Final

North American Air Quality and Climate Change Standards, Regulations, Planning and Enforcement at the National, State/Provincial and Local Levels

Commission for Environmental Cooperation

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This document was prepared for the CEC Secretariat by M.J. Bradley and Associates, Inc., under an activity in the CEC's 2003 work plan to conduct a comparative study of the air quality standards, regulations, planning, and enforcement practices at the national, state/provincial, and local levels in the three North American countries, building on previous research and work undertaken by the CEC on North American air management systems. The opinions, views or other information contained herein do not necessarily reflect the views of the CEC, or the governments of Canada, Mexico or the United States.

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Acronym and Symbol List

Best Available Control Technology	BACT
Canada-wide Standard	CWS
Canadian Council of Ministers of the Environment	CCME
Carbon dioxide	CO_2
Carbon monoxide	CO
Clean Air Act	CAA
Clean Air Scientific Advisory Committee	CASAC
Comisión Ambiental Metropolitana	CAM
Corporate Average Fuel Economy	CAFE
Federal Implementation Plan	FIP
Greenhouse gas	GHG
Gross Domestic Product	GDP
Hazardous air pollutants	HAPs
Indice Metropolitano de la Calidad del Aire	Imeca
International Thermonuclear Experimental Reactor	ITER
Large Final Emitters	LFE
Lead	Pb
Lowest Achievable Emission Rate	LAER
Maximum Achievable Control Technology	MACT
Mexico City Metropolitan Area	MCMA
Multi-pollutant Emissions Reduction Strategies	MERS
National Ambient Air Quality Objective	NAAQO
National Ambient Air Quality Standard	NAAQS
National Institute of Ecology	INE

New Source Performance Standards	NSPS
New Source Review	NSR
New Substances Notification Regulations	NSNR
Nitrogen dioxide	NO_2
Nitrogen oxides	NO_x
Office of Air Quality Planning and Standards	OAQPS
Official Mexican Standard (*Norma Oficial Mexicana)*	NOM
Ozone	O_3
Particles less than 10 micrometers in diameter	PM_{10}
Particles less than 2.5 micrometers in diameter	$PM_{2.5}$
Persistent organic pollutants	POPs
Pest Control Products Act	PCPA
Prevention of Significant Deterioration	PSD
Priority Substances List	PSL
Procuraduría Federal de Protección al Ambiente	Profepa
Programa Para Mejorar la Calidad del Aire en el Valle de México	Proaire
Reasonably Available Control Technology	RACT
Registro de Emisiones y Transferencia de Contaminantes	RETC
Secretaría del Medio Ambiente y Recursos Naturales	Semarnat
Secretaría de Salud	SSA
State Implementation Plan	SIP
Sulfur dioxide	SO_2
Sulfur Oxides Management Area	SOMA
The Canadian Environmental Protection Act	CEPA
Total suspended particulates	TSP

Toxic Substances Management Policy	TSMP
Toxics Management Process	TMP
United Nations Framework Convention on Climate Change	UNFCCC
United States Environmental Protection Agency	EPA
Volatile organic compounds	VOCs

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Introduction

This descriptive report details how Canada, Mexico, and the United States define and pursue their air quality and climate change goals, objectives and strategies. The report is intended for an audience that is familiar with air quality issues, and is particularly intended for air quality planners who would like to know more about air management systems implemented in other parts of North America.

The report describes air quality management systems in each of the countries, but is not a comparison of them, as components of these systems are not always directly comparable. The discussion of the air quality management systems are organized by major area as follows:

1. criteria air pollutants or contaminants,
2. hazardous air pollutants or toxics, and
3. greenhouse gases.

For each of these main areas, the report summarizes how goals and objectives are developed as well as how strategies are formulated and implemented.

This report contains updated information on the key air quality initiatives of each country through the end of 2003. Internet links (URLs) and contacts were valid as of that time.

1 Canada

In Canada, air quality management is a partnership between the federal and provincial governments to develop national strategies, which involve a commitment to act, but are generally non-binding in nature (though there are some exceptions such as toxic emissions). Such strategies generally include a range of implementation measures that could be undertaken by the level(s) of government best situated to achieve air quality goals.

The Canadian Environmental Protection Act (CEPA) is the principal act for regulation of environmental contaminants. Under CEPA, the federal government regulates air pollution through three main types of measures:

- National Ambient Air Quality Objectives – non-binding ambient concentrations for certain pollutants.
- Guidelines – technology-based goals or suggestions by the federal government of maximum levels of emissions of various pollutants that should not be exceeded by individual facilities. These guidelines, intended to reflect best available technology in particular industrial sectors, have traditionally been developed by government-industry committees coordinated by Environment Canada. The intention is to encourage provinces to adopt them as binding standards.
- Standards/regulations – CEPA retains the provision of the earlier Canada 1971 Clean Air Act regarding the authority of the federal government to establish enforceable emission-based standards or regulations if human health is endangered or if an international treaty is at risk of being violated.

In addition to objectives, guidelines, and regulations, CEPA gives the Minister of the Environment the authority to require a company or facility to prepare and implement a pollution prevention plan in certain circumstances. CEPA also allows the Governor in Council to pass fuel regulations, and it incorporates authority formerly from the Motor Vehicle Safety Act to set emissions standards for engines in new on-road and off-road vehicles.

CEPA also gives the federal government greater authority to address toxic substances.[1] Health Canada and Environment Canada work together to assess potentially toxic substances and to develop regulations for toxic substances. (See the section entitled *Reducing Toxic Emissions* for more information on regulation of these substances.)

This chapter addresses the Canadian system of air quality management in the following sections:

- Reducing Environmental Contaminants (discusses the Canada-wide Standards, the National Ambient Air Quality Objectives, and the Canada-wide Acid Rain Strategy for Post-2000)
- Reducing Toxic Emissions
- Reducing Emissions From Vehicles, Engines and Fuels

[1] See the following web site <http://www.ec.gc.ca/EnviroRegs/ENG/SearchDetail.cfm?intAct=1001>.

- Reducing Greenhouse Gas Emissions

1.1 Reducing Environmental Contaminants

The Canada approach to reducing environmental contaminants provides for a different "level of effort" in each jurisdiction in recognition that air quality and the number and nature of sources contributing to emissions vary significantly from region to region. Federal and provincial ministers and their designated officials have discretion to choose which measures they wish to implement within particular time frames in order to achieve their air quality goals. Measures taken by all levels of government combined are coordinated in order to achieve these objectives.

For different issues, one level of government may also be seen as best situated to act due to its history of involvement and existing legislative framework. For example, the federal government sets emission standards for vehicles and requirements for fuel quality, which are federal regulations and national in scope. The federal government is also involved in issues that span provincial or national boundaries. Provinces and territories (and in two cases, large municipalities with authority delegated from the provincial level) oversee the permitting of large stationary sources to protect local air quality under the authority of legislation made in provincial legislatures. Provincial governments have the primary responsibility for many facets of air pollution control, but provinces' actions are becoming increasingly coordinated with federal actions and priorities.

The more significant collaborative national strategies include the Canada-wide Standards (which address benzene, dioxins and furans, mercury, fine particulate matter, ground-level ozone, and petroleum hydrocarbons in soil), the National Ambient Air Quality Objectives (which address SO_2, total suspended particulates (TSP), CO, NO_2, and ozone) and the Canada-wide Acid Rain Strategy for Post 2000 (which addresses sulfur dioxide and nitrogen oxides). Note that although the Canada-wide Standards address some pollutants traditionally labeled "toxics," we will discuss specific strategies for managing toxic substances in the section on *Reducing Toxic Emissions*.

1.1.1 Canada-wide Standards

The signing of the Canada-wide Accord on Environmental Harmonization by the federal, provincial and territorial Ministers of the Environment (with the exception of Quebec[2]) in January 1998, established Canada-wide Standards (CWSs) as the primary process for development of national goals for the management of air pollutants and other substances of concern (other than those associated with global climate change). This process is outlined in the Canada-wide Environmental Standards Sub-Agreement, one of three sub-agreements under the Accord. The Canadian Council of Ministers of the Environment (CCME) administers the CWS process.

[2] The province of Quebec has indicated that it intends to act within its area of jurisdiction in a manner consistent with the other Canadian Council Ministers of the Environment member jurisdictions regarding the Canada-Wide Standards and the deadlines for attaining them, although it did not sign the 1998 Canada-wide Accord on Environmental Harmonization.

Environment ministers from the federal, provincial, and territorial governments are all members of the CCME. Meeting as peers, the 14 ministers discuss national environmental priorities and determine, through consensus, which issues would benefit from joint action. CCME ministers set national strategies, develop long-term plans, and pool resources to create technical products that can assist them in carrying out their own environmental mandates.

1.1.1.1 Setting Goals and Objectives

Under the terms of the Standards sub-agreement, the CWSs encompass qualitative or quantitative standards, guidelines, objectives and criteria for protecting the environment and human health. While the main focus of this sub-agreement is on ambient standards, standards can also take the form of discharge and product limits or codes of practice.

The CWSs have been and will be developed for substances deemed by the CCME to be priorities. Once the Ministers establish priorities, jurisdictions work together to develop the appropriate type of standard. Development of standards, as well as opportunities for public comment, will vary for different substances depending on what is appropriate in each case but are required to meet general requirements for openness and transparency set out in the sub-agreement and CCME policy relating to the conduct of consultations with stakeholders.

The CWS process differs from processes traditionally used in Canada to develop guidelines. The CWS process must consider socioeconomic and technical factors (technical feasibility). In addition, greater public participation is planned in the process. Finally, governments are expected to commit to attaining the CWSs and to prepare implementation plans, which are to be made available to the public. Implementation is fundamentally at the discretion of individual jurisdictions.

When CWSs are proposed to the Ministers for endorsement, they are generally expected to include numeric limits, a commitment and timetable for attainment, a list of initial actions to attain the standard, and a framework for reporting to the public. Once endorsed by the Ministers, final CWSs are made public.

The ministers have endorsed the following CWSs:

- Benzene (Phases 1 and 2);
- Dioxins and furans for waste incinerators, pulp and paper boilers burning salt-laden wood, iron sintering, and steel manufacturing;
- Mercury from incineration and base metal smelting, as well as mercury in lamps and dental amalgam waste;
- Fine particulate matter and ground-level ozone; and
- Petroleum hydrocarbons in soil.

Additional CWSs are under development for:

- Dioxins and furans emissions from conical waste burners and

- Mercury emissions from electric power generation.

PM and Ozone CWSs

The CWSs for PM and ozone were established by the CCME in June, 2000. The primary commitment in the CWSs is to meet ambient target concentrations for the pollutants $PM_{2.5}$ and ozone by the year 2010. The CWSs provisions include numeric targets for $PM_{2.5}$ and ozone, and their associated statistical forms. The numeric targets are:

- $PM_{2.5}$: 30 µg/m^3, 24-hour (midnight to midnight) averaging time
- Ozone: 65 ppb, 8-hour averaging time

The statistical forms of the numeric targets are:

- $PM_{2.5}$: 98th percentile ambient measurement annually, averaged over three consecutive years
- Ozone: 4th highest measurement annually, averaged over three consecutive years

Mercury CWS for Electric Power Generation

Although mercury is on the List of Toxic Substances in CEPA, and therefore could be regulated as a toxic, it is not on that list from recent scientific assessments, but rather from an older assessment. Therefore, Canada has more flexibility in controlling mercury and can choose other methods such as the CWSs. Many provinces have already begun implementation of the mercury CWSs that have been endorsed by the ministers (mercury from incineration, base metal smelting, lamps, and dental amalgam). The status of implementation is uneven across provinces, as some provinces have already developed implementation plans while others have not. Some provinces, however, do not have sources affected by all of the standards (e.g., some provinces do not have smelters).

In further work, the CCME has committed to developing a standard by 2005 to reduce mercury emissions from the coal-fired electric power generation sector by 2010. The group is exploring targets in the range of 60–90 percent capture of mercury emitted from coal combustion. The CCME also committed to align with United States standards for mercury. The United States recently published a proposed maximum achievable control technology rule for mercury from power plants with less stringent targets and timeframes than proposed previously. This creates a gap between the CCME commitment to explore the capture of 60–90 percent mercury from coal combustion and aligning this target range with the United States mercury rule in its most recent proposal, which the CCME will need to address.

1.1.1.2 Formulating Air Quality Strategies

Each government is responsible for implementation of the various CWSs in its own jurisdiction and each government also has responsibility for public consultations during implementation. “CWSs do not themselves have any legal force. In implementing the standards, governments

may choose to use their existing legal authorities, or create new ones where necessary."[3] Different governments may take measures such as pollution prevention planning, voluntary programs, codes of practice, guidelines, economic instruments, or regulations.

Each jurisdiction is responsible for meeting the CWSs, including those for PM and ozone. The agreement on these two pollutants requires jurisdictions to develop implementation plans for achievement of the CWSs by establishing and maintaining monitoring networks, producing air quality management plans and tracking progress. Jurisdictional implementation plans are the primary vehicle for CWSs implementation, and outline more comprehensive actions being taken within each jurisdiction. Another important commitment is to consider the principles of continuous improvement, pollution prevention, and keeping-clean-areas-clean (with respect to areas with ambient concentrations below the CWSs levels) when developing implementation plans.

The first steps toward achieving the PM and ozone CWSs are a set of joint initial actions, to be undertaken by all of Canada's jurisdictions. These include the development of multi-pollutant emissions reduction strategies (MERS) for certain industry sectors, including electric power, iron and steel, base metals smelting, pulp and paper, lumber and allied wood products, and concrete and asphalt plants. The goal is to have these strategies in place by 2005, while the target date to achieve the CWSs for PM and ozone is 2010. For the electricity-generating sector, the CCME has made available a "workbook" of information related to multi-pollutant strategies. Though the jurisdictions are collaborating on the MERS, each jurisdiction will develop its own implementation plan.

1.1.2 National Ambient Air Quality Objectives

Prior to the Canada-wide Standards process, the federal government developed and issued non-binding National Ambient Air Quality Objectives (NAAQOs). These objectives are in the form of specific ambient concentrations for certain pollutants. They have not historically represented a binding obligation on the part of any province or territory to achieve, or maintain, that level of air quality. Instead, they represent the view of the federal government of target ambient concentrations taking into account the best available science and social, economic and technological considerations. The NAAQOs have not included attainment plans or schedules, and there is no reporting mechanism to determine the extent of implementation of objectives nationally.

The federal government in the 1970s set NAAQOs for the five common or 'criteria' pollutants—SO_2, TSP, CO, NO_2, and ozone (O_3)—which are shown in Table 1.1. In 1997, the federal ministers of environment and health established the current framework of a single-level NAAQO. This is a national air quality goal set to protect public health, the environment, or aesthetic properties of the environment. Although it is primarily an effects-based objective, it also takes into account technological, economic and societal information. Recommendations from the CEPA National Advisory Committee Working Group on Air Quality Objectives and Guidelines form the basis for establishing and reviewing the NAAQOs. This group is composed

[3] See the following web site <http://www.ccme.ca/initiatives/standards.html?category_id=45>.

of representatives of federal, provincial, and territorial departments of environment and health. The role of this group is now under review and the mechanism for the review and establishment of NAAQOs is subject to change as a result of this activity.

Table 1.1: National Ambient Air Quality Objectives in Canada

Pollutant	Averaging Time	Maximum Desirable Level	Maximum Acceptable Level	Maximum Tolerable Level
Sulfur dioxide (SO_2)	Annual	11 ppb	23 ppb	---
	24 hours	57 ppb	115 ppb	306 ppb
	1 hour	172 ppb	334 ppb	---
Total Suspended Particulates (TSP)	Annual	60 µg/m^3	70 µg/m^3	---
	24 hours	---	120 µg/m^3	400 µg/m^3
Carbon monoxide (CO)	8 hours	5 ppm	13 ppm	17 ppm
	1 hour	13 ppm	31 ppm	---
Nitrogen dioxide (NO_2)	Annual	32 ppb	53 ppb	---
	24 hours	---	106 ppb	160 ppb
	1 hour	---	213 ppb	532 ppb
Ozone (O_3)	Annual	---	15 ppb	---
	24 hours	15 ppb	25 ppb	---
	1 hour	51 ppb	82 ppb	153 ppb

The federal government promulgates the NAAQOs but provincial governments may adopt the NAAQOs through processes they choose. They may also implement them as they choose; therefore, the NAAQOs may be used differently across provinces and territories. In many cases, provincial objectives are based on the NAAQOs. As well, provinces, particularly those with more research and modeling capacity (such as British Columbia, Alberta and Ontario), may develop autonomous guidelines or objectives based on their own assessment of relevant factors. The approach taken by a province in making this determination may depend on the pollutant in question. Provinces generally develop their own objectives if they wish to reflect particular regional ecosystem sensitivities, or consider a different range or weighting of issues than the federal government in the development of objectives. In addition, provinces may develop ambient objectives for substances for which NAAQOs are not available.

1.1.3 Canada-wide Acid Rain Strategy for Post-2000

The Canada-wide Acid Rain Strategy for Post-2000 constitutes a further step past the 1985 Eastern Canada Acid Rain Program. The Strategy sets out new commitments by Canadian governments to work toward achievement of critical loads for acidic deposition to the environment, to protect clean ecosystems, and to further reduce emissions of acidifying pollutants. A federal-provincial task group, reporting to the National Air Issues Coordinating Committee, has been developed and is overseeing an implementation strategy on acid rain. This

group has most recently been expanded into a Full Task Force, to include nongovernmental stakeholders. So far, Ontario, Quebec, New Brunswick and Nova Scotia have announced new targets and timetables for SO_2 emission reductions. Such targets could be the basis for further discussions to revise the regional Sulfur Oxides Management Area (SOMA) target for eastern Canada. Future program needs, both on the policy and science side, will flow from a comprehensive Acid Rain Science Assessment which will be published in December 2004. As part of the strategy, Canada will also continue to work with the United States under the Canada-United States Air Quality Agreement to seek further reductions in the transboundary flows of acidifying pollutants.

1.2 Reducing Toxic Emissions

1.2.1 Setting Goals and Objectives

The federal process for establishing air quality goals for air toxics differs from those used with respect to other air pollutants. The degree to which national goals and standards are set for air toxics, whether ambient or emission-based, is largely defined by CEPA. CEPA formally incorporates key elements of the 1995 federal Toxic Substances Management Policy (TSMP) developed by Environment Canada. This policy elaborates procedures for setting goals for toxics emissions. In 1998, the Canadian Council of Environment Ministers embraced the Policy for the Management of Toxic Substances that is virtually identical to the 1995 TSMP policy.

The TSMP and CEPA set virtual elimination as the goal for toxic substances that are persistent and bioaccumulative, and result predominantly from human activity. For other substances, the goal is management throughout their entire life cycles to prevent or minimize their release.

CEPA defines substances as toxic if they:

- 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.

Under CEPA, the Minister of the Environment and the Minister of Health are responsible for developing the “Priority Substances List” (PSL), which is a list of substances that must be assessed to determine if they are toxic or capable of becoming toxic under the Act. CEPA prescribes a five-year time period for these assessments. If a substance is assessed and found to be toxic and recommended by the Ministers, it is then proposed for addition to the List of Toxic Substances in Schedule 1 of CEPA.

By February 1994, assessments had been completed for 44 substances from the first PSL under CEPA 1988 (“PSL1”). Assessment Reports for each of these PSL1 substances were published following a critical review of relevant identified data. Conclusions of whether the substances were considered toxic under CEPA were published. In some cases, there were substances for which a conclusion could not be reached. Follow-up to the original assessment report has been

undertaken following a review of new information. A second list of 25 substances (known as PSL2) was established in December 1995 following recommendations of an Expert Advisory Panel. Reports have been completed for 23 of these substances, and the Ministers have suspended the assessment period for the other two to allow more time to collect information.

As of July 2003, the List of Toxic Substances in Schedule 1 of CEPA included 68 toxic substances. The List of Toxic Substances includes substances traditionally considered toxics, such as formaldehyde and asbestos, but it also includes substances such as ozone, sulfur dioxide, and respirable particulate matter less than or equal to 10 microns.

For new substances, the New Substances Notification Regulations (NSNR) of CEPA 1999 are an integral part of the federal government's national pollution prevention strategy. As part of the "cradle to grave" management approach for toxic substances laid out in the Act, the NSNR were created to ensure that no new substances are introduced into the Canadian marketplace before an assessment of whether they are potentially toxic has been completed, and any appropriate or required control measures have been taken. Requirements for assessment do not apply if the new substance is regulated under another Act of Parliament.

The federal Pest Control Products Act (PCPA) and regulations are intended to protect people and the environment from risks posed by pesticides. Any pesticide imported into, sold or used in Canada must first be registered under the PCPA which is administered by the Pest Management Regulatory Agency (PMRA). In December 2002, the new PCPA received Royal Assent and is expected to come into force some time in 2004 pending the development of supporting regulations.

1.2.2 Formulating Toxic Strategies

Under CEPA 1999, within two years of the Ministerial recommendation that a substance be added to the List of Toxic Substances in the Act, Environment Canada and Health Canada are required to publish in the *Canada Gazette* a proposed instrument to address preventative or control actions for managing the substance. The instruments provided for by CEPA 1999 are regulations, environmental quality objectives and guidelines, release guidelines, codes of practice, pollution prevention plans, environmental emergency plans, and administrative agreements.

The instruments chosen are developed in consultation with industry, provincial, territorial and aboriginal governments, municipal governments, other federal departments and nongovernmental organizations (environmental, health, academia, youth, aboriginal, etc.). After publishing the proposed instrument in the *Canada Gazette,* there is a 60-day public comment period and Environment Canada then determines if further discussions or review are necessary. Environment Canada must finalize and publish the instrument within 18 months of publication of the proposed instrument. Affected parties will then have a set period of time, as outlined in the instrument, to meet its requirements.[4]

[4] Note that the overall objective of the Toxics Management Process is similar to that of the formerly used Strategic Options Process, which developed goals, targets, and options for management of substances found to be toxic under

For substances added to the List of Toxic Substances under CEPA, the Toxics Management Process (TMP), administered by Environment Canada in conjunction with Health Canada, is the approach used to develop management tools, including preventive or control instruments. A central component of the TMP is the Risk Management Strategy, which describes the proposed approach for reducing the risks to human health and the environment that are posed by the use or release of the toxic substance:

"In developing the Risk Management Strategy, Environment Canada identifies the sectors that pose the greatest risk to the environment and human health, guided by the science in the risk assessment. A risk management objective is then identified for these sectors. This objective is usually based on results achieved from the best available processes, products, or techniques used by the sector or, in some cases, environmental quality objectives."[5]

Next, to achieve the risk management objective, the management tools and instruments are selected for each sector to be addressed. These management tools and instruments may be used to control any aspect of the substance's life cycle—from the design and development stage to its manufacture, use, storage, transport, and ultimate disposal. The process considers all available tools, including existing management initiatives. These include instruments under CEPA 1999 as well as other risk management tools that are outside of CEPA 1999, including the regulatory provisions of other governments and voluntary approaches. A combination of tools, representing the most feasible options for managing a substance can be used. However, for substances added to the List of Toxic Substances, at least one of the risk management tools used must be a "CEPA Instrument" that meets the requirements of Sections 91 and 92 of CEPA 1999.[6]

As examples, there are a number of management tools that have been employed to manage the risk associated with acetaldehyde and respirable particulate matter less than or equal to 10 microns in diameter (PM_{10}). Both acetaldehyde and PM_{10} are found on the Toxic Substances List, and therefore require at least one CEPA instrument be employed. For acetaldehyde, the tools established include Environmental Emergency Regulations, On-Road Vehicle and Engine Emission Regulations, and Off-Road Small Spark-Ignition Engine Emission Regulations. For PM_{10}, the tools developed to manage risks associated with the substance include the New Source Emission Guidelines for Thermal Electricity Generation, Canada-wide Standards for PM and Ozone, On-Road Vehicle and Engine Emission Regulations, Sulfur in Diesel Fuel Regulations, Sulfur in Gasoline Regulations, and Off-Road Small Spark-Ignition Engine Emission Regulations.

1.3 Reducing Emissions from Vehicles, Engines and Fuels

Both the federal government and the provinces regulate fuels. Provinces generally regulate aspects such as vapor pressure of gasoline, which pertains to regional smog problems. The federal government controls aspects of fuels that are of general concern, such as sulfur, benzene, and vehicle/fuel compatibility.

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the original CEPA. The Toxics Management Process, however, was developed to meet requirements of CEPA 1999 and it replaces the Strategic Options Process.

[5] <http://www.ec.gc.ca/CEPARegistry/gene_info/fs_rm1.cfm>

[6] <http://www.ec.gc.ca/CEPARegistry/gene_info/fs_rm1.cfm>

The details of a 10-year Plan of Action for cleaner vehicles, engines, and fuels were released in February 2001. The measures will be supported by regulations, guidelines, and studies and were developed through consultations with provincial and territorial governments, environmental and health organizations, and automobile and fuel sector industry representatives.

Canada has established national emission standards for on-road vehicles and engines. These regulations came into effect on 1 January 2004. In addition, in November 2003, Environment Canada announced new regulations for emissions standards for off-road engines (engines found in lawnmowers, chainsaws, snowblowers and other small tools and equipment). The sources will be subject to the new standards by 2005. Canada also regulates sulfur in gasoline and benzene in gasoline. Diesel fuel regulations will set a new limit for sulfur in 2006. Canada's general approach in this area is to harmonize standards with the US Environmental Protection Agency (EPA) standards.

1.4 Reducing Greenhouse Gas Emissions

Canada is a party to the United Nations Framework Convention on Climate Change (UNFCCC) and has ratified the Kyoto Protocol. Canada's legally binding commitment under Kyoto, once in force, will be to reduce its greenhouse gas (GHG) emissions to six percent below 1990 levels between 2008 and 2012—a reduction of 240 megatonnes (Mt) from the projected "business-as-usual" emissions level in 2010.

1.4.1 Setting Goals and Objectives

Canada's "National Climate Change Process" was created after the Kyoto Protocol was negotiated in December 1997. The National Climate Change Secretariat coordinated the National Climate Change Process. Through this process, the federal government released the Climate Change Plan for Canada in November 2002, a package of policies and measures to help reach its Kyoto Protocol commitment. To address the industry concerns over the costs of meeting the Kyoto Protocol reduction target, the Government of Canada made a commitment to cap permit prices at C$15 per tonne for the first commitment period. Canada's Climate Change Plan challenges all Canadians to reduce their greenhouse gas emissions by one tonne. That is about 20 percent of what each individual Canadian produces on average each year.

As a core part of the Canadian Climate Change Plan, the government is in the process of establishing the Large Final Emitters (LFE) system, which will seek 55 Mt of emission reductions from industrial sectors. This is equivalent to a 15-percent reduction in emission intensities (i.e., the amount of greenhouse gas emissions generated per a given amount of output) from the Government's business-as-usual forecast for 2010. Canada defines the industry sectors that form part of the LFE system as those sectors where: (1) average annual greenhouse gas emissions per facility are 8 kilotonnes of CO_2 equivalent or more and (2) average annual emissions per $1,000 output are 20 kilograms of CO_2 equivalent or more. The "CO_2 equivalent" is a mass adjusted amount for non-CO_2 greenhouse gases that takes into account their different global warming potentials over a 100 year period. Large Final Emitters encompass the oil and gas, thermal electricity generation, and manufacturing and mining sectors. The mining and

manufacturing sectors include chemicals, fertilizers, pulp and paper, mining, smelting and refining (including aluminum), steel, cement, lime, and glass.

1.4.2 Formulating Climate Change Strategies

The Climate Change Plan for Canada sets out the targets in terms of emission intensity as opposed to absolute emission reductions. The Government of Canada has been working with industry since late 2002 to determine greenhouse gas emissions reduction targets in these sectors. The Government of Canada will need a number of tools to meet these goals, including backstop legislation and regulations, negotiated covenants, a domestic emissions trading system, domestic offsets, and the international carbon market established under the Kyoto Protocol.

The legal framework for emission reduction targets will set out the measurement, reporting and compliance guidelines. In addition, emitters can, if they wish and the government agrees, vary certain aspects of the regulations, such as their emissions intensity target, through a negotiated covenant with the federal government. As part of the LFE system, the Canadian government plans to allocate permits to each LFE where one permit confers the authorization to emit one tonne of CO_2 equivalent. Firms that operate under either the backstop or a negotiated covenant will have the option to trade these permits as a means to achieve compliance.

In addition, LFE sectors will be able to use credits generated from offsets projects to help reach their emission reduction targets. The federal government is currently developing rules for such a domestic offsets program. Sectors, such as agriculture, forestry and possibly landfills, are being considered for inclusion in an offset system. In addition, a variety of targeted measures will be implemented to achieve emission reductions in other sectors. For example, for the transportation sector, the Ethanol Expansion Program will provide up to $100 million over the next three years toward the construction of fuel ethanol production facilities in Canada. This is to help achieve the *Climate Change Plan for Canada* target of having at least 35 percent of gasoline contain ten percent ethanol by 2010.

1.5 Key Contacts

Canada-wide Standards for Particulate Matter and Ground-level Ozone
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Multi-Pollutant Emission Reductions Strategies
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1.6 Key Web Sites

Environment Canada
<http://www.ec.gc.ca/>

Health Canada
<http://www.hc-sc.gc.ca/>

Natural Resources Canada
<http://www.nrcan-rncan.gc.ca/inter/index.html>

The Canadian Council of Ministers of the Environment
<http://www.ccme.ca>

National Air Issues Coordinating Committee
<http://www.ccme.ca/initiatives/climate.html?category_id=37>

The National Air Pollution Surveillance Network (NAPS)
<http://www.etc-cte.ec.gc.ca/naps/index_e.html>

CCME Canada-wide Standards site
<http://www.ccme.ca/initiatives/standards.html>

CCME Mercury Standard/Status site
<http://www.ccme.ca/initiatives/standards.html?category_id=53>

CCME Particulate Matter and Ground-level Ozone Standard/Status site
<http://www.ccme.ca/initiatives/standards.html?category_id=59>

CCME Acid Rain

<http://www.ccme.ca/initiatives/climate.html?category_id=31>

The CEPA Environmental Registry
<http://www.ec.gc.ca/CEPARegistry/>

Environment Canada Management of Toxic Substances (includes a list of some of the toxics and the various instruments that have been established)
<http://www.ec.gc.ca/TOXICS/EN/mainlist.cfm?par_actn=s2>

Health Canada Fuels and Engines Emissions
<http://www.hc-sc.gc.ca/hecs-sesc/air_quality/fuels.htm>

Government of Canada Climate Change Website
<http://www.climatechange.gc.ca>

Government of Canada Climate Change Hub Gateway
<http://www.nccp.ca/NCCP/cchg/index_e.html>

Canada's National Climate Change Process
<http://www.nccp.ca>

Natural Resources Canada Large Final Emitters Group
<http://www.nrcan-rncan.gc.ca/lfeg-ggef/>

2 Mexico

Mexico's air quality management system is largely based on the authority provided to the federal government to regulate all air pollution sources by Mexico's General Law of Ecological Balance and Environmental Protection. Air pollution management is increasingly characterized by collaboration between the federal, state and local levels of government. The air quality management system in Mexico is a combination of federal non-binding ambient air quality standards and mandatory emission-based standards. The focus has been on the Mexico City Metropolitan Urban Area since 1990 and the metropolitan areas of Guadalajara, Monterrey, Toluca and Ciudad Juárez since 1996. While the federal government has the responsibility for setting air quality standards at the federal level, states may implement more stringent standards at the local level while the federal standards set a floor for state standards to adhere to. States have jurisdiction to apply their State laws and to prevent and control air pollution from industries and mobile sources not under federal jurisdiction. All 31 states and the Federal District (Mexico City) in Mexico now have enacted their own set of environmental laws. Many municipal governments have also adopted their own laws addressing a broad range of environmental matters as well.

2.1 National Development Plans

The Mexican Federal Planning Law requires the issuance of National Development Plans by each President at the beginning of his or her six-year term. The National Development Plan establishes the specific goals and strategies that govern the policies within plans or programs developed by each secretariat of the federal government. Most recently, the Mexican government initiated a new National Program of Environment and Natural Resources 2001–2006 following the 2000 presidential election.

The first step in the new environmental policy for Mexico following the 2000 elections was a restructuring of the federal government to create the Secretariat for the Environment and Natural Resources (*Secretaría del Medio Ambiente y Recursos Naturales* or Semarnat). The main responsibilities of Semarnat are the creation of regulations, development of environmental strategies, and environmental management. Under the new environmental policy for 2001–2006, Semarnat outlines its new regulatory goals and legislative directives as they relate to air, water, and soil concerns. Enforcement goals are contained in the Program of Environmental Justice Procuration 2001–2006.

2.2 Reducing Atmospheric Pollution

Mexico's General Law of Ecological Balance and Environmental Protection (otherwise known as the Ecology Law) establishes federal authority over air pollution management. Under Mexico's system, a fundamental element in the effort to improve air quality is the establishment of standards defining emission limits for activities, processes and technologies. Federal regulatory standards applicable to the industries under federal jurisdiction generally specify maximum permissible limits, require procedures for monitoring and reporting emissions, and require the use of pollutant reduction technologies and less polluting processes. Industries with

pollution sources under explicit federal jurisdiction include chemical, petroleum and petrochemical, paints and inks, automobile manufacturing, cellulose and paper, metallurgical, glass, power generation, asbestos, cement and limestone, and hazardous waste treatment. The Ecology Law requires the states to control pollution produced by other stationary sources operating as industrial establishments. Municipalities must enforce environmental laws regarding emissions from stationary sources operating as commercial or service-provider establishments.

2.2.1 Setting Goals and Objectives

The Secretariat of Health (*Secretaría de Salud*—SSA) sets Official Mexican Standards (*Norma Oficial Mexicana*—NOM) for ambient concentrations of specific pollutants. The air quality standards must be reviewed every five years. The air quality goals apply, thus far, to criteria pollutants, but not to toxics or acid rain. The SSA utilizes a multidisciplinary and multi-sectoral work group to assist it with its review.

Chapter II of the Fourth Title of the Ecology Law deals with the Prevention and Control of Atmospheric Pollution for both mobile and stationary sources. This title charges the Semarnat with the issuance of NOMs for maximum allowable emissions in different areas or regions within the national territory, based on the maximum permissible limits of pollutants in the environment for public health as determined by the Secretariat of Health. Semarnat also determines the standards for monitoring ambient levels of criteria pollutants (see Table 2.1).

Table 2.1 Official Mexican Standards for Ambient Concentrations of Specific Pollutants

	Acute Exposure		**Chronic Exposure**
Pollutant/Standard	**Concentration/time**	**Maximum acceptable frequency**	**(For the protection of susceptible populations)**
Ozone/ NOM-020-SSA1-1993	0.11ppm (1 hr)	1/3 years	
SO_2/ NOM-022-SSA1-1993	0.13ppm (24 hr)	1/year	0.03ppm (annual arithmetic mean)
NO_2/ NOM-023-SSA1-1993	0.21ppm (1 hr)	1/year	
CO/ NOM-021-SSA1-1993	11ppm (8 hr)	1/yr	
Total Suspended Particles/ NOM-024-SSA1-1993	260µg/m^3 (24 hr)	1/yr	75µg/m^3 (annual arithmetic mean)
PM_{10}/ NOM-025-SSA1-1993	150µg/m^3 (24 hr)	1/yr	50µg/m^3 (annual arithmetic mean)
Lead/ NOM-026-SSA1-1993			1.5µg/m^3 (three-month arithmetic mean)

As defined in the NOMs, both the federal stationary source and mobile source emission limits are applied nationwide. In accordance with a provision of the Ecology Law, however, they are applied with different stringency depending upon their defined zones, which are (1) metropolitan areas or zones, (2) Mexico's northern border with the United States, (3) critical areas or those deemed to have the most severe pollution problems, and (4) the rest of the country.

In the past, the National Institute of Ecology (*Instituto Nacional de Ecología*—INE) was responsible for issuing other air-related standards not covered by the Secretariat of Health. Standards historically under INE's jurisdiction included stationary source emissions (including combustion sources), mobile source emissions, fuel characteristics, environmental monitoring, and industry emission standards for NO_x, SO_2 and PM. However, upon its creation, Semarnat undertook responsibility for the issuance of standards. As a result, the nomenclature of all environmental standards changed in April of 2003 to reflect the new structure.

Currently, the INE serves as a decentralized research institute of Semarnat. It was reorganized in June 2001 to promote and coordinate research on environmental issues to inform the policy making process. The INE consists of four General Directorates; 1) Ecological Land-use, Planning and Ecosystem Conservation, 2) Research on Urban, Regional, and Global Pollution, 3) Research on Public Policies and Environmental Economics, and 4) National Environmental Research and Training Center. These directorates reflect a division of research into four specific "scientific agendas"—green, brown, socioeconomic, and experimental research and training, as outlined below.

- The "green ecology agenda" aims to carry out research that leads to the sustainable use of natural resources through ecological land use planning, biodiversity conservation, and the integrated management of basins.
- The "brown ecology agenda" encompasses pollution control measures at a local, regional, and global scale. Its aim is to develop research to formulate policies that allow the prevention of pollution and the adequate management of hazardous materials.
- The "socioeconomic agenda" is formed by research projects oriented at designing new economic instruments for environmental policy, developing economic assessment methodologies for natural capital and environmental services, and, in general, establishing environmental accounting systems.
- The "experimental research and training agenda" includes research activities with an experimental approach, studying pollution-control technologies, and monitoring and characterization of pollutants, substances, and waste in all environmental matrices. It also includes the practical and theoretical training of human resources oriented towards the analysis of the environment in state-of-the-art laboratories where applied studies of specific problems are performed.

Since 23 January 2003, the actual structure of Semarnat is composed of three undersecretaries; 1) the Undersecretary of Management for Environmental Protection (*Subsecretaría de Gestión para la Protección Ambiental*), 2) the Undersecretary of Planning and Environmental Policy (*Subsecretaría de Planeación y Políticas Ambientales*), and 3) the Undersecretary of Development and Environmental Standards (*Subsecretaría de Fomento y Normatividad*

Ambiental), which function as the fundamental pillars for the execution of environmental policy. In this context, in combination with modifications of the rules of procedure of Semarnat, the basic structure of the Secretariat was modified and the General Directorate of Management of Air Quality and Registry of Emissions and Transference of Pollutants was created under the Undersecretary of Management for Environmental Protection.

The Undersecretary of Management for Environmental Protection is responsible for establishing primary targets for sustainable development. The General Directorate of Management of Air Quality and Registry of Emissions and Transference of Pollutants has the mission of preventing the deterioration of, as well as improving, air quality in Mexico.

2.2.2 Formulating Atmospheric Pollution Strategies

Since the Mexican ambient air quality standards are viewed as goals, the Ecology Law does not establish a deadline for the attainment of these ambient standards. However, they do have an obligatory aspect in that states are required to formulate air quality improvement plans within 180 days of an ambient standard's promulgation that describe how attainment will be achieved. Mexican air quality plans are designed to improve air quality, but do not necessarily provide for the attainment of air quality standards. No current sanctions exist for states failing to comply with the requirements.

The federal government gives priority to the development of air quality management programs in major urban centers. The government sets its priorities based on the severity of the air pollution and the interest expressed by state and local agencies, as well as other organizations. The Mexican federal government, which works with the state and local entities to develop ambient air quality plans, provides considerable latitude regarding the form of measures proposed to achieve emissions reductions.

The three main areas in the development of strategies to meet the national ambient goals and enforceable emission standards include; 1) Programs to Improve Air Quality (otherwise known as Proaire Plans), 2) the issuance of licenses and permits, and 3) an emissions registry system.

2.2.2.1 Proaire Plans

As noted above, the federal government gives priority to the development of air quality management programs in urban centers. In 1996, the government created the *Comisión Ambiental Metropolitana* (CAM) to coordinate responsible institutions involved in the development of air quality plans for the Valley of Mexico.[7] In 1996, the *Programa Para Mejorar la Calidad del Aire en el Valle de México* 1995–2000 (Proaire) began, combining the efforts of the CAM, and federal, state and municipal environmental authorities.

Due to the severity of its air quality problems, Mexico City receives much of the attention. Proaire plans, however, have also been or are being developed for Guadalajara, Monterrey, Toluca, Ciudad Juárez, Mexicali, Tijuana-Rosarito and Salamanca. Proaire plans are not legally enforceable, but do commit participating agencies to implement specific measures and evaluate

[7] The area covered includes the Federal District (Mexico City) and 18 surrounding municipalities.

the results. The goals of the plans are expressed in what are known as Imeca points. Imeca stands for *Indice Metropolitano de la Calidad del Aire* or Metropolitan Air Quality Index.

Due to the severity of poor air quality in the Mexico Valley Metropolitan Area, the Federal, State of Mexico, and Mexico City governments extended the Proaire 1995–2000 program to Proaire 2002–2010, covering a time horizon of nine years. Among the priorities of this expanded plan are conversion of public transportation vehicles to natural gas, stricter limits for NO_x emissions, regulation of $PM_{2.5}$, and the introduction of TIER II motor vehicles. Tier II refers to vehicles in the United States that meet new US emission standards promulgated pursuant to the 1990 Clean Air Act Amendments.

Proaire 2002–2010 is a collaboration of municipal, state, and federal governments to improve air quality and protect the public health of people living in the Valley of Mexico. Proaire 2002–2010 calls for spending $14.7 billion on 89 projects to reduce emissions, with contributions in approximately equal parts from public and private investments. The plan focuses on the reduction of ozone and particulate matter, and emphasizes environmental education and citizen participation.

Proaire 2002–2010 contains many provisions for the reduction of air pollutant emissions in the Mexico City Metropolitan Area (MCMA). The program includes more than 80 measures affecting the transportation sector, the service sector, natural resources, health, and education. Through these types of measures, the plan seeks to achieve reductions of 18% in PM_{10}, 16% in SO_2, 26% in CO, 43% in NO_x and 17% in hydrocarbons by 2010 relative to 1998 total emissions. Emissions from motor vehicles are responsible for a significant portion of the MCMA's air pollution. Based on the 1998 MCMA emission inventory (Proaire 2002–2010, Chapter 5), motor vehicles are responsible for 36% of PM_{10} emissions, 21% of SO_2, 98% of CO, 80% of NO_x, and 40% of hydrocarbons in the region. As such, several programs specifically address transportation in this area (see Table 2.2).

Table 2.2: Proaire 2002–2010 Transportation Measures in Mexico

Gasoline Vehicles	Diesel Vehicles	Other
Stricter emission limits for new vehicles	Stricter emissions limits for new vehicles	Establishment of transport corridors
Sulfur content reduction to 50 ppm in gasoline	Update the Emissions Test Program of the federal jurisdiction fleet for diesel vehicles	Foster the management and coordination for the construction of peripheral highways
Improvement of the mandatory emissions test program	Diesel retrofit program	Elimination of old polluting vehicles in private use
No-Driving Day Program improvement	Revision and reinforcement of the Diesel Vehicles Regulation Program	Integral Program of the local cargo carrier fleet
Redesign of the Catalytic Converter Replacement Program (PIREC)	Renewal of diesel public transport and electric vehicles fleets	Encourage use of alternative fuels by public transportation fleet
Adapt emissions control program for unequipped vehicles	Regulate driving schedule of the local cargo carrier fleet	
Redesign Ostensible Pollutant Vehicles Program and vehicles without pollutant emissions test.	Reduction of sulfur content in diesel fuel	
Renewal of the low-capacity public transportation vehicular fleet		
New high-capacity vehicles in public transportation fleet.		

2.2.2.2 Licenses and Permits

Implementation mechanisms for emission standards are provided for under Mexico's air regulations and include a permitting regime for emission sources under federal jurisdiction. The Director General of Management of Air Quality and Registry of Emissions and Transference of Pollutants administers three primary licenses and permits for stationary sources; 1) the Annual Operating Certificate (*Cédula de Operación Anual*), 2) the Sole Environmental License (*Licencia Ambiental Única*), and 3) the Operation License (*Licencia de Funcionamiento*) (see Table 2.3).

Table 2.3 Primary Licenses and Permits for Stationary Sources in Mexico

Certificate	Purpose	Affected sources
Annual Operating Certificate	For tracking of the licenses and recording annual emissions and transference information (water, air, soil, and hazardous waste)	All stationary sources under federal jurisdiction
Sole Environmental License	Created in 1995 to streamline regulation of stationary sources. Includes environmental impact and risk studies, air pollution release, hydraulic services, and generation and handling of hazardous waste (Replaces License of Operation)	Required for new or re-licensed stationary sources under federal jurisdiction, optional for existing stationary sources with Operating Licenses
Operation License	Precursor to the Sole Environmental License	Stationary sources under federal jurisdiction established prior to 1995

Additional permits include the Open Air Burning Permit (*Permiso para la Combustión a Cielo Abierto*), and Approval and Registry for the Use of Equipment, Processes, Test Methods, Mechanisms, Procedures or Alternative Technologies to the Established Ones in the Mexican Official Norms in Environmental Matter *(Aprobación y Registro para el Uso de Equipos, Procesos, Métodos de Prueba, Mecanismos, Procedimientos o Tecnologías Alternativas a las Establecidas en las Normas Oficiales Mexicanas en Materia Ambiental).*

The Federal Environmental Protection Agency (*Procuraduría Federal de Protección al Ambiente*—Profepa) acts as the federal environmental justice agency and therefore handles enforcement activities including environmental audits and industrial inspections. Under the new environmental justice program, Profepa seeks by 2006 to increase the percentage of industrial inspections at facilities considered as highest risk from 50 to 100 percent and increase compliance with national standards from 40 to 75 percent.

2.2.2.3 Emissions Registry

The Director General of Management of Air Quality and Registry of Emissions and Transference of Pollutants, which operates under Semarnat, administers the Registry of Emissions and Transference of Pollutants (*Registro de Emisiones y Transferencia de Contaminantes*—RETC). The RETC integrates information about some substances (toxics, criteria air pollutants, and unregulated compounds) that are emitted to the environment and that cause an adverse impact on human health and ecosystems. The registry includes data derived annually from the Annual Operating Certificate. This information includes discharges, emissions and transference of contaminants, as well as details of the particular chemical species of the contaminant, the type of establishment, and the specific industrial sector to which it belongs. The RETC is based on the listings in the registries of the Toxics Release Inventory (TRI) of the United States and the National Pollutant Release Inventory (NPRI) of Canada. Currently, the RETC looks to develop its capacity for database administration, use of GIS, and modeling of indirect emissions from non-point sources.

2.2.2.4 The Border 2012 Program

For decades, the United States and Mexico have collaborated on efforts to protect the environment and health of border communities. In 2002, the US EPA, the US Department of Health and Human Services, Mexico's Secretariat of Environment and Natural Resources, Mexico's Secretariat of Health, the US border Tribes, and the environmental agencies from each of the ten US-Mexico border states drafted a new binational border program called Border 2012.[8] The Border 2012 Program is the latest multi-year, binational planning effort to be implemented under the La Paz Agreement and succeeds Border XXI, a previous bilateral initiative begun in 1996 and ended in 2002.

The mission of the Border 2012 Program is to protect public health and the environment in the US-Mexico border region, consistent with the principles of sustainable development. Border 2012 emphasizes a bottom-up approach with local decision making, priority setting and project implementation to address environmental issues in the border region. The program seeks to include concrete measurable results, public participation, transparency, and timely access to environmental information. The Border 2012 Program proposes some key changes from the earlier Border XXI including: 1) a new mission statement; 2) integration of natural resource issues, pollution prevention, and environmental information into the activities of all coordinating bodies; and 3) a new organizational structure that focuses on regional workgroups to facilitate regional- and local-level planning and priority setting.

One of the main goals of the Border 2012 program is to improve regional air quality, and it sets the following air quality objective:

- Objective 1 – By 2012 or sooner, reduce air emissions as much as possible toward attainment of respective national ambient air quality standards, and reduce exposure in the border region, as supported by the following interim objectives:
    - Interim Objective 1 – By 2003, define baseline and alternative scenarios for emissions reductions along the border, and their impacts on air quality and human exposure.
    - Interim Objective 2 – By 2004, based on results from Interim Objective 1, define specific emission reductions strategies and air quality and exposure objectives to be achieved by 2012.

Regional workgroups established under the Border 2012 Program are to coordinate activities at the regional level and support the efforts of local task forces. The workgroups are multimedia and geographically focused, emphasizing regional public health and environmental issues. Four binational regional workgroups will be established in the following regions: 1) California-Baja California, 2) Arizona-Sonora, 3) New Mexico-Texas-Chihuahua, and 4) Texas-Coahuila-Nuevo León-Tamaulipas. The regional workgroups will:

- Identify and prioritize regional environmental issues;

[8] Border 2012: US Mexico Environmental Program, US EPA Doc. No. EPA-160-D-02-001 (23 September 2002), available at <http://www.epa.gov/usmexicoborder/pdf/2012_english_web.pdf> (accessed 30 April 2004).

- Recommend issues beyond a regional scope to be addressed by border-wide workgroups or policy forums; and
- Work with border-wide bodies to address those issues.

Each regional workgroup will have one state and one federal co-chair from each country. The regional workgroups will be broad-based and will include representatives from local communities from both sides of the border, as well as from binational organizations such as the Border Environment Cooperation Commission, the North American Development Bank, the International Boundary and Water Commission, nongovernmental and community-based organizations, academic institutions, and the private sector. In addition, the regional workgroups will include relevant federal, state, local, and tribal government agencies, including representatives from environment, health, natural resource, and emergency response agencies.

There will also be border-wide workgroups to concentrate on issues that are multi-regional, (identified as a priority by two or more regional workgroups) and considered primarily federal in nature. One example is a common cross-border emergency response protocol, whose development and consistent application is considered a federal role.

2.3 Reducing Greenhouse Gas Emissions

The Director General of Management of Air Quality and Registry of Emissions and Transference of Pollutants in Semarnat has responsibility for participating in the definition and development of strategies for climate action undertaken by the Secretariat and other dependencies and organizations of the Federal Public Administration.

2.3.1 Setting Goals and Objectives

On 7 September 2000, Mexico was the first North American signatory to ratify the Kyoto Protocol. As a developing nation, Mexico does not have a legally binding greenhouse gas emission reduction obligation under the Kyoto Protocol. Within INE, the Director General for the Investigation of Urban, Regional and Global Pollution (*Dirección General de Investigación Sobre la Contaminación Urbana Regional y Global*) conducts much of the research and sets many goals for Mexico in the area of climate change.

Specific objectives of the INE climate change activities are:

- Update the national inventory of greenhouse gas emissions.
- Elaboration of National Communications before the United Nations Framework Convention on Climate Change.
- Conduct studies on mitigation of GHG emissions from the power and forest sectors
- Conduct analysis of climatic variability and climatic change.
- Assess vulnerability and adaptation options.
- Project future emissions scenarios.

- Study co-benefits of reduction of fossil fuel combustion in cities to promote the development of cleaner technologies.

2.3.2 Formulating Climate Change Strategies

Although Mexico does not have a legally binding greenhouse gas reduction target under the Kyoto Protocol, it is implementing strategies to reduce emissions. These strategies seek to reduce carbon dioxide and methane emissions mostly through forestry sequestration, energy efficiency improvements, technology upgrades, and fuel switching. Some of the projects include the reforestation of more than 740 thousand hectares (PRONARE Program) of land, forest planting of more than 47 thousand hectares between 1997 and 2003 (PRODEPLAN Program), and reclaiming of over 1.3 million hectares of agricultural lands for forestry production. According to INE, during the period from 1997 to 2000, these reclaiming actions captured 3.3 million tons of carbon.

Mexico is looking to expand participation in the Kyoto Protocol through the Clean Development Mechanism. In 2003, the Mexican government created the Office of Clean Development Mechanism (CDM) and, in conjunction with the Secretariat of Energy and Sagarpa (*Secretaría de Agricultura, Ganadeña, Desarollo Rural, Pesca y Alimentación*), formed the *Comité Mexicano para Proyectos de Mitigación y Captura de Gases de Efecto Invernadero* (Mexican Committee for Mitigation Projects and Capture of Greenhouse Gases). This committee is charged with identifying and developing CDM projects for Mexico's industry. In 2004, Mexico will meet with European nations to further explore these possibilities.

2.4 Key Contacts

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2.5 Key Web Sites

Semarnat home page:
<http://www.semarnat.gob.mx/wps/portal>

INE home page
<http://www.ine.gob.mx>

Director General of Management of Air Quality and Registry of Emissions and Transference of Pollutants Home Page
<http://148.233.168.204/dgca/index.shtml>

Semarnat in the Federal Register:
<http://148.233.168.204/dof/index.shtml>

Secretariat of Health, Environmental Health Page
<http://www.gob.mx/wb2/egobierno/Egob_Medio_Ambiente>

Official Mexican Standards for Ambient Air Quality
<http://www.salud.gob. mx/unidades/cdi/cgi-bin/wxis/unidades/cdi/data/iah/>

Second National Communication of Mexico on Climate Change
<http://unfccc.int/resource/docs/natc/mexnc2.pdf>

Integrated Program on Urban, Regional and Global Air Pollution
<http://www-eaps.mit.edu/megacities/default.html>

3 United States

The United States defines its air quality goals and objectives differently depending on the source category as well as the air pollutant in question. For example, mobile sources are generally treated differently than stationary sources. Conventional air pollutants (e.g., ozone and carbon monoxide) are treated differently than what are termed hazardous air pollutants (e.g., dioxins and mercury). The same can be said with regard to the strategies used to achieve the identified air quality objectives. These differences stem from the legal obligations established by the federal Clean Air Act, which addresses numerous air quality issues, including the establishment of air quality standards, motor vehicle emissions, hazardous air pollutants, acid rain, operating permits, stratospheric ozone, environmental enforcement, as well as other issues. As greenhouse gases are not currently regulated under the Clean Air Act, climate change goals and objectives of the US are handled differently from air pollution goals and objectives, as discussed at the end of this chapter.

The Clean Air Act provides the broad outline and authority for the regulation of air pollution. The US EPA, working with state and local governments, is responsible for implementing the Act, which involves translating general legislative language into detailed regulations. This process is often controversial, and the federal courts are sometimes asked to intervene, for example when industry or environmental advocates challenge a regulation.

The White House Office of Management and Budget is also involved in the federal regulatory process, reviewing EPA regulations and evaluating the costs and benefits of regulations promulgated by agencies across the federal government, including the EPA.[9]

At any time, Congress can revisit the Clean Air Act, modify its existing requirements, or create new obligations. The air quality goals and objectives adopted by Congress can be very precise (e.g., specifying the annual allowable emissions for a given industry sector) or more general in nature. For the most part, Congress does not specify the technologies or measures required to achieve the goals and objectives of the Clean Air Act, although it will often require a specific form of regulation (e.g., market-based or command-and-control).

This chapter summarizes the system of air quality and greenhouse gas goals, standards, regulations, planning and enforcement in the United States. Additional information is available in the National Research Council's 2004 report *Air Quality Management in the United States*.[10]

3.1 Reducing Criteria Air Pollutant Emissions

Title I of the US Clean Air Act establishes the basic regulatory structure for control of the most commonly produced air pollutants from stationary and mobile sources. Title I requires the EPA to identify pollutants that, in its judgment, endanger public health or welfare. Under this authority, the Agency has adopted standards for six pollutants: particulate matter (PM_{10}—

[9] The Clean Air Act also requires the US EPA to evaluate the benefits and costs of clean air programs. Section 812 of the Clean Air Act requires the EPA to conduct periodic, scientifically reviewed studies to assess the benefits and the costs of the entire Clean Air Act.

[10] <http://www.nap.edu/books/0309089328/html/>.

particles less than 10 micrometers in diameter, and $PM_{2.5}$—particles less than 2.5 micrometers in diameter), ozone (O_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO) and lead (Pb). These pollutants are referred to as criteria pollutants because the EPA develops a compilation of information (or "criteria") about the environmental levels and the health and environmental effects of a particular pollutant in order to establish the standards. Note that reduction of ozone is accomplished by control of its precursor pollutants, volatile organic compounds (VOCs) and nitrogen oxides (NO_x). Air toxics or hazardous air pollutants (HAPs) are not regulated through ambient air quality standards (see discussion below).

3.1.2 Setting Goals and Objectives

The goals and objectives of Title I of the US Clean Air Act are defined in terms of national ambient air quality standards or NAAQS. In order to establish these standards, the EPA Office of Research and Development National Center for Environmental Assessment evaluates peer-reviewed information on the effects of criteria pollutants on human health and the environment. This information is published in a draft criteria document, which is reviewed by an independent, nongovernmental panel of scientists, called the Clean Air Scientific Advisory Committee (CASAC). The Office of Air Quality Planning and Standards (OAQPS) then prepares a "staff paper" that summarizes what is, in its view, the most important scientific information, and makes recommendations regarding the need to adjust or modify the existing standards. The Agency then undertakes a rulemaking process including rule proposal, public comment, and publication of a final rule upon signature of the Administrator. The EPA sets "primary" (to protect the public health) and "secondary" (to protect the public welfare) NAAQS for each of the criteria pollutants (see Table 3.1).

The process for establishing a primary and secondary NAAQS is based on human health and environmental criteria. With regard to a primary NAAQS, the Clean Air Act requires the establishment of "ambient air quality standards the attainment and maintenance of which in the judgment of the Administrator, based on such criteria and allowing an adequate margin of safety, are requisite to protect the public health." The Clean Air Act did not intend a NAAQS to be set based on the costs of achieving the standard. In contrast, the strategies employed to achieve a NAAQS are selected based on cost and other criteria, as discussed later in this section.

Table 3.1: US National Ambient Air Quality Standards

Pollutant	Primary	Secondary
SO_2	**Annual**: 0.030 ppm **24-hour**: 0.14 ppm	**3-hour**: 0.5 ppm
$PM_{2.5}$	**Annual**: 15.0 μg/m^3 **24-hour**: 65 μg/m^3	**Annual**: 15.0 μg/m^3 **24-hour**: 65 μg/m^3
PM_{10}	**Annual**: 50 μg/m^3 **24-hour**: 150 μg/m^3	**Annual**: 50 μg/m^3 **24-hour**: 150 μg/m^3
CO	**8-hour**: 9 ppm (10 mg/m^3) **1-hour**: 35 ppm (40 mg/m^3)	
Ozone*	**1-hour**: 0.12 ppm (235 μg/m^3) **8-hour**: 0.08 ppm	**1-hour**: 0.12 ppm (235 μg/m^3) **8-hour**: 0.08 ppm
NO_2	**Annual**: 0.053 ppm (100 μg/m^3)	**Annual**: 0.053 ppm (100 μg/m^3)
Lead	**Annual**: 1.5 μg/m^3	**Annual**: 1.5 μg/m^3

*The 1-hour standard will no longer apply to an area once EPA determines that the area has air quality meeting the 1-hour standard.

These air quality standards apply across the country. The Clean Air Act requires the EPA to review the standards every five years, during which the EPA determines whether new information provides a basis for revising the primary or secondary standards. For example, in July 1997 the EPA issued new NAAQS for ozone and PM. Among other things, the new primary ozone standard replaced the previous one-hour standard with an eight-hour standard designed to address longer exposure periods. The EPA also added a standard specifically for $PM_{2.5}$ for the first time. This strengthening of the air quality standards has resulted in several areas that are now expected to not meet these national standards, particularly in the eastern United States and California.

Thus far this chapter has focused on the federal role in this process. As discussed above, the EPA; 1) identifies the pollutants that are worthy of regulation under Title I of the Clean Air Act, 2) reviews the scientific evidence on the human health and environmental effects of these criteria pollutants, 3) establishes primary and secondary standards following a public comment process, and 4) reviews these standards on a regular basis to determine if any changes are warranted. State and local officials also play an important role. Most of their responsibility involves the formulation of strategies to meet the federal standards, which is discussed later in this section. However, they also work with the EPA to identify the areas that are attaining or failing to attain the national standards by conducting air quality monitoring.

State and local authorities monitor ambient concentrations of criteria pollutants on a continuous basis with a network of air quality monitors. Based on the data collected, the states and the EPA determine if an area is meeting (or failing to meet) the federal standards. The state is then required to develop a plan to either maintain or improve its air quality. In areas attaining the standards, the focus is on *maintaining* air quality. In areas failing to attain the standards (i.e.,

nonattainment areas), the focus is on *improving* air quality, and as a result more stringent emission reduction requirements apply.

There are a number of recent initiatives and ongoing developments that are relevant to the discussion of setting goals and objectives under Title I of the Clean Air Act. These include the ongoing implementation of the revised ozone and PM NAAQS and the scientific review of these same standards. This document provides a brief update of these developments, before turning to the processes by which US policymakers develop the strategies for meeting the NAAQS.

3.1.3 Implementation of the Revised PM and Ozone NAAQS

As indicated above, the EPA adopted revised standards for ozone and PM in July 1997. After adopting the standards, the rule was subjected to a protracted legal challenge, which was ultimately decided in the EPA's favor. A decision by the US Supreme Court upheld the Agency's authority to define standards to protect public health even when there is continuing scientific debate as to the appropriate level of risk and the level of pollution that ensures no significant adverse health risk (American Trucking Associations *v.* US EPA, 2001). The EPA is currently in the midst of implementing the standards. The states have now collected three years of air quality monitoring data, allowing them to recommend their attainment designations (i.e., the areas within their borders that are meeting or failing to meet the national standards). The EPA aims to make final attainment designations for PM and ozone by the end of 2004. The complete implementation schedule is summarized in Table 3.2.

Table 3.2: Schedule for Making Ozone and PM Attainment Designations in US

Ozone NAAQS	PM NAAQS
Most states and tribes have recommended to the EPA their attainment designations	By the summer of 2004, the EPA aims to finalize the rule for implementing the standard
By 15 April 2004, the EPA will promulgate final attainment designations	By December 2004, the EPA hopes to promulgate final $PM_{2.5}$ attainment designations based on the most recent three years of complete data available (2001–2003)
In the 2007–2008 timeframe, states must submit to the EPA their plans for attaining the standards	By December 2007, states must submit their plans for attaining the standards to the EPA
Between 2007 and 2019 (or longer), states must attain the standards	Between 2010 and 2014, states must attain the standards

3.1.4 Review of the Ozone and PM NAAQS

As indicated above, the Clean Air Act requires the EPA to review the NAAQS every five years. The schedule for the revised ozone and PM NAAQS was altered because of litigation. In May

2003, the EPA and a coalition of environmental groups announced the settlement of a lawsuit establishing a new schedule for the review of the existing standards. The schedule specified in this legal settlement is summarized in Table 3.3. The review of the PM NAAQS is proceeding ahead of the ozone NAAQS review. The EPA has released preliminary staff drafts and intends to issue a new PM health risk assessment late in 2004.

Table 3.3: Schedule for Review and Possible Revision of the Ozone and PM NAAQS in US

Ozone NAAQS	PM NAAQS
By 20 December 2004 the EPA will issue a final Criteria Document for ozone	By 31 March 2005, the EPA will sign for publication in the *Federal Register* a proposed rulemaking with its proposed decision concerning the review for PM; EPA will also propose new standards if it is then appropriate
By 31 March 2006, the EPA will sign for publication in the Federal Register a proposed rulemaking with its proposed decision concerning the review for ozone; EPA will propose new standards if appropriate	By 20 December 2005, the EPA will sign the final rulemaking for publication in the *Federal Register*
By 20 December 2006, the EPA will sign the final rulemaking for publication in the *Federal Register*	

3.1.5 Formulating Air Quality Strategies

When it comes to formulating the strategies for achieving the NAAQS, there is a division of responsibility between the EPA and the states. In areas that are failing to meet the air quality standards, the states must develop plans for improving the air quality situation. The states embody the selected strategies into a document known as a State Implementation Plan (SIP). The EPA approves or disapproves the state plans, and has the authority to impose sanctions on non-complying states. The Agency may devise a federal plan known as a Federal Implementation Plan (FIP) to meet the standards. States must also have programs that prevent significant deterioration of air quality in areas that are found to meet the NAAQS.

Title I of the Clean Air Act creates a tiered regulatory program for nonattainment areas for some of the criteria pollutants. For example, under the previous ozone standard, nonattainment areas were classified as marginal, moderate, serious, severe and extreme. The Act also provides for less complex tiered systems for carbon monoxide and particulate matter. This classification system is significant because it determines the control measures that states must adopt. As an area's classification increases in severity, a more stringent set of air pollution controls becomes applicable, but with more time provided to meet the standard. Some of the mandatory control measures required in ozone nonattainment areas include: low Reid vapor pressure gasoline, reformulated gasoline, vehicle inspection and maintenance programs, gasoline vapor recovery systems, alternative fueled vehicles, transportation control measures (e.g., commuter lanes), and emission standards for stationary sources.

The process followed when a SIP is drafted involves development of a statewide emissions inventory (to identify the sources of pollution), air quality modeling (to determine the pollution reductions required to meet the standards), and an analysis of the programs and policies available

for reducing criteria pollutant emissions. This evaluation typically requires several years to complete. The proposed strategies are then subjected to a formal rulemaking process, which involves publication of the proposal, public meetings, hearings, and review of public comments. Once the programs and policies have been reviewed and adopted by the state, a revised SIP is submitted to the EPA for review and approval. The SIP revision is federally enforceable after it has been approved by the Agency. The SIPs are revised and updated when new federal or state pollution control requirements are enacted, when new data improve modeling techniques, when a specific area's attainment status changes, or when an area fails to reach attainment within the timeframe allowed by the Clean Air Act.

The states are not alone in their efforts to achieve the NAAQS. The Clean Air Act establishes several important federal programs aimed at reducing criteria pollutant emissions, including the New Source Review (NSR) program, the New Source Performance Standards (NSPS), and programs aimed at reducing pollution transport. These programs are mandated by Title I of the Clean Air Act.

3.1.6 New Source Review and New Source Performance Standards

Under the NSR program, anyone who seeks to construct a new stationary source that will be a major source of regulated pollutants must obtain a permit from State authorities before beginning construction. In order to obtain the permit, the owner or operator must, among other things, demonstrate that the new source will have state-of-the-art pollution control devices. The NSR program also applies to existing sources if they undergo a "modification." A major modification qualifies for NSR treatment if it is a "physical change or change in the method of operation of a major stationary source that would result in a 'significant net emissions increase' of any pollutant subject to regulation under the Act."

NSR is really two programs, with the applicable program depending on the attainment status of the area where the plant is located. The Prevention of Significant Deterioration (PSD) program applies to preconstruction permitting in areas that are in attainment or unclassifiable. Nonattainment NSR applies in areas that are in nonattainment. A source may be subject to both the PSD and the nonattainment NSR permitting requirements at a single facility if the area where it is located is classified as attainment for some pollutants but nonattainment for others. Generally, the discussion that follows lumps the PSD and nonattainment programs together in this discussion under the nomenclature "NSR."

The specific control strategies required by the NSR program depend on whether the construction activity is subject to PSD or nonattainment NSR. A PSD source must install the Best Available Control Technology (BACT). BACT standards are determined on a case-by-case basis at the time of application. The analysis incorporates review of environmental, energy and economic impacts. A nonattainment NSR source must meet the Lowest Achievable Emission Rate (LAER). LAER is determined on a case-by-case basis using the same criteria as BACT, except economic impacts are not considered. A nonattainment NSR source must also offset any emissions increases remaining after application of LAER with emissions decreases (called "offsets") from other sources that affect the nonattainment area.

The EPA maintains an online database of BACT/LAER technologies known as the RACT (Reasonably Available Control Technology)/BACT/LAER Clearinghouse or RBLC. The database is intended to assist state and local environmental officials in determining the types of controls and pollution prevention measures that have been required for different source categories and the effectiveness of these technologies. Because the database is not always up to date with the latest permitting activities, it is usually necessary to supplement the clearinghouse information.

For certain categories of major new stationary industrial sources built or modified after 1970, regardless of location, the Act requires the agency to develop nationally uniform, technology-based standards (known as New Source Performance Standards or NSPS standards) that establish emission limits for both criteria and hazardous pollutants listed in the Act. These are determined by the best "adequately demonstrated" control technology available (see Section 111 of the Clean Air Act). The NSPS standards establish the minimum level of control for covered sources. The NSR program requirements, described above, are generally more stringent because BACT and LAER are re-evaluated for every case, whereas the NSPS requirements are fixed to the date of promulgation.

3.1.7 Reducing Emissions from Mobile Sources and Fuels

Under Title II of the Clean Air Act, the federal government has the primary authority to reduce emissions from mobile sources, which include automobiles, lawn mowers, diesel engines, and many other sources. The EPA has developed a full range of emissions standards, including fuel parameter controls designed to reduce emissions from these sources. For example, the EPA's Tier II program requires significant reductions in sulfur levels in gasoline and the introduction of low emitting vehicles starting in 2004. In 2007, diesel engine emission standards coupled with low sulfur diesel fuel will apply to on-highway vehicles. Similar standards have also been adopted to address nonroad diesel engines.

Additionally, the EPA is developing voluntary initiatives that also help support the introduction of technologies to reduce emissions from mobile sources. The retrofit program has been successful in working with industry, states, and nongovernmental organizations in developing local programs for the introduction of cleaner engines and low sulfur fuels. The Clean School Bus USA program is a good example of these efforts. Another voluntary program is the SmartWay Transport program in which the EPA works with the ground freight industry to reduce freight and fleet sector fuel consumption and related air pollutant emissions.

The states have a prominent role in this effort as well, especially in the area of fuel controls. In addition, California has its own authority to set mobile source emissions standards for air pollutants, provided the program meets certain criteria listed in the Clean Air Act.

3.1.8 Addressing Air Pollution Transport

The Clean Air Act also provides the EPA with the authority to address transboundary air pollution. In some areas of the country, transported air pollution can be a significant contributor to local air quality problems. In these situations, state air quality officials may find it very

difficult to meet the federal air quality standards unless something is done to address the pollution entering the state from upwind states.

Section 110 (a)(2)(D) of the Clean Air Act gives the EPA the authority to require state plans to prohibit "any source from emitting any air pollutant in amounts which will contribute significantly to nonattainment in, or interfere with maintenance by, any other State." Based on this authority, the EPA has required states in the eastern United States to reduce their summertime NO_x emissions in order to address widespread nonattainment with the ozone NAAQS. This program is known as the "NO_x SIP Call" (i.e., a request for states to submit SIP amendments). The NO_x SIP Call requires states throughout the Eastern United States to revise their SIPs to reduce the amount of ozone that is transported downwind. Based on air quality modeling, the EPA determined the NO_x emissions that states would be allowed to release to the atmosphere each year. The states then had to decide on the strategies they would use to meet these emission budgets. The Clean Air Act, under Section 110, prohibits the EPA from dictating the precise control measures that states must use. The Agency, however, was able to propose a model cap-and-trade program for power plants and other large industrial boilers (modeled after Title IV), and ultimately all of the states opted to participate because it offered the most cost-effective alternative for reducing NO_x emissions. Compliance with the NO_x SIP Call is required beginning in May 2004.

Currently, the EPA is in the midst of developing a new rulemaking aimed at addressing the widespread nature of the fine particulate problem in the eastern US as well as noncompliance with the new 8-hour ozone standard. The Interstate Air Quality Rule proposes state emission budgets (for NO_x and SO_2) based on regional scale air quality modeling, as was done previously for the NO_x SIP call. The EPA has also proposed a model trading program for regulating emissions of NO_x and SO_2 from power plants. The EPA proposed the Interstate Air Quality Rule (now known as the Clean Air Interstate Rule) in late 2003 and expects to issue a final rule in 2005. Emission reductions would be required in two phases in 2010 and 2015.

Section 126 of the Clean Air Act allows states to petition the EPA to take action to mitigate the transport of air pollutants from stationary sources located in other states. For example, eleven states (Connecticut, Delaware, Massachusetts, Maryland, Maine, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont) and the District of Columbia petitioned the EPA in 1997–1999, arguing that certain stationary sources in upwind states are emitting NO_x emissions that contribute significantly to ozone nonattainment or maintenance problems in the petitioning state. In 2004, North Carolina filed a Section 126 petition with respect to the 8-hour ozone and fine particulate standards. Similar petitions could conceivably be filed in the future.

3.1.9 The Acid Rain Program

The Acid Rain Program, established under Title IV of the 1990 Clean Air Act Amendments, requires reductions in SO_2 and NO_x emissions from power plants. The program sets a cap on the total amount of SO_2 that can be emitted from power plants in the United States. It employs a cap-and-trade mechanism for SO_2. The program also sets emission rate limits on NO_x emissions (but not a cap) from certain coal-fired electric utility boilers. The Acid Rain Program has two phases:

- Phase I – applied primarily to the largest coal-fired sources from 1995 through 1999 for SO_2 and 1996 through 1999 for NO_x;

- Phase II – applies to thousands of electric generating units and became effective in 2000 for both SO_2 and NO_x.

The SO_2 trading program is considered by many observers to be a great success. By 2002, SO_2 emissions from power plants were 41 percent lower than they were in 1980. This cap-and-trade approach establishes an annual limit on the quantity of pollution that regulated sources can release to the atmosphere. A cap-and-trade program does not specify the quantity of emissions that an individual power plant can emit; rather, it distributes allowances to affected sources in a quantity equivalent to the cap. Companies are allowed to trade allowances or bank them for future use, but at the end of each year they must hold a quantity of allowances that is equal to or greater than their actual emissions. This process encourages investment in the most cost-effective control strategies, minimizing the overall costs of the policy.

The Acid Rain Program also has helped the US address the goals established under the 1991 Canada-United States Air Quality Agreement. This agreement established a formal and flexible method of addressing transboundary air pollution. Although the initial focus of the Agreement was on acid rain, Canada and the United States recently expanded cooperative efforts to control transboundary ground-level ozone and to conduct joint analyses on transboundary particulate matter.

3.1.10 Addressing Visibility Improvement

In 1999, the EPA announced a major effort to improve air quality in national parks and wilderness areas. The Regional Haze Rule calls for state and federal agencies to work together to improve visibility in 156 national parks and wilderness areas such as the Grand Canyon, Yosemite, the Great Smoky Mountains, and Shenandoah. The rule requires the states, in coordination with the EPA, the National Park Service, the US Fish and Wildlife Service, the US Forest Service, and other interested parties, to develop and implement air quality protection plans to reduce the pollution that causes visibility impairment. The first state plans for regional haze are due in the 2003–2008 timeframe. Five multi-state regional planning organizations are working together now to develop the technical basis for these plans.

3.2 Reducing Hazardous Air Pollutant Emissions

The Clean Air Act establishes a very different regime for addressing emissions of hazardous air pollutants. Section 112 of the Clean Air Act authorizes the EPA to establish emissions standards for the control of hazardous air pollutants (HAPs), which are sometimes also referred to as "air toxics." The emissions standards are known as maximum achievable control technology, or MACT, standards. The Act specifies 189 such chemicals[11] that are known to present or are suspected of presenting a threat of adverse human health or environmental effects. The US EPA looked at a subset of 33 pollutants (including diesel particulate matter which is not on the

[11] Of the original 189 chemicals listed in the 1990 Clean Air Act Amendments, the EPA has subsequently exercised its authority to delist caprolactam and in 2003 began the process of delisting methyl ethyl ketone (MEK).

section 112 HAPs list) in an assessment of air toxics at the national and regional scales. This assessment identified acrolein, benzene, chromium, and formaldehyde as among the biggest drivers for cancer risk and noncancer hazard at the national scale, and a number of other air toxics were of concern at the regional scale.

3.2.1 Setting Goals and Objectives

The 1990 Clean Air Act Amendments completely overhauled the pre-existing program for HAPs. The new Amendments shift the focus of the air toxics program from a risk-based chemical-specific approach to a source category, technology-based strategy. In contrast to its predecessor, the new section 112 in the Clean Air Act includes a statutory listing of substances presumed to require regulation, and directs the Agency to identify categories of sources that emit substantial quantities of one or more of the listed air toxics. The EPA has compiled this list of "major sources" subject to regulation. Congress defined "major source" as any stationary source or group of stationary sources at a single location and under common control that emits or has the potential to emit 10 tons per year or more of any HAP or 25 tons per year or more of any combination of HAPs. Section 112 further requires the EPA to list categories and subcategories of area sources (i.e., stationary sources that are not major) provided those sources meet one of the following statutory criteria: (1) the EPA determines that the category or subcategory of area sources presents a threat of adverse effects to human health or the environment in a manner that warrants regulation under section 112; or (2) the category or subcategory of area sources falls within the purview of section 112(k)(3)(B) (see below). Once the EPA has listed a source category, whether it is a category of major sources or area sources, section 112(d) calls for the promulgation of emission standards.

Section 112 of the Clean Air Act also establishes a second phase of regulation to address risks that remain following the implementation of the MACT program, the so-called "residual risk standards." This risk-based phase requires that the EPA determine whether more stringent standards are required after application of MACT controls to protect public health and the environment. The risk-based standards would be necessary only in those instances in which the technology-based standards are not adequately protective of public health and the environment. The Clean Air Act requires that the EPA promulgate residual risk standards generally within eight years of promulgating the applicable MACT standard for any given source category.

3.2.2 Formulating Hazardous Air Pollutant Strategies

The standards for each source category, and by extension the strategies that are available to meet the standards, depend on the EPA's determination of the "MACT floor." The MACT floor for *new sources* is the level of HAP emissions control currently achieved by the best-controlled similar source. The MACT floor for *existing sources* is the average level of HAP emissions control achieved by the best performing 12 percent of the currently operating sources (or the best performing five sources in categories with fewer than 30 sources). The MACT standard may require more stringent controls than the MACT floor. These "beyond-the-floor" standards consider the cost and feasibility of more stringent controls. The MACT standard for a given source category may not, however, be less stringent than the MACT floor.

The Clean Air Act required the EPA to promulgate MACT standards for all categories and subcategories of HAP emission sources (other than utility boilers) by 15 November 2000. (Standards for some source categories were actually required earlier than this.) However, the EPA entered into settlements that set later promulgation dates for some source categories. The EPA signed a number of final MACT rules by the August 2003 settlement deadline and is on schedule to sign the additional standards by its February 2004 deadline. Therefore, most of the MACT standards have now been promulgated.[12]

Utility steam generating sources were subject to special study. The Clean Air Act required the EPA first to determine whether regulation under section 112 is necessary. In December 2000, the EPA released its *Regulatory Finding on the Emissions of Hazardous Air Pollutants from Electric Utility Steam Generating Units*. The EPA concluded that regulation of HAPs from coal- and oil-fired electric (but not natural gas-fired) utility steam generating units is necessary, and that mercury is the air toxic of most serious concern (with the National Academy of Science supporting the EPA's view regarding the toxicity of mercury). The EPA proposed national emissions standards for HAPs and standards of performance for electric utility steam generating units in late 2003. A final rule is expected to be issued in 2004. The proposed emissions standards would regulate mercury air emissions from new and existing coal-fired electric utility steam generating units and nickel air emissions from new and existing oil-fired electric utility steam generating units. In addition to the proposed emissions standards, the EPA proposed an alternative approach which would implement a cap-and-trade program using EPA's authority under section 111 of the Act. Under this program, mercury emissions from new and existing coal-fired utility steam generating units would be capped at specified nationwide levels.

In addition to regulating individual sources, Congress instructed the EPA to develop a strategy for air toxics in urban areas that includes specific actions to address the large number of smaller, area sources, and that contains broader risk reduction goals encompassing all stationary sources. The Air Toxics Strategy is the EPA's integrated framework for addressing air toxics in those urban areas by looking at stationary, mobile, and indoor source emissions. Air toxics can pose special threats in urban areas because of the large number of people and the variety of sources of toxic air pollutants, such as cars, trucks, large factories, gasoline stations, and dry cleaners. Individually, some of these sources may not emit large amounts of toxic pollutants. All of these pollution sources combined, however, can potentially pose significant health threats, particularly to sensitive subgroups such as children and the elderly. The EPA is also concerned about the impact of toxic emissions on minority and low-income communities, which are often located close to industrial and commercial urbanized areas.

The EPA also is working to address air toxics emissions from mobile sources. The Clean Air Act requires the EPA to set (and periodically revise) motor vehicle and fuel standards that reduce emissions as much as possible, given technology, cost, and other factors. The Agency has identified 21 mobile source air toxics, set gasoline toxic emission performance standards, and laid out a Technical Analysis Plan to continue to conduct research and analysis on mobile source air toxics. Based on the results of that research, the EPA is reviewing the feasibility and need for additional controls in a proposal expected in December 2004.

[12] A list of promulgated MACT standards can be found at <http://www.epa.gov/ttn/atw/mactfnl.html>.

Finally, it is also possible for some air toxics (such as mercury) to be transported long distances and affect distant regions of the globe. The US is working to better understand and address such problems through several internationally-focused activities. For example, the US is party to the Stockholm Convention on Persistent Organic Pollutants (POPs), in which participating governments agree to take actions to reduce or eliminate the production, use, or release of certain of these pollutants.

3.3 Reducing Greenhouse Gas Emissions

The EPA does not regulate greenhouse gas (GHG) emissions, and historically, the President of the United States has set the course of climate change policy for the country. The United States has generally emphasized voluntary measures, tax incentives, and other positive policy actions, as opposed to mandatory regulation, although a variety of regulations enacted for other policy purposes—such as the Corporate Average Fuel Economy (CAFE) program—also serve the policy goal of reducing GHG emissions. The US is party to the United Nations Framework Convention on Climate Change (UNFCCC), which identified the goal of stabilizing atmospheric GHG concentrations at a level that will prevent dangerous human interference with the climate system. The United States, however, has not pursued ratification of the Kyoto Protocol.

3.3.1 Setting Goals and Objectives

Following a Cabinet level review of the climate change issue, the United States announced a goal of cutting US carbon intensity—the ratio of carbon emissions to gross domestic product (GDP)—8 percent over 10 years, from an estimated 183 metric tons per $1 million in GDP in 2002 to 151 metric tons by 2012. The US is pursuing this goal through a range of voluntary, mandatory, and incentive-based programs.

3.3.2 Formulating Climate Change Strategies

While the United States is not pursuing the Kyoto Protocol, the US is engaging the international community both through multilateral and bilateral activities. Multilaterally, the US remains actively engaged in, and provides funding for, the UNFCCC and the Intergovernmental Panel on Climate Change. The United States also leads major research and development projects for other energy sources, including the Generation IV International Forum, which is developing the next-generation nuclear systems, and the International Thermonuclear Experimental Reactor (ITER), to develop the potential for fusion energy. Since June 2001, the United States has engaged in bilateral partnerships with Australia, Canada, China, seven Central American countries (Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama), the European Union, India, Italy, Japan, New Zealand, Republic of Korea, the Russian Federation and South Africa on issues ranging from climate change science to energy and sequestration technologies to policy approaches. Taken together, these bilateral agreements include countries that account for over 70 percent of global GHG emissions. Two of the most notable international initiatives of the US are the International Partnership for the Hydrogen Economy to accelerate the global transition to a hydrogen economy and the Hydrogen Fuel Initiative**.** The Carbon Sequestration Leadership Forum, which seeks to develop new cost-effective technologies to capture and store emissions

from utilizing coal and other fossil fuels and the related US FutureGen Initiative is an international effort among governments and private sector partners to create the world's first coal-based, zero emissions electricity and hydrogen power plant. This project is designed to dramatically reduce air pollution and capture and store greenhouse gas emissions.

Federal government agencies administer nearly 60 different voluntary programs to encourage energy efficiency, agricultural practices, and GHG reductions. For example, the EPA has a series of voluntary government/industry partnership programs that promote voluntary actions to reduce GHG emissions. Significant EPA initiatives include the Climate Leaders and SmartWay Transport Programs. Climate Leaders is a voluntary industry and government partnership that encourages companies to develop long-term comprehensive climate change strategies and set GHG emissions reduction goals. As of January 2004, 54 corporations have joined the Climate Leaders program and 20 of those have already announced voluntary reduction goals. SmartWay Transport is a voluntary partnership between various freight industry sectors and the EPA that establishes incentives for fuel efficiency improvements and greenhouse gas emissions reductions. By 2012, this initiative aims to reduce between 33 and 66 million metric tons of carbon dioxide emissions and up to 200,000 tons of NO_x emissions per year.

Another US government and industry partnership is the Department of Energy's Climate VISION (Voluntary Innovative Sector Initiatives: Opportunities Now) program. Climate VISION involves 12 industry sectors, representing 90 percent of US industrial GHG emissions, that have made commitments to reduce their GHG intensity over the next decade and, in some cases, beyond.

The Department of Energy also manages the Voluntary Greenhouse Gas Reporting program (commonly referred to as the 1605(b) program), which is the main federal program for reporting reductions in GHG emissions. The program began in 1994 and is currently undergoing extensive revisions to improve the accuracy, reliability, and verifiability of reported emissions and emissions reductions. The DOE, the EPA, and other federal agencies have established programs to encourage companies, trade associations and other nongovernmental organizations to take voluntary actions to reduce, sequester, or avoid greenhouse gas emissions. For example, industry participants in the DOE's "Climate VISION" program and the EPA's Climate Leaders program have made voluntary commitments to reduce GHG emissions or emissions intensity by a specified amount, and to monitor and report on their progress. The US intends to use the 1605(b) program to document, where possible, the progress of participants in these voluntary Federal programs. Additional reporting, however, may be required for other specific voluntary Federal programs in order to provide distinct benefits to program participants.

The US Congress also has increased its activity on the climate change issue significantly over the last few years also. During its consideration of energy policy measures over the past several years, Congress has considered voluntary and mandatory GHG reporting programs, efficiency standards for consumer and commercial appliances, automobile fuel economy standards, tax incentives for low-emitting or non-emitting sources of energy and energy-efficient equipment, and regulatory controls on GHG emissions, either for a particular sector (electric power) or the economy as a whole.

Also in the US, many governments at the regional and state levels have enacted their own climate change policies and regulations, ranging from renewable energy portfolio requirements and tax incentives for energy-efficient technologies to voluntary GHG registries and GHG emissions reduction goals.

3.4 Key Contacts

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3.5 Key Web Sites

EPA Homepage
www.epa.gov

EPA Office of Air and Radiation
<http://www.epa.gov/oar/>

EPA Office of Transportation and Air Quality
<http://www.epa.gov/otaq>

EPA's National Ambient Air Quality Standards
<http://www.epa.gov/ttn/naaqs/>

The Clean Air Act
<http://www.epa.gov/air/oaq_caa.html>

EPA's Clean Air Markets Division – Emission Trading
<http://www.epa.gov/airmarkt/trading/index.html>

Technology Transfer Network Clean Air Technology Center RACT/BACT/LAER Clearinghouse
<http://cfpub1.epa.gov/rblc/htm/bl02.cfm>

EPA's Utility Mercury Reductions Rule
<http://www.epa.gov/mercury/actions.htm>

EPA's Interstate Air Quality Rule
<http://www.epa.gov/interstateairquality/>

EPA's Global Warming Web Site
<http://yosemite.epa.gov/oar/globalwarming.nsf/content/index.html>

DOE's Climate VISION Web Site
<http://www.climatevision.gov>

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