National Pollutant Release Inventory (NPRI) - Criteria Air Contaminants (CACs)

ENGO Report

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Overview

There can be no doubt that exposure to the vast multitude and quantity of pollutants is severely compromising human health and the environment, marginalizing the most vulnerable and susceptible populations while poisoning the air, water and soil. Children are clearly bearing the burden of poor air quality – witnessed by rising levels of asthma. Rising cancer rates, developmental disorders, allergies – are becoming all too common.

It has usually taken disasters, such as the major chemical spill of 1984 in Bhopal, to galvanize the public and pressure government to take strong and necessary measures to significantly reduce the level of pollutants in the environment. The development of publicly accessible pollutant inventories was mainly a response to public demand for right-to-know what poisons they are subjected to in their local communities.

Pollutant inventories are not all-inclusive. Rather, they represent a fraction of the quantity and range of pollutants released into the environment from specific industrial sources. However, by providing a quantitative aspect on the total pollutant burden, they provide the public with access to information not otherwise readily available and serve as a catalyst for implementing environmental, health and safety protection.

Since their inception, pollutant inventories have evolved as a fundamental tool and reference for governments and the public in a variety of ways such as; tracking the environmental performance of specific industries; raising public awareness; developing and assessing air quality strategies; determining emission trends and projections; and providing input into air quality modeling. They are also used as a means of accountability as to whether Canada is meeting its obligations with respect to reductions of specific pollutants at a regional, national and international level.

At the same time, for inventories to be a reliable resource of information for the multitude of applications, there has to be a reasonable degree of confidence that the data are valid within acceptable margins of error.

However, significant issues have surfaced related to data quality, particularly with respect to the emissions of Criteria Air Contaminants (CACs) reported by industry to the NPRI. This reported data is very much out of line with what has been estimated by Environment Canada and its provincial counterparts. These issues are highly disconcerting and raise concerns as to the credibility and reliability of the NPRI data, and not only for CACs. It is important that these issues be dealt with appropriately and the quality of information on the NPRI is truly representative of the level of pollutants emitted into the environment.

The industry has taken a very hard-line position on this matter. They speak of "burden" of reporting, "level of effort" and confidentiality matters as barriers to doing more or giving more information than they currently do. These arguments ring hollow – considering that it is civil society that bears the "burden" of the pollutants, no industry sector is conducting direct measurements of reported emissions, and the type of information claimed to be confidential is publicly available from other government bodies. And all of the arguments deflect from the real problem – the degradation in the environment and human health for the sake of short-term convenience and "prosperity".

The ENGO community is naturally a strong supporter of the NPRI and is cognizant of the pressures that could potentially weaken the NPRI. ENGOs are deeply concerned that the data discrepancies are of such an order to make the NPRI for CACs virtually unusable and strongly support the need to explore mechanisms to improve the quality and quantity of information on the NPRI in general and specifically and more urgently, CACs.

As a means of addressing these issues, a sub-group of the NPRI Working Group was convened in the fall of 2005 to develop options to rectify and resolve the problems identified. Environment Canada has provided its rationale for collecting information not hitherto required to affirm CAC emissions. They have also indicated that a review and update historical NPRI data (back to 2002) would be needed.

To date, the most contentious issues for industry are the provision of process-level data (confidentiality), historical corrections, and the overall issue of the "burden of reporting", although there is a strong undercurrent of more issues that impact on the NPRI in the longer term. On the other hand, ENGOs feel major improvements for reporting to the NPRI are justified and support the need to improve on matters such as estimation methodology; the application of direct measurement and monitoring of emissions; verification and auditing mechanisms; and the collection of data elements such as specific process-level information for affirming the reported emissions of CACs.

The following section provides background on the national comprehensive CAC Inventory and its interface with the NPRI; a detailed description of the various issues and problems related to data quality, inconsistencies and information gaps for CACs; and recommendations.

A. Criteria Air Contaminants (CACs) - Inventories

Since the 1970s, Environment Canada has been compiling a national comprehensive inventory on CACs on a 5-year cycle[1]. The data is collected mainly in collaboration with provinces and territories as well as some industrial sectors, using a variety of mechanisms such as provincial permits, surveys, GIS mapping, modeling and estimation methodologies. The data is subsequently reviewed by all parties for consistency and comprehensiveness and updated and revised as needed. The latest published national

[1] The CACs in the comprehensive inventory include SO_2, NOx, Particulate Matter –Total PM, PM_{10} and $PM_{2.5}$, VOCs and CO and NH_3 (ammonia). [Biogenic NOx and VOCs are also listed in this inventory.] The inventory includes area, mobile, natural and open sources as well as point sources (industrial).

CAC inventory is for the year 2000. The inventory is now being updated and revised for 2002, a critical year for input into the 2006 Biennial Review of the current Ozone Annex between Canada and the U.S.

The proliferation of national programs and international protocols and agreements on air quality issues and the need for Canada to meet its reporting and emission reduction obligations have become a driving force in seeking to improve the accuracy and accessibility of information on the inventory and the frequency with which such information is solicited and reported[2]. As a result, Environment Canada decided to utilize the NPRI data collection provisions as the primary source of facility-based emissions data as input to the comprehensive national CAC inventory. It is anticipated that this inventory as a whole will be upgraded to an annual basis.

In 2002, seven CACs were added to the NPRI at specified reporting threshold values[3]. Industries that meet the thresholds are required to report their CAC emissions on an annual basis. Furthermore, the NPRI requires facilities to submit specific data elements to meet requirements for emissions inventories and air quality models. Such elements include specific stack parameters related to emissions, the nature of emissions (fugitive, spills, storage), the basis for emission estimates, variations in emissions – hourly, weekly, monthly, pollution prevention activities, and anticipated releases for the next 5 years.

In addition, in 2003, 60 speciated forms of VOCs were added to the NPRI. These VOCs were selected based on a number of criteria that would indicate their influence on the formation of ozone and would be useful information in regional air quality modeling.

While one would expect that the NPRI would represent an efficient and effective mechanism for collecting point source data, there are notable discrepancies between the estimates and calculations on CAC emissions done by Environment Canada and that reported by industry to the NPRI for the same sectors. As well, there are serious gaps in data and information collected and issues on data quality.

Facilities are not required to measure the data submitted to the NPRI and only need to indicate what methodology was used to generate the data. Furthermore, while Environment Canada reviews the data and may request re-calculation or further information where large discrepancies are noted, there is no verification or formal auditing system in place. Also, since requirements for reporting in the NPRI are subject to specific thresholds, those facilities with emissions below threshold values may not be captured by the NPRI but would have to be factored into the comprehensive inventory.

The implications of these anomalies and data gaps are significant and need to be addressed if the NPRI data is to be used in determining whether Canada is meeting its domestic and international obligations which include the provision of compatible

[2] The Appendix to this report gives a brief summary of international agreements.
[3] These CACs include SO_2, NOx, TPM, PM_{10}, $PM_{2.5}$, Volatile Organic Compounds (VOCs), and Carbon Monoxide (CO). Ammonia (NH_3), which is on the comprehensive inventory, was already reported on the NPRI.

information and data elements as that of other CAC inventories such as those maintained by the United Nations Economic Commissions for Europe (U.N. ECE) and the U.S.. As well, it is important that the public have access to reliable data which they can interpret and analyze with reasonable confidence.

B. Gaps and Discrepancies

Emissions for VOCs, NOx and Particulate Matter in the national CAC inventory for 2000 are substantially higher than emissions reported by facilities for the years 2002 to 2004. The following chart illustrates some of the more dramatic differences.

CAC data comparison:

Substance	**Sector**	**CAC 2000 Inventory (tonnes)** (Est. by EC)	**NPRI 2002-4 (average) tonnes** Reported by facilities	**Per Cent difference** (base-CAC inventory)
VOCs	Upstream Oil & Gas Iron and Steel	540 000 19 600	29 300 2 370	95% 88%
NOx	Oil Sands	44 000	25 000	43%
TPM	Iron Ore Mining Wood Industry	45 800 119 000	7 540 25 200	84% 79%

Other anomalies noted include:

- Emissions data of CO are so variable that it is impossible to compare or judge the values reported or estimated by either inventory.
- Information reported by many industries is incomplete and in some cases, irreconcilable. For example,
  - No combustion emissions are reported although the facility has a large combustion device.
  - Either only one or two pollutants are reported (e.g., VOC emissions) or all pollutants are reported except VOCs.
  - Many facility emissions reported to the NPRI are quite different from the emissions reported to and/or compiled by the provinces for previous emission inventories[4].
  - Emissions reported on Particulate Matter, TPM (total), PM_{10} (coarse) and $PM_{2.5}$ (fine), are highly variable and inconsistent. Some facilities report total PM but not the smaller fractions or vice versa. Some sectors did not report any PM – an unlikely scenario considering the sectors involved (e.g., Power Generation, the Wood Industry).
- Facilities report threshold values instead of actual emissions.

[4] Approximately 600 facilities are not reporting emissions for one of the CACs although their emissions from provincial inventories were above NPRI thresholds.

On a positive note, SO_2 is the one CAC for which emissions exhibit good comparability between the two inventories

A number of factors could be contributing to these anomalies.

- Neither the comprehensive inventory nor the NPRI requires that facilities conduct measurements of emissions. The source of data has typically been on emission factors which have inherent uncertainties that question their reliability.
- Specific process (or combustion data) is not required, which means that it is difficult to determine reasonable estimates from various stages in processes that would allow for an analysis of the data.
- CAC reporting has been in place a relatively short time. Based on what data has been submitted, a number of facilities have reported numbers, in particular, for Particulate Matter and its subsets, simply do not "add up" to a logical conclusion. This may be contributed to misunderstanding or lack of guidance.
- Reporting to the NPRI is triggered by thresholds. Hence, not all facilities are included, whereas the comprehensive inventory captures all facilities.
- Data collection mechanisms by provinces are highly variable and not consistent.

The data gaps and inconsistencies make it difficult, if not impossible, to utilize the present NPRI information for the comprehensive emission inventories required annually. They also constrain the ability of governments to track the effectiveness of current air quality management programs and control strategies as well as the development of trends over time. Furthermore, there is no means of assessing or reconciling the difference between 2002 NPRI and previous provincial data.

Clearly, these differences and gaps warrant serious investigation. Neither the public nor any government body can utilize this information with confidence for the purposes that it has been developed. What's more, the public would view the emissions reported by industry with great skepticism and would favour estimated values done by government sources. However, the estimation methods of governments also need to be reviewed.

Once a thorough study is done to resolve these discrepancies, corrections may be required to historical estimates, particularly for the year 2002, an important year for input into air quality modeling and other requirements both on the domestic and international front.

C. Data Quality – Measurement and Estimation Methods

Facilities use a variety of estimation methods to calculate and report their emissions to the NPRI. However no submitted CAC data is derived from direct measurement, nor has this been required by the NPRI.

Emission factors and engineering estimates are the most common methods used to determine facility-level data. Other methods include source testing, continuous emission monitors (CEMs) and mass balance determinations. These methods likely represent an improvement over estimation factors. The application of these latter methods tends to be

dependent on the particular pollutant[5]. For example, over 60% of SOx data is derived from CEMs and mass balance. Interestingly, SO_2 is the one CAC for which data consistency is not an issue.

Emission factors have often come under criticism by industry (and government) as not being relevant or appropriate. Yet these factors continue to be used. If industries are so concerned about public interpretation of their facility data, then it would be in their best interest to be more diligent and use more reliable means to determine the emissions. However, the NPRI does not require facilities to expend any effort beyond what that they normally do for calculating emissions.

The inordinate reliance on emission factors that are purportedly inadequate must be altered. Otherwise, for a number of contaminants and industrial sectors, the NPRI data is so questionable and cannot meet the needs and purpose of a public inventory. There must be a shift to direct measurement techniques and monitoring.

Technologies are presently available and have been used that could be employed to conduct testing and measurement for some facilities for a number of the CACs. For example, DIAL (Differential Absorption Lidar Technology) is a laser-based mobile method in use for over 15 years for measuring and mapping concentrations and mass emissions in the lower atmosphere. It is very effective in leak quantification capability[6]. Another measurement technology, developed by Leak Surveys Inc., utilizes a camera that can detect hydrocarbon gas emissions and VOC gases.

In fact, finding out sources of leaks is beneficial from an operational view and would lead to improvements in processing techniques, greater efficiency in operation and lower emissions. It would be advisable to establish a measurement-testing program (joint government-industry sponsored) to explore these and other emerging technologies as a means of checking emissions data.

D. Process Level Data

CACs are emitted from both process/combustion sources and fugitive emissions (leaks). Process level data would include information such as consumption and production of materials, equipment capacity, emission control devices, and their efficiencies.

Neither the comprehensive CAC inventory nor the NPRI requires or collects process level emissions and related information. The lack of process level information and emissions makes it difficult to assess the completeness and accuracy or large variations in emissions.

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[5] About 29% of TPM data is derived from source testing, while only about 27% of NOx is from CEMs and the remainder is from various estimation factors.

[6] DIAL Technology is a laser-based mobile method has been used in a 2004 Upstream Oil and Gas Survey in Alberta for VOCs and SO_2. www.ptac.org/env/dl/envp0403.pdf.
Refer to www.leaksurveysinc.com for information on Leak Surveys Inc.

On the other hand, CAC inventories maintained by other countries or organizations with which Canada has agreements do collect process level data. For example, the UN ECE (United Nations Economic Commissions for Europe) annual emissions reports require specific process and fuel-related information that include a breakdown by process/fuel for 7 CACs[7].

The U.S. air inventories (state-wide and federal) have traditionally required facilities to report process-level emissions and related information for CACs (except TPM). Under the Consolidated Emissions Reporting Rule (CERR), this information is required on a 3-year cycle.

Within Canada, there are different requirements for this information. For example,

- Québec has been collecting process level information on a voluntary basis for more than 15 years. The province is moving to a mandatory system that will require specific process information such as fuel characteristics to be reported annually by facilities[8].

- British Columbia requires process data for its air-shed management program and for projections. This data is also available to the public if requested. Without such process information, B.C. is not able to use NPRI data, which defeats the purpose of a national one-window inventory.

- Environment Canada's Mandatory GHG Reporting System requires a breakdown of the emissions according to stationary combustion, process, fugitive, venting & flaring, and on-site transportation emissions.

Harmonizing provincial-federal inventories where feasible and other inventory information to simplify reporting requirements is a worthwhile effort. However, where the needs of the provinces and other inventories clearly point to collecting process level information, these needs must not be sacrificed by harmonization. In fact, the NPRI could take a page from its provincial counterparts as a means of improving the consistency and quality of its data and obtain a more accurate picture of emissions of CACs.

Lack of process-level information affects Canada's capacity to meet the annual reporting obligations of domestic programs and international agreements and to provide the required data files for the air quality models used in Canada and in the United-States. (Note: 2002 data is required for input into the 2006 Biennial Review of the Ozone Annex of the Canada-US Air Quality Agreement).

Canadian industries are strongly resistant to supplying process-level information to the NPRI and consider such information to be of a confidential nature. However, comparable

[7] The CACs include SO_2, NOx, TPM, PM10, PM2.5 and NH_3) for all sources (except forest fires).
[8] The proposed regulation, Bill 44, was published on March 1st, 2006 in the Québec Official Gazette. http://www2.publicationsduquebec.gouv.qc.ca/home.php

facilities in the U.S. and other regions do submit this data which makes the case for Canadian industries specious.

E. Other Issues

VOC Speciation: The speciation of VOCs (Part 5, NPRI), introduced in 2003, has encountered some problems. The speciation information reported only accounts for 51% of the total VOC emissions. The VOCs listed may not necessarily be the appropriate selection for the purposes of EC in modeling air quality and other purposes.

Stack Height: The limit of 50 meters for stack emissions is not adequate for some regional air quality modelling and will need to be reviewed.

F. ENGO Recommendations

The following recommendations have been formulated for consideration and discussion within the sub-group and the Working Group itself. This list is not exhaustive but focuses on the elements that in the opinion of the ENGOs are significant.

Data measurement – Direct measurement techniques need to be employed as a means of obtaining solid information on emissions. The use of emission factors deemed to be inaccurate should not be acceptable. The sub-group should explore direct measurement and monitoring technologies and advise on cooperative action to conduct such studies for sectors where data discrepancies are outstanding.

Reporting requirements - The fact that the NPRI does not require facilities to expend any effort beyond what that they normally do for calculating emissions is a problem and needs to be examined.

Verification – Issues with data quality described vividly illustrate the need for the development of a uniform data verification protocol that would apply for CACs and potentially to all substances on the NPRI.

Process-level data – Clearly, process-level data is essential, although the specific and the degree of information required and frequency of reporting this information to the NPRI needs to be worked out in order that the data collected would be useful and compatible with other inventories – international and provincial, and other domestic reporting requirements (such as Green-house Gases Inventory). Furthermore, the degree of public access to process data needs to be determined.

Historical emissions (from 2002 on) - A reporting requirement for facilities needs to be developed to allow for the revision of historical emissions to resolve the large data variations between different years and the incompleteness of the data for 2002. These corrections are required not only because the 2002 emissions inventory is the baseline for Canada and the United-States for joint analyses and air quality modeling, but also to improve the quality of the inventory as a whole for all users.

Coverage of CACs , Comprehensive Inventory - The issue of emissions of CACs from those facilities that do not meet the NPRI threshold for reporting or are exempt from reporting to the NPRI need to be addressed. Furthermore, the comprehensive CAC inventory should be reviewed as to sources of information, coverage and completeness.

VOC speciation - The current speciated list is not adequate for the purposes it was formed. The requirements and criteria for listing VOC species need to be reviewed.

Stack Height - The 50 meter cut-off for major stacks may not be appropriate to track CAC emissions and needs to be reviewed.

Harmonization - The current and upcoming reporting requirements for different programs (provincial, federal) need to be considered in terms of possible linkages and benefits of harmonization.

Reporting tools and guidance - New and improved reporting tools (emission calculators, VOC speciation) need to be developed along with improved reporting guidance from Environment Canada.

Summary

The addition of CACs to the NPRI in 2002 provides a more comprehensive picture of pollutants released to the environment. So it is vital that an analysis of this reported information be carried out in light of the noted gaps and discrepancies and these matters be rectified. This is important not only for Canada to meet its obligations under domestic and international agreements on emissions reporting elements but also for tracking the effectiveness of air-quality programs, forecasting trends, regional air quality modeling, and as a useful and reliable public information tool.

On another note, while Canada has signed on to and ratified a number of protocols under the Convention on Long-Range transboundary Air Pollution (LRTAP), it has not been able to ratify 1999 Gothenburg Protocol under LRTAP because it cannot meet the reductions required for VOCs. This may be related to the incomplete and inconsistent information on VOCs. This matter is of public concern, particularly as Canada is considered to be a willing and at times leading participant on such protocols.

The CAC sub-group has been charged with discussing options to move forward on the critical issues that have been identified with the NPRI. At this stage, there is still an exploratory phase with no outcome. However, time is also of the essence and the ramifications of option chosen extend beyond the CAC substances.

ENGOs urge Environment Canada to consider their recommendations which speak to the need for process-level information data, quality verification mechanisms, the use of measured data, a review of speciated data and stack height criteria, and a review in general of data estimation methodologies and requirements in reporting to the NPRI.

Appendix

Summary of Agreements relating to the NPRI:

i) Domestic Programs

All air-related initiatives depend on the NPRI to assess "progress" in meeting targets. For example,

- Canada-wide Standards (CWS) for PM and Ozone includes provincial plans for attainment along with emission trends and projections.
- Canada-wide Acid Rain Strategy requires reductions in SO_2 and NOx and annual reports indicating trends and projections.
- Canadian Clean Air Agenda includes initiatives to reduce emissions from various sources (transportation, industries) and the tracking of progress to reduce emissions.

ii) **International Programs –** United Nations Economic Commissions for Europe (UNECE)

Canada has signed on to and ratified a number of protocols under the Convention on Long-Range transboundary Air Pollution (LRTAP). These protocols include reductions of sulphur emissions, control of emissions of NOx, Heavy Metals, Persistent Organic Pollutants (POPs) and the Monitoring and Evaluating of long-range transmission of air pollutants in Europe.

Canada has signed on to the 1999 Gothenburg Protocol under the LRTAP Convention concerning abatement of Acid Rain, Eutrophication and Ground-Level Ozone which requires reductions of VOCs, SO_2, NOx, and ammonia. However, Canada has not been able to ratify this protocol because it can't meet the stipulated reductions in VOCs.

iii) Binational Canada -U.S. Air Quality Agreement

This agreement (signed in 1991) also includes an Ozone Annex (2000). Both nations are committed to reduce emissions of SO_2, NOx and VOCs and to cooperate and exchange information as to the causes and effects of air pollution.

Requirements of this agreement and the Annex include:

- Biennial progress report on emission trends and projections for the affected regions annual and ozone seasons.
- Detailed emissions information for joint air quality modeling and analyses which includes process level emissions along with related information.