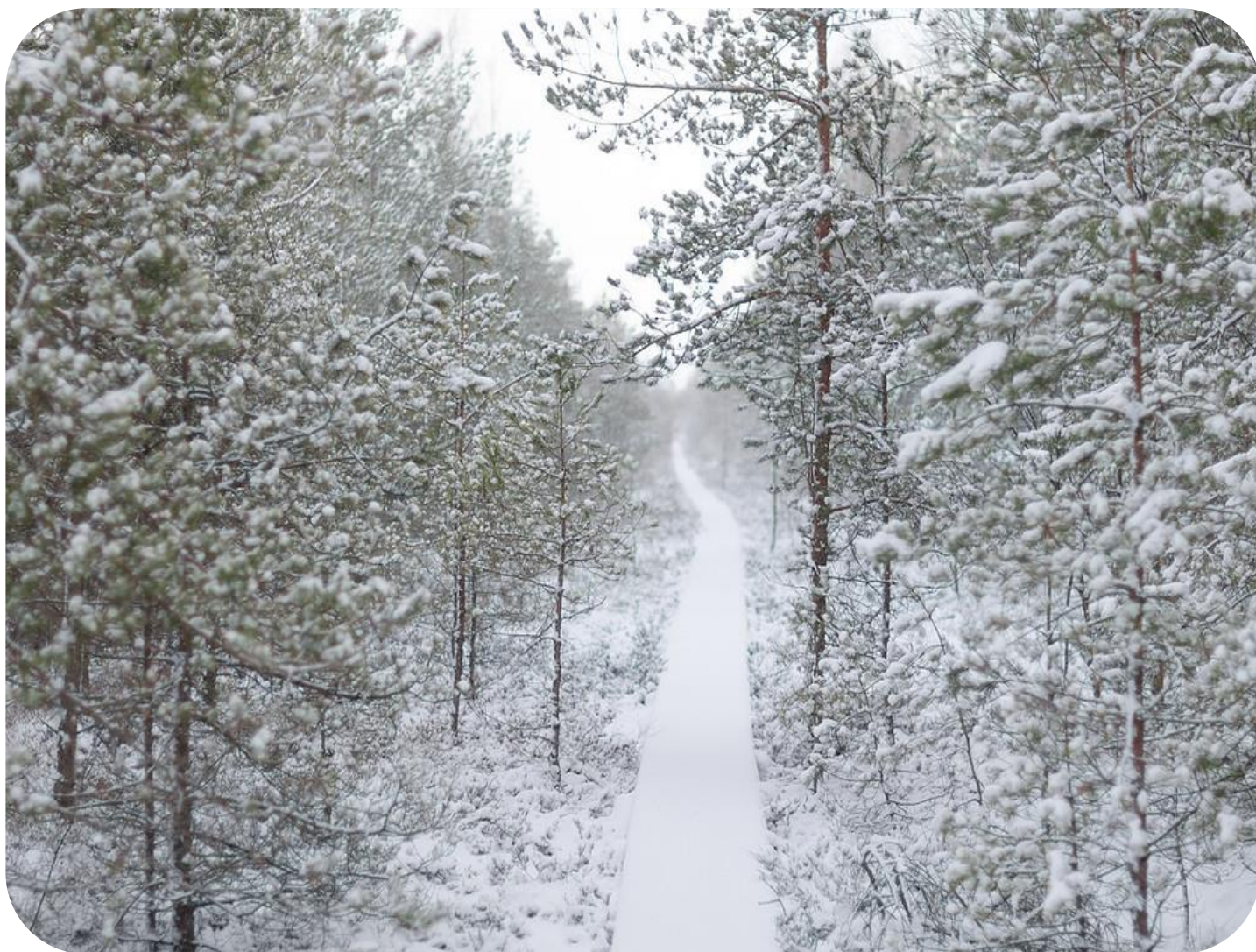




Latvia's Informative Inventory Report 2016

Submitted under the Convention on Long-Range Transboundary Air Pollution

15th March 2016

Data sheet

Title

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Submitted under the Convention on Long-Range Transboundary Air Pollution

Date

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Abbreviations

CSB – Central Statistical Bureau of Latvia

EMEP – Co-operative Programme for Monitoring and Evaluation of the Long Range Transmission of Air Pollutants in Europe

EMEP/CORINAIR – Atmospheric emission inventory guidebook, Co-operative Programme for Monitoring and Evaluation on the Long Range Transmission of Air Pollutants in Europe, The Core Inventory of Air Emissions in Europe

EMEP/EEA 2013 – EMEP/EEA air pollutant emission inventory guidebook 2013

GHG – Greenhouse gases

IPCC – Intergovernmental Panel on Climate Change

IPCC GPG 2000 – IPCC Good Practice Guidance and Uncertainty management in national Greenhouse Gas Inventories (2000)

IPCC GPG LULUCF 2003 – IPCC Good Practice Guidance for Land Use, Land Use Change and Forestry (2003)

2006 IPCC Guidelines - 2006 IPCC Guidelines for National Greenhouse Gas Inventories

IPPU – Industrial processes and Product use

LEGMC – Latvian Environment, Geology and Meteorology Centre

LULUCF – Land Use, Land Use Change and Forestry

MEPRD - Ministry of the Environmental Protection and Regional Development

MoA - Ministry of Agriculture

NCV – Net calorific value

NFR – Nomenclature For Reporting

REBs – Regional Environmental Boards

RTSD – Road Traffic Safety Department

SFS – State Forest Service

UN – United Nations

UNFCCC – United Nations Framework Convention on Climate Change

Pollutants

Main pollutants (from 1990)

NO_x – nitrogen oxides, expressed as NO₂

NM VOC – non-methane volatile organic compounds

NH₃ – ammonia

SO₂ – sulphur dioxide

Other (from 1990)

CO – carbon monoxide

POPs - persistent organic pollutants (from 1990)

PCDD/PCDF – polychlorinated dibenzodioxins/furans

HCB – hexachlorobenzene

PCB – polychlorinated biphenyls

PAHs – polycyclic aromatic hydrocarbons, includes:

benzo(a)pyrene

benzo(b)fluoranthene

benzo(k)fluoranthene

indeno(1,2,3-cd)pyrene)

PM - particulate matter (from 2000)

PM_{2.5} – particulate matter, particle size <2.5 µm

PM₁₀ – particulate matter, particle size <10 µm

TSP – total suspended particulates

BC – black carbon

HM - heavy metals (from 1990)

Pb – lead

Cd – cadmium

Hg – mercury

As – arsenic

Cr – chromium

Cu – copper

Ni – nickel

Se – selenium

Zn – zinc

Executive summary

In 7 July 1994 Cabinet of Ministers of Republic of Latvia ratified the Convention on Long-Range Transboundary Air Pollution (CLRTAP). Since then Latvia has signed following protocols - Aarhus Protocol on Persistent Organic Pollutants (POPs), Aarhus Protocol on Heavy Metals and Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone.

Latvia's inventory report of air pollution has been prepared by Latvian Environment, Geology and Meteorology Centre in collaboration with Ministry of the Environmental Protection and Regional Development (MEPRD), Central Statistical Bureau (CSB), Institute of Physical Energetics, Latvian State Forest Research Institute "Silava", Latvia University of Agriculture, according to the 2014 Reporting Guidelines and revised Gothenburg Protocol. The Informative Inventory Report (IIR) is submitted to the UNECE Secretariat and to the EEA annually under Geneva Convention agreement.

Emission inventories for years from 1990 to 2014 for anthropogenic emissions of - NO_x, NMVOC, SO₂, NH₃ (Main pollutants), CO (Other), TSP, PM₁₀, PM_{2.5}, BC (Particulate matter), Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn (Heavy metals) and PCDD/PCDF (g i-Teq), PAHs, PCB, HCB (POPs) are included.

Latvia's IIR 2016 includes detailed information about air pollutant sectors (Energy, Industrial Processes and Product Use, Agriculture and Waste) and their subsectors. Each subsector is described with following chapters – overview, trends in emissions, methods, emission factors, activity data, uncertainties, QA/QC and verification, recalculations, planned improvements. Activity data used for emission calculation was obtained by CSB, EU ETS, national database "2-Air", "2-Water", "3-Waste" and other different databases and from enterprises and institutions.

This report of most recent estimates of air pollution emissions for 1990¹-2014 shows significant changes. Mainly the emissions have decreased, with exception of Cd and HCB emissions which have increased.

Comparing key categories of 2013 in Submission 2015 versus key categories of 2013 in Submission 2016, changes can be seen due to recalculations, which were carried out, to improve accuracy of emission calculation. Comparing emissions for Submission 2015 and Submission 2016, there can be seen changes between submissions. The recalculations are done due to changes in methodology in several sectors and subsectors (e.g., Energy, Agriculture, IPPU), as well as updated activity data and emission factors. For example, in 2013, NO_x, NMVOC and PM_{2.5} emissions have decreased by 1.1%, 37.3% and 23.5%, respectively. For NH₃ and SO₂ emissions there can be seen an increase by 10.9% and 40.0%, respectively.

Improvements are planned according to key category analysis as well as projects with funding for relevant sectors within UNFCCC, if these have impact also on air pollutants.

There are no adjustments made to comply with Gothenburg protocol, therefore the national total and national total for compliance is the same. There are no differences with NECD report and slight differences in reported national totals with UNFCCC reports due to the fact that in CLRTAP inventory emissions from international aviation LTO phase are included in national emissions. NECD/CLRTAP/UNFCCC estimates have been compared and reported to European Commission according to obligations stated in Monitoring Mechanism Regulation (525/2013/EC).

¹ Particulate matter emissions have been reported from 2000.

1 Introduction

1.1 Background information on emission inventories

The Republic of Latvia has ratified the Convention on Long-Range Transboundary Air Pollution (Geneva, 1979) by Resolution Nr. 63 of 7 July 1994 of the Cabinet of Ministers of Latvia. Later on Latvia has signed following Protocols of Convention:

- The 1998 Aarhus Protocol on Persistent Organic Pollutants (POPs);
- The 1998 Aarhus Protocol on Heavy Metals;
- The 1999 Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone.

According to the revised Guidelines for Reporting Emission Data under the Convention on Long-range Transboundary Air Pollution ([ECE/EB.AIR/125](#), revised 13 March 2014 hereinafter referred to as the Reporting Guidelines) Party shall annually submit emission inventory to the secretariat of the Convention on Long-Range Transboundary Air Pollution (CLRTAP).

Latvian Informative Inventory Report (IIR) submitted on 15th March 2016 contains information on Latvia's inventories for 1990 – 2014 and covers information on trends in emissions, descriptions of each NFR category, recalculations and planned improvements.

The annual emission inventory for Latvia is reported in the Nomenclature for Reporting ([NFR14](#) dated 08.07.2015) format as requested in the Reporting Guidelines.

The latest recalculations in emission inventory were done for the time period from 1990 to 2013. These were done because of the change of activity data in all sectors, as well as changes in emission factors due to adoption of EMEP/EEA 2013 and 2006 IPCC Guidelines.

This report is prepared based on emission data submitted on 15th March 2016. It contains information on Latvia's emission inventories for years from 1990² to 2014 for anthropogenic emissions of:

Main pollutants: NO_x, NMVOC, SO₂, NH₃ (kt)

Other: CO (kt)

Particulate matter: TSP, PM₁₀, PM_{2.5}, BC (kt)

Heavy metals: Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn (t)

POPs: PCDD/PCDF (g i-Teq), PAHs (t), PCB, HCB (kg)

1.2 Description of the institutional arrangement for inventory preparation

Latvian IIR is prepared by the state Ltd "Latvian Environment, Geology and Meteorology Centre" (LEGMC) in cooperation with other institutions. The purpose of LEGMC is to collect and process environmental information, to carry out environmental monitoring and inform the public of the status of the environment, to provide geological supervision and rational use of natural resources, to implement the state policies in geology, meteorology, climatology, hydrology, and air quality and the impact of transboundary air pollution.

The experts at LEGMC have created emission inventory using expert publications and evaluations and in co-operation with following institutions:

- Ministry of the Environmental Protection and Regional Development (MEPRD);
- Central Statistical Bureau (CSB);
- Institute of Physical Energetics;
- Latvian State Forest Research Institute "Silava";
- Latvia University of Agriculture;

² Particulate matter emissions have been reported from 2000.

- Ministry of Agriculture (MoA).

1.3 Description of the process of inventory preparation

The process of inventory compilation consists of inventory planning that includes decision making of methodological and organisational issues and time frame for inventory preparation.

In the first stage specific responsibilities are defined and allocated. In the second stage, the inventory preparation process, activity data, emission factors and all relevant information needed for final emission estimation is collected.

Latvia's emission inventory generally is based on the EMEP/EEA 2013 with a few exceptions in particular sectors where previous versions of EMEP emission inventory guidebooks and data and methodologies from 2006 IPCC Guidelines are used.

NFR14 format is used to prepare inventory for years 1990–2014. For all sectors, except for Road transport supplemental databases in Ms Excel format have been developed and used for emission calculations. A special *COmputer Programme to calculate Emissions from Road Transport* (COPERT IV), which is proposed to be used by EEA member countries for the compilation of EMEP/EEA emission inventories, is used. Additional research in different source categories was made, to compile data and investigate appropriate approach to fulfil Convention obligations.

Generally, activity data are obtained by CSB, Ministry of Agriculture, Ministry of Economics, Ministry of Transport and other different enterprises and institutions.

The deadline for submitting the activity data and its description for all institutions involved in inventory process is 1st of November. Final data regarding fuel consumption are submitted until 30th of November when CSB prepares Energy balances for EUROSTAT according to additional agreement.

More detailed information on methodologies and activity data is given in the description of the sectors in Chapters 3-7.

1.4 Description of key source categories

The Key category analysis (KCA) for years 1990 and 2014 was done by LEGMC according to EMEP/EEA 2013 Level assessment. According to EMEP/EEA 2013, key categories are emission sources which all together contribute to 80% of the total national emissions. KCA was performed for each reported pollutant separately. The key categories for 1990 and 2014 are shown in Table 1.1 and Table 1.2.

Table 1.1 Key categories in 1990³

Component	Key categories (Sorted from high to low from left to right)													Total (%)
SO₂	1A1a (35.9%)	1A4ai (23.2%)	1A4bi (8.6%)	1A2e (8.3%)	1A2gviii (7.8%)									83.9
NO_x	1A3biii (11.9%)	1A3bi (11.8%)	1A4ai (11.2%)	1A1a (11.0%)	1A3c (9.5%)	1A2e (6.3%)	1A2gviii (6.2%)	3Da1 (5.6%)	1A4ci (4.8%)	1A4ciii (3.6%)				81.9
NH₃	3B3 (22.0%)	3B1a (19.3%)	3Da2a (19.2%)	3Da1 (16.7%)	3B1b (7.0%)									84.2
NMVOC	1A3bi (15.7%)	1A4bi (9.5%)	2D3g (9.0%)	2D3d (8.2%)	3B1a (6.9%)	2D3h (6.4%)	3B1b (5.6%)	1A3biii (4.2%)	1A4ai (3.4%)	2H2 (3.4%)	2D3a (3.3%)	1A3bv (3.2%)	1A4cii (2.7%)	81.5
CO	1A3bi (41.3%)	1A4bi (29.1%)	1A4cii (7.0%)	1A4ai (4.8%)										82.2
Pb	1A3bi (56.1%)	1A3biii (21.5%)	1A3bii (8.0%)											85.6
Hg	1A4ai (47.5%)	1A4bi (19.4%)	1A1a (12.4%)	1A4ci (6.5%)										85.8
Cd	1A4bi (56.9%)	1A4ai (19.5%)	1A1a (11.1%)											87.5

³ Full list of NFR codes can be seen on Annex IV.

Component	Key categories (Sorted from high to low from left to right)												Total (%)
DIOX	1A4bi (57.8%)	5C1biii (18.7%)	1A4ai (14.9%)										91.4
PAH	1A4bi (67.2%)	6A (15.7%)											82.9
HCB	1A4bi (52.4%)	1A4ai (18.0%)	1A1a (13.5%)										83.8

In 1990, Energy sector was a key source for the largest part of pollutants. For SO₂, Hg, Cd, PCDD/F, PAH and HCB emissions the main contributor was Stationary combustion (NFR 1A1, 1A2, 1A4), especially Residential subsector (NFR 1A4b), for NO_x, CO and Pb emissions – Transport subsector (NFR 1A3), particularly Road transport (NFR 1A3b). The main contributor for NH₃ emissions in 1990 was Agriculture sector (NFR 3), and for NMVOC emissions the main contributors were solvent use (NFR 2D) as well as Transport (1A3b).

Table 1.2 Key categories in 2014

Component	Key categories (Sorted from high to low from left to right)												Total (%)
SO₂	1A4bi (30.9%)	1A2gviii (17.8%)	1A1a (13.6%)	1A4ai (10.6%)	1A2f (10.5%)								83.4
NO_x	1A3biii (19.8%)	1A1a (10.5%)	1A3c (10.5%)	1A3bi (10.3%)	3Da1 (8.3%)	1A4ci (6.3%)	1A4bi (6.1%)	1A2gviii (6.1%)	1A4ai (5.3%)				83.2
NH₃	3Da1 (21.9%)	3Da2a (15.7%)	3B1a (15.1%)	3B3 (11.5%)	1A4bi (8.0%)	3B1b (4.8%)	5D1 (4.3%)						81.4
NMVOC	1A4bi (16.3%)	2D3d (16.2%)	2D3a (13.8%)	1A2gviii (8.2%)	2D3g (6.8%)	2D3h (6.7%)	3B1a (4.0%)	1A3bi (3.1%)	3B1b (2.9%)	1A4ai (2.9%)			80.8
CO	1A4bi (64.2%)	1A3bi (8.3%)	1A2gviii (6.3%)	6A (3.3%)									82.0
TSP	2D3b (43.7%)	1A4bi (31.4%)	1A2gviii (6.0%)										81.1
PM₁₀	1A4bi (46.1%)	2D3b (14.4%)	1A2gviii (8.8%)	3De (7.4%)	1A1a (7.3%)								84.1
PM_{2.5}	1A4bi (60.7%)	1A2gviii (11.7%)	1A1a (8.5%)										80.9
Pb	1A3bi (33.5%)	1A4bi (21.7%)	1A2gviii (11.8%)	1A1a (6.7%)	1A2f (6.0%)	1A4ai (5.3%)							85.0
Hg	1A1a (25.3%)	1A4bi (21.4%)	1A2f (18.6%)	1A2gviii (12.3%)	1A4ai (11.0%)								88.6
Cd	1A4bi (49.7%)	1A2gviii (30.4%)											80.2
DIOX	1A4bi (50.8%)	1A2f (33.4%)											84.2
PAH	1A4bi (74.2%)	6A (9.3%)											83.6
HCB	1A4bi (35.7%)	1A2gviii (21.9%)	1A1a (17.1%)	1A2f (15.3%)									90.0

As it can be seen in tables above, the key sources have slightly changed in 2014, comparing with 1990. The main source for the majority of pollutants has remained the Energy sector, especially the Residential subsector. Also the Road transport have remained as a key category for NO_x, and Agriculture sector for NH₃ emissions. Changes in main emission sources can be observed for CO emissions, where Transport was replaced by Residential subsector. The main producers of particulate matter emissions are Energy and Industrial Processes and Product Use (IPPU) sectors.

1.5 Quality assurance/Quality control

The following Quality control (QA/QC) activities were carried out in the inventory preparation process:

- Processing;
- Handling,
- Documentation;
- Recalculations;

- Cross – checking.

The inventory is archived each year and it is possible to regenerate information.

Quality Control (QC):

Quality Control (QC) is a system of routine technical activities, to measure and control the quality of the inventory as it is being developed. The QC system is designed to:

- Provide routine and consistent checks to ensure data correctness and completeness;
- Identify and address errors and omissions;
- Document and archive inventory material.

QC activities include general methods such as accuracy checks on data acquisition and calculations and the use of approved standardized procedures for emission calculations, measurements, estimating uncertainties, archiving information and reporting. These activities are implemented by sectoral experts and national inventory compiler.

Before submitting data to CEIP/EEA, NFR tables are checked with [RepDab](#), an electronic tool to check the format, completeness and internal consistency of submissions, provided by CEIP.

Quality assurance (QA)

Quality Assurance (QA) activities include a system of review procedures conducted by personnel not directly involved in the inventory compilation/development process. In the inventory preparation process, general quality control procedures have been applied. Some specific quality control procedures related to check of activity data and emission factors were carried out.

1.6 General uncertainty evaluation

The calculation of uncertainty estimates was made according to Tier 1 method presented in EMEP/EEA 2013. Tier 1 method is based on emission estimates and uncertainty coefficients for activity data and emission factors.

Uncertainty coefficients have been assigned based on expert judgement or on default uncertainty estimates according to IPCC GPG 2000, 2006 IPCC Guidelines, EMEP/EEA 2009 Guidebook and EMEP/EEA 2013, because there is lack of information about background data to make actual calculations. For each source, the uncertainty for activity data and emission factors was estimated and given in per cent. The uncertainty analysis was done for the all sectors: Energy, IPPU, Agriculture, Waste and LULUCF (reported as Other under NFR 6A). Uncertainties were estimated for main pollutants - NO_x, NMVOC, SO₂, NH₃ and CO, as well as for particulate matter (PM_{2.5}, PM₁₀, TSP, BC), priority heavy metals (Pb, Cd, Hg) and POPs (PCDD/F, PAHs, HCB, PCBs).

Table 1.3 Uncertainty assessment results in 2014

	Overall uncertainty, %	Trend uncertainty, %
NO_x	61.68	30.95
NMVOC	56.12	35.67
SO₂	62.09	7.16
NH₃	83.12	40.31
CO	90.88	50.68
PM_{2.5}	93.74	46.07
PM₁₀	92.64	55.56
TSP	89.82	76.57
BC	87.02	53.05
Pb	78.12	12.65
Cd	80.46	77.98
Hg	65.63	39.23
PCDD/F	56.83	71.69
PAHs	69.69	39.93
HCB	72.66	92.26

	Overall uncertainty, %	Trend uncertainty, %
PCBs	71.60	25.53

Complete set of reporting tables for main pollutants can be found in Annex III.

1.7 General assessment of the completeness

The emission inventory covers all territory of Latvia. Emissions from almost all sectors and subsectors have been estimated. Where this is not the case, notation keys – NE (not estimated), IE (included elsewhere), NA (not applicable) or NO (not occurred), are used.

NE (not estimated):

“NE” is used for activity data and/or emissions by sources of pollutants which have not been estimated but for which a corresponding activity may occur.

Table 1.4 Sources not estimated in 2014 (NE)

NFR14 code	Substance(s)	Reason for not estimated
1A1a Public electricity and heat production	NH ₃	no methodology available, NE according to EMEP/EEA 2013
1A1c Manufacture of solid fuels and other energy industries	NH ₃	no methodology available, NE according to EMEP/EEA 2013
1A2a Stationary combustion in manufacturing industries and construction: Iron and steel	NH ₃	no methodology available, NE according to EMEP/EEA 2013
1A2b Stationary combustion in manufacturing industries and construction: Non-ferrous metals	NH ₃	no methodology available, NE according to EMEP/EEA 2013
1A3ai(i) International aviation LTO (civil)	NH ₃ , Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn	no methodology available, NE according to EMEP/EEA 2013
1A3aii(i) Domestic aviation LTO (civil)	NH ₃ , Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn	no methodology available, NE according to EMEP/EEA 2013
1A3c Railways	Pb, Hg, As	no methodology available, NE according to EMEP/EEA 2013
1A3di(ii) International inland waterways	NO _x , NMVOC, SO ₂ , NH ₃	no methodology available, NE according to EMEP/EEA 2013
1A3dii National navigation (shipping)	Pb, Hg, As	no methodology available, NE according to EMEP/EEA 2013
1A4ciii Agriculture/Forestry/Fishing: National fishing	NH ₃	no methodology available, NE according to EMEP/EEA 2013
1A5b Other, Mobile (including military, land based and recreational boats)	NH ₃	no methodology available, NE according to EMEP/EEA 2013
1B1a Fugitive emission from solid fuels: Coal mining and handling	NMVOC, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn	no methodology available, NE according to EMEP/EEA 2013
2A1 Cement production	Pb, Cd, As, Cr, Cu, Ni, Se, Zn, benzo(a)pyrene, benzo (b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, PAHs	no methodology available, NE according to EMEP/EEA 2013
2A3 Glass production	NO _x , SO ₂ , NH ₃ , CO, PCDD/F, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, PAHs, HCB	no methodology available, NE according to EMEP/EEA 2013
2A5a Quarrying and mining of minerals other than coal	PM _{2.5} , PM ₁₀ , TSP	no methodology available, NE according to EMEP/EEA 2013
2A5b Construction and demolition	PM _{2.5} , PM ₁₀ , TSP	no methodology available, NE according to EMEP/EEA 2013
2A5c Storage, handling and transport of mineral products	PM _{2.5} , PM ₁₀ , TSP	no methodology available, NE according to EMEP/EEA 2013
2B10a Chemical industry: Other	NO _x , NMVOC, SO ₂ , NH ₃ , BC, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, PCDD/F, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, PAHs, HCB, PCB	no methodology available, NE according to EMEP/EEA 2013
2B7 Soda ash production	PM _{2.5} , PM ₁₀ , TSP, BC	no methodology available, NE according to EMEP/EEA 2013
2C1 Iron and steel production	NH ₃ , Se, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene	no methodology available, NE according to EMEP/EEA 2013

NFR14 code	Substance(s)	Reason for not estimated
2D3b Road paving with asphalt	NO _x , SO ₂ , CO, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, PAHs, HCB	no methodology available, NE according to EMEP/EEA 2013
2D3c Asphalt roofing	Pb, Cd, Hg, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, PAHs, HCB	no methodology available, NE according to EMEP/EEA 2013
2H1 Pulp and paper industry	benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, PAHs, HCB	no methodology available, NE according to EMEP/EEA 2013
2H2 Food and beverages industry	PM _{2.5} , PM ₁₀ , TSP, BC	no methodology available, NE according to EMEP/EEA 2013
2I Wood processing	NO _x , NMVOC, SO ₂ , NH ₃ , PM _{2.5} , PM ₁₀ , TSP, BC, CO, As, Cu	no statistical data is available
3Da1 Inorganic N-fertilizers	TSP	no methodology available, NE according to EMEP/EEA 2013
3Da2b Sewage sludge applied to soils	NH ₃	no methodology available, NE according to EMEP/EEA 2013
3Da2c Other organic fertilisers applied to soils	NH ₃	no methodology available, NE according to EMEP/EEA 2013
3Da4 Crop residues applied to soils	NO _x , NH ₃ ,	no methodology available, NE according to EMEP/EEA 2013
5A Biological treatment of waste - Solid waste disposal on land	NH ₃ , CO, Hg	no methodology available, NE according to EMEP/EEA 2013
5B1 Biological treatment of waste - Composting	NO _x , NMVOC, SO ₂ , PM _{2.5} , PM ₁₀ , TSP, BC, CO	no methodology available, NE according to EMEP/EEA 2013
5C1bii Hazardous waste incineration	NH ₃ , Cr, Cu, Se, Zn, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene	no methodology available, NE according to EMEP/EEA 2013
5C1biii Clinical waste incineration	NH ₃ , PM _{2.5} , PM ₁₀ , Se, Zn, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene	no methodology available, NE according to EMEP/EEA 2013
5C1bv Cremation	BC	no methodology available, NE according to EMEP/EEA 2013
5C2 Open burning of waste	All pollutants	no statistical data is available

IE (included elsewhere):

“IE” is used for emissions by sources of pollutants estimated but included elsewhere in the inventory instead of under the expected source category.

Table 1.5 Sources included elsewhere in 2014 (IE)

NFR14 code	Substance(s)	Included in NFR category
1A3ei Pipeline transport	All pollutants	1A4a i Commercial/institutional: Stationary
1A3bii Road transport: Light duty vehicles	PCDD/F, PAHs	1A3b i Road transport: Passenger cars
1A3biii Road transport: Heavy duty vehicles and buses	PCDD/F, PAHs	1A3b i Road transport: Passenger cars
1A3biv Road transport: Mopeds & motorcycles	PCDD/F, PAHs	1A3b i Road transport: Passenger cars
3Db Indirect emissions from managed soils	NH ₃	3Da1 Inorganic N-fertilizers (includes also urea application)
5D1 Domestic wastewater handling	NMVOC	5D3 Other wastewater handling
5D2 Industrial wastewater handling	NMVOC	5D3 Other wastewater handling

NA (*not applicable*) is used for activities under a given source category that do occur within the Party but do not result in emissions of a specific pollutant.

C (*confidential*) is used for emissions by sources of pollutants of which the reporting could lead to the disclosure of confidential information. In case of Latvia, particular notation key is not used.

NO (*not occurring*) is used for categories or processes within a particular source category that do not occur within a Party.

NR (*not relevant*) is used to ease the reporting where reporting of emissions is not strictly required by the different protocols. In case of Latvia “NR” is used for particulate matter emissions in 1990-1999.

The completeness is estimated taking into account the usage of notation key NE relation this number to total amount of the subcategories. Completeness is checked for all emissions.

2 Air pollutant emission trends

2.1 Overview

The emission estimates of air pollutants in Latvia include emissions from following gases: sulphur dioxide, nitrogen oxides, carbon monoxide, non-methane volatile organic compounds, ammonia, particulate matter (TSP, PM₁₀, PM_{2.5}), heavy metals (lead, cadmium, mercury, arsenic, chromium, copper, nickel, vanadium, zinc), PAHs, PCBs and PCDD/F.

2.2 Main pollutants (NO_x, NMVOC, SO₂, NH₃, CO)

Sulphur dioxide, nitrogen oxides, carbon monoxide, non-methane volatile organic compounds and ammonia emission trend and the main emission sources are shown in Figure 2.1-Figure 2.5. However, detailed information about emission trends in each sector can be found in relevant chapters.

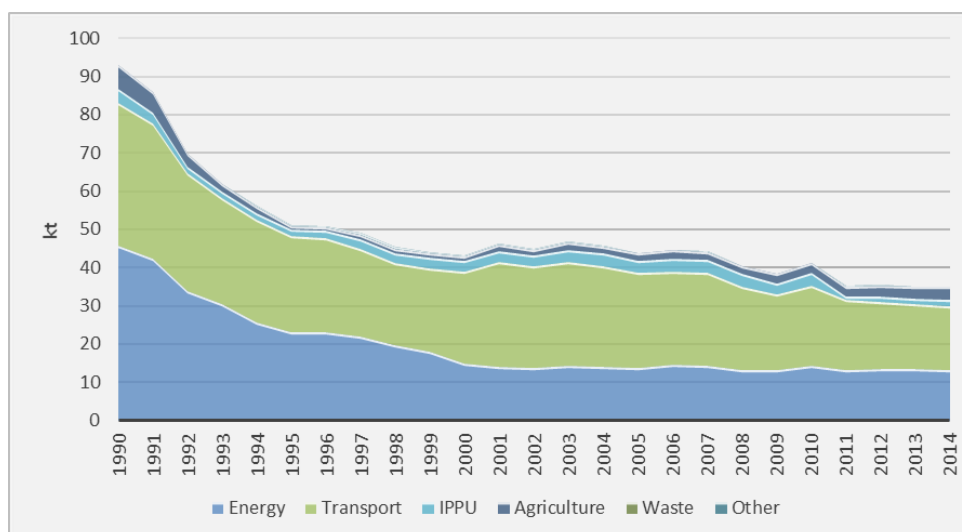


Figure 2.1 Total NO_x emissions (kt)

The total NO_x emissions have decreased by 62.4% from 1990 to 2014. Generally the reduction is due to decrease of total fuel consumption that was caused by transformation of national economy as well as energy efficiency and control measures, and also with replacement of solid fuels and heavy liquid fuels with natural gas and biomass fuels. In 2014, the total NO_x emissions were 35.02 kt, generated mainly in the Energy sector, including Transport (85.3% of total emissions).

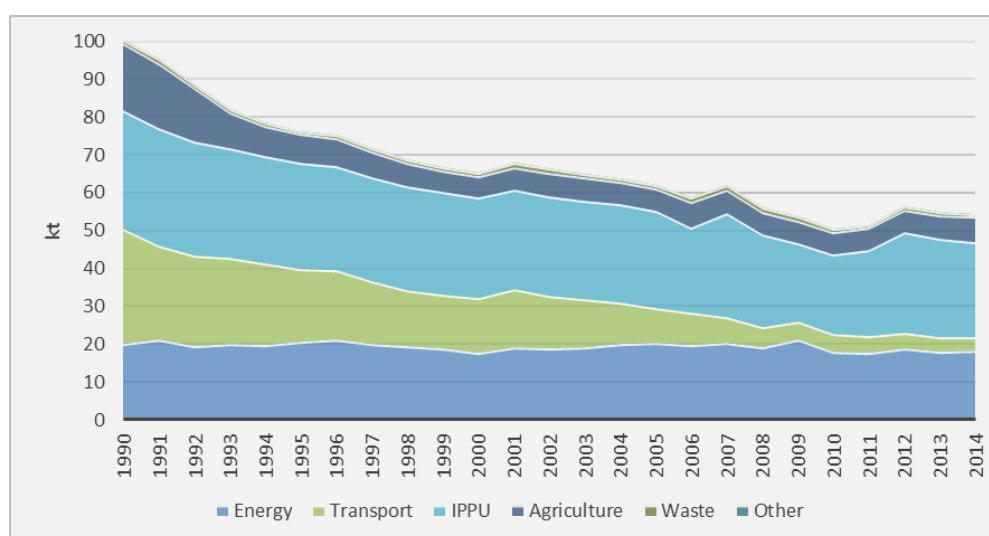


Figure 2.2 Total NMVOC emissions (kt)

The total NMVOC emissions were 54.48 kt in 2014, and have decreased by 45.8% from 1990 to 2014. The decrease in NMVOC emissions can be mainly explained with better technologies used in cars and gas stations which prevent gasoline from evaporation. In recent years, largest NMVOC emission producer are IPPU sector (46.6% of total emissions) and Energy sector including Transport (33.6%). Approximately 12% of all NMVOCs are generated in Agriculture sector from manure management, and emissions from particular sector are stable through all time series.

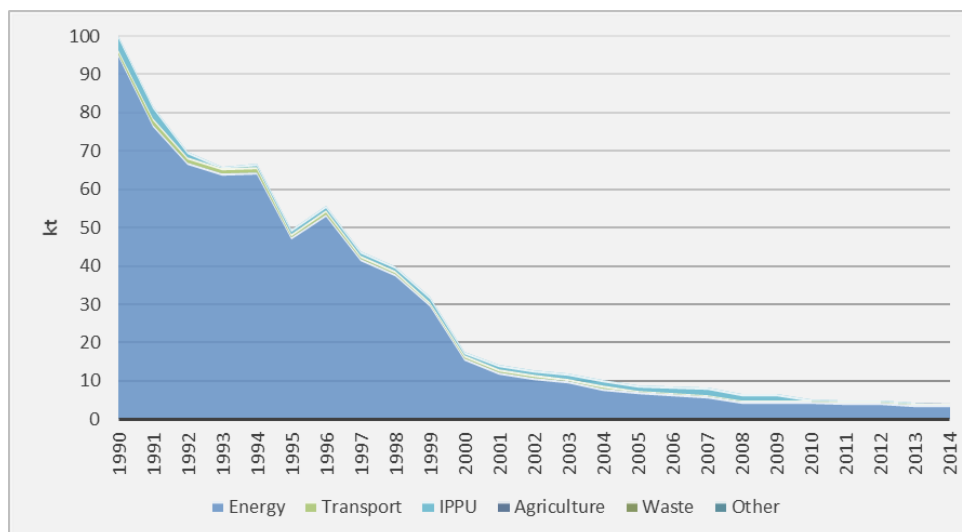


Figure 2.3 Total SO₂ emissions (kt)

Since 1990, total SO₂ emissions have decreased from 100 kt to 4.16 kt (-95.8%). The reduction is mainly due to use of fuels with lower sulphur content as well as fuel switching from solid and liquid types of fuel to natural gas and biomass. In 2014, SO₂ emissions are mainly produced in the Energy sector, including Transport (95.9% of total emissions).

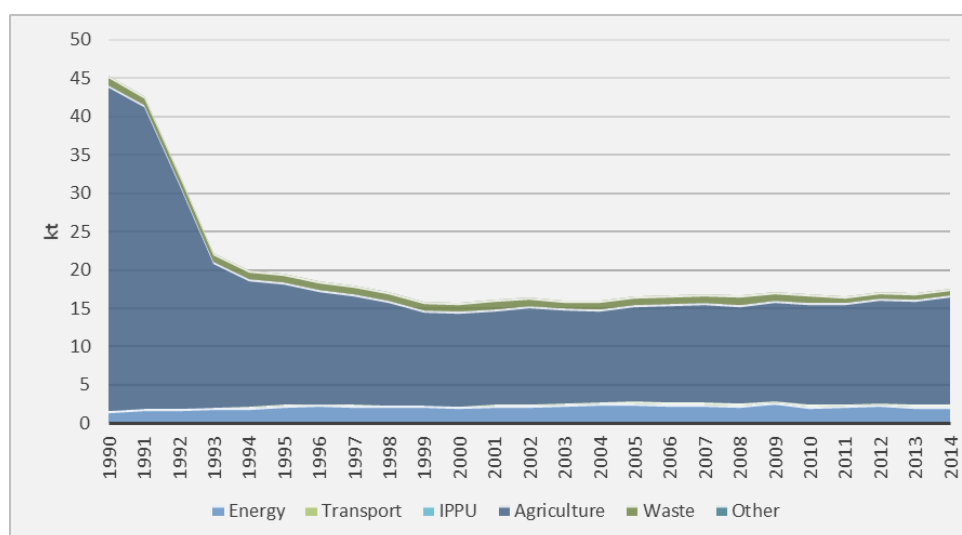


Figure 2.4 Total NH₃ emissions (kt)

The total ammonia emissions have decreased approximately by 61.4% from 1990 to 2014. In 2014, the amount of total NH₃ emissions produced was 17.47 kt. The large decrease can be explained with the collapse of USSR, when many farms were closed and agricultural activities stopped. The largest part – 81.6% of NH₃ emissions are produced from agricultural activities in 2014, and the remaining producers of ammonia are Energy and Waste sectors. Negligible NH₃ amounts are produced also in IPPU sector.

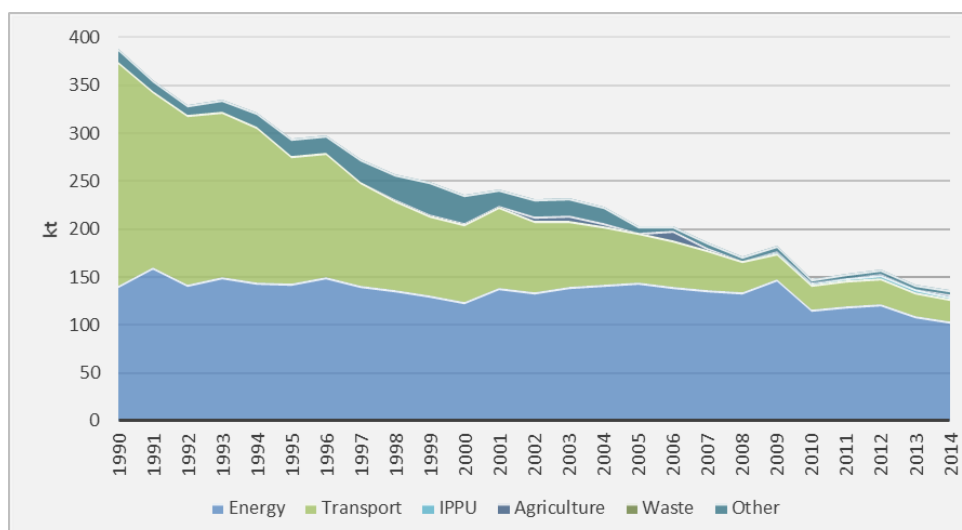


Figure 2.5 Total CO emissions (kt)

Carbon monoxide emission trend shows a decrease in emissions for period 1990 – 2014 by 61.5%. CO emissions, total 136.45 kt (2014), originates generally from the Energy (76.4%) and Transport (16.8% of total emissions). The decrease in CO emissions can be mainly explained with better technologies used in cars which prevent gasoline from incomplete combustion.

2.3 Particulate matter (PM_{2.5}, PM₁₀, TSP)

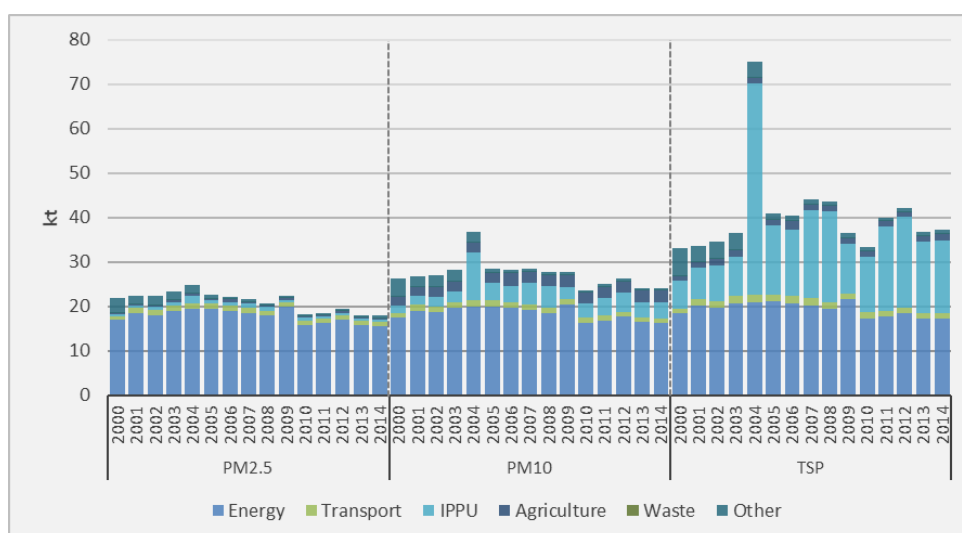


Figure 2.6 Total PM emissions (kt)

PM_{2.5} and PM₁₀ emissions show a slight decrease in 2000-2014 (PM_{2.5} – 18.6%; PM₁₀ – 8.3%), while TSP emissions have increased by 12.1%. Decrease of small particle emission can be explained by the use of best available technologies which limit fine particle emissions. However, the increase of TSP emissions could be explained by increased activities in IPPU sector. The largest part of PM emissions are produced in Energy sector (including Transport) – PM_{2.5} is 91.9%, PM₁₀ – 71.4% and TSP – 49.3% from total emissions in 2014, respectively. It is connected with intensive combustion of wood, especially in Residential sector (NFR 1A4b). Peak in PM emissions in 2004 can be explained with increased activities in Road paving (IPPU) in Via Baltic that connects the capitals of all Baltic States was built in particular year.

2.4 Heavy metals (Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn)

Emissions of heavy metals are shown in the Figure 2.7-Figure 2.9. In IIR, only priority HMs are described, but emissions for additional heavy metals can be found in NFR tables.

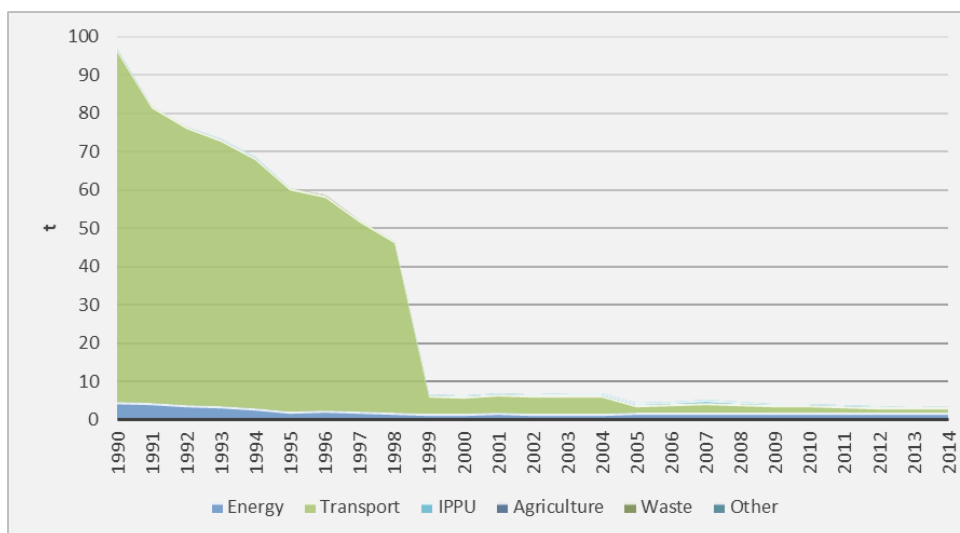


Figure 2.7 Total Pb emissions (t)

The most relevant changes can be seen in lead emissions (Figure 2.7). In comparison with the year 1990, Pb emissions have decreased by 98.1% in 2014, and the amount of Pb emitted in 2014 is 3.44 kt. The most significant decrease of lead emissions by 85.9%, can be seen in 1999. That can be explained with the changes in international legislation that prohibited the use of liquid fuels with high lead content. In 2013, the main sources of lead were Energy (mainly Residential) and Transport sectors with 52.9% and 41.7% of total emissions, accordingly.

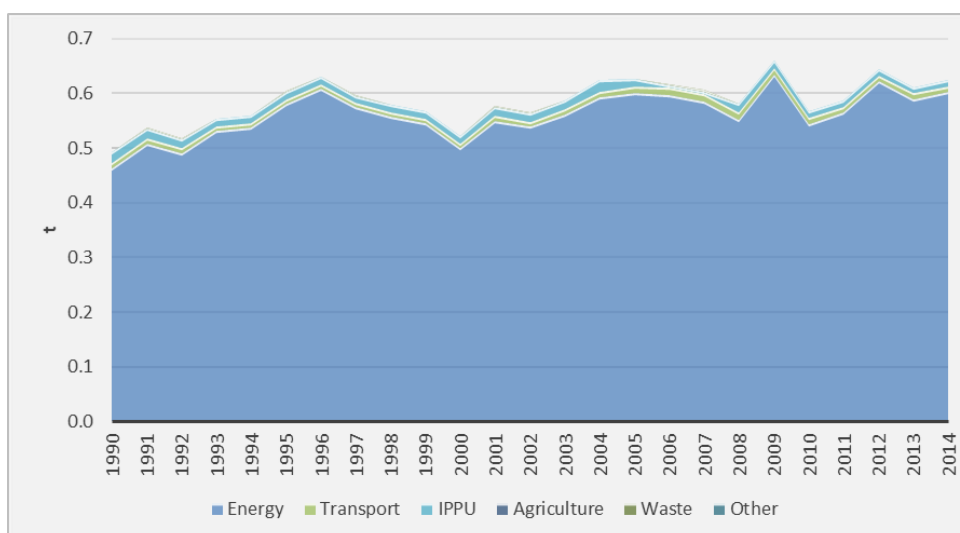


Figure 2.8 Total Cd emissions (t)

In 1990-2014, Cd emissions have increased by 26.8%, and in 2014 total amounts of Cd emitted are 0.62 tonnes. Energy (including Transport) contributes to 96.4% of total Cd emissions. The increase of Cd emissions can be explained with increased use of biomass, especially in Residential sector, where biomass products are widely used (according to EMEP/EEA 2013, biomass has the highest Cd emission factor).

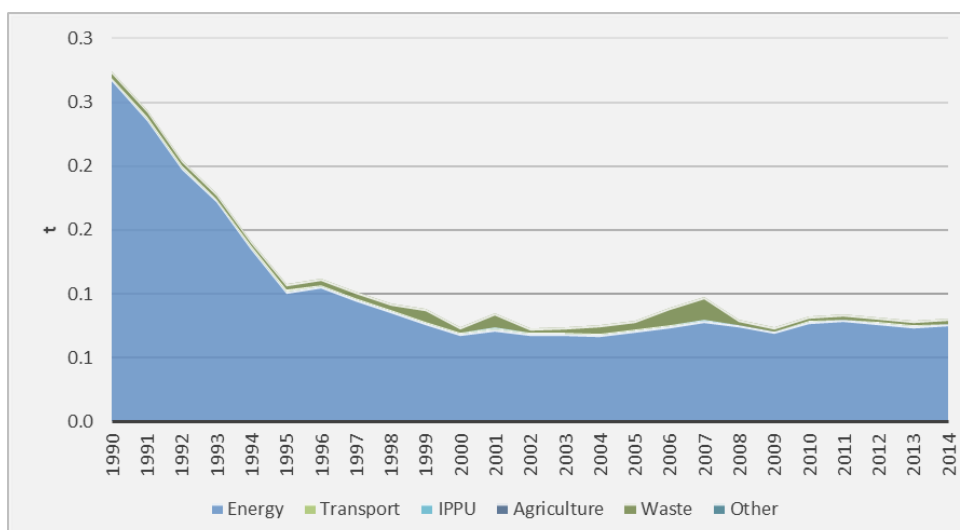


Figure 2.9 Total Hg emissions (t)

Mercury emission trend shows a decrease in emissions for period 1990 – 2014 by 70.8%. Hg emissions, total 0.08 t (2014), originates generally from the Energy sector (94.9%). The decrease in Hg emissions can be mainly explained with less amounts of fossil fuels used in combustion.

2.5 Persistent organic pollutants (PCDD/F, PAHs, PCB, HCB)

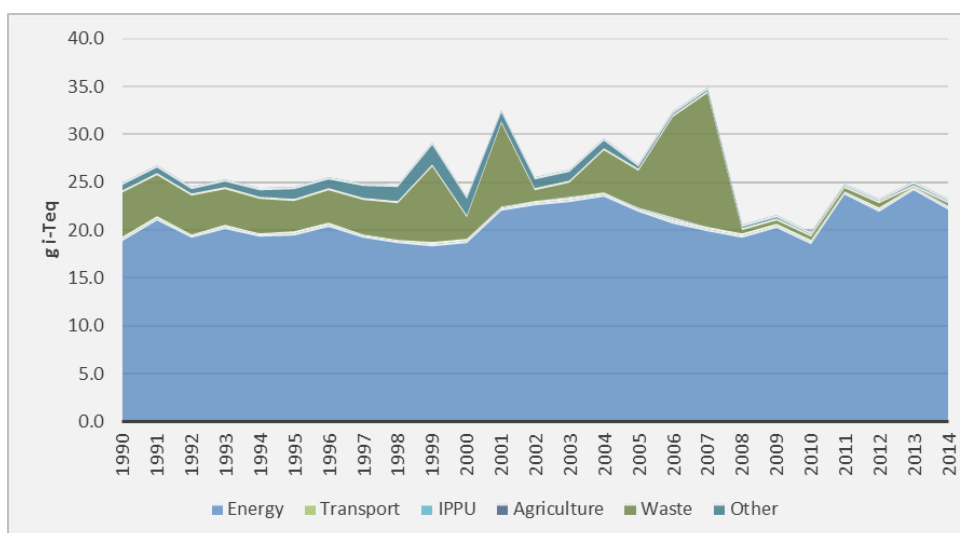


Figure 2.10 Total PCDD/F emissions (g i-Teq)

PCDD/F emissions have decreased by 6.6% in 1990-2014 and have a fluctuating trend in between. It is connected with waste incineration processes, as well as with biomass combustion. In 2014, approximately 96.5% emissions from all PCDD/F emissions are generated in the Energy sector (including Transport), but the remaining part of emissions are generated by the Waste incineration (NFR 5C), combustion of wood harvesting residues (NFR 6A) and grassland burning (NFR 3I). In Waste incineration PCDD/F emissions are fluctuating very remarkably due increased amounts of incinerated clinical waste in 2006-2007, but from year 2008 the facility is closed. In Energy sector the emissions have increased due to larger amounts of biomass combusted, which is mainly due to climate policy and establishment of the European Union Trading System (EU ETS). In Latvia's case the wooden products are local fuel, therefore widely used, and also the seasonal changes in temperature can be seen and are analysed in comparison with fuel consumption in relevant subchapters of stationary combustion.

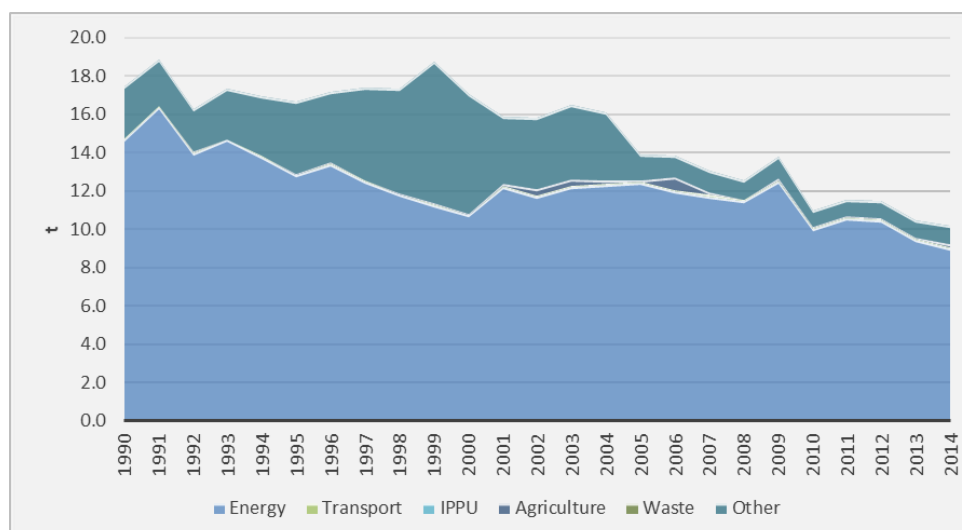


Figure 2.11 Total PAH emissions (t)

PAH emissions have decreased in 1990–2014 by 41.8%, reaching 10.17 tonnes in 2014. The fluctuations through the time series can be explained with changes in national economy and also weather conditions which influenced the consumption of particular fuels. In 2014 88.9% from PAHs were generated in Energy (including Transport) and mainly in solid biomass combustion processes. In Submission 2016 the main contributor of PAH emissions have been recalculated (changed approach in Residential sector from Tier 1 to Tier 2, taking into account the types of combustion installation), therefore PAH emissions presented in Figure 2.11 are more precise than values provided in the previous submission. Also, in 2014, 9.3% of PAHs emissions are reported as generated in on-site slash burning in the forests (NFR 6A). As there is no precise information on burned amounts, the expert's assumption is used.

It has to be noted that since 1999 total PAH emissions slightly differ from summarized benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and indeno(1,2,3-cd)pyrene emissions (can be seen in NFR tables, columns X to AA). It is because of unavailability of segregated emission factors for each pollutant for industrial waste incineration (combusted in NFR 1A2 Manufacturing and Construction Industries for energy purposes), where emission factor only for total PAH emissions can be found. The difference in 1999-2014 is 0.02-0.52 tonnes between total PAHs and sum of particular pollutants.

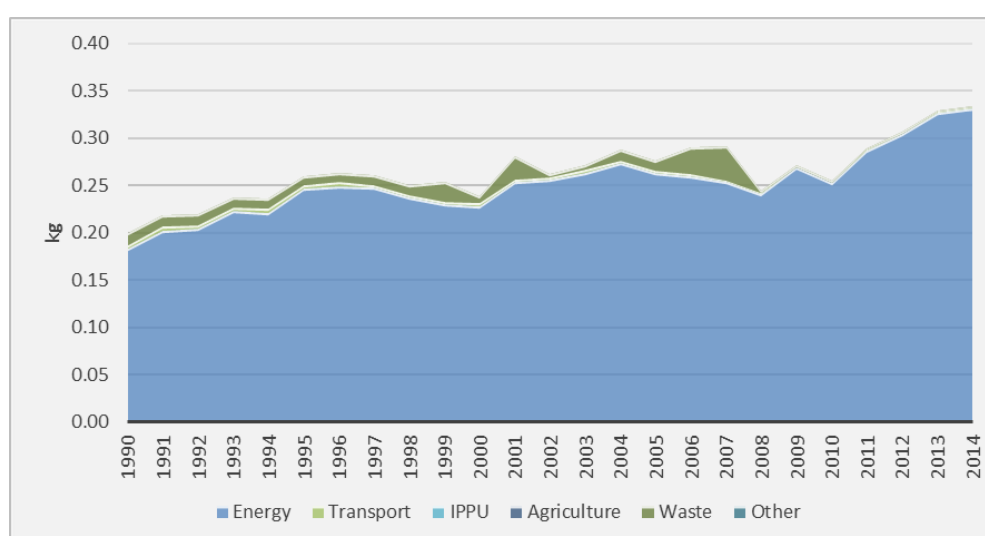


Figure 2.12 Total HCB emissions (kg)

HCB emissions have increased by 67.8% from 1990-2014, reaching 0.33 kg in 2014. Emissions have increased because of increasing use of wood and wood waste consumption in stationary fuel combustion

sector. HCB emissions from stationary fuel combustion are estimated only from solid fuels – coal and coke, and solid biomass combustion activities. 99.5% from HCB emissions in 2014 are generated in Energy (including Transport) and mainly in solid biomass combustion processes.

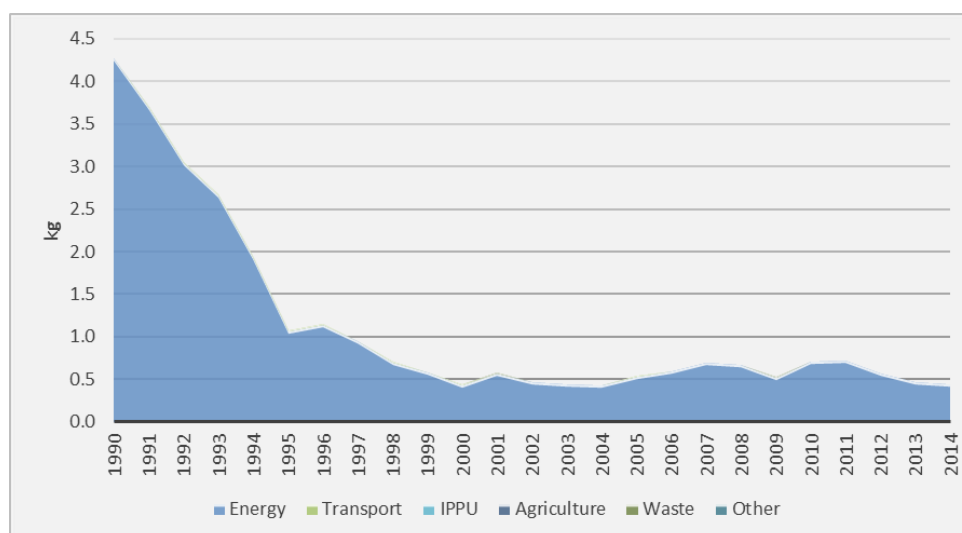


Figure 2.13 Total PCB emissions (kg)

PCB emission trend shows a decrease in emissions for period 1990 – 2014 by 89.7%. PCB emissions, total 0.44 kg (2014), originates generally from the Energy sector (including Transport), contributing 94.9% from all emissions. The decrease in PCB emissions can be mainly explained with less amounts of fossil fuels used in combustion.

3 Energy sector (NFR 1)

3.1 Sector overview

3.1.1 Quantitative overview

Both the imported (natural gas, liquid gas, oil and oil products, coal) and local fuels (wood, peat, hydro resources) are used in the Energy sector in Latvia (Table 3.1). Mainly the imported fuels (natural gas, coal) are used in heat generation in large combustion plants. Smaller boiler houses burn local fuel (wood) and coal as well.

Table 3.1 Consumption of energy resources in Latvia (TJ)

	1990	1995	2000	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Energy consumption	301321	171177	144029	163373	166207	168018	175633	179083	171262	168282	175642	164863	166457	166933	166226
Liquid fuels, total	142929	75365	53283	55529	57142	56988	62648	68307	64066	59077	61430	55347	54226	54765	55684
Shale oil	NO	79	2440	315	118	157	118	118	79	39	39	79	39	NO	NO
Liquefied petroleum gas	3689	1548	2140	2368	2505	2550	2687	2414	2186	2003	2103	2414	3279	3840	4235
Gasoline and aviation gasoline	26796	18128	14831	15214	15346	15126	16753	18299	16672	13941	12667	11926	10146	9282	9018
Jet kerosene	3067	1166	1123	1685	2074	2463	2852	3414	4105	4297	4926	4925	5012	5185	4623
Other kerosene	648	432	43	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Diesel oil (oven fuel inclusive)	43000	17166	20693	29063	31188	32887	36371	41343	39133	36500	38994	35268	35182	36222	37732
Residual fuel oil	63092	36134	9460	4547	3735	3167	2152	1624	1096	1421	1069	735	568	194	41
Petroleum coke	NO	NO	NO	956	1088	429	627	132	NO	165	627	NO	NO	NO	NO
Other liquids	2637	712	2553	1381	1088	209	1088	963	795	711	1005	NO	NO	42	35
Solid fuels, total	26363	7225	2787	2675	2596	3199	3441	4248	4248	4309	4378	4509	3645	2906	2473
Coal	26098	7172	2761	2648	2570	3146	3409	4248	4248	3409	4378	4509	3645	2906	2473
Coke	237	53	26	27	26	53	32	NO	NO	NO	NO	NO	NO	NO	NO
Oil shale	28	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Peat products, total	4153	4241	2483	915	90	80	70	91	91	36	106	43	34	84	35
Peat	3286	3838	2452	915	90	80	70	90	90	30	100	40	30	80	30
Peat briquettes	867	403	31	NO	NO	NO	NO	1	1	6	6	3	4	4	5
Natural gas	99653	42279	45635	56408	55785	56852	58892	56922	55814	51381	61313	54034	50806	50269	45386
Biomass, total	27581	42120	39736	47174	49784	49904	50227	49191	46544	53284	47406	48985	55619	56758	60103
Wood and wood products	27581	42102	39695	46969	49434	49396	49748	48706	46018	52591	45646	46901	52503	53106	55921
Charcoal	NO	NO	NO	NO	30	60	30	45	60	60	60	60	59	90	90
Bioethanol	NO	NO	NO	NO	NO	NO	43	NO	1	108	350	318	279	264	257
Biodiesel	NO	NO	NO	NO	NO	107	60	73	82	73	808	749	659	631	741
CH ₄ from landfill gas	NO	NO	NO	162	242	251	259	271	290	323	331	349	347	371	369
CH ₄ from other biogas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	37	465	1629	2141	2535
CH ₄ from sewage sludge gas	NO	18	41	43	78	90	76	80	79	100	114	100	105	97	91
Straws	NO	NO	NO	NO	NO	NO	11	16	14	29	60	43	38	58	99
Other fuels, total	879	NO	131	699	810	1022	382	324	499	195	1009	1945	2127	2151	2545
Used oils	879	NO	NO	409	497	848	263	234	263	117	95	88	58	29	29
Industrial waste	NO	NO	131	290	313	174	119	90	81	21	161	514	374	550	470
Municipal waste	NO	NO	NO	NO	NO	NO	NO	NO	155	57	753	1343	1695	1572	2046

Liquid fossil fuels have an important place in the Latvian energy resource market; their market share is around 33% in 2014, including residual fuel oil. The share of residual fuel oil consumption has a significant decrease - in 1990 it was 21% from total fuel consumption, but in 2014 it was 0.02%. The essential decrease of heavy oil share in energy balance can be explained with the increase of costs for the use of this fuel due to requirements of the EU Directive 1999/32/EC prescribing that sulphur content of heavy oil shall not exceed 1%. The biggest part from liquid fuel consumption contributes to gasoline and diesel oil with approximately 84.0% from total liquid fuel consumption in 2014 where gasoline is mostly consumed in transport sector and only a small part is used in off-roads. Diesel oil was combusted in transport sector and in stationary combustion installations, respectively 76.2% and 23.8% from total diesel oil consumption in 2014. The total consumption of liquid fuels in 2014 has decreased by 61.0% since 1990.

Total share of *solid fuels* in national market is quite low – approximately 1.5% in 2014. The solid fuel consumption in recent years is stable although the consumption have decreased by 90.5% since 1990. A decrease in solid fuel consumption (-19.8%) can be seen in 2008-2009 due to global economic crisis. However, from 2009 to 2011 the consumption of solid fuels increased by 32.3% that can mainly be explained with an increase of coal consumption, but in years 2011-2014 there can be seen a decrease in solid fuel consumption by 45.2% due to reduced use of coal.

Peat and peat briquettes are local fuels used in Latvia in early 1990-ties with 1.4% of total energy consumption in 1990. However, nowadays amounts of peat products used have decreased and have reached 0.02% of total share in 2014.

The largest consumers of *natural gas* are combined heat and power plants, and heat generation enterprises as well as industrial enterprises. Natural gas has a stable place in total fuel consumption where its share is 33.0% in 1990 and 27.3% in 2014. Natural gas consumption has decreased by 54.5% in 1990-2014. Recent years until 2011 the consumption of natural gas had an increasing trend – from 2009 to 2010 it increased by 19.3%, but in 2010-2014 there can be seen a decrease of natural gas consumption by 26.0%.

Biomass fuels are wood and wood products, straw, charcoal and liquid biofuels – bioethanol and biodiesel. In the total fuel consumption the share of firewood and other wood products is quite substantial and has reached its peak with 33.6% of total energy consumption in 2014, comparing with 1990 when firewood consumption was only about 9.2% from total energy consumption. In 2010-2014 wood and wood products' use increased by 22.5%. In latest years liquid and gaseous biofuels are becoming more popular and their share from 0.27% in 2005 has reached 2.40% in 2014 from total fuel consumption. Recently also such biomass fuels as straws are used, and it has an increasing trend with fluctuations, especially in 2010-2011 and 2013-2014, which can mainly be explained with significant temperature differences in winter.

There are also more *industrial and municipal wastes* consumed in the latest years, and the most significant increase can be observed in 2010 – comparing with 2009 the consumption of waste has almost 11-fold increase, and it reached 0.52% from total share. However, in the following years the increase of other fuels consumed was not as rapid as in previous 2009-2010. The increase in particular fuels' use in 2013-2014 was by 19%, and it formed 1.51% from the total amount of all used fuels in 2014. Also used oils are reported as other fuels, however, this fuel type has a decreasing trend.

Hydroelectric power plants (HPP) and combined heat and power plants (CHP) produce part of the electrical power, while part is imported (Table 3.2, Table 3.3). Volume of electricity generation directly depends on the through-flow of the river Daugava. Also the import of electricity from Russia, Estonia and Lithuania has a quite substantial role in the electricity supply.

Table 3.2 Heat production and consumption in Latvia (TJ)

	Production	Own use and losses	Final consumption		
			NFR 1A2	NFR 1A4	TOTAL
1990	99439	15171	32929	51339	84268
1995	46112	7156	1969	36987	38956
2000	31867	6815	659	24393	25052

	Production	Own use and losses	Final consumption		
			NFR 1A2	NFR 1A4	TOTAL
2001	33937	7038	641	26258	26899
2002	33048	6541	630	25877	26507
2003	33516	6409	626	26481	27107
2004	31093	6174	608	24311	24919
2005	31144	5886	684	24574	25258
2006	30056	5454	634	23968	24602
2007	28685	4911	554	23220	23774
2008	26402	4010	356	22036	22392
2009	26308	4099	298	21911	22209
2010	28662	4590	387	23685	24072
2011	25000	4104	268	20628	20896
2012	26857	4464	259	22134	22393
2013	26249	4551	479	21219	21698
2014	25747	4608	890	20249	21139

Table 3.3 Electricity production and consumption in Latvia (TJ)

	Production	Own use and losses	Import	Export	Final consumption			
					NFR 1A2	NFR 1A3	NFR 1A4	TOTAL
1990	23933	6883	25700	12798	11484	918	17550	29952
1991	20318	6682	15217	7	10807	785	17255	28847
1992	13803	5645	14688	7	8316	745	13777	22838
1993	14126	6102	9619	612	5440	688	10904	17032
1994	15984	6681	9533	2988	5076	670	10102	15848
1995	14324	6372	9529	1408	5130	677	10267	16074
1996	11254	7989	12377	760	4975	641	9266	14882
1997	16218	7694	6566	4	5519	634	8935	15088
1998	20869	6559	3290	1382	5296	612	10310	16218
1999	14796	5774	9349	2311	5130	554	10375	16059
2000	14890	5202	7589	1159	5159	547	10411	16117
2001	15408	5688	8424	1645	5562	623	10314	16499
2002	14310	5188	10217	1764	5494	518	11563	17575
2003	14310	5065	9616	137	5778	490	12456	18724
2004	16881	4975	9839	2290	5882	500	13072	19454
2005	17658	4767	10278	2545	6120	533	13972	20625
2006	17607	4522	10116	1087	6332	540	15242	22114
2007	17176	4194	17870	7070	6538	504	16740	23782
2008	18987	4198	16715	7643	6066	497	17298	23861
2009	20048	4032	15333	9378	5421	436	16114	21971
2010	23857	4626	14303	11160	5724	453	16197	22374
2011	21938	4133	14432	9950	6012	446	15829	22287
2012	22202	3636	17766	11678	7175	464	17015	24654
2013	22352	3556	18018	13140	6509	446	16719	23674
2014	18508	3146	19221	10883	6003	421	17276	23700

Types of fuels used for combustion in Latvia:

Liquid fuels are mainly imported from Latvia's neighbouring countries – Lithuania, Belarus, Russian Federation, Norway and others and consist of:

- shale oil;
- liquefied petroleum gas;
- motor gasoline and aviation gasoline;
- kerosene type jet fuel;
- other kerosene;
- gasoline type jet fuel;
- motor diesel oil and heating gas oil;
- residual fuel oil (RFO);

- other liquids;
- petroleum coke.

Solid fuels consist of coal and coke imported from Commonwealth of Independent States (countries of former Union of Soviet Socialist Republics), as well as local fuel – peat briquettes – that are mainly produced inside country but not imported;

Peat is 100% produced inside of the country;

Gaseous fuels (natural gas) are 100% imported from Russian Federation;

Biomass fuels:

- solid biomass – wood and other wood products, charcoal, straw, is mainly produced and used inside of the country,
- methane obtained from biogas that is 100% produced inside of the country – landfill gas that is used since 2002 when first landfill started to collect and combust biogas with energy recovery, and sludge gas that is combusted with energy recovery since 1993 in one sewage purification plant, and also other biogases from anaerobic fermentation,
- liquid biofuels – biogasoline and biodiesel, which are mainly imported from Latvia's neighbourhood countries.

Other fuels are municipal waste (ecofuel) and industrial wastes (used tires, different types of industrial ecofuel) collected by and combusted in cement production plant in Latvia, as well as used oils.

3.1.2 Description

Emissions from fuel combustion comprise all in-country fuel consumption for heat and electricity production purposes and to provide operation of transport vehicles. These emissions include point sources, transport and other fuel combustion. Emissions from fuel combustion in the Energy sector are divided into following subcategories:

- NFR 1A1 – Energy Industries;
- NFR 1A2 – Manufacturing Industries and Construction;
- NFR 1A3 – Transport – covers emissions from road transport, civil aviation, railways and domestic navigation, as well as emissions from off-road machinery (NFR 1A2g vii, 1A4a ii, 1A4b ii, 1A4c ii, 1A4c iii);
- NFR 1A4 – Other Sectors (Commercial/Institutional, Residential, Agriculture/Forestry/ Fisheries);
- NFR 1A5 – Other (Not elsewhere specified) – covers emissions from military machinery (offroad);
- NFR 1B – Fugitive emissions from solid fuels, natural gas and oil.

3.2 Stationary fuel combustion (NFR 1A1, 1A2, 1A4)

3.2.1 Sector overview

3.2.1.1 Source category description

This chapter includes stationary combustion plants and autoproducer plants (undertakings that generate electricity/heat wholly or partly for their own use, as an activity that supports their primary activity).

NFR 1A1 Energy industries sectors include emissions from fuel combustion in point sources in energy production including emissions from off-road. NFR 1A1 sector also includes the emissions from on-site use of fuel in the energy production facilities and emissions from manufacturing of solid fuels (peat briquettes plant) – these emissions are reported under 1A1c Manufacture of solid fuels and other energy industries sector. There is no petroleum refining in Latvia, therefore emissions in NFR 1A1b sector are not occurring.

NFR 1A2 and 1A4 sectors include emissions from autoproducers in the industrial production and commercial facilities – according to 2006 IPCC Guidelines, emissions from autoproducers are assigned to the sector where they were generated and not under NFR 1A1.

Under 1A2g viii Other sector emissions from following industrial sectors are reported:

- Transport Equipment;
- Machinery;
- Mining and Quarrying;
- Wood and Wood Products;
- Construction;
- Textiles and Leather;
- Non-specified (Industry).

Table 3.4 Source categories and methods for Stationary fuel combustion sectors

NFR code	Description	Method	AD	EF
1 A 1 a	Public electricity and heat production	Tier 1	NS ⁴ , PS ⁵	D ⁶ , PS
1 A 1 c	Manufacture of solid fuels and other energy industries	Tier 1	NS	D
1 A 2 a	Stationary combustion in manufacturing industries and construction: Iron and steel	Tier 1	NS	D
1 A 2 b	Stationary combustion in manufacturing industries and construction: Non-ferrous metals	Tier 1	NS	D
1 A 2 c	Stationary combustion in manufacturing industries and construction: Chemicals	Tier 1	NS	D
1 A 2 d	Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print	Tier 1	NS	D
1 A 2 e	Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco	Tier 1	NS	D
1 A 2 f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	Tier 1	NS, PS	D
1 A 2 g viii	Stationary combustion in manufacturing industries and construction: Other	Tier 1	NS	D
1 A 4 a i	Commercial/Institutional	Tier 1	NS, PS	D
1 A 4 b i	Residential	Tier 2	NS	D
1 A 4 c i	Agriculture/Forestry/Fishing	Tier 1	NS	D

Table 3.5 Reported emissions in Stationary fuel combustion sectors in 2014

NFR code	Emissions
1 A 1 a	NO _x , NMVOC, SO ₂ , PM _{2.5} , PM ₁₀ , BC, TSP, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, dioxins, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, total PAHs, HCB, PCB
1 A 1 b	NO
1 A 1 c	NO _x , NMVOC, SO ₂ , PM _{2.5} , PM ₁₀ , BC, TSP, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, dioxins, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, total PAHs, HCB, PCB
1 A 2 a	NO _x , NMVOC, SO ₂ , PM _{2.5} , PM ₁₀ , BC, TSP, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, dioxins, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, total PAHs
1 A 2 b	NO _x , NMVOC, SO ₂ , PM _{2.5} , PM ₁₀ , BC, TSP, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, dioxins, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, total PAHs
1 A 2 c	NO _x , NMVOC, SO ₂ , NH ₃ , PM _{2.5} , PM ₁₀ , BC, TSP, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, dioxins, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, total PAHs, HCB, PCB
1 A 2 d	NO _x , NMVOC, SO ₂ , NH ₃ , PM _{2.5} , PM ₁₀ , BC, TSP, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, dioxins, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, total PAHs, HCB, PCB
1 A 2 e	NO _x , NMVOC, SO ₂ , NH ₃ , PM _{2.5} , PM ₁₀ , BC, TSP, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, dioxins, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, total PAHs, HCB, PCB
1 A 2 f	NO _x , NMVOC, SO ₂ , NH ₃ , PM _{2.5} , PM ₁₀ , BC, TSP, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, dioxins, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, total PAHs, HCB, PCB
1 A 2 g viii	NO _x , NMVOC, SO ₂ , NH ₃ , PM _{2.5} , PM ₁₀ , BC, TSP, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, dioxins, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, total PAHs, HCB, PCB
1 A 4 a i	NO _x , NMVOC, SO ₂ , NH ₃ , PM _{2.5} , PM ₁₀ , BC, TSP, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, dioxins, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, total PAHs, HCB, PCB
1 A 4 b i	NO _x , NMVOC, SO ₂ , NH ₃ , PM _{2.5} , PM ₁₀ , BC, TSP, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, dioxins, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, total PAHs, HCB, PCB

⁴ National statistics

⁵ Plant specific (AD – data obtained from plant)

⁶ Default EF from EMEP/EEA 2013

NFR code	Emissions
1 A 4 c i	NO _x , NMVOC, SO ₂ , NH ₃ , PM _{2.5} , PM ₁₀ , BC, TSP, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, dioxins, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, total PAHs, HCB, PCB

3.2.1.2 Key sources

In 2014, in stationary combustion the Energy industries (NFR 1A1) was the most important source for As, Ni and Se, Manufacturing industries (NFR 1A2) for PCBs and SO₂, and Other sectors (commercial/institutional, households and agriculture/forestry/fishery; NFR 1A4) for NO_x, NMVOCs, CO, PMs, Pb, Cd, Hg, Cr, Cu, Zn, PCDD/F, PAHs and HCB emissions Figure 3.1.

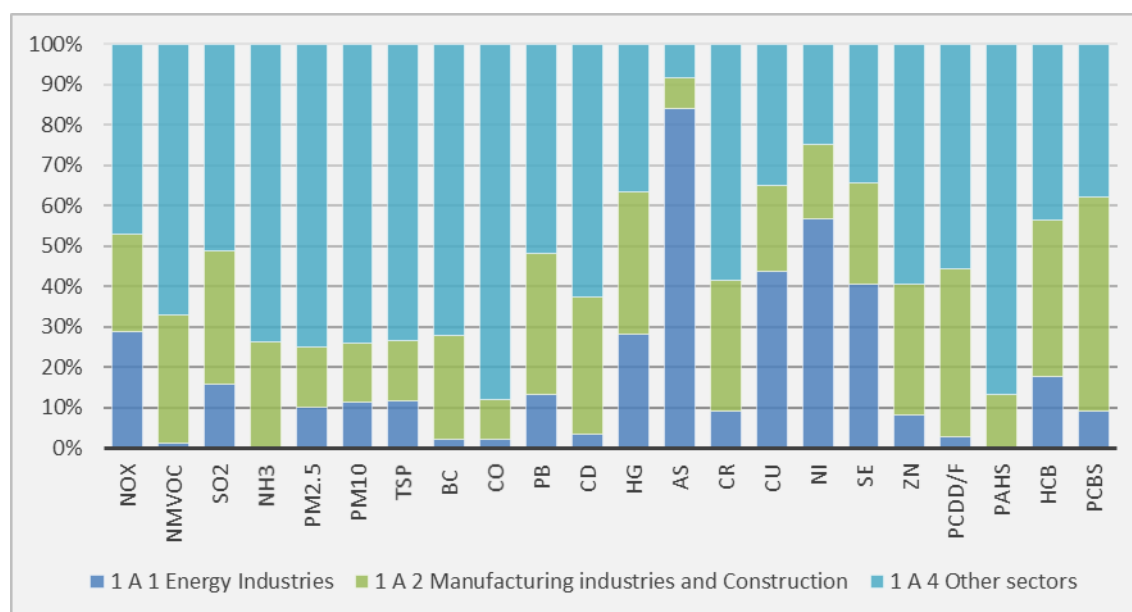


Figure 3.1 Distribution of emissions in Stationary combustion by subsectors in 2014 (%)

Main pollutants

NO_x emissions generated in stationary fuel combustion sectors are 37.8% from total emissions in 2014. The largest part in Stationary combustion were produced in 1A4 Other sectors (47.0%). **SO₂** emissions from stationary fuel combustion were 91.1% from total SO₂ emissions in 2014, and 1A4 sector was the most important with 51.1% (within Stationary combustion). Stationary fuel combustion generated 29.3% **NMVOC** emissions from Energy sector contribute to 33.6% of the total Latvia's NMVOC emissions in 2014. 1A4 sector contributed to the largest part with 67.2% from Stationary combustion emissions. The most important source for NMVOC emissions from stationary fuel combustion is solid biomass combustion. The largest part of **NH₃** emissions in stationary fuel combustion are produced in 1A4 sector – in 2014 there are produced 12.4% of total NH₃ emissions. According to EMEP/EEA 2013, there are no emission factors for NH₃ emission estimation in 1A1 sector, therefore notation key NE in particular sector was used.

In 2014, stationary fuel combustion sectors accounted 76.4% of the total Latvia's **CO** emissions. 1A4 sector was the largest emission source accounting for 87.9% of stationary combustion emissions.

Particulate matter

Stationary fuel combustion generated 87.5% of **PM_{2.5}** emissions, 67.3% of **PM₁₀** emissions, 46.1% of **TSP** emissions and 85.3% of Latvia's total **black carbon** emissions in 2014. The largest part of PM emissions in stationary combustion are generated in 1A4 Other sectors (around 74-75%; for BC – 87.9%). Mainly particulate matter emissions are produced in biomass combustion process.

Heavy metals

Lead emissions from stationary fuel combustion were 52.9% from total Pb emissions in 2014, and 1A4 sector was the most important with 51.8% (within Stationary combustion). **Cadmium** emissions from

stationary fuel combustion account 96.4% from total emissions, and 1A4 sector is the biggest producer of cadmium emissions in stationary fuel combustion sector with 62.5% from total Cd emissions. In 2014 stationary fuel combustion accounted 94.9% of the Latvia's total mercury emissions. **Mercury** emissions from stationary fuel combustion are mainly emitted in solid fuels and biomass combustion, and the largest part of emissions are produced in 1A4 Other sectors (36.5%).

POPs

Stationary fuel combustion is the main producer of POPs emissions – **PCDD/F** (96.0%), **PAHs** (88.3%), **HCB** (99.3%) and **PCB** (99.7%). In Submission 2016, HCB emissions only from solid fuels and solid biomass combustion were estimated, and 1A4 sector is the largest sector of HCB emissions with 43.6% of total stationary fuel combustion emissions. Solid biomass combustion is the main source of PAHs emissions in 2014, and 1A4 sector is the largest contributor to PAH emissions with 86.8% from stationary combustion respectively. In stationary fuel combustion, 1A4 Other sectors is a key source with 55.6% for the PCDD/F emissions where solid biomass and solid fuels are the main emitters for the particular emissions.

3.2.1.3 Trends in emissions

Table 3.6 Reported emissions in Stationary fuel combustion sectors in 1990-2014⁷

	Unit	1990	1995	2000	2005	2010	2011	2012	2013	2014	Change in 1990 -2014, %
NOx	kt	45.80	23.00	14.74	13.73	14.30	13.25	13.59	13.52	13.23	-71
NMVOC		15.77	17.55	15.24	18.20	15.80	16.37	17.36	16.21	15.95	1
SO₂		95.23	47.37	16.01	7.03	4.67	4.21	4.30	3.86	3.79	-96
NH₃		1.55	2.35	2.13	2.54	2.14	2.23	2.39	2.19	2.16	39
PM_{2.5}		NR	NR	16.88	19.39	15.78	16.32	17.07	15.87	15.62	-7
PM₁₀		NR	NR	17.41	19.98	16.29	16.84	17.62	16.45	16.23	-7
TSP		NR	NR	18.34	21.01	17.15	17.72	18.53	17.33	17.12	-7
BC		NR	NR	2.50	2.90	2.46	2.54	2.70	2.50	2.46	-2
CO	t	141.05	143.46	124.36	143.92	116.01	120.00	122.19	108.76	104.09	-26
Pb		4.78	2.26	1.50	1.79	1.82	1.89	1.87	1.78	1.82	-62
Cd		0.46	0.58	0.50	0.60	0.54	0.56	0.62	0.59	0.60	30
Hg		0.268	0.102	0.069	0.071	0.078	0.079	0.077	0.075	0.076	-72
PCDD/F	g I-Teq	19.11	19.70	18.93	22.14	18.81	23.91	22.20	24.39	22.38	17
PAHs	t	14.68	12.82	10.73	12.43	10.00	10.59	10.47	9.47	8.98	-39
HCB	kg	0.18	0.25	0.23	0.26	0.25	0.29	0.30	0.33	0.33	82
PCB		4.27	1.07	0.43	0.53	0.70	0.72	0.56	0.46	0.44	-90

The majority of total emissions from stationary fuel combustion has decreased in 1990-2014, except for NMVOC, NH₃, Cd, dioxins and HCB emissions. An increase in particular emissions is directly related with the increased use of biomass in 1990-2014.

SO₂ has the biggest decrease in time period 1990–2014 by 96% (Table 3.6) and in 2010-2014 SO₂ emissions have decreased by 19%. The emission decrease is explained with fuel switch from heavy liquid fuels and solid fuels to natural gas and biomass use to cut the increased costs of these fuels and to meet the commitments of EU ETS.

There is also a remarkable decrease in NOx emissions by 71%, that can be explained with change in fuel types – solid fuels widely used previously were changed to biomass that has lower NOx emission factor, therefore the emissions decreased.

NMVOC and NH₃ emissions, however, have increased by 1% and 39% in 1990-2014, accordingly, which is mainly because of increased use of biomass, especially in case of NH₃ emissions which currently are calculated only from biomass burning processes in 1A2 and 1A4 sectors.

⁷ For PMs the base year is 2000 instead of 1990

Particulate matter emissions have decreased in 2000-2014 by 7%. Since 2005 particulate matter emissions have decreased due to the decrease of total fuel consumption as well as with increase of natural gas consumption in commercial and institutional buildings instead of wood and wood products consumption. In 2013-2014 particulate matter emissions slightly decreased due to decrease of biomass consumption.

Heavy metal emissions have decreased by 62-72% in 1990-2014, except Cd, which has increased by 30%. Decrease of emissions is explained with a decrease of total fuel consumption in early 90-ties due to economic crisis in country. In recent years heavy metal emissions decreased due to fuel switch from heavy liquid and solid fuels to natural gas and biomass consumption, except for Cd, which has relatively high emission factor for biomass.

PAH emissions have decreased by 39% in 1990-2014, HCB emissions increased by 82% and PCDD/F emissions increased by 17% in 1990-2014 that is explained with sharp increase of solid biomass consumption and decrease of fossil fuel consumption. The decrease of PCB emissions by 90% is explained with decrease of solid fuel consumption – solid fuels have significantly higher emission factor than solid biomass therefore the decrease of first mentioned has a bigger effect.

3.2.2 Energy industries (NFR 1A1)

3.2.2.1 Overview

NFR 1A1 Energy industries sector includes emissions from fuel combustion in point sources in energy production including emissions from off-road. Fuel consumption in autoproducer combustion installations is excluded from this sector and included in particular sectors of NFR 1A2, 1A4a and 1A4c sectors according to 2006 IPCC Guidelines.

Emissions from combustion installations with NACE 2 codes 35.11 and 35.30 are reported in NFR 1A1a sector. There are no direct electricity-only production plants in Latvia. There are no petroleum refineries in Latvia. NFR 1A1 sector also includes the emissions from on-site use of fuel in the energy production facilities and emissions from manufacturing of solid fuels (peat briquettes and charcoal production plants) – these emissions are reported under NFR 1A1c Manufacture of solid fuels and other energy industries sector.

3.2.2.2 Trends in emissions

Table 3.7 Trends in emissions from 1A1 Energy Industries sector in 1990-2014⁸

Year	Unit	1990	1995	2000	2005	2010	2011	2012	2013	2014	Change in 1990-2014, %
NO_x	kt	10.543	6.249	4.404	3.698	4.097	3.806	3.618	4.075	3.818	-64
NM_{VOC}		0.217	0.123	0.116	0.124	0.142	0.132	0.132	0.163	0.168	-23
SO₂		36.392	22.828	7.635	2.007	0.891	0.651	0.595	0.626	0.598	-98
PM_{2.5}		NR	NR	0.563	0.653	0.762	0.705	0.839	1.298	1.569	179
PM₁₀		NR	NR	0.683	0.764	0.886	0.820	0.977	1.511	1.825	167
TSP		NR	NR	0.811	0.862	0.987	0.913	1.086	1.676	2.024	149
BC	t	NR	NR	0.021	0.022	0.025	0.023	0.028	0.043	0.052	145
CO		2.612	1.387	1.558	1.735	2.016	1.872	1.850	2.254	2.286	-12
Pb		0.238	0.177	0.138	0.103	0.118	0.109	0.131	0.201	0.241	1
Cd		0.056	0.034	0.020	0.011	0.011	0.010	0.012	0.018	0.021	-63
Hg		0.037	0.023	0.020	0.011	0.013	0.012	0.014	0.019	0.021	-42
PCDD/F	g I-Teq	0.176	0.163	0.216	0.243	0.293	0.272	0.324	0.498	0.597	239
PAHs	t	0.002	0.002	0.004	0.005	0.007	0.006	0.007	0.012	0.014	812
HCB	kg	0.032	0.038	0.034	0.023	0.030	0.028	0.034	0.051	0.059	87
PCB		0.002	0.004	0.011	0.015	0.019	0.017	0.021	0.033	0.041	2531

⁸ For PMs the base year is 2000 instead of 1990

Large part of emissions from NFR 1A1 sector have decreased in 1990-2014 with an exception of PMs, PAHs and dioxins, as well as HCB and PCB emissions (Table 3.7) that can mainly be explained with decrease of liquid and solid fuels consumption and increased use of biomass consumption in 1A1 sector.

3.2.2.3 Methods

Tier 1 method was used to calculate emissions from the stationary fuel combustion. Calculation of all emissions from fuel combustion is done in Excel databases developed by experts from LEGMC.

The general method for preparing inventory data was used:

$$Em = EF \times B_q$$

where:

Em – total emissions (kt)

EF – emission factor (t/TJ)

B_q – amount of fuel in thermal units (TJ)

3.2.2.4 Emission factors

The main source for emission factors is EMEP/EEA 2013 (emission factors used for Energy sector are presented in Annex I, Table 1).

SO₂ emissions factors were calculated by formula taken from EMEP/EEA 2013 and were calculated by national expert considering physical characterizations of types of fuels used in Latvia and national and international legislation. Percentage amount of sulphur content in used fuels is taken from national database “2-AIR” where polluters report the sulphur content data for certain types of fuels (Annex I, Table 2).

Emission factors for SO₂ are calculated by using following equation:

$$EF = 2 \times \left(\frac{s}{100} \right) \times \frac{1}{Q} \times 10^6 \times \left(\frac{100 - r}{100} \right) \times \left(\frac{100 - n}{100} \right)$$

where:

EF – emission factor (kg/TJ)

2 – SO₂ / S (kg/kg)

s – sulphur content in fuel (%)

r – retention of sulphur in ash (%)

Q – net calorific value (TJ/kt)

10⁶ – (unit) conversion factor

n – efficiency of abatement technology and/or reduction efficiency (%).

The default emission factors used in emission estimations were taken from EMEP/EEA 2013 (Annex I, Table 1). Emission factors for sludge gas and landfill gas were equalized to natural gas emission factors due to unavailability of particular emission factors for sludge gas. Emission factors for biodiesel were equalized to diesel emission factor.

3.2.2.5 Activity data

Mainly emissions from fuel combustion are calculated using fuel consumption data from the national Energy Balance, prepared by CSB. In previous submissions the Annual Questionnaires sent to EUROSTAT were used, but after internal third party review in 2014 the expert's conclusion was to use Energy Balance, if possible, to ensure more precise data. As in the EUROSTAT tables fuel consumption mainly is in natural units (kt, millions m³) therefore net calorific values provided by CSB were used to calculate fuel consumption into terajoules. However, there were differences between Annual Questionnaires' and Energy Balance data due to rounding and conversion of units, therefore it was decided to use Energy Balance data with accuracy up to 1 TJ (instead of Annual Questionnaire's accuracy up to 1 kt). Data on fuel consumption in NFR 1A1 sector are presented in Annex II, Table 2.

The CSB data collection system is based on detailed compulsory survey 2-EK (annual). Form 2-EK “Survey on acquisition and consumption of energy resources” is collected from about 6000 enterprises and

organizations (with all kind of economic activity) that are included in the lists of suppliers of statistical information.

Approximately 6000 respondents were surveyed - all enterprises of the local and public administration employing 10 or more persons, other enterprises employing 80 and more persons, as well as enterprises with turnovers equal or more than 4 mln euro, and other enterprises that CSB considers to be significant enough to include in the energy balance, for example, with large imports of briquettes, coal and oil products. Enterprises and organizations that are not included in the above mentioned selection were surveyed by the random sampling and afterwards the acquired results were extrapolated. 2-EK represents the basic tool for creating energy balances at a country level.

The amounts of methane from landfill gas combusted are taken from Waste expert, therefore are consistent with numbers of recovered amounts of landfill gas in Waste sector. The amounts of methane from sludge gas combusted are consistent with numbers of gas, recovered from Wastewater handling sector.

In Figure 3.2 there can be seen fuel consumption by fuel types in 1990-2014 in Energy Industries sector. The largest amounts of fuel types consumed are gaseous fuels in the whole time series and liquid fuels in the beginning of 1990-ties. The amounts of biomass consumed are slightly increasing, while the consumption of solid fuels and peat has sharply decreased.

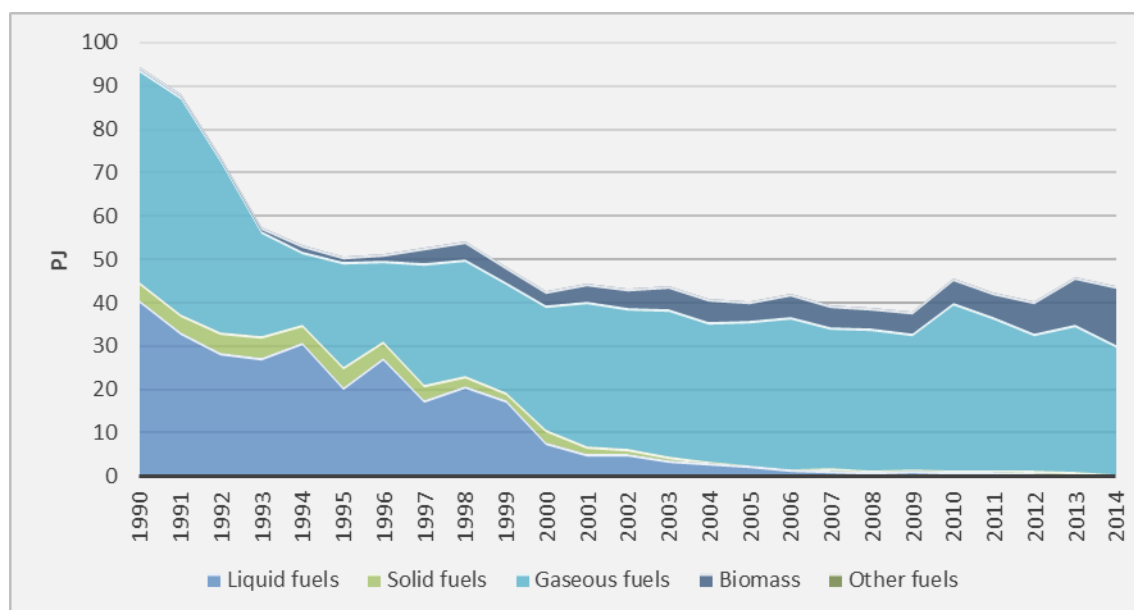


Figure 3.2 Fuel consumption in NFR 1A1 Energy Industries in 1990-2014 (PJ)

The biggest decrease in time period 1990–2014 for the two sub-sectors of NFR 1A1 Energy industries sector was for liquid fuel due to significant decrease of fuel consumption in 1A1a subsector by 99.9%. It is explained with fuel switching processes when liquid fuels were switched to cheaper fuels. Also a stronger legislation contributed fuel switch to the type of fuels with lower level of emissions. It also explains why consumption of solid fuels decreased. However, in 2007-2013 the consumption of solid fuels increased that is explained with the increase of coal consumption in NFR 1A1a subsector by 304% in 2006-2014. The increase of solid fuel consumption was promoted by increase of oil price in world when coal became cheaper than residual fuel oil, diesel oil and natural gas. In 2013-2014 the consumption of coal in NFR 1A1a reduced by 58.7%.

Consumption of biomass fuel has almost 30-fold increase in 1990–2014. Solid biomass is a local fuel and has lower costs therefore liquid and solid fuels were replaced with biomass and natural gas.

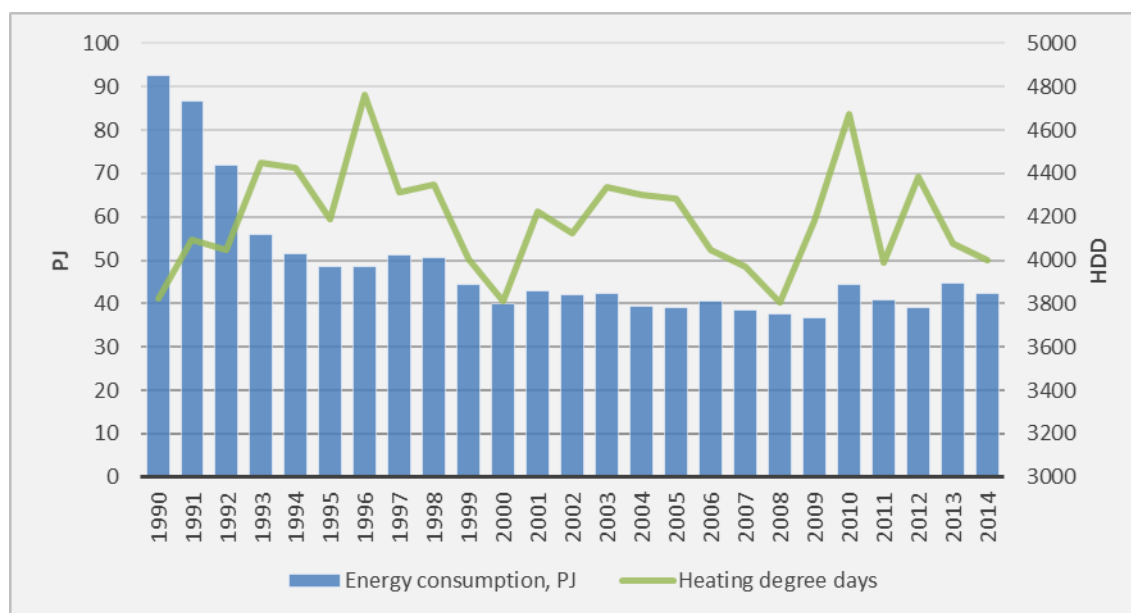


Figure 3.3 Fuel consumption in NFR 1A1a Main activity electricity and heat production and heating degree days in Latvia

As it can be seen in Figure 3.3 the fuel consumption in 1A1a sector can be related with the heating degree days(HDD)⁹ with an exception of 1990-ties when Soviet Union collapsed and reorganizations took place in Latvia. However, for time period from 1997 to 2002 there can be seen that in years where energy consumption reduced, the HDD were also reduced. Years 2006-2008 had quite high average temperature therefore the fuel consumption of combined heat plants and heat plants for heat production decreased as there was limited need for heat production. In 2009-2010 the average temperature was lower and the use of fuel consumption increased. However, in year 2011 the fuel consumption decreased because of a relatively warm winter, and in year 2012 the consumption of fuel continued to decrease despite the fall of average temperature (hence the decrease in HDDs), which could be explained with better heat insulation in houses therefore less heat needed to be produced. In 2013 the fuel consumption increased, however, HDD were less than in 2012, while in 2014 fuel consumption decreased, as well as the number of HDDs.

3.2.2.6 Uncertainties

Uncertainty in activity data of fuel combustion in NFR 1A1 sector is $\pm 2\%$ in 2014. CSB gives approximately 2% statistical sample error for statistical data. According to CSB, as data are obtained using information given by respondents, this number is a variation coefficient which characterizes selection of respondents. Total variation coefficient for energy balance is within 2-3%. In Latvia all fossil fuels (oil, natural gas and coal) are imported and import and export statistics are fairly accurate.

Uncertainty of activity data for solid biomass combustion was assigned as 5% because biomass activity data were collected by CSB with questionnaires sent by enterprises consumed biomass. Also, according to 2006 IPCC Guidelines, Volume 2, Chapter 1, pg. 1.19, biomass data are generally more uncertain than other data in national energy statistics, because a large fraction of the biomass may be part of the informal economy, and the trade in these type of fuels is frequently not registered in the national energy statistics and balances. That was a reason for higher uncertainty for biomass than for other fuel types. Uncertainty of sludge gas stationary combusted in enterprises covered by 1A1 Energy Industries sector was assumed rather low – 2% because the combusted fuel amount is obtained directly from wastewater treatment plant

⁹ Heating degree day (HDD) is a proxy for the energy demand needed to heat a home or a business; it is derived from measurements of outside air temperature. The heating requirements for a given structure at a specific location are considered to be to some degree proportional to the number of HDD at that location. HDD are defined relative to a base temperature (18°C, according to EUROSTAT), the outside temperature below which a building is assumed to need heating (<http://www.eea.europa.eu/data-and-maps/indicators/heating-degree-days-1>).

that has precise measurement equipment for accounting of combusted fuel. Still the methane percentage amount in combusted sludge gas is given approximately, therefore final uncertainty of combusted sludge gas is assumed as 5%. The same applies to landfill gas. Taking into account uncertainties of solid biomass and biogas consumption total biomass fuel consumption uncertainty is assumed as 5%.

Emission factor uncertainty is assumed as 50%, as these are default emission factors taken from EMEP/EEA 2013.

3.2.2.7 QA/QC and verification

Disaggregated data at the finest level possible are presented in the corresponding Annex. Data completeness has been explained in the previous subchapter.

Activity data have been checked at the data provider – CSB, which has its own internal QA/QC procedures based on mathematic model and analysis to avoid logic mistakes. When activity data have been received, the sectoral expert responsible for the emission estimation and reporting are comparing all data changes with the previous inventory, and all changes are explained in the corresponding subchapter. All fluctuations or changes in NCVs are double checked and agreed with CSB.

To verify the emissions, logical mistakes are checked by checking the time series of the activity data, emission factors and emissions consistency to display all significant and illogical changes in the activity data and emissions. The emissions for substances reported also under UNFCCC as indirect GHGs are cross-checked for verification purposes.

3.2.2.8 Recalculations

In Submission 2016, there were following recalculations done:

- updated SO₂ emission factors for several fuel types for all time series;
- for the first time, SO₂ emissions for wood and natural gas for all time series (1990-2014) have been calculated;
- SO₂ and NO_x emissions from 1A1a sector have been recalculated, using country-specific or EMEP/EEA 2013 emission factors.

3.2.2.9 Planned improvements

It is planned to obtain country-specific emission factors for heavy metals.

3.2.3 Manufacturing industries and construction (NFR 1A2)

3.2.3.1 Overview

NFR 1A2 Manufacturing industries and construction sector includes emissions from fuel combustion in combustion installations for industrial production including emissions from off-road. NFR 1A2 sector also includes the emissions from on-site use of fuel in the industrial production facilities (autoproducers) – these emissions are reported under particular sub-sectors of NFR 1A2 according to 2006 IPCC Guidelines.

Under NFR 1A2f Other sector emissions from following industrial sectors are reported:

- Non-Metallic Minerals;
- Transport Equipment;
- Machinery;
- Mining and Quarrying;
- Wood and Wood Products;
- Construction;
- Textiles and Leather;
- Other non-specified (Industry).

3.2.3.2 Trends in emissions

Table 3.8 Trends in emissions from 1A2 Manufacturing Industries and Construction sector in 1990-2014¹⁰

Year	Unit	1990	1995	2000	2005	2010	2011	2012	2013	2014	Change in 1990-2014, %
NO_x	kt	17.46	9.60	4.87	3.48	3.83	3.22	3.54	3.25	3.19	-82
NM_{VOC}		1.66	1.43	1.28	2.20	3.50	3.94	4.43	4.59	5.07	205
SO₂		24.32	15.08	4.70	1.56	1.53	1.35	1.54	1.23	1.26	-95
NH₃		0.02	0.09	0.10	0.20	0.36	0.41	0.48	0.50	0.57	2393
PM_{2.5}		NR	NR	0.56	0.96	1.65	1.86	2.09	2.10	2.34	316
PM₁₀		NR	NR	0.57	0.99	1.70	1.91	2.15	2.15	2.40	319
BC		NR	NR	0.59	1.03	1.78	2.00	2.26	2.26	2.51	324
TSP		NR	NR	0.19	0.26	0.44	0.48	0.55	0.56	0.63	230
CO		4.50	3.38	2.55	4.69	7.87	8.83	9.77	9.39	10.32	129
Pb	t	0.23	0.16	0.11	0.29	0.53	0.64	0.67	0.60	0.63	180
Cd		0.011	0.033	0.036	0.074	0.132	0.152	0.174	0.182	0.205	1764
Hg		0.030	0.014	0.010	0.019	0.028	0.032	0.033	0.027	0.027	-10
PCDD/F	g I-Teq	0.43	0.40	2.09	3.09	4.24	8.94	6.92	10.72	9.34	2071
PAHs	t	0.25	0.18	0.23	0.47	0.78	1.15	1.07	1.21	1.17	372
HCB	kg	0.004	0.012	0.024	0.042	0.069	0.105	0.103	0.127	0.128	3066
PCB		0.26	0.11	0.04	0.17	0.32	0.38	0.37	0.24	0.23	-11

As it can be seen in Table 3.8, the largest part of emissions with an exception of NO_x and SO₂, Hg and PCB have increased in 1990-2014, which can be explained with increased use of solid fuels and biomass comparing to 1990.

Emissions from 1A2 have been increasing in the latest years with a fluctuating trend. The increase in 2000-ties were due to sharp development of nation economy and industry as well as increase of demand of industrial production and improvement of well-being of population. Increase of emissions are also caused by constant increase of solid fuels – coal, and other fuels (used tires) consumption that mostly is combusted in mineral and steel production industry. Decrease of emissions in 2007-2008 was influenced by the features of national economy development when in-country industrial production had started to decrease due to increase of costs of the production and dominance of imported products. Crisis in national economy in the second half of 2008 also caused a decrease of total emissions. In year 2012 there can be seen a decrease of fossil fuels, but increase in biomass usage, therefore NMVOC, NH₃, PM, Cd and POPs emissions have increased, because biomass has larger emission factors for particular pollutants, while other pollutant emissions have decreased due to less use of fossil fuels.

3.2.3.3 Methods

Tier 1 method was used to calculate emissions from the stationary fuel combustion. Calculation of all emissions from fuel combustion is done in Excel databases developed by experts from LEGMC.

The general method for preparing inventory data was used:

$$Em = EF \times B_q$$

where:

Em – total emissions (kt)

EF – emission factor (t/TJ)

B_q – amount of fuel in thermal units (TJ)

3.2.3.4 Emission factors

The main source of emission factors is EMEP/EEA 2013 (emission factors used for Energy sector are presented in Annex I, Table 1).

¹⁰ For PMs the base year is 2000 instead of 1990

SO₂ emission factors are calculated using the same methodology as for NFR 1A1 sector, using Tier 2.

The default emission factors used in estimation of emissions were taken from EMEP/EEA 2013 (Annex I). Emission factors for biodiesel were equalized to diesel emission factor.

The municipal waste consumption is reported in 1A2f, and the emission factors are taken from Waste sector after 3rd Stage in-depth review in 2013 where Energy expert suggested Latvia to use emission factors from particular sector.

3.2.3.5 Activity data

Mainly emissions from fuel combustion are calculated using fuel consumption data from the national Energy Balance, prepared by CSB. The data collection system for NFR 1A2 sector is the same as for NFR 1A1 sector. Data on fuel consumption in NFR 1A2 sector are presented in Annex II, Table 2.

Autoproducers data prepared by CSP are taken into account into the calculation of the emissions from NFR 1A2 sector according to 2006 IPCC Guidelines.

Only gasoline combustion is reported as off-roads in NFR 1A2g vii sector. It is sure that diesel oil is also consumed as off-roads but for now it is not possible for CSB and LEGMC to divide the consumption between fuel combusted stationary and filled in technological vehicles. Due to that all diesel oil reported in the sector is estimated as combusted stationary.

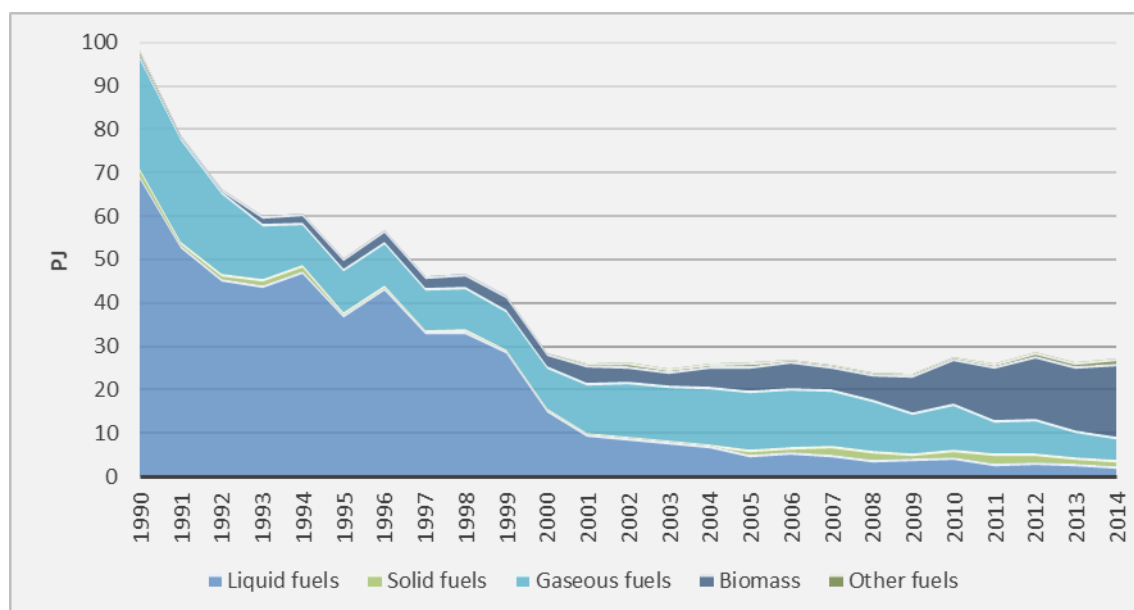


Figure 3.4 Fuel consumption in NFR 1A2 Manufacturing industries and construction in 1990-2014 (PJ)

The most of fuel types with an exception of biomass and other fossil fuels have decreased in 1990-2014 (Figure 3.4). Liquid fuels have the biggest decrease in time period by 92%. It is explained with fuel switching processes when liquid fuels were replaced with other cheaper fuels. Also stronger legislation contributed fuel replacement to the type of fuels with lower level of emissions. Decrease of natural gas reflects the total decrease of industrial production if comparing with 1990.

The consumption of solid fuels (mainly coal) decreased in 1990-2004 with an exception of 1993-1994, mainly due to increased use of coal in Construction and Textiles and Leather sectors. Solid fuels consumption was growing rapidly by 7.1 times since 2004 until 2008 because of the growth in national economy, and decreased in 2009 by 32% due to global crisis. However, starting from 2009, the consumption of solid fuels increased by 58% until year 2012. The increase of solid fuel consumption was caused by the increase of oil price overall the world when coal combustion was cheaper than combustion of residual fuel oil and diesel oil. The increase in can also be explained with the development of mineral production sector – cement production – where coal is consumed. In 2012-2014 there can be seen a drop in solid fuel

consumption – in Non-metallic minerals sector the consumption decreased by 34%, and in Iron and Steel sector by 100% because of bankruptcy of the largest steel producing company.

After the crisis in the beginning of 90-ties natural gas consumption steadily increased with some small exceptions due to fuel replacement processes and development of national economy.

Consumption of biomass fuel had increased very significantly – by 2.6 times in 1990–2014 with some fluctuations in 2000-2008. Lower costs of solid and liquid biomass, free and large availability of the fuel in-country as well as development of EU ETS were the main reasons for liquid and solid fuels' replacement with biomass and natural gas.

Consumption of used tires and municipal wastes in Mineral production (information taken from „CEMEX”, the only company which combusts used tires and municipal waste for energy purposes) reported as other fossil fuels had a 46-fold increase in 1999-2014, and continue to increase year by year. Comparing with 2010, the consumption of wastes had increased by 2.1 times in 2014. The increase was influenced by intensified cement production that was caused by increased demand of construction materials and sharp development of construction sector. In the category of other fossil fuels also used oils are reported, and the amount of this fuel is fluctuating over years with a decreasing trend in recent years.

3.2.3.6 *Uncertainties*

Uncertainty in activity data of fuel combustion in NFR 1A2 sector is $\pm 2\%$ in 2014. CSB gives approximately 2% statistical sample error for statistical data. According to CSB, as data are obtained using information given by respondents, this number is a variation coefficient which characterizes selection of respondents. Total variation coefficient for energy balance is within 2-3%. In Latvia all fossil fuels (oil, natural gas and coal) are imported and import and export statistics are fairly accurate.

Uncertainty of activity data for solid biomass combustion was assigned as 5% because biomass activity data were collected by CSB with questionnaires sent by enterprises consumed biomass. Also, according to 2006 IPCC Guidelines, Volume 2, Chapter 1, pg. 1.19, biomass data are generally more uncertain than other data in national energy statistics, because a large fraction of the biomass may be part of the informal economy, and the trade in these type of fuels is frequently not registered in the national energy statistics and balances.

Uncertainty of other fuels consumption – municipal and industrial wastes used in mineral production is also assumed as low – 2% as the activity data is obtained from only one producer within EU ETS therefore the data is verified by accredited verifier and Regional Environmental Board.

Emission factor uncertainty is assumed as 50% as emission factors are taken from EMEP/EEA 2013.

3.2.3.7 *QA/QC and verification*

Disaggregated data at the finest level possible are presented in the corresponding Annex. Data completeness has been explained in the previous subchapter.

Activity data have been checked at the data provider – CSB, which has its own internal QA/QC procedures based on mathematic model and analysis to avoid logic mistakes. When activity data have been received, the sectoral expert responsible for the emission estimation and reporting are comparing all data changes with the previous inventory, and all changes are explained in the corresponding subchapter. All fluctuations or changes in NCVs are double checked and agreed with CSB.

To verify the emissions, logical mistakes are checked by checking the time series of the activity data, emission factors and emissions consistency to display all significant and illogical changes in the activity data and emissions. The emissions for substances reported also under UNFCCC as indirect GHGs are cross-checked with for verification purposes.

3.2.3.8 *Recalculations*

In Submission 2016, there were following recalculations done:

- updated SO₂ emission factors for several fuel types for all time series;
- for the first time, SO₂ emissions for wood and natural gas for all time series (1990-2014) have been calculated;
- updated activity data for anthracite, coal, waste.

3.2.3.9 Planned improvements

It is planned to obtain country-specific emission factors for heavy metals. There is also a research on off-road fuel consumption and installations planned in 2016, as currently it is assumed that only gasoline is used off-roads.

3.2.4 Other sectors (NFR 1A4)

3.2.4.1 Overview

NFR 1A4 Other Sectors include emissions from the small combustion plants used in Commercial/Institutional Residential sectors and Agriculture/Forestry/Fisheries. Also emissions from autoproductors are included in relevant sectors of NFR 1A4 as it is stated that emissions have to be reported in sector they are produced.

Emissions from mobile machinery used in Commercial (NFR 1A4a ii), Residential (NFR 1A4b ii) and Agriculture/Forestry (1A4c ii) and Fishery (1A4c iii) sectors are reported as off-road under Transport chapter.

3.2.4.2 Trends in emissions

Table 3.9 Trends in emissions from 1A4 Other sectors in 1990-2014¹¹

	Unit	1990	1995	2000	2005	2010	2011	2012	2013	2014	Change in 1990-2014, %
NO_x	kt	17.80	7.15	5.47	6.55	6.37	6.22	6.42	6.20	6.22	-65
NMVOC		13.89	15.99	13.84	15.88	12.16	12.29	12.80	11.46	10.71	-23
SO₂		34.51	9.47	3.67	3.47	2.26	2.21	2.16	2.00	1.94	-94
NH₃		1.53	2.26	2.03	2.33	1.78	1.81	1.91	1.69	1.59	4
PM_{2.5}		NR	NR	15.75	17.78	13.36	13.76	14.14	12.48	11.72	-26
PM₁₀		NR	NR	16.15	18.23	13.71	14.11	14.49	12.79	12.01	-26
BC		NR	NR	16.93	19.12	14.38	14.80	15.18	13.40	12.58	-26
TSP		NR	NR	2.29	2.62	2.00	2.04	2.12	1.89	1.78	-22
CO		133.94	138.69	120.25	137.50	106.12	109.30	110.56	97.12	91.48	-32
Pb	t	4.32	1.93	1.24	1.40	1.17	1.14	1.07	0.98	0.94	-78
Cd		0.39	0.51	0.44	0.52	0.40	0.40	0.44	0.39	0.38	-5
Hg		0.201	0.065	0.038	0.041	0.037	0.035	0.031	0.029	0.028	-86
PCDD/F	g I- Teq	18.51	19.13	16.62	18.80	14.27	14.69	14.96	13.17	12.44	-33
PAHs	t	14.43	12.64	10.49	11.96	9.21	9.44	9.40	8.25	7.79	-46
HCB	kg	0.15	0.20	0.17	0.20	0.15	0.15	0.17	0.15	0.14	-2
PCBs		4.00	0.95	0.38	0.35	0.36	0.32	0.17	0.18	0.17	-96

Almost all emissions have decreased in 1990-2014 1A4 Other Sectors, except for NMVOC (Table 3.9). It is explained with changes and redistribution of structure of national economy as well as with significant decrease of fuel consumption in the sector. Increase of emissions in 2008–2009 is explained with development of national economy and well-being of population. But in years 2009-2010 there can be seen a decrease in emissions, which can be explained with consequences caused by crisis. The emissions are also affected by weather conditions and recent increase of individual heating supply consumers in 1A4b Residential sector. The increase of gaseous fuels consumption, steady biomass fuel consumption and increase of peat consumption caused the increase of all emissions with the exception of SO₂ and PCBs

¹¹ For PMs the base year is 2000 instead of 1990

emissions. Also high costs of liquid fuels and increase of natural gas prices in Latvia have caused the situation when previously used fuels had switched to biomass.

3.2.4.3 Methods

Tier 1 method was used to calculate emissions from the stationary fuel combustion. Calculation of all emissions from fuel combustion is done in Excel databases developed by experts from LEGMC.

The general method for estimation of emissions was used:

$$Em = EF \times B_q$$

where:

Em – total emissions (kt)

EF – emission factor (t/TJ)

B_q – amount of fuel in thermal units (TJ)

For residential sector Tier 2 method was used to calculate emissions, taking into account also the combustion installations. Data about installations are taken from CSB 5-yearly household questionnaires and calculations are made, using expert's judgement. The following method for estimation of emissions from EMEP/EEA 2013 was used:

$$E_i = \sum_{j,k} EF_{i,j,k} \times A_{j,k}$$

where:

E_i – annual emission of pollutant *i*,

EF_{i,j,k} – default emission factor of pollutant *i* for source type *j* and fuel *k*

A_{j,k} – annual consumption of fuel *k* in source type *j*

Calculations of all emissions are done in Excel databases developed by experts from LEGMC.

3.2.4.4 Emission factors

The main source for emission factors is EMEP/EEA 2013. Emission factors used for Energy sector are presented in Annex I, Table 1.

SO₂ emission factors are calculated using the same methodology as for NFR 1A1 and 1A2 sectors, using Tier 2, where sulphur content is country-specific for each fuel type.

The default emission factors used in estimation of emission were taken from EMEP/EEA 2013 (Annex I, Table 1). Emission factors for landfill gas were equalized to natural gas emission factors due to unavailability of particular emission factors for landfill gas. Emission factors for biodiesel were equalized to diesel emission factor.

3.2.4.5 Activity data

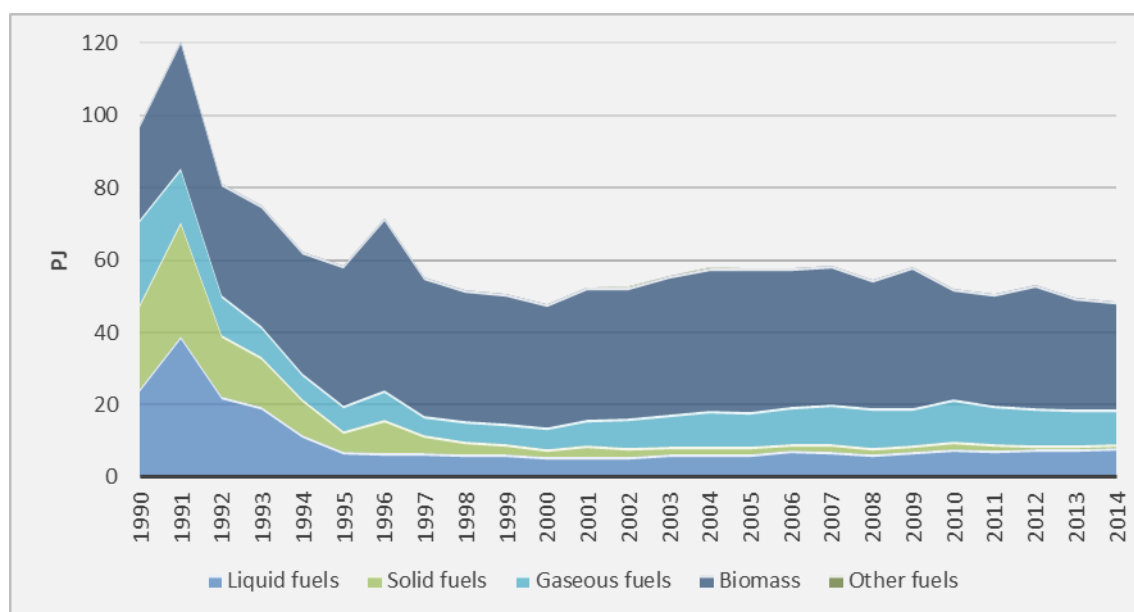


Figure 3.5 Fuel consumption in NFR 1A4 Other sectors in 1990–2014 (PJ)

The biggest decrease in 1990–2014 was for solid fuel consumption – 95.9% and liquid fuels consumption – 58.3% (Figure 3.5). It is explained with fuel switching processes when solid and liquid fuels were replaced with cheaper fuels. Also stronger legislation contributed fuel switching to the type of fuels with a lower level of emissions.

Since 1990 biomass dominates as a fuel in NFR 1A4 sector. The biggest part of solid biomass consumption goes to Residential sector where biomass is the main fuel in small capacity burning installations. Consumption of biomass fuel has increased by 12.9% in 1990–2014 in Other sectors. However, it can be seen that the used amount of biomass has been fluctuating over recent years, which can mainly be explained with temperature fluctuations during winter.

Since 1997 natural gas consumption was constantly increasing until 2007, because it had lower costs therefore liquid and solid fuels were replaced with natural gas as a fuel. The increase in fuel consumption in NFR 1A4 Other sectors is strongly linked to decrease in fuel consumption in NFR 1A1 Energy industries when central heating supply consumers switched to individual heating supply. In the recent years decrease in consumption of natural gas can be observed, which was influenced by increase of natural gas price.

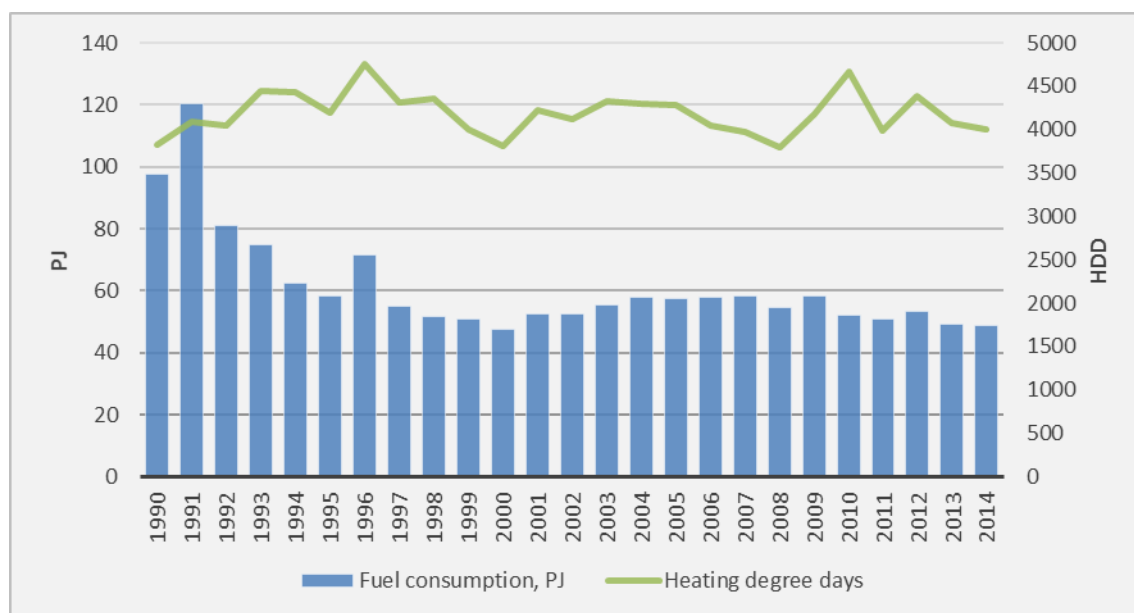


Figure 3.6 Fuel consumption in NFR 1A4 Other sectors and heating degree days in Latvia

As it can be seen in Figure 3.6, fuel consumption in 1A4 sector is related with changes in temperature – in years where heating degree days are more, the amounts of consumed fuel are also larger, especially it can be seen in 1994-2003 and in the most recent years. In 2008 there was considerably low number of HDDs, and also the fuel consumed was less than in 2007. However, in 2009-2010 the correlation between HDDs and consumption is less visible because of impact of global crisis, which clearly affected the Residential sector. In 2011-2013 correlation can be seen in HDDs and fuel consumption – in 2012 the number of HDDs was by 9.9% higher than in 2011, and the amounts of fuel consumed were by 5% more. In 2013 the number of HDDs was by 7% less, and also fuel consumed was by 7% less than in 2012. In 2014 the number of HDDs was 2% less while the consumption of fuels was 1.6% less.

3.2.4.6 Uncertainties

Uncertainty in activity data of fuel combustion in 1A4 sector is $\pm 10\%$ in 2014.

CSB gives approximately 2% statistical sample error for statistical data. According to CSB, as data are obtained using information given by respondents, this number is a variation coefficient, which characterizes selection of respondents. Total variation coefficient for energy balance is within 2-3%. In Latvia all fossil fuels (oil, natural gas and coal) are imported and import and export statistics are fairly accurate.

Uncertainty of activity data for solid biomass combustion was assigned as 10% because biomass activity data were collected by CSB with questionnaires sent by enterprises consumed biomass. As fuel consumption in NFR 1A4b Residential sector is obtained only every 5 years using questionnaire and data are extrapolated until the next survey, therefore the uncertainty of all fuel consumption in residential sector is assumed 10%. According to 2006 IPCC Guidelines, Volume 2, Chapter 1, pg. 1.19, biomass data are generally more uncertain than other data in national energy statistics, because a large fraction of the biomass may be part of the informal economy, and the trade in these type of fuels is frequently not registered in the national energy statistics and balances. Uncertainty of landfill gas stationary combusted in enterprises covered by 1A4 Other sectors was assumed rather low – 2% because the combusted fuel amount is obtained directly from landfill plant that has precise measurement equipment for accounting of combusted fuel. Still the methane percentage amount in combusted landfill gas is given approximately, therefore final uncertainty of combusted landfill gas is assumed as 5%.

Emission factor uncertainty is assumed as 50%.

3.2.4.7 QA/QC and verification

Disaggregated data at the finest level possible are presented in the corresponding Annex.

Activity data have been checked at the data provider – CSB, which has its own internal QA/QC procedures based on mathematic model and analysis to avoid logic mistakes. When activity data have been received, the sectoral expert responsible for the emission estimation and reporting are comparing all data changes with the previous inventory, and all changes are explained in the corresponding subchapter. All fluctuations or changes in NCVs are double checked and agreed with CSB.

To verify the emissions, logical mistakes are checked by checking the time series of the activity data, emission factors and emissions consistency to display all significant and illogical changes in the activity data and emissions. The emissions for substances reported also under UNFCCC as indirect GHGs are cross-checked with for verification purposes.

3.2.4.8 Recalculations

In Submission 2016, there were following recalculations done:

- change in methodology from Tier 1 to Tier 2 in Residential sector, taking into account the combustion installation types which are available in CSB database;
- updated SO₂ emission factors for several fuel types for all time series;
- for the first time, SO₂ emissions for wood and natural gas for all time series (1990-2014) have been calculated;
- updated activity data for anthracite, coal, waste.

3.2.4.9 Planned improvements

It is planned to obtain country-specific emission factors for heavy metals. There is also a research on off-road fuel consumption and installations planned in 2016, as currently it is assumed that only gasoline is used in off-roads.

3.3 Transport (NFR 1A3, NFR 1A5)

3.3.1 Sector overview

3.3.1.1 Source category description

Transport sector is a major contributor to national NO_x and Pb emissions in 2014. The sector includes civil aviation, road transport, railways, domestic navigation and off-road transport. Road Transport includes all transportation types of vehicles on roads: passenger cars, light duty vehicles, buses, heavy-duty vehicles and motorcycles and mopeds. It does not cover farm and forest tractors driving occasionally on the roads because these are included in “Other sectors” as off-roads (NFR 1A2g vii, 1A4a ii, 1A4b ii, 1A4c ii). Railway Transport includes railway transport operated by diesel locomotives. Civil Aviation includes helicopters, airplanes with turbojet engine and airplanes with piston engines. Military aircrafts are included in Other (NFR 1A5b). Domestic Navigation comprises for miscellaneous vessels (tugs, barges, towboats, icebreakers), recreational crafts and personal boats. Emissions from fishing boats are included in NFR 1A4c iii sector.

Table 3.10 shows the methods and source for activity data and emission factors used for emission calculating in Transport sector. Table 3.11 shows list of pollutants, which are produced in Transport sector.

Table 3.10 Source categories and methods for Transport sector

NFR code	Description	Method	AD	EF
1 A 3 a	Civil aviation	Tier 1, 2	NS ¹²	D ¹³
1 A 3 b	Road transport	Tier 2	NS	D
1 A 3 c	Railways	Tier 1	NS	D
1 A 3 d	Waterborne navigation	Tier 1	NS	D
1 A 3 e	Pipeline compressors	Tier 1	NS	D
1 A 2 g vii	Mobile Combustion in manufacturing industries and construction	Tier 1	NS	D

¹² National Statistics

¹³ Default emission factor from guidelines

NFR code	Description	Method	AD	EF
1 A 4 a ii	Commercial/industrial land based mobile machinery	Tier 1	NS	D
1 A 4 b ii	Residential: household and gardening land based machinery	Tier 1	NS	D
1 A 4 c ii	Agriculture/Forestry/Fishing: off-road vehicles and other machinery	Tier 1	NS	D
1 A 4 c iii	National fishing	Tier 1	NS	D
1 A 5 b ii	Military aviation, navigation	Tier 1	NS	D

Table 3.11 Reported emissions in Transport sector in 2014

NFR code	Emissions
1 A 2 g vii	NO _x , NMVOC, SO ₂ , NH ₃ , PM _{2.5} , PM ₁₀ , TSP, BC, CO, Pb, Cd, Cr, Cu, Ni, Se, Zn, benzo(a)pyrene, benzo(b)fluoranthene, total PAHs
1 A 3 a ii (i)	NO _x , NMVOC, SO ₂ , PM _{2.5} , PM ₁₀ , BC, CO
1 A 3 a i (i)	NO _x , NMVOC, SO ₂ , PM _{2.5} , PM ₁₀ , BC, CO
1 A 3 b i	NO _x , NMVOC, SO ₂ , NH ₃ , PM _{2.5} , PM ₁₀ , BC, CO, Pb, Cd, Cr, Cu, Ni, Se, Zn, PCDD/F, benzo(a)pyrene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, total PAHs
1 A 3 b ii	NO _x , NMVOC, SO ₂ , NH ₃ , PM _{2.5} , PM ₁₀ , BC, CO, Pb, Cd, Cr, Cu, Ni, Se, Zn
1 A 3 b iii	NO _x , NMVOC, SO ₂ , NH ₃ , PM _{2.5} , PM ₁₀ , BC, CO, Pb, Cd, Cr, Cu, Ni, Se, Zn
1 A 3 b iv	NO _x , NMVOC, SO ₂ , NH ₃ , PM _{2.5} , PM ₁₀ , BC, CO, Pb, Cd, Cr, Cu, Ni, Se, Zn
1 A 3 b v	NMVOC
1 A 3 b vi	PM _{2.5} , PM ₁₀ , TSP, BC
1 A 3 b vii	PM _{2.5} , PM ₁₀ , TSP
1 A 3 c	NO _x , NMVOC, SO ₂ , NH ₃ , PM _{2.5} , PM ₁₀ , TSP, BC, CO, Cd, Cr, Cu, Ni, Se, Zn, benzo(a)pyrene, benzo(b)fluoranthene, total PAHs
1 A 3 d i (ii)	NA, NE
1 A 3 d ii	NO _x , NMVOC, SO ₂ , NH ₃ , PM _{2.5} , PM ₁₀ , TSP, BC, CO, Cd, Cr, Cu, Ni, Se, Zn, benzo(a)pyrene, benzo(b)fluoranthene, total PAHs
1 A 3 e i	IE
1 A 4 a ii	NO _x , NMVOC, SO ₂ , NH ₃ , PM _{2.5} , PM ₁₀ , TSP, BC, CO, Pb, Cd, Cr, Cu, Ni, Se, Zn, benzo(a)pyrene, benzo(b)fluoranthene, total PAHs
1 A 4 b ii	NO _x , NMVOC, SO ₂ , NH ₃ , PM _{2.5} , PM ₁₀ , TSP, BC, CO, Pb, Cd, Cr, Cu, Ni, Se, Zn, benzo(a)pyrene, benzo(b)fluoranthene, total PAHs
1 A 4 c ii	NO _x , NMVOC, SO ₂ , NH ₃ , PM _{2.5} , PM ₁₀ , TSP, BC, CO, Pb, Cd, Cr, Cu, Ni, Se, Zn, benzo(a)pyrene, benzo(b)fluoranthene, total PAHs
1 A 4 c iii	NO _x , NMVOC, SO ₂ , PM _{2.5} , PM ₁₀ , TSP, BC, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, PCDD/F, HCB, PCBs
1 A 5 b	NO _x , NMVOC, SO ₂ , PM _{2.5} , PM ₁₀ , TSP, BC, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, PCDD/F, HCB, PCBs

3.3.1.2 Key sources

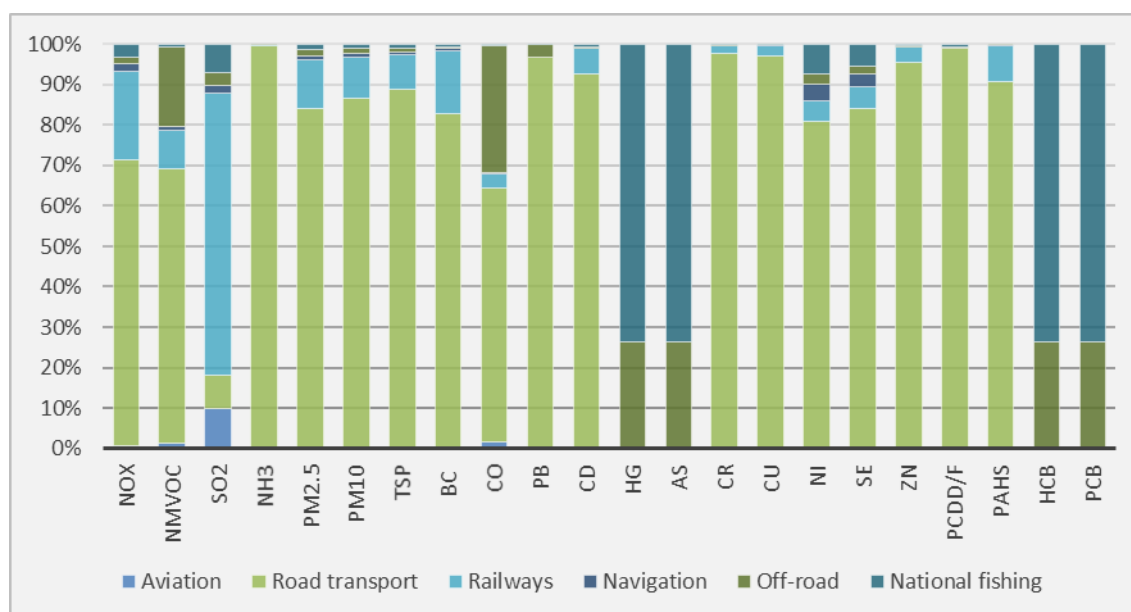


Figure 3.7 Distribution of emissions in Transport sector by subsectors in 2014 (%)

The biggest part of Transport emissions take up Road Transport then follows Railways, off-road and fishing emissions (Figure 3.7). Civil aviation and domestic navigation contribute a very small part of transport emissions.

3.3.1.3 Trends in emissions

Table 3.12 Fuel consumption in Transport sector in 2013 and 2014 (TJ)

	Liquid fuel		Change in 2013-2014, %	Biofuels		Change in 2013-2014, %
	2013	2014		2013	2014	
Aviation	759.70	737.67	-2.9	NO	NO	NO
Road transport	34928.45	36915.63	5.7	737.00	840.00	14.0
Railways	3017.00	2889.00	-4.2	48.00	83.00	72.9
Navigation	344	175	-49.1	NO	NO	NO
Off-road	571.87	524.96	-8.2	NO	NO	NO
National fishing	297.00	297.00	0.0	NO	NO	NO

In 2014, total fuel consumption in the transport sector, compared to 2013 level, has increased by around 4.3% (Table 3.12). In different subsectors various changes have taken place in 2014. In aviation the fuel consumption has decreased by 2.9%, whereas in the railway transport it has decreased by 3.0 %. In the road transport the fuel consumption has increased by around 5.9%, but in domestic navigation it has decreased approximately 2 times.

In total, road transport consumes around 86.9%, railway – about 6.8%, domestic civil aviation – around 1.7% (including international LTO) and off roads, national fishing and domestic navigation – the remaining share of fuel.

Diesel oil is the major fuel type in the transport sector and it constitutes 66.6%, and is followed by gasoline – 20.2%, but LPG constitutes 6.2% and biofuels (biodiesel and bioethanol) 2.2% of the total fuel consumption in the transport sector.

Table 3.13 Trends in emissions from Transport sector in 1990 and 2014¹⁴

Pollutant	Unit	1990	1995	2000	2005	2010	2011	2012	2013	2014	Change in 1990-2014, %
NO _x	kt	37.26	25.32	24.12	24.95	21.01	18.19	17.29	16.83	16.66	-55
NM VOC		27.43	16.73	12.40	8.27	4.31	4.17	4.30	3.87	3.45	-87
SO ₂		1.23	1.09	0.64	0.37	0.20	0.23	0.22	0.21	0.20	-84
NH ₃		0.02	0.04	0.08	0.25	0.25	0.24	0.23	0.23	0.24	1469
PM _{2.5}		NR	NR	0.84	1.18	0.96	0.83	0.81	0.79	0.79	-6
PM ₁₀		NR	NR	0.98	1.37	1.15	1.00	0.98	0.98	1.00	2
TSP		NR	NR	1.18	1.65	1.45	1.26	1.23	1.18	1.21	3
BC		NR	NR	0.38	0.59	0.50	0.43	0.43	0.40	0.40	5
CO	t	233.48	132.84	81.15	51.94	26.34	26.66	26.94	25.87	22.84	-90
Pb		91.66	58.18	4.58	2.08	1.91	1.76	1.53	1.45	1.44	-98
Cd		0.01104	0.00798	0.00811	0.01129	0.01218	0.01071	0.01008	0.01011	0.01063	-4
Hg		0.00114	0.00117	0.00078	0.00076	0.00036	0.00039	0.00027	0.00025	0.00028	-75
As		0.00936	0.00743	0.00497	0.00363	0.00048	0.00052	0.00035	0.00034	0.00038	-96
Cr		0.17	0.12	0.13	0.18	0.20	0.17	0.16	0.17	0.18	6
Cu		4.09	2.99	3.22	4.53	5.03	4.32	4.10	4.23	4.46	9
Ni		0.50	0.38	0.28	0.24	0.11	0.10	0.09	0.10	0.10	-80
Se		0.01673	0.01320	0.01185	0.01504	0.01435	0.01284	0.01180	0.01263	0.01291	-23
Zn		1.79	1.32	1.39	1.98	2.20	1.92	1.82	1.86	1.97	10
PCDD/F	g I-Teq	0.19	0.16	0.15	0.17	0.16	0.15	0.12	0.12	0.12	-38
PAHs	t	0.052	0.034	0.038	0.059	0.069	0.060	0.058	0.061	0.065	25
HCB	kg	0.00408	0.00390	0.00260	0.00238	0.00096	0.00103	0.00071	0.00068	0.00076	-81
PCBs	kg	0.022	0.014	0.015	0.022	0.025	0.021	0.021	0.021	0.023	1

Generally the largest part of emissions have decreased in 1990-2014 (Table 3.13) with an exception of NH₃, Cr, Cu and PAHs. NH₃ emissions are likely to increase due to the increasing number of vehicles equipped with catalytic systems for combustion gas treatment. However, the amounts of ammonia produced in Transport sector are very small, that the significant increase in Transport sector has no impact on national total NH₃ emissions.

3.3.2 Civil aviation (NFR 1A3a)

3.3.2.1 Overview

Civil aviation includes emissions both from national and international aviation LTO cycles. This category does not include military aviation, which is reported under 1A5b sector. In Latvia civil aviation constitutes a small part of total emissions therefore it is not considered as a key source. The aviation gasoline is mainly used by small-sized propeller planes but jet kerosene is used by airplanes with turbo jets and turbo props engines.

3.3.2.2 Trends in emissions

Table 3.14 Trends and emissions in Civil aviation in 1990-2014¹⁵

	Unit	1990	1995	2000	2005	2010	2011	2012	2013	2014	Change in 1990-2014, %
NO _x	kt	0.51	0.18	0.19	0.07	0.14	0.15	0.14	0.14	0.13	-74
NM VOC		0.05	0.02	0.02	0.02	0.04	0.05	0.04	0.04	0.04	-17
SO ₂		0.05	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.02	-63
PM _{2.5}		NR	NR	NE	0.001236	0.002378	0.002542	0.002414	0.002405	0.002323	NA
PM ₁₀		NR	NR	NE	0.001236	0.002378	0.002542	0.002414	0.002405	0.002323	NA
TSP		NR	NR	NE	0.001236	0.002378	0.002542	0.002414	0.002405	0.002323	NA
BC		NR	NR	NE	0.000593	0.001141	0.00122	0.001158	0.001154	0.001115	NA
CO		0.26	0.09	0.10	0.19	0.38	0.41	0.38	0.39	0.37	42

¹⁴ For PMs the base year is 2000 instead of 1990

¹⁵ For PMs the base year is 2000 instead of 1990

Different trend tendencies during the time span 1990 - 2014 have to be noted for emissions in civil aviation (Table 3.14). Up to year 2005 mostly all emissions have declined due to decreasing of activities in civil aviation (number of flights and fuel consumption). After year 2005 there is an increase of emissions mainly due to rather rapid increase of international flights to Riga airport (international landing and take-off emissions are included in emissions' calculation).

3.3.2.3 Methods

EMEP/EEA 2013 Tier 1 and Tier 2 approaches have been applied. Tier 2 approach with split in LTO and cruise cycles has been applied for jet kerosene emission calculation for time period 2004-2014. Tier 1 approach has been applied for aviation gasoline emission calculation.

3.3.2.4 Emission factors

Default emission factors for Civil aviation are taken from EMEP/EEA 2013 methodology and are presented in Table 3.15.

Table 3.15 Emission factors used in the calculation of emissions from Civil aviation (kt/PJ)

	NO _x	CO	NMVOC	SO ₂	PM
Aviation petrol	0.25	0.1	0.05	0.005	0.21

Using Tier 2 approach for jet kerosene, emissions for LTO (landing/take off) and cruise are calculated individually. Prior to the emission calculation, representative aircraft type was chosen, for which the fuel consumption and emission data exist in the EMEP/EEA 2013.

3.3.2.5 Activity data

The data about fuel consumption in aviation is derived from the CSB. CSB has started to collect data as of year 2006 (Figure 3.8). For the time period 1990 – 2005 and for aviation gasoline consumption the data is used from the study (FEI, 2004¹⁶). For 2004 onwards, the air flight statistics is provided by the Riga International Airport.

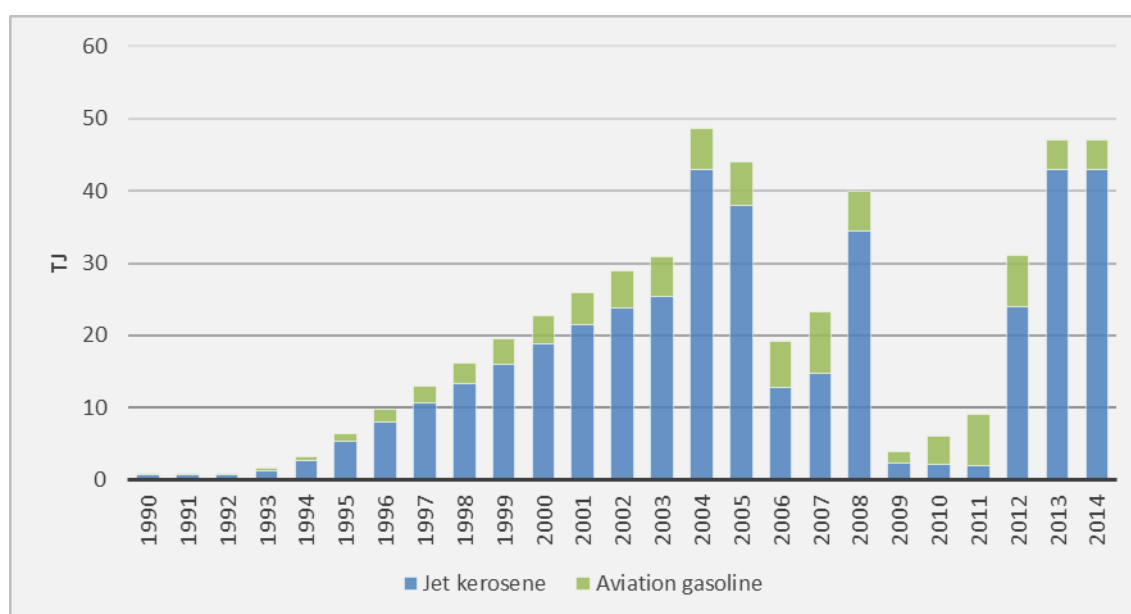


Figure 3.8 Fuel consumption in Civil aviation (TJ)

3.3.2.6 Uncertainties

Uncertainty in activity data of fuel consumption for time period 2006 – 2014 is $\pm 2\%$. CSB gives approximately 2% statistical sample error for statistical data. For the rest of time period uncertainty in activity data of fuel

¹⁶ "Research on fuel consumption by domestic aviation and private boats in domestic navigation"

consumption is $\pm 20\%$. Taking into account that it is used representative emission factors for LTO and cruise activities the uncertainty of EF lies between 20-45%.

3.3.2.7 QA/QC and verification

Assessment of trends have been performed.

3.3.2.8 Recalculations

Recalculations have been carried out (year 2006 and 2007) for domestic civil aviation due to corrected jet fuel consumption.

3.3.2.9 Planned improvements

No improvements are planned for the next submission.

3.3.3 Road transport (NFR 1A3b)

3.3.3.1 Overview

Road transport is producing the greatest part of emissions in Transport sector (Table 3.16). In the source category there are passenger cars, light and heavy duty vehicles as well as mopeds and motorcycles. In the source category emissions also from gasoline evaporation, Automobile road abrasion and Automobile tyre and brake wear are calculated.

3.3.3.2 Trends in emissions

Table 3.16 Trends and emissions in Road transport in 1990-2014¹⁷

	Unit	1990	1995	2000	2005	2010	2011	2012	2013	2014	Change in 1990-2014, %
NO_x	kt	24.219	17.819	18.267	18.407	15.981	12.577	11.865	11.549	11.747	-51
NM VOC		22.185	16.005	11.469	7.098	3.297	2.883	3.093	2.606	2.349	-89
SO₂		0.361	0.285	0.288	0.086	0.019	0.017	0.015	0.016	0.016	-95
NH₃		0.014	0.036	0.079	0.251	0.246	0.237	0.233	0.228	0.239	1624
PM_{2.5}		NR	NR	0.682	1.003	0.834	0.680	0.674	0.651	0.663	-3
PM₁₀		NR	NR	0.803	1.177	1.022	0.845	0.832	0.835	0.861	7
TSP		NR	NR	1.003	1.456	1.309	1.096	1.072	1.033	1.075	7
BC		NR	NR	0.307	0.499	0.433	0.353	0.355	0.325	0.328	7
CO	t	188.552	129.383	74.921	43.278	18.665	16.691	17.656	15.789	14.312	-92
Pb		82.862	57.719	4.542	2.031	1.867	1.700	1.479	1.389	1.389	-98
Cd		0.009	0.007	0.007	0.010	0.011	0.010	0.009	0.009	0.010	12
PCDD/F		g I-Teq	0.182	0.148	0.140	0.167	0.159	0.144	0.123	0.116	-36
PAHs	t	0.038	0.028	0.033	0.053	0.064	0.054	0.052	0.054	0.059	54

In the road transport all main emissions have decreased in time period 1990 – 2014 with an exception of NH₃ and PM (Table 3.16). NH₃ emissions are likely to increase due to the increasing number of vehicles equipped with catalytic systems for combustion gas treatment. The main reason for decrease of emissions is steady improvement of cars' technologies.

When analyzing the development of emissions in road transport in 2014 following trends could be mentioned:

- NO_x and SO₂ emissions have increased comparing with year 2013 by 1.7% and 5.5% corresponding. The main reason for such trend is increase of diesel fuel consumption, however increase of NO_x emission is partly compensated by the increased share of EURO 4 and EURO 5 cars;
- In 2014, PM emissions in road transport, compared to 2013 level have increased by 1.8%. The main reason for such trend is increasing of diesel fuel consumption by passenger cars, LDV and HDV.
- NMVOC emissions have decreased by 9.9% in 2014 comparing with year 2013 mainly due to decreasing of gasoline consumption;

¹⁷ For PMs the base year is 2000 instead of 1990

- The main sources of NO_x emissions are heavy duty vehicles (HDV) 59% followed by passenger cars 30.7%;
- The main sources of NMVOC emissions are passenger cars 74.6% and HDV 16.2%.
- The main sources of SO₂ emissions are passenger cars 54.4% and HDV 33.7%.

3.3.3.3 *Methods*

Emission calculation from Road transport is performed using the “Computer Programme to calculate Emissions from Road Transportation” (COPERT IV), which is proposed to be used by EEA member countries for the compilation of CORINAIR emission inventories. COPERT IV methodologies can be applied for the calculation of traffic emission estimates at a relatively high aggregation level. Calculation of emissions is based on fuel consumption of road vehicles and of average mileage of vehicles and the fixed emission factors. Road traffic vehicles use five different fuels – gasoline, diesel oil, liquid petroleum gases (LPG), natural gas and biofuel. Before emission calculation COPERT IV model was calibrated to be consistent with actual sold fuel (energy statistics). Deviation between fuel consumption in COPERT model and statistics is less than 0.1%. Thus we can say that all emission calculation is based on actual sold fuel.

Corresponding to the COPERT IV fleet classification, all vehicles in the Latvia fleet are grouped into vehicle classes, subclasses and layers. The layer classification is a further division of vehicle sub-classes into groups of vehicles with the same average fuel consumption and emission factors, according to EU emission legislation levels.

In COPERT IV, fuel consumption and emission simulation can be made for operationally hot engines, taking into account gradually tighten emission standards and emission degradation due to catalyst wear. Furthermore, the emission effects of cold-start and evaporation are simulated. Estimation of evaporative emissions of hydrocarbons and the inclusion of cold start emission effects are dealt with in the Latvian inventory by using LEGMC meteorological input data for ambient temperature variations during months; the distribution of evaporate emissions in the driving modes are used default by COPERT IV model. Trip-speed dependent basis factors for fuel consumption and emissions are implemented. The fuel consumption and emission factors used in the Latvia inventory come from the COPERT IV model.

3.3.3.4 *Activity data*

As a basis for model input information, CSB data have been used considering the actual fuel consumption calibration with statistical fuel consumption, Road Traffic Safety Directorate (RTSD) collected and published data have been used considering stock of road transport in Latvia. Total mileage data for passenger cars, light duty trucks, heavy duty trucks and buses produced by the RTSD is used for the years 1996-2014 and can be seen on Annex I, Table 4.

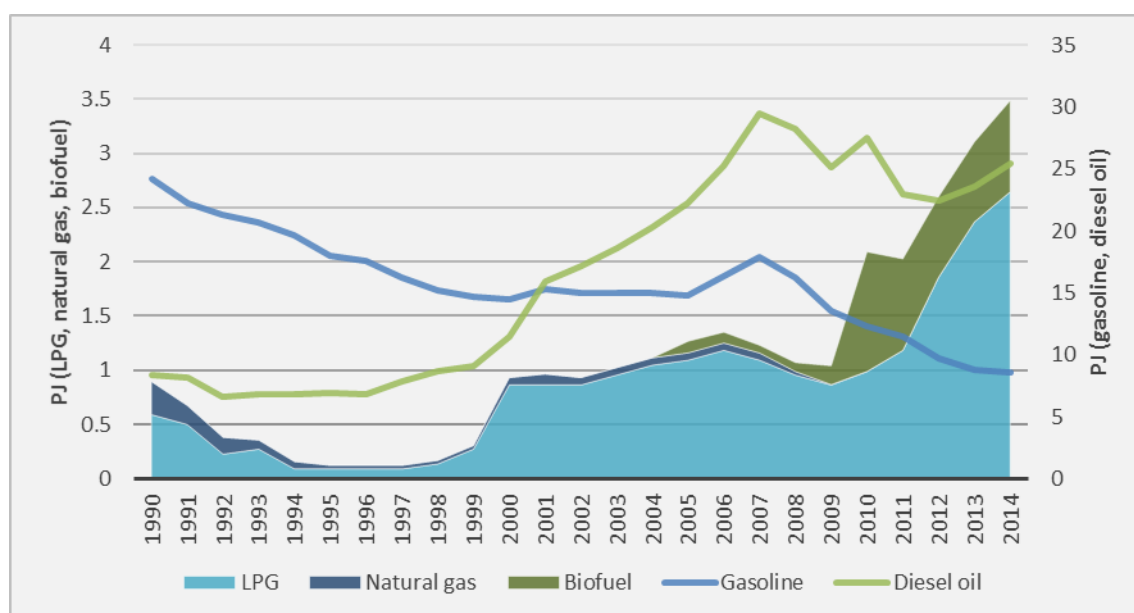


Figure 3.9 Development of fuel consumption in Road transport (TJ)

As seen in Figure 3.9, the fuel consumption has essentially changed in the time period 1990 – 2014. The gasoline consumption from the highest consumption in 1990 has decreased till 1999, reaching the lowest consumption and after six year stabilization the increase was seen in 2006 and 2007. Consumption of gasoline had decreased in 2014 by 2% compare with year 2013. Whereas the diesel fuel consumption starting from 1997 had increased all the time till 2007. While it decreased in 2008 and 2009 due to an economic recession. Diesel fuel consumption has increased in 2014 by around 8% compare with year 2013. It was in place substantial LPG consumption increasing starting from year 2011. LPG consumption has increased in 2014 by 11.7% compare with year 2013.

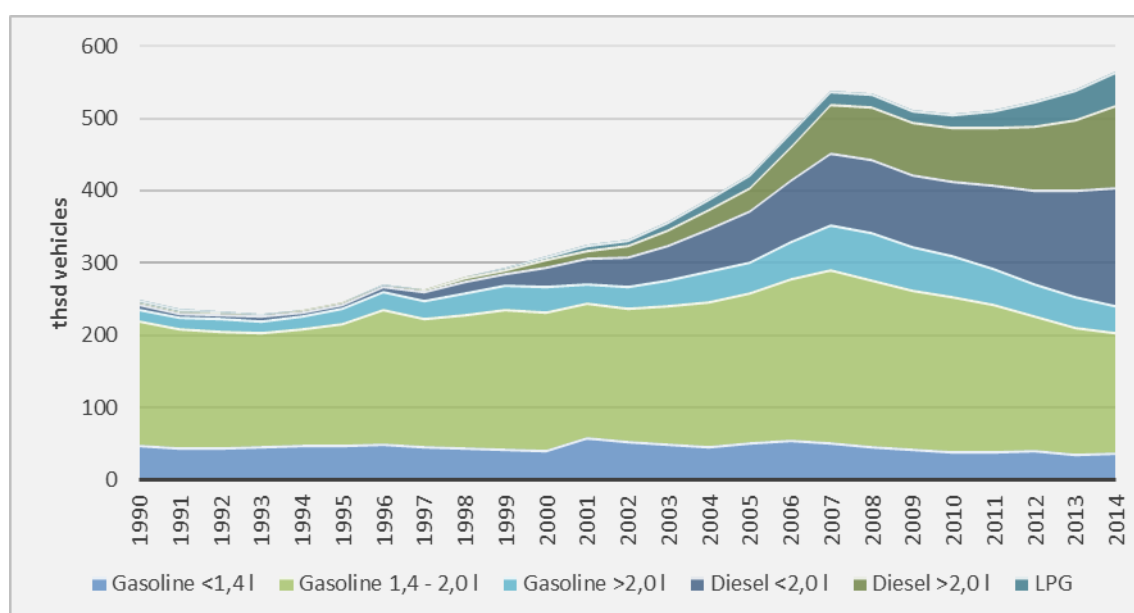


Figure 3.10 Distribution of passenger cars fleet by sub-classes

Analysing the development of the passenger car fleet in the time period 1990 – 2014, following features can be noted (Figure 3.10, Figure 3.11, Figure 3.12):

- Cars with a gasoline engine of a capacity > 2.0l constitute the major part;
- Cars with a gasoline engine of a capacity < 1.4l during the whole period have small changes and it's constitute approximately 7% in year 2014 from total passenger cars;

- Cars with a gasoline engine of a capacity >2.0l starting from year 2010 have a small increasing in their share of total passenger cars;
- As of 2000, the number of cars with diesel engines, both, <2.0l and >2.0l, grow rapidly and its share is 48.9% from the total number of passenger cars in 2014;
- As of 2005, in the car fleet with a gasoline engine, the number of EURO 3 and EURO 4 cars grows rapidly. In 2014 a share of EURO3 and EURO4 and EURO5 and EURO6 cars constitutes 26.4%;

As of 2005, in the car fleet with a diesel engine, the number of EURO 4 and EURO 5 cars grows rapidly. In 2014 a share of EURO4, EURO5 and EURO6 cars constitute 27.4%.

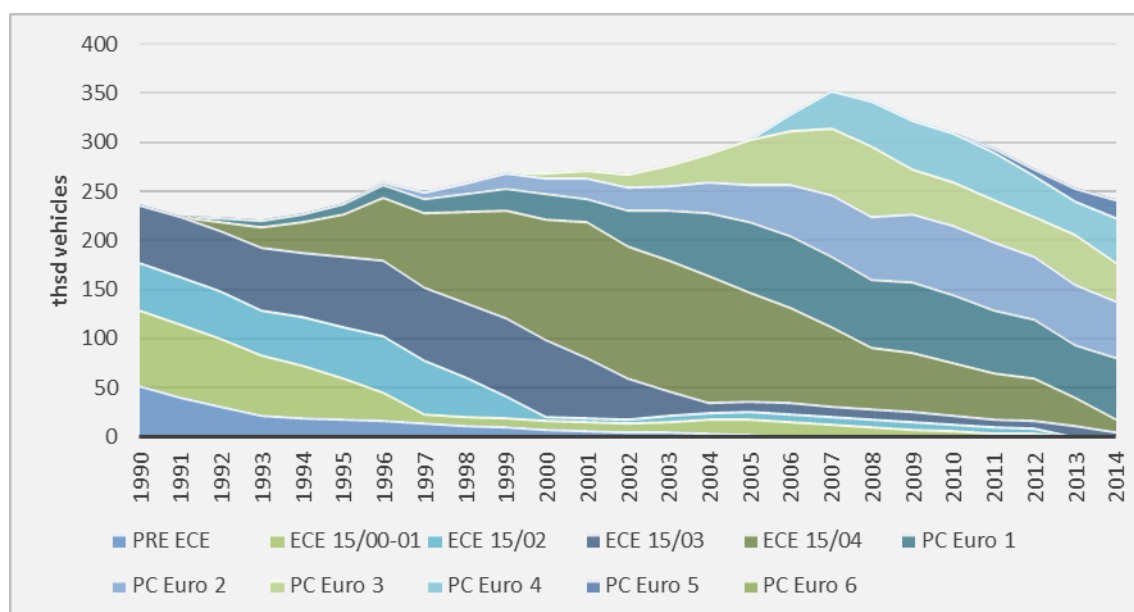


Figure 3.11 Distribution of gasoline passenger cars fleet by layers

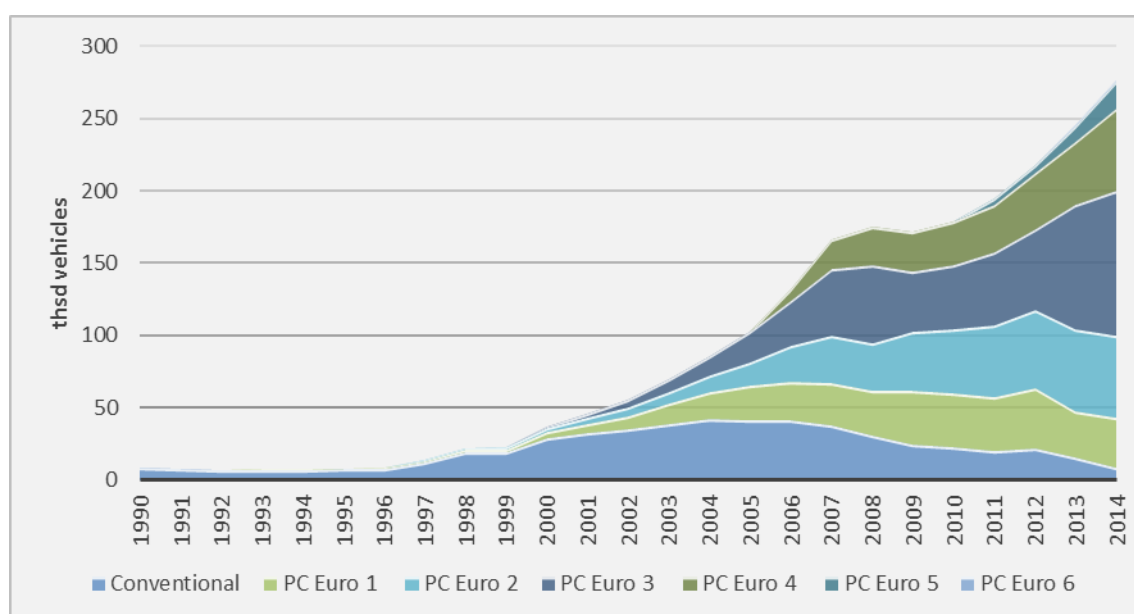


Figure 3.12 Distribution of diesel oil passenger cars fleet by layers

Analysing the development of LDV fleet (Figure 3.13, Figure 3.14) in the following time period, major features can be noted as follows:

- As of 1996, the number of cars with a gasoline engine decreases;
- As of 2000, the number of cars with a diesel engine rapidly increases. In 2014 a share of diesel cars is 92.7%;

- As of 2005, the number of EURO4 and EURO5 cars increases. In 2014 a share of EURO4, EURO5 and EURO6 cars constitute 45.5%;

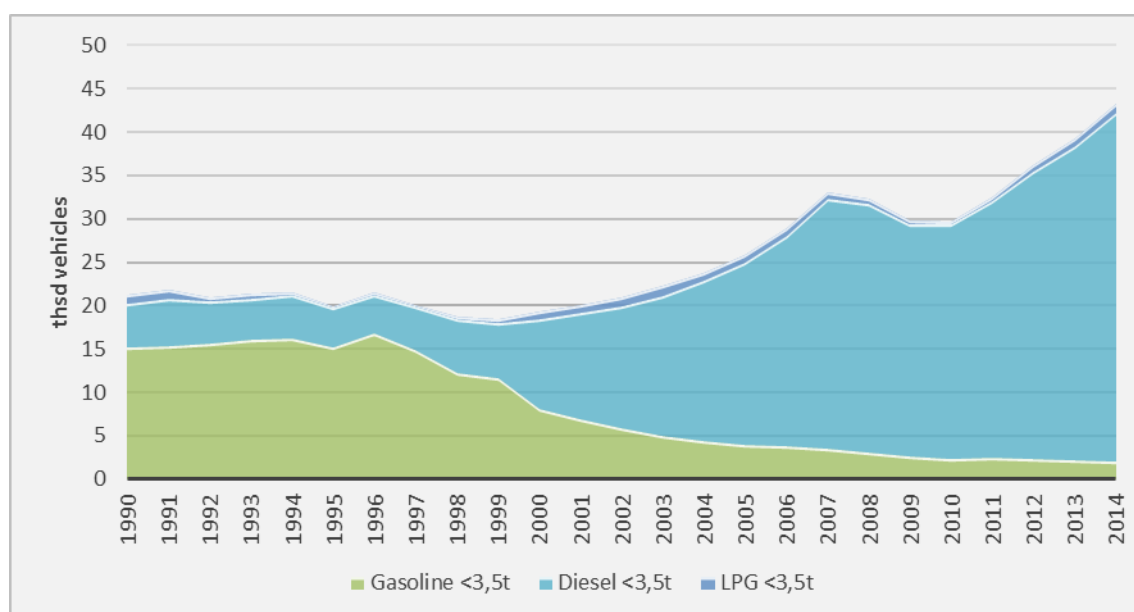


Figure 3.13 Distribution of light duty vehicles fleet by sub-classes

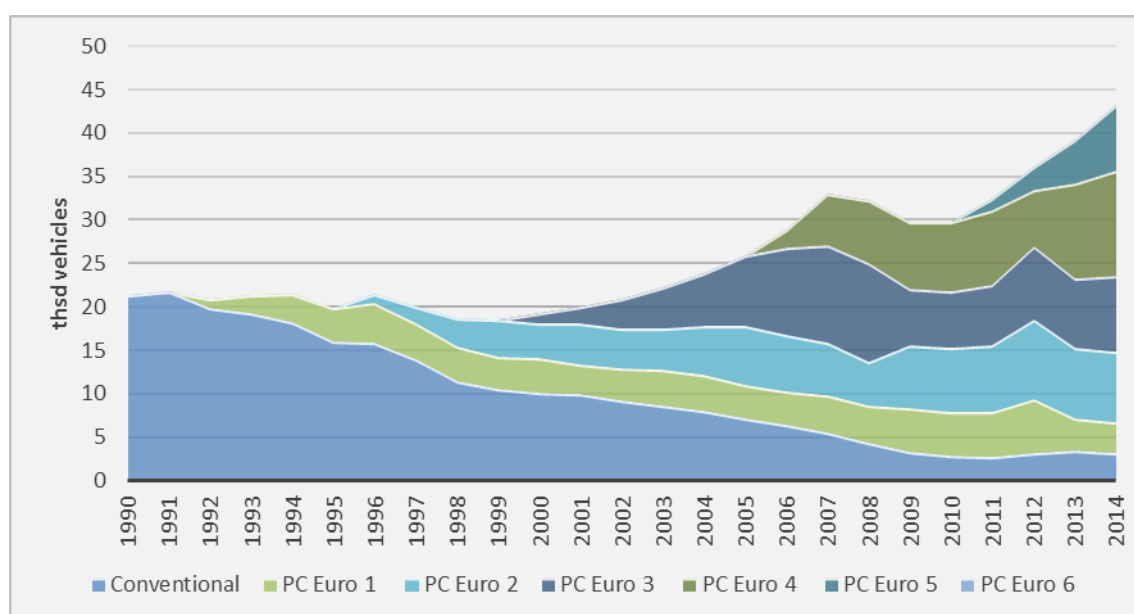


Figure 3.14 Distribution of light duty vehicles fleet by layers

The vehicle numbers per HDV sub-classes and layers are presented in the following figures.

Analysing the development of HDV fleet in the following time period, major features can be noted as follows:

- As of 2000, the number of cars with a gasoline engine rapidly decreases. A share of gasoline cars has decreased from 33% to 4.1 % corresponding years 2000 and 2014;
- As of 2000, the number HDV cars with tonnage 14-34 t and a diesel engine starts to increase;
- As of 2000, average age reduction of cars takes place gradually. In 2014 a share of EURO IV, EURO V and EURO VI cars constitute 41.2%.

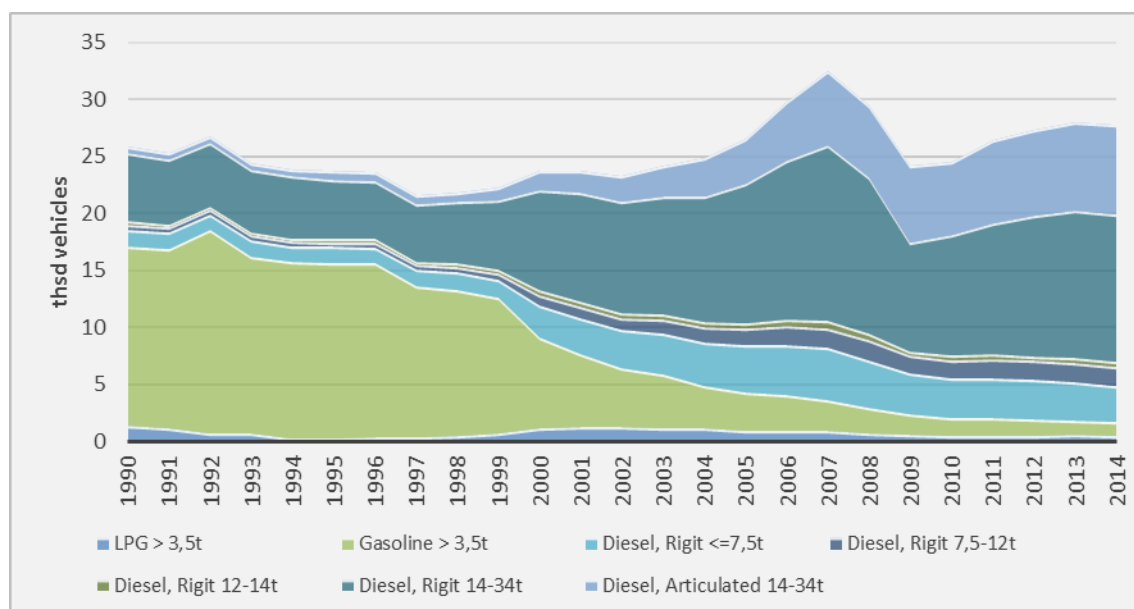


Figure 3.15 Distribution of heavy duty vehicles fleet by sub-classes

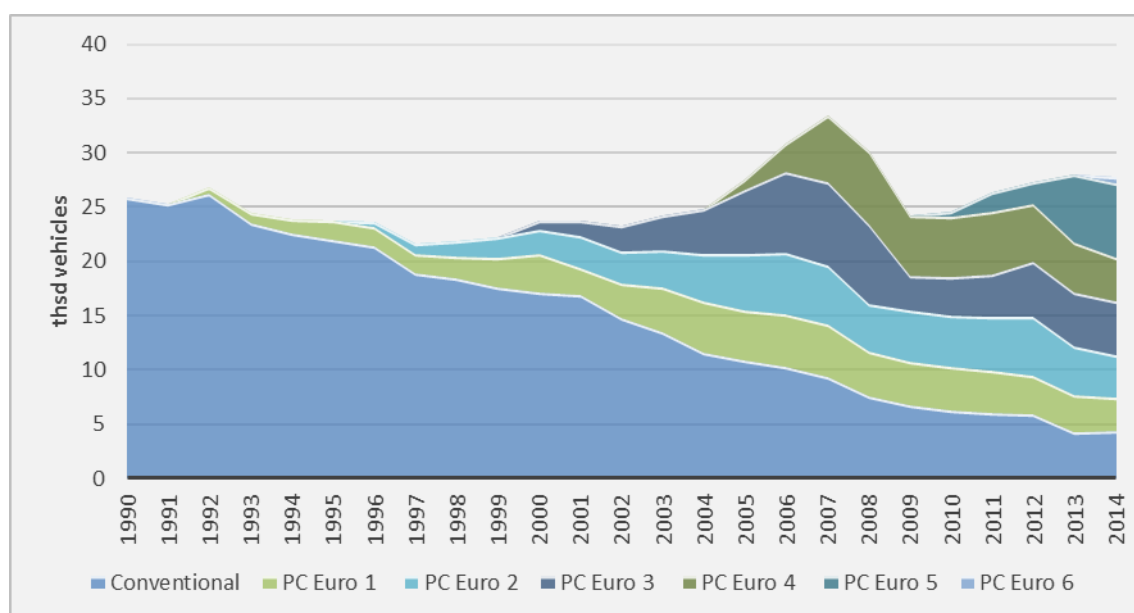


Figure 3.16 Distribution of heavy duty vehicles fleet by layers

Starting from the year 2011 emission for gasoline evaporation has been calculated according to the COPERT IV model method. Calculation of PM emissions has been performed taking into account emissions from road abrasion, tyres and brakes.

3.3.3.5 Uncertainties

Taking into account that CSB gives approximately 2% statistical sample error for statistical data, uncertainty in activity data of fuel consumption is $\pm 2\%$. To ensure time series consistency any recalculation related with model version updating is realized for all time period. Linear interpolation has been implemented only for cases when activity data fluctuation does not take place.

3.3.3.6 QA/QC and verification

Assessment of trends has been performed.

3.3.3.7 Recalculations

Table 3.17 Recalculations for Road transport

Sub-category	Recalculation	Improvements
Road transport	All emissions for year 2012 and 2013 have been recalculated	Recalculations have been done due to improvement of activity data and corrected gasoline consumption. Improvements comprise more precise split of passenger cars, LDV and HDV by subgroups (depending on engine volume) and layers (EURO classes) and mileage.

3.3.3.8 Planned improvements

No improvements are planned for the next submission.

3.3.4 Railway (NFR 1A3c)

3.3.4.1 Overview

The source category 1A3c Railways includes emissions from all diesel-powered rail transport in Latvia. The railway transport accomplishes approximately 59% (2014) of freight transport in Latvia and the transit transport traffic is dominant.

3.3.4.2 Trends in emissions

Table 3.18 Trends and emissions in Railway in 1990-2014¹⁸

Pollutant	Unit	1990	1995	2000	2005	2010	2011	2012	2013	2014	Change in 1990-2014, %
NO _x	kt	8.86	3.98	3.41	4.30	3.50	3.99	4.22	3.78	3.67	-59
NM ₁₀ VOC		0.79	0.35	0.30	0.38	0.31	0.36	0.37	0.34	0.33	-59
SO ₂		0.68	0.30	0.06	0.06	0.13	0.16	0.16	0.14	0.14	-79
NH ₃		0.00118	0.00053	0.00045	0.00057	0.00047	0.00053	0.00056	0.00050	0.00049	-59
PM _{2.5}		NR	NR	0.089	0.112	0.090	0.106	0.108	0.099	0.096	8
PM ₁₀		NR	NR	0.094	0.118	0.095	0.112	0.114	0.104	0.101	8
TSP		NR	NR	0.099	0.125	0.100	0.118	0.120	0.110	0.106	8
BC		NR	NR	0.058	0.073	0.059	0.069	0.070	0.064	0.062	8
CO	t	1.808	0.813	0.696	0.877	0.706	0.830	0.845	0.772	0.748	-59
Cd		0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	-59
PAHs		0.014	0.006	0.005	0.007	0.005	0.006	0.005	0.006	0.006	-59

When analysing the development of emissions trends in railway (Table 3.18), following features could be noted:

- Due to the decreasing of diesel oil consumption by around 58% in railway in time period 1990 – 2014 all emissions have been decreased by 58 – 80 %;
- In time span 2000 – 2014 it is in place diesel fuel consumption increasing in railway by around 8%. It is a reason for PM and TSP emission increasing by around 7.6%;
- Due to the decreasing of fuel consumption in railway all emissions have decreased by approximately 3-5 % in year 2014 comparing with year 2013.

3.3.4.3 Methods

When calculating emissions from railway, Tier 1 method has been applied.

3.3.4.4 Emission factors

Default emission factors for Railway (Table 3.19, Table 3.20) are taken from EMEP/EEA 2013. The emission factors for Particulate Matters are taken from CEPMEIP/TNO database (Table 3.10). The SO₂ emissions factors are used consistent with sulphur content in diesel oil by years (Table 3.21).

¹⁸ For PMs the base year is 2000 instead of 1990

Table 3.19 Emission factors used for emissions calculation from Railway

Pollutant	Unit	Diesel oil
NO _x	kt/PJ	1.233
CO		0.252
NMVOC		0.109
NH ₃	t/PJ	0.000165
Cd		0.00024
Cr		0.00118
Cu		0.04001
Ni		0.00165
Se		0.00024
Zn		0.02353
benzo(a)pyrene		0.000706
benzo(b)fluoranthene		0.0011767

Table 3.20 Emission factors used in the calculation of Particulate Matters emissions from Railway

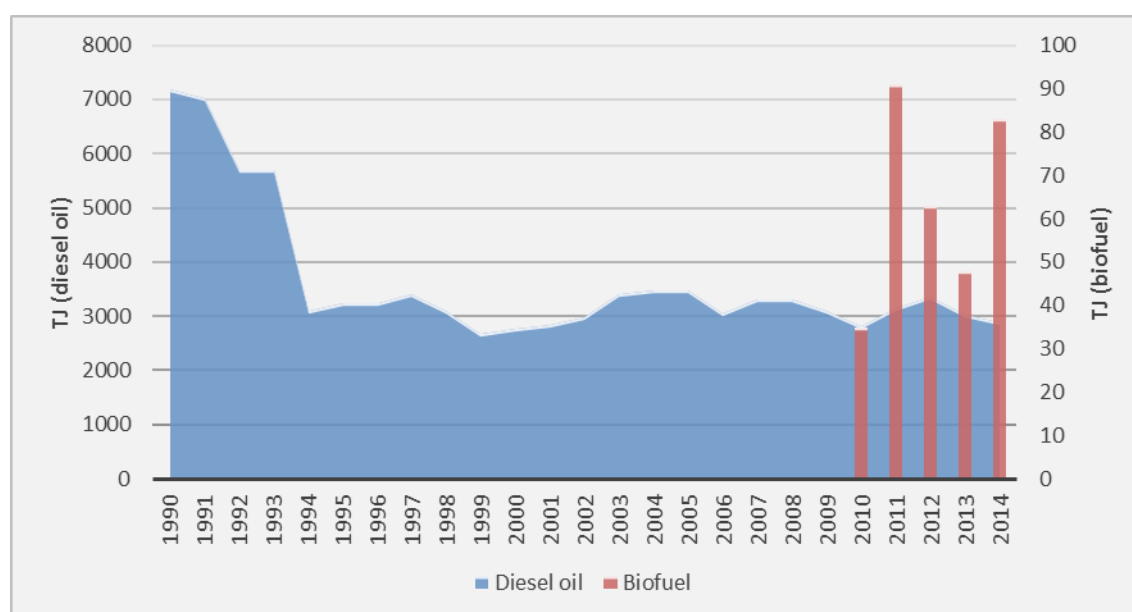
	PM _{2.5}	PM ₁₀	TSP
	kt/PJ		
Diesel oil	0.03224	0.03389	0.03577

Table 3.21 SO₂ emission factors for Diesel oil used in the calculation of SO₂ emissions from Railway

	Sulphur content	NCV	EF (kt/PJ)
1990-1998	0.2	42.49	0.0941
1999-2003	0.05	42.49	0.0235
2004-2014	0.035	42.49	0.0165

3.3.4.5 Activity data

Information about fuel consumption from CSB as a basis for emission calculation have been used. In 2009 and 2010, transported freight along the railway and therefore the diesel consumption has a slightly decreased, compared to 2008 level (Figure 3.17). Fuel consumption has decreased by 3% in 2014 compare with year 2013 but diesel fuel consumption has decreased even by 4.2%.

**Figure 3.17 Fuel consumption in Railway transport (TJ)**

3.3.4.6 Uncertainties

Uncertainty in activity data of fuel consumption is $\pm 2\%$ in 2014. CSB gives approximately 2% statistical sample error for statistical data. The uncertainty of EF lies between 20-45%.

3.3.4.7 QA/QC and verification

Assessment of trends has been performed.

3.3.4.8 Recalculations

NH₃ emissions have been recalculated for all time series due to corrected EFs from EMEP/EEA 2013.

3.3.4.9 Planned improvements

No improvements are planned for the next submission.

3.3.5 Navigation (NFR 1A3d)

3.3.5.1 Overview

Although Latvia has several ports, domestic navigation that providing transport of freight or passengers among local ports is not developed. Major activities in ports deal with international freight transport. In domestic navigation, the emissions are calculated for miscellaneous vessels (tugs, barges, towboats, icebreakers), recreational crafts and personal boats.

In 2014, the diesel oil consumption has decreased approximately 2 times compared to 2013 level. Number of services for international freight in harbours mostly affects the changes in the fuel consumption, however dramatic fuel consumption decreasing in year 2014 is due to completed of a project (carried out during year 2013) concerning harbour deepening.

3.3.5.2 Trends in emissions

Table 3.22 Trends and emissions in Navigation in 1990-2014¹⁹

	Unit	1990	1995	2000	2005	2010	2011	2012	2013	2014	Change in 1990-2014, %
NO_x	kt	0.021	0.011	0.012	0.011	0.392	0.392	0.315	0.629	0.315	1377
NM_{VOC}		0.011	0.012	0.014	0.017	0.026	0.026	0.030	0.039	0.032	189
SO₂		0.000283	0.000156	0.000166	0.000147	0.005103	0.005103	0.004103	0.00818	0.004105	1352
NH₃		1.8E-06	9.41E-07	9.95E-07	8.5E-07	3.39E-05	3.39E-05	2.72E-05	5.44E-05	0.0000272	1410
PM_{2.5}		NR	NR	0.00093	0.00102	0.00763	0.00785	0.00657	0.01207	0.00668	615
PM₁₀		NR	NR	0.00095	0.00104	0.00813	0.00835	0.00697	0.01287	0.00708	646
TSP		NR	NR	0.00095	0.00104	0.00813	0.00835	0.00697	0.01287	0.00708	646
BC		NR	NR	0.00010	0.00010	0.00220	0.00220	0.00177	0.00352	0.00179	1691
CO		0.035	0.039	0.045	0.052	0.076	0.076	0.088	0.111	0.095	175
Cd	t	3.22E-09	2.04E-09	2.23E-09	2.14E-09	7.06E-08	5.06E-08	4E-08	9.9E-07	1.1771E-06	36491
PAHs		2.57E-05	1.64E-05	1.79E-05	1.72E-05	0.000565	0.000405	0.000328	0.000647	0.0003292	1179

Analysing the development of the emission trends in domestic navigation (Table 3.22), following features can be noted:

- Due to remarkable increasing in fuel consumption in time period 1990 – 2014 (more than 10 times) all emissions have increased by several times;
- In year 2014 NO_x and SO₂ emissions have decreased corresponding by around 50% comparing with year 2013 due to fuel consumption decreasing. NM_{VOC} emissions have decreased by around 18% but PM_{2.5} and PM₁₀ emissions by 44.6% and 45%, correspondingly.

3.3.5.3 Methods

When calculating emissions from navigation, Tier 1 method has been applied.

¹⁹ For PMs the base year is 2000 instead of 1990

3.3.5.4 Emission factors

Default EFs (Table 3.23) for navigation is used (EMEP/EEA 2013):

Table 3.23 Emission factors used in the calculation of emissions from navigation

	NO _x	CO	NM VOC	NH ₃	PM _{2.5}	PM ₁₀	TSP
	kt/PJ						
Diesel oil	1.84749	0.17416	0.06589	0.00016	0.03295	0.0353	0.0353
Gasoline (from 2003)	0.214	13.05505	4.12875	0.00016	0.21611	0.21611	0.21611
Gasoline (1990-2002)	0.2138	13.0549	4.12702	0.00016	0.21611	0.21611	0.21611

EFs for gasoline are different due to varying NCV. The SO₂ emissions factors are used consistent with sulphur content in diesel oil and gasoline.

3.3.5.5 Activity data

The data about diesel oil consumption and gasoline consumption in domestic navigation are derived from the CSB. CSB have started to collect data about diesel oil consumption and gasoline consumption in domestic navigation from year 2006. For the time period 1990 – 2005 and 1990 – 2009 correspondingly for diesel oil and gasoline consumption data evaluation method from the study (“Evaluation of fuel consumption for domestic aviation and navigation” (FEI²⁰, 2004) is used. Development of the fuel consumption in navigation is presented in Figure 3.18 below.

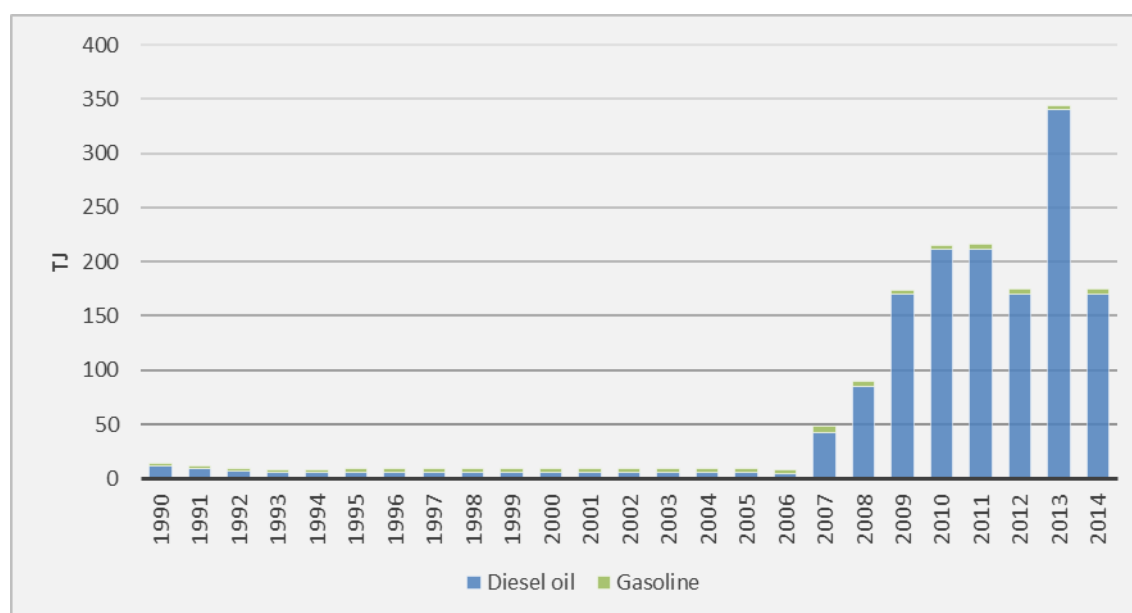


Figure 3.18 Development of gasoline and diesel oil fuel consumption in Navigation

3.3.5.6 Uncertainties

Uncertainty in activity data of fuel consumption for time period 2006 – 2014 is $\pm 2\%$ in 2013. CSB gives approximately 2% statistical sample error for statistical data. For the rest of time period uncertainty in activity data of fuel consumption is $\pm 20\%$. The uncertainty of EF lies between 20-40%

3.3.5.7 QA/QC and verification

Assessment of trends has been performed.

3.3.5.8 Recalculations

No recalculations have been carried out.

²⁰ “Research on fuel consumption by domestic aviation and private boats in domestic navigation”

3.3.5.9 Planned improvements

No improvements are planned for the next submission.

3.3.6 Off-road mobile machinery (NFR 1A2fii, 1A4aai, 1A4bii, 1A4cii, 1A4ciii, 1A5b)

3.3.6.1 Overview

Under the NFR 1A2g vii, 1A4a ii, 1A4b ii, 1A4c ii there are reported emissions from gasoline use. It is assumed that all gasoline is consumed for off-road purposes in Manufacturing industries and Construction, Commercial, Residential and Agriculture and Forestry sectors.

Under the NFR 1A4c iii Fishing sector it is assumed that all diesel and residual fuel oil is consumed for fishing boats.

Under the NFR 1A5b Other Mobile sources emissions from liquid fuels – aviation gasoline, diesel oil and jet kerosene, used in military aircrafts and ships are reported. These emissions appear since 1996.

3.3.6.2 Trends in emissions

Table 3.24 Trends and emissions in off-roads in 1990-2014²¹

	Unit	1990	1995	2000	2005	2010	2011	2012	2013	2014	Changes in 1990-2014, %
NO_x	kt	3.66	3.32	2.25	2.16	1.00	1.08	0.76	0.73	0.80	-78
NM VOC		4.39	0.34	0.59	0.75	0.63	0.86	0.77	0.85	0.70	-84
SO₂		0.14	0.49	0.27	0.21	0.03	0.03	0.02	0.02	0.02	-85
NH₃		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-84
PM_{2.5}		NR	NR	0.07	0.06	0.03	0.03	0.02	0.02	0.02	-68
PM₁₀		NR	NR	0.08	0.07	0.03	0.03	0.02	0.02	0.02	-69
TSP		NR	NR	0.08	0.07	0.03	0.03	0.02	0.02	0.02	-69
BC		NR	NR	0.01	0.01	0.01	0.01	0.00	0.00	0.00	-68
CO	t	42.82	2.51	5.39	7.54	6.52	8.66	7.97	8.81	7.32	-83
Pb		8.80	0.46	0.04	0.05	0.04	0.06	0.05	0.06	0.05	-99
Cd		0.00054	0.00051	0.00034	0.00031	0.00012	0.00013	0.00009	0.00008	0.00009	-82
Hg		0.00114	0.00117	0.00078	0.00076	0.00036	0.00039	0.00027	0.00025	0.00028	-75
PCDD/F	g I-Teq	0.0095	0.0085	0.0057	0.0048	0.0016	0.0017	0.0011	0.0011	0.0012	-87
PAHs	t	4.64E-06	2.40E-07	5.60E-07	7.20E-07	6.40E-07	8.81E-07	7.99E-07	8.81E-07	7.22E-07	-84
HCB	kg	0.00408	0.00390	0.00260	0.00238	0.00096	0.00103	0.00071	0.00068	0.00076	-81
PCB		0.00798	0.00638	0.00426	0.00314	0.00046	0.00049	0.00034	0.00032	0.00036	-95

As it can be seen from Table 3.24 above, the emissions have decreased in 1990-2014 because of decreased amounts of fuel consumed, especially in 1A4ci sector where can be seen how rapidly fuel consumption decreases in 1990-1991 due to collapse of Soviet Union.

3.3.6.3 Methods

When calculating emissions from off-roads, Tier 1 method has been applied.

3.3.6.4 Emission factors

Emission factors are taken from EMEP/EEA 2013. A complete table with all emission factors and references is presented in Annex I.

²¹ For PMs the base year is 2000 instead of 1990

3.3.6.5 Activity data

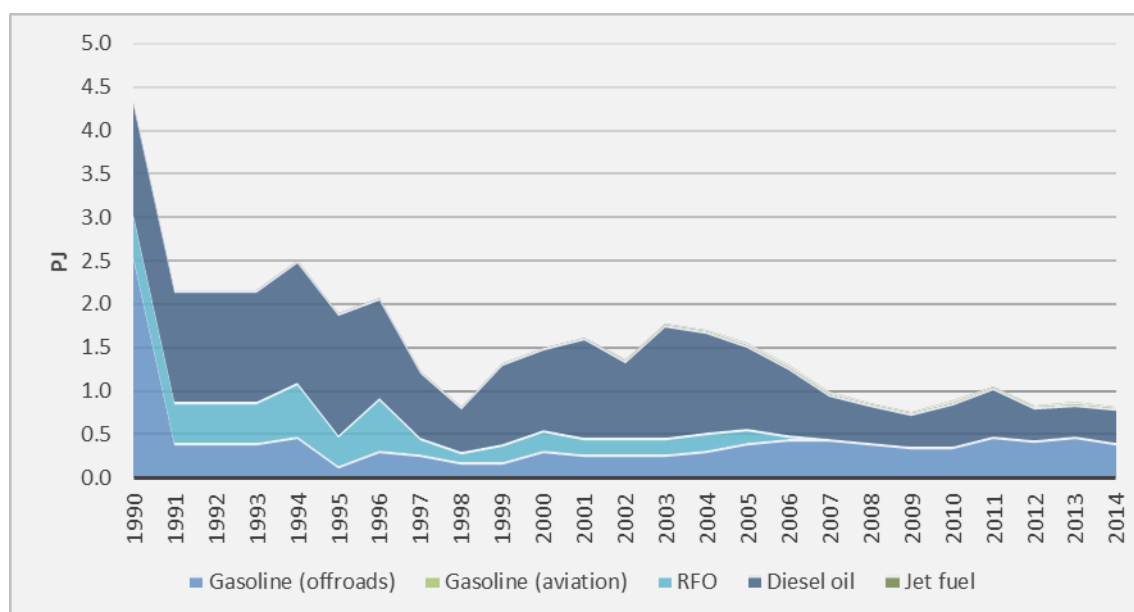


Figure 3.19 Fuel consumption in off-roads (PJ)

The data about diesel oil consumption and gasoline consumption in off-roads are derived from the CSB (Figure 3.19).

3.3.6.6 Uncertainties

Uncertainty for activity data is assumed as 20%. Uncertainty for emission factors are assumed as 100%.

3.3.6.7 QA/QC and verification

Disaggregated data at the finest level possible are presented in the corresponding Annex.

Activity data have been checked at the data provider – CSB, which has its own internal QA/QC procedures based on mathematic model and analysis to avoid logic mistakes. When activity data have been received, the sectoral expert responsible for the emission estimation and reporting are comparing all data changes with the previous inventory, and all changes are explained in the corresponding subchapter. All fluctuations or changes in NCVs are double checked and agreed with CSB.

To verify the emissions, logical mistakes are checked by checking the time series of the activity data, emission factors and emissions consistency to display all significant and illogical changes in the activity data and emissions. The emissions for substances reported also under UNFCCC as indirect GHGs are cross-checked with for verification purposes.

3.3.6.8 Recalculations

In Submission 2016, there were following recalculations done:

- updated SO₂ emission factors for several fuel types for all time series.

3.3.6.9 Planned improvements

There is a research on off-road fuel consumption and installations planned in 2016, as currently only gasoline is assumed as consumed in off-roads.

3.4 Fugitive emissions (NFR 1B)

3.4.1 Overview

Under fugitive emissions from fuels Latvia reports following categories:

- NFR 1B1a Fugitive emission from solid fuels: Coal mining and handling includes fugitive particulate matters emissions from coal transportation and storage;
- NFR 1B2a v Distribution of oil products includes NMVOC emissions from oil storage;
- NFR 1B2b Fugitive emissions from natural gas (exploration, production, processing, transmission, storage, distribution and other) includes NMVOC emissions from natural gas transmission, storage and distribution systems in Latvia;
- NFR 1B2c Venting and flaring (oil, gas, combined oil and gas) includes NMVOC emissions from natural gas venting in Latvia.

There are no oil refineries in Latvia, therefore NMVOC emissions from gasoline distribution were calculated for the time period 1990–2013.

Fugitive particulate matters emissions in 2000-2013 from the operations of solid fuels – coal and coke, transportation via railways and storage and handling, are estimated.

3.4.2 Trends in emissions

Table 3.25 Fugitive emissions in 1990-2014²²

	Unit	1990	1995	2000	2005	2010	2011	2012	2013	2014	Change in 1990-2014, %
NMVOC	kt	4.18	3.19	2.48	2.28	2.35	1.40	1.44	1.71	2.34	-44
PM_{2.5}		NR	NR	0.000032	0.000038	0.000051	0.000053	0.000044	0.000037	0.000031	-6
PM₁₀		NR	NR	0.000324	0.000381	0.000510	0.000525	0.000435	0.000369	0.000306	-6
TSP		NR	NR	0.000810	0.000953	0.001275	0.001313	0.001088	0.000923	0.000765	-6

NMVOC emissions are decreasing due to less use of gasoline (Table 3.25). Also particulate matter emissions have decreased if compared to 2000 due to decrease of imported amounts of coal and coke.

3.4.3 Methods

LEGMC are receiving data about emissions from gas leakage directly from the natural gas holding company “Latvijas Gāze” for the time period 1990–2014. Consequently company “Latvijas Gāze” calculates emissions by itself, using data of natural gas density and other physical parameters, and measures the content of methane and other chemical compounds in natural gas, therefore it is assumed as Tier 2 method, using country-specific data and calculations.

LEGMC has methodological material, which describes how the amounts of natural gas leaked are calculated. The methodology is translated in English and a brief essence of methods will be available on National Inventory Report submitted under UNFCCC.

EMEP/EEA 2013 Tier 1 methodology is used to estimate fugitive NMVOC emissions from operations with gasoline in 1990–2014. It uses the general equation, where emissions are obtained by multiplying the total amount of gasoline sold with the emission factor.

Particulate matters emissions are estimated by using Tier 2 methodology from EMEP/EEA 2013.

3.4.4 Emission factors

NMVOC emission factor – 2 kg/t oil – for emission from gasoline distribution was taken from EMEP/EEA 2013, Chapter 1.B.2.a.v Distribution of oil products, Table 3-1.

²² For PMs the base year is 2000 instead of 1990

Emission factors for particulate matters emission estimation are taken from EMEP/EEA 2013, Chapter 1.B.1.a Fugitive emissions from solid fuels: Coal mining and handling, Table 3-6 (Table 3.26).

Table 3.26 PM emission factors (g/t)

	Coal
TSP	7.5
PM₁₀	3
PM_{2.5}	0.3

3.4.5 Activity data

Table 3.27 Gasoline consumption in Latvia in 1990-2014 (TJ)

1990	26796
1991	22616
1992	21692
1993	21032
1994	20108
1995	18128
1996	17908
1997	16456
1998	15400
1999	14872
2000	14831
2001	15535
2002	15228
2003	15214
2004	15346
2005	15126
2006	16753
2007	18299
2008	16672
2009	13941
2010	12667
2011	11926
2012	10146
2013	9282
2014	9018

Table 3.28 Activity data used for particulate matters emissions calculation in 2000–2014 (kt)

	Coal	Coke
2000	97	11
2001	127	11
2002	102	10
2003	101	6
2004	98	7
2005	120	7
2006	130	6
2007	162	4
2008	162	5
2009	130	5
2010	167	3
2011	172	3
2012	139	6
2013	121	2
2014	102	0

Table 3.29 Amounts of natural gas leaked in 1990-2014 (10⁶ m³)

	Venting	Transmission and storage	Distribution	Other	Total
1990	5.61	0.13	0.69	12.44	18.87
1991	5.38	0.13	0.69	11.98	18.17
1992	4.83	0.13	0.59	10.92	16.47
1993	4.58	0.13	0.69	10.44	15.85
1994	4.46	0.13	0.69	10.21	15.48
1995	4.32	0.13	0.69	9.94	15.08
1996	4.13	0.13	0.69	9.58	14.53
1997	3.80	0.13	0.69	8.94	13.56
1998	3.63	0.11	0.69	8.58	13.01
1999	3.42	0.11	0.69	8.18	12.40
2000	3.11	0.11	0.69	7.57	11.48
2001	0.30	0.10	0.69	10.03	11.14
2002	0.98	0.10	0.69	9.86	11.63
2003	1.09	0.10	0.69	7.20	9.07
2004	1.56	0.09	0.69	6.63	8.98
2005	3.25	0.09	0.69	6.12	10.15
2006	1.80	0.08	0.69	4.71	7.28
2007	1.76	0.07	0.69	4.95	7.47
2008	2.44	0.07	0.69	4.48	7.67
2009	1.78	0.06	0.69	4.71	7.25
2010	1.64	0.06	0.69	4.59	6.98
2011	1.77	0.05	0.69	1.70	4.21
2012	1.34	0.05	0.69	3.35	5.43
2013	1.09	0.04	0.69	4.06	5.89
2014	1.53	0.04	0.66	5.69	7.93

3.4.6 Uncertainties

Activity data for fugitive emissions from operations with gasoline were taken from CSB and uncertainty was assumed as very low for about 2% as statistical frame mistake. Uncertainty for emission factor is assumed as 50%.

Uncertainty for particulate matter from coal handling is assumed as 50% for activity data and 100% for emission factor.

The representative of only natural gas distributing company „Latvijas Gāze” determined the level of uncertainty. The total uncertainty of NMVOC emissions from natural gas leakages in gas distribution and transmission systems, as well as in gas storage facility is assigned as quite low – 20%, as emissions were measured and estimated by only enterprise operated with natural gas in Latvia – “Latvijas Gāze” by methodology developed for enterprise.

3.4.7 QA/QC and verification

Activity data have been checked at the data provider – Central Statistical Bureau, which has its own internal QA/QC procedures based on mathematic model and analysis to avoid logic mistakes. When activity data have been received, the sectoral expert responsible for the emission estimation and reporting are comparing all data changes with the previous inventory, and all changes are explained in the corresponding subchapter. All fluctuations or changes in NCVs are double checked and agreed with CSB.

As all emission factors are taken from EMEP/EEA 2013, no additional verification procedures have been performed.

To verify the NMVOC emissions, logical mistakes are checked by checking the time series of the activity data, emission factors and emissions consistency to display all significant and illogical changes in the activity

data and emissions. The emissions are also cross-checked with emissions reported within UNFCCC for verification purposes.

3.4.8 Recalculations

No recalculations were performed in Submission 2016.

3.4.9 Planned improvements

No improvements have been planned for the next submission.

3.5 International bunkers

3.5.1 Overview

International bunkers cover International Aviation (only cruise mode) and International Navigation according to the IPCC GPG 2000. Emissions from International Aviation and Navigation are not included into national total emissions.

3.5.2 Trends in emissions

International maritime navigation contributed around 96%, 98% and 98% in total international emissions corresponding for NO_x and SO₂ and PM emissions in year 2014.

3.5.3 Emission factors

Default emission factors for International Aviation and Navigation are taken from EMEP/EEA 2013 methodology and are presented in Table 3.30 and Table 3.31. The emission factors for Particulate Matters for International Navigation are taken from CEPMEIP/TNO database (Table 3.32).

Table 3.30 Emission factors to calculate emissions from International Aviation

Fuel type	Emissions factors, kt/PJ			
	NO _x	CO	NMVOC	SO ₂
Jet fuel	0.25	0.1	0.05	0.023

Table 3.31 Emission factors to calculate emissions from International Navigation

Fuel type	NO _x	CO	NMVOC	NH ₃	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
	kt/PJ				t/PJ								
Diesel oil	1	0.25	0.11	0.0038	0.0024	0.00024	0.0012	0.0012	0.0009	0.0012	0.0016	0.0047	0.0118
RFO	1.6	0.5	0.11	0.0062	0.0049	0.00074	0.0005	0.0123	0.0049	0.0123	0.7389	0.0099	0.0222

Table 3.32 Emission factors for Particulate Matters for international navigation

Fuel type	Emissions factors, kt/PJ		
	PM ₁₀	PM _{2.5}	TSP
Diesel oil	0.035	0.033	0.035
RFO	0.1527	0.1379	0.1527

The SO₂ emissions factors are used consistent with sulphur content in diesel oil (Table 3.33, Table 3.34).

Table 3.33 SO₂ emission factors used for Diesel oil in the SO₂ calculation of emissions for International Bunkers

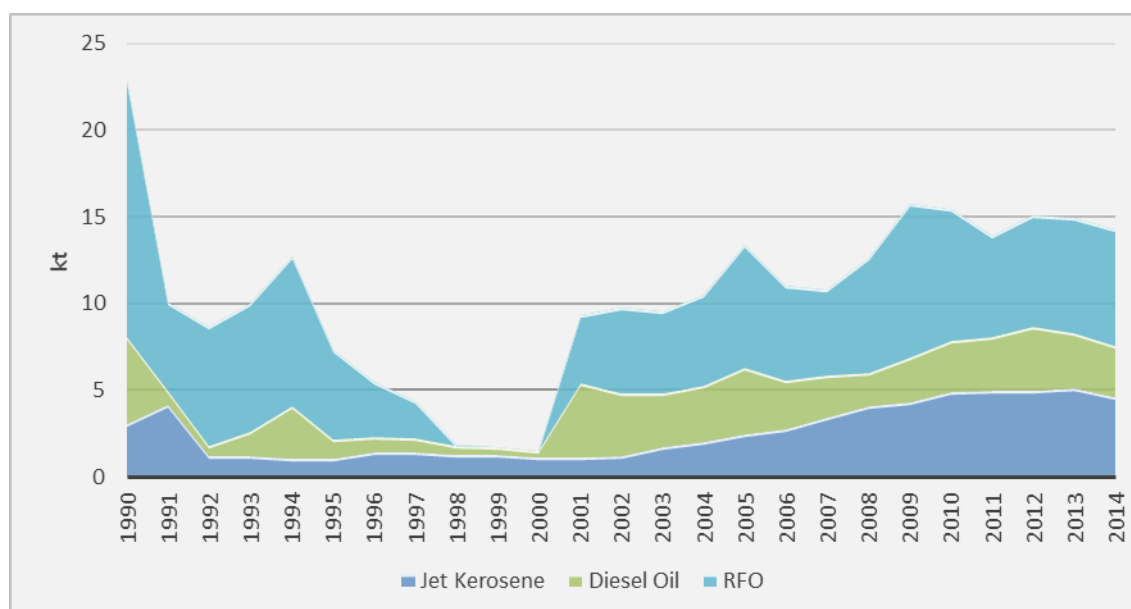
	Fuel content	NCV	EF (kt/PJ)
1990-2007	0.2	42.49	0.094
2008-2014	0.1	42.49	0.0471

Table 3.34 SO₂ Emission factors used for RFO in the SO₂ calculation of emissions for International Bunkers

RFO	Fuel content	NCV	EF (kt/PJ)
1990-2006	2.8	40.6	1.352
2007-2014	1.5	40.6	0.7241

3.5.4 Activity data

Fuel consumption for emission calculation is obtained from CSB (Figure 3.20). To provide the consistent allocation of fuel consumption between domestic and international mode in the navigation and aviation, CSB each month collects and summarises the information which is submitted by enterprises which perform fuel bunkering. For this purpose the particular statistical report format is elaborated in which the enterprises have to fill in the data regarding amount of fuel sold respectively in domestic and international navigation and aviation.

**Figure 3.20 Fuel consumption in International Transport (PJ)**

Taking into consideration the fact that ports in Latvia are focused on transit cargo transport, navigation activities have big fluctuations and depend on neighbouring countries' economical and international trading activities and competitiveness of Latvian ports' with other neighbouring ports in Baltic Sea. At the same time fuel consumption and emissions from aviation are more stable, and recent trend depicts a persistent increase from year 2003.

4 Industrial processes and Product use (NFR 2)

4.1 Sector overview

4.1.1 Overview of sector

Sources of emissions from Industrial processes and Product use are:

- Mineral products (NFR 2 A);
- Chemical industry (NFR 2 B);
- Metal production (NFR 2 C);
- Other solvent and product use (NFR 2 D – 2 H)

There are no emissions reported from Wood processing (2 I), POPs production (2 J) as well as POPs and heavy metal consumption (2 K) and other sectors (2 L) in Latvia.

Table 4.1 Source categories and methods for Industrial processes and Product use sector

NFR code	Description	Method	AD	EF
2 A 1	Cement production	Tier 3	PS	PS
2 A 2	Lime production	Tier 2, Tier 1	PS, NS	D, PS
2 A 3	Glass production	Tier 1	PS, NS	D, PS
2 A 5 a	Quarrying and mining of minerals other than coal	NO	NO	NO
2 A 5 b	Construction and demolition	NO	NO	NO
2 A 5 c	Storage, handling and transport of mineral products	NO	NO	NO
2 A 6	Other mineral products	NO	NO	NO
2 B 1	Ammonia production	NO	NO	NO
2 B 2	Nitric acid production	NO	NO	NO
2 B 3	Adipic acid production	NO	NO	NO
2 B 5	Carbide production	NO	NO	NO
2 B 6	Titanium dioxide production	NO	NO	NO
2 B 7	Soda ash production	NO	NO	NO
2 B 10 a	Chemical industry: Other (please specify in the IIR)	Tier 1	NS	D
2 B 10 b	Storage, handling and transport of chemical products (please specify in the IIR)	NO	NO	NO
2 C 1	Iron and steel production	Tier 2	NS, PS	D
2 C 2	Ferroalloys production	NO	NO	NO
2 C 3	Aluminium production	NO	NO	NO
2 C 4	Magnesium production	NO	NO	NO
2 C 5	Lead production	NO	NO	NO
2 C 6	Zinc production	NO	NO	NO
2 C 7 a	Copper production	NO	NO	NO
2 C 7 b	Nickel production	NO	NO	NO
2 C 7 c	Other metal production (please specify in the IIR)	NO	NO	NO
2 C 7 d	Storage, handling and transport of metal products (please specify in the IIR)	NO	NO	NO
2 D 3 a	Domestic solvent use including fungicides	Tier 2	NS	Tier 2
2 D 3 b	Road paving with asphalt	Tier1	NS	D
2 D 3 c	Asphalt roofing	Tier1	NS	D
2 D 3 d	Coating applications	Tier 1	NS	Tier 1
2 D 3 e	Degreasing	Tier 1	NS	Tier 1
2 D 3 f	Dry cleaning	CS	NS	CS
2 D 3 g	Chemical products	Tier 1, Tier 2	NS	Tier 1, Tier 2
2 D 3 h	Printing	Tier 1	NS	Tier 1
2 D 3 i	Other solvent use (please specify in the IIR)	Tier 1, Tier 2	NS	Tier 1, Tier 2
2 G	Other product use (please specify in the IIR)	Tier 2	NS	Tier 2
2 H 1	Pulp and paper industry	Tier 1	NS	D
2 H 2	Food and beverages industry	Tier 1	NS	D
2 H 3	Other industrial processes (please specify in the IIR)	NO	NO	NO
2 I	Wood processing	NE	NE	NE

NFR code	Description	Method	AD	EF
2 J	Production of POPs	NO	NO	NO
2 K	Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)	NO	NO	NO
2 L	Other production, consumption, storage, transportation or handling of bulk products (please specify in the IIR)	NO	NO	NO

Table 4.2 Reported emissions in Industrial Processes sector in 2014

NFR code	Emissions
2A1	NO _x , NMVOC, SO ₂ , PM _{2.5} , PM ₁₀ , TSP, BC, CO, Hg
2A2	PM _{2.5} , PM ₁₀ , TSP, BC
2A3	NMVOC, PM _{2.5} , PM ₁₀ , TSP, BC, Pb, Cd, Hg, As, Cr, Cu, Ni, Zn
2B10b	PM _{2.5} , PM ₁₀ , TSP
2C1	NO _x , NMVOC, SO ₂ , PM _{2.5} , PM ₁₀ , TSP, BC, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Zn, PCDD/PCDF, total PAHs, PCBs
2D3a	NMVOC
2D3b	NMVOC, PM _{2.5} , PM ₁₀ , TSP, BC
2D3c	NMVOC, PM _{2.5} , PM ₁₀ , TSP, BC, CO
2D3d	NMVOC
2D3e	NMVOC
2D3f	NMVOC
2D3g	NMVOC
2D3h	NMVOC
2D3i	NMVOC
2H2	NMVOC
2G	NO _x , NMVOC, SO ₂ , NH ₃ , PM _{2.5} , PM ₁₀ , TSP, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Zn, PCDD/PCDF, benzo(a) pyrene, benzo(b) fluoranthene, benzo(k) fluoranthene, Indeno (1,2,3-cd) pyrene

4.1.2 Key sources

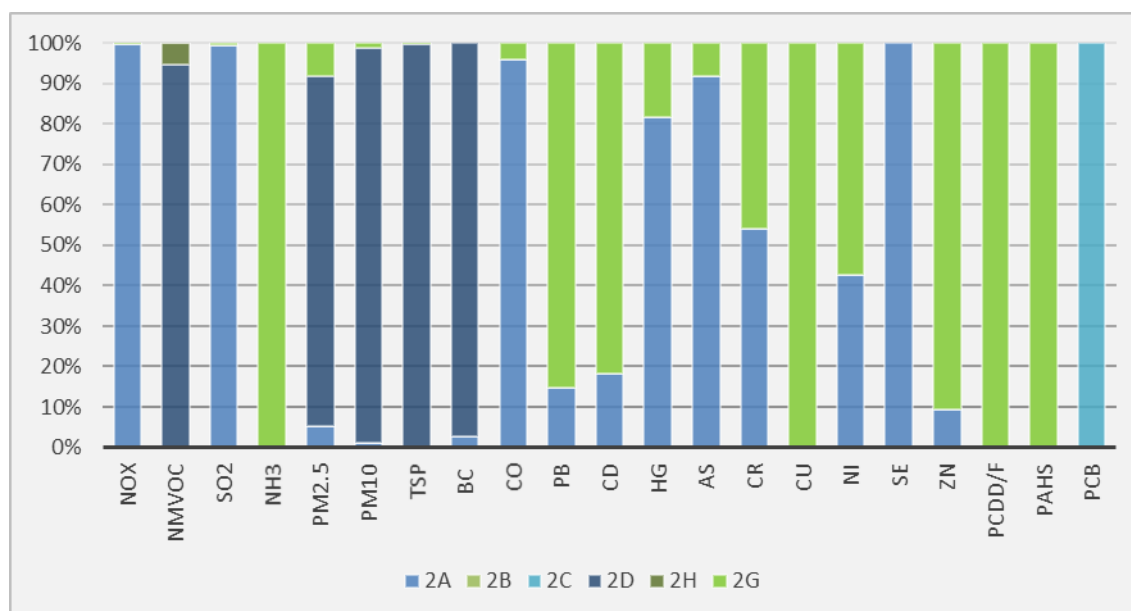


Figure 4.1 Emissions from Industrial Processes and Product Use sector by subsectors in 2014

There are three main categories in IPPU sector – mineral production dominates in NO_x, SO₂, CO and in heavy metal emissions, but metal production dominates in PCDD/PCDDF, PAHs and PCBs. Coating application sector (NFR 2 D 3 d) dominates in NMVOC, particulate matter and BC emissions (Figure 4.1). Division of emission most likely could be different because several emissions are not estimated due to lack of official methodology and default or country specific emission factors.

Cement production sector is a key source category for NO_x and SO₂ emissions with 5.0% and 3.6% from total NO_x and SO₂ emissions in 2014.

The main share of total NMVOC emissions was contributed by Coating (2D3d) –16.2% or 8.82 kt and Domestic solvent use (2D3a) – 13.8% or 7.50 kt. Road paving with asphalt is a key source category for TSP emissions with 43.7% from total TSP emissions, 14.4% from total PM₁₀ emissions and 2.6% from total PM_{2.5} emissions in 2014.

4.1.3 Trends in emissions

Table 4.3 Change in emissions from Industrial Processes sector in 1990-2014²³

	Unit	1990	1995	2000	2005	2010	2011	2012	2013	2014	Change from 1990 to 2014, %
NOx	kt	3.712	1.666	2.781	3.189	3.216	0.959	1.576	1.525	1.769	-52
NMVOC		31.269	27.924	26.762	25.678	21.149	22.767	26.478	26.195	25.366	-19
SO₂		3.571	0.944	0.933	1.443	0.157	0.384	0.372	0.179	0.149	-96
PM_{2.5}		NR	NR	0.551	0.862	0.740	0.599	0.656	0.535	0.549	0
PM₁₀		NR	NR	1.733	3.828	3.083	4.116	4.419	3.525	3.622	109
TSP		NR	NR	6.137	15.641	12.586	18.964	20.306	16.104	16.549	170
BC		NR	NR	0.017	0.033	0.028	0.030	0.033	0.026	0.027	62
CO	t	0.13	0.12	0.12	0.10	0.91	1.82	3.61	2.67	2.32	1660
Pb		0.250	0.107	0.327	0.464	0.298	0.155	0.202	0.182	0.186	-26
Cd		0.019	0.014	0.013	0.013	0.012	0.011	0.012	0.011	0.012	-39
Hg		1.31E-04	3.10E-05	3.40E-05	8.68E-05	5.70E-05	6.93E-05	1.59E-04	8.51E-05	6.34E-05	-52
PCDD/F		2.75E-04	2.42E-04	2.46E-04	2.10E-04	2.16E-04	6.65E-04	2.69E-03	7.40E-04	1.69E-04	-39
PAHs	kg	5.92E-04	5.52E-04	5.27E-04	4.30E-04	4.49E-04	4.78E-04	8.46E-04	4.88E-04	4.15E-04	-30
PCB	kg	NA	NA	NA	NA	NA	4.19E-06	2.09E-05	4.83E-06	2.31E-09	-100

Data on emissions in the Industrial Processes sector are linked with the economic situation of the country as well as availability of statistical data. The largest decrease in emissions occurred between 1990 and 1993, when industry was affected by a crisis (Table 4.3).

It has to be noted that in the beginning of 90ties during the countrywide change in government system and national economy, statistics was not well kept. Therefore there is a lack of statistical data regarding industry during this time period or they are vague. The data extrapolation was carried out for the sectors where possible although the extrapolation is almost impossible to do due to different circumstances – changes and total restructuring of national economy when industrial development wasn't predictable and explainable.

From 2000-2008 the emissions from IPPU increased because of growing demand of industrial products in neighbouring countries. It led to rapid development of Latvian industry due to increased activity in construction and production of building materials.

Industrial production faced significant decrease at the end of 2008 and 2009, caused by financial crisis in Latvia's economy. It led to reduced purchase capacity which can be explained with decrease of population welfare. Due to that, the building and construction sector development decreased as well because companies were charged with higher taxes. In industrial sector in 2010 all emissions have increased with exception of SO₂ emissions that decreased by 95.95% and NOx by 31.33%. It is explained with changes from wet to dry technology of cement production in the first half of 2010. The data of SO₂ and NOx are not representative because the new dry process cement production technology began to work with full capacity only in July of 2010. To reduce NOx emissions from cement production SNCR (Selective Non-Catalytic Reduction System) method is used. With the help of SNCR system the NOx emission reduction in flue gas of 40-60% is achievable, depending on the cement kiln type, fuel and NOx content. Reducing agents such as urea and ammonia are injected into the hot flue gases. They react with nitrogen monoxide and form nitrogen and water. In addition, SNCR are used together with more than 50% ecofuel which functions as blaze extinguisher in that way to reduce NOx emissions. Switched from wet to dry process cement

²³ For PMs the base year is 2000 instead of 1990

production SO₂ and NO_x are measured automatically in new technological plant and are considered as plant-specific data that are available and taken from national statistical database "2-AIR".

Comparing 1990-2014 there are remarkable decreased in heavy metal emissions from metal industry due to technological changes in Metal production plant that occurred in 2011. Since then all crude steel are produced only in Electric arc furnace (EAF) whose EFs are lower than Open hearth furnace (OHF) technology which was used in years 1990-2010. Additionally in Submission 2016 PCDD/PCDF, PAHs and PCBs emissions from metal industry are calculated. PCBs emissions are applicable only for EAF technology. These emissions are reported for 2011-2014. In years 2010-2014 there are remarkable increased of CO emissions due to new cement plant that use dry technology. New cement plant reported emissions are automatically measured at plant side and accredited verifier under EU ETS approves annual emissions.

4.2 Mineral products (NFR 2A)

4.2.1 Source category description

4.2.1.1 Overview

This chapter includes industrial production plants and emissions from production processes:

- NFR 2A1 Cement production – NO_x, NMVOC, SO₂, particulate matters and BC, heavy metals emissions;
- NFR 2A2 Lime production – particulate matters emissions, BC;
- NFR 2A3 Glass and glass fibre production – NMVOC, particulate matters and BC, heavy metals emissions.

4.2.1.2 Trends in emissions

Table 4.4 Change in emissions from Mineral Products in 1990-2014²⁴

	Unit	1990	1995	2000	2005	2010	2011	2012	2013	2014	Change from 1990 to 2014, %
NO_x	kt	0.902	0.237	0.226	0.358	0.483	0.934	1.464	1.497	1.766	96
NMVOC		0.155	0.042	0.041	0.072	0.022	0.026	0.014	0.013	0.019	-88
SO₂		3.409	0.896	0.853	1.354	0.070	0.374	0.321	0.167	0.149	-96
PM_{2.5}		NR	NR	0.037	0.054	0.024	0.005	0.006	0.025	0.029	-24
PM₁₀		NR	NR	0.115	0.146	0.037	0.005	0.008	0.037	0.042	-63
TSP		NR	NR	0.174	0.174	0.042	0.007	0.008	0.039	0.043	-75
BC		NR	NR	0.00093	0.00144	0.00060	0.00002	0.00006	0.00065	0.00074	-20
CO	t	NA	NA	NA	NA	0.805	3.506	3.506	2.580	2.227	176
Pb		0.074	0.017	0.012	0.038	0.027	0.027	0.027	0.027	0.027	-63
Cd		5.66E-03	1.32E-03	9.55E-04	2.94E-03	2.09E-03	2.09E-03	2.09E-03	2.09E-03	2.09E-03	-63
Hg		1.31E-04	3.06E-05	2.20E-05	6.79E-05	4.90E-05	5.17E-05	1.04E-04	6.43E-05	5.19E-05	-60

Most emissions have increased in 1990-2014 mainly due to increase of industrial production in Cement production. CO emissions have increased due to the new cement production plant that started to work in 2010 using dry process technology (Table 4.4).

All heavy metals emissions have decreased by 63.05%. Heavy metals are estimated only from glass production processes so these emissions represent total emission decrease of glass production sector. The emission levels have significantly changed in time period 1990-2014. In 2014 NO_x and CO emissions have increased by 96% and 176% comparing with 1990 due to the changes in technology of cement production. In cement plant NO_x, SO₂ and CO emissions, as well as particulates and Hg are detected automatically at

²⁴ For PMs the base year is 2000 instead of 1990

plant site. Emissions of particulates decrease for PM_{2.5}, PM₁₀ and TSP by about 24%, 63% and 75%. To reduce particulates, all mineral producers are equipped with filters.

NMVOC emissions have decreased for 88% in 2014 comparing to 1990. It is mainly due to the closure of glass production plant in 2005 and change of technology in cement plant.

4.2.2 Cement clinker production (NFR 2A1)

4.2.2.1 Overview

Under this sector NO_x, NMVOC, SO₂, PM_{2.5}, PM₁₀ and TSP, BC and heavy metals emissions are reported from Cement production sector including emissions from cement and clinker production processes.

4.2.2.2 Trends in emissions

Table 4.5 Change in emissions from Cement clinker production in 1990-2014²⁵

	Unit	1990	1995	2000	2005	2010	2011	2012	2013	2014	Change in 1990-2014, %
NO _x	kt	0.902	0.237	0.226	0.358	0.483	0.934	1.464	1.497	1.766	96
NMVOC		0.154	0.040	0.038	0.061	0.008	0.011	0.011	0.011	0.011	-93
SO ₂		3.409	0.896	0.853	1.354	0.070	0.374	0.321	0.167	0.149	-96
PM _{2.5}		NR	NR	0.0301	0.0478	0.0199	0.0007	0.0020	0.0215	0.0247	-18
PM ₁₀		NR	NR	0.0853	0.1354	0.0293	0.0011	0.0031	0.0326	0.0374	-56
TSP		NR	NR	0.1003	0.1592	0.0302	0.0025	0.0032	0.0336	0.0386	-62
BC		NR	NR	0.000903	0.001433	0.000598	0.000021	0.000061	0.000646	0.000741	-18
CO	t	NE	NE	NE	NE	0.805	1.731	3.506	2.580	2.227	176
Hg		NE	NE	NE	NE	9.5E-07	3.4E-06	0.000056	0.000016	3.6E-06	279

In 1990-2010 wet technology for cement production was used, that caused emissions increase due to different EFs.

Comparing 1990-2014 NMVOC, SO₂ and particulate matter emissions have decreased (Table 4.5) because all emissions are automatically detected in plant site and total suspended particulates are weighted and returned in further production for different types of cement.

Starting from 2010 in cement production fully dry process kiln was used. For 2009 both kiln processes - dry and wet - was used in cement production. Previously (1990 – 2009 partly) only wet process kiln was used in cement production. From year 2009 to 2010 SO₂ emissions have decreased about 95.95% due to the change of cement clinker production technology from wet to dry process kiln. As resources there are used tyres and lube oil which contains sulphur compounds, all necessary for producing clinker. NO_x are decreased about 31.34% but these data are not representative due to the new technology that started to work with full capacity only in July 2010. In 2011 and 2012 there are increased emissions from NFR 2A1 sector due to increase activity in cement production comparing with previous year. In 2013 cement production decreased about 6.57% but in 2014 increased about 3.6% Cement products are mainly exported thereby activity of cement production are directly depended on demand in external and internal market.

4.2.2.3 Methods

Tier 2 approach was used to calculate NO_x, NMVOC, SO₂ (from EMEP/CORINAIR 2007) and particulate matters emissions (from EMEP/EEA 2013) from cement production taking into account produced amount of clinker in wet process kilns and technology based EFs.

In the middle of 2009 previously operating cement production plant was closed and the new one was opened in different area. In the new facility dry process kiln is used instead of wet process kiln that was used previously in the old production plant. Therefore all emissions that are automatically measured are

²⁵ For PMs the base year is 2000 instead of 1990

reported from plant site. Starting with 2010 all emissions are reported as plant-specific and Tier 3 method are applicable for these emissions.

According to A category pollution permit there are total of 36 dedusting equipments (filters) installed in the cement production plant with total efficiency approximately 99%.²⁶ These filters mainly are designed to collect large coarse particles. Therefore, total TSP emissions are decreased by 99% due to the filters that cement plant are equipped with. TSP emissions are measured automatically in plant.

All plant data are reported and used from statistical data base „2-AIR”. Plant reported their emissions that are automatically measured at new technology plant site. For years 2010-2014 there are additional Hg emissions reported, also taken from data base „2-AIR”.

4.2.2.4 Emission factors

As the EFs for NO_x, NMVOC and SO₂ are not available in EMEP/EEA 2013²⁷ (marked as “Not Estimated”) the EFs from EMEP/CORINAIR 2007²⁸ were used as these emissions are emitted in the production process according to cement production plant (Table 4.6). EFs were divided for wet process kiln used in the first half of 2009 and for dry process kiln used starting with second half of 2009 and afterwards.

Table 4.6 EFs for cement clinker production (kt/kt)

	NO _x	NMVOC	SO ₂	PM _{2.5}	PM ₁₀	TSP
wet process kiln	0.00135	0.00023	0.0051	0.00018	0.00051	0.0006

As for years 2010-2014 data from plant is used, there is not applicable EF for new dry process technology but reported plant- specific emission data.

4.2.2.5 Activity data

The produced clinker is not weighed in cement production plant, but estimated from final cement type by multiplying it with cement/clinker ration according to data taken from cement producer annual GHG report (Figure 4.2).

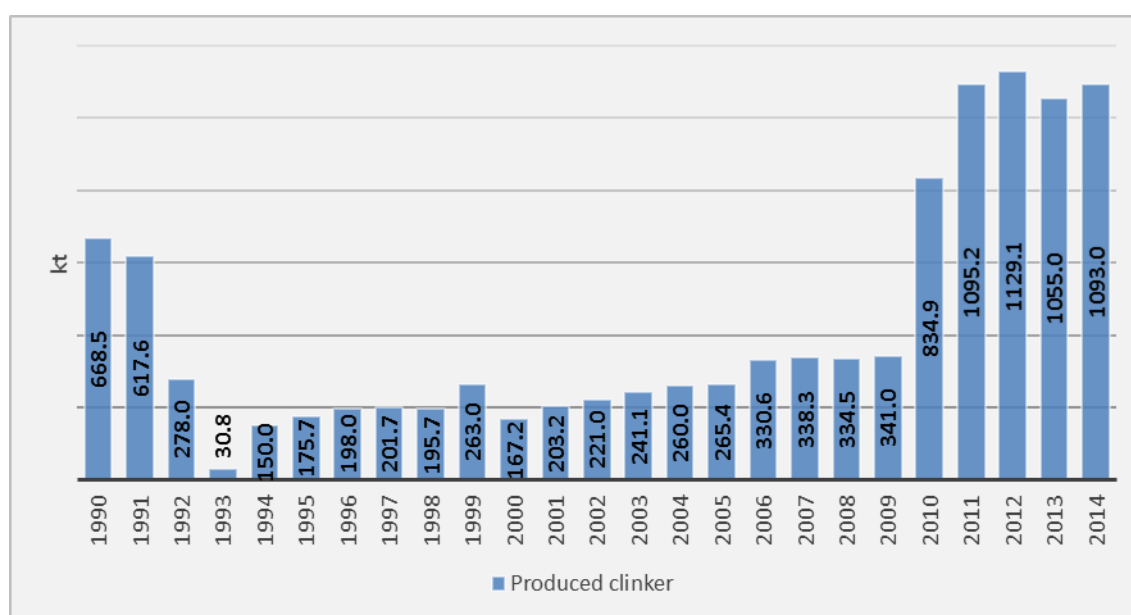


Figure 4.2 Cement production activity data in 1990–2014 (kt)

²⁶ http://old.vpvb.gov.lv/ippc/atlauja/Aatl/Cemex_meiri.pdf (page 15)

²⁷ <http://www.eea.europa.eu/publications/emep-eea-guidebook-2013/part-b-sectoral-guidance-chapters/2-industrial-processes/2-a-mineral-products/2-a-1-cement-production/view> (pages 12-13)

²⁸ <http://www.eea.europa.eu/publications/EMEPCORINAIR5/B3311vs2.4.pdf/view> (pages 12-13)

4.2.2.6 Uncertainties

Uncertainty of cement production data is assumed as 10% as clinker production data is estimated from final cement production data because produced clinker is not weighted separately before the final cement mixture is produced.

Emission factor for NFR 2A1 sector is used only for NMVOC emissions and for all other emissions in time period 1990-2009 and partially in 2010 so uncertainty of 10% is assumed. For CO, NO_x, SO₂, particulates and Hg emission factor is not applicable as these emissions are detected automatically at plant site starting from middle of 2010.

It has been concluded that up to 50% of uncertainties may be assigned to the emission estimates of most of the trace elements emitted from major point sources in Europe (Pacyna, 1994). Similar uncertainty can be assigned for emission estimates of these compounds from cement production.

4.2.2.7 QA/QC and verification

Assessment of trends have been performed. All data are checked on input mistakes to comparing calculation data base with input data in NFR tables in all time series. All figures and tables represented in IIR 2016 are made based on final completed NFR data table.

4.2.2.8 Recalculations

No recalculations have been carried out.

4.2.2.9 Planned improvements

No improvements are planned for the next submission.

4.2.3 Lime production (NFR 2A2)

4.2.3.1 Overview

Under this sector PM_{2.5}, PM₁₀ and TSP and BC emissions from direct lime production and lime production in Iron & Steel production are reported as these emissions are estimated based on total produced quicklime (CaO) data.

In Iron & Steel production facility lime necessary for steel smelting in open heart furnaces is produced only from limestone in vertical shaft kiln.

4.2.3.2 Trends in emissions

Table 4.7 Emissions from Lime production in 1990-2014²⁹

	Unit	2000	2005	2010	2011	2012	2013	2014	Change in 1990-2014, %
PM _{2.5}	kt	5.53E-03	6.13E-04	5.16E-04	5.61E-06	1.67E-05	1.49E-05	2.49E-05	-99.55
PM ₁₀		2.76E-02	4.09E-03	3.44E-03	3.74E-05	1.12E-04	9.92E-05	1.66E-04	-99.40
TSP		7.10E-02	8.17E-03	6.88E-03	7.48E-06	2.23E-05	1.98E-04	3.32E-05	-99.95
BC		2.54E-05	2.82E-06	2.38E-06	2.58E-08	7.70E-08	6.85E-08	1.15E-07	-99.55

In 1990-2004 reported emissions are calculated with uncontrolled emission process EF from lime production processes and 2005-2014 emissions with controlled emission process EFs.

For the most sectors emissions in 2008-2009 have decreased significantly due to the economical crisis (Table 4.7). There are increased emissions from lime production due to overall increasing of activity in Industrial processes. In 2011, emissions of produced lime, that are used for metal production, are decreased due to technology change of metal production as plant switched to steel production in EAF (Electric arc furnace) only and operation of this plant was partially suspended due to reconstruction in this year. In 2012 there are increased emissions of particulate matters about 21.81% comparing with 2011 that is explained

²⁹ For PMs the base year is 2000 instead of 1990

with overall activity increase in this sector and fact that Metal production plant works with full capacity again. In 2013 there is a remarkable decrease of emissions from lime production sector due to changes in operation of metal plant that is on the edge of bankruptcy and the plant is not operating a whole year but only 5-10 months. In 2014 steel production plant didn't use any limestone or dolomite because plant was operating only one day for experimental reason.

4.2.3.3 Methods

Tier 2 approach was used to estimate particulate matters and BC emissions from lime production processes. Only particulate matters emissions and BC were estimated from lime production. There are three lime production plants. Two of them are direct lime production plant where in one lime is produced from dolomite and in other the lime is produced from limestone. Lime is also produced in iron and steel plant where it is then directly used in steel production process as result non-marketed quicklime is produced in Iron and steel production plant.

4.2.3.4 Emission factors

All 3 lime production plants have A category pollution permits since 2005 the facilities must have best available technology (BAT) installed and the emissions from the production processes have to be controlled. Therefore controlled EFs from EMEP/EEA 2013 for particulate matters and BC are used for time period 2005-2014. For time period 1990-2004 the uncontrolled EFs from EMEP/EEA 2013 are used to estimate particulate matters and BC emissions.

Following emission factors from EMEP/EEA 2013 to estimate particulate matters emissions and BC are used (Table 4.8).

Table 4.8 Emission factors for lime production in 1990–2014 (kt/kt)

	PM _{2.5}	PM ₁₀	TSP
Lime (total production) 1990-2005	0.0007	0.0035	0.009
Lime (total production) 2005-2014	0.00003	0.0002	0.0004

4.2.3.5 Activity data

Activity data of produced lime in steel production company is taken from plant's GHG reports within ETS (Figure 4.3).

Unfortunately the data of produced lime in direct lime production plants is not available due to confidentiality. These data are re-estimated backwards taking into account the approximate percentage of the lime that is produced by using stated amount of raw materials.

The information of technology used in lime production is available:

- in the first facility lime is produced only from limestone and there are 3 shaft-type kilns installed in facility;
- in the second facility lime is produced only from dolomite using shaft-type kilns;
- in the iron and steel production facility lime necessary for steel smelting in open hearth furnaces is produced only from limestone in vertical shaft kiln.

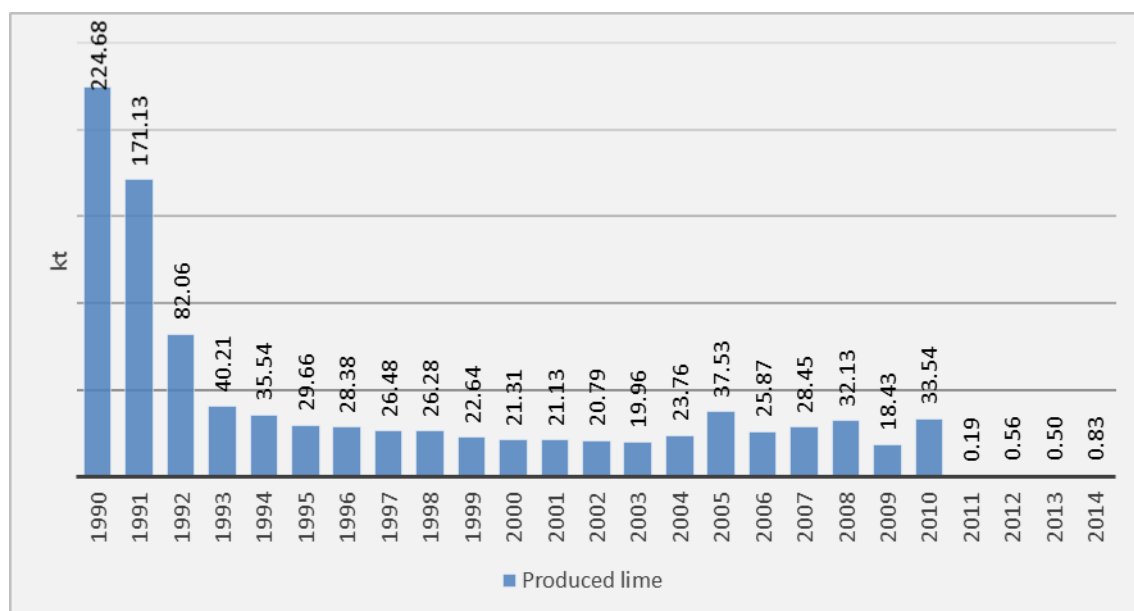


Figure 4.3 Lime production activity data in 1990–2014 (kt)

In 2011 production was stopped in one of the largest lime production plants due to preparation of implementing the highest BAT.

4.2.3.6 Uncertainties

Although according to IPCC GPG 2000 the uncertainty of non-marketed lime production data could reach 100% and more, it is assumed that the uncertainty of activity data for non-marketed lime production in NFR 2A2 sector is 2% as only one plant specific data verified by accredited verifier and approved by Regional Environmental Board is used.

As default emission factors for lime production from IPCC GPG 2000 as well as Monitoring reporting Guidelines (MRG³⁰) are used. Uncertainty is assumed 50% due to unavailable plant specific data of produced lime and because this is default emission factor for quicklime production.

4.2.3.7 QA/QC and verification

Assessment of trends has been performed. All data are checked on input mistakes comparing calculation database with input data in NFR tables in all time series. All figures and tables represented in IIR 2016 are made based on final completed NFR data table.

4.2.3.8 Recalculations

In 2011 and 2012 recalculations were made in sector 2.A.2 for particulate matters and BC emissions due to input mistake of activity data. In 2012 was no activity in one of the lime production plant.

4.2.3.9 Planned improvements

No improvements are planned for the next submission.

4.2.4 Glass production (NFR 2A3)

4.2.4.1 Overview

In this sector particulate matter and heavy metals emissions come from use of additional raw materials in glass production plants. Emissions from fluorspar, potash, soda and witherite (barium carbonate), are

³⁰ Commission Regulation (EU) No 601/2012 of 21 June 2012 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council

reported, as well as NMVOC emissions from glass production and glass fibre production reported by production facilities.

4.2.4.2 Trends in emissions

Table 4.9 Emissions from Glass production in 1990-2014³¹

	Unit	1990	1995	2000	2005	2010	2011	2012	2013	2014	Change in 1990-2014, %
NMVOC	kt	0.00128	0.00158	0.00273	0.01138	0.01404	0.01539	0.00224	0.00257	0.00759	493
PM_{2.5}		NR	NR	0.00176	0.00543	0.00386	0.00386	0.00386	0.00386	0.00386	119
PM₁₀		NR	NR	0.00198	0.00611	0.00435	0.00435	0.00435	0.00435	0.00435	119
TSP		NR	NR	0.00220	0.00679	0.00483	0.00483	0.00483	0.00483	0.00483	119
BC		NR	NR	2.62E-10	8.08E-10	5.75E-10	5.75E-10	5.75E-10	5.75E-10	5.75E-10	119
Pb	t	0.0741	0.0173	0.0125	0.0385	0.0274	0.0274	0.0274	0.0274	0.0274	-63
Cd		0.00566	0.00132	0.00095	0.00294	0.00209	0.00209	0.00209	0.00209	0.00209	-63
Hg		0.000131	0.000031	0.000022	0.000068	0.000048	0.000048	0.000048	0.000048	0.000048	-63

NMVOC emissions from year 1997 to 2014 were taken from national database "2-AIR" where glass fibre production plant reported its emissions divided by NMVOC sub-type (Table 4.9). For time period 1990-1996 only butylacetate data is available from glass fibre production company's application for GHG permit within EU ETS. For year 2005 also glass production company had reported its NMVOC emissions but since then glass is no longer produced in Latvia, thereby NMVOC emissions from glass production are reported only for 2005.

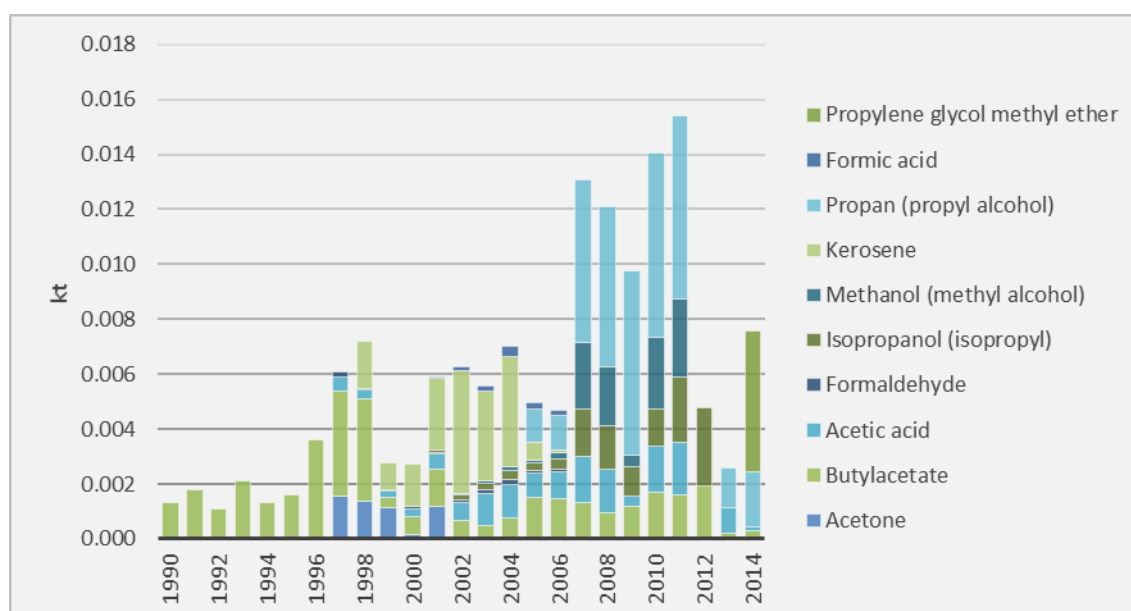


Figure 4.4 NMVOC emissions from glass fibre production in 1990–2014 (kt)

Use of potash as well as NMVOC emissions from glass production stopped in 2005 when one of the glass production plant suspended its activity but in the other glass production plants raw materials are used (Figure 4.4). Use of witherite occurred only in 2005-2007 in glass production manufacturing plant but in 2008 and 2009 the plant suspended its activity. Since 2005 NMVOC emissions are emitted from glass fibre production but in smaller amounts.

³¹ For PMs the base year is 2000 instead of 1990

In 2013 only butylacetate, acetic acid and propane was used in glass production. In 2014 propylene glycol methyl ether was used in glass production that was not used before, it resulted with additional 0.007 kt NMVOC emissions and it is about 195.5% more than 2013.

4.2.4.3 Methods

EFs of particulate matters and heavy metals were taken from EMEP/EEA 2013 for Tier 1 approach.

NMVOC emissions were taken from national database "2-AIR" where glass fibre production plant has reported its NMVOC emissions therefore no EF was used.

4.2.4.4 Emission factors

To estimate particulate matter emissions, EF from EMEP/EEA 2013 are used (Table 4.10).

Table 4.10 Emission factors for glass production

	PM _{2.5}	PM ₁₀	TSP	BC	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
	kt/kt				t/t								
Glass production	0.00024	0.00027	0.0003	0.062% of PM _{2.5}	0.0017	0.00013	0.000003	0.00019	0.00023	0.000007	0.00049	0.0008	0.00037

4.2.4.5 Activity data

Emissions from additional raw materials used in glass production plants – fluorspar, potash, soda and witherite (barium carbonate) are used as activity data to estimate heavy metals and particulate matters from glass production plants (Figure 4.5).

Emissions from Glass fibre production are estimated taking into account NMVOC emissions as activity data due to the fact that there is no data about used raw materials but plant report NMVOC emissions.

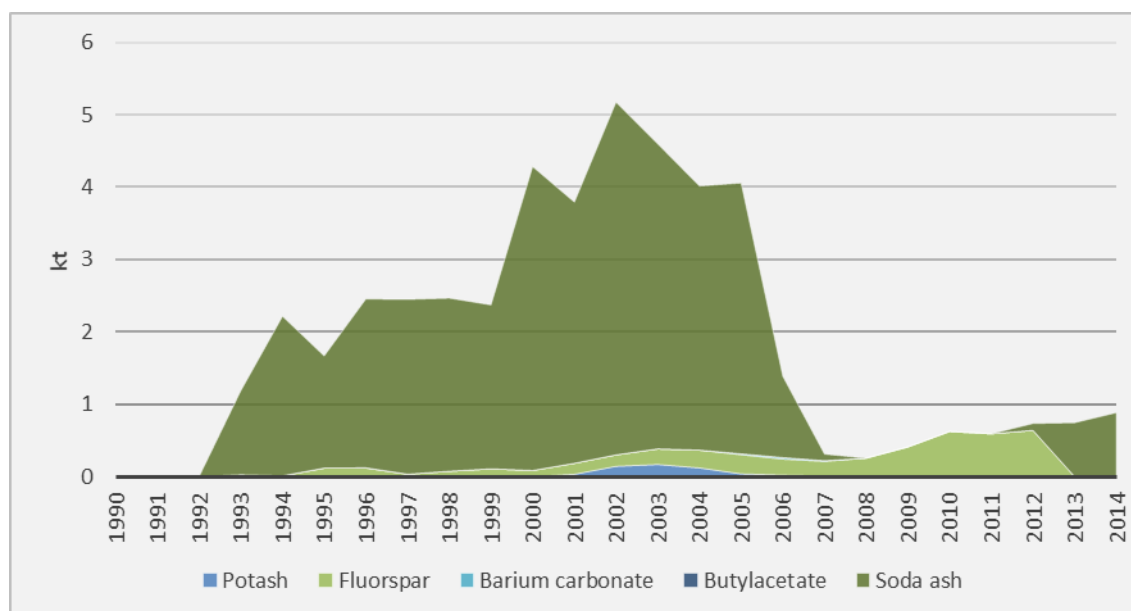


Figure 4.5 Activity data for raw materials use in glass production in 1990-2014 (kt)

4.2.4.6 Uncertainties

The uncertainty of activity data for this sector is assumed as 2% as plant specific reported data is used. Accredited verifiers and Latvia's Regional Environmental Boards verify the activity data reported in production plant's annual GHG reports within ETS so the activity data is adequately verified.

EFs for this sector are taken from glass production plant so the uncertainty could be assumed as quite low. Still the estimation of the emission factors can't be adequately verified so the uncertainty is assumed as quite high – 60%, according to 2006 IPCC Guidelines.

4.2.4.7 QA/QC and verification

Assessment of trends have been performed. All data are checked on input mistakes by comparing calculation data base with input data in NFR tables in all time series. All figures and tables represented in IIR 2016 are made based on final completed NFR data table.

4.2.4.8 Recalculations

No recalculations have been carried out.

4.2.4.9 Planned improvements

No improvements are planned for the next submission.

4.3 Chemical industry (NFR 2B)

4.3.1 Overview

Although there are strong traditions of the chemical industry in Latvia there are nonchemical industry production processes listed in 2006 IPCC Guidelines and EMEP/EEA 2013 that generate emissions.

The biggest part of chemical industry is medicine production and smaller part of paint and varnishe production.

Under this sector particulate matters emissions from phosphate fertilizers is reported.

All available data and emissions from chemical and pharmaceutical production are reported and described under sector 2D3g - Chemical products.

4.3.2 Trends in emissions

Particulate matters emissions from phosphate fertilizers were estimated and reported in 2B10a sector but only for years 2008-2014 as activity data for previous years are not available because for years 1999-2008 they are marked as "confidential" in national statistics (Table 4.11).

Table 4.11 Particulate matter emissions from Chemical Industry in 2008-2014

	Unit	2008	2009	2010	2011	2012	2013	2014	Trend in 2008-2014, %
PM _{2.5}	kt	0.00001287	0.000756	0.000866	0.002541	0.000129	0.000304	0.000138	970
PM ₁₀		0.00001716	0.001008	0.001155	0.003387	0.000172	0.000406	0.000184	970
TSP		0.00002145	0.00126	0.001443	0.004234	0.000215	0.000507	0.00023	970

4.3.3 Methods

Tier 1 method from EMEP/EEA 2013 was used to calculate emissions from phosphate fertilizers production. Calculation of all emissions is done in Excel databases developed by experts from LEGMC.

4.3.4 Emission factors

Particulate matter emission factors are taken from EMEP/EEA 2013 (Table 4.12).

Table 4.12 Emission factors for phosphate fertilizers (kt/kt)

PM _{2.5}	PM ₁₀	TSP
0.00018	0.00024	0.0003

4.3.5 Activity data

Activity data that is obtained from enterprises and collected in Latvia's Chemical Substances Registry are used for emission estimation.

Table 4.13 Activity data of phosphate fertilizers in 2008-2014 (kt)

	Used phosphate fertilizers
2008	0.072
2009	4.200
2010	4.811
2011	14.114
2012	0.715
2013	1.690
2014	0.765

4.3.6 Uncertainties

No specific issues for activity data and emission factors in Chemical industry.

4.3.7 QA/QC and verification

Assessment of trends have been performed. All data are checked for input mistakes comparing calculation data base with input data in NFR tables in all time series. All figures and tables represented in IIR 2016 are made based on final completed NFR data table.

Data from Chemical substance registry at LEGMC is checked according to Safety data sheet comparing information in this sheet and enterprise reported information. Information is checked on data entry mistakes or uncertainties of defining substances before expert have entered this data in Chemical substance registry. Data is not validated of quantitative amount for several substances report by enterprises only in case there are obvious mistake between last years.

4.3.8 Recalculations

No recalculations have been carried out.

4.3.9 Planned improvements

There are plans to obtain and analyse historical data trends even for those years that are confidential according to CSB. These improvements will give more complete time series in sector 2B10a for time period back to 2008. At the moment in progress is process of implementing online system for reporting substances in Chemical substance registry. For Submission 2017 it is planned to gather more complete historical data as far as possible and obtain a reasonable data for extrapolation.

4.4 Metal production (NFR 2C)

4.4.1 Overview

Emissions from crude iron as input material in iron and steel production in open-hearth furnaces as well as crude iron used in electric arc furnaces are included in the inventory according to IPCC GPG 2000 unlike scrap metal, used in crude steel production, which is excluded from inventory report. The indirect GHG emission sources are included under iron and steel production too.

4.4.2 Trends in emissions

Emissions of NMVOC, CO, NO_x and SO₂ gases as well as emissions of particulate matters, heavy metals and dioxins are reported under 2C1 Iron and Steel production sector (Table 4.14).

Table 4.14 Emissions from Metal production in 1990-2014³²

	Unit	1990	1995	2000	2005	2010	2011	2012	2013	2014	Trend in 1990-2014, %
NO_x	kt	2.805	1.425	2.551	2.827	2.730	0.022	0.109	0.025	1.20E-05	-100.000

³² For PMs the base year is 2000 instead of 1990

	Unit	1990	1995	2000	2005	2010	2011	2012	2013	2014	Trend in 1990-2014, %
NM VOC		0.011	0.006	0.010	0.011	0.011	0.008	0.038	0.009	4.26E-06	-99.961
SO₂		0.088	0.045	0.080	0.089	0.086	0.010	0.050	0.012	5.55E-06	-99.994
PM_{2.5}		NR	NR	0.300	0.333	0.321	0.004	0.018	0.004	1.94E-06	-99.999
PM₁₀		NR	NR	0.400	0.443	0.428	0.004	0.020	0.005	2.22E-06	-99.999
TSP		NR	NR	0.500	0.554	0.535	0.005	0.025	0.006	2.78E-06	-99.999
BC		NR	NR	0.007	0.008	0.008	0.000	0.000	0.000	6.99E-09	-100.000
CO		5.50E-04	2.79E-04	5.00E-04	5.54E-04	5.35E-04	2.85E-07	1.42E-06	3.28E-07	1.57E-07	-99.971
Pb	t	0.170	0.084	0.150	0.166	0.161	0.000	0.002	0.001	2.41E-07	-100.000
Cd		4.40E-04	2.23E-04	4.00E-04	4.43E-04	4.28E-04	3.35E-05	1.67E-04	3.86E-05	1.85E-08	-99.996
PCDD/PCDF	g i- Teq	3.69E-05	1.87E-05	3.35E-05	3.71E-05	3.59E-05	5.03E-04	2.51E-03	5.80E-04	2.78E-07	-99.247
PAHs	t	5.50E-06	2.79E-06	5.00E-06	5.54E-06	5.35E-06	8.05E-05	4.01E-04	9.27E-05	4.44E-08	-99.193
PCBs	kg	NA	NA	NA	NA	NA	4.19E-06	2.09E-05	4.83E-06	2.31E-09	-99.945

One of the biggest decrease in emissions occurred in time period 1990–1991 due to crisis in Latvia's national economy. Crisis in late 90-ties was caused by economic crisis in Russia and it reflected in decrease of demand of products from Metal Production sector. Also final amount of steel products produced in the only metal industry facility decreased in latest years.

Main decrease of emission trend occurred in early 90ties can be explained with economical situation in industry during this period. Since 1995 emissions were increasing due to increase in metal production. Emissions slightly decreased from 2004 to 2005 by 0.5% that is explained with decrease in production of steel, because production was affected by economic situation and decrease in demand of product in national and international market.

In 1990-2007 emissions have increased by 1.5% and decreased by 5% in 2007-2008 that can be explained with economic crisis that begun in the second part of 2008. The emissions continued to decrease by 16.97% in 2008-2009.

Emissions in 2010 have increased by 21.55% compared to 2009. In 2011 can observed remarkable decrease (about 68.60%) of all emissions from Metal production sector due to changes in technology used in Metal production plant when steel production process was stopped after a semester. The plant switched their technology from Open hearth furnace (OHF) to Electric arc furnace (EAF). In 2011 Metal production plant went under reconstruction as a result amount of steel produced in EAF and OHF decreased for 75.11% and 68.67%.

In 2012 all emissions from Metal production sector increased after plant reconstruction. Comparing year 2012 with base year particulate matter emissions have increased by 67.18%. NO_x, NMVOC, SO₂ and heavy metals increased about 52.07%. In 2013 production plant operated for 5-7 months that is why there is noticeable decrease of produced steel amount and produced emissions. Comparing emission trend with base year there are remarkable decrease in all emissions, except PCDD/PCDF, PAHs and PCBs emissions that were additionally calculated on Submission 2016 for Metal production sector. PCBs emissions are applicable only from 2011 as there are all crude steel produced in EAF. PCDD/PCDF and PAHs emissions have increased so remarkably because these emissions are calculated with quite higher EFs that are applicable for EAF technology. In 2014 steel production plant worked only one day for experimental reason and at the moment plant is in process of insolvency.

4.4.3 Methods

Tier 2 method from EMEP/EEA 2013 was used to calculate emissions from steel production. Calculation of all emissions is done with Excel databases developed by experts from LEGMC.

4.4.4 Emission factors

Emission factors for NO_x, CO and SO₂ emissions are taken from EMEP/CORINAIR 2007 for 1990-2010 because EFs are not available in EMEP/EEA 2013 for OHF technology. Particulate matters and heavy metals

emission factors are taken from EMEP/EEA 2013. According to methodology for estimations of emissions from processes in OHF, where 95% of total steel production is produced, EFs for 1990-2010 taken from EMEP/EEA 2013 are applicable. After 2011 all crude steel was produced in EAF and EFs applicable to this production technology are taken from EMEP/EEA 2013.

Table 4.15 Emission factors for Iron and Steel production

	Unit	EF for 1990-2010	EF for 2011-2014
NO _x	kt/kt	0.0051	0.00013
NM VOC		0.00002	0.000046
SO ₂		0.00016	0.00006
PM _{2.5}		0.0006	0.000021
PM ₁₀		0.0008	0.000024
TSP		0.001	0.00003
BC	% of PM _{2.5}	2.4	0.36
CO	kt/kt	0.000001	1.7E-09
Pb	t/t	0.0003	0.0000026
Cd		0.0000008	0.0000002
Hg		0.00000005	0.00000005
As		0.00003	0.00000015
Cr		0.0000023	0.0000001
Cu		0.0000003	0.00000002
Ni		0.00001	0.0000007
Zn		0.00001	0.0000036
PCDD/F		6.7E-08	0.000003
Total 4 PAHs		0.01	0.00000048
PCB		NA	0.00000025

4.4.5 Activity data

Activity data were taken from the CSB and enterprises. Activity data on production and output by manufacturing companies are freely available until 1999. CSB gives only restricted information on production and output of goods since 1999, the information is classified as confidential. LEGMC has signed an agreement with CSB to receive data about total production of products from sectors whose data are confidential. Still as industrial producers are participants in the EU ETS the GHG reports of these enterprises have to be freely available.

The GHG reports of EU ETS operators are published on LEGMC home page. The data source of the activity data is industrial producers and the confidentiality rules no longer apply.

Latvia has simpler situation in activity data from 2C1 Metal Production because there is only one steel producer and it participates in EU ETS. It is possible to obtain more accurate and complete activity data and emission factors from enterprise that is involved in the emission trading system (Figure 4.6).

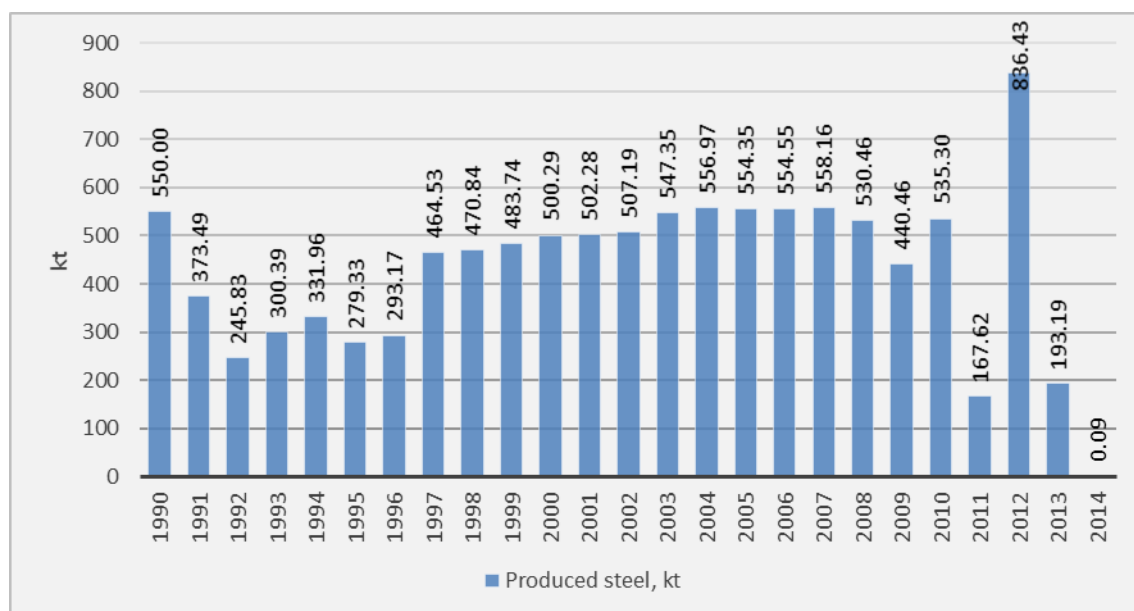


Figure 4.6 Steel production activity data in 1990–2014 (kt)

After going through a crisis in 2008-2009, there was increase in all emissions from Metal production in 2010. There are sharp decrease of emissions in 2011 due to change in technology of metal production, and decrease in amount of steel produced in EAF (about 75.11%) and steel produced in OHF (about 68.67 %). Since mid-2011 the OHF is not used anymore in this company. At the end of 2010 installation was dismantled and new one was set up. In 2011 plant was working for 4 months. All crude steel was produced from crude iron and scrap metal in EAF. In 2011-2013 all crude steel was produced in EAF and plant was not operating a full year but only for 4-7 month in these years. In 2012 sharp increase of produced crude steel can be observed as new technology was implemented, but production plant operated for 7 month with full capacity. In 2014 steel production plant works only one day for experimental reason and produced 0.093 kt of steel.

4.4.6 Uncertainties

Only one enterprise operates in iron and steel industry category in Latvia and this company reports data of production and raw materials used in production processes. Used raw materials data divided by technological processes are not available and are estimated by using approximate percentage. So the uncertainty of activity data of iron and steel industry is assumed 25%.

Uncertainty of emission factors taken from EMEP/EEA 2013 methodologies is assigned as 20 % so it is appropriate for OHF and EAF in iron and steel industry in Latvia.

4.4.7 QA/QC and verification

Assessments of trends have been performed. Data is checked on input mistakes by comparing calculation data base with input data from NFR tables in all time series. All figures and tables represented in Submission 2016 are made based on final completed NFR data table.

4.4.8 Recalculations

No recalculations have been carried out.

4.4.9 Planned improvements

No improvements are planned for the next submission.

4.5 Other solvent and product use (NFR 2D-2L)

4.5.1 Source category description

4.5.1.1 Overview

Other solvent and product use sector includes indirect emissions from:

- 2D3a Domestic solvent use including fungicides;
- 2D3b Road paving with asphalt;
- 2D3c Asphalt roofing;
- 2D3d Coating applications;
- 2D3e Degreasing;
- 2D3f Dry cleaning;
- 2D3g Chemical products;
- 2D3h Printing;
- 2D3i Other solvent and product use;
- 2 G Other product use (tobacco, fireworks);
- 2H1 Pulp and paper industry;
- 2H2 Food and beverages industry.

Under this sector there was made research on pulp and paper sector as there are two producers that are reporting activity data with the PRODCOM code 17.11.14.00.00 - manufacture of pulp. According to available information these two manufactures have changed their activity and there are no information about raw materials that could be produced or imported.

4.5.1.2 Trends in emissions

Table 4.16 Emissions from Other solvent and product use in 1990-2014³³

	Unit	1990	1995	2000	2005	2010	2011	2012	2013	2014	Change in 1990-2014, %
NMVOC	kt	31.10	27.88	26.71	25.59	21.12	22.73	26.43	26.17	25.35	-19
SO₂		0.0732	0.0031	NO	NO	NO	NO	NO	NO	NO	-100
PM_{2.5}		NR	NR	0.213	0.475	0.394	0.589	0.632	0.505	0.505	137
PM₁₀		NR	NR	1.218	3.239	2.617	4.103	4.392	3.483	3.580	194
TSP		NR	NR	5.463	14.912	12.007	18.947	20.273	16.059	16.506	202
BC		NR	NR	0.009	0.024	0.019	0.030	0.033	0.026	0.026	204
CO		0.131	0.123	0.119	0.099	0.101	0.092	0.103	0.091	0.096	-27

Coating application sector (NFR 2D3d) was the largest pollution source of NMVOC emissions under Other solvent and product use in 2014 and it covered 36.8% off all NMVOC emissions. The NMVOC emissions from Solvent Use sector have constantly decrease since the beginning of 90ties till 2006 mostly due to the industry going through a crisis. The sharp emission increase in 2007 can be explained with growth in import of NMVOC containing products. In subsequent years decrease can be observed back till 2009. At the end of 2008 the world was struck by the economic crisis which also affected the Solvent Use sector in Latvia. During the period of 2009 till 2012 NMVOC emissions of Solvent Use sector gradually increased by 22%. Slight decrease in trends of NMVOC emissions from Solvent Use sector can be observed in later years. For instance, emissions of NMVOC have decreased by 4.2%, from 25.05 kt NMVOC in 2012 to 23.99 kt NMVOC in 2014 (Table 4.16).

The emissions from Asphalt roofing and Road paving with asphalt sectors are constantly increasing since the beginning of 90ties. Slight emission decrease in 1999-2000 is explained with the change of percentage that is used to divide activity data used in roofing and road paving. Sharp emission increase in 2003-2004 is explained with availability of funding from EU which was the main reason why the road paving works

³³ For PMs the base year is 2000 instead of 1990

increased before and afterwards. In that particular year Via Baltic that connects the capitals of all Baltic States was built. According to CSB one particular road contractor has quite large amount of bitumen mixtures imported and used. That particular contractor was working on the Via Baltic highway. In the next years road paving activities decreased but not to the level before 2004. Due to Latvia is participant in EU since 2004 financial resources from EU projects are available for national infrastructure projects. Activity in road paving and building is depended on demand in country and on financial resources in these sectors.

4.5.2 Road paving with asphalt and Asphalt roofing (NFR 2D3b, 2D3c)

4.5.2.1 Overview

In this sector NMVOC, particulate matter, BC and CO emissions from construction materials production as well as road paving activities are reported.

According to CSB information the biggest part of NMVOC and other emissions occurs during road paving with asphalt. Just a small part of all bitumen mixtures are used in asphalt roofing sector.

4.5.2.2 Trends in emissions

Table 4.17 Emissions from Asphalt roofing and Road paving in 1990-2014³⁴

	Unit	1990	1995	2000	2005	2010	2011	2012	2013	2014	Trend in 1990-2014, %
NMVOC	kt	0.00151	0.00567	0.012	0.032	0.026	0.041	0.043	0.034	0.035	2236
PM_{2.5}		NR	NR	0.156	0.429	0.345	0.545	0.583	0.462	0.475	204
PM₁₀		NR	NR	1.161	3.192	2.568	4.059	4.343	3.439	3.535	204
TSP		NR	NR	5.406	14.866	11.958	18.904	20.224	16.016	16.460	204
BC		NR	NR	0.0087	0.0239	0.0192	0.0304	0.0325	0.0258	0.0265	204
CO		7.41E-05	0.000222	0.000402	0.00111	0.00089	0.00141	0.00151	0.00119	0.00123	1554

The emissions from these two particular sectors are constantly increasing since the beginning of 90ties. Slight emission decrease in 1999-2000 is explained with the change of percentage that is used to divide activity data used in roofing and road paving. Sharp emission increase in 2003-2004 is explained with construction works of Via Baltic which connects capitals of the Baltic states. As it is explained previously there are increasing trend of emissions from road paving and asphalt roofing activity in 2010. In 2011 and 2012 increased amount of activity data used for road paving and asphalt roofing about 58.08% and 6.99% respectively. In 2013 all emissions have decreased by about 20.81% and that was strictly influenced by road construction and building activity. In 2014 there are increased road paving activity about 2.7%.

4.5.2.3 Methods

EMEP/EEA 2013 Tier 1 approach was used to estimate NMVOC emissions from the 2D3c. Asphalt roofing and 2D3b Road Paving with Asphalt. According to CSB the biggest part of bitumen mixtures amount is used for road paving. Only a small part is used for roofing activities.

NMVOC emissions are estimated using simpler default methodology:

$$E_{NMVOC} = AD_{bitumen} \times EF_{NMVOC}$$

where:

E_{NMVOC} – NMVOC emissions (kt)

$AD_{bitumen}$ – bitumen and bitumen mixtures used in 2D3b and 2D3c activities (kt)

EF_{NMVOC} – NMVOC emission factor (kt/kt)

³⁴ For PMs the base year is 2000 instead of 1990

4.5.2.4 Emission factors

Default CO and NMVOC, as well as particulate matter and BC emission factors are taken from EMEP/EEA 2013. Due to lack of information about the technology used Tier 1 EFs was implemented (Table 4.18).

Table 4.18 Emission factors for asphalt roofing and road paving

	CO	NMVOC	PM _{2.5}	PM ₁₀	TSP	BC
Unit	kt/kt	kt/kt	kt/kt	kt/kt	kt/kt	% of PM _{2.5}
Asphalt Roofing	0.0000095	0.00013	0.00008	0.0004	0.0016	5.7
Road Paving with Asphalt	NE	0.000016	0.0004	0.003	0.014	0.013

4.5.2.5 Activity data

The activity data to calculate NMVOC emissions from road paving and asphalt roofing are taken from the CSB (Table 4.19). For previous submissions the amount of bitumen was used as activity data but starting with year 2000 the amount of bitumen mixtures was used as activity data. According to CSB the bitumen mixtures includes:

- Asphalt bitumen that usually consists of 60% or more of bitumen and solvent. Used for highway paving;
- Emulsion – or a solid asphalt, bitumen, pitch, tar suspensions in water that are used especially in highway paving;
- Asphalt mastic and other bitumen resins, and similar bituminous mixtures that include minerals such as sand or asbestos;
- Products that are sintered in blocks and that are repeatedly melted before use.

According to information provided by CSB the biggest part of bitumen mixtures is used for road paving. According to 2006 IPCC Guidelines typically 80-90% of bitumen is used for road paving materials.³⁵ Latvia before the beginning of 90ties was part of former USSR and was going through the economic transition phase, it was assumed that 80% is used for road paving and remaining is used for asphalt roofing till 2000. After 2000 it is assumed that 90% was used for road paving.

Table 4.19 Activity data for road paving with asphalt and asphalt roofing production

	Amount of bitumen mixtures used (kt)	% of asphalt used for road paving	% of asphalt used for roofing	Road Paving With asphalt (kt)	Asphalt roofing (kt)
1990	39.00	80%	20%	31.20	7.80
1991	12.60	80%	20%	10.08	2.52
1992	2.10	80%	20%	1.68	0.42
1993	58.93	80%	20%	47.14	11.79
1994	125.63	80%	20%	100.50	25.13
1995	116.99	80%	20%	93.59	23.40
1996	214.81	80%	20%	171.85	42.96
1997	225.00	80%	20%	180.00	45.00
1998	225.53	80%	20%	180.43	45.11
1999	334.81	80%	20%	267.85	66.96
2000	423.64	90%	10%	381.28	42.36
2001	495.70	90%	10%	446.13	49.57
2002	558.42	90%	10%	502.58	55.84
2003	625.67	90%	10%	563.11	62.57
2004	3651.96	90%	10%	3286.76	365.20
2005	1165.02	90%	10%	1048.51	116.50

³⁵ http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/3_Volume3/V3_5_Ch5_Non_Energy_Products.pdf (page 5.14)

	Amount of bitumen mixtures used (kt)	% of asphalt used for road paving	% of asphalt used for roofing	Road Paving With asphalt (kt)	Asphalt roofing (kt)
2006	1116.70	90%	10%	1005.03	111.67
2007	1492.52	90%	10%	1343.27	149.25
2008	1536.66	90%	10%	1382.99	153.67
2009	838.45	90%	10%	754.60	83.84
2010	937.18	90%	10%	843.46	93.72
2011	1481.48	90%	10%	1333.33	148.15
2012	1584.97	90%	10%	1426.48	158.50
2013	1255.14	90%	10%	1129.62	125.51
2014	1289.97	90%	10%	1160.97	129.00

As mentioned before in 2004 sharp increase of bitumen mixtures use can be observed that is explained with large amount of road paving works before Latvia's acceptance to EU and after, when EU financial instruments became available (Table 4.19). In 2004 Via Baltic was build it connects all Baltic states. Amount of materials used and emissions produced in this sector are strictly depending on activity in road construction and building.

4.5.2.6 *Uncertainties*

Uncertainty of activity data for estimations of emissions from 2D3c Asphalt roofing sector and 2D3b Road Paving with Asphalt sector is assumed rather low as CSB data of used bitumen mixtures is used and the percentage of IPCC 2006 Guidelines is used to divide bitumen use for roofing and paving activities. As it is not clear how much of the total bitumen is used for asphalt paving and for asphalt roofing (bitumen use in construction sector) the uncertainty is assumed as at least 20%.

The emission factors for 2D3c and 2D3b sectors are assumed as high as 70% because default emission factors are used. The uncertainty of indirect emission factors for these two sectors are taken from EMEP/EEA 2013 and Tier 1 EFs is assumed as high as 50% due to the default emission factors that are used.

4.5.2.7 *QA/QC and verification*

Assessment of trends have been performed. All data are checked on input mistakes by comparing calculation data base with input data from NFR tables in all time series. All figures and tables represented in IIR 2016 are made based of final completed NFR data table.

4.5.2.8 *Recalculations*

No recalculations have been carried out.

4.5.2.9 *Planned improvements*

No improvements are planned for the next submission.

4.5.3 Solvent use (NFR 2D3a, 2D3d, 2D3e, 2D3f, 2D3h, 2D3i)

4.5.3.1 *Overview*

Use of solvents and products containing solvents results in emissions of non-methane volatile organic compounds (NMVOC). The largest share of total NMVOC emissions was for Coating application (NRF 2D3d) – 36.8% under Other solvent and product use (Figure 4.7).

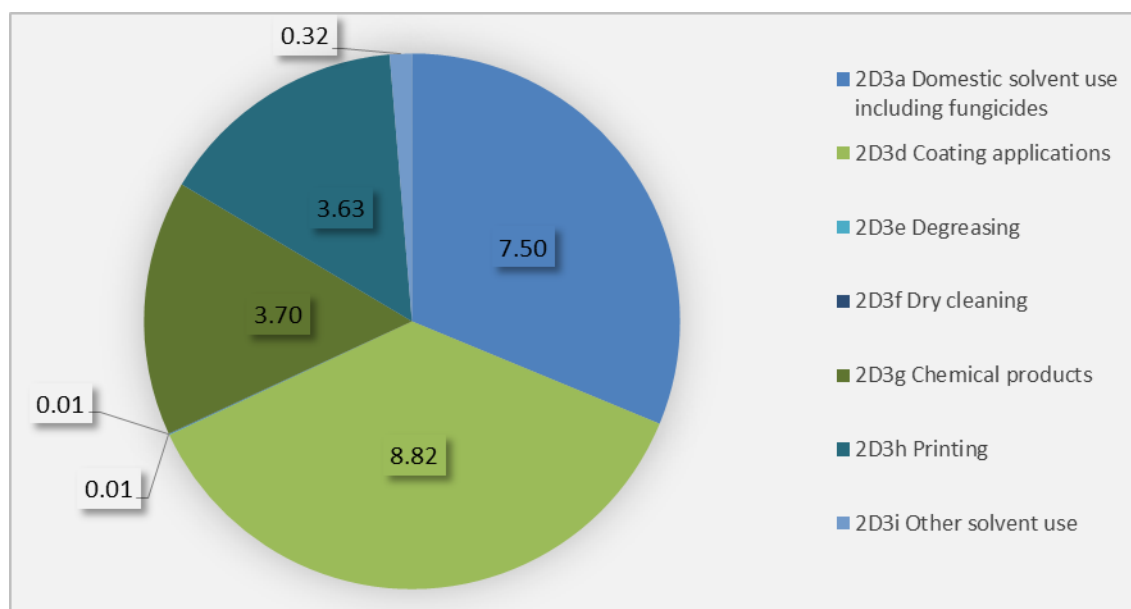


Figure 4.7 Distribution of NMVOC emissions in Other solvent and product use sector in 2014 (kt)

Domestic solvent use including fungicides (NRF 2D3a) comprises NMVOC emissions from a number of product categories, for instance, cosmetics & toiletries, household products, construction and car care products. *Coating applications* (NRF 2D3d) includes paints and varnishes from *Decorative coating application* (paints for architectural application by construction enterprises and professional painters as well as by private consumers), *Industrial coating application* (paint application for manufacture automobiles, car repairing, coil coating, boat building, wood as well as other industrial paint applications) and *Other coating applications*. *Degreasing* (NRF 2D3e) includes cleaning products from water-insoluble substances such as grease, fats, oils waxes and tars. *Dry Cleaning* (NRF 2D3f) constitutes a small amount which is included in NRF 2D3e due to the lack of statistics. *Chemical products* (NRF 2D3g) sector covers NMVOC emissions from the use of chemical products taking into account many activities such as polyurethane and polystyrene foam processing, organic chemical industry, manufacture of paints, inks and glues, fat edible and non-edible oil extraction and industrial application of adhesives. *Printing* (NRF 2D3h) involved the use of inks, cleaning solvents and organic dampeners. *Other product use* (NRF 2D3i) includes emissions from application of underseal treatment and conservation of vehicles, glues and adhesives, preservation of wood and other solvent use.

To divide the NMVOC containing products by NFR subsectors EMEP/EEA 2013 was used.

4.5.3.2 Trends in emissions

Solvent Use sector was the largest pollution source of NMVOC emissions in Latvia in 2014 and it covered over 44.1% (24.0 kt) from the total Latvia's NMVOC emissions. The NMVOC emissions from Solvent Use sector have been constantly decreasing since the beginning of 90ties till 2006 mostly due to the industry going through a crisis. The sharp emission increase in 2007 is explained with import growth of NMVOC containing products. In subsequent years decrease can be observed back till 2009. At the end of 2008 the world was struck by the economic crisis which also affected the Solvent Use sector in Latvia. During the period of 2009 till 2012 NMVOC emissions of Solvent Use sector increased gradually by 22%. Slight decrease in trends in later years can be observed in later years. For instance, emissions of NMVOC have decreased by 4.2%, from 25.1 kt NMVOC in 2012 to 24.0 kt NMVOC in 2014 (see Table 4.20)

Table 4.20 NMVOC emissions from Solvent use in 1990-2014

	1990	1995	2000	2005	2010	2011	2012	2013	2014	Change in 1990-2013, %
Domestic solvent use including fungicides	3.309	3.101	2.948	2.790	5.654	6.937	7.439	8.111	7.496	127
Coating applications	8.266	7.747	7.365	6.970	8.219	8.246	9.587	8.636	8.823	7
Degreasing	0.004	0.003	0.003	0.003	0.011	0.010	0.012	0.012	0.011	213
Dry cleaning	0.002	0.002	0.002	0.002	0.005	0.005	0.007	0.014	0.009	256
Chemical products	8.999	8.434	8.019	7.588	3.079	2.773	3.787	3.774	3.703	-59
Printing	6.459	6.054	5.755	5.446	2.415	3.152	3.918	3.808	3.626	-44
Other solvent use	0.668	0.626	0.596	0.564	0.325	0.244	0.296	0.423	0.321	-52

4.5.3.3 Methods

NMVOC emissions from Solvent Use sector (except 2D3f and partly 2D3g) were estimated according to EMEP/EEA 2013 methodology based on Tier 1 or Tier 2 approach.

NMVOC emissions (kt) from Solvent Use sector were calculated for the time series 2005-2014 using the equation below:

$$E_{NMVOC} = EF_{NMVOC} \times AD$$

where:

E_{NMVOC} – non-methane volatile organic compounds emissions from solvents and other production use (kt);

EF_{NMVOC} – emission factor from EMEP/EEA 2013;

AD – activity data from the Chemical Register, kt.

To obtain a comparable data in time series for years where statistics was not in sufficient quality NMVOC emissions were calculated using the same methodology as for years 2005-2014. Assuming that base year for NMVOC emissions is year 2005, NMVOC emissions for years where statistics was not well kept were calculated proportionally, taking into account the number of inhabitants provided by the Central Statistical Bureau (Table 4.21).

Table 4.21 The number of population used as activity data under Other solvent and product use for years 1990-2006

	Number of inhabitants
1990	2668140
1991	2658161
1992	2643000
1993	2585675
1994	2540904
1995	2500580
1996	2469531
1997	2444912
1998	2420789
1999	2399248
2000	2377383
2001	2353384
2002	2320956
2003	2299390
2004	2276520
2005	2249724

NMVOC emissions data from Dry cleaning and Chemical products subsectors is obtained directly from database "2-Air" at Ltd. Latvian Environment, Geology and Meteorology Centre for 2005-2014. From the 1990ties till 2004 statistics for NMVOC emissions data also was not well kept. "2-Air" is database where enterprises (that do any pollution activity and have category A, B, or C polluting activity) report their emissions data; it is approximately 3000 enterprises in total every year. From these approximately 3000

enterprises data is used only from the enterprises that produced NMVOC emissions according to the *EMEP/EEA 2013*. The enterprises have been reporting their produced NMVOC emissions dividing in a particular NMVOC.

4.5.3.4 Emission factors

The NMVOC emission factors (Table 4.22) are taken from the *EMEP/EEA 2013*.

Table 4.22 Approaches and emission factors for Solvent Use sector

Subcategories	NRF	EF	Tier	Unit
Cosmetics and toiletries (all)	2D3a	0.83	2	t/t solvent
Household products (all)	2D3a	0.65	2	t/t solvent
DIY/buildings (all), Adhesives, Paint/varnish removers and solvents	2D3a	0.95	2	t/t solvent
Car care products (all)	2D3a	0.94	2	t/t solvent
Pesticides	2D3a	0.865	2	t/t solvent
Domestic use of pharmaceutical products	2D3a	0.606	2	t/t product
Paint application: construction and buildings	2D3d	0.15	1	t/t paint applied
Paint application: domestic use	2D3d	0.15	1	t/t paint applied
Coating applications: manufacture of automobiles	2D3d	0.4	1	t/t paint applied
Paint application: car repairing	2D3d	0.4	1	t/t paint applied
Paint application: coil coating	2D3d	0.4	1	t/t paint applied
Coating applications: Boat building	2D3d	0.4	1	t/t paint applied
Paint application: wood	2D3d	0.4	1	t/t paint applied
Coating applications: Other industrial paint application	2D3d	0.2	1	t/t paint applied
Other non industrial paint application	2D3d	0.2	1	t/t paint applied
Degreasing	2D3e	0.46	1	t/t cleaning products
Chemical products, manufacture and processing	2D3g	0.01	1	t/t product
Polystyrene foam processing	2D3g	0.06	2	t/t polystyrene
Rubber processing	2D3g	0.008	2	t/t rubber produced
Tyre production	2D3g	0.01	2	t/t tyres
Paints manufacturing	2D3g	0.011	2	t/t product
Glass Wool Enduction	2D3g	0.25	2	t/t solvent
Pharmaceutical products manufacturing	2D3g	0.3	2	t/t solvent
Printing	2D3h	0.5	1	t/t ink
Fat, edible and non-edible oil extraction	2D3i	0.002	1	t/t product used
Application of glues and adhesives	2D3i			
Preservation of wood	2D3i	0.945	2	t/t preservative (organic solvent-borne preservative)
Preservation of wood	2D3i	0.005	2	t/t preservative (waterborne preservative)
Other solvent and product use	2D3i	0.002	2	t/t product

4.5.3.5 Activity data

From the 1990ties till 2004 statistics for Solvent Use was not well kept due to the country-wide changes in the governmental system and national economy. For 2005-2014 activity data for Paint application, Degreasing, Chemical Products (part of the activity data), Printing industry, Domestic solvent use and Other solvent use was obtained from the Register of Chemical Substances and Chemical Mixtures (CR) at Ltd. Latvian Environment, Geology and Meteorology Centre. In the CR data of imported and produced amount of chemical products containing NMVOCs is collected together with the percentage of a particular NMVOC in imported or produced products. It is assumed that the NMVOC containing products imported in the country in a particular year are utilized in the same year as the data of the actual use is not available or is confidential. In the CR information on a particular year, amount of produced and imported chemicals (ton), NACE code, trade name, chemical name, CAS number and concentration (from ... till ... %) is provided.

To obtain a comparable data in time series for years where statistics was not in sufficient quality activity data was obtained using the same methodology as for NMVOC calculation. Assuming that base year for

activity data is year 2005, activity data for years where statistics was not well kept were calculated proportionally, taking into account the number of inhabitants provided by the Central Statistical Bureau (Table 4.21).

Activity data from Dry cleaning and part of the activity data from Chemical products subsectors reported by enterprises is not available as these data is not required to be reported and could be assumed as confidential.

4.5.3.6 Uncertainties

Uncertainty of available activity data for Other solvent and product use was $\pm 2\%$ (for Chemical products: $\pm 3\%$) by expert judgment in 2014. Emission factor uncertainty is assumed to be $\pm 20\%$ accordance with EMEP/EEA 2013, 2.D Other solvent and product use. Time series consistency was ensured by using one method for all time series.

4.5.3.7 QA/QC and verification

QA/QC check is performed with Tier1 method from EMEP/EEA 2013, 2.D Other solvent and product use.

All estimations of the emissions done in the LEGMC also are checked on the logical mistakes by checking the time series of the activity data, emission factors and emissions consistency to display all significant and illogic changes in the activity data and emissions.

Quality control check list is filled for each category taking into account criteria given in QA/QC plan approved in national legislation. All findings were documented and introduced in GHG inventory. All corrections are archived in centralized archiving system (common FTP folder).

4.5.3.8 Recalculations

For period 1990-2014 recalculations have been carried out under Solvent Use sector mainly due to two reasons. The first one is that the list of NMVOCs substance was supplemented, therefore recalculations were carried out for all time series. The second reason is change of method for all time series. Previously, there was incomplete method.

4.5.3.9 Planned improvements

It is planned to implement electronic reporting for importers and producers in the Chemicals Register from 2016. According to that, possible changes in activity data are expected. It is planned to get more accurate division by subcategories taking into account that previously it was done by expert judgment.

4.5.4 Other product use (NFR 2G)

4.5.4.1 Overview

Other Product Use sub-sector includes emissions from Use of fireworks and Tobacco combustion. This sub-sector contains NO_x, NMVOC, SO₂, NH₃, PM_{2.5}, PM₁₀, TSP, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Zn, PCDD/PCDF, benzo(a) pyrene, benzo(b) fluoranthene, benzo(k) fluoranthene, Indeno (1,2,3-cd) pyrene emissions.

4.5.4.2 Trends in emissions

The emissions from Other product use subsector have constantly decreased overall since the beginning of 90ties although emissions from Use of fireworks have increased. Emissions of heavy metals mostly occur from Use of fireworks and their increase in the latest years is linked with the economic situation of the country (Table 4.23).

Table 4.23 Emissions from Other product use sector in 1990-2014

	Unit	1990	1995	2000	2005	2010	2011	2012	2013	2014	Change in 1990-2014, %
NO_x	kt	0.0043	0.0040	0.0039	0.0032	0.0033	0.0030	0.0033	0.0029	0.0031	-28
NMVOC		0.0115	0.0108	0.0103	0.0083	0.0087	0.0078	0.0087	0.0078	0.0082	-29

	Unit	1990	1995	2000	2005	2010	2011	2012	2013	2014	Change in 1990-2014, %
SO ₂		2.37E-05	2.22E-05	0.000634	0.001	0.000425	0.000489	0.000663	0.000592	0.00061	2471
NH ₃		0.00989	0.00927	0.00881	0.00716	0.00748	0.00671	0.00749	0.00667	0.00700	-29
PM _{2.5}		NR	NR	0.0573	0.0466	0.0487	0.0437	0.0487	0.0434	0.0456	-21
PM ₁₀		NR	NR	0.0573	0.0466	0.0487	0.0437	0.0488	0.0434	0.0456	-21
TSP		NR	NR	0.0573	0.0466	0.0487	0.0437	0.0488	0.0434	0.0456	-21
CO		0.131	0.123	0.118	0.097	0.100	0.090	0.101	0.090	0.094	-28
Pb	t	0.006	0.006	0.165	0.260	0.110	0.127	0.172	0.154	0.158	2471
Cd		0.0129	0.0121	0.0118	0.0098	0.0099	0.0090	0.0101	0.0090	0.0094	-27
Hg		4.48E-07	4.2E-07	1.2E-05	1.89E-05	8.01E-06	9.23E-06	1.25E-05	1.12E-05	1.15E-05	2471
PCDD/F	g i- Teq	0.000238	0.000223	0.000212	0.000173	0.00018	0.000162	0.000181	0.000161	0.000169	-29
PAH	t	0.000586	0.000549	0.000522	0.000424	0.000443	0.000398	0.000444	0.000396	0.000415	-29

4.5.4.3 Methods

Emissions from Use of fireworks and Tobacco combustion were calculated according to EMEP/EEA 2013 methodology and based on Tier 2 approach.

Emissions (kt) from Use of fireworks and Tobacco combustion sector were calculated for the time series 2003-2014 using the equation below:

$$E = EF \times AD$$

where:

E – emissions from Use of fireworks and Tobacco combustion (kt);

EF – emission factor from EMEP/EEA 2013;

AD – activity data from the Central Statistical Bureau, kt.

To obtain a comparable data in time series for years where statistics was not in sufficient quality emissions were calculated using the same methodology as for years 2003-2014. Assuming that base year for NMVOC emissions is year 2002, emissions for years where statistics was not well kept were calculated proportionally, taking into account the number of inhabitants provided by the Central Statistical Bureau (Table 4.22).

4.5.4.4 Emission factors

All emission factors for Use of fireworks and Tobacco combustion are taken from the EMEP/EEA 2013.

4.5.4.5 Activity data

From the 1990ties till 2002 statistics for Use of fireworks and Tobacco combustion was not well kept due to the country-wide changes in the governmental system and national economy. For 2003-2014 the quantity of used fireworks (CN code 3604) and tobacco combusted (CN code 2402) in Latvia is estimated by the import and export data available from Central Statistical Bureau of Latvia. Data regarding production of fireworks and tobacco are not available.

To obtain a comparable data in time series for years where statistics was not in sufficient quality activity data was obtained using the same methodology as for emission calculation. Assuming that base year for activity data is year 2002, activity data for years where statistics was not well kept were calculated proportionally, taking into account the number of inhabitants provided by the Central Statistical Bureau (Table 4.21).

4.5.4.6 Uncertainties

Emission factor uncertainty is assumed to be $\pm 20\%$ accordance with EMEP/EEA guidebook 2013, 2.D Other solvent and product use. Time series consistency was ensured by using one method for all time series.

4.5.4.7 QA/QC and verification

All estimations of the emissions done in the LEGMC are checked on the logical mistakes by checking the time series of the activity data, emission factors and emissions consistency to display all significant and illogic changes in the activity data and emissions.

Quality control check list is filled for each category taking into account criteria given in QA/QC plan approved in national legislation. All findings were documented and introduced in GHG inventory. All corrections are archived in centralized archiving system (common FTP folder).

4.5.4.8 Recalculations

No recalculations have been carried out.

4.5.4.9 Planned improvements

No improvements are planned.

4.5.5 Pulp and paper industry and Food and beverages industry (NFR 2H1, 2H2)

4.5.5.1 Overview

Other Production sub-sector includes indirect emissions from:

- Pulp and Paper industry;
- Food and drink industry.

Under this sector a research on pulp and paper sector was made as there are two producers that are reporting activity data with the PRODCOM code 17.11.14.00.00 - manufacture of pulp. According to available information these two manufactures have changed their activity and there are no information about raw materials that could be produced or imported.

4.5.5.2 Trends in emissions

Table 4.24 Emissions from Pulp and Paper (NFR 2H1) and Food and Drink (NFR 2H2) production sectors in 1990-2014

	Unit	1990	1995	2000	2005	2010	2011	2012	2013	2014	Trend in 1990-2014, %
NMVOC	kt	3.38	1.89	2.00	2.19	1.37	1.32	1.33	1.35	1.32	-61
SO₂		0.07318	0.00308	NO	NO	NO	NO	NO	NO	NO	-100

The biggest fluctuations occurred in time period 1991–1993 due to the changes in economic situation in country (Table 4.24). Decrease of NMVOC emissions in time period 1999–2001 is explained with economic crisis in neighbor country Russian Federation with whom Latvia have stable economic relations. In 2002–2004 NMVOC emissions were stable. NMVOC emissions have decreased by 29.3% in 2006-2007 that is explained with decrease of spirits produced by 35.5%. Emissions in 2008-2009 have decreased by 5.99% that is explained with the crisis in national economy that affected food and drink production industry because of decrease in purchasing capacity due to lower salaries, increased taxes etc. After going through a crisis in 2009 emissions in 2010 increased about 5.08%. In 2011 NMVOC emissions are decreased about 4.06% comparing with 2010. In 2012 NMVOC emissions are increased about 0.77% comparing to 2011 that makes stable situation in this sector in last two years. In 2013 the situation is quite stable and NMVOC emissions from this sector increased about 1.90%.

SO₂ emissions are reported for time period 1990 – 1996 when pulp and paper industry were active. In 1996, pulp and paper facility closes. In latest years wood pulp and paper industry is developing again, but wood pulp is imported and not produced in country so SO₂ emissions that occurred in pulp production processes are not emitted.

4.5.5.3 Methods

Tier 1 method from EMEP/EEA 2013 was used to calculate emissions from Pulp and paper production and Food and drink production sectors. NMVOC emissions from the food and drink industry as well as SO₂ emissions from pulp and paper industry are calculated.

4.5.5.4 Emission factors

The NMVOC emission factors (Table 4.25) are taken from the EMEP/EEA 2013 with exception of NMVOC emission factor for spirits production. For Submission 2016, NMVOC emissions factor from EMEP/CORINAIR that corresponds to other spirits was used. CSB provided aggregated statistical data where it can be seen that 95.5% of all spirits produced in Latvia is produced from grains (sheer alcohol or spirits) and no brandy and whiskey is produced in Latvia. That's why previously used emission factor as for Spirits (unspecified sort) 15 kg/hl (alcohol) was changed to emission factor as for Other Spirits 0.4 kg/hl (alcohol).

Table 4.25 Emission factors for food and drink industries

Production	Emission factors
Food and drink industries (NMVOC)	
Wine	0.08 kg/hl
Beer	0.035 kg/hl
Spirits	0.4 kg/hl
Meet, fish, poultry	0.3 kg/t
Sugar	10 kg/t
Cakes, biscuits, breakfast cereals	1 kg/t
Bread	8 kg/t
Animal feed	1 kg/t
Pulp and paper industry (SO ₂)	
Pulp and paper	0.002 kt/kt

4.5.5.5 Activity data

Activity data for calculation of the NMVOC emissions from the food and drink industry is obtained from the CSB. Activity data of pulp and paper sub-sector were taken from CSB (Table 4.25). For the 2007 data for the category – wine production, was classified as confidential and not available for the LEGMC. That's why for this category 2006 year's data was used also for years 2007-2014.

	Pulp and Paper	Wine	Beer	Spirits	Meat, fish, poultry	Sugar	Cakes, biscuits, breakfast cereals	Bread	Animal feed
	kt	1000 hl	1000 hl	1000 hl	kt	kt	kt	kt	kt
1990	36.6	19.9	87.4	324.5	569.3	31	54.8	314	200
1991	44.7	197.5	1295.3	330	490.4	35	39.2	293	200
1992	30.8	179.8	858.9	259.3	281.6	39	22.1	240	200
1993	4.7	87.7	545.9	217.4	154	26	15.8	177.4	245.4
1994	0.2	134.2	637.9	314.8	95.6	15.8	22.7	161.5	174
1995	1.5	159.2	652.8	341.5	82.8	29.3	24.4	145.4	214.4
1996	1.5	154.7	644.9	379.6	100.5	31.2	13.1	137.1	206.2
1997	NO	114.7	714.8	456.4	129.1	41.2	16.9	132.1	205
1998	NO	99.6	721	417.4	110.9	64.9	18.1	124.8	203.3
1999	NO	C	953.2	C	166.9	C	20.8	121.5	144.5
2000	NO	C	945.1	C	197.3	C	24.3	121.1	173.8
2001	NO	C	996.6	C	244.6	C	24.4	123.1	184.9
2002	NO	C	1199.2	C	262.9	C	29	122.6	201.3
2003	NO	C	1336.6	C	264.4	C	37.3	124	201.4
2004	NO	C	1313.1	C	262.5	C	43.6	119.3	211.8
2005	NO	C	1293.3	C	243.8	C	53.6	116.3	248.6
2006	NO	C	1383	C	288.4	C	45	107.3	244.2
2007	NO	C	1414.3	C	286	NO	46.5	102.3	336.8
2008	NO	C	1333.8	C	297.7	NO	38.5	100.7	307.3
2009	NO	C	1292.4	C	253.5	NO	33.3	95.9	299.3
2010	NO	C	1484.9	C	242.2	NO	37.5	89.9	405.8

	Pulp and Paper	Wine	Beer	Spirits	Meat, fish, poultry	Sugar	Cakes, biscuits, breakfast cereals	Bread	Animal feed
	kt	1000 hl	1000 hl	1000 hl	kt	kt	kt	kt	kt
2011	NO	C	1626.6	C	261.5	NO	39.7	88.6	360.9
2012	NO	C	1488.5	C	264.3	NO	44.5	91.4	348.2
2013	NO	C	1513.7	C	286.2	NO	56.4	88.1	380.1
2014	NO	C	967.5	C	270.747	NO	50.4	84.9	379.5

4.5.5.6 *Uncertainties*

Uncertainty of activity data was assumed as $\pm 2\%$ for 1990-2006 because statistical data from CSB were used. For 2007-2014 the uncertainty is assumed higher – 10%, as no precise information is available for wine production. NMVOC emission factors were assigned as 50% because default emission factors taken from EMEP/EEA 2013 were used.

4.5.5.7 *QA/QC and verification*

Assessment of trends have been performed. All data are checked on input mistakes to comparing calculation data base with input data in NFR tables in all time series. All figures and tables represented in IIR 2016 are made on basis of final completed NFR data table.

4.5.5.8 *Recalculations*

No recalculations have been carried out.

4.5.5.9 *Planned improvements*

No improvements are planned.

5 Agriculture (NFR 3)

5.1 Sector overview

5.1.1 Overview

In Agriculture sector emissions from following subsectors are calculated:

- Manure management (NFR 3B), which includes cattle, sheep, goats, horses, swine, poultry and fur animals;
- Agricultural soils (NFR 3D), which includes inorganic N-fertilizers;
- PM emissions from Stables (NFR 3B);
- Other (3I), which includes emissions from last year's grass burning.

Table 5.1 Source categories and methods for Agriculture sector

NFR code	Longname	Method	EF	AD
3 B 1 a	Manure management - Dairy cattle	Tier 1, 2	D ³⁶ , CS ³⁷	NS ³⁸
3 B 1 b	Manure management - Non-dairy cattle	Tier 1, 2	D, CS	NS
3 B 2	Manure management - Sheep	Tier 1, 2	D, CS	NS
3 B 3	Manure management - Swine	Tier 1, 2	D, CS	NS
3 B 4 a	Manure management - Buffalo	NO		
3 B 4 d	Manure management - Goats	Tier 1, 2	D, CS	NS
3 B 4 e	Manure management - Horses	Tier 1, 2	D, CS	NS
3 B 4 f	Manure management - Mules and asses	NO		
3 B 4 g i	Manure management - Laying hens	Tier 1, 2	D, CS	NS
3 B 4 g ii	Manure management - Broilers	Tier 1, 2	D, CS	NS
3 B 4 g iii	Manure management - Turkeys	Tier 1, 2	D, CS	NS
3 B 4 g iv	Manure management - Other poultry (Ducks, Geese)	Tier 1, 2	D, CS	NS
3 B 4 h	Manure management - Other animals (Fur animals)	Tier 1,2	D, CS	NS
3 D a 1³⁹	Inorganic N-fertilizers (includes also urea application)	Tier 2	D	NS
3 D a 2 a	Animal manure applied to soils	Tier 2	D, CS	NS
3 D a 2 b	Sewage sludge applied to soils	NA		
3 D a 2 c	Other organic fertilisers applied to soils (including compost)	NA		
3 D a 3	Urine and dung deposited by grazing animals	Tier 2	D, CS	NS
3 D a 4	Crop residues applied to soils	IE		
3 D b	Indirect emissions from managed soils	IE		
3 D c	Farm-level agricultural operations including storage, handling and transport of agricultural products	NA		
3 D d	Off-farm storage, handling and transport of bulk agricultural products	NA		
3 D e	Cultivated crops	Tier 1	D	NS
3 D f	Use of pesticides	NA		
3 F	Field burning of agricultural residues	NO		
3 I	Agriculture other	Tier 1	D	NS

In the Submission 2016, NO_x, NMVOC, NH₃, PM, CO, as well as DIOX and PAH emissions from Agricultural sector are included (Table 5.2).

Table 5.2 Reported emissions in Agriculture sector in 2014

NFR code	Emissions
3 B 1 a	NO _x , NMVOC, NH ₃ , PM _{2.5} , PM ₁₀ , TSP
3 B 1 b	NO _x , NMVOC, NH ₃ , PM _{2.5} , PM ₁₀ , TSP

³⁶ Default value from EMEP/EEA 2013 or 2006 IPCC Guidelines

³⁷ Country specific value

³⁸ National statistics

³⁹ 3Da2b, 3Da4, 3Db included

NFR code	Emissions
3 B 2	NO _x , NMVOC, NH ₃ , PM _{2.5} , PM ₁₀ , TSP
3 B 3	NO _x , NMVOC, NH ₃ , PM _{2.5} , PM ₁₀ , TSP
3 B 4 d	NO _x , NMVOC, NH ₃ , PM _{2.5} , PM ₁₀ , TSP
3 B 4 e	NO _x , NMVOC, NH ₃ , PM _{2.5} , PM ₁₀ , TSP
3 B 4 gi	NO _x , NMVOC, NH ₃ , PM _{2.5} , PM ₁₀ , TSP
3 B 4 gii	NO _x , NMVOC, NH ₃ , PM _{2.5} , PM ₁₀ , TSP
3 B 4 giii	NO _x , NMVOC, NH ₃ , PM _{2.5} , PM ₁₀ , TSP
3 B 4 giv	NO _x , NMVOC, NH ₃ , PM _{2.5} , PM ₁₀ , TSP
3 B 4 h	NO _x , NMVOC, NH ₃ , PM _{2.5} , PM ₁₀ , TSP
3 D a 1 ⁴⁰	NO _x , NH ₃
3 D a 2 a	NH ₃
3 D a 3	NH ₃
3 D e	NMVOC, PM _{2.5} , PM ₁₀
3 I	NO _x , NMVOC, SO ₂ , NH ₃ , PM _{2.5} , PM ₁₀ , TSP, BC, CO, dioxins, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, total PAHs

5.1.2 Key sources

The Agriculture sector is responsible for the largest part of total NH₃ emissions – 81.6% in 2014. The remaining part originates from Transport, Combustion in power plants and in households, as well as from Waste water handling.

In 2014, the main part of the NH₃ emissions in Agriculture sector was related to Manure Management – 73.07% (10.43 kt) and use of synthetic fertilizers – 26.78% (3.82 kt). 55.84% (0.21 kt) of PM_{2.5} originated from manure management, 67.68% (1.79 kt) of PM₁₀ originated from crop production (Figure 5.1).

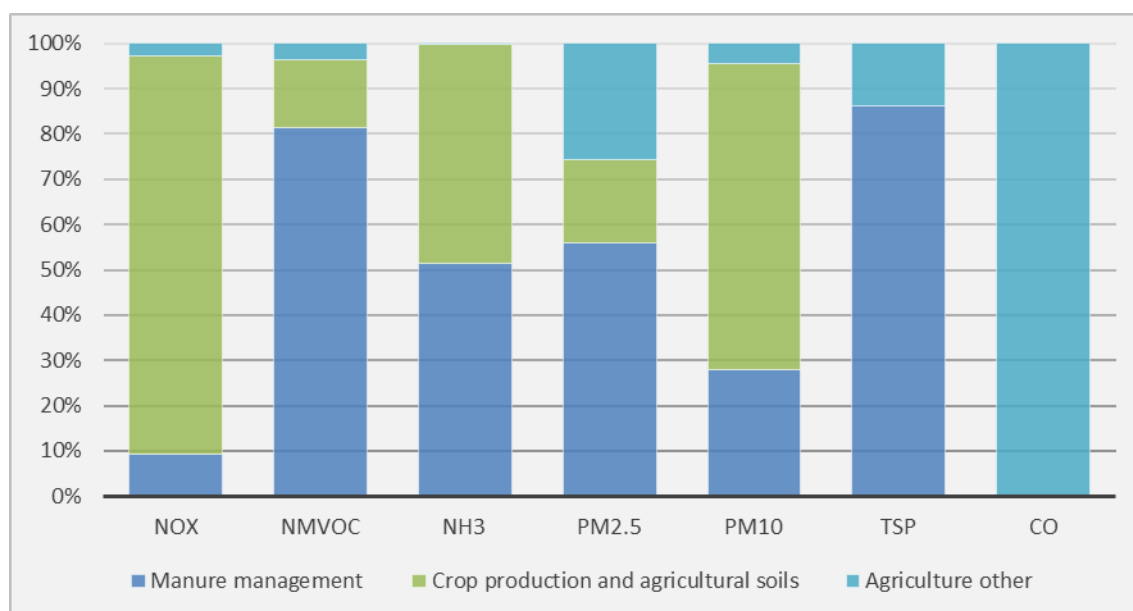


Figure 5.1 Distribution of emissions in Agriculture sector by subsectors in 2014 (%)

5.1.3 Trends in emissions

The NH₃ emissions from Agriculture have decreased by 66.45% over the period of 1990 – 2014 (Table 5.3). The general reason for this is transition to a market economy during 1991-1995, when the number of livestock on farms was significantly decreased as well as the use of nitrogen fertilisers. In the latest years it is possible to observe positive trends of mineral N fertilizer consumption due to increase of agriculture land use and expanding of crop production.

⁴⁰ 3Da2b, 3Da4, 3Db included

Table 5.3 Emissions from Agriculture sector in 1990-2014⁴¹

	Unit	1990	1995	2000	2005	2010	2011	2012	2013	2014	Changes in 1990-2014, %
NO_x	kt	6.15	0.86	1.22	1.92	2.66	2.66	2.90	3.10	3.30	-46
NM_{VOC}		17.63	7.69	5.60	5.87	5.88	5.80	6.05	6.18	6.58	-63
NH₃		42.52	15.92	12.41	12.55	13.27	13.27	13.66	13.76	14.27	-66
PM_{2.5}		NR	NR	0.278	0.292	0.306	0.285	0.297	0.302	0.372	34
PM₁₀		NR	NR	2.050	2.313	2.512	2.423	2.518	2.570	2.652	29
TSP		NR	NR	1.110	1.200	1.213	1.133	1.167	1.192	1.309	18
BC		NR	NR	NE	NE	NE	NE	NE	NE	NE	NE
CO	g i-Teq	0.207	0.196	0.844	0.756	0.931	0.604	0.698	0.703	2.543	1128
PCDD/PCDF		0.0043	0.0041	0.0176	0.0157	0.0194	0.0126	0.0145	0.0146	0.0530	1132
PAHs		0.014	0.014	0.058	0.052	0.064	0.042	0.048	0.049	0.175	1127

The emissions of PM is compiled for 2000 to 2014 (Table 5.3). PM emission amount depends on the number of produced animals and crops. The particle emission primary includes particles in the form of dust from holdings. In 2000-2014 PM emissions have increased by 29.35-33.75% which can be explained with the increase of livestock number, especially – non-dairy cattle, sheep, poultry and fur-bearing animals.

Emissions from grassland burning were determined according to 2006 IPCC Guidelines. In Latvia it appears seasonally and emission amount depends on the burned area. Prohibition to burn grass and crop residues on field has been included into good agricultural and environmental condition practice under cross-compliance framework and has been respectively penalized in respect to beneficiaries of direct payment schemes and RD area-related payments of the programming period 2007-2014.

The area of grassland burning was taken from the State Fire and Rescue Service – SFRS. Under this system, SFRS sends reports on the found cases to the Rural Support Service who applies sanctions to the beneficiaries, such requirement under standards of good agricultural and environmental condition and respective sanctions will be continued onwards.

5.2 Manure management (NFR 3B)

5.2.1 Overview

In the NFR category 3B NO_x, NM_{VOC} and NH₃ emissions from Manure Management are included.

In Figure 5.2, NH₃ emissions from Manure Management are broken down by different livestock categories in 2014. It can be seen that the majority of NH₃ emission is related to the dairy cattle (36%), swine (27%), non – dairy cattle (12%), fur animals (depicted as *other animals*; 9%) and laying hens (8%) production.

⁴¹ For PMs the base year is 2000 instead of 1990

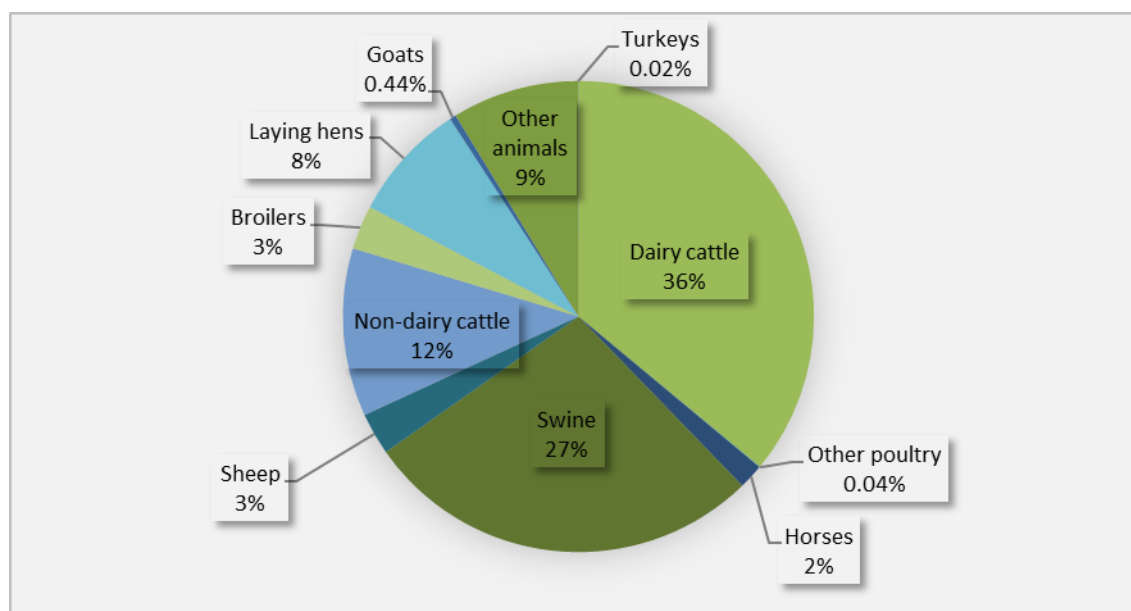


Figure 5.2 NH₃ emissions from Manure management in 2014

5.2.2 Trends in emissions

As seen in Table 5.4, emissions from agriculture noticeably decreased since the beginning of 90's after the collapse of the Soviet Union and the restoration of Latvian independence. Particularly significant changes in the livestock industry began in 1992 when most of big farms went into liquidation. However, after Latvia joined the EU in 2004 it is possible to observe a slight increase of sown area, livestock numbers and consumption of mineral N-fertilizers. Latvian livestock industry has been influenced by historical events and the changing economic situation⁴².

Table 5.4 Trends in emissions from Manure management in 1990-2014

	Unit	1990	1995	2000	2005	2010	2011	2012	2013	2014	Change in 1990-2014, %
NO _x	kt	0.908	0.398	0.274	0.262	0.257	0.253	0.279	0.292	0.303	-67
NM VOC	kt	16.21	6.87	4.77	4.94	4.85	4.81	5.02	5.13	5.36	-67
NH ₃	kt	25.15	10.74	7.39	7.37	7.07	6.90	7.06	7.20	7.33	-71

5.2.3 Methods

Emission calculations are based on EMEP/EEA 2013. For NH₃ and NO emissions estimates, Tier 2 (mass flow approach) is used, which is described in the EMEP/EEA methodology. Calculations were done with the Excel spreadsheet provided in the Appendix B of chapter 3B – Manure Management. Due to the N-flow calculation process, NH₃ emission estimates were obtained from manure management systems from housing, storage, on field application and grazing. In the same process NO emissions are also calculated from manure storage. Emission estimates are done separately for each animal category (NFR 3B1a,b; 3B2; 3B4d,e,f,h and 3Bgi,ii,iii,iv).

NO emission factor that is given in the EMEP/EEA 2013 is converted from NO emission to NO₂ emission due to the reporting requirements.

NM VOC and PM emissions were estimate using Tier 1 methodology described in the EMEP/EEA 2013.

$$E_{\text{pollutant}_{\text{animal}}} = AAP_{\text{animal}} \times EF_{\text{pollutant}_{\text{animal}}}$$

42 Aina Dobeļe, Irina Pilvere, Edgars Ozols, Lasma Dobeļe Land Resources For Agricultural Production In Latvia.

http://www.westeastinstitute.com/journals/wp-content/uploads/2013/02/ZG12-261-Aina-and-Lasma-Full-Paper_formatted-Land-Resources-For-Agricultural-Production-In-Latvia.pdf

where:

EF_{pollutant_animal} - pollutant emissions for each livestock category;

AAP_{animal} - number of animals of a particular category that are present, on average, within the year;

EF_{pollutant_animal} - EF of pollutant (kg a⁻¹).

5.2.4 Emission factors

The emission factors used to estimate NH₃ emissions from manure management are default Tier 2 from EMEP/EEA 2013, 3B Manure management (Table 5.5).

Table 5.5 Emission factors used for calculation of the NH₃-N emissions from manure management

Animal type	Manure type	EF housing	EF storage	EF spreading	EF grazing
Dairy cattle	slurry	0.20	0.20	0.55	0.10
	solid	0.19	0.27	0.79	0.10
Other cattle	slurry	0.20	0.20	0.55	0.06
	solid	0.19	0.27	0.79	0.06
Fattening pigs	slurry	0.28	0.14	0.40	-
	solid	0.27	0.45	0.81	-
Sows	slurry	0.22	0.14	0.29	-
	solid	0.25	0.45	0.81	-
Sheep, goats	solid	0	0	1	0
Horses	solid	0.22	0.35	0.90	0.35
Laying hens	solid	0.41	0.14	0.69	-
Broilers	solid	0.28	0.17	0.66	-
Turkeys	solid	0.35	0.24	0.54	-
Ducks	solid	0.24	0.24	0.54	-
Geese	solid	0.57	0.16	0.45	-
Fur animals	solid	0.27	0.09	NA	-

Emission factors used to estimate NO emissions from manure management are the default values from EMEP/EEA 2013 (Table 5.6).

Table 5.6 Emission factors used for calculation of the NO-N emissions from manure management

EF Storage	
Slurry	Solid
0.0001	0.0100

Emission factors used to estimate NMVOC emissions from this source category are default Tier 1 values from Table 3.4 of EMEP/EEA 2013 of chapter 3B Manure management.

The NH₃ emission calculations are based on ammonia emission abatement measures for cattle and pig slurry storage. According to Regulations No 834 of the Cabinet of Ministers of Latvia⁴³, all animal housings with more than 10 animal units and in the vulnerable zone with more than 5 animal units must have manure storages. In 2014 a 10-year transitional period ended with the EU requirements for the execution of the construction of manure storage facilities in accordance with the environmental requirements. Intensive manure storage construction and improvement activities occurred in Latvia from 2004 to 2014. Therefore NH₃ emission reduction potential is included in the emission calculation and based on EMEP/EEA 2013 recommendations it is set as 50% for storage. It is obligated by national regulations that application of slurry need to be done within 12 h, therefore reduction of emissions in this category is 30% for cattle and pig and 70% for poultry. Solid manure need to be incorporated within 24 h, reduction rate by this activity is 35% for

⁴³National regulations No. 834 *Regarding Protection of Water and Soil from Pollution with Nitrates Caused by Agricultural Activity*
<http://likumi.lv/ta/id/271376-noteikumi-par-udens-un-augsnes-aizsardzibu-no-lauksaimnieciskas-darbibas-izraisita-piesarnojuma-ar-nitratem>

cattle and pig. NH₃ emissions reduction potential implemented in the inventory is 46% from cattle housing⁴⁴.

5.2.5 Activity data

The number of cattle, sheep, swine, goats, horses, poultry and fur-bearing animals population, as well as data on milk production and fat content in milk are obtained from the Central Statistical Bureau (CSB) of Latvia Database⁴⁵ and statistical yearbooks⁴⁶. The distribution of different manure management systems (MMS) is adopted from national studies. Calculations of the distribution are done based on research results and developed methodology provided by Latvia University of Agriculture.

Statistical information about livestock number in Latvia is included in Table 5.7. The number of fur-bearing animals is not available for 1990-1992 and 1995, therefore interpolation and extrapolation is used to fill in the gaps of time series.

Table 5.7 Number of livestock (thousand heads), 1990–2014

Year	1990	1995	2000	2005	2010	2011	2012	2013	2014
Dairy cows	535.10	291.90	204.50	185.20	164.10	164.10	164.60	165.00	165.90
Beef cattle under 1 year	257.65	47.23	22.24	26.30	23.55	21.85	26.10	26.80	35.45
Dairy cattle under 1 year	267.55	87.57	75.67	92.60	82.05	82.05	82.30	82.50	82.95
Beef cattle 1- 2 years old	88.56	17.78	10.70	17.00	13.45	12.55	15.68	20.85	20.15
Dairy cattle 1 - 2 years old	214.04	64.22	40.90	42.60	54.15	54.15	54.32	54.45	54.75
Cattle after 2 years old	611.50	312.60	217.20	206.70	206.30	210.10	214.70	221.90	228.80
Fattening pigs	974.37	366.41	279.50	304.62	275.76	265.70	255.56	264.30	251.72
Sows	426.73	186.39	114.00	123.28	113.94	109.30	99.64	103.30	97.58
Sheep	164.60	72.20	28.60	41.60	76.80	79.70	83.60	84.80	92.50
Goats	5.40	8.90	10.40	14.90	13.50	13.40	13.30	12.60	12.30
Horses	30.90	27.20	19.90	13.90	12.00	11.50	10.90	10.70	10.10
Layers	8050.46	2071.20	1980.50	2121.80	2549.50	2315.90	2395.00	2430.50	2443.80
Broilers	2270.64	923.63	570.20	1365.00	1638.30	1417.70	1898.30	1906.40	1796.65
Turkeys	10.10	10.10	12.50	15.10	1.00	1.10	1.40	1.70	2.00
Ducks	48.60	48.60	51.00	38.40	2.90	2.90	3.10	3.80	5.50
Geese	12.60	12.60	14.40	16.20	1.60	1.80	1.90	2.10	2.70
Fur animals	260.20	213.50	97.20	141.70	167.00	183.70	231.60	231.60	313.90

Data of N excretion during the year per each livestock category used for the inventory are country specific and are obtained from national studies⁴⁷; EMEP/EEA 2013 or are calculated by following 2006 IPCC Guidelines.

All N excretion values in the inventory are represented in Table 5.8 and Table 5.9.

Table 5.8 Average N excretions (N, kg year⁻¹) per head of animal

Livestock category	1990-2004	2005-2014	Source
Sheep	6.00	13.00	National studies
Goats	6.00	13.00	National studies
Horses	46.00	47.00	National studies
Layers	0.60	0.60	National studies
Broilers and others	0.36	0.36	EMEP/EEA 2013

⁴⁴ Bittman, S., Dedina, M., Howard C.M., Oenema, O., Sutton, M.A., (eds), 2014, Options for Ammonia Mitigation: Guidance from the UNECE Task Force on Reactive Nitrogen, Centre for Ecology and Hydrology, Edinburgh, UK

⁴⁵ Agriculture, Forestry and Fishery. <http://data.csb.gov.lv/pxweb/en/lauks/?rxid=a79839fe-11ba-4ecd-8cc3-4035692c5fc8>

⁴⁶ Agriculture in Latvia. Collection of Statistical Data. Riga: 2014. 64 pp

⁴⁷ Fertiliser Recommendations for Agricultural Crops (2013) Ed.A. Karklins and A.Ruza. Jelgava: LLU, 55 p.

Livestock category	1990-2004	2005-2014	Source
Turkeys	1.64	1.64	EMEP/EEA 2013
Ducks	1.26	1.26	EMEP/EEA 2013
Geese	0.55	0.55	EMEP/EEA 2013
Fur animals	8.34	8.34	EMEP/EEA 2013

Values about annual N excretion ($N_{ex(T)}$) per animal for cattle were calculated according to IPCC Tier 2 methodology⁴⁸:

$$N_{ex(T)} = N_{intake} \cdot (1 - N_{retention})$$

where:

$N_{ex(T)}$ = annual N excretion rates, kg N animal⁻¹ yr⁻¹;

$N_{intake(T)}$ = the annual N intake per head of animal of species/category T, kg N animal⁻¹ yr⁻¹;

$N_{retention(T)}$ = fraction of annual N intake that is retained by animal of species/category T, dimensionless.

The daily N intake per head of animal of species/category is calculated as⁴⁹:

$$N_{intake(T)} = \frac{GE}{18.45} \cdot \left(\frac{CP\%}{6.25} \right)$$

where:

N intake (T) = daily N consumed per animal of category T, kg N animal⁻¹ day⁻¹;

GE = gross energy intake of the animal, MJ animal⁻¹ day⁻¹;

18.45 = conversion factor for dietary GE per kg of dry matter, MJ kg⁻¹;

CP% = percent crude protein in diet, input;

6.25 = conversion from kg of dietary protein to kg of dietary N, kg feed protein (kg N)⁻¹.

The daily N retention per head of animal of species/category is estimated as⁵⁰:

$$N_{retention(T)} = \left[\frac{Milk \cdot \frac{(Milk PR\%)}{100}}{6.38} \right] + \left[\frac{WG \cdot \left[268 - \left(\frac{7.03 NE_g}{WG} \right) \right]}{\frac{1000}{6.25}} \right]$$

where:

$N_{retention(T)}$ = daily N retained per animal of category T, kg N animal⁻¹ day⁻¹;

Milk = milk production, kg animal⁻¹ day⁻¹ (dairy cows only);

Milk PR% = percent of protein in milk, calculated as $[1.9 + 0.4 \cdot \%Fat]$;

6.38 = conversion from milk protein to milk N, kg Protein (kg N)⁻¹;

WG = weight gain, input for each livestock category, kg day⁻¹;

268 and 7.03 = constants;

NE_g = net energy for growth, MJ day⁻¹;

6.25 = conversion from kg dietary protein to kg dietary N, kg Protein (kg N⁻¹).

Calculated N excretion values for cattle are included in Table 5.9.

Table 5.9 Average N excretions for cattle (N, kg year⁻¹) per head of cattle

Year	Dairy cows	Beef cattle under 1 year	Dairy cattle under 1 year	Beef cattle 1- 2 year	Dairy cattle 1 - 2 year	Cattle after 2 years
1990	96.30	24.54	21.35	53.76	40.22	61.38
1995	95.15	24.54	21.34	53.76	40.20	61.38
2000	102.71	24.54	21.21	53.76	40.08	61.38
2005	107.86	24.54	21.08	53.76	39.94	61.38
2010	113.73	24.54	20.94	53.76	39.78	61.38

48 2006 IPCC Guidelines. Volume 4, Chapter 10, Equation 10.31, page 10.58

49 2006 IPCC Guidelines. Volume 4, Chapter 10, Equation 10.32, page 10.58

50 2006 IPCC Guidelines. Volume 4, Chapter 10, Equation 10.33, page 10.60

Year	Dairy cows	Beef cattle under 1 year	Dairy cattle under 1 year	Beef cattle 1- 2 year	Dairy cattle 1 - 2 year	Cattle after 2 years
2011	113.82	24.54	20.89	53.76	39.73	61.38
2012	114.86	24.54	20.85	53.76	39.68	61.38
2013	116.30	24.54	20.80	53.76	39.63	61.38
2014	118.16	24.54	20.86	53.76	39.67	61.38

For Submission 2016, recalculations of emissions from manure management for period 1900-2014 are done based on implementation of new approach to calculate manure management system distribution.

Recalculations of MMS are done according to one of pre-defined project "Development of the National System for Greenhouse Gas Inventory and Reporting on Policies, Measures and Projections" under the most important outcomes of 2009 - 2014 EEA Grants Programme *National Climate Policy*. Input data of MMS were originated within activity 1.2.2. Agricultural Sector GHG Emissions Calculation Methodology and Data Analysis with Development of Modelling Tools Integrating the Climate Change in the inventory. Main differences caused by implementation of the new methodology to determine MMS should be tended to liquid manure system, which was found as not typical for cattle in Latvia. Significantly, the share of pasture, range and paddock was reduced for all livestock groups, except beef cattle. Most of the large livestock farms refuse grazing to keep high productivity of animals and arrange resources in economically feasible way. Table 5.10 represents the share of each manure management system in 2014.

Table 5.10 Share of each Manure Management System per animal type, 2014

	Pasture	Solid storage	Slurry	Anaerobic digester
Dairy cows	0.07	0.53	0.27	0.13
Beef cattle under 1 year old	0.79	0.21	0.00	0.00
Dairy cattle under 1 year old	0.08	0.82	0.00	0.10
Beef cattle 1- 2 years old	0.79	0.21	0.00	0.00
Dairy cattle 1 - 2 years old	0.08	0.82	0.00	0.10
Cattle after 2 years old	0.79	0.21	0.00	0.00
Fattening pigs	0.00	0.11	0.52	0.36
Sows	0.00	0.12	0.52	0.36
Sheep	0.21	0.79	0.00	0.00
Goats	0.11	0.89	0.00	0.00
Horses	0.11	0.89	0.00	0.00
Layers	0.03	0.46	0.00	0.51
Broilers	0.00	1.00	0.00	0.00
Turkeys	0.14	0.86	0.00	0.00
Ducks	0.17	0.83	0.00	0.00
Geese	0.16	0.84	0.00	0.00
Fur animals	0.00	1.00	0.00	0.00

5.2.6 Uncertainties

The uncertainty associated with activity data is received from CSB of Latvia. Generally, the uncertainty of activity data provided by CSB of Latvia is set as 2%. Emission factors may be uncertain to 50%. According to EMEP/EEA 2013, the EFs are a first estimate only and uncertainty are not provided.

5.2.7 QA/QC and verification

Assessment of trends has been performed by sectoral expert. Statistical data are verified by CSB.

5.2.8 Recalculations

Changes between last year's submission and this year submission result from:

- implementation of fully adopted the EMEP/EEA 2013 methodology to estimate NH₃ and NO emissions from manure management;

- implementation of new approach to estimate manure management distribution values according to the latest national studies;
- updating Nex values for swine and poultry;
- splitting down calculation for poultry in following subgroups: layers, broilers, turkeys, geese and ducks.

5.2.9 Planned improvements

Tier 2 approach will be implemented for NMVOC calculation for cattle.

5.3 Agricultural soils (NFR 3D)

5.3.1 Overview

Latvia reports under category 3D NH₃ and NO_x emissions from inorganic N-fertiliser application, as well as NMVOC and PM emissions from crop cultivation.

5.3.2 Trends in emissions

Emission of NH₃ from inorganic fertilizer is based on the consumption of fertilizer of different types and emission factors. Emission of NO_x is based on the total consumption of N in inorganic N fertilizer and emission factor. NMVOC and PM emissions is based on the total sown area and emission factors.

Table 5.11 Emissions from fertilizer use and crop production and agricultural soils, 1990-2014 (kt)

	Unit	1990	1995	2000	2005	2010	2011	2012	2013	2014	Changes in 1990-2014, %
NO _x	kt	5.24	0.46	0.92	1.63	2.37	2.38	2.60	2.78	2.91	-45
NMVOC		1.40	0.80	0.76	0.86	0.95	0.93	0.97	0.99	0.99	-29
NH ₃		17.37	5.17	5.01	5.17	6.20	6.36	6.60	6.55	6.91	-60
PM _{2.5}		NR	NR	0.053	0.060	0.066	0.065	0.067	0.069	0.069	31
PM ₁₀		NR	NR	1.37	1.56	1.72	1.70	1.75	1.79	1.79	31

Emissions noticeably decreased since the beginning of 90's when the most of collective farms were liquidated and agricultural production was reduced. However, emissions from crop production and agricultural soils are increasing since 2000. This can be explained by an increase of area covered by crops and agricultural soils. In 2014, NH₃ emissions increased most rapidly in relation to inorganic N-fertilizer use.

5.3.3 Methods

NH₃, NO_x, NMVOC and PM emissions are calculated by methodology explained in EMEP/EEA 2013. NH₃ and NO_x emissions from crop production and agricultural soils are calculated by the equation:

$$E_{\text{pollutant}} = AR_{\text{fertilizer applied}} \times EF_{\text{pollutant}}$$

where:

$E_{\text{pollutant}}$ = amount of pollutant emitted (kg a⁻¹),

$AR_{\text{fertilizer applied}}$ = amount of N applied (kg a⁻¹),

$EF_{\text{pollutant}}$ = EF of pollutant (kg kg⁻¹).

For calculation of NH₃ emission from inorganic N-fertilizers in the country, the number of each fertilizer type consumption (expressed as mass of fertilizer-N used per year) is multiplied by the appropriate emission factor. The emissions from the different fertilizer types are summed for period 2007-2014.

NMVOC and PM emissions from crop production and agricultural soils are calculated by the equation:

$$E_{\text{pollutant}} = AR_{\text{area}} \times EF_{\text{pollutant}}$$

where:

$E_{\text{pollutant}}$ = amount of pollutant emitted (kg a⁻¹),

AR_{area} = area covered by crop (ha),

$EF_{\text{pollutant}}$ = EF of pollutant (kg ha⁻¹).

5.3.4 Emission factors

The default emission factors for NMVOC, PM_{2.5}, PM₁₀ and NO was used for calculations as given in EMEP/EEA 2013 (section 3.D, Table 3-1) and the same emission factors are used for all years 1990-2014:

- 0.86 kg ha⁻¹ for NMVOC;
- 0.06 kg ha⁻¹ for PM 2.5;
- 1.56 kg ha⁻¹ for PM 10;
- 0.026 kg kg⁻¹ for NO.

NO emission factor that is given in the EMEP/EEA 2013 is converted from NO emission to NO₂ emission due to the reporting requirements. NH₃ emissions are calculated based on consumption data of inorganic fertilizer types and suggested EF's according to EMEP/EEA 2013 methodology. Two emission factors are implemented to calculate NH₃ emissions for period 1990-2006, because there is no available detailed data on fertilizer types for this period. EF 0.040 (kg kg⁻¹ fertilizer-N applied) is used for all fertilizer types except urea, and EF 0.243 (kg kg⁻¹ fertilizer-N applied) is used for urea. For 2007-2014, emissions of NH₃ are estimated based on fertilizer types. The implemented emission factors for each fertilizer type to calculate NH₃ emissions are represented in Table 5.11.

Table 5.11 NH₃ emission factors (EF) for different fertilizer types

Fertilizer type	EF, kg NH ₃ -N per kg N
Ammonium nitrate	0.037
Ammonium sulphate	0.013
Calcium ammonium nitrate	0.022
Urea	0.243
Urea and ammonium nitrate solutions	0.125
NPK complex	0.037
Other	0.040

NH₃ emissions from pasture grazed by livestock are derived by Tier 2 methodology that is implemented for NH₃ emission calculation from manure management.

5.3.5 Activity data

Information regarding to inorganic N-fertilizer consumption and the area covered by crops is provided by Central Statistical Bureau (CSB) of Latvia for the period 1990-2014. Data about the use of N with inorganic fertilizers are provided in Figure 5.3.

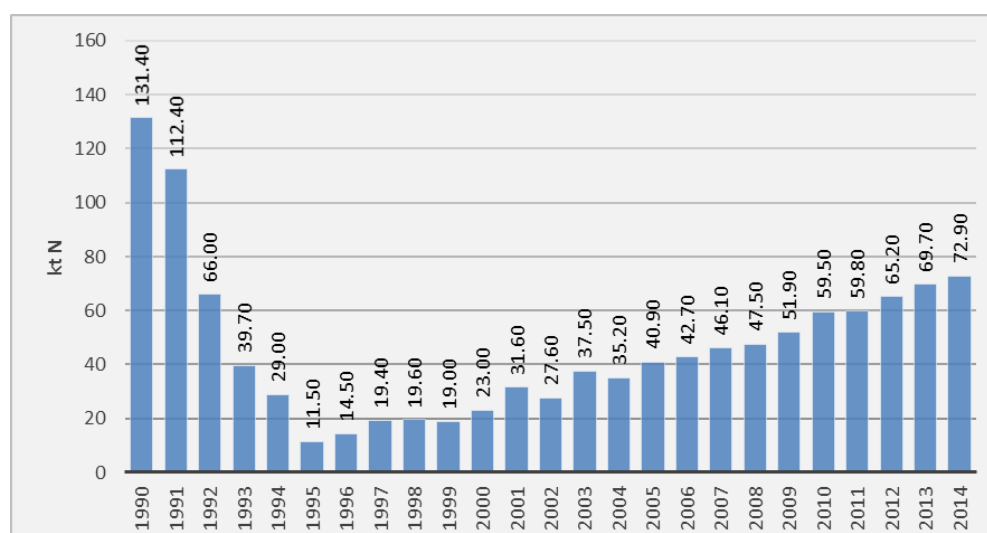


Figure 5.3 Used N with inorganic N-fertilizer (kt), 1990-2014

However, there are no statistics for the whole data series on the distribution of fertilizer types. Detailed statistics of consumption of different types of N fertilizers are available for 2007-2013. For years 1990-2006 data on consumption of urea was derived by interpolation or extrapolation of available statistical data. Same additional results of urea consumption were obtained from FAO statistics for 2002 and 2003. Consumption data of urea and other N fertilizer for that period is based on calculations including statistics of N consumption in inorganic fertilizers (Table 5.12).

Table 5.12 Consumption of fertilizer types (t), 2007-2014

Fertilizer type	2007	2008	2009	2010	2011	2012	2013	2014
Ammonium nitrate	89155	84006	103333	107953	113185	109837	112238	127237
Ammonium sulphate	4176	5728	11294	14931	17559	23524	32114	33135
Calcium ammonium nitrate	NA	19399	9084	4699	4891	4748	8738	4669
Urea	1946	4323	5930	5459	5798	7901	5558	6445
Urea and ammonium nitrate solutions	2091	1025	3356	NA	NA	NA	NA	NA
NPK complex	105896	92952	72195	107669	112652	131702	157503	147146

The consumption of inorganic fertilizers could be slightly linked to increasing tendency for sown area. According to CSB information, in 2014 the use of nitrogen per one ha of sown area continued to grow by 4% and reached 63 kg, compared to 2013. The share of straight nitrogen mineral fertilizer use was 49.7% in 2014. The total sown area in 2014 reached 1150.5 thousand ha. The number of total sown area increased by 0.3% compared to 2013. Area covered by crops for period 1990-2014 is represented in Figure 5.4.

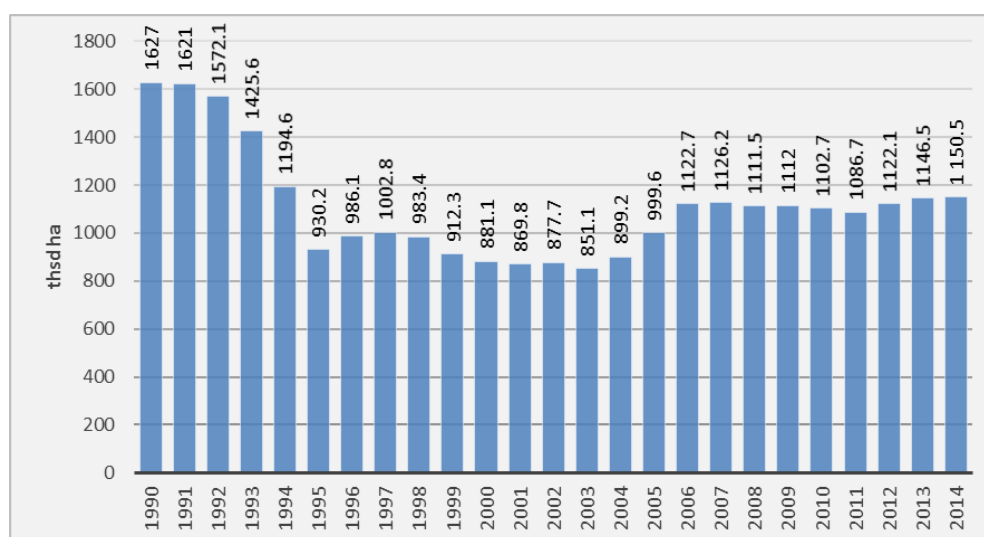


Figure 5.4 Area covered by crops (thsd. ha), 1990-2014

5.3.6 Uncertainties

The uncertainty associated with activity data are received from CSB of Latvia. Generally, the uncertainty of activity data provided by CSB of Latvia is set as 2%. Emission factors may be uncertain to 100%.

5.3.7 QA/QC and verification

Assessment of trends has been performed by sectoral expert. Statistical data are verified by CSB.

5.3.8 Recalculations

Recalculations have been done due to conversion of NO emissions to NO₂ emissions according to the reporting requirements for NO_x.

5.3.9 Planned improvements

Reporting of NH₃ emissions will be supplemented by NH₃ emissions calculation from sewage sludge and other organic fertilizers in the next inventory.

5.4 PM emissions from stables (NFR 3B)

5.4.1 Overview

The particulate matter (PM) emission includes primary particles in the form of dust from stables. The main sources of PM emission is livestock feeding and buildings of housing livestock. These emissions originate mainly from feed, bedding materials, feathers and manure. Emissions of PM occur also from free-range animals, but EMEP/EEA 2013 methodology has focused on housed animals. PM emission in the inventory is given in TSP (total suspended particulate matter), PM₁₀ and PM_{2.5}.

5.4.2 Trends in emissions

All main types of stables are included in the inventory (Figure 5.5). Predominant part of PM emissions are related to cattle, swine and poultry. Amount of emissions is strongly linked to changes in the number of livestock.

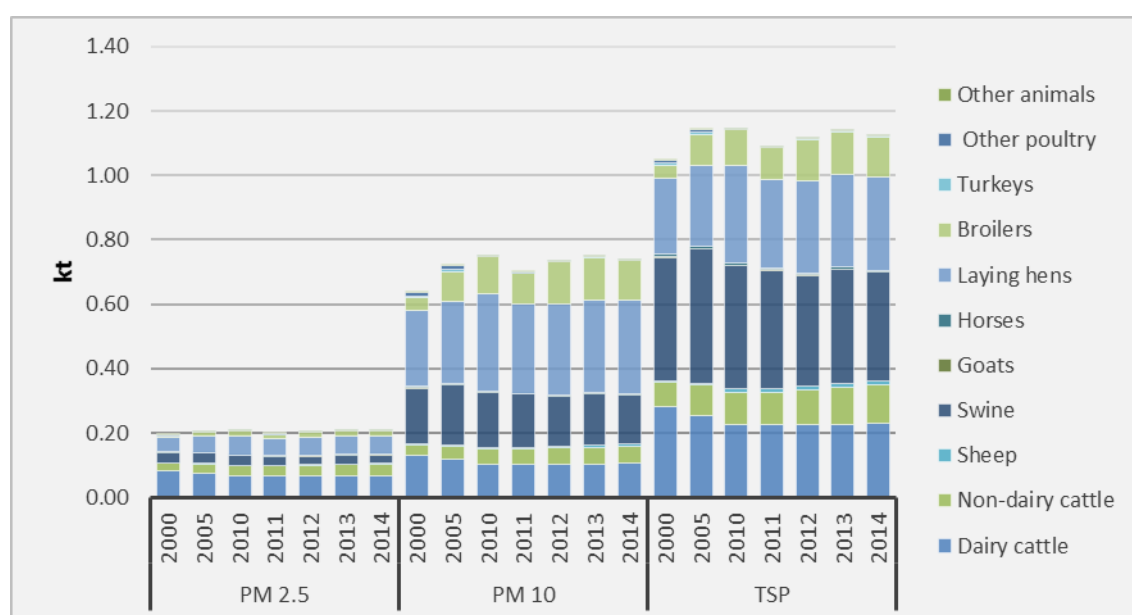


Figure 5.5 PM emissions from stables in 2000-2014

5.4.3 Methods

The Tier 1 default EF's are used for the inventory to calculate PM emissions from animal husbandry as described in EMEP/EEA 2013 (section 3.B, Table 3-3). The emissions are calculated as the sum of activities multiplied by the emission factors (EF) for each activity.

5.4.4 Emission factors

The calculation is based on EMEP/EEA 2013 methodology. Emission factors by type are shown in the Table 5.13.

Table 5.13 PM and TSP emission factors (EF)

	EF TSP	EF PM ₁₀	EF PM _{2.5}
Dairy cows	1.38	0.63	0.41
Other cattle	0.47	0.22	0.14
Fattening pigs	0.75	0.34	0.06
Sows	1.53	0.69	0.12

	EF TSP	EF PM ₁₀	EF PM _{2.5}
Sheep	0.14	0.06	0.02
Goats	0.14	0.06	0.02
Horses etc	0.48	0.22	0.14
Layers	0.12	0.12	0.02
Broilers	0.07	0.07	0.01
Turkeys	0.52	0.52	0.07
Ducks	0.14	0.14	0.02
Geese	0.24	0.24	0.03
Fur animals	0.02	0.01	0.00

5.4.5 Activity data

For Tier 1, data are required on livestock numbers for each of the category. This information provided by CSB of Latvia and shown in the Table 5.7.

5.4.6 Uncertainties

The uncertainty associated with livestock population is received from CSB of Latvia. Generally, the uncertainty of activity data provided by CSB of Latvia is set as 2%. According to EMEP/EEA 2013 the EFs are a first estimate only and uncertainty are not provided.

5.4.7 QA/QC and verification

Assessment of trends has been performed by sectoral expert. Statistical data are verified by CSB.

5.4.8 Recalculations

Recalculations have been due to implementation of cattle and swine age-subgroups. Emissions calculation for poultry is split down in following subgroups: layers, broilers, turkeys, geese and ducks.

5.4.9 Planned improvements

It is planned to continue activities to implement Tier 2 approach to calculate PM emissions.

5.5 Other (NFR 3I)

5.5.1 Overview

Under category 3I Other NO_x, CO, DIOX and PAH emissions from grassland burning are included. Such activities in Latvia appeared seasonally.

5.5.2 Trends in emissions

Table 5.14 Emissions from grassland burning in 1990-2014

	Unit	1990	1995	2000	2005	2010	2011	2012	2013	2014	Change in 1990-2014, %
NO _x	kt	0.007	0.007	0.029	0.026	0.032	0.021	0.024	0.025	0.089	1128
NM VOC		0.019	0.018	0.077	0.069	0.085	0.055	0.064	0.064	0.232	1128
SO ₂		0.002	0.002	0.007	0.006	0.007	0.005	0.006	0.006	0.020	1128
NH ₃		0.002	0.002	0.007	0.006	0.007	0.005	0.006	0.006	0.020	1128
PM _{2.5}		NR	NR	0.032	0.028	0.035	0.023	0.026	0.026	0.095	202
PM ₁₀		NR	NR	0.039	0.035	0.043	0.028	0.032	0.032	0.117	202
TSP		NR	NR	0.060	0.054	0.066	0.043	0.049	0.050	0.180	202
CO	g i-Teq	0.207	0.196	0.844	0.756	0.931	0.604	0.698	0.703	2.543	1128
PCDD/PCDF		0.004	0.004	0.018	0.016	0.019	0.013	0.015	0.015	0.053	1132
PAHs		0.014	0.014	0.058	0.052	0.064	0.042	0.048	0.049	0.175	1127

Emission amount depends on the burned area and is shown in the Table 5.14. It can be seen that emissions have increased due to the increase of areas burned.

5.5.3 Methods

Emissions from grassland burning were determined according to the EMEP/EEA 2013 and IPCC 2006. Emissions from wildfires in grassland were calculated using equation 2.27 of the IPCC 2006. Mass of available fuel in grassland's fires – 2.1 t DM ha⁻¹ (Table 2.4 of IPCC 2006), fraction of the biomass combusted 0.74 (Table 2.6 of IPCC 2006).

5.5.4 Emission factors

Emission factors for NO_x, CO, NMVOC, SO₂, NH₃, TSP, PM₁₀ and PM_{2.5} emission calculation regarding burning of grassland are shown in the Table 5.15 (EMEP/EEA 2013, 11.B Forest fires, Table 3-8).

Table 5.15 Emission factors for grassland burning according to EMEP/EEA 2013

Pollutant	Value	Unit
NO _x	13	kg/ha area burned
CO	373	kg/ha area burned
NMVOC	34	kg/ha area burned
SO ₂	3	kg/ha area burned
NH ₃	3	kg/ha area burned
TSP	17	g/kg wood burned
PM ₁₀	11	g/kg wood burned
PM _{2.5}	9	g/kg wood burned

PAH emissions are calculated according to EMEP/CORINAIR Emission Inventory Guidebook, but DIOX emissions are calculated according to UNEP, Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases. Emission factor is chosen as for Grassland and moor fires – 5 µg TEQ/t.

5.5.5 Activity data

Area of grassland burning was taken from the SFRS and data are available starting from 1993 (Figure 5.6). For 1990-1992 no statistical information exists. However, an expert's assumption for years 1990-1992 was made, using extrapolation from burned areas of the following 5 years' period. The number of grassland fires and burnt area is directly dependent on anthropogenic activities. Over the past 15 years, most (in numbers and area burned) grassland fires occurred in 2006.

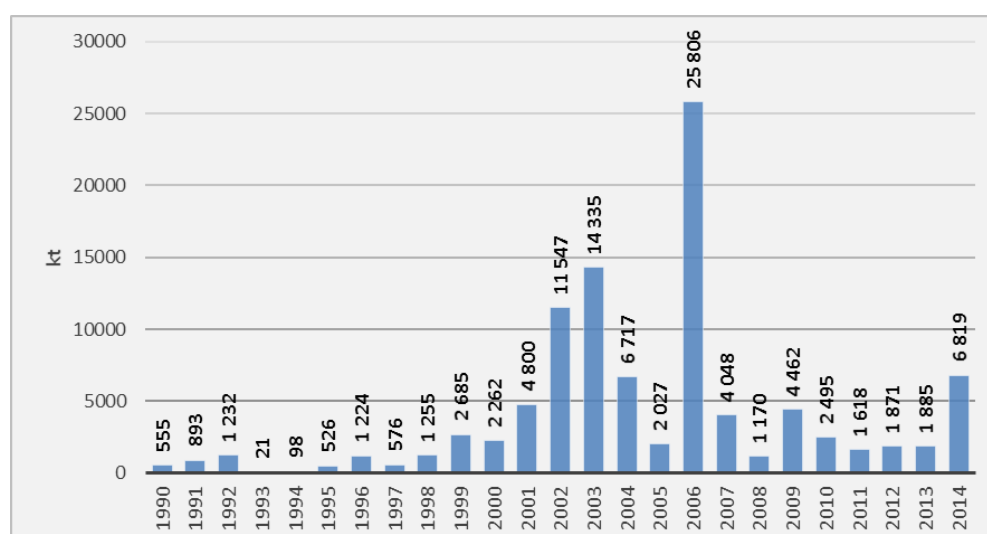


Figure 5.6 Area of last years grass burned (ha)

5.5.6 Uncertainties

Uncertainty of activity data (area) for biomass burning is estimated at ±10 % based on expert judgement. Uncertainties in emission factors are based on the EMEP/EEA emission inventory guidebook 2013 (11.B Forest fires, Table 3-8) default values.

5.5.7 QA/QC and verification

Quality control procedures named in IPCC 2006 were done. Assessment of trends has been performed. Land areas of wildfires burning were reviewed with latest statistics.

5.5.8 Recalculations

Recalculations are done for NO_x, CO, NMVOC, SO₂, NH₃, TSP, PM₁₀ and PM_{2.5} emissions from grassland burning, new emission factors for grassland burning according to EMEP/EEA 2013 were used (previously NO_x and CO emission factors according to IPCC 2006 were used, but NMVOC, SO₂, NH₃, TSP, PM₁₀ and PM_{2.5} emissions were not calculated). Comparison of previously used CO and NO_x emission factors according to 2006 IPCC, Volume 4, Chapter 2, Table 2.5 and new emission factors according to EMEP/EEA 2013 are shown in Table 5.16.

Table 5.16 Comparison of CO and NO_x emission factors for grassland burning

Category	References	Unit	CO	NO _x
Savannah and grassland	IPCC 2006 Table 2.5, Andreae and Merlet (2001)	g kg ⁻¹ dry matter burnt	65±20	3.9±2.4
Grass/ steppe	EMEP/EEA 2013, 11.B Forest fires, Table 3-8	kg ha ⁻¹ area burned	373	13

5.5.9 Planned improvements

No improvements are planned to be carried out.

6 Waste (NFR 5)

6.1 Sector overview

6.1.1 Overview

Waste management has acquired prior significance in the environmental protection policy as one of the instruments for sustainable use of natural resources. The main directions in the waste management are the development of the construction of polygons and collecting system for non-hazardous municipal waste and the development of system for the collection and treatment of hazardous waste. At the moment 11 non-hazardous waste polygons and one polygon for hazardous waste got A category permit according to IPPC directive. Biogas collection and use for energy production from biodegradable wastes and sludge is set as one of priorities in Latvia.

Main activity data sources for emissions calculations in waste sector is "3-Waste" data base, which is developed by LEGMC. According to the information from LEGMC the total generated volume of waste are shown in Table 6.1.

Table 6.1 Generated wastes in Latvia

Year	Municipal (all non-hazardous) wastes	Hazardous wastes	Total
2006	1420.46	54.372	1474.832
2007	1386.57	41.605	1428.175
2008	1368.79	46.4	1415.16
2009	1033.91	55.563	1089.473
2010	1131.404	55.089	1186.493
2011	1535.057	58.476	1593.533
2012	1799.440	85.121	1884.561
2013	1902.007	109.23	2011.237
2014	2013.695	80.978	2094.673

Data of water abstraction and use, wastewater treatment and discharge have been collected since 1991 in the frame of state statistical survey "2 – Water". State statistical survey "2-Water" must be reported by all enterprises which have issued permits on water use, water resources use or mineral deposits quarry use, or IPPC permit.

Table 6.2 shows the methods and source for activity data and emission factors used for emission calculating in Waste sector. Table 6.3 shows list of pollutants which are produced in Waste sector.

Table 6.2 Source categories and methods for Waste sector

NFR code	Long name	Method	AD	EF
5 A	Solid waste disposal on land	Tier 1	PS	D
5 B 1	Biological treatment of waste - Composting	Tier 1	PS	D
5 C 1 b ii	Hazardous waste incineration	Tier 1	PS	D
5 C 1 b iii	Clinical waste incineration	Tier 1	PS	D
5 C 1 b v	Cremation	Tier 1	PS	D
5 D	Waste-water handling	Tier 2	PS, CS	D

Table 6.3 Reported emissions in Waste sector in 2014

NFR code	Emissions
5A	NM VOC, PM _{2.5} , PM ₁₀ , TSP
5B1	NH ₃
5 C 1 b ii	NO _x , NM VOC, SO ₂ , TSP, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, dioxines, PAHs, HCB, PCB
5 C 1 b iii	NO _x , NM VOC, SO ₂ , TSP, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, dioxines, benzo(a)pyrene
5 C 1 b v	NO _x , NM VOC, SO ₂ , PM _{2.5} , PM ₁₀ , TSP, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, PCDD/ PCDF, PAHs, HCB, PCBs
5D1	NH ₃
5D3	NM VOC

6.1.2 Key sources

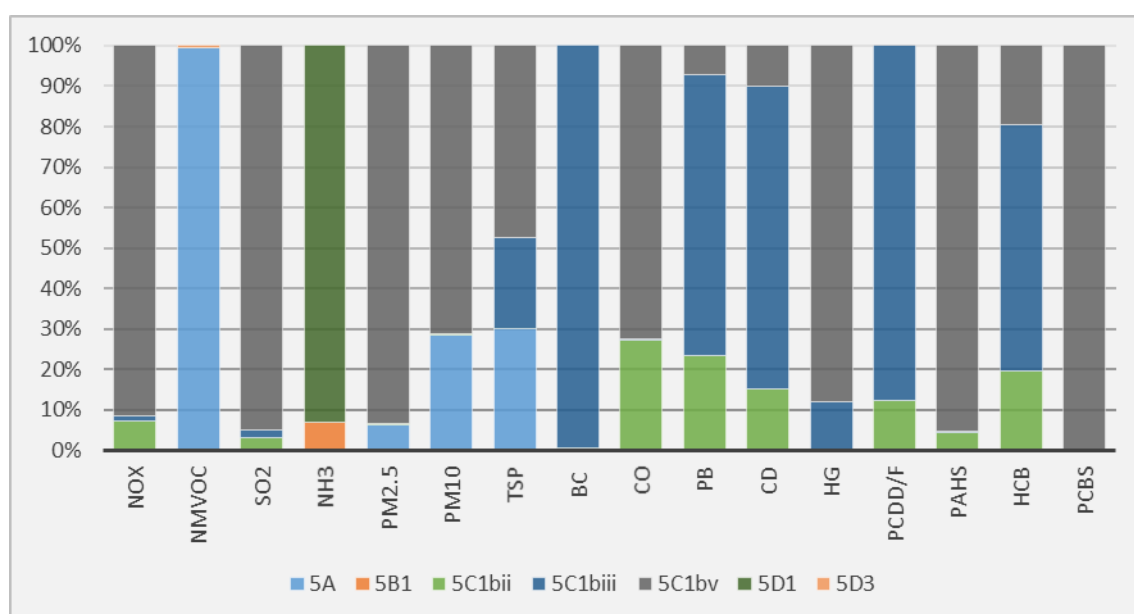


Figure 6.1 Distribution of emissions in Waste sector by subsectors in 2014 (%)

Emissions of NH₃ are key source in Waste water handling sector (5D; Figure 6.1). Emissions of heavy metals, PAHs, HCB, PCBs and PCDD/PCDF occurs only from waste incineration and cremation, relatively these are small amounts. NMVOC emissions mainly occurs from solid waste disposal.

6.1.3 Trends in emissions

Table 6.4 Change in emissions from Wastes sector between 1990⁵¹ and 2014 (%)

Pollutant	Unit	1990	1995	2000	2005	2010	2011	2012	2013	2014	Change in 1990-2014, %
NOx	kt	0.00064	0.00093	0.00166	0.00168	0.00194	0.00182	0.00167	0.00179	0.00200	212
NMVOc		1.003	0.720	0.941	0.958	0.949	0.860	0.830	0.837	0.792	-21
SO ₂		0.00008	0.00012	0.00019	0.00024	0.00025	0.00025	0.00023	0.00025	0.00026	218
NH ₃		1.224	1.148	1.090	1.129	1.149	0.832	0.845	0.821	0.800	-35
PM _{2.5}		NR	NR	0.00006	0.00007	0.00009	0.00029	0.00027	0.00035	0.00026	329
PM ₁₀		NR	NR	0.00017	0.00019	0.00021	0.00042	0.00040	0.00049	0.00039	122
TSP		NR	NR	0.00129	0.00208	0.00058	0.00088	0.00094	0.00086	0.00078	-39
BC		NR	NR	0.00002	0.00004	0.00001	0.00000	0.00001	0.00000	0.00000	-82
CO	t	0.000323	0.000311	0.000652	0.000384	0.000437	0.000309	0.000279	0.000302	0.000430	33
Pb		0.0078	0.0056	0.0044	0.0067	0.0011	0.0009	0.0012	0.0004	0.0009	-88
Cd		0.000977	0.000705	0.000526	0.000846	0.000133	0.000113	0.000154	0.000058	0.000111	-89
Hg		0.0050	0.0045	0.0041	0.0067	0.0037	0.0038	0.0037	0.0035	0.0038	-25
PCDD/F	g I-Teq	4.819	3.465	2.498	4.160	0.584	0.512	0.722	0.236	0.472	-90
PAHs	t	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	496
HCB	kg	0.0125	0.0091	0.0072	0.0109	0.0020	0.0016	0.0021	0.0009	0.0017	-86
PCB		NA	0.000231	0.000462	0.000627	0.000862	0.000885	0.000808	0.000882	0.000911	100

Emission estimates from the waste sector include:

- NMVOC, PM_{2.5}, PM₁₀, TSP emissions from solid waste disposal;
- NH₃ emissions from composting;
- NMVOC, NH₃ emissions from waste water handling;

⁵¹ For PMs the base year is 2000 instead of 1990

- Many pollutant emissions from incineration of hazardous and clinical wastes and cremation. Emissions from waste incineration with energy recovery are counted under Energy sector.

Data on hazardous waste in Latvia have been collected and compiled by LEGMC since 1997, but data on municipal waste since 2001. Since year 2002 data bases about hazardous and municipal wastes are combined in one data base "3-Wastes". Data in this data base are taken from State Statistical survey about wastes, which occurs every year. Statistical survey about wastes must fill all enterprises, which have permits on pollutant activities (A and B category) and all enterprises, which have permits on waste management operations.

Data of wastewater treatment and discharge have been collected since 1991 in the frame of state statistical survey "2-Water". State statistical survey "2-Water" must be filled by all enterprises which have permits on water use, water resources use or mineral deposits quarry use, or else A and B category polluting activity permit or C category acknowledgment. CSB data also are used as activity data for emission calculation.

6.2 Solid waste disposal (NFR 5A)

6.2.1 Overview

Solid waste disposal is a main waste treatment operation in Latvia. Significant amount of landfill gas is emitted annually from waste disposal sites. NMVOC are some part of landfill gas. NMVOC emissions relates to disposed wastes amounts.

6.2.2 Trends in emissions

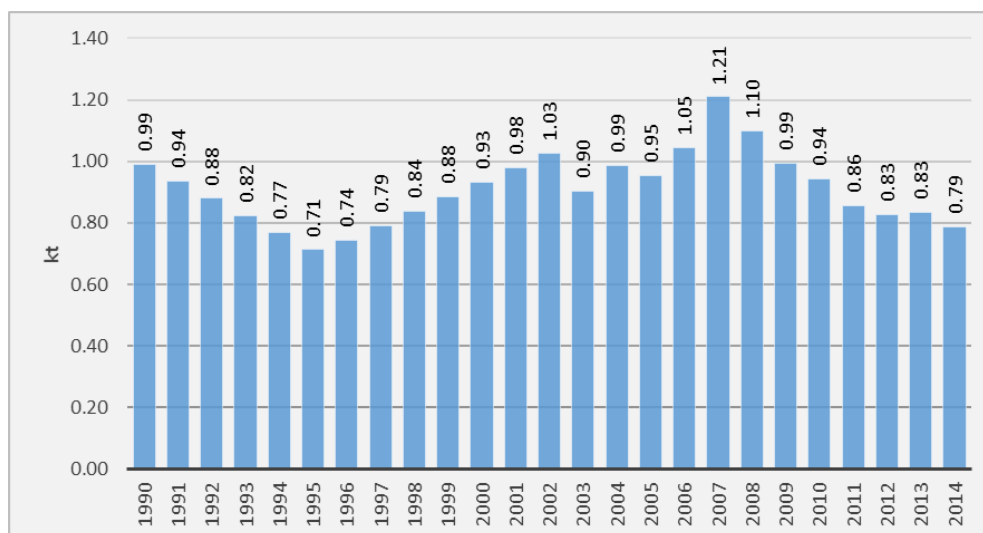


Figure 6.2 NMVOC emissions from Solid waste disposal (kt)

Emissions of NMVOC from solid waste disposal (Figure 6.2) correlate with CH₄ emissions, which are calculated according to UNFCCC requirements. These emissions mostly relates to disposed waste amounts in landfills.

6.2.3 Methods

NMVOC, PM_{2.5}, PM₁₀, TSP emissions from solid waste disposal are calculated. EMEP/EEA 2013 for emissions calculations is used. To estimate NMVOC, PM_{2.5}, PM₁₀, TSP emissions from solid waste disposal disposed amount are multiplied with emission factors from "Table 3-1 Tier 1 emission factors for source category 5.A Biological treatment of waste - Solid waste disposal on land".

6.2.4 Emission factors

Table 6.5 Emission factors for disposed wastes

Pollutant	EF (unit/disposed wastes)
NM VOC	1.56 kg/t
PM _{2.5}	0.033 g/t
PM ₁₀	0.219 g/t
TSP	0.463 g/t

6.2.5 Activity data

To calculate NM VOC, PM_{2.5}, PM₁₀, TSP emissions - amount of disposed waste must be known.

Data about disposed amounts are taken from waste statistical survey "3-Wastes" (Figure 6.3).

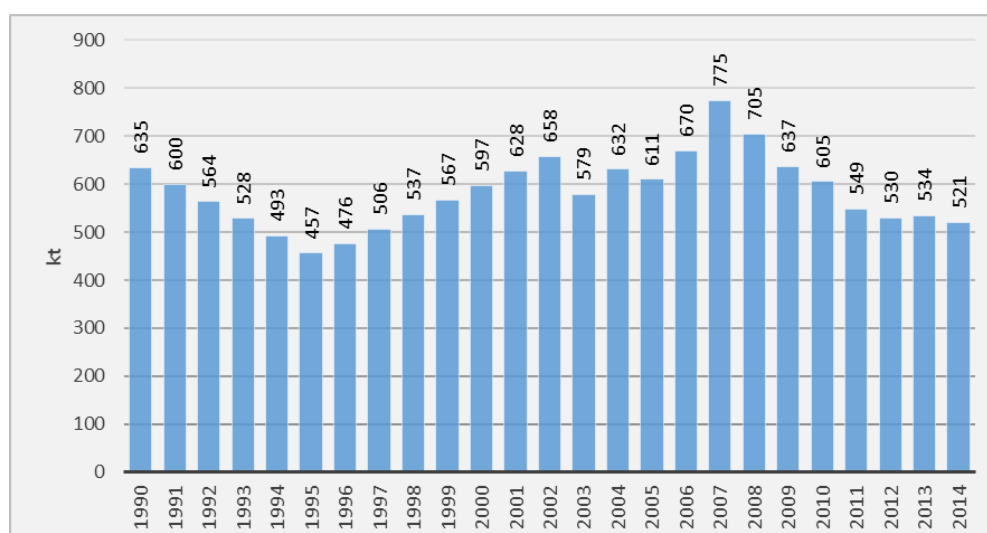


Figure 6.3 Disposed waste amounts in Latvia (kt)

6.2.6 Uncertainties

Uncertainty for activity data is estimated as 7%. The same uncertainty is used also for emission calculations in UNFCCC.

6.2.7 QA/QC and verification

Disposed wastes amounts are taken from waste data bases. Data in this data bases are checked and approved by Regional Environmental Boards. Check of emissions calculations are done. Assessments of trends have been performed.

6.2.8 Recalculations

No recalculations are done in this submission.

6.2.9 Planned improvements

It is planned to reassess emissions from solid waste disposal. New research will be available for landfill management in Latvia.

6.3 Composting and anaerobic digestion (NFR 5B)

6.3.1 Overview

NH₃ emissions from waste composting are calculated under this category. Composting is set as one of priorities in waste treatment in Latvia. For composting biological degradable wastes are useful. In Latvia these are mostly "park - garden" and "food production" wastes.

Data about industrial composting become available since 2003, when waste treatment companies start waste composting and get IPPC permits on this activity.

Composting in private households has been very popular for many years. Composted amount in households is estimated according to research done by Waste Management Association of Latvia in year 2015. In this research total amount of composted wastes in households are estimated for years 2012 – 2014. Time series till 1990 is developed according to population changes.

6.3.2 Trends in emissions

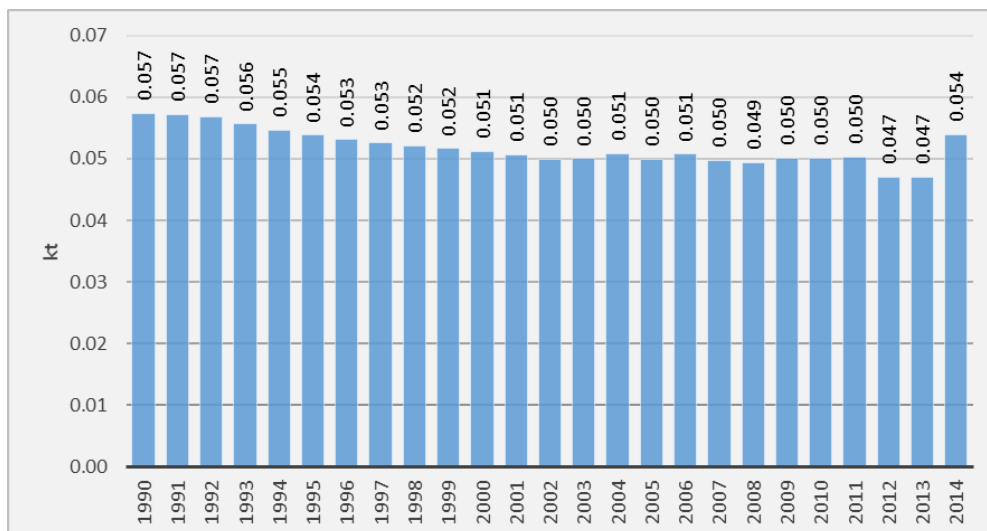


Figure 6.4 NH₃ emissions from composting (kt)

6.3.3 Methods

Composted waste amount is multiplied by emission factor.

6.3.4 Emission factors

NH₃ emission factor 0.24 kg/t is taken from EMEP/EEA 2013.

6.3.5 Activity data

Composted waste amount is taken from “3-Waste” database, R3 - Recycling/reclamation of organic substances that are not used as solvents (including composting and other biological transformation processes), recovery operation for determination of composted amounts was used. Not all amounts, which classified under recovery as R3, are composted. To determine composted amount, each enterprise, which reports with recovery operations R3, working profile must be taken in account. Starting from year 2013 separate R3A code for composting was implemented in Latvia legislation and reporting requirements.

Table 6.6 Composted waste amounts (kt)

	Industrial waste composted	Household waste composted	Total waste composted
1990	NO	239.09	239.09
1991	NO	238.20	238.20
1992	NO	236.84	236.84
1993	NO	231.70	231.70
1994	NO	227.69	227.69
1995	NO	224.08	224.08
1996	NO	221.29	221.29
1997	NO	219.09	219.09
1998	NO	216.93	216.93
1999	NO	215.00	215.00

	Industrial waste composted	Household waste composted	Total waste composted
2000	NO	213.43	213.43
2001	NO	210.89	210.89
2002	NO	207.98	207.98
2003	2.22	206.05	208.27
2004	7.91	204.00	211.90
2005	6.56	201.60	208.16
2006	11.70	199.64	211.34
2007	9.42	197.93	207.35
2008	9.28	196.41	205.69
2009	15.11	193.81	208.92
2010	18.55	190.02	208.57
2011	23.70	185.91	209.60
2012	17.62	178.16	195.78
2013	14.37	181.35	195.72
2014	40.04	184.61	224.65

6.3.6 Uncertainties

Uncertainty for activity data is estimated as 29%. The same uncertainty is used also for calculations in UNFCCC.

6.3.7 QA/QC and verification

Industrial composted wastes amounts are taken from waste data bases. Data in this data bases are checked and approved by Regional Environmental Boards. Assessments of trends have been performed.

6.3.8 Recalculations

NH₃ emissions from household composting is calculated for first time.

6.3.9 Planned improvements

No planned improvements.

6.4 Waste incineration (NFR 5C)

6.4.1 Overview

Currently there are no large amounts of waste being incinerated in Latvia without energy recovery. The main source of emissions is attributed to the hazardous and clinical waste incineration. The amounts of incinerated clinical waste are registered in the hazardous waste database (from 2002 in "3-Waste" data base) as Health service for humans and animals as well as related research waste. The rest of the incinerated waste from hazardous waste database is considered as hazardous (industrial) wastes.

Incinerated amounts for years 1990 – 1998 is extrapolated according to average value of incinerated amount for years 2002 – 2013 what is attributed to disposed wastes value.

In cremation sector 5C1bv emissions from human bodies and animal waste (carcasses) incineration are calculated.

Emissions from various types of fires such as landfill fires and open burning of garden waste are not estimated for Latvia.

6.4.2 Trends in emissions

In 2001 large increase of emissions are shown, because one enterprise reported huge amount of incinerated wastes, but another years' amount is much smaller. Emissions are increased compared with 1990. Increase is due to one more emission source occurred since 1994, when crematorium starts to operate in Latvia.

For clinical wastes all 18 EWC group codes are counted. For clinical wastes increase are shown in years 2006 and 2007, when clinical wastes were incinerated in hazardous waste incineration facility. From year 2008 facility was closed.

PM_{2.5}, PM₁₀, TSP emissions are calculated from animal (carcasses) wastes burning. Data in "3-Wastes" data base is available from year 2011. Bird factory and cattle remains were burned in installation without energy recovery.

Table 6.7 Emissions in Waste incineration in 1990-2014

	Unit	1990	1995	2000	2005	2010	2011	2012	2013	2014	Changes in 1990-2014, %
NO_x	kt	0.00064	0.00093	0.00166	0.00168	0.00194	0.00182	0.00167	0.00179	0.00200	212
NM_{VOC}		0.00326	0.00235	0.00516	0.00168	0.00152	0.00008	0.00004	0.00003	0.00127	-61
SO₂		0.00008	0.00012	0.00019	0.00024	0.00025	0.00025	0.00023	0.00025	0.00026	218
PM_{2.5}		NR	NR	0.000042	0.000054	0.000074	0.000272	0.000256	0.000333	0.000248	492
PM₁₀		NR	NR	0.000044	0.000055	0.000074	0.000305	0.000287	0.000376	0.000277	530
TSP		NR	NR	0.001009	0.001797	0.000301	0.000628	0.000696	0.000613	0.000547	-46
BC		NR	NR	0.000022	0.000040	0.000005	0.000005	0.000007	0.000002	0.000004	-82
CO		0.00032	0.00031	0.00065	0.00038	0.00044	0.00031	0.00028	0.00030	0.00043	33
Pb	t	0.00780	0.00562	0.00443	0.00666	0.00112	0.00086	0.00118	0.00043	0.00092	-88
Cd		0.00098	0.00071	0.00053	0.00085	0.00013	0.00011	0.00015	0.00006	0.00011	-89
Hg		0.00504	0.00447	0.00414	0.00668	0.00370	0.00376	0.00371	0.00346	0.00376	-25
PCDD/F	g i-Teq	4.82	3.46	2.50	4.16	0.58	0.51	0.72	0.24	0.47	-90
PAHs	t	1.33E-08	2.86E-08	5.42E-08	6.01E-08	7.56E-08	7.37E-08	6.74E-08	7.30E-08	7.89E-08	496
HC_B	kg	0.01253	0.00909	0.00719	0.01087	0.00200	0.00161	0.00210	0.00091	0.00170	-86
PC_B	kg	NA	0.00023	0.00046	0.00063	0.00086	0.00088	0.00081	0.00088	0.00091	100

6.4.3 Methods

For emissions calculation EMEP/EEA 2013 methodology are used. The amount of incinerated waste is multiplied with emission factors.

6.4.4 Emission factors

Table 6.8 Emission factors for waste incineration

Pollutant	Units EF	Industrial EF	Clinical EF	Animal EF
NO _x	kg/t	0.87	2.3	
NM _{VOC}	kg/t	7.4	0.7	
SO ₂	kg/t	0.047	0.54	
CO	kg/t	0.07	0.19	
PM _{2.5}	kg/t	0.004	NE	0.538
PM ₁₀	kg/t	0.007	NE	0.628
TSP	kg/t	0.01	17	0.897
Pb	g/t	1.3	62	
Cd	g/t	0.1	8	
Hg	g/t	0.056	43	
As	g/t	0.016	0.2	
Cr	g/t	NE	2	
Cu	g/t	NE	98	
Ni	g/t	0.14	2	
Se	g/t	NE	NE	
Zn	g/t	NE	NE	
PCDD/PCDF	µg i-Teq/t	350	40	
PAHs	g/t	0.02	0.04	
HC _B	g/t	0.002	0.1	
PC _B s	g/t	NE	NA	

Emissions from cremation are calculated according to EMEP/EEA 2013. PM_{2.5}, PM₁₀, Se and Zn are not calculated, because emission factors are not available.

Table 6.9 Emission factors from cremation

Pollutant	EF	Units EF
NO _x	0.825	kg/body
NM VOC	0.013	kg/body
SO ₂	0.113	kg/body
CO	0.14	kg/body
PM _{2.5}	34.70	g/body
PM ₁₀	34.70	g/body
TSP	14.6	g/body
CO	0.14	kg/body
Pb	30.03	mg/body
Cd	5.03	mg/body
Hg	1.49	mg/body
As	13.61	mg/body
Cr	13.56	mg/body
Cu	12.43	mg/body
Ni	17.33	mg/body
Se	19.78	mg/body
Zn	160.12	mg/body
PCDD/ PCDF	0.027	µg/body
benzo(a) pyrene	13.2	µg/body
HCB	0.15	mg/body
PCBs	2.41	mg/body

6.4.5 Activity data

Table 6.10 Incinerated wastes in Latvia

Year	Hazardous waste (kt)	Clinical waste (kt)	Animal waste (kt)	Total (kt)
1990	0.429082	0.116729	NO	0.545812
1991	0.404964	0.110168	NO	0.515131
1992	0.380845	0.103606	NO	0.484451
1993	0.356726	0.097045	NO	0.453771
1994	0.332607	0.090484	NO	0.423091
1995	0.308488	0.083922	NO	0.392410
1996	0.321434	0.087444	NO	0.408878
1997	0.341924	0.093018	NO	0.434942
1998	0.362414	0.098592	NO	0.461006
1999	0.347210	0.201420	NO	0.548630
2000	0.690280	0.056410	NO	0.746690
2001	1.319270	0.213310	NO	1.532580
2002	0.165643	0.032247	NO	0.197890
2003	0.201813	0.040607	NO	0.242420
2004	0.210125	0.112325	NO	0.322450
2005	0.215127	0.102127	NO	0.317254
2006	0.786160	0.261890	NO	1.048050
2007	0.540500	0.350861	NO	0.891361
2008	0.299750	0.012361	NO	0.312111
2009	0.200000	0.011663	NO	0.211663
2010	0.200000	0.012843	NO	0.212843
2011	0.006300	0.012738	0.366092	0.385130
2012	NO	0.018049	0.348861	0.366910
2013	NO	0.005887	0.479833	0.485720

Year	Hazardous waste (kt)	Clinical waste (kt)	Animal waste (kt)	Total (kt)
2014	0.166927	0.010341	0.3166033	0.493301

Emissions from cremation are calculated according to EMEP/EEA 2013.

Data about burned bodies are provided by operator of crematorium. In Latvia operates only one crematorium.

Table 6.11 Burned bodies in Riga crematorium

Year	Burned bodies
1994	54
1995	564
1996	819
1997	817
1998	869
1999	982
2000	1127
2001	1297
2002	1293
2003	1389
2004	1391
2005	1529
2006	1630
2007	1959
2008	2227
2009	1977
2010	2102
2011	2158
2012	1970
2013	2150
2014	2222

6.4.6 Uncertainties

Uncertainty for cremation of bodies are not estimated, because it is correct figure from crematorium. Uncertainty of incinerated amount from "3-Wastes" data base is 44%. The same uncertainty is used also for calculations in UNFCCC.

6.4.7 QA/QC and verification

Incinerated wastes amounts are taken from waste data bases. Data in this data bases are checked and approved by Regional Environmental Boards. Assessments of trends have been performed.

QA/QC and verification included:

- Quality check of activity data in the period of reporting;
- Quality check in calculation of emissions for UNFCCC NIR;
- Trend analysis.

6.4.8 Recalculations

Emissions recalculated due to reclassification of animal waste from clinical to carcasses.

6.4.9 Planned improvements

No planned improvements.

6.5 Waste water handling (NFR 5D)

6.5.1 Overview

Data of LEGMC shows there were 182 millions m³ of waste water discharged in Latvia (2014). Most of national population (77%, 2014) is served by urban waste water collecting and treatment.

Emissions of NH₃ from latrines and NMVOC from Waste Water Handling were calculated within this report.

6.5.2 Trends in emissions

Table 6.12 NMVOC and ammonia emissions from Waste water handling (kt)

	Unit	1990	1995	2000	2005	2010	2011	2012	2013	2014	Change in 1990-2014, %
NMVOC	kt	0.009	0.0054	0.0039	0.0034	0.0033	0.0036	0.0035	0.0036	0.0027	-69.67
NH ₃		1.17	1.09	1.04	1.08	1.1	0.78	0.8	0.77	0.75	-36.04

Both NMVOC and NH₃ emissions are decreasing over entire period (Table 6.12) due to such factors as slow decrease of national population, increase of collection and treatment of waste water and increase of industrial activity because of collapse of USSR.

6.5.3 Methods

For emission calculation, EMEP/EEA 2013 was used as methodology source (Table 6.13). According to methodology, activity data are multiplied by according emission factors to calculate emissions, and for both substances emitted methodologies are considered to be Tier 2 methods.

6.5.4 Emission factors

Table 6.13 Activity data and emission factors for calculation of NH₃ and NMVOC emission from Waste Water Handling sector

Emission	Activity data	Emission factor value	Emission factor unit
NH ₃	Population using latrines	1.6	kg/person/year
NMVOC	Amount of waste water produced	15	mg/m ³ waste water

Default EMEP emission factors for both NH₃ and NMVOC were used.

6.5.5 Activity data

Activity data were taken from water use, treatment and discharge national statistics (data base of state statistical survey "2-Water").

Table 6.14 Activity data type and value example

Emission	Source of activity data	Activity data value (2014)
NH ₃	Population using latrines was calculated as difference between entire national population and number of population served by urban waste water treatment plants	467 (thousands of people)
NMVOC	Amount of waste water produced and discharged	182 (millions of m ³)

Statistical data on number of national population served or not served by waste water collecting and treatment services is available from year 2000. Extrapolation was used to obtain part of population not served for period 1990-1999. Extrapolation and change in reporting procedure implemented in 2008 can lead to some inconsistency of statistical data results.

Table 6.15 Activity data and result of emission (NH₃ and NMVOC) calculations from Waste Water Handling sector 1990-2014

Year	Population using latrines	Emission of NH ₃ , kt	Amount of waste water produced, mio m ³	Emission of NMVOC, kt
1990	729 442	1.17	600	0.00900
1991	726 714	1.16	571	0.00857

Year	Population using latrines	Emission of NH ₃ , kt	Amount of waste water produced, mio m ³	Emission of NMVOC, kt
1992	722 569	1.16	526	0.00789
1993	706 897	1.13	427	0.00641
1994	694 657	1.11	402	0.00603
1995	683 633	1.09	357	0.00536
1996	675 144	1.08	331	0.00497
1997	668 414	1.07	327	0.00491
1998	661 819	1.06	320	0.00480
1999	655 930	1.05	283	0.00425
2000	649 234	1.04	257	0.00386
2001	754 049	1.21	244	0.00366
2002	703 320	1.13	243	0.00365
2003	583 470	0.93	229	0.00344
2004	687 532	1.10	211	0.00317
2005	674 381	1.08	226	0.00339
2006	651 694	1.04	196	0.00294
2007	637 464	1.02	210	0.00315
2008	751 138	1.20	191	0.00287
2009	655 395	1.05	226	0.00339
2010	686 788	1.10	222	0.00333
2011	488 318	0.78	241	0.00362
2012	498 677	0.80	234	0.00351
2013	483 784	0.77	238	0.00357
2014	466 535	0.75	182	0.00273

6.5.6 Uncertainties

The following uncertainties were used for Wastewater Handling sector for activity data and emission factors:

Table 6.16 Uncertainties for Waste Water handling sector

Emission	Activity data	Emission factor
NH ₃	10%	30%
NMVOC	10%	30%

6.5.7 QA/QC and verification

QA/QC and verification included:

- Quality check of activity data in the period of annual reporting, when water using enterprises are submitting their annual water data (including both number of national population served by waste water collection and/or certain type and level of treatment, and amount of total waste water discharged); data are submitted electronically in a water statistics data base "2-Water", and only after a quality check, performed by an inspector of Regional Environment Board of State Environment Service, the particular report is included in a national statistics.
- Quality check in calculation of emissions for UNFCCC NIR;
- Trend analysis.

6.5.8 Recalculations

NH₃ emissions were recalculated for entire periods 2000 – 2008 and 2011 – 2013 due to update of nation population data and number of national population provided by collection and treatment of waste water.

6.5.9 Planned improvements

It is planned to review number of population using latrines in accordance with 2006 IPCC Guidelines and improve uncertainty estimation and documentation in the next submission.

7 Other and natural emissions (NFR 6A, 11A)

7.1 Sector overview

This category comprises NO_x, CO, PM_{2.5}, PM₁₀, TSP, PCDD/ PCDF and PAHs emissions arising from burning on site in forest (Table 7.1)

Table 7.1 Emissions from on – site burning in the forest

	Unit	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Change in 1990-2014, %
NO_x	kt	0.18	0.25	0.41	0.09	0.07	0.08	0.07	0.08	0.05	0.06	0.06	0.06	0.06	-65
PM_{2.5}		NR	NR	3.38	0.74	0.60	0.63	0.55	0.64	0.45	0.46	0.49	0.48	0.52	-85
PM₁₀		NR	NR	4.13	0.90	0.74	0.77	0.67	0.78	0.55	0.56	0.59	0.59	0.63	-85
TSP		NR	NR	6.39	1.39	1.14	1.20	1.04	1.20	0.85	0.86	0.92	0.91	0.97	-85
CO		12.89	17.75	29.31	6.39	5.23	5.48	4.75	5.50	3.88	3.95	4.20	4.19	4.47	-65
PCDD/F	g i-Teq	0.83	1.14	1.88	0.41	0.34	0.35	0.30	0.35	0.25	0.25	0.27	0.27	0.29	-65
PAHs	t	2.74	3.77	6.22	1.36	1.11	1.16	1.01	1.17	0.82	0.84	0.89	0.89	0.95	-65

Variation of the emissions depends from the annual felling stock and the approach used to utilize harvesting residues. Since 2005 it is becoming more common to use harvesting residues from final felling in forest biofuel production, therefore, incineration and other types of utilization of residues are not used widely anymore in final felling. In thinning harvesting residues are used to improve soils bearing capacity during forwarding. The study on the actual utilization practice was implemented by LSFRI Silava in 2012 and 2014. The study results demonstrated that no harvesting residues are incinerated in state forests and in 15 % of the clear-felling sites (by area) harvesting residues are incinerated in private forests⁵². Due to lack of information about transition between previous practice and correct figures of incineration of harvesting residues, it is assumed that incineration of harvesting residues is reduced in 2011, but earlier studies⁵³ are used for previous years.

7.2 Methodological issues

Methods

Generally 2006 IPCC Guidelines, EMEP/EEA 2013 and EMEP/CORINAIR simpler methodology were used. Emissions are estimated as follows: emission factor multiplied by activity data provided by National forest inventory, State forest service and Fire and Rescue Service.

Dioxins (PCDD/ PCDF) are calculated according to the UNEP methodology, EF from 97. pp. 5 micrograms TEQ/t incinerated material.

Emission factors and other parameters

For CO and NO_x emission calculation from burning on - site in the forest were used default emission factors according to 2006 IPCC Guidelines, Volume 4, Chapter 2, Table 2.6. For PM_{2.5}, PM₁₀ and TSP emission calculation from burning on - site in the forest were used default emission factors according to EMEP/EEA 2013, 11.B Forest fires, Table 3-1 ().

Table 7.2 Emission factors for open burning of forests

Pollutant	Value	Unit
CO	78 ± 31	g kg ⁻¹ dry matter burnt
NO _x	1.1 ± 0.6	g kg ⁻¹ dry matter burnt
TSP	17	g kg ⁻¹ wood burned

⁵² Lazdiņš, A., Zariņš, J., 2013. Meža ugunsgrēku un mežizstrādes atlieku dedzināšanas radītās siltumnīcefekta gāzu emisijas Latvijā (Greenhouse gas emissions due to forest fires and incineration of harvesting residues in Latvia), in: ReferātuTēzes. Presented at the Latvijas Universitātes 71. zinātniskā konference "Ģeogrāfija, ģeoloģija, vides zinātne", Latvijas Universitāte, Rīga, pp. 133–137.

⁵³ Līpiņš, L., 2004. Assessment of wood resources and efficiency of wood utilization (Koksnes izejvielu resersu un to izmantošanas efektivitātes novērtējums).

Pollutant	Value	Unit
PM ₁₀	11	g kg ⁻¹ wood burned
PM _{2.5}	9	g kg ⁻¹ wood burned

Emission factors for PAHs were estimated by multiplying the benz[a]pyrene emission factor by the appropriate ratios (Table 7.3).

Table 7.3 PAHs emission factors for open burning of forests

PAH	Default emission factor (best estimate), g t ⁻¹	Ratio	Emission factor, g t ⁻¹
Benzo [b] fluoranthene	7.2	0.6	4.32
Benzo [k] fluoranthene	7.2	0.3	2.16
Benz [a] pyrene	7.2	1.0	7.20
Indeno [123cd] pyrene	7.2	0.4	2.88

The following assumptions have been made for burnt harvesting residues calculation (Source: State Forest Service, private forest owners questionnaires):

- 1990 to 2000 – 50 % of harvesting residues left for incineration and 67 % incinerated, the rest left to decay;
- 2001 to 2004 – 30 % of harvesting residues left for incineration and 67 % incinerated and 70 % left to decay;
- 2005 to 2009 – 7 % of harvesting residues left for incineration and 100 % burned on-site, the rest left for decay or extracted for bioenergy production.
- starting from 2010 – 4 % of harvesting residues left for incineration and 100 % burned on-site, the rest left for decay or extracted for bioenergy production.

Activity data

Emissions from controlled fires were calculated considering average stock of harvesting residues (BEF for conversion of stem biomass to above-ground biomass), which considerably increased due to increase of estimates of harvesting stock (Figure 7.1).

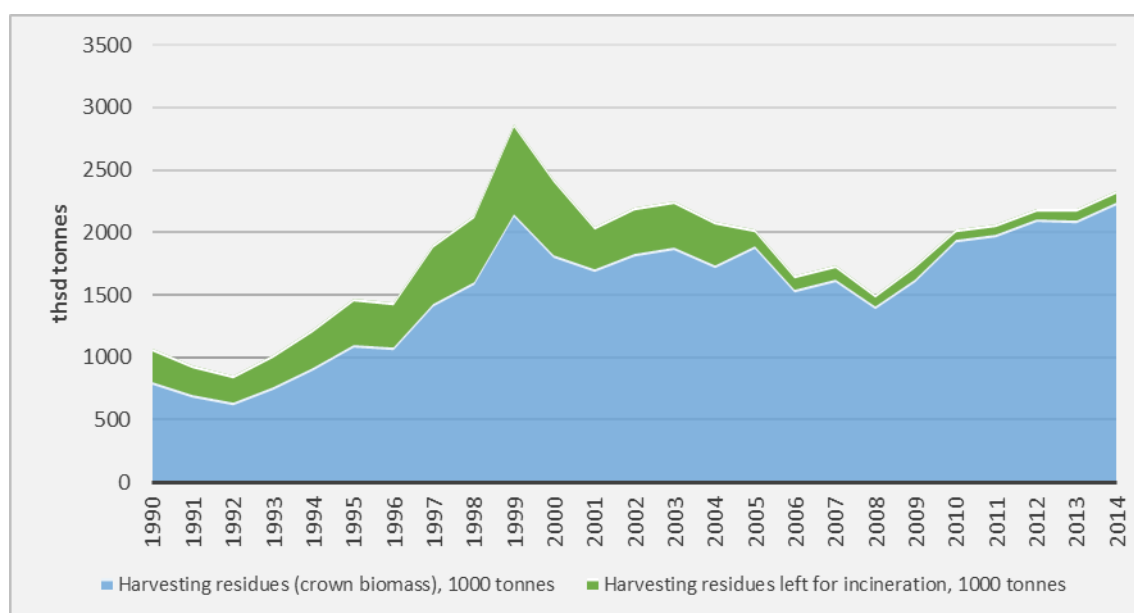


Figure 7.1 Harvesting residues and residues left for incineration (1000 tons)

Uncertainties

Uncertainty concerning combustion efficiencies in combined is $\pm 10\%$ according to the expert judgment. Uncertainties of emission factors are based on the 2006 IPCC Guidelines' and EMEP/EEA 2013 default values.

8 Recalculations and improvements

8.1 Recalculations

In Submission 2016, large recalculations have been made. That affected almost all main pollutant emissions, especially NMVOC (Figure 8.1).

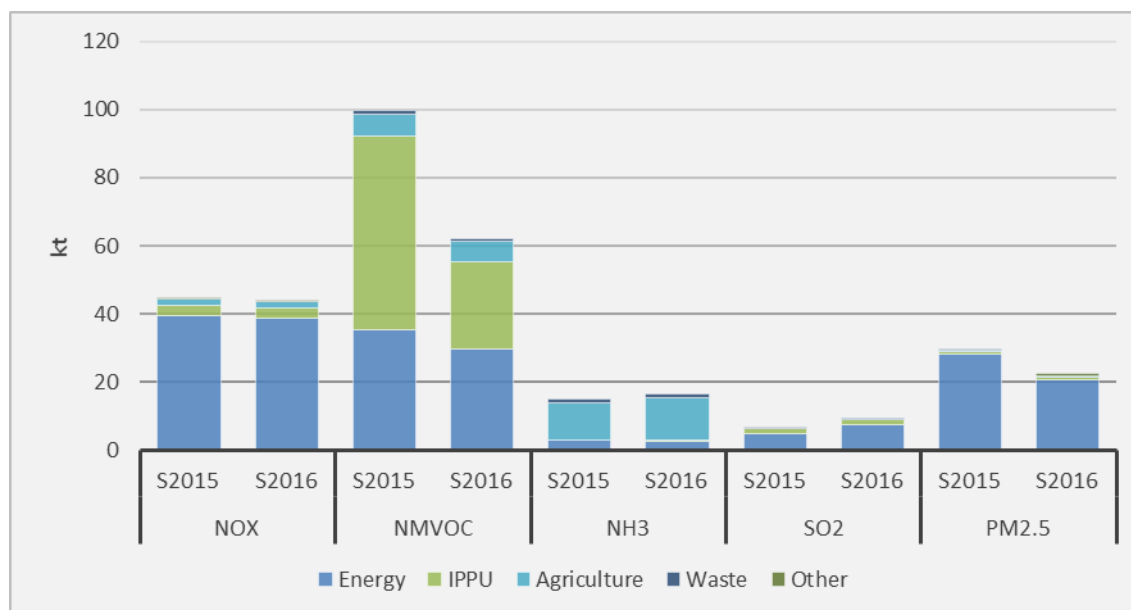


Figure 8.1 Emission comparison for 2013 between Submission 2015 and Submission 2016

Comparing reported emissions of 2013 in Submission 2015 and Submission 2016, NO_x emissions have decreased by 1.1% mainly due to the changes in methodology in Energy subsectors. The remarkable changes in NMVOC emissions by -37.7% are because of changes in methodology in Solvent use (IPPU), as well as in Residential sector (Energy). NH₃ emissions have changed by 10.9%, which can generally be explained with updated algorithm in Agriculture sector to calculate these emissions. Quite noticeable changes in SO₂ emissions by 40.0% are because of updated SO₂ methodology in Energy sector, while changes in PM_{2.5} emissions by -23.5% are mainly due to methodology change in Residential sector (Energy).

List of main recalculations by sectors are listed below:

Energy sector

- change of approach (Tier 1 to Tier 2) in NFR 1A4b Residential sector which caused changes in emissions for all pollutants;
- updated SO₂ emission factors for several fuel types;
- for the first time, SO₂ emissions for wood and natural gas for all time series (1990-2014) have been calculated;
- changes of activity data for several fuel types (anthracite, other biogas, waste, wood, gasoline);
- improvements comprise more precise split of passenger cars, LDV and HDV by subgroups (depending on engine volume) and layers (EURO classes) and mileage;
- updated NH₃ emission factors in Railway.

IPPU sector

- updated methodology for Solvent use which caused changes in NMVOC emissions;
- slight changes in activity data (Lime production) which caused changes in PM emissions.

Agriculture sector

- implementation of EMEP/EEA 2013 methodology to estimate NH₃ and NO emissions from manure management;

- implementation of new approach to estimate manure management distribution values according to the latest national studies;
- updated Nex values for swine and poultry;
- split down calculation for poultry in following subgroups: layers, broilers, turkeys, geese and ducks;
- implementation of cattle and swine age-subgroups;
- new emission factors for grassland burning according to EMEP/EEA 2013 (affects also NFR 6A emissions).

Waste sector

- NH₃ emissions from household composting were calculated for the first time;
- update of nation population data and number of national population provided by collection and treatment of waste water which caused changes in NH₃ emissions;
- reclassification of animal waste from clinical to carcasses which caused significant changes in POPs emissions.

8.2 Planned improvements

Planned improvements are as follow:

Energy sector

- Obtain country-specific emission factors for heavy metals.
- Research on off-road fuel consumption and installations planned in 2016, as currently it is assumed that only gasoline is used off-roads..

IPPU sector

- There are plans to obtain and analyse historical data trends even for those years that are confidential according to CSB. These improvements will give more complete time series in sector 2B10a for time period back to 2008. At the moment in progress is process of implementing online system for reporting substances in Chemical substance registry. For Submission 2017 it is planned to gather more complete historical data as far as possible and obtain a reasonable data for extrapolation.
- It is planned to implement electronic reporting for importers and producers in the Chemicals Register from 2016. According to that, possible changes in activity data in Solvents and other product use are expected. It is planned to get more accurate division by subcategories taking into account that previously it was done by expert judgment.

Agriculture sector

- Tier 2 approach will be implemented for NMVOC calculation for cattle (Manure management).
- Reporting of NH₃ emissions will be supplemented by NH₃ emissions calculation from sewage sludge and other organic fertilizers in the next inventory (Agricultural soils).
- It is planned to continue activities to implement Tier 2 approach to calculate PM emissions (from stables).

Waste sector

- It is planned to reassess emissions from solid waste disposal. New research will be available for landfill management in Latvia.
- It is planned to review number of population using latrines in accordance with 2006 IPCC Guidelines and improve uncertainty estimation and documentation in the next submission.

9 Projections

Last projections were submitted in NFR14 format on 15th March, 2016. It is planned to prepare complete version of projections in Submission 2017.

In the figures below progress in meeting the reduction targets set in the amended version of the Gothenburg protocol (2012) can be observed. Based on the projections with existing measures, Latvia will be in compliance with Gothenburg protocol, excluding ammonia emissions after 2020.

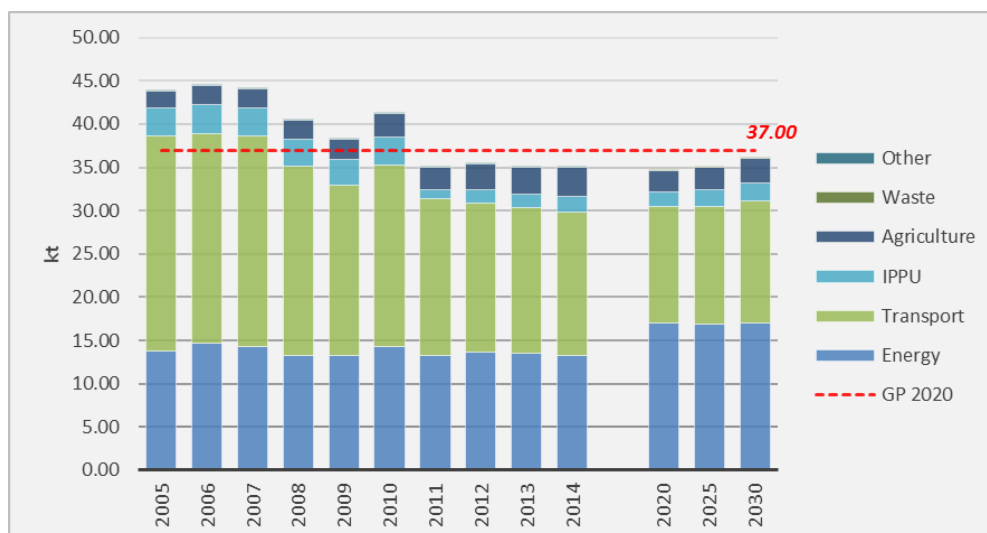


Figure 9.1 NOx emissions in 2005-2030 (kt)

Largest part of NOx emissions both in historical years and in 2020-2030 arise from Energy sector, including Transport (in the figures Transport sector was extracted for transparency purposes). It is projected, that NOx emission level in the scenario with existing measures will be around 2014 level – in 2020, NOx emissions will be 1.3% lower.

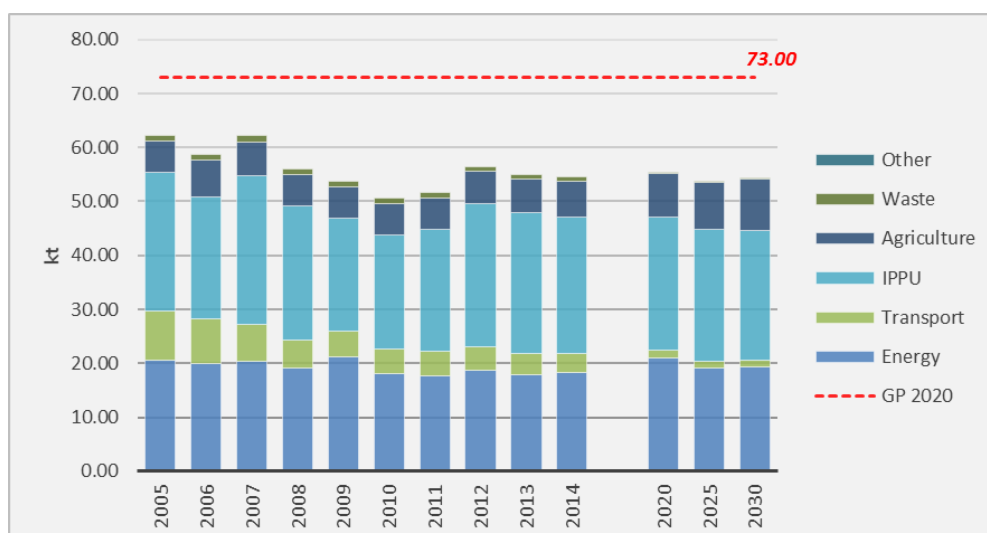


Figure 9.2 NMVOC emissions in 2005-2030 (kt)

NMVOC emissions were recalculated in Submission 2016 for Solvents, due to the changes in methodology. It is projected, that Latvia will be in compliance with targets of Gothenburg protocol. The largest part of emissions both in historical years, and in 2020-2030 contributes to IPPU, as well as Energy sectors. Small part of NMVOCs contributes to Agriculture and Transport sectors. It is projected that NMVOC emissions in 2020 will be 1.7% higher than in 2014.

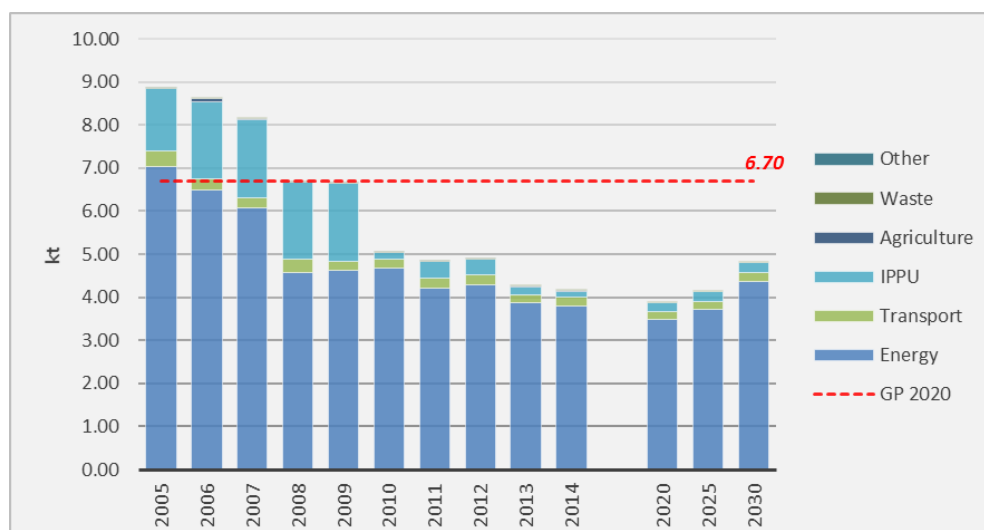


Figure 9.3 SO₂ emissions in 2005-2030 (kt)

SO₂ emissions are mainly produced by Energy sector, including Transport, as well as by IPPU. It is projected, that SO₂ emission level in 2020 scenario with existing measures will be 7.1% lower than in 2014. However, after 2020 an increase of emissions can be seen due to projected increase in coal consumption. Nevertheless, targets set in Gothenburg protocol will be complied.

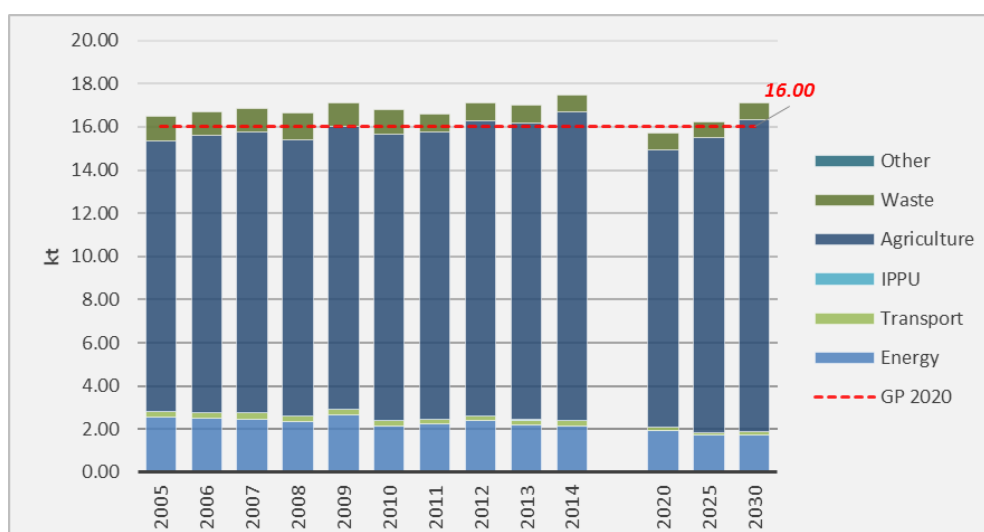


Figure 9.4 NH₃ emissions in 2005-2030 (kt)

The level of ammonia emissions is quite constant since 2005, and the largest part from NH₃ emissions is contributed by Agriculture sector. It is projected, that in 2020 total NH₃ emissions will be reduced by 10.2%, comparing to 2014. However, in the following years there are plans to increase livestock, therefore it is possible that after 2020 the emissions could increase, exceeding Gothenburg ceilings in 2025-2030.

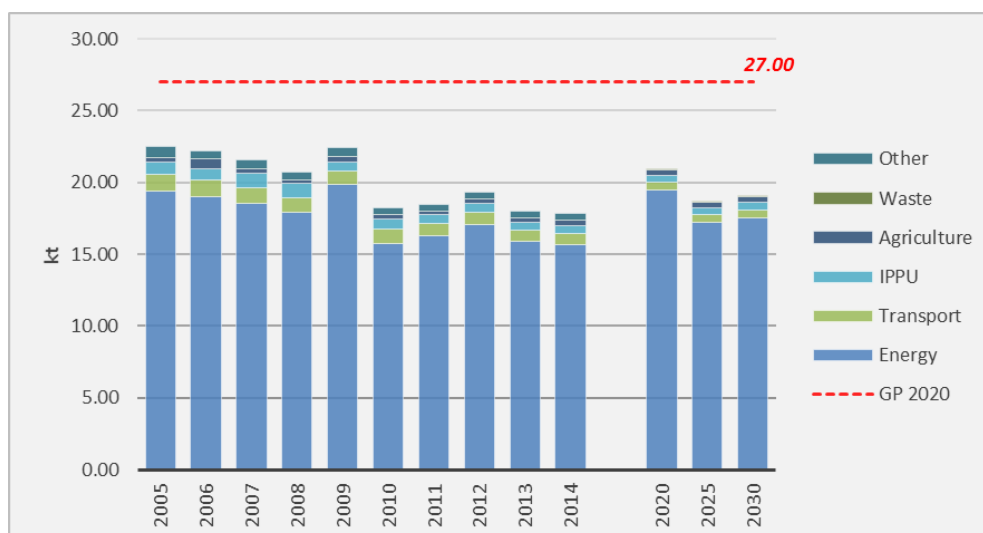


Figure 9.5 PM_{2.5} emissions in 2005-2030 (kt)

The largest part of PM_{2.5} emissions contributes to Energy, and it is projected that in 2020 the emission level will increase by 16.9%, comparing to 2014 level. However, after 2020 it is projected that emissions will decrease. Gothenburg targets will be complied if absolute targets are taken into account.

10 Submission of Latvia's gridded emissions data

The latest data were reported on 09.12.2013. The next submission of gridded emissions is planned to be reported on 2017.

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Annex I: Detailed methodological descriptions

Table 1 Emission factors and assumptions for Energy sector

	NO _x	NM _{VOC}	NH ₃	PM _{2.5}	PM ₁₀	TSP	CO	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	PCDD/F	B(a)p	B(b)f	B(k)f	I(1,2,3-cd)P	HCB	PCB	Reference	
Unit	g/GJ							mg/GJ										ng I-TEQ/GJ	mg/GJ				μg/GJ		μg/WHO-TEG/GJ
1.A.1																									
Diesel oil	65	0.8	NE	0.8	3.2	6.5	16.2	4.07	1.36	1.36	1.81	1.36	2.72	1.36	6.79	1.81	0.5	NE	NE	NE	0.007	NE	NE	EMEP/EEA 2013 - 1A1 - Table 3-6	
RFO	142	2.3	NE	19.3	25.2	35.6	15.1	4.56	1.2	0.341	3.98	2.55	5.31	255	2.06	87.8	2.5	NE	0.005	0.005	0.007	NE	NE	EMEP/EEA 2013 - 1A1 - Table 3-5	
LPG	89	2.6	NE	0.89	0.89	0.89	39	0.0015	0.00025	0.1	0.12	0.00076	0.000076	5E-04	0.011	0.002	0.5	6E-04	8E-04	8E-04	8E-04	NE	NE	EMEP/EEA 2013 - 1A1 - Table 3-4	
Jet fuel	65	0.8	NE	0.8	3.2	6.5	16.2	4.07	1.36	1.36	1.81	1.36	2.72	1.36	6.79	1.81	0.5	NE	NE	NE	0.007	NE	NE	EMEP/EEA 2013 - 1A1 - Table 3-6	
Other kerosene	65	0.8	NE	0.8	3.2	6.5	16.2	4.07	1.36	1.36	1.81	1.36	2.72	1.36	6.79	1.81	0.5	NE	NE	NE	0.007	NE	NE	EMEP/EEA 2013 - 1A1 - Table 3-6	
Other liquid	65	0.8	NE	0.8	3.2	6.5	16.2	4.07	1.36	1.36	1.81	1.36	2.72	1.36	6.79	1.81	0.5	NE	NE	NE	0.007	NE	NE	EMEP/EEA 2013 - 1A1 - Table 3-6	
Petroleum coke	65	0.8	NE	0.8	3.2	6.5	16.2	4.07	1.36	1.36	1.81	1.36	2.72	1.36	6.79	1.81	0.5	NE	NE	NE	0.007	NE	NE	EMEP/EEA 2013 - 1A1 - Table 3-6	
Waste oils	65	0.8	NE	0.8	3.2	6.5	16.2	4.07	1.36	1.36	1.81	1.36	2.72	1.36	6.79	1.81	0.5	NE	NE	NE	0.007	NE	NE	EMEP/EEA 2013 - 1A1 - Table 3-6	
Shale oil	65	0.8	NE	0.8	3.2	6.5	16.2	4.07	1.36	1.36	1.81	1.36	2.72	1.36	6.79	1.81	0.5	NE	NE	NE	0.007	NE	NE	EMEP/EEA 2013 - 1A1 - Table 3-6	
Coal	209	1	NE	3.4	7.7	11.4	8.7	7.3	0.9	1.4	7.1	4.5	7.8	4.9	23	19	10	7E-04	0.037	0.029	0.001	6.7	0.0033	EMEP/EEA 2013 - 1A1 - Table 3-2	
Coke	209	1	NE	3.4	7.7	11.4	8.7	7.3	0.9	1.4	7.1	4.5	7.8	4.9	23	19	10	7E-04	0.037	0.029	0.001	6.7	0.0033	EMEP/EEA 2013 - 1A1 - Table 3-2	
Peat briquettes	247	1.4	NE	3.2	7.9	11.7	8.7	15	1.8	2.9	14.3	9.1	1	9.7	45	8.8	10	0.001	0.037	0.029	0.002	6.7	0.0033	EMEP/EEA 2013 - 1A1 - Table 3-3	
Peat	247	1.4	NE	3.2	7.9	11.7	8.7	15	1.8	2.9	14.3	9.1	1	9.7	45	8.8	10	0.001	0.037	0.029	0.002	6.7	0.0033	EMEP/EEA 2013 - 1A1 - Table 3-3	
Natural gas	89	2.6	NE	0.89	0.89	0.89	39	0.0015	0.00025	0.1	0.12	0.00076	0.000076	5E-04	0.011	0.002	0.5	6E-04	8E-04	8E-04	8E-04			EMEP/EEA 2013 - 1A1 - Table 3-4	
Wood	81	7.31	NE	133	155	172	90	20.6	1.76	1.51	9.46	9.03	21.1	14.2	1.2	181	50	1.12	0.043	0.016	0.037	5	3.5	EMEP/EEA 2013 - 1A1 - table 3-7	
CH4 from Sludge Gas	89	2.6	NE	0.89	0.89	0.89	39	0.0015	0.00025	0.1	0.12	0.00076	0.000076	5E-04	0.011	0.002	0.5	6E-04	8E-04	8E-04	8E-04	NE	NE	EMEP/EEA 2013 - 1A1 - Table 3-4	
Landfill gas	89	2.6	NE	0.89	0.89	0.89	39	0.0015	0.00025	0.1	0.12	0.00076	0.000076	5E-04	0.011	0.002	0.5	6E-04	8E-04	8E-04	8E-04	NE	NE	EMEP/EEA 2013 - 1A1 - Table 3-4	

	NO _x	NM	VOC	NH ₃	PM _{2.5}	PM ₁₀	TSP	CO	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	PCDD/F	B(a)p	B(b)f	B(k)f	I(1,2,3-cd)P	HCB	PCB	Reference
Unit	g/GJ							mg/GJ									ng I-TEQ/GJ	mg/GJ				µg/GJ	µg/WHO-TEQ/GJ		
Other Biogas	89	2.6	NE	0.89	0.89	0.89	39	0.0015	0.00025	0.1	0.12	0.00076	0.000076	5E-04	0.011	0.002	0.5	6E-04	8E-04	8E-04	8E-04	NE	NE	EMEP/EEA 2013 - 1A1 - Table 3-4	
Biodiesel	65	0.8	NE	0.8	3.2	6.5	16.2	4.07	1.36	1.36	1.81	1.36	2.72	1.36	6.79	1.81	0.5	NE	NE	NE	0.007	NE	NE	EMEP/EEA 2013 - 1A1 - Table 3-6	
1.A.2																									
Diesel oil	513	25	NE	20	20	20	66	0.08	0.006	0.12	0.03	0.2	0.22	0.008	0.11	29	1.4	0.002	0.015	0.002	0.002	NE	NE	EMEP/EEA 2013 - 1A2 - Table 3-4	
RFO	513	25	NE	20	20	20	66	0.08	0.006	0.12	0.03	0.2	0.22	0.008	0.11	29	1.4	0.002	0.015	0.002	0.002	NE	NE	EMEP/EEA 2013 - 1A2 - Table 3-4	
LPG	74	23	NE	0.78	0.78	0.78	29	0.011	0.0009	0.54	0.1	0.013	0.0026	0.013	0.058	0.73	0.52	7E-04	0.003	0.001	0.001	NE	NE	EMEP/EEA 2013 - 1A2 - Table 3-3	
Jet fuel	513	25	NE	20	20	20	66	0.08	0.006	0.12	0.03	0.2	0.22	0.008	0.11	29	1.4	0.002	0.015	0.002	0.002	NE	NE	EMEP/EEA 2013 - 1A2 - Table 3-4	
Other kerosene	513	25	NE	20	20	20	66	0.08	0.006	0.12	0.03	0.2	0.22	0.008	0.11	29	1.4	0.002	0.015	0.002	0.002	NE	NE	EMEP/EEA 2013 - 1A2 - Table 3-4	
Other liquid	513	25	NE	20	20	20	66	0.08	0.006	0.12	0.03	0.2	0.22	0.008	0.11	29	1.4	0.002	0.015	0.002	0.002	NE	NE	EMEP/EEA 2013 - 1A2 - Table 3-4	
Petroleum coke	513	25	NE	20	20	20	66	0.08	0.006	0.12	0.03	0.2	0.22	0.008	0.11	29	1.4	0.002	0.015	0.002	0.002	NE	NE	EMEP/EEA 2013 - 1A2 - Table 3-4	
Waste oils	513	25	NE	20	20	20	66	0.08	0.006	0.12	0.03	0.2	0.22	0.008	0.11	29	1.4	0.002	0.015	0.002	0.002	NE	NE	EMEP/EEA 2013 - 1A2 - Table 3-4	
Shale oil	513	25	NE	20	20	20	66	0.08	0.006	0.12	0.03	0.2	0.22	0.008	0.11	29	1.4	0.002	0.015	0.002	0.002	NE	NE	EMEP/EEA 2013 - 1A2 - Table 3-4	
Coal	173	88.8	NE	108	117	124	931	134	1.8	7.9	4	13.5	17.5	13	1.8	200	203	45.5	58.9	23.7	18.5	0.62	170	EMEP/EEA 2013 - 1A2 - Table 3-2	
Coke	173	88.8	NE	108	117	124	931	134	1.8	7.9	4	13.5	17.5	13	1.8	200	203	45.5	58.9	23.7	18.5	0.62	170	EMEP/EEA 2013 - 1A2 - Table 3-2	
Peat briquettes	173	88.8	NE	108	117	124	931	134	1.8	7.9	4	13.5	17.5	13	1.8	200	203	45.5	58.9	23.7	18.5	0.62	170	EMEP/EEA 2013 - 1A2 - Table 3-2	
Peat	173	88.8	NE	108	117	124	931	134	1.8	7.9	4	13.5	17.5	13	1.8	200	203	45.5	58.9	23.7	18.5	0.62	170	EMEP/EEA 2013 - 1A2 - Table 3-2	
Anthracite	173	88.8	NE	108	117	124	931	134	1.8	7.9	4	13.5	17.5	13	1.8	200	203	45.5	58.9	23.7	18.5	0.62	170	EMEP/EEA 2013 - 1A2 - Table 3-2	
Oil shale	173	88.8	NE	108	117	124	931	134	1.8	7.9	4	13.5	17.5	13	1.8	200	203	45.5	58.9	23.7	18.5	0.62	170	EMEP/EEA 2013 - 1A2 - Table 3-2	
Natural gas	74	23	NE	0.78	0.78	0.78	29	0.011	0.0009	0.54	0.1	0.013	0.0026	0.013	0.058	0.73	0.52	7E-04	0.003	0.001	0.001	NE	NE	EMEP/EEA 2013 - 1A2 - Table 3-3	
Wood	91	300	NE	140	143	150	570	27	13	0.56	0.19	23	6	2	0.5	512	100	10	16	5	4	5	0.06	EMEP/EEA 2013 - 1A2 - Table 3-5	
Blodiesel	513	25	NE	20	20	20	66	0.08	0.006	0.12	0.03	0.2	0.22	0.008	0.11	29	1.4	0.002	0.015	0.002	0.002	NE	NE	EMEP/EEA 2013 - 1A2 - Table 3-4	

	NO _x	NM	VOC	NH ₃	PM _{2.5}	PM ₁₀	TSP	CO	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	PCDD/F	B(a)p	B(b)f	B(k)f	I(1,2,3-cd)P	HCB	PCB	Reference	
Unit	g/GJ							mg/GJ								ng I-TEQ/GJ	mg/GJ				μg/GJ	μg/WHO-TEQ/GJ				
Landfill gas	74	23	NE	0.78	0.78	0.78	29		0.011	0.0009	0.54	0.1	0.013	0.0026	0.013	0.058	0.73	0.52	7E-04	0.003	0.001	0.001	NE	NE	EMEP/EEA 2013 - 1A2 - Table 3-3	
Unit	kg/Mg waste							g/Mg waste								μg I-TEQ/Mg waste					g/Mg waste					
Industrial wastes (used tires)	0.87	7.4	NE	0.004	0.007	0.01	0.07		1.3	0.1	0.056	0.016	NE	NE	0.14	NE	NE	350	NE	NE	NE	NE	0.002	NE	EMEP/EEA 2013 5.C.1.b - Table 3-1	
Unit	g/Mg							mg/Mg								ng/Mg	μg/Mg				ng/Mg					
Municipal wastes	1071	5.9	3	3	3	3	41		58	4.6	18.8	6.2	16.4	13.7	21.6	11.7	24.7	52.5	8.4	17.9	9.5	11.6	45.2	3.4	EMEP/EEA 2013 - 5.C.1.a - Table 3-1	
1.A.4.a i, 1.A.4.c i																										
Unit	g/GJ							mg/GJ								ng I-TEQ/GJ	mg/GJ				μg/GJ					
Diesel oil	513	25	NE	20	20	20	66		0.08	0.006	0.12	0.03	0.2	0.22	0.008	0.11	29	1.4	0.002	0.015	0.002	0.002	NE	NE	EMEP/EEA 2013 - 1A4 - Table 3-9	
RFO	513	25	NE	20	20	20	66		0.08	0.006	0.12	0.03	0.2	0.22	0.008	0.11	29	1.4	0.002	0.015	0.002	0.002	NE	NE	EMEP/EEA 2013 - 1A4 - Table 3-9	
LPG	74	23	NE	0.78	0.78	0.78	29		0.011	0.0009	0.54	0.1	0.013	0.0026	0.013	0.058	0.73	0.52	7E-04	0.003	0.001	0.001	NE	NE	EMEP/EEA 2013 - 1A4 - Table 3-8	
Jet fuel	513	25	NE	20	20	20	66		0.08	0.006	0.12	0.03	0.2	0.22	0.008	0.11	29	1.4	0.002	0.015	0.002	0.002	NE	NE	EMEP/EEA 2013 - 1A4 - Table 3-9	
Other kerosene	513	25	NE	20	20	20	66		0.08	0.006	0.12	0.03	0.2	0.22	0.008	0.11	29	1.4	0.002	0.015	0.002	0.002	NE	NE	EMEP/EEA 2013 - 1A4 - Table 3-9	
Other liquid	513	25	NE	20	20	20	66		0.08	0.006	0.12	0.03	0.2	0.22	0.008	0.11	29	1.4	0.002	0.015	0.002	0.002	NE	NE	EMEP/EEA 2013 - 1A4 - Table 3-9	
Petroleum coke	513	25	NE	20	20	20	66		0.08	0.006	0.12	0.03	0.2	0.22	0.008	0.11	29	1.4	0.002	0.015	0.002	0.002	NE	NE	EMEP/EEA 2013 - 1A2 - Table 3-4	
Waste oils	513	25	NE	20	20	20	66		0.08	0.006	0.12	0.03	0.2	0.22	0.008	0.11	29	1.4	0.002	0.015	0.002	0.002	NE	NE	EMEP/EEA 2013 - 1A2 - Table 3-4	
Shale oil	513	25	NE	20	20	20	66		0.08	0.006	0.12	0.03	0.2	0.22	0.008	0.11	29	1.4	0.002	0.015	0.002	0.002	NE	NE	EMEP/EEA 2013 - 1A4 - Table 3-9	
Coal	173	88.8	NE	108	117	124	931		134	1.8	7.9	4	13.5	17.5	13	1.8	200	203	45.5	58.9	23.7	18.5	0.62	170	EMEP/EEA 2013 - 1A4 - Table 3-7	
Coke	173	88.8	NE	108	117	124	931		134	1.8	7.9	4	13.5	17.5	13	1.8	200	203	45.5	58.9	23.7	18.5	0.62	170	EMEP/EEA 2013 - 1A4 - Table 3-7	
Oil shale	173	88.8	NE	108	117	124	931		134	1.8	7.9	4	13.5	17.5	13	1.8	200	203	45.5	58.9	23.7	18.5	0.62	170	EMEP/EEA 2013 - 1A4 - Table 3-7	
Peat briquettes	173	88.8	NE	108	117	124	931		134	1.8	7.9	4	13.5	17.5	13	1.8	200	203	45.5	58.9	23.7	18.5	0.62	170	EMEP/EEA 2013 - 1A4 - Table 3-7	
Peat	173	88.8	NE	108	117	124	931		134	1.8	7.9	4	13.5	17.5	13	1.8	200	203	45.5	58.9	23.7	18.5	0.62	170	EMEP/EEA 2013 - 1A4 - Table 3-7	
Natural gas	74	23	NE	0.78	0.78	0.78	29		0.011	0.0009	0.54	0.1	0.013	0.0026	0.013	0.058	0.73	0.52	7E-04	0.003	0.001	0.001			EMEP/EEA 2013 - 1A4 - Table 3-8	

	NO _x	NM _{VOC}	NH ₃	PM _{2.5}	PM ₁₀	TSP	CO	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	PCDD/F	B(a)p	B(b)f	B(k)f	I(1,2,3-cd)P	HCB	PCB	Reference	
Unit	g/GJ							mg/GJ									ng I-TEQ/GJ	mg/GJ				μg/GJ	μg/WHO-TEG/GJ		
Wood	91	300	37	140	143	150	570	27	13	0.56	0.19	23	6	2	0.5	512	100	10	16	5	4	5	0.06	EMEP/EEA 2013 1A4 - Table 3-10	
Landfill gas	74	23	NE	0.78	0.78	0.78	29	0.011	0.0009	0.54	0.1	0.013	0.0026	0.013	0.058	0.73	0.52	7E-04	0.003	0.001	0.001			EMEP/EEA 2013 - 1A4 - Table 3-8	
Straws	91	300	37	140	143	150	570	27	13	0.56	0.19	23	6	2	0.5	512	100	10	16	5	4	5	0.06	EMEP/EEA 2013 - 1A4 - Table 3-10	
Biodiesel	513	25	NE	20	20	20	66	0.08	0.006	0.12	0.03	0.2	0.22	0.008	0.11	29	1.4	0.002	0.015	0.002	0.002			EMEP/EEA 2013 - 1A4 - Table 3-9	
Off road (1.A.2.f ii, 1.A.4.a ii, 1.A.4.b ii, 1.A.4.c ii, 1.A.4.c iii, 1.A.5.b ii)																									
Unit	g/tonnes fuel							mg/kg									μg/kg								Reference
Gasoline: 2-stroke	2765	242197	3	3762	3762	3762	620793	1990-1998 - 0.00015 1999-2012 - 5.05391	0.01	NE	NE	0.05	1.7	0.07	0.01	1	NE	40	40	NE	NE	NE	NE	EMEP/EEA 2013 - 1A4 Other mobile - Table 3-1	
Gasoline: 4-stroke	7117	17602	4	157	157	157	770368		0.01	NE	NE	0.05	1.7	0.07	0.01	1	NE	40	40	NE	NE	NE	NE	EMEP/EEA 2013 - 1A4 Other mobile - Table 3-1	
Unit	kg/Mg							g/Mg									μg/Mg					mg/Mg		Reference	
Aviation gasoline	4	19	NE	NE	NE	NE	1200	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE		EMEP/EEA 2013 - 1A3d Navigation- shipping - Table 3- 2
Diesel oil (in Fisheries)	78.5	2.8	NE	1.4	1.5	1.5	7.4	0.13	0.01	0.03	0.04	0.05	0.88	1	0.1	1.2	0.13	NE	NE	NE	NE	0.08	0.038		EMEP/EEA 2013 - 1A3a Aviation - Table 3-4

Table 2 Emission factors in Residential wood burning appliances

		Conventional boilers	Energy efficient stoves	Advanced/ecolabelled stoves	Conventional stoves	Pellet stoves
NO _x	g/GJ	80	80	95	50	80
CO		4000	4000	2000	4000	300
NM _{VOC}		350	350	250	600	10
NH ₃		74	37	37	70	12
TSP		500	400	100	800	31
PM ₁₀		480	380	95	760	29
PM _{2.5}		470	370	93	740	29
BC		75.2	59.2	26.04	74	4.35
Pb	mg/GJ	27	27	27	27	27
Cd		13	13	13	13	13
Hg		0.56	0.56	0.56	0.56	0.56

		Conventional boilers	Energy efficient stoves	Advanced/ecolabelled stoves	Conventional stoves	Pellet stoves
As		0.19	0.19	0.19	0.19	0.19
Cr		23	23	23	23	23
Cu		6	6	6	6	6
Ni		2	2	2	2	2
Se		0.5	0.5	0.5	0.5	0.5
Zn		512	512	512	512	512
PCBs	µg/GJ	0.06	0.03	0.007	0.06	0.01
PCDD/F	ng/GJ	550	250	100	800	100
benzo(a)pyrene	mg/GJ	121	121	10	121	10
benzo(b)fluoranthene		111	111	16	111	16
benzo(k)fluoranthene		42	42	5	42	5
indeno(1,2,3-cd)pyrene		71	71	4	71	4
HCB	µg/GJ	5	5	5	5	5
Reference		EMEP/EEA 2013 - 1A1 - Table 3-18	EMEP/EEA 2013 - 1A1 - Table 3-23	EMEP/EEA 2013 - 1A1 - Table 3-24	EMEP/EEA 2013 - 1A1 - Table 3-17	EMEP/EEA 2013 - 1A1 - Table 3-25

Table 3 Sulphur content and SO₂ emission factors used in Energy sector

Fuel	NCV	Sulphur content (%)																			
		1990-95	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Diesel	42.49	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
RFO	40.6	2	2	2.12	2.10	2.00	2.08	1.98	1.96	2.02	1.38	1.23	0.99	1.21	0.91	0.79	0.91	0.97	0.94	0.80	0.84
Gasoline	43.97	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.005	0.005	0.005	0.001	0.001	0.001	0.001	0.001	0.001
Jet fuel	43.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Other liquids	41.86	0.650	0.607	0.595	0.583	0.570	0.558	0.546	0.533	0.521	0.509	0.497	0.484	0.472	0.460	0.447	0.435	0.423	0.410	0.398	0.386
LPG	45.54	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029
Shale oil	39.35	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Coal	26.22	1.8	1.8	1.47	1.37	1.06	0.90	0.87	0.78	0.66	0.67	0.72	0.66	0.52	0.45	0.46	0.39	0.41	0.50	0.44	0.48
Coke	26.79	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Oil shale	9.2	1.6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Peat	10.05	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
RFO (marine)	40.6	2	2	2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1	1	1	1	1
Wood	6.7	0.0150	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
Natural gas	Changes annually	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029	0.00029
EF (Gg/PJ)																					
Diesel		0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.047	0.047	0.047	0.047	0.047	0.047	0.047
RFO		0.966	0.966	1.024	1.012	0.968	1.003	0.957	0.948	0.976	0.665	0.596	0.479	0.583	0.441	0.382	0.442	0.467	0.456	0.389	0.405
Gasoline		0.00682	0.00682	0.00682	0.00682	0.00682	0.00682	0.00682	0.00682	0.00682	0.00682	0.00682	0.00227	0.00227	0.00227	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045
Jet fuel		0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046
Other liquids		0.311	0.290	0.284	0.278	0.272	0.267	0.261	0.255	0.249	0.243	0.237	0.231	0.225	0.220	0.214	0.208	0.202	0.196	0.190	0.184
LPG		0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013
Shale oil		0.407	0.407	0.407	0.407	0.407	0.407	0.407	0.407	0.407	0.407	0.407	0.407	0.407	0.407	0.407	0.407	0.407	0.407	0.407	0.407
Coal		1.138	1.138	0.928	0.865	0.673	0.567	0.551	0.493	0.451	0.459	0.498	0.454	0.357	0.308	0.318	0.266	0.280	0.342	0.328	0.359
Coke		0.410	0.410	0.410	0.410	0.410	0.410	0.410	0.403	0.403	0.403	0.403	0.403	0.403	0.403	0.403	0.403	0.403	0.403	0.403	0.403
Oil shale		3.13	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Peat		0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507	0.507
RFO (marine)		0.966	0.966	0.966	0.724	0.724	0.724	0.724	0.724	0.724	0.724	0.724	0.724	0.724	0.724	0.724	0.483	0.483	0.483	0.483	0.483
Wood		0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045
Natural gas		0.00017	0.00018	0.00018	0.00018	0.00018	0.00017	0.00017	0.00017	0.00017	0.00017	0.00017	0.00017	0.00017	0.00017	0.00017	0.00017	0.00017	0.00017	0.00017	0.00017

Notes:

Gasoline, diesel oil – EU legislation

RFO – EU legislation, average value from database Nr.2-Air

Other liquids – average value from database Nr.2-Air

Coal – average value from database Nr.2-Air

Shale oil – Luik, H. "Coal, oil shale, natural bitumen, heavy oil and peat" Vol. II *Chemicals and Other products from Shale Oil*

Oil shale – Gavrilova, O., Randa, T., Vallner, L., Strandberg, M., Vilu, R. 2005. "Life Cycle Analysis of the Estonian Oil Shale Industry"

Peat, peat briquettes – Latvian Peat Producers Association

Wood – Zandersons, J, Žūriņš, A., Rižikovs, J., Dobeļe, G., Latvian Institute of Wood chemistry "Feasibility of processing and utilisation of used up railway sleepers"

Natural gas – allowed content of mercaptan (3 mg/m³)

Table 4 Distribution of road transport fleet by subsectors and layers, year 2014

Subsector	Technology	Population	Mileage
Passenger Cars			
Gasoline <1,4 l	ECE 15/03	400	2700
Gasoline <1,4 l	ECE 15/04	934	3600
Gasoline <1,4 l	PC Euro 1 - 91/441/EEC	5023	5500
Gasoline <1,4 l	PC Euro 2 - 94/12/EEC	7189	9000
Gasoline <1,4 l	PC Euro 3 - 98/69/EC Stage2000	6934	12000
Gasoline <1,4 l	PC Euro 4 - 98/69/EC Stage2005	10715	14000
Gasoline <1,4 l	PC Euro 5 - EC 715/2007	6031	19000
Gasoline <1,4 l	PC Euro 6 - EC 715/2007	164	19000
Gasoline 1,4 - 2,0 l	ECE 15/03	4552	2430
Gasoline 1,4 - 2,0 l	ECE 15/04	10621	3600
Gasoline 1,4 - 2,0 l	PC Euro 1 - 91/441/EEC	50263	7150
Gasoline 1,4 - 2,0 l	PC Euro 2 - 94/12/EEC	41820	12000
Gasoline 1,4 - 2,0 l	PC Euro 3 - 98/69/EC Stage2000	23128	15068
Gasoline 1,4 - 2,0 l	PC Euro 4 - 98/69/EC Stage2005	27028	17000
Gasoline 1,4 - 2,0 l	PC Euro 5 - EC 715/2007	9656	20000
Gasoline 1,4 - 2,0 l	PC Euro 6 - EC 715/2007	279	22000
Gasoline >2,0 l	ECE 15/03	690	2700
Gasoline >2,0 l	ECE 15/04	1610	4228
Gasoline >2,0 l	PC Euro 1 - 91/441/EEC	7074	9902
Gasoline >2,0 l	PC Euro 2 - 94/12/EEC	9149	14000
Gasoline >2,0 l	PC Euro 3 - 98/69/EC Stage2000	8975	15000
Gasoline >2,0 l	PC Euro 4 - 98/69/EC Stage2005	7886	19000
Gasoline >2,0 l	PC Euro 5 - EC 715/2007	2178	21000
Gasoline >2,0 l	PC Euro 6 - EC 715/2007	160	21500
Diesel <2,0 l	Conventional	5262	10000
Diesel <2,0 l	PC Euro 1 - 91/441/EEC	19961	11000
Diesel <2,0 l	PC Euro 2 - 94/12/EEC	35457	12000
Diesel <2,0 l	PC Euro 3 - 98/69/EC Stage2000	53902	14000
Diesel <2,0 l	PC Euro 4 - 98/69/EC Stage2005	33920	16545
Diesel <2,0 l	PC Euro 5 - EC 715/2007	13002	21586
Diesel <2,0 l	PC Euro 6 - EC 715/2007	614	22000
Diesel >2,0 l	Conventional	3035	11872
Diesel >2,0 l	PC Euro 1 - 91/441/EEC	14486	13000
Diesel >2,0 l	PC Euro 2 - 94/12/EEC	21856	14000
Diesel >2,0 l	PC Euro 3 - 98/69/EC Stage2000	46364	15000
Diesel >2,0 l	PC Euro 4 - 98/69/EC Stage2005	22095	18000
Diesel >2,0 l	PC Euro 5 - EC 715/2007	5684	23000
Diesel >2,0 l	PC Euro 6 - EC 715/2007	507	22000
LPG	Conventional	3110	15000
LPG	PC Euro 1 - 91/441/EEC	10994	19000
LPG	PC Euro 2 - 94/12/EEC	13692	20000
LPG	PC Euro 3 - 98/69/EC Stage2000	10127	21000
LPG	PC Euro 4 - 98/69/EC Stage2005	6221	22040
LPG	PC Euro 5 - EC 715/2007	1484	23690
LPG	PC Euro 6 - EC 715/2007	6	24620
Light Duty Vehicles			
LPG	Conventional	255	30369
LPG	LD Euro 1 - 93/59/EEC	171	30369
LPG	LD Euro 2 - 96/69/EEC	154	31000
LPG	LD Euro 3 - 98/69/EC Stage2000	117	33000
LPG	LD Euro 4 - 98/69/EC Stage2005	233	43074
LPG	LD Euro 5 - 2008 Standards	139	47984
Gasoline <3,5t	Conventional	266	17000
Gasoline <3,5t	LD Euro 1 - 93/59/EEC	201	18000
Gasoline <3,5t	LD Euro 2 - 96/69/EEC	404	19000
Gasoline <3,5t	LD Euro 3 - 98/69/EC Stage2000	303	21500

Subsector	Technology	Population	Mileage
Gasoline <3,5t	LD Euro 4 - 98/69/EC Stage2005	593	28000
Gasoline <3,5t	LD Euro 5 - 2008 Standards	308	31000
Gasoline <3,5t	LD Euro 6	5	31000
Diesel <3,5 t	Conventional	2636	25000
Diesel <3,5 t	LD Euro 1 - 93/59/EEC	3245	25000
Diesel <3,5 t	LD Euro 2 - 96/69/EEC	7540	26000
Diesel <3,5 t	LD Euro 3 - 98/69/EC Stage2000	8297	27800
Diesel <3,5 t	LD Euro 4 - 98/69/EC Stage2005	11203	32460
Diesel <3,5 t	LD Euro 5 - 2008 Standards	7203	39000
Diesel <3,5 t	LD Euro 6	21	39000
Heavy Duty Trucks			
LPG	Conventional	340	24000
LPG	HD Euro I - 91/542/EEC Stage I	120	24400
LPG	HD Euro II - 91/542/EEC Stage II	62	26000
Gasoline >3,5 t	Conventional	769	18000
Gasoline >3,5 t	HD Euro I - 91/542/EEC Stage I	293	18500
Gasoline >3,5 t	HD Euro II - 91/542/EEC Stage II	72	18644
Gasoline >3,5 t	HD Euro III - 2000 Standards	13	25057
Rigid <=7,5 t	Conventional	873	20400
Rigid <=7,5 t	HD Euro I - 91/542/EEC Stage I	526	20411
Rigid <=7,5 t	HD Euro II - 91/542/EEC Stage II	630	20411
Rigid <=7,5 t	HD Euro III - 2000 Standards	566	27431
Rigid <=7,5 t	HD Euro IV - 2005 Standards	443	40071
Rigid <=7,5 t	HD Euro V - 2008 Standards	182	42079
Rigid <=7,5 t	HD Euro VI	11	42079
Rigid 7,5 - 12 t	Conventional	439	20600
Rigid 7,5 - 12 t	HD Euro I - 91/542/EEC Stage I	273	20603
Rigid 7,5 - 12 t	HD Euro II - 91/542/EEC Stage II	310	20603
Rigid 7,5 - 12 t	HD Euro III - 2000 Standards	342	28929
Rigid 7,5 - 12 t	HD Euro IV - 2005 Standards	247	38291
Rigid 7,5 - 12 t	HD Euro V - 2008 Standards	88	36565
Rigid 7,5 - 12 t	HD Euro VI	5	36565
Rigid 12 - 14 t	Conventional	135	20700
Rigid 12 - 14 t	HD Euro I - 91/542/EEC Stage I	87	20702
Rigid 12 - 14 t	HD Euro II - 91/542/EEC Stage II	72	20702
Rigid 12 - 14 t	HD Euro III - 2000 Standards	31	23111
Rigid 12 - 14 t	HD Euro IV - 2005 Standards	41	29129
Rigid 12 - 14 t	HD Euro V - 2008 Standards	16	31534
Rigid 12 - 14 t	HD Euro VI	2	31534
Rigid 14 - 20 t	Conventional	795	29000
Rigid 14 - 20 t	HD Euro I - 91/542/EEC Stage I	588	29000
Rigid 14 - 20 t	HD Euro II - 91/542/EEC Stage II	1337	29000
Rigid 14 - 20 t	HD Euro III - 2000 Standards	1887	36000
Rigid 14 - 20 t	HD Euro IV - 2005 Standards	1380	52000
Rigid 14 - 20 t	HD Euro V - 2008 Standards	3364	57000
Rigid 14 - 20 t	HD Euro VI	239	57000
Rigid 20 - 26 t	Conventional	266	38000
Rigid 20 - 26 t	HD Euro I - 91/542/EEC Stage I	295	38000
Rigid 20 - 26 t	HD Euro II - 91/542/EEC Stage II	303	38000
Rigid 20 - 26 t	HD Euro III - 2000 Standards	419	53000
Rigid 20 - 26 t	HD Euro IV - 2005 Standards	380	74000
Rigid 20 - 26 t	HD Euro V - 2008 Standards	629	78000
Rigid 20 - 26 t	HD Euro VI	67	78000
Rigid 26 - 28 t	Conventional	31	38000
Rigid 26 - 28 t	HD Euro I - 91/542/EEC Stage I	45	38000
Rigid 26 - 28 t	HD Euro II - 91/542/EEC Stage II	45	38000
Rigid 26 - 28 t	HD Euro III - 2000 Standards	79	53000
Rigid 26 - 28 t	HD Euro IV - 2005 Standards	56	74000
Rigid 26 - 28 t	HD Euro V - 2008 Standards	95	78000

Subsector	Technology	Population	Mileage
Rigid 26 - 28 t	HD Euro VI	20	78000
Rigid 28 - 32 t	Conventional	18	38400
Rigid 28 - 32 t	HD Euro I - 91/542/EEC Stage I	33	38400
Rigid 28 - 32 t	HD Euro II - 91/542/EEC Stage II	50	38400
Rigid 28 - 32 t	HD Euro III - 2000 Standards	67	53000
Rigid 28 - 32 t	HD Euro IV - 2005 Standards	63	74000
Rigid 28 - 32 t	HD Euro V - 2008 Standards	94	78000
Rigid 28 - 32 t	HD Euro VI	12	78000
Rigid >32 t	Conventional	22	38400
Rigid >32 t	HD Euro I - 91/542/EEC Stage I	22	38400
Rigid >32 t	HD Euro II - 91/542/EEC Stage II	43	38400
Rigid >32 t	HD Euro III - 2000 Standards	37	53000
Rigid >32 t	HD Euro IV - 2005 Standards	98	74000
Rigid >32 t	HD Euro V - 2008 Standards	37	78000
Rigid >32 t	HD Euro VI	2	78000
Articulated 14 - 20 t	Conventional	340	29200
Articulated 14 - 20 t	HD Euro I - 91/542/EEC Stage I	252	29500
Articulated 14 - 20 t	HD Euro II - 91/542/EEC Stage II	573	29550
Articulated 14 - 20 t	HD Euro III - 2000 Standards	808	38000
Articulated 14 - 20 t	HD Euro IV - 2005 Standards	591	52000
Articulated 14 - 20 t	HD Euro V - 2008 Standards	1441	57000
Articulated 14 - 20 t	HD Euro VI	103	57000
Articulated 20 - 28 t	Conventional	335	38000
Articulated 20 - 28 t	HD Euro I - 91/542/EEC Stage I	383	38000
Articulated 20 - 28 t	HD Euro II - 91/542/EEC Stage II	392	38000
Articulated 20 - 28 t	HD Euro III - 2000 Standards	562	52000
Articulated 20 - 28 t	HD Euro IV - 2005 Standards	492	74000
Articulated 20 - 28 t	HD Euro V - 2008 Standards	816	78000
Articulated 20 - 28 t	HD Euro VI	97	78000
Articulated 28 - 34 t	Conventional	46	38000
Articulated 28 - 34 t	HD Euro I - 91/542/EEC Stage I	62	38000
Articulated 28 - 34 t	HD Euro II - 91/542/EEC Stage II	105	38000
Articulated 28 - 34 t	HD Euro III - 2000 Standards	117	52000
Articulated 28 - 34 t	HD Euro IV - 2005 Standards	182	74000
Articulated 28 - 34 t	HD Euro V - 2008 Standards	149	78000
Articulated 28 - 34 t	HD Euro VI	15	78000
Buses			
Urban Buses	Conventional	7	29840
Urban Buses	HD Euro I - 91/542/EEC Stage I	2	29840
Urban Buses	HD Euro II - 91/542/EEC Stage II	11	29840
Urban Buses Midi <=15 t	Conventional	245	32567
Urban Buses Midi <=15 t	HD Euro I - 91/542/EEC Stage I	199	32567
Urban Buses Midi <=15 t	HD Euro II - 91/542/EEC Stage II	260	32567
Urban Buses Midi <=15 t	HD Euro III - 2000 Standards	308	43891
Urban Buses Midi <=15 t	HD Euro IV - 2005 Standards	354	56098
Urban Buses Midi <=15 t	HD Euro V - 2008 Standards	627	52520
Urban Buses Midi <=15 t	HD Euro VI	47	52520
Coaches Standard <=18 t	Conventional	229	47805
Coaches Standard <=18 t	HD Euro I - 91/542/EEC Stage I	199	47805
Coaches Standard <=18 t	HD Euro II - 91/542/EEC Stage II	180	47805
Coaches Standard <=18 t	HD Euro III - 2000 Standards	168	59027
Coaches Standard <=18 t	HD Euro IV - 2005 Standards	115	62020
Coaches Standard <=18 t	HD Euro V - 2008 Standards	129	69080
Coaches Standard <=18 t	HD Euro VI	1	69080
Coaches Articulated >18 t	Conventional	55	47805
Coaches Articulated >18 t	HD Euro I - 91/542/EEC Stage I	126	47805
Coaches Articulated >18 t	HD Euro II - 91/542/EEC Stage II	183	47805
Coaches Articulated >18 t	HD Euro III - 2000 Standards	251	59027
Coaches Articulated >18 t	HD Euro IV - 2005 Standards	76	62020

Subsector	Technology	Population	Mileage
Coaches Articulated >18 t	HD Euro V - 2008 Standards	19	69080
Coaches Articulated >18 t	HD Euro VI	48	69080
Mopeds			
<50 cm ³	Conventional	132	1000
<50 cm ³	Mop - Euro I	1456	1150
<50 cm ³	Mop - Euro II	11648	1150
Motorcycles			
2-stroke >50 cm ³	Conventional	1252	1100
2-stroke >50 cm ³	Mot - Euro I	1879	1600
2-stroke >50 cm ³	Mot - Euro II	835	1600
2-stroke >50 cm ³	Mot - Euro III	1253	1600
4-stroke <250 cm ³	Mot - Euro III	702	400
4-stroke 250 - 750 cm ³	Conventional	1168	1400
4-stroke 250 - 750 cm ³	Mot - Euro I	1752	2000
4-stroke 250 - 750 cm ³	Mot - Euro II	1168	2000
4-stroke 250 - 750 cm ³	Mot - Euro III	1752	2400
4-stroke >750 cm ³	Conventional	730	1800
4-stroke >750 cm ³	Mot - Euro I	1094	2000
4-stroke >750 cm ³	Mot - Euro II	730	2000
4-stroke >750 cm ³	Mot - Euro III	1094	2400

Annex II: National energy balance

Table 1 National Energy Balance in 2014, TJ

	Oil products - total	Shale oil	Liquefied petroleum gas	Motor and aviation petrol	Petrol type jet fuel	Kerosene type jet fuel	Kerosene	Diesel oil (oven fuel inclusive)	Residual (heavy) fuel oils	White spirit	Lubricants	Oil bitumen	Paraffin waxes	Other oil products	Used oils	Coal	Peat	Peat briquettes	Coke oven coke	Natural gas	Fuelwood	Used tires	Municipal waste for heating	Charcoal	Bioethanol	Biodiesel	Landfill gas	Sewage sludge gas	Other biogas	Straw
NCV		39.35	45.54	43.97	43.21	43.21	43.2	42.49	40.6	41.86	41.86	41.86	41.86	41.86	29.23	24.16	10.05	15.49	26.79	34.57		27.98	17.05	30	0.03	0.04	19.02	20.49	19.02	14.4
Production																	50				85567					2788	355	93	2688	99
Recycled products	29														29							168	171							
Imports	89374	79	8971	9491		4796	43	58254	41	42	1426	3014	335	2882		2061			0	32733	2454	196	2046	60	259	380				
Imported for bunkering	9712							2932	6780																					
Exports	35007	79	4645	912		173	43	25027	487		836			2805		145					30318			360	11	2454				
Bunkering	9712							2932	6780																					
Interproduct transfers																														
Stock changes	5225		-91	791				4122	487		42	-84		-42		557	-20	5		12653	-1782		153		9	27				
Statistical difference	31			-352				383																						
Gross energy consumption	59652		4235	9018		4623		37732	41	42	632	2930	335	35	29	2473	30	5	0	45386	55921	364	2370	-300	257	741	355	93	2688	99
Transformation	-51		-7					-34	-10							-244				-30263	-13694			390			-214	-93	-2473	-23
electricity plants																					-41									
public CHP	-10							-10								-167				-26460	-6575						-31	-93	-1842	
autoproducer CHP																				-506	-481						-183		-631	
public heat plants	-23		-1					-12	-10							-8				-2580	-4568									
autoproducer heat plants	-18		-6					-12								-69				-717	-1245									-23
production of peat briquettes																														
charcoal production																					-784			390						
Energy sector	286							286												830										
Losses																				588										
Final consumption	59315		4228	9018		4623		37412	31	42	632	2930	335	35	29	2229	30	5	0	13705	42227	364	2370	90	257	741	141		215	76

Table 2 Fuel consumption in Energy sector (stationary combustion), TJ**1.A.1 Energy Industries**

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
1.A.1. Energy Industries																									
Total	94337	88210	73651	57391	53160	50514	51326	52637	54187	48325	42657	44355	43268	43796	41000	40407	41916	39400	38929	37897	45595	42380	40380	46022	43785
Liquid Fuels	40437	33253	28441	27170	30859	20519	27333	17437	20662	17491	7900	5235	5033	3576	3055	2365	1511	1389	905	1194	918	848	662	466	319
Solid Fuels	2305	1736	1935	2106	1366	1395	740	541	455	398	371	398	285	209	210	183	105	341	446	472	419	419	513	424	175
Peat	2088	2343	2814	3007	2841	3430	2974	3083	2157	1275	2351	1230	1005	663	70	60	30	29	20	10	11	9	NO	40	NO
Gaseous Fuels	49029	50288	39788	24246	16770	24107	18644	28165	26802	25464	28803	33510	32497	34074	32371	33306	35181	32613	32650	31236	38687	35607	31872	33926	29870
Biomass	436	590	673	862	1324	1063	1634	3412	4111	3697	3232	3940	4406	5245	5206	4464	5089	5028	4908	4956	5531	5494	7333	11166	13421
Other Fossil Fuels	42	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	42	42	29	88	29	NO	NO	NO	29	29	3	NO	NO	NO
1.A.1.a. Public Electricity and Heat Production																									
Total	92472	86689	71901	55946	51496	48590	48499	51233	50453	44329	39919	42931	41998	42183	39348	39061	40483	38378	37639	36780	44274	40852	39004	44542	42275
Liquid Fuels	40098	33002	28190	26919	30426	20266	26110	17107	18116	14486	6350	5065	4821	3406	2843	2153	1299	1219	693	1031	705	593	492	211	33
Solid Fuels	2305	1736	1935	2106	1366	1395	740	541	427	370	371	398	285	209	210	183	105	341	446	472	419	419	513	424	175
Peat	1377	1703	1945	2437	2246	2703	2403	2600	1764	1046	1970	1125	995	653	60	40	20	20	20	10	11	9	NO	40	NO
Gaseous Fuels	48214	49658	39158	23622	16134	23163	17612	27599	26069	24831	27996	32633	31691	33199	31499	32434	34242	32043	31845	30739	37812	34664	30895	32997	29040
Biomass	436	590	673	862	1324	1063	1634	3386	4077	3596	3232	3668	4164	4687	4648	4222	4817	4755	4635	4499	5298	5164	7104	10870	13027
Other Fossil Fuels	42	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	42	42	29	88	29	NO	NO	NO	29	29	3	NO	NO	NO
Diesel oil	5524	5226	3824	935	382	85	42	297	85	85	127	42	42	42	42	42	42	43	43	16	15	25	127	94	22
RFO	32561	26147	23183	24563	30044	20016	25984	16768	17905	14007	5279	4425	4425	3207	2801	2111	1218	1137	650	1015	690	568	365	113	10
LPG	46	46	46	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	4	1
Other liquid	1967	1583	1137	1421	NO	126	84	42	126	NO	NO	126	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Shale oil	NO	NO	NO	NO	NO	39	NO	NO	NO	394	944	472	354	157	NO	NO	39	39	NO	NO	NO	NO	NO	NO	NO
Coal	2305	1736	1935	2106	1366	1395	740	541	427	370	371	398	285	209	210	183	105	341	446	472	419	419	513	424	175
Peat briquettes	31	15	15	15	15	77	62	77	15	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	1	NO	NO	NO	NO
Peat	1346	1688	1930	2422	2231	2626	2341	2523	1749	1046	1970	1125	995	653	60	40	20	20	20	10	10	9	NO	40	NO
Natural gas	48214	49658	39158	23622	16134	23163	17612	27599	26069	24831	27996	32633	31691	33199	31499	32434	34242	32043	31845	30739	37812	34664	30895	32997	29040
Wood	436	590	673	831	1300	1045	1595	3363	4060	3558	3191	3617	4097	4644	4570	4132	4741	4675	4556	4390	5120	4635	5793	9198	11184
Sludge gas	NO	NO	NO	31	24	18	39	23	17	38	41	51	67	43	78	90	76	80	79	100	114	100	105	97	91
Landfill gas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	9	18	22	22	14	15
Other biogas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	37	355	1145	1561	1737
Biodiesel	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	8	52	39	NO	NO
Straws	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	1	NO	NO	NO	NO
Waste oils	42	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	42	42	29	88	29	NO	NO	NO	29	29	3	NO	NO	NO
1.A.1.c. Manufacture of Solid Fuels and Other Energy Industries																									
Total	1865	1521	1750	1445	1664	1924	2826	1405	3734	3996	2738	1424	1270	1613	1652	1346	1433	1022	1290	1117	1321	1528	1376	1480	1510
Liquid Fuels	339	251	251	251	433	253	1223	330	2546	3005	1550	170	212	170	212	212	212	170	212	163	213	255	170	255	286

[illegible]

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Peat briquettes	NO	NO	NO	NO	15	15	15	15	15	15	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	4	NO	NO	4	4	
Peat	NO	20	10	NO	NO	NO	NO	10	10	NO	NO	NO	NO	NO	10	NO	NO	NO	NO	NO	10	2	2	20	20	
Natural gas	25894	23752	19059	12482	9783	10014	9815	9484	9712	9080	9873	11583	12838	12729	13157	13680	13395	12881	11836	9261	10537	7578	7952	6259	5258	
Wood	617	603	616	1779	2101	2414	2664	2740	3188	3176	2696	3856	3393	3309	4706	5535	6425	5387	5797	8633	9801	11187	12921	13530	15368	
Biodiesel	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	3	2	1	8	8	1	4	2	4	
Other biogas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	18	125	57	125	
Municipal wastes (biomass fraction)	NO	NO	NO	NO	NO	NO	NO	NO	NO	10	37	70	94	82	89	49	34	26	98	33	510	1193	1250	1035	1266	
Waste oils	837	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	293	628	322	293	789	205	205	234	88	58	85	58	29	29	
Industrial wastes (used tires)	NO	NO	NO	NO	NO	NO	NO	NO	NO	26	94	176	238	208	224	125	85	65	58	15	84	331	242	379	335	
Municipal wastes	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	80	30	320	332	577	707	915	
1.A.2.a. Iron and Steel																										
Total	6331	4649	4157	3651	4019	3065	3282	5079	5083	4991	5076	5142	4861	4932	5016	4804	5059	5081	4738	4187	4870	1207	1633	583	13	
Liquid Fuels	1219	1016	732	731	912	705	785	1162	1088	1130	1172	1042	963	963	963	126	963	963	917	792	1006	NO	NO	NO	NO	
Solid Fuels	NO	NO	NO	28	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	27	27	5	NO	NO	NO	26	27	184	32	NO	
Peat	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
Gaseous Fuels	4275	3633	3425	2892	3107	2360	2497	3917	3995	3861	3904	4058	3898	3969	4026	4125	4091	4118	3821	3395	3838	1180	1449	551	13	
Biomass	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
Other Fossil Fuels	837	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	42	NO	NO	NO	526	NO	NO	NO	NO	NO	NO	NO	NO	NO	
Diesel oil	42	42	42	NO	42	NO	NO	NO	NO	NO	42	NO	NO	NO	NO	42	NO	NO	NO	NO	1	NO	NO	NO	NO	
RFO	1177	974	690	284	284	203	325	325	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	122	81	NO	NO	NO	NO	NO	
Other liquid	NO	NO	NO	447	586	502	460	837	1088	1130	1130	963	963	963	963	84	963	963	795	711	1005	NO	NO	NO	NO	
Shale oil	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	79	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
Coal	NO	NO	NO	28	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	26	27	102	5	NO	
Coke	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	27	27	5	NO	NO	NO	NO	NO	NO	NO	NO	
Anthracite	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	82	27	NO	
Natural gas	4275	3633	3425	2892	3107	2360	2497	3917	3995	3861	3904	4058	3898	3969	4026	4125	4091	4118	3821	3395	3838	1180	1449	551	13	
Waste oils	837	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	42	NO	NO	NO	526	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1.A.2.b. Non-Ferrous Metals																										
Total	NO	NO	NO	NO	NO	NO	NO	NO	53	100	168	232	269	302	269	203	204	201	134	101	135	172	173	138	72	
Liquid Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	42	NO	NO	NO	NO	NO	NO	NO	NO	NO	2	3	NO	NO	
Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	2	1	NO	NO	
Peat	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
Gaseous Fuels	NO	NO	NO	NO	NO	NO	NO	NO	53	100	168	190	269	302	269	203	204	201	134	101	135	168	168	138	72	
Biomass	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	1	NO	NO	
Other Fossil Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
Diesel oil	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	42	NO	NO	NO	NO	NO	NO	NO	NO	NO	2	3	NO	NO	
Coal	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	2	1	NO	NO	

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Total	15020	11250	10442	11139	8145	8394	9317	8809	8443	7299	6167	5366	5452	4763	5219	5315	5131	4254	3351	3086	2908	2694	2911	2789	2637	
Liquid Fuels	10547	7700	7046	6807	4419	4693	5429	5205	5238	4133	2970	1651	1442	1034	873	912	916	673	420	586	566	376	500	475	378	
Solid Fuels	1069	598	655	594	565	309	309	252	168	224	140	140	141	158	105	132	106	79	79	52	52	16	27	25	24	
Peat	NO	NO	NO	NO	15	NO	NO	15	15	15	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	3	NO	NO	NO	NO	
Gaseous Fuels	3177	2722	2511	3500	2829	3065	3250	3013	2694	2578	2607	2775	2985	2764	3238	3149	3249	2684	2370	1930	1919	1886	1819	1808	1729	
Biomass	228	231	230	238	316	327	330	325	328	349	450	800	842	719	916	1034	772	701	394	488	339	360	536	452	477	
Other Fossil Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	42	88	88	88	88	117	88	30	29	56	29	29	29	
Diesel oil	3229	3229	3102	3229	765	552	510	807	722	552	552	467	340	340	340	297	255	213	212	212	170	85	121	170	152	
RFO	7105	4425	3898	3532	3654	4060	4791	4223	4384	3492	1745	975	893	609	406	406	447	329	122	244	285	121	203	81	31	
LPG	46	46	46	46	NO	NO	NO	46	46	46	NO	46	46	46	46	46	91	91	46	91	72	91	137	182	160	
Jet fuel	NO	NO	NO	NO	NO	NO	43	86	43	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
Other kerosene	NO	NO	NO	NO	NO	NO	43	43	43	43	43	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
Other liquid	167	NO	NO	NO	NO	42	42	NO	NO	NO	NO	84	84	NO	42	84	84	NO	NO	NO	NO	NO	NO	42	35	
Shale oil	NO	NO	NO	NO	NO	39	NO	NO	NO	NO	630	79	79	39	39	79	39	40	40	39	39	79	39	NO	NO	
Coal	911	598	655	541	512	256	256	199	142	171	114	114	114	131	105	105	79	79	79	52	52	16	27	25	24	
Coke	158	NO	NO	53	53	53	53	53	26	53	26	26	27	27	NO	27	27	NO	NO	NO	NO	NO	NO	NO	NO	
Peat briquettes	NO	NO	NO	NO	15	NO	NO	15	15	15	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	3	NO	NO	NO	NO	
Natural gas	3177	2722	2511	3500	2829	3065	3250	3013	2694	2578	2607	2775	2985	2764	3238	3149	3249	2684	2370	1930	1919	1886	1819	1808	1729	
Wood	228	231	230	238	316	327	330	325	328	349	450	800	842	719	916	1034	772	701	394	483	333	360	535	449	467	
Biodiesel	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	5	6	NO	1	0	NO	
Other biogas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	3	10	
Waste oils	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	42	88	88	88	88	117	88	30	29	56	29	29	29	
1.A.2.f. Non-metallic minerals																										
Total	9496	5911	5584	2962	3998	4052	3941	3145	3045	3071	2512	2797	3673	3903	3648	4271	4296	4484	4307	2694	4555	5271	5573	5062	5400	
Liquid Fuels	3585	1307	1301	1260	3057	2562	2519	2396	1912	2274	1521	482	358	1367	1209	764	920	379	207	293	864	298	291	297	275	
Solid Fuels	170	85	114	199	171	114	57	85	28	28	28	28	28	26	26	682	1127	1809	1888	1285	1757	2136	1910	1299	1254	
Peat	NO	NO	NO	NO	NO	NO	NO	10	10	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
Gaseous Fuels	5734	4513	4163	1476	750	1282	1345	634	1066	698	808	1821	2352	1884	1845	2381	1878	1979	1782	942	1010	977	1280	1344	1353	
Biomass	7	6	6	27	20	94	20	20	29	44	61	82	111	184	139	144	169	165	175	100	520	1196	1273	1035	1269	
Other Fossil Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	26	94	385	824	442	429	300	202	153	255	74	404	664	819	1086	1250	
Diesel oil	127	127	42	42	169	84	42	42	85	85	42	42	42	42	42	255	212	127	127	128	237	298	291	297	275	
RFO	3289	1137	1259	1218	2842	2436	2477	2354	1827	2071	731	162	NO	NO	NO	41	NO	81	41	NO	NO	NO	NO	NO	NO	
LPG	NO	NO	NO	NO	46	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
Other kerosene	43	43	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
Other liquid	126	NO	NO	NO	NO	42	NO	NO	NO	NO	NO	42	NO	251	NO	NO	42	NO	NO	NO	NO	NO	NO	NO	NO	
Petroleum coke	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	198	956	1088	429	627	132	NO	165	627	NO	NO	NO	NO	
Shale oil	NO	NO	NO	NO	NO	NO	NO	NO	NO	118	748	236	118	118	79	39	39	39	39	NO	NO	NO	NO	NO	NO	
Coal	142	85	114	199	171	114	57	85	28	28	28	28	28	26	26	682	1127	1809	1888	1285	1757	2136	1910	1299	1254	

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Oil shale	28	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
Peat	NO	NO	NO	NO	NO	NO	NO	10	10	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
Natural gas	5734	4513	4163	1476	750	1282	1345	634	1066	698	808	1821	2352	1884	1845	2381	1878	1979	1782	942	1010	977	1280	1344	1353	
Wood	7	6	6	27	20	94	20	20	29	34	24	12	17	102	50	95	135	139	77	67	10	3	23	NO	NO	
Biodiesel	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	3	
Municipal wastes (biomass fraction)	NO	NO	NO	NO	NO	NO	NO	NO	NO	10	37	70	94	82	89	49	34	26	98	33	510	1193	1250	1035	1266	
Waste oils	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	209	586	234	205	175	117	88	117	29	NO	NO	NO	NO	NO	
Industrial wastes (used tires)	NO	NO	NO	NO	NO	NO	NO	NO	NO	26	94	176	238	208	224	125	85	65	58	15	84	331	242	379	335	
Municipal wastes	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	80	30	320	332	577	707	915	
1.A.2.g. Other																										
Total	20768	18288	13240	10639	9420	8356	8536	7965	8819	7920	5993	6718	6504	6766	8175	8695	10106	9688	9583	11272	13077	14964	16657	16429	17805	
Liquid Fuels	10551	8067	6546	5199	4867	4156	4160	4039	4347	3699	1790	1300	1041	931	1233	1064	1276	1832	1408	1149	967	1477	1695	1667	1436	
Solid Fuels	278	171	171	677	623	170	169	56	169	141	84	56	56	52	52	104	130	79	30	26	26	47	27	50	58	
Peat	NO	20	10	NO	NO	15	15	NO	NO	NO	NO	NO	NO	NO	10	NO	NO	NO	NO	NO	11	2	2	4	13	
Gaseous Fuels	9557	9664	6134	3318	2360	2115	1910	1515	1512	1380	1968	2335	2922	3334	3208	3177	3258	3318	3014	2275	2928	2862	2797	1930	1678	
Biomass	382	366	380	1445	1570	1899	2281	2355	2791	2699	2152	2985	2485	2449	3673	4350	5442	4459	5132	7793	9116	10547	12107	12778	14620	
Other Fossil Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	42	NO	NO	NO	NO	NO	NO	NO	29	29	29	29	NO	NO	
Gasoline	880	220	220	220	132	44	132	88	88	44	44	44	69	44	88	88	88	88	88	44	44	44	44	44	43	
Diesel oil	2039	2081	763	508	593	849	763	891	848	848	848	806	849	805	975	806	1060	1657	1275	1105	863	1301	1559	1529	1278	
RFO	7632	5766	5563	4385	4099	3086	3085	2883	3411	2761	813	366	123	82	82	82	82	41	NO	NO	41	41	NO	NO	NO	
LPG	NO	NO	NO	NO	NO	91	137	91	NO	46	46	NO	NO	NO	46	46	46	46	45	NO	19	91	92	94	115	
Other kerosene	NO	NO	NO	86	43	86	43	86	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
Other liquid	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	84	NO	NO	42	42	NO	NO	NO	NO	NO	NO	NO	NO	NO	
Shale oil	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	39	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
Coal	199	171	171	625	597	170	169	56	169	141	84	56	56	52	52	104	130	79	30	26	26	47	27	50	58	
Coke	79	NO	NO	52	26	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
Peat briquettes	NO	NO	NO	NO	NO	15	15	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	1	NO	NO	4	3	
Peat	NO	20	10	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	10	NO	NO	NO	NO	NO	10	2	2	NO	10	
Natural gas	9557	9664	6134	3318	2360	2115	1910	1515	1512	1380	1968	2335	2922	3334	3208	3177	3258	3318	3014	2275	2928	2862	2797	1930	1678	
Wood	382	366	380	1445	1570	1899	2281	2355	2791	2699	2152	2985	2485	2449	3673	4350	5442	4459	5132	7793	9115	10547	12051	12776	14620	
Biodiesel	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	1	NO	2	2	NO	
Other biogas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	54	NO	NO	
Waste oils	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	42	NO	NO	NO	NO	NO	NO	NO	29	29	29	29	NO	NO	

1.A.4 Other Sectors

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
1.A.4 Other Sectors																									
Total	101006	107881	83180	76877	64625	60182	61263	56261	52470	52089	49117	54029	53828	57273	59428	59055	58857	59344	55403	58823	52940	51629	53940	50149	49247
Liquid Fuels	27829	32499	24223	21319	14008	8817	8761	7849	6947	7439	6888	7363	6919	7887	7936	7807	8456	7888	7114	7778	8334	8351	8351	8476	8753
Solid Fuels	22398	19894	15853	13347	9363	5180	5521	4639	3330	2817	2162	2988	2390	2203	2150	2045	1940	1940	1783	1574	2098	1861	983	1075	962
Peat	1128	880	1030	617	515	391	506	357	266	66	41	15	NO	10	NO	20	40	61	31	16	21	32	32	NO	11
Gaseous Fuels	23203	23548	11201	8384	7002	7150	6732	5434	5670	5865	6218	7061	8098	8795	9651	9632	9983	11027	10959	10241	11819	10343	10477	9809	9670
Biomass	26448	31060	30873	33210	33737	38643	39743	37983	36257	35902	33808	36561	36295	38321	39574	39523	38380	38399	35487	39215	30659	31042	34097	30789	29851
Other Fossil Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	42	126	58	117	29	58	29	29	NO	8	NO	NO	NO	NO
Gasoline	1672	176	176	176	352	88	176	176	88	132	264	220	195	220	220	308	352	352	308	308	308	440	395	440	354
Diesel oil	16189	22860	16189	14574	6840	5267	5098	4248	3611	4419	4589	5099	4886	5651	5863	5566	6288	6288	5566	6365	6942	6902	6896	6981	7234
RFO	6415	6292	5318	3897	4507	1664	1990	1706	1340	1218	772	772	569	528	447	527	406	40	80	41	44	5	NO	NO	NO
LPG	2961	2869	2368	2413	2050	1366	1367	1503	1822	1412	1184	1230	1185	1321	1321	1367	1367	1184	1139	1047	1023	1002	1055	1055	1165
Jet fuel	NO	NO	NO	NO	NO	86	43	173	43	130	NO	NO	NO	NO	43	NO	43	24	21	17	17	2	4	NO	NO
Other kerosene	215	302	172	259	259	346	86	43	43	86	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Other liquid	377	NO	NO	NO	NO	NO	NO	NO	NO	42	NO	42	84	167	42	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Shale oil	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	79	NO	NO	NO	NO	39	NO	NO	NO	NO	NO	NO	NO	NO	NO
Coal	22398	19894	15853	13347	9363	5180	5521	4639	3330	2817	2162	2988	2390	2203	2150	2045	1940	1940	1783	1574	2098	1861	983	1075	962
Peat briquettes	836	588	728	527	294	309	355	247	186	46	31	15	NO	NO	NO	NO	NO	1	1	6	1	3	4	NO	1
Peat	292	292	302	90	221	82	150	110	80	20	10	NO	NO	10	NO	20	40	60	30	10	20	29	28	NO	10
Natural gas	23203	23548	11201	8384	7002	7150	6732	5434	5670	5865	6218	7061	8098	8795	9651	9632	9983	11027	10959	10241	11819	10343	10477	9809	9670
Wood	26448	31060	30873	33210	33737	38643	39743	37983	36257	35902	33808	36561	36249	38159	39302	39211	38080	38067	35123	38811	30222	30442	33226	29652	28585
Charcoal	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	30	60	30	45	60	60	60	60	59	90	90
Landfill gas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	46	162	242	251	259	271	290	314	314	327	326	357	333
Other biogas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	91	358	523	673
Straws	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	11	16	14	29	59	43	38	58	99
Biodiesel	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	5	79	90	108	71
Waste oils	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	42	126	58	117	29	58	29	29	NO	8	NO	NO	NO	NO
1.A.4.a. Commercial/Institutional																									
Total	39260	39062	33600	26832	17464	16517	16581	14795	12297	13125	11356	12366	13179	13856	15142	14292	14964	15997	13248	12578	13329	11772	12744	12526	12018
Liquid Fuels	13453	16642	11910	10556	5308	2890	2758	2459	2017	2346	1715	1928	1818	2207	2167	1860	2289	1902	1596	1586	1619	1397	1859	1939	2129
Solid Fuels	14913	11413	10872	7854	4297	2903	3272	2732	2419	2049	1565	1536	1423	1338	1285	1049	1075	1075	918	735	1023	891	354	519	407
Peat	672	517	620	288	326	114	250	163	71	15	31	15	NO	10	NO	20	40	61	31	16	1	32	32	NO	11
Gaseous Fuels	5004	5328	4916	2625	1903	2328	2271	1805	2175	2536	3054	3347	4103	4278	4680	4598	4851	5676	5679	5415	5623	5055	4952	4477	4401
Biomass	5218	5162	5282	5508	5630	8282	8029	7636	5615	6179	4991	5497	5709	5965	6894	6737	6651	7253	4995	4826	5054	4398	5547	5591	5070
Other Fossil Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	42	126	58	117	29	58	29	29	NO	8	NO	NO	NO	NO
Gasoline	44	44	44	44	220	NO	88	88	44	88	88	77	46	44	44	44	44	44	44	44	44	88	44	88	44

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Total	25995	26331	10533	9255	8599	6005	6094	5424	4837	4937	4910	5365	4983	5716	6025	5815	5938	6077	5088	5436	6050	6059	6079	6394	6383
Liquid Fuels	9468	10186	7310	6752	5852	4526	4731	4027	3476	3687	3730	3994	3660	4282	4326	4370	4546	4548	4125	4167	4478	4725	4255	4300	4341
Solid Fuels	1081	939	541	456	655	456	285	199	114	85	85	113	113	78	78	52	52	52	52	26	26	26	52	26	24
Peat	31	31	31	71	45	25	15	15	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Gaseous Fuels	14195	13945	1380	670	739	641	699	566	599	500	505	712	702	850	1014	841	806	764	587	521	977	808	1044	1066	1017
Biomass	1220	1229	1271	1306	1307	358	365	617	648	665	590	546	508	506	607	552	534	713	324	722	569	500	727	1002	1001
Other Fossil Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Gasoline	1628	132	132	132	132	88	88	88	44	44	44	11	17	44	44	44	44	44	NO	NO	NO	88	88	88	46
Diesel oil	6161	8583	6161	5269	4419	3951	3909	3654	3229	3399	3442	3739	3399	3994	4079	4164	4461	4504	4079	4122	4462	4589	4121	4164	4248
RFO	1421	1339	974	1217	1258	487	691	285	203	244	244	244	244	244	203	162	41	NO	NO	NO	3	3	NO	NO	NO
LPG	46	46	NO	91	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	46	45	13	45	46	48	47
Other kerosene	86	86	43	43	43	NO	43	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Other liquid	126	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Coal	1081	939	541	456	655	456	285	199	114	85	85	113	113	78	78	52	52	52	52	26	26	26	52	26	24
Peat briquettes	31	31	31	31	15	15	15	15	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Peat	NO	NO	NO	40	30	10	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Natural gas	14195	13945	1380	670	739	641	699	566	599	500	505	712	702	850	1014	841	806	764	587	521	977	808	1044	1066	1017
Wood	1220	1229	1271	1306	1307	358	365	617	648	665	590	546	508	506	607	552	534	713	324	722	568	361	299	460	292
Other biogas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	91	358	474	604
Straws	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	14	14	46
Biodiesel	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	1	48	56	54	59

1.A.5 Other

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
1.A.5 Other (Not elsewhere specified)																									
Total	NO	NO	NO	NO	NO	NO	3	1	3	2	2	2	94	84	131	104	103	39	47	73	107	98	100	88	128
Liquid Fuels	NO	NO	NO	NO	NO	NO	3	1	3	2	2	2	94	84	131	104	103	39	47	73	107	98	100	88	128
Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Peat	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Gaseous Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Biomass	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Other Fossil Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Gasoline	NO	NO	NO	NO	NO	NO	3	1	3	2	2	2	2	2	3	2	6	1	5	1	0	NO	NO	NO	NO
Diesel oil	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	75	65	111	77	73	14	21	49	87	80	79	63	105
Jet fuel	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	17	17	17	24	24	24	21	23	20	18	21	24	23

NFR category code	Pollutant	1990 Estimate	2014 Estimate	Base year estimate Ex,t	Latest year estimate Ex,t	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
1A1a	NOx	10.27	3.69	10.266	3.694	2.00%	20.00%	20.10%	2.12%	-0.18%	3.97%	-0.04%	0.11%	0.12%
1A1b	NOx	NO	NO											
1A1c	NOx	0.28	0.12	0.278	0.124	2.00%	20.00%	20.10%	0.07%	0.02%	0.13%	0.00%	0.00%	0.01%
1A2a	NOx	1.37	0.00	1.371	0.001	2.00%	40.00%	40.05%	0.00%	-0.55%	0.00%	-0.22%	0.00%	0.22%
1A2b	NOx	NO	0.01		0.005	2.00%	40.00%	40.05%	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%
1A2c	NOx	1.90	0.08	1.900	0.078	2.00%	40.00%	40.05%	0.09%	-0.68%	0.08%	-0.27%	0.00%	0.27%
1A2d	NOx	0.31	0.01	0.311	0.009	2.00%	40.00%	40.05%	0.01%	-0.12%	0.01%	-0.05%	0.00%	0.05%
1A2e	NOx	5.83	0.31	5.831	0.314	2.00%	40.00%	40.05%	0.36%	-2.02%	0.34%	-0.81%	0.01%	0.81%
1A2f	NOx	2.29	0.65	2.293	0.653	2.00%	40.00%	40.05%	0.75%	-0.23%	0.70%	-0.09%	0.02%	0.09%
1A2gvii	NOx	0.12	0.01	0.121	0.006	20.00%	100.00%	101.98%	0.02%	-0.04%	0.01%	-0.04%	0.00%	0.04%
1A2gviii	NOx	5.75	2.13	5.751	2.131	2.00%	40.00%	40.05%	2.44%	-0.03%	2.29%	-0.01%	0.06%	0.07%
1A3ai(i)	NOx	0.51	0.13	0.511	0.133	2.00%	30.00%	30.07%	0.11%	-0.06%	0.14%	-0.02%	0.00%	0.02%
1A3aii(i)	NOx	0.00	0.00	0.000	0.000	2.00%	30.00%	30.07%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1A3bi	NOx	11.03	3.60	11.027	3.601	2.00%	20.00%	20.10%	2.07%	-0.59%	3.87%	-0.12%	0.11%	0.16%
1A3bii	NOx	2.08	1.21	2.080	1.214	2.00%	20.00%	20.10%	0.70%	0.46%	1.30%	0.09%	0.04%	0.10%
1A3biii	NOx	11.11	6.93	11.110	6.925	2.00%	20.00%	20.10%	3.98%	2.95%	7.44%	0.59%	0.21%	0.63%
1A3biv	NOx	0.00	0.01	0.001	0.007	2.00%	20.00%	20.10%	0.00%	0.01%	0.01%	0.00%	0.00%	0.00%
1A3bv	NOx	NA	NA											
1A3bvi	NOx	NA	NA											
1A3bvii	NOx	NA	NA											
1A3c	NOx	8.86	3.67	8.856	3.665	2.00%	35.00%	35.06%	3.67%	0.36%	3.94%	0.13%	0.11%	0.17%
1A3di(ii)	NOx	NO	NE			2.00%	35.00%	35.06%						
1A3dii	NOx	0.02	0.32	0.021	0.315	2.00%	35.00%	35.06%	0.32%	0.33%	0.34%	0.12%	0.01%	0.12%
1A3ei	NOx	IE	IE											
1A3eii	NOx	NO	NO											
1A4ai	NOx	10.40	1.86	10.400	1.857	2.00%	50.00%	50.04%	2.65%	-2.20%	1.99%	-1.10%	0.06%	1.10%
1A4aii	NOx	0.01	0.01	0.006	0.006	20.00%	100.00%	101.98%	0.02%	0.00%	0.01%	0.00%	0.00%	0.00%
1A4bi	NOx	2.95	2.14	2.948	2.145	10.00%	50.00%	50.99%	3.12%	1.11%	2.30%	0.56%	0.33%	0.64%
1A4bii	NOx	NO	0.04		0.036	20.00%	100.00%	101.98%	0.11%	0.04%	0.04%	0.04%	0.01%	0.04%
1A4ci	NOx	4.45	2.22	4.451	2.215	2.00%	50.00%	50.04%	3.17%	0.58%	2.38%	0.29%	0.07%	0.30%
1A4cii	NOx	0.22	0.01	0.223	0.006	20.00%	100.00%	101.98%	0.02%	-0.08%	0.01%	-0.08%		

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3F	NOx	NO	NO											
3I	NOx	0.01	0.09	0.007	0.089	10.00%	61.50%	62.31%	0.16%	0.09%	0.10%	0.06%	0.01%	0.06%
5A	NOx	NA	NA											
5B1	NOx	NE	NE											
5B2	NOx	NO	NO											
5C1a	NOx	NO	NO											
5C1bi	NOx	NO	NO											
5C1bii	NOx	0.00	0.00	0.000	0.000	44.00%	50.00%	66.60%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
5C1biii	NOx	0.00	0.00	0.000	0.000	44.00%	50.00%	66.60%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
5C1biv	NOx	NO	NO											
5C1bv	NOx	NO	0.00		0.002		50.00%	50.00%	0.00%	0.00%	0.00%	0.00%		0.00%
5C1bvi	NOx	NO	NO											
5C2	NOx	NE	NE											
5D1	NOx	NA	NA											
5D2	NOx	NA	NA											
5D3	NOx	NA	NA											
5E	NOx	NO	NO											
6A	NOx	0.18	0.06	0.182	0.063	10%	54.5%	55.41%	0.10%	-0.01%	0.07%	0.00%	0.01%	0.01%
National total for the entire territory		93.11	35.02	93.11	35.02	2.070	18.550	18.897	37.168%	-0.088%	37.444%	-0.810%	1.699%	7.582%
						Percentage uncertainty in total inventory			60.97%				Trend uncertainty	27.53%

NMVOC

NFR category code	Pollutant	1990 Estimate	2014 Estimate	Base year estimate Ex,t	Latest year estimate Ex,t	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
1A1a	NMVOC	0.21	0.16	0.214	0.162	2.00%	50.00%	50.04%	0.15%	0.05%	0.16%	0.02%	0.00%	0.02%
1A1b	NMVOC	NO	NO											
1A1c	NMVOC	0.00	0.01	0.004	0.005	2.00%	50.00%	50.04%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%
1A2a	NMVOC	0.15	0.00	0.150	0.000	2.00%	50.00%	50.04%	0.00%	-0.08%	0.00%	-0.04%	0.00%	0.04%
1A2b	NMVOC	NO	0.00		0.002	2.00%	50.00%	50.04%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

[illegible]

[illegible]

NFR category code	Pollutant	1990 Estimate	2014 Estimate	Base year estimate Ex,t	Latest year estimate Ex,t	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
5C1bv	NMVOC	NO	0.00		0.000		50.00%	50.00%	0.00%	0.00%	0.00%	0.00%		0.00%
5C1bvi	NMVOC	NO	NO											
5C2	NMVOC	NE	NE											
5D1	NMVOC	IE	IE											
5D2	NMVOC	IE	IE											
5D3	NMVOC	0.01	0.00	0.009	0.003	10.00%	30.00%	31.62%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
5E	NMVOC	NO	NO											
6A	NMVOC	NA	NA											
National total for the entire territory		100.46	54.48	100.46	54.48	2.660	25.100	25.451	34.283%	-0.461%	53.212%	-0.144%	2.678%	14.912%
					Percentage uncertainty in total inventory			58.55%					Trend uncertainty	38.62%

SO₂

NFR category code	Pollutant	1990 Estimate	2014 Estimate	Base year estimate Ex,t	Latest year estimate Ex,t	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
1A1a	SO ₂	35.93	0.57	35.933	0.567	2.00%	10.00%	10.20%	1.39%	-0.93%	0.57%	-0.09%	0.02%	0.09%
1A1b	SO ₂	NO	NO											
1A1c	SO ₂	0.46	0.03	0.459	0.031	2.00%	10.00%	10.20%	0.08%	0.01%	0.03%	0.00%	0.00%	0.00%
1A2a	SO ₂	1.40	0.00	1.401	0.000	2.00%	10.00%	10.20%	0.00%	-0.06%	0.00%	-0.01%	0.00%	0.01%
1A2b	SO ₂	NO	0.00		0.000	2.00%	10.00%	10.20%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1A2c	SO ₂	3.05	0.02	3.049	0.019	2.00%	10.00%	10.20%	0.05%	-0.11%	0.02%	-0.01%	0.00%	0.01%
1A2d	SO ₂	0.23	0.00	0.229	0.000	2.00%	10.00%	10.20%	0.00%	-0.01%	0.00%	0.00%	0.00%	0.00%
1A2e	SO ₂	8.33	0.06	8.328	0.060	2.00%	10.00%	10.20%	0.15%	-0.29%	0.06%	-0.03%	0.00%	0.03%
1A2f	SO ₂	3.48	0.44	3.479	0.439	2.00%	10.00%	10.20%	1.08%	0.29%	0.44%	0.03%	0.01%	0.03%
1A2gvii	SO ₂	0.01	0.00	0.006	0.000	20.00%	35.00%	40.31%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1A2gviii	SO ₂	7.84	0.74	7.838	0.741	2.00%	10.00%	10.20%	1.81%	0.41%	0.74%	0.04%	0.02%	0.05%
1A3ai(i)	SO ₂	0.05	0.02	0.053	0.020	2.00%	10.00%	10.20%	0.05%	0.02%	0.02%	0.00%	0.00%	0.00%
1A3aii(i)	SO ₂	0.00	0.00	0.000	0.000	2.00%	10.00%	10.20%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1A3bi	SO ₂	0.12	0.01	0.122	0.009	2.00%	10.00%	10.20%	0.02%	0.00%	0.01%	0.00%	0.00%	0.00%
1A3bii	SO ₂	0.03	0.00	0.033	0.002	2.00%	10.00%	10.20%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1A3biii	SO ₂	0.21	0.01	0.206	0.006	2.00%	10.00%	10.20%	0.01%	0.00%	0.01%	0.00%	0.00%	0.00%
1A3biv	SO ₂	0.00	0.00	0.000	0.000	2.00%	10.00%	10.20%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

[illegible]

NFR category code	Pollutant	1990 Estimate	2014 Estimate	Base year estimate Ex,t	Latest year estimate Ex,t	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
3B4h	SO ₂	NA	NA											
3Da1	SO ₂	NA	NA											
3Da2a	SO ₂	NA	NA											
3Da2b	SO ₂	NA	NA											
3Da2c	SO ₂	NA	NA											
3Da3	SO ₂	NA	NA											
3Da4	SO ₂	NA	NA											
3Db	SO ₂	NA	NA											
3Dc	SO ₂	NA	NA											
3Dd	SO ₂	NA	NA											
3De	SO ₂	NA	NA											
3Df	SO ₂	NA	NA											
3F	SO ₂	NO	NO											
3I	SO ₂	0.00	0.02	0.002	0.020	10.00%	61.50%	62.31%	0.31%	0.02%	0.02%	0.01%	0.00%	0.01%
5A	SO ₂	NA	NA											
5B1	SO ₂	NE	NE											
5B2	SO ₂	NO	NO											
5C1a	SO ₂	NO	NO											
5C1bi	SO ₂	NO	NO											
5C1bii	SO ₂	0.00	0.00	0.000	0.000	44.00%	50.00%	66.60%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
5C1biii	SO ₂	0.00	0.00	0.000	0.000	44.00%	50.00%	66.60%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
5C1biv	SO ₂	NO	NO											
5C1bv	SO ₂	NO	0.00		0.000		50.00%	50.00%	0.00%	0.00%	0.00%	0.00%		0.00%
5C1bvi	SO ₂	NO	NO											
5C2	SO ₂	NE	NE											
5D1	SO ₂	NA	NA											
5D2	SO ₂	NA	NA											
5D3	SO ₂	NA	NA											
5E	SO ₂	NO	NO											
6A	SO ₂	NA	NA											
National total for the entire territory		100.03	4.16	100.03	4.16	1.920	5.750	6.260	11.565%	-0.017%	4.143%	0.002%	0.283%	0.537%
					Percentage uncertainty in total inventory			34.01%			Trend uncertainty			7.33%

NFR category code	Pollutant	1990 Estimate	2014 Estimate	Base year estimate Ex,t	Latest year estimate Ex,t	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
1A1a	NH ₃	NE	NE											
1A1b	NH ₃	NO	NO											
1A1c	NH ₃	NE	NE											
1A2a	NH ₃	NE	NE			2.00%	50.00%	50.04%						
1A2b	NH ₃	NO	NE			2.00%	50.00%	50.04%						
1A2c	NH ₃	NE	0.01		0.010	2.00%	50.00%	50.04%	0.03%	0.02%	0.02%	0.01%	0.00%	0.01%
1A2d	NH ₃	NE	0.00		0.000	2.00%	50.00%	50.04%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1A2e	NH ₃	0.01	0.02	0.008	0.017	2.00%	50.00%	50.04%	0.05%	0.03%	0.04%	0.02%	0.00%	0.02%
1A2f	NH ₃	0.00	0.00	0.000	0.000	2.00%	50.00%	50.04%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1A2gvii	NH ₃	0.00	0.00	0.000	0.000	20.00%	100.00%	101.98%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1A2gviii	NH ₃	0.01	0.54	0.014	0.541	2.00%	50.00%	50.04%	1.55%	1.18%	1.19%	0.59%	0.03%	0.59%
1A3ai(i)	NH ₃	NE	NE											
1A3aii(i)	NH ₃	NE	NE											
1A3bi	NH ₃	0.01	0.23	0.010	0.229	2.00%	20.00%	20.10%	0.26%	0.50%	0.50%	0.10%	0.01%	0.10%
1A3bii	NH ₃	0.00	0.00	0.001	0.004	2.00%	20.00%	20.10%	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%
1A3biii	NH ₃	0.00	0.01	0.003	0.005	2.00%	20.00%	20.10%	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%
1A3biv	NH ₃	0.00	0.00	0.000	0.000	2.00%	20.00%	20.10%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1A3bv	NH ₃	NA	NA											
1A3bvi	NH ₃	NA	NA											
1A3bvii	NH ₃	NA	NA											
1A3c	NH ₃	0.00	0.00	0.001	0.000	2.00%	35.00%	35.06%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1A3di(ii)	NH ₃	NO	NE											
1A3dii	NH ₃	0.00	0.00	0.000	0.000	2.00%	35.00%	35.06%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1A3ei	NH ₃	IE	IE											
1A3eii	NH ₃	NO	NO											
1A4ai	NH ₃	0.19	0.17	0.193	0.172	2.00%	50.00%	50.04%	0.49%	0.22%	0.38%	0.11%	0.01%	0.11%
1A4aii	NH ₃	0.00	0.00	0.000	0.000	20.00%	100.00%	101.98%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1A4bi	NH ₃	1.29	1.41	1.294	1.406	10.00%	100.00%	100.50%	8.09%	2.00%	3.10%	2.00%	0.44%	2.05%
1A4bii	NH ₃	NO	0.00		0.000	20.00%	100.00%	101.98%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1A4ci	NH ₃	0.05	0.01	0.045	0.013	2.00%	50.00%	50.04%	0.04%	-0.01%	0.03%	-0.01%	0.00%	0.01%
1A4cii	NH ₃	0.00	0.00	0.000	0.000	20.00%	100.00%	101.98%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1A4ciii	NH ₃	NE	NE											
1A5a	NH ₃	NO	NO											
1A5b	NH ₃	NO	NE											
1B1a	NH ₃	NA	NA											
1B1b	NH ₃	NO	NO											
1B1c	NH ₃	NO	NO											

NFR category code	Pollutant	1990 Estimate	2014 Estimate	Base year estimate Ex,t	Latest year estimate Ex,t	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
5C1biii	NH ₃	NE	NE											
5C1biv	NH ₃	NO	NO											
5C1bv	NH ₃	NO	NA											
5C1bvi	NH ₃	NO	NO											
5C2	NH ₃	NE	NE											
5D1	NH ₃	1.17	0.75	1.167	0.746	10.00%	30.00%	31.62%	1.35%	0.65%	1.65%	0.20%	0.23%	0.30%
5D2	NH ₃	NA	NA											
5D3	NH ₃	NA	NA											
5E	NH ₃	NO	NO											
6A	NH ₃	NA	NA											
National total for the entire territory		45.33	17.47	45.33	17.47	1.420	17.200	17.298	54.744%	-0.757%	36.741%	1.925%	1.205%	9.188%
Percentage uncertainty in total inventory									73.99%	Trend uncertainty			30.31%	

PM_{2.5}

NFR category code	Pollutant	2000 Estimate	2014 Estimate	Base year estimate Ex,t	Latest year estimate Ex,t	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
1A1a	PM _{2.5}	0.56	1.52	0.560	1.516	2.00%	50.00%	50.04%	4.25%	4.83%	6.91%	2.42%	0.20%	2.42%
1A1b	PM _{2.5}	NO	NO											
1A1c	PM _{2.5}	0.00	0.05	0.003	0.053	2.00%	50.00%	50.04%	0.15%	0.23%	0.24%	0.12%	0.01%	0.12%
1A2a	PM _{2.5}	0.03	0.00	0.026	0.000	2.00%	50.00%	50.04%	0.00%	-0.10%	0.00%	-0.05%	0.00%	0.05%
1A2b	PM _{2.5}	0.00	0.00	0.000	0.000	2.00%	50.00%	50.04%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1A2c	PM _{2.5}	0.01	0.04	0.009	0.041	2.00%	50.00%	50.04%	0.11%	0.15%	0.19%	0.08%	0.01%	0.08%
1A2d	PM _{2.5}	0.00	0.00	0.003	0.001	2.00%	50.00%	50.04%	0.00%	-0.01%	0.00%	0.00%	0.00%	0.00%
1A2e	PM _{2.5}	0.14	0.07	0.140	0.074	2.00%	50.00%	50.04%	0.21%	-0.18%	0.34%	-0.09%	0.01%	0.09%
1A2f	PM _{2.5}	0.04	0.14	0.037	0.142	2.00%	50.00%	50.04%	0.40%	0.51%	0.65%	0.25%	0.02%	0.26%
1A2gvii	PM _{2.5}	0.00	0.00	0.001	0.001	20.00%	100.00%	101.98%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
1A2gviii	PM _{2.5}	0.35	2.08	0.346	2.081	2.00%	50.00%	50.04%	5.83%	8.21%	9.49%	4.10%	0.27%	4.11%
1A3ai(i)	PM _{2.5}	NE	0.00		0.002	2.00%	30.00%	30.07%	0.00%	0.01%	0.01%	0.00%	0.00%	0.00%
1A3aii(i)	PM _{2.5}	NE	0.00		0.000	2.00%	30.00%	30.07%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1A3bi	PM _{2.5}	0.15	0.21	0.153	0.212	2.00%	20.00%	20.10%	0.24%	0.40%	0.97%	0.08%	0.03%	0.08%
1A3bii	PM _{2.5}	0.08	0.09	0.077	0.087	2.00%	20.00%	20.10%	0.10%	0.11%	0.40%	0.02%	0.01%	0.03%
1A3biii	PM _{2.5}	0.32	0.14	0.317	0.135	2.00%	20.00%	20.10%	0.15%	-0.56%	0.62%	-0.11%	0.02%	0.11%
1A3biv	PM _{2.5}	0.00	0.00	0.001	0.001	2.00%	20.00%	20.10%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%

NFR category code	Pollutant	2000 Estimate	2014 Estimate	Base year estimate Ex,t	Latest year estimate Ex,t	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
1A3bv	PM _{2.5}	NA	NA											
1A3bvi	PM _{2.5}	0.09	0.16	0.086	0.161	2.00%	35.00%	35.06%	0.32%	0.41%	0.73%	0.15%	0.02%	0.15%
1A3bvii	PM _{2.5}	0.05	0.07	0.048	0.066	2.00%	35.00%	35.06%	0.13%	0.12%	0.30%	0.04%	0.01%	0.04%
1A3c	PM _{2.5}	0.09	0.10	0.089	0.096	2.00%	35.00%	35.06%	0.19%	0.11%	0.44%	0.04%	0.01%	0.04%
1A3di(ii)	PM _{2.5}	NO	NA											
1A3dii	PM _{2.5}	0.00	0.01	0.001	0.007	2.00%	35.00%	35.06%	0.01%	0.03%	0.03%	0.01%	0.00%	0.01%
1A3ei	PM _{2.5}	IE	IE											
1A3eii	PM _{2.5}	NO	NO											
1A4ai	PM _{2.5}	0.91	0.74	0.906	0.740	2.00%	50.00%	50.04%	2.07%	0.01%	3.37%	0.00%	0.10%	0.10%
1A4aii	PM _{2.5}	0.00	0.00	0.002	0.001	20.00%	100.00%	101.98%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
1A4bi	PM _{2.5}	14.70	10.84	14.704	10.845	10.00%	100.00%	100.50%	61.05%	-5.09%	49.44%	-5.09%	6.99%	8.65%
1A4bii	PM _{2.5}	0.00	0.01	0.003	0.006	20.00%	100.00%	101.98%	0.04%	0.02%	0.03%	0.02%	0.01%	0.02%
1A4ci	PM _{2.5}	0.14	0.13	0.142	0.131	2.00%	50.00%	50.04%	0.37%	0.07%	0.60%	0.04%	0.02%	0.04%
1A4cii	PM _{2.5}	0.00	0.00	0.001	0.001	20.00%	100.00%	101.98%	0.01%	0.00%	0.01%	0.00%	0.00%	0.00%
1A4ciii	PM _{2.5}	0.06	0.01	0.064	0.010	20.00%	100.00%	101.98%	0.06%	-0.19%	0.04%	-0.19%	0.01%	0.20%
1A5a	PM _{2.5}	NO	NO											
1A5b	PM _{2.5}	NA	0.00		0.003	2.00%	100.00%	100.02%	0.02%	0.02%	0.02%	0.02%	0.00%	0.02%
1B1a	PM _{2.5}	0.00	0.00	0.000	0.000	50.00%	100.00%	111.80%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1B1b	PM _{2.5}	NO	NO											
1B1c	PM _{2.5}	NO	NO											
1B2ai	PM _{2.5}	NO	NO											
1B2aiv	PM _{2.5}	NO	NO											
1B2av	PM _{2.5}	NA	NA											
1B2b	PM _{2.5}	NA	NA											
1B2c	PM _{2.5}	NO	NO											
1B2d	PM _{2.5}	NO	NO											
2A1	PM _{2.5}	0.03	0.02	0.030	0.025	10.00%	50.00%	50.99%	0.07%	0.00%	0.11%	0.00%	0.02%	0.02%
2A2	PM _{2.5}	0.01	0.00	0.006	0.000	2.00%	50.00%	50.04%	0.00%	-0.02%	0.00%	-0.01%	0.00%	0.01%
2A3	PM _{2.5}	0.00	0.00	0.002	0.004	2.00%	60.00%	60.03%	0.01%	0.01%	0.02%	0.01%	0.00%	0.01%
2A5a	PM _{2.5}	NE	NE											
2A5b	PM _{2.5}	NE	NE											
2A5c	PM _{2.5}	NE	NE											
2A6	PM _{2.5}	NA	NA											
2B1	PM _{2.5}	NO	NO											
2B2	PM _{2.5}	NO	NO											
2B3	PM _{2.5}	NO	NO											
2B5	PM _{2.5}	NO	NO											
2B6	PM _{2.5}	NO	NO											
2B7	PM _{2.5}	NE	NE											
2B10a	PM _{2.5}	NE	0.00		0.000	10.00%	20.00%	22.36%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

NFR category code	Pollutant	2000 Estimate	2014 Estimate	Base year estimate Ex,t	Latest year estimate Ex,t	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
2B10b	PM _{2.5}	NO	NO											
2C1	PM _{2.5}	0.30	0.00	0.300	0.000	25.00%	20.00%	32.02%	0.00%	-1.11%	0.00%	-0.22%	0.00%	0.22%
2C2	PM _{2.5}	NO	NO											
2C3	PM _{2.5}	NO	NO											
2C4	PM _{2.5}	NO	NO											
2C5	PM _{2.5}	NO	NO											
2C6	PM _{2.5}	NO	NO											
2C7a	PM _{2.5}	NO	NO											
2C7b	PM _{2.5}	NO	NO											
2C7c	PM _{2.5}	NO	NO											
2C7d	PM _{2.5}	NO	NO											
2D3a	PM _{2.5}	NA	NA											
2D3b	PM _{2.5}	0.15	0.46	0.153	0.464	20.00%	70.00%	72.80%	1.89%	1.55%	2.12%	1.09%	0.60%	1.24%
2D3c	PM _{2.5}	0.00	0.01	0.003	0.010	20.00%	70.00%	72.80%	0.04%	0.03%	0.05%	0.02%	0.01%	0.03%
2D3d	PM _{2.5}	NA	NA											
2D3e	PM _{2.5}	NA	NA											
2D3f	PM _{2.5}	NA	NA											
2D3g	PM _{2.5}	NA	NA											
2D3h	PM _{2.5}	NA	NA											
2D3i	PM _{2.5}	NA	NA											
2G	PM _{2.5}	0.06	0.05	0.057	0.046	2.00%	20.00%	20.10%	0.05%	0.00%	0.21%	0.00%	0.01%	0.01%
2H1	PM _{2.5}	NO	NO											
2H2	PM _{2.5}	NE	NE											
2H3	PM _{2.5}	NO	NO											
2I	PM _{2.5}	NE	NE											
2J	PM _{2.5}	NO	NO											
2K	PM _{2.5}	NO	NO											
2L	PM _{2.5}	NO	NO											
3B1a	PM _{2.5}	0.08	0.07	0.084	0.068	2.00%	50.00%	50.04%	0.19%	0.00%	0.31%	0.00%	0.01%	0.01%
3B1b	PM _{2.5}	0.02	0.04	0.023	0.036	2.00%	50.00%	50.04%	0.10%	0.08%	0.16%	0.04%	0.00%	0.04%
3B2	PM _{2.5}	0.00	0.00	0.000	0.002	2.00%	50.00%	50.04%	0.00%	0.01%	0.01%	0.00%	0.00%	0.00%
3B3	PM _{2.5}	0.03	0.03	0.030	0.027	2.00%	50.00%	50.04%	0.08%	0.01%	0.12%	0.00%	0.00%	0.01%
3B4a	PM _{2.5}	NA	NA											
3B4d	PM _{2.5}	0.00	0.00	0.000	0.000	2.00%	50.00%	50.04%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
3B4e	PM _{2.5}	0.00	0.00	0.003	0.001	2.00%	50.00%	50.04%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%
3B4f	PM _{2.5}	NA	NA											
3B4gi	PM _{2.5}	0.05	0.06	0.046	0.056	2.00%	50.00%	50.04%	0.16%	0.09%	0.26%	0.04%	0.01%	0.04%
3B4gii	PM _{2.5}	0.01	0.02	0.005	0.016	2.00%	50.00%	50.04%	0.05%	0.05%	0.07%	0.03%	0.00%	0.03%
3B4giii	PM _{2.5}	0.00	0.00	0.001	0.000	2.00%	50.00%	50.04%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
3B4giv	PM _{2.5}	0.00	0.00	0.001	0.000	2.00%	50.00%	50.04%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

NFR category code	Pollutant	2000 Estimate	2014 Estimate	Base year estimate Ex,t	Latest year estimate Ex,t	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
3B4h	PM _{2.5}	0.00	0.00	0.000	0.001	2.00%	50.00%	50.04%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%
3Da1	PM _{2.5}	NA	NA											
3Da2a	PM _{2.5}	NA	NA											
3Da2b	PM _{2.5}	NA	NA											
3Da2c	PM _{2.5}	NA	NA											
3Da3	PM _{2.5}	NA	NA											
3Da4	PM _{2.5}	NA	NA											
3Db	PM _{2.5}	NA	NA											
3Dc	PM _{2.5}	NA	NA											
3Dd	PM _{2.5}	NA	NA											
3De	PM _{2.5}	0.05	0.07	0.053	0.069	2.00%	100.00%	100.02%	0.39%	0.12%	0.31%	0.12%	0.01%	0.12%
3Df	PM _{2.5}	NA	NA											
3F	PM _{2.5}	NO	NO											
3I	PM _{2.5}	0.03	0.10	0.032	0.095	10.00%	61.50%	62.31%	0.33%	0.32%	0.43%	0.20%	0.06%	0.20%
5A	PM _{2.5}	0.00	0.00	0.000	0.000	7%	100%	100.24%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
5B1	PM _{2.5}	NE	NE											
5B2	PM _{2.5}	NO	NO											
5C1a	PM _{2.5}	NO	NO											
5C1bi	PM _{2.5}	NO	NO											
5C1bii	PM _{2.5}	0.00	0.00	0.000	0.000	44.00%	50.00%	66.60%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
5C1biii	PM _{2.5}	NE	NE											
5C1biv	PM _{2.5}	NO	NO											
5C1bv	PM _{2.5}	0.00	0.00	0.000	0.000		50.00%	50.00%	0.00%	0.00%	0.00%	0.00%		0.00%
5C1bvi	PM _{2.5}	NO	NO											
5C2	PM _{2.5}	NE	NE											
5D1	PM _{2.5}	NA	NA											
5D2	PM _{2.5}	NA	NA											
5D3	PM _{2.5}	NA	NA											
5E	PM _{2.5}	NO	NO											
6A	PM _{2.5}	3.38	0.52	3.382	0.516	10%	54.5%	55.41%	1.60%	-10.18%	2.35%	-5.55%	0.33%	5.56%
National total for the entire territory		21.93	17.85	21.93	17.85	3.190	26.400	26.850	78.759%	9.913%	78.605%	2.955%	8.404%	18.396%
						Percentage uncertainty in total inventory			88.75%				Trend uncertainty	42.89%

NFR category code	Pollutant	2000 Estimate	2014 Estimate	Base year estimate Ex,t	Latest year estimate Ex,t	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
1A1a	PM ₁₀	0.67	1.76	0.674	1.763	2.00%	50.00%	50.04%	3.66%	4.35%	6.70%	2.17%	0.19%	2.18%
1A1b	PM ₁₀	NO	NO											
1A1c	PM ₁₀	0.01	0.06	0.009	0.063	2.00%	50.00%	50.04%	0.13%	0.21%	0.24%	0.10%	0.01%	0.10%
1A2a	PM ₁₀	0.03	0.00	0.026	0.000	2.00%	50.00%	50.04%	0.00%	-0.09%	0.00%	-0.05%	0.00%	0.05%
1A2b	PM ₁₀	0.00	0.00	0.000	0.000	2.00%	50.00%	50.04%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1A2c	PM ₁₀	0.01	0.04	0.009	0.042	2.00%	50.00%	50.04%	0.09%	0.13%	0.16%	0.06%	0.00%	0.06%
1A2d	PM ₁₀	0.00	0.00	0.003	0.001	2.00%	50.00%	50.04%	0.00%	-0.01%	0.00%	0.00%	0.00%	0.00%
1A2e	PM ₁₀	0.14	0.08	0.142	0.076	2.00%	50.00%	50.04%	0.16%	-0.21%	0.29%	-0.10%	0.01%	0.10%
1A2f	PM ₁₀	0.04	0.15	0.038	0.153	2.00%	50.00%	50.04%	0.32%	0.45%	0.58%	0.23%	0.02%	0.23%
1A2gvii	PM ₁₀	0.00	0.00	0.001	0.001	20.00%	100.00%	101.98%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1A2gviii	PM ₁₀	0.35	2.13	0.353	2.126	2.00%	50.00%	50.04%	4.41%	6.85%	8.08%	3.43%	0.23%	3.43%
1A3ai(i)	PM ₁₀	NE	0.00		0.002	2.00%	30.00%	30.07%	0.00%	0.01%	0.01%	0.00%	0.00%	0.00%
1A3aii(i)	PM ₁₀	NE	0.00		0.000	2.00%	30.00%	30.07%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1A3bi	PM ₁₀	0.15	0.21	0.153	0.212	2.00%	20.00%	20.10%	0.18%	0.27%	0.81%	0.05%	0.02%	0.06%
1A3bii	PM ₁₀	0.08	0.09	0.077	0.087	2.00%	20.00%	20.10%	0.07%	0.06%	0.33%	0.01%	0.01%	0.02%
1A3biii	PM ₁₀	0.32	0.14	0.317	0.135	2.00%	20.00%	20.10%	0.11%	-0.59%	0.51%	-0.12%	0.01%	0.12%
1A3biv	PM ₁₀	0.00	0.00	0.001	0.001	2.00%	20.00%	20.10%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%
1A3bv	PM ₁₀	NA	NA											
1A3bvi	PM ₁₀	0.17	0.30	0.167	0.304	2.00%	35.00%	35.06%	0.44%	0.57%	1.16%	0.20%	0.03%	0.20%
1A3bvii	PM ₁₀	0.09	0.12	0.089	0.122	2.00%	35.00%	35.06%	0.18%	0.15%	0.46%	0.05%	0.01%	0.06%
1A3c	PM ₁₀	0.09	0.10	0.094	0.101	2.00%	35.00%	35.06%	0.15%	0.06%	0.38%	0.02%	0.01%	0.02%
1A3di(ii)	PM ₁₀	NO	NA											
1A3dii	PM ₁₀	0.00	0.01	0.001	0.007	2.00%	35.00%	35.06%	0.01%	0.02%	0.03%	0.01%	0.00%	0.01%
1A3ei	PM ₁₀	IE	IE											
1A3eii	PM ₁₀	NO	NO											
1A4ai	PM ₁₀	0.94	0.76	0.935	0.757	2.00%	50.00%	50.04%	1.57%	-0.38%	2.88%	-0.19%	0.08%	0.21%
1A4aii	PM ₁₀	0.00	0.00	0.002	0.001	20.00%	100.00%	101.98%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1A4bi	PM ₁₀	15.07	11.12	15.072	11.115	10.00%	100.00%	100.50%	46.30%	-10.25%	42.26%	-10.25%	5.98%	11.87%
1A4bii	PM ₁₀	0.00	0.01	0.003	0.006	20.00%	100.00%	101.98%	0.03%	0.01%	0.02%	0.01%	0.01%	0.01%
1A4ci	PM ₁₀	0.14	0.13	0.145	0.133	2.00%	50.00%	50.04%	0.28%	0.00%	0.50%	0.00%	0.01%	0.01%
1A4cii	PM ₁₀	0.00	0.00	0.001	0.001	20.00%	100.00%	101.98%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1A4ciii	PM ₁₀	0.07	0.01	0.070	0.010	20.00%	100.00%	101.98%	0.04%	-0.21%	0.04%	-0.21%	0.01%	0.21%
1A5a	PM ₁₀	NO	NO											
1A5b	PM ₁₀	NA	0.00		0.004	2.00%	100.00%	100.02%	0.02%	0.01%	0.01%	0.01%	0.00%	0.01%
1B1a	PM ₁₀	0.00	0.00	0.000	0.000	50.00%	100.00%	111.80%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1B1b	PM ₁₀	NO	NO											
1B1c	PM ₁₀	NO	NO											

NFR category code	Pollutant	2000 Estimate	2014 Estimate	Base year estimate Ex,t	Latest year estimate Ex,t	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
2G	PM ₁₀	0.06	0.05	0.057	0.046	2.00%	20.00%	20.10%	0.04%	-0.03%	0.17%	-0.01%	0.00%	0.01%
2H1	PM ₁₀	NO	NO											
2H2	PM ₁₀	NE	NE											
2H3	PM ₁₀	NO	NO											
2I	PM ₁₀	NE	NE											
2J	PM ₁₀	NO	NO											
2K	PM ₁₀	NO	NO											
2L	PM ₁₀	NO	NO											
3B1a	PM ₁₀	0.13	0.10	0.129	0.105	2.00%	50.00%	50.04%	0.22%	-0.05%	0.40%	-0.03%	0.01%	0.03%
3B1b	PM ₁₀	0.03	0.06	0.035	0.055	2.00%	50.00%	50.04%	0.11%	0.09%	0.21%	0.04%	0.01%	0.04%
3B2	PM ₁₀	0.00	0.01	0.002	0.005	2.00%	50.00%	50.04%	0.01%	0.01%	0.02%	0.01%	0.00%	0.01%
3B3	PM ₁₀	0.17	0.15	0.174	0.153	2.00%	50.00%	50.04%	0.32%	-0.02%	0.58%	-0.01%	0.02%	0.02%
3B4a	PM ₁₀	NA	NA											
3B4d	PM ₁₀	0.00	0.00	0.001	0.001	2.00%	50.00%	50.04%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
3B4e	PM ₁₀	0.00	0.00	0.004	0.002	2.00%	50.00%	50.04%	0.00%	-0.01%	0.01%	0.00%	0.00%	0.00%
3B4f	PM ₁₀	NA	NA											
3B4gi	PM ₁₀	0.24	0.29	0.236	0.291	2.00%	50.00%	50.04%	0.60%	0.28%	1.11%	0.14%	0.03%	0.15%
3B4gii	PM ₁₀	0.04	0.12	0.039	0.124	2.00%	50.00%	50.04%	0.26%	0.33%	0.47%	0.17%	0.01%	0.17%
3B4giii	PM ₁₀	0.01	0.00	0.007	0.001	2.00%	50.00%	50.04%	0.00%	-0.02%	0.00%	-0.01%	0.00%	0.01%
3B4giv	PM ₁₀	0.01	0.00	0.011	0.001	2.00%	50.00%	50.04%	0.00%	-0.03%	0.01%	-0.02%	0.00%	0.02%
3B4h	PM ₁₀	0.00	0.00	0.001	0.003	2.00%	50.00%	50.04%	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%
3Da1	PM ₁₀	NA	NA											
3Da2a	PM ₁₀	NA	NA											
3Da2b	PM ₁₀	NA	NA											
3Da2c	PM ₁₀	NA	NA											
3Da3	PM ₁₀	NA	NA											
3Da4	PM ₁₀	NA	NA											
3Db	PM ₁₀	NA	NA											
3Dc	PM ₁₀	NA	NA											
3Dd	PM ₁₀	NA	NA											
3De	PM ₁₀	1.37	1.79	1.375	1.795	2.00%	100.00%	100.02%	7.44%	2.03%	6.82%	2.03%	0.19%	2.04%
3Df	PM ₁₀	NA	NA											
3F	PM ₁₀	NO	NO											
3I	PM ₁₀	0.04	0.12	0.039	0.117	10.00%	61.50%	62.31%	0.30%	0.31%	0.44%	0.19%	0.06%	0.20%
5A	PM ₁₀	0.00	0.00	0.000	0.000	7%	100%	100.24%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
5B1	PM ₁₀	NE	NE											
5B2	PM ₁₀	NO	NO											
5C1a	PM ₁₀	NO	NO											
5C1bi	PM ₁₀	NO	NO											
5C1bii	PM ₁₀	0.00	0.00	0.000	0.000	44.00%	50.00%	66.60%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

NFR category code	Pollutant	2000 Estimate	2014 Estimate	Base year estimate Ex,t	Latest year estimate Ex,t	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
5C1biii	PM ₁₀	NE	NE											
5C1biv	PM ₁₀	NO	NO											
5C1bv	PM ₁₀	0.00	0.00	0.000	0.000		50.00%	50.00%	0.00%	0.00%	0.00%	0.00%		0.00%
5C1bvi	PM ₁₀	NO	NO											
5C2	PM ₁₀	NE	NE											
5D1	PM ₁₀	NA	NA											
5D2	PM ₁₀	NA	NA											
5D3	PM ₁₀	NA	NA											
5E	PM ₁₀	NO	NO											
6A	PM ₁₀	4.13	0.63	4.134	0.631	10%	54.5%	55.41%	1.45%	-12.00%	2.40%	-6.54%	0.34%	6.55%
National total for the entire territory		26.30	24.13	26.30	24.13	3.190	26.400	26.850	77.910%	11.764%	88.898%	3.938%	10.753%	29.475%
						Percentage uncertainty in total inventory			88.27%				Trend uncertainty	54.29%

TSP

NFR category code	Pollutant	2000 Estimate	2014 Estimate	Base year estimate Ex,t	Latest year estimate Ex,t	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
1A1a	NOx	0.80	1.95	0.796	1.954	2.00%	50.00%	50.04%	2.63%	3.20%	5.89%	1.60%	0.17%	1.61%
1A1b	NOx	NO	NO											
1A1c	NOx	0.02	0.07	0.015	0.070	2.00%	50.00%	50.04%	0.09%	0.16%	0.21%	0.08%	0.01%	0.08%
1A2a	NOx	0.03	0.00	0.026	0.000	2.00%	50.00%	50.04%	0.00%	-0.09%	0.00%	-0.04%	0.00%	0.04%
1A2b	NOx	0.00	0.00	0.000	0.000	2.00%	50.00%	50.04%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1A2c	NOx	0.01	0.04	0.010	0.044	2.00%	50.00%	50.04%	0.06%	0.10%	0.13%	0.05%	0.00%	0.05%
1A2d	NOx	0.00	0.00	0.004	0.001	2.00%	50.00%	50.04%	0.00%	-0.01%	0.00%	-0.01%	0.00%	0.01%
1A2e	NOx	0.15	0.08	0.146	0.079	2.00%	50.00%	50.04%	0.11%	-0.26%	0.24%	-0.13%	0.01%	0.13%
1A2f	NOx	0.04	0.16	0.038	0.162	2.00%	50.00%	50.04%	0.22%	0.36%	0.49%	0.18%	0.01%	0.18%
1A2gvii	NOx	0.00	0.00	0.001	0.001	20.00%	100.00%	101.98%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1A2gviii	NOx	0.37	2.23	0.369	2.229	2.00%	50.00%	50.04%	3.00%	5.47%	6.72%	2.74%	0.19%	2.74%
1A3ai(i)	NOx	NE	0.00		0.002	2.00%	30.00%	30.07%	0.00%	0.01%	0.01%	0.00%	0.00%	0.00%
1A3aii(i)	TSP	NE	0.00		0.000	2.00%	30.00%	30.07%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1A3bi	TSP	0.15	0.21	0.153	0.212	2.00%	20.00%	20.10%	0.11%	0.12%	0.64%	0.02%	0.02%	0.03%

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3B4d	TSP	0.00	0.00	0.001	0.002	2.00%	50.00%	50.04%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%
3B4e	TSP	0.01	0.00	0.010	0.005	2.00%	50.00%	50.04%	0.01%	-0.02%	0.01%	-0.01%	0.00%	0.01%
3B4f	TSP	NA	NA											
3B4gi	TSP	0.24	0.29	0.236	0.291	2.00%	50.00%	50.04%	0.39%	0.08%	0.88%	0.04%	0.02%	0.05%
3B4gii	TSP	0.04	0.12	0.039	0.124	2.00%	50.00%	50.04%	0.17%	0.24%	0.37%	0.12%	0.01%	0.12%
3B4giii	TSP	0.01	0.00	0.007	0.001	2.00%	50.00%	50.04%	0.00%	-0.02%	0.00%	-0.01%	0.00%	0.01%
3B4giv	TSP	0.01	0.00	0.011	0.001	2.00%	50.00%	50.04%	0.00%	-0.03%	0.00%	-0.02%	0.00%	0.02%
3B4h	TSP	0.00	0.01	0.002	0.006	2.00%	50.00%	50.04%	0.01%	0.01%	0.02%	0.01%	0.00%	0.01%
3Da1	TSP	NA	NE											
3Da2a	TSP	NA	NA											
3Da2b	TSP	NA	NA											
3Da2c	TSP	NA	NA											
3Da3	TSP	NA	NA											
3Da4	TSP	NA	NA											
3Db	TSP	NA	NA											
3Dc	TSP	NA	NA											
3Dd	TSP	NA	NA											
3De	TSP	NA	NA											
3Df	TSP	NA	NA											
3F	TSP	NO	NO											
3I	TSP	0.06	0.18	0.060	0.180	10.00%	61.50%	62.31%	0.30%	0.34%	0.54%	0.21%	0.08%	0.22%
5A	TSP	0.00	0.00	0.000	0.000	7%	100%	100.24%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
5B1	TSP	NE	NE											
5B2	TSP	NO	NO											
5C1a	TSP	NO	NO											
5C1bi	TSP	NO	NO											
5C1bii	TSP	0.00	0.00	0.000	0.000	44.00%	50.00%	66.60%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
5C1biii	TSP	0.00	0.00	0.001	0.000					0.00%	0.00%			
5C1biv	TSP	NO	NO											
5C1bv	TSP	0.00	0.00	0.000	0.000		50.00%	50.00%	0.00%	0.00%	0.00%	0.00%		0.00%
5C1bvi	TSP	NO	NO											
5C2	TSP	NE	NE											
5D1	TSP	NA	NA											
5D2	TSP	NA	NA											
5D3	TSP	NA	NA											
5E	TSP	NO	NO											
6A	TSP	6.39	0.97	6.389	0.975	10%	54.5%	55.41%	1.45%	-18.63%	2.94%	-10.15%	0.42%	10.16%

NFR category code	Pollutant	2000 Estimate	2014 Estimate	Base year estimate Ex,t	Latest year estimate Ex,t	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
National total for the entire territory		33.16	37.17	33.16	37.17	3.170	25.400	25.850	73.729%	18.359%	108.623%	6.877%	19.717%	51.960%
				Percentage uncertainty in total inventory					85.87%	Trend uncertainty			72.08%	

BC

[illegible]

NFR category code	Pollutant	2000 Estimate	2014 Estimate	Base year estimate Ex,t	Latest year estimate Ex,t	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
3Da2b	BC	NA	NA											
3Da2c	BC	NA	NA											
3Da3	BC	NA	NA											
3Da4	BC	NA	NA											
3Db	BC	NA	NA											
3Dc	BC	NA	NA											
3Dd	BC	NA	NA											
3De	BC	NA	NA											
3Df	BC	NA	NA											
3F	BC	NO	NO											
3I	BC	NA	NA											
5A	BC	NA	NA											
5B1	BC	NE	NE											
5B2	BC	NO	NO											
5C1a	BC	NO	NO											
5C1bi	BC	NO	NO											
5C1bii	BC	0.00	0.00	0.000	0.000	44.00%	50.00%	66.60%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
5C1biii	BC	0.00	0.00	0.000	0.000	44.00%	50.00%	66.60%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
5C1biv	BC	NO	NO											
5C1bv	BC	NE	NE											
5C1bvi	BC	NO	NO											
5C2	BC	NE	NE											
5D1	BC	NA	NA											
5D2	BC	NA	NA											
5D3	BC	NA	NA											
5E	BC	NO	NO											
6A	BC	NA	NA			10%	54.5%	55.41%						
National total for the entire territory		2.90	2.89	2.90	2.89	2.310	18.150	18.452	73.111%	0.113%	99.601%	-8.585%	8.988%	31.228%
Percentage uncertainty in total inventory									85.51%				Trend uncertainty	55.88%

NFR category code	Pollutant	1990 Estimate	2014 Estimate	Base year estimate Ex,t	Latest year estimate Ex,t	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
1A1a	CO	2.57	2.21	2.567	2.213	2.00%	50.00%	50.04%	0.81%	0.34%	0.57%	0.17%	0.02%	0.17%
1A1b	CO	NO	NO											
1A1c	CO	0.04	0.07	0.044	0.072	2.00%	50.00%	50.04%	0.03%	0.01%	0.02%	0.01%	0.00%	0.01%
1A2a	CO	0.26	0.00	0.260	0.000	2.00%	50.00%	50.04%	0.00%	-0.02%	0.00%	-0.01%	0.00%	0.01%
1A2b	CO	NO	0.00		0.002	2.00%	50.00%	50.04%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1A2c	CO	0.25	0.19	0.253	0.186	2.00%	50.00%	50.04%	0.07%	0.03%	0.05%	0.01%	0.00%	0.01%
1A2d	CO	0.12	0.00	0.119	0.005	2.00%	50.00%	50.04%	0.00%	-0.01%	0.00%	0.00%	0.00%	0.00%
1A2e	CO	1.91	0.36	1.912	0.360	2.00%	50.00%	50.04%	0.13%	-0.08%	0.09%	-0.04%	0.00%	0.04%
1A2f	CO	0.57	1.23	0.565	1.233	2.00%	50.00%	50.04%	0.45%	0.27%	0.32%	0.13%	0.01%	0.13%
1A2gvii	CO	14.66	0.72	14.659	0.717	20.00%	100.00%	101.98%	0.54%	-1.15%	0.18%	-1.15%	0.05%	1.15%
1A2gviii	CO	1.39	8.54	1.392	8.536	2.00%	50.00%	50.04%	3.13%	2.07%	2.20%	1.04%	0.06%	1.04%
1A3ai(i)	CO	0.26	0.37	0.263	0.365	2.00%	30.00%	30.07%	0.08%	0.07%	0.09%	0.02%	0.00%	0.02%
1A3aii(i)	CO	0.00	0.01	0.000	0.009	2.00%	30.00%	30.07%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1A3bi	CO	160.26	11.29	160.259	11.287	2.00%	20.00%	20.10%	1.66%	-11.58%	2.91%	-2.32%	0.08%	2.32%
1A3bii	CO	18.01	0.94	18.010	0.940	2.00%	20.00%	20.10%	0.14%	-1.39%	0.24%	-0.28%	0.01%	0.28%
1A3biii	CO	9.85	2.06	9.850	2.059	2.00%	20.00%	20.10%	0.30%	-0.36%	0.53%	-0.07%	0.02%	0.07%
1A3biv	CO	0.43	0.21	0.433	0.210	2.00%	20.00%	20.10%	0.03%	0.01%	0.05%	0.00%	0.00%	0.00%
1A3bv	CO	NA	NA											
1A3bvi	CO	NA	NA											
1A3bvii	CO	NA	NA											
1A3c	CO	1.81	0.75	1.808	0.748	2.00%	35.00%	35.06%	0.19%	0.03%	0.19%	0.01%	0.01%	0.01%
1A3di(ii)	CO	NO	NA											
1A3dii	CO	0.03	0.09	0.035	0.095	2.00%	35.00%	35.06%	0.02%	0.02%	0.02%	0.01%	0.00%	0.01%
1A3ei	CO	IE	IE											
1A3eii	CO	NO	NO											
1A4ai	CO	18.51	3.31	18.512	3.315	2.00%	50.00%	50.04%	1.22%	-0.82%	0.85%	-0.41%	0.02%	0.41%
1A4aii	CO	0.73	0.73	0.733	0.733	20.00%	100.00%	101.98%	0.55%	0.12%	0.19%	0.12%	0.05%	0.13%
1A4bi	CO	112.89	87.63	112.889	87.635	10.00%	100.00%	100.50%	64.54%	12.32%	22.60%	12.32%	3.20%	12.73%
1A4bii	CO	NO	4.40		4.401	20.00%	100.00%	101.98%	3.29%	1.13%	1.13%	1.13%	0.32%	1.18%
1A4ci	CO	2.54	0.53	2.542	0.528	2.00%	50.00%	50.04%	0.19%	-0.09%	0.14%	-0.05%	0.00%	0.05%
1A4cii	CO	27.12	0.76	27.120	0.762	20.00%	100.00%	101.98%	0.57%	-2.26%	0.20%	-2.26%	0.06%	2.26%
1A4ciii	CO	0.31	0.05	0.311	0.052	20.00%	100.00%	101.98%	0.04%	-0.01%	0.01%	-0.01%	0.00%	0.02%
1A5a	CO	NO	NO											
1A5b	CO	NO	0.65		0.650	2.00%	100.00%	100.02%	0.48%	0.17%	0.17%	0.17%	0.00%	0.17%
1B1a	CO	NA	NE											
1B1b	CO	NO	NO											
1B1c	CO	NO	NO											

	Percentage uncertainty in total inventory	88.68%		Trend uncertainty	47.24%
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[illegible][illegible]

Cd[illegible]

NFR category code	Pollutant	1990 Estimate	2014 Estimate	Base year estimate Ex,t	Latest year estimate Ex,t	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
3Da2b	Cd	NA	NA											
3Da2c	Cd	NA	NA											
3Da3	Cd	NA	NA											
3Da4	Cd	NA	NA											
3Db	Cd	NA	NA											
3Dc	Cd	NA	NA											
3Dd	Cd	NA	NA											
3De	Cd	NA	NA											
3Df	Cd	NA	NA											
3F	Cd	NO	NO											
3I	Cd	NA	NA											
5A	Cd	NA	NA											
5B1	Cd	NE	NA											
5B2	Cd	NO	NO											
5C1a	Cd	NO	NO											
5C1bi	Cd	NO	NO											
5C1bii	Cd	0.00	0.00	0.000	0.000	44.00%	50.00%	66.60%	0.00%	-0.01%	0.00%	0.00%	0.00%	0.00%
5C1biii	Cd	0.00	0.00	0.001	0.000	44.00%	50.00%	66.60%	0.01%	-0.22%	0.02%	-0.11%	0.01%	0.11%
5C1biv	Cd	NO	NO											
5C1bv	Cd	NO	0.00		0.000		50.00%	50.00%	0.00%	0.00%	0.00%	0.00%		0.00%
5C1bvi	Cd	NO	NO											
5C2	Cd	NE	NE											
5D1	Cd	NA	NA											
5D2	Cd	NA	NA											
5D3	Cd	NA	NA											
5E	Cd	NO	NO											
6A	Cd	NA	NA											
National total for the entire territory		0.49	0.62	0.49	0.62	1.750	14.800	15.058	64.836%	0.313%	126.770%	19.112%	10.723%	62.463%
						Percentage uncertainty in total inventory			80.52%			Trend uncertainty		79.03%

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	Percentage uncertainty in total inventory	73.64%			Trend uncertainty	38.31%
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[illegible]

NFR category code	Pollutant	1990 Estimate	2014 Estimate	Base year estimate Ex,t	Latest year estimate Ex,t	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
3B4giii	PCDD/F	NA	NA											
3B4giv	PCDD/F	NA	NA											
3B4h	PCDD/F	NA	NA											
3Da1	PCDD/F	NA	NA											
3Da2a	PCDD/F	NA	NA											
3Da2b	PCDD/F	NA	NA											
3Da2c	PCDD/F	NA	NA											
3Da3	PCDD/F	NA	NA											
3Da4	PCDD/F	NA	NA											
3Db	PCDD/F	NA	NA											
3Dc	PCDD/F	NA	NA											
3Dd	PCDD/F	NA	NA											
3De	PCDD/F	NA	NA											
3Df	PCDD/F	NA	NA											
3F	PCDD/F	NO	NO											
3I	PCDD/F	0.00	0.05	0.004	0.053	10.00%	90.00%	90.55%	0.21%	0.20%	0.21%	0.18%	0.03%	0.18%
5A	PCDD/F	NA	NA											
5B1	PCDD/F	NE	NA											
5B2	PCDD/F	NO	NO											
5C1a	PCDD/F	NO	NO											
5C1bi	PCDD/F	NO	NO											
5C1bii	PCDD/F	0.15	0.06	0.150	0.058	44.00%	50.00%	66.60%	0.17%	-0.33%	0.23%	-0.16%	0.15%	0.22%
5C1biii	PCDD/F	4.67	0.41	4.669	0.414	44.00%	50.00%	66.60%	1.18%	-15.79%	1.66%	-7.90%	1.03%	7.96%
5C1biv	PCDD/F	NO	NO											
5C1bv	PCDD/F	NO	0.00		0.000		50.00%	50.00%	0.00%	0.00%	0.00%	0.00%		0.00%
5C1bvi	PCDD/F	NO	NO											
5C2	PCDD/F	NE	NE											
5D1	PCDD/F	NA	NA											
5D2	PCDD/F	NA	NA											
5D3	PCDD/F	NA	NA											
5E	PCDD/F	NO	NO											
6A	PCDD/F	0.83	0.29	0.826	0.287	10%	90%	90.55%	1.11%	-1.94%	1.15%	-1.75%	0.16%	1.76%
National total for the entire territory		24.95	23.31	24.95	23.31	1.030	9.400	9.614	51.804%	17.955%	90.173%	11.778%	7.921%	36.310%
Percentage uncertainty in total inventory									71.97%			Trend uncertainty		60.26%

[illegible]

NFR category code	Pollutant	1990 Estimate	2014 Estimate	Base year estimate Ex,t	Latest year estimate Ex,t	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
2G	PAHs	0.00	0.00	0.001	0.000	2.00%		2.00%	0.00%	0.00%	0.00%		0.00%	0.00%
2H1	PAHs	NE	NE											
2H2	PAHs	NA	NA											
2H3	PAHs	NO	NO											
2I	PAHs	NA	NA											
2J	PAHs	NA	NA											
2K	PAHs	NO	NO											
2L	PAHs	NO	NO											
3B1a	PAHs	NA	NA											
3B1b	PAHs	NA	NA											
3B2	PAHs	NA	NA											
3B3	PAHs	NA	NA											
3B4a	PAHs	NA	NA											
3B4d	PAHs	NA	NA											
3B4e	PAHs	NA	NA											
3B4f	PAHs	NA	NA											
3B4gi	PAHs	NA	NA											
3B4gii	PAHs	NA	NA											
3B4giii	PAHs	NA	NA											
3B4giv	PAHs	NA	NA											
3B4h	PAHs	NA	NA											
3Da1	PAHs	NA	NA											
3Da2a	PAHs	NA	NA											
3Da2b	PAHs	NA	NA											
3Da2c	PAHs	NA	NA											
3Da3	PAHs	NA	NA											
3Da4	PAHs	NA	NA											
3Db	PAHs	NA	NA											
3Dc	PAHs	NA	NA											
3Dd	PAHs	NA	NA											
3De	PAHs	NA	NA											
3Df	PAHs	NA	NA											
3F	PAHs	NO	NO											
3I	PAHs	0.01	0.18	0.014	0.175	10.00%	90.00%	90.55%	1.56%	0.96%	1.00%	0.86%	0.14%	0.87%
5A	PAHs	NA	NA											
5B1	PAHs	NE	NA											
5B2	PAHs	NO	NO											
5C1a	PAHs	NO	NO											
5C1bi	PAHs	NO	NO											
5C1bii	PAHs	0.00	0.00	0.000	0.000	44.00%	50.00%	66.60%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

NFR category code	Pollutant	1990 Estimate	2014 Estimate	Base year estimate Ex,t	Latest year estimate Ex,t	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
5C1biii	PAHs	0.00	0.00	0.000	0.000	44.00%	50.00%	66.60%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
5C1biv	PAHs	NO	NO											
5C1bv	PAHs	NO	0.00		0.000		50.00%	50.00%	0.00%	0.00%	0.00%	0.00%		0.00%
5C1bvi	PAHs	NO	NO											
5C2	PAHs	NE	NE											
5D1	PAHs	NA	NA											
5D2	PAHs	NA	NA											
5D3	PAHs	NA	NA											
5E	PAHs	NO	NO											
6A	PAHs	2.74	0.95	2.740	0.950	10%	90%	90.55%	8.46%	-3.68%	5.43%	-3.31%	0.77%	3.40%
National total for the entire territory		17.48	10.17	17.48	10.17	1.450	11.100	11.354	47.589%	2.708%	51.726%	2.695%	6.348%	15.078%
					Percentage uncertainty in total inventory				68.98%			Trend uncertainty		38.83%

HCB

[illegible]

NFR category code	Pollutant	1990 Estimate	2014 Estimate	Base year estimate Ex,t	Latest year estimate Ex,t	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
3Da1	HCB	NA	NA											
3Da2a	HCB	NA	NA											
3Da2b	HCB	NA	NA											
3Da2c	HCB	NA	NA											
3Da3	HCB	NA	NA											
3Da4	HCB	NA	NA											
3Db	HCB	NA	NA											
3Dc	HCB	NA	NA											
3Dd	HCB	NA	NA											
3De	HCB	NA	NA											
3Df	HCB	NA	NA											
3F	HCB	NO	NO											
3I	HCB	NA	NA											
5A	HCB	NA	NA											
5B1	HCB	NE	NA											
5B2	HCB	NO	NO											
5C1a	HCB	NO	NO											
5C1bi	HCB	NO	NO											
5C1bii	HCB	0.00	0.00	0.001	0.000	44.00%	50.00%	66.60%	0.07%	-0.56%	0.17%	-0.28%	0.10%	0.30%
5C1biii	HCB	0.01	0.00	0.012	0.001	44.00%	50.00%	66.60%	0.21%	-9.31%	0.52%	-4.66%	0.32%	4.67%
5C1biv	HCB	NO	NO											
5C1bv	HCB	NO	0.00		0.000		50.00%	50.00%	0.05%	0.17%	0.17%	0.08%		0.08%
5C1bvi	HCB	NO	NO											
5C2	HCB	NE	NE											
5D1	HCB	NA	NA											
5D2	HCB	NA	NA											
5D3	HCB	NA	NA											
5E	HCB	NO	NO											
6A	HCB	NA	NA											
National total for the entire territory		0.20	0.33	0.20	0.33	0.740	8.000	8.254	61.187%	9.874%	166.898%	20.899%	11.567%	84.077%
Percentage uncertainty in total inventory									78.22%			Trend uncertainty		91.69%

[illegible]

NFR category code	Pollutant	1990 Estimate	2014 Estimate	Base year estimate Ex,t	Latest year estimate Ex,t	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
5C1biii	PCB	NA	NA											
5C1biv	PCB	NO	NO											
5C1bv	PCB	NO	0.00		0.001		50.00%	50.00%	0.10%	0.02%	0.02%	0.01%		0.01%
5C1bvi	PCB	NO	NO											
5C2	PCB	NE	NE											
5D1	PCB	NA	NA											
5D2	PCB	NA	NA											
5D3	PCB	NA	NA											
5E	PCB	NO	NO											
6A	PCB	NA	NA											
National total for the entire territory		4.27	0.44	4.27	0.44	0.750	7.700	7.853	51.642%	0.010%	10.306%	0.094%	0.535%	6.330%
Percentage uncertainty in total inventory									71.86%			Trend uncertainty		25.16%

Annex IV: List of NFR codes

NFR Code	Longname
1A1a	Public electricity and heat production
1A1b	Petroleum refining
1A1c	Manufacture of solid fuels and other energy industries
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel
1A2b	Stationary combustion in manufacturing industries and construction: Non-ferrous metals
1A2c	Stationary combustion in manufacturing industries and construction: Chemicals
1A2d	Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print
1A2e	Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals
1A2gvii	Mobile Combustion in manufacturing industries and construction: (please specify in the IIR)
1A2gviii	Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR)
1A3ai(i)	International aviation LTO (civil)
1A3aai(i)	Domestic aviation LTO (civil)
1A3bi	Road transport: Passenger cars
1A3bii	Road transport: Light duty vehicles
1A3biii	Road transport: Heavy duty vehicles and buses
1A3biv	Road transport: Mopeds & motorcycles
1A3bv	Road transport: Gasoline evaporation
1A3bvi	Road transport: Automobile tyre and brake wear
1A3bvii	Road transport: Automobile road abrasion
1A3c	Railways
1A3di(ii)	International inland waterways
1A3dii	National navigation (shipping)
1A3ei	Pipeline transport
1A3eii	Other (please specify in the IIR)
1A4ai	Commercial/institutional: Stationary
1A4aai	Commercial/institutional: Mobile
1A4bi	Residential: Stationary
1A4bii	Residential: Household and gardening (mobile)
1A4ci	Agriculture/Forestry/Fishing: Stationary
1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery
1A4ciii	Agriculture/Forestry/Fishing: National fishing
1A5a	Other stationary (including military)
1A5b	Other, Mobile (including military, land based and recreational boats)
1B1a	Fugitive emission from solid fuels: Coal mining and handling
1B1b	Fugitive emission from solid fuels: Solid fuel transformation
1B1c	Other fugitive emissions from solid fuels
1B2ai	Fugitive emissions oil: Exploration, production, transport
1B2aiv	Fugitive emissions oil: Refining / storage
1B2av	Distribution of oil products
1B2b	Fugitive emissions from natural gas (exploration, production, processing, transmission, storage, distribution and other)
1B2c	Venting and flaring (oil, gas, combined oil and gas)
1B2d	Other fugitive emissions from energy production
2A1	Cement production
2A2	Lime production
2A3	Glass production
2A5a	Quarrying and mining of minerals other than coal

NFR Code	Longname
2A5b	Construction and demolition
2A5c	Storage, handling and transport of mineral products
2A6	Other mineral products (please specify in the IIR)
2B1	Ammonia production
2B2	Nitric acid production
2B3	Adipic acid production
2B5	Carbide production
2B6	Titanium dioxide production
2B7	Soda ash production
2B10a	Chemical industry: Other (please specify in the IIR)
2B10b	Storage, handling and transport of chemical products (please specify in the IIR)
2C1	Iron and steel production
2C2	Ferroalloys production
2C3	Aluminium production
2C4	Magnesium production
2C5	Lead production
2C6	Zinc production
2C7a	Copper production
2C7b	Nickel production
2C7c	Other metal production (please specify in the IIR)
2C7d	Storage, handling and transport of metal products (please specify in the IIR)
2D3a	Domestic solvent use including fungicides
2D3b	Road paving with asphalt
2D3c	Asphalt roofing
2D3d	Coating applications
2D3e	Degreasing
2D3f	Dry cleaning
2D3g	Chemical products
2D3h	Printing
2D3i	Other solvent use (please specify in the IIR)
2G	Other product use (please specify in the IIR)
2H1	Pulp and paper industry
2H2	Food and beverages industry
2H3	Other industrial processes (please specify in the IIR)
2I	Wood processing
2J	Production of POPs
2K	Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)
2L	Other production, consumption, storage, transportation or handling of bulk products (please specify in the IIR)
3B1a	Manure management - Dairy cattle
3B1b	Manure management - Non-dairy cattle
3B2	Manure management - Sheep
3B3	Manure management - Swine
3B4a	Manure management - Buffalo
3B4d	Manure management - Goats
3B4e	Manure management - Horses
3B4f	Manure management - Mules and asses
3B4gi	Manure management - Laying hens
3B4gii	Manure management - Broilers
3B4giii	Manure management - Turkeys

NFR Code	Longname
3B4giv	Manure management - Other poultry
3B4h	Manure management - Other animals (please specify in IIR)
3Da1	Inorganic N-fertilizers (includes also urea application)
3Da2a	Animal manure applied to soils
3Da2b	Sewage sludge applied to soils
3Da2c	Other organic fertilisers applied to soils (including compost)
3Da3	Urine and dung deposited by grazing animals
3Da4	Crop residues applied to soils
3Db	Indirect emissions from managed soils
3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products
3Dd	Off-farm storage, handling and transport of bulk agricultural products
3De	Cultivated crops
3Df	Use of pesticides
3F	Field burning of agricultural residues
3I	Agriculture other (please specify in the IIR)
5A	Biological treatment of waste - Solid waste disposal on land
5B1	Biological treatment of waste - Composting
5B2	Biological treatment of waste - Anaerobic digestion at biogas facilities
5C1a	Municipal waste incineration
5C1bi	Industrial waste incineration
5C1bii	Hazardous waste incineration
5C1biii	Clinical waste incineration
5C1biv	Sewage sludge incineration
5C1bv	Cremation
5C1bvi	Other waste incineration (please specify in the IIR)
5C2	Open burning of waste
5D1	Domestic wastewater handling
5D2	Industrial wastewater handling
5D3	Other wastewater handling
5E	Other waste (please specify in IIR)
6A	Other (included in national total for entire territory) (please specify in IIR)
Memo items (not to be included in national totals)	
1A3ai(ii)	International aviation cruise (civil)
1A3aii(ii)	Domestic aviation cruise (civil)
1A3di(i)	International maritime navigation
1A5c	Multilateral operations
1A3	Transport (fuel used)
6B	Other not included in national total of the entire territory (please specify in the IIR)
11A	Volcanoes
11B	Forest fires
11C	Other natural emissions (please specify in the IIR)