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Foreword

This annual report provides an overview of the key results achieved under the *Canadian Environmental Protection Act, 1999* (CEPA 1999) for the period April 1, 2005, to March 31, 2006.

The publication of this report responds to the requirement under the *Canadian Environmental Protection Act, 1999* to provide an annual report to Parliament on the administration and enforcement of the Act, as well as the research conducted by Environment Canada and Health Canada. The chapters are organized according to the 11 major parts of the *Canadian Environmental Protection Act, 1999*. Each chapter contains introductory remarks that describe the applicable provisions of the *Canadian Environmental Protection Act, 1999* followed by a description of the key results achieved under that part.

The *Canadian Environmental Protection Act, 1999* specifies reporting on the following sections of the Act:

- **Activities of the *Canadian Environmental Protection Act, 1999* National Advisory Committee and any committees established under paragraph 7(1)(*a*)**: Section 1.1 of this report highlights the activities of the National Advisory Committee in 2005–06. There were no other committees established under paragraph 7(1)(*a*) of the *Canadian Environmental Protection Act, 1999* in 2005–06.
- **Administration of the Act under administrative agreements**: Section 1.2 of this report describes the activities under the administrative agreements in 2005–06.
- **Administration of agreements respecting equivalent provisions**: Section 1.3 of this report describes the activities under the *Canada–Alberta Equivalency Agreement* in 2005–06.
- **Research conducted under the authority of the Act**: Environment Canada and Health Canada scientists published numerous reports, papers, book chapters, articles, and manuscripts on subjects related to the *Canadian Environmental Protection Act, 1999*. This impressive body of work appeared in books and scientific journals that are available in libraries and from the publishers. Although it is not possible to describe all of these activities, Section 3.2 of this report provides examples of the types of research initiatives under way and their key contributions in 2005–06.
- **Administration of the international air pollution provisions**: Although there was no exercise of these specific provisions (Division 6 of Part 7) of the *Canadian Environmental Protection Act, 1999* in 2005–06, Section 7.7 of this report highlights results that flow from commitments to several international agreements respecting air pollution.
- **Administration of the international water pollution provisions**: Although there was no exercise of these specific provisions (Division 7 of Part 7) of the *Canadian Environmental Protection Act, 1999*, the findings of the International Joint Commission's *Twelfth Biennial Report on Great Lakes Water Quality* are discussed in Section 7.8.

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1 Administration (Part 1)

The administrative duties set out in the preamble of the Act are binding on the Government of Canada and include general requirements to:

- *protect the environment, including its biological diversity;*
- *apply the precautionary principle—i.e. where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation;*
- *promote pollution prevention;*
- *implement an ecosystem approach;*
- *encourage public participation;*
- *cooperate with other governments;*
- *avoid duplicating other federal regulations; and*
- *apply and enforce the Act fairly.*

Part 1 of the Canadian Environmental Protection Act, 1999 *(CEPA 1999) contains the authorities that enable the Minister to carry out the administrative duties through advisory committees such as the National Advisory Committee and the implementation of administrative and equivalency agreements.*

1.1 National Advisory Committee

The Canadian Environmental Protection Act, 1999 *requires the Minister of the Environment to establish a National Advisory Committee composed of one representative for each of the federal Ministers of Environment and Health, representatives from each province and territory, and not more than six representatives of Aboriginal governments drawn from across Canada.*

The Committee advises the Ministers on actions taken under the Act, enables national, cooperative action, and seeks to avoid duplication in regulatory activity among governments. The Committee also serves as the single window into provincial and territorial governments and representatives of Aboriginal governments on consultations and offers to consult.

To carry out its duties in 2005–06, the National Advisory Committee participated in one face-to-face meeting, five conference calls, and ongoing correspondence among members throughout the year. Federal initiatives brought to the Committee for discussion included:

- Risk management activities, such as developing, amending or repealing regulations, pollution prevention and environmental emergency plans, guidelines and codes of practice, proposed options for managing risk to the environment and human health, and issues related to a wide range of initiatives under the *Canadian Environmental Protection Act, 1999* and the pollution prevention provisions of the *Fisheries Act*.
- Risk assessment activities, such as screening assessments, procedures for categorizing substances on the Domestic Substances List with the greatest potential of exposure to humans, and an integrated framework for the health-related components of the Domestic Substances List categorization when it is released for public comment and establishment of an information exchange procedure between federal, provincial, territorial and Aboriginal governments in Canada respecting substances that are prohibited or substantially restricted for environmental or health reasons under the *Canadian Environmental Protection Act, 1999*.
- Other issues, including the *Canadian Environmental Protection Act, 1999* parliamentary five-year review and continued delivery on the federal agenda on cleaner vehicles, engines and fuels, were discussed.

The Committee's involvement varies with the nature of the issue and its relative priority for each jurisdiction. Shown below are two examples of how the Committee's advice helped to advance policy initiatives.

- **Used crankcase oil:** Letters of intent were received from provincial and territorial governments informing the departments that the risks posed by used crankcase oil are being addressed through provincial and territorial programs, legislation and regulations.
- **Climate change:** Multiple consultations on climate change were held throughout the year, including some on the 2005 Notice of Intent to regulate large final emitters.

www.ec.gc.ca/ceparegistry/gene_info/nac.cfm

1.2 Administrative Agreements

The Act allows the federal government to enter into administrative agreements with provincial and territorial governments as well as Aboriginal governments. These

agreements usually cover activities such as inspections, enforcement, monitoring, and reporting, with each jurisdiction retaining its legal authorities.

www.ec.gc.ca/CEPARegistry/agreements/Admin_Agree.cfm

1.2.1 Canada–Saskatchewan Administrative Agreement

The *Canada–Saskatchewan Administrative Agreement*, which came into force in September 1994, is a work-sharing arrangement covering certain provincial legislation and seven *Canadian Environmental Protection Act, 1999* regulations, including two regulations related to the pulp and paper sector, two regulations on ozone-depleting substances, and three regulations on polychlorinated biphenyls. There were no prosecutions under these regulations in 2005–06.

In this reporting period:

- Provincial authorities relayed to Environment Canada reports of five releases of electrical fluids that could have contained polychlorinated biphenyls. It was concluded that corrective actions were taken, including the immediate clean-up of the spills and proper disposal of polychlorinated biphenyls and contaminated soils. Of these five reported releases, one contained pure polychlorinated biphenyls at levels exceeding the federal prescribed limit of 50 parts per million, and one contained polychlorinated biphenyls at levels exceeding the provincial prescribed limit of 5 parts per million.
- Saskatchewan Environment continued to promote the use of the TIP line for environmental offences in 2005–06. A total of 822 TIP calls were received by Saskatchewan Environment over the year, of which 99 were related to environmental matters, including 5 involving the *Canadian Environmental Protection Act, 1999*.
- The only mill subject to the *Pulp and Paper Mill Effluent Chlorinated Dioxins and Furans Regulations* has been closed; continual effluent discharges are therefore no longer an issue. Due to rain and runoff, however, it was necessary for the mill to conduct a fall discharge in September 2006: it was found to be in compliance.
- Environment Canada conducted five field inspections under the *Ozone-depleting Substances Regulations, 1998*. No violations were detected.
- Environment Canada conducted three field inspections under the *Storage of PCB Material Regulations* (40 facilities are regulated by these Regulations), and no violations were detected. Saskatchewan Environment conducted three inspections under the provincial *PCB Storage* Regulations.

www.mb.ec.gc.ca/pollution/e00s63.en.html

1.3 Equivalency Agreements

The Act allows the Government of Canada to enter into Equivalency Agreements where provincial or territorial environmental legislation contains provisions that are equivalent to the Canadian Environmental Protection Act, 1999 *provisions. The purpose of these agreements is to eliminate the duplication of environmental regulations where equivalent regulatory standards (including similar measurement and testing procedures and penalties and enforcement programs) and similar provisions for citizens to request investigations are available in provincial or territorial environmental legislation.*

www.regulation.gc.ca/default.asp?Language=E&Page=smartregint

The federal government has the responsibility to report annually to Parliament on the administration of Equivalency Agreements.

1.3.1 Canada–Alberta Equivalency Agreement

In December 1994, an *Agreement on the Equivalency of Federal and Alberta Regulations for the Control of Toxic Substances in Alberta* came into effect. As a result of the agreement, the following *Canadian Environmental Protection Act, 1999* regulations no longer apply in Alberta:

- *Pulp and Paper Mill Effluent Chlorinated Dioxins and Furans Regulations* (all sections);
- *Pulp and Paper Mill Defoamer and Wood Chip Regulations* (sections 4(1), 6(2), 6(3)(*b*), 7, and 9);
- *Secondary Lead Smelter Release Regulations* (all sections); and
- *Vinyl Chloride Release Regulations, 1992* (all sections).

Under the terms of the Agreement, the regulated industries in Alberta are not required to submit reports to Environment Canada. As a result, Alberta Environment identifies instances of non-compliance to Environment Canada. In 2005–06, all four pulp and paper mills complied with the chlorinated dioxins and furans emission limits set out in the regulations. There were two reports of non-compliance at one of the two vinyl chloride plants in Alberta. Alberta Environment

investigated the incidents and found the company duly diligent. Currently, there are no lead smelters in Alberta, and therefore there are no compliance issues to be addressed or reported under the *Secondary Lead Smelter Release Regulations*.

www.mb.ec.gc.ca/pollution/e00s61.en.html

1.4 Related Federal/Provincial/Territorial Agreements

1.4.1 Canada–Ontario Agreement Respecting the Great Lakes Basin Ecosystem

Under subsection 9(1), the Minister of the Environment may negotiate an agreement with a government with respect to the administration of the *Canadian Environmental Protection Act, 1999*. The *Canada–Ontario Agreement Respecting the Great Lakes Basin Ecosystem* is an important administrative mechanism through which the governments of Canada and Ontario plan and coordinate actions to restore, protect and conserve the Great Lakes Basin ecosystem.

Pollution prevention is a key aspect of the annexes to the *Canada–Ontario Agreement Respecting the Great Lakes Basin Ecosystem*: Cleaning up the most severely degraded spots in the Great Lakes (Annex 1—Areas of Concern); working toward virtual elimination of toxic substances on an ecosystem scale (Annex 2—Harmful Pollutants); developing and implementing multistakeholder-endorsed plans to restore and protect each of the Great Lakes (Annex 3—Lakewide Management); and coordinating monitoring, research and information (Annex 4—Monitoring and Information Management). Pollution prevention actions taken in 2005–06 under *Canada–Ontario Agreement Respecting the Great Lakes Basin Ecosystem* include the following:

- Regulatory as well as voluntary measures by the public and industry have resulted in significant reductions in concentrations of harmful pollutants, including 89% for high-level polychlorinated biphenyls, 84% for mercury, 87% for dioxins/furans, 45% for benzo(a)pyrene, and 68% for hexachlorobenzene since 1988.
- In April 2005, a guide titled *Dental Wastes: Best Management Practices Guide for the Dental Community* was published. The guide was aimed at informing members of the dental community on the proper management of hazardous wastes in order to minimize the release of toxic substances, especially mercury, to the environment.
- As of July 1, 2005, more than 450 Canadian automobile recyclers participated in the Auto Switch-out Program (a voluntary, Canada-wide program to collect mercury-containing switch pellets from vehicles before they enter the waste stream) and close to 80,000 switches were collected.
- A joint Canada–Ontario workshop on emerging substances, *Identifying and Developing Strategies for Canada's and Ontario's Response to Emerging Substances in the Great Lakes Basin,* was held in March 2006 in Toronto, Ontario. Approximately 100 federal and provincial representatives participated in the workshop to share knowledge regarding the research, assessment and management of emerging substances; identify challenges and data gaps; and discuss potential strategies and approaches that could inform future work under the *Canada–Ontario Agreement Respecting the Great Lakes Basin Ecosystem*.

www.on.ec.gc.ca/greatlakes

1.4.2 Canada-wide Standards

Developed under the Canadian Council of Ministers of the Environment Harmonization Accord and Sub-agreement on Environmental Standards, Canada-wide Standards are designed to provide a high level of environmental quality and consistency in environmental management across the country. While the standards are developed by the Canadian Council of Ministers of the Environment, the Minister of the Environment uses section 9 of the *Canadian Environmental Protection Act, 1999*, related to administrative agreements, to enter into federal commitments to meet the Canada-wide Standards.

Priority substances for Canada-wide Standards include mercury, dioxins and furans, benzene, particulate matter, ground-level ozone, and petroleum hydrocarbons in soil. During the reporting period, there were 12 Canada-wide Standards in place addressing these six substances or groups of substances from the perspective of various sectors. The Ministers have committed to being accountable to the public and each other by developing implementation plans to achieve the targets set out in the standards. More information on the status of the Canada-wide Standards can be found on the Canadian Council of Ministers of the Environment Web site.

www.ccme.ca/ourwork/environment.html?category_id=108

1.4.2.1 Dioxins and Furans

In preparation for the 2006 review of the Canada-wide Standards for dioxins and furans, Environment Canada, along with the Canadian Council of Ministers of the Environment, conducted a scoping analysis for the review. This analysis examined the status of sectoral emissions, researched developments in alternative technologies, and assessed the feasibility of implementing any new technologies identified for controlling emissions from waste incineration, coastal pulp and paper boilers, iron sintering, and electric arc furnaces used in steel manufacturing. The outcome of this exercise was a recommendation that waste incineration was the only sector for which the Canada-wide Standards for dioxins and furans were in need of review. A Waste Incineration Working Group was formed to review the Canada-wide Standards starting in fiscal year 2006–07. In 2005–06, this group updated the inventory of incinerators owned, operated or managed by federal departments and agencies. Further, the Canadian Council of Ministers of the Environment commissioned a report titled *Dioxins and Furans Canada-wide Standards: Emission Inventory Update and Review of Technical Pollution Prevention Options*. This report provides an update on the status of facilities in the incineration, coastal pulp and paper, iron sintering and electric arc furnace sectors with respect to achievement of their relevant Canada-wide Standards for dioxins and furans, and assesses the potential for the deployment of new control technologies or production processes.

1.4.2.2 Mercury

Canada-wide Standards were endorsed for mercury emissions (base-metal smelting and waste incineration) in 2000 and for mercury-containing lamps and dental amalgam waste in 2001. Timelines for achieving the Canada-wide Standards targets are 2008 (base-metal smelting), 2003–06 (waste incineration), 2010 (mercury-containing lamps), 2005 (dental amalgam waste) and 2010 (coal-fired electric power generation plants).

For mercury-containing lamps, industry has voluntarily surpassed the target of a 70% reduction by 2005 (currently at 73.5%) and is expected to achieve the 80% reduction target by 2010. As a complementary activity to the Canada-wide Standards, Environment Canada is working with federal departments to encourage life cycle management of mercury-containing products, particularly fluorescent lamps. A guidance manual for federal facilities has been developed and promotion is under way.

For dental amalgam waste, which may be discharged to municipal wastewater systems, the primary tool for national implementation is the Memorandum of Understanding between Environment Canada and the Canadian Dental Association. Collaborative work was undertaken with the Canadian Dental Association and jurisdictions in 2004 and 2005 to promote attainment of the Canada-wide Standard by December 31, 2005. The evaluation of the outcomes of the Canada-wide Standards and the Memorandum of Understanding are ongoing and will be reported on in the 2006–07 *Canadian Environmental Protection Act, 1999* Annual Report.

Through Environmental Technology Verification Canada, a new procedure was developed to test equipment that removes mercury from dental amalgam waste prior to its discharge to sewer systems. This Canadian method is equivalent to the ISO 11143 method currently available in Europe.

Since 1997, the Ontario Centre for Environmental Technology Advancement, under a licensing agreement with Environment Canada, has been delivering Canada's Environmental Technology Verification program. The Environmental Technology Verification program is a voluntary initiative that promotes the commercialization of new environmental technologies through independent third-party verification of the technology proponent's performance claims. These verifications assure clients and users of high technical credibility and performance standards.

As for waste incineration, Environment Canada is working with federal departments that own and/or operate non-hazardous waste incinerators to ensure achievement of the targets in the Canada-wide Standards. Efforts to reduce mercury emissions will be implemented through the adoption of the *Mercury-containing Product Stewardship Manual for Federal Facilities*. Information is currently being gathered on mercury emissions at federally owned hazardous waste incineration facilities. This includes verification of federally owned hazardous waste incinerators and the collection of information pertaining to mercury emissions.

For base-metal smelting, Environment Canada is working through the Base Metals Environmental Multi-stakeholder

Advisory Group to monitor progress towards achievement of the standard. Work indicates that all facilities, with the exception of one, are meeting the Canada-wide Standards. In addition, on September 25, 2004, a *Proposed Notice Requiring the Preparation and Implementation of Pollution Prevention Plans in respect to Specified Toxic Substances Released from Base Metals Smelters and Refineries and Zinc Plants* was published. A draft *Environmental Code of Practice for Base Metals Smelters and Refineries*, dated June 2004, was also published. Both include the Canada-wide Standards for mercury emissions among the factors to consider. Work to finalize this Notice proceeded through 2005–06, as described in Section 4.1 of this report, and publication of the Final Notice, including reference to this Canada-wide Standard in Part I of the *Canada Gazette,* was expected for April 2006.

www.ec.gc.ca/MERCURY/MM/EN/mm-cws.cfm?SELECT=MM#mcl<

Along with the governments of the provincial and territorial jurisdictions, Environment Canada endorsed the Canada-wide Standards for mercury emissions from coal-fired power plants in 2006. The Canada-wide Standards are set to reduce mercury emissions from coal-fired power plants by 45% relative to 2003.

1.4.2.3 Particulate Matter and Ozone

Under the agreement on particulate matter and ozone, the federal government was responsible for developing an implementation plan which, among other things, would contribute to:

- Reducing the transboundary flow of particulate matter and ozone and their precursor pollutants into Canada;
- Reducing transportation-based emissions;
- Reducing emissions from commercial and consumer products, including residential wood-burning appliances and solvent-containing products;
- Continually improving and retaining keeping-clean-areas-clean strategies for federally owned lands and facilities;
- Advancing health and environmental science, monitoring and outreach.

In 2005–06, Health Canada initiated the development of new assessments for particulate matter and ozone to meet the requirements of the Canada-wide Standards to review the numerical standards by 2010. The first draft of these assessments will be completed by June 2007, and the final assessments are scheduled for completion by March 2008. Environment Canada continued its work developing Environmental Codes of Practice for steel manufacturing facilities and finalizing the Pollution Prevention Planning Notice for the base metals smelting sector, as detailed in Section 4.1. These initiatives include a variety of measures addressing the control of emissions of particulate matter, ozone and their precursors from these sectors.

The Burn It Smart campaign has been used in different venues (e.g. workshops, expos, fairs, magazines) to educate Canadians on good wood burning practices. A Model Municipal By-Law to regulate wood burning appliances is under development with the contribution of a stakeholder group. Environment Canada collaborates with the British Columbia Ministry of the Environment in its wood heating emission reduction initiative.

1.4.2.4 Petroleum Hydrocarbons

The Canada-wide Standard for petroleum hydrocarbons in soil is currently undergoing its first five-year review. Information regarding the implementation of the Canada-wide Standards continues to be collected in anticipation of the next requirement to report to Ministers in 2008. It is expected that there will have been an increase in the application of the Canada-wide Standards during the assessment or remediation of sites with petroleum hydrocarbon contamination, beyond the 50% estimated for 2003–04.

www.ccme.ca/ourwork/environment.html?category_id=108

1.4.3 Canada-wide Strategy for the Management of Wastewater Effluents

Environment Canada recognizes the key role that provinces and territories play in the management of wastewater and is working with these jurisdictions and other stakeholders through the Canadian Council of Ministers of the Environment. In November 2003, the the Canadian Council of Ministers of the Environment agreed to develop a Canada-wide Standard for the management of municipal wastewater effluents. The strategy, to be completed in 2007, will include:

- a harmonized regulatory framework;
- coordinated science and research; and
- an environmental risk management model.

Environment Canada intends to develop a regulation under the *Fisheries Act* as its principal instrument to contribute

to the implementation of the Canada-wide Standards. The regulation will include national standards and be applied in a harmonized regulatory framework with the provinces and territories. The desired outcomes are a set of standards applied in a fair, consistent and predictable manner and to ensure that the release of wastewater effluent poses no unacceptable risks to human and ecosystem health or fisheries resources.

2 Public Participation (Part 2)

Public participation in matters related to the Canadian Environmental Protection Act, 1999 *(CEPA 1999) is an integral part of the success of the Act. Part 2 outlines participation requirements under the Act, such as the establishment of an environmental registry, whistleblower protection, and the right to seek damages.*

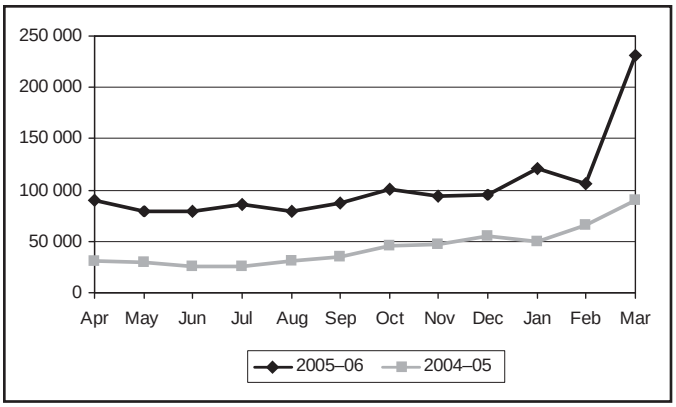
2.1 CEPA Environmental Registry

The CEPA Environmental Registry was launched on Environment Canada's Web site with the proclamation of the *Canadian Environmental Protection Act, 1999* on March 31, 2000. Since that time, ongoing efforts have been made to increase the registry's reliability and user-friendliness. The content and structure of the registry continue to evolve as new documents are added and as improvements are identified by users. To date, usage reports have indicated that the information found on the registry is useful not only to the public, but also within Environment Canada itself. The registry continues to expand to serve Canadians better and now encompasses thousands of *Canadian Environmental Protection Act, 1999* related documents and references. It has become an important source of environmental information for the public and private sectors, both nationally and internationally, and promotes greater public participation in key departmental priorities.

The *Canadian Environmental Protection Act, 1999* requires that the implementation of the Act be reviewed every five years by parliamentary committees. To assist Canadians in developing and sharing their views on issues they believe should be addressed during the Parliamentary Committee Review of the *Canadian Environmental Protection Act, 1999*, a new section of the Registry was developed. The CEPA Review chapter of the Registry is a collection of public information on activities related to the Parliamentary Review, and it was launched in January 2005 with an invitation for the public to participate in a series of workshops structured around a draft scoping paper on *Canadian Environmental Protection Act, 1999* related issues. As the Review of the *Canadian Environmental Protection Act, 1999* unfolds, additional reports and updates will be added to keep Canadians up-to-date on the progression through the four phases of the Review process: Preparations for Parliamentary Review, Review of Act by Parliamentary Committee, Government Response, and Bill Phase, if required.

Since the launch of the CEPA Environmental Registry, usage has continued to follow an upward trend. The 1,250,000 visits to the Web site during 2005–06 were more than double the total of the previous year. Throughout 2005–06, usage continued to grow to the point that, by March 2006, the number of visits per month had increased to more than 230,000, well above the yearly average of just over 100,000 visits per month.

Figure 1 Number of Environmental Registry Visits



www.ec.gc.ca/CEPARegistry

2.2 Public Consultations

The public was invited to comment on 11 *Canadian Environmental Protection Act, 1999*-related Notices, Orders and Regulations published in the *Canada Gazette*, the official newspaper of the Government of Canada. In addition, 8 environmental and health protection initiatives were posted on the CEPA Environmental Registry for stakeholder and public input. Some initiatives were also posted on various Environment Canada and Health Canada Web sites.

www.ec.gc.ca/CEPARegistry/participation/

Canadian Environmental Protection Act, 1999 ***Public Participation Initiatives for 2005–06 as Reported in the CEPA Registry***

Agreements

- Notice respecting an administrative agreement between the governments of Canada and Quebec pertaining to the pulp and paper sector
- Memorandum of Understanding for environmental protection through action under CCPA Responsible Care® with the Canadian Chemical Producers' Association
- Draft Environmental Performance Agreement for refractory ceramic fibers
- Agreement respecting the Canada-wide Standard for mercury emissions from coal-fired electric power generation plants. Environment Canada's response to comments received by the public was also published.

Guidelines

- Proposed residential indoor air quality guideline for formaldehyde

Pollution Prevention

- Proposed notice requiring the preparation and implementation of pollution prevention plans for inorganic arsenic compounds, hexavalent chromium compounds, polychlorinated dibenzodioxins, polychlorinated dibenzofurans and/or hexachlorobenzene used by wood preservation facilities
- Draft notice requiring the preparation and implementation of pollution prevention plans for inorganic arsenic compounds, hexavalent chromium compounds, polychlorinated dibenzodioxins, polychlorinated dibenzofurans, and/or hexachlorobenzene used by wood preservation facilities

Regulations

- *Regulations Respecting 2-butoxyethanol*
- *Regulations Amending the Prohibition of Certain Toxic Substances Regulations, 2005 (2-methoxyethanol, pentachlorobenzene and tetrachlorobenzenes)*
- Notice of intent to regulate greenhouse gas emissions by large final emitters
- Potential amendments to the *Sulphur in Diesel Fuel Regulations*
- *Regulations Amending the On-road Vehicle and Engine Emissions Regulations*
- Drafting Instructions: Cross-cutting Provisions for the *Large Final Emitters Regulations*
- Proposed Regulatory Provisions for the Export and Import of Non-hazardous Waste

Substances

- The recommended approach for the exchange of information with member countries of the Organisation for Economic Co-operation and Development regarding substances that are prohibited or substantially restricted
- Priority Substances List 1 *Draft Follow-up Report on the Assessment of Chlorinated Paraffins*
- Proposed Integrated Framework for the Health-related Components of Categorization of the Domestic Substances List
- Order Adding Greenhouse Gases to the Toxic Substances List (Schedule 1)
- Order to correct an inconsistency in the numbering of the Toxic Substances List (Schedule 1)

3 Information Gathering, Objectives, Guidelines and Codes of Practice (Part 3)

Part 3 authorizes the Minister of the Environment to:

- *establish environmental monitoring systems;*
- *collect and publish data on environmental quality in Canada;*
- *conduct research and studies on pollution control and environmental contamination;*
- *formulate plans for pollution prevention and the control and abatement of pollution; and*
- *publish information on pollution prevention, pertinent information on all aspects of environmental quality, and a periodic report on the state of the Canadian environment.*

This Part also authorizes the Minister of Health to:

- *collect, process, correlate and publish, on a periodic basis, data from any research or studies conducted relating to the role of substances in illnesses or in health problems; and*
- *distribute available information to inform the public about the effects of substances on human health.*

3.1 Environmental Quality Monitoring

Delivering environmental results depends, in part, on Environment Canada and Health Canada:

- *having the information needed to determine whether or not programs and tools are having their intended effect of improving environmental quality and of reducing human exposure to harmful substances in the environment with subsequent health benefits; and*
- *providing the public, including industry, with information related to environmental quality and trends that might prompt it to change its behaviour.*

In Canada, air and water quality monitoring is carried out through partnerships among provincial, territorial and federal governments, municipalities, universities, air and water associations, environmental groups and volunteers.

www.ec.gc.ca/CEPARegistry/SandT/Monitoring.cfm

3.1.1 National Air Pollution Surveillance Network

The National Air Pollution Surveillance network is a joint federal, provincial, territorial and municipal network established in 1969. It is primarily an urban network, with nearly 300 air monitoring stations in 177 communities. In total, almost 840 instruments, including continuous analyzers, particulate monitors, and samplers, are used to provide air quality measurements of toxic substances such as polycyclic aromatic hydrocarbons and dioxins and furans, as well as heavy metals such as arsenic, lead and mercury. Over the years, the network has produced one of the largest and most geographically diverse databases of pollutants in Canada.

Data from the National Air Pollution Surveillance network is used in the Canada-wide Standards programs for assessing trends in both particulate matter and ozone. Ozone data is used by the Canadian Environmental Sustainability Indicators program for its air indicator, while the Canada–U.S. Agreement on Air Quality uses data from the National Air Pollution Surveillance network for discussions relating to transboundary pollution. In addition, a large number of requests for data are received each year from Environment Canada and Health Canada and by provincial, territorial and municipal governments for their various studies.

In 2005–06, the network was expanded to provide enhanced coverage of particulate matter with a median diameter of 2.5 microns in anticipation of the Canadian Environmental Sustainability Indicators program adding particulate matter with a median diameter of 2.5 microns to the air indicator for 2006 and subsequent years. Since no standard technique exists for measuring particulate matter with a median diameter of 2.5 microns, an intercomparative study was initiated to provide information on the differences between the common real-time measurement techniques and the conventional gravimetric techniques. To understand the composition of particulate matter with a median diameter of 2.5 microns, which varies considerably with location and season, a particulate matter with a median diameter

of 2.5 microns speciation network was also established. By summer 2006, this network will have 12 sites in place. Samples taken at each site will be analyzed for organic and elemental carbon, ions and metals. The data will then be analyzed to ascertain the impact of local sources, both stationary and mobile, and long-range transport. As well, the data will be used to understand the various chemical processes that occur in the atmosphere.

Health Canada has collaborated with Environment Canada since 2002 to assure consistency between Health Canada's measurements of airborne metals in indoor environments and those of the National Air Pollution Surveillance network. Accomplishments in 2005–06 include interlaboratory and intermethod comparisons between the Environmental Health Sciences Bureau of Health Canada and Environment Canada's Environmental Technology Centre. A valuable outcome of this work was the improvements on protocols for the total extraction of metals from urban particles.

3.1.2 Canadian Air and Precipitation Monitoring Network

The Canadian Air and Precipitation Monitoring Network is a regional/remote monitoring network that has been measuring air quality since 1978. There are currently 30 measurement sites in Canada, located in rural areas representative of regional air quality. One site in the United States and another in Canada ensure the comparability of measurement methods between the Canadian and U.S. networks.

In 2005–06, the network continued to support air quality programs by:

- providing the background information required for Environment Canada's environmental prediction and air quality forecasts for ground-level ozone;
- exchanging data under the *Canada–United States Air Quality Agreement* Ozone Annex obligations (see Section 7.7.1); and
- providing data to the Aerometric Information Retrieval System database for near-real-time reporting of ozone levels and particulate matter in Canada and the United States.

Data have also been collected at selected sites on a wide range of other pollutants, including substances that were found to meet the criteria of section 64 of the *Canadian Environmental Protection Act, 1999* (e.g. particulate sulphate, gaseous ammonia, nitrate, gaseous sulphur dioxide and nitric acid). Over 25,000 samples of all types were analyzed in 2005–06 in support of Canadian environmental research initiatives.

www.msc-smc.ec.gc.ca/natchem/particles/n_capmon_e.html

3.1.3 North American Commission for Environmental Cooperation

Under the North American Commission for Environmental Cooperation, Health Canada is leading a tri-national maternal blood contaminant study with the United States Centers for Disease Control and Prevention and the Mexican National Institute of Public Health. The protocol has been finalized and sampling is under way, after initial delays in enrolment due to ethics reviews at all the Canadian sites. When the results are available from all three national sampling programs, Health Canada has agreed to assemble the tri-national database and undertake the national comparisons. A tri-national report and scientific papers will be prepared based on the results of this study.

3.1.4 Northern Contaminants Program

The Northern Contaminants Program has continued its monitoring and assessment work by measuring levels and time trends of pollutants, including persistent organic pollutants, mercury and other metals, as well as new and emerging chemicals, in air, water, biota, country foods and human beings. Human health research on exposure to and effects of these contaminants is being funded by the Northern Contaminants Program and is under way in Arctic Canada. The Northern Contaminants Program is led by Indian and Northern Affairs Canada, but is managed by an interdepartmental (Health, Environment, Fisheries) and multi-sectoral (Aboriginal groups, territorial governments) management team.

In 2005–06 a special issue of the journal *The Science of the Total Environment* included an assessment of Arctic human health issues by 17 health scientists. Titled "Human Health Implications of Environmental Contaminants in Arctic Canada: A Review," the information it contains has been used by Canada to meet some of its reporting and monitoring requirements under international agreements such as the *Stockholm Convention on Persistent Organic Pollutants* and the United Nations Economic Commission for Europe's *Convention on Long-range Transboundary Air Pollution*.

The Northern Contaminants Program agreed in 2005–06 to undertake an update on the human health implications of Arctic environmental contaminants and this assessment will be released in 2008. This will provide input of Canadian data to the Arctic Monitoring and Assessment Programme.

3.1.5 Arctic Monitoring and Assessment Programme

The Canadian Northern Contaminants Program and the international Arctic Monitoring and Assessment Programme collect and publish data on the health impacts of the long-range transport of pollutants into the Arctic. Their findings show that bioaccumulation of some persistent organic pollutants in the traditional marine mammal diet of Inuit peoples can exceed human health guidelines for dietary intake. The Arctic Monitoring and Assessment Programme Human Health Assessment Group, co-led by Canada (Health Canada) and Denmark, has agreed to undertake a third contaminant assessment of the circumpolar Arctic, including special reference to mercury, as requested by the Arctic Monitoring and Assessment Programme Working Group and Arctic Council of Ministers; its release is scheduled for late 2008.

3.1.6 Global Atmospheric Passive Sampling Study

The Global Atmospheric Passive Sampling Study is a global network for monitoring chemicals in the environment using simple sampling devices that require no electricity. This two-year pilot study was initiated in December 2004 at more than 50 sites located on all seven continents. It is a collaborative effort managed by Environment Canada scientists working with a team of international researchers. The results of the study will contribute to Canada's obligations under the *Stockholm Convention on Persistent Organic Pollutants* under the United Nations Environment Programme, specifically Article 16 on Effectiveness Evaluation, and the United Nations Economic Commission for Europe's Persistent Organic Pollutants Protocol. As a result of the successful pilot study and the need for continued measurements of persistent organic pollutants in the air, Global Atmospheric Passive Sampling will be maintained over the next few years with an emphasis on filling data gaps for persistent organic pollutants, and capacity building and technology transfer with developing regions.

3.1.7 Water Quality Monitoring

Environment Canada, in partnership with Statistics Canada, Health Canada, and the provinces and territories, began implementation of the national Freshwater Quality Indicator program under the Canadian Environmental Sustainability Indicators initiative. The program includes the expansion of the nationwide water quality monitoring network to support the data requirements of annual reporting on freshwater quality. A preliminary national freshwater indicator was reported on in the first Canadian Environmental Sustainability Indicators annual report, published in the fall of 2005. It integrates data from federal, provincial and territorial water quality monitoring networks.

Environment Canada completed a three-year, national-scale surveillance project to identify the presence and levels of priority pesticides in selected Canadian aquatic ecosystems. This project, which was funded by Environment Canada's Pesticide Science Fund, focused on vulnerable watersheds (e.g. sensitive aquatic habitats and drinking water sources). The results of this project provide direct decision-support to the Pest Management Regulatory Agency for pesticide re-evaluations and special reviews, assisting the Pest Management Regulatory Agency to measure the success of some of its risk-management efforts.

3.1.8 Framework for National Northern Strategy

On December 14, 2004, the Prime Minister and Territorial First Ministers released a draft framework for the first-ever jointly developed Northern Strategy. The framework included a draft vision for the North, along with suggested principles to guide the development of the Strategy and set possible goals and objectives to realize the vision for the North, as laid out in the Northern Strategy Framework.

Several monitoring programs will support the strategy. In 2004–05, four air quality monitoring stations, through the National Air Pollutant Surveillance network, were deployed in the North to provide data in support of the Strategy's objectives. Yellowknife has two monitoring sites that are equipped to sample for ozone, sulphur dioxide, nitrogen oxides, carbon monoxide, particulate matter less than or equal to 2.5 and 10 microns, and total suspended solids. The other two stations are located in the Yukon and Nunavut. The Yukon station is set up to monitor for ozone, nitrogen oxides, carbon

monoxide and particulate matter less than or equal to 2.5, whereas the Nunavut station, located in downtown Iqaluit, allows for the collection of coarse particulate matter. Nunavut has plans to include additional stations and the monitoring of fine particulate matter.

In addition, the Northwest Territories have made plans to expand the air monitoring network to address the proposed Mackenzie Gas Project (natural gas pipeline), diamond mines, diesel power generation, hospital biomedical waste incinerators, and overall community air quality.

The Ecological Monitoring and Assessment Network seeks to improve understanding of ecological change in Northern Canada by promoting coordination and communication of the results of long-term ecological monitoring. The network also contributes to the understanding of issues such as persistent organic pollutants and heavy metals, climate change, environmental predictions, and changes to fresh water. The data collected will be used to support the Northern Strategy and its goals.

Other monitoring programs that monitor the North include:

- Air quality monitoring at Alert, Nunavut, under the World Meteorological Organization's Global Atmospheric Watch network. Alert (latitude 82°N, longitude 63°W) is the northernmost observatory in the Global Atmosphere Watch network of stations that have been tracking the chemistry of the atmosphere on a global basis. Substances monitored include carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, chlorofluorocarbons, carbon monoxide, ozone, aerosols, peroxyacetyl nitrate, radon, mercury, and ultraviolet radiation.
- The Canadian Air and Precipitation Monitoring Network (see Section 3.1.2): The network is planning to upgrade its Web site to acquire continuous ozone and particulate matter less than or equal to 2.5 data for air quality forecasts.

www.eman-rese.ca/eman/

www.msc.ec.gc.ca/iadn/

3.1.9 Great Lakes and Regional Environmental Quality Monitoring and Surveillance

Ambient environment quality monitoring programs are carried out in Lakes Superior, Huron, Erie, and Ontario, as well as in the St. Clair/Detroit corridor and the Niagara and St. Lawrence rivers. Measurements of organic contaminants (including emerging chemicals) and trace metals are made in water, whole fish (top predators) and sediment to assess progress toward specific goals in environmental improvement, to identify problems and emerging issues, and to support planning and decision-making. While long-term trends indicate declining concentrations of most contaminants, some chemicals continue to exceed water and sediment quality guidelines, as well as guidelines for the protection of piscivorous wildlife; and fish consumption advisories continue throughout the Great Lakes. Reports on legacy pollutants, in-use pesticides (Kannan et al., 2006),[1] including a series of reports highlighting the results of screening-level surveys of sediment quality in Great Lake tributaries (Burniston and Kraft, 2006a),[2] (Burniston and Kraft 2006b);[3] (Burniston, et al., 2006)[4] and Lake St. Clair surface sediment contamination (Gewurtz, et al., 2006)[5] have been completed.

In 2003, the Binational Executive Committee, which is co-chaired by the United States Environmental Protection Agency and Environment Canada, endorsed the Cooperative Monitoring Initiative to improve the coordination of monitoring in the Great Lakes. A five-year rotational cycle was adopted to focus on one lake per year, with Lake Ontario being the first (2003), followed by Lake Erie (2004), Lake Superior (2005–06) and Lake Huron (2007). During both 2005 and 2006, the focus was on Lake Superior. Cooperative Monitoring efforts included multi-media (atmospheric, water, sediment, fish and lower foodweb) measurements of critical pollutants, as well as atrazine and emerging chemicals; nearshore and offshore lower trophic level monitoring; screening of Canadian and U.S. tributaries for toxic contaminants; and a multi-agency intercomparison study for contaminants in fish. These efforts

[1] Kannan, K., J. Ridal, and J. Struger. 2006. *Pesticides in the Great Lakes*; In: Persistent Organic Pollutants in the Great Lakes. Series: the Handbook of Environmental Chemistry: Volume 5. Ed., R. Hites. ISBN: 987-3-540-29168-8

[2] Burniston, D.A. and J. Kraft. 2006a. Sediment Quality in Lake Huron Tributaries: A Screening-Level Survey. EDH Reports # ECB/EHD-OR/06-01/I.

[3] Burniston, D.A. and J. Kraft. 2006b. Sediment Quality in Lake Superior Tributaries: A Screening Level Survery. EHD Reports # ECB/EHD-OR-06-03/I.

[4] Burniston, D.A., A. Dove and J. Kraft. 2006. Sediment Quality in Lake Ontario and Lake Erie Tributaries: Status and Follow-up Results of ongoing Investigations. EHD Reports # ECB/EHD-OR/05-03/I.

[5] Gewurtz, S.B., P.A. Helm, J. Waltho, G.A. Stern, E.J. Reiner, S. Painter and C.H. Marvin. 2007 Spatial distribution and temporal trends in sediment contamination in Lake St. Clair. J. Great Lakes Res. 33:668-685.

pulled together federal, state and provincial agencies in a unique way that allowed for building on existing programs.

Mean values of eight contaminants in Herring Gull eggs were calculated for 15 Great Lakes sites for the five-year period from 1998 to 2002. The sites were ranked according to the concentrations of seven compounds relative to fish flesh criteria for the protection of piscivorous wildlife and a single overall rank was calculated for each site. Eggs from Saginaw Bay, the St. Lawrence River and northern Lake Michigan ranked as the three most contaminated sites, and those from eastern Lake Superior, southern Lake Huron and eastern Lake Erie ranked as the three least contaminated sites *(*Weseloh, Pekarik, and de Solla, 2006).[6]

3.1.10 Integrated Atmospheric Deposition Network

Mandated by Annex 15 of the Great Lakes Water Quality Agreement, the Integrated Atmospheric Deposition Network is a Canada–United States network that monitors concentrations of persistent, bioaccumulative and toxic pollutants in the air and in precipitation near the Great Lakes. In 2005–06, the network measured the concentrations of polychlorinated biphenyls, organochlorine pesticides, polycyclic aromatic hydrocarbons and trace metals in the atmosphere at stations located on the shores of all the Great Lakes. The results show that the lakes are still receptors of atmospheric deposits of toxic chemicals and that levels of banned compounds in air and precipitation are generally decreasing following the in-basin emission control of these substances. In addition, data indicate that future reductions in the levels of toxic chemicals in the water will be directly related to decreasing concentrations of these compounds in the atmosphere.

A report on contaminant loadings for the period 2001–04 indicates that polychlorinated biphenyls continue their trend of volatilizing—the process by which polychlorinated biphenyls in surface waters become airborne—out of the Great Lakes, emphasizing the link between lake water and atmospheric concentrations. Loadings of combustion and industrial by-products such as polycyclic aromatic hydrocarbons and trace metals have remained constant over time. Urban areas are important sources of atmospheric toxic pollutants, particularly polychlorinated biphenyls and polycyclic aromatic hydrocarbons, and the inclusion of urban data is critical to obtaining an accurate representation of the deposition of airborne toxic pollutants to the Great Lakes Basin.

www.on.ec.gc.ca/monitoring/water-quality/

3.1.11 State of the St. Lawrence Monitoring Program

Monitoring of physical, chemical and biological parameters in the St. Lawrence is ongoing. Data were collected on the quality of water and sediment, shore erosion, land-use patterns, changes in the composition of wetland plants, invasive plant species, and the benthic communities inhabiting Lake Saint-Pierre and analysed to report on the situation to the public. Monitoring of recreational usage of Lake Saint-Pierre was also begun thanks to the involvement of non-governmental organizations.

Six fact sheets were prepared for dissemination on the Internet and access to information on St. Lawrence wetlands and sediment geochemistry were made possible by the use of an interactive mapping application.

All the program partners also made a special effort to prepare the second edition of the public forum *St. Lawrence Rendez-Vous 2006.* The main objective of this triennial event is to make public the updated results of the environmental indicators of the State of the St. Lawrence Monitoring Program.

www.qc.ec.gc.ca/csl/acc/csl001_e.html

3.2 Research

Scientific research is used to:

- *evaluate the impact of toxic substances and other substances of concern on the environment and human health;*
- *determine the extent of exposure to contaminants;*
- *guide risk assessments;*
- *develop preventive and control measures by identifying pollution prevention and technology solutions; and*
- *provide specialized sampling and analytical techniques used in compliance promotion and enforcement.*

[6] Weseloh, D.V.C., C. Pekarik, and S.R. de Solla. 2006. Spatial patterns and rankings of contaminant concentrations in herring gull eggs from 15 sites in the Great Lakes and connecting channels, 1988–2002. *Environ. Monitor. Assess*. 113: 265–284.

Environment Canada and Health Canada scientists published hundreds of articles, reports and papers during this reporting period. The following examples illustrate the types and range of research undertaken in 2005–06.

3.2.1 Wildlife

The Canadian Wildlife Service and the Science and Technology Branch (National Wildlife Research Centre, NWRC) have been investigating the exposure and health effects of legacy and new, emerging chemicals of concern on wildlife, particularly snapping turtles, mink and herring gulls. Results have been presented at a number of management and policy meetings for several Canadian Areas of Concern on the Great Lakes. In addition, results have either been published (e.g. mink: *Environmental Monitoring and Assessment*, 2006) or are in review (e.g. snapping turtles: *Environmental Science and Technology*).

Methodology

The avian, embryonic neuronal cell culture method that was developed in the laboratory at the National Wildlife Research Centre has been used as a preliminary screening tool for various suspected neurotoxins such as polybrominated diphenyl ethers and perfluorinated compounds.

Several analytical methods have been developed including the following.

- Fluorescent ribonucleic acid (RNA)-arbitrarily primed polymerase chain reaction has been used to determine the impacts of chemical contaminants (flame retardants, rodenticides, pharmaceutical products) at the level of gene expression in both wild (Herring Gull, Mallard Duck, Rainbow Trout) and domestic (chicken) species. The goal is to identify molecular markers to elucidate mechanisms of action of these contaminants.
- An analytical method based on high-performance liquid chromatography-mass spectrometry was developed to determine carotenoids and retinoids in fish (Chinook Salmon) eggs. Carotenoids impart the red colour to salmon eggs, and are regarded as an indicator of fitness and health. This method was developed to identify and quantify carotenoids in Chinook Salmon in relation to immune integrity and disease challenge survival of the eggs of different colours of races of Chinook Salmon.[7]
- An analytical method based on high-performance liquid chromatography-mass spectrometry was developed to determine a class of major metabolites of polychlorinated biphenyls, the hydroxylated polychlorinated biphenyls in mammalian plasma. hydroxylated polychlorinated biphenyls are proven, persistent organic pollutants in wildlife and humans, mainly in blood, and shown to be biological active (e.g. hormone system effects).[8]
- The molecular avian sexing method to permit accurate, rapid sexing of many species using deoxyribonucleic acid obtained from feather tips was improved. The method has also been used to determine sex in endangered species such as the Piping Plover, Ivory Gull and Eastern Loggerhead Shrike with the goal of identifying sex ratios in species of concern without recourse to invasive or lethal sampling.
- Using Herring Gull microsatellite deoxyribonucleic acid (DNA) sequences, attempts are being made to determine the fertility status of early-stage Herring Gull embryos that are found dead in the field. There is an effort to elucidate whether embryos are aborting early in their development as a result of contaminant exposure or if the embryos are infertile. Comparing the microsatellite genomic fingerprint of deoxyribonucleic acid from various sources (e.g. eggshells, egg contents, parental blood) will permit the detection of fertility status.
- The importance of the deoxyribonucleic acid (DNA) sequence of the protein that mediates the toxic responses of dioxin and dioxin-like polychlorinated biphenyls in birds was determined. This research has resulted in the development of a simple genetic test that can predict which species of birds are most sensitive to dioxins and polychlorinated biphenyls. This test is of some future importance: the strategies used in this discovery (and method) will be of practical use not only for dioxin and polychlorinated biphenyl toxicology, but also for elucidating some of the effects of other environmental contaminants.
- A small-scale sub-cellular bioassay was developed with photosynthetic enzyme complexes that can assess the toxic potential of freshwater sediments and associated elutriates/pore waters in under two hours. The test system is amenable to direct in situ testing and holds promise as a generic assay to rapidly appraise sediments impacted by both organic and inorganic classes of contaminants.

Substance Specific Research

The following studies are an indication of the type of substance specific research conducted by Environment Canada scientists.

[7] Li, H., S.T. Tyndale, D.D. Heath, and R.J. Letcher. 2005. Carotenoids and retinoids in eggs of chinook salmon (*Oncorhynchus tshawytscha*) using high-performance liquid chromatography-electrospray ionization-tandem mass spectrometry. *J. Chromatog. B: Biomed. Sci Appl.* 816(1–2): 49–56.

[8] Letcher, R.J., S.G. Chu, and H. Li. 2005. Determination of hydroxylated polychlorinated biphenyls (OH-PCBs) in plasma by high performance liquid chromatography-electrospray-tandem quadruple mass spectrometry. *J. Anal. Toxicol*. 29: 209–216.

- Environment Canada researchers have been investigating the reproductive and developmental effects of ubiquitous polybrominated diphenyl ethers (flame retardants) on birds. The results of this ongoing, multi-year study were recently presented at the International Ornithological Union (Hamburg, Germany), the North American Ornithological Congress (Veracruz, Mexico), and at the Society of Environmental Toxicology and Chemistry (Montréal, Quebec). Four publications summarized the initial findings in the *Journal of Toxicology and Environmental Health* (2006), *Environmental Toxicology and Chemistry* (2006) (involving Ken Drouillard—University of Windsor), *Toxicological Sciences* (2005), and *Environmental Pollution* (2005).
- The Canadian Wildlife Service (Ontario) and Michigan State University undertook a collaborative study on the health impacts of consumption of Great Lakes fish, containing elevated levels of polychlorinated biphenyls, by mink. It yielded valuable information on the effects in the thyroid system, vitamin A regulation, growth and development of exposed kits. The results were presented at the Society of Environmental Toxicology and Chemistry and have yielded publications in *Environmental Research* (2006) and *Archives of Environmental Contamination and Toxicology* (2006).
- The Canadian Wildlife Service (Ontario) collaborated with Michigan State University on a two-year, two-part study to assess the impacts of a commercial formulation of the polybrominated diphenyl ether, flame retardant mixture DE-71 on ranched mink. A short-term exposure study was followed by a chronic reproductive study. Both studies assessed immune system function, thyroid function, and vitamin A regulation; the second study also evaluated overall reproductive success and growth. The results were presented at the Society of Environmental Toxicology and Chemistry conferences and have yielded two publications: *Archives of Environmental Contamination and Toxicology* (in press) and *Environmental Toxicology and Chemistry* (in press).
- A study was completed and published on the effects of the known polymer plasticizer additive and environmental contaminant bisphenol A relative to eight bisphenol A-related and commercially used diphenylalkanes on estrogen receptor-mediated vitellogenin production in freshly removed liver cells from male carp fish (*Cyprinus carpio*). Environmental exposure of fish to bisphenol A and related diphenylalkane substances, depending on the structure, may pose anti-estrogenic and, to a lesser extent, estrogenic risks to development and reproduction.[9]
- The identities and spatial trends of several brominated flame retardant compounds (i.e. polybrominated diphenyl ethers and hexabromocyclododecane) and hydroxylated and methoxylated organohalogen contaminants were characterized in plasma collected from Bald Eagle nestlings at sites along the Canadian West Coast in southwestern British Columbia and one reference site in northern British Columbia. The study demonstrated that previously unreported organohalogens are present in Bald Eagles living on the West Coast of Canada and that there are potential impacts on the health and survival of these raptors.[10]
- Studies were completed to examine the effects on aquatic birds of elevated selenium levels in streams in the Rocky Mountain foothills, the result of local open-pit coal mining. Research results found levels of selenium are elevated in the dietary items of aquatic birds, but adverse effects on reproduction are unlikely.[11]
- The health impacts of the biological magnification of polychlorinated biphenyls in the marine food web, including seabirds, were assessed near a military radar site in northern Labrador (Kuzyk et al. 2005).[12] The resulting effects of polychlorinated biphenyls on breeding seabirds were included in a review of Arctic pollution impacts on Canadian wildlife (Fisk et al. 2005).[13]
- For mercury, research results found significant relationships between levels of certain neurochemical receptors and mercury in the brains of wild mink and otter and also in captive mink fed diets containing environmentally realistic concentrations of methyl mercury. These findings indicate that important neurochemical changes precede overt signs

[9] Letcher, R.J., J.T. Sanderson, B. Bokkers, J.P. Giesy, and M. van den Berg. 2005. Effects of bisphenol A-related diphenylalkanes on vitellogenin production in male carp (*Cyprinus carpio*) hepatocytes and aromatase (CYP19) activity in human H295R adrenocortical carcinoma cells. *Toxicol. Appl. Pharmacol.* 209: 95–104.

[10] McKinney, M.A., L. Cesh, J.E. Elliott, T.D. Williams, D.K. Garcelon, and R.J. Letcher. 2006. Brominated flame retardants and halogenated phenolic compounds in North American west coast bald eaglet (*Haliaeetus leucocephalus*) plasma. *Environ. Sci. Technol*. 40: 6275–6281.

[11] Wayland, M. and R. Crosley. 2006. Selenium and other trace elements in aquatic insects in coal mine-affected streams in west-central Alberta, Canada. *Arch. Environ. Contam. Toxicol*. 50: 511-522.

Wayland, M., J. Kneteman, and R. Crosley. 2006. The American dipper as a bioindicator of selenium contamination in a coal mine-affected stream in west-central Alberta, Canada. *Environ. Monitor. Assess. 123: 1–3.*

Wayland, M., R. Casey, and E. Woodsworth. A dietary-based assessment of selenium risk to aquatic birds in a coal mine-affected stream in Alberta, Canada. *Hum. Ecol. Risk Assess.* In press.

[12] Kuzyk, Z.A., J.P. Stow, N.M. Burgess, S.M. Solomon, and K.J. Reimer. 2005. PCBs in sediments and the coastal food web near a local contaminant source in Saglek Bay, Labrador. *The Science of the Total Environment* 351–352: 264–284.

[13] Fisk, A.T., C.A. de Wit, M. Wayland, Z. Kuzyk, N. Burgess, R. Letcher, B. Braune, R. Norstrom, S. Polischuk Blum, C. Sandau, E. Lie, H.J.S. Larsen, J.U. Skaare and D.C.G. Muir. 2005. An assessment of the toxicological significance of anthropogenic contaminants in Canadian arctic wildlife. *The Science of the Total Environment* 351–352: 57–93.

of methylmercury intoxication in fish-eating wildlife. The developed assays hold promise as indicators of subtle neurobehavioural toxicity in wildlife due to environmental mercury exposure.

- A report was published on the effects of environmental metal contamination from mine tailings on aquatic and terrestrial wildlife in Abitibi, a major copper and gold ore region in northwestern Quebec. Small mammals and amphibians were collected from different sites in the area and their tissues analyzed for arsenic, cadmium, copper, lead, zinc and biomarkers. Compared with values reported in the scientific literature, frogs and voles from one study site had high levels of arsenic and cadmium, and those from another site had high levels of cadmium. No neoplastic lesions were observed, but a few samples of vole hepatocytes had heterogeneous size of cells and nucleus which could be caused by metal exposure. Based on surveys and trapping efforts, the abundance and diversity of small mammals and amphibians appear to be reduced at the most contaminated sites. The results indicate bioaccumulation of metals as well as potential effects on health and in populations of small mammals and frogs at mine tailing areas in the Abitibi region.
- The uptake and effects of chlorinated hydrocarbon and 4-nonylphenol contaminants were measured in the insectivorous Tree Swallow at a wastewater treatment plant in Vancouver, British Columbia. Clutch size and fledging success were lower and the mean liver mass of nestlings significantly higher at the treatment plant compared to the reference site. Levels of 4-nonylphenol residues in sediment and insects were also relatively higher. Results suggest that Tree Swallows may be useful indicators of exposure to 4-nonylphenol, although further work is required to determine the extent of uptake and effects of 4-nonylphenol in insect-eating birds.[14]
- Exposure to polychlorinated biphenyls and toxicological assessments of the effects in otters in Victoria Harbour, British Columbia, were investigated in cooperation with Simon Fraser University. This involved the use of fecal deoxyribonucleic acid measurements to constant population monitoring and relationships to contaminant exposure of individual otters.
- Concentrations of methanearsonate metabolites were quantified from mountain pine beetle populations to assess the potential exposure of insectivorous birds, especially woodpeckers, to organic arsenicals through ingestion of wood-boring insects from methanearsonate treated trees. Methanearsonate concentrations were highest in adult mountain pine beetle populations and woodpeckers were observed to forage in methanearsonate treated pine stands. The field work and laboratory investigation have been completed and a technical report has been published.[15]
- A study on Bald Eagle foraging at the Delta landfill showed that although large numbers (up to 450 individual eagles present on some days) of eagles use the landfill, only about 10% regularly feed at the site, thus greatly reducing the risk of exposure to contaminants from the potential point source. The study was intended to provide information or relevance to the broader assessment issues.[16]
- A risk assessment of road salts has led to more rational use and more careful storage of the material so as to reduce environmental contamination. However, a harder problem to tackle is the toxicity of high doses of granular salt to small bird species, primarily cardueline finches (so-called "winter finches": crossbills, grosbeaks and siskins). There is good evidence that salt poisoning is a strong contributory element to birds being struck by moving vehicles.[17]
- The Canadian Wildlife Service, Pacific and Yukon Region, continued their investigation to locate the source or sources of the lead shot responsible for poisoning at least 1,800 Trumpeter Swans in Sumas Prairie, British Columbia, and Whatcom County, Washington State, U.S.A., since 1999. Extensive effort was devoted to monitoring the movement of 250 radio-tagged swans, seven of which died last winter while on their wintering grounds. A comparison of areas used by "healthy" swans and swans that died of lead poisoning has identified certain areas of interest. Low levels of shot have been discovered at several roosts and forage fields. Carcass retrieval (approximately 385 in 2005–06) and examination were also conducted. The investigation is a collaborative effort involving primarily the Canadian Wildlife Service, the Washington Department of Fish and Wildlife, the U.S. Fish and Wildlife Service, University of Washington, and the Trumpeter Swan Society.

[14] Dods, P.L., E.M. Birmingham, T.D. Williams, M.G. Ikonomou, D.T. Bennie, and J.E. Elliott. 2005. Reproductive success and contaminants in Tree Swallows (*Tachycineta bicolor*) breeding at a wastewater treatment plant. *Environmental Toxicology and Chemistry* 24: 3106–3112.

[15] Morrissey, C.A., J.E. Elliott, P. Dods, C. Albert, V. Lai, and W. Cullen. 2006. *Assessing the Impact of Monomethanearsonate (MSMA) as Used for Bark Beetle Control to Forest Birds in British Columbia*. Canadian Wildlife Service, Technical Report Series No. 460. 89 pp.

Morrissey, C.A., C.A. Albert, P.L. Dods, W.R. Cullen, V.W.-M. Lai, and J.E. Elliott. Arsenic accumulation in bark beetles and forest birds occupying mountain pine beetle-infested stands treated with monosodium methanearsonate (MSMA). *Environmental Science & Technology* (accepted).

[16] Elliott, K.H., S.L. Lee, and J.E. Elliott. 2006 Foraging ecology of bald eagles at an anthropogenic food source: Does the Vancouver landfill affect local populations? *Wilson Bulletin* 118: 380–390.

[17] Mineau, P. and L. Brownlee. 2005. Road salts and wildlife: an assessment of the risk with particular emphasis on winter finch mortality. *Wildl. Soc. Bull.* 33(3): 835–841.

Bollinger, T.K., P. Mineau, and M.L. Wickstrom. 2005. Toxicity of sodium chloride to house sparrows *(Passer domesticus). J. Wildl. Diseases* 41(2): 363–370.

- The use of lead shot, even small caliber bullets used for hunting small game or "vermin" control (e.g. the organized hunt for Richardson's Ground Squirrel in Saskatchewan), leads to the potentially lethal lead contamination of carcasses. This lead takes the form of fine particles that sheer off the bullet along its trajectory in the animal. We estimate that one in five ground squirrel carcasses could contain enough lead to be lethal to a scavenging bird of prey.[18]
- Between 1996 and 1998, an examination of the gizzards of gallinaceous birds killed by hunters in Quebec found lead shot only in ruffed grouse (1.2%). The mean lead concentrations measured in the bones were lower than those that occur naturally in the environment (< 6 μg/g dry weight). Based on an analysis of the health risk associated with consumption of ptarmigan muscle, we conclude that the use of lead ammunition for hunting gallinaceous birds may pose an unnecessary risk of lead poisoning because of the possible ingestion of lead shot, bullets, fragments or embedded shot.[19]
- Research results indicate that turtles exposed to aqueous octylphenol exhibited changes in growth rates, but the effects were transient, ceasing once exposure ended. Alkylphenols are commonly found in treated wastewater, and thus aquatic animals downstream may be chronically exposed.[20]

Pesticides

Some of the research undertaken on the impacts of pesticides is reflected in the following studies.

- A test of reproductive function in birds is part of pesticide registration procedures worldwide. However, a review of the endpoints measured in this test compared to reports of contaminant-induced breeding failure in the wild points to a serious disconnect. It is apparent that we need to rethink how we assess the impact of pesticides on bird reproduction.[21]
- Temporal and spatial trends in polychlorinated biphenyls and organochlorine pesticides were determined in eggs of Double-crested and Pelagic Cormorants collected from colonies throughout the Strait of Georgia, British Columbia, from 1970 to 2002. Concentrations of dominant organochlorine pesticides and polychlorinated biphenyls dropped mainly during the 1970s, with minor declines thereafter. Contaminant levels have now stabilized at low levels throughout the resident population. Areas of the southern strait were significantly more contaminated than the northern areas. During the 1980s, 2,3,7,8,-tetrachlorodibenzo-p-dioxin toxic equivalents were correlated with physiological and biochemical alterations as well as relative rates of deformed chicks. Colony-wide productivity of Double-crested Cormorants was poorer in the southern colonies where polychlorinated biphenyls were also elevated, although ecological variables, particularly changing prey-predator dynamics, may be dominant contributors to the reductions.[22]
- As part of impact assessments of insecticides on wildlife in the South Okanagan, a publication reports that robins produced in regional orchards and exposed *in ovo* to dichlorodiphenyltrichloroethane and related chemicals have altered brain morphology, particularly related to sexual development.[23]
- A study was completed and published on current-use chlorophenoxy herbicides, including 2,4-dichlorophenoxyacetic acid, triclopyr, dicamba, dimethyl tetrachloroterephthalate, and the metabolite of pyrethroids, 3-phenoxybenzoic acid and the fungicide chlorothalonil, in the eggs of osprey (*Pandion haliaetus*) collected from 15 sites in five study areas of the Puget Sound/Seattle region of Washington State, United States of America. These findings indicate that dimethyl tetrachloroterephthalate and dimethyl tetrachlorophthalate can be accumulated in the food chain of fish-eating osprey and transferred *in ovo* to eggs. They may thus be of concern to the health of the developing chick and the general reproductive health of this osprey population.[24]
- Research results show that the herbicide atrazine has been suspected of affecting sexual development in exposed animals by increasing the production of estrogens. Snapping Turtle eggs were exposed to atrazine-treated

[18] Knopper, L.D., P. Mineau, A.M. Scheuhammer, D.E. Bond, and D.T. Mckinnon. 2006 Carcasses of shot Richardson's ground squirrels may pose lead hazards to scavenging hawks. *J. Wildl. Mgmt.* 70(1): 295–299.

[19] Rodrigue, J., R. McNicoll, D. Leclair, and J.F. Duchesne. 2005. Lead concentration in ruffed grouse, rock ptarmigan, and willow ptarmigan in Quebec. *Arch. Environ. Contam. Toxicol.* 49(1): 97–104.

[20] Raymond, J., S.R. de Solla, S. Ashpole, R.J. Brooks, and V. Trudeau. Effect of aqueous 4-octylphenol exposure on growth of hatchling snapping turtles, *Chelydra serpentina*. Submitted to *Bull. Environ. Contam. Toxicol.*

[21] Mineau, P. 2005. A review and analysis of study endpoints relevant to the assessment of "long term" pesticide toxicity in avian and mammalian wildlife. *Ecotoxicology* 14(8): 775–799.

[22] Harris, M.L., L.K. Wilson, J.E. Elliott. 2005. An assessment of PCBs and OC pesticides in eggs of double-crested (*Phalacrocorax auritus*) and pelagic (*P. pelagicus*) cormorants from the west coast of Canada, 1970–2002. *Ecotoxicology* 14: 607–625.

[23] Iwaniuk, A.N., D.T. Koperski, K.M. Cheng, J.E. Elliott, L.K. Smith, L.K. Wilson, and D.R.W. Wylie. 2006. The effects of environmental exposure to DDT on the brain of a songbird: Changes in structure associated with mating and song. *Behavioural Brain Research* 173: 1–10.

[24] Chu, S.-G., C. Henny, J.L. Kaiser, K.G. Drouillard, G.D. Haffner, and R.J. Letcher. 2007. Dacthal isomers, chlorophenoxy herbicides and chlorothalonil fungicide in eggs of osprey *(Pandion haliaetus)* from the Puget Sound area of Washington State, U.S.A. *Environ. Pollut.* 145(1): 374–381.

soil during embryonic development. Although a few feminized males were produced, there was little evidence that atrazine induced feminization in the exposed turtles, even at application rates 10 times greater than normal agricultural usage. Similar work on hatching success and growth is continuing with ammonium nitrate and urea fertilizers.[25]

- Using previously developed models, we assessed the lethal risk, both in space and time, to birds alighting in United States cropland. This analysis was done for the United States, because comprehensive pesticide use information is available for the United States but not for Canada. Also, many of our birds migrate to the southern United States in winter. In general, the lethal risk to birds has been declining in most major crops, largely because of the advent of new pesticides of lesser toxicity. The Gulf Coast region of the United States remains a problem area for Canadian birds.[26]
- Granular insecticides used at planting (prophylactic use) for the control of flea beetles in canola appear to have caused regional declines in a number of grassland/farmland bird species such as Western Meadowlarks, Horned Larks and even House Sparrows. A certain number of granules are always left on the soil surface and ingested by birds who mistake them for seed or grit. This is the first modern example of regional population declines apparently being caused by pesticide lethality.[27]
- Golf course pesticides, most notably the fungicide chlorothalonil, have been shown to cause single-strand deoxyribonucleic acid breakage in small mammals trapped near the courses. The degree of breakage appears to be dose-dependent, but the damage is repaired quickly and does not appear to lead to obvious health problems in the affected animals.[28]
- The impacts of pesticides on native amphibians were examined by exposing the animals to pesticides in the laboratory and in outdoor mesocosms using controlled exposures, and by monitoring amphibians breeding in agricultural areas. The research results demonstrated lethal and sublethal toxicity associated with exposures of amphibians to current-use pesticides, as assessed using key biological endpoints such as acute toxicity/survival and developmental deformities, disease occurrence in relation to pesticide-induced immunotoxicity, and histopathology. Common toxicity endpoints that can be used in the laboratory, in outdoor mesocosms, or in field exposures of amphibians were developed.

Arctic

Various studies that focused on the Arctic region are included below.

- Scientists from Norway and Environment Canada completed and published the results of several studies, including:
  - the relationships between established and emerging persistent organic pollutants that can elicit hormone-like activities (e.g. polychlorinated biphenyls, organochlorine pesticides, polybrominated diphenyl ethers flame retardants, polychlorinated biphenyl and polybrominated diphenyl ethers metabolites and other by-products), and reproductive, circulating hormone levels (i.e. thyroid, estrogen and androgen) and biochemical indicators of basal metabolism in a breeding population of a top Arctic predator, the Glaucous Gull.[29]
  - the identity, tissue distribution and mother-to-egg transfer of a large suite of established and emerging organohalogen pollutants and their by-products (e.g. polychlorinated biphenyls, organochlorine pesticides, polybrominated diphenyl ethers flame retardants, other important flame retardants and polyfluoroalkyl substances) in a top Arctic predator, the Glaucous Gull.[30]

[25] de Solla, S.R., P.A. Martin, K.J. Fernie, B.J. Park, and G. Mayne. 2006. Effects of environmentally relevant concentrations of atrazine on gonadal development of snapping turtles (*Chelydra serpentina*). *Environ. Toxicol. Chem*. 25: 514–519.

de Solla, S.R. and P.A. Martin. 2007. Toxicity of nitrogenous fertilizers to eggs of snapping turtles (*Chelydra serpentina*) in field and laboratory exposures. *Environ. Toxicol. Chem.* 26(9): 1890-1895.

[26] Mineau, P. and M. Whiteside. 2006. The lethal risk to birds from insecticide use in the U.S.: A spatial and temporal analysis. *Environ. Toxicol. Chem.* 25(5): 1214–1222.

[27] Mineau, P., C.M. Downes, D.A. Kirk, E. Bayne, and M. Csizy. 2005. Patterns of bird species abundance in relation to granular insecticide use in the Canadian prairies. *Ecoscience* 12(2): 267–278.

[28] Knopper, L.D., P. Mineau, J.P. McNamee, and D.R.S. Lean. 2005. Use of comet and micronucleus assays to measure genotoxicity in meadow voles *(Microtus pennsylvanicus)* living in golf course ecosystems exposed to pesticides. *Ecotoxicology,* 14 (3): 323–335.

Knopper, L.D. and P. Mineau. 2004. Effects of pesticide exposure on meadow voles *(Microtus pennsylvanicus)* living in golf course ecosystems: Developmental toxicology, clinical hematology, blood parasitology and body condition. *Environ. Toxicol. Chem.* 23 (6): 164–171.

[29] Verreault, J., C. Bech, R.J. Letcher, E. Ropstad, E. Dahl, and G.W. Gabrielsen. 2007. Organohalogen contamination in breeding glaucous gulls from the Norwegian Arctic: Associations with basal metabolism and thyroid hormones. *Environ. Pollut.* 145(1): 138–145.

Verreault, J., R.J. Letcher, E. Ropstad, E. Dahl, and G.W. Gabrielsen. 2006. Organohalogen contaminants and metabolites and reproductive hormones in incubating glaucous gulls (*Larus hyperboreus*) from the Norwegian Arctic. *Environ. Toxicol. Chem.* 25(11): 2990–2996.

[30] Verreault, J., R.A. Villa, G.W. Gabrielsen, J.-U. Skaare, and R.J. Letcher. 2006. Maternal transfer of organohalogen contaminants and metabolites to eggs of glaucous gulls from Bear Island. *Environ. Pollut.* 144(3): 1053–1060.

Verreault, J., M. Houde, G.W. Gabrielsen, U. Berger, M. Haukaas, R.J. Letcher, and D.C.G. Muir. 2005. Perfluorinated alkyl substances in plasma, liver, brain and eggs of glaucous gulls (*Larus hyperboreus*) from the Norwegian Arctic. *Environ. Sci. Technol*. 39: 7439–7445.

- a study identifying and characterizing the levels and differences in congener patterns of several brominated flame retardant compounds (i.e. polybrominated diphenyl ethers and hexabromocyclodecane) and hydroxylated and methoxylated polybrominated diphenyl ethers, which may be polybrominated diphenyl ethers metabolites or of natural origin, in the top Arctic predators, Glaucous Gull and Polar Bear.[31]

- Scientists from Denmark and Environment Canada completed and published the results of two studies on:
  - the effects of contaminants on the health of Polar Bears in the Arctic. Relationships of concentrations of persistent organic pollutants, including new potential pollutants such as brominated flame retardants, were reported with respect to immune system, endocrine and physiological (e.g. sex organ size and renal lesions) health biomarkers.[32]
  - West Greenland sledge dogs (*Canis familiaris*) exposed to a daily diet of Minke Whale (*Balaenoptera acutorostrata*) blubber that was naturally contaminated with a complex mixture of organohalogen pollutants (e.g. polychlorinated biphenyls, organochlorine pesticides and polybrominated diphenyl ethers, flame retardants). The various chemical exposures were found to be related to an impairment effect of the specific and nonspecific cellular immune systems of the dogs. These findings are also relevant, as a surrogate of similar cause-and-effect relationships, for the Arctic's top predator, the phylogenetically related Polar Bear.[33]

- Scientists from several circumpolar nations, including Norway, Denmark and the United States, and Canada (represented by Environment Canada) completed and published the results of a multi-year study of the spatial, seasonal and temporal trends, and tissue distribution, of persistent organic pollutants, including new potential pollutants such as brominated flame retardants and perfluorinated acids and metals, in the tissues of Polar Bears collected in circumpolar Arctic regions.[34]

Verreault, J., G.W. Gabrielsen, D.C.G. Muir, S.G. Chu, W. Gebbink, and R.J. Letcher. 2005. Novel organochlorine contaminants and metabolites in plasma and eggs of glaucous gulls (*Larus hyperboreus*) from the Norwegian Arctic. *Environ. Toxicol. Chem.* 24: 2486–2499.

[31] Verreault, J., G.W. Gabrielsen, S.-G. Chu, D.C.G. Muir, M. Andersen, A. Hamaed, and R.J. Letcher. 2005. Brominated flame retardants and methoxylated and hydroxylated PBDEs in top predator species from the Norwegian Arctic: Glaucous gulls (*Larus hyperboreus*) and polar bears (*Ursus maritimus*). *Environ. Sci. Technol.* 39: 6021–6028.

[32] Sonne, C., P.S. Leifsson, R. Dietz, E.W. Born, R.J. Letcher, L. Hyldstrup, F.F. Riget, M. Kirkegaard, and D.C.G. Muir. 2006. Xenoendocrine pollutants may reduce size of sexual organs in East Greenland polar bears (*Ursus maritimus*). *Environ. Sci. Technol.* 40: 5668–5674.

Sonne, C. R. Dietz, P.S. Leifsson, E.W. Born, M. Kirkegaard, R.J. Letcher, D.C.G. Muir, F.F. Riget, L. Hyldstrup. 2006. Are organohalogen contaminants a co-factor in the development of renal lesions in East Greenland polar bears (*Ursus maritimus*)? *Environ. Toxicol. Chem.* 25(6): 1551–1557.

Sonne, C., P.S. Leifsson, R. Dietz, E.W. Born, R.J. Letcher, M. Kirkegaard, D.C.G. Muir, L.W. Andersen, F.F. Riget, and L. Hyldstrup. 2005. Enlarged clitoris in wild polar bears (*Ursus maritimus*) can be misdiagnosed as pseudohermaphroditism. *Sci. Tot. Environ.* 337(1–3): 45–58.

Sonne, C., R. Dietz, P.S. Leifsson, E.W. Born, R.J. Letcher, M. Kirkegaard, D.C.G. Muir, F.F. Riget, and L. Hyldstrup. 2005. Do organohalogen contaminants contribute to histopathology in liver of polar bears (*Ursus maritimus*) from East Greenland? *Environ. Health Perspect.* 113: 1569–1574.

Kirkegaard, M., C. Sonne, P.S. Leifsson, R. Dietz, E.W. Born, D.C.G. Muir, and R.J. Letcher. 2005. Histology of selected immunological organs in polar bear (*Ursus maritimus*) from East Greenland in relation to levels of organohalogen contaminants. *Sci. Tot. Environ.* 341(1–3): 119–132.

[33] Verreault, J., R.J. Norstrom, M.A. Ramsay, M. Mulvihill, and R.J. Letcher. 2006. Composition of chlorinated hydrocarbon contaminants among major adipose tissue deposits of polar bear (*Ursus maritimus*) from the Canadian High Arctic. *Sci. Tot. Environ*. 370: 580–587.

Sonne, C., S. Fonfara, R. Dietz, M. Kirkegaard, R.J. Letcher, S. Shahmiri, S. Andersen, S.E. Joensen, and P. Møller. Multiple cytokine and acute-phase protein gene transcription in West Greenland Sledge Dogs (*Canis familiaris*) dietary exposed to organic environmental pollutants. *Arch. Environ. Contam. Toxicol*. Accepted Oct. 2006.

Sonne, C., H.J. S. Larsen, R. Dietz, M. Kirkegaard, P. Møller, K.E. Loft, S. Shahmiri, and R.J. Letcher. 2006. Impairment of cellular immunity in West Greenland Sledge Dogs (*Canis familiaris*) Dietary exposed to polluted minke whale (*Balaenoptera acutorostrata*) blubber. *Environ. Sci. Technol*. 40: 2056–2062.

[34] Dietz, R., F.F. Riget, C. Sonne, R.J. Letcher, S. Backus, E.W. Born, M. Kirkegaard, and D.C.G. Muir. 2006. Seasonal trends and bioaccumulation of polybrominated diphenyl ethers in free-ranging East Greenland polar bears (*Ursus maritimus*). *Environ. Pollut.* Available online Oct. 19, 2006.

Muir, D.C.G., S. Backus, A.E. Derocher, R. Dietz, T.J. Evans, G.W. Gabrielsen, J. Nagy, R.J. Norstrom, C. Sonne, I. Stirling, M.K. Taylor, and R.J. Letcher. 2006. Brominated flame retardants in polar bears (*Ursus maritimus)* from Alaska, the Canadian Arctic, Greenland and Svalbard. *Environ. Sci. Technol.* 40: 449–455.

Smithwick, M.M., D.C.G. Muir, S. Mabury, K. Solomon, J.W. Martin, C. Sonne, E.W. Born, R.J. Letcher, and R. Dietz. 2005. Perfluoroalkyl contaminants in liver tissue from East Greenland polar bears (*Ursus maritimus*). *Environ. Toxicol. Chem*. 24(4): 981–986.

Smithwick, M.M., D.C.G. Muir, S. Mabury, K. Solomon, C. Sonne, E.W. Born, R. Dietz, A.E. Derocher, T. Evans, G.W. Gabrielsen, R.J. Letcher, J. Martin, J. Nagy, I. Stirling, and M.K. Taylor. 2005. A circumpolar study of perfluorinated acids in polar bears (*Ursus maritimus*). *Environ. Sci. Technol.* 39(15): 5517–5523.

Sonne, C., F.F. Riget, R. Dietz, M. Kirkegaard, E.W. Born, R.J. Letcher, and D.C.G. Muir. 2005. Trends in fluctuating asymmetry in East Greenland polar bears *(Ursus maritimus)* from 1892 to 2002 in relation to organohalogen pollution. *Sci. Tot. Environ.* 341(1–3): 81–96.

Verreault, J., D.C.G. Muir, R.J. Norstrom, I. Stirling, A.T. Fisk, G.W. Gabrielsen, A.E. Derocher, T.J. Evans, R. Dietz, C. Sonne, G.M. Sandala, W. Gebbink, E.W. Born, F.F. Riget, M.K. Taylor, J. Nagy, and R.J. Letcher. 2005. Chlorinated hydrocarbon contaminants and metabolites in polar bears (*Ursus maritimus)* from Alaska, Canada, East Greenland, and Svalbard: 1996–2002. *Sci. Tot. Environ*. 351–352: 369–390.

3.2.2 Air

Examples of research on indoor and outdoor air quality in 2005–06 are listed below.

Profiling chemical characterization

- Health Canada researchers completed a study of total and bioaccessible metals in vacuum samples of settled dust and corresponding garden soils in 20 Ottawa homes previously sampled for metals in air. The results of this study indicate that concentrations of certain key metals are elevated in indoor dust compared to corresponding garden soils, in background residential environments (i.e. not contaminated sites). Results using a biologically relevant extraction method (simulated stomach acid) increases the indoor:outdoor ratios compared to results using an aggressive total metal extraction. Speciation studies show that organic matter content plays an important role in controlling the bioaccessibility of metals in house dust.
- Health Canada collaborated with the University of Washington in Seattle on an interlaboratory comparison under the United States Environmental Protection Agency Multi-Ethnic Study of Atherosclerosis cohort Air Pollution Study. The purpose was quality assurance for mass measurement of particulate matter collected on Teflon filters, using Health Canada's patent-pending buoyancy-corrected gravimetric analysis system (Archimedes M3™). By participating in international round-robin exercises, Health Canada is demonstrating that its analytical protocols for particulate mass measurement meet international quality standards of excellence.

Understanding the impact of persistant organic pollutants and heavy metals on ecosystems

- In the second year of the Border Air Quality Strategy, Health Canada continued its health and environmental monitoring activities in the Windsor/Detroit area. A valuable outcome was the implementation of analytical methods for the reliable determination of metals in indoor, outdoor and personal air samples collected in Windsor, and to address data gaps associated with human exposures to metals through ingestion and inhalation.

Understanding the adverse impacts of air quality

- Health Canada continued to use its buoyancy-corrected gravimetric analysis system for accurate mass measurements of airborne particulate matter. Health Canada filed United States and worldwide patents for the invention. The facility housing this technological invention became fully operational in 2004 and was used to analyze over 8,000 samples collected under the Border Air Quality Strategy.
- A Health Canada study of the effects of air pollution in Hamilton Harbour has confirmed the earlier published finding that ambient levels of airborne particulate matter removed by HEPA filtration cause heritable deoxyribonucleic acid mutations in the sperm of exposed mice. Observations have been extended to include increases in deoxyribonucleic acid damage and changes in the methylation of deoxyribonucleic acid (DNA). Research continues to understand the human health consequences of these effects.
- Health Canada has developed the Air Quality Benefit Assessment Tool, a computer simulation tool designed to estimate the human health and welfare benefits or damages associated with changes in Canada's ambient air quality. This tool incorporates flexibility for combining and linking of pollutants, health endpoints, geographic areas and scenario years, and contains historical and projected population data and pollutant concentrations. During 2005–06, work progressed on developing and testing the application and revising the concentration response functions.
- Health Canada has created a conceptual framework for the undertaking of a biodiesel risk/benefit analysis and is integrating peer-review comments and identifying and evaluating data gaps relative to this risk/benefit assessment.
- Health Canada research activities funded through the Program on Energy Research and Development, administered by the Office of Energy Research and Development at Natural Resources Canada, deployed a multi-disciplinary research team to assess the toxicological detriments and benefits associated with current and emerging engine technologies. An integrated approach consisting of assessment and mechanistic validation of toxicity using *in vitro* and *in vivo* systems of increasing complexity and sophistication was used. The aim is to identify a framework for early validation of the impacts of control technologies on the toxicity of emissions, and its eventual integration in research and development decision paths and risk management. Design and development of a Mobile Inhalation Toxicology Exposure System was initiated for use in inhalation exposure of experimental subjects to diluted engine emissions and validation of *in vitro* effects and in establishing dose responses.
- As part of Health Canada's research to develop biomarkers of exposure and adverse effects of inhaled urban air contaminants in atherosclerosis and asthma, an array of complementary analytical platforms was established. This array was validated for high-throughput, system-wide screening of proteins and other biological molecules for use as markers of exposure and effects. They are valuable molecular markers/tools for population exposure and health effects screening in support of regulatory activities. Preliminary *in vitro* research work has provided some interesting candidate markers that will be further validated using *in vivo* models.

Understanding the relative contributions of numerous sources of pollution

Canada-U.S. Border Air Quality Strategy

Health Canada is participating in research designed to gather information on the relative importance of cross-border versus local pollution, in coordination with similar studies in United States border communities.

- Georgia Basin–Puget Sound International Airshed Strategy: Deals with the management of shared air quality studies through the B.C. Centre for Disease Control, and conducted by the University of British Columbia, the University of Victoria, and the University of Washington. Studies are under way on the distribution of traffic- and woodsmoke-related air pollution and its adverse impact on respiratory health of children, birth outcomes and cardiovascular outcomes in older adults. They should be completed by March 2007.
- Great Lakes Basin Airshed: Health Canada fieldwork and preliminary analyses are completed or nearing completion. Work includes a children's respiratory health study and an exposure assessment study (asthmatic children and healthy adults) in Windsor, a diabetic study investigating the impact of air pollution on cardiovascular health, and air pollution monitoring to investigate the intra-urban variability of a range of pollutants. Findings indicate that increased concentrations in particulate matter are associated with significant increases in markers of oxidative stress in blood. A toxicological study to collect particle and cytotoxicity data at a variety of locations around Windsor is on-going.

Understanding why air quality is changing

- Health Canada also conducted studies to further knowledge on particulate matter emissions of Canadian smelters. The work was based on an in-house time sequential methodology previously developed to differentiate easily soluble from less soluble metal fractions. From this study, insoluble nickel was identified as the major fraction of all samples from nickel smelters and this provided an indicator of potential health impacts since insoluble nickel substances are considered to be the most carcinogenic.

3.2.3 Contaminated Sites

Examples of research in 2005–06 are presented hereunder.

Understanding the effect on human health of exposure

- A Health Canada research study using developmental exposure in rodents to assess the impact of a mixture of metals commonly found at contaminated sites has been completed. Preliminary results indicate no significant toxicity in mothers or their offspring after perinatal exposure to a mixture of lead, nickel, copper, chromium and zinc at doses up to 1000 times expected exposure at current guideline levels.
- Health Canada initiated research to assess the bioavailability of lead from lead-contaminated soil through the use of adult swine to identify more precisely the human exposure to lead from soil. Work was completed on project parameters including animal suppliers, animal husbandry, tissue sampling and handling issues.
- Health Canada researchers investigated dermal adsorption of contaminated soils and developed an *in vitro* model using human skin and a commercial gardening soil.
- Health Canada has undertaken research on complex mixtures of polycyclic aromatic hydrocarbons in contaminated soils. Comparisons of synthetic mixtures containing priority polycyclic aromatic hydrocarbons in amounts that correspond to levels found at selected contaminated sites indicate that mutagenic effects, and presumably corresponding carcinogenic effects, are cumulative. However, the total cumulative hazard attributable to priority polycyclic aromatic hydrocarbons in the mixture may be substantially less than that determined using standard risk assessment procedures that assume total risk is the sum of individual risks associated with each detected priority polycyclic aromatic hydrocarbon. For this reason, site management decisions based on standard screening-level risk assessments may be conservative. On-going research will validate these initial findings.

3.2.4 Water Quality

Examples of research conducted in 2005–06 are presented hereunder.

Understanding the effect of pollution on water and sediment quality

From April 1, 2005, to March 31, 2006, seven fish processing plants were sampled as part of an ongoing wastewater characterization study. The fish processing plants were located in the Atlantic Provinces of Nova Scotia, New Brunswick, and Newfoundland and Labrador. The characterizations included conventional chemical parameters as well as toxicity testing of the wastewater. Sediment samples taken in the vicinity of fish processing wastewater outfalls were also obtained in March. They were characterized by various physical-chemical parameters and toxicity testing to an amphipod species. The levels of toxicity in the effluents and adjacent sediments were found to range from negligible to high. The next step in this project is the start of a formal assessment of fish plant effluent nation-wide. The assessment process will take place over the next three years to determine

the environmental risks associated with effluents from fish processing plants across Canada and possible mitigative measures.

A number of projects were undertaken to determine the sources of emerging contaminants such as organo-silicone compounds, polybrominated diphenyl ethers and other brominated flame retardants in the Canadian environment. Among them is an assessment of country foods, a study to determine levels of polybrominated diphenyl ethers and other brominated flame retardants in sewage sludge and soils at southern locations in Canada. Other studies will determine the limit for polybrominated diphenyl ethers in effluents from sewage treatment plants and biosolid substances found to be persistent, bioaccumulative and toxic under the *Canadian Environmental Protection Act, 1999* and that meet the criteria for virtual elimination. These studies provide early estimates of the levels of these chemicals released from wastewater treatment plants.

Health Canada is conducting research on disinfection by-products and emerging contaminants in drinking water. This work includes the development of analytical methods for these substances and studies of their occurrence and stability in distribution systems. The methods targeted over 40 compounds, some of them included on the *Canadian Environmental Protection Act, 1999* Priority Substances List. Selected samples collected in 2005–06 showed levels of N-nitrosodimethylamine below 2.5 ng/L. Current studies targeted other nitrosamines (nitrosodibutlyamine, nitrosodiethylamine, nitrosomorpholine, nitrosopiperidine and nitrosopyrrolidine), in addition to 3-chloro-4-(dichloromethyl)-5-hydroxy-2(5H)-furanone or Mutagen X (MX), haloacetic acids, trihalomethanes, haloacetonitriles, haloketones, haloacetaldehydes, chloropicrin and cyanogen chloride.

Studies continued to evaluate the sources of fecal coliforms and waterborne pathogens in aquatic ecosystems, particularly the Great Lakes, and to develop methods for source tracking and detection of these microbial contaminants in water. This work resulted in publications on denaturing gradient gel electrophoresis, a method based on the difference of melting points of double-stranded deoxyribonucleic acid fragments. Work continued on the deoxyribonucleic acid microarray fingerprinting of microbial communities to determine batch-to-batch variation and shelf life of microbial biotechnology products subject to the *Canadian Environmental Protection Act, 1999*. This work led to the closure of polluted beaches in Hamilton Harbour and Toronto to swimmers.

Methodology

- An analytical method based on high-performance liquid chromatography-mass spectrometry was developed to determine the brominated flame retardants tetrabromobisphenol A and degradation (debrominated) products, with application to sewage sludge. Tetrabromobisphenol A is among the high-volume, commercial flame retardant additives in current use. Tetrabromobisphenol A was found in sewage sludge from two municipal wastewater treatment plants in Windsor, Ontario.[35]
- A multiple-effects measurement bioassay was developed with a hydra animal model (*Hydra attenuata*) that allows concurrent assessment of acute and chronic (sub)lethal toxicity, teratogenicity as well as oxidative stress biomarker endpoints. This assay is intended for use in toxicity studies of complex media like industrial or municipal effluents and contaminants at large.
- A multi-biomarker rainbow trout primary hepatocyte test system was optimized to measure the toxic effects of municipal effluents and pharmaceutical products. Data generated thus far, to circumscribe its scope of use, suggest it is a powerful tool for assessing cytotoxicity as well as a variety of physiological stresses imparted on aquatic biota by chemical pollutants.
- A new method was developed to isolate, identify and quantify polybrominated diphenyl ethers in municipal wastewater effluent. In support of the *Canadian Environmental Protection Act, 1999* regulations for persistent, bioaccumulative, and toxic substances, a reference method has been developed and validated for the measurement of hexachlorobutadiene, hexachlorobenzene, pentachlorobenzene, and the three tetrachlorobenzenes in chlorinated solvents.
- Microbial genomics tools including a deoxyribonucleic acid (DNA) microarray for monitoring pathogens and other microorganisms in environmental samples such as wastewater were developed.
- Studies developed methods for accurate measurement of the perfluorocarboxylates in aqueous samples such as effluents, lake waters and precipitation. New methods showed perfluorocarboxylates in precipitation at two of three sites, quite unlike previous reports on perfluorooctanoic acid, which could not be found in measurable concentrations at rural sites. In addition, when these compounds were present, they were one-tenth of previously reported levels.

[35] Chu, S.-G., G.D. Haffner, and R.J. Letcher. 2005. Simultaneous determination of tetrabromobisphenol A, tetrachlorobisphenol A, bisphenol A and other halogenated analogues in sediment and sludge by HPLC-ESI-MS-MS. *J. Chromatogr. A* 1097: 25–32.

3.2.5 Ecosystem Initiatives

3.2.5.1 St. Lawrence Plan

Examples of research conducted in 2005–06 are presented hereunder.

Environmental chemistry

Urban effluents are considered one of the primary reasons for nuisance pollution and represent an important risk to the ecosystems. Urban effluents, by their volume and concentration, represent an important source of conventional and emergent contamination. Principal results include the modeling of the complexion of metal in the effluent matrix that controls the inherent toxicity and bioavailability of the contaminant, and the development of an automated method for quantifying certain antibiotic substances both in the effluents and in surface waters. The fate of certain antibiotic substances was documented, as was the level of elimination of pharmaceutical substances by new proposed test technologies that are being evaluated.

Ecotoxicology

Field studies conducted in the freshwater portion of the St. Lawrence River (Lac St-Pierre archipelago, rich in biodiversity) and in its estuarine portion (Saguenay Fjord) with caged and endemic bivalves as model species, have shown deleterious effects of contaminant mixtures on reproduction (hormonal effects triggering high levels of egg yolk protein, feminization and/or masculinization, and neuro-endocrine anomalies), on immune response (immuno-suppression), as well as on their general state of health (lipid peroxidation, genotoxicity, premature aging) owing to the presence of mixed and diffuse sources of pollution. In addition to field studies, real-time exposure to urban effluents confirmed the source of neuro-endocrine anomalies for fluvial ecosystems. Research continues to attempt to link chemical sources to the observed effects so that curative actions can be taken and determine whether the implementation of secondary treatment processes could mitigate these harmful effects.

New projects on the evaluation of nanoproducts using bioassays and biomarkers were initiated in 2006. These projects will address different modes of action of nanoproducts. The trophic chain toxicity of nanomaterials will be studied using microbiotests and biochemical indicators to determine their mode of action. Preliminary results indicate some environmental toxicity of several nanoproducts or an increase in the toxicity of other contaminants in water or substrates.

3.2.5.2 Great Lakes

Examples of the research conducted in the Great Lakes are given below.

- The endocrine-disrupting chemical alkylphenol was found to be present in Cootes Paradise, a polluted section of Hamilton Harbour. Alkylphenols and ethoxylates are considered to be toxic under the *Canadian Environmental Protection Act, 1999*. Studies show that ethoxylates are the dominant alkylphenol in this water column. Sites receiving the effluents of wastewater treatment plants, combined sewer overflows and other point sources show the highest levels of alkylphenols, leading to significant accumulation in benthic invertebrates and thus confirming contaminant transfer.
- Research at the National Water Research Institute continued on the sources and fates of hazardous air pollutants, including flame retardants, in the Great Lakes Basin to determine the regulations, etc., appropriate to protect human and ecosystem health. Information was generated on the occurrence, persistence, fate and effects of waterborne toxic chemicals and other substances of concern, including pathogens, genetically modified organisms, and effluents generated by industry, agriculture and sewage treatment plants, all of which is necessary to protect humans, wildlife populations and ecosystems in the Great Lakes Basin. Research continues to determine the impact of pharmaceuticals and personal care products.
- As part of a broad assessment of fish and wildlife health and its relationship to contaminant exposures at Areas of Concern on the Canadian side of the Great Lakes, we are assessing the incidences of liver tumours in bottom feeding fish. In 2005–06 we sampled and analyzed fish from the Bay of Quinte, Cornwall, Wheatley, Detroit River, and St. Clair River. The occurrence of tumours and deformities in fish is beneficial use impairment that would lead to remediation actions. An additional component of the Areas of Concern research involved the ongoing assessment of thyroidal status in pelagic and benthic fish species. We also explored the relationship between polychlorinated biphenyl exposures, temperature and thyroid status in rainbow trout.

3.2.6 Hormone-disrupting Substances

Health Canada research scientists continued their activities aimed at understanding the toxic effects of mixtures of hormone-disrupting substances present in breast milk and human serum. Recent results suggest that a mixture of polychlorinated biphenyls, p,p'-dichlorodiphenyltrichloroethane and dichlorodiphenyldichloroethene changed the hepatic metabolism of estrogens, and that this could be a sensitive

indicator of long-term effects (Desaulniers et al. 2005).[36] Early exposure to a different mixture of polychlorinated biphenyls, polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans led to hepatic changes in deoxyribonucleic acid methylation and estrogen signalling (Desaulniers et al. 2005).[37] None of the mixtures induced changes at the estimated dose received by humans. Ongoing experiments are aimed at understanding the contribution of additional chemicals to the toxicity of complex mixtures, with the intent of differentiating the magnitude of the risks that might be attributed *in utero* from the postnatal period of exposure.

Research funded by the Health Canada Genomics Research and Development Programme has shown that suppression of thyroid hormone causes permanent developmental changes in the expression of genes. This information is being used to identify biomarkers of thyroid suppression.

3.2.7 Technology Development

Examples of research conducted in 2005–06 are presented hereunder.

Reducing the health and safety impacts of environmental threats by using:

- Microwave-Assisted Processes™ technologies (large-scale applications) to reduce energy use, solvent use, and greenhouse gas emissions in industrial processing, such as those found in the commodity food oils industry and manufacturing operations. Ongoing work includes substituting n-butane for hexanes, thereby contributing significantly to the benefits of greenhouse gas reductions to air quality;
- microwaves (preliminary application) for chemical synthesis to reduce energy use by approximately 95% when taking into account the overall energy production cycle (solvent production, synthesis, purification, solvent removal);
- after-treatment reduction technology to determine the potential for reductions in nitrogen oxide emissions from marine propulsion engines;
- bench- and pilot-scale optimization of anaerobic co-digestion of sewage sludge and the organic fraction of municipal solid waste for improved stabilization and enhanced biogas production;
- bench-scale optimization of the aerobic digestion process to optimally reduce the pathogen content of biosolids and thus reduce the risk of exposure to these harmful pollutants after they have been applied to land;
- optimization of septic tank design: recirculating sand filter technology to produce effluents with low concentrations of ammonia and other contaminants. This technology can serve as an affordable and reliable on-site treatment system to protect sensitive receiving waters in small communities;
- application of the Integrated Fixed Film/Activated Sludge and moving bed biological reactor processes as cost-effective upgrades to conventional treatment systems in large municipalities, in order to produce a nitrified effluent year-round with minimal capital expansion.

3.2.8 Pharmaceutical and Personal Care Products in the Environment

In 2005–06, a number of collaborative efforts were carried out by Health Canada to advance knowledge of the fate and effects of pharmaceutical and personal care products on the environment. This research included evaluating the persistence and mobility of chemical and microbial contaminants contained in biosolids applied to agricultural fields, the effects of selected anti-microbial agents on aquatic microbial community structure, diversity and function, and the occurrence of antibiotic-resistant aerobic bacteria in sediments at aquaculture sites in the Fundy Isles Region of southwest New Brunswick. The results obtained will be relevant to assessment of the potential risk of these compounds in the environment and contribute to the development of new environmental assessment regulations for substances in *Food and Drugs Act* products currently underway.

Currently, there is limited understanding of the ecological implications of pharmaceutical and personal care products. Pharmaceuticals and broad-spectrum antibiotics have been widely detected in the natural environment; they enter ecosystems in runoff and in the discharge of treated sewage effluent into aquatic water bodies.

Studies were undertaken to gain a better understanding of the effects of pharmaceutical compounds, present in treated sewage effluent, on the microbial ecology of the Wascana Creek/Qu'Appelle River system. Evaluations were made of in situ bacterial and algal production and biomass, microbial

[36] Desaulniers, D., G. Cooke, K. Leingartner, K. Soumano, J. Cole, J. Yang, M. Wade, A. Yagminas, *et al*. 2005. Effects of postnatal exposure to a mixture of polychlorinated biphenyls, *p,p'*-dichlorodiphenyltrichloroethane, and *p.p'*-dichlorodiphenyldichloroethene in prepubertal and adult female Sprague-Dawley rats. *International Journal of Toxicology* 24: 111-127.

[37] Desaulniers, D., G.-H. Xiao, K. Leingartner, I. Chu, B. Musicki and B.K. Tsang. 2005. Comparisons of brain, uterus, and liver mRNA expression for cytochrome P450s, DNA methyltransferase-1, and catechol-*o*-methyltransferase in prepubertal female Sprague-Dawley rats exposed to a mixture of aryl hydrocarbon receptor agonists. *Toxicological Sciences* 86: 175-184.

biodiversity and physiological state at sites downstream of the city of Regina's sewage treatment plant. Creek water was monitored (upstream and downstream from the sewage treatment plant) to investigate concentrations of pharmaceuticals and personal care products. Trimethoprim was present in the highest concentration (90 ng/L) at Site 2 (0.4 km downstream of the Regina sewage treatment plant), with concentrations gradually decreasing until the last sampling site located 104 km downstream of the sewage treatment plant, where none was detected.

In an additional study salicylic acid, ibuprofen, gemfibrozil, naproxen, triclosan, ketoprofen, diclofenac, and indomethacin were all detected in all the influent and most effluent samples taken from a wastewater treatment plant. Currently, there is very limited understanding of the ecological implications. Studies were also performed in rotating annular bioreactors to assess the impact of pharmaceuticals on river biofilms.

Even at only 10 ppb, pharmaceuticals appeared to exhibit both nutrient-like and toxic effects on the microbial communities in these aquatic systems.

A gas chromatography-tandem mass spectrometry method has been developed for the determination of selected acidic and neutral pharmaceutical products in sewage influent and roughly primary-treated effluent at the ng/L level. Results show that physical and chemical processes at wastewater treatment plants remove little of the studied pharmaceuticals. Pilot studies were conducted to test three different types of wastewater disinfection processes (ultraviolet radiation, performic acid, and ozonation) on the removal efficiency for those substances. Ozonation appears to be more effective in removing the detected substances in wastewaters than either ultraviolet radiation or performic acid treatments. New metabolites emerging from disinfection treatments, however, remain unknown.

More than 2,000 groundwater and surface-water samples provided by the Department of Defense, Environment Canada, the provinces and other agencies were analyzed. Sampling efforts addressed areas where perchlorate contamination was of potential concern: military installations, mining, sectors using sodium chlorate, firework displays and arid areas. Perchlorate was not detected at concentrations $> 6\ \mu g/L$ (Health Canada's proposed guideline) in drinking water, but it was observed to exceed this level in areas where specific point sources of perchlorate were identified. The evolving science on this issue continues to be monitored and the survey results will serve to add to our understanding of perchlorate as a contaminant in Canada.

3.3 Pollution Prevention Demonstration Projects

There are numerous programs across the country that are intended to enable Environment Canada to demonstrate that pollution prevention practices can be achieved at work and in everyday lives. Examples of regional pollution prevention actions are listed in the following sections.

3.3.1 Pacific and Yukon Region

Whitehorse Community Challenge

The Whitehorse Community Challenge received funding from Environment Canada to focus on energy efficiency and waste reduction activities. Organizers conducted free waste assessments for local businesses and created a "Welcome to Whitehorse" package for new residents that included information on waste diversion programs, active transportation, and greenhouse gas reduction. The community also offered do-it-yourself workshops with free instructions and consultations on home renovations, EnergySTAR products, heating source options, and landscaping to increase home energy efficiency.

3.3.2 Prairie and Northern Region

Town of Morden and Winkler

The Town of Morden and Winkler in Manitoba received funding from Environment Canada and the province of Manitoba's Climate Change Community Challenge initiative to develop environmentally sustainable capital projects and encourage citizens to take action to reduce greenhouse gas emissions. They worked with community councils to develop a strategic action plan to retrofit public facilities. The Town of Morden initiated a geothermal heat pump retrofit for the fire hall and retrofitted municipal buildings with energy efficient lighting and programmable thermostats. This initiative was successful in decreasing the amount of energy required to operate municipal structures and in raising awareness for such actions throughout the community.

The North

Through departmental programs like Weather Watchers (i.e. individual Canadians submit information on weather

status and trends), the One-Tonne Challenge, and EcoAction program (projects to protect, rehabilitate or enhance the natural environment and build the capacity of communities to sustain these activities into the future), Environment Canada works directly with Northerners to encourage them to act on climate change and other environmental priorities. In addition to such efforts, Environment Canada has undertaken new relationships with local governments and Aboriginal organizations across the North to build understanding and action to address environmental issues.

The occurrence, trends and pathways of contaminants in the Arctic were discussed in a special issue of the journal *The Science of the Total Environment,* with an additional special issue dealing with contaminants in fish, wildlife and humans in this area.

3.3.3 Ontario Region

Don Valley West Community Challenge

In Ontario, the Don Valley West Community Challenge worked with the local utility, Enbridge, to deliver the TAPS program (Take Action with Programs for Savings). This program targets homeowners to turn down their hotwater tanks, install aerators in faucets, pipe-wrap hot and cold water lines, replace showerheads with a low-flow model and install compact fluorescent lightbulbs. Through this program, 600 homes in the community were successfully retrofitted.

Business Air Quality Program Pilot

The goal of the Business Air Quality Program pilot is to motivate small and medium-sized enterprises in the industrial manufacturing sector to implement voluntary and beyond-compliance best practices, as a way to improve their environmental performance and economic competitiveness through material substitution and process improvements. The objective is to reduce key criteria air pollutants, including nitrogen oxides, sulphur dioxide, particulate matter and volatile organic compounds.

Delivered under the Canada–United States Border Air Quality Strategy, the Business Air Quality Program pilot focuses on reducing air emissions from industrial small and medium-sized enterprises in southwestern Ontario. In March 2006, an agreement was reached with the Ag Energy Co-operative to partner on their Demand Side Management Program. This involves conducting energy audits at selected greenhouse facilities in southwestern Ontario, in support of emissions reductions under the Border Air Quality Strategy. This program is supported by The Ontario Greenhouse Alliance which represents flower and vegetable growers, Ontario Ministry of Agriculture, Food and Rural Affairs, Hydro One, Enbridge, Union Gas, Ontario Power Authority and The Cecil Delworth Foundation. The Rural Economic Development Program of the Ontario Ministry of Agriculture, Food and Rural Affairs is also providing financial support.

Environment Canada contributed a front-end subsidy of 50% of pollution prevention audit costs, to a maximum of $5,000 per facility. The participating small and medium-sized enterprises are responsible for the remainder of the audit costs. This pilot is also being coordinated with Natural Resources Canada's existing Industrial Energy Audit Incentive to capture air quality co-benefits that are currently not being quantified. Over 20 facilities are participating in the program, which has now been extended to March 2007.

Burn It Smart

In Ontario, 18 *Burn It Smart* workshops were held to help professional contractors and the general public to identify ways to reduce the impacts of residential wood burning. An additional 10 workshops were held for First Nations communities in Ontario. The *Burn It Smart* campaign was presented at a number of public events, including the Cottage Life Show and International Plow Match, to reach and educate the local public outside the workshop format.

Retail partnerships were established with Home Depot and Home Hardware. Home Depot had *Burn It Smart* events at six of their locations in Ontario. The events were a great success, with customers continuing to ask for their return. *Burn It Smart* information was also provided at a national meeting for Home Hardware retailers from across the country.

The campaign also produced new educational material, including a DVD containing three videos on Environmental Protection Agency approved woodstoves, firewood preparation and woodstove operation. This DVD has been well received, with retailers offering it in their stores and the United States Environmental Protection Agency using it in their education campaigns.

Through ongoing collaboration with the United States Environmental Protection Agency under the Great Lakes Binational Toxics Strategy, *Burn It Smart* workshops were provided to local citizens in border towns in the states of New York, Wisconsin and Michigan, and also to Native Americans.

A number of research projects were undertaken in conjunction with the Puget Sound Clean Air Agency, the Hearth, Patio and Barbeque Association in the United States, and the United States Environmental Protection Agency to characterize emissions from wax firelogs and to determine emission factor verifications for conventional wood stoves.

The Toronto Region Sustainability Program

This Greater Toronto Area-based program is aimed at advancing the environmental performance of small and medium-sized enterprises in the manufacturing sector in the areas of pollution prevention and sustainable development. It addresses reductions in toxic substances listed in both the *Canada–Ontario Agreement on the Great Lakes* and the *Great Lakes Binational Toxics Strategy*.

Specific objectives include encouraging businesses to take action to reduce smog precursors, reduce or eliminate the use of toxics, and move to zero generation of toxic wastes. The program is a collaborative, multi-stakeholder effort, in partnership with the Toronto and Region Conservation Authority, and local and provincial governments. Small and medium-sized enterprises have seen a real value in the Toronto Region Sustainability Program, where all three levels of government have identified their priorities for action. For small and medium-sized enterprises, pollution prevention opportunities have brought significant returns on investment, cost savings, reduced risk of non-compliance that could be followed by enforcement actions, and better marketing opportunities.

In the first five years of the program, 44 of the 56 participating facilities have completed pollution prevention assessments, which represent the following identified annual pollution prevention results and savings:

Toronto Region Sustainability Program
Annual Pollution Prevention Reductions and Savings

Volatile organic compounds (VOCs)	*618 tonnes*
Metals	*2 200 kilograms*
Hazardous wastes	*1 394 tonnes*
Toxic substances	*32 000 kilograms*
Water	*327 478 tonnes*
Greenhouse gases (GHGs)	*1 673 tonnes*
Particulate matter (PM < 10)	*15.4 tonnes*
Generic waste diversion (to recycling)	*49 512 tonnes*
Mercury waste diversion (to recycling)	*5 044 grams*
Average cost savings (per SME)	*> $70,000*

EcoSchools: Resources for Schools

Ontario EcoSchools is a voluntary environmental education program that addresses both how the schools are run and what students learn. It has been designed collaboratively by school boards for school boards, with input from federal, provincial and municipal governments, to incorporate environmental education and environmentally responsible action into the school setting. The program aims to influence young people during a formative period of life and to have an exponential impact as children take a culture of conservation home with them.

Comprehensive guides have been developed to reduce energy use, minimize waste and design environmentally friendly school grounds. In addition, Ontario curriculum expectations that relate to climate change have been identified and elementary and secondary teaching resources have been developed for grades 1 to 12. The program focus is unique in that no other environmental education program actively involves both curriculum and facilities departments.

In 2005–06, 108 schools in six school boards were in various stages of implementing the EcoSchools program. Measurable successes include that on average, certified EcoSchools use 12% less electricity and 7% less natural gas than comparable non-certified EcoSchools (Toronto District School Board Energy Management Program Review, 2006).[38]

The program is designed to be replicated across all Ontario boards, and has the potential to be exported to other provinces and/or territories with appropriate curriculum modifications.

Ontario Snow Resorts Association Environmental Best Practices Task Force

Through a cooperative partnership, the Canadian Centre for Pollution Prevention, Environment Canada and the Ontario Snow Resorts Association have been actively promoting environmental best practices to the Ontario Snow Resorts Association membership since 2003, through the creation of the Ontario Snow Resorts Association Environmental Best Practices Task force. This task force serves as a forum on issues related to pollution prevention, where ski resort operators can exchange information on best practices

[38] ICF International. 2006. *Toronto District School Board Energy Management Program Review*, pp. 28-29.

and work collaboratively with one another and with other partners to prevent pollution locally and regionally. The task force has developed an action plan that reflects the environmental priorities of ski resorts across Ontario whose scope encompasses the four-season reality of ski resort operations. The Blue Mountain and Osler Bluff ski resorts have been leaders in the industry, demonstrating that the recommendations in the handbook are realistic and achievable for both large and small facilities. They are both realizing reductions in energy consumption, solid waste, maintenance and operating expenses and are implementing green procurement in all areas of their facilities.

CleanMarine Eco-Rating Program

The CleanMarine Eco-Rating Program is an environmental best management practices initiative to assist marina operators and managers become more sustainable by implementing initiatives and policies designed to protect the environment. It was developed by the CleanMarine Partnership in 1997.

The CleanMarine program is led by the Ontario Marine Operators Association (OMOA: www.omoa.com) with input and support from the CleanMarine Partnership, which includes representatives from Environment Canada, Ontario Ministry of Environment, Ontario Sailing Association, Canadian Power and Sail Squadron, Canadian Marine Manufacturers Association, Ontario Boating Forum, Federation of Ontario Cottager Associations, Ontario Federation of Anglers and Hunters, and TerraChoice Environmental Marketing.

When the partnership was formed, information was compiled and developed into a resource tool that marina managers could use to assist them in protecting the environment and better managing their businesses. An audit is conducted by a third party to verify the initiatives implemented. The audit report provides the marinas with the information they require to help them improve their operations and it acknowledges the initiatives that they performed well. Re-audits are conducted every four years to encourage continuous improvement and ensure marinas continue to operate at the rating level initially awarded. As of March 2006, 248 marinas throughout Ontario had been audited.

Marina owners and managers have improved their business practices, reduced their impact on water resources, increased energy efficiency, managed natural habitats better and participated in community environmental projects, reduced solid waste and associated costs, reduced use of toxic substances, decreased risks of an environmental emergency, increased recycling of waste and prevented pollution. In 2005, over 1,000 tonnes of plastic shrink wrap was collected from participating marinas in Ontario and recycled instead of being landfilled.

Greening Retail

The goal of the Greening Retail program is to provide retailers with specific tools, strategies, and programs to improve their energy efficiency and environmental performance, and to play a major part in the transformation of society towards improving the environment. The project will demonstrate to retailers that undertaking these initiatives can enhance their bottom line and thus makes good business sense. All stakeholders associated with the retail industry will be engaged, starting with manufacturers and distributors, then to the retail developer or property manager, and ending with the consumer.

Identifying the Greening Retail opportunity for Canadian retailers is phase 1 of a three-part project that was initiated and completed in 2005–06. Research conducted in phase 1 confirmed the initial premise of Greening Retail: that retailers can profit from the implementation of good environmental practices and that leading retailers are embracing them. However, the research also indicated that the adoption of best practices is not yet pervasive in the sector. Discussions with leading retailers indicated that there is a need to support retailers with industry guidelines and detailed information to assist in the adoption of best practices in environmental management. Canadian retailers employ 12% of the Canadian workforce, generate $368 billion in annual sales and are primarily small or medium-sized enterprises. In 2002, retail facilities and their suppliers were responsible for 39 megatonnes of greenhouse gas emissions.

3.3.4 Quebec Region

Centre québécois d'actions sur les changements climatiques

In the fall of 2005, the Quebec Public and Education Outreach Hub launched the *Cocktail Transport* campaign to promote sustainable transportation. This province-wide

initiative encouraged people to opt for alternate modes of transportation and to carpool to work. Baseline and follow-up research indicated that two million people were reached through various marketing channels: Web site, radio, newspapers, posters, bus panels and roadside advertising. Incentives such as free bicycles and free transit passes were used to encourage participation in the campaign.

Enviroclub[OM]

Enviroclub[OM] is a Quebec organization that encourages small and medium-sized enterprises in the manufacturing sector to voluntarily reduce harmful emissions and lessen their dependency on natural resources while increasing their competitiveness. From the start of the program (2000) to March 2006, 14 Enviroclubs involving 168 small and medium-sized enterprises had been established. This resulted in $11.7 million invested in environmental projects, of which $2.9 million came from the federal government and $8.8 million from the private sector. The average payback period for these projects was one year and the total recurrent annual savings are estimated at $10.6 million. On the environmental front, these pollution prevention projects yielded net savings of 165,000 gigajoules/year, equivalent to 27,000 barrels of oil, a reduction of 800 tonnes of toxic substances, a decrease of 17,000 tonnes of wastes, and a reduction of 29,000 tonnes of carbon dioxide equivalent—comparable to the annual emissions of 6,200 cars. Added to the economic and environmental benefits generated by the Enviroclub program were the social ones: Enviroclub members become acquainted with pollution prevention concepts via the four days of mandatory training for all participating small and medium-sized enterprises. For more information on the Enviroclub program, visit www.enviroclub.ca.

Along with the Enviroclub program, the Quebec Environmental Protection Activities Branch promotes innovative technological solutions to improve environmental performance. There are currently 38 ongoing environmental technology projects in Quebec, while 21 have been completed. These projects have been in the areas of atmospheric emissions, climate change, wastes, toxics, wastewater, soil and groundwater decontamination, and energy. The immediate impacts of these technologies were in reduced atmospheric emissions, reduced water use, reduced water pollution, rehabilitation of brownfields, reduced material consumption, reduction and reclamation of wastes, reduced energy consumption, and reduction and disposal of toxic substances and hazardous wastes. These 59 projects totalled $56 million in investments, of which $18 million came from a variety of federal programs from several departments and agencies (National Research Council of Canada, Canada Economic Development for Quebec Regions, Industry Canada, Natural Resources Canada). The remaining $38 million in investment came from the private sector.

Residential wood heating

The air quality station, in operation since 1998 in a Montréal residential neighborhood impacted by wood heating, has allowed linking its use to a reduction in air quality. In January 2006, a new station was added to the National Air Pollution Surveillance Network in a residential area near Québec that is also impacted by residential wood heating. This second station should allow confirmation of the trend.

Initial data analyses of the new data are planned for 2007–08.

A Model Municipal By-Law to regulate wood heating appliances has been made available to municipalities in June 2006. The model by-law is a tool box to be used by a municipality wishing to develop and put in place a municipal by-law to regulate wood heating appliances. It is intended to be used by municipalities that experience air quality problems because of residential wood combustion.

3.3.5 Atlantic Region

A Bright Idea: Prince Edward Island, Climate Change Hub

A Bright Idea is an energy-saving campaign that ran in the winter of 2006 to educate homeowners about energy efficiency and climate change. Across Prince Edward Island, 94 homeowners were selected to have their homes retrofitted with up to 20 compact fluorescent lightbulbs. Pre- and post-campaign measurements conducted by Maritime Electric demonstrated that once the 1,730 compact fluorescent lightbulbs were installed, a total of 820,000 kilowatts were saved, amounting to an annual reduction of 61 tonnes of greenhouse gases. For homeowners, this resulted in a total annual savings of $8,200.

3.4 Objectives, Guidelines, and Codes of Practice

Pursuant to subsection 54(1) of the Canadian Environmental Protection Act, 1999*, the Minister of the Environment shall issue environmental quality objectives, environmental quality guidelines, release guidelines, and codes of practice. These instruments shall relate to:*

- *the environment;*
- *pollution prevention or the recycling, reusing, treating, storing, or disposing of substances or reducing the releases of substances into the environment;*
- *works, undertakings, or activities that affect or may affect the environment; or*
- *the conservation of natural resources and sustainable development.*

Pursuant to subsection 55(1) of the Act, the Minister of Health shall issue objectives, guidelines, and codes of practice with respect to the elements of the environment that may affect the life and health of the people of Canada.

3.4.1 Environmental Quality Guidelines

Environmental Quality Guidelines specify recommendations in quantitative or qualitative terms to support and maintain particular uses of the environment, such as protection of aquatic life, and land uses, including agricultural, industrial, commercial, and residential/parkland. Environmental Quality Guidelines are used to help interpret monitoring data and assess contaminated sites and are an integral part of the Canadian Environmental Sustainability Indicators by providing a means of consistent comparison.

In 2005–06, six Canadian Environmental Quality Guidelines, developed under the Canadian Council of Ministers of the Environment, were finalized. Also completed were revisions to the Protocol for the derivation of Soil Quality Guidelines for the protection of environmental and human health. Thirteen other Canadian Environmental Quality Guidelines were under development (see Table 1). Revisions were ongoing to the protocol used to develop Canadian Water Quality Guidelines for the protection of aquatic life and to the Sediment Quality Index, a communication tool for the management of contaminated sediment that uses a suite of Canadian Sediment Quality Guidelines.

During this reporting period, Environment Canada also provided six training sessions on the derivation and implementation of Canadian Water Quality Guidelines for the protection of aquatic life to government, industry and academia.

3.4.2 Drinking Water Quality Guidelines

Drinking water quality guidelines are established by the Federal-Provincial-Territorial Committee on Drinking Water and published by the Minister of Health. They establish maximum acceptable concentrations of contaminants in drinking water.

In 2005–06, Health Canada continued to work in collaboration with the Federal-Provincial-Territorial Committee on Drinking Water to develop the Guidelines for Canadian Drinking Water Quality.

Table 1 Canadian Environmental Quality Guidelines from March 2005 to April 2006

Guideline	Published	Progress
Water	biocriteria framework; diisopropanolamine;*† permethrin; sulfolane*†	alcohol ethoxylates;* guidance for the deposition of organic matter/feed from aquaculture operations; marine eutrophication guidance framework; nickel; imidacloprid; phosphorus ecoregion guidelines; uranium; aquatic life protocol revisions
Sediment	N/A	sediment quality index
Soil	propylene glycol; trichloroethylene; protocol revisions.	carcinogenic polycyclic aromatic hydrocarbons; diisopropanolamine;* sulfolane;* uranium
Tissue	N/A	N/A

* In partnership with industry.
† Includes values for the protection of aquatic life and agricultural water uses.

Table 2 Guidelines for Canadian Drinking Water Quality from March 2005 to April 2006

Guideline	Status as of April 2006
Trichloroethylene	Final approval
E. coli	Final approval
Emerging pathogens	Final approval
Heterotrophic plate count	Final approval
Methyl Tertiary Butyl Ether (MTBE)	Submitted for final approval
Trihalomethanes	Submitted for final approval
Bromodichloromethane	Submitted for final approval
Arsenic	Submitted for final approval
Chlorite	Consultation completed
Chlorate	Consultation completed

The guidelines for Canadian Drinking Water Quality, including a summary table of all guidelines, are published on the Health Canada Web site.

www.healthcanada.gc.ca/waterquality

www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/sum_guide-res_recom/index_e.html

3.4.3 Release Guidelines

The final *Guidelines for the Reduction of Ethylene Oxide Releases from Sterilization Applications* were published on October 1, 2005. The guidelines recommend that health care facilities and commercial facilities that use ethylene oxide for sterilization purposes install an emission control system to reduce releases of ethylene oxide to the ambient air, thereby reducing exposure of the Canadian population.

canadagazette.gc.ca/partI/2004/20040403/html/notice-e.html#i2

3.5 State of the Environment Reporting

State of the environment reports and environmental indicators provide Canadians with information and knowledge about current environmental issues and foster the use of science and data in policy- and decision-making. Indicators, reports, data and tools are housed at or referenced through Environment Canada's State of the Environment Web site. This site also includes resources for reporting and indicator practitioners.

www.ec.gc.ca/soer-ree/English/default.cfm

There is a growing need to develop tools to improve our ability to recognize environmental change. One such need centres on improving our understanding of food web structure and how food webs may change through time. Food web structure is important in determining the flow of energy, nutrients and contaminants through ecosystems. By measuring stable isotopes and fatty acids in archived Herring Gull eggs, we found that gull diets change over time. These changes reflected alterations in the Great Lakes that reduced prey fish availability. Dietary changes in fish-eating birds are important in terms of affecting diet quality and exposure to contaminants.[39]

3.5.1 Environmental Indicators

Environment Canada collaborated with federal departments and agencies, other levels of government, and stakeholders to develop environmental indicators in support of decision-making on priority environmental issues, policies and actions.

Environment Canada, together with its partners Statistics Canada and Health Canada, completed the first annual report on the Canadian Environmental Sustainability Indicators, published in December 2005. This initiative is in response to recommendations of the National Round Table on Environment and Economy to focus on national indicators on air quality, water quality and greenhouse gas emissions, and is available online at two Web sites:

www.environmentandresources.ca (indicators)

or

www.statcan.ca

Environment Canada continued to work in collaboration with federal partners to develop, enhance and update environmental indicators (last reported on in 2003). These are a comprehensive set of indicators covering drivers and pressures and the state and quality of Canada's environment;

[39] Hebert, C.E., M.T. Arts, and D.V. Weseloh. 2006. Ecological tracers can quantify food web structure and change. *Environmental Science and Technology* 40: 5618–5623.

Hebert, C.E. and D.V. Weseloh. 2006. Adjusting for temporal change in trophic position results in reduced rates of contaminant decline. *Environmental Science and Technology* 40: 5624–5628.

they are a source of integrated data and science-based information to foster understanding and support decision-making on environmental sustainability.

3.5.2 Regional Reports

During 2005–06, Environment Canada also contributed to the advancement and completion of state of the environment reports and the development of environmental indicators for several ecosystems in Canada.

Progress was made towards continued, periodic reporting on Environment Canada's ecosystem initiatives, as presented below.

Environment Canada co-chaired, with the United States Environmental Protection Agency, a multi-agency, multi-disciplinary team on the development and reporting of a suite of nine ecosystem indicators aimed at better understanding key ecosystem stresses and responses in the Georgia Basin–Puget Sound transboundary region. These indicators are: toxics in Harbour Seals; river, stream and lake quality; marine water quality; air quality; shellfish; marine species at risk; population health; urbanization and forest change; and solid waste and recycling. *The Georgia Basin-Puget Sound Ecosystem Indicators Report* increases the depth and breadth of ecosystem indicators reported in 2002 and is tailored to the information needs of the public and decision-makers, based on feedback received on the 2002 report.

www.epa.gov/region10/psgb/indicators/

In partnership with the United States Environmental Protection Agency, Environment Canada released the *State of the Great Lakes 2005* report. The sixth in a series of biennial reports beginning in 1995, this report provides an assessment of Great Lakes Basin ecosystem components using a suite of ecosystem health indicators.

The Northern Ecosystem Initiative has made progress towards the preparation of an indicators report for the Canadian North. A synthesis report including an initial suite of northern indicators drawing upon local, traditional and scientific knowledge and methods from across the Canadian North was drafted, in a collective effort to provide the latest understanding of the status and important trends in Northern ecosystems.

A survey of ecological monitoring activities within the Atlantic Coastal Action Program was conducted from February through April 2005. The survey compiled information on monitoring programs, data dissemination and management, as well as the effectiveness of data delivery and its impacts on policy and decision-making. One of the recommendations to emerge from this initiative was the development of a State of the Atlantic Coastal Action Program Environment report.

Environment Canada, along with a number of other partners, including the Department of Fisheries and Oceans, the provincial government and universities, contributed to a comprehensive report on the terrestrial and marine environments of the British Columbia coast. The work entailed the development of a largely new suite of indicators from those used in previous State of the Environment reports and the identification of data gaps for improved State of the Environment reporting. The indicators provided a synthesis of balanced peer-reviewed scientific information on six aspects of the coastal environment: ecosystem protection, industrial contaminants, fisheries, biodiversity, population and economic activity, and climate change. This integrated report establishes a baseline for environmental conditions and pressures for future comparisons.

www.env.gov.bc.ca/soe/bcce/

3.6 Gathering and Reporting of Pollution and Greenhouse Gas Information

3.6.1 National Pollutant Release Inventory

The National Pollutant Release Inventory provides Canadians with access to information on the releases and transfers of key pollutants from industrial facilities located in their communities. The National Pollutant Release Inventory is the only national, legislated, publicly accessible inventory of its kind in Canada and it is an important consideration in managing risks to the environment and human health. Public access to the National Pollutant Release Inventory motivates industry to prevent and reduce pollutant releases and helps the Government of Canada track progress in pollution prevention, evaluate releases and transfers of substances of concern, identify and take action on environmental priorities, and implement appropriate policy initiatives and risk-management measures.

The National Pollutant Release Inventory tracks releases to air, water and land, quantities sent for disposal and recycling, and pollution prevention activities. For 2004 reporting, it included 323 pollutants, including toxic substances like mercury, dioxins and furans, hexachlorobenzene and polycyclic aromatic hydrocarbons, and air pollutants such as sulphur dioxide, particulate matter and nitrogen that contribute to smog and acid rain.

During 2005–06, almost 8,500 facilities reported to the National Pollutant Release Inventory on their releases and transfers of National Pollutant Release Inventory pollutants for the 2004 reporting year. The information they reported was made publicly available through the National Pollutant Release Inventory Web site and other means.

Recent changes, including the addition of reporting on air pollutants and the removal of the exemption on upstream oil and gas facilities, mean that National Pollutant Release Inventory is providing a more accurate and comprehensive picture of pollutants released to the environment from Canadian facilities.

Data for the 2004 reporting year were collected for the first time through the One Window to National Environmental Reporting System, which was launched in March 2005. The One Window to National Environmental Reporting System is a secure online reporting tool being used by Environment Canada, provincial and municipal governments, and private-sector organizations to collect environmental data from industry. Over time, One Window to National Environmental Reporting System will be able to consolidate many environmental reporting requirements into a single, integrated, online reporting platform, increasing the efficiency of reporting for both governments and industry while increasing the quality of reported data, the timeliness of their collection and publication, and their usefulness for environmental decision-making by governments, industry and the public alike.

www.ec.gc.ca/pdb/NPRI

3.6.2 Compilation of National Emission Inventories for Key Air Pollutants

Comprehensive emission inventories are compiled by Environment Canada for key air pollutants that contribute to environmental effects such as smog, acid rain and poor visibility. These inventories are used to track the progress of current emission-reduction strategies for various pollution sources, including industrial activities, residential fuel combustion, transportation vehicles, forest fires and road dust. In addition, they are used to identify priorities for future pollution prevention actions and to support the negotiation and implementation of domestic environmental programs and international agreements.

www.ec.gc.ca/pdb/cac/

www.ec.gc.ca/pdb/ghg/ghg_home_e.cfm

3.6.3 Greenhouse Gas Emissions Reporting

The Greenhouse Gas Emissions Reporting program was established by the Minister under the authority of subsection 46(1) of *Canadian Environmental Protection Act, 1999*, and announced through the publication of the *Canada Gazette* notice in March 2004. The collection of greenhouse gas emissions was continued with the *Canada Gazette* notice published in March 2005.

The greenhouse gas reporting program has four main objectives: to supply information to the national greenhouse gas inventory, to support regulatory development, to inform the public by publishing facility-level data, and to support provincial/territorial emissions information requirements. The program focuses on a limited number of emitters and basic reporting requirements, and lays the foundation for the development of a harmonized and efficient domestic reporting system for greenhouse gas emissions. Facilities that emit 100,000 tonnes of carbon dioxide equivalent (100 kt CO_2 eq) or more annually are required to submit their greenhouse gas emission information to Statistics Canada by June 1 of each year. The reporting facilities include major industrial facilities that produce electricity, heat or steam using fossil fuels, certain power generation facilities, as well as integrated steel mills, facilities involved in smelting and refining metals, petroleum refineries, and chemical producers.

In June 2005, a total of 326 greenhouse gas reports were submitted, with the majority of reporting facilities being located in Alberta, Ontario and Quebec (71%). The total greenhouse gas emissions for 2004 from all reporting facilities presented just over one-third (37%) of Canada's total greenhouse gas emissions as published in the *National Inventory Report, 1990–2004: Greenhouse Gas Sources and Sinks in Canada*.

The data is published on the greenhouse gas program Web site at www.ec.gc.ca/pdb/ghg/facility_e.cfm.

www.ec.gc.ca/pdb/ghg/ghg_home_e.cfm

Other actions taken by the program in 2005–06 include:

- Continuation of consultations with the National Steering Committee on Reporting and the Stakeholders Advisory Committee on Reporting;
- Collaboration with provincial and territorial governments to harmonize legislative and Greenhouse Gas reporting requirements; and
- Enhancement of the electronic data reporting system and reporting, as well as updating the Web site and publishing of guidance documents to assist reporters.

3.6.4 Compilation of National Emission Inventory for Greenhouse Gases

As a signatory to the United Nations Framework Convention on Climate Change, Canada is obliged to submit an inventory of its greenhouse gas emissions on an annual basis. Using an internationally approved format, the inventory monitors six gases: carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, perfluorocarbons and hydrofluorocarbons, and provides an analysis of the factors underlying the trends in emissions since 1990. Emissions and removals are grouped into six sectors: energy; industrial processes; solvent and other product use; agriculture; land use, land-use change and forestry; and waste.

Canada's Greenhouse Gas Inventory, 1990–2003 was submitted to the United Nations Framework Convention on Climate Change in April 2005 and represents Canada's eleventh *National Inventory Report*. The publication of the *National Inventory Report* allows Canada to track its progress in meeting its emissions reduction goals. The national greenhouse gas inventory also serves as the basis of the greenhouse gas indicator, as recommended by the National Round Table on the Environment and the Economy.

www.ec.gc.ca/pdb/ghg/ghg_home_e.cfm

4 Pollution Prevention (Part 4)

The Act allows the Minister to publish a Pollution Prevention Planning Notice requiring any person described in the Notice to prepare and implement a pollution prevention plan in respect of a substance or group of substances specified on the List of Toxic Substances in Schedule 1. The Minister may also require pollution prevention plans from Canadian sources of international air and water pollution for substances not on the List of Toxic Substances, with the approval of the Governor-in-Council and if the government responsible for the area in which the pollution source is located cannot or will not take action.

The Canadian Environmental Protection Act, 1999 *(CEPA 1999) enables the establishment of a national pollution prevention information clearinghouse to facilitate the collection, exchange, and distribution of information about pollution prevention. Authority is also provided to create an awards program to recognize significant achievements in the area of pollution prevention.*

4.1 Pollution Prevention Plans

As of March 31, 2006, six final Pollution Prevention Planning Notices were published and one was proposed.

Acrylonitrile—The final Notice, published in 2003, applies to any person or class of persons who, on the date of publication of this notice, owns or operates a facility involving the manufacture of synthetic rubber, where such manufacture uses acrylonitrile and results in releases of acrylonitrile to the environment. The risk management objective is to reduce the releases of acrylonitrile to the lowest achievable levels using best available techniques economically achievable by December 31, 2005. The one facility subject to this Notice is working towards achieving the risk management objective.

Nonylphenol and Its Ethoxylates Used in the Wet Processing Textile Industry and Effluents from Textile Mills that Use Wet Processing—The final Notice, published in 2004, targets persons involved in textile wet processing activities who discharge the effluents generated by wet processes to off-site wastewater treatment facilities and whose daily effluent discharge exceeded 30 cubic metres at least once between 1999 and 2003. The Notice is aimed at approximately 80 textile mills. The risk management objectives are to reduce the use of nonylphenol and its ethoxylates by 97% from 1998 levels and to achieve and maintain a maximum acute toxicity of 13% IC_{50} (50% inhibiting concentration) of textile mill effluents. Of the 56 reports received from facilities to end of fiscal year 2005–06, 100% have indicated that they will meet the risk management objectives for nonylphenol and its ethoxylates by 2009 and 29% have indicated that they currently meet the risk management objectives for the toxicity of textile mill effluents.

Nonylphenol and Its Ethoxylates Contained in Products—The final Notice, published in 2004, outlines the requirements for manufacturers and importers of soap and cleaning products, processing aids used in textile wet processing, and pulp and paper processing aids containing nonylphenol and its ethoxylates to prepare and implement pollution prevention plans. The Notice targets manufacturers and importers who purchase or otherwise acquire a total of 2,000 kilograms or more of these substances annually for any year between January 1, 2003, and December 31, 2012. The risk management objective is to reduce the total use of these substances in products manufactured in or imported into Canada by 50% from 1998 levels by 2007 and by 95% from 1998 levels by 2010. The Notice targets approximately 89 manufacturers and importers. Of the 69 reports received from facilities to end of fiscal year 2005–06, 63 (91%) have indicated that they are on track to meeting the risk management objective.

Wood Preservation—The final Notice, published on October 22, 2005, targets five facilities that use wood preservatives containing the following substances listed on Schedule 1 of the *Canadian Environmental Protection Act, 1999*: arsenic compounds, chromium compounds, dioxins and furans, and/or hexachlorobenzene. The intent of this Notice is to reduce the releases and exposures to these substances. The Notice uses the pollution prevention planning provisions of the *Canadian Environmental Protection Act, 1999* to provide a backstop to a voluntary best management practices) implementation program. The voluntary program was initiated in 2000 and the majority of facilities have met

the 2005 deadline to implement best management practices. This will be confirmed by a final audit program being conducted in 2006.

Specified Toxic Substances Released from Base Metal Smelters and Refineries and Zinc Plants—During 2005–06, significant action was taken and progress made after the publication of the proposed Pollution Prevention Notice for specified toxic substances released from base metals smelters and refineries and zinc plants and a complementary *Environmental Code of Practice for Base Metal Smelters and Refineries*, in Part I of the *Canada Gazette* dated September 25, 2004.

Independent economic and technical studies on the proposed targets were conducted. Further consultations with stakeholders and the Base-metals Environmental Multi-stakeholder Advisory Group were conducted and modifications were proposed for inclusion in the Final Notice.

The substances listed on Schedule 1 of the Act that will be addressed by the Final Notice include particulate matter containing metals that is released in emissions from copper smelters or refineries, or from both, and from zinc plants; sulphur dioxide; particulate matter less than or equal to 10 microns; lead; mercury; arsenic compounds; cadmium compounds; nickel compounds; dioxins and furans. Reports on progress will be made in subsequent years.

In the Final Notice, each of the 11 facilities will have to consider the following requirements in developing and implementing their pollution prevention plans:

- compliance with the recommendations contained in an *Environmental Code of Practice for Base Metal Smelters and Refineries*;
- development and implementation of a Community Air Quality Protection Program to prevent local exceedances of air quality objectives;
- development and implementation of a Smelter Emissions Reduction Program with annual release target limits for each facility for 2008 and 2015;
- noting intention of the Minister to develop base metal smelters regulations to be in effect by 2015; and
- noting existing and new studies on environmental, health, engineering, and economics related to the sector.

The Final Notice was published in April 2006 in Part I of the *Canada Gazette*.

4.2 Pollution Prevention Awards

Environment Canada participates in the Canadian Council of Ministers of the Environment Pollution Prevention Awards Program, which recognizes organizations that have shown leadership and innovation in pollution prevention. The 2006 Canadian Council of Ministers of the Environment Pollution Prevention Awards marked the creation of a new category for Micro Business, for which the achievements of six organizations were recognized in 2005.

Micro Business Award

Chanterelle Country Inn and Cottages Ltd. in Baddeck, Nova Scotia. This tourist accommodation provider is dedicated to providing a “green” environment for its guests. One of the inn’s main features—an active solar water heating system—was installed on the south side of the roof to provide domestic hot water and radiant heat through an in-floor space heating system. It is estimated that the inn’s energy systems, combined with high efficiency insulation and windows, save about 25,000 kWh of energy per year and have eliminated the consumption of fossil fuels for space and water heating.

Micro Business Award

Elite Earth-friendly Cleaners, Victoria, British Columbia. This garment cleaner converted its dry cleaning plant to accommodate an ecologically sustainable, water-based, wet-cleaning process that uses citrus- and soy-based cleaning agents and banana-oil spotting agents. By converting to this new process, Elite completely eliminated its use of the toxic solvent perchloroethylene and its production of hazardous waste.

Medium Business Award

Omron Dualtec Automotive Electronics Inc., Oakville, Ontario. This automotive electronics manufacturer was recognized for the construction of its new Leadership in Energy and Environmental Design Canada-certified Electronics Control Unit facility. A key component is the high-performance building envelope that contributes to an overall annual energy savings of 688,000 kWh, enabling the company to reduce its required number of heating, ventilation and air conditioning units. High-efficiency models that contain no ozone-depleting chlorofluorocarbons or hydrochlorofluorocarbons in the refrigerant were installed.

Large Business Award

Purolator Courier, Mississauga, Ontario. Purolator incorporated leading-edge fuel efficient technology into its vehicle fleet. As of November 2005, the company's 10 diesel-hybrid electric vehicles had driven a total of 43,811 kilometres and reduced fuel consumption by 6,790 litres, preventing approximately 16 tonnes of carbon dioxide from being emitted. In addition, the company introduced a hydrogen fuel cell hybrid electric vehicle that produces no greenhouse gas or other smog-inducing emissions.

Greenhouse Gases Reduction Award to the City of Fredericton, New Brunswick. For the last 15 years, the City of Fredericton has painted its traffic lines using water-based paints rather than conventional solvent-based paints. In 2005 alone, the use of 11,630 litres of water-based paints has prevented an estimated 3.7 tonnes of volatile organic compounds from being emitted to the atmosphere. Through the city's *Municipal Building Initiative,* numerous energy efficiency building upgrades resulted in savings of 1,828,086 kWh of electricity between 2000 and 2004. The conversion of 65 traffic and signal lights to the light-emitting diode type represents a savings of 1,552 kWh per month.

Honourable Mention Greenhouse Gases Reduction to TransCanada PipeLines Ltd. of Calgary, Alberta. This company implemented a full-scale fugitive emissions management program to detect leaks, and track immediate repairs and associated emissions along its pipeline system. Since 1998, the system has helped TransCanada avoid the release of more than 500 million cubic feet of methane to the atmosphere, which is equivalent to over two million tonnes of carbon dioxide emissions.

4.3 Canadian Pollution Prevention Information Clearinghouse

For the purposes of encouraging and facilitating pollution prevention, Part 4 of the *Canadian Environmental Protection Act, 1999* provides for the establishment and maintenance of a national pollution prevention information clearinghouse. The Canadian Pollution Prevention Information Clearinghouse, an online database and comprehensive resource on pollution prevention, continues to grow as over 170 new resources were added to the database and additional improvements were made to the Web site.

In the months immediately following the redesign of the Canadian Pollution Prevention Information Clearinghouse, completed April 2005, the database experienced a tremendous increase in the number of site visitors and the number of viewed records.

Efforts to promote the clearinghouse continue through exhibit presence at tradeshows, Web site linkages, articles, newsletters, etc.

www.ec.gc.ca/cppic

5 Controlling Toxic Substances (Part 5)

The Canadian Environmental Protection Act, 1999 *(CEPA 1999) includes specific requirements for the assessment and management of substances currently existing in commerce or being released to the environment in Canada and substances that are new to Canada.*

A substance meets the criteria of section 64 if it is entering or may enter the environment in a quantity or concentration or under conditions that:

- *have or may have an immediate or long-term harmful effect on the environment or its biological diversity;*
- *constitute or may constitute a danger to the environment on which life depends; or*
- *constitute or may constitute a danger in Canada to human life or health.*

Determining whether a substance meets these criteria and requires management is a function of the substance's physical, chemical and biological properties, the nature and extent of current or possible releases, and the potential for the substance to affect the environment or human health.

Part 5 of the Act sets specific timelines for taking preventive or control action to manage the risks posed by substances recommended for addition to Schedule 1, including virtual elimination from the environment for substances meeting certain criteria. The Canadian Environmental Protection Act, 1999 *allows for the setting of conditions and prohibitions on new substances. Part 5 also provides for the development of regulations and interim orders as well as the management of exports of substances.*

5.1 Existing Substances

5.1.1 Risk Assessment

Environment Canada and Health Canada, through the Existing Substances Program, jointly identify, prioritize, and assess the risks resulting from exposure to existing substances. Existing substances are those listed on the Domestic Substances List and include substances that were in Canadian commerce or used for manufacturing purposes or manufactured in or imported into Canada in a quantity of 100 kilograms or more in any calendar year between January 1, 1984, and December 31, 1986.

Candidate substances for risk assessment are identified through seven main mechanisms under the Canadian Environmental Protection Act, 1999*:*

- *industry information;*
- *categorization of the Domestic Substances List;*
- *provincial or international decisions;*
- *public nominations;*
- *new substances notifications;*
- *emerging science and monitoring; and*
- *international assessment or data collection.*

These seven mechanisms allow Environment Canada and Health Canada to provide a scientifically rigorous, open and transparent process for identifying and prioritizing candidate substances for assessment as potential risks within Canada.

5.1.1.1 Categorization and Screening of the Domestic Substances List

During 2005–06, government scientists continued to collect and review information on all 23,000 substances on the Domestic Substances List to identify which of these substances may need additional action.

Categorization

The categorization exercise was an enormous undertaking—it has not been attempted by any other government in the world. And yet, all nations face the same challenge. That is why the Government of Canada seeks input from other nations and is freely sharing the information that this exercise generates so that many countries can contribute to the effort to protect our global environment and our collective health from the adverse effects of pollutants. With the help of many institutions and organizations, the Government of Canada is generating a substantial body of research and robust scientific tools that will assist in future chemical assessments and risk management decisions. The categorization exercise under the *Canadian Environmental Protection Act, 1999* is providing

a wealth of additional scientific benefits that will advance our understanding of substances around the world.

During 2005–06 Environment Canada and Health Canada continued to engage stakeholders from industry, environmental groups, and the public, soliciting input for categorization decisions and approaches. Industries play an important role by sharing the information they have on the chemicals they use and by being innovative in finding ways to manage those chemicals identified as hazardous. Research institutes and universities in Canada and around the world are also involved by filling information gaps and developing tools for efficient assessment of these chemicals. The environmental community is monitoring the process and lending its own expertise to the consultation process.

Results under the categorization exercise in 2005–06 include the following:

- Draft *Decisions for Ecological Categorization of Substances on the Domestic Substances List* (in July 2006)
- At the end of the reporting period, Environment Canada had collected, generated and reviewed the available information and produced categorization decisions for all the substances on the Domestic Substances List. Draft final categorization decisions were issued in July 2006. The categorization exercise has been completed as mandated.
- Environment Canada produced CD-ROMs in April 2005, July 2005, October 2005 and January 2006 that contain:
    - background material on the progress of categorization;
    - Guidance Manual for the Ecological Categorization of Organic and Inorganic Substances on Canada's Domestic Substances List;
    - category approaches for decisions on data-poor substances;
    - spreadsheets containing information on the 23,000 substances on the Domestic Substances List and the preliminary categorization decisions;
    - Robust Study Summaries of laboratory studies pivotal to categorization decisions; and
    - information submitted by stakeholders to improve categorization decisions.

The health aspects of the categorization of the Domestic Substances List were completed by the end of fiscal year 2005–06. Documentation associated with completion of the health-related components of Domestic Substances List categorization was produced.

Screening Assessments

Environment Canada and Health Canada conducted several screening assessments to refine their screening assessment approaches and processes. Progress in this area during 2005–06 includes:

- Screening health assessments for polybrominated diphenyl ethers and perfluorooctane sulfonate were completed and published in the Canada Gazette in early 2006. Draft State of the Science reports on nine substances—hexachloroethane; 4,6-dinitro-o-cresol; phenol, 2,2'-methylenebis[6-(1,1-dimethylethyl)-4-methyl- (MBMBP); ethylbenzene, dibromoethane, dichloroethene, quinoline, biphenyl; and 4,4'-Methylenebis(2-chlorobenzenamine) (MBOCA)—were published on the Health Canada Web site.

Table 3 Substances Undergoing Screening Assessments

CAS Number	Substance Name
534-52-1	DNOC
91-22-5	Quinoline
119-47-1	MBMBP
92-52-4	Biphenyl
75-35-4	Dichloroethene
67-72-1	Hexachloroethane
106-93-4	1,2,dibromoethane
101-14-4	MBOCA
100-41-4	Ethylbenzene
67-64-1	Acetone
7783-06-4	H_2S
79-94-7; 25327-89-3; 4162-45-2	TBBPA
Group	PFOA and its salts
Group	Polychlorinated naphthalenes
74-85-1	Ethene
115-07-1	1-propene
3194-55-6	HBCDD

5.1.1.2 Decisions of Other Jurisdictions

The recommended approach for the exchange of information with member countries of the Organisation for Economic Co-operation and Development regarding substances that are prohibited or substantially restricted was issued for public comments.

5.1.1.3 First Priority Substances List

Under the 1988 *Canadian Environmental Protection Act*, 44 substances were assessed under the program of the first Priority Substances List. Of 44 substances, 27 were found to

meet the requirements of section 11 of the original *Canadian Environmental Protection Act*, and 10 did not. There has been insufficient information to conclude on the remaining substances.

In 2005–06, the follow-up assessment for chlorinated paraffins was published for a 60-day public comment period on June 11, 2005. It was proposed that these substances be added to the List of Toxic Substances with the goal of virtually eliminating short-chain and medium-chain chlorinated paraffins (see Table 4).

www.ec.gc.ca/CEPARegistry/subs_list/PSL1.cfm

In 2005–06 the Minister of Environment also published final orders for pentachlorobenzene and tetrachlorobenzenes. The Ministers of Environment and Health concluded that these substances met the criteria set out in section 64 and have proposed adding these substances to the List of Toxic Substances in Schedule 1 of the *Canadian Environmental Protection Act, 1999*. These substances were also to be considered as candidates for virtual elimination.

Work on an assessment of aniline, an "Insufficient to Conclude" substance on the first Priority Substances List, was initiated based on a re-evaluation of the exposure assessment information in the first Priority Substances List assessment.

Table 4 Status of First Priority Substances List Assessments in 2005–06

Status	Substances
Recommended for addition to Schedule 1	Chlorinated paraffins
No further action recommended	Used crankcase oils
Ongoing follow-up assessments	Aniline

5.1.1.4 Second Priority Substances List

As of March 31, 2005, final conclusions had been reached for 23 of the 25 substances on the second Priority Substances List, which was published in 1995.

Based on information provided by industry, Health Canada initiated a report on ethylene glycol.

Health Canada continued to liaise with industrial stakeholders on the status of the suspended second Priority Substances List assessment of aluminum salts. Discussions were held on options for modifying draft protocols developed by the industrial stakeholders for the neurotoxicity studies required for completion of the second Priority Substance List assessment.

Table 5 Status of Second Priority Substances List Assessments in 2005–06

Status	Substances
Recommended for addition to Schedule 1	None
No further action recommended	Releases of radionuclides from nuclear facilities (impact on non-human biota)

5.1.1.5 Addition of Substances to Schedule 1

When a substance is assessed and determined to meet the criteria of section 64, one of the measures the Ministers of Environment and Health may propose is its addition to the List of Toxic Substances in Schedule 1 of the *Canadian Environmental Protection Act, 1999.* The *Canadian Environmental Protection Act, 1999* gives the federal government the authority to make regulations or require the preparation of pollution prevention plans or environmental emergency plans for substances in Schedule 1.

Six greenhouse gases were added to Schedule 1 of the *Canadian Environmental Protection Act, 1999*.

5.1.1.6 Information Gathering

The Canadian Environmental Protection Act, 1999 *provides several authorities to require any person to provide or generate data for the purpose of assessing a substance or for deciding whether or how to control a substance.*

www.ec.gc.ca/Ceparegistry/notices

Notices

An information-gathering *Notice with respect to Selected Substances Identified as Priority for Action* was published in the *Canada Gazette* on March 4, 2006. This notice required companies who manufactured or imported more than 100 kilograms of listed substances to provide information on their activities. Substances covered by this notice have been identified, through categorization of the Domestic

Table 6 Substances Added to or Being Considered for Addition to the List of Toxic Substances (Schedule 1) in 2005–06

Substance	Proposed Order Adding to Schedule 1—Date	Final Order Adding to Schedule 1—Date	Sectors/Sources Involved
Carbon dioxide, which has the molecular formula CO_2 Methane, which has the molecular formula CH_4 Nitrous oxide, which has the molecular formula N_2O Hydrofluorocarbons that have the molecular formula $C_nH_xF_{(2n+2-x)}$ in which $0<n<6$ The following perfluorocarbons: (a) those that have the molecular formula C_nF2_{n+2} in which $0<n<7$; and (b) octafluorocyclobutane, which has the molecular formula C_4F_8 Sulphur hexafluoride, which has the molecular formula SF_6	September 3, 2005	November 21, 2005	Carbon dioxide, methane and nitrous oxide are produced from a wide variety of sectors and sources. The fluoroalkanes are used in a wide range of industrial, commercial and even medical applications, including use as refrigerants, propellants and solvents.
Methane	September 3, 2005	November 21, 2005	These six substances or groups of substances were included in the *Kyoto Protocol* because they have significant global warming potentials (GWPs), are long-lived and therefore of global concern. Furthermore, given historical emissions from anthropogenic sources, and the quantity of emissions expected over the next century, they have the potential to contribute substantially to climate change.
Carbon dioxide	September 3, 2005	November 21, 2005	
Nitrous oxide	September 3, 2005	November 21, 2005	
Hydrofluorocarbons	September 3, 2005	November 21, 2005	
Some perfluorocarbons and octafluorocyclobutane	September 3, 2005	November 21, 2005	
Sulphur hexafluoride	September 3, 2005	November 21, 2005	
Tetrachlorobenzenes and pentachlorobenzene	April 24, 2004	September 21, 2005	Tetrachlorobenzenes and pentaclorobenzene are not produced or used in their pure form in Canada. They may be formed and released to the environment as a result of municipal solid waste and hazardous waste incineration and barrel burning of household waste, dielectric fluids, pesticides, wood preservative chemicals, magnesium productions and other potential minor sources.
Chlorinated paraffins	June 11, 2005		
Polybrominated diphenyl ethers	July 1, 2006		
Perfluorooctane sulfonate (PFOS), its salts and its precursors, compounds that contain one of the following groups: $C_8F_{17}SO_2$, $C_8F_{17}SO_3$ or $C_8F_{17}SO_2N$	July 1, 2006		

Substances List, as potentially hazardous to the environment or human health or as representing the greatest potential for human exposure or as substances of emerging concern and international interest.

Preliminary research has indicated that a high percentage of these substances may no longer be manufactured or imported in Canada. One of the goals of the survey is to identify substances that were not commercially available during the 2005 calendar year. Confirmation of those substances not currently marketed in Canada will allow government to ensure that post-categorization efforts are focused on substances with potential for release into the Canadian environment.

The second major goal is to identify companies whose current activities involve any of these substances for purposes of gathering, where necessary, more detailed information on patterns of use, for example, in order to prioritize future assessment and/or risk management activities. Future detailed data collection regarding these substances will be designed in consideration of the level of activity or sector identified in the responses to the Notice.

The information gathered pursuant to the Notice will be used, along with other data sources, to inform current and future risk assessment and risk management activities conducted under the *Canadian Environmental Protection Act, 1999*.

An information-gathering *Notice with respect to certain hydrofluorocarbons* was published on April 16, 2005, with an amendment being published on May 21, 2005.

Health Canada responded to information and inquiries regarding the maximal list of substances that were prioritized for consideration in screening assessment under the *Canadian Environmental Protection Act, 1999*.

5.1.2 Risk Management

The Canadian Environmental Protection Act, 1999 *sets specific timelines for taking preventive or control actions to manage the risks posed by substances on Schedule 1. Preventive or control instruments for each toxic substance or group of toxic substances are developed through the Toxics Management Process. The risk management actions are developed in a way that ensures that industry and public stakeholders are properly consulted and that the obligations to protect the environment and human health set out in the* Canadian Environmental Protection Act, 1999 *are met. The cornerstone of the Toxics Management Process is the development of Risk Management Strategies. Risk Management Strategies detail how the risks to human health and the environment will be addressed using a range of measures to control any aspect of a substance's life cycle. Examples of preventive or control instruments under the Act include regulations under Part 5, guidelines and codes of practice under Part 3, pollution prevention plans under Part 4, and environmental emergency plans under Part 8. Measures can also be taken under other federal acts or provincial, territorial, or Aboriginal legislation. Voluntary measures such as Environmental Performance Agreements may also be used.*

Appendix A contains a list of the risk management measures proposed or finalized in 2005–06.

5.1.2.1 Regulations

In 2005–06, the following final regulation was published under Part 5 of the *Canadian Environmental Protection Act, 1999*:

- ***Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations*** (finalized June 1, 2005, proposed March 20, 2004). The purpose of these Regulations is to protect Canada's environment and the health of Canadians from the risks posed by the transboundary movement of hazardous wastes and hazardous recyclable materials and to implement Canada's international obligations. The Regulations revoke and replace the former *Export and Import of Hazardous Wastes Regulations* adopted in 1992 under the authority of the former *Canadian Environmental Protection Act*.

In 2005–06, two proposed regulations were published for comment:

- ***Regulations Amending the Prohibition of Certain Toxic Substances Regulations, 2005 (2-Methoxyethanol, Pentachlorobenzene and Tetrachlorobenzenes)*** (proposed July 9, 2005). This amendment will add 2-methoxyethanol, pentachlorobenzene and tetrachlorobenzenes to the Prohibited Toxic Substances List in Schedule 2, Parts 1 and 2, of the *Prohibition of Certain Toxic Substances Regulations, 2005*.
- ***Regulations Respecting 2-Butoxyethanol*** (proposed July 9, 2005). The purpose of the proposed Regulations is to protect the health of Canadians by setting limits for the concentration of 2-butoxyethanol in products designed for indoor use. This will reduce human exposure to 2-butoxyethanol present in cleaning, painting and coating products. The proposed concentration limits will apply to products that are manufactured, imported, offered for sale, sold or used in Canada.

www.ec.gc.ca/CEPARegistry/regulations

5.1.2.2 Greenhouse Gas Notice of Intent

A proposed regulatory framework for Greenhouse Gas emissions from industrial sectors was developed in a *Notice of Intent to Regulate*, published in the *Canada Gazette*, Part I, on July 16, 2005.

- Detailed discussions were undertaken with individual sectors to define emission intensity targets to be set out in sectoral regulations.

- A draft of the cross-cutting provisions for the proposed regulations was developed and released for consultation.
- Development of a proposed single-window quantification and reporting system was pursued in collaboration with provinces and stakeholders.
- A proposed design for the offset crediting system was published and national consultations were conducted.
- Draft rules and guidance for offset program elements were developed, and drafting of quantification protocols for a number of key project types was initiated in collaboration with provinces and stakeholders.

5.1.2.3 Extended Producer Responsibility and Stewardship

Extended Producer Responsibility is a concept under which producers and brand owners of products are required or in some cases volunteer to take the financial and operational responsibility to recover and manage their products in an environmentally sound manner when consumers are finished using them. It has been used to target a broad and growing range of post-consumer products in Canada, including used oil, scrap tires, refrigerants, paints, and pesticides. In March 2006, in Calgary, Environment Canada co-hosted, with Alberta Environment, Canada's 4th National Workshop on Extended Producer Responsibility. Through its leadership of a national committee on electronics waste, Environment Canada also remains engaged in activities with provinces, territories, industry, and other stakeholders to help foster consistent regional and national Extended Producer Responsibility approaches for a variety of electronic devices, including computers and televisions. Environment Canada also participates in the Canadian Council of Ministers of the Environment's Extended Producer Responsibility Task Group, which has a mandate to develop supportive tools and guidance for the application of Extended Producer Responsibility programs across the country.

5.1.2.4 Memoranda of Understanding and Environmental Performance Agreements

An Environmental Performance Agreement is a negotiated agreement with principles and design criteria that are negotiated among parties to achieve specified environmental results. Environmental Performance Agreements are second-generation, voluntary instruments that flow from Environment Canada's experience with Memoranda of Understanding with industrial sectors. The negotiation and implementation of Memoranda of Understanding during the 1990s provided Environment Canada with valuable experience and led to the development of a Policy Framework for Environmental Performance Agreements (June 2001).

Environmental Performance Agreement must consider specified core design criteria in the negotiating process. The Policy Framework provides assurance of transparency and accountability as well as a solid basis for negotiating agreements.

No new agreements were signed in 2005–06 as five were already in place.

- ***Environmental Performance Agreement Respecting Refractory Ceramic Fiber.*** This agreement, signed in 2002 with six companies, applies to environmental emissions monitoring. The data collected under the monitoring program were used by health and environment specialists to better evaluate the risks associated with this substance. Based on the information collected in the *2002 Environmental Performance Agreement*, this agreement was re-negotiated in 2004–05 (to be signed in fall 2006) to include additional processors of Refactory Ceramic Fiber, to continue the monitoring program and to implement an industry-wide product stewardship program.

www.ec.gc.ca/epa-epe/rcf/en/details.cfm

- ***Environmental Performance Agreement Respecting the Production and Distribution of 1,2-Dichloroethane.*** This agreement was signed with two Dow Chemical facilities in 2001 to manage emissions of 1,2-dichloroethane, a toxic substance under the *Canadian Environmental Protection Act, 1999*. As of 2004 Dow has reported release reductions of over 5,200 kg (37%) from base-year levels. The models and methods used to obtain these results were verified by an independent third-party audit.

www.ec.gc.ca/epa-epe/1_2-DCE-Dow/en/details.cfm

- ***Environmental Performance Agreement Automotive Parts Manufacturers' Association.*** This agreement was signed in 2002 by the Automotive Parts Manufacturers' Association, Environment Canada, and Industry Canada and is due to expire in December of 2007. The Environmental Performance Agreement focuses on sector-wide targets to reduce substances like volatile organic compounds, smog precursors and greenhouse gases, metals and substances listed on Schedule 1 of the *Canadian Environmental Protection Act, 1999*. Currently, there are 38 facilities among five companies participating in the Automotive Parts Manufacturers' Association Environmental Performance Agreement. The Automotive Parts Manufacturers' Association committed to an aggregate 20% reduction per unit of output of volatile organic

compounds emissions from the participating Ontario-based companies, and an aggregate 3% reduction in carbon dioxide emissions per unit of output from all participating companies (based on a year 2000 baseline).

www.ec.gc.ca/epa-epe/apma/EN/details.cfm?

- ***Environmental Performance Agreement with Specialty Graphic Imaging Association.*** This agreement was signed in 2003 and it provides an opportunity for screen and digital printers in the Greater Toronto Area to implement activities to reduce releases of volatile organic compounds and other substances of concern. Twelve companies are actively engaged and achieving significant reductions. Technograph completely eliminated the use of methylene chloride; North American Decal decreased solid waste (film, fluorescent lamps, plastics, paper products and skids) sent to landfills by over 11%, despite an increase in sales and in the volume of printing completed; Ellis Studios reduced volatile organic compounds emissions by more than 93% by converting to ultra violet technology. Further, North American Decal is in the process of converting its facility to using ultra violet technology and will soon be realizing significant reductions in volatile organic compounds emissions.

www.ec.gc.ca/epa-epe/sgia/EN/details.cfm?

- ***Memorandum of Understanding with the Canadian Chemical Producers' Association.*** This agreement is a renewal of the previous Memorandum of Understanding with the Canadian Chemical Producers' Association. It was signed in 2001 by Health Canada, Industry Canada, Environment Canada, Ontario Ministry of the Environment, Alberta Ministry of the Environment and the Canadian Chemical Producers' Association. The objective of this Memorandum of Understanding is the prevention and reduction of the release of toxic and other chemical substances through voluntary, non-regulatory action by encouraging and publicly recognizing progress made by Canadian Chemical Producers' Association and its member companies. Included in this agreement is an annex committing member companies to reduce their releases volatile organic compounds. This agreement expired in 2005, and is currently being re-negotiated.

www.ec.gc.ca/epa-epe/ccpa-acfpc/en/details.cfm

5.2 New Substances

Substances that are not on the Domestic Substances List are considered to be new to Canada. A new substance cannot be manufactured or imported until:

- *the Minister has been notified prior to manufacturing or importation significant quantities of the substance;*
- *relevant information needed for an assessment of its potential toxicity has been provided by the notifier; and*
- *the period for assessing the information (as set out in regulations) has expired.*

When the assessment process identifies a new substance that may pose a risk to human health or the environment, the Act empowers the Minister of the Environment to intervene by placing restrictions on the substance, or prohibiting the substance from import or manufacture in Canada.

When the Ministers of the Environment and Health suspect that a significant new activity in relation to a new substance that had been previously assessed and found not to be toxic may result in the substance becoming toxic, they can issue a Significant New Activity Notice to ensure that adequate additional information is provided by the notifier or any other proponent who wishes to manufacture, import, or use the substance for activities not specified by the notice. The additional information allows Environment Canada and Health Canada to assess the potential environmental and human health risks associated with the new activities.

The Canadian Environmental Protection Act, 1999 *Part 5 requirements apply to new substances (chemicals and polymers) that are manufactured or imported unless other applicable Acts provide for notice and assessment and are specifically identified on Schedule 2.*

5.2.1 Risk Assessment of New Substances

During 2005–06, 550 new substance notifications were received pursuant to the *New Substances Notification Regulations.* Environment Canada received 455 notifications for substances regulated under *Canadian Environmental Protection Act, 1999* and Health Canada received 95 notifications for products regulated under the *Food and Drugs Act*.

5.2.1.1 Notifications

Of the total 550 notifications it received, Environment Canada issued two conditions and no prohibitions, rescinded three conditions related to some of these substances (see Table 8), and published 10 Significant New Activity notices (see Table 7).

Table 7 Risk Management of New Substances

Part 5 of CEPA—New Substances Statistics: Significant New Activity (SNAc) Notices Published in 2005–06

Substance Name	Chemical, Polymer or Organism	Action	*Canada Gazette* Publication Date
Propane, 1,1,1,3,3-pentafluoro-	chemical	SNAc	4-Jun-05
Clarified oils (petroleum), catalytic cracked, reaction products with cresol and polymethylene polyphenylene isocyanate	polymer	SNAc	18-Jun-05
Formamide, N-ethenyl-	chemical	SNAc	25-Jun-05
Difluoromethane	chemical	SNAc	26-Nov-05
Alkanethioic acid, S-[3-(triethoxysilyl)propyl] ester, reaction products with 2-methyl-alkanediol	chemical	SNAc	17-Dec-05
Alkanethioic acid, S-[3-(triethoxysilyl)propyl] ester, hydrolysis products with 2-methyl-alkanediol	chemical	SNAc	17-Dec-05
Silane, triethoxy(3,3,4,4,5,5,6,6,7,7,8,8,8-tridecafluorooctyl)-	chemical	SNAc	28-Jan-06
Propane, 1,1,1,3,3-pentafluoro-,	chemical	Rescinded SNAc New SNAc	18-Feb-06 18-Feb-06
Benzenesulfonic acid, 4-[[4-[(4-hydroxy-2-methylphenyl)azo]phenyl]amino]-3-nitro-, monosodium salt	chemical	SNAc	11-Mar-06

Table 8 Notices of Ministerial Conditions and Prohibitions in 2005–06

Part 5 of CEPA—New Substances Statistics: Notices of Ministerial Conditions and Prohibitions Issued in 2005–06

Substance Name	Chemical, Polymer or Organism	Action	*Canada Gazette* Publication Date
Piperidine, 1-acetyl-4-(3-dodecyl-2,5-dioxo-1-pyrrolidinyl)-2,2,6,6-tetramethyl-	Chemical	Modification to condition	9-Apr-05
Benzene, 1,1ó-(1-methylethylidene)bis[3,5-dibromo-4-(2,3-dibromopropoxy)-	Chemical	Modification to condition	30-Apr-05
Alphatic, aromatic unsaturated bicyclic derivative	Chemical	Condition	13-Aug-05
Phosphorous acid, mixed 4-isononylphenyl and lauryl and tridecyl triesters	Chemical	Condition	15-Oct-05
Difluoromethane	Chemical	Rescinded condition	26-Nov-05
Propane, 1,1,1,3,3-pentafluoro-	Chemical	Rescinded two conditions	18-Feb-06

www.ec.gc.ca/substances/nsb/eng/home_e.shtml

5.2.1.2 Regulations Regarding New Substances

On September 21, 2005, four proposed regulations or regulatory amendments were published in the *Canada Gazette*, Part II, and came into force on October 30, 2005:

New Substances Notification Regulations (Chemicals and Polymers) (pre-published on October 30, 2004).The regulations are the culmination of extensive stakeholder consultation on the chemicals and polymers portion of the existing *New Substances Notification Regulations* and the New Substances Program. The regulations implement consensus-based recommendations from the new substances notification multi-stakeholder consultative process. This process used the experience of stakeholders to suggest improvement to the effectiveness and efficiency of the new substances notification and assessment process for chemicals and polymers, while maintaining high standards for the protection of the environment and human health.

New Substances Notification Regulations (Organisms) (pre-published on October 30, 2004). The purpose of these regulations is to implement part of a new regulatory structure for new substances notifications under the *Canadian Environmental Protection Act, 1999*. The regulatory structure carves out the provisions related to organisms from the provisions related to chemicals and polymers in the existing *New Substances Notification Regulations.*

Regulations Repealing the New Substances Notification Regulations (pre-published on October 30, 2004). These regulations repealed the existing regulations, which were replaced with the above-noted regulations for chemicals and polymers and organisms.

Regulations Amending the New Substances Fees Regulations (pre-published on October 30, 2004). The amendments harmonize the *New Substances Fees Regulations* with the *New Substances Notification Regulations (Chemicals and Polymers).*

The pre-publication of all these regulations was followed by a 75-day public review period during which five sets of written comments were received: four submissions from industry and industry associations and one from an environmental group.

Health Canada, in collaboration with Environment Canada, developed and released the *Options Analysis Paper: An Environmental Assessment Regime for New Substances in Products Regulated under the Food and Drugs Act*. The *Options Analysis Paper* was released in June 2005 and an electronic consultation proceeded with comments from all stakeholders requested for September 2005.

The comments from stakeholders on the options presented in the *Options Analysis Paper* were analysed to produce the *Options Analysis Paper Feedback Analysis Report,* which was released in February 2006.

To proceed with the development of appropriate regulations for new substances contained in products regulated under the *Food and Drugs Act*, Health Canada hosted a multi-stakeholder consultation in March 2006. The major outcome of the consultation was that Health Canada should proceed with developing the regulations under the New Substances Provisions of the *Canadian Environmental Protection Act, 1999*.

5.2.2 Additions to the Domestic Substances List

Substances listed under the *Food and Drugs Act* are eligible to be added to the Domestic Substances List provided that the Minister of the Environment is satisfied that these substances, between 1984 and 1986, were manufactured in or imported into Canada by a person in a quantity of no less than 100 kilograms in any one calendar year or used in Canadian commerce or used for commercial manufacturing purposes in Canada.

During the reporting period, 339 substances were added to the Domestic Substances List.

5.2.3 International Actions

In 2005–06 the New Substances Program continued its international regulatory and scientific cooperation. Canada worked with other countries to find common ways of doing business that will continue to improve decision-making on new chemicals and polymers in Canada and internationally, while protecting human health and the environment. Examples of this are the Organisation for Economic Co-operation and Development New Substances Task Force, Mutual Acceptance of Notifications ongoing project to standardize notification procedures for industry with Organisation for Economic Co-operation and Development countries. A table showing all international areas of

cooperation and activities has been designed and made available on the New Substances Web site.

www.ec.gc.ca/substances/nsb/eng/cp_int_e.shtml

5.2.3.1 Four Corners Arrangement

The Four Corners Arrangement was revised in November 2003 and signed in January 2004 by Environment Canada, Health Canada, the United States Environmental Protection Agency, the American Chemical Council, and the Industry Coordinating Group of Canada. The overall objective of the revised arrangement is to work towards achieving efficiency of resources for all parties related to the introduction of new substances to the North American marketplace, by avoiding duplication of efforts associated with assessments through enhanced information and work sharing, without compromising the protection of human health and the environment. One notification was received in 2005 under the Four Corners Arrangement. The Arrangement is under review by the New Substances Program to ascertain its benefits with other international activities.

5.2.3.2 Canada–Australia Arrangement

The Cooperative Arrangement on New Industrial Chemicals among the National Industrial Chemicals Notification and Assessment Scheme of Australia, Environment Canada, and Health Canada allows both the sharing of information on new industrial chemicals and the potential alignment of national new industrial chemicals schemes. The arrangement has been renewed and continues to support information exchanges in technical, regulatory, and policy areas. Canada has been recognized under the foreign schemes provision of the Australian legislation as a competent authority in new substances.

In 2005–06, 14 requests were made to share information with Australia under the Arrangement. Canada and Australia continue to work on comparing assessment approaches and methodologies for chemicals and polymers.

5.2.3.3 New Chemicals Task Force

The Organisation for Economic Co-operation and Development New Chemicals Task Force was established to improve information and work sharing associated with notification and assessment of new industrial chemicals.

A Steering Group was formed to lead the implementation of the pilot phase of the Parallel Process, which involves sharing hazard assessments between jurisdictions. The pilot phase is expected to be finalized by the end of 2008. Representatives of the Steering Group include Australia, Canada (Chair), Japan, the United States, and the Business and Industry Advisory Committee to the Organisation for Economic Co-operation and Development.

The main objectives of this initiative are to:

- reduce the burden and costs for governments and industry;
- improve efficiency; and
- increase collaboration expertise in order to harmonize assessment approaches among the member countries.

5.2.3.4 Good Laboratory Practice

The Organisation for Economic Co-operation and Development's principles of good laboratory practice set out managerial concepts covering the organization of test facilities and the conditions under which pre-clinical safety studies are executed. Their purpose is to ensure the generation of high-quality and reliable test data (*in vitro* and *in vivo*) related to the safety of chemicals and preparations in the framework of the Mutual Acceptance of Data.

The revised regulations require that biotic studies be good-laboratory-practice compliant and that all other studies must be consistent with the principles of good laboratory practice.

www.etc-cte.ec.gc.ca/organization/spd_e.html

5.3 Export of Substances

The authorities in the Act allow the Minister to establish an Export Control List containing substances whose export is controlled because their manufacture, import, and/or use in Canada are prohibited or severely restricted or because Canada has agreed, through an international agreement, such as the Rotterdam Convention, to control their export. The authorities also allow the Minister to make regulations in relation to substances specified on the Export Control List.

5.3.1 Export Control List

The *Export Control List Notification Regulations* require exporters to provide notice to the Minister of the Environment

of the proposed export of substances on the Export Control List and to submit annual reports. In 2005–06, 12 notifications of export were received, and no additional substances were added to the Export Control List.

5.3.2 Rotterdam Convention

Canada implements the provisions of the Rotterdam Convention (*Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade)* through the *Export of Substances under the Rotterdam Convention Regulations*. The main purpose of the regulations is to ensure that chemicals and pesticides subject to the Prior Informed Consent procedure are not exported to parties to the Convention, unless the importing Party has provided its consent prior to the import taking place. Canada has also undertaken to ensure that Canadian exporters respect any conditions imposed on the importation of these substances.

In 2005–06, there were no consultations on the addition of substances to the Prior Informed Consent procedure.

www.ec.gc.ca/international/multilat/rotterdam_e.htm

6 Animate Products of Biotechnology (Part 6)

The Act establishes an assessment process for living organisms that are new animate products of biotechnology that mirrors provisions in Part 5 of the Canadian Environmental Protection Act, 1999 *(CEPA 1999) respecting new substances which are chemicals or polymers. Animate products of biotechnology may pose several potential risks to the environment, including possible impacts on natural biodiversity. They may introduce toxins, interfere with naturally occurring plants and animals, and harm natural genetic diversity.*

Living organisms that are not on the Domestic Substances List are considered to be new. These cannot be used, manufactured, or imported until:

- *the Minister has been notified;*
- *relevant information needed for an assessment has been provided by the applicant; and*
- *the period for assessing the information has expired.*

When the assessment process identifies a living organism that may pose a risk to human health or the environment, the Act empowers Environment Canada to intervene by implementing a risk management process, placing restrictions on the organism, or prohibiting the organism from import or manufacture in Canada.

When Environment Canada and Health Canada suspect that a significant new activity in relation to a living organism that had been previously assessed and found not to be toxic may result in the organism becoming toxic, a Significant New Activity Notice is issued to ensure that adequate additional information is provided to the Minister by the notifier or any other proponent who wishes to manufacture, import, or use the organism for activities not specified by the notice. The additional information allows Environment Canada and Health Canada to assess the potential environmental and human health risks associated with the new activities.

The Canadian Environmental Protection Act, 1999 *requirements apply to new living organisms that are manufactured or imported unless other applicable Acts provide for notice and assessment and are specifically identified on Schedule 4 of the Act.*

6.1 Risk Assessment and Management

Sixteen notifications were received from which:

- Five New Substance Notifications were received and assessed. No risk management measures were deemed necessary.
- Three were not assessed or were incomplete.
- Seven notifications of living organisms regulated under the *Food and Drugs Act* were received and assessed. No risk management measurements were deemed necessary.
- One Significant New Activity Notification was received and assessed. Risk management measures (conditions) were recommended to mitigate potential environmental/human health risks.

Supporting documents containing comprehensive pathogenicity/toxicity information from various sources (including the scientific literature) continue to be developed and updated for each of the Domestic Substances List microbial strains.

Different sectors (environmental, agricultural, industrial, etc.) in Canada use Domestic Substances List microbial strains; therefore information on use patterns has begun to be collected.

Proposed guidelines on prioritization, screening assessment, external review, and review of decisions from other jurisdictions on Domestic Substances List microbial strains are in development.

For risk management actions, see Table 9 below.

Table 9 Risk Management Actions

Part 6 of CEPA—New Substances Statistics: Notices of Ministerial Conditions and Prohibitions Issued in 2005–06

Substance Name	Chemical, Polymer or Organism	Action	*Canada Gazette* Publication Date
Fusarium fungus species strain CK 46-8	Organism	Condition	11-Mar-06

Health Canada research also addresses micro-organisms and their by-products in the generation of essential scientific

information for use in present and future assessments as well as risk management decisions. This led to the (i) updating of information critical for definitive micro-organism identification by advanced methodology (e.g. comparative genomics and proteomics to measure relatedness to clinical counterparts) and (ii) testing of the toxicity and immunologic effects of certain selective genera of which *Acinetobacter*, *Bacillus*, *Pseudomonas* are three examples. These three genera are pathogens and are applications of biotechnology. The completion of physical and chemical characterizations of 35 micro-organisms has led to prioritized animal testing. This scientific information is shared across the collaborative Biotechnology networks within the Government of Canada.

Environment Canada research addresses the need for data to complete screening level risk assessments for microbial substances on the Domestic Substances List. Data has been generated to assess the potential hazard posed by microbial substances to soil-dwelling organisms. To address this existing data gap, the Soil Toxicology Laboratory performed fate (persistence) and effect (pathogenicity and toxicity) testing on more than 20 bacterial and fungal microbial strains between 2003 and 2005; portions of this work were completed with the assistance of researchers at Carleton University. The pathogenicity and toxicity testing was conducted according to the new *Guidance Document for Testing the Pathogenicity and Toxicity of New Microbial Substances to Aquatic and Terrestrial Organisms* (EPS 1/TM/44) published as part of the Biological Test Method Series in March 2004. The data generated through this project will assist the New Substances Branch with their risk assessment of Domestic Substances List-listed substances, an obligation under the *Canadian Environmental Protection Act, 1999*.

Table 10 Significant New Activity Notices Published in 2005–06

Part 6 of CEPA—New Substances Statistics: Significant New Activity Notices Published in 2005–06

Substance Name	Chemical, Polymer or Organism	Action	*Canada Gazette* Publication Date
Fusarium fungus species strain CK 46-8	Organism	Rescinded SNAc	11-Mar-06

6.2 Working Group on Harmonization of Regulatory Oversight in Biotechnology

The Organisation for Economic Co-operation and Development Working Group for the Harmonisation of Regulatory Oversight in Biotechnology met on 24–26 October 2005 in Paris. The working group completed work on a consensus document on Acidithiobacillus (a genus of bacteria important in mining). The working group also continues to work on a guidance document on the biology of Acinetobacter (another genus of bacteria), as well as providing feedback on the development of a consensus document on the biology of the Atlantic Salmon.

7 Controlling Pollution and Managing Waste (Part 7)

Part 7 provides the Minister with authorities to deal with substances that have not been assessed or designated toxic under the Canadian Environmental Protection Act, 1999 *(CEPA 1999) but have the potential to harm the environment or human health.*

7.1 Nutrients

Inputs of nutrients in the form of nitrogen and phosphorus to aquatic ecosystems as a result of human activity can result in excessive aquatic plant growth, depletion of oxygen, and deleterious changes in abundance and diversity of aquatic organisms. This "eutrophication" process poses a serious threat to the biodiversity and health of coastal waters in Canada as well as freshwater systems. The Canadian Environmental Protection Act, 1999 *provides the authority to regulate nutrients in cleaning products and water conditioners that degrade or have a negative impact on an aquatic ecosystem.*

In 2005–06, the Great Lakes Sustainability Fund, a component of the Canadian Federal Great Lakes Program, was used by various agencies and proponents to reduce the amount of nutrients (phosphorus and nitrogen), solids, and bacteria entering watercourses from both rural and urban sources. Under the Great Lakes Sustainability Fund's municipal wastewater program, studies were supported to address the reduction of phosphorus associated with solids from stormwater runoff in the Toronto Area of Concern. These studies included field evaluation of sediment capture ponds from construction sites, development of erosion and sediment control guidelines, performance evaluation of source control technologies (such as porous pavements and bioswales), and preliminary engineering studies addressing implementation options for stormwater and combined sewer overflow controls. In the Bay of Quinte Area of Concern, the Great Lakes Sustainability Fund supported a preliminary engineering study on upgrading the Picton sewage treatment plant, which included the enhanced removal of phosphorus. Other Remedial Action Plan recommendations related to phosphorus removal (not supported under the Great Lakes Sustainability Fund but driven under the Remedial Action Plan program and other municipal issues such as land development) are proceeding in municipalities in the Hamilton Harbour and the Niagara River Areas of Concern.

www.ec.gc.ca/ceqg-rcqe/English/whatsnew/default.cfm#sbs

During this period, the Great Lakes Sustainability Fund also worked with agencies in the Niagara River, St. Lawrence River (Cornwall), Hamilton, Toronto, St. Clair River, Detroit River, and Wheatley Harbour Areas of Concern to deliver programs to reduce nutrient inputs to watercourses. Under these programs, outreach and education programs were directed to rural farming and non-farming landowners to encourage the adoption of rural best management practices such as upgrading manure, milkhouse wash water or domestic septic systems; restricting livestock access to watercourses; adopting conservation tillage practices; reducing soil erosion; and establishing windbreaks, wooded areas and riparian buffer strips. In 2005–06, landowners completed in excess of 50 best management practice projects on their properties. The results of this work include the construction of more than 6 km of fencing to prevent livestock entering watercourses, upgrades to nine septic systems and seven manure storage facilities, and a reduction in soil erosion through the completion of projects to stabilize streambanks, establish windbreaks and install rock chutes. In addition, the Great Lakes Sustainability Fund supported the continued development of the Agricultural Nonpoint-Source computer model to aid in the tracking and mitigation of nutrient sources, provided technical and financial support to an Environment Canada publication on manure management, and hosted a one-day *Agricultural Nonpoint-Source Pollution Reduction Symposium* to disseminate the latest information to those implementing agricultural nonpoint-source pollution reduction projects and programs.

7.2 Protection of the Marine Environment from Land-based Sources of Pollution

The Act provides authorities to issue objectives, guidelines, and codes of practice to help implement Canada's National Programme of Action for the Protection of the Marine

Environment from Land-based Activities. These provisions are intended to supplement the authorities that exist in other federal, provincial, territorial, and Aboriginal government laws.

7.2.1 National Programme of Action

In 1995, Canada, together with over 100 maritime nations, adopted the *Global Programme of Action for the Protection of the Marine Environment from Land-based Activities*. This international, non-legally binding agreement calls on countries to develop national and regional programs of action to protect human health and prevent, reduce, and control land-based activities that threaten the health, productivity and biodiversity of marine and coastal environments and associated freshwater systems. Canada was the first country to release a National Programme of Action in June 2000. Canada's National Programme of Action is a collaborative federal/provincial/territorial programme which focuses on protecting Canada's marine environments from land-based sources of contaminants, and the physical alteration and destruction of habitat.

Canada's goals under National Programme of Action are to:

- protect human health;
- reduce the degradation of the marine environment;
- remediate damaged areas;
- promote the conservation and sustainable use of marine resources; and
- maintain the productive capacity and biodiversity of the marine environment.

In 2005–06, the National Programme of Action Secretariat provided some financial and in-kind support to several initiatives that contribute to the goals of the National Programme of Action, including those presented hereunder.

At the national level:

National Programme of Action Clearing-House Update

Launched in the spring of 2001, the National Programme of Action Information Clearing-House contains a wide range of online resources and expertise relevant to the National Programme of Action and links to community groups, scientists and government. It also serves as a focal point for the National Programme of Action Secretariat, as well as a means of providing news and distributing documents to the public. In 2005–06, the Clearing-House was revised and updated to conform to new Government of Canada standards, increase public accessibility, improve site architecture and modernize the design. The revised Clearing-House was launched in 2006 (visit the Web site at www.npa-pan.ca).

Oceans Day Programming

Each year, Canada celebrates World Oceans Day on June 8. Since 1995, Environment Canada has collaborated with partners to sponsor specific Oceans Day activities and develop education and awareness materials, distributed by the Canadian Wildlife Federation to a network of over 20,000 schools across Canada. In 2005–06, the Ocean Day activities included beach clean-ups, exhibits and presentations. An annual Oceans Day festival also takes place at the Museum of Nature in Ottawa, thus providing an interactive venue to promote oceans awareness among Canadian youth and communities.

Nearshore Marine Monitoring Workshop 2006

In an effort to better inform decisions and policies, over 170 representatives from community groups, non-governmental organizations, government, aboriginal groups, industry and other organizations from across Canada met in Halifax in February 2006 to discuss opportunities for better collaboration and coordination of monitoring in nearshore marine environments. The workshop was coordinated by the Ecological Monitoring and Assessment Network.

APEC Symposium 2005

An Asia-Pacific Economic Cooperation symposium was held in Korea in November 2005. The purpose of the symposium was to inform government officials, researchers and policy-makers of the importance of managing land-based pollution to protect the marine environment. Canada, among other countries, presented a paper about its experience with implementing the Global Programme of Action and Canada's National Programme of Action, sharing lessons learned with developing countries.

At the regional level:

Towards Best Management Practices for Land-use Planning in Atlantic Canada (Atlantic Region)

Municipalities plan and manage land-use activities in the coastal zone and adjacent watersheds, often in the absence of the necessary knowledge, capacity or resources to reduce the

impacts of land-based activities such as marine pollution or habitat alteration. To date, the National Programme of Action Atlantic Team has developed fact sheets on saltwater marshes and coastal erosion. Each fact sheet provides a concise, easily understood characterization of the particular coastal issue or feature and the areas of major concern for coastal communities. They also describe existing best management practices and links to additional sources of information, and list relevant experts in Atlantic Canada that can be contacted for information and advice.

Inventory of Land-based Sources of Pollution in Northern Quebec Watersheds that Can Impact on the Northern Marine Environment (Quebec Region)

Current knowledge of the marine environment of Hudson Bay, Hudson Strait and the Ungava Bay basins is poor and the impact of land-based activities limited. As part of preliminary efforts to expand the National Programme of Action to include Northern Quebec, a study of the coastal zone of Nunavik identified land-based sources of pollution and evaluated their impacts on the marine environment. While the 60-km-long coastal strip that was studied represents only a very small part of the watershed, pollution sources can have significant local impacts. Data were gathered on pollution sources and the marine environment. The project also recommended monitoring some specific sites that may become potential pollution sources for the region and the marine environment. The next steps will be to study the priorities in this area and compare them with the situation in the National Programme of Action Arctic Region.

Technology Investigation for Enhancing Municipal Wastewater Treatment in Arctic Climates

The majority of communities in northern coastal regions rely on lagoon wastewater treatment systems. As these systems only provide primary treatment, they are susceptible to seepage which can impact wetlands, lakes and other watercourses during the thaw season. This two-year project is examining the use of two bio-remediation systems—Little River Pond Mills and Airolator—to improve the quality of effluents and releases to downstream coastal and marine environments on a year-round basis. The outcome of the project will be three-fold: if a bio-remediation system proves to be effective in the test communities, the knowledge can be transferred to other communities; a comparison between the two technologies will enable communities to choose a technology based on their needs; and the opportunity for training in water sampling and in the operation and maintenance of the aeration devices will engage community members.

Building First Nations Capacity to Undertake Marine Water Quality Monitoring (Pacific Region)

High fecal coliform bacteria counts in British Columbia have led to the closures of commercial and food/social/ceremonial harvest for smaller First Nations Communities. The report titled *Building First Nation Capacity to Undertake Marine Water Quality Monitoring under the Canadian Shellfish Sanitation Program: Working with Two Communities on Vancouver Island, B.C.* explains a capacity-building exercise with Kyuquot/Checleset and T'Sou-ke First Nations groups. The project identified sources of fecal pollution and determined whether there are noticeable patterns that can affect counts, built local capacity to identify problems plaguing the shellfish industry, and documented the success of the particular methods used in capacity building.

www.npa-pan.ca

7.2.2 Regional Programme of Action for the Arctic

In response to the 1995 Global Programme of Action, Canada and seven other circumpolar nations of the Arctic Council developed a Regional Programme of Action for the Protection of the Marine Environment from Land-based Activities in 1998.

The Arctic Marine Strategic Plan, which was adopted by Arctic Ministers in 2004, recognized the importance of the continued implementation of the Arctic Regional Programme of Action and called upon Arctic countries to consider broadening the Regional Programme of Action to address other source categories and reflect new pollution assessment information.

During 2005–06, the Arctic Council's Working Group on Protection of the Arctic Marine Environment considered a possible update of the Regional Programme of Action document to account for information that has become available since 1997. In March 2006, Canada presented a draft qualitative assessment report examining the need for amendments to the Regional Programme of Action. A decision to proceed with the update was made at the fall 2006 Protection of the Arctic Marine Environment meeting. If

accepted, it was agreed that Canada and Iceland would serve as lead countries for the Regional Programme of Action update.

www.pame.is/

7.3 Disposal at Sea

The Act includes provisions to prohibit the disposal of wastes and other matter at sea within Canadian jurisdiction, and by Canadian ships in international waters, unless the disposal is done under a permit issued by the Minister. A permit for disposal at sea will be approved only if it is the environmentally preferable and practical option. Incineration at sea is banned except under emergency situations. The Canadian Environmental Protection Act, 1999 *provides additional controls on disposal at sea, including:*

- *a ban on the export of a substance for disposal at sea;*
- *a list of six substances that may be considered for disposal at sea (Schedule 5);*
- *an assessment framework for reviewing permit applications, based on the precautionary principle, which must be followed (Schedule 6); and*
- *a legal obligation for Environment Canada to monitor disposal sites.*

There is also a legal obligation under the *Canadian Environmental Assessment Act* to conduct environmental assessments prior to issuing permits.

7.3.1 Disposal at Sea Permits

In 2005–06, 97 permits were issued in Canada for the disposal of 4.8 million tonnes of waste and other matter (see tables 11 and 12). Most of this waste was composed of dredged material removed from harbours and waterways to keep them safe for navigation. The number of permits issued has remained relatively stable since 1995. The quantities permitted were higher than in 2004–05, but still remain well within the range seen since the introduction of monitoring fees. Historically, the quantity permitted has been greater than

Table 11 Quantities Permitted and Permits Issued in Canada in 2005–06

Material	Quantity Permitted (Tonnes)	Permits Issued	Percentage of Quantity	Percentage of Permits
Dredged material*	3 350 100	43	70	44
Geological matter*	1 391 000	6	29	6
Fisheries waste	68 925	45	1	46
Vessels	280	2	0	2
Organic	200	1	0	1
Total	**4 810 505**	**97**	**100**	**100**

* Dredged material and geological matter were converted to tonnes using an assumed density of 1.3 tonnes per cubic metre.

Table 12 Quantities Permitted and Permits Issued, by Region, in 2005–06

Material	Atlantic		Quebec		Pacific and Yukon		Prairie and Northern	
	Quantity Permitted (Tonnes)	Permits Issued	Quantity Permitted (Tonnes)	Permits Issued	Quantity Permitted (Tonnes)	Permits Issued	Quantity Permitted (Tonnes)	Permits Issued
Dredged material*	1 134 900	12	87 100	11	2 128 100	20	0	0
Geological matter*	0	0	0	0	1 391 000	6	0	0
Fisheries waste	65 825	40	3 100	5	0	0	0	0
Vessels	260	1	0	0	20	1	0	0
Organic	0	0	0	0	0	0	200	1
Total	**1 200 985**	**53**	**90 200**	**16**	**3 519 120**	**27**	**200**	**1**

* Dredged material and geological matter were converted to tonnes using an assumed density of 1.3 tonnes per cubic metre.

the actual quantity disposed of at sea (often by 30–50%); however, with the monitoring fee for dredged material and inert, inorganic geological matter in place since 1999, the quantities permitted now more closely reflect the actual quantities sent for disposal.

7.3.2 Monitoring Program

As required by the *Canadian Environmental Protection Act, 1999*, disposal sites are monitored to verify that permit conditions are met and that scientific assumptions made during the permit review and site selection process are correct and adequate to protect the environment.

In 2005–06, field monitoring was conducted at 13 ocean disposal sites:

- nine disposal sites in the Pacific and Yukon Region (Malaspina Strait, Cape Mudge, Watts Point, Thornborough Channel, Queen Charlotte Strait, Malcolm Island, two sites in Johnston Strait, and Sand Heads in British Columbia); and
- four disposal sites in the Atlantic Region (Cheticamp, Nova Scotia; Miramichi and Black Point, New Brunswick; and Mosquito Cove, Newfoundland and Labrador).
- Quebec Region completed and published its analysis of site stability work undertaken in previous years in the Magdalene Islands.
- Further details can be found in the *Compendium of Monitoring Activities at Ocean Disposal Sites*, which is sent to permit holders and submitted to the International Maritime Organization annually.

www.ec.gc.ca/seadisposal/reports/index_e.htm#Compend

7.3.3 Regulations

In 2005–06, further work was undertaken on proposed amendments to the *Disposal at Sea Regulations*. The aim of these regulatory amendments is to clarify the boundaries between the sea and fresh water for four major estuaries across Canada, including the Fraser River Delta, the Mackenzie River estuary, the Bras D'Or Lakes, and the Miramichi River estuary, for the purposes of applying the disposal at sea controls. The amendments will improve the Department's ability to administer and enforce the Regulations within these areas. The Regulations are expected to come into force during 2007–08.

Further analysis and consultation was also carried out on the permit fees, which are governed by the *Financial Administration Act,* under the *Disposal at Sea Regulations.* A discussion document was circulated to stakeholders, governments and Aboriginal groups in late 2005 outlining potential changes to the fees, including a possible cap on the maximum amount that can be charged for a single disposal at sea permit and suggestions for increasing the efficiency of the permit system by increasing the duration of a permit from one year to four years. A variety of comments were received from proponents with opposing views. As a result of comments from some large-volume clients and also from Aboriginal groups, further analysis is being undertaken prior to advancing firm regulatory proposals.

7.3.4 Standards Development

Environment Canada continued to study improvements to the toxicity assay using echinoderms (i.e. sea stars and sea urchins) for assessing the quality of sediments proposed for disposal at sea and for disposal site monitoring. This multi-year project is aimed at improving sediment pore water extraction techniques, investigating the suitability and sensitivity of several echinoderm test species, and developing an assay that uses the embryo development endpoint in a sediment contact test for use by Canada's Disposal at Sea Program.

7.3.5 London Convention and Protocol on Disposal at Sea

Environment Canada's Disposal at Sea Program is designed, among other things, to meet domestic waste management objectives and enable Canada to fulfil its international obligations on the prevention of marine pollution from ocean dumping. Canada has been a party to the *Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972* (better known as the *London Convention*) since 1976. This agreement requires it to control disposal of waste at sea, monitor disposal sites, and report to the Office of the *London Convention*. Canada is one of the few countries credited with consistent reporting.

During 2005–06:

- Canada chaired the annual Consultative Meeting of Parties in 2005, its final year of a five-year term as chair. Spain was elected as the next chair of the Consultative Meeting.
- After 10 years, the *1996 Protocol to the London Convention* entered into force in March 2006, with the ratification of Mexico as the 26th member country. In 2000, Canada acceded to the *Protocol*, which is a more

stringent treaty limiting the type of material that can be considered for ocean disposal. The Protocol also asks parties to implement the precautionary approach, the polluter-pay principle, and a comprehensive assessment and monitoring process that compares disposal options and looks for reduction and reuse of wastes. Leading up to this milestone, Canada actively promoted the coming into force of the Protocol at both the Meeting of the Scientific Group and the Consultative Meeting of Parties.

- Canada participated in discussions on the applicability of the *London Convention* and *Protocol* to the storage of carbon dioxide in sub-seabed geological formations and promoted the proposal that carbon dioxide storage in sub-seabed geological formations could be enabled if controlled through the disposal at sea permit system and could provide another tool in a portfolio of options to reduce atmospheric levels of carbon dioxide and slow the rate of ocean acidification.
- Canada began work on a guidance document that will assist Parties in the development and use of Action Lists within the context of the *London Protocol*. This will determine contamination or biological response levels above which permits for disposal at sea should not be issued unless the material is rendered acceptable through the use of management techniques and processes.
- Canada presented a paper on its experience in setting standards for the cleaning of vessels destined for disposal at sea, which was well received. Canada's guidance has been widely referred to and adopted in several countries and by other United Nations bodies.
- Canada took the lead on a joint London Convention/ Marine Environmental Protection Committee working group looking at clarifying boundary issues between the London Convention and the International Convention for the Prevention of Pollution from Ships. London Protocol and London Convention control deliberate "dumping" at sea and International Convention for the Prevention of Pollution from Ships controls "discharges" from the normal operations of a ship (bilge water, sewage, daily garbage, etc.). It is not always clear what is dumping and what is discharge. Dumping is prohibited except with a permit, while discharge is allowed so long as the rules and conditions are met. At present, the question being examined by this Working Group is whether the disposal of a spoilt cargo (e.g. sugar that has become wet, animals that have died) is dumping and needs a permit or whether it can be discharged under rules of International Convention for the Prevention of Pollution from Ships as part of a ship's "normal operations." Advice to mariners is being prepared to help them manage this type of waste correctly and efficiently.
- At the Consultative Meeting of Parties, Canada led the working groups in developing compliance procedures and mechanisms for the 1996 Protocol. The procedures will help the effectiveness of the Protocol now that it has entered into force. The Protocol requires that compliance mechanisms be set within two years of the treaty coming into force.

7.4 Fuels

The Canadian Environmental Protection Act, 1999 *provides authorities for a performance-based approach to fuel standards and allows for a range of fuel characteristics to be regulated to reduce emissions. These regulations may distinguish between different sources of fuels or the place or time of use of the fuel. There are also provisions for regulations to establish a "national fuels mark," a trademark that could be used to promote a national standard for fuels where certain characteristics may be desirable.*

7.4.1 Regulations

The purpose of the *Regulations* amending the Sulphur in Diesel Fuel Regulations (finalized October 19, 2005, proposed October 2, 2004) is to reduce harmful emissions from diesel-powered engines and equipment used in off-road applications (such as construction, agricultural and industrial equipment) and rail and marine applications (such as locomotives and marine vessels). The amendment establishes limits for sulphur levels in diesel fuel produced, imported or sold for the above use. The successful outcome of this regulatory initiative is a reduction of sulphur in off-road diesel from nearly 2,000 mg/kg to less than 15 mg/kg. These lower sulphur diesel fuels are enabling the introduction and effective operation of advanced emission control technologies for diesel engines to be placed on off-road diesel-powered equipment for the first time.

7.5 Vehicle, Engine, and Equipment Emissions

Under the Act, the Minister has authority to set emission standards for on-road vehicles and engines. The Canadian Environmental Protection Act, 1999 *also includes authority to set emission standards for off-road vehicles and engines, such as those found in lawn mowers, construction equipment, hand-held equipment, and recreational vehicles.*

7.5.1 Regulations

The proposed *Regulations Amending the On-Road Vehicle and Engine Emission Regulations* were published in the

Canada Gazette, Part I, on November 5, 2005, initiating a 60-day public consultation period. The proposed amendments to the Regulations were required to maintain alignment with new elements of the United States motorcycle emission standards for 2006 and later model years, including expanding their scope to cover small motorcycles having an engine displacement of less than 50 cubic centimetres. The original *On-Road Vehicle and Engine Emission Regulations* came into effect on January 1, 2004, establishing smog-forming emission standards for all classes of on-road vehicles for 2004 and subsequent model years, including motorcycles.

The *Off-Road Compression-Ignition Engine Emission Regulations* came into effect on January 1, 2006, establishing smog-forming emission standards for 2006 and later-model-year diesel engines typically found in construction, agricultural, forestry and mining equipment.

www.ec.gc.ca/CEPARegistry/regulations

7.5.2 Emissions Testing

Environment Canada's Vehicle, Engine and Equipment Emissions Confirmatory Testing Program assesses whether cars and light-duty trucks, heavy-duty off-road and on-road engines and small-spark ignition engines from manufacturers meet their prescribed emissions certification standards. In 2005–06, 360 tests were conducted on passenger cars and light-duty trucks under this program. In addition, exhaust emissions testing was conducted to support a departmental engineering investigation that was undertaken with a manufacturer on a non-compliant vehicle. The Department continues to build capacity in order to respond to the various regulations that are part of the Federal Agenda on Cleaner Vehicles, Engines and Fuels and under the authority of the *Canadian Environmental Protection Act, 1999*. This process includes the ability to measure emissions from small marine engines, high-speed heavy-duty diesel engines, and recreational vehicles.

7.6 Control of Movement of Hazardous Waste and Hazardous Recyclable Material and of Prescribed Non-Hazardous Waste for Final Disposal

The Minister has the authority to enact regulations governing the export and import of hazardous waste, including hazardous recyclable materials. The Act also provides authorities to introduce regulations on the export and import of prescribed non-hazardous waste for final disposal; require exporters of hazardous wastes destined for final disposal to submit export reduction plans; and set criteria that the Minister may consider in refusing to issue an export, import, or transit permit if the waste or recyclable material will not be managed in a manner that will protect the environment and human health. Provisions that require the Minister to publish notification requiring information on exports, imports, and transits of hazardous waste and hazardous recyclable material are also included in the Canadian Environmental Protection Act, 1999*.*

7.6.1 Exports and Imports of Hazardous Wastes

During the 2005 calendar year,[40] nearly 6,800 Notices were processed for proposed imports, exports, and transits of hazardous wastes and hazardous recyclable materials, representing over 18,000 waste streams. The waste streams for which Notices were received exhibited a range of hazardous properties arising from compressed gases, including flammability, acute toxicity and environmentally hazardous. The hazardous waste streams came from a variety of sources that included various industrial activities, (e.g. leftovers of oil refining, the manufacturing of chemicals, and metal processing). During the same period, over 35,000 shipping manifests and movement documents were received, tracking actual individual shipments.

In 2005, Canadian transboundary movements of hazardous waste and hazardous recyclable material totalled 804,162 tonnes, an increase of over 79,669 tonnes from the 2004 total. Canadian imports totalled 476,416 tonnes, up 14% from the approximately 416,136 tonnes reported in 2004. Exports increased as well, by approximately 6%, from 308,357 tonnes in 2004 to 327,746 tonnes in 2005 (see Figure 2 for trends and Table 13 for quantities imported and exported).

Based on the annual statistics for international transboundary movements in 2005, nearly 99% of Canadian imports came

[40] Export and import quantities set out in Section 7.6.1, including Figure 2 and Table 13, represent actual movement values that took place during the 2005 calendar year (from January 1 to December 31, 2005. These values are consistent with Canada's international reports, which are all based on the calendar year.

Figure 2 Imports and Exports of Hazardous Wastes, 1999–2005

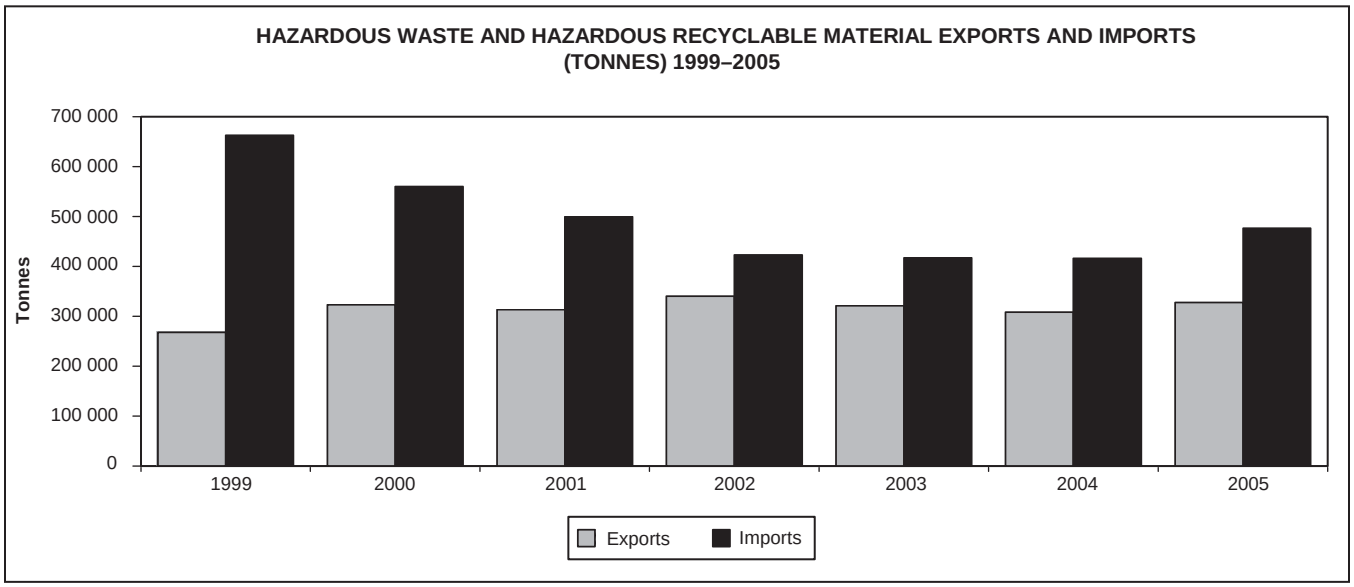


Table 13 Hazardous Waste and Hazardous Recyclable Material Movements, 1999–2005

	Imports (Tonnes)							Exports (Tonnes)						
	1999	2000	2001	2002	2003	2004	2005	1999	2000	2001	2002	2003	2004	2005
Recycling	269 067	281 458	237 069	193 318	189 110	200 097	174 983	205 962	236 338	237 872	238 597	205 356	187 986	226 380
Total imports	662 893	560 032	499 758	423 067	417 368	416 136	476 416	267 931	323 370	313 361	340 261	321 294	308 357	327 746

from the United States, with the remainder coming from Europe as hazardous recyclable material destined for metal recovery operations. Shipments destined for recycling, which reduce reliance on primary resources and benefit Canadian industry, represented nearly 40% of all imports. Batteries, metal-bearing waste, and manufacturing residues make up the majority of imports of hazardous recyclable material into Canada. Other hazardous waste imports included liquors from metallurgical processes and residues from oil refining destined for disposal operations.

Imports of hazardous waste for recycling were shipped to five provinces, with Quebec and Ontario continuing to receive the vast majority of all imports into Canada, and small quantities imported into British Columbia, Alberta, and New Brunswick. The situation is similar for imports of hazardous waste for final disposal, with most destined for Quebec and Ontario and relatively small quantities imported into British Columbia and Alberta.

www.ec.gc.ca/wmd/

7.6.2 Regulations

The *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations* came into force on November 1, 2005. The Regulations provide the Minister with the authorities to protect Canada's environment and the health of Canadians from the risks posed by the transboundary movement of hazardous wastes and hazardous recyclable materials exported from and imported into Canada, as well as transits through Canadian territory or transits originating in Canada that pass through another foreign jurisdiction en route to an authorized Canadian recycling or disposal facility. They also help Canada meet its international commitment under the *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal*, the Organisation for Economic Co-operation and Development Decision of the Council Concerning the Transfrontier Movements of Wastes Destined for Recovery Operations, and the *Canada–U.S. Agreement Concerning the Transboundary Movement of Hazardous Waste*. The

regulations replaced the former *Export and Import of Hazardous Wastes Regulations* adopted in 1992.

The *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations* place notification and permitting requirements on certain newly listed wastes and recyclable materials not covered under the former regulations, such as used lubricating oils from combustion engine sources. In addition, certain low risk hazardous recyclable materials have been exempted from regulatory controls when shipped between Organisation for Economic Co-operation and Development member countries.

www.ec.gc.ca/CEPARegistry/regulations

In February 2006, final consultations were initiated for the proposed regulatory provisions for the export, import and transit of non-hazardous waste destined for final disposal. The regulatory provisions are intended to protect Canada's environment and the health of Canadians from risks posed by unregulated trafficking of non-hazardous waste and ensure it is handled in an environmentally sound manner. They also help Canada meet its international commitment with respect to non-hazardous waste under the *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal* and the *Canada–U.S. Agreement Concerning the Transboundary Movement of Hazardous Waste*, as amended in 1992 to include provisions for non-hazardous waste. The regulatory provisions would serve as the mechanisms through which the authority of the *Canadian Environmental Protection Act, 1999* would be applied and from which Environment Canada may issue permits for movements of non-hazardous waste. They will also implement a system for notification, prior informed consent, and tracking of non-hazardous waste. All comments received will be taken into consideration in finalizing the proposed regulatory provisions.

7.7 International Air

The Minister has the authority to address Canadian sources of pollution that contribute to air pollution in another country or violate an international agreement binding on Canada. This section applies to the release of substances that may not have been determined to be toxic under Part 5, but nevertheless contribute to international air pollution.

Although no actions were taken under these provisions in 2005–06, the following sections describe the results of several international agreements respecting air pollution.

7.7.1 Canada–United States Air Quality Agreement

Canada and the United States continued to meet their commitments pursuant to the *Air Quality Agreement* to reduce emissions of several substances that are toxic under the *Canadian Environmental Protection Act, 1999*, including sulphur dioxide, nitrogen oxides, and volatile organic compounds. In 2005–06, Health Canada continued its participation in the Canada–U.S. Air Quality Agreement Subcommittee—the forum for scientific discussions toward implementation of the Agreement. As required, a draft chapter on Health Canada's work regarding air pollution-population health impact was submitted for inclusion in the 2006 progress report, including a progress report on border air quality pilot studies, the air quality health index, and the air health indicator.

The biennial progress report, mandated under the *Canada–U.S. Air Quality Agreement*, can be found on the following Web site:

www.ec.gc.ca/cleanair-airpur/Pollution_Issues/Transboundary_Air/Canada_-_United_States_Air_Quality_Agreement-WS83930AC3-1_En.htm

7.7.2 Stockholm Convention on Persistent Organic Pollutants

The *Stockholm Convention on Persistent Organic Pollutants* entered into force on May 17, 2004. It seeks the elimination or restriction of the production and use of all intentionally produced persistent organic pollutants. As well, the Convention aims to minimize and, where feasible, eliminate releases of unintentionally produced persistent organic pollutants, including such toxic substances under the *Canadian Environmental Protection Act, 1999* as dioxins and furans and hexachlorobenzene. Under the Convention, stockpiles of these chemicals must be managed and disposed of in a safe, efficient, and environmentally sound manner.

In 2006, Canada completed and submitted its National Implementation Plan to the Stockholm Convention

on Persistent Organic Pollutants. The Plan includes a National Action Plan on unintentional persistent organic pollutants—dioxins, furans, hexachlorobenzene and co-planar polychlorinated biphenyls. The National Implementation Plan is available on the Stockholm Convention and Environment Canada CEPA Environmental Registry Web sites.

www.ec.gc.ca/ceparegistry/documents/nip/nip.cfm

Global Atmospheric Passive Sampling Study

The Global Atmospheric Passive Sampling Study is a global network for monitoring chemicals in the environment using simple sampling devices that require no electricity. This one-year pilot study was initiated in December 2004 at more than 50 sites around the world on all continents and is a collaborative effort managed by Environment Canada scientists working with a team of international researchers. Results from the study will contribute to Canada's obligations under the Stockholm Convention on Persistent Organic Pollutants and the United Nations Economic Commission for Europe's Persistent Organic Pollutants Protocol.

www.pops.int

7.7.3 United Nations Economic Commission for Europe Convention on Long-range Transport of Air Pollution

Parties to this 25-year-old convention include Canada, the United States, and many European countries. The Convention aims to cut emissions of substances of concern, including toxic substances under the *Canadian Environmental Protection Act, 1999* such as sulphur dioxide, nitrogen oxides, particulate matter and mercury from industrial sources (iron and steel industry, non-ferrous metals industry), combustion processes (power generation, road transport), and waste incineration. It sets limits for emissions from stationary sources and suggests best available technologies, such as special filters, scrubbers, or mercury-free processes, to achieve these limits. The Convention also includes a protocol on persistent organic pollutants whose ultimate objective is to eliminate discharges, emissions or losses of 16 persistent organic pollutants substances, including dichlorodiphenyltrichloroethane, polychlorinated biphenyls and dioxins.

In 2005–06, under the Persistent Organic Pollutants Protocol, the Task Force on Persistent Organic Pollutants completed a review of the adequacy and effectiveness of the Protocol. Management options were explored for the first two substances nominated for addition to the Protocol: pentabromodiphenyl ether and perfluorooctane sulfonates. The task force concluded that further work was needed on management options, alternatives, international regulations and quantification of emissions and use. The task force also reviewed five other substances nominated for inclusion under the Persistent Organic Pollutants Protocol—hexachlorobutadiene, octabromodiphenyl ether, polychlorinated naphthalene, 2,2',4,6,6'-pentachlorobiphenyl and short chain chlorinated paraffins—and found that there was sufficient information to consider their nomination and that management options should be explored for these substances.

www.unece.org/env/lrtap/welcome.html

7.7.4 United Nations Environment Programme's Mercury Programme

The long-term objective of the Mercury Programme is to facilitate national, regional, and global actions to reduce and eliminate anthropogenic uses and releases of mercury and mercury compounds, thereby significantly reducing the global adverse impacts on health and the environment of these toxic compounds. Canada contributes financial resources and technical expertise to the program and is engaged in a range of domestic, bilateral and regional activities that support its goals of identifying populations at risk from mercury exposure, minimizing exposure through outreach, and reducing anthropogenic mercury emissions and releases.

In February 2005, countries decided to continue the global mercury program. From 2005 to 2006 several voluntary partnerships were established to seek measurable release reductions. Partnership areas are coal-fired power generation, artisanal gold mining, mercury research and inventories, mercury-containing products, and the mercury cell chlor-alkali sector. As well, an information report on global mercury supply, trade and demand was prepared.

www.chem.unep.ch/mercury/

7.8 International Water

The Minister has the authority to address Canadian sources of pollution that contribute to water pollution in another country or violate an international agreement binding on Canada. This section applies to the release of substances that may not have been determined to be toxic under Part 5, but nevertheless contribute to international water pollution.

7.8.1 International Joint Commission Biennial Report on Great Lakes Water Quality Agreement

The *Canada–U.S. Great Lakes Water Quality Agreement*, originally signed in 1972, is the primary binational mechanism for cooperation between Canada and the United States to restore and maintain the chemical, physical, and biological integrity of the waters of the Great Lakes Basin ecosystem.

The Great Lakes Water Quality Agreement also requires the International Joint Commission to assess progress and assist Canada and the United States in achieving the purpose and objectives of the Agreement. To meet this requirement, the International Joint Commission prepares biennial reports that are submitted to Canada and the United States to assess the progress made by the parties in implementing the Great Lakes Water Quality Agreement, highlight issues that need attention, and make recommendations for consideration by the parties based on its findings. The International Joint Commission's 12th biennial report is available at:

www.ijc.org/php/publications/html/12br/english/report/index.html

The report makes recommendations to the governments of Canada and the United States addressing the impact of urban land use on Great Lakes water quality, aquatic invasive species, the protection of drinking water, potential neuro-developmental effects associated with methyl mercury and polychlorinated biphenyls, fish advisories, mercury deposition, and continued funding for binational research efforts.

The report indicates that the parties have made progress on developing and implementing best management practices to accommodate the growing pressure of human development in the basin. Knowledge of the potential impacts of climate change on the Great Lakes is improving, and results indicate that many toxic chemical releases have declined over the past decades. Chemical contamination continues, however, to endanger human health and restrict the number of fish that can safely be eaten. Several adverse health effects associated with exposure to methyl mercury, a highly toxic substance, have been identified in human and animal studies. In the Great Lakes Basin, human exposure to methyl mercury is due almost exclusively to the consumption of fish.

Canada's response to the recommendations in the 12th International Joint Committee biennial report was prepared by Environment Canada in close collaboration with the federal and provincial agencies involved in the Canadian Great Lakes Program. Concurrence with the United States was also obtained for those recommendations which called for some form of binational initiative. Canada's response to the 12th biennial report can be found at:

www.on.ec.gc.ca/greatlakes/default.asp?lang=En&n=F09D81D4-1

8 Environmental Emergencies (Part 8)

The Canadian Environmental Protection Act, 1999 *(CEPA 1999) provides authorities for the Governor-in-Council to require environmental emergency plans for substances that affect or may affect human health or the environment as a result of an environmental emergency. It allows the Governor-in-Council to establish regulations respecting emergency prevention, preparedness, response, and recovery for the uncontrolled, unplanned, or accidental releases of a substance that has been identified as posing potential harm to the environment or to human health. Part 8 also provides authorities to issue guidelines and codes of practice. In addition, it establishes a regime that makes the person who owns or controls the substance liable for restoring the damaged environment and for the costs and expenses incurred in responding to an environmental emergency.*

8.1 Regulations

The objective of the *Environmental Emergency Regulations* is to enhance the protection of the environment and human health in environmental emergency situations by promoting prevention and ensuring preparedness, response and recovery. Persons who own or manage one of the 174 flammable and other hazardous substances specified in Schedule 1 of the Regulations at or above the specified thresholds in containers with capacity at or above the same thresholds must provide the required information on the substance quantities and container sizes. Companies meeting both criteria must prepare and implement environmental emergency plans. If either the quantity or container criterion is met, regulatees are required to submit only a Notice of Identification of Substance and Place.

The environmental emergency plans Web site, completed in November 2003, includes copies of model plans for propane and anhydrous ammonia along with a common issues section and online notice filing and search capabilities. The database provides public access to basic information about registered facilities (e.g. company names and addresses). Public safety authorities and other interested parties can obtain access to the full database, including information on substances and their quantities, once they have registered online with Environment Canada.

During fiscal year 2005–06, an additional 287 facilities filed Notices of Identification of Substance and Place (Notice #1), for a total of 3,487 facilities. While 91% of these notices are for the 20 most commonly reported substances, 97 of the 174 substances on the list have been reported at least once. The five most commonly reported substances addressed by the *Environmental Emergency Regulations* continue to be propane, anhydrous ammonia, chlorine, n-pentane, and gasoline. In addition, about 1,850 facilities have filed notices indicating that they have prepared and implemented their environmental emergency plans.

During fiscal year 2005–06, work also began on proposed amendments to the Regulations. More specifically, a total of 97 substances were evaluated using the Risk Evaluation Framework established to support decision-making with respect to the listing of substances, as set forth in section 200 of the *Canadian Environmental Protection Act, 1999*. Environment Canada has completed these evaluations and informed stakeholders of the results in a consultation package sent out in July 2005. The analysis indicates that environmental emergency plans should be required for 34 of the substances evaluated. More detailed summary reports outlining the results of these evaluations are available at:

https://cepae2-lcpeue.ec.gc.ca/cepae2.cfm?screen=Evaluations/List&Token=Public&Language=en

Discussions with the regulated community also identified a number of issues associated with the current *Environmental Emergency Regulations* that were thought to warrant consideration for possible modification or deletion from the proposed regulatory amendment process. These issues were also outlined in the above-noted consultation package distributed to stakeholders in July 2005.

9 Government Operations and Federal and Aboriginal Lands (Part 9)

Part 9 of the Canadian Environmental Protection Act, 1999 *provides the authority to regulate departments, boards, and agencies of the Government of Canada, federal works and undertakings, federal land, Aboriginal land, persons on that land and other persons insofar as their activities involve that land, and Crown corporations. It also requires the Minister to establish objectives, guidelines, and codes of practice for the purpose of carrying out the Minister's duties and functions under Part 9 related to the quality of the environment.*

9.1 Regulations

Development of the proposed *Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations* continued in 2005–06. Final consultations with the regulated community were conducted in 2005–06 and the final text of the proposed regulations is expected to be ready in the second quarter of 2006–07.

The proposed regulations will replace the existing *Federal Registration of Storage Tank Systems for Petroleum Products and Allied Petroleum Products on Federal Lands or Aboriginal Lands Regulations* and will provide a more comprehensive framework to prevent soil and groundwater contamination caused by storage tank systems. The proposed regulations will include requirements for the registration of storage tank systems, removal of leaking systems, removal of high-risk systems, leak detection testing, requirements for suppliers of petroleum products, spill reporting, and emergency planning.

10 Compliance Including Enforcement (Part 10)

The Canadian Environmental Protection Act, 1999 *(CEPA 1999) provides enforcement officers with a wide range of powers to enforce the Act, including the powers of a peace officer.*

These officers can carry out inspections to verify compliance with the Act; conduct investigations of suspected violations; enter premises, open containers, examine contents, and take samples; conduct tests and measurements; obtain access to information (including data stored on computers); stop and detain conveyances; enter, search, seize, and detain items related to the enforcement of the Act; secure inspection warrants to enter and inspect premises that are locked and/or abandoned or where entry has been refused; seek search warrants; and arrest offenders.

Officers whose main responsibility is responding to environmental emergencies can receive notifications of and written reports on environmental emergency incidents, access the site of an environmental emergency, and conduct inspections. They can also give direction to take remedial or preventive measures and collect relevant information regarding the emergency. Relevant information can include examining substances, collecting samples, and preserving other physical evidence.

CEPA analysts can enter premises when accompanied by an enforcement officer. They can exercise the following inspection powers: open containers, examine contents and take samples, conduct tests and measurements, and secure access to information. Although CEPA analysts have no authority to issue warnings, directions, tickets, or orders, they may be called as expert witnesses for the purpose of securing an injunction or conducting prosecutions.

The Act provides a wide range of responses to alleged violations, including warnings, directions, tickets, prohibition orders, recall orders, detention orders for ships, injunctions to stop or prevent a violation, prosecutions, Environmental Protection Alternative Measures (EPAM), and Environmental Protection Compliance Orders (EPCOs). Enforcement activities include measures to compel compliance without resorting to formal court action and measures to compel compliance through court action.

In June 2005, Environment Canada took steps to reorganize its enforcement functions by creating the Enforcement Branch, headed by a Chief Enforcement Officer.

By bringing all enforcement responsibilities and accountability under one leader, the Department has enhanced its ability to react quickly to issues and re-align processes and resources to improve efficiency and effectiveness with the resources available.

Under the new structure of the Enforcement Branch, the National Capital Region is responsible for the direction, guidance and general administration of all enforcement operations. The National Capital Region is also responsible for the creation of national policies, training programs, strategic intelligence, inspection and priority planning. The five regions (Atlantic, Quebec, Ontario, Prairie and Northern, and Pacific and Yukon) are responsible for operational program implementation, including conducting inspections based on the planning process, investigations, preparation for court action, cooperation and coordination of enforcement activities with federal/provincial/territorial counterparts, and operational and tactical intelligence.

The following sections highlight achievements of the newly formed Enforcement Branch during the 2005–06 fiscal year.

10.1 Training and Designations

In 2005–06, there were a total of 153 designated *Canadian Environmental Protection Act, 1999* enforcement officers. There are another 31 officers with the Emergencies Program who are mainly responsible for responding to environmental emergencies and who have only limited enforcement powers.

Environment Canada also developed a training program for compliance-promotion staff to ensure that they understand the impacts of their work and adopt best practices to ensure the integrity and enhance the quality of the compliance-promotion services offered by the Department. The training will be delivered to compliance-promotion officers in all regions in 2006–07.

In 2005–06, Environment Canada began a three-year project to redesign the basic enforcement training program

Table 14 Enforcement activities and measures carried out under the Canadian Environmental Protection Act, 1999, during 2005–2006

	Inspections			Investigations	Enforcement measures							
	Total	On-site	Off-site		Written warnings	Written directives	Tickets	EPCO	Charges	EPAM	Prosecutions	Convictions
CEPA 1999	**5210**	**2232**	**2978**	**35**	**2216**	**8**	**26**	**76**	**11**	**1**	**12**	**2**
Benzene in Gasoline	234	78	156	3	1	0	2	0	0	0	0	0
CEPA 1999—Section(s)*	838	317	521	7	84	0	0	1	5	0	2	2
Chlor-Alkali Mercury Release	6	1	5	0	0	0	0	0	0	0	0	0
Chlorobiphenyls	129	106	23	2	0	4	0	0	0	0	0	0
Contaminated Fuel	0	0	0	0	0	0	0	0	0	0	0	0
Disposal at Sea	69	49	20	1	1	0	0	0	0	0	0	0
Environmental Emergency	402	83	319	1	512	0	0	0	0	0	0	0
Export and Import of Hazardous Waste and Hazardous Recyclable Material	133	92	41	1	174	0	0	0	0	0	0	0
Export and Import of Hazardous Waste	365	247	118	6	42	0	0	0	0	0	0	0
Export Control List Notification	0	0	0	0	0	0	0	0	0	0	0	0
Export of Substances under the Rotterdam Convention	0	0	0	0	0	0	0	0	0	0	0	0
Federal Halocarbon, 2003	303	183	120	0	210	1	0	2	0	0	0	0
Federal Registration of Storage Tank Systems for Petroleum Products and Allied Petroleum Products on Federal Lands or Aboriginal Lands	0	0	0	0	0	0	0	0	0	0	0	0
Fuels Information, No. 1	136	11	125	0	4	0	10	2	0	0	0	0
Gasoline	35	25	10	0	0	0	0	0	0	0	0	0
Gasoline and Gasoline Blend Dispensing Flow Rates	0	0	0	0	0	0	0	0	0	0	0	0
Glycol Guidelines	2	2	0	0	0	0	0	0	0	0	0	0
Interprovincial Movement of Hazardous Waste	36	34	2	0	0	0	0	0	0	0	0	0
National Pollutant Release Inventory	439	42	397	0	237	2	0	2	0	0	0	0
New Substances Notification	43	37	6	1	0	0	0	0	0	0	0	0
New Substances Notification—Biotechnology	35	29	6	0	1	0	0	0	0	0	0	0
New Substances Notification— Chemicals and Polymers	1	1	0	0	0	0	0	0	0	0	0	0
New Substances Notification— Organisms	0	0	0	0	0	0	0	0	0	0	0	0
On-Road Vehicle and Engine Emissions	0	0	0	0	0	0	0	0	0	0	0	0
Ozone-depleting Substances, 1998	175	80	95	11	2	0	13	0	6	1	10	0
PCB Waste Export	0	0	0	0	0	0	0	0	0	0	0	0
PCB Waste Export, 1996	9	9	0	0	0	0	0	0	0	0	0	0
Phosphorus Concentration	5	5	0	0	0	0	0	0	0	0	0	0
Prohibition of Certain Toxic Substances, 2005	0	0	0	0	0	0	0	0	0	0	0	0
Pulp and Paper Mill Defoamer and Wood Chip	65	8	57	0	2	0	0	0	0	0	0	0
Pulp and Paper Mill Effluent Chlorinated Dioxins and Furans	142	19	123	1	2	0	0	0	0	0	0	0

(Cont'd...)

Table 14 Enforcement activities and measures carried out under the Canadian Environmental Protection Act, 1999, during 2005–2006 (*Cont'd*)

	Inspections			Investigations	Enforcement measures							
	Total	On-site	Off-site		Written warnings	Written directives	Tickets	EPCO	Charges	EPAM	Prosecutions	Convictions
Secondary Lead Smelter Release	13	10	3	0	0	0	0	0	0	0	0	0
Solvent Degreasing	22	11	11	0	8	0	1	0	0	0	0	0
Storage of PCB Materials	324	154	170	1	179	0	0	0	0	0	0	0
Sulphur in Diesel Fuel	229	61	168	2	10	0	0	2	0	0	0	0
Sulphur in Gasoline	146	77	69	1	2	0	0	0	0	0	0	0
Tetrachloroethylene (Use in Dry Cleaning and Reporting Requirements)	861	460	401	2	746	1	0	67	0	0	0	0
Vinyl Chloride Release, 1992	13	1	12	1	0	0	0	0	0	0	0	0

EPCO = Environmental Protection Compliance Order.
EPAM = Environmental Protection Alternative Measure.

* These numbers include activities that are undertaken pursuant to enforceable provisions of the *Canadian Environmental Protection Act, 1999* rather than enforceable provisions found within the *Canadian Environmental Protection Act, 1999* regulations.

Explanatory notes:

Number of inspections — **new way of counting**: only closed files using the end date are tabulated. The number of inspections relates to the number of regulatees inspected for compliance under each of the applicable regulations.

Investigations are tabulated by number of investigation files. An investigation file may include activities relating to another law or to more than one law and more than one regulation. Therefore, the total number of investigations shown by regulation does not add up to the total at the legislation level.

All measures (except for prosecutions and Environmental Protection Alternative Measures) are tabulated at the section level of a regulation. For example, if the outcome of an inspection is the issuance of a written warning that relates to alleged violations of three sections of a given regulation, the number of written warnings is three.

The number of prosecutions is represented by the number of regulatees that were prosecuted by date charged, regardless of the number of regulations involved.

The number of Environmental Protection Alternative Measures is represented by the number of regulatees who signed Environmental Protection Alternative Measures, regardless of the number of regulations involved.

Additional statistics:

There were 66 referrals to another federal government department, or to a provincial or municipal government.

Of the 35 investigations started in 2005–06, seven ended in 2005–06 and 28 are ongoing. In addition, of the 52 investigations initiated before 2005–06, 23 were completed in 2005–06 and 29 are ongoing.

in cooperation with a contracted law-enforcement training facility. This course was not delivered during the fiscal year, and therefore no new officers were designated with full enforcement officer powers.

During this period, the Limited Powers/Analyst Designation course was redesigned and delivered. Following the course, 13 officers received designation with limited powers and 22 analysts were designated as CEPA analysts. Other learning projects carried out included:

- development and delivery of a seminar and development of an online course for the revised Export and Import of Hazardous Waste and Hazardous Recyclable Materials Regulations;
- preparation of a professional development and apprenticeship program for enforcement officers;
- learning needs analysis and design of training in Bill C-15, Birds Oiled at Sea legislation; and
- learning needs analysis and planning for the design of a training course in advanced investigation techniques.

10.2 Compliance Promotion

Compliance promotion activities include the planning, development and delivery of information to persons subject to enforceable and non-enforceable risk management instruments in order to promote compliance/adherence voluntarily. An important planning tool for compliance promotion is the Compliance Analysis and Planning program, and in 2005–06, Environment Canada continued its activities to further develop and implement the program. This includes developing a Web-based mapping, planning and reporting tool that integrates facility, program and environmental data. It will allow Environment Canada to better identify compliance promotion and inspection priorities and estimate compliance rates within the regulated community by facility, sector, and regulation.

Also in 2005–06, a number of effective compliance promotion approaches were used for instruments under the *Canadian Environmental Protection Act, 1999*. Only a few of the many compliance promotion activities conducted in 2005–06 are presented hereunder.

Collaboration with Other Government Departments and Non-Governmental Organizations

- "Operation Clean Feather," an education program for the prevention of marine pollution, was undertaken again in 2005–06. A total of 230 ocean-going vessels were visited at 12 East Coast ports in Atlantic Canada. As part of this initiative a new brochure, in 10 languages, and a calendar were developed and distributed during ship visits. Clean Feather is undertaken in cooperation with Transport Canada and the shipping industry. As part of 2005–06 activities, Environment Canada initiated contact with the United States Coast Guard. As a result, the United States Coast Guard agreed to disseminate Operation Clean Feather compliance promotion material at five major ports along the Eastern Seaboard.
- Environment Canada's Quebec Region collaborated with the École nationale du meuble et de l'ébénisterie du Cégep de Victoriaville to develop a course on the good practices recommended in the *Code of Practice for the Safe Handling, Use and Storage of Dichloromethane-based Paint Strippers in Commercial Furniture Refinishing and Other Stripping Applications*. A trainer's guide and a learner's guide were developed. To date, the course has been given twice by École nationale du meuble et de l'ébénisterie du Cégep de Victoriaville to very positive feedback. The next step will be to promote these documents at the other woodworking schools in Quebec. There is also interest in translating them for use in other parts of Canada.

Collaboration with First Nations

- In November 2005, Environment Canada staff gave water management-themed presentations at the 4th Annual National Aboriginal Land Managers' Association meeting in Halifax, Nova Scotia. With members in each of Canada's provinces and territories, the National Aboriginal Land Managers' Association network aims to enhance technical expertise related to land management while incorporating Aboriginal values and grassroots practices. Materials presented included the First Nations Water Management Strategy (including source water protection and sustainable water use initiatives), wastewater technology, design and protocols, and upcoming opportunities for Aboriginal engagement related to the Canadian Council of Ministers of the Environment, *CCME Canada-wide Strategy for the Management of Municipal Wastewater Effluents*.
- Environment Canada's Prairie and Northern Region conducted a one-day, multi-instrument information session specifically for First Nations. Prairie and Northern Region partnered with the Saskatchewan Aboriginal Lands Technicians to provide regulatory compliance information to First Nations land managers, land officers, band councillors, treaty land entitlement coordinators/trustees, economic development members, and Indian and Northern Affairs Canada employees. Environment Canada provided presentations on relevant *Canadian Environmental Protection Act, 1999* instruments and on the *Fisheries Act*. The session was a success, judging by the questions asked during the presentations and the comments received on the evaluation forms.

- Environment Canada's Ontario Region successfully concluded the administration of a four-year environmental management project with seven northern Ontario First Nations communities. The project included hiring, training and mentoring an Aboriginal environmental technician, and provision of ongoing technical support to develop a pollution prevention and environmental management plan. Activities conducted under this plan included implementing spill prevention and contingency response measures and conducting fuel storage tank inventories and assessments. Funding for the project was made available under a court order agreement directing that fines levied against those responsible for a large fuel spill in the area be used to assist the communities to meet legislated standards.

Targeting the Right Audience

- Environment Canada's Ontario Region held workshops on the *Environmental Emergency Regulations* and spill prevention in Ottawa, Sault Ste. Marie, and London, Ontario. Additional effort was made to contact potential regulatees in the water treatment, wastewater treatment and metal finishing sectors directly, where there was believed to be lower compliance.
- Environment Canada's Pacific and Yukon Region developed and carried out a survey for municipalities in British Columbia to engage with the target audience of the *Code of Practice for the Environmental Management of Road Salts* and confirm organization contact information, raise awareness of the *Code*, and gather information on current implementation of the *Code*. Using the information from the survey, an accurate list of the target community was compiled.
- In November 2005, Environment Canada's Pacific and Yukon Region hosted an information session on the *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations* for existing regulatees. The full-day session was very well attended.
- For the *Polychlorinated Biphenyl (PCB) Regulations*, Environment Canada's Atlantic Region contacted federal polychlorinated biphenyl owners and managers within the Atlantic Provinces in an effort to proactively track regional progress towards achieving current and proposed domestic and international obligations for the management of polychlorinated biphenyls. Overall, the compliance promotion approach included self-certification forms, site visits and encouragement of polychlorinated biphenyl site owners and managers to identify in-use polychlorinated biphenyl items, send stored polychlorinated biphenyl items for destruction at authorized facilities, and shut down any unneeded polychlorinated biphenyl storage sites.

Ensuring Regulatees Are Reached

- For the *Tetrachloroethylene (Use in Dry Cleaning and Reporting Requirements) Regulations*, Environment Canada developed compliance promotion materials in many different languages, including Punjabi, Korean, Chinese and Persian, to ensure regulatees understood what was required of them. In addition, Environment Canada's Pacific and Yukon Region held information sessions for dry cleaners during evenings and weekends to accommodate the working schedules of the small business owners.
- An amendment to the *Sulphur in Diesel Fuel Regulations* was published October 19, 2005, in Part II of the *Canada Gazette*. A compliance promotion package was sent in January 2006 to all regulatees (approximately 250).
- Environment Canada's Pacific and Yukon Region and Prairie and Northern Region worked together to update a workshop on the *Federal Halocarbon Regulations, 2003*. The regions then held 10 one-day training sessions in six cities. Over 400 stakeholders were in attendance.
- For the *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations*, all Environment Canada regions developed and delivered compliance promotion material, including workshops, meetings, mail-outs, and information sessions.

Using New and Different Tools to Deliver the Message

- Many regions tested video conferencing to deliver information sessions to the regulated community. Use of video technology for this purpose can save resources by eliminating the need for travel by the regulated community.
- Environment Canada's Ontario Region developed and distributed three issues of a regional compliance newsletter, *ComproUpdate*, to federal facilities and First Nations. The newsletter's circulation surpassed 500.
- When appropriate, the regions delivered multi-instrument information sessions to the regulated community whereby an overview of a few instruments under the *Fisheries Act* and the *Canadian Environmental Protection Act, 1999* were covered during an information session. These sessions are efficient as many members of the regulated community may be subject to more than one risk management instrument.
- Quebec Region produced a bilingual environmental compliance guide aimed at all federal government departments, agencies and boards, Crown corporations, federal enterprises, Aboriginal lands, federal lands, and persons whose activities involve those lands and who are located in Quebec. Almost 200 copies of the guide were distributed. The guide summarizes the laws, regulations, guidelines and other reference documents dealing with the protection of the environment on the territory of the province of Quebec.

Success of Compliance Promotion Activities

- Fact sheets were mailed out for the *New Substances Notification Regulations (Organisms)* and the *New Substances Notification Regulations (Chemicals and Polymers)*. This mail-out was coordinated with other

Environment Canada programs because the 10,000 potentially affected facilities included the regulated communities of the National Pollutant Release Inventory, the *Ozone-depleting Substances Regulations*, the *Environmental Emergency Regulations* and the *Metal Mining Effluent Regulations*. A telephone survey was used to solicit information on the effectiveness of the mail-out. It was determined that the mail-out was successful as most respondents considered themselves more knowledgeable about the *New Substances Notification Regulations*.

- Quebec Region contributed to promoting environmental compliance in the "federal house" by organizing two federal seminars on environmental compliance. These seminars inform the federal community about Environment Canada's intentions relative to risk management tools for polychlorinated biphenyls, fuel storage tanks, hazardous waste, and municipal wastewater. Close to 100 people from agencies and enterprises of the Government of Canada attended alongside environmental service providers. More than 70% of participants surveyed reported that the subject matter covered in the seminars was interesting or very interesting.
- The *Code of Practice for the Environmental Management of Road Salts* asks organizations using 500 tonnes or more of road salts to voluntarily develop and report on a management plan. Many types of compliance promotion activities were developed and delivered, including presentations, workshops, a promotional booth, success stories, brochures, promotional posters and an Implementation Guide. Ontario Region contacted over 125 individual road authorities by e-mail, identified their specific level of code implementation, and reminded them to complete the elements missing from their letters of intent, salt management plans, and 2005 annual reports. Following this exercise, salt management planning increased by 36% among Ontario road authorities.
- The compliance promotion activities for the *Notice with respect to Reporting of Greenhouse Gases* consisted of the publication and distribution of a technical guidance manual, a direct-mail campaign and information sessions held across Canada. In 2005, EC received 324 reports from facilities representing approximately 37% of Canada's total emissions.

In addition, numerous compliance promotion activities were delivered for individual control instruments under the *Canadian Environmental Protection Act, 1999*. Some examples follow hereunder.

- ***Tetrachloroethylene (Use in Dry Cleaning and Reporting Requirements) Regulations.*** All regions participated in compliance promotion activities: mail-outs were sent to nearly 3,000 regulatees reminding them to submit 2004 annual reports by April 30, 2005; information sessions were held across the country; and queries regarding the reporting requirements were answered.
- ***Federal Halocarbon Regulations, 2003.*** Collectively, Prairie and Northern Region, Pacific and Yukon Region, and Quebec Region held seven information sessions. Fact sheets tailored to service contractors working in the heating, refrigeration and air-conditioning industries as well as the fire-extinguishing equipment industry were developed in Pacific and Yukon Region and Quebec Region.
- ***Environmental Emergency Regulations.*** Ontario Region held three information sessions and delivered compliance promotion to potential regulatees in the water treatment, wastewater treatment and metal finishing sectors. Two information sessions were held in the Atlantic Region and an information mail-out was sent to 100 facilities. Atlantic Region also participated in nine site visits, reviewed five plans, and evaluated two exercises. Prairie and Northern Region held several sessions in conjunction with the National Pollutant Release Inventory and delivered compliance promotion information sessions. Prairie and Northern Region also sent out compliance promotion materials to regulatees. Quebec Region held approximately 13 information sessions across Quebec for industry, municipalities, governments, and others. The compliance rate across Canada was about 80% at the end of March 2006. The Department is currently analyzing environmental emergency reporting trends to more effectively target and deliver future compliance promotion.
- ***Notice requiring the preparation and implementation of pollution prevention plans in respect of effluents from textile mills that use wet processing and nonylphenol and its ethoxylates.*** Quebec Region held two information sessions for textile factories in the province. Close to 40 people from about 30 different factories attended. Quebec Region developed a technical resource guide to help these factories prepare and implement pollution prevention plans.

10.3 Inspection Priorities

Every year, a national inspection plan is developed that describes the inspection activities that will be carried out in that fiscal year for the *Canadian Environmental Protection Act, 1999* and the pollution prevention provisions of the *Fisheries Act*. To maximize the effectiveness of these activities, priority is given to specific regulations.

In 2005–06, priority regulations were identified on the basis of a comprehensive internal consultation process involving all Environment Canada enforcement partners. Factors that influence the identification of the priority regulations include the risk to the environment and human health represented by the regulated substance or activity, compliance rates, new and amended regulations, nature of the regulatory provisions,

operational complexity and capacity, and domestic and international commitments and obligations. The number of inspections carried out under the plan is supplemented by a large number of inspections resulting from responses to spills, complaints, intelligence or other information.

In 2005–06, the national inspection plan identified the following as national priorities:

- *Gasoline Regulations*;
- *Fuels Information Regulations, No. 1*;
- *Sulphur in Diesel Fuel Regulations*;
- *Sulphur in Gasoline Regulations*;
- *Benzene in Gasoline Regulations*;
- *Export and Import of Hazardous Wastes Regulations*;
- *Tetrachloroethylene (Use in Dry Cleaning and Reporting Requirements) Regulations*;
- *Federal Halocarbon Regulations, 2003*;
- *Metal Mining Effluent Regulations* under the *Fisheries Act*;
- *Pulp and Paper Effluent Regulations* under the *Fisheries Act*; and
- General Prohibition Provisions under the *Fisheries Act* (section 36[3]).

In addition, a number of regulations were identified as regional inspection priorities. The priority placed on regulations in each region was influenced by a number of factors, including geography, demographic factors, and provincial and territorial environmental sensitivities.

10.4 Key Investigations

Enforcement officers appointed under the *Canadian Environmental Protection Act, 1999* carry out two categories of enforcement activity: inspections and investigations.

The purpose of an inspection is to verify compliance with the *Canadian Environmental Protection Act, 1999* and its regulations. An investigation involves gathering, from a variety of sources, evidence and information relevant to an alleged violation. Any response to an alleged violation will be taken in accordance with the Compliance and Enforcement Policy for the *Canadian Environmental Protection Act, 1999*.

For more information, please refer to:

www.ec.gc.ca/CEPARegistry/documents/policies/candepolicy/toc.cfm

10.5 Enforcement Activities

10.5.1 Environmental Protection Compliance Orders

An Environmental Protection Compliance Order (EPCO) can be issued to prevent a violation from occurring; to stop or correct one that is occurring or continuing over a period of time; or to correct an omission where one is occurring under the *Canadian Environmental Protection Act, 1999* or one of its regulations.

As part of the Environmental Protection Compliance Order process, a Notice of Intent to issue an Environmental Protection Compliance Order is sent to the alleged offender, who has the opportunity to make written or oral representations to the enforcement officer issuing the Environmental Protection Compliance Order. The enforcement officer will then consider the information provided in these representations and may choose to issue the Environmental Protection Compliance Order as is, modify it, or not issue it at all. There have been a few files for which the company involved provided information during representations that brought them into compliance or showed that they were now in compliance with the *Canadian Environmental Protection Act, 1999*, and therefore the issuance of the Environmental Protection Compliance Order was no longer deemed to be necessary.

In 2005–06, 76 Environmental Protection Compliance Orders were issued, 67 to dry cleaners for violations of the *Tetrachloroethylene (Use in Dry Cleaning and Reporting Requirement) Regulations* and the remaining nine for violating various other regulations.

10.5.2 Environmental Protection Alternative Measures

Environmental Protection Alternative Measures (EPAM) allow for a negotiated return to compliance without a court trial. In order to participate in an Environmental Protection Alternative Measures program, there are a number of conditions that must be met. These conditions are as follows:

- Charges for the offence(s) must be laid.
- The Crown prosecutor must be satisfied that the environment and human life and health will be protected if the Environmental Protection Alternative Measure is used.

- The accused's compliance history makes it likely that he or she will abide by the Environmental Protection Alternative Measure and return to compliance.
- Also taken into account before the negotiation of an Environmental Protection Alternative Measures agreement are the accounts of the accused after the alleged violation occurred. Did the accused take any corrective action after the violation or preventive measure to ensure that the alleged offence(s) does not recur? Was the accused cooperative or did he or she try to conceal information?
- In entering the Environmental Protection Alternative Measures program, the accused is not required to plead guilty to the alleged offence, but he or she must accept responsibility. Once the Environmental Protection Alternative Measures is negotiated, it is filed with the courts and becomes a public document. Once the conditions of the Environmental Protection Alternative Measures are fulfilled, the courts will dismiss the charges against the accused.
- If the accused fails to comply with the Environmental Protection Alternative Measures, this is in itself an offence under the *Canadian Environmental Protection Act, 1999*, and prosecution for failure to comply will be undertaken.

In 2005–06, an Environmental Protection Alternative Measures agreement was negotiated between Environment Canada and a Quebec company. The company had been charged with contraventions of the *Ozone-depleting Substances Regulations* for the import, sale, and offering for sale of products containing hydrochlorofluorocarbons. The company entered into the agreement rather than proceed with court action. As part of the agreement, the company was required to implement operational procedures to prevent contraventions of the Regulations, publish an article in an information bulletin, and pay $15,000 to the Environmental Damages Fund.

For information on the Fund, visit the following Web site:

www.ec.gc.ca/edf-fde/

10.5.3 Prosecutions and Court Cases

A significant prosecution took place in 2005–06 in Ontario when the owner of a company pleaded guilty to two charges under the *Export and Import of Hazardous Waste Regulations* made pursuant to the *Canadian Environmental Protection Act, 1999*. He received a sentence of 30 days on each count, to be served concurrently. All charges against the company were withdrawn and a diversion agreement was negotiated with the company. The company agreed to pay $5,000 to the Niagara Peninsula Conservation Authority for environmental projects in the Niagara region.

10.6 Domestic and International Actions

Enforcement-related activities are carried out under various international and domestic agreements and organizations. Key international and domestic activities in 2005–06 are presented hereunder.

- **International Network for Environmental Compliance and Enforcement**—The network of more than 100 countries held its 7th annual conference in Marrakech, Morocco. Environment Canada's Enforcement Branch participated in the panels and workshops and supported the *Marrakech Statement: Making Law Work for People, Environment, and Sustainable Development*.
- **North American Agreement on Environmental Cooperation**—The Enforcement Working Group under the Commission for Environmental Cooperation provides a forum to help member countries (Mexico, United States and Canada) work together on projects and initiatives that encourage tri-national environmental enforcement collaboration.

11 Miscellaneous Matters (Part 11)

The Act sets out general authorities or conditions for disclosure of information, general regulation-making provisions, regulations regarding cost recovery, use of economic instruments (deposit/refund systems and tradeable unit systems), requirements governing publication of various Canadian Environmental Protection Act, 1999 *(CEPA 1999) instruments, boards of review, and review of the Act by Parliament every five years.*

11.1 Economic Instruments

There were no new economic instruments introduced under the *Canadian Environmental Protection Act, 1999* during 2005–06.

11.2 The *Canadian Environmental Protection Act, 1999* Review

The *Canadian Environmental Protection Act, 1999* stipulates that a Parliamentary Committee must review the provisions and operations of the Act every five years after it comes into force. On April 5, 2005, the House of Commons ordered by unanimous consent that the Standing Committee on Environment and Sustainable Development would be responsible for reviewing the *Canadian Environmental Protection Act, 1999*. The Committee decides the scope of the issues to be examined. On October 24, 2005, the Committee invited stakeholders to provide it with submissions to assist in identifying and analyzing issues of concern and a potential list of witnesses.

The work of the Committee was halted when Parliament was dissolved on November 29, 2005, for an election.

www.ec.gc.ca/CEPARegistry/review/default.cfm

Appendix A: Management Measures Proposed or Finalized in 2005–06

Management Tool	Status
REGULATIONS	
New Substances Notification Regulations (Chemicals and Polymers)	Finalized September 21, 2005
New Substances Notification Regulations (Organisms)	Finalized September 21, 2005
Regulations Repealing the New Substances Notification Regulations	Finalized September 21, 2005
Regulations Amending the New Substances Fees Regulations	Finalized September 21, 2005
Regulations Amending the Sulphur in Diesel Fuel Regulations	Finalized October 19, 2005
Regulations Amending the Prohibition of Certain Toxic Substances Regulations, 2005 (2-Methoxyethanol, Pentachlorobenzene and Tetrachlorobenzene)	Proposed July 9, 2005
Regulations Respecting 2-Butoxyethanol	Proposed July 9, 2005
Regulations Amending the On-Road Vehicle and Engine Emission Regulations (Motorcycle Regulations)	Proposed November 5, 2005
Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations	Finalized June 1, 2005
POLLUTION PREVENTION PLANS	
Pollution Prevention Plans in respect of inorganic arsenic compounds, hexavalent chromium compounds, polychlorinated dibenzodioxins, polychlorinated dibenzofurans and/or hexachlorobenzene used by wood preservation facilities	Finalized October 22, 2005
GUIDELINES	
Guidelines for the Reduction of Ethylene Oxide Releases from Sterilization Applications	Finalized October 1, 2005

Appendix B: Selected Atmospheric Science Publications, 2005–06

PLEASE NOTE THIS IS NOT A COMPREHENSIVE LIST.

2005 Publications

1. Aklilu, Y., M. Mozurkewicha, A.J. Prennib, S.M. Kreidenweisb, M.R. Alfarrac, J.D. Alland, K. Anlaufe, J. Brooke, W.R. Leaitch, S. Sharma, H. Boudries, D.R. Worsnop. 2005. Hygroscopicity of particles at two rural, urban influenced sites during Pacific 2001: Comparison with estimates of water uptake from particle composition. *Atmospheric Environment*, doi: 10.1016.
2. Alegria, H., F. Wong, T.F. Bidleman, M. Salvador Figueroa, G. Gold Bouchot, S. Waliszewski, V. Ceja Moreno and R. Infanzon. 2005. Ambient Levels of Organochlorine Psticides in Ar in Southern Mexico. In *Golfo de Mexico Contaminacion e Impacto Ambiental: Diagnositico y Tendencias, 2da Ed.,* by V. Botello *et al.*, Univ. Auton. de Campeche, Univ. Nacional. Auton. de Mexico, Instituto Nacional de Ecologia, 225-235.
3. Bailey, P., D. Waite, L. Quinnett-Abbott and B. Ripley. 2005. Analysis of DDT and Other Selected Organochlorine Pesticide Residues in Soils from Saskatchewan, Canada. *Canadian Journal of Soil Science* 85: 265-271.
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Appendix C: Contacts

This report in PDF and XHTML formats is posted on Environment Canada's CEPA Environmental Registry,

www.ec.gc.ca/CEPARegistry

which is the main source for federal government information on the *Canadian Environmental Protection Act, 1999* (CEPA 1999) and related activities.

Further information about the *Canadian Environmental Protection Act, 1999* (CEPA 1999) and related activities is available on

- Environment Canada's Web site (*www.ec.gc.ca*)
- Health Canada's Web site (*www.hc-sc.gc.ca*)

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List of Acronyms

ACAP	Atlantic Coastal Action Program
AMAP	Arctic Monitoring and Assessment Programme
AMSP	Arctic Marine Strategic Plan
AOC	Area of Concern
APEC	Asia-Pacific Economic Cooperation
APMA	Automotive Parts Manufacturers' Association
AQBAT	Air Quality Benefit Assessment Tool
BEMAG	Base-metals Environmental Multi-stakeholder Advisory Group
C2P2	Canadian Centre for Pollution Prevention
CCME	Canadian Council of Ministers of the Environment
CCPA	Canadian Chemical Producers Association
CEPA 1999	*Canadian Environmental Protection Act, 1999*
CFLs	compact fluorescent lightbulbs
COA	Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem
CWSs	Canada-wide Standards
DSL	Domestic Substances List
EIHWR	*Export and Import of Hazardous Wastes Regulations*
EMAN	Ecological Monitoring and Assessment Network
EPAM	Environmental Protection Alternative Measure
EPCO	Environmental Protection Compliance Order
EPR	Extended Producer Responsibility
GAPs	Global Atmospheric Passive Sampling
GC-MS	gas chromatography-mass spectrometry
GEMS	Global Environment Monitoring System
GHG	greenhouse gas
GLSF	Great Lakes Sustainability Fund
IJC	International Joint Commission
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
LC-MS	liquid chromatography-mass spectrometry
LED	light-emitting diode
MARPOL 73/78	International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto
MOU	Memoranda of Understanding
NAPS	National Air Pollution Surveillance Network
NCP	Northern Contaminants Program
NGOs	Non-governmental organizations
NIR	National Inventory Report

NPA	National Programme of Action for the Protection of the Marine Environment from Land-based Activities
NPRI	National Pollutant Release Inventory
NRTEE	National Round Table on the Environment and the Economy
NWRC	National Wildlife Research Centre
OECD	Organisation for Economic Co-operation and Development
OWNERS	One Window to National Environmental Reporting System
PAME	Protection of the Arctic Marine Environment
PERD	Program on Energy Research and Development
PIC	Prior Informed Consent
PMRA	Pest Management Regulatory Agency
PPCPs	pharmaceuticals and personal care products
PSL1	First Priority Substances List
PSL2	Second Priority Substances List
RPA	Regional Programme of Action (for the Protection of the Arctic Marine Environment from Land-based Activities)
SETAC	Society of Environmental Toxicology and Chemistry
SOE	State of the Environment Reports
SMEs	small and medium-sized enterprises
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
USCG	United States Coast Guard
U.S. EPA	United States Environmental Protection Agency
U.S. EPA MESA	United States Environmental Protection Agency Multi-Ethnic Study of Atherosclerosis cohort
UV	ultraviolet

Substances Mentioned Within Report

PLEASE NOTE THIS IS NOT A COMPREHENSIVE LIST.

AP	alkylphenols
2-BE	2-butoxyethanol
BFRs	brominated flame retardants
BPA	bisphenol A
3-PBA	3-phenoxybenzoic acid
CFCs	chlorofluorocarbons
CH_4	methane
CO_2	carbon dioxide
CP	chlorinated paraffins
DCPA or *dacthal*	dimethyl tetrachloroterephthalate
DDE	dichlorodiphenyldichloroethene
DDT	dichlorodiphenyltrichloroethane
diMe-TCP	dimethyl tetrachlorophthalate
DNA	deoxyribonucleic acid
DNOC	4,6-dinitro-o-cresol
GHG	Greenhouse Gases
5H	5-Hydroxy
HA	haloacetaldehydes
HAA	haloacetic acids
HAN	haloacetonitriles
HCB	hexachlorobenzene
HCBD	hexachlorobutadiene
HCFCs	hydrochlorofluorocarbons
HCH	hexachlorocyclohexane
HFCs	hydrofluorocarbons
HK	haloketones
MBMBP	2,2'-*m*ethylene-*b*is(4-*m*ethyl-6-*tert*-*b*utyl-*p*henol)
MeO	methoxylated
MSMA	methanearsonate
MTBE	Methyl Tertiary Butyl Ether
MX	Furanone or Mutagen X
N_2O	nitrous oxide
NDMA	N-nitrosodimethylamine
NP/NPE	nonylphenol and its ethoxylates
Octa-BDE	octabromodiphenyl ether
OH	hydroxylated (OH-)

PAHs	polycyclic aromatic hydrocarbons
PBDEs	polybrominated diphenyl ethers
PCBs	polychlorinated biphenyls
PCDDs	polychlorinated dibenzo-p-dioxins
PCDFs	polychlorinated dibenzofurans
PCN	polychlorinated naphthalene
PeCB	Pentachlorobiphenyl
PFAs	perfluoroalkyl substances
PFCs	perfluorocarbons
PFCAs	perfluorocarboxylates
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
PM	particulate matter
$PM_{2.5}$	particulate matter less than or equal to 2.5 microns
PM_{10}	particulate matter less than or equal to 10 microns
POPs	persistent organic pollutants
1,1,1,3,3-pentafluoro-	Propane
QCB	pentachlorobenzene
RNA	ribonucleic acid
SCCP	short chain chlorinated paraffins
SF_6	sulphur hexafluoride
TBBPA	tetrabromobisphenol A
TCDD	2,3,7,8,-tetrachlorodibenzo-p-dioxin
TeCBs	tetrachlorobenzenes
THM	trihalomethanes
VOC	volatile organic compounds
Vtg	vitellogenin