

**Availability and Infrastructure of North American
Electric Generating Utility Emission Inventories and
Opportunities for Future Coordination**

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1 Introduction

In an age of international air quality agreements and annexes, the Commission for Environmental Cooperation has identified a need for a state-of-knowledge application of emission inventories for purposes of public outreach, emission trends reporting, fulfilling data requests, control strategy application studies, benefit analyses, and estimating air quality in large regional areas. However, without consistent emission data sets within the domain of study, results of these applications can be speculative, at best. The Commission for Environmental Cooperation (CEC) has been working closely with North American federal environmental agencies to try and gather the latest emissions data which can be used to secure these end results.

The objective of this report is to demonstrate the comparability of techniques and methodologies for data gathering and analysis, data management, and electronic data communications for promoting access to publicly available environmental information held by public authorities of each of the three participating countries. By understanding what types of emissions data are collected and in what manner and frequency they are processed, managed, and distributed, we hope to provide the first steps in the development phase of a North American coordinated emission inventory. We have not attempted to characterize or compare emission totals in this report as these have been presented in previous work completed for the Commission.

Building on one of these previous reports (CEC 2002), we further the process in developing a comprehensive comparison of electric generating utility (EGU) emission source data with the goal of providing a summary of available EGU emission-related data and a synopsis of the data gaps necessary to fill in order to complete the development of a coordinated North American criteria, toxics, and greenhouse gas emission inventory.

Although the ultimate objective in a process such as this would be to collect and summarize these data for all source types and for all pollutants, these data are just not available at this time. In order to best identify a foothold on this process, the source category which is most reported by each of the Parties is focused upon. In this report, we have identified, acquired, and compiled available power plant data from across North America and utilized these data to try to address questions related to the application and improvement of these data for emission inventory users.

The report's final sections attempt to provide a discussion of the opportunities that exist in the current international framework which would allow the pursuit of a common set of comparable databases and the eventual transparent evaluation of North American emission inventories.

2 Data Sources

The generation of electricity from the burning of fossil fuels continues to be a significant source of air pollutants and greenhouse gases in Canada, Mexico, and the United States. Electric utilities are responsible for approximately 20 to 40 percent of all NO_x, CO₂, and mercury emissions and almost 70 percent of SO₂ emissions in the North American airshed. Through the evolution of this sector in an integrated energy market, it will become more and more important to track changes and compare emission sources to create equitable accessibility to these data for outreach, emission trends reporting, policy decision and application studies, allowance trading programs, benefit analyses, and estimating air quality on an international scale.

To date, this information has been varied in level of detail, reporting year, and methodology of estimation. Each of three participating Parties has requirements to report emissions and associated data for the electricity sector, but no common policy has been established. Through investigation of the available data and reports published by entities in each of the three countries, we have compiled a comprehensive list of the sources of emissions and associated unit data. This collection attempts to put into perspective what challenges still remain in order to prepare a uniformly available and comparable set of data.

2.1 Canada

2.1.1 National Pollutant Release Inventory

The National Pollutant Release Inventory (NPRI) is a database of information on annual releases to air, water, and land, and off-site transfers for disposal or recycling. Established in 1992 and legislated under the Canadian Environmental Protection Act, 1999 (CEPA 1999), the NPRI requires companies to report information on releases and transfers of pollutants to the Government of Canada on an annual basis. This information is made available in an annual public report issued by Environment Canada who maintains the supporting detailed inventory that can be accessed and searched through an online database.

In addition to the emissions data available in the NPRI, the locational, employment, and industrial classification data support a wide range of environmental initiatives and analyses, including toxic substance assessment, pollution prevention and abatement, air quality modeling, and community right-to-know. All NPRI data are accessible by the public and provide information on all sectors—industrial, government, commercial and others.

Being the only legislated, nationwide, publicly-accessible inventory of its type in Canada, the NPRI is a major starting point for identifying and monitoring sources of pollution in the country. It is an important consideration in managing risks to the environment and human health as well as in monitoring indicators for the quality of our air, land, and water. It is also emerging as an indicator for corporate environmental performance (Dunn 2003).

Public access to this inventory motivates industry to prevent and reduce pollutant releases. The Government of Canada uses the NPRI to track progress in pollution prevention, evaluate releases

and transfers of substances of concern, identify and take action on environmental priorities, and implement policy initiatives and risk management measures.

2.1.2 Criteria Air Contaminants Inventory

Every five years, Environment Canada issues a national inventory of criteria air contaminant (CAC) emissions from all sources in Canada, including both point and non-point (area and mobile) sources. This information is used as a basis for other air quality programs, including acid rain, particulate matter and smog. Summary data for provinces and industrial sectors are available for review and download on Environment Canada's Green Lane web site.

The 1995 Canadian Emissions Inventory of Criteria Air Contaminants is currently the most recent data available to the public for the air pollutants of sulfur oxides (SO_x), oxides of nitrogen (NO_x), volatile organic compounds (VOC), carbon monoxide (CO), particulate matter (PM), and ammonia (NH₃). The inventory provides national summary data as well as provincial emissions data. The inventory provides emissions estimates for approximately 80 different sector sources, which are condensed into 57 sector sources within five major categories (industrial, transportation, miscellaneous, non-industrial fuel combustion and incineration) in the final inventory report.

The national emission inventories are compiled by the Pollution Data Branch (PDB) of Environment Canada in collaboration with the provinces and territories. In general, emissions estimates from major industrial sources are compiled by the provinces. The PDB is responsible for compiling data on emissions from the remaining sources, which include anthropogenic and minor industrial sources, the transportation sources, and the fugitive and natural sources. Because of issues related to confidentiality of point source information, these data are not available at a facility- or unit-specific level. Summary information can be accessed and searched through the online Green Lane database.

2.1.3 Greenhouse Gas Inventory

As part of the Government of Canada's National Implementation Strategy on Climate Change, Environment Canada's Greenhouse Gas Division, Canada's central agency responsible for monitoring and reporting sources and sinks of greenhouse gases, has assumed additional responsibilities in support of domestic climate change actions and in support of Canada's commitments under the United Nations Framework Convention on Climate Change (UNFCCC).

The Greenhouse Gas Division of Environment Canada is responsible for developing, monitoring, analyzing and reporting emissions and removals of greenhouse gases. As part of these responsibilities, the Division is responsible for the development and publication of Canada's National Inventory Report to the United Nations on greenhouse gas emissions and removals. This annual report fulfills Canada's reporting obligations under the UNFCCC, which include an analysis of emission trends, factors affecting those trends, and detailed descriptions of the methods, models and procedures used to develop and verify the data.

Through an online database, greenhouse gas emissions, as submitted to the UNFCCC, can be queried by gas, sector, year, and at a provincial or national level. The data are not currently available in a facility- or unit-specific manner as the inventory is developed using a “top down” method using national fuel parameters and emission factors.

2.1.4 The Canadian Electricity Association Mercury Program

Eight coal-fired power generation companies in Canada have joined forces to develop and implement the Canadian Electricity Association (CEA) Mercury Program. The program is designed to improve the information base around the measurement and control of mercury emissions from coal-fired generation (CEA 2002).

Research and development, a two-phase laboratory analysis and quality assurance approach to coal research, and the improvement of the estimation of mercury through consistent sampling methods are the key components of the program. Building on significant efforts over the past few years, these coal-fired electric generation companies, in cooperation with governments, are embarking on a three-year program to reduce the uncertainties involved in this process. The program is designed to:

- Improve emission inventories and the development of management options through an intensive two year coal, ash and stack sampling program;
- Promote effective stack testing through the development of guidance material and the support of on-site training on the Ontario Hydro Method for employees, government representatives and contractors, on an as-needed basis;
- Strengthen laboratory analytical capabilities through analysis and quality assurance programs; and
- Create and maintain an information clearinghouse to ensure that all parties can keep informed on global mercury research and development activities.

The voluntary program is being implemented with regular, publicly available reporting of results. It is anticipated that the findings of this program will provide critical information for establishing and reviewing a mercury standard for Canada, and finding cost-effective and efficient management options for mercury emissions over the long-term. The unit- and facility-specific data collected during this process is being published in document form on a CEA clearinghouse.

The types of information provided in these documents are general facility information (owner, address, description of processes); fuel type and characteristics; general boiler information (number, type, in-service dates); boiler identification and capacity data; net generation information; pollution control equipment; emission summaries for SO_x, NO_x, PM, and mercury; and recent stack tests and stack test methods.

2.1.5 Other Canadian Emission Inventories

The Emission and Projections Working Group (EPWG), a technical working group made up of emission inventory, forecasting experts and practitioners within all provincial and territorial energy and environment ministries, the Greater Vancouver Regional District and the Federal Government of Canada, has been tasked with coordinating federal/provincial work in producing Canada's emission inventories and forecasts, specifically for criteria air contaminants and greenhouse gases. Recent reports published by the EPWG find that many provinces and regions develop their own inventories of criteria air contaminants for purposes of addressing air quality concerns (EPWG 2000).

These vary in level of detail, sector coverage and frequency of updating. Most are developed to provide data for provincial air quality programs such as ozone, acid rain and particulates, to determine time trends and to verify data for the national inventory. Some of the provincial inventories consider facility-specific emissions information to be confidential and therefore provide only sectoral-level analysis. Other provinces provide facility-specific data. Only a handful of provincial emission inventories provide facility specific data easily accessible on the Internet.

2.2 Mexico

2.2.1 National Emission Inventory

The draft Mexico National Emissions Inventory (NEI) is the result of significant efforts by many participants from Mexico, the United States, and Canada. This draft inventory and associated report contains preliminary emissions estimates for the six northern Mexican states of Baja California, Sonora, Chihuahua, Coahuila, Nuevo León, and Tamaulipas (ERG 2003).

For the EGU sector, the Mexican NEI is a compilation of inventory data collected by the Secretariat of Energy (*Secretaría de Energía—Sener*) and the Federal Electricity Commission (*Comisión Federal de Electricidad—CFE*) of emissions from individual power plants in Mexico, emission reports submitted under federal and state Annual Operating Reports (*Cédula de Operación Annual—COA*), and DATGEN (stands for “Datos Generales”) data elements.

This NEI contains estimates of nitrogen oxides (NO_x), sulfur oxides (SO_x), volatile organic compounds (VOC), carbon monoxide (CO), particulate matter less than 10 micrometers (µm) in aerodynamic diameter (PM₁₀) and less than 2.5 µm in aerodynamic diameter (PM_{2.5}), and ammonia (NH₃) emissions for the year of 1999. Although the point source emission inventory was compiled using emissions data for individual facilities, the initial report provides the emission inventory at the source category level due to confidentiality of the facility-level data. The final Mexican NEI emission inventory files will be made compatible with the US EPA's National Emissions Inventory Format (NIF) but to date no databases are available.

A second “draft final” report will contain the interim emission inventory for the entire country (i.e., six northern states and the remaining 25 Mexican states, plus the Federal District). The third and “final” report will contain the final emission inventory for the entire country as well as

estimates at the municipality level for all sources of air pollution occurring in 1999 and is expected to be released in July 2004.

2.2.2 National Power Plant Inventory for 1999

The Secretariat of Energy and the Commission of Federal Electricity developed an inventory of emissions from individual power plants in Mexico (ERG 2003). The types of information provided as part of this inventory include a plant name and identification code; industrial classification for the facility (e.g, thermoelectric, carboelectric); the spent fuel type and quantity; the fuel sulfur content; the plant generation (e.g., gigawatt-hours); and emissions by facility for the air pollutants CO, NO_x, non-methane organic compounds (NMOC), SO₂, and total suspended particulates (TSP). As with the Mexican NEI, no databases have been made publicly available.

2.2.3 Federal COAs

Federal COAs are emission reports from federal point sources that are submitted directly to Mexico's National Institute of Ecology (*Instituto Nacional de Ecología*—INE) or via the Secretariat of the Environment and Natural Resources (*Secretaría de Medio Ambiente y Recursos Naturales*—Semarnat) delegations located in each state. These federal point source categories include industrial facilities in eleven sectors, one of which is electrical energy generation. COAs collect the following types of information relevant to Mexico inventory development, although the COAs are inconsistent with regard to their completeness pertaining to this information: general facility information (name, address, municipality); emissions for various criteria air contaminants and CO₂; raw materials (chemicals used); output products; fuel type and usage; energy consumption; equipment type and operating characteristics (capacity, hours in operation, fuel); emission release point physical characteristics (height, temperature, flow, velocity, diameter); and pollutants and monitoring methods.

2.2.4 State COAs

State COAs are emission reports from state point sources that were submitted to the state environmental agencies (SEAs). State jurisdiction point sources are industrial facilities not included within the eleven federal sectors and not located within a federal zone. Generally, industrial facilities under state jurisdiction include operations that a state requires to obtain and update an operating permit. The types of industries required to obtain permits are determined at the discretion of the SEA; therefore, the categories considered to be point sources may vary between states. For the Mexican NEI, all facilities under federal or state jurisdiction were considered to be point sources.

2.2.5 DATGEN

DATGEN is a spreadsheet containing emission inventory information for federal and state point sources (mainly combustion emissions), located in areas where air quality plans have already been developed (ERG 2003). DATGEN (stands for "Datos Generales") is updated every two

years. The areas and the year for their emission inventory contained in the current DATGEN are as follows:

- Mexico City Metropolitan Area and Valley of Mexico, DF and the State of Mexico, (preliminary for 2000);
- Guadalajara, Jalisco (1995);
- Metropolitan Zone of Monterrey, Nuevo León (1995);
- Tijuana, and Rosarito, Baja California (1998);
- Ciudad Juárez, Chihuahua (1996);
- Valley of Toluca, Mexico (preliminary 2000);
- Mexicali, Baja California (1996); and
- La Laguna (i.e., Torreón, Coahuila, and Lerdo and Gómez Palacios, Durango) (2002).

Multiple worksheets collect inventory information for the facilities located in these areas. These worksheets contain the following information; facility name, fuel type and usage, emissions (mainly NO_x and SO₂ emissions; some CO, VOC, and PM emissions) in megagrams per year (Mg/year); location (latitude and longitude), quantity of raw material processed, quantity of materials manufactured or produced, fuel type and usage; and stack parameters (e.g., type, height, temperature, flow rate).

2.3.6 National Communication

Because of its status as a non-Annex I Party to the United Nations Framework Convention on Climate Change (UNFCCC), Mexico is not required to submit to the secretariat a national greenhouse gas inventory of anthropogenic emissions. Considered a non-Annex I Party, Mexico must report in more general terms on their actions to address climate change and adapt to its effects. The First National Communication was submitted to the United Nations Framework Convention on Climate Change in 1997. This first report included the advances and results of studies, workshops, courses, talks and publications on vulnerability, and inventories of greenhouse gas emissions.

The preparation of the Second National Communication of Mexico on Climate Change began in 2000 and was ratified on September 7 of the same year. The document includes the updating of the National Greenhouse Gas Emissions Inventory for the period 1994–1998. The figures of the inventory for land use and land-use change for 1998 will be published later as an annex to the Communication, as soon as the validation of the National Forest Inventory prepared in 2000 is completed.

2.3.7 Other Mexican Emission inventories

Other metropolitan- and regional-scale inventories have been conducted in Mexico for purposes of air quality planning and assessments (ERG 2003). Several of these inventories, which are

listed below according to their geographic area and base year, provided building blocks for the Mexican NEI but contain limited information related to electric generation sources not already found in the inventories listed above:

- Mexico City Metropolitan Area and Valley of Mexico (1998);
- Guadalajara (1995);
- Monterrey (1995);
- Ciudad Juárez (1996);
- Toluca (1996);
- Mexicali (1996); and
- Tijuana, Tecate, and Rosarito (1998).

2.3 United States

2.3.1 National Emission Inventory

The US EPA's Emission Factor and Inventory Group prepares a national database of air emissions information with input from numerous state and local air agencies, from tribes, and from industry. This National Emission Inventory (NEI) database contains information on stationary and mobile sources that emit criteria air pollutants and their precursors, as well as hazardous air pollutants (HAPs). The database includes estimates of annual emissions of air pollutants by source in each area of the country, on an annual basis. These estimates are for all 50 states, the District of Columbia, Puerto Rico, and the US Virgin Islands. Individual point or major sources (facilities), as well as county level emission estimates for area, mobile and other sources, are available currently for years 1985 through 1999 for criteria pollutants, and for years 1996 and 1999 for HAPs (EPA 2001).

For the EGU sector, the NEI is a compilation of inventory data from state-submitted data required under Clean Air Act regulations, from the Emissions and Generation Resource Integrated Database (eGRID), and from various data and compliance reports published by EPA's Clean Air Markets Division.

Locational information, physical characteristic data, and applied control technology elements make these data from the NEI useful for air dispersion modeling, regional strategy development, regulation establishment, air toxics risk assessment, and tracking trends in emissions over time. For emission inventories prior to 1999, criteria pollutant emission estimates were maintained in the National Emission Trends (NET) database and HAP emission estimates were maintained in the National Toxics Inventory (NTI) database. Beginning with 1999, criteria and HAP emissions data are being prepared in a more integrated fashion in the NEI, which takes the place of the NET and the NTI.

These data are made available to the public through an online query tool, static emission summaries, and databases at the source or facility/unit level.

2.3.2 Emissions and Generation Resource Integrated Database

The Emissions and Generation Resource Integrated Database (eGRID) is a comprehensive source of data on the environmental characteristics of virtually all electric power generated in the United States. The eGRID integrates 24 different federal data sources. It provides information on air emissions and resource mix for individual power plants, generating companies, states, and regions of the power grid. The data are expressed in terms that allow direct comparison of the environmental attributes of electricity generation at any level. This database also reports changes in ownership and industry structure as well as power flows between states and grid regions.

Using data from eGRID, US states can help consumers exercise the choice of how their power is generated and seek cleaner sources of electricity such as wind and solar power. For US state and local policymakers, eGRID data can be used to support consumer information disclosure, renewable portfolio standards, development of emission inventories and emission standards, analysis of changing power markets, and estimation of avoided emissions. Aggregation of eGRID data facilitates comparison of the environmental attributes of different companies, states, and grid regions.

These data have been made available through a data browsing application and through spreadsheets provided for user review. An online query tool to eGRID data is expected in late 2003.

2.3.3 Clean Air Markets Division Emissions Data & Compliance Reports

EPA's Clean Air Market Programs collect data from electric power plants and other generation facilities. Compliance reports provide emission levels, allowances banked and other information nationally and for each regulated unit. Emissions scorecard data for units affected by the Acid Rain Program provide data, including SO₂, NO_x, and CO₂ emissions and heat input. These scorecard data are recorded for regulated sources with continuous emissions monitors (CEM) and reported under the emission tracking system (ETS) at the hourly level of aggregation. The hourly data are then processed and provided in raw form or in seasonal summaries for each generator. Facility and unit identification codes and industrial classification, control equipment types and parameters, fuel types, heat input, operating parameters, and CO, SO_x, and NO_x emissions and emission rates are provided with these data.

2.3.4 Inventory of US Greenhouse Gas Emissions and Sinks

The *Inventory of US Greenhouse Gas Emissions and Sinks* is a catalog of anthropogenic greenhouse gas (GHG) emissions in the United States. Carbon dioxide can also be sequestered (i.e., stored) in "sinks" that result from forestry and other land-use practices. Excluding all naturally occurring greenhouse gas emissions and sinks, the inventory provides a detailed record of all emissions and sinks directly attributable to human activities. It does not address naturally occurring emissions or sinks.

This is the official national GHG inventory of the United States and is submitted by EPA directly to the US State Department for the purpose of meeting international treaty reporting

requirements under the United Nations Framework Convention on Climate Change. It is currently prepared by EPA with coordination from the Energy Information Administration and trade associations who share energy data and source information. The data are not currently available in a facility- or unit-specific manner, as the inventory is developed using a “top down” method, using national fuel parameters and emission factors.

Table 2.1 Electric Generating Data Element Comparison

Data Element	Currently Available Data Sets ¹					
	United States			Canada ²		Mexico
	NEI	eGRID	CEM	NPRI	CAC	NEI (NPPI) ³
Inventory Year	X	X	X	X	X	X
Facility Identification	X	X	X	X		X
Unit Identification	X	X	X			
Unit Capacity	X	X	X			
Primary Fuel Type	X	X	X			X
Fuel Characteristics	X	X				X
Fuel Throughput	X	X				X
Heat Input		X	X			
Generation Output		X				X
Emissions	X	X	X	X	X	X
Emission Factors	X	X	X			X
Operating Schedule	X		X	X		
Location Data	X	X		X		
Stack Parameters	X			X ⁴		
SIC / NAICS	X			X		X
Control Equipment	X		X	X		

¹ NEI – National Emission Inventory, eGRID—Emissions and Generation Resource Integrated Database, CEM—Continuous Emissions Monitors, NPRI—National Pollutant Release Inventory, CAC—Criteria Air Contaminants Inventory, NPPI—National Power Plant Inventory for 1999

² NPRI and CAC reporting will be combined starting in 2004.

³ Not currently available electronically. Expected in July 2004.

⁴ For stacks ≥ 50 meters meeting emission thresholds.

3 Reporting Regulation

3.1 Canada

3.1.1 Canadian Environmental Protection Act

The *Canadian Environmental Protection Act, 1999* (CEPA 1999) is designed to protect the environment and human health and to promote sustainable development. It contains information-gathering provisions, including some that allow the Minister of the Environment to request information on certain substances. The provisions also require the Minister to establish and publish a national inventory of releases of pollutants.

Under the authority of CEPA 1999, Environment Canada requires owners or operators of facilities that manufacture, process or otherwise use one or more of the NPRI-listed substances under prescribed conditions to report to the NPRI. Beginning in 2002, Environment Canada also requires reporting of criteria air contaminants, in addition to hazardous air pollutants, to the NPRI.

Established in 1992 and legislated under the CEPA, the NPRI requires companies to report information on releases and transfers of pollutants to the Government of Canada on an annual basis. Environment Canada makes the information available to Canadians in an annual public report, and maintains a detailed inventory that can be accessed and searched through an online database.

If a facility meets the NPRI reporting thresholds for the list of substances specified in the *Canada Gazette*, the company must report the following:

- information about the company, its location and number of employees;
- information about each substance that meets the reporting requirements, including the substance name and Chemical Abstracts Service registry, the nature of the activities (such as whether the substance is manufactured, processed or otherwise used at the facility);
- the quantity of the substance that is released at the facility to water, air or land, and/or underground injection;
- the quantity of the substance that is transferred off site to another location for final disposal or treatment prior to disposal and the nature of the treatment;
- the quantity of each reported substance that is transferred off-site for recycling and for energy recovery, and the address of the receiving facility;
- the reasons for year-to-year changes in releases, transfers and recycling;
- information on anticipated changes (mandatory for the three years following the reporting year) in releases, transfers and recycling; and
- information on the types of pollution prevention activities undertaken at the facility.

3.2 Mexico

3.2.1 General Law of Ecological Balance and Environmental Protection

Title IV of the General Law of Ecological Balance and Environmental Protection (*Ley General del Equilibrio Ecológico y la Protección al Ambiente*—LGEEPA) establishes the regulatory framework for Mexico's air quality program. Article 111 of Title IV requires that the Secretariat of the Environment and Natural Resources (*Secretaría de Medio Ambiente y Recursos Naturales*—Semarnat) develop and periodically update an air emission inventory of the pollutant sources under federal jurisdiction. Also, Semarnat must coordinate with state and municipal governments to integrate regional inventories and a national inventory. The National Institute of Ecology (*Instituto Nacional de Ecología*—INE), as the research entity within Semarnat, is the lead agency for development of the Mexican NEI. Maintaining and updating the Mexican NEI is the responsibility of Semarnat's Undersecretariat of Environmental Management (*Subsecretaría de Gestión para la Protección Ambiental*).

On 31 December 2001, Article 109-bis of the LGEEPA was modified to require pollution sources to provide information to Semarnat (or states, municipalities, and the Federal District, depending on jurisdiction) for purposes of developing an inventory of emissions and transfers of pollutants to the air, water, soil and subsoil, materials and waste. This inventory is called the Pollutant Releases and Transfers Register (*Registro de Emisiones y Transferencia de Contaminantes*—RETC). Article 109-bis as modified also requires that the information will be made public and accessible. The proposed mechanism for submitting these data is the Annual Operating Certificate (*Cédula de Operación Anual*—COA). Semarnat has drafted regulations to implement the COA and its submittal schedule, but these regulations were not yet final as of September 2003. Future mandatory reporting and the level of information that is made publicly available will determine the feasibility of future updates to the Mexican NEI.

3.3 United States

3.3.1 Consolidated Emissions Reporting Rule

The Consolidated Emissions Reporting Rule (CERR) was published in the *Federal Register* on 10 June 2002 (FR Volume 67, Number 111, pp 39602), and an Information Collection Request (ICR) addressing point source PM_{2.5} and NH₃ was approved on 20 June 2003 (FR Volume 68, Number 119, pp 39682). The purpose of the CERR and ICR are to simplify reporting, offer options for data collection and exchange, and unify reporting dates for various categories of criteria pollutant emission inventories. The rule applies to US state and local agencies. Previous reporting requirements have, at times, forced reporting agencies into inefficient collecting and reporting activities. This rule consolidates the emission inventory reporting requirements found in various parts of the US Clean Air Act (CAA). Consolidation of reporting requirements will enable state and local agencies to better explain to program managers and the public the necessity for a consistent inventory program, increases the efficiency of the emission inventory program, and provide more consistent and uniform data.

The first emissions reportable under the CERR are annual point source emissions for the year 2001 and are due 1 June 2003. States will be required to prepare a comprehensive statewide inventory every three years with a required annual reporting for the largest point sources. The first three-year inventory will be for the year 2002 and will be due 1 June 2004.

All anthropogenic source categories must be reported under the rule. Data elements that States must report include:

- the starting and ending dates and year of the emissions data;
- general information about the facility, including its location and industrial classification;
- identification of each process and unit located at the facility;
- information about each pollutant that meets the reporting requirements, including the process and source category code (SCC) from which the pollutant is generated;
- activity (fuel spent, vehicle miles traveled, etc.) and emission factors used to estimate pollutant releases;
- information about the physical characteristics of the fuel used (ash, heat, sulfur content);
- operating schedule and parameters of each process (seasonal throughput, hours per day, days per week, etc.);
- latitude and longitude of each unit or process at the facility;
- physical emission release point characteristics (height, diameter, temperature, flow);
- unit design capacity and maximum nameplate capacity (MMBtu/hr or MW);
- control equipment type and efficiencies by pollutant; and
- resulting annual and summer season daily emissions.

3.4 United Nations Framework Convention on Climate Change

Under the United Nations Framework Convention on Climate Change (UNFCCC), the United States, Canada, and Mexico along with other countries, agreed to develop and submit national inventories of anthropogenic greenhouse gas emissions and sinks. Under the direction of the Intergovernmental Panel on Climate Change (IPCC), hundreds of scientists and national experts collaborated in developing a set of methodologies and guidelines to help countries create inventories that are comparable across international borders. The information presented in the GHG inventories for each of the North American countries is in full compliance with these IPCC guidelines.

Canada and the United States are considered Annex I Parties in the UNFCCC. In accordance with Articles 4 and 12 of the Convention, and the relevant decisions of the Conference of the Parties (COP), Parties to the Convention submit to the UNFCCC Secretariat national greenhouse gas inventories and sinks of anthropogenic emissions of greenhouse gases not controlled by the Montreal Protocol.

Annex I Parties must submit regular reports, known as national communications, detailing their climate change policies and measures. In addition, Annex I Parties must submit an annual inventory of their greenhouse gas emissions, which also includes data for their base year (1990, except for some countries with economies in transition). National communications are subject to an individual in-depth review by teams of experts, including in-country visits. Since 2000, annual inventories have also been subject to a technical review.

Mexico, considered a non-Annex I Party, must report in more general terms on its actions to address climate change and adapt to its effects. The time frame for the submission of initial national communications, including emission inventories, is less tight than for Annex I Parties and is contingent on the receipt of funding. Because of this, non-Annex I Parties started to submit their national communications later than Annex I Parties. Mexico has already submitted its second communication. Non-Annex I Parties are not obliged to submit an annual emission inventory, nor are their national communications subject to in-depth review.

Because of the “top-down” nature of greenhouse gas inventory development, UNFCCC-participating countries provide these data in document or spreadsheet form on a national, annual, source category aggregate basis. This protocol does not require reporting of facility-specific data.

4 North American Coordination Activities

To date, a number of initiatives are attempting to integrate North American emissions and air quality data providing a common platform on which to make decisions related to coordinated air quality objectives. The projects listed below are examples of where these data, both EGU and other anthropogenic sources, if uniformly available on a comparable basis, could make an immediate impact on bi- and trinational air quality analyses.

4.1 Canada-US Air Quality Agreement

The purpose of this Agreement is to establish a practical and effective instrument to address shared concerns regarding transboundary air pollution. Using coordinated or cooperative scientific and technical activities, economic research, and information exchange, each Party agreed to establish specific emission reduction or limitation objectives of SO₂, NO_x, and VOC.

Through this Agreement, the Parties have agreed to exchange, on a regular basis, monitoring, emissions, technologies, measures and mechanisms for controlling emissions, atmospheric processes, and effects of air pollutants as they relate to the transboundary area.

Every two years the Parties prepare a progress report that focuses on acid rain, ozone and other transboundary air quality cooperation as part of the original agreement. The report emphasizes the continued success of both governments in reducing emissions of sulfur dioxide and nitrogen oxides, the major contributors of acid rain.

The 2002 report is the first to address new requirements and reporting of air quality data under the Ozone Annex to the Agreement signed by both governments in December 2002 and also details joint efforts on transboundary particulate matter analysis. In addition, this report includes the second five-year comprehensive review of the Air Quality Agreement, which is aimed at assessing the agreement's effectiveness.

4.2 Canada-US Border Air Quality Strategy Border Projects

Three joint projects have been announced under the *Canada-US Border Air Quality Strategy*:

- The Great Lakes Basin Airshed Management Framework;
- The Georgia Basin/Puget Sound International Airshed Strategy; and
- A study on the feasibility of emissions trading for NO_x (nitrogen oxides) and SO₂ (sulfur dioxide).

The two airshed pilot projects will explore the human health effects of air pollution and the serious concerns about air quality expressed by Canadians and Americans living in these border regions. Joint airshed strategies and management measures to improve air quality will be explored under both projects and will include health studies and atmospheric science tools and science assessments, and targeted public outreach.

4.3 US-Mexico Border Environmental Program: Border 2012

As a result of the partnership among federal, state and local governments in the United States and Mexico, and with US border tribes, the mission of the Border 2012 program is to protect the environment and public health in the Mexico-US border region, consistent with the principles of sustainable development.

The ten-year Border 2012 program emphasizes a bottom-up, regional approach, anticipating that local decision-making, priority-setting, and project implementation will best address environmental issues in the border region. It brings together a wide variety of stakeholders to produce prioritized and sustained actions that consider the environmental needs of the different border communities. In particular, one of the goals of the program relates to the coordination of air emissions data.

The two governments, in partnership with border tribal, state and local governments, have worked to increase the knowledge about pollution sources and their impacts on both sides of the border, establish monitoring networks in several key areas, conduct emission inventories, and build local capacity through training. Through these efforts, the two countries have established a foundation for binational air quality planning and management programs. The overall program goals are to:

- determine ambient concentrations from pollutant emissions;
- assess contributing emission sources and their relative impacts; and
- develop and implement cost-effective control strategies.

4.4 Mexico's National Emission Inventory

The main objectives of the Mexican NEI are to provide the technical basis for improved air quality analyses within Mexico and on both sides of its borders, to support institutional capacity for developing emission inventories within INE and Semarnat, to assist with regional haze requirements in the United States, and to support the development of a trinational emission inventory of criteria pollutants for Mexico, the United States, and Canada (ERG 2003). In order to satisfy these objectives, the main goals of the Mexican NEI were established as follows:

- Develop a first-time national inventory for Mexico using the highest quality Mexico-specific data available;
- Estimate 1999 annual emissions on state and municipality levels; and
- Identify and compile data and determine methods for improving spatial and temporal resolution of the annual inventory in the future.

These goals are being achieved through the financial, technical, and managerial support of Mexico's National Institute of Ecology (*Instituto Nacional de Ecología*—INE), the Western Governors' Association, the US Environmental Protection Agency, and the Commission for Environmental Cooperation of North America.

5 Opportunities for Improvement

Collection, administration and exchange of environmental data are essential to effective environmental management. Some examples include harmonizing international environmental protocols or information management systems (e.g., emission trading programs) and developing effective data collection and information exchange mechanisms between North American partners and stakeholders. The information documented in Chapter 2 of this report indicates that we are still not to the point of having a common set of comparable databases that would allow the transparent evaluation of North American power plants.

Although the information presented here represents a collection of electric generating utility data, it is meant to characterize the larger data exchange framework which permits countries to work cooperatively with neighboring regions, to share emission inventory development tools and resources, and to work towards a common language and methodology for emissions estimation. A number of these cooperative efforts are already underway and presented in the previous chapter of this document.

For any number of reasons, the development of a trinational assembly of emissions and air quality data would prove to be beneficial. In addition to providing information of comparable quality for each of the three North American countries for compliance and emissions trading programs as well as public right-to-know goals, it would allow policy makers to focus on practical solutions to emission reduction targets and in planning regulatory requirements that involve atmospheric modeling of airsheds across international boundaries (CEC 2001).

5.1 Emissions Data Sharing

The ability to make emissions and associated data publicly available for modeling and analysis requires a common, flexible, and well-documented data format. To date, individual national, state/provincial, local and tribal air agencies have collected and maintained data in formats that best suited their individual needs. Some of these agencies may have only required summary data for general reporting requirements, others may have needed individual facility reporting to gain permit approvals, while others may have required more temporally and spatially refined emissions in order to support regulatory and policy setting analyses.

A common reporting format would allow individuals to maintain responsibility and control over their own data and reporting schedule, while at the same time making it available to other interested parties in a format already understood and documented. This format should provide a minimum set of information on methods, aggregate emission factors, and activity data, as well as relevant assumptions that underlie the estimates for each emission category. Information provided by a common reporting format is aimed at enhancing the comparability and transparency of inventories by facilitating activity data and aggregate emission factor cross-comparisons among Parties, and easy identification of possible mistakes, misunderstandings and omissions in the inventories.

Examples of common reporting formats currently in use include the US EPA NEI Input Format (NIF) and the United Nations Framework Convention on Climate Change.

The current versions of the NIF and all user documentation are posted online for users to download. In addition, there is an associated software program for download to help NIF users perform quality control checks on their files to ensure correct format specification (EPA web site). This format is widely used by state and local agencies to transfer data to the EPA's National Emission Inventory. The final Mexican NEI emission inventory files are expected to be made compatible with the NIF and discussions with inventory developers in Canada indicate the NPRI will also be converted for purposes of data exchange.

Under the United Nations Framework Convention on Climate Change, reporting guidelines and requirements to submit an annual inventory report on greenhouse gases are increasing the need for more detailed inventories. Countries are also being encouraged to report on additional air contaminants through this framework. The revised Intergovernmental Panel on Climate Change guidelines and common reporting format developed under this framework might be considered in the efforts of a consolidated North American inventory.

5.2 Emissions Estimation Methodology Development

The comparability of emission inventory data is as important as their accuracy. Through the improvement of emission estimate methodologies and the documentation of these standards, we can better compare, replicate, and assess emissions on a uniform scale. A mutually agreed upon set of reporting units could be identified to which individuals, who derive their data in alternate native units, could easily convert. Common data and software protocol could be developed which would allow spatial and temporal interpolations and projections making it again easier for individuals to use their and other data for similar purposes (e.g., air quality modeling).

In addition to direct emissions data, the associated elements of power generation (fuel consumption, generation output, emission rates, etc.) are as valuable as the emissions themselves. These data elements are extremely important when used for purposes of direct facility-to-facility or unit type-to-type comparisons or in circumstances of verifying emission output or control program effectiveness. Source efficiency as a function of emissions per fuel throughput or output generation is used to compare available power generation sources, allowing for informed decision making to choose energy-efficient solutions and best management practices. These decisions can lead not only to more comparable energy and environmental attributes for the public but also to the increase in energy management practices by facilities providing electricity to the energy market.

Pollutant, source category, and temporal and spatial reporting could be prioritized to minimize the investment in data gathering and improvement. By estimating the highest emitting categories within each area, smaller, less contributing sources could be estimated when resources become more available.

The prioritization of joint efforts to improve emission estimation methodologies, common activities and emission factors will facilitate consistently accurate and comparable emission estimates and allow future activities for coordinated inventory development.

5.3 Capacity Building / Technology Transfer

Even with an agreed upon data sharing protocol, reporting format, and common methodology, there continues to exist a disjunction between the experience and resources available between various Parties. Through international programs these Parties could assist each other in identifying the capacity building and technology transfer needs necessary to improve data collection and data processing. With the sponsorship of the CEC and other international organizations, these needs could further be identified and strategies outlined with an overall goal of developing the high-quality, accurate, and comprehensive emission inventories necessary for the various data transfer needs listed above.

The Networked Environmental Information System for Global Emissions Inventories (NEISGEI) proposal is an example of a strategy that involves the creation of a web-based global air emission inventory network in the form of a Web portal that provides a catalog of distributed emission inventory data, tools for processing and analyzing the data, means for registering new data, and an environment for collaboration among international researchers, policy makers, and the interested public (Hemming *et al.* 2003).

The capacity building element of this initiative includes making readily available to developing countries the technical information and support for inventory development according to international standards. The inventory network will partner with international aid programs to maximize the use of the network's resources for new inventory development.

The proposed project involves the initial creation of the underlying network infrastructure, using newly available off-the-shelf and web-based distributed database management tools, and the creation of a consortium of users and inventory developers. Under this strategy, each of the participating Parties could provide or benefit from the underlying data used to estimate emission inventories from participants in the user community.

5.4 Public Information

Open communication with participants involved with data analyses is the most important way to insure interactive and effective feedback during any process. Through regular contact with those individuals who prepare emission inventory estimates, one can better understand the process and procedures used to develop those estimates. However, a commitment to staying abreast of the latest developments in inventory collection and preparation methods developed and used by every member in the emission inventory development community would be time consuming, if not impossible. With the development of nationally consolidated annual progress reports or data preparation documents, individuals could access those routines with a little research and be able to utilize, modify or provide feedback relative to their interest in the overall inventory process.

Understanding data and assumptions that go into each inventory development process allows a greater opportunity to review data for quality assurance and improvement opportunities. The clarification of complicated technical issues during the stages of inventory development, not after the process is complete, allows important and time saving steps to be accomplished. Through the continual interaction of inventory developers via workgroups, web sites, or listserves dedicated to the advancement of emission inventories and associated data, individuals

can participate with other partners to interpret data sets, provide feedback on the positive and negative aspects of the data or its development and organization, and provide recommendations for correcting problems and addressing data gaps.

Reports in line with the CEC's *Taking Stock* series are important to continue to develop as they offer focused comparisons of available data and provide outreach to user communities, including business, public interest, and academic users who would not be alert to the continual update and improvement cycles that emission inventories currently undergo.

6 Summary

Absent the three North American countries adopting a single set of reporting regulations and formats, there will always be differences in the way emission inventory and associated data are prepared, presented, and used. Ideally, through cooperative efforts, the countries can work together to enhance data comparability and accessibility, and hence, minimize potential errors and misunderstandings arising from incompatible data sets. The development of a single comprehensive and accurate emission inventory is essential for the coordinated reporting, policy development, transport analyses, and socio-economic studies that create an environment for collaboration among international researchers, policy makers, and the interested public.

Using the electric generation utility (EGU) sector as an example, this report has discussed available emissions and emission-related data of Canada, Mexico and the United States. Although this source sector is thought to be one of the most consistently reported among the three countries, it can be seen that there still is a way to go before the data are considered transparent enough to represent a coordinated North American inventory.

These inventories should be based on the fact that emissions information is universally available for the purpose of developing local, regional, national, and international plans that are comparable on a source sector basis. The data presented in this report show that although individual local or regional inventories are prepared and exchanged in common ways, additional international coordination still needs to occur. Reporting periods, unit-specific information, confidential data, and methods for estimation continue to be opportunities where improvement can be achieved.

The importance of a common methodology derived through international coordination counts on a uniform reporting structure, consistency among reporting entities, the ease of information submission and modification, and reduction of burden for information exchange.

A summary of greenhouse gas inventories for each country demonstrates the importance of a common methodology, derived by intergovernmental agreement, producing emission estimates that are comparable at a national level. These methods, designed to develop and refine an internationally-agreed methodology and encourage the widespread use of this methodology by countries participating in the Intergovernmental Panel on Climate Change and by signatories of the United Nations Framework Convention on Climate Change have been touted as credible, objective, and transparent (EPA 2002).

Our long-term goal as inventory data developers and users should be the advancement of a North American emission inventory that is: universally available to all who want to access its information, of high resolution and source- and facility-specific, comprehensive with respect to pollutants and sources, well documented and easily duplicated, and based on comparable methodologies and factors. By addressing these common denominator issues as a collective, instead of as individuals, we can make these data useful to not only our adjacent bordering partners, but to those who share the same global environment we populate.

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