PUBLIC REVIEW DRAFT

North American Regional Action Plan
Dioxins and Furans, and Hexachlorobenzene

18 July 2003

Table of Contents

1 Preface

This North American Regional Action Plan (NARAP) on dioxins and furans, and hexachlorobenzene,[1] is a regional undertaking stemming from the North American Agreement on Environmental Cooperation (NAAEC), a parallel side agreement to the North American Free Trade Agreement (NAFTA). The NAAEC came into force for the governments of Canada, Mexico and the United States of America on 1 January 1994, as an overarching framework for environmental cooperation. The NAAEC established the Commission for Environmental Cooperation (CEC) to "facilitate cooperation on the conservation, protection and enhancement of the environment in their territories."

The CEC Council (of Ministers) adopted Resolution 95-05 on the Sound Management of Chemicals (SMOC) on 13 October 1995, at its second regular meeting, held in Oaxaca, Mexico. The Resolution adopted as a priority the development of Regional Action Plans for certain persistent and toxic substances. It also established a "working group composed of two senior officials selected by each Party whose duties pertain to the regulation or management of toxic substances and who shall work with the Commission for Environmental Cooperation (CEC) to implement the decisions and commitments set out in this Resolution."

Resolution 95-05 directed the working group to incorporate, as appropriate, pollution prevention principles and precautionary approaches in NARAP development and, consistent with Chapter 19 of Agenda 21 (see section 2.3 below), to recommend:

- concerted activities to reduce risks presented by toxic chemicals, taking into account the entire life cycle of the chemicals; and
- policies, regulatory and non-regulatory measures to identify and minimize exposure to toxic chemicals by replacing them with less toxic substitutes and ultimately phasing out the chemicals that pose unreasonable and otherwise unmanageable risks to human health and the environment and those that are toxic, persistent and bio-accumulative and whose use cannot be adequately controlled.

NARAPs developed under Resolution 95-05 reflect a shared commitment by the Parties to work cooperatively, while recognizing the differentiated responsibilities of each country, to enhance capacities for the sound management of chemicals in the three countries, to pursue regional action that is results based, and to bring a regional perspective to international initiatives that are in place or being negotiated to address toxic chemicals. Since 1995, NARAPs have been developed for PCBs, DDT, chlordane and mercury, and for environment monitoring and assessment. A NARAP on lindane is under development,and lead is under consideration for trilateral action.

The Parties actively seek meaningful public participation in the development and implementation of NARAPs, consistent with the spirit of cooperation reflected in the NAAEC and in Council Resolution 95-05 on the Sound Management of Chemicals (SMOC).

---

[1] The Task Force terms of reference stipulate: *in addressing dioxins within the NARAP, (the Task Force) will take into account other subsets of chemicals that are "dioxin-like" as regards chemical structure, physical-chemical properties and which invoke a common battery of toxic responses. This group of dioxin-like compounds includes the seven polychlorinated dibenzo-p-dioxins, 10 polychlorinated dibenzofurans, and 13 polychlorinated biphenyls, for which the World Health Organisation has established dioxin toxic equivalents.*

2 Introduction

2.1 Objective

This NARAP addressing dioxins and furans, and hexachlorobenzene documents how the three governments will cooperate in implementing their obligations and commitments established in CEC Council Resolutions 95-05 and 99-01, the Stockholm Convention, other international agreements to which one or more of the Parties is a signatory, and their respective national programs.

The objective of this NARAP, comprising joint and individual actions of the Parties, is to improve the capacities of the Parties to reduce exposure to dioxins and furans, and hexachlorobenzene of North American ecosystems, fish and wildlife, and especially humans, and to prevent and reduce anthropogenic releases to the environment of dioxins and furans, and hexachlorobenzene and to promote continuous reduction of releases where feasible.

2.2 Path Forward for Phase 1

The Parties are adopting a comprehensive approach for the development of the dioxins and furans, and hexachlorobenzene NARAP. It is anticipated that a comprehensive NARAP could require approximately two to three years to develop. However, the Parties have identified NARAP activities that are candidates for early action.

To accommodate early action, the dioxins and furans, and hexachlorobenzene NARAP is being released in two phases. Phase 1 documents actions that will be initiated within approximately the first two years of implementation. Phase 2 of the NARAP, to be released in 2004, will document actions that might need a longer time frame.

This NARAP document constitutes Phase 1. After CEC Council approval of this Phase 1 NARAP, the Task Force will develop the Phase 2 NARAP and consult with the public before adopting it.

Recognizing that the three countries are at different stages in addressing dioxins and furans, and hexachlorobenzene, Phase 1 of the NARAP concentrates on sharing expertise and developing or increasing capacities to address dioxins and furans, and hexachlorobenzene, in the three countries.

2.3 Guiding Principles

This NARAP supports:

- the elements and obligations contained in:
  - *Agenda 21: A Global Action Plan for the 21st Century*, adopted at the 1992 United Nations Conference on Environment and Development, in particular, Chapter 19 on the sound management of chemicals and the precautionary approach as stated in Principle 15 of Agenda 21 and adopted at the Rio Declaration;
  - *The Great Lakes Binational Toxics Strategy*: *Canada-United States Strategy for the Virtual Elimination of Substances in the Great Lakes*;
  - the *North American Agreement on Environmental Cooperation (*NAAEC);
  - CEC Council Resolution 95-05 for the Sound Management of Chemicals; and
  - The Stockholm Convention on Persistent Organic Pollutants.
- ongoing and cooperative activities to achieve the goals of Canada, Mexico and the United States under this NARAP;

- public participation in NARAP development and implementation;
- partnerships with industry, public interest groups, indigenous populations and international organizations in Canada, Mexico and the United States to involve them in NARAP implementation;
- a regional perspective that encourages sharing experience with other countries in the Caribbean and Latin America; and
- participation in and building upon related global initiatives.

2.4 Rationale

Dioxins, dioxin-like compounds, and hexachlorobenzene are of concern because they are toxic compounds that can be present in the environment in toxic amounts. These compounds are found in most human tissues as a result of a complex interaction between sources, the processes of fate and transport and their physical, chemical, and biological proprieties. Understanding these properties and processes and the quantitative linking of sources to exposure is central to the successful management of the risks these compounds pose.

2.4.1 Dioxin and Dioxin-like Compounds

The term "dioxin," or "dioxins," refers to a group of 30 chemical compounds that share certain similar chemical structures and a common biological mode-of-action. They are members of three closely related families: the chlorinated dibenzo-*p*-dioxins (CDDs), chlorinated dibenzofurans (CDFs), and certain polychlorinated biphenyls (PCBs).[2] All three families of the chemicals are semi-volatile and extremely persistent in the environment. Because of their hydrophobic and lipophilic properties, they bioaccumulate in the food chain. CDDs and CDFs are produced both in nature and, inadvertently, by a number of human activities, including most forms of combustion, certain types of chemical manufacturing and processing, and other high-temperature industrial processes in which chlorine is present in some form. Anthropogenic sources dominate environmental levels, with waste combustion being, historically, the major source.

Unlike CDDs and CDFs, an estimated 0.75 million to 1.5 million tons of PCBs were commercially produced worldwide, with about five percent of the total PCB production being dioxin-like PCBs. Although PCBs are no longer manufactured in North America, significant quantities were released into the environment and therefore continue to be redistributed and incorporated into the human food chain. Also, like dioxins, PCBs can be produced as unwanted by-products of many of the same human activities that lead to the formation of dioxins.

In industrialized North America, dioxin levels in the environment increased significantly, from the 1920s, and continued into the late 60s or early 70s, but have declined significantly since then.

This decline is thought to be associated with the general application of pollution control measures for combustion sources, along with specific actions such as the discontinued use of 2,4,5-T (2,4,5-trichlorophenoxyacetic acid), hexachlorophene, lead in gasoline, and restriction on the use of pentachlorophenol. More recently, reductions in environmental levels are due to dioxin-specific control measures applied to municipal and medical waste incinerators.

Levels of dietary intake and human tissue levels of dioxin also appear to be declining in Canada and the United States. These same declines have been observed in Europe; however, it has not yet been determined if Mexico has experienced a similar pattern of increase and decline.

[2] ibid.

There remain a number of sources of dioxins for which the magnitude of environmental release has not yet been quantified because of insufficient data. These sources include landfill fires, agricultural burning, forest fires, structural fires, ferrous and nonferrous metal foundries, ceramic manufacturing, coke ovens, wood stoves, burning of waste oil, municipal waste, water treatment effluent, and animal manures. Another source category, which may be of particular importance but for which adequate data do not exist, is reservoir sources. These are the result of past releases of dioxins and dioxin-like compounds that, once released into the environment, are temporarily stored, and can be re-released into the environment at a later time. Soil, for example, can serve as a reservoir source through the resuspension of soil particles into the air or through direct volatilization. Dioxins stored in sediment serve as a reservoir source to surface water, often being the primary determinant of water column concentration. As contemporary formation sources are reduced through environmental controls, the relative contribution of reservoir sources increases.

Most dioxin exposure to the general population occurs through the diet. In the US and Canada, over 95 percent of dioxin intake for a typical person is estimated to come through dietary intake of animal fats. In Mexico, exposure pathways have yet to be quantified. This dietary exposure pathway results in widespread, low-level exposure of the general population. In addition to diet, small amounts of exposure occur from breathing air that has been contaminated with trace amounts of dioxin, from inadvertent ingestion of soil containing dioxin, and from absorption through the skin.

Dioxins are incorporated into the food supply by two principal exposure pathways: air deposition onto plants eaten by domestic meat and dairy animals, and uptake from water by fish, particularly freshwater fish and other aquatic organisms. The roots of plants do not generally take up dioxins; however, the cuticle surface of plant leaves effectively collects and retains dioxins deposited from the air. This deposition can be both from vapor deposition or the deposition of particles. When these leaves are eaten by domestic animals, either through grazing or, more commonly, as an ingredient in animal feed, the dioxins are retained and bioconcentrate in animal fats. Humans consume these fats in the form of meat and dairy products. Fish can accumulate dioxins, either by extracting them directly from water through gill uptake, from contact with dioxin-contaminated sediments, or by bioaccumulation through the aquatic food chain. Dioxins can enter the aquatic environment through industrial discharge into receiving waters, direct air deposition, or through soil erosion and urban storm water runoff. Soil contamination, as well as dioxins found in urban runoff, is most often the product of air deposition. Consequently, dioxin exposure through both the terrestrial and aquatic food chains is closely linked to air transport and deposition.

In addition to the general population being exposed to trace levels in the general food supply, a few individuals may be exposed at higher levels because of unique exposure circumstances. It is unclear if these elevated exposures were only isolated incidents or are indicative of a more routine occurrence. Past examples of elevated exposures include those due to occupational settings, industrial accidents, discrete food contamination incidents, or because of living in proximity to elevated environmental levels.

Dioxins are potent animal toxicants with the potential to produce a broad spectrum of adverse effects in humans. They can alter the fundamental growth and development of cells so as to cause adverse effects on reproduction and development, suppression of the immune system, chloracne (a severe acne-like condition that sometimes persists for many years), and cancer. The International Agency for Research on Cancer (IARC) characterizes 2,3,7,8-tetrachlorodibenzo-*para*-dioxin (TCDD) as carcinogenic to humans, based on the weight of evidence of animal and human studies. The World Health Organization (WHO) and the Joint Expert Committee on Food Additives (JECFA) have also recognized dioxins as carcinogens but have placed greater emphasis

on dioxins' non-cancer effects. Based on human studies, elevated prenatal exposure may affect the gender ratio among newborns, and studies in both humans and animals have indicated that elevated prenatal exposure may affect the developing fetus.

2.4.2 Hexachlorobenzene (HCB)

Hexachlorobenzene was used from the 1940s to the late 1970s as a fungicide on grain seeds such as wheat, and was produced as a fungicide in the United States until 1984, when the last registered use as a pesticide was voluntarily cancelled. Hexachlorobenzene has been used as a solvent and as an intermediate and/or additive in various manufacturing processes, including the production of synthetic rubber, PVC, pyrotechnics and ammunition, dyes, and pentachlorophenol. HCB is also formed as an inadvertent by-product at trace levels in a variety of combustion and incineration processes, in the production of magnesium, and several currently used pesticides. Stack tests have shown that HCB is usually detected with high dioxin/furans concentrations in combustion and incineration processes.

HCB is a highly persistent environmental toxin that degrades slowly in air and, consequently, undergoes long-range atmospheric transport. It bioaccumulates in fish, marine animals, birds, lichens, and animals that feed on fish or lichens. In these species, HCB accumulates in fatty tissues, including fat deposits, and in the liver. HCB can also accumulate in wheat, grasses, vegetables and other plants.

In the United States, environmental levels peaked in the 1970s and have generally declined since that time. For example, HCB levels in Great Lakes sediments were reported to have peaked at about 460 ppb in the years 1971–1976 and declined to 270 ppb in 1976–1980, the most recent period for which comparative data is available. The decline in environmental concentrations is primarily due to the cancellation of HCB as a registered pesticide based on a concern for human risk. HCB is considered a probable human carcinogen and is toxic by all routes of exposure.

Short-term high exposures at levels significantly above general population exposure can lead to kidney and liver damage, central nervous system excitation and seizures, circulatory collapse, and respiratory depression. Based on studies conducted on animals, long-term, low-level exposures may damage a developing fetus, cause cancer, lead to kidney and liver damage, and cause fatigue and skin irritation.

Human exposure pathways for HCB are inhalation, ingestion of contaminated food, and skin contact with contaminated soil. Exposure of the general population occurs through ingestion of contaminated food, particularly meat, dairy products, poultry, and fish. Subpopulations that may be exposed to higher levels of HCB than the general population include workers occupationally exposed to HCB, individuals living near facilities where HCB is produced as a by-product, and individuals living near current or former hazardous waste sites where HCB is present.

3 Background

3.1 Canada

In Canada, protection of the environment is a responsibility shared by all levels of government, as well as by industry, organized labor and individuals. The Canadian Environmental Protection Act, 1999 (CEPA 1999), provides new instruments for the management of toxic substances. The development of management tools is carried out through multi-stakeholder consultations. The use of non-regulatory approaches can be used to achieve early action.

3.1.1 Dioxins and Furans

In 1990, polychlorinated para-dibenzodioxins and polychlorinated dibenzofurans (D/F) were declared toxic under the *Canadian Environmental Protection Act*. This triggered the development of regulations for these substances in liquid effluent discharged from pulp and paper mills.

In 1992, the *Pulp and Paper Mill Effluent Chlorinated Dioxins and Furans Regulations* were adopted<http://laws.justice.gc.ca/en/C-15.31/SOR-92-267/> along with controls on the precursors of these substances and the *Pulp and Paper Mill Defoamer and Wood Chip Regulations* <http://laws.justice.gc.ca/en/C-15.31/SOR-92-268/>. As a result of implementing the Pulp and Paper Regulations and complementary provincial regulatory initiatives, dioxins and furans releases to the aquatic environment were reduced by more than 99 percent, thereby achieving the goal of virtual elimination (V.E.)[3] from this sector by 1997. This achievement was attributed to the strict standards required (non-measurable) for dioxins/furans, which encouraged the industry to switch to an elemental chlorine-free bleaching technology.

In 1995, the federal government adopted the *Toxic Substances Management Policy* (TSMP), a key element of which outlines the requirement of *Virtual Elimination* for those toxic substances that meet specific criteria for persistence, bio-accumulation and that result primarily from a human activity. As described by the TSMP, "*…The ultimate objective of eliminating a Track 1 substance from the environment is set irrespective of socio-economic factors. Nevertheless, management plans such as targets and schedules to achieve that long-term objective will be based on analyses of environmental and human health risks as well as social, economic and technical considerations…*" <http://www.ec.gc.ca/toxics/en/index.cfm>.

Figure 1, below, illustrates how targets and timelines have been adopted for the iron sintering sector, as a step toward achieving virtual elimination.

In 1998, the Canadian Council of Ministers of the Environment (CCME) adopted a complementary Policy for the Management of Toxic Substances that establishes an integrated, cooperative and concerted approach for the management of toxic substances. This policy also prescribes virtual elimination for Track 1 substances such as dioxins and furans <http://www.ccme.ca/initiatives/environment.html?category_id=27>.

In 1999, Environment Canada published its first national *Release Inventory* report for dioxins and furans prepared by a federal, provincial and territorial task force with participation and input from stakeholders <http://www.ec.gc.ca/pdb/npri/2002guidance/guide2002/app7_e.cfm>. The inventory report was updated in February 2001 and will be revised periodically as new information becomes available. During the last decade, atmospheric releases were reduced by approximately 60 percent, attributable to the implementation of the CCME guidelines for incinerators and cement kilns burning hazardous wastes and to voluntary actions on the part of other sectors.

There are a number of potential sources of releases of dioxins, furans and hexachlorobenzene in the Canadian environment that remain to be evaluated and incorporated into national inventories. Of particular relevance in this context are releases associated with the open combustion of municipal waste in isolated communities across the central and northern regions of Canada.

[3] In Canada's legislation, "virtual elimination" means, in respect of a toxic substance released into the environment as a result of human activity, the ultimate reduction of the quantity or concentration of the substance in the release below the level of quantification. Level of Quantification (LOQ) is the lowest concentration that can be accurately measured using sensitive but routine sampling and analytical methods. For dioxins and furans emissions, that level is 32 picograms TEQ per cubic metre.

Efforts are under way to evaluate strategies for quantifying these sources and other dispersed releases to the Canadian environment.

3.1.1.1 Canada-wide Standards

In January 1998, the Canadian Council of Ministers of the Environment signed the Harmonization Accord and sub-agreement on Canada-Wide Standards. Among the first priority substances identified by Ministers were dioxins and furans. Based on the Environment Canada Inventory Report, the CCME Development Committee for Canada-wide Standards (CWS) for dioxins/furans identified a suite of priority sectors that accounted for about 80 percent of 1998 total releases to the atmosphere.

In June 2001, the CCME approved Canada-wide Standards for two priority sectors for dioxins/furans: boilers burning salt-laden wood and waste incineration. The coastal pulp and paper boiler CWS applies only to British Columbia coastal mills that burn salt-laden wood fuel in their boilers. The incineration standard applies to municipal solid waste, hazardous waste, medical waste and sewage sludge facilities.

In September 2001, the CCME approved in principle the CWS for *iron sintering* and also agreed to bring the proposed CWS for *electric arc furnaces* forward for decision and signature at their fall 2002 meeting. The existing sintering plant in Canada is the largest single point source of dioxins and furans atmospheric emissions in Canada, accounting for four percent of national releases to the atmosphere.

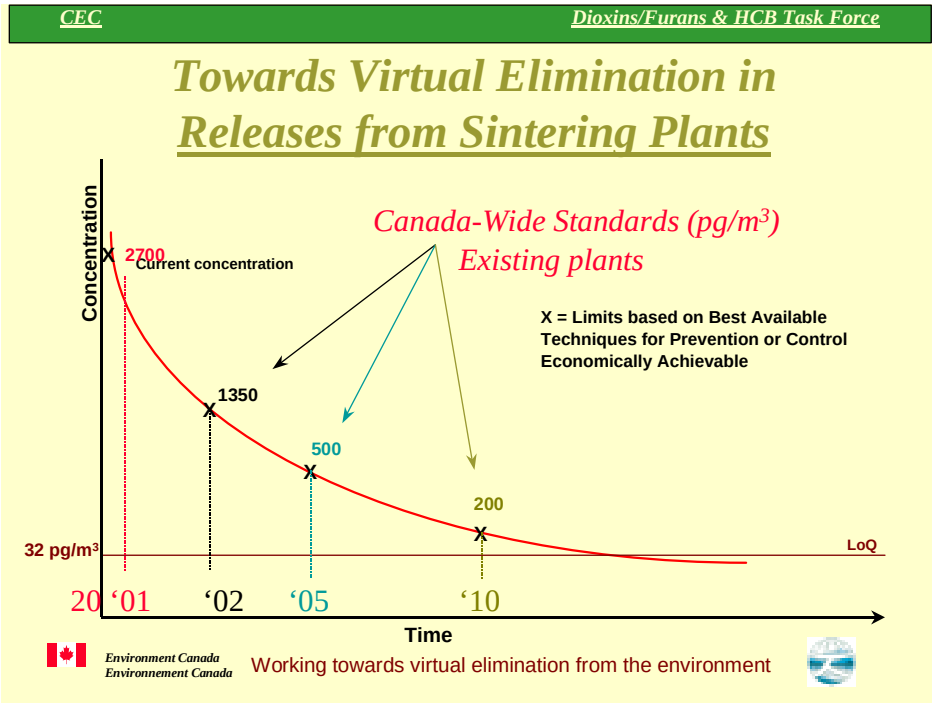

Figure 1: Anticipated results of application of CWS to the iron sintering sector

The standard has been set to achieve an emission reduction of at least 90 percent from this source by 2010, based on 1998 test results. Steel manufacturing electric arc furnaces (EAFs) account for seven percent of national releases to the atmosphere. The standard has been set to achieve an emission reduction from these facilities of at least 60 percent by 2010.

Other sectors releasing dioxins/furans will be reviewed by the Dioxins and Furans CWS Development Committee.

3.1.2 Hexachlorobenzene (HCB)

In 1994, hexachlorobenzene was declared toxic under CEPA. Based on the criteria set in the Toxic Substances Management Policy, it is managed as a Track 1 substance with a goal of virtual elimination.

HCB is no longer in commerce in Canada. The principle sources of HCB are from the application of HCB-contaminated chlorinated pesticides and the incineration of wastes. HCB can also be released from the volatilization/leaching from in-service utility poles (treated wood), and from other minor sources, such as cement kilns, chemical production, the use of ferric/ferrous chloride and some chlorinated solvents.

A strategy has been developed to manage HCB as a commercial chemical and as a contaminant in products. In September 2001, Canada proposed to ban the manufacture, use, or import of HCB and products containing HCB above a specified concentration. Since the formation of HCB is associated with dioxins and furans in combustion sources, releases of HCB are addressed through actions to be carried out for dioxins and furans. The Canadian Pest Management Regulatory Agency (PMRA) is reviewing HCB levels in pesticides under the authority of the Pest Control Products Act.

3.1.3 Other Initiatives in Canada

Other initiatives to address dioxins and furans and hexachlorobenzene in Canada include mandatory reporting of dioxins and furans and hexachlorobenzene in the National Pollutant Release Inventory commencing in the Year 2000; the development of guidelines for wood treaters and a national waste management strategy to manage out-of-service treated utility poles; the development of a Federal Hazardous Waste Regulation that will restrict releases of dioxins/furans from federal incinerators, and air emissions characterization, including dioxins/furans and hexachlorobenzene from residential wood stoves and base metal smelters.

Under the Canada-US Great Lakes Binational Toxics Strategy, targets are set to reduce dioxins/furans and hexachlorobenzene releases from anthropogenic sources and to remediate contaminated sediments. A workgroup has been formed to develop and implement a strategy to reduce barrel burning in the Great Lakes Basin. As releases of dioxins/furans from point sources decline due to standards, regulations and voluntary actions, area sources, such as burn barrels and other open burning, are now emerging issues for dioxins/furans in Canada. The burn barrel issue is being reviewed under the Canada-Wide Standard process for dioxins and furans. Practice in the disposal of municipal waste in remote and northern communities will be assessed.

3.1.4 Results

Canada's efforts to control environmental releases of dioxins and furans are working. The national inventory of sources indicates that dioxins and furans releases have declined by more than 60 percent since 1990. Accordingly, levels of dioxin-like compounds measured in Canadian serum and breast milk surveys declined by about one-half from the 1980s to the 1990s. A declining trend for dioxins and furans is also shown in the Canadian ambient air monitoring network.

3.2 United States

The US Environmental Protection Agency (EPA) has pursued the control and management of dioxin through each of its major program areas; collectively, these actions place strict regulatory controls on all of the major well-defined industrial sources of dioxins. The EPA is also in the process of completing a comprehensive reassessment of risks from dioxins, including sources of dioxins, their fate and transport, levels of human exposure, and their toxic effects on humans and other animals. Using this emerging scientific understanding, the EPA intends to review its dioxin control efforts to determine if, collectively, they adequately address potential dioxin risks to humans, and to determine if redirected or additional action is needed. Dioxins have also been a focus of the United States in food safety programs of the US Department of Agriculture and the Food and Drug Administration of the US Department of Health and Human Services. Recent activities have included the expansion of efforts to monitor dioxins in the food supply and animal feeds, and specific action to eliminate the use of naturally-occurring, dioxin-contaminated ball clay as an animal feed additive.

3.2.1 Specific Program Actions

Releases to Air: Incinerations of municipal and medical waste have, historically, been the two largest industrial categories of dioxin releases to the United States environment. Over the past decade, emissions from these sources have been significantly reduced as a result of federal and state attention. Additional emission reductions are taking place as a result of new, stringent regulatory requirements promulgated by the EPA under authority of the Clean Air Act (CAA) and its amendments. The CAA requires the EPA to set emission limits for dioxins and other hazardous air pollutants based on "maximum achievable control technology" (MACT). EPA regulations promulgated in 1995 for municipal waste combustors, and 1997 for medical waste

incinerators, should result in a greater than 95 percent reduction in dioxin emissions from these two source categories. Under the combined authorities of the CAA and the Resource Conservation and Recovery Act (RCRA), the EPA has recently regulated dioxin emissions from facilities that burn hazardous waste. These include commercial hazardous waste incinerators, cement kilns burning hazardous waste, and some lightweight aggregate kilns. With the completion of these rules, the major categories of commercial and municipal waste combustion are under direct regulation for their dioxin emissions.

Releases to Water: Dioxin releases to water are managed through a combination of risk-based and technology-based tools established under the Clean Water Act (CWA). Using the authority of the CWA, EPA published in 1984 ambient water quality criteria for 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD). Ambient water quality criteria serve as EPA guidance for states in establishing and adopting their own ambient water quality standards. These state standards set a limit on the maximum pollutant concentration allowed for surface waters anywhere within that state and are implemented through discharge limitations contained in National Pollutant Discharge Elimination System (NPDES) permits.

In 1993 EPA proposed integrated rules for the pulp and paper industry, which included an effluent guideline for dioxins. Effluent guidelines establish limits on facility effluent concentrations based upon application of best available control technology as defined by the CWA. Pulp and paper effluent guidelines were promulgated in 1998 and will reduce this industry's dioxin discharges at least 96 percent. Pulp and paper facilities that used elemental chlorine bleaching processes were the largest known industrial dischargers of dioxins into water. The technology-based effluent guidelines are implemented under the NPDES program, along with health-based, state ambient water quality standards. Under the NPDES, each facility must meet the more stringent of these separate performance requirements placed upon it.

To maintain the quality of public drinking water, in 1992, EPA promulgated a maximum contaminant level goal (MCLG, a non-enforceable, voluntary health goal) of zero, and a maximum contaminant level (MCL) of $3x10^{-8}$ mg/l for TCDD under the Safe Drinking Water Act (SDWA).

In addition to these direct regulatory actions under the CWA and SDWA, EPA is working with the states and the Army Corps of Engineers to manage the dredging and disposal of dioxin-contaminated sediment.

Contamination of Land: Clean up of dioxin-contaminated lands is an important part of the EPA Superfund and RCRA Corrective Action programs. There are dozens of Superfund sites around the country in which dioxin is one of the chemicals of concern. Times Beach, Missouri, and Love Canal, New York, are the best-known examples, both of which have now been cleaned up. To prevent future problems like these, EPA has developed, under RCRA authority, Hazardous Waste Identification and Disposal Rules. These rules identify and strictly limit the disposal options for wastes formally designated as dioxin-containing. Dioxins can also be found in low concentrations in wastes applied to the land as fertilizers or soil amendments. These materials include wastewater treatment sludge from pulp and paper plants, sludge from publicly owned wastewater treatment facilities and dust from activities at cement plants.

Under the authority of the Toxic Substances Control Act (TSCA), the EPA proposed rules to restrict the use of dioxin-contaminated pulp and paper sludge. The subsequent promulgation (1998) of the pulp and paper effluent guidelines should effectively reduce dioxin concentrations in this sludge to such an extent that promulgation of the TSCA sludge rule is no longer needed. In

the interim, the paper industry has participated in a voluntary program to limit dioxin concentration in land-applied pulp and paper sludge. During 1999, the EPA proposed regulations limiting the dioxin content of cement kiln dust from cement plants and sludge from publicly owned sewage treatment facilities when these by-product materials are used as soil additives.

Contaminated Products: Dioxins can exist as trace contaminants in certain industrial chemical products. Legal authorities under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), and under TSCA, are used to control or eliminate the use of such chemicals. The registration of the herbicide 2,4,5-T was cancelled because of concern about dioxins. Similarly, most of the uses of the wood preservative pentachlorophenol have been eliminated, in part because of concern for dioxin. The toxic substance program, through voluntary industry agreements, has restricted the levels of dioxins found in the industrial chemical chloranil (tetrachloro-1,4-benzoquinone), which is used in the manufacture of certain pigments and tires. Additionally, the TSCA New Chemicals Program, in cooperation with industry, has effectively prevented the manufacture of any new chemicals that are significantly contaminated with dioxins.

3.3 Mexico

Dioxins, furans and HCB comprise new issues for Mexico's environmental agenda. Under CEC Council Resolution 99-01, adopted 28 June 1999, Mexico agreed to initiate cooperative activities with Canada and United States to develop this NARAP. In addition, Mexico is a signatory country to the Stockholm Convention.

INE's National Environmental Research and Training Center (CENICA) have developed a preliminary Mexican inventory on dioxins and furans. Mexico used US EPA emissions factors for calculating source emissions in the inventory. Mexico has not yet developed capacity for the analysis of such compounds. Total emissions in Mexico are estimated to be 582g TEQ/year (toxicity equivalents/year) for 1995 and 461g TEQ/year for 2000. The most important sources include agricultural fuel combustion, backyard trash burning, residential landfill burning, and cement kilns, in order of magnitude. There is no inventory for HCB.

Mexico is also developing legislation related to air emissions for dioxins and furans. Two regulations are in the process of public consultation. One of them is for waste incineration, the other is related to cement kilns emissions.

4 Phase 1 NARAP Actions

Phase 1 NARAP actions are organized according to the following subject areas:

- Monitoring and assessment;
- Laboratory testing,
- Inventories,
- Pollution prevention,
- Pollution control,
- Policy options, and
- Leveraging financial resources.

4.1 Monitoring and Assessment

4.1.1 Purpose

The Parties will improve monitoring and assessment data on dioxins and furans, and hexachlorobenzene, to assist with target actions to reduce human exposure and environmental releases, with particular reference to strengthening understanding in Mexico, including:

- the extent of environmental releases of dioxins and furans, and hexachlorobenzene, with particular emphasis on Mexico;
- trends of environmental contamination of dioxins and furans, and hexachlorobenzene spatially and over time for Mexico and North American as a whole; and
- human exposure to and tissue levels of dioxins and furans, and hexachlorobenzene.

4.1.2 Actions

The following actions on monitoring and assessment will be initiated in this Phase 1 NARAP.

4.1.2.1 North American Air Monitoring Network

The Parties will support the establishment of a Mexican ambient air monitoring network for dioxin-like compounds. The Mexican network will parallel the operation in the United States of its US National Dioxin Air Monitoring Network[4] or NDAMN, and the Parties shall work to integrate the Mexican, the US NDAMN and the Canadian National Air Pollution Surveillance Network (NAPS)[5] to produce a North American Air Monitoring Network for Dioxin-like Compounds.

In 2003, this activity will involve:

- Identifying at least six distinct sites for monitoring stations;
- Providing training opportunities to assist Semarnat's National Institute of Ecology to establish the monitoring stations; and
- By 2003, making the monitoring stations operational.

In 2003, Canada and the United States will assess the compatibility of their air monitoring networks, and the need for add-ons to their existing monitoring networks to achieve adequate national coverage for dioxin and furans.

4.1.2.2 Freshwater Sediment Cores

In 2003, the Parties will collect freshwater sediment cores in Mexico to improve data on trends in concentrations of dioxins and furans, and hexachlorobenzene in Mexico's environment. Canada and the United States will share information with and provide assistance to Mexico to analyze the sediment core samples.

[4] The US National Dioxin Air Monitoring Network is a nationally based, ambient air-monitoring network, consisting of 17 stations, mostly in rural and non-impacted sites. It is used to estimate regional variability of the target analytes, which include vapor and particulate phases of dioxin-like compounds.

[5] Canada's PCDD/PCDF ambient air monitoring program has been carried out under the National Air Pollution Surveillance Network (NAPS) since 1989. Currently in the NAPS there are five rural and 14 urban monitoring sites in operation. Both particulate and vapor-phase PCDD/PCDF are collected using a modified high-volume sampler and analyses are conducted using high-resolution gas chromatography and high-resolution mass spectrometry. Samples are collected over 24-hours once every 12 or 24 days at the sites. Hexachlorobenzene is monitored at the NAPS stations located in the Great Lakes Basin. It is also measured in air and precipitation samples at five stations, one located at each of the Great Lakes, under the Integrated Atmospheric Deposition Network (IADN), which is jointly operated by Canada and the United States.

Canada is conducting freshwater sediment cores studies in the Great Lakes Basin. Historical trends of dioxins and furans, hexachlorobenzene, PCBs and other substances of concern in the Great Lakes Basin are being analyzed. The study is complete for Lake Ontario, Lake Erie and Lake St. Clair. Sediment cores analysis will also be conducted for the remaining lakes, Lake Huron and Lake Superior, within the next two years. In 2003, Canada will assess the need for additional lake sediment sampling and analysis.

4.1.2.3 Human Serum Sampling

In 2003, Mexico, assisted by Canada and the United States, will develop a study design for serum sampling designed to determine the nature and extent of exposure to dioxins and furans, and, if feasible, hexachlorobenzene, within the general Mexican population.

In 2003, the Parties will assess the feasibility of establishing a North America databank on human exposure as a means of assessing baseline levels and evaluating trends of dioxins and furans, and hexachlorobenzene, identifying populations at risk, and comparing and contrasting exposure among regions within North America over time.

By 2003, Canada will assess the need for additional sampling to assess exposure levels to dioxins, furans, and hexachlorobenzene, with particular reference to populations at risk. If judged necessary on the basis of the assessment, Canada will initiate serum sampling in selected populations to expand its database for exposure to these substances and will undertake periodic sampling subject to the availability of funding.

In 2003, the Parties will work collaboratively to assess serum sampling and analysis in Mexico.

4.1.2.4 Food Pathways Analysis

In 2003, the Parties will initiate or continue studies of food production, distribution and consumption patterns within North America with particular reference to Mexico and indigenous populations as way to better understand potential pathways of exposure to dioxins and furans, and hexachlorobenzene where data do not currently exist.

In 2004 the Parties will initiate a study design or continue existing efforts for food sampling and analysis, building upon the results of the food pathway study. Appropriate training will be established and sampling and analysis will be initiated in 2003.

In 2004, the Parties will have initiated identification and evaluation of opportunities to reduce dioxins exposure in food, taking into account food production, distribution and consumption patterns in their countries.

4.1.2.5 Fate and Transport Modelling

In 2003, the Parties will identify the role and application of models, information gaps, and possible steps to fill information gaps, in the quantification of long-range transport of dioxins and furans, and hexachlorobenzene, and identification of exposure pathways in North America.

4.1.2.6 Analytical Protocols and Sampling Techniques

In 2003, Canada and the United States will initiate assistance to Mexico to:

- identify analytical protocols and sampling techniques by surveying existing national protocols in OECD countries, including the potential of continuous dioxin monitoring systems;
- adopt protocols and sampling techniques by reference; and
- train government experts to monitor contractors for quality assurance/quality control, based on adopted protocols and techniques.

4.2 Laboratory Testing

4.2.1 Purpose

The Parties will work collaboratively to improve access to analytical laboratory services that operate with internationally accepted methods for measurement of dioxins and furans, and hexachlorobenzene.

4.2.2 Actions

The following actions on laboratory testing will be initiated in this Phase 1 NARAP.

4.2.2.1 Needs Analysis

In 2003, the Parties will work collaboratively to assess:

- Mexico's needs for laboratory services (i.e., with internationally accepted methods for measurement of dioxins and furans, and hexachlorobenzene); and
- alternatives to meet Mexico's needs for these laboratory services.

As part of this work, the Parties will also develop and devise a plan to maintain a current inventory of laboratory and field sampling capacity within North America.

4.2.2.2 Analytical Protocols

In 2003, Canada and the United States will initiate technical assistance to Mexico to:

- identify analytical protocols and sampling techniques by surveying prevailing practices in other countries;
- adopt protocols by reference; and
- train responsible government experts to monitor contractors for quality assurance and quality control, based on adopted protocols and sampling techniques.

4.3 Inventories

4.3.1 Purpose

The Parties will develop, refine, and maintain inventories of dioxins and furans, and hexachlorobenzene to improve characterization and verification of releases from existing and new sources,[6] and inform priority setting regarding risk-reduction activities.

4.3.2 Actions

The following actions on inventories will be initiated in this Phase 1 NARAP.

4.3.2.1 Improvement in Inventories

In 2003, the Parties will initiate source testing to:

- begin empirically verifying the emission factors used in Mexico's preliminary draft inventory completed as part of Phase 1 NARAP preparation; and
- establish or verify emission factors for source categories that remain untested within Canada, the United States and Mexico, or which are new to their respective inventories (e.g., uncontrolled combustion).

In 2004, the Parties will initiate work to:

- better estimate the size and flux of releases attributable to reservoir sources (e.g., the contribution of co-planar PCBs);[7]
- improve methodologies for conducting inventories; and
- where practicable, improve comparability of North American inventory data.

4.3.2.2 Public Access to Inventory Data

In 2004, the Parties will:

- assess current mechanisms for public access to data from national inventories and identify areas for improvements in public assess; and
- explore with the CEC's Pollutant Release and Transfer Register (PRTR) Working Group the possible relationships between PRTR activities and public access to information about releases of dioxins and furans, and hexachlorobenzene.

4.4 Pollution Prevention

4.4.1 Purpose

The Parties will identify and promote best environmental practices and best available techniques to prevent formation of dioxins and furans, and hexachlorobenzene.

4.4.2 Actions

The following actions on pollution prevention will be initiated in this Phase 1 NARAP.

4.4.2.1 Small-Scale and Household Waste Disposal

In 2003, the Parties will collaborate to initiate the preparation of a publicly releasable study to identify practices and techniques to prevent the formation of dixons and furans, and

-

[6] New sources are anticipated to include potentially significant sources, such as open burning dumps, forest clearing, titanium dioxide, that were not inventoried as of June 2001.

[7] Any compartment in which past emissions have been stored and from which they can be subsequently released.

hexachlorobenzene applicable to small-scale and household waste disposal, and assess their potential feasibility for remote communities and others with similar needs.

4.4.2.2 Production Processes

In 2004, the Parties will collaborate to prepare and publicly release a report identifying production processes that typically release dioxins and furans, and hexachlorobenzene to the environment, and alternatives to these processes and their potential feasibility (taking into account, as applicable, prevention measures referenced in Annex C, Part V (A) Annex C of the Stockholm Convention).

4.4.2.3 Microcontamination in Pesticides

The Parties will work in partnership with registrants to reduce/eliminate HCB, and 2,3,7,8-substituted dioxins and furans as microcontaminants in currently registered pesticides, in line with the best available technology from a manufacturing perspective and encourage the development of new technology, including the development of non-chemical alternatives.

If the level of the microcontamination remains unacceptable in currently registered pesticides, the Parties will work in partnership with registrants and other stakeholders to develop alternative products and/or pest control strategies to prevent or minimize releases.

4.5 Pollution Control

4.5.1 Purpose

The Parties will work collaboratively to identify and promote best environmental practices and best available techniques for pollution control in the three countries.

4.5.2 Actions

The following actions on pollution control will be initiated in this Phase 1 NARAP.

4.5.2.1 Controls on Combustion Sources

In 2003, the Parties will initiate a study for public release on pollution control techniques for small-scale waste disposal. This work will be integrated into the pollution prevention study, small-scale and household waste disposal (Section 4.4.2.1).

By 2004, the Parties will assess current approaches for pollution controls on combustion sources for dioxins to determine whether these approaches result in corresponding reductions in hexachlorobenzene emissions.

4.5.2.2 Small and Medium-Size Enterprises

In 2004, the Parties will initiate a study for public release pollution control techniques for small and medium-size enterprises. This work will be integrated into the pollution prevention study on production processes (Section 4.4.2.2).

4.6 Policy/Management Options

4.6.1 Purpose

The Parties will work to: (1) educate the public regarding the issues associated with environmental releases of dioxins, furans and hexachlorobenzene and the subsequent mandate of the NARAP and (2) collaboratively assess the current state of public policy options for reducing exposure to and preventing formation of dioxins and furans, and hexachlorobenzene.

4.6.2 Actions

4.6.2.1 Public Information Materials and Awareness Raising

By 2004, the Parties will prepare material for public release outlining the health and environmental concerns associated with these substances. Canada and the US will provide suitable materials to assist Mexico in developing various types of fact sheets and similar educational material suitable for distribution to the Mexican public.

4.6.2.2 Review and Analysis of Policy Options

In 2003, the Parties will work collaboratively to initiate a study for public release on options in law, policy and regulations found in North America, the European Union and Japan designed to address exposure to and formation of dioxins and furans, and hexachlorobenzene. Among other factors, this study will consider options for requiring best available technology or techniques for new sources.

4.6.2.3 Workshop on Policy Options

In 2003, in light of Mexico's evolving legislative and regulatory regime in these areas, the Parties will work with the CEC Secretariat to hold a workshop on policy options composed of two components, a government-to-government component and a public workshop component.

4.6.2.4 Voluntary Release Reduction Trial Initiative

In 2003, Mexico, assisted by CEC Secretariat, will assess prospects for working with one industrial sector to develop a sectoral voluntary approach to continuous improvement in reduction of releases.

4.7 Financial Resources for NARAP Implementation

4.7.1 Purpose

The Parties will work collaboratively to develop project proposals for leveraging third-party resources in the implementation of this NARAP.

4.7.2 Actions

4.7.2.1 Outreach to International Financial Institutions

Initiated in 2003 and continuing thereafter, the Parties will work collaboratively, supported by the CEC Secretariat, to share this NARAP with potential funding agencies (public and private) and third-party delivery agents and identify and develop projects (inclusive of proposals and applications for projects) with the aim of attracting third-party funding for activities requiring significant funding.

5 Implementation

5.1 Legal Infrastructure

The Parties agree to work to put in place the appropriate legal infrastructure, as required to implement the provisions of this NARAP.

5.2 Implementation Oversight Body

Upon Council adoption of this action plan, the SMOC Working Group will create a North American Implementation Task Force on Dioxins and Furans, and Hexachlorobenzene. The North American Task Force on Dioxins and Furans, and Hexachlorobenzene recommends that its members constitute the implementation task force. That group will track and report to the SMOC Working Group at its regular meetings on progress implementing NARAP actions and meeting NARAP goals and objectives.

5.3 Public Outreach and Transparency

The implementation task force for this NARAP will ensure that documents produced under this NARAP that are final products are made available to the public on the CEC web page and that workshops are held when appropriate to share information and encourage dialogue with stakeholders in the three countries.

6 Reporting

Canada, Mexico and the United States will report publicly to the CEC Council one year after approval of the Phase 1 NARAP and annually thereafter on success in implementing Phase 1 NARAP actions, as well as reporting on trends in levels in the environment and humans. Where progress has been slow, the Parties will make proposals for ameliorating/overcoming obstacles to action implementation.