considered by many to be a potential future secretary-general of the United Nations.

Brazil is represented by her permanent ambassador to the United Nations in Geneva. The ambassador is a senior career diplomat who has led the Brazilian delegations at a number of sensitive negotiations; these include meetings of the GATT, the preparatory committee of UNCED, and regional trade negotiations. S(he) has also served as Brazil's ambassador to (West) Germany (1982-84) and then Czechoslovakia (1989-91) and is well respected in both developing and developed countries. For the current year, Brazil chairs the Group of 77 (a UN-based caucus of more than 130 developing countries). As such, the ambassador may also be representing the views of this group at the meeting.

China is represented by the director of the Environment Desk of the Ministry of Foreign Affairs in Beijing. Recently appointed to this position, s(he) holds a doctorate in forestry economics, and left a teaching position at the University of Shanghai to join the Ministry of Foreign Affairs ten years ago. Since then, s(he) has been a member of Chinese delegations to a number specialized environmental negotiations, including those pertaining to the climate convention, the desertification convention, the forestry convention, and the fisheries protocol. For the last year before being named director of the Environment Desk, s(he) was a senior research fellow at the Chinese National Institute of International Affairs, working on issues of international trade and the environment.

The Czech Republic's representative is the director of the Office of International Affairs in the

Czech Ministry of Trade and Industry. S(he) is an old-line bureaucrat who has been in government for 18 years. As such, s(he) is a survivor. S(he) has been with the Ministry of Trade for the past ten years, but has no prospects for moving up, as the Ministry has become increasingly dominated by a younger generation.

Germany is represented by the current minister of Foreign Affairs, and former director of the Environment Ministry. S(he) is well respected in international circles as well as within Germany, and is known for having the ability to bridge the gap between conflicting interests when negotiating international agreements.

Green Strategies' representative has been a senior staff member of Green Strategies for the last 15 years. S(he) is one of the co-authors of the "Transition Plan to a Chlorine-Free Economy." S(he) has been working on Green Strategies' Chlorine Phase-Out Project since its inception four years ago.

The **ICSA** representative is the special assistant to the executive director. S(he) graduated from MIT two years ago (in 1996), with a PhD in Chemistry. S(he) is 35e, and has been with ICSA for just over one year, having been heavily recruited by the executive director during his/her last year at MIT. S(he) is very ambitious, and has set his/her sights on eventually rising to the level of executive director of ICSA.

The **IUCE** representative is the deputy director for External Affairs for the IUCE. S(he) has been with the IUCE for 12 years, having started as an intern after graduate school. S(he) has a Masters degree from the Yale School of Forestry.

India is represented by the additional secretary for International Trade in the Ministry of Industries and Trade. A career bureaucrat and the second highest-ranking official in the Ministry, the additional secretary is considered by most to be *the* most influential official in the Indian government, after the Trade and Industries minister, as far as international trade is concerned. The additional secretary is a veteran of numerous international trade negotiations at GATT and various bilateral forums, and is widely respected among Western diplomats for being a bright and savvy negotiator. Her/his appointment as the leader of the Indian delegation has, however, surprised many Indian environmentalists who would have preferred that the delegation be led by someone from the Ministry of Environment and Natural Resources.

The **International Business Roundtable** is represented by the director of the Roundtable's Department of Multinational Trade Issues. The director received an undergraduate degree in Business Administration from the Wharton School, a Masters in Economics from the University of Chicago, and a Doctorate in Business Administration from Harvard Business School. S(he) worked in Corporate Communications for Allied Signal in Texas, moved to Washington, D.C. to lobby for the Chemical Manufacturers' Association, then served on the Bush Administration team to prepare for, then negotiate at, the 1992 conference on development and the environment at Rio de Janeiro. After the election, s(he) left the administration to work with his/her former supervisor at Allied Signal -- Edward Arbus.

Japan is represented by the director of the Global Environmental Affairs Office within the Industrial Location and Environmental Protection Bureau. An energy analyst by initial training, s(he) has been a career civil servant for the last 15 years and had worked for short periods of time both with the Ministry of Foreign Affairs (in its Global Environmental Affairs Division) and with the Ministry of International Trade and Industry (MITI). For the last six years, however, s(he) has been with the Industrial Location and Environmental Protection Bureau where s(he) helped establish the Global Environmental Affairs Office that s(he) now leads. Although s(he) has been a member of the Japanese delegation to a large number of international negotiations, this is the first time that s(he) has been called upon to lead the delegation; in fact, this is the first important international negotiation in which an official of the Industrial Location and Environmental Protection Bureau is leading the Japanese delegation instead of someone in the Ministry of Foreign Affairs.

The **Norway** representative is the director of the Office of International Affairs and Development with Norway's Ministry of Environment. S(he) is a senior level official with 20 years of experience in environmental issues. S(he) reports directly to the minister of the Environment, and is the minister's handpicked appointee. His/her participation is an indication of the importance the minister attaches to the discussions.

The **United States'** representative is the director of the Office of Environmental Protection in the U.S. State Department's Bureau of Oceans and International Environmental and Scientific Affairs (OES). S(he) is a senior-level career diplomat who has spent the last ten years working on environmental issues. S(he) reports to the deputy secretary of State for Environment and Development, who is a political appointee. S(he) typically heads the U.S. delegation for most routine negotiations on environmental issues. Prior to entering the Foreign Service, s(he) was an executive with an advertising agency.

UNITED NATIONS ENVIRONMENTAL PROGRAMME

MEMORANDUM

To: Participants in the UNEP Working Group on Managing the Global Use of Organochlorines
From: The Executive Director
Re: Ground Rules for the First Meeting of the Working Group

Thank you so much for agreeing to attend the UNEP Working Group Meeting today. Based on my conversations with all of you, I am quite optimistic that progress can be made.

The note I sent you earlier ("Information for all Participants") explained the events leading up to the meeting, the reasons I have invited the specific countries and NGOs that are participating, the Agenda for the meeting, and the scope of the problem as UNEP sees it. There are two other issues I should have touched on, but neglected to cover. The first is the matter of the person I have asked to chair the group. As you know, it is absolutely imperative that the chair be someone who can facilitate the discussion effectively. To that end, I have asked the former president and ambassador to the United Nations of Costa Rica, to serve as chair. As you know, the president is someone with a remarkable record for bringing contending groups together in a great many situations. I am certain you can count on the president's neutrality, discretion, and responsiveness to your concerns.

The other issue I should have covered is the role that NGOs will be playing in this meeting. I know it is a bit unusual, but I have invited the NGO representatives to sit at the table as equal partners in the discussion. Since we are not meeting as a formal body (indeed, if we were, it would be difficult to justify involving only eight countries), I felt it was reasonable to ask them to participate on a co-equal basis. The NGO representatives involved all have a great deal of technical background. In no way does my decision to invite the NGOs to sit at the table in a co-equal role constitute any change in UNEP's or the UN's position on the appropriate role of NGOs in formal international decision making.

I do not expect the Working Group to reach a formal agreement or to publish its final recommendations. Indeed, if the facilitator can prepare a summary of points of agreement and help to improve the draft treaty my staff has prepared, that would be a great accomplishment. UNEP will not publish anything by or about the Working Group that references the names of the participants or attributes specific positions or statements to them.

Again, my thanks for your willingness to participate in this important effort.