Compilation of annual emission inventories in Canada for Criteria Air Contaminants

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ABSTRACT

A new process is being implemented in Canada for the compilation of the national emission inventories for Criteria Air Contaminants. Canadian emission inventories were compiled on a 5 year cycle since the 70's, but this frequency has been found to be no longer acceptable in recent years to meet the reporting requirements and obligations of domestic programs and international protocols and agreements. This process has been initiated to compile the emission inventories on an annual basis using a more centralized approach for the collection of industrial emissions by Environment Canada. This new approach uses the data collection infrastructure of the National Pollutant Release Inventory (NPRI), which is Canada's Pollutant Release and Transfer Register (PRTR) program. The NPRI reporting requirements were modified in 2002 to collect the emissions and other related information to support the compilation of the national emissions inventory of Criteria Air Contaminants. To ensure the comprehensiveness of the national emission inventory, the industrial emissions collected through the NPRI are supplemented with the annual emission estimates for the area, mobile, natural, and open sources. This paper describes the new emissions inventory process and the advantages that it provides such as the improvement of the accuracy and the accessibility of the Canadian emission inventory and its timeliness. Additional adjustments are also being proposed for the coming years and are described below.

BACKGROUND

Environment Canada has been compiling emission inventories for a number of air pollutants since the 1970's. These emission inventories were compiled to support the air quality management programs under the Clean Air Act introduced in 1969, and subsequently the Canadian Environmental Protection Act in 1999. The number and the complexity of the various programs to improve the air quality and protect the health of Canadians and the environment have greatly increased during the past 30 years. Canada now has both domestic programs and international agreements in place such as the Canada-Wide Air Quality Standards for Particulate Matter and Ozone, the Canada-Wide Acid Rain Strategy, the Canada-United States Air Quality Agreements, and various protocols under the Long Range Transport of Air Pollutants (LRTAP) Convention of the United-Nations Economic Commission for Europe. Annual and detailed

emission inventories are now required to fulfill the reporting requirements and the legal obligations of these air quality management programs and international agreements.

In Canada, the national emission inventories for Criteria Air Contaminants (CAC) are compiled in close collaboration with the provincial and territorial ministries of the environment and energy. Historically the provinces and territories were responsible for the collection of the point source emissions. A mixture of voluntary and mandatory data collection mechanisms such as regulations, permit fees, and surveys were used by these agencies to meet their emissions inventory requirements and contribute to the national program. The role of Environment Canada in this effort included the estimation of the emissions for small point sources, area, mobile, natural, and open sources. It also included the integration of the emissions information into a national database system and the review of the information to ensure the comprehensiveness and consistency of the emission estimates across the country.

DESCRIPTION OF THE NEW EMISSIONS INVENTORY COMPILATION PROCESS

In 2002, Environment Canada initiated a more centralized approach for the compilation of the national emissions inventory on an annual basis. Using the authority of the Canadian Environmental Protection Act (CEPA 99), Canadian industries are required to report their emissions of Particulate Matter (TPM, PM_{10}, $PM_{2.5}$), Sulphur Dioxide (SO_2), Nitrogen Oxides (NO_x), Volatile Organic Compounds (VOC), and Carbon Monoxide (CO) to Environment Canada on an annual basis. The industries that meet the reporting requirements and exceed the reporting thresholds for any of these air pollutants are required to report their emissions by June 1st of every year to the National Pollutant Release Inventory (NPRI). The NPRI is Canada's Pollutant Release and Transfer Register (PRTR) program, which collects information on the releases to air, water, and land for more than 323 substances, including the CAC. The data elements that are collected through the NPRI to meet the requirements for the emission inventories and the air quality models include:

- The facility identification such as address and contacts;
- The total emissions from stacks or point releases, storage or handling, fugitives, spills, and other non-point releases;
- The emissions for the individual stacks which are greater than 50 meters in height, including the stack parameters such as height, diameter, exit temperature, and flow rate;
- The basis of the emission estimates;
- The monthly, weekly, and hourly variations of the emissions;
- The pollution prevention activities;
- The anticipated releases for the next five years;
- The emissions for more than 170 VOC species.

Further information on the NPRI reporting requirements for all substances including the CAC, can be found in the documents on the NPRI web site at http://www.ec.gc.ca/pdb/npri/npri_cgaz_e.cfm.

The collection of the emissions from the industrial sources by Environment Canada has reduced the time to access and process this information, hence reducing the time to compile the national emissions inventory by approximately one year. With this new process, the role of the provinces and territories has evolved to one of providing assistance in the review and validation of the information reported by the industries, in the improvement of the emission inventories for area, mobile, natural, and open sources; and in the development of the comprehensive emission inventories.

With the addition of the CAC emissions to the NPRI list of substances in 2002, and with the removal of the reporting exemption for the upstream oil and gas industry in 2003, a total of 6,670 industrial facilities filed 17,252 reports for CAC emissions and VOC species to the NPRI in 2004. The number of reporters and reports are likely to increase in the future with the removal of other reporting exemptions, and with the implementation of an enhanced data verification and compliance promotion program.

To support the industries in estimating and filing their annual emissions, Environment Canada provides various forms of technical assistance. A help desk is available along with training sessions which are conducted across the country to inform and educate the reporters on the reporting requirements, the emission reporting guidance documents, and the emission estimation tools that can be downloaded from the NPRI web site (http://www.ec.gc.ca/pdb/npri/npri_gdocs_e.cfm). The emission estimation tools include many case studies and calculation spreadsheets that provide in-depth information for selected industries, emission sources, and pollutants such as:

- Auto part painting;
- Newspaper printing;
- Compressor stations;
- Gas plants;
- Oil Battery;
- Terminal operations;
- Anthracite combustion from industrial and commercial boilers;
- Breweries;
- Electric Arc Welding.

Environment Canada also collaborates with industrial associations on the development and the improvement of emission factors, emission estimation guides, and codes of practice.

When compared to the latest national emissions inventory for Criteria Air Pollutants in Canada, the CAC emissions reported to the NPRI account for

approximately 82% of the SO_2 emissions, 33% of the NO_x emissions, 10% of the VOC emissions, 7% of $PM_{2.5}$ emissions, and 1% of PM_{10} emissions. Of the total number of industries reporting to the NPRI, 82% reported CAC emissions in 2004.

To ensure the comprehensiveness of the national emission inventory, the industrial emissions collected through the NPRI are supplemented with the annual emission estimates for the area, mobile, natural, and open sources.

ENHANCED ELECTRONIC REPORTING SYSTEM

In addition to the collection of industrial emissions by Environment Canada to accelerate the compilation of the industrial emissions and the national emission inventory, a number of enhancements to the electronic reporting infrastructure of the NPRI were also introduced recently.

In March of 2005, a One Window for Environmental Reporting System (OWNERS) was launched by Environment Canada to streamline the environmental reporting by the industry to various federal, provincial, regional and private sector programs, creating efficiencies for both governments and industry. OWNERS is a secure web based application that replaces the original NPRI electronic reporting software application which had been used for the past 10 years. It was designed to meet the current reporting requirements of the NPRI and to provide a single window for the collection of regulatory and voluntary information to support various environmental programs in the future.

For the 2004 reporting year, OWNERS will collect information for the NPRI and for other environmental programs such as:

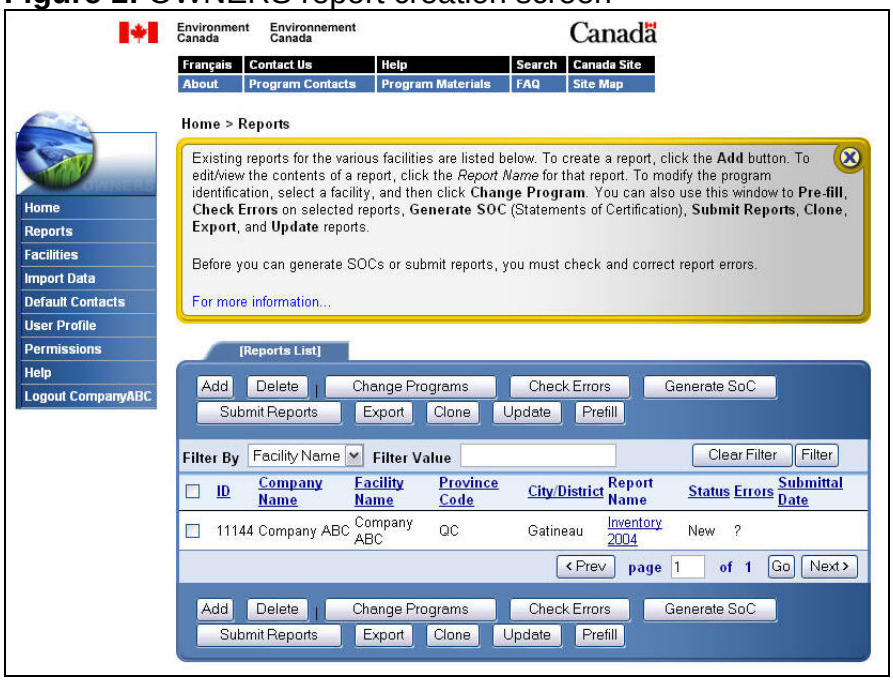
- The Airborne Contaminant Discharge Monitoring and Reporting Regulation of the Ontario Ministry of the Environment (O. Reg. 127/1);
- The Air Monitoring Directive of Alberta Environment;
- The Air Quality Management Bylaw 937 of the Greater Vancouver Regional District (GVRD);
- The National Emissions Reduction Masterplan (NERM) of the Canadian Chemical Producers' Association.

Each of these agencies has secure and in some cases a restricted access to the information filed into the system. It is expected that the reporting requirements of other environmental agencies and other Environment Canada programs will be integrated within OWNERS during the coming years.

As shown in figure 1 below, OWNERS provides an intuitive interface with online help to facilitate the entry of information by the industry. It is a highly complex system that has taken two years to be researched, designed, and tested. The

information filed through OWNERS is stored directly into a new national database system, providing a more rapid access to the information for verification and dissemination. OWNERS provides major improvements in the data collection and processing of point source information when compared to the previous NPRI process which made use of five regional databases with regular transfers and update to a national database.

Figure 1: OWNERS report creation screen



In addition to its main web portal, OWNERS is also available as a desktop application for industrial facilities that have restrictions with web based applications. An eXtensible Markup Language (XML) schema is also available to allow industries to export data from their current system and to file their reports electronically.

Some of the key features provided by OWNERS to streamline the reporting process and to ensure the quality of the information include:

- Web based access;
- The possibility of pre-filling new reports with previous years data;
- The possibility of cloning a report for a company with multiple facilities;
- The possibility to import data from other systems using an XML schema;
- The provision of context sensitive help;
- The validation of various data fields during the data entry process reducing the requirements for manual verification;
- The requirements that reports are error free before a statement of certification is issued and the reports are accepted by the system.

Environment Canada currently uses a separate database system called the Residual Discharge Information System (RDIS-II) to compile the comprehensive emissions inventories for the CAC. This database system includes the annual emissions for point, area, mobile, natural, and open sources including the industrial information collected through the NPRI. A new data interchange mechanism between the RDIS-II and the OWNERS database is currently being investigated to provide a more rapid transfer of information and further accelerate the compilation of the national emission inventories.

BENEFITS OF THE NEW APPROACH

Some of the benefits that have been obtained through this new approach to compile the national emissions inventory include:

- Improved timeliness for the compilation and the validation of the point source emissions;
- A uniform data collection process in all provinces;
- Improved accuracy of the point source emission estimates provided by selected industrial sectors based on source measurements;
- New VOC speciation profiles for selected industries;
- Improved timeliness for the dissemination of the point source emissions;
- The removal of the data confidentiality restrictions for point source emissions;
- Reduced requirements for the manual verification of the emission reports for errors and inconsistencies;
- Improved timeliness for the compilation and the dissemination of the national emissions inventory.

FUTURE DIRECTION

Environment Canada has made progress in streamlining its data collection process for the point sources. Additional improvements are being considered to further improve the accuracy of this information. These improvements include:

- The development of additional and more comprehensive guidance documents for selected industrial sectors and pollutants;
- Improvement of the OWNERS functionality such as the integration of emission calculations and VOC speciation capabilities;
- The collection of additional information for each facility to allow Environment Canada to more easily assess the completeness and the accuracy of the reported emissions and further reduce the amount of time required to compile the annual emission inventories.
    - The additional information required for this assessment include the type of materials consumed and produced, the type of process and

combustion devices in place, the efficiency and type of emission control equipment, and the emission factors used.

Environment Canada is currently compiling the national emissions inventory for the calendar year 2002, which is expected to be published during the summer of 2005. The Canadian industries are required to file their release reports for the 2004 calendar year, by June 1st of this year. With this information and the 2003 data filed last year, the compilation of the 2003 and the 2004 emission inventories will be initiated during the coming months. To accelerate the access, the review, and the use of these two emission inventories by various users, draft versions are planned to be released during the first quarter of 2006 followed with the release of the final versions during the second quarter of the year. Environment Canada is planning to use similar timelines for the release of draft and final versions of subsequent emission inventories, hence providing yearly emission inventories with a 1.5 year time lag.

REFERENCES

Environment Canada, *NPRI Canada Gazette Notices*, http://www.ec.gc.ca/pdb/npri/npri_cgaz_e.cfm, Ottawa, Ontario, February 2005.

Environment Canada, *One Window for Environmental Reporting System (OWNERS),* http://www.owners.gc.ca/home_e.html, Ottawa, Ontario, March 2005.

Environment Canada, *NPRI reporting Tools and Guidance*, http://www.ec.gc.ca/pdb/npri/npri_gdocs_e.cfm#2004, Ottawa, Ontario, March 2005.

Environment Canada, *2003 National Pollutant Release Inventory data - Preliminary Version Release*, http://www.ec.gc.ca/pdb/npri/early_release/index_e.cfm, Ottawa, Ontario, March 2005.

Environment Canada, *2000 CAC Emission Summaries*, http://www.ec.gc.ca/pdb/ape/cac_ESummaries_e.cfm, Ottawa, Ontario, December 2004.

KEYWORDS

CAC Emission Inventories, NPRI, OWNERS, Environment Canada.