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Report on the individual review of the inventory submission of Canada submitted in 2016*

Note by the expert review team

Summary

Each Party included in Annex I to the Convention must submit an annual greenhouse gas (GHG) inventory covering emissions and removals of GHG emissions for all years from the base year (or period) to two years before the inventory due date (decision 24/CP.19). This report presents the results of the individual inventory review of the 2016 inventory submission of Canada, conducted by an expert review team in accordance with the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories". The review took place from 17 to 22 October 2016.

* In the symbol for this document, 2016 refers to the year in which the inventory was submitted, and not to the year of publication.

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Contents

I. Introduction

1. This report covers the review of the 2016 inventory submission of Canada organized by the UNFCCC secretariat, in accordance with the "Guidelines for the technical review of information reported under the Convention related to greenhouse gas inventories, biennial reports and national communications by Parties included in Annex I to the Convention" (hereinafter referred to as the UNFCCC review guidelines) and particularly Part III, "UNFCCC guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention".[1] The review took place from 17 to 22 October 2016 and was coordinated by Ms. Suvi Monni and Mr. Vitor Gois Ferreira (UNFCCC secretariat). Table 1 provides information on the composition of the expert review team (ERT) that conducted the review of Canada.

Table 1
Composition of the expert review team that conducted the review of Canada

Area of expertise	*Name*	*Party*
Generalist	Ms. Valentina Idrissova	Kazakhstan
	Ms. Riitta Pipatti	Finland
Energy	Mr. Ralph Harthan	Germany
	Mr. John Watterson	United Kingdom of Great Britain and Northern Ireland
IPPU	Ms. Anke Herold	Germany
	Mr. Predrag Novosel	Montenegro
Agriculture	Mr. Abdulkadir Bektas	Turkey
	Ms. Olga Gavrilova	Estonia
LULUCF	Ms. Andrea Brandon	New Zealand
	Mr. Giacomo Grassi	European Union
	Ms. Kimberly Robertson	New Zealand
Waste	Ms. Juliana Bempah	Ghana
	Mr. Kai Skoglund	Finland
	Ms. Tatiana Tugui	Republic of Moldova
Lead reviewers	Ms. Valentina Idrissova	
	Ms. Riitta Pipatti	

Abbreviations: IPPU = industrial processes and product use, LULUCF = land use, land-use change and forestry.

2. This report contains findings based on the assessment by the ERT of the 2016 inventory submission against the UNFCCC review guidelines. The ERT has made

[1] Annex to decision 13/CP.20.

recommendations to resolve those findings related to issues.[2] Other findings, and, if applicable, the ERT's encouragements to resolve them, are also included.

3. A draft version of this report was communicated to the Government of Canada, which provided comments that were considered and incorporated, as appropriate, into this final version of the report.

4. An overview of the greenhouse gas (GHG) emissions reported under the Convention for Canada is provided in annex I; table 6 shows GHG emissions with and without indirect carbon dioxide emissions for selected years, and tables 7 and 8 show GHG emissions reported under the Convention by gas and by sector, respectively.

II. Summary and general assessment of the 2016 inventory submission

5. Table 2 provides the ERT assessment of the inventory submission with respect to the tasks undertaken during the review. Further information on the issues identified, as well as additional findings, may be found in tables 3 and 5 below.

Table 2
Summary of review results and general assessment of the inventory of Canada

Assesssment				*Issue ID number(s) in tables 3 and/or 5[a]*
Date of submission	Original submission: 14 April 2016 (NIR), 14 April 2016, version 3, (CRF tables)			
Review format	Desk review			
Application of the requirements of the UNFCCC Annex I inventory reporting guidelines and Wetlands Supplement (if applicable)	Have any issues been identified in the following areas:			
	1.	Identification of key categories	Yes	G.6, L.14
	2.	Selection and use of methodologies and assumptions	Yes	E.24, I.12, L.21, W.17
	3.	Development and selection of emission factors	Yes	E.3, E.13, I.15, I.22, W.11, W.19, W.21
	4.	Collection and selection of activity data	Yes	E.2, I.23, L.7, L.13
	5.	Reporting of recalculations	Yes	E.30, E.32
	6.	Reporting of a consistent time series	Yes	I.13, I.16, I.21, A.17
	7.	Reporting of uncertainties, including methodologies	Yes	G.1, L.5
	8.	Quality assurance/quality control	No	
	9.	Missing categories/completeness[b]	Yes	E.14, E.23, I.2, I.3, I.17, I.18, I.24, A.1, A.9, A.12,

[2] "Issues" are defined in decision 13/CP.20, annex, paragraph 81.

Assesssment			*Issue ID number(s) in tables 3 and/or 5*[a]
			A.15, L.2, L.3, L.9, L.10
	10. Application of corrections to the inventory	No	
Significance threshold	For categories reported as insignificant, has the Party provided sufficient information showing that the likely level of emissions meets the criteria in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines?	No	W.22
Description of trends	Did the ERT conclude that the description in the NIR of the trends for the different gases and sectors is reasonable?	Yes	
National inventory arrangements	Have any issues been identified with the effectiveness and reliability of the institutional, procedural and legal arrangements for estimating GHG emissions?	No	
Response from the Party during the review	Has the Party provided the ERT with responses to the questions raised, including the data and information necessary for the assessment of conformity with the UNFCCC Annex I inventory reporting guidelines and any further guidance adopted by the Conference of the Parties?	Yes	
Recommendation for an exceptional in-country review	On the basis of the issues identified, does the ERT recommend that the next review be conducted as an in-country review?	No	

Abbreviations: CRF = common reporting format, ERT = expert review team, GHG = greenhouse gas, IPPU = industrial processes and product use, LULUCF = land use, land-use change and forestry, NIR = national inventory report, UNFCCC Annex I inventory reporting guidelines = "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories", Wetlands Supplement = *2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands*.

[a] The ERT identified additional issues in the general, energy, IPPU, agriculture, LULUCF and waste sectors that are not specifically listed in table 2 but are included in table 3 and/or 5.

[b] Missing categories, for which methods are provided in the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, may affect completeness and are listed in annex II to this document.

III. Status of implementation of issues raised in the previous review report

6. Table 3 compiles all the recommendations made in the previous review report, published on 30 March 2016. For each issue, the ERT specified whether it believes the issue has been resolved by the conclusion of the review of the 2016 inventory submission and provided the rationale for its determination, taking into consideration the publication date of the previous review report and national circumstances.

Table 3
Status of implementation of issues raised in the previous review report of Canada

ID#	*Issue classification*[a]	*Recommendation made in previous review report*	*ERT assessment and rationale*
General			
G.1	Uncertainty analysis (G.5, 2015) (table 4, 2014) (18, 2013) (24, 2012) (19, 2011) Adherence to the UNFCCC Annex I inventory reporting guidelines	Calculate the trend uncertainty, including LULUCF	Not resolved. Canada has not reported the trend uncertainty, including LULUCF, in its 2016 submission
G.2	Methods (G.7, 2015) Adherence to the UNFCCC Annex I inventory reporting guidelines	Ensure consistency between the NIR and CRF summary table 3 in the description of the method applied for subcategories within transport, in the energy sector	Resolved. The ERT did not identify any inconsistencies in the descriptions of the methods applied for subcategories within transport
Energy			
E.1	1. General (energy sector) (E.3, 2015) (19, 2014) Transparency	Document how the EFs and ECFs map on to the AD and describe problems associated with obtaining annual provincial ECFs. Document progress on efforts in the improvement plan and in the NIR	Resolved. The ERT noted that in the previous review report, the ERT had noted that the EFs for natural gas had been mapped. The present ERT further considers that the provision of information on the problems involved in obtaining annual provincial ECFs is no longer necessary, because the Party is already taking steps to obtain them. Namely, section 3.2.4.6 of the NIR, titled “Planned Improvements”, explains that an analysis is currently under way to evaluate and assess the availability of regional (provincial and territorial) natural gas ECFs for 1990 onwards, in order to accurately track energy density change at the national level. See also ID#s E.2 and E.3
E.2	1. General (energy sector) (E.4, 2015)	Take steps to ensure that the conversion of volumes of natural gas to energy units is completed appropriately for both marketable and non-marketable natural gas.	Addressing. According to table 8-4 of the NIR, titled “Summary of Canada’s

ID#	*Issue classification*[a]	*Recommendation made in previous review report*	*ERT assessment and rationale*
	(19, 2014) Accuracy	Document the progress on efforts in the improvement plan and in the NIR	Inventory Improvement Plan", data analysis is under way to implement the recommendation
E.3	1. General (energy sector) all fuels – CO_2 (E.11, 2015) Accuracy	Develop a plan that provides a timeline for updating the carbon content factors regularly, prioritizing fuels used in large quantities within Canada, as well as fuels with high carbon content variabilities	Addressing. During the review, Canada explained that it has initiated a project from which the carbon content and heating values for gasoline and on-road diesel may be determined over a more recent time period. The project is not yet complete; once the data are obtained, a review will be conducted to determine if there are any statistically significant differences in these fuel parameters compared with those currently used in the inventory. The results of this action will determine Canada's next step with respect to the updating of these specific fuel parameters. See also ID# E.25
E.4	Fuel combustion – reference approach: all fuels – CO_2 (E.13, 2015) Adherence to the UNFCCC Annex I inventory reporting guidelines	Revise the implementation of the reference approach to follow the 2006 IPCC Guidelines	Resolved. Section A4.2 of the NIR explains that the reference approach follows the method provided in the 2006 IPCC Guidelines. The ERT noted that the difference between the reference and sectoral approaches is less than 2% for most years (the largest difference occurs for 1992, with –2.3%)
E.5	1.A Fuel combustion – sectoral approach: all fuels – CO_2, CH_4 and N_2O (E.16, 2015) Transparency	Indicate in the NIR under which category emissions from uranium fuel production and processing are reported	Resolved. The Party explains in the NIR (part 1, page 69) that uranium fuel production and processing occur at separate facilities, and any GHG emissions associated with these facilities are reported under the relevant subcategory of manufacturing industries and construction
E.6	1.A Fuel combustion –	In the absence of country-specific data, apply the IPCC default CH_4 EFs from table 2.5 of the 2006 IPCC	Resolved. The EFs used in the inventory, adapted from the

ID#	*Issue classification*[a]	*Recommendation made in previous review report*	*ERT assessment and rationale*
	sectoral approach: liquid fuels – CH_4 (E.22, 2015) Completeness	Guidelines and estimate and report CH_4 emissions from combustion of refinery (still) gas and motor gasoline used in stationary combustion	default EFs in the 2006 IPCC Guidelines, for CH_4 emissions from motor gasoline and still gas are presented in the NIR (annex 6, tables A6-4 and A6-7, respectively)
E.7	1.A Fuel combustion – sectoral approach: liquid and gaseous fuels – CO_2, CH_4 and N_2O (E.17, 2015) Transparency	Describe in the NIR how flaring emissions for the various provinces are calculated and reported, clearly noting that around 98% of flaring emissions from upstream oil and gas, and oil sands/bitumen are estimated using the amount of fuel flared as reported to Statistics Canada in the *Report on Energy Supply and Demand* (RESD)	Resolved. The information is reported in section A3.2.2.6, titled "Flaring Special Case – Avoiding Double Counting", in annex 3 to the NIR (part 2, page 59), which provides an explanation of the issue, how it is dealt with and also a discussion of the emissions in specific provinces
E.8	1.A. Fuel combustion – sectoral approach: liquid and gaseous fuels – CO_2, CH_4 and N_2O (E.18, 2015) Accuracy	Develop and implement QA/QC procedures in order to ensure that the subtracted flaring emissions from the subcategory petroleum refining do not cause an underestimation of the reported emissions	Resolved. Section A3.1.4.1.2 of the NIR (part 2) explains that the fuel use, energy content and emission data associated with flaring are subtracted from the petroleum refining category (1.A.1.b) to avoid double counting and reported under category 1.B.2
E.9	1.A.1.c Manufacture of solid fuels and other energy industries: all fuels – CO_2, CH_4 and N_2O (E.19, 2015) Comparability	Report the CO_2, CH_4 and N_2O emissions from the purchased fuels used in manufacture of solid fuels and other energy industries in that category	Addressing. During the review, Canada explained that it currently receives fuel information for this category from the RESD provided by Statistics Canada in the category titled "Total Mining and Oil and Gas Extraction". Canada has initiated preliminary discussions with Statistics Canada to disaggregate the AD to "mining" and "oil and gas extraction". However, Canada explained that this improvement may take several years to be completed
E.10	1.A.2.a Iron and steel: all fuels – CO_2, CH_4 and N_2O (E.20, 2015) Comparability	Reallocate emissions from fuels used for coke production to the subcategory manufacture of solid fuels and other energy industries	Resolved. During the review, Canada explained that emissions from fuels used for coke production are currently allocated under both energy and industrial processes. Since coking operations occur

ID#	*Issue classification*[a]	*Recommendation made in previous review report*	*ERT assessment and rationale*
			at integrated iron and steel plants, and since the amount of fuel used in heat cokers is not disaggregated in the energy data, the reallocation of emissions is difficult. Canada is still considering options to reallocate these emissions. The ERT accepts that the Canadian energy statistics do not provide data at a level of disaggregation that would allow the Party to report the emissions in accordance with the CRF categories. The ERT notes that it is acceptable for a Party to include emissions elsewhere when the Party can justify the reasons for its reporting. See also ID# E.27
E.11	1.A.2.e Fuel combustion – sectoral approach: all fuels – CO_2, CH_4 and N_2O (E.21, 2015) Comparability	Reallocate emissions from fuels used in food industries to the subcategory food processing, beverages and tobacco, as required by the 2006 IPCC Guidelines and the UNFCCC Annex I inventory reporting guidelines	Resolved. The ERT noted from the response provided by the Party during the review that Canada does not yet have a clear plan to improve the reporting of emissions from this category. In its response to the provisional main findings of the ERT, Canada explained that its statistics agency, which is responsible for the compilation of the national energy balance (RESD), does not disaggregate the energy data to the food processing, beverages and tobacco subcategory. The ERT accepts that the Canadian energy statistics do not provide data at a level of disaggregation that would allow the Party to report in accordance with the CRF categories. The ERT notes that it is acceptable for a Party to report emissions as "IE" when the Party can justify the reasons for its reporting. See

ID#	*Issue classification*[a]	*Recommendation made in previous review report*	*ERT assessment and rationale*
			also ID# E.27
E.12	1.A.3.b Road transportation: gasoline – CO_2 (E.23, 2015) Transparency	Provide an explanation in the NIR that the low IEF for gasoline reported in the CRF tables is attributed to the outdated GCVs used to convert the AD and EF from physical to energy units	Not resolved. The response provided by the Party during the review indicates that efforts to address the recommendation are ongoing, but no explanation has been provided in the NIR
E.13	1.A.3.b Road transportation: liquid fuels – CO_2 (E.7, 2015) (27, 2014) Accuracy	Carry out the analysis to evaluate the opportunities to repeat portions of the McCann (2000)[b] study to investigate the evolution and current applicability of the final applied EF, and document progress made in this regard in the improvement plan and in the NIR	Addressing. According to table 8-4 of the NIR, titled "Summary of Canada's Inventory Improvement Plan", the Party has initiated the necessary data collection/study
E.14	1.A.3.c Railways: solid fuels – CO_2, CH_4 and N_2O (E.24, 2015) Completeness	Either estimate and include in the inventory CO_2, CH_4 and N_2O emissions from steam trains, or provide a justification in the NIR, consistent with the UNFCCC Annex I inventory reporting guidelines, that these emissions are considered insignificant	Addressing. NIR table 8-4 states that the implementation of this recommendation is under verification and finalization
E.15	1.A.3.d Domestic navigation: liquid fuels – CO_2, CH_4 and N_2O (E.8, 2015) (28, 2014) (29, 2013) (58, 2012) (38, 2011) (38, 2010) (47, 2009) (36, 2008/2007) (36, 2006) Accuracy	Report on the progress of investigations regarding the availability of data which would enable the accurate disaggregation of domestic and international navigation fuels. If new data become available, revise the emission estimates for the entire time series	Resolved. The Party reported on progress in its NIR, section 3.2.6.6. The ERT is of the view that the method used by the Party is appropriate considering the currently available data. See ID# E.31
E.16	1.A.3.e Other transportation: all fuels – CO_2, CH_4 and N_2O (E.25, 2015) Comparability	Reallocate emissions from fuels used in fisheries to the subcategory agriculture/forestry/fishing	Resolved. During the review, the Party stated that it is currently unable to disaggregate fishing from domestic navigation. The ERT notes that it is acceptable for a Party to include emissions elsewhere when the Party can justify the reasons for its reporting. See also ID# E.27
E.17	1.A.3.e Other transportation:	Document the progress made in reallocating the associated emissions from the subcategory fuels used in	Not resolved. The response provided by the Party during

ID#	*Issue classification*[a]	*Recommendation made in previous review report*	*ERT assessment and rationale*
	all fuels – CO_2, CH_4 and N_2O (E.26, 2015) Comparability	off-road activities under agriculture and forestry to the subcategory off-road vehicles and other machinery (agriculture/forestry/fishing)	the review indicates that efforts to address the recommendation are ongoing. However, the ERT could not find any information in the NIR to indicate the progress made towards implementation of this recommendation specifically. However, the ERT noted that the planned improvement listed in NIR table 8-4 ("improved, bottom-up methodology for off-road GHGs") may contribute to addressing this recommendation
E.18	1.A.4.c Agriculture/forestry/ fishing: all fuels – CO_2, CH_4 and N_2O (E.27, 2015) Not an issue	Identify ways to collect the necessary data for the disaggregation between domestic and international navigation (please refer to table 3, issue ID# E.8 in the 2015 inventory review report) to revise the CO_2, CH_4 and N_2O emission estimates for the entire time series for the subcategory fishing	No longer relevant. The ERT considers that this issue is covered by ID# E.15 above
E.19	1.A.5.b Mobile: liquid fuels – CO_2, CH_4 and N_2O (E.28, 2015) Transparency	Indicate in the NIR under which category emissions from domestic military navigation are reported	Resolved. The NIR (section 3.2.6.2) states that fuel use by Canada's national defence (military) and coastguard are reported under "Public administration" in the RESD and are not reported separately owing to confidentiality reasons. Consequently, these emissions are included under transportation (for diesel and gasoline fuel) or under stationary combustion (for light fuel oil and heavy fuel oil)
E.20	1.B.1.a Coal mining and handling: solid fuels – CO_2 (E.29, 2015) Transparency	Report the CO_2 emissions from underground mines as "NA" and indicate in the NIR that no CO_2 emissions associated with flaring and drainage systems of underground mines occur in the country	Addressing. The response provided by the Party during the review indicates that the recommendation has been implemented. The ERT noted that the notation key "NA" has been used in CRF table 1.B.1, but was unable to find any reference in the NIR to the assumption that no CO_2

ID#	*Issue classification*[a]	*Recommendation made in previous review report*	*ERT assessment and rationale*
			emissions associated with flaring and drainage systems of underground mines occur
E.21	1.B.1.a Coal mining and handling: solid fuels – CH_4 (E.30, 2015) Transparency	Document in the NIR that production in Nova Scotia mines stopped in 2001	Resolved. The NIR (annex 3, section A3.2.1.2, titled "Abandoned Underground Coal Mines") provides a discussion of Nova Scotia coal mine closures
E.22	1.B.1.a Coal mining and handling: solid fuels – CH_4 (E.32, 2015) Transparency	Transparently explain in the NIR the assumptions, country-specific surface mines data, parameters and information from the national studies that were used, in order to justify the accuracy of the emission calculations. If this information is not available, then, as a first step, for emissions from surface mines which were estimated by using the adjusted Coal Industry Advisory Board Method (CIABM), apply the respective tier 1 method from the 2006 IPCC Guidelines, and afterwards plan and implement the application of a tier 2/tier 3 method that will be transparently described in the NIR, provided that it is developed in a manner consistent with the 2006 IPCC Guidelines and following the provisions of paragraph 41 of the UNFCCC Annex I inventory reporting guidelines	Not resolved. The ERT could not identify where changes have been made in the 2016 NIR to increase the level of detail provided in comparison with the 2015 submission. During the review the Party indicated that the recommendation has been implemented. In response to the provisional main findings of the ERT, Canada explained that the CIABM approach consists of an industry report which contains confidential information. For transparency purposes, Canada has historically shared this report with the ERTs via a confidentiality agreement. The Party further stated that the adjusted CIABM approach is a tier 2/tier 3, country-specific method and that several previous in-country reviews which have had access to the CIABM report have not provided a recommendation that Canada apply the IPCC tier 1 approach. The ERT notes this information
E.23	1.B.1.b Solid fuel transformation: solid fuels – CO_2, CH_4 and N_2O (E.34, 2015) Completeness	Verify that the emissions from all coke oven gas both consumed and flared at the four integrated iron and steel plants are included in the inventory and report accordingly in the NIR	Not resolved. The ERT considers that the statements in section 3.2.5.2 of the NIR on the estimation and reporting of emissions from coke oven gas are not fully transparent. The ERT also noted that the response

ID#	*Issue classification*[a]	*Recommendation made in previous review report*	*ERT assessment and rationale*
			provided by the Party during the review indicates that the recommendation has been noted and is under consideration
E.24	1.B.2.a Oil: liquid fuels – CH_4 (E.9, 2015) (29, 2014) Accuracy	Continue to explore ways to review and update the bitumen model to capture industry changes and document progress on this in the improvement plan and in the NIR	Addressing. During the review, Canada explained that a study to update the emission estimates for bitumen production started in April 2016. The study is scheduled to be completed in the summer of 2017, and will provide facility-specific emission data for all existing facilities in Canada for 2015. Additionally, emissions for each facility will be provided for the years 2003 to 2014 either by using facility-reported data, or by using backcasting techniques to ensure time-series consistency. This information was not provided in the NIR
IPPU			
I.1	2.A.4 Other process uses of carbonates – CO_2 (I.9, 2015) Transparency	Include AD for all emissive uses of carbonates in the NIR (AD for limestone and dolomite use other than that used for iron and steel production were not included)	Resolved. The AD for consumption of limestone and dolomite in category 2.A.4.d are included in the NIR (part 1, table 4-4)
I.2	2.A.4 Other process uses of carbonates – CO_2 (I.10, 2015) Completeness	Include CO_2 emissions from ceramics production in the inventory or demonstrate that the emissions are insignificant, as defined in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines	Not resolved. Emissions from ceramics production are still not estimated (reported as "NE" in CRF table 2(I).A-Hs1). The ERT noted that the production activity is covered by NAICS category 32711 "Pottery, Ceramics and Plumbing Fixture Manufacturing", with a total number of 216 establishments in Canada. During the review, the Party explained that a study is under development, but so far no progress has been made
I.3	2.B.8 Petrochemical	Include CO_2 and CH_4 emissions from ethylene oxide	Not resolved. CO_2 and CH_4

ID#	*Issue classification*[a]	*Recommendation made in previous review report*	*ERT assessment and rationale*
	and carbon black production – CO_2 and CH_4 (I.11, 2015) Completeness	production in the inventory or demonstrate that the emissions are insignificant, as defined in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines	emissions from ethylene oxide production are still not estimated (reported as "NE" in CRF table 2(I).A-Hs1). In response to the draft review report, Canada explained that data on ethylene oxide production will be collected by Statistics Canada for the year 2016 onwards. To help with completing the set of data needed for the time series, Canada may consider having a consulting study done. Results of data collection and study are expected to allow for the assessment of the significance of this category
I.4	2.C.1 Iron and steel production – CO_2 (I.5, 2015) (37, 2014) Transparency	Include the allocation of non-energy use of other reductants identified in this category in the improvement plan and implement steps to further disaggregate the energy statistics and other (industrial processes) category	Addressing. In response to the provisional main findings of the ERT, Canada explained that all the emissions related to the use of metallurgical coke as a reagent for reduction of iron ore in the production of pig iron are allocated in the IPPU sector and that the allocation of emissions from reductants other than metallurgical coke (i.e. natural gas and coal) to category 2.C.1 (iron and steel production) are included in Canada's improvement plan
I.5	2.C.3 Aluminium production – CO_2 and PFCs (I.14, 2015) Transparency	Update the information in the NIR regarding the methods used to estimate CO_2 and PFC emissions for the entire time series	Resolved. The methods used for the time series are provided in section 4.11.2 of the NIR
I.6	2.C.3 Aluminium production – SF_6 (I.13, 2015) Transparency	Include the reasons for the significant changes in the trend in the SF_6 IEF between 2011 and 2012 in the NIR	Resolved. Explanations were included in section 4.11.1 of the NIR
I.7	2.D Non-energy products from fuels and solvent use – CO_2	Include in the improvement plan acknowledged in the previous review report (see issue ID# I.6 in the 2015 inventory review report) an analysis that will allow the Party to disaggregate this category by fuel, indicating	Resolved. The ERT noted from NIR tables A3-20 and A3-21 and information provided by Canada during

ID#	*Issue classification*[a]	*Recommendation made in previous review report*	*ERT assessment and rationale*
	(I.12, 2015) Transparency	the related uses, EFs and fraction of stored carbon in products, at least for the main components, with full documentation in the NIR	the review that Canada is able to disaggregate the category by fuel and by use, and therefore considered that the analysis referred to in the previous recommendation was carried out. However, emissions are not reported in a disaggregated manner owing to confidentiality constraints
I.8	2.D Non-energy products from fuels and solvent use – CO_2 and CH_4 (I.6, 2015) (37 and 41, 2014) (47, 2013) (78, 2012) (77, 2011) Transparency	Implement the scheduled improvements for this category, reporting on progress in future inventory submissions, and continue the improvements necessary to document the methods and sources of AD and EFs in the NIR	Addressing. Ethylene and methanol production (2 340.30 kt CO_2 in total for 2014), previously included under emissions from non-energy products from fuels, are now allocated to category 2.B.8 (petrochemical and carbon black production) based on the disaggregation provided by a country-specific study (NIR, section 4.9.5). However, the ERT noted that the improvements to other categories are still pending and that considerable CO_2 emissions (amounting to 13 093.69 kt CO_2 for 2014) are still allocated under category 2.D.3, "other and undifferentiated", for which the transparency of the reporting can be further improved
I.9	2.E Electronics industry – NF_3 (I.15, 2015) Accuracy	Provide information on the parameters used for estimating emissions from this category, and use a constant EF for the entire time series	Resolved. Relevant information was provided in the NIR (sections 4.14.2 and 4.14.5). A constant EF was used for the entire time series
I.10	2.F Product uses as substitutes for ozone-depleting substances – HFCs, PFCs and SF_6 (I.7, 2015) (40, 2014) (44, 2013) (76, 2012)	Continue to work on incorporating into the inventory the results of a study on country-specific EFs for halocarbons and SF_6, and continue to improve the transparency and comparability of the inventory	Resolved. Canada has continued to improve the estimation of HFC emissions. For example, section 4.15.5 of the NIR reports recalculations using new country-specific EFs. In response to the provisional main findings of the ERT, the Party explained

ID#	*Issue classification*[a]	*Recommendation made in previous review report*	*ERT assessment and rationale*
	(75, 2011) (59, 2010) (63, 2009) (51, 2008) Accuracy		that the study in question was about HFCs, and not about PFCs and SF_6. The ERT also notes that HFC emissions cover over 99.9% of total emissions from category 2.F and therefore considers that the issue is resolved
I.11	2.F Product uses as substitutes for ozone-depleting substances – HFCs (I.16, 2015) Accuracy	Fix the acknowledged errors (HFC emissions in domestic refrigeration, commercial refrigeration and mobile air-conditioning equipment on decommissioning were not reported), update the time series and develop an appropriate QC check to ensure that such errors do not reoccur	Resolved. The Party corrected the reporting in CRF table 2(II)B-Hs2, indicating that an appropriate QC check had been undertaken
I.12	2.F Product uses as substitutes for ozone-depleting substances – HFCs (I.17, 2015) Accuracy	Correct the identified problems in estimates for manufacturing and servicing/maintenance emissions, as well as in the foam blowing, fire protection, aerosols, solvents and electrical equipment subcategories, in order to allow the correct utilization of either the tier 2a method (with data for emissions related to the management of refrigerant containers, emissions related to the refrigerant charge, annual emissions from the banks of refrigerants and servicing emissions at system disposal) or the tier 2b method (with data for annual sales of new refrigerant, total charge of new equipment, original total charge of retiring equipment and amount of intentional destruction) from the 2006 IPCC Guidelines	Addressing. During the review, Canada explained that servicing quantities for the estimation of assembly HFC emissions have been excluded, as recommended. In the final data preparation step for reporting in the CRF tables, the equation for calculating the quantity for manufacturing was, however, not modified to exclude the servicing HFC quantity. Canada informed the ERT that it plans to correct this for the 2017 submission
I.13	2.F Product uses as substitutes for ozone-depleting substances – HFCs (I.18, 2015) Consistency	Apply the methodology presented in the 2006 IPCC Guidelines for refrigeration and air conditioning for the entire time series (including for 1995–1998), and, if this is not possible, use one of the techniques provided in the 2006 IPCC Guidelines to estimate the missing values	Not resolved. During the review, the Party explained that this issue has been noted and is under consideration
I.14	2.G Other product manufacture and use – SF_6 (I.19, 2015) Comparability	Correctly report SF_6 emissions from manufacturing, use and disposal of electrical equipment and report the corresponding AD (part of the emissions were incorrectly allocated to manufacturing)	Resolved. All emissions were reported under “from stocks” in CRF table 2(II)B-Hs2. In response to the provisional main findings of the ERT, Canada explained that SF_6 emission estimates are provided by the Canadian Electricity Association and Hydro-Québec and relate to aggregated values, combining emissions from SF_6 use (to

ID#	*Issue classification*[a]	*Recommendation made in previous review report*	*ERT assessment and rationale*
			top up equipment), equipment disposal and equipment failure. The ERT noted that this is also explained in the NIR (section 4.17.2). See also ID# I.24
Agriculture			
A.1	3. General (agriculture) – CH_4 and N_2O (A.11, 2015) Completeness	Provide documentation to support the reporting that there were no wild boar between 1990 and 1996 or extrapolate from the available data (from Statistics Canada),[c] to fill the population data gap instead of using 0 (zero) for the years between 1990 and 1996	Not resolved. Canada has not provided any supporting documentation regarding the non-existence of wild boars between 1990 and 1996, nor has it provided any AD or emission estimates for this period
A.2	3.A Enteric fermentation – CH_4 (A.13, 2015) Adherence to the UNFCCC Annex I inventory reporting guidelines	Review the QA/QC procedures in the light of the new CRF Reporter software and ensure that the same live weight data are used to calculate CH_4 emissions from enteric fermentation and manure management for non-dairy cattle for the time series	Resolved. Canada has reported the same weight for non-dairy cattle in CRF tables 3.As2 and 3.B(b) (e.g. 636.86 kg/animal for 2014)
A.3	3.A.4 Other livestock – CH_4 (A.12, 2015) Comparability	Use the notation key "NE" for CH_4 emissions from enteric fermentation from fur-bearing animals and rabbits	Resolved. Canada has used the notation key "NE" for CH_4 emissions from enteric fermentation from fur-bearing animals and rabbits in CRF table 3.As1
A.4	3.B Manure management – CH_4 (A.14, 2015) Adherence to the UNFCCC Annex I inventory reporting guidelines	Review the QA/QC procedures in the light of the new CRF Reporter software and ensure that the correct VS values are reported in the CRF tables for all animal types	Resolved. Canada has reported the same VS values in NIR table A3-35 (part 2, page 84) and in CRF table 3.B(a)s1 for all animal types
A.5	3.B Manure management – CH_4 and N_2O (A.15, 2015) Adherence to the UNFCCC Annex I inventory reporting guidelines	Correct the rounding of the MMS allocation of other systems for dairy cattle in the NIR	Resolved. Canada has reported the same MMS allocation values for dairy cattle for other systems in NIR table A3-39 (part 2, page 87) and in CRF table 3.B(a)s2
A.6	3.B.4 Other livestock – CH_4	Provide an explanation for the MCF values used in the NIR for poultry (0.2 (liquid systems), 0.015 (solid	Resolved. Canada provided an explanation for the MCF

ID#	*Issue classification*[a]	*Recommendation made in previous review report*	*ERT assessment and rationale*
	(A.5, 2015) (50, 2014) Transparency	storage and dry lot), 0.015 (pasture, range and paddock) and "NA" (other systems)), which are derived from the 2006 IPCC Guidelines	values used for poultry in the NIR (part 2, section A3.4.3.3)
A.7	3.B.4 Other livestock – CH_4 (A.6, 2015) (50, 2014) Adherence to the UNFCCC Annex I inventory reporting guidelines	Correct the transcription errors between the NIR and the CRF tables for poultry, whereby in the NIR the notation key "NA" was reported for the MCF for poultry in other systems, but in CRF table 4.B(a) an MCF value of 0.01 was reported	Resolved. Canada reported 0.015 as the MCF for poultry in other systems in table A6-30 of the NIR (part 2, page 205) and in CRF table 3.B(a)s2
A.8	3.D Direct and indirect N_2O emissions from agricultural soils – N_2O (A.9, 2015) (52, 2014) Adherence to the UNFCCC Annex I inventory reporting guidelines	Address the observed inconsistency between the NIR and the CRF table regarding the amount of nitrogen excretion for buffalo and provide revised estimates	Resolved. Canada reported the same value for the nitrogen excretion rate of 67.6 kg N/head/year for buffalo in the NIR (part 2, table A3-44, page 92) and in CRF table 3.B(b)
A.9	3.D Direct and indirect N_2O emissions from agricultural soils – N_2O (A.16, 2015) Completeness	Report direct N_2O emissions from sewage sludge and other organic fertilizers applied to soils	Not resolved. Canada has not reported direct N_2O emissions from sewage sludge and other organic fertilizers applied to soils in CRF table 3.D (the notation key "NE" was used for both subcategories). Furthermore, it is stated in the NIR (part 2, page 180) that data on the amount of N in sewage sludge and other organic fertilizers applied to soils are not available. See also ID# A.15
A.10	3.G Liming – CO_2 (A.17, 2015) Completeness	Either obtain data on the use of dolomite and estimate CO_2 emissions using the IPCC default value (0.13 t CO_2-C/t) or use the notation key "NE" instead of the notation key "IE"	Resolved. The Party has included emissions from dolomite in emissions from limestone (the notation key "IE" has been used in CRF table 3.G-I for dolomite), and has changed the EF for limestone to take into account the 24% portion of dolomite contained in liming material, as explained in the NIR (part 1, pages 141 and 189)

ID#	*Issue classification*[a]	*Recommendation made in previous review report*	*ERT assessment and rationale*
LULUCF			
L.1	4. General (LULUCF) (L.2, 2015) (57, 2014) Transparency	Provide a summary table including all uncertainties that have been calculated, including the overall uncertainty of the sector	No longer relevant. The ERT considers that there is no explicit requirement to provide sectoral sums (or sectoral summary tables) for the uncertainty estimates in the 2006 IPCC Guidelines. During the review, the Party explained that an overall uncertainty assessment is a planned improvement. See ID# L.15
L.2	4. General (LULUCF) (L.4, 2015) (59, 2014) (9 and 63, 2013) Completeness	Improve the completeness of reporting of the pools in all mandatory categories currently reported as "NE" and include a description on how the notation keys have been used	Not resolved. Canada has revised its notation keys for some carbon pools (e.g. grassland remaining grassland in reporting zone RZ8 Hudson Plains is reported as "NO" instead of "NE"), but the completeness of the reporting has not improved in terms of providing estimates for categories or pools previously reported as "NE". In the CRF tables of the 2016 submission, Canada reported several carbon pools as "NE": all pools in wetlands and settlements converted to cropland and in cropland and wetlands converted to settlements, and in several reporting zones under settlements remaining settlements (see annex II to this document); soils in all reporting zones in settlements remaining settlements; and soils in grassland remaining grassland in several reporting zones (soils in other reporting zones in grassland remaining grassland are reported as "NO"). The NIR cites a lack of AD as the reason for reporting the notation key "NE" (sections 6.8.2.1 and 6.6). This is an area that the Party has included in its

ID#	*Issue classification*[a]	*Recommendation made in previous review report*	*ERT assessment and rationale*
			planned inventory improvements listed in table 8-4 of the NIR. Justification for the application of the insignificance threshold (defined in para. 37(b) of the UNFCCC Annex I inventory reporting guidelines) for the use of the notation key "NE" in the Party's reporting has not been provided
L.3	4. General (LULUCF) (L.13, 2015) Completeness	Improve the completeness for representing land areas in the LULUCF sector by amending the reporting (both the land-use change matrix and the estimates for category-specific emissions/removals in the CRF tables) by including all land areas and making it clear which categories and subcategories occur in Canada and whether the emissions/removals are calculated or not. This includes both managed land areas where no emissions/removals are expected (e.g. grassland remaining grassland) as well as unmanaged areas	Addressing. During the review, the Party clarified that CRF table 4.1 includes the total land area and all unmanaged land is included together. The Party further explained that in the planned inventory improvements, priority is given to improving the completeness of the land-use change matrix for conversions reported as "NE" in which anthropogenic emissions and removals are expected to occur (see also ID#s L.16 and L.17)
L.4	4. General (LULUCF) (L.14, 2015) Transparency	Include information to explain the application of the 20-year transition time, specifically showing how areas of land converted to forest land over 20 years are classified under forest land remaining forest land in the NIR, as this procedure was not clearly explained in the 2015 NIR	Resolved. The NIR (part 1, page 145) explains that the IPCC default land-use change transition period of 20 years is used for all land-use change categories, except for land conversion to flooded lands (reservoirs) for which a 10-year transition period is used. The NIR further notes that the use of the 20-year land transition period for reporting land areas is simply procedural since higher-tier estimation methods are used to calculate the emission and removal estimates
L.5	4.A Forest land – CO_2 (L.6, 2015) (63, 2014) Transparency	Provide further numerical examples of verification activities of the CBM-CFS-3 model at the pool level, as well as pool-specific uncertainties in the NIR	Addressing. The NIR (section 6.3.1.3) includes the mean error between the CBM-CFS-3 model predictions and the national forest inventory for

ID#	*Issue classification*[a]	*Recommendation made in previous review report*	*ERT assessment and rationale*
			four pools, but the pool-specific uncertainties have not been provided
L.6	4.A Forest land – CO_2 (L.17, 2015) Transparency	Improve the graphical description of the structure of the CBM-CFS-3 model in the NIR by adding a figure for example, including references to IPCC carbon pools including harvested wood products	Resolved. NIR figure A3-11, titled "Carbon Pools and Transfers Simulated by the CBM-CFS-3", is sufficiently transparent with reference to carbon pools (biomass, dead wood, litter, soil organic matter), but does not include a link to the harvested wood products pool (because it is not part of the CBM-CFS-3 model). See also ID# L.18
L.7	4.A.2 Land converted to forest land – CO_2 (L.19, 2015) Accuracy	Provide additional information on why using zero for annual area conversions to forest land for the period 2009–2013 is considered reasonable compared with other alternative ways to construct the time series. Continue with efforts to acquire the missing AD for land converted to forest land	Not resolved. The ERT was unable to identify such additional information in the NIR. During the review, the Party explained that afforestation subsidies were used prior to 2009, and therefore extrapolation based on the afforestation data covering that time period is not reasonable for the later time period when subsidies are not available. Canada explains in the NIR (section 6.3.2.6) that efforts are under way to obtain AD for recent years from provincial and territorial resource management agencies
L.8	4.B.2 Land converted to cropland – CO_2 (L.9, 2015) (66, 2014) Accuracy	Evaluate the method used; consider how to combine the results from the CBM-CFS-3 model and the equation for carbon loss (equation A3-66) used in the estimates; and clearly explain in the NIR which components are included in the estimates	Resolved. The NIR (part 2, page 119) explains which components from the CBM-CFS-3 model are included. This excludes soil organic matter emissions on forest land converted to cropland. The methodology used for estimating soil organic carbon emissions is explained in section A3.5.3.3 of the NIR
L.9	4(II) Emissions and removals from drainage and rewetting and other	Provide evidence that drainage does not occur on forest land and consider whether the notation key "NE" should be used instead of the notation key "NO" for	Addressing. The notation key "NE" was used in CRF table 4(II) for drained organic soils on forest land. Canada

ID#	*Issue classification*[a]	*Recommendation made in previous review report*	*ERT assessment and rationale*
	management of organic/mineral soils – CH_4 and N_2O (L.5, 2015) (61, 2014) Completeness	emissions of CH_4 or N_2O	explained and documented in the NIR (table 8-4) that it is conducting ongoing work to gather information on the extent to which forestry practices, including drainage, are applied in peatlands
L.10	4(III) Direct N_2O emissions from N mineralization/ immobilization and 4(IV) Indirect N_2O emissions from managed soils – N_2O (L.24, 2015) Completeness	Estimate all the direct N_2O emissions as well as the associated indirect N_2O emissions from nitrogen mineralization/immobilization associated with loss/gain of soil organic matter. Until the estimation is implemented, provide information on the planned improvement and assessment of the quantitative impact of this missing category in accordance with the provisions in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines	Not resolved. Emissions are reported only for cropland (CRF table 4(III)). Emissions from forest land, grassland remaining grassland, wetlands and settlements are reported as "NE". Justification for the application of the insignificance threshold (defined in para. 37(b) of the UNFCCC Annex I inventory reporting guidelines) for the use of the notation key "NE" is not provided. This issue is not included in the Party's inventory improvement plan. In CRF table 4(IV), indirect emissions are reported as "IE"
L.11	4(V) Biomass burning – CO_2 (L.23, 2015) Adherence to the UNFCCC Annex I inventory reporting guidelines	Include in the inventory submission: (1) information on total CO_2 emissions with and without indirect CO_2; and (2) an explanation of the methodology and assumption(s) used to convert from CO to CO_2 that the Party provided during the review	Resolved. The Party's submission now includes total CO_2 emissions with and without indirect CO_2 emissions in CRF table 10. An explanation of the methodology and assumption(s) used to convert from CO to CO_2 is not provided, but is not a requirement of the 2006 IPCC Guidelines. See also ID# L.21
L.12	4(V) Biomass burning – CO_2 (L.23, 2015) Adherence to the UNFCCC Annex I inventory reporting guidelines	Reflect the information on emissions with and without indirect CO_2 in CRF table 10	Resolved. CRF table 10 includes emissions with and without indirect CO_2
L.13	4.G Harvested wood products – CO_2 (L.22, 2015)	Include data for 1900–1940 for estimating emissions from the category harvested wood products, as part of the improvement work in relation to the category, and	Addressing. In NIR table 8-4, titled "Summary of Canada's Inventory Improvement Plan", the Party explains that

ID#	*Issue classification*[a]	*Recommendation made in previous review report*	*ERT assessment and rationale*
	Accuracy	consider how the uncertainty may be affected	the expansion of temporal coverage is limited by a lack of AD. The harvested wood products uncertainty analysis is presented for the first time in the 2016 NIR (section 6.4.2) and improvements to this analysis are planned, according to NIR table 8-4
Waste			
W.1	5. General (waste) (W.3, 2015) (74, 2014) (76, 2013) Transparency	Include a detailed overview of waste streams, including at least the information provided to the ERT during the 2014 review process (i.e. amounts of waste generated, waste disposal (landfill and incineration) and waste diversion (recycling and composting))	No longer relevant. A detailed overview of waste streams has not been included in the NIR but the ERT considers that the inclusion of a waste stream analysis is not a mandatory requirement but one of the possible approaches that can be used
W.2	5.A Solid waste disposal on land – CH_4 (W.7, 2015) (78, 2014) Transparency	Document the source of data for, and the methods used to estimate, the CH_4 recovery values for 1990–1996. In the absence of such justification, assume no recovery for the period 1990–1996	Resolved. The Party described in the NIR (part 1, page 177) that data from 1991 to 1996 were interpolated based on the data for 1990, 1995 and 1997
W.3	5.A Solid waste disposal on land – CH_4 (W.13, 2015) Adherence to the UNFCCC Annex I inventory reporting guidelines	Implement the equations from the 2006 IPCC Guidelines for estimating CH_4 emissions from landfills and provide an explanation of how the country-specific parameters were calculated	Resolved. According to the NIR (part 2, page 149), the normalization factor used in the Scholl Canyon model has been corrected using information provided in the 2006 IPCC Guidelines. The Party also explained during the review that the approach used is mathematically equivalent to the IPCC first-order decay method. The basis for the country-specific parameters is explained in the NIR (part 2, section A3.6.1.1)
W.4	5.A Solid waste disposal on land – CH_4 (W.14, 2015) Adherence to the UNFCCC Annex I inventory reporting	Update the documentation on estimating the DOC values and use the references and equations from the 2006 IPCC Guidelines	Resolved. The equation used by the Party is provided in the NIR, with reference to the 2006 IPCC Guidelines (part 2, page 157, equation A3-88) and the choice of DOC values is explained in the NIR (part

ID#	*Issue classification*[a]	*Recommendation made in previous review report*	*ERT assessment and rationale*
	guidelines		2, section A3.6.1.1)
W.5	5.A Solid waste disposal on land – CH_4 (W.15, 2015) Transparency	Include in the NIR the rationale for the allocation of emissions from wood waste landfills to the category uncategorized waste disposal sites	Not resolved. During the review, the Party explained the rationale for reporting the wood waste disposal sites under the category uncategorized solid waste disposal sites (see ID# W.20). However, this information was not included in the NIR
W.6	5.A Solid waste disposal on land – CH_4 (W.16, 2015) Transparency	Either improve the transparency of the justification for using an oxidation value of zero, or apply the default value from the 2006 IPCC Guidelines	No longer relevant. The default value for an oxidation factor as provided in the 2006 IPCC Guidelines (volume 5, page 3.15) is zero
W.7	5.A Solid waste disposal on land – CH_4 (W.17, 2015) Transparency	Explain the approach used to extrapolate the AD for the amount of waste landfilled	Resolved. The approach used to extrapolate the AD when data are not available for the most recent years of the time series is explained in the NIR (part 1, page 174). The ERT agrees that the extrapolation of AD is a good practice when no data exist
W.8	5.B.1 Composting – CH_4 and N_2O (W.18, 2015) Completeness	Report CH_4 and N_2O emissions from composting	Resolved. CH_4 and N_2O emissions from composting are reported in the inventory for the first time in the 2016 submission, for the entire time series
W.9	5.B.2 Anaerobic digestion at biogas facilities – CH_4 and N_2O (W.19, 2015) Adherence to the UNFCCC Annex I inventory reporting guidelines	Improve the QA/QC procedures for the waste sector and ensure that the use of notation keys is consistent between the NIR and the CRF tables	Resolved. No inconsistencies between the NIR and the CRF tables were identified during the review
W.10	5.C.1 Waste incineration (W.2, 2015) (73, 2014) (83, 2013) (53, 2012) (31, 2011) Comparability	Report all emissions related to energy recovery in the energy sector	Addressing. The Party indicates in NIR table 8-4 on planned inventory improvements that, based on the recommendations of previous ERTs, the Party has initiated data analysis to separate energy recovery from

ID#	*Issue classification*[a]	*Recommendation made in previous review report*	*ERT assessment and rationale*
			MSW incineration and to allocate the emissions to the energy sector. The ERT noted that the situation is similar to that explained in the 2015 review report. During the review, the Party indicated that this inventory improvement is planned to be implemented for the 2017 or 2018 submission
W.11	5.C.1 Waste incineration – N_2O (W.22, 2015) Accuracy	Either justify the continued use of the default EF from the Revised 1996 IPCC Guidelines as appropriate to Canada's national circumstances, or update the EF to that provided in the 2006 IPCC Guidelines	Not resolved. The Party explains in the NIR (section A3.6.6.1) that it uses the EF 148 g N_2O/t waste incinerated, which is the average of the range of the default EFs for five-stoker facilities provided in the Revised 1996 IPCC Guidelines. The Party has not justified the use of this EF in the NIR. The ERT notes that the EF is in the range of values presented in the 2006 IPCC Guidelines
W.12	5.C.1 Waste incineration – CO_2 (W.20, 2015) Adherence to the UNFCCC Annex I inventory reporting guidelines	Update the references and equations used to those provided in the 2006 IPCC Guidelines, particularly given that the approaches are mathematically equivalent	Resolved. The methodological description in the NIR (section 7.4.2.1) has been updated to refer to the 2006 IPCC Guidelines
W.13	5.C.1 Waste incineration – CO_2 (W.9, 2015) (84, 2014) (84, 2013) Completeness	Estimate the CO_2 emissions from clinical waste incineration in dedicated clinical waste incinerators	Resolved. The CO_2 emissions from clinical waste incineration have been included in the inventory for the entire time series
W.14	5.C.1 Waste incineration – N_2O (W.21, 2015) Completeness	Estimate the N_2O emissions from clinical waste incinerated in dedicated waste incinerators	Resolved. The N_2O emissions from clinical waste incineration have been included in the inventory for the entire time series
W.15	5.D Wastewater treatment and discharge	Include a detailed overview of wastewater streams and of wastewater treatment discharge pathways in the NIR to improve transparency and to underpin the use of the	No longer relevant. The ERT considers that a detailed overview of waste streams

ID#	*Issue classification*[a]	*Recommendation made in previous review report*	*ERT assessment and rationale*
	– CH_4 and N_2O (W.11, 2015) (81, 2014) Transparency	selected EFs	and of waste treatment discharge pathways is not required as documentation by the 2006 IPCC Guidelines. A summary of the methods, AD and EFs used is included in the NIR (section 7.5)
W.16	5.D.1 Domestic wastewater – CH_4 (W.10, 2015) (80, 2014) Transparency	Correct the description in the NIR to improve the transparency of the AD used for estimating CH_4 emissions from domestic and commercial wastewater handling	Resolved. The ERT considers the current description in the NIR (part 2, section A3.6.2) as sufficiently transparent
W.17	5.D.1 Domestic wastewater – CH_4 and N_2O (W.12, 2015) (82, 2014) Accuracy	Justify the assumption that there is 100% efficient combustion and flaring at anaerobic wastewater treatment systems servicing urban municipalities	Addressing. During the review, the Party explained that the distribution systems for these facilities are typically under negative pressure and the utilization systems are highly efficient and have close to 100% combustion of CH_4. The Party also explained that consideration has been given to amending the Canadian federal wastewater regulations that were first implemented in 2015 in order to obtain facility-level AD across the country. The ERT noted that there is no information on this issue in the NIR
W.18	5.D.1 Domestic wastewater – CH_4 and N_2O (W.23, 2015) Not an issue	Investigate possibilities to disaggregate the national-level AD used (population) in line with the different treatment systems used in order to improve transparency	No longer relevant. The previous review report indicated that the disaggregation mentioned in the recommendation would improve transparency. However, the present ERT noted that the Party uses a country-specific method and parameters to estimate the emissions and these are thoroughly explained in the NIR (section A3.6.2.1) and in the report of AECOM Canada (2011)[d] provided to the ERT during the review. The ERT

ID#	*Issue classification*[a]	*Recommendation made in previous review report*	*ERT assessment and rationale*
			considers that the reporting is sufficiently transparent
W.19	5.D.1 Domestic wastewater – CH_4 (W.23, 2015) Accuracy	Investigate whether the organic load per capita per day (BOD) of 0.05 kg/person/day used in the estimates for municipal wastewater treatment (which is different from the default value provided in the 2006 IPCC Guidelines of 0.06 kg BOD_5/person/day) could be used in the Party's inventory as a country-specific value	Not resolved. Canada has not provided justification for the use of the lower value. Also, the AECOM Canada (2011)[d] report recommends the use of the default value of 0.06 kg BOD_5/person/day provided in the 2006 IPCC Guidelines

Abbreviations: AD = activity data, BOD = biochemical oxygen demand, CRF = common reporting format, DOC = degradable organic carbon, ECF = energy conversion factor, EF = emission factor, ERT = expert review team, GCV = gross calorific value, GHG = greenhouse gas, IE = included elsewhere, IEF = implied emission factor, IPCC = Intergovernmental Panel on Climate Change, IPPU = industrial processes and product use, LULUCF = land use, land-use change and forestry, MCF = methane conversion factor, MMS = manure management systems, MSW = municipal solid waste, NA = not applicable, NAICS = North American Industry Classification System, NE = not estimated, NIR = national inventory report, NO = not occurring, RESD = *Report on Energy Supply and Demand*, Revised 1996 IPCC Guidelines = *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, QA/QC = quality assurance/quality control, UNFCCC Annex I inventory reporting guidelines = "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories", VS = volatile solids, 2006 IPCC Guidelines = *2006 IPCC Guidelines for National Greenhouse Gas Inventories*.

[a] References in parentheses are to the paragraph(s) and the year(s) of the previous review report(s) where the issue was raised. Issues are further classified as defined in decision 13/CP.20, annex, paragraph 81.

[b] TJ McCann and Associates Ltd and Clearstone Engineering Ltd. March 2000. *1998 Fossil Fuel and Derivative (CO_2 per Unit of Fuel and Heating Values) Factors*. Prepared for the Pollution Data Branch, Environment Canada.

[c] Statistics Canada. 2008. Alternative Livestock on Canadian Farms: Census years 1981, 1986, 1991, 1996, 2001, and 2006 (Catalogue # 23-502-X). Available at <http://www.statcan.gc.ca/pub/23-502-x/23-502-x2007001-eng.pdf>.

[d] AECOM Canada. 2011. *Improved Methodology for the Estimation of Greenhouse Gases from Canadian Municipal Wastewater Treatment Facilities*.

IV. Issues identified in three successive reviews and not addressed by the Party

7. In accordance with paragraph 83 of the UNFCCC review guidelines, the ERT noted that the issues included in table 4 have been identified in three successive reviews, including the review of the 2016 inventory submission of Canada, and have not been addressed by the Party.

Table 4
Issues identified in three successive reviews and not addressed by Canada

ID#[a]	*Previous recommendation for the issue identified*	*Number of successive reviews issue not addressed*
General		
G.1	Calculate the trend uncertainty including LULUCF	6 (2011–2016)
Energy		
	No such issues for the energy sector were identified	

ID#[a]	*Previous recommendation for the issue identified*	*Number of successive reviews issue not addressed*
IPPU		
	No such issues for the IPPU sector were identified	
Agriculture		
	No such issues for the agriculture sector were identified	
LULUCF		
L.2*	Improve the completeness of the reporting of the pools in all mandatory categories currently reported as “NE” and include a description of how the notation keys have been used	4 (2013–2016)
Waste		
W.10	Report all emissions related to energy recovery in the energy sector	6 (2011–2016)

Abbreviations: IPPU = industrial processes and product use, LULUCF = land use, land-use change and forestry, NE = not estimated.

[a] An asterisk is included after any issue ID# where the underlying issue is related to accuracy or completeness of a key category, a missing category or a potential key category, as indicated in decision 13/CP.20, annex, paragraph 83.

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V. Additional findings made during the 2016 technical review

8. Table 5 contains findings made by the ERT during the technical review of the 2016 inventory submission of Canada that are additional to those identified in table 3 above.

Table 5
Additional findings made during the 2016 technical review of the inventory submission of Canada

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue[a]? If yes, classify by type*
General			
G.3	NIR	The Party provides little AD in the NIR but instead provides links to certain data on publicly accessible websites (e.g. the time series for fuels combusted and animal numbers are not directly included in the NIR). In particular, in cases where the AD presented in the CRF tables are more aggregated than the data used in the calculation of the emissions, it is not possible to review how the calculations have been made. For several categories, Canada reports that AD are not available for all years or from the same sources for the whole time series (1990 to the latest reported year); for example, some AD for the agriculture sector are collected only every five years. Also, in the energy sector, for instance, the vehicle population data are taken from different data sources for different periods of the time series. The inclusion of sectoral tables with the key AD used in the calculations together with explanations of the sources of the data (references and information on when the data were modelled/interpolated/extrapolated) would facilitate the understanding of how the estimates have been derived and the assessment of time-series consistency. The EFs and parameters vary over time for many categories. Where this is the case, the provision of further information (e.g. tables in the NIR) on the time series for the EFs and parameters would also increase the transparency of the NIR The ERT recommends that Canada improve the transparency of the reporting by including information that explains changes over the times series for the key AD, EFs and parameters used in the NIR for fuels combusted (at the level of CRF table1.A(b)), and disaggregated animal number data where higher tiers are used. The AD, EFs and parameters should be reported in sufficient detail to facilitate (using both the CRF tables and the NIR) the understanding and replication of the calculations of the emission/removal estimates, where applicable	Yes. Transparency
G.4	NIR	Canada provided comprehensive trend descriptions in chapter 2 and in the executive summary of the NIR. The sectoral trends are addressed in the sectoral chapters. The trend descriptions address both short-term trends (from 2005 to the latest inventory year) and long-term trends (from 1990 to the latest inventory year), but do not address changes	Not an issue

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue[a]? If yes, classify by type*
		compared with the previous year. According to the outline of the NIR provided in the UNFCCC Annex I inventory reporting guidelines, any significant changes in emissions compared with the previous year should be explained The ERT encourages Canada to amend its descriptions and interpretation of emission trends in the NIR to include information on any significant changes in the latest inventory year compared with the previous inventory year	
G.5	Follow-up to previous reviews	Canada has not provided information in its NIR on how it has addressed all recommendations from the previous review report. In table 8-3 of the NIR, part 1, Canada provides information on changes in the latest inventory submission, including improvements due to the implementation of previous recommendations. Table 8-4 includes information on recommendations which are included in Canada's inventory improvement plan. However, information in these two tables addresses only a part of the recommendations and information provided in the improvement plan is very general in nature The ERT encourages Canada to include information in its NIR on whether and how it has addressed all recommendations from the previous review report to increase the transparency of the reporting, as well as to facilitate the review process. The ERT further encourages the Party to include information in the NIR on how it has progressed in implementing the recommendations as well as the reasoning for not addressing specific recommendations from the previous review report	Not an issue
G.6	Key category analysis	Canada aggregates categories in its key category analysis in a manner which differs from the categorization recommended in the 2006 IPCC Guidelines and does not provide detailed information on how this aggregation is performed in its NIR (e.g. it was not clear under which category emissions from biomass burning in the LULUCF sector were included (see ID# L.14 below)) The ERT recommends that Canada improve the transparency of the key category analysis by providing category-specific information on the aggregation of categories in the key category analysis	Yes. Transparency
Energy			
E.25	1. General (energy sector): all fuels – CO_2, CH_4 and N_2O	The ERT notes that Canada uses some CVs and EFs that deviate from the ranges set out in the 2006 IPCC Guidelines. For example, the anthracite EF reported for 2014 (CRF table 1.A(d)) was 23.50 t C/TJ on a GCV basis, equating to about 24.70 t C/TJ on an NCV basis. This is below the IPCC default of 26.8 t C/TJ (2006 IPCC Guidelines, volume 2, table 1.3). The ERT also notes that the low IEF for gasoline reported in the CRF tables	Yes. Transparency

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue[a]? If yes, classify by type
		is attributed to the outdated GCVs used to convert the AD and EFs from physical to energy units. For example, Canada reported an IEF of 66.17 t CO_2/TJ for gasoline for 2014 (see ID# E.3 in table 3)	
		In addition to the recommendation in ID# E.2 (see table 3) to update the CV for natural gas, the ERT also recommends that Canada review and, where necessary, update its CVs for other fuels. The ERT also recommends that Canada, following the plan referred to in ID# E.3, update its CO_2 EFs where appropriate, and provide references for these in the NIR. The ERT further recommends that Canada document all instances where the CVs and/or the CO_2 EFs deviate from the ranges set out in the 2006 IPCC Guidelines, and provide concise explanations for the reasons for these deviations, where the reasons are understood; where the reasons are not understood, Canada should investigate them and the ERT encourages Canada to summarize in the NIR the objectives and outcomes of any work programmes to update the CVs and/or CO_2 EFs which are in progress or which are planned, including those referred to in ID# E.3	
E.26	1.A. Fuel combustion – sectoral approach: all fuels – CO_2, CH_4 and N_2O	The ERT notes that there are some large differences between the AD used in the sectoral approach and the comparable IEA energy statistics. The ERT also notes that this is quite a common finding for Parties. It further notes that in many cases Canada knows the reasons for these differences. For example, production data for coal mines reported in the CRF tables are systematically higher (16–36%) than those reported to IEA. The response provided by the Party during the review explained that the CRF data reported reflect "gross production", while the figures reported to IEA are "net" or commercial quantities of coal	Not an issue
		The ERT encourages Canada to document the main reasons that might be expected for the differences between the AD used in the sectoral approach and in the IEA energy statistics in the NIR. This includes, inter alia, differences which can be attributed to data set timing (monthly and annual, provisional and revised) and possible different conversions from physical fuel units to energy units because Canada uses country-specific energy content factors	
E.27	1.A. Fuel combustion – sectoral approach: all fuels – CO_2, CH_4 and N_2O	The ERT noted that Canada is not able to disaggregate AD to all CRF subcategories, including liquid and gaseous fuels used in coke production (1.A.1.c); all fuels used in food processing, beverages and tobacco (1.A.2.e); and all fuels used in fishing (1.A.4.c.iii) (see ID#s E.10, E.11 and E.16, respectively, in table 3)	Yes. Transparency
		The ERT encourages Canada to continue to consider options which would allow more transparent reporting of CO_2, CH_4 and N_2O emissions from liquid and gaseous fuels used in coke production (1.A.1.c); all fuels used in food processing, beverages and tobacco	

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue[a]? If yes, classify by type*
		(1.A.2.e); and all fuels used in fishing (1.A.4.c.iii) for which the emissions and AD are currently reported as "IE" . If the Party is unable to report the CO_2, CH_4 and N_2O emissions from liquid and gaseous fuels used in coke production (1.A.1.c); all fuels used in food processing, beverages and tobacco (1.A.2.e); and all fuels used in fishing (1.A.4.c.iii) in the expected subcategories, the ERT recommends that it provide information in the NIR indicating under which subcategories they are reported, and include an explanation for its reporting in the NIR	
E.28	1.A. Fuel combustion – sectoral approach: peat – CO_2, CH_4 and N_2O	Canada has very large areas of peat soils. The ERT identified data sources[b] which suggest that peat extraction occurs in Canada, and also noted that CRF table 4.D for the LULUCF sector includes areas subject to peat extraction. The ERT further noted that Canada reported peat consumption in the energy sector as "NO" for the entire time series, but no reference is made in the NIR to the use, or not, of peat for energy purposes. However, there are some references to studies[c] that suggest that peat is used on a minor scale in Canada for fuel. During the review, Canada explained that all peat extraction in Canada is for agricultural purposes and that there is no extraction for energy purposes The ERT recommends that Canada explain in the NIR that peat is extracted in Canada for agricultural purposes only	Yes. Transparency
E.29	1.A.1.c Manufacture of solid fuels and other energy industries: solid fuels – CO_2, CH_4 and N_2O	In the NIR (section 3.2.5.2), Canada explained that the emissions from metallurgical coke production are included in the iron and steel subcategory (1.A.2.a). However, no methodological description is provided in the section of the NIR on the energy sector. Table A3-4 in the annex 3 to the NIR does not provide an estimation methodology, but only general indications of the data sources used In response to the provisional main findings of the ERT, Canada explained that, as stated in the NIR (section A3.1.4.1.3), only the CH_4 and N_2O emissions from iron and steel production are included in CRF category 1.A.2.a. Emissions of CO_2 are included in the IPPU sector. The methodology used to estimate emissions for category 1.A.2.a is presented in section A3.1.1 of the NIR and equation A3-1 was applied. Section A3.1.4.1.3 and table A3-4 of the NIR provide specific information on the allocation and handling of fuels/feedstocks from the national energy balance (RESD), while the applicable EFs are presented in annex 6 to the NIR. Section A.3.1.4.1.3 and table A3-4 also explain where the resulting emissions have been allocated. The Party further stated that the methodology used to calculate the emissions from iron and steel production is presented in section A3.3.3 of the NIR The ERT recommends that Canada add cross-references in the main section of the NIR to the methodological details provided in the relevant annexes to the NIR which describe the	Yes. Transparency

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue[a]? If yes, classify by type
		estimation of emissions from metallurgical coke production. The ERT also recommends that Canada clearly state in the NIR the categories where the emissions of each GHG from metallurgical coke production are reported	
E.30	1.A.2 Manufacturing industries and construction: all fuels – CO_2	Canada recalculated CO_2 emissions from manufacturing industries and construction, but the ERT noted that the reasons for and effects of the changes to the AD and EFs were not clearly explained in the NIR. During the review, Canada explained that the recalculations for manufacturing industries and construction (category 1.A.2) are almost wholly due to revisions of AD by the national statistics agency, Statistics Canada. The agency identified under-reported quantities of natural gas and heavy fuel oil in the mining industry and therefore provided revised quantities for 2013. This resulted in an increase in emissions of over 3.76 Mt CO_2 in this category for 2013. Natural gas was responsible for 102% and heavy fuel oil for 1.99% of the increase, while petroleum coke and light fuel oil were responsible for decreases of 1.67% and 2.17%, respectively, all relative to the total increase of 3.76 Mt CO_2. Further revisions by Statistics Canada resulted in much smaller changes to coal, kerosene and coke oven gas. There were small revisions to the EF for pet coke and still gas, accounting for approximately 10 kt of the CO_2 emission increase, or about 0.2%	Yes. Adherence to the UNFCCC Annex I inventory reporting guidelines
		The ERT recommends that Canada provide category-specific information on recalculations that relate to changes in the collection of AD and the choice of EF or method used, including information on the reasoning for the recalculations in the NIR	
E.31	1.A.3.d Domestic navigation: liquid fuels – CO_2, CH_4 and N_2O	See ID# E.15. During the review, the Party explained the difficulties it is experiencing in disaggregating domestic and international navigation and referred to the NIR, section 3.2.6.6, which explains that Canada has investigated the applicability of various methods and data sources for the disaggregation (such as tax data)	Not an issue
		The ERT encourages the Party to continue its efforts to investigate the availability of data which would enable the accurate disaggregation of domestic and international navigation fuels. If new data become available, the ERT encourages the Party to revise the emission estimates for the entire time series	
E.32	1.A.4 Other sectors: all fuels –CH_4 and N_2O	Canada recalculated CH_4 and N_2O emissions from other sectors, but the ERT noted that the reasons for and the effects of the recalculations were not clearly explained in the 2016 NIR. During the review, Canada explained that the recalculations were a result of changes to the CH_4 and N_2O EFs for residential firewood. The historical CH_4 and N_2O EFs were not based on Canadian data; rather, the CH_4 EF was based on a United States Environmental Protection Agency (EPA) "AP-42: Compilation of Air Emission Factors" value from 1996, which EPA no longer recommends, and the N_2O EF was based on a	Yes. Adherence to the UNFCCC Annex I inventory reporting guidelines

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue[a]? If yes, classify by type*
		Norwegian publication from 1990. Since there were no Canadian data available, it was determined that current international factors were more applicable; IPCC default EFs from the 2006 IPCC Guidelines were therefore adopted	
		The ERT recommends that Canada provide category-specific information on recalculations that relate to changes in the collection of AD and the choice of EF or method used, including information on the reasoning for the recalculations in the NIR	
E.33	1.B.1.b Solid fuel transformation: solid fuels – CO_2 and CH_4	The NIR (section 3.3.1.1) explains that emissions from briquette manufacturing are not estimated owing to a lack of data. In CRF table 1.B.1, CO_2 and CH_4 emissions from solid fuel transformation are reported as "NE". During the review, Canada explained that the emissions are included elsewhere. The Party further stated that the specific AD for briquette manufacturing are not available to allow for the reallocation of emissions from post-mining activities (which are included in subcategory 1.B.1.a.ii (surface mines)) to subcategory 1.B.1.b (solid fuel transformation). Canada explained that it is known that the production takes place at one coal mine in the province of Saskatchewan and that emissions associated with this process were accounted for in the King (1994) study[d]	Yes. Transparency
		The ERT recommends that Canada report CO_2 and CH_4 emissions from briquette manufacturing under solid fuel transformation. If this cannot be done, the ERT recommends that Canada use the correct notation key for solid fuel transformation ("IE" instead of "NE") and update the description in the NIR accordingly. The ERT further recommends that the Party document the methodology and data sources used to estimate emissions for briquette manufacturing in its NIR	
IPPU			
I.15	2.A.2 Lime production – CO_2	In the NIR (part 1, section 4.3.2), the Party explains that it used a tier 2 method to estimate emissions from lime production (category 2.A.2). However, during the review, Canada explained that it did not include the correction factor for LKD in its estimate because it used the tier 2 method from the IPCC good practice guidance and not that from the 2006 IPCC Guidelines	Yes. Accuracy
		The ERT recommends that Canada improve the tier 2 method used by including the correction factor for LKD using the IPCC default value (2006 IPCC Guidelines, volume 3, page 2.24), if a country-specific LKD correction factor is not available	
I.16	2.B.2 Nitric acid production – N_2O	A significant inter-annual change occurred in the N_2O IEF in 2007–2008 (an increase of 55.8%, from 0.0032 t/t to 0.0050 t/t). During the review, Canada explained that the emissions for 2007 and 2008 were estimated based on nitric acid production values directly reported by facilities. However, because the reported data are confidential, it was	Yes. Consistency

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue[a]? If yes, classify by type
		decided to input the total nitric acid production values published by Statistics Canada as AD in the CRF tables. Between 2007 and 2008, the published data show a decrease in production, whereas the reported data (used in the estimates) show an increase The ERT recommends that Canada investigate why there is such an inconsistency between the statistical data (showing decreasing nitric acid production in the period 2007–2008) and the data reported by facilities (showing increasing production in the period 2007–2008) and whether there could be any errors in the data reported by the facilities, and report on the results of such an investigation in the NIR, including information on the QA/QC activities undertaken in relation to the facility-level data received	
I.17	2.B.6 Titanium dioxide production – CO_2	In CRF table 2(I).A-Hs1, the Party reports these emissions as "IE". However, the ERT considers that no evidence has been provided to explain that these emissions are included elsewhere. The Rio Tinto plant produces titanium dioxide in Canada via the chloride route,[e] which leads to process emissions that should be reported under category 2.B.6. The ERT assumes that part of the non-energy use of fuels reported in CRF table 1.A(d) may be emitted in titanium dioxide production and that this may constitute an omission in the IPPU sector. In response to the provisional main findings of the ERT, Canada stated that the emissions are reported under category 2.D.3 (other and undifferentiated) The ERT recommends that Canada confirm that the emissions from titanium dioxide production are included in the inventory and report the CO_2 emissions under category 2.B.6 (titanium dioxide production). If the emissions are reported under another subcategory, the ERT recommends that the Party explain so in the NIR	Yes. Completeness
I.18	2.B.8 Petrochemical and carbon black production – CO_2	The ERT noted that CO_2 emissions from carbon black and styrene production are not estimated. The notation key "IE" is used in the CRF tables and its use is explained in CRF table 9 with the description "disaggregated data currently not available" (see also ID# I.7 related to category 2.D (non-energy products from fuels and solvent use)). The ERT also noted that the methodological description provided in the NIR (part 1, section 4.9.2) refers only to CH_4 emissions from these subcategories. During the review, Canada indicated that the combined CO_2 emissions from carbon black and styrene production contribute to approximately 25% of the total CO_2 emissions from petrochemical production and that data to support this estimate are considered to be confidential and cannot be shared with the ERT. The ERT considered that if the emissions are approximately 25% of the total CO_2 emissions for petrochemical production, together they amount to approximately 585 kt CO_2 , making it possible that one of the categories is above the threshold defined in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines	Yes. Completeness

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue[a]? If yes, classify by type*
		The ERT recommends that Canada include in the inventory CO_2 emissions from carbon black production or justify its exclusion in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines. The ERT also encourages Canada to include CO_2 emissions from styrene production in its inventory	
I.19	2.C.1 Iron and steel production – CO_2	The ERT noted from table A5-2 of the NIR that the emissions from ferroalloys production are included under pig iron production (subcategory 2.C.1.b). During the review, the Party explained that this allocation is used because ferroalloys production is a direct production of speciality steels from iron ore via the electric arc furnace process using reductants. However, the reductant portion is not disaggregated in Statistics Canada's RESD publication; therefore, emissions from the use of reductants were allocated to pig iron production (subcategory 2.C.1.b)	Yes. Transparency
		The ERT recommends that the Party more transparently describe the allocation of emissions from ferroalloys production in the NIR	
I.20	2.C.3 Aluminium production – CO_2 and PFCs	The ERT noted that the AD reported in CRF table 2(I).A-Hs2 for aluminium production seemed too high (2 783 980 kt for 2012 in the 2016 submission compared with 2 783.98 kt for 2012 in the 2014 submission), and considered that this may be due to a unit error (AD in t instead of kt), which leads to a very low IEF. Additional data sent to the ERT by the Party during the review showed different production data from those reported in the CRF tables	Yes. Comparability
		The ERT recommends that Canada correct the AD reported in CRF tables 2(I).A-Hs2 and 2(II)B-Hs1 and adjust the AD to the unit of kt for reporting in CRF table 2(I).A-Hs2	
I.21	2.C.4 Magnesium production – SF_6	A significant inter-annual change of 60.5% occurred in the SF_6 IEF for 1999–2000 (from 0.94 to 1.51 kg/t). During the review, Canada explained that efforts will be made to check the AD reported for 1999–2000 that are used to calculate the IEF. Canada also explained that it would be very difficult to check these values given that all the magnesium plants that reported for 1999–2000 have been shut down. However, best efforts will be made to do the checks	Yes. Consistency
		The ERT recommends that Canada check the AD reported for 1999–2000 and revise them, if appropriate. The ERT also recommends that the Party improve the QA/QC procedures in order to detect such fluctuations in IEFs and provide a corresponding explanation in the NIR	
I.22	2.D.1 Lubricant use – CO_2	The ERT notes that the default value from the 2006 IPCC Guidelines (volume 3, table 5.2) for the proportion of lubricants oxidized during use is 20%. According to the NIR (annex 3, table A3-21), Canada uses the value 0.5 for the fraction of carbon stored in	Yes. Accuracy

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue[a]? If yes, classify by type
		lubricants. During the review, the Party explained that the value for the fraction of carbon stored of 0.5 is the default value from the Revised 1996 IPCC Guidelines. The Party also explained that emissions from lubricant combustion are not included in category 2.D. Emissions from combustion of small quantities of lubricating oils are included in the emissions from generalized waste fuel combusted for energy in the cement industry. The Party further stated that emissions from the combustion of used lubricants are not reported in the waste sector under waste incineration without energy recovery	
		The ERT recommends that Canada implement the methodology provided in the 2006 IPCC Guidelines for this key category by applying a factor of 0.2 for the amount of lubricants oxidized during use. The ERT further recommends that Canada explain in the NIR how the emissions from oxidation of lubricants during their use and due to the end of their use are estimated and in which CRF categories the emissions are reported	
I.23	2.D.3 Non-energy products from fuels and solvent use – other	The total amount of CO_2 emissions reported in categories 2.D (non-energy products from fuels and solvent use) and 2.B.8 (petrochemical and carbon black production) is 15 433.99 kt CO_2 for 2014, whereas in CRF table 1.A(d) a total amount of 11 723.01 kt CO_2 is reported as "CO_2 emissions from the NEU reported in the inventory" under these categories	Yes. Accuracy
		The ERT recommends that Canada improve the consistency of the information provided in CRF table 1.A(d) and in the IPPU sector, in particular regarding categories 2.D.3 (non-energy products from fuels and solvent use – other) and 2.B.8 (petrochemical and carbon black production)	
I.24	2.G Other product manufacture and use – SF_6	The ERT noted that in CRF table 2(II)B-Hs2, SF_6 emissions from manufacturing of electrical equipment are reported as "NE". In response to the provisional main findings of the ERT, Canada explained that the Party's understanding is that electrical equipment purchased by the Canadian electricity industry is manufactured in the United States of America, Europe or Asia and, hence, emissions associated with manufacturing would have occurred mainly outside of Canada	Yes. Completeness
		The ERT recommends that Canada investigate whether manufacture of electrical equipment (category 2.G.1) occurs in Canada. If manufacture does occur, the ERT recommends that the Party estimate the related SF_6 emissions, or, if it does not occur, the ERT recommends that the Party use the notation key "NO" instead of "NE" in CRF table 2(II)B-Hs2	

Agriculture

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue[a]? If yes, classify by type*
A.11	3.A.4 Other livestock – CH_4	The ERT found that in CRF tables 3.As2 and 3.B(a)s1 the reported weight for goats is inconsistent (65.00 and 64.00 kg, respectively, for 2014). During the review, the Party informed the ERT that for 2014, the weight for goats in CRF table 3.As2 is inconsistent with the rest of the time series, because an issue occurred during the transfer of the data into the CRF Reporter software. The correct value is 64.00 kg. The Party further stated that the inventory team continues to improve its knowledge and ability to work with this new software and that this value will be corrected for future submissions The ERT recommends that Canada report the correct weight for goats in CRF table 3.As2	Yes. Adherence to the UNFCCC Annex I inventory reporting guidelines
A.12	3.B Manure management – CH_4 and N_2O	In CRF tables 3.B(a)s2 and 3.B(b), Canada used the notation key "NE" to report anaerobic lagoon and daily spread. There is no explanation in the NIR of the 2016 submission or in the CRF tables documentation box for the use of the notation key, even though an explanation was provided in the NIR of the 2015 submission. In the 2015 NIR (part 2, table A5-1, page 193), Canada provided the explanation that anaerobic lagoons and daily spread manure management systems are considered to be minor by Canadian experts when compared with liquid/slurry and solid and dry lot storage. During the present review, the Party confirmed that use of these AWMS may exist in Canada but no information on them is available from the data source used in the inventory. Due to the lack of information on these AWMS, the Party assumed that these systems are not used for a significant portion of the livestock population. The Party further stated that it will provide the rationale to explain its reporting in the next NIR submission The ERT recommends that Canada provide in the NIR the reasons why emissions from anaerobic lagoon and daily spread have not been estimated, in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines	Yes. Completeness
A.13	3.B.4 Other livestock – CH_4	The Party has assumed that manure handled by AWMS is the same for llamas and alpacas as for sheep and lambs, according to footnote 2 to table A3-39 of the NIR (part 2, page 87). The ERT noted that the Party has provided neither background documentation nor any explanation to support this assumption. Further, the ERT noted that the values reported in table A3-39 for manure handled by AWMS are actually different for llamas and alpacas compared with sheep and lambs (NIR, part 2, page 87). During the review, Canada informed the ERT that the fraction of manure handled by AWMS is the same for llamas and alpacas as for sheep and lambs, at the provincial level. However, the national values represent the weighted average based on provincial animal populations, and therefore the percentages that appear in table A3-39 are not the same for both animal categories. The Party further stated that this will be clarified in footnote 2 to table A3-39 in future submissions	Yes. Transparency

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue[a]? If yes, classify by type
		The ERT recommends that Canada provide in the NIR an explanation for the assumption that the fraction of manure handled by AWMS is the same for llamas and alpacas as for sheep and lambs	
A.14	3.B.4 Other livestock – CH_4	The ERT noted that in CRF table 3.B(a)s1, Canada used the notation key "NE" to report the CH_4-producing potential (B_0) for mules and asses. In table A6-29 of the NIR (part 2, page 205), the Party has reported a B_0 value of 0.33 m^3 CH_4/kg VS for mules and asses and in table A6-30 the Party has reported an MCF value of 0.01 for mules and asses. During the review, the Party indicated that a tier 1 EF was used for the calculation of emissions and, therefore, the B_0 and MCF values were not used in the inventory. The Party further explained that tables A6-29 and A6-30 include the default tier 2 B_0 and MCF values, respectively, from the 2006 IPCC Guidelines, but as they are not used in the inventory, they should be excluded from the NIR	Yes. Transparency
		The ERT recommends that Canada exclude from the NIR the default values from the 2006 IPCC Guidelines for B_0 and MCF for mules and asses, which are not used in the inventory	
A.15	3.D.b Indirect N_2O emissions from managed soils	The ERT noted the recommendation from the previous review report that Canada estimate direct N_2O emissions from application of sewage sludge and other organic fertilizers to soils (see ID# A.9 in table 3). The ERT considers that the indirect N_2O emissions should also be reported to ensure completeness	Yes. Completeness
		The ERT recommends that Canada, when estimating direct N_2O emissions from application of sewage sludge and other organic fertilizers to soils, also estimate the related indirect N_2O emissions	
A.16	3.D.b.1 Atmospheric deposition – N_2O	In the 2016 NIR, (part 2, equation A3-53, page 104), Canada stated that the $Frac_{GASM}$ value equals 0.2 kg (NH_3-N+NO_X-N)/kg N (with reference to the 2006 IPCC Guidelines). The ERT noted that this value is consistent with the 2006 IPCC Guidelines (volume 4, table 11.3, page 11.24). However, in CRF table 3.D, under the additional information table, the value of $Frac_{GASM}$ reported by the Party is 0.31 kg (NH_3-N+NO_X-N)/kg N. During the review, Canada explained that the value of 0.31 it reported in CRF table 3.D is defined as the fraction of livestock N excretion that volatizes as NH_3- and NO_X-N, including manure storage, handling and soil application. The Party also acknowledged that this is different from the definition of $Frac_{GASM}$ in the 2006 IPCC Guidelines	Yes. Comparability
		The ERT recommends that Canada correct its reporting of $Frac_{GASM}$ in the additional information table of CRF table 3.D to correspond to the $Frac_{GASM}$ value (0.2 kg NH_3-N +NO_X-N/kg N) provided in the 2006 IPCC Guidelines, which was used in the inventory	

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue[a]? If yes, classify by type*
A.17	3.G Liming – CO_2	Canada reported the same amount of CO_2 emissions from liming for 2012, 2013 and 2014 based on a constant AD of 747,981.00 t/year (for limestone $CaCO_3$). In the earlier years of the time series, significant inter-annual variability in the CO_2 emissions from liming has been observed (for 1994–1993, 2001–2000, 2004–2003, 2005–2004, 2011–2010 and 2012–2011). The ERT also notes that since 2008 (AD of 389 303.00 t/year) the trend in lime use has been increasing. During the review, Canada explained that lime data have been held constant at the 2012 level for 2013 and 2014 while the Party searches for an alternative data source	Yes. Consistency
		The ERT recommends that Canada continue its efforts to find a data source for liming in agriculture. The ERT further recommends that until a new data source is identified, the Party increase the consistency of its emission estimates by extrapolating data for the missing years (2013 and 2014)	
LULUCF			
L.14	4. General (LULUCF)	Canada's key category analysis, presented in the NIR, is disaggregated differently from the key category analysis automatically performed by the CRF Reporter software, making it difficult to understand where biomass burning is included in the Party's key category analysis	Yes. Adherence to the UNFCCC Annex I inventory reporting guidelines
		The ERT recommends that the Party provide more details in the NIR on how the CRF categories are disaggregated in the Canadian key category analysis, in accordance with paragraph 50(d)(ii) of the UNFCCC Annex I inventory reporting guidelines, particularly in relation to where emissions from biomass burning are included (see also ID# G.6 above)	
L.15	4. General (LULUCF)	The ERT noted that the Party did not provide in the NIR an overview of the uncertainties calculated for the LULUCF sector (see ID# L.1) and considered that the provision of such an overview would improve transparency	Not an issue
		The ERT encourages the Party to provide in the NIR a summary table including all uncertainties that have been calculated for the LULUCF sector, including the overall uncertainty of the sector	
L.16	Land representation	See ID# L.3 in table 3	Yes. Transparency
		The ERT recommends that the Party specify in the NIR that the total land area is included in the inventory and report the land area in CRF table 4.1 separately for unmanaged forest, unmanaged grassland and unmanaged wetlands	

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue[a]? If yes, classify by type
L.17	Land representation	The ERT notes that the Party's reporting in CRF table 4.1 is not correct. The purpose of this new table is not to duplicate the information already included in CRF tables 4.A–4.F in terms of cumulated land-use changes over 20 years, but to add new information on the annual values of changes, which was not available in the previous version of the CRF tables. During the review, Canada clarified that it has already started a project to revise and improve the consistency and completeness of the land transition matrix; however, given the size of the country and the need to involve several government departments and reconcile multiple data sources, this is still a work in progress that might take several years to complete. The ERT welcomes this ongoing work	Yes. Transparency
		The ERT recommends that Canada include in the NIR the correction of the reporting in CRF table 4.1 (to include information on annual changes) as part of the planned improvement, along with any update on the status of implementation of other parts of the ongoing project to revise and improve the consistency and completeness of the land transition matrix	
L.18	4.A Forest land – CO_2, CH_4 and N_2O	The NIR includes a figure (A3-11) describing the structure of the CBM-CFS-3 model; however, the model does not include HWP (see ID# L.6 in table 3)	Not an issue
		The ERT encourages the Party to add to figure A3-11 a link to the external HWP module (and a reference to figure A3-29) to help the ERT's understanding of the links between pools	
L.19	4.A Forest land – CO_2, CH_4 and N_2O	The ERT notes that organic soil emissions and removals are currently reported together with mineral soils in CRF table 4.A owing to a lack of disaggregated AD	Yes. Comparability
		The ERT recommends that Canada disaggregate the carbon stock changes in mineral and organic soils to increase transparency and comparability and ensure that the emissions are neither under- nor overestimated. Until this is implemented, the ERT encourages the Party to provide more information on the planned improvement projects (as outlined in the Party's response to the question raised by the ERT on the issue) and the likely time frame for addressing this issue in the NIR	
L.20	4(II) Emissions and removals from drainage and rewetting and other management of organic/mineral soils – CO_2, CH_4 and N_2O	In CRF table 4(II), emissions from rewetted organic and mineral cropland soils and from rewetted organic soils in peat extraction lands are not estimated (the notation key "NE" has been used)	Not an issue
		The ERT encourages the Party to provide more information in the NIR on the planned improvement projects and likely time frame for estimating emissions from rewetted cropland soils and from rewetted organic soils in peat extraction lands. The ERT further encourages the Party to use the Wetlands Supplement in preparing its estimates for	

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue[a]? If yes, classify by type*
		rewetted soils in future annual submissions	
L.21	4 (V) Biomass burning – CO_2	According to the NIR (part 1, page 144) and explanations in the documentation box of CRF table 4(V), CO emissions from biomass burning are reported as CO_2 in CRF table 4(V). The ERT noted that therefore these emissions are also included in the total CO_2 emissions of the LULUCF sector. According to the NIR, these emissions are also included in CRF table 6 as indirect CO_2 emissions from the LULUCF sector. The ERT noted that this leads to double counting of the indirect CO_2 emissions under "total CO_2 equivalent emissions, including indirect CO_2, with land use, land-use change and forestry" In response to the draft version of this review report, Canada noted that CH_4 emissions displayed as source emissions in CRF table 6 are not reported by a Party; they are taken automatically by the CRF Reporter software from the total amount of CH_4 emissions reported in each sector Since CRF table 6 displays only CH_4 emissions reported in the LULUCF sector as the possible source of the indirect CO_2 emissions in the sector and CO is reported as "NE", "NA", "NO", "IE", it is not possible to assess how the amount of indirect CO_2 in CRF table 6 is calculated based on the information given The ERT recommends that indirect CO_2 emissions from atmospheric oxidation of CO emissions due to biomass burning be included in CRF table 6 and excluded from CRF table 4(V) to correct the identified double counting of indirect CO_2 from CO emissions. The ERT also recommends that Canada more clearly explain in the NIR which source emissions are considered as indirect CO_2 and how these indirect emissions have been calculated	Yes. Accuracy
L.22	4.G Harvested wood products – CO_2	The ERT notes that Canada reports HWP in a manner that is different from other Parties included in Annex I to the Convention. As a general rule, the transfer of carbon from one pool to another pool is counted as loss of carbon in the original pool and as a gain of carbon in the receiving pool. This rule avoids any possible double counting and should be applied consistently to all carbon pools, including HWP. By contrast, Canada reports the transfer of carbon from managed forests to wood products entirely in the HWP category (in addition to the CO_2 emissions from the manufacturing, use and disposal of wood products), and not as loss from the living biomass pool in CRF tables 4.A–4.F (where applicable). Furthermore, given the way in which the CRF tables are structured, this approach makes it difficult to interpret and review the correctness of data in CRF table 4.Gs1, because the difference between gains (i.e. annual carbon inflow to the HWP pool)	Yes. Comparability

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue[a]? If yes, classify by type
		and losses (i.e. annual carbon outflow from the HWP pool) does not correspond to the value of net emissions/removals from HWP in use. While the approach followed by Canada to report HWP does not affect accuracy, it affects the comparability of data, because it prevents a meaningful comparison of HWP estimates with those of any other Party In response to questions from the ERT, the list of provisional main findings of the ERT and the draft version of this review report, Canada noted that this issue of comparability is due to the current design of the LULUCF CRF tables that do not clearly differentiate transfers to HWP from emissions to the atmosphere occurring due to forest harvest in CRF tables 4.A–4.F The ERT recommends that Canada modify the reporting of the HWP pool, so that the HWP estimates can be compared with those of other Parties	
Waste			
W.20	5.A Solid waste disposal on land – CH_4	The Party has reported wood waste disposal sites as uncategorized SWDS in CRF table 5.A and used a methane correction factor of 0.8. The ERT noted that in the 2006 IPCC Guidelines (volume 5, table 3.1), the default methane correction factor for uncategorized SWDS is 0.6 and methane correction factor of 0.8 is the default value for unmanaged deep SWDS. During the review, the Party explained that the value of 0.8 was chosen because wood waste disposal sites are deep, unmanaged and have homogenous waste composition The ERT recommends that the Party categorize the wood waste disposal sites as unmanaged and use this categorization in the NIR and in the CRF tables	Yes. Transparency
W.21	5.B. Biological treatment of solid waste – N_2O	Canada used the default value of 0.30 g N_2O/kg on a wet weight basis for the estimation of N_2O emissions from solid waste composting in accordance with table 4.1 of the 2006 IPCC Guidelines, as originally published. The IPCC has provided corrected values for the N_2O EF on a wet weight basis (0.24 g N_2O/kg), because the original EF was not consistent with the one provided on a dry weight basis. During the review, the Party informed the ERT that it plans to update the EF accordingly for the 2017 submission The ERT recommends that the Party use the corrected IPCC default EF value as the N_2O EF for composting, based on wet weight (0.24 g N_2O/kg)	Yes. Accuracy
W.22	5.B.2 Anaerobic digestion at biogas facilities –	The Party has not estimated CH_4 emissions from anaerobic digestion of municipal solid waste at biogas facilities. Canada reported the emissions using the notation key “NE”. During the review, Canada provided an approximate estimate of the magnitude of the	Yes. Transparency

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue[a]? If yes, classify by type*
	CH_4	anaerobic digestion and resulting emissions. Using the default EF provided in the 2006 IPCC Guidelines, the Party estimated that the national CH_4 emissions from anaerobic digestion are expected to be about 0.044 kt CH_4	
		The ERT recommends that Canada include in its NIR the approximate estimate of CH_4 emissions from anaerobic digestion at biogas facilities, to justify that the emissions are below the threshold defined in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines	

Abbreviations: AD = activity data, AWMS = animal waste management system, B_0 = methane-producing potential, CRF = common reporting format, CV = calorific value, EF = emission factor, ERT = expert review team, $Frac_{GASM}$ = fraction of livestock N excretion that volatilizes as NH_3 and NO_X, GVC = gross calorific value, HWP = harvested wood products, IE = included elsewhere, IEA = International Energy Agency, IEF = implied emission factor, IPCC = Intergovernmental Panel on Climate Change, IPCC good practice guidance = *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*, IPPU = industrial processes and product use, LKD = lime kiln dust, LULUCF = land use, land-use change and forestry, MCF = methane conversion factor, NA = not applicable, NCV = net calorific value, NE = not estimated, NIR = national inventory report, NO = not occurring, QA/QA = quality assurance/quality control, RESD = *Report on Energy Supply and Demand*, Revised 1996 IPCC Guidelines = *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, SWDS = solid waste disposal site, UNFCCC Annex I inventory reporting guidelines = "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories", VS = volatile solids, Wetlands Supplement = *2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands*, 2006 IPCC Guidelines = *2006 IPCC Guidelines for National Greenhouse Gas Inventories*.

[a] Recommendations are related to issues as defined in decision 13/CP.20, annex, paragraph 81, identified by the ERT during the review. Encouragements are made to the Party to address all findings not related to such issues.

[b] See <http://manitobapeatlands.weebly.com/canadian-peat-mining.html> and <http://www.geog.mcgill.ca/faculty/roulet/Published%20Manuscript%20pdfs/Cleary%20et%20al.%20Ambio%202005.pdf>.

[c] See <http://www.peatsociety.org/peatlands-and-peat/peat-energy-resource>.

[d] King BG. 1994. *Management of Methane Emissions from Coal Mines: Environmental, Engineering, Economic and Institutional Implications of Options*. Report prepared by Neill and Gunter Ltd. for Environment Canada.

[e] See <http://www.riotinto.com/canada/rtft/our-products-15035.aspx>.

Annex I

Overview of greenhouse gas emissions and removals for Canada for submission year 2016 as submitted by Canada

Table 6 shows total greenhouse gas (GHG) emissions, including and excluding land use, land-use change and forestry and, for Parties that have decided to report indirect carbon dioxide (CO_2) emissions, with and without indirect CO_2. Tables 7 and 8 show GHG emissions reported under the Convention by Canada by gas and by sector, respectively.

Table 6
Total greenhouse gas emissions for Canada, 1990–2014[a]
(kt CO_2 eq)

	Total GHG emissions excluding indirect CO_2 emissions		*Total GHG emissions including indirect CO_2 emissions*[b]	
	Total including LULUCF	*Total excluding LULUCF*	*Total including LULUCF*	*Total excluding LULUCF*[c]
1990	525 676.69	612 866.05	529 718.75	612 866.05
1995	846 196.85	665 304.28	869 276.97	665 304.28
2000	662 624.80	744 240.71	664 375.12	744 240.71
2010	761 035.53	706 402.87	772 810.73	706 402.87
2011	779 184.45	709 764.47	792 282.49	709 764.47
2012	759 048.57	718 346.89	770 177.57	718 346.89
2013	701 791.93	731 424.09	707 790.98	731 424.09
2014	804 212.19	732 418.88	818 965.18	732 418.88

Abbreviations: GHG = greenhouse gas, LULUCF = land use, land-use change and forestry.

[a] Emissions/removals reported in the sector other (sector 6) are not included in total GHG emissions.

[b] The Party has reported indirect CO_2 emissions in common reporting format table 6.

[c] The value for total GHG emissions with indirect CO_2 emissions and without LULUCF differs from the corresponding entry in CRF table summary 2 for Canada as the value in CRF table summary 2 currently also includes indirect CO_2 from the LULUCF sector.

Table 7
Greenhouse gas emissions by gas for Canada, excluding land use, land-use change and forestry, 1990–2014[a]
(kt CO_2 eq)

	CO_2[b]	*CH_4*	*N_2O*	*HFCs*	*PFCs*	*Unspecified mix of HFCs and PFCs*	*SF_6*	*NF_3*
1990	463 493.33	95 378.25	42 239.73	970.58	7 557.90	NA	3 225.93	0.32
1995	497 224.84	113 111.08	45 650.33	693.37	6 349.22	NA	2 275.16	0.28
2000	572 290.39	120 724.87	39 936.36	3 400.33	4 985.57	NA	2 902.96	0.24
2010	555 003.76	103 730.44	37 891.75	7 477.17	1 859.18	NA	440.42	0.15
2011	558 152.72	103 884.67	37 652.73	7 991.64	1 687.38	NA	395.18	0.15
2012	563 423.61	105 633.62	38 773.54	8 277.68	1 798.64	NA	439.63	0.15
2013	573 094.04	107 063.13	40 647.06	8 564.62	1 617.10	NA	437.98	0.15
2014	574 099.78	108 436.72	39 407.11	9 024.46	1 088.04	NA	362.63	0.15
Per cent change 1990–2014	**23.9**	**13.7**	**–6.7**	**829.8**	**–85.6**	**NA**	**–88.8**	**–53.4**

Abbreviation: NA = not applicable.

[a] Emissions/removals reported in the sector other (sector 6) are not included in total greenhouse gas emissions.

[b] Canada did not include indirect CO_2 emissions in common reporting format table 6 expect for indirect CO_2 emissions from the LULUCF sector.

Table 8
Greenhouse gas emissions by sector for Canada, 1990–2014[a b]
(kt CO_2 eq)

	Energy	*IPPU*	*Agriculture*	*LULUCF*	*Waste*	*Other*
1990	481 950.69	55 879.64	49 007.78	–83 147.30	26 027.94	NA
1995	523 544.09	58 870.10	55 698.75	203 972.70	27 191.34	NA
2000	603 466.34	53 523.95	58 503.03	–79 865.59	28 747.40	NA
2010	570 145.50	50 481.99	56 805.25	66 407.86	28 970.14	NA
2011	573 540.90	51 430.58	55 949.92	82 518.02	28 843.07	NA
2012	576 271.69	55 752.96	57 934.14	51 830.69	28 388.09	NA
2013	589 946.04	52 675.67	60 370.99	–23 633.11	28 431.39	NA
2014	593 816.61	50 989.24	59 095.53	86 546.29	28 517.50	NA
Per cent change 1990–2014	**23.2**	**–8.8**	**20.6**	**–204.1**	**9.6**	**NA**

Abbreviations: IPPU = industrial processes and product use, LULUCF = land use, land-use change and forestry, NA = not applicable.

[a] Emissions/removals reported in the sector other (sector 6) are not included in total greenhouse gas emissions.

[b] Totals include indirect CO_2 emissions reported in common reporting format table 6.

Annex II

Additional information to support findings in table 2

Missing categories that may affect completeness

The categories for which methods are included in the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* were reported as "NE" (not estimated) or for which the expert review team otherwise determined that there may be an issue with the completeness of reporting in the Party's inventory are the following:

(a) 1.A.3.c Railways – CO_2, CH_4 and N_2O emissions from steam trains (see ID# E.14);

(b) 1.B.1.b Solid fuel transformation – CO_2, CH_4 and N_2O emissions from coke oven gas consumed and flared at integrated iron and steel plants (see ID# E.23);

(c) 2.A.4.a Ceramics – CO_2 (see ID# I.2);

(d) 2.B.6 Titanium dioxide production – CO_2 (see ID# I.17);

(e) 2.B.8.d Ethylene oxide – CO_2 and CH_4 (see ID# I.3);

(f) 2.B.8.f Carbon black – CO_2 (see ID# I.18);

(g) 2.G.1 Other product manufacture and use – SF_6 emissions from manufacture of electrical equipment (see ID# I.24);

(h) 3. General (agriculture) – CH_4 and N_2O emissions from wild boar for the period 1990–1996 (see ID# A.1);

(i) 3.B Manure management – CH_4 and N_2O emissions from anaerobic lagoons and daily spread (see ID# A.12);

(j) 3.D.a.2.b Sewage sludge applied to soils – N_2O and related indirect N_2O emissions (3.D.b) from managed soils (see ID#s A.9 and A.15);

(k) 3.D.a.2.c Other organic fertilizers applied to soils – N_2O and related indirect N_2O emissions (3.D.b) from managed soils (see ID#s A.9 and A.15);

(l) 4. General (LULUCF) – completeness of land representation (see ID# L.3);

(m) 4.B.2 Wetlands and settlements converted to cropland – all carbon pools (see ID# L.2);

(n) 4.C Grassland remaining grassland – CO_2 from organic and mineral soils (see ID# L.2);

(o) 4.E.1 Settlements remaining settlements – all carbon pools for the following reporting zones: RZ18 Taiga Shield West, RZ16 Boreal Cordillera, RZ8 Hudson Plains, RZ13 Taiga Plain, RZ4 Taiga Shield East and RZ17 Taiga Cordillera; soils for all reporting zones (see ID# L.2);

(p) 4.E.2 Cropland and wetlands converted to settlements – (see ID# L.2);

(q) 4(II) Emissions and removals from drainage and rewetting and other management of organic/mineral soils – CH_4 and N_2O from drainage of organic soils on forest land (see ID# L.9);

(r) 4(III) Direct N_2O emissions from N mineralization/immobilization – N_2O emissions from forest land, grassland remaining grassland, wetlands and settlements and related indirect N_2O emissions from managed soils (category 4(IV)) (see ID# L.10).

Annex III

Documents and information used during the review

A. Reference documents

Aggregate information on greenhouse gas emissions by sources and removals by sinks for Parties included in Annex I to the Convention. Note by the secretariat. Available at <http://unfccc.int/resource/webdocs/agi/2015.pdf>.

Annual status report for Canada for 2016. Available at <http://unfccc.int/resource/docs/2016/asr/can.pdf>.

FCCC/ARR/2015/CAN. Report on the individual review of the inventory submission of Canada submitted in 2015. Available at <http://unfccc.int/resource/docs/2016/arr/can.pdf>.

FCCC/ARR/2014/CAN. Report on the individual review of the inventory submission of Canada submitted in 2014. Available at <http://unfccc.int/resource/docs/2015/arr/can.pdf>.

FCCC/ARR/2013/CAN. Report of the individual review of the inventory submission of Canada submitted in 2013. Available at <http://unfccc.int/resource/docs/2014/arr/can.pdf>.

FCCC/ARR/2012/CAN. Report of the individual review of the inventory submission of Canada submitted in 2012. Available at <http://unfccc.int/resource/docs/2013/arr/can.pdf>.

FCCC/ARR/2011/CAN. Report of the individual review of the inventory submission of Canada submitted in 2011. Available at <http://unfccc.int/resource/docs/2012/arr/can.pdf>.

FCCC/ARR/2010/CAN. Report of the individual review of the inventory submission of Canada submitted in 2010. Available at <http://unfccc.int/resource/docs/2011/arr/can.pdf>.

FCCC/ARR/2009/CAN. Report of the individual review of the inventory submission of Canada submitted in 2009. Available at <http://unfccc.int/resource/docs/2010/arr/can.pdf>.

FCCC/ARR/2008/CAN. Report of the individual review of the greenhouse gas inventories of Canada submitted in 2007 and 2008. Available at <http://unfccc.int/resource/docs/2009/arr/can.pdf>.

FCCC/ARR/2006/CAN. Report of the individual review of the greenhouse gas inventory of Canada submitted in 2006. Available at <http://unfccc.int/resource/docs/2008/arr/can.pdf>.

"Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories". Annex to decision 24/CP.19. Available at <http://unfccc.int/resource/docs/2013/cop19/eng/10a03.pdf#page=4>.

"Guidelines for the technical review of information reported under the Convention related to greenhouse gas inventories, biennial reports and national communications by Parties

included in Annex I to the Convention". Annex to decision 13/CP.20. Available at <http://unfccc.int/resource/docs/2014/cop20/eng/10a03.pdf#page=6>.

Intergovernmental Panel on Climate Change. 2006. *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. Available at <http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html>.

Intergovernmental Panel on Climate Change. 2014. *2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands*. Available at <http://www.ipcc-nggip.iges.or.jp/public/wetlands/index.html>.

B. Additional information provided by the Party

Responses to questions during the review were received from Ms. Dominique Blain and Mr. Lindsay Pratt (Environment Canada), including additional material on the methodology and assumptions used. The following documents[1] were also provided by Canada:

AECOM Canada. 2011. *Improved Methodology for the Estimation of Greenhouse Gases from Canadian Municipal Wastewater Treatment Facilities.*

AECOM Canada. 2012. *Evaluation of Canada's Estimation Methodology of Nitrous Oxide Emissions from Human Sewage Final Report.*

[1] Reproduced as received from the Party.

Annex IV

Acronyms and abbreviations

AD	activity data
AWMS	animal waste management system
B_0	methane-producing potential
BOD	biochemical oxygen demand
C	carbon
$CaCO_3$	calcium carbonate
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
CRF	common reporting format
CV	calorific value
ECF	energy conversion factor
EF	emission factor
ERT	expert review team
$Frac_{GASM}$	fraction of livestock N excretion that volatilizes as NH_3 and NO_x
GCV	gross calorific value
GHG	greenhouse gas
IE	included elsewhere
IPCC	Intergovernmental Panel on Climate Change
IPPU	industrial processes and product use
kg	kilogram
kt	kilotonne (1 kt = 1 gigagram (Gg))
LKD	lime kiln dust
LULUCF	land use, land-use change and forestry
MCF	methane conversion factor
MMS	manure management system
MSW	municipal solid waste
Mt	million tonnes
N	nitrogen
N_2O	nitrous oxide
NA	not applicable
NCV	net calorific value
NE	not estimated
NF_3	nitrogen trifluoride
NH_3	ammonia
NIR	national inventory report
NO	not occurring
PFCs	perfluorocarbons
QA/QC	quality assurance/quality control
SF_6	sulphur hexafluoride
SWDS	solid waste disposal site
t	tonne
TJ	terajoule
UNFCCC	United Nations Framework Convention on Climate Change
VS	volatile solids