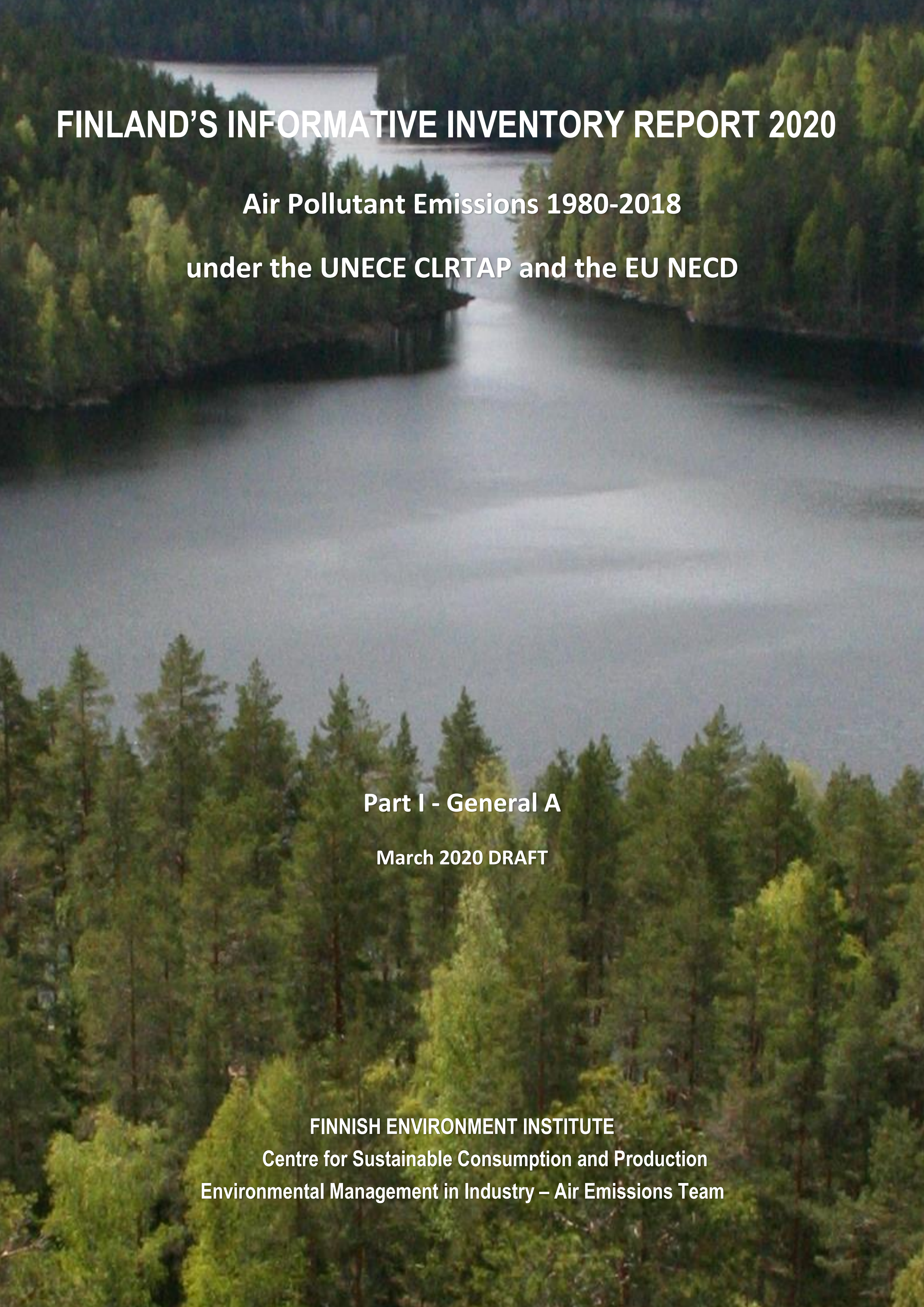

FINLAND'S INFORMATIVE INVENTORY REPORT 2020

Air Pollutant Emissions 1980-2018

under the UNECE CLRTAP and the EU NECD

Part I - General A

March 2020 DRAFT

FINNISH ENVIRONMENT INSTITUTE
Centre for Sustainable Consumption and Production
Environmental Management in Industry – Air Emissions Team

PART 1

GENERAL A

Cover page Part 1: Esa Nikunen (2016) Repovesi, Ympäristöhallinnon kuvapankki

PREFACE

Finland's Informative Inventory Report (IIR) 2020 under the United Nations Economic Commission for Europe's (UNECE) Convention on Long-Range Transboundary Air Pollution (CLRTAP) and under the EU National Emission Ceilings Directive (NECD) contains information on the organisation of the national air pollutant emissions inventory, on emission sources, trends, methods and data analysis for the emissions time series 1980-2018.

The IIR is prepared according to the Guidelines for Reporting Emission Data under the Convention on Long-Range Transboundary Air Pollution (ECE/EB.AIR/97, 27 January 2010) and its structure follows the template of the Informative Inventory Report. The report is reviewed and completed annually to include updated information.

The IIR consists of the following general parts

Part 1A General	General information, data analysis, emission trends, progress in meeting targets. Time series of emissions are summarised in Tables 1.1-1.3.
Part 1B General	Recalculations, projections, inventory improvement, gridded data, LPS, adjustments, memo items
Part 7 Annexes	

Methods used to estimate emissions are presented in Parts 2-6 of the IIR
Part 2 Energy
Part 3 Transport
Part 4 Industrial processes and product use
Part 5 Agriculture
Part 6 Waste
Part 7 Annexes

The Finnish submissions of NFR tables and IIR can be downloaded from the EIONET CDR website and from Finnish Environmental Administration's website http://www.environment.fi > State of the environment > Air > Air pollutant emissions in Finland (in English). The website is updated annually by 31st March with the latest data and reports.

The submissions to the UNECE CLRTAP and the EU NECD are prepared at the Finnish Environment Institute SYKE by the Air Emission Team: Mr Tommi Forsberg, Mr Juha Grönroos, Ms Johanna Mikkola-Pusa, Mr Joonas Munther, Mr Jouko Petäjä and Ms Kristina Saarinen. Transport sector emissions are calculated by Mr Kari Mäkelä (Tremmo) and Mr Kari Grönfors (Statistics Finland) in cooperation with VTT Technical Research Centre of Finland.

Contact information for the inventory: Kristina Saarinen, email kristina.saarinen@environment.fi, telephone +358 400 148715, address Finnish Environment Institute, P.O.Box 140, FIN-00251 Helsinki, Finland

Helsinki 13th March 2020

Requested information on
- inclusion of the condensable part of P M emissions is summarized on the next page, page 4
- NECD preliminary review results at the bottom of page 14 (Explanations for Notation Keys)

A summary of information on the condensable part of particulate matter

The summary presented in the table below on whether the condensable part of particulate matter is included or not in the emissions estimates, covers only those cases where (1) emission data reported by the plants are used in the inventory, or (2) domestic emission factors used in the calculation.

Information on whether the emission factors from the EMEP/EEA Emission Inventory Guidebook include or exclude the condensable part has not thoroughly been studied.

Energy		
NFRs 1A1/1A2	Combustion in the energy production units - TSP emission concentrations are measured in the stack according to the agreed the EN standards (EN 13284-1), which is a gravimetric particle measurement and thus does not cover condensable particles. In cases where PM10 and PM2.5 are calculated from reported TSP emissions or using domestic TSP EFs, the condensable part of PMs is not included.	Part 2 Energy p. 33
NFR 1A4	For small scale wood combustion, country specific emission factors are based on measurements where the condensable part is included. For coal combustion, Guidebook EFs are used and we refer to the knowledge of the Guidebook regarding inclusion or exclusion of condensables.	Part 2 Energy
Transport		
NFR 1A3	For all transport modes Guidebook EFs are used - According to general information, the transport sector standard measurements include dilution of the sample and cooling it to 51 °C temperature, which enables the measurement to capture most of the condensable part of particulate matter	Part 3 Transport
Industry and product use		
NFR 2	Industrial processes - TSP emission concentrations are measured in the stack according to the agreed the EN standards (EN 13284-1), which is a gravimetric particle measurement and thus does not cover condensable particles. When Guidebook 2016 EFs for particles are used, we refer to the Guidebook in the knowledge of inclusion or exclusion of condensables.	Part 4 IPPU p. 5
Agriculture		
NFR 3F	Field burning - When Guidebook EFs for particles are used, we refer to the Guidebook in the knowledge of inclusion or exclusion of condensables.	Part 5 Agriculture
Waste		
NFR 5C	Waste incineration - TSP emission concentrations are measured in the stack according to the agreed the EN standards (EN 13284-1), which is a gravimetric particle measurement and thus does not cover condensable particles. When Guidebook 2016 EFs for particles are used, we refer to the Guidebook in the knowledge of inclusion or exclusion of condensables.	Part 6 Waste

CONTENTS

PART 1 GENERAL A (Part 1 General B is at the end of the IIR)

PART 3 - TRANSPORT

PART 4 - IPPU

PART 5 AGRICULTURE

AGRICULTURE (NFR 3)

The documentation of the Agricultural Emissions Calculation Model is saved in the 2018 CDR folder "Revised IIR 2018 – Annexes Part 5"

PART 6 WASTE AND OTHER SOURCES

PART 7 ANNEXES

ABBREVIATIONS

CEPMEIP	Co-ordinated European Programme on Particulate Matter Emission Inventories, Projections and Guidance
CLRTAP	Convention on Long Range Transboundary Air Pollution
CRF	Common Reporting Format tables, reported to the UNFCCC Secretariat
GNFR	Gridding NFR (emissions gridded for each GNRF aggregated sector)
GPG	IPCC Good Practice Guidance
EEA	European Environment Agency
EMEP	Cooperative programme for the monitoring and evaluation of the long range transmission of air pollutants in Europe (European Monitoring and Evaluation Programme)
E-PRTR	European Pollutant and Transfer Register
EU	European Union
EUMM	Decision No 280/2004/EC of the European Parliament and of the Council of 11 February 2004 concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol, OJ L 49, 19.02.2004
ILMI	Calculation model for emissions from aviation at VTT Technical Research Centre of Finland
IPCC	Intergovernmental Panel on Climate Change
IPPC	Integrated Pollution Prevention and Control
IPTJ	Air pollutant emission data system at the Finnish Environment Institute SYKE
LCP	Large combustion plant
LIISA	Calculation model for the road transport sector emissions at VTT Technical Research Centre of Finland
LIPASTO	Calculation system for the transport sector emissions at VTT Technical Research Centre of Finland
LPS	Large point sources, equals to the definition of E-PRTR installations
LUKE	Natural Resources Institute Finland (Luonnonvarakeskus)
MEERI	Calculation model for emissions from navigation at VTT Technical Research Centre of Finland
MTT	MTT Agrifood Research Finland
NECD	Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants, OJ L 309, 27 November 2001
NFR	Nomenclature for Reporting
SYKE	Finnish Environment Institute
SNAP	Selected Nomenclature for Air Pollution
TIKE	Information Center of the Ministry of Agriculture and Forestry
TYKO	Calculation model for emissions from off-road machinery at VTT Technical Research Centre of Finland
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environmental Programme
UNFCCC	United Nations Framework Convention for Climate Change
USEPA	United States Environmental Protection Agency
VAHTI	Compliance Monitoring Data System at the Centres for Economic Development, Transport and the Environment
VTT	VTT Technical Research Centre of Finland

Pollutants

As	Arsenic
BC	Black carbon
Cd	Cadmium
Cr	Chromium
Cu	Copper
CO	Carbon monoxide
HCB	Hexachlorobenzene
HCl	Hydrochloric acid
Hg	Mercury
HM	Heavy metals
SO_2	Sulphur dioxide, all sulphur compounds expressed as sulphur dioxide
NH_3	Ammonia
Ni	Nickel
NMVOC	Non-methane volatile organic compounds, any organic compound, excluding methane, having a vapour pressure of 0.01 kPa or more at 293.15 K, or having a corresponding volatility under the particular conditions of use. For the purpose of the UNECE CLRTAP Reporting Guidelines, the fraction of creosote which exceeds this value of vapour pressure at 293.15 K is considered as a NMVOC
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides, nitric oxide and nitrogen dioxide, expressed as nitrogen dioxide
PAH-4	Polyaromatic hydrocarbons expressed as the sum of benzo(a)pyrene, benzo(b)fluoranthene,benzo(k), fluoranthene and indeno(1,2,3,-cd)pyrene
Pb	Lead
PCDD/F	Dioxins and furans: 1,2,3,7,8-PeCDD; 2,3,4,7,8-PeCDF; 1,2,3,4,7,8-HxCDF;1,2,3,6,7,8-HxCDF
PCB	Polychlorinated biphenyls
PCP	Pentachlorophenol
$PM_{2.5}$	Particulate matter, the mass of particulate matter that is measured after passing through a size-selective inlet with a 50 per cent efficiency cut-off at 2.5 µm aerodynamic diameter
PM_{10}	Particulate matter, the mass of particulate matter that is measured after passing through a size-selective inlet with a 50 per cent efficiency cut-off at 10 µm aerodynamic diameter
POP	Persistent organic pollutants, (lindane, dichloro-diphenyl-trichloroethane (DDT), polychlorinated biphenyl (PCBs), pentabromodiphenyl ether (PeBDE), perfluorooctane sulfonate (PFOS) ,hexachlorobutadeine (HCBD), octabromodiphenyl ether (OctaBDE), polychlorinated naphthalenes (PCNs), pentachlorobenzene (PeCB) and short-chained chlorinated paraffins (SCCP)
SCCP	Short-chained chlorinated paraffins
TSP	Total suspended particulates. the mass of particles, of any shape, structure or density, dispersed in the gas phase at the sampling point conditions which may be collected by filtration under specified conditions after representative sampling of the gas to be analyzed, and which remain upstream of the filter and on the filter after drying under specified conditions
Zn	Zinc

Notation keys

IE Included elsewhere – Emissions for this source are estimated and included in the inventory but not presented separately for this source (the source where included is indicated).

NA Not applicable – The source exists but relevant emissions are considered never to occur. Instead of NA, the actual emissions are presented for source categories where both the sources and their emissions are well-known due to availability of bottom-up data (i.e. mainly in the energy and industrial processes sectors). When pointing the value "0.000" with the cursor, the actual emissions can be seen and the value "0.000" is shown due to the rounding of data to three significant decimals.

NE Not estimated – Emissions occur, but have not been estimated or reported.

NO Not occurring – A source or process does not exist within the country.

C Confidential information – Emissions are aggregated and included elsewhere in the inventory because reporting at a disaggregated level could lead to the disclosure of confidential information.

NR Not relevant - According to paragraph 9 in the Emission Reporting Guidelines, emission inventory reporting should cover all years from 1980 onwards if data are available. However, “NR” (not relevant) is introduced to ease the reporting where emissions are not strictly required by the different protocols, e.g. for some Parties emissions of NMVOCs prior to 1988. – NR is not in use in the Finnish inventory report.

The use of notation keys in the Finnish inventory is explained in the sector specific Chapters 4 - 9.

RESPONSES TO NECD PRELIMINARY REVIEW 2020

Pollutant, NFR	Issue	Explanation	Corrected
NH3 – 5B2	Missing value	Added to the resubmission 14032020	yes
PAH - total	PAH-4/individual 4 species	PAH species values are provided where it has been possible to estimate the value. However, the plants have an obligation to report PAH-4 (EPRTR) and not for the species. Not all species are relevant to all activities and it has not been possible to identify the specific species by each plant. This is a question related to the differences in reporting obligations (CLRTAP/NECD and EPRTR). Using plant level data ensures the accuracy of emissions while calculating emissions using surrogate AD and Guidebook EFs would increase inaccuracies and likely overestimate emissions. The split has, however, been done for industry emissions after interviewing the plants. For the energy sector, it is not possible to interview all operators regarding all boilers. We consider it better to report accurate PAH-4 values (as the reduction requirement is for PAH-4) than to report inaccurate PAH emissions by PAH species..	NA
NE analysis	Only Se	Se is not one of the obligatory metals. However, we intend to complete the inventory in the coming years	NA
Errors	ke	The notation was corrected to NE in the resubmission.	yes

i Background information on air pollutants inventories

Changes in chapter	
Update of text	March 2018 KS

Responsibilities in the Finnish national system for air emission inventories are divided between Statistics Finland, responsible for greenhouse gas inventories, and the Finnish Environment Institute, responsible for air pollutant emission inventories, as shown in Figure 1.1.

UNECE CLRTAP

The United Nations Economic Commission for Europe Convention on Long-Range Transboundary Air Pollution (UNECE CLRTAP) entered into force in 1983. Under the Convention there are eight protocols: the protocol on Reduction of Sulphur Emissions and their Transboundary Fluxes (entered into force in 1987), protocol on Control of Nitrogen Oxides or their Transboundary Fluxes (entered into force in 1991), protocol on Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes (entered into force in 1997), protocol on Further Reduction of Sulphur Emissions (entered into force in 1998), protocol on Persistent Organic Pollutants POPs (entered into force in 2003, protocol on Heavy Metals (entered into force in 2003) and protocol on Abating Acidification, Eutrophication and Ground-level Ozone (entered into force in 2005). Reduction targets and base years for the emission inventories are specified for the substances covered by each Protocol.

The annual reports under the UNECE CLRTAP Convention include emission inventories for sulphur as SO_2, nitrogen oxides, ammonia, non-methane volatile organic compounds (NMVOCs), heavy metals and persistent organic compounds since their base years as specified in the relevant protocols. Projected emissions for sulphur dioxide, nitrogen oxides, ammonia, particulate matter and NMVOCs are reported for the years 2020 and 2050. Methods used to quantify emissions as well as data analysis and other additional information to understand the emission trends as required in the reporting guidelines[1] are included in national Informative Inventory Reports (IIRs) submitted annually.

Finland has annually submitted emission data and inventory reports to the UNECE Secretariat since the 1980's to meet the obligations of the United Nations Economic Commission for Europe Convention on Long-Range Transboundary Air Pollution (UNECE CLRTAP). The inventory reports submitted to the UNECE Secretariat and to the EEA are uploaded to the EIONET CDR (http://cdr.eionet.europa.eu/) as specified in the reporting instructions. Information on air pollutant inventories and submission of reports under the UNECE CLRTAP is provided on the website of Finland's Environmental Administration in Finnish[2], Swedish[3] and English[4].

EU NECD

The aim of Directive 2001/81/EC, revised 2016/2284, of the European Parliament and of the Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants is to limit emissions of acidifying and eutrophying pollutants and ozone precursors. The Directive establishes national emission ceilings as benchmarks, for SO_2, NO_x, NH_3, NMVOC and $PM_{2.5}$ emissions.

[1] http://www.ceip.at/fileadmin/inhalte/emep/reporting_2009/Rep_Guidelines_ECE_EB_AIR_97_e.pdf
[2] http://www.ymparisto.fi/default.asp?node=6323&lan=fi
[3] http://www.ymparisto.fi/default.asp?contentid=371537&lan=fi&clan=sv
[4] http://www.ymparisto.fi/default.asp?node=13255&lan=en

Emission inventories and projections as well as additional data are reported since the 2017 submission according to the revised NEC Directive (Directive 2016/2284) reporting requirements.

Finland has submitted emission inventories to the European Commission and to the EEA annually since the first reporting under the NECD in 2002 for the year 2000 final data. The data and reports are uploaded to the EIONET CDR (http://cdr.eionet.europa.eu/). Detailed information on air pollutant inventories is provided on the website of Finland's Environmental Administration in Finnish[5], Swedish[6] and English[7]

ii Summary of national emissions related to trends

Changes in chapter	
March 2020	KS

Summaries of air pollutant emissions in Finland for the years 1980-2017 are presented in Tables 1.1, 1.2 and 1.3.

The methodology presented in the EMEP EEA Emission Inventory Guidebook has been applied in the inventory and completed by national methods where available, according to the Guidebook principles.

Table 1.1. Summary of main air pollutant emissions in Finland for 1980–2018. Corrections to data reported in 2019 are printed in red.

kt/a	NO_x (as NO_2)	NMVOC	SO_x (as SO_2)	NH_3	CO	$PM_{2.5}$	PM_{10}	TSP	BC
1980	307	*	584	36					
1981	287	*	534	37	*	*	*	*	*
1982	282	*	484	37					
1983	273	*	372	37					
1984	269	*	368	37					
1985	287	*	382	37					
1986	289	*	331	37					
1987	300	229	328	36					
1988	303	240	302	35					
1989	310	233	244	33					
1990	306	231	249	35	754	46	73	98	10
1991	303	221	205	33	726	42	66	85	9
1992	288	215	156	32	705	38	60	78	9
1993	293	209	138	32	690	35	56	72	8
1994	293	208	123	33	672	34	55	72	8
1995	273	202	105	34	665	32	51	68	8
1996	277	194	109	34	657	31	49	65	7
1997	271	194	101	36	651	30	49	64	7
1998	257	189	93	35	645	28	45	58	7
1999	252	183	92	38	626	28	45	60	7
2000	241	177	82	35	595	26	43	56	6

* No estimates for total national emissions are available for 1980-1989 although estimates are provided for individual NFR categories

[5] http://www.ymparisto.fi/default.asp?node=6323&lan=fi
[6] http://www.ymparisto.fi/default.asp?contentid=371537&lan=fi&clan=sv
[7] http://www.ymparisto.fi/default.asp?node=13255&lan=en

kt/a	NO_x (as NO_2)	NMVOC	SO_x (as SO_2)	NH_3	CO	$PM_{2.5}$	PM_{10}	TSP	BC
2001	244	174	96	35	595	27	43	58	7
2002	242	166	90	36	579	27	44	59	7
2003	248	161	101	37	556	27	45	60	6
2004	237	156	84	37	541	26	44	58	6
2005	208	144	70	38	509	25	41	56	6
2006	224	140	83	37	500	25	43	59	5
2007	211	135	81	37	481	24	40	55	5
2008	194	121	67	36	463	23	39	53	5
2009	176	112	59	36	440	22	38	52	5
2010	187	113	66	37/34*	454	24	39	54	6
2011	171	104	60	35/33*	414	21	36	51	5
2012	161	101	50	35/33*	407	21	35	49	5
2013	158	97	48	35/33*	389	20	34	49	5
2014	151	94	44	35/33*	383	19	34	48	5
2015	139	89	41	33/32*	361	18	31	45	4
2016	134	90	40	33/32*	368	18	32	47	4
2017	130	88	35	32/31*	359	18	31	45	4
2018	127	85	33	32/*31**	351	18	31	45	4

Remark 1: Due to rounding the sum of subtotals does not equal to total figure
*NH_3 including accepted adjustments under the UNECE CLRTAP for the years 2010-2017, for 2018 the adjustment will be reviewed in June 2020.

Table 1.2. **Summary of heavy metal emissions in Finland for the years 1990–2018.**

	Heavy Metals (t/a)								
	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
1990	321	7	1	35	47	157	78		679
1991	237	4	1	24	60	149	61		469
1992	165	3	1	18	47	124	52		371
1993	105	3	1	16	38	111	45		346
1994	74	3	1	11	40	106	44		401
1995	73	2	1	5	36	116	47		403
1996	49	2	1	8	33	110	37		269
1997	32	2	1	13	29	128	38		146
1998	37	2	1	14	30	84	33		149
1999	35	2	1	5	31	68	37		139
2000	31	1	1	4	29	65	35		127
2001	30	2	1	5	26	66	32		130
2002	31	1	1	4	39	69	38		146
2003	25	1	1	4	29	62	35	NE*	126
2004	26	2	1	4	26	60	30		122
2005	21	1	1	3	20	58	26		123
2006	25	1	1	3	25	59	28		116
2007	22	1	1	3	29	44	25		118
2008	20	1	1	3	27	42	22		106
2009	17	1	1	3	17	40	21		117
2010	20	1	1	3	26	42	23		130
2011	19	1	1	3	17	42	20		126
2012	16	1	1	3	18	41	19		128
2013	16	1	1	3	18	42	17		124
2014	17	1	1	3	23	43	17		132
2015	15	1	1	2	17	41	16		119
2016	16	1	1	3	18	41	16		127
2017	16	1	1	2	17	41	15		120
2018	15	1	1	2	15	40	14		119

Remark 1: Due to rounding the sum of subtotals does not equal to total figures

[6]The time series for Se emissions is not yet completed.
**The IPPU sector emission value for Cd in 1999 needs to be corrected

Table 1.3. **Summary of persistent organic pollutant emissions in Finland for the years 1990–2018.**

Year	Persistent Organic Pollutants			
	PCDD/F (g I-TEQ)	PAH-4 (Mg)	HCB (kg)	PCB (kg)
1990	18	7	36	29
1991	19	7	36	25
1992	18	7	36	26
1993	18	7	36	28
1994	19	7	36	29
1995	19	8	36	29
1996	18	8	38	28
1997	18	8	38	30
1998	18	8	38	31
1999	18	8	38	30
2000	19	8	39	30
2001	16	9	18	29
2002	16	9	12	29
2003	14	9	10	30
2004	14	9	26	31
2005	14	9	32	31
2006	15	9	36	32
2007	14	9	38	32
2008	17	10	19	31
2009	12	10	27	21
2010	16	11	9	28
2011	14	10	26	28
2012	15	10	10	25
2013	15	10	17	23
2014	16	10	22	25
2015	14	10	16	24
2016	16	10	60	26
2017	13	10	34	26
2018	14	10	32	26

Remark 1: Due to rounding the sum of subtotals do not equal to total figures

iii Overview of source category specific emission estimates and trends

Changes in chapter	
November 2017	KS

The sources of air pollutants are discussed in details in Sections 3 - 10 of this report. For the land use change and forestry sector no air pollutant emissions have been estimated thus far.

Energy

Combustion of fuels in the energy and heat production sectors is the main source of SO_2, NO_x, particulate matter and heavy metal emissions. NMVOC and POP compounds are released especially from small combustion sources. Transport sector is a significant source of NO_x, CO and NMVOC emissions.

Emissions from the energy sector are related to the production, distribution and consumption of fuels and fluctuate from year to year due to the economic trends and variations in the energy supply structure. The availability of hydropower in the integrated Nordic electricity market has a notable effect on the emissions.

In the transport sector, emissions have a decreasing trend though the use of fuels is increasing. One of the most essential emission reduction measures in the transport sector is the EU level agreement with car manufacturers on reducing vehicles' fuel consumption. Emissions from the off-road sector are increasing.

Industrial Processes

Emissions from the industrial processes sector include, among others

- all sulphur compounds reported as sulphur dioxide (SO_2), covering also emissions total reduced sulphur compounds (TRS) from chemical and pulp and paper industries,
- NMVOCs from pulp and paper, chemical and food and drink industries,
- heavy metal, POP and particle emissions from metal industry,
- POP emissions from mineral and chemical industries.

The trends are in general decreasing but variations due to fluctuations in production occur annually.

Solvent and other product use

The inventory of the solvent and other product use sector covers NMVOC compounds, particles, heavy metals and POP compounds. Paint application and printing are the most significant NMVOC sources.

The trends of emissions are generally decreasing. Efforts have been made to include more product use related emissions to the inventory, but in many cases there is lack of both methods and activity data to quantify emissions from many product use sources. Several projects are, however, under way to study emissions from the use of products.

Agriculture

Agriculture is the main source for ammonia emissions and also a source of particle emissions. The main emission sources for ammonia are manure management and fertilizers. The emissions trends are decreasing due to decreases in the numbers of livestock and in nitrogen fertilisation. The decreasing ammonia emission trends are safeguarded in the EU common agricultural policy by adopting support measures encouraging production that minimises the burden on the greenhouse gas balance.

The national emission ceiling for ammonia, set in the EU NEC Directive for 2010, was 31 kilotonnes for Finland. The ceiling has not yet been met. At the time of setting the ceiling for 2010 it was not foreseen that the ceiling would not be met. However, new understanding of the generation and development of ammonia emissions, especially from manure management, as well as identification of some new sources that were not known during the establishment of the ceiling, have been taken into the inventory, and have significantly increased the emissions. Finland applied for an adjustment to the road transport and small-scale combustion NH3 emissions, which were accepted, and when applying the accepted adjustments, the emissions are in 2016 and 2017 below the ceiling.

Waste

Emissions from the waste sector include SO_2, NO_x, CO, NMVOC, particulate matter, heavy metals and POPs. The trends of these emissions are generally declining.

1 INTRODUCTION

1.1 Background information on air pollutants emissions and their impact on the environment

Changes in chapter	
March 2020	KS

1.1.1 National circumstances relevant to air pollutant emissions

Population and geography

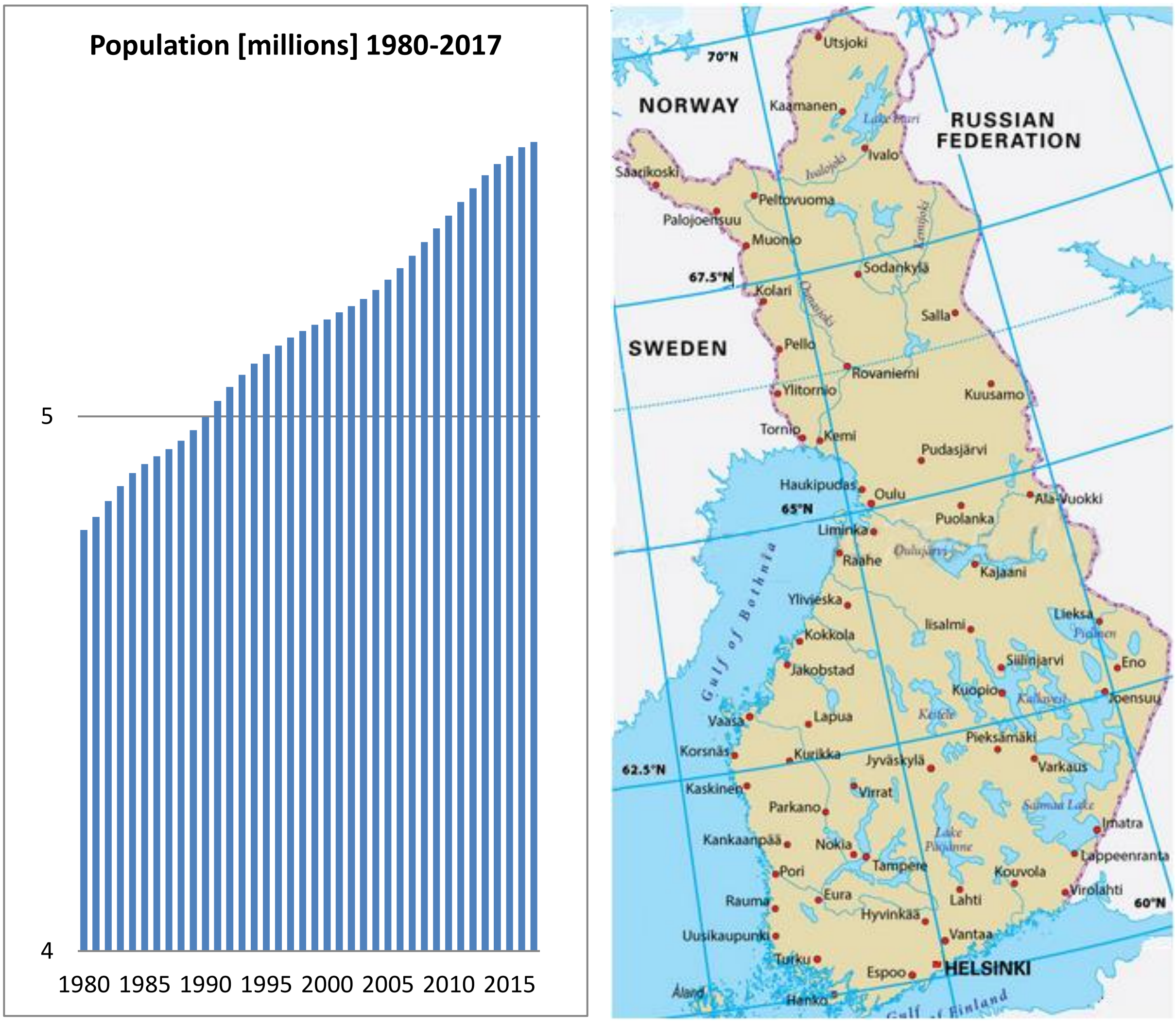

Figure 1.1 Population and geographical location of Finland

The population of Finland was 5 513 130 at the end of 2017 (Figure 1.1). As a result of the low population density, 18 inhabitants per km², and the geographical extent of the country, the average distances travelled for different purposes can be quite long.

Finland is situated at a latitude between 60 and 70 degrees north, with a quarter of the country extending north of the Arctic Circle. With a total area of 338,432 km2, it is Europe's seventh largest country. Nearly all of Finland is situated in the boreal coniferous forest zone, and 72 per cent of the total land area is classified as forest land, while only some 8 per cent is farmed. Finland has more than 34,300 km2 of inland water systems, which represents approximately 10 per cent of its total area. There are some 190,000 lakes and 180,000 islands.

Climate

Finland's northern location increases the demand for energy and natural resources but the cold climate has also forced efficient use of energy.

The climate of Finland displays features of both maritime and continental climates, depending on the direction of air flow. Considering its northern location, the mean temperature in Finland is several degrees higher than in most other areas at these latitudes. The temperature is higher due to the Baltic Sea, because of the inland waters and, above all, as a result of air flows from the Atlantic Ocean, which are warmed by the Gulf Stream. The mean annual temperature is approximately 5.5°C in south-western Finland and decreases towards the northeast.

Winter – Winter begins around mid-October in Lapland and during November in the rest of Finland, while not until December in the southwestern archipelago. The sea and large lakes, where existing, slow down the progress of winter. Winter is the longest season in Finland, lasting for about 100 days in southwestern Finland and 200 days in Lapland. The mean temperature in winter remains below 0°C. North of the Arctic Circle, part of winter is the period known as the "polar night", when the sun does not rise above the horizon at all. In the northernmost corner of Finland, the polar night lasts for 51 days. In southern Finland, the shortest day is about 6 hours long. Permanent snow covers open grounds about two weeks after winter begins. The snow cover is deepest around mid-March, with an average of 60 to 90 cm of snow in eastern and northern Finland and 20 to 30 cm in southwestern Finland. The lakes freeze over in late November and early December. The ice is thickest in early April, at about 50 to 65 cm. In severe winters, the Baltic Sea may ice over almost completely, but in mild winters it remains open except for the far ends of the Gulf of Bothnia and the Gulf of Finland. The coldest temperatures in winter are from -45°C to -50°C in Lapland and eastern Finland; from -35°C to -45°C elsewhere; and -25°C to -35°C over islands and coastal regions. The lowest temperature recorded in Helsinki is -34.3°C (1987). The lowest temperature recorded at any weather station in Finland as of 2010 is -51.5°C (1999).

Spring - In spring, the mean daily temperature rises from 0°C to 10°C. Spring begins in a month earlier in the southern part of the country, early April, and proceeds to Lapland in early May, ranging from 45 to 65 days, and being longest in the maritime islands and coastal regions, because of the coolness of the sea. Once the mean daily temperature exceeds 5°C, the thermal growing season is considered to have begun. This takes place about one month after the beginning of spring: at the end of April in southern Finland and at the end of May in northernmost Lapland. For the real growing season to begin the snow must melt. Melting depends on the amount of snow, elevation and the position of the region relative to the sea. Open areas lose their snow cover within two to three weeks of the beginning of spring, whereas on average the snow in the forest smelts about two weeks later. The lakes usually become ice-free soon after the growing season begins in April in southwestern Finland, in May in the interior and in June in Lapland.

Summer - In summer the mean daily temperature is consistently above 10°C. Summer usually begins in late May in southern Finland and lasts until mid-September, while in Lapland it starts about one month later and ends a month earlier. The regions north of the Arctic Circle are characterized by "polar days", when the sun does not set at all, 73 days in the northernmost area. In southern Finland, the longest day (around Midsummer) is nearly 19 hours long. The highest summer temperatures measured in the Finnish interior are from 32°C to 35°C. Near the sea and over the maritime islands, temperatures over 30°C are extremely rare; the highest temperature ever recorded in Helsinki is 31.6°C. Heat waves, with a maximum daily temperature exceeding 25°C, occur on an average of 10 to 15 days per summer inland in southern and central Finland, and 5 to 10 days in northern Finland and on the coast. In the course of the summer, thunderstorms occur on 8 to 14 days in the interior and 4 to 8 days in coastal areas and northern Lapland.

Autumn - Daily mean temperature in the Autumn remains below 10°C. Autumn begins around the last week of August in northern Finland and about one month later in southwestern Finland. The growing season ends in autumn when the mean daily temperature drops below 5°C around the last week of September in northern Finland and in late October in southwestern Finland. The average length of the growing season is 180 days in the southwestern archipelago, 140 to 175 days elsewhere in southern and central Finland and 100 to 140 days in Lapland. The first snow falls in northern Finland in September and elsewhere in October.

Source: Finnish Meteorological Institute FMI

Economy and industrial activities

Finland has an open economy with prominent service and manufacturing sectors. The main manufacturing industries include electrical and electronics, forest and metal and engineering industries. Foreign trade is important, with exports accounting for about 40 per cent of the gross domestic product (GDP) (Figure 1.2).

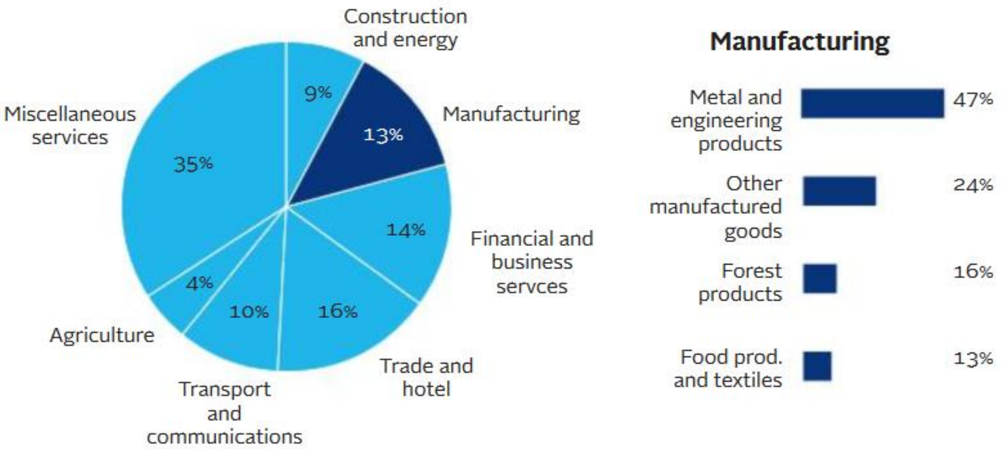

Figure 1.2 Economic Structure Finland (Blue Wings 1/2016)

The total annual energy consumption is around 1 500 PJ, out of which the domestic industry uses approximately half. For decades, the use of primary energy as well as electricity has been increasing, and they reached their top values in the years 2006–2007. Demand rose more rapidly than GDP until 1994. Since then, parallel with the structural changes in the economy, both the energy intensity and the electricity intensity of the economy have decreased. Finland has a high share in non-fossil energy sources in power and heat production, i.e. hydro, nuclear and biomass sources.

Finland has significant forest resources that have led to the development of forest industries. Metal, technology and refinery industries developed due to paying reparations to the Soviet Union and due to the bilateral trade with the Soviet Union. The great depression in the beginning of the 1990's was due to the collapse of the Soviet Union as well as the unsuccessful monetary policy. Finland recovered

from the depression that brought down thousands of enterprises and the mass unemployment through the growth of information technologies, mobile phones and telecommunication services. In 2009 there was a recession with the value of industrial output felling by approximately one third from year before. (Figure 1.3)
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Finland joined the EU in 1995 and the Euro zone in 2001.

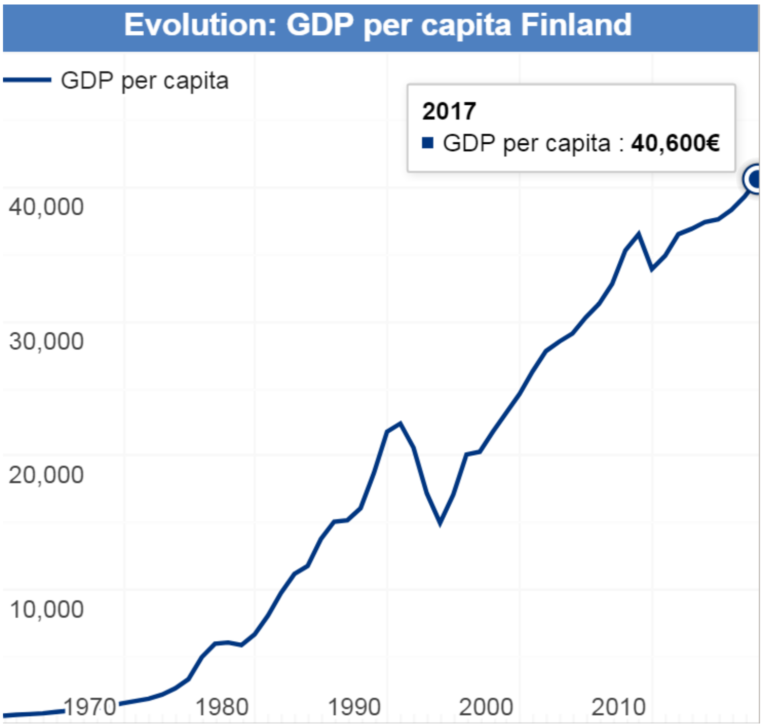

Figure 1.3 GDP evolution 1970-2017 (https://countryeconomy.com/gdp/finland)

Domestic passenger transport, measured in terms of passenger-kilometres, has increased by approximately 22 per cent since 1990. Cars account for around 83 per cent of the total passenger-kilometres. The total number of freight tonne-kilometres in Finland is almost double the EU average, mainly because of the long distances and the industrial structure. Indoor heating is a large source of emissions, however, during the past three decades the consumption of energy per unit of heated space has been reduced significantly, in particular due to tightening building regulations.
(Reference: Finland's 6th National Communication to the UNFCCC, Population Statistics, Statistics Finland)

1.1.2 Environmental Protection

Figure 1.4. Snapshots of Finnish Environment

Finland's low population density and comparatively unspoilt natural environment has given good starting points to facilitate nature conservation. Environmental protection actions have resulted in many of the earlier polluted lakes and rivers to be cleaned up. Air quality has improved around industrial locations and a network of protected area has been built up to safeguard biodiversity. Forests are managed more sensitively than in the past and the overall annual growth rate exceeds the total timber harvest.

Finland has been rated among the world's leading countries in many international comparisons of environmental protection standards, such as the Global Economic Forum's regularly compiled Environmental Sustainability Index. Finland's strengths include highly effective environmental administration and legislations, and the ways environmental protection is considered in all sectors of the society. However, Finland has large ecological footprint and high levels of material and energy consumption.

Measures taken to combat acidification have had the desired effects. Finland's soils are naturally vulnerable to acidification since they only contain low concentrations of calcium to buffer the acidifying effects of sulphur and nitrogen compounds deposited in the soils from airborne pollution. The same applies to forests and inland waters. Farmland soils in Finland have to be regularly limed due to their natural acidity.

In Finland well-planned measures to combat air pollution have led to a considerable reduction in the emissions and acidifying deposits over the last 30 years. Instead, the amount of street dust and long-range transport of ozone have not decreased and emissions from agricultural sources continue to be a problem. While the air quality on average is still, in difficult weather conditions in winter and spring, the amounts of pollutants in certain urban areas may rise to the same level as in cities of about the same size in Central Europe.

Unnatural concentrations of toxic chemicals in the environment do not currently represent health risk in Finland. Emissions of the most hazardous substances have been significantly reduced and Finland does not suffer from large quantities of airborne toxic pollution originating from other countries.

Finland's winters are too cold for many crop pests to survive, so there is no need to use as much pesticides as in the south. However, in the harsh conditions, even small quantities of hazardous substances can be fateful for sensitive ecosystems and the cold climate can slow the natural degradation of toxic substances.

Chemicals contaminating soil can cause problems decades after the pollution occurs. In Finland there are approximately 20 000 sites potentially suffering from soil contamination. Efforts to remediate such sites intensified in the late 1990s and more recent clean-up work has been initiated at several hundred sites annually.

Air Pollution Control Programmes 2010 and 2030

In 2002 the Finnish Government adopted a national programme establishing the maximum annual emission levels for sulphur dioxide, nitrogen oxides, volatile organic compounds and ammonia as from 2010. The programme sets out the measures to reduce emissions in energy production, transport, agriculture and manufacturing industries as well as actions that contribute to emission reduction in working machinery, pleasure boats and residential wood combustion. Finland has successfully reduced emissions in line with the programme, with ammonia emissions as an exception.

The air pollution control programme up to 2030 is currently under preparation and will be finalized by the end of 2018.

International cooperation

The air presents an efficient transport route for gaseous and particulate substances, making it possible for emissions to spread to neighboring regions and even to the other side of the globe. This means that, besides national action in Finland, reaching the air pollution control objectives calls for international collaboration. More than half of the small particle loading and acidifying and eutrophying loading comes to Finland as long-range transboundary pollution. All countries in the world share the same ozone layer, which is why the responsibility for its protection rests with the international community.

The most significant international agreements on which air pollution control and the protection of the ozone layer in Finland are based are:

- UN Convention on Long Range Transboundary Air Pollution to control the transport of air pollutants between countries,
- Vienna Convention and the more detailed Montreal Protocol under it, imposing strict restrictions on the manufacture, consumption and trade of substances that deplete the ozone layer, and
- EU directives and regulations.

1.1.3 Environmental conditions

Air quality in Finland is generally good and the local impacts of air pollution are fairly limited. During periods when certain atmospheric conditions prevail, however – particularly atmospheric inversions in the winter and spring – concentrations of pollutants in the air in Finnish cities may be compared to those observed in cities of similar size elsewhere in Europe.

Acidifying compounds can reach the ground with rain or snow as wet deposition, or in the form of particles or gases as dry deposition. Ecosystems may eventually lose their neutralising or buffering capacity completely, if acid deposition rates persistently exceed the critical levels. Rainfall is naturally slightly acidic, but certain types of air pollutants can increase its acidity considerably. Combustion gases formed during the use of fossil fuels like oil, coal and peat particularly contain oxides of nitrogen and sulphur that can subsequently react in the atmosphere to produce acids that are dissolved in precipitation.

Acidification problems first became evident in the 1960s, when industrial emissions increased rapidly, and efficient methods for cleaning waste gases had not yet been developed. It took some time for action to be taken, although the threat of “acid rain” was clearly serious, with fish disappearing from some lakes, forests dying, and metal structures being rapidly corroded. Ultimately international agreements were signed to force industry and energy production to curb harmful emissions, and these measures have been particularly successful where sulphur emissions are concerned.

Finland carries out extensive monitoring of air quality/deposition and effects in various sectors. Finland participates in all the international effects programmes (ICPs) of the Working Group on Effects of the UNECE CLRTAP and has carried out extensive air quality/deposition monitoring as part of EMEP. Results from these activities have also been published in several national assessment reports and in papers in scientific journals.

Acidification represents a serious threat to many plants and animals, particularly in sensitive aquatic ecosystems. One of the most harmful impacts of acidification is that in acidic conditions toxic aluminium and heavy metal ions are more easily rinsed out of the soil and absorbed by living organisms. The ecosystems most sensitive to acidification are the nutrient-poor lakes and forests of northern Finland, whose natural buffering capacity is already weak. In more fertile regions, soils and the bedrock typically contain higher concentrations of calcium, which helps to prevent acidification.

The concentrations of sulphur compounds declined and buffering capacity increased in all types of lakes in Finland during the 1990s, thanks to dramatic reductions in the atmospheric deposition. Some 5,000 smaller lakes in Finland are now considered to be recovering well from serious acidification problems.

Since the early 1990s stocks of perch (Perca fluviatilis) have been increasing in many lakes in forested areas of southern Finland where fish stocks had suffered badly from acidification in the 1970s and 1980s.

Declining atmospheric deposition has also reduced acidification problems in Finland’s vital groundwater reserves. It may still take decades for groundwater to recover completely, since sulphur compounds and other acidifying impurities are still widely present in the soil, and are only gradually leached out into water courses.

(Ministry of the Environment 2017 Air Pollution Control, http://www.ymparisto.fi/en-US/Climate_and_air/Air_pollution_control and Lyytimäki J. 2014 Environmental protection in Finland, Finnish Environment Institute)

1.2 Institutional arrangements for inventory preparation

Changes in chapter	
November 2017	KS

Responsibilities in the Finnish national system for air emission inventories are divided between Statistics Finland, which is responsible for greenhouse gas inventories under the UNFCCC and the EU CO_2 Monitoring Mechanism Decision, and the Finnish Environment Institute SYKE, which is responsible for air pollutant emissions under the UNECE CLRTAP and the EU Directives (NECD, LCPD). E-PRTR reporting is under the responsibility of the Centres for Economic Development, Transport and the Environment. Energy Authority is the responsible unit for EU ETS data.

Change in inventory organization since the 2020 submission

All transport sector emissions are calculated by VTT Technical Research Centre starting from the 2020 submission. In the previous years, heavy metals, POPs, small particles, abrasion and volatile emissions were calculated at SYKE.

The share of responsibilities between the different organizations in the preparation on air emission inventories is illustrated in Figure 1.5.

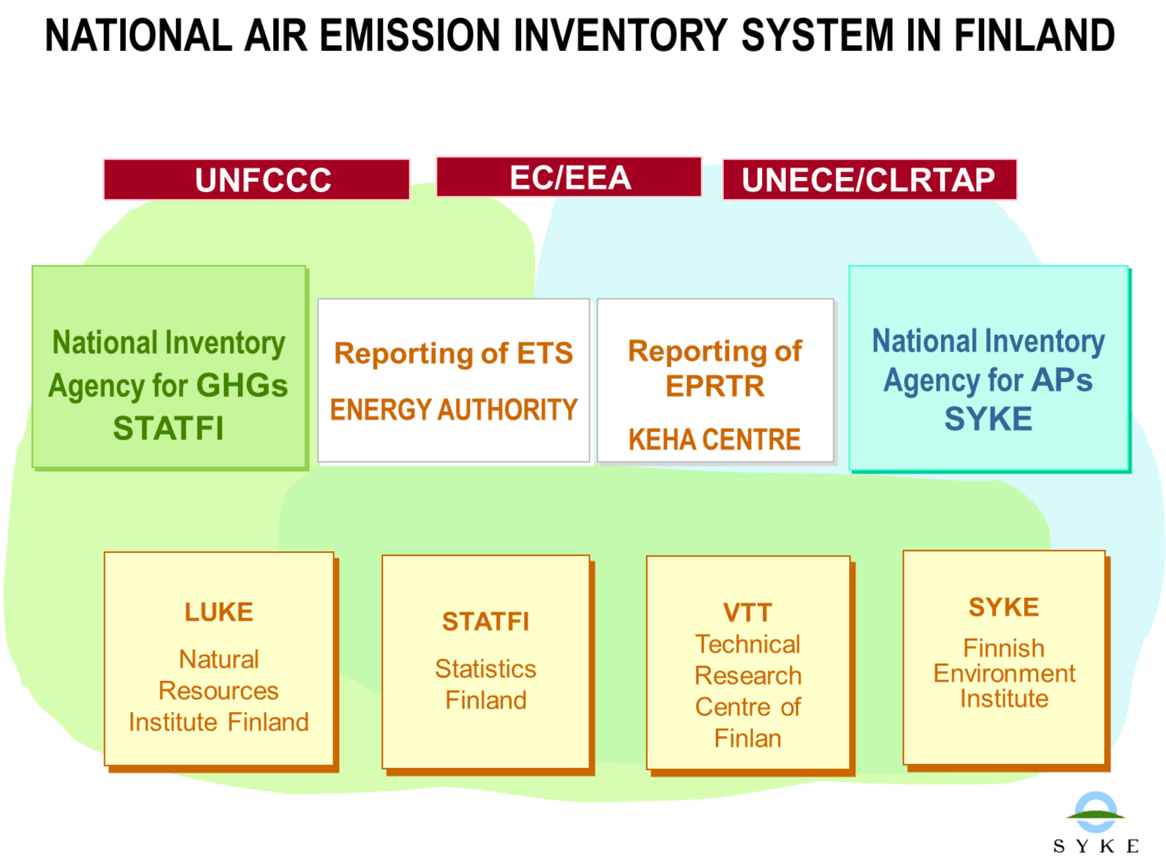

Figure 1.5. National systems for air emission inventories in Finland.

1.3 Brief description of the process of inventory preparation

1.3.1 Organization of the air pollutant inventory

Changes in chapter	
March 2020	KS

The inventory of air pollutant emissions to the UNECE CLRTAP Secretariat is coordinated by, and for the most parts also carried out, at Finnish Environment Institute (SYKE). SYKE also compiles the NFR reporting tables and the Informative Inventory Report (IIR) (Figure 1.6).

In the preparation of the inventory SYKE cooperates with several authorities: Finnish Customs; Finnish Food Safety Authority Evira; Finnish Safety and Chemicals Agency TUKES; Natural Resources Institute LUKE; Ministry of Employment and the Economy; Ministry of the Environment, Ministry of Transport and Communications; National Institute for Health and Welfare THL; National Supervisory Authority for Welfare and Health Valvira; Rescue Services in Finland; Statistics Finland.

Several industrial associations and companies provide data for the preparation of the inventory: Association of Finnish Paint Industry; Chemical Industry Federation of Finland; Confederation of Finnish Construction Industries RT; Finnish Cosmetic, Toiletry and Detergent Association TY; Finavia (aviation and airports); Finnish Energy Industries Finergy, Finnish Food and Drinks Industries' Federation ETL; Finnish Forest Industries Federation; Finnish Petroleum Federation ÖKKLI; Federation of Finnish Technology Industries; First Quantum Minerals Ltd Lemminkäinen Infra Ltd Asphalt Division; Nynas Ltd (specialty oils); Paulig Ltd (coffee); Suomen Hiiva (yeast), Yara (chemicals) as well as the following research institutes: Natural Resources Institute LUKE and VTT Technical Research Centre of Finland.

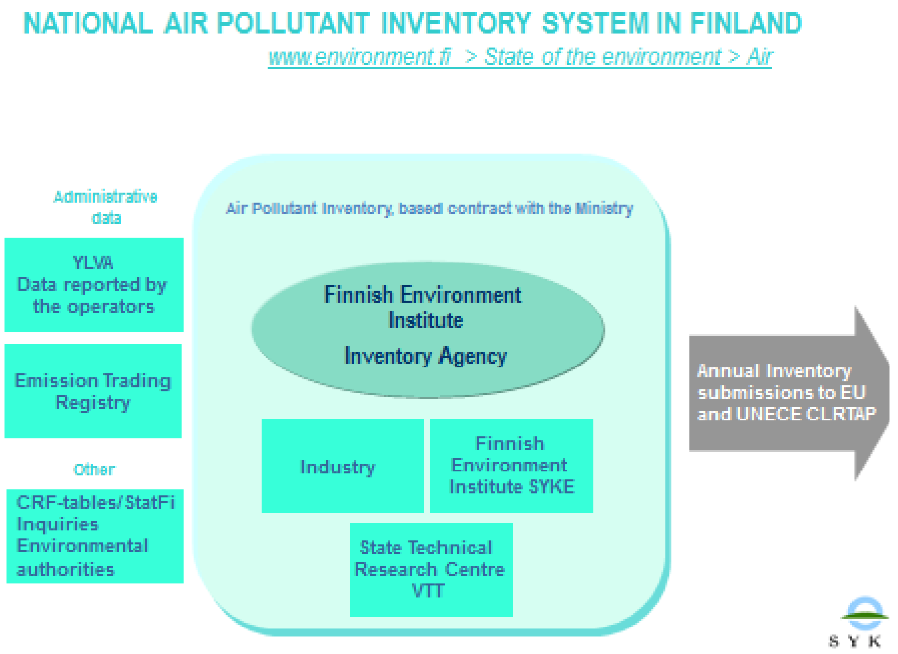

Figure 1.6 Organization of the air pollutant emission inventory in Finland.

1.3.2 Preparation of the inventory

Changes in chapter	
March 2017	KS

Air pollutant inventory agency

The national air pollutant emission inventories under the UNECE CLRTAP and the EU Directives (NECD and LCPD) are carried out at SYKE by the Air Emissions Team. Resources used for the preparation of air pollutant inventories are about 2.5 man years.

The team also participates the national greenhouse gas inventory by carrying out the inventory of F-gases and the waste sector inventory, as well as the NMVOC emission inventory to be reported under the UNFCCC and EU CO_2 Monitoring Mechanism. Resources used for contributing the greenhouse gas inventory are about 0.9 man years.

The annual schedule of the inventory work is presented in Figure 1.7.

Supporting tasks

*D*evelopment and maintaining national release estimation techniques for air pollutants and providing information[8] on the methods to the operators of industrial installations and to environmental authorities is included in the work. The team develops tools for estimating greenhouse gases on the level of municipalities, participates in national and international research and development projects related to air emissions and provides expert services and technical support to the Ministry of the Environment.

Participation in national cooperation with research institutes and industry as well as in international working groups under the UNECE TFEIP, IPCC, OECD and Nordic Council of Ministers as well as in the review programmes under the UNFCCC and CLRTAP/NECD ensure maintaining necessary knowledge and expertise in the preparation of inventories.

Annual schedule of air emission inventories

The annual working schedule of air pollutant and greenhouse gas inventories at Finnish Environment Institute SYKE is provided in Figure 1.7.

[8] Information on national emission estimation methods is provided in Finnish and in Swedish on the website www.ymparisto.fi/paastot

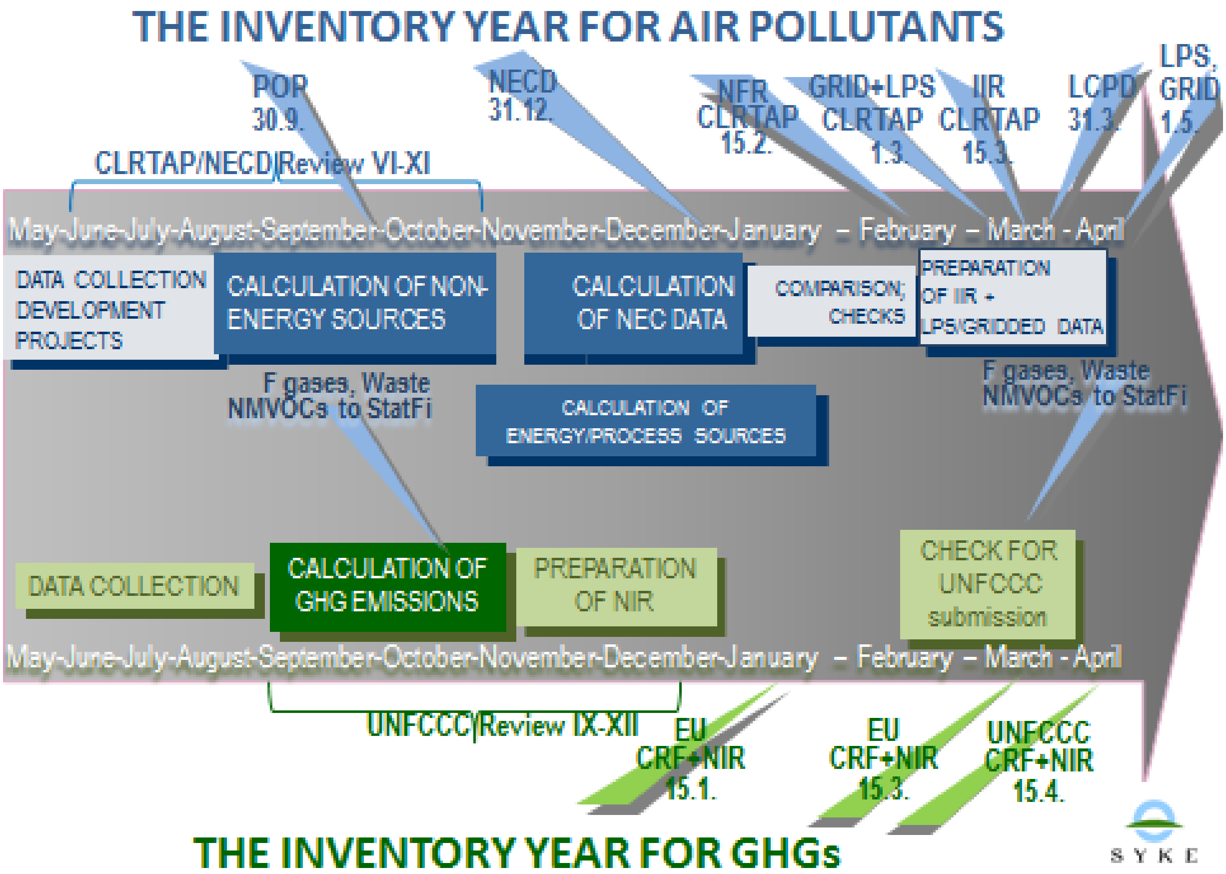

Figure 1.7. Annual schedule of inventory work at SYKE.

1.3.3 Reporting tool IPTJ

Changes in chapter	
February 2019	ks

The air pollutant emission data system IPTJ (Ilmapäästötietojärjestelmä) was built up during 2000 – 2003 as a reporting tool for the inventory. IPTJ currently contains emission data for the years 2000 - 2014. During the year 2013 the compilation of data was automated using a Microsoft Visual Studio 2008 extension Business Intelligence Development Studio (BIDS). Microsoft Access based queries were extracted and the syntax converted into a format compatible with Microsoft SQL Server Database and most SQL-compatible database management systems and the SQL queries stored as SQL Server Integration Services (SSIS) packages.

Emission data from 1980 to 2000 have been calculated with the old data system SIPS[9]. Data for the earlier years 1980-1999 is stored in calculation sheets for the sectoral sub-models. Data since 1990 will be incorporated into the IPTJ tool after the energy sector recalculation has been finalized.

Emission data in the IPTJ system is retrievable in different reporting formats: SNAP (Source Nomenclature for Air Pollutants), CRF (Common Reporting Format, IPCC), IPPC (Integrated Pollution Prevention and Control, Council directive 96/61/EC), as well as in IPPC and EPRTR categories. The structure of IPTJ is presented in Figure 1.8.

Spatial emission data calculated at the level of EMEP grids (0.1º * 0.1º and 50 km * 50 km) as well as for each municipality (431 municipalities in 2006 and 320 in 2013), provinces (19 in 2013) and Centres for Economic Development, Transport and the Environment (sc. ELY Centres, the number of which were 16 in 2014).

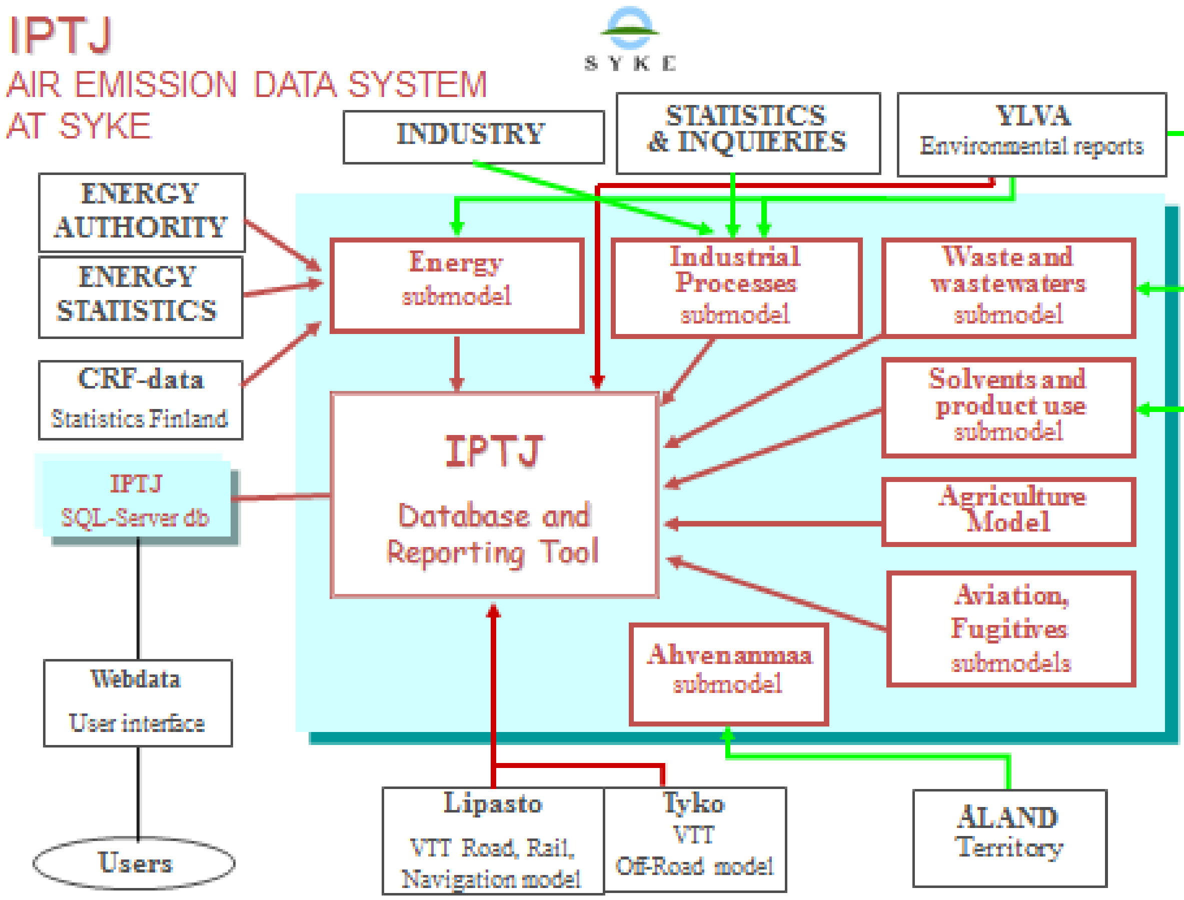

Figure 1.8. Structure of the air pollutant emission data system IPTJ at the Finnish Environment Institute SYKE.

[9] SIPS (1998) Suomen ilmapäästöt ja skenaariot (Finnish Air Emissions and Scenarios)

1.3.4 Use of bottom-Up Data in the Emission Inventories

Changes in chapter	
February 2019	KS

The approach

A specific feature of the Finnish emission inventories is the use of data reported by the industrial installations[10]. The installations report their annual emissions to the supervising authorities at the Centres for Economic Development, Transport and the Environment according to the monitoring and reporting obligations determined in their environmental permits. After checking and approving the emission reports by the plants the supervising authorities record the information, including emission data for the supervised period, into their database (YLVA)[11] from where it is available also for emission inventory purposes.

At the Finnish emission inventory agencies (i.e. Finnish Environment Institute for air pollutants and Statistics Finland for greenhouse gases), the data is checked with normal statistical comparisons (e.g. check of magnitude and trend) and according to the IPCC Good Practice Guidelines principles before it is taken into the inventory databases of the inventory agencies. The use of bottom-up data increases the accuracy of the inventory by allowing actually measured emissions to be included into the inventory and covering, for instance, emissions during exceptional situations[12], which otherwise would not easily be captured (Figures 1.9 and 1.10). However, this also brings along additional work load in checking and allocating this information correctly. Results of the quality check carried out for the 2014 energy sector data is presented in Annex 4 of Part 2 of the IIR.

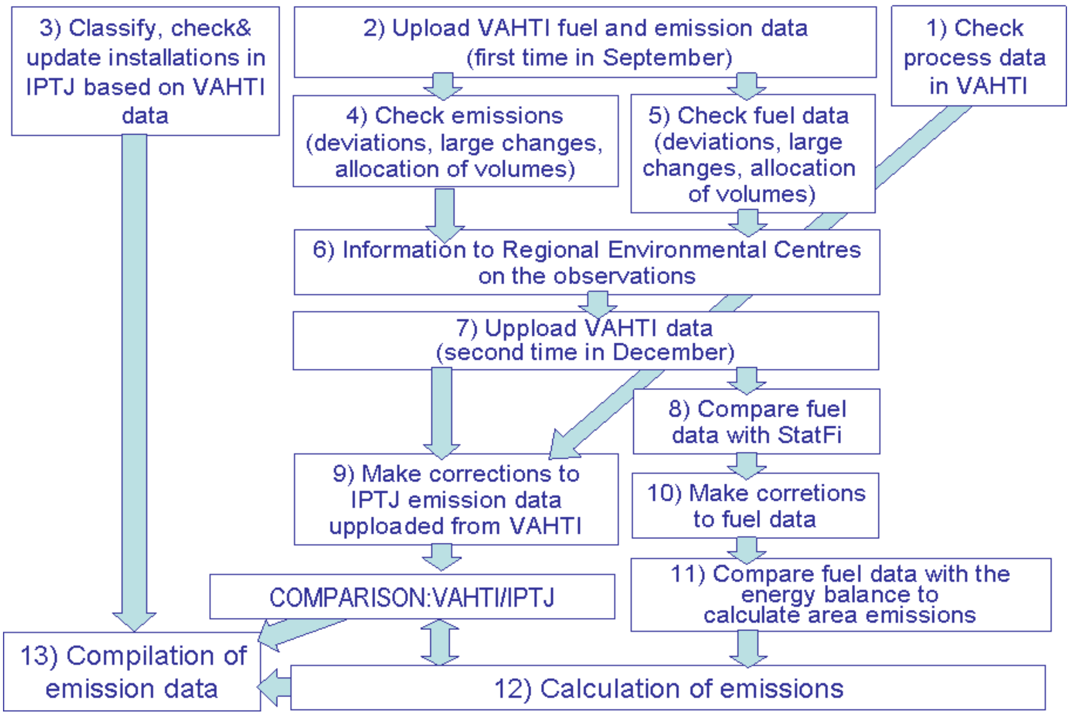

Figure 1.9. Processing of emission data reported by the plants for use in the air pollutant emission inventory, Part 1. (Note; the name of VAHTI has been changed to YLVA in 2018)

[10] This data is reported by the operators according to the reporting obligation in the environmental permit, as described in Chapter 1.3.3 first paragraph.
[11] Database for the supervising authority
[12] Such as malfunctioning of abatement technique, accidental releases due to process failures etc.

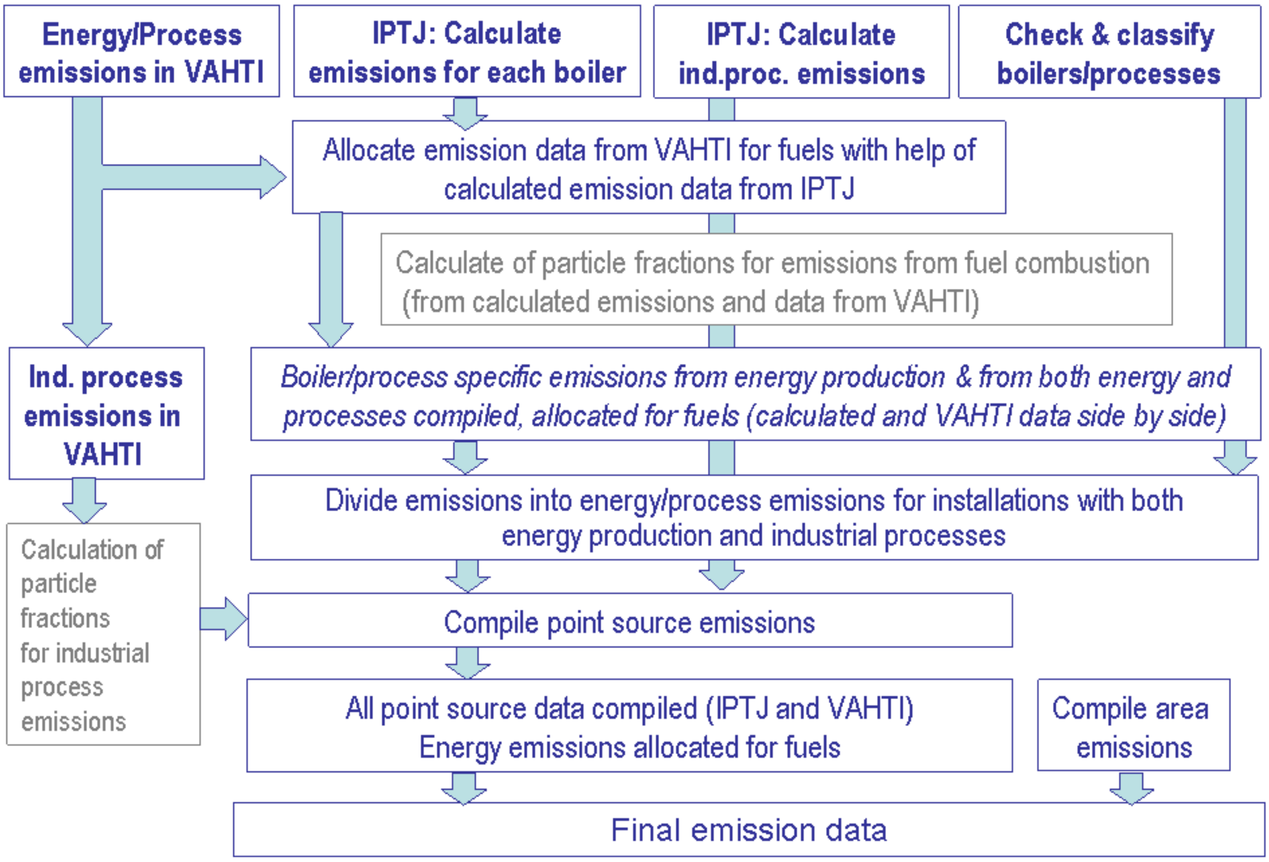

Figure 1.10. Processing of emission data reported by the plants for use in the air pollutant emission inventory, Part 2. (Note; the name of VAHTI has been changed to YLVA in 2018)

YLVA database

The Centres for Economic Development, Transport and the Environment (ELY Centres[13]) process environmental permits and monitor the compliance of activities to the requirements. The operators report data and information according to the monitoring and reporting obligations in their permits. The data is collected into the central YLVA database of the ELY Centres (Figure 1.11 to be updated to the next submission).

YLVA includes information and data on wastes generated, wastewater discharges and emission into the air. This baseline data is used by the ELY Centres in their work for supervising the activities. Emission data is also available to the inventory agencies for the use in emission inventories.

YLVA contains information on how facilities comply with the environmental regulations. A case management tool is incorporated into the system and the user interface makes it possible to add new customers, change or add customer data, retrieve reports from database and write inspection reports. The system includes mapping functions and a calendar to remind the inspector of time limits. Currently, there are 800 active users of the system.

[13] https://www.ely-keskus.fi/en/web/ely-en/

YLVA is a customer information system. The information recorded of the customer (i.e. an industrial plant) include, for example:

- facility identification details
- contact persons at the facility and environmental administration
- environmental permit conditions
- environment insurance information
- discharge points (stacks and sewers)
- information on process techniques and existing
- release control techniques
- information on fuels used
- information on landfills
- information on releases to air, water and wastes as well as related analysis data
- information on energy production and other production
- information on consumption of raw materials and water

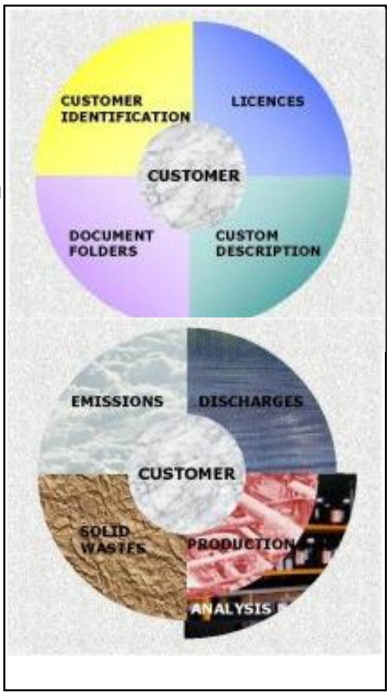

Figure 1.11. Structure of the VAHTI/YLVA database

The operators of installations (i.e. energy producers, industrial installations, fish farmers, peat producers, waste management, wastewater treatment plants) that have an environmental permit report information to the ELY Centres through a national portal (TYVI), which is the same one used for reporting on taxation (see chapter 2.3.6.4 and Figure 1.12). After checking and approving the data the supervising authorities record the data into the YLVA database from where it is available also for emission inventory purposes.

The coverage of installations in the Finnish environmental legislation is wider than in the European Union's IPPC Directive. YLVA database includes information of about 31 000 clients out of which about 28 000 are currently in operation and about 3 000 out of operation. Out of these only about 600 installations fall under the European Union's IPPC Directive. In 2006, 3 401 facilities sent their emission reports to the authorities. The number of facilities that reported information in 2015 on emissions to air, water or on wastes is presented in Table 1.4.

Table 1.4 Facilities reporting information to VAHTI in 2015. (to be updated to the contents of YLVA)

Activity	Water	Air	Waste
Energy production and industrial installations	1 110	623	770
Municipalities	384	6	261
Fish farms	169	0	20
Others	111	421	1 096
Total	1 774	1 050	2 147

Small facilities as well as part of the medium sized facilities, such as small animal shelters and petrol stations, are not yet requested to report to the authorities.

Air pollutant reporting obligations for plant operators

Annual emissions reporting under the environmental permit

In the environmental permit, or in a plant specific emission monitoring and reporting programme annexed to the permit, requirements are determined on what the operator (i.e. a person or a legal person in charge of a facility) must report to the authorities. The annual reporting obligation of an installation concerns emissions for which the installation has an emission limit value (ELV) in the environmental permit. The monitoring system for these substances is stipulated together with the ELV for these compounds. In the environmental permits ELVs are usually given for emissions of sulphur (as SO_2), particles (as TSP or PM_{10}) and nitrogen oxides (as NO_2), in some cases also for heavy metals, NMVOCs, ammonia, POPs and halogens, but not for greenhouse gases (carbon dioxide, methane, nitrous oxide or F-gases).

E-PRTR reporting

Emissions falling under the European Pollutant Release and Transfer Register (E-PRTR)[14] reporting scheme are reported as total emissions for an industrial site. Those air pollutants that are not included in the reporting requirements under the environmental permits may, however, fall under the reporting requirement of the E-PRTR.

Format and procedure of reporting

The plants report the emissions by individual boilers and processes or as total emissions for an industrial site, according to how the data is stipulated to be reported in the environmental permit.

The operators also report on the types, characteristics and consumption of fuels, though this data may not be as complete as emission data. Information on waste amounts, with official classification codes, to solid waste disposal sites, and wastewater handling data are available from YLVA.

The operators may submit emission reports to the supervising authorities as hard copies, electronically by email or through the Internet (Figure 1.12). The larger industrial installations have systems, which allow direct information flow from the plant information systems to the supervising authority.

The emission data is always checked by the supervising authority before it is recorded into YLVA.

When the operator chooses to send the data over the Internet using the national authorities' centralized data collection system (TYVI)[15] the data is automatically checked for completeness and only the completed data set will be sent to the authorities for further checking.

[14] According to the Finnish Environmental Protection Act paragraph 27.2 the Environmental Protection Register contains information about emission reports and monitoring connected to the environmental permits. The Regional Environmental Centres and municipal authorities are responsible for collecting the data from the operators. This data, as well as the data reported under the EPER or E-PRTR obligations are recorded into the VAHTI data system from where it is available for inventory purposes.

[15] The centralized data collection system TYVI is a consultant service used in various data collection procedures from the companies to the governmental authorities. In addition to the environmental administration also to e.g. the tax authority, the customs and statistics uses the data collection service.

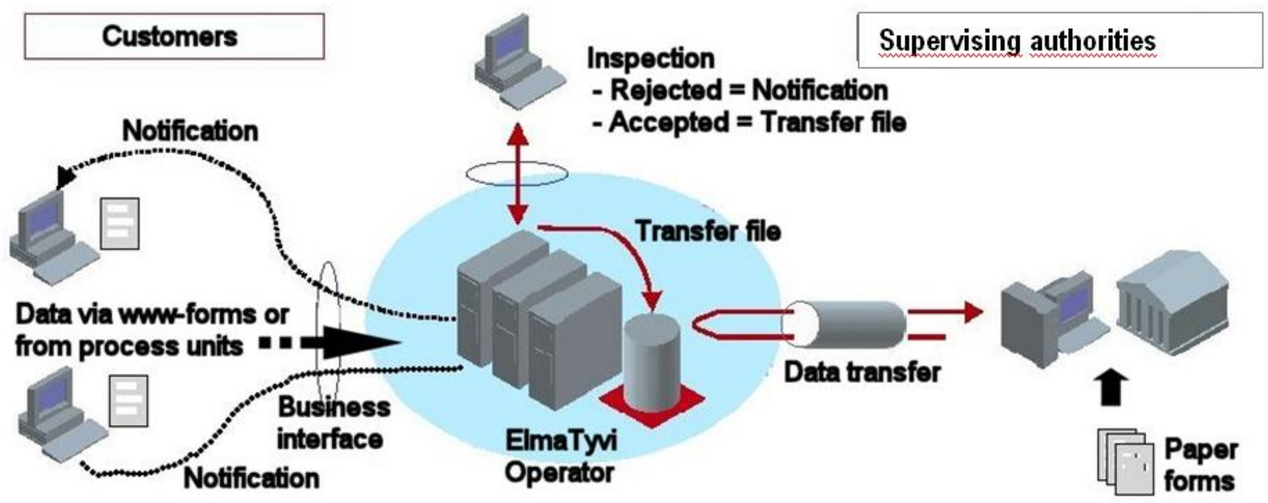

Figure 1.12. Reporting options for the operators.

QA/QC carried out by the supervising authority

When receiving the emission report from the operator the supervising authority checks the correctness of the data as well whether the data is produced according to the methods agreed upon in the environmental permit or in a separate monitoring programme for the plant. The methods usually include the use of international standards or approved in-house methods. The principles of the EU IPPC Reference Document on Monitoring of Emissions (Monitoring BREF) are also followed.

Programme to improve point source data

In 2011-2013 a project (TIVA2) was running in the environmental administration to integrate the contents of YLVA database with corrected and completed data from air and wastewater databases at SYKE to provide the end-users of data the latest and corrected information through a new interface. This means that cross-checks and corrections made e.g. in the air pollutant emission inventory are included in the data available through the new system. The new interface is planned to serve also the needs of a national PRTR system.

Use of EU ETS data

The operators report emissions of carbon dioxide as well as fuel data to the Energy Market Authority that keeps the Emission Trading Register. The annual emission data in the EU ETS was earlier reported mainly on process level but recently only on the level of facilities. This data is available for emission inventory purposes for Statistics Finland and the Finnish Environment Institute.

More details of the use of ETS data in the inventory is provided under the Energy sector in Chapter 4.2.4 Source specific QA/QC and verification.

How data reported to authorities is handled in the inventory

For all substances falling under the substances list of the CLRTAP, default emissions are calculated in the inventory system. These default emissions are used in the preparation of the national inventory. In case the operator reports any emission values, these are compared against the default values calculated in the inventory system and in case found reasonable, included in the inventory in-stead of the default values. In unclear cases, the inventory agency contacts the supervising authorities or the plant operator directly to confirm the correctness of the reported value and the reason behind any deviating values. The comparison between the calculated default values and data reported by the operator can be seen as part of a verification process for both data sets.

In cases where the operator reports only the total emissions of a site, the default emissions calculated for energy production activities (e.g. boilers, turbines etc.) for the site, are used to allocate the total emissions of the site under relevant NFR categories as follows: the default emission value(s) calculated for energy production are subtracted from the total emission of a site and the remainder is reported under the relevant NFR sector (e.g. under an industrial processes sector).

1.3.5 Inter-comparison with greenhouse gas emission inventory data

The calculation systems for the air emissions inventories under the UNECE CLRTAP and EU NECD are separate from the GHG calculation system, but use mostly the same basic data sources for calculating emissions from fuel combustion. The independence of the calculation systems is used as a verification tool for the inventories, and moreover, as a source of additional corrections in point source data. Comparisons between the data in these two calculations systems are performed continuously during the inventory preparation. The annual calculation at Finnish Environment Institute SYKE is performed a bit later than the GHG inventory and, thus, the source data set usually includes more updated data than used in the preliminary EU GHG inventory. The thorough comparison between the Air pollutant and GHG inventories in accordance with the EU Regulation 525/2013 is performed after 15 February and the differences are either corrected or accounted for by the 15 March submissions.

The inter-comparison between Statistics Finland and the Finnish Environment Institute is carried out with data related to the fuel combustion source categories at the aggregation level allowed for statistical confidentiality as presented in Figure 1.13. The inter-comparison is explained in more details under Energy sector in Chapter 4.2.4 Source-specific QA/QC and verification.

The observed omissions and errors are corrected to both inventories according to the results of the inter-comparison. The remaining differences are explained in Chapter 2.4.3. and the results of the comparison of possible differences in the regular annual reports are presented in Appendix 2.

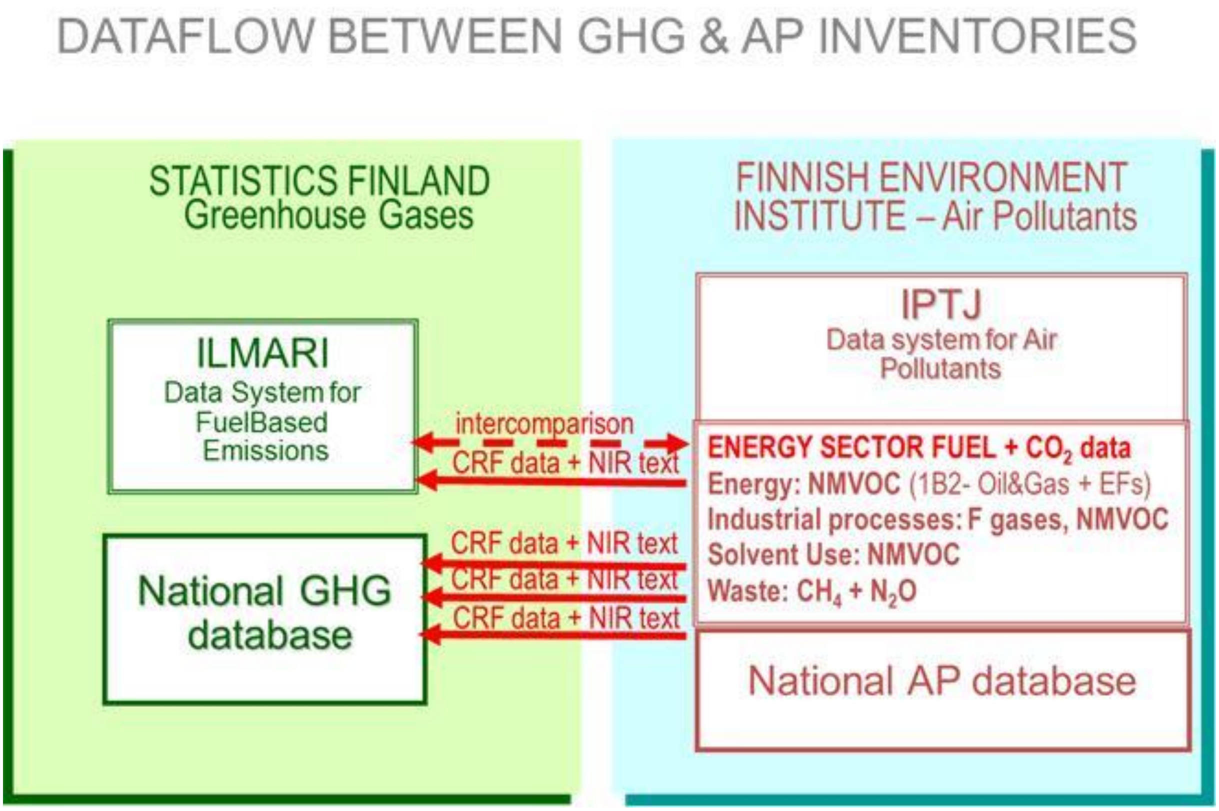

Figure 1.13. Inter-comparison of air emissions inventory data between Statistics Finland and SYKE.

1.4 Methods and data sources

1.4.1 Methodology

Changes in chapter	
November 2017	KS

The EMEP/EEA Emission Inventory Guidebook methodology and national methods are used in the preparation of air pollutant emission inventories. Country specific emission factors and compliance data reported by the operators or emissions estimated by the industrial associations are used when ever they provide better estimates of the national circumstances than the default values.

The Nomenclature for Reporting (NFR) tables are used in reporting the emission figures under the UNECE CLRTAP and the EU NECD.

In this report, compilation of emission data for 2016 is described in details while the compilation of the data for the earlier years is presented at a more general level.

No comprehensive recalculations have been made to the time series, although new sources have been added and major errors identified have been corrected for the earlier years, too.

1.4.2 Differences in the methods between the submissions in 2017 and in 2018

Changes in chapter
March 2019

The purpose is to provide in this chapter a summary of methodological changes in the present inventory compared to the methods used in the previous years, such as introduction of more accurate calculation methods or improved activity data. Recalculations for the whole time series are currently underway and the results will be reported partly in the submission 15 March 2018 and in an additional submission later in spring 2018 after thorough quality checks have been made successfully. A complete recalculation of the inventory was pending for 15 years due to lack of resources allocated to the finalization of the recalculation in the energy sector. Due to the structure of the inventory (see chapter 2.3.2.) this also prevented a complete recalculation of emissions in the industrial processes sector.

Improvements are carried out to follow the latest versions of the EMEP/EEA Emission Inventory Guidebook and on ad hoc basis to correct obvious errors identified in the data for the earlier years More details on improvements carried out for the reporting in 2018 are presented in Chapters 4 – 9, and summarised in Chapter 14.

1.4.3 Differences between emission data reported under different reporting obligations and cooperation between inventory agencies

Changes in chapter	
March 2020	KS

This chapter explains differences between the submissions to the UNECE CLRTAP Secretariat and to the EU NECD to the UNFCCC Secretariat and to the Commission under the European Union CO2 and other greenhouse gas Monitoring Mechanism.

A quantification of differences in the 2019 submissions to the UNFCCC, CLRTAP and NECD regarding data for 2017 are presented in Table 1.5.

Table 1.5 Differences UNFCCC-CLRTAP-NECD

Submissions				Difference %		
2017	**UNFCCC**	**CLRTAP**	**NECD**	**UNFCCC-CLRTAP**	**UNFCCC-NECD**	**CLRTAP-NECD**
SOx	33.66	33.127	33.603	-1.6	-1.6	0
NOx	121.12	126.595	116.169	4.3	4.3	0
NMVOC	95.77	85.317	62.641	12.3	12.3	0
CO	322.91	350.531	359.082	7.9	7.9	0

The differences for NOx and NMVOC emissions are because emissions from agriculture are not yet fully included in the greenhouse gas inventory. For NMVOC and CO, additional differences originate from the method used to calculate emissions from small scale wood combustion, where the greenhouse gas inventory not yet has updated the emission factors.

In addition, some minor differences generally exist for SO_2, NO_x, NMVOC and CO emissions, due to the following reasons:

(1) Energy sector emission data in Finland is calculated in two different calculation systems:

- The data submitted to the UNFCCC Secretariat and to the EU Commission under the CO_2 Monitoring Mechanism Decision is calculated at Statistics Finland, which is the National Inventory Agency for Greenhouse Gas Inventories.
- The data submitted to the UNECE CLRTAP Secretariat and the EU Commission under the EU NECD is calculated at the Finnish Environment Institute, which is responsible for the national inventory of air pollutants and point source inventories (e.g. LCPD).

(2) Allocation of data in the CRF and NFR tables: harmonization of the allocation of emissions has some inherent challenges due to the different reporting formats (CRF and NFR). For instance, it is not always possible to report the same activities under the corresponding CRF/NFR source categories because certain sources fall under a CFR category in the greenhouse gas inventory, while air pollutants generated from the same activity are not related to the given CRF/NFR category and are therefore reported under the main activity of the plant.

(3) The allocation of point sources in the CRF and NFR inventory categories differs somewhat in the data systems of the two institutes. Further cooperation will be carried out during 2017-2019 to harmonize the allocation where possible.

(4) Currently in the time series of the inventories there are certain differences, some of which are related to a different timing of uploading point source data from the compliance reporting database VAHTI (Chapter 2.3.3), as the contents of YLVA is being improved by completing and correcting the data throughout the year, for both the current and the historical years. In cases where deficient data is not corrected in YLVA database, the inventory agencies cooperate to use corrected data in their inventories. Some differences between the two energy sector inventories may also be related to errors and omissions in the inventory databases at Finnish Environment Institute or Statistics Finland. Efforts are made to ensure consistency of the data.

The annual inter-comparisons between Statistics Finland and Finnish Environment Institute are explained in Chapter 2.3.4.

Benefits of the cooperation

Due to intensive cooperation of energy experts at Statistics Finland and SYKE, the two inventory approach in calculation of energy sector emissions can be regarded as an efficient QA/QC tool because errors and omissions are efficiently identified and corrected where found.

NMVOC emissions

NMVOC emissions for other sources than energy are calculated at Finnish Environment Institute and integrated into the CRF tables reported under the UNFCCC and EU MM. Thus the emission data, activity data and methodologies are the same in all of these inventories. Energy sector NMVOC emissions are calculated in both Statistics Finland and SYKE’s calculation systems using the same emission factors. In the 2017 reporting emissions for small scale combustion sources are calculated by the new technology specific model under the CLRTAP and NECD while not yet included in the UNFCCC reporting, where adoption of the new model is underway.

Nitrogen/NH_3 emissions

Nitrogen emissions used as input data in the greenhouse gas inventory are calculated at LUKE (Agrifood Finland) for the use of agriculture sector greenhouse gas emission inventory. The emissions are calculated in the same model (see Chapter 7.1.2 Nitrogen model) as ammonia emissions in the air pollutant emission inventory. The model is accessible for both institutes through the Internet. This guarantees that the source data and emissions are the same in both inventories.

1.4.4 Possibility of differences between the emission inventory reports under the UNECE CLRTAP and the EU NECD

Changes in chapter	
February 2017	KS

Since the revision of the NECD and adoption of the same reporting requirements than the CLRTAP, no differences will be in the reported emissions because a copy of the data submitted under the CLRTAP is reported under the NECD.

The inventories under the UNECE CLRTAP and under the EU NECD are both calculated in the same inventory system at Finnish Environment Institute.

1.5 Key categories

Changes in chapter	
March 2020	TF, KS

According to the Good Practice Guidance for the CLRTAP Emission Inventories, "a key parameter is a parameter that has significant influence on either the inventory of total emissions or trend or their uncertainties". In the CLRTAP Good Practice Guidance, several methods to perform a sensitivity analysis (to find the key parameters) are described. The results of the key category analysis are in accordance with the results received from the RepDab-tool.

The results of the key category analysis are used in prioritizing the inventory improvements. For the Finnish 2018 submission inventory, two of these methods are utilised to find the key parameters, as described below (Tier 1 and Tier 2).

Presentation of key categories for the base years of pollutants will be added to the submission in 2019.

Tier 1 method

A simple approach is used for level evaluation (presented in the EMEP/EEA emission inventory guidebook 2013). The emission categories are sorted according to their contribution to emissions in 2016 for each pollutant. The key categories are those that represent together 80% of the emissions. This approach is applied at the third NFR level.

Tier 2 method
The key category analysis was also carried out at Tier 2 level and the results are used in further development of the inventory but are not published as in many cases the dominating values are measured at large point sources.

Results of the key category analysis

The combined results of the level and trend analysis for the 2020 submission are presented below:

NOx

NFR Code	Fuel	Pollutant	Identification criteria
1A3biii	Diesel oil	NOx	L1, T1
1A2d	Liquid	NOx	L1, T1
1A3bi	Diesel oil	NOx	L1, T1
1A1a	Biomass	NOx	L1, T1
1A1a	Solid	NOx	L1, T1
1A3dii	Liquid	NOx	L1, T1
3Da1		NOx	L1, T1
1A3bii	Diesel oil	NOx	L1, T1
1A4bi	Biomass	NOx	L1, T1
1A3bi	Motor gasoline	NOx	L1, T1
1A4cii	Liquid	NOx	L1, T1
3Da2a		NOx	L1, T1
1A2a	Gaseous	NOx	L1, T1
1A1a	Gaseous	NOx	L1, T1
1A2gvii	Liquid	NOx	L1
1A1a	Peat	NOx	L1
1A2d	Biomass	NOx	L1
1A1a	Liquid	NOx	L1
1A1b	Gaseous	NOx	L1
1A2d	Gaseous	NOx	L1

NMVOC

NFR Code	Fuel	Pollutant	Identification criteria
1A4bi	Biomass	NMVOC	L1, T1
2D3d		NMVOC	L1, T1
3B1a		NMVOC	L1, T1
2D3a		NMVOC	L1, T1
3B1b		NMVOC	L1, T1
1A3bi	Motor gasoline	NMVOC	L1, T1
1A4cii	Liquid	NMVOC	L1, T1
1B2aiv		NMVOC	L1
1A3dii	Liquid	NMVOC	L1
1B2av		NMVOC	L1
1A4bii	Liquid	NMVOC	L1
2B10a		NMVOC	L1
3Da2a		NMVOC	L1
2D3g		NMVOC	L1
2H1		NMVOC	L1
2H2		NMVOC	L1
2D3i		NMVOC	L1
1A3bv		NMVOC	T1
2D3h		NMVOC	T1
1A3biii	Diesel oil	NMVOC	T1
2D3c		NMVOC	T1
1A4aii	Liquid	NMVOC	T1

SOx

NFR Code	Fuel	Pollutant	Identification criteria
1A1a	Solid	SOx	L1, T1
1A1a	Peat	SOx	L1, T1
1A1b	Gaseous	SOx	L1, T1
1A2b	Solid	SOx	L1, T1
2B10a		SOx	L1, T1
1A2d	Liquid	SOx	L1, T1
1A2b	Liquid	SOx	L1, T1
1A1a	Biomass	SOx	L1, T1
2H1		SOx	L1, T1
2C1		SOx	L1, T1
1A1a	Liquid	SOx	L1, T1
1A4ai	Liquid	SOx	L1
1A5a	Liquid	SOx	L1
1A2d	Peat	SOx	L1
1A1b	Liquid	SOx	L1
1A1b	Solid	SOx	T1
1A2d	Solid	SOx	T1
1A2a	Solid	SOx	T1
1A2gviii	Liquid	SOx	T1
1A4ci	Peat	SOx	T1
1A3biii	Diesel oil	SOx	T1

NH3

NFR Code	Fuel	Pollutant	Identification criteria
3Da2a		NH3	L1, T1
3B1a		NH3	L1, T1
3B1b		NH3	L1, T1
3B3		NH3	L1, T1
3B4h		NH3	L1, T1
3Da1		NH3	L1, T1
3Da3		NH3	L1
1A3bi	Motor gasoline	NH3	T1
3B4gii		NH3	T1
1A4bi	Biomass	NH3	T1
3B4e		NH3	T1

PM2.5

NFR Code	Fuel	Pollutant	Identification criteria
1A4bi	Biomass	PM2.5	L1, T1
1A2d	Liquid	PM2.5	L1, T1
1B1c		PM2.5	L1, T1
1A3bvi		PM2.5	L1, T1
1A3bvii		PM2.5	L1, T1
2H2		PM2.5	L1, T1
1A3bi	Diesel oil	PM2.5	L1, T1
1A2gvii	Liquid	PM2.5	L1
1A3dii	Liquid	PM2.5	L1
2B10a		PM2.5	L1
1A3bii	Diesel oil	PM2.5	L1
1A3biii	Diesel oil	PM2.5	T1
2C1		PM2.5	T1
1A4cii	Liquid	PM2.5	T1
2H1		PM2.5	T1
1A1a	Solid	PM2.5	T1
1A1a	Liquid	PM2.5	T1

PM10

NFR Code	Fuel	Pollutant	Identification criteria
1A4bi	Biomass	PM10	L1, T1
1A3bvii		PM10	L1, T1
3Dc		PM10	L1, T1
1B1c		PM10	L1, T1
1A2d	Liquid	PM10	L1, T1
1A3bvi		PM10	L1, T1
1A1a	Biomass	PM10	L1, T1
1A5a	Biomass	PM10	L1, T1
2B10a		PM10	L1
2H2		PM10	L1
1A1a	Solid	PM10	T1
1A3biii	Diesel oil	PM10	T1
2C1		PM10	T1
1A3bi	Diesel oil	PM10	T1
2H1		PM10	T1
1A2d	Biomass	PM10	T1
1A4cii	Liquid	PM10	T1
1A1a	Liquid	PM10	T1

TSP

NFR Code	Fuel	Pollutant	Identification criteria
1A3bvii		TSP	L1, T1
1A4bi	Biomass	TSP	L1, T1
3Dc		TSP	L1, T1
1B1c		TSP	L1, T1
1A5a	Biomass	TSP	L1, T1
1A2d	Liquid	TSP	L1, T1
1A3bvi		TSP	L1, T1
1A1a	Biomass	TSP	L1, T1
1A4ci	Peat	TSP	L1, T1
1A1a	Peat	TSP	L1
2A5c		TSP	L1
1A1a	Solid	TSP	T1
2C1		TSP	T1
1A3biii	Diesel oil	TSP	T1
1A2d	Biomass	TSP	T1
2H1		TSP	T1
1A3bi	Diesel oil	TSP	T1
1A2f	Solid	TSP	T1
1A1a	Liquid	TSP	T1

BC

NFR Code	Fuel	Pollutant	Identification criteria
1A4bi	Biomass	BC	L1, T1
1A2gvii	Liquid	BC	L1, T1
1A3bi	Diesel oil	BC	L1, T1
1A3bvi		BC	L1
1A3bii	Diesel oil	BC	L1
1A3biii	Diesel oil	BC	T1
1A4cii	Liquid	BC	T1

CO

NFR Code	Fuel	Pollutant	Identification criteria
1A4bi	Biomass	CO	L1, T1
1A4bii	Liquid	CO	L1, T1
1A3bi	Motor gasoline	CO	L1, T1
1A4aii	Liquid	CO	L1, T1
1A3dii	Liquid	CO	L1
1A2d	Liquid	CO	L1
1A1a	Biomass	CO	L1

Pb

NFR Code	Fuel	Pollutant	Identification criteria
1A2d	Liquid	Pb	L1, T1
1A1b	Solid	Pb	L1, T1
1A1a	Peat	Pb	L1, T1
2G		Pb	L1, T1
1A2f	Solid	Pb	L1
1A1a	Biomass	Pb	L1
1A4bi	Biomass	Pb	L1
1A3bvi		Pb	L1
1A3bi	Motor gasoline	Pb	T1
2C7c		Pb	T1
2C1		Pb	T1

Cd

NFR Code	Fuel	Pollutant	Identification criteria
1A2d	Liquid	Cd	L1, T1
1A4bi	Biomass	Cd	L1, T1
1A1a	Biomass	Cd	L1, T1
1A1b	Solid	Cd	L1, T1
1A5a	Biomass	Cd	L1
1A4ci	Biomass	Cd	L1
1A2d	Biomass	Cd	L1
1A2f	Solid	Cd	L1
2C7c		Cd	T1
2C6		Cd	T1

Hg

NFR Code	Fuel	Pollutant	Identification criteria
1A2d	Liquid	Hg	L1, T1
2C7c		Hg	L1, T1
1A1a	Solid	Hg	L1, T1
1A2f	Solid	Hg	L1, T1
1A1a	Biomass	Hg	L1, T1
2B10a		Hg	L1, T1
2C1		Hg	L1
1A1a	Peat	Hg	L1
1A4bi	Biomass	Hg	L1
5C1bv		Hg	L1
1A2gviii	Other	Hg	T1
2C1		Hg	T1

As

NFR Code	Fuel	Pollutant	Identification criteria
1A1a	Peat	As	L1, T1
1A1b	Solid	As	L1, T1
2C7c		As	L1, T1
1A2d	Liquid	As	L1, T1
1A4ci	Peat	As	L1, T1
1A2f	Solid	As	L1
1A1a	Solid	As	L1

Cr

NFR Code	Fuel	Pollutant	Identification criteria
1A1b	Solid	Cr	L1, T1
2C1		Cr	L1, T1
1A4bi	Biomass	Cr	L1, T1
1A3bvi		Cr	L1, T1
2C2		Cr	L1, T1
1A1a	Peat	Cr	L1, T1
1A2f	Solid	Cr	L1
1A1a	Solid	Cr	T1
1A1a	Biomass	Cr	T1
1A2e	Solid	Cr	T1

Cu

NFR Code	Fuel	Pollutant	Identification criteria
1A3bvi		Cu	L1, T1
1A1a	Peat	Cu	L1
1A1b	Solid	Cu	L1
2C7c		Cu	T1
1A1a	Solid	Cu	T1

Ni

NFR Code	Fuel	Pollutant	Identification criteria
2C7b		Ni	L1, T1
1A4bi	Biomass	Ni	L1, T1
1A1a	Peat	Ni	L1, T1
2C1		Ni	L1, T1
1A2f	Solid	Ni	L1, T1
1A1b	Liquid	Ni	L1, T1
1A1a	Biomass	Ni	L1, T1
1A5a	Biomass	Ni	L1, T1
1A5a	Liquid	Ni	L1
1A2d	Liquid	Ni	L1
1A4ai	Liquid	Ni	L1
1A3dii	Liquid	Ni	L1
1A2c	Liquid	Ni	L1
2C7b		Ni	T1
1A1a	Solid	Ni	T1
1A1a	Liquid	Ni	T1
1A4ci	Peat	Ni	T1

Se

NFR Code	Fuel	Pollutant	Identification criteria
1A4bi	Biomass	Se	L1, T1
2C7a		Se	L1, T1
1A4ci	Biomass	Se	L1
2C7c		Se	T1

Zn

NFR Code	Fuel	Pollutant	Identification criteria
1A4bi	Biomass	Zn	L1, T1
1A3bvi		Zn	L1, T1
1A1a	Biomass	Zn	L1, T1
1A5a	Biomass	Zn	L1
1A1b	Solid	Zn	L1
1A4ci	Biomass	Zn	L1
1A1a	Other	Zn	L1
2C1		Zn	T1
2C7c		Zn	T1

PCDD/F

NFR Code	Fuel	Pollutant	Identification criteria
1B1b		PCDD/F	L1, T1
1A1a	Biomass	PCDD/F	L1, T1
2C1		PCDD/F	L1, T1
1A4bi	Biomass	PCDD/F	L1, T1
5E		PCDD/F	L1, T1
2C3		PCDD/F	L1, T1
1A1a	Other	PCDD/F	L1
1A1a	Peat	PCDD/F	L1
1A2d	Biomass	PCDD/F	L1
1A2gviii	Other	PCDD/F	L1
1A3bi	Diesel oil	PCDD/F	L1
2B10a		PCDD/F	T1
1A1a	Other	PCDD/F	T1
1A3bi	Motor gasoline	PCDD/F	T1

PAH-4

NFR Code	Fuel	Pollutant	Identification criteria
1A4bi	Biomass	PAH-4	L1
1A1a	Other	PAH-4	T1
1A1a	Biomass	PAH-4	T1
2C1		PAH-4	T1
1A4bi	Liquid	PAH-4	T1
1B1b		PAH-4	T1
1A4ai	Liquid	PAH-4	T1
1A2gviii	Other	PAH-4	T1
1A1a	Liquid	PAH-4	T1
1A2d	Other	PAH-4	T1
1A5a	Liquid	PAH-4	T1
1A2d	Biomass	PAH-4	T1
1A3bi	Motor gasoline	PAH-4	T1

HCB

NFR Code	Fuel	Pollutant	Identification criteria
2B10a		HCB	L1, T1
2C7a		HCB	L1, T1

PCB

NFR Code	Fuel	Pollutant	Identification criteria
2C1		PCB	L1, T1
1A4bi	Biomass	PCB	L1, T1
1B1b		PCB	L1, T1
1A2d	Solid	PCB	T1
1A2f	Solid	PCB	T1
1A2a	Solid	PCB	T1

Trend analysis

The key category assessment by trend for the 2019 submission is presented below.

NOx

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2018 emission of the NFR category	Year 2018 total emission	Unit	Trend assessment	Contribution to trend. %	Cumulative total. %	Key source
1A3bi	Motor	62.636	305.861	3.413	126.595	Gg	0.074	22.072	22.072	Yes
1A3biii	Diesel oil	58.866	305.861	12.897	126.595	Gg	0.037	11.244	33.316	Yes
1A2d	Liquid	7.012	305.861	11.845	126.595	Gg	0.029	8.768	42.084	Yes
1A1a	Solid	36.204	305.861	6.786	126.595	Gg	0.027	8.038	50.122	Yes
1A1a	Biomass	0.805	305.861	7.795	126.595	Gg	0.024	7.316	57.438	Yes
1A3bi	Diesel oil	6.783	305.861	9.350	126.595	Gg	0.021	6.415	63.853	Yes
1A4bi	Biomass	2.903	305.861	4.191	126.595	Gg	0.01	2.931	66.784	Yes
1A3dii	Liquid	9.130	305.861	6.473	126.595	Gg	0.009	2.641	69.425	Yes
1A3bii	Diesel oil	4.439	305.861	4.421	126.595	Gg	0.008	2.533	71.959	Yes
1A4cii	Liquid	12.825	305.861	3.131	126.595	Gg	0.007	2.135	74.094	Yes
1A2a	Gaseous	1.090	305.861	2.277	126.595	Gg	0.006	1.790	75.884	Yes
1A1a	Gaseous	8.866	305.861	1.850	126.595	Gg	0.006	1.784	77.668	Yes
3Da1		9.143	305.861	5.538	126.595	Gg	0.006	1.719	79.387	Yes
3Da2a		3.002	305.861	2.878	126.595	Gg	0.005	1.603	80.990	Yes
1A2d	Biomass	3.752	305.861	3.182	126.595	Gg	0.005	1.598	82.588	
1A1a	Other	0.006	305.861	1.344	126.595	Gg	0.004	1.316	83.904	

1A2gvii	Liquid	12.486	305.861	6.312	126.595	Gg	0.004	1.121	85.025
1A2d	Solid	2.455	305.861	0.042	126.595	Gg	0.003	0.955	85.980
1A5a	Biomass	0.032	305.861	0.963	126.595	Gg	0.003	0.932	86.912
1A1a	Peat	9.791	305.861	4.840	126.595	Gg	0.003	0.772	87.684
1A4bii	Liquid	0.396	305.861	0.887	126.595	Gg	0.002	0.709	88.393
1A3ai(i)	Liquid	0.251	305.861	0.821	126.595	Gg	0.002	0.703	89.096
1A2f	Solid	3.724	305.861	0.889	126.595	Gg	0.002	0.639	89.735
1A4aii	Liquid	5.216	305.861	1.557	126.595	Gg	0.002	0.590	90.326
1A5a	Gaseous	0.247	305.861	0.614	126.595	Gg	0.002	0.502	90.827
1A1b	Gaseous	2.857	305.861	1.691	126.595	Gg	0.002	0.498	91.325
1A3bii	Motor	1.532	305.861	0.139	126.595	Gg	0.002	0.485	91.811
1A2gviii	Other	0.148	305.861	0.503	126.595	Gg	0.001	0.433	92.244
1A2d	Other	0.044	305.861	0.458	126.595	Gg	0.001	0.431	92.675
1A2c	Liquid	0.713	305.861	0.696	126.595	Gg	0.001	0.393	93.068
1A2d	Peat	1.476	305.861	0.998	126.595	Gg	0.001	0.379	93.447
1A5b	Liquid	0.087	305.861	0.390	126.595	Gg	0.001	0.347	93.794
1A4ci	Biomass	0.520	305.861	0.566	126.595	Gg	0.001	0.344	94.137
1A4bi	Liquid	3.105	305.861	0.946	126.595	Gg	0.001	0.333	94.470
1A3c	Liquid	4.212	305.861	1.412	126.595	Gg	0.001	0.325	94.795
1A2gviii	Biomass	0.803	305.861	0.663	126.595	Gg	0.001	0.324	95.119
1A2f	Other	0.580	305.861	0.554	126.595	Gg	0.001	0.308	95.427
1A5a	Liquid	1.961	305.861	1.102	126.595	Gg	0.001	0.285	95.711
3Da3		0.729	305.861	0.543	126.595	Gg	0.001	0.237	95.948
1A2d	Gaseous	3.423	305.861	1.646	126.595	Gg	0.001	0.225	96.173
1A2f	Gaseous	0.35	305.861	0.365	126.595	Gg	0.001	0.216	96.389
1A2a	Other	0.521	305.861	0.0001	126.595	Gg	0.001	0.211	96.600
1A2gviii	Gaseous	0.107	305.861	0.257	126.595	Gg	0.001	0.209	96.810
1A2e	Liquid	0.661	305.861	0.062	126.595	Gg	0.001	0.208	97.017
1A4ai	Biomass	0.156	305.861	0.257	126.595	Gg	0.001	0.188	97.206
1A4ci	Peat	0.040	305.861	0.206	126.595	Gg	0.001	0.186	97.391
1A4ciii	Liquid	3.580	305.861	1.645	126.595	Gg	0.001	0.160	97.551
1A3biv	Motor	0.065	305.861	0.187	126.595	Gg	0.001	0.157	97.708
1A2gviii	Liquid	1.295	305.861	0.386	126.595	Gg	0.0005	0.147	97.855
1A1a	Liquid	3.867	305.861	1.742	126.595	Gg	0.0005	0.139	97.994
1A2b	Solid	0.422	305.861	0.043	126.595	Gg	0.0004	0.129	98.123
1A2a	Solid	1.661	305.861	0.558	126.595	Gg	0.0004	0.126	98.250
1A2a	Liquid	0.316	305.861	0.004	126.595	Gg	0.0004	0.124	98.374
1A2c	Solid	0.346	305.861	0.269	126.595	Gg	0.0004	0.124	98.498
1A2e	Peat	0.165	305.861	0.189	126.595	Gg	0.0004	0.119	98.616
2B2		0.744	305.861	0.428	126.595	Gg	0.0004	0.118	98.734
1A4ai	Liquid	2.314	305.861	0.852	126.595	Gg	0.0003	0.103	98.838
2B10a		0.061	305.861	0.123	126.595	Gg	0.0003	0.096	98.933
3B1b		0.118	305.861	0.138	126.595	Gg	0.0003	0.087	99.020
1A4ci	Liquid	0.739	305.861	0.226	126.595	Gg	0.0003	0.078	99.099
3B4gii		0.027	305.861	0.087	126.595	Gg	0.0002	0.075	99.173
1A3aii(i)	Liquid	0.311	305.861	0.197	126.595	Gg	0.0002	0.067	99.240
1A2gviii	Peat	0.046	305.861	0.077	126.595	Gg	0.0002	0.057	99.297
1A2b	Liquid	0.205	305.861	0.133	126.595	Gg	0.0002	0.047	99.344
1A4bi	Gaseous	0.039	305.861	0.064	126.595	Gg	0.0002	0.047	99.391
1A1b	Liquid	0.232	305.861	0.142	126.595	Gg	0.0001	0.045	99.435
1A2f	Liquid	0.575	305.861	0.195	126.595	Gg	0.0001	0.042	99.478
3B4h		0.041	305.861	0.055	126.595	Gg	0.0001	0.038	99.515
1A4ai	Gaseous	0.043	305.861	0.056	126.595	Gg	0.0001	0.038	99.553
3Da2b		0.088	305.861	0.003	126.595	Gg	0.0001	0.033	99.585
1A1b	Solid	0.231	305.861	0.124	126.595	Gg	0.0001	0.027	99.613
1A2c	Other	0.077	305.861	0.004	126.595	Gg	0.0001	0.027	99.640
1A2c	Biomass	0.062	305.861	0.0004	126.595	Gg	0.0001	0.025	99.665
3B4e		0.016	305.861	0.031	126.595	Gg	0.0001	0.024	99.689
1A2c	Gaseous	0.707	305.861	0.314	126.595	Gg	0.0001	0.021	99.710
3B3		0.068	305.861	0.006	126.595	Gg	0.0001	0.021	99.732
1A2b	Gaseous	0.036	305.861	0.035	126.595	Gg	0.0001	0.020	99.752

3B4gi		0.052	305.861	0.042	126.595	Gg	0.0001	0.020	99.772	
1A4ci	Gaseous	0.061	305.861	0.006	126.595	Gg	0.0001	0.020	99.791	
1A2f	Biomass	0.0002	305.861	0.019	126.595	Gg	0.0001	0.018	99.809	
3B1a		0.136	305.861	0.039	126.595	Gg	0.0001	0.017	99.826	
1A2e	Gaseous	0.090	305.861	0.022	126.595	Gg	0.0001	0.015	99.842	
1A2e	Biomass	0.031	305.861	0.029	126.595	Gg	0.0001	0.015	99.857	
1A4bi	Solid	0.037	305.861	0.001	126.595	Gg	0.00005	0.014	99.871	
1A3biv	Diesel oil	NO	305.861	0.014	126.595	Gg	0.00005	0.014	99.885	
1A2gvii	Gaseous	0.164	305.861	0.081	126.595	Gg	0.00004	0.012	99.897	
1A2e	Solid	0.247	305.861	0.115	126.595	Gg	0.00004	0.012	99.910	
1A4bi	Peat	0.065	305.861	0.015	126.595	Gg	0.00004	0.012	99.921	
3F		0.113	305.861	0.059	126.595	Gg	0.00004	0.012	99.933	
3B4giii		0.001	305.861	0.009	126.595	Gg	0.00003	0.009	99.942	
1A4ai	Peat	0.015	305.861	0.015	126.595	Gg	0.00003	0.008	99.950	
3B2		0.007	305.861	0.011	126.595	Gg	0.00003	0.008	99.958	
1A4ci	Solid	0.024	305.861	0.017	126.595	Gg	0.00002	0.007	99.966	
1A3biii	Gaseous	NO	305.861	0.006	126.595	Gg	0.00002	0.006	99.972	
1A2b	Other	0.001	305.861	0.005	126.595	Gg	0.00002	0.005	99.976	
1A2gviii	Solid	0.010	305.861	0.00003	126.595	Gg	0.00001	0.004	99.980	
1A3ei	Gaseous	0.009	305.861	0.008	126.595	Gg	0.00001	0.004	99.984	
1A4ai	Other	0.011	305.861	0.001	126.595	Gg	0.00001	0.003	99.987	
1A2a	Biomass	NO	305.861	0.003	126.595	Gg	0.00001	0.003	99.990	
1A2e	Other	0.001	305.861	0.003	126.595	Gg	0.00001	0.003	99.993	
1A3bi	Gaseous	NO	305.861	0.002	126.595	Gg	0.000006	0.002	99.995	
2G		0.01	305.861	0.006	126.595	Gg	0.000006	0.002	99.997	
1A4bi	Other	0.003	305.861	0.0001	126.595	Gg	0.000004	0.001	99.998	
3B4giv		0.007	305.861	0.004	126.595	Gg	0.000003	0.001	99.999	
1A4ci	Other	0.001	305.861	0.00002	126.595	Gg	0.000001	0.0004	99.999	
1A3bii	Gaseous	NO	305.861	0.0003	126.595	Gg	0.000001	0.0003	100	
3B4d		0.0005	305.861	0.0004	126.595	Gg	0.000001	0.0002	100	

NMVOC

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2018 emission of the NFR category	Year 2018 total emission	Unit	Trend assessment	Contribution to trend. %	Cumulative total. %	Key source
1A3bi	Motor	49.364	231.091	1.613	85.317	Gg	0.072	22.511	22.511	Yes
1A4bi	Biomass	13.796	231.091	21.285	85.317	Gg	0.07	21.941	44.452	Yes
2D3a		3.581	231.091	5.031	85.317	Gg	0.016	5.026	49.478	Yes
1A3bv		13.655	231.091	1.349	85.317	Gg	0.016	5.004	54.482	Yes
2D3d		27.500	231.091	6.538	85.317	Gg	0.016	4.898	59.380	Yes
3B1a		7.633	231.091	6.294	85.317	Gg	0.015	4.710	64.090	Yes
2D3h		8.800	231.091	0.661	85.317	Gg	0.011	3.507	67.597	Yes
3B1b		3.720	231.091	3.939	85.317	Gg	0.011	3.477	71.074	Yes
1A3biii	Diesel oil	7.843	231.091	0.365	85.317	Gg	0.011	3.429	74.504	Yes
2D3c		6.260	231.091	0.202	85.317	Gg	0.009	2.858	77.361	Yes
1A4aii	Liquid	6.267	231.091	0.526	85.317	Gg	0.008	2.423	79.784	Yes
1A4cii	Liquid	6.642	231.091	1.438	85.317	Gg	0.004	1.374	81.159	Yes
2I		1.070	231.091	1.322	85.317	Gg	0.004	1.257	82.415	
1A1a	Biomass	0.094	231.091	0.796	85.317	Gg	0.003	1.032	83.447	
3Da2a		4.080	231.091	2.245	85.317	Gg	0.003	1.001	84.448	
2H2		2.523	231.091	1.661	85.317	Gg	0.003	0.989	85.437	
2D3i		2.085	231.091	1.493	85.317	Gg	0.003	0.981	86.417	
2H1		2.966	231.091	1.759	85.317	Gg	0.003	0.900	87.317	
3B4h		1.237	231.091	1.116	85.317	Gg	0.003	0.894	88.211	
1A3dii	Liquid	9.646	231.091	2.937	85.317	Gg	0.003	0.846	89.057	
3B4gii		0.224	231.091	0.686	85.317	Gg	0.003	0.817	89.874	
1A3bii	Motor	1.669	231.091	0.045	85.317	Gg	0.002	0.774	90.648	
2D3e		2.638	231.091	0.439	85.317	Gg	0.002	0.724	91.372	
1B2aiv		6.600	231.091	2.948	85.317	Gg	0.002	0.694	92.066	

2B10a		7.836	231.091	2.403	85.317	Gg	0.002	0.664	92.730
1A2gvii	Liquid	2.115	231.091	1.190	85.317	Gg	0.002	0.554	93.284
2D3g		3.956	231.091	1.856	85.317	Gg	0.002	0.536	93.82
1A4ci	Peat	0.080	231.091	0.412	85.317	Gg	0.002	0.518	94.338
1A3bi	Diesel oil	1.332	231.091	0.113	85.317	Gg	0.002	0.514	94.852
3De		1.062	231.091	0.732	85.317	Gg	0.001	0.461	95.313
1A1a	Other	0.001	231.091	0.337	85.317	Gg	0.001	0.456	95.769
1A4bii	Liquid	6.597	231.091	2.702	85.317	Gg	0.001	0.361	96.130
1A3biv	Motor	2.767	231.091	1.255	85.317	Gg	0.001	0.317	96.447
2C1		1.027	231.091	0.181	85.317	Gg	0.001	0.269	96.716
3B4e		0.153	231.091	0.249	85.317	Gg	0.001	0.261	96.977
1A1a	Peat	0.199	231.091	0.211	85.317	Gg	0.001	0.186	97.164
3B2		0.105	231.091	0.168	85.317	Gg	0.001	0.175	97.339
1B2b		0.255	231.091	0.22	85.317	Gg	0.001	0.1700	97.509
3B4gi		0.256	231.091	0.212	85.317	Gg	0.001	0.159	97.668
2B10b		0.134	231.091	0.158	85.317	Gg	0.0005	0.147	97.815
1A1a	Solid	0.117	231.091	0.151	85.317	Gg	0.0005	0.146	97.961
1B2av		7.411	231.091	2.841	85.317	Gg	0.0005	0.142	98.103
3B3		0.428	231.091	0.257	85.317	Gg	0.0004	0.134	98.237
1A5a	Biomass	0.014	231.091	0.096	85.317	Gg	0.0004	0.124	98.361
1A3ai(i)	Liquid	0.056	231.091	0.107	85.317	Gg	0.0004	0.118	98.478
1A2gviii	Biomass	0.199	231.091	0.150	85.317	Gg	0.0003	0.104	98.582
1A1a	Gaseous	0.042	231.091	0.092	85.317	Gg	0.0003	0.103	98.686
1A3biv	Diesel oil	NO	231.091	0.070	85.317	Gg	0.0003	0.095	98.780
1A2d	Liquid	0.271	231.091	0.170	85.317	Gg	0.0003	0.094	98.875
1B1b		0.037	231.091	0.066	85.317	Gg	0.0002	0.071	98.946
1A5a	Gaseous	0.025	231.091	0.061	85.317	Gg	0.0002	0.071	99.017
1A2d	Biomass	0.333	231.091	0.170	85.317	Gg	0.0002	0.063	99.080
1A1b	Gaseous	0.009	231.091	0.048	85.317	Gg	0.0002	0.060	99.140
1A5b	Liquid	0.028	231.091	0.044	85.317	Gg	0.0001	0.046	99.186
3B4giii		0.007	231.091	0.035	85.317	Gg	0.0001	0.044	99.230
1A2gvii	Gaseous	0.251	231.091	0.122	85.317	Gg	0.0001	0.040	99.269
3F		0.253	231.091	0.122	85.317	Gg	0.0001	0.039	99.309
1A2a	Gaseous	0.124	231.091	0.017	85.317	Gg	0.0001	0.039	99.347
1A2gviii	Gaseous	0.002	231.091	0.029	85.317	Gg	0.0001	0.038	99.385
2D3b		0.900	231.091	0.359	85.317	Gg	0.0001	0.037	99.422
1A4bi	Solid	0.074	231.091	0.002	85.317	Gg	0.0001	0.035	99.457
2C7b		0.010	231.091	0.029	85.317	Gg	0.0001	0.034	99.491
3Da3		0.104	231.091	0.062	85.317	Gg	0.0001	0.033	99.524
1A4ciii	Liquid	0.144	231.091	0.073	85.317	Gg	0.0001	0.027	99.551
1A4bi	Peat	0.130	231.091	0.030	85.317	Gg	0.0001	0.024	99.576
1A5a	Liquid	0.099	231.091	0.054	85.317	Gg	0.0001	0.024	99.600
1A2d	Other	0.0003	231.091	0.017	85.317	Gg	0.0001	0.023	99.623
1A4ai	Peat	0.016	231.091	0.021	85.317	Gg	0.0001	0.021	99.644
1A2d	Peat	0.018	231.091	0.022	85.317	Gg	0.0001	0.020	99.664
1A4ci	Biomass	0.02	231.091	0.021	85.317	Gg	0.0001	0.019	99.683
1A1b	Solid	NO	231.091	0.014	85.317	Gg	0.0001	0.019	99.701
1A1b	Liquid	0.002	231.091	0.014	85.317	Gg	0.0001	0.018	99.720
1A2gviii	Other	0.011	231.091	0.018	85.317	Gg	0.0001	0.018	99.738
1A2d	Solid	0.038	231.091	0.001	85.317	Gg	0.0001	0.018	99.756
1A4bi	Liquid	0.194	231.091	0.059	85.317	Gg	0.0001	0.017	99.773
1A3aii(i)	Liquid	0.056	231.091	0.033	85.317	Gg	0.0001	0.017	99.790
1A2e	Peat	0.012	231.091	0.015	85.317	Gg	0.00005	0.015	99.804
1A3c	Liquid	0.234	231.091	0.076	85.317	Gg	0.00004	0.014	99.818
1A2f	Other	NO	231.091	0.010	85.317	Gg	0.00004	0.013	99.832
2G		0.027	231.091	0.020	85.317	Gg	0.00004	0.013	99.845
5D2		0.022	231.091	0.018	85.317	Gg	0.00004	0.013	99.858
1A2c	Gaseous	0.003	231.091	0.010	85.317	Gg	0.00004	0.011	99.870
5D1		0.003	231.091	0.009	85.317	Gg	0.00004	0.011	99.881
5A		0.234	231.091	0.079	85.317	Gg	0.00003	0.010	99.891
1A2d	Gaseous	0.077	231.091	0.021	85.317	Gg	0.00003	0.010	99.900

1A4ai	Biomass	0.007	231.091	0.010	85.317	Gg	0.00003	0.010	99.910
1A3bii	Diesel oil	0.796	231.091	0.301	85.317	Gg	0.00003	0.009	99.919
1A1a	Liquid	0.029	231.091	0.016	85.317	Gg	0.00003	0.008	99.927
1A4ai	Liquid	0.125	231.091	0.052	85.317	Gg	0.00003	0.008	99.935
1A4bi	Gaseous	0.004	231.091	0.006	85.317	Gg	0.00002	0.007	99.942
1A4ai	Gaseous	0.003	231.091	0.005	85.317	Gg	0.00002	0.006	99.948
2L		0.013	231.091	0.001	85.317	Gg	0.00002	0.006	99.953
2C7c		0.025	231.091	0.006	85.317	Gg	0.00001	0.005	99.958
3B4d		0.004	231.091	0.004	85.317	Gg	0.00001	0.004	99.961
2A1		0.054	231.091	0.022	85.317	Gg	0.00001	0.003	99.964
3B4giv		0.041	231.091	0.017	85.317	Gg	0.00001	0.003	99.967
1A2gviii	Liquid	0.017	231.091	0.004	85.317	Gg	0.00001	0.003	99.970
1A4ci	Liquid	0.043	231.091	0.014	85.317	Gg	0.00001	0.003	99.973
2C2		NO	231.091	0.002	85.317	Gg	0.00001	0.002	99.975
1A2e	Biomass	0.007	231.091	0.004	85.317	Gg	0.00001	0.002	99.977
1A2gviii	Peat	0.002	231.091	0.002	85.317	Gg	0.00001	0.002	99.980
1A2f	Biomass	0.000004	231.091	0.002	85.317	Gg	0.00001	0.002	99.982
1A2e	Liquid	0.005	231.091	0.0005	85.317	Gg	0.00001	0.002	99.984
1A2f	Gaseous	0.004	231.091	0.003	85.317	Gg	0.00001	0.002	99.986
1A2e	Other	0.0003	231.091	0.001	85.317	Gg	0.00001	0.002	99.987
1A2c	Solid	0.004	231.091	0.0001	85.317	Gg	0.00001	0.002	99.989
2C6		0.001	231.091	0.001	85.317	Gg	0.000005	0.001	99.991
1A2f	Liquid	0.004	231.091	0.0004	85.317	Gg	0.000004	0.001	99.992
1A3bi	Gaseous	NO	231.091	0.001	85.317	Gg	0.000004	0.001	99.993
2C7a		NO	231.091	0.001	85.317	Gg	0.000002	0.001	99.994
1A2a	Biomass	NO	231.091	0.001	85.317	Gg	0.000002	0.001	99.995
1A2e	Solid	0.007	231.091	0.003	85.317	Gg	0.000002	0.001	99.995
1A2a	Liquid	0.002	231.091	0.0002	85.317	Gg	0.000002	0.001	99.996
1A2b	Liquid	0.001	231.091	0.001	85.317	Gg	0.000002	0.001	99.996
1A4ci	Gaseous	0.002	231.091	0.001	85.317	Gg	0.000002	0.0005	99.997
1A2b	Gaseous	0.0002	231.091	0.0004	85.317	Gg	0.000001	0.0005	99.997
1A2c	Biomass	0.002	231.091	0.0003	85.317	Gg	0.000001	0.0004	99.998
1A3biii	Gaseous	NO	231.091	0.0003	85.317	Gg	0.000001	0.0004	99.998
1A2c	Liquid	0.003	231.091	0.001	85.317	Gg	0.000001	0.0003	99.999
1A2f	Solid	0.009	231.091	0.004	85.317	Gg	0.000001	0.0003	99.999
1A4ci	Solid	0.001	231.091	0.0004	85.317	Gg	0.000001	0.0003	99.999
1A3bii	Gaseous	NO	231.091	0.0002	85.317	Gg	0.000001	0.0002	99.999
1A2gviii	Solid	0.0005	231.091	0.00003	85.317	Gg	0.000001	0.0002	100
1A3ei	Gaseous	0.00004	231.091	0.0001	85.317	Gg	0.0000005	0.0001	100
1A2b	Solid	0.0005	231.091	0.0002	85.317	Gg	0.0000003	0.0001	100
1A4bi	Other	0.0002	231.091	0.00001	85.317	Gg	0.0000003	0.0001	100
2A3		0.001	231.091	0.001	85.317	Gg	0.0000003	0.0001	100
1A2e	Gaseous	0.001	231.091	0.0004	85.317	Gg	0.0000001	0.00002	100
1A4ci	Other	NO	231.091	0.0000005	85.317	Gg	2E-09	0.000001	100

SOx

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2018 emission of the NFR category	Year 2018 total emission	Unit	Trend assessment	Contribution to trend. %	Cumulative total. %	Key source
1A1b	Gaseous	1.599	248.768	3.636	33.127	Gg	0.014	12.793	12.793	Yes
1A1a	Peat	8.877	248.768	4.335	33.127	Gg	0.013	11.785	24.578	Yes
2H1		22.811	248.768	0.903	33.127	Gg	0.009	7.978	32.556	Yes
1A2d	Liquid	24.674	248.768	1.405	33.127	Gg	0.008	7.030	39.586	Yes
1A1b	Solid	15.681	248.768	0.265	33.127	Gg	0.007	6.814	46.399	Yes
1A1a	Liquid	16.69	248.768	0.722	33.127	Gg	0.006	5.610	52.009	Yes
1A2b	Solid	4.034	248.768	1.910	33.127	Gg	0.006	5.131	57.140	Yes
1A1a	Biomass	0.547	248.768	1.308	33.127	Gg	0.005	4.614	61.754	Yes
1A1a	Solid	50.545	248.768	5.750	33.127	Gg	0.004	3.667	65.421	Yes

1A2b	Liquid	4.045	248.768	1.373	33.127	Gg	0.003	3.120	68.542	Yes
1A2d	Solid	6.141	248.768	0.009	33.127	Gg	0.003	3.024	71.565	Yes
1A2a	Solid	6.995	248.768	0.221	33.127	Gg	0.003	2.656	74.222	Yes
1A2gviii	Liquid	4.979	248.768	0.209	33.127	Gg	0.002	1.699	75.920	Yes
1A4ci	Peat	0.072	248.768	0.371	33.127	Gg	0.001	1.350	77.271	Yes
2C1		2.867	248.768	0.739	33.127	Gg	0.001	1.336	78.606	Yes
1A3biii	Diesel oil	2.738	248.768	0.016	33.127	Gg	0.001	1.304	79.911	Yes
2B10a		13.894	248.768	1.538	33.127	Gg	0.001	1.165	81.076	Yes
1A4ai	Liquid	10.103	248.768	1.045	33.127	Gg	0.001	1.124	82.200	
1A2f	Solid	1.111	248.768	0.400	33.127	Gg	0.001	0.941	83.141	
1A2c	Gaseous	1.839	248.768	0.004	33.127	Gg	0.001	0.899	84.040	
1A4bi	Biomass	0.181	248.768	0.262	33.127	Gg	0.001	0.889	84.929	
1A1a	Other	0.027	248.768	0.226	33.127	Gg	0.001	0.831	85.760	
1A2e	Solid	0.783	248.768	0.302	33.127	Gg	0.001	0.738	86.498	
1A2d	Biomass	1.155	248.768	0.348	33.127	Gg	0.001	0.726	87.224	
1A5a	Biomass	0.008	248.768	0.193	33.127	Gg	0.001	0.716	87.940	
1A2a	Liquid	1.958	248.768	0.072	33.127	Gg	0.001	0.706	88.646	
1A2c	Liquid	3.311	248.768	0.614	33.127	Gg	0.001	0.647	89.293	
1A4ci	Liquid	3.231	248.768	0.260	33.127	Gg	0.001	0.637	89.931	
1A2e	Liquid	3.245	248.768	0.264	33.127	Gg	0.001	0.629	90.559	
1A2f	Liquid	1.827	248.768	0.083	33.127	Gg	0.001	0.599	91.158	
1A2gviii	Biomass	0.276	248.768	0.175	33.127	Gg	0.001	0.516	91.674	
1A3dii	Liquid	1.650	248.768	0.084	33.127	Gg	0.001	0.506	92.180	
1A2gvii	Liquid	1.003	248.768	0.004	33.127	Gg	0.001	0.482	92.662	
1A4cii	Liquid	0.986	248.768	0.003	33.127	Gg	0.001	0.479	93.142	
1A1b	Liquid	4.507	248.768	0.727	33.127	Gg	0.001	0.474	93.616	
1A2c	Solid	0.962	248.768	0.003	33.127	Gg	0.001	0.466	94.082	
1A1a	Gaseous	0.002	248.768	0.117	33.127	Gg	0.0005	0.438	94.519	
1A3bi	Diesel oil	0.909	248.768	0.009	33.127	Gg	0.0005	0.420	94.940	
2C7a		0.0002	248.768	0.111	33.127	Gg	0.0004	0.415	95.355	
1A2d	Gaseous	0.239	248.768	0.135	33.127	Gg	0.0004	0.387	95.741	
1A3bi	Motor	0.860	248.768	0.019	33.127	Gg	0.0004	0.359	96.100	
1A3bii	Diesel oil	0.705	248.768	0.003	33.127	Gg	0.0004	0.338	96.438	
1A2e	Peat	0.230	248.768	0.098	33.127	Gg	0.0003	0.254	96.691	
1A2gviii	Peat	0.019	248.768	0.063	33.127	Gg	0.0002	0.225	96.916	
1A5a	Gaseous	0.0001	248.768	0.058	33.127	Gg	0.0002	0.218	97.134	
1A3c	Liquid	0.438	248.768	0.0002	33.127	Gg	0.0002	0.217	97.351	
1A4aii	Liquid	0.409	248.768	0.001	33.127	Gg	0.0002	0.199	97.550	
1B1b		0.795	248.768	0.053	33.127	Gg	0.0002	0.198	97.748	
1A4ci	Solid	0.093	248.768	0.064	33.127	Gg	0.0002	0.193	97.941	
1A3ai(i)	Liquid	0.021	248.768	0.050	33.127	Gg	0.0002	0.178	98.119	
1A2d	Peat	5.876	248.768	0.741	33.127	Gg	0.0002	0.154	98.273	
1A2gviii	Other	0.307	248.768	0.079	33.127	Gg	0.0002	0.141	98.413	
1A5a	Liquid	5.951	248.768	0.755	33.127	Gg	0.0002	0.140	98.554	
1A2a	Gaseous	0.271	248.768	0.073	33.127	Gg	0.0001	0.136	98.690	
1A2f	Gaseous	0.064	248.768	0.043	33.127	Gg	0.0001	0.130	98.820	
1A4ci	Biomass	0.033	248.768	0.038	33.127	Gg	0.0001	0.127	98.947	
1A4bi	Solid	0.290	248.768	0.005	33.127	Gg	0.0001	0.126	99.072	
1A5b	Liquid	0.007	248.768	0.032	33.127	Gg	0.0001	0.116	99.189	
1A4ciii	Liquid	0.195	248.768	0.0003	33.127	Gg	0.0001	0.096	99.284	
1A2gviii	Gaseous	0.028	248.768	0.029	33.127	Gg	0.0001	0.095	99.379	
1A2d	Other	0.390	248.768	0.076	33.127	Gg	0.0001	0.090	99.469	
1A4ai	Peat	0.016	248.768	0.022	33.127	Gg	0.0001	0.075	99.544	
2C7b		0.004	248.768	0.015	33.127	Gg	0.0001	0.056	99.600	
1A4ai	Biomass	0.010	248.768	0.016	33.127	Gg	0.0001	0.055	99.655	
1A4bi	Peat	0.117	248.768	0.027	33.127	Gg	0.00005	0.043	99.698	
2D3i		0.089	248.768	0.001	33.127	Gg	0.00004	0.042	99.739	
1A4bi	Liquid	4.226	248.768	0.552	33.127	Gg	0.00004	0.041	99.780	
1A3aii(i)	Liquid	0.021	248.768	0.014	33.127	Gg	0.00004	0.041	99.821	
1A2f	Biomass	0.0001	248.768	0.006	33.127	Gg	0.00003	0.024	99.845	
3F		0.015	248.768	0.008	33.127	Gg	0.00002	0.022	99.867	

1A2f	Other	0.033	248.768	0.010	33.127	Gg	0.00002	0.020	99.887	
1A2c	Biomass	0.038	248.768	0.0001	33.127	Gg	0.00002	0.018	99.905	
1A3bii	Motor	0.032	248.768	0.0001	33.127	Gg	0.00002	0.015	99.921	
2G		0.001	248.768	0.004	33.127	Gg	0.00002	0.015	99.936	
1A4bii	Liquid	0.032	248.768	0.001	33.127	Gg	0.00001	0.013	99.949	
1A2gviii	Solid	0.023	248.768	0.00001	33.127	Gg	0.00001	0.011	99.960	
1A2c	Other	0.044	248.768	0.008	33.127	Gg	0.00001	0.009	99.969	
1A2e	Other	0.001	248.768	0.002	33.127	Gg	0.00001	0.008	99.977	
2C2		NO	248.768	0.002	33.127	Gg	0.00001	0.007	99.984	
2L		NO	248.768	0.001	33.127	Gg	0.00001	0.005	99.989	
1A2a	Biomass	NO	248.768	0.001	33.127	Gg	0.00001	0.005	99.994	
1A2b	Gaseous	0.0000004	248.768	0.0004	33.127	Gg	0.000002	0.001	99.995	
1A3biv	Motor	0.007	248.768	0.001	33.127	Gg	0.000001	0.001	99.997	
2D3g		0.002	248.768	0.00001	33.127	Gg	0.000001	0.001	99.998	
1A2e	Gaseous	0.005	248.768	0.001	33.127	Gg	0.000001	0.001	99.999	
1A2e	Biomass	0.025	248.768	0.004	33.127	Gg	0.000001	0.001	99.999	
1A4bi	Other	0.0004	248.768	0.00001	33.127	Gg	0.0000002	0.0002	99.999	
1A4ai	Gaseous	0.00003	248.768	0.00004	33.127	Gg	0.0000002	0.0002	99.999	
1A4bi	Gaseous	0.00002	248.768	0.00004	33.127	Gg	0.0000002	0.0001	100	
2C7c		0.001	248.768	0.0001	33.127	Gg	0.0000001	0.0001	100	
1A3biv	Diesel oil	NO	248.768	0.00003	33.127	Gg	0.0000001	0.0001	100	
1A4ci	Other	NO	248.768	0.00002	33.127	Gg	0.0000001	0.0001	100	
1A2gvii	Gaseous	0.0001	248.768	0.000005	33.127	Gg	0.0000001	0.00005	100	
1A3bi	Gaseous	NO	248.768	0.00001	33.127	Gg	3E-08	0.00002	100	
1A3ei	Gaseous	0.000002	248.768	0.000005	33.127	Gg	2E-08	0.00002	100	
1A3biii	Gaseous	NO	248.768	0.000002	33.127	Gg	1E-08	0.00001	100	
1A4ci	Gaseous	0.00002	248.768	0.000002	33.127	Gg	4E-09	0.000004	100	
1A3bii	Gaseous	NO	248.768	0.000001	33.127	Gg	4E-09	0.000004	100	

NH3

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2018 emission of the NFR category	Year 2018 total emission	Unit	Trend assessment	Contribution to trend. %	Cumulative total. %	Key source
3Da2a		9.487	34.785	7.008	32.189	Gg	0.051	18.542	18.542	Yes
3Da1		3.733	34.785	2.058	32.189	Gg	0.040	14.626	33.168	Yes
3B1b		4.210	34.785	4.964	32.189	Gg	0.031	11.179	44.347	Yes
3B4h		1.837	34.785	2.487	32.189	Gg	0.023	8.241	52.588	Yes
3B3		3.979	34.785	3.075	32.189	Gg	0.017	6.347	58.935	Yes
3B1a		5.504	34.785	5.676	32.189	Gg	0.017	6.106	65.041	Yes
1A3bi	Motor	0.235	34.785	0.769	32.189	Gg	0.016	5.771	70.812	Yes
3B4gii		0.206	34.785	0.669	32.189	Gg	0.014	5.010	75.822	Yes
1A4bi	Biomass	0.831	34.785	1.155	32.189	Gg	0.011	4.042	79.864	Yes
3B4e		0.386	34.785	0.693	32.189	Gg	0.010	3.518	83.382	Yes
2H1		0.542	34.785	0.199	32.189	Gg	0.009	3.166	86.548	
2B10a		0.582	34.785	0.306	32.189	Gg	0.007	2.431	88.979	
3Da3		1.654	34.785	1.347	32.189	Gg	0.005	1.928	90.906	
5E		0.275	34.785	0.381	32.189	Gg	0.004	1.325	92.232	
2D3i		0.097	34.785	0.213	32.189	Gg	0.004	1.290	93.522	
3B2		0.072	34.785	0.177	32.189	Gg	0.003	1.159	94.680	
3B4giii		0.009	34.785	0.072	32.189	Gg	0.002	0.663	95.344	
5B1		0.035	34.785	0.091	32.189	Gg	0.002	0.613	95.957	
3B4giv		0.103	34.785	0.040	32.189	Gg	0.002	0.580	96.537	
3Da2b		0.060	34.785	0.002	32.189	Gg	0.002	0.560	97.096	
2D3e		0.061	34.785	0.004	32.189	Gg	0.002	0.548	97.644	
3F		0.109	34.785	0.057	32.189	Gg	0.001	0.461	98.105	
2C1		0.003	34.785	0.044	32.189	Gg	0.001	0.427	98.533	
3B4gi		0.535	34.785	0.463	32.189	Gg	0.001	0.336	98.868	
2G		0.042	34.785	0.013	32.189	Gg	0.001	0.271	99.140	

1A3bi	Diesel oil	0.005	34.785	0.026	32.189	Gg	0.001	0.224	99.363	
1A3biii	Diesel oil	0.010	34.785	0.028	32.189	Gg	0.001	0.199	99.562	
2C7b		0.100	34.785	0.084	32.189	Gg	0.0002	0.089	99.652	
2L		0.020	34.785	0.025	32.189	Gg	0.0002	0.069	99.720	
1A3bii	Diesel oil	0.003	34.785	0.008	32.189	Gg	0.0001	0.054	99.774	
1A1a	Other	0.001	34.785	0.004	32.189	Gg	0.0001	0.029	99.803	
5D1		0.001	34.785	0.003	32.189	Gg	0.0001	0.029	99.832	
1A3bi	Gaseous	NO	34.785	0.003	32.189	Gg	0.0001	0.027	99.859	
1A4ai	Biomass	0.003	34.785	0.005	32.189	Gg	0.0001	0.023	99.882	
3B4d		0.005	34.785	0.007	32.189	Gg	0.0001	0.020	99.902	
1A4ci	Biomass	0.011	34.785	0.012	32.189	Gg	0.00005	0.018	99.920	
1B1b		0.002	34.785	0.003	32.189	Gg	0.00004	0.016	99.936	
1A2gviii	Other	NO	34.785	0.001	32.189	Gg	0.00004	0.014	99.949	
1A3biv	Motor	0.001	34.785	0.002	32.189	Gg	0.00004	0.013	99.962	
2D3g		0.003	34.785	0.004	32.189	Gg	0.00003	0.011	99.973	
1A2gvii	Liquid	0.002	34.785	0.003	32.189	Gg	0.00002	0.008	99.982	
1A3bii	Gaseous	NO	34.785	0.0003	32.189	Gg	0.00001	0.003	99.985	
1A3c	Liquid	0.0004	34.785	0.0001	32.189	Gg	0.00001	0.003	99.987	
2C7c		0.0002	34.785	0.00002	32.189	Gg	0.00001	0.002	99.989	
1A4ciii	Liquid	0.0004	34.785	0.0002	32.189	Gg	0.00001	0.002	99.991	
1A4cii	Liquid	0.002	34.785	0.002	32.189	Gg	0.000005	0.002	99.993	
1A4aii	Liquid	0.001	34.785	0.001	32.189	Gg	0.000004	0.001	99.994	
1A4bii	Liquid	0.0002	34.785	0.0003	32.189	Gg	0.000003	0.001	99.996	
1A3biii	Gaseous	NO	34.785	0.0001	32.189	Gg	0.000003	0.001	99.997	
1A3bii	Motor	0.002	34.785	0.002	32.189	Gg	0.000003	0.001	99.998	
1A3dii	Liquid	0.001	34.785	0.001	32.189	Gg	0.000002	0.001	99.999	
1A3biv	Diesel oil	NO	34.785	0.0001	32.189	Gg	0.000002	0.001	99.999	
1A2gvii	Gaseous	0.0001	34.785	0.00003	32.189	Gg	0.000001	0.0003	100	
1A5a	Liquid	0.0001	34.785	0.0001	32.189	Gg	0.0000005	0.0002	100	
1A4bi	Solid	0.00002	34.785	0.000002	32.189	Gg	0.0000004	0.0001	100	
1A2b	Other	NO	34.785	0.000002	32.189	Gg	0.0000001	0.00002	100	

PM2.5

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2018 emission of the NFR category	Year 2018 total emission	Unit	Trend assessment	Contribution to trend. %	Cumulative total. %	Key source
1A4bi	Biomass	6.628	46.430	8.968	17.798	Gg	0.138	34.619	34.619	Yes
1A2d	Liquid	9.021	46.430	1.207	17.798	Gg	0.048	12.123	46.742	Yes
1A3biii	Diesel oil	4.287	46.430	0.204	17.798	Gg	0.031	7.751	54.492	Yes
2C1		3.152	46.430	0.208	17.798	Gg	0.022	5.386	59.879	Yes
1B1c		1.085	46.430	1.183	17.798	Gg	0.017	4.133	64.012	Yes
1A3bi	Diesel oil	2.366	46.430	0.256	17.798	Gg	0.014	3.507	67.519	Yes
1A3bvi		0.542	46.430	0.644	17.798	Gg	0.009	2.352	69.871	Yes
1A4cii	Liquid	1.620	46.430	0.230	17.798	Gg	0.008	2.109	71.980	Yes
2H1		1.420	46.430	0.157	17.798	Gg	0.008	2.085	74.065	Yes
1A1a	Solid	1.103	46.430	0.036	17.798	Gg	0.008	2.083	76.148	Yes
1A3bvii		0.404	46.430	0.476	17.798	Gg	0.007	1.727	77.875	Yes
1A1a	Liquid	0.810	46.430	0.028	17.798	Gg	0.006	1.520	79.395	Yes
2H2		0.303	46.430	0.396	17.798	Gg	0.006	1.506	80.901	Yes
1A2d	Biomass	0.637	46.430	0.051	17.798	Gg	0.004	1.039	81.940	
2A5b		0.504	46.430	0.003	17.798	Gg	0.004	1.026	82.965	
1A2gvii	Liquid	1.421	46.430	0.355	17.798	Gg	0.004	1.021	83.986	
1A2f	Solid	0.526	46.430	0.018	17.798	Gg	0.004	0.990	84.976	
2C2		0.014	46.430	0.179	17.798	Gg	0.004	0.937	85.913	
1A4aii	Liquid	0.746	46.430	0.113	17.798	Gg	0.004	0.932	86.845	
1A2gviii	Liquid	0.471	46.430	0.012	17.798	Gg	0.004	0.910	87.755	
1A3bii	Diesel oil	1.074	46.430	0.277	17.798	Gg	0.003	0.724	88.479	
1A1a	Biomass	0.145	46.430	0.179	17.798	Gg	0.003	0.666	89.145	

1A4ai	Liquid	0.506	46.430	0.084	17.798	Gg	0.002	0.595	89.741
1A3dii	Liquid	0.511	46.430	0.298	17.798	Gg	0.002	0.553	90.294
3Dc		0.268	46.430	0.202	17.798	Gg	0.002	0.533	90.827
1A5a	Biomass	0.002	46.430	0.096	17.798	Gg	0.002	0.514	91.341
2B6		0.248	46.430	0.001	17.798	Gg	0.002	0.507	91.848
1A1a	Peat	0.467	46.430	0.089	17.798	Gg	0.002	0.486	92.335
1A2f	Liquid	0.219	46.430	0.005	17.798	Gg	0.002	0.424	92.758
1A4ci	Biomass	0.101	46.430	0.109	17.798	Gg	0.002	0.382	93.140
2C7c		0.201	46.430	0.006	17.798	Gg	0.002	0.381	93.521
1B2aiv		0.189	46.430	0.003	17.798	Gg	0.001	0.373	93.894
1A5a	Liquid	0.304	46.430	0.059	17.798	Gg	0.001	0.308	94.202
2I		0.131	46.430	0.001	17.798	Gg	0.001	0.268	94.470
1A4bii	Liquid	0.242	46.430	0.142	17.798	Gg	0.001	0.263	94.733
1A2d	Peat	0.154	46.430	0.011	17.798	Gg	0.001	0.260	94.992
1A2e	Liquid	0.143	46.430	0.007	17.798	Gg	0.001	0.256	95.248
1A4ci	Liquid	0.167	46.430	0.020	17.798	Gg	0.001	0.239	95.488
1A4bi	Solid	0.118	46.430	0.003	17.798	Gg	0.001	0.231	95.718
2A3		0.124	46.430	0.005	17.798	Gg	0.001	0.227	95.945
1A2d	Solid	0.110	46.430	0.0001	17.798	Gg	0.001	0.226	96.171
1A4ai	Biomass	0.030	46.430	0.051	17.798	Gg	0.001	0.212	96.384
3F		0.287	46.430	0.148	17.798	Gg	0.001	0.205	96.589
1A4ci	Peat	0.008	46.430	0.041	17.798	Gg	0.001	0.205	96.794
1A3bi	Motor	0.174	46.430	0.034	17.798	Gg	0.001	0.178	96.972
1A2a	Solid	0.087	46.430	0.001	17.798	Gg	0.001	0.175	97.147
1A4bi	Peat	0.208	46.430	0.048	17.798	Gg	0.001	0.171	97.318
2D3i		0.064	46.430	0.056	17.798	Gg	0.001	0.167	97.486
2G		0.153	46.430	0.087	17.798	Gg	0.001	0.151	97.637
1A2c	Solid	0.073	46.430	0.00003	17.798	Gg	0.001	0.150	97.787
1A2c	Liquid	0.184	46.430	0.043	17.798	Gg	0.001	0.147	97.933
2A5a		0.068	46.430	0.0004	17.798	Gg	0.001	0.139	98.072
2D3b		0.087	46.430	0.058	17.798	Gg	0.001	0.135	98.207
1A4bi	Liquid	0.219	46.430	0.060	17.798	Gg	0.001	0.132	98.338
1A2gviii	Biomass	0.203	46.430	0.054	17.798	Gg	0.001	0.129	98.467
1A2a	Liquid	0.069	46.430	0.002	17.798	Gg	0.001	0.129	98.596
1A1b	Liquid	0.076	46.430	0.009	17.798	Gg	0.0004	0.109	98.706
3B1b		0.079	46.430	0.050	17.798	Gg	0.0004	0.104	98.810
1A5b	Liquid	0.004	46.430	0.017	17.798	Gg	0.0003	0.086	98.895
3B1a		0.132	46.430	0.063	17.798	Gg	0.0003	0.064	98.959
5E		0.299	46.430	0.103	17.798	Gg	0.0003	0.064	99.023
1A2b	Liquid	0.038	46.430	0.003	17.798	Gg	0.0002	0.060	99.083
2C6		0.028	46.430	0.00003	17.798	Gg	0.0002	0.058	99.141
1A4ciii	Liquid	0.069	46.430	0.037	17.798	Gg	0.0002	0.055	99.196
2A2		0.026	46.430	0.0002	17.798	Gg	0.0002	0.053	99.248
2A5c		0.049	46.430	0.028	17.798	Gg	0.0002	0.052	99.300
2C7a		0.026	46.430	0.0004	17.798	Gg	0.0002	0.051	99.351
1A2e	Peat	0.023	46.430	0.0005	17.798	Gg	0.0002	0.045	99.396
3B4gii		0.003	46.430	0.009	17.798	Gg	0.0002	0.043	99.440
1A2f	Other	NO	46.430	0.007	17.798	Gg	0.0002	0.039	99.478
2L		0.054	46.430	0.028	17.798	Gg	0.0001	0.037	99.516
3B4h		0.013	46.430	0.012	17.798	Gg	0.0001	0.037	99.552
1A3c	Liquid	0.084	46.430	0.026	17.798	Gg	0.0001	0.037	99.589
2B10a		0.738	46.430	0.289	17.798	Gg	0.0001	0.031	99.620
1A2b	Solid	0.014	46.430	0.0003	17.798	Gg	0.0001	0.027	99.647
1A3ai(i)	Liquid	0.003	46.430	0.006	17.798	Gg	0.0001	0.026	99.673
3B4e		0.004	46.430	0.006	17.798	Gg	0.0001	0.025	99.699
3B4gi		0.014	46.430	0.010	17.798	Gg	0.0001	0.025	99.724
1A2e	Solid	0.013	46.430	0.001	17.798	Gg	0.0001	0.021	99.745
1A1a	Other	0.001	46.430	0.004	17.798	Gg	0.0001	0.021	99.766
1A2e	Biomass	0.011	46.430	0.0004	17.798	Gg	0.0001	0.021	99.787
2D3g		0.016	46.430	0.003	17.798	Gg	0.0001	0.020	99.806
1A1b	Solid	0.020	46.430	0.004	17.798	Gg	0.0001	0.017	99.823

1A2gviii	Other	0.009	46.430	0.0005	17.798	Gg	0.0001	0.017	99.840	
1A3biv	Motor	0.057	46.430	0.019	17.798	Gg	0.0001	0.015	99.855	
3B4giii		0.001	46.430	0.003	17.798	Gg	0.0001	0.015	99.870	
3B4giv		0.032	46.430	0.010	17.798	Gg	0.00005	0.012	99.882	
1A2d	Other	0.005	46.430	0.004	17.798	Gg	0.00005	0.012	99.893	
1A3bii	Motor	0.006	46.430	0.0001	17.798	Gg	0.00004	0.011	99.904	
1A3biv	Diesel oil	NO	46.430	0.002	17.798	Gg	0.00004	0.010	99.914	
1B2av		0.005	46.430	0.0001	17.798	Gg	0.00003	0.009	99.923	
1A4ai	Peat	0.002	46.430	0.002	17.798	Gg	0.00003	0.008	99.931	
1B1b		0.003	46.430	0.003	17.798	Gg	0.00003	0.008	99.940	
1A2gviii	Solid	0.004	46.430	0.0000001	17.798	Gg	0.00003	0.007	99.947	
3B2		0.001	46.430	0.002	17.798	Gg	0.00003	0.007	99.954	
1A2d	Gaseous	0.052	46.430	0.021	17.798	Gg	0.00003	0.007	99.960	
2B10b		0.001	46.430	0.001	17.798	Gg	0.00002	0.006	99.966	
5C1bv		0.0003	46.430	0.001	17.798	Gg	0.00002	0.005	99.971	
2D3d		0.0003	46.430	0.001	17.798	Gg	0.00002	0.004	99.975	
1A2f	Biomass	0.0001	46.430	0.001	17.798	Gg	0.00001	0.003	99.979	
1A3aii(i)	Liquid	0.002	46.430	0.001	17.798	Gg	0.00001	0.003	99.982	
3B3		0.004	46.430	0.002	17.798	Gg	0.00001	0.003	99.985	
2C7d		0.001	46.430	0.001	17.798	Gg	0.00001	0.003	99.988	
1A2a	Gaseous	0.001	46.430	0.000001	17.798	Gg	0.00001	0.003	99.990	
1A2c	Biomass	0.001	46.430	0.00001	17.798	Gg	0.00001	0.002	99.993	
1A2gviii	Peat	0.001	46.430	0.0002	17.798	Gg	0.00001	0.001	99.994	
2C3		0.001	46.430	0.00001	17.798	Gg	0.00001	0.001	99.996	
2D3e		0.001	46.430	0.00001	17.798	Gg	0.00001	0.001	99.997	
1A2gvii	Gaseous	0.001	46.430	0.001	17.798	Gg	0.000003	0.001	99.998	
1A3bi	Gaseous	NO	46.430	0.0001	17.798	Gg	0.000002	0.0005	99.998	
1A4bi	Other	0.0002	46.430	0.000005	17.798	Gg	0.000002	0.0004	99.999	
1A2a	Biomass	NO	46.430	0.0001	17.798	Gg	0.000002	0.0004	99.999	
1A2e	Other	0.0001	46.430	0.0001	17.798	Gg	0.000001	0.0004	99.999	
1A4ci	Solid	0.001	46.430	0.0004	17.798	Gg	0.000001	0.0002	100	
3B4d		0.00004	46.430	0.0001	17.798	Gg	0.000001	0.0002	100	
1A3bii	Gaseous	NO	46.430	0.00002	17.798	Gg	0.0000003	0.0001	100	
1A3biii	Gaseous	NO	46.430	0.00001	17.798	Gg	0.0000003	0.0001	100	
5A		0.0002	46.430	0.0001	17.798	Gg	0.0000002	0.00004	100	
1A4ci	Other	NO	46.430	0.000002	17.798	Gg	3E-08	0.00001	100	

PM10

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2018 emission of the NFR category	Year 2018 total emission	Unit	Trend assessment	Contribution to trend. %	Cumulative total. %	Key source
1A4bi	Biomass	6.841	73.166	9.257	31.116	Gg	0.087	20.372	20.372	Yes
1A3bvii		4.766	73.166	5.599	31.116	Gg	0.049	11.466	31.837	Yes
1A2d	Liquid	11.187	73.166	1.680	31.116	Gg	0.042	9.878	41.715	Yes
1A1a	Solid	4.794	73.166	0.179	31.116	Gg	0.025	5.969	47.684	Yes
1A3biii	Diesel oil	4.287	73.166	0.204	31.116	Gg	0.022	5.195	52.879	Yes
3Dc		4.905	73.166	3.658	31.116	Gg	0.021	5.044	57.923	Yes
2C1		4.059	73.166	0.225	31.116	Gg	0.021	4.817	62.740	Yes
1B1c		1.544	73.166	1.685	31.116	Gg	0.014	3.299	66.040	Yes
1A3bvi		0.982	73.166	1.169	31.116	Gg	0.01	2.411	68.450	Yes
1A3bi	Diesel oil	2.366	73.166	0.256	31.116	Gg	0.01	2.408	70.858	Yes
2H1		1.965	73.166	0.196	31.116	Gg	0.009	2.053	72.912	Yes
1A2d	Biomass	1.700	73.166	0.097	31.116	Gg	0.009	2.010	74.922	Yes
1A5a	Biomass	0.012	73.166	0.501	31.116	Gg	0.007	1.592	76.514	Yes
1A4cii	Liquid	1.620	73.166	0.230	31.116	Gg	0.006	1.475	77.988	Yes
1A1a	Liquid	1.218	73.166	0.065	31.116	Gg	0.006	1.454	79.442	Yes
1A1a	Biomass	0.396	73.166	0.563	31.116	Gg	0.005	1.267	80.710	Yes
1A2f	Solid	0.971	73.166	0.039	31.116	Gg	0.005	1.198	81.908	

2A5b		0.796	73.166	0.019	31.116	Gg	0.004	1.025	82.934
1A2gviii	Liquid	0.747	73.166	0.023	31.116	Gg	0.004	0.947	83.881
2H2		0.320	73.166	0.411	31.116	Gg	0.004	0.883	84.764
1A2gvii	Liquid	1.421	73.166	0.355	31.116	Gg	0.003	0.799	85.564
2C2		0.020	73.166	0.254	31.116	Gg	0.003	0.789	86.352
1A1a	Peat	1.337	73.166	0.359	31.116	Gg	0.003	0.674	87.026
1A2d	Solid	0.493	73.166	0.0003	31.116	Gg	0.003	0.672	87.697
1A4aii	Liquid	0.746	73.166	0.113	31.116	Gg	0.003	0.656	88.353
1A4ai	Liquid	0.814	73.166	0.148	31.116	Gg	0.003	0.635	88.989
1A4ci	Peat	0.042	73.166	0.214	31.116	Gg	0.003	0.631	89.619
1A3bii	Diesel oil	1.074	73.166	0.277	31.116	Gg	0.002	0.576	90.195
2C7c		0.408	73.166	0.007	31.116	Gg	0.002	0.533	90.728
1A2a	Solid	0.394	73.166	0.004	31.116	Gg	0.002	0.524	91.252
1A2f	Liquid	0.358	73.166	0.010	31.116	Gg	0.002	0.457	91.709
1A2gviii	Biomass	0.666	73.166	0.154	31.116	Gg	0.002	0.415	92.124
1B2aiv		0.312	73.166	0.005	31.116	Gg	0.002	0.408	92.532
1A2d	Peat	0.326	73.166	0.025	31.116	Gg	0.002	0.364	92.896
2B6		0.248	73.166	0.001	31.116	Gg	0.001	0.335	93.232
1A5a	Liquid	0.481	73.166	0.101	31.116	Gg	0.001	0.333	93.564
1A2c	Solid	0.243	73.166	0.0001	31.116	Gg	0.001	0.331	93.895
2A5a		0.230	73.166	0.004	31.116	Gg	0.001	0.302	94.197
2I		0.271	73.166	0.024	31.116	Gg	0.001	0.294	94.491
1A3dii	Liquid	0.565	73.166	0.330	31.116	Gg	0.001	0.289	94.780
1A2e	Liquid	0.221	73.166	0.012	31.116	Gg	0.001	0.265	95.045
3B4gii		0.031	73.166	0.092	31.116	Gg	0.001	0.254	95.299
1A4ci	Liquid	0.269	73.166	0.036	31.116	Gg	0.001	0.253	95.551
2A5c		0.478	73.166	0.277	31.116	Gg	0.001	0.235	95.786
1A4ci	Biomass	0.104	73.166	0.115	31.116	Gg	0.001	0.227	96.013
2B10a		1.156	73.166	0.425	31.116	Gg	0.001	0.214	96.227
1A4bi	Liquid	0.336	73.166	0.080	31.116	Gg	0.001	0.202	96.429
2C6		0.146	73.166	0.0001	31.116	Gg	0.001	0.199	96.628
1A2c	Liquid	0.289	73.166	0.067	31.116	Gg	0.001	0.179	96.807
3B4gi		0.189	73.166	0.135	31.116	Gg	0.001	0.174	96.981
2A3		0.142	73.166	0.006	31.116	Gg	0.001	0.174	97.155
1A4bi	Solid	0.133	73.166	0.003	31.116	Gg	0.001	0.173	97.328
1A2a	Liquid	0.117	73.166	0.004	31.116	Gg	0.001	0.148	97.476
1A4bi	Peat	0.234	73.166	0.054	31.116	Gg	0.001	0.146	97.622
1A2e	Peat	0.111	73.166	0.003	31.116	Gg	0.001	0.143	97.765
1A3bi	Motor	0.174	73.166	0.034	31.116	Gg	0.001	0.129	97.894
1A4ai	Biomass	0.032	73.166	0.053	31.116	Gg	0.0005	0.125	98.020
1A4bii	Liquid	0.242	73.166	0.142	31.116	Gg	0.0005	0.124	98.144
1A1b	Liquid	0.123	73.166	0.014	31.116	Gg	0.0005	0.123	98.267
2A2		0.072	73.166	0.001	31.116	Gg	0.0004	0.094	98.360
1A2b	Solid	0.072	73.166	0.001	31.116	Gg	0.0004	0.093	98.454
3F		0.301	73.166	0.155	31.116	Gg	0.0004	0.088	98.542
3B4giv		0.227	73.166	0.072	31.116	Gg	0.0003	0.080	98.622
5E		0.299	73.166	0.103	31.116	Gg	0.0003	0.078	98.701
3B1b		0.122	73.166	0.076	31.116	Gg	0.0003	0.078	98.779
1A2e	Solid	0.065	73.166	0.004	31.116	Gg	0.0003	0.075	98.854
2D3b		0.095	73.166	0.064	31.116	Gg	0.0003	0.075	98.929
2G		0.153	73.166	0.087	31.116	Gg	0.0003	0.070	98.999
1A1b	Solid	0.103	73.166	0.023	31.116	Gg	0.0003	0.066	99.064
1A2b	Liquid	0.059	73.166	0.005	31.116	Gg	0.0003	0.063	99.127
2D3i		0.187	73.166	0.060	31.116	Gg	0.0003	0.063	99.190
1A2gviii	Other	0.048	73.166	0.001	31.116	Gg	0.0003	0.062	99.252
1A5b	Liquid	0.004	73.166	0.017	31.116	Gg	0.0002	0.051	99.303
1A2e	Biomass	0.04	73.166	0.002	31.116	Gg	0.0002	0.049	99.351
3B4giii		0.003	73.166	0.016	31.116	Gg	0.0002	0.048	99.399
2C7a		0.034	73.166	0.0004	31.116	Gg	0.0002	0.044	99.444
1A2f	Other	NO	73.166	0.013	31.116	Gg	0.0002	0.042	99.485
3B4h		0.026	73.166	0.024	31.116	Gg	0.0002	0.04	99.526

1A1a	Other	0.002	73.166	0.012	31.116	Gg	0.0002	0.036	99.562
1A3c	Liquid	0.089	73.166	0.027	31.116	Gg	0.0001	0.035	99.597
1A2d	Other	0.011	73.166	0.015	31.116	Gg	0.0001	0.031	99.628
3B1a		0.203	73.166	0.096	31.116	Gg	0.0001	0.031	99.659
3B3		0.086	73.166	0.046	31.116	Gg	0.0001	0.03	99.690
2B10b		0.007	73.166	0.012	31.116	Gg	0.0001	0.028	99.718
2L		0.081	73.166	0.043	31.116	Gg	0.0001	0.026	99.744
1A4ciii	Liquid	0.077	73.166	0.041	31.116	Gg	0.0001	0.026	99.770
1A4ai	Peat	0.009	73.166	0.012	31.116	Gg	0.00011	0.025	99.795
1A2gviii	Solid	0.017	73.166	0.000001	31.116	Gg	0.0001	0.023	99.818
3B4e		0.006	73.166	0.010	31.116	Gg	0.0001	0.023	99.841
1A2d	Gaseous	0.074	73.166	0.025	31.116	Gg	0.00009	0.020	99.861
1A3biv	Motor	0.057	73.166	0.019	31.116	Gg	0.00007	0.017	99.878
2C7d		0.006	73.166	0.008	31.116	Gg	0.00007	0.016	99.894
1A3ai(i)	Liquid	0.003	73.166	0.006	31.116	Gg	0.00007	0.015	99.909
3B2		0.002	73.166	0.005	31.116	Gg	0.00005	0.012	99.921
1B1b		0.008	73.166	0.007	31.116	Gg	0.00005	0.011	99.932
2D3g		0.017	73.166	0.004	31.116	Gg	0.00004	0.010	99.942
1A2f	Biomass	0.0003	73.166	0.003	31.116	Gg	0.00004	0.009	99.950
1A3bii	Motor	0.006	73.166	0.0001	31.116	Gg	0.00003	0.007	99.958
1A3biv	Diesel oil	NO	73.166	0.002	31.116	Gg	0.00003	0.006	99.964
1B2av		0.005	73.166	0.0001	31.116	Gg	0.00002	0.006	99.969
1A2a	Gaseous	0.004	73.166	0.000004	31.116	Gg	0.00002	0.005	99.974
1A2gviii	Peat	0.005	73.166	0.001	31.116	Gg	0.00002	0.004	99.978
1A2c	Biomass	0.003	73.166	0.0001	31.116	Gg	0.00002	0.004	99.982
2D3d		0.0004	73.166	0.001	31.116	Gg	0.00002	0.004	99.986
5C1bv		0.0003	73.166	0.001	31.116	Gg	0.00001	0.003	99.989
2D3e		0.002	73.166	0.0001	31.116	Gg	0.00001	0.002	99.991
2C3		0.002	73.166	0.00003	31.116	Gg	0.00001	0.002	99.994
1A3aii(i)	Liquid	0.002	73.166	0.001	31.116	Gg	0.00001	0.002	99.995
1A2a	Biomass	NO	73.166	0.0004	31.116	Gg	0.000005	0.001	99.996
1A4ci	Solid	0.003	73.166	0.002	31.116	Gg	0.000005	0.0011	99.998
1A2e	Other	0.0003	73.166	0.0005	31.116	Gg	0.000005	0.0011	99.999
1A4bi	Other	0.0003	73.166	0.00001	31.116	Gg	0.000001	0.0003	99.999
3B4d		0.0001	73.166	0.0002	31.116	Gg	0.000001	0.0003	99.999
1A3bi	Gaseous	NO	73.166	0.0001	31.116	Gg	0.000001	0.0003	100
1A2gvii	Gaseous	0.001	73.166	0.001	31.116	Gg	0.000001	0.0003	100
1A3bii	Gaseous	NO	73.166	0.00002	31.116	Gg	0.0000002	0.00005	100
1A3biii	Gaseous	NO	73.166	0.00001	31.116	Gg	0.0000002	0.00004	100
1A4ci	Other	NO	73.166	0.00001	31.116	Gg	0.0000001	0.00003	100
5A		0.001	73.166	0.001	31.116	Gg	1E-09	0.0000002	100

TSP

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2018 emission of the NFR category	Year 2018 total emission	Unit	Trend assessment	Contribution to trend. %	Cumulative total. %	Key source
1A3bvii		9.531	97.653	11.198	45.069	Gg	0.070	15.172	15.172	Yes
1A4bi	Biomass	7.126	97.653	9.643	45.069	Gg	0.065	14.177	29.350	Yes
1A2d	Liquid	12.179	97.653	1.890	45.069	Gg	0.038	8.324	37.674	Yes
1A1a	Solid	7.164	97.653	0.222	45.069	Gg	0.032	6.883	44.557	Yes
2C1		5.545	97.653	0.275	45.069	Gg	0.023	5.097	49.654	Yes
1A5a	Biomass	0.046	97.653	1.927	45.069	Gg	0.020	4.252	53.906	Yes
1A3biii	Diesel oil	4.287	97.653	0.204	45.069	Gg	0.018	3.959	57.865	Yes
1B1c		2.363	97.653	2.578	45.069	Gg	0.015	3.318	61.183	Yes
3Dc		4.905	97.653	3.658	45.069	Gg	0.014	3.110	64.293	Yes
1A2d	Biomass	3.264	97.653	0.186	45.069	Gg	0.014	2.947	67.240	Yes
1A1a	Biomass	0.876	97.653	1.417	45.069	Gg	0.010	2.260	69.500	Yes
1A3bvi		1.325	97.653	1.576	45.069	Gg	0.010	2.152	71.653	Yes

2H1		2.389	97.653	0.262	45.069	Gg	0.009	1.876	73.528	Yes
1A3bi	Diesel oil	2.366	97.653	0.256	45.069	Gg	0.009	1.866	75.394	Yes
1A2f	Solid	1.954	97.653	0.095	45.069	Gg	0.008	1.801	77.195	Yes
1A4ci	Peat	0.160	97.653	0.824	45.069	Gg	0.008	1.673	78.868	Yes
1A1a	Liquid	1.398	97.653	0.104	45.069	Gg	0.006	1.209	80.077	Yes
1A4cii	Liquid	1.62	97.653	0.230	45.069	Gg	0.005	1.156	81.233	
1A2a	Solid	0.932	97.653	0.012	45.069	Gg	0.004	0.933	82.166	
2A5b		1.014	97.653	0.061	45.069	Gg	0.004	0.907	83.073	
2C7c		0.855	97.653	0.012	45.069	Gg	0.004	0.854	83.927	
1A2gviii	Liquid	0.832	97.653	0.033	45.069	Gg	0.004	0.784	84.710	
1A2d	Solid	0.715	97.653	0.0004	45.069	Gg	0.003	0.736	85.446	
1A2gviii	Biomass	1.572	97.653	0.405	45.069	Gg	0.003	0.715	86.162	
1A2gvii	Liquid	1.421	97.653	0.355	45.069	Gg	0.003	0.671	86.833	
2C2		0.023	97.653	0.299	45.069	Gg	0.003	0.643	87.476	
2H2		0.329	97.653	0.430	45.069	Gg	0.003	0.622	88.097	
1A4ai	Liquid	0.994	97.653	0.198	45.069	Gg	0.003	0.581	88.678	
2C6		0.562	97.653	0.001	45.069	Gg	0.003	0.578	89.256	
1A4aii	Liquid	0.746	97.653	0.113	45.069	Gg	0.002	0.516	89.772	
3B4gi		0.897	97.653	0.640	45.069	Gg	0.002	0.503	90.276	
1A3bii	Diesel oil	1.074	97.653	0.277	45.069	Gg	0.002	0.487	90.763	
2D3i		0.598	97.653	0.065	45.069	Gg	0.002	0.472	91.235	
1B2aiv		0.442	97.653	0.007	45.069	Gg	0.002	0.440	91.675	
1A2f	Liquid	0.449	97.653	0.012	45.069	Gg	0.002	0.436	92.111	
2A5a		0.400	97.653	0.007	45.069	Gg	0.002	0.396	92.507	
1A2d	Peat	0.435	97.653	0.033	45.069	Gg	0.002	0.375	92.882	
2B10a		1.409	97.653	0.491	45.069	Gg	0.002	0.356	93.238	
3B4gii		0.061	97.653	0.184	45.069	Gg	0.002	0.348	93.586	
2I		0.590	97.653	0.122	45.069	Gg	0.002	0.335	93.921	
2A5c		1.218	97.653	0.709	45.069	Gg	0.002	0.328	94.249	
1A5a	Liquid	0.588	97.653	0.134	45.069	Gg	0.001	0.306	94.556	
1A2c	Solid	0.291	97.653	0.0001	45.069	Gg	0.001	0.300	94.856	
1A2b	Solid	0.277	97.653	0.006	45.069	Gg	0.001	0.272	95.128	
2B6		0.248	97.653	0.001	45.069	Gg	0.001	0.253	95.381	
1A2e	Solid	0.251	97.653	0.008	45.069	Gg	0.001	0.241	95.622	
1A2e	Liquid	0.260	97.653	0.014	45.069	Gg	0.001	0.237	95.859	
1A4bi	Liquid	0.425	97.653	0.092	45.069	Gg	0.001	0.233	96.091	
1A4ci	Liquid	0.329	97.653	0.049	45.069	Gg	0.001	0.230	96.322	
1A1b	Solid	0.395	97.653	0.089	45.069	Gg	0.001	0.208	96.530	
1A2gviii	Other	0.189	97.653	0.008	45.069	Gg	0.001	0.176	96.706	
2A2		0.174	97.653	0.003	45.069	Gg	0.001	0.172	96.879	
1A2c	Liquid	0.325	97.653	0.079	45.069	Gg	0.001	0.158	97.036	
1A3dii	Liquid	0.565	97.653	0.330	45.069	Gg	0.001	0.155	97.191	
1A2e	Peat	0.169	97.653	0.009	45.069	Gg	0.001	0.154	97.346	
1A4ci	Biomass	0.108	97.653	0.119	45.069	Gg	0.001	0.154	97.499	
1A2a	Liquid	0.157	97.653	0.004	45.069	Gg	0.001	0.152	97.651	
2A3		0.158	97.653	0.007	45.069	Gg	0.001	0.148	97.799	
1A4bi	Solid	0.148	97.653	0.003	45.069	Gg	0.001	0.145	97.945	
1A4bi	Peat	0.260	97.653	0.060	45.069	Gg	0.001	0.134	98.078	
1A1a	Other	0.013	97.653	0.064	45.069	Gg	0.001	0.129	98.207	
3B3		0.518	97.653	0.295	45.069	Gg	0.001	0.125	98.332	
1A1b	Liquid	0.150	97.653	0.016	45.069	Gg	0.001	0.118	98.450	
1A3bi	Motor	0.174	97.653	0.034	45.069	Gg	0.0005	0.104	98.554	
3B1b		0.264	97.653	0.165	45.069	Gg	0.0004	0.097	98.6500	
1A4ai	Biomass	0.037	97.653	0.055	45.069	Gg	0.0004	0.084	98.735	
5E		0.299	97.653	0.103	45.069	Gg	0.0004	0.079	98.813	
3B4giv		0.234	97.653	0.073	45.069	Gg	0.0004	0.077	98.891	
1A4bii	Liquid	0.242	97.653	0.142	45.069	Gg	0.0003	0.067	98.958	
1A4ai	Peat	0.034	97.653	0.044	45.069	Gg	0.0003	0.064	99.022	
1A2gviii	Solid	0.062	97.653	0.000002	45.069	Gg	0.0003	0.064	99.086	
2B10b		0.023	97.653	0.037	45.069	Gg	0.0003	0.059	99.145	
2D3b		0.126	97.653	0.085	45.069	Gg	0.0003	0.059	99.204	

1A2e	Biomass	0.073	97.653	0.007	45.069	Gg	0.0003	0.058	99.263
3B4h		0.059	97.653	0.053	45.069	Gg	0.0003	0.058	99.321
1A2b	Liquid	0.069	97.653	0.006	45.069	Gg	0.0003	0.056	99.377
1A2d	Other	0.017	97.653	0.028	45.069	Gg	0.0002	0.045	99.423
2C7a		0.043	97.653	0.001	45.069	Gg	0.0002	0.043	99.465
3F		0.305	97.653	0.158	45.069	Gg	0.0002	0.037	99.503
1A1a	Peat	2.295	97.653	1.042	45.069	Gg	0.0002	0.037	99.540
2G		0.153	97.653	0.087	45.069	Gg	0.0002	0.036	99.576
1A5b	Liquid	0.004	97.653	0.017	45.069	Gg	0.0002	0.035	99.611
3B4e		0.014	97.653	0.021	45.069	Gg	0.0002	0.033	99.644
3B4giii		0.003	97.653	0.016	45.069	Gg	0.0002	0.033	99.678
1A3c	Liquid	0.094	97.653	0.028	45.069	Gg	0.0002	0.033	99.711
2L		0.093	97.653	0.056	45.069	Gg	0.0001	0.030	99.740
1A2f	Other	0.029	97.653	0.025	45.069	Gg	0.0001	0.026	99.767
1A2c	Other	0.023	97.653	0.0001	45.069	Gg	0.0001	0.023	99.79
1A2d	Gaseous	0.088	97.653	0.031	45.069	Gg	0.0001	0.022	99.812
2C7d		0.012	97.653	0.015	45.069	Gg	0.0001	0.021	99.834
1A2f	Biomass	0.001	97.653	0.010	45.069	Gg	0.0001	0.021	99.855
3B2		0.005	97.653	0.011	45.069	Gg	0.0001	0.019	99.873
1A3biv	Motor	0.057	97.653	0.019	45.069	Gg	0.0001	0.016	99.890
1B1b		0.019	97.653	0.016	45.069	Gg	0.0001	0.016	99.906
1A4ciii	Liquid	0.077	97.653	0.041	45.069	Gg	0.0001	0.012	99.917
3B1a		0.445	97.653	0.211	45.069	Gg	0.0001	0.012	99.929
1A3ai(i)	Liquid	0.003	97.653	0.006	45.069	Gg	0.00005	0.010	99.939
1A2a	Gaseous	0.009	97.653	0.00001	45.069	Gg	0.00004	0.009	99.948
2D3g		0.019	97.653	0.005	45.069	Gg	0.00004	0.008	99.956
1A3bii	Motor	0.006	97.653	0.0001	45.069	Gg	0.00003	0.006	99.962
1A2gviii	Peat	0.007	97.653	0.001	45.069	Gg	0.00002	0.005	99.967
1B2av		0.005	97.653	0.0001	45.069	Gg	0.00002	0.004	99.971
1A3biv	Diesel oil	NO	97.653	0.002	45.069	Gg	0.00002	0.004	99.975
1A2a	Biomass	NO	97.653	0.001	45.069	Gg	0.00001	0.003	99.978
2D3d		0.001	97.653	0.002	45.069	Gg	0.00001	0.003	99.981
2D3e		0.003	97.653	0.0001	45.069	Gg	0.00001	0.003	99.985
1A2c	Biomass	0.003	97.653	0.0003	45.069	Gg	0.00001	0.003	99.988
1A2e	Other	0.001	97.653	0.002	45.069	Gg	0.00001	0.003	99.99
2C3		0.003	97.653	0.00005	45.069	Gg	0.00001	0.003	99.993
1A2b	Other	0.005	97.653	0.003	45.069	Gg	0.00001	0.002	99.995
5C1bv		NO	97.653	0.001	45.069	Gg	0.00001	0.002	99.998
1A3aii(i)	Liquid	0.002	97.653	0.001	45.069	Gg	0.000005	0.001	99.999
3B4d		0.0003	97.653	0.0004	45.069	Gg	0.000002	0.001	99.999
1A4bi	Other	0.0003	97.653	0.00001	45.069	Gg	0.000001	0.0003	99.999
5A		0.003	97.653	0.001	45.069	Gg	0.000001	0.0002	100
1A3bi	Gaseous	NO	97.653	0.0001	45.069	Gg	0.000001	0.0002	100
1A4ci	Solid	0.008	97.653	0.004	45.069	Gg	0.0000005	0.0001	100
1A2gvii	Gaseous	0.001	97.653	0.001	45.069	Gg	0.0000003	0.0001	100
1A3bii	Gaseous	NO	97.653	0.00002	45.069	Gg	0.0000002	0.00003	100
1A3biii	Gaseous	NO	97.653	0.00001	45.069	Gg	0.0000001	0.00003	100
1A4ci	Other	NO	97.653	0.000002	45.069	Gg	2E-08	0.000003	100

BC

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2018 emission of the NFR category	Year 2018 total emission	Unit	Trend assessment	Contribution to trend. %	Cumulative total. %	Key source
1A4bi	Biomass	1.954	9.834	2.600	4.014	Gg	0.183	42.492	42.492	Yes
1A3biii	Diesel oil	2.272	9.834	0.108	4.014	Gg	0.083	19.305	61.796	Yes
1A3bi	Diesel oil	1.349	9.834	0.146	4.014	Gg	0.041	9.536	71.333	Yes
1A4cii	Liquid	0.877	9.834	0.108	4.014	Gg	0.025	5.884	77.217	Yes
1A2gvii	Liquid	0.877	9.834	0.216	4.014	Gg	0.014	3.342	80.559	Yes

1A3bvi		0.140	9.834	0.167	4.014	Gg	0.011	2.578	83.137
1A3bvii		0.079	9.834	0.124	4.014	Gg	0.009	2.157	85.294
1A3bii	Diesel oil	0.591	9.834	0.152	4.014	Gg	0.009	2.089	87.383
1A1a	Liquid	0.177	9.834	0.008	4.014	Gg	0.007	1.514	88.897
1A4aii	Liquid	0.230	9.834	0.031	4.014	Gg	0.006	1.492	90.389
1A2gviii	Liquid	0.140	9.834	0.003	4.014	Gg	0.005	1.266	91.654
1A4ai	Liquid	0.152	9.834	0.025	4.014	Gg	0.004	0.869	92.524
1A3dii	Liquid	0.069	9.834	0.061	4.014	Gg	0.003	0.781	93.304
1A2d	Liquid	0.113	9.834	0.019	4.014	Gg	0.003	0.635	93.939
1A5a	Biomass	0.0001	9.834	0.027	4.014	Gg	0.003	0.635	94.574
1A2f	Liquid	0.066	9.834	0.002	4.014	Gg	0.003	0.599	95.174
1A5a	Liquid	0.092	9.834	0.018	4.014	Gg	0.002	0.457	95.631
2C2		0.001	9.834	0.018	4.014	Gg	0.002	0.409	96.040
1A2e	Liquid	0.043	9.834	0.002	4.014	Gg	0.002	0.363	96.403
2H1		0.046	9.834	0.004	4.014	Gg	0.002	0.350	96.753
1A4ci	Liquid	0.050	9.834	0.006	4.014	Gg	0.001	0.344	97.096
1A4bii	Liquid	0.027	9.834	0.022	4.014	Gg	0.001	0.261	97.357
1A4bi	Liquid	0.072	9.834	0.020	4.014	Gg	0.001	0.225	97.582
1A1a	Solid	0.024	9.834	0.001	4.014	Gg	0.001	0.215	97.796
1A2c	Liquid	0.051	9.834	0.012	4.014	Gg	0.001	0.207	98.003
1A5b	Liquid	0.002	9.834	0.008	4.014	Gg	0.001	0.179	98.182
1A2d	Biomass	0.021	9.834	0.002	4.014	Gg	0.001	0.162	98.344
1A2a	Liquid	0.015	9.834	0.0003	4.014	Gg	0.001	0.138	98.482
1A3c	Liquid	0.055	9.834	0.017	4.014	Gg	0.001	0.136	98.618
1A3bi	Motor ..	0.021	9.834	0.004	4.014	Gg	0.0005	0.106	98.723
1A2f	Solid	0.012	9.834	0.0004	4.014	Gg	0.0004	0.102	98.826
2C1		0.012	9.834	0.001	4.014	Gg	0.0004	0.095	98.921
1A1a	Biomass	0.005	9.834	0.006	4.014	Gg	0.0004	0.089	99.010
1A2b	Liquid	0.011	9.834	0.001	4.014	Gg	0.0004	0.087	99.097
3F		0.037	9.834	0.019	4.014	Gg	0.0004	0.085	99.183
1A1a	Peat	0.015	9.834	0.003	4.014	Gg	0.0003	0.079	99.262
1A1b	Liquid	0.010	9.834	0.001	4.014	Gg	0.0003	0.079	99.341
1A4ciii	Liquid	0.024	9.834	0.013	4.014	Gg	0.0003	0.069	99.410
1A3ai(i)	Liquid	0.001	9.834	0.003	4.014	Gg	0.0002	0.057	99.467
1A4ci	Biomass	0.003	9.834	0.004	4.014	Gg	0.0002	0.052	99.519
5E		0.027	9.834	0.009	4.014	Gg	0.0002	0.045	99.564
2B6		0.004	9.834	0.00002	4.014	Gg	0.0002	0.043	99.606
1A2d	Peat	0.005	9.834	0.0004	4.014	Gg	0.0002	0.040	99.647
2D3b		0.005	9.834	0.003	4.014	Gg	0.0001	0.031	99.678
1A4ci	Peat	0.0003	9.834	0.001	4.014	Gg	0.0001	0.029	99.707
1A4ai	Biomass	0.001	9.834	0.002	4.014	Gg	0.0001	0.029	99.736
1A4bi	Peat	0.007	9.834	0.002	4.014	Gg	0.0001	0.029	99.765
1A3biv	Diesel oil	NO	9.834	0.001	4.014	Gg	0.0001	0.025	99.790
1A4bi	Solid	0.003	9.834	0.0001	4.014	Gg	0.0001	0.024	99.813
1A2gviii	Other	0.002	9.834	0.00002	4.014	Gg	0.0001	0.024	99.837
1A2d	Solid	0.002	9.834	0.000002	4.014	Gg	0.0001	0.023	99.860
1A2gviii	Biomass	0.007	9.834	0.002	4.014	Gg	0.0001	0.022	99.883
1A2a	Solid	0.002	9.834	0.00002	4.014	Gg	0.0001	0.017	99.900
1A2f	Other	NO	9.834	0.001	4.014	Gg	0.0001	0.016	99.915
1A2c	Solid	0.002	9.834	0.000001	4.014	Gg	0.0001	0.015	99.930
1A3biv	Motor ..	0.006	9.834	0.002	4.014	Gg	0.00005	0.011	99.941
5C1bv		0.0001	9.834	0.001	4.014	Gg	0.00005	0.011	99.952
1A2e	Peat	0.001	9.834	0.00002	4.014	Gg	0.00003	0.007	99.959
1A3aii(i)	Liquid	0.001	9.834	0.001	4.014	Gg	0.00003	0.007	99.966
2B10a		0.013	9.834	0.005	4.014	Gg	0.00002	0.005	99.971
1A1a	Other	0.00002	9.834	0.0002	4.014	Gg	0.00002	0.004	99.975
1A2e	Biomass	0.0004	9.834	0.000012	4.014	Gg	0.00001	0.003	99.978
1A2b	Solid	0.0003	9.834	0.000006	4.014	Gg	0.00001	0.003	99.980
2G		0.001	9.834	0.0004	4.014	Gg	0.00001	0.003	99.983
1A3bii	Motor ..	0.0003	9.834	0.000007	4.014	Gg	0.00001	0.003	99.986
1A2e	Solid	0.0003	9.834	0.000018	4.014	Gg	0.00001	0.002	99.988

1A1b	Solid	0.0004	9.834	0.0001	4.014	Gg	0.00001	0.002	99.990	
1A4bi	Other	0.0002	9.834	0.000004	4.014	Gg	0.00001	0.001	99.991	
2A2		0.0001	9.834	0.000001	4.014	Gg	0.00001	0.001	99.992	
1A4ai	Peat	0.0001	9.834	0.0001	4.014	Gg	0.00001	0.001	99.993	
1A2e	Other	0.00004	9.834	0.0001	4.014	Gg	0.000005	0.001	99.994	
1A2d	Other	0.002	9.834	0.001	4.014	Gg	0.000005	0.001	99.996	
1A2a	Gaseous	0.0001	9.834	0.0000001	4.014	Gg	0.000004	0.001	99.996	
1A2gviii	Solid	0.0001	9.834	3E-09	4.014	Gg	0.000003	0.001	99.997	
2A3		0.0001	9.834	0.000003	4.014	Gg	0.000003	0.001	99.998	
1A2f	Biomass	0.000002	9.834	0.00002	4.014	Gg	0.000002	0.0005	99.998	
1A2d	Gaseous	0.004	9.834	0.001	4.014	Gg	0.000002	0.0004	99.999	
1A2c	Biomass	0.00004	9.834	0.0000002	4.014	Gg	0.000002	0.0004	99.999	
1A2gviii	Peat	0.00004	9.834	0.00001	4.014	Gg	0.000001	0.0002	99.999	
2C7a		0.00002	9.834	2E-08	4.014	Gg	0.000001	0.0002	100	
2C3		0.00002	9.834	0.0000006	4.014	Gg	0.000001	0.0001	100	
1A2gvii	Gaseous	0.0001	9.834	0.00003	4.014	Gg	0.000001	0.0001	100	
2D3i		0.00002	9.834	0.000002	4.014	Gg	0.0000005	0.0001	100	
1A2a	Biomass	NO	9.834	0.000002	4.014	Gg	0.0000002	0.0001	100	
1A4ci	Other	NO	9.834	0.000001	4.014	Gg	0.0000001	0.00003	100	
1A4ci	Solid	0.00002	9.834	0.00001	4.014	Gg	0.0000001	0.00001	100	
1B1b		0.000004	9.834	0.000001	4.014	Gg	3E-08	0.00001	100	

CO

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2018 emission of the NFR category	Year 2018 total emission	Unit	Trend assessment	Contribution to trend. %	Cumulative total. %	Key source
1A3bi	Motor	412.338	753.386	24.931	350.531	Gg	0.222	43.772	43.772	Yes
1A4bi	Biomass	113.872	753.386	158.269	350.531	Gg	0.140	27.610	71.382	Yes
1A4bii	Liquid	34.909	753.386	39.906	350.531	Gg	0.031	6.205	77.587	Yes
1A4aii	Liquid	11.336	753.386	16.077	350.531	Gg	0.014	2.833	80.420	Yes
1A1a	Biomass	0.858	753.386	10.847	350.531	Gg	0.014	2.740	83.160	
1A3dii	Liquid	22.554	753.386	19.565	350.531	Gg	0.012	2.379	85.539	
1A3bii	Motor	18.286	753.386	0.743	350.531	Gg	0.010	2.036	87.575	
1A2d	Liquid	19.466	753.386	16.077	350.531	Gg	0.009	1.841	89.416	
1A5a	Biomass	0.130	753.386	4.817	350.531	Gg	0.006	1.247	90.664	
1A2gvii	Liquid	8.124	753.386	7.682	350.531	Gg	0.005	1.023	91.687	
1A3biii	Diesel oil	15.069	753.386	3.220	350.531	Gg	0.005	0.994	92.681	
1A3bi	Diesel oil	9.979	753.386	0.875	350.531	Gg	0.005	0.988	93.669	
1A2f	Solid	12.941	753.386	2.829	350.531	Gg	0.004	0.837	94.506	
1A2a	Solid	6.570	753.386	0.443	350.531	Gg	0.003	0.685	95.192	
1A3biv	Motor	7.906	753.386	5.595	350.531	Gg	0.003	0.503	95.694	
1A1a	Peat	1.544	753.386	2.538	350.531	Gg	0.002	0.477	96.171	
1A2gviii	Biomass	3.840	753.386	3.007	350.531	Gg	0.002	0.320	96.491	
1A2f	Other	NO	753.386	1.212	350.531	Gg	0.002	0.318	96.809	
1A2d	Biomass	6.834	753.386	4.340	350.531	Gg	0.002	0.304	97.113	
1A2f	Gaseous	2.421	753.386	0.071	350.531	Gg	0.001	0.277	97.390	
1A4ci	Biomass	1.515	753.386	1.647	350.531	Gg	0.001	0.247	97.637	
1A4cii	Liquid	18.799	753.386	9.522	350.531	Gg	0.001	0.203	97.841	
1A3ai(i)	Liquid	0.231	753.386	0.852	350.531	Gg	0.001	0.195	98.036	
1A1b	Gaseous	0.480	753.386	0.916	350.531	Gg	0.001	0.182	98.217	
1A1a	Solid	0.793	753.386	1.017	350.531	Gg	0.001	0.170	98.388	
1A1a	Other	0.008	753.386	0.519	350.531	Gg	0.001	0.135	98.523	
1A4ai	Biomass	0.455	753.386	0.718	350.531	Gg	0.001	0.133	98.655	
1A5a	Gaseous	0.246	753.386	0.614	350.531	Gg	0.001	0.131	98.786	
2C1		0.464	753.386	0.620	350.531	Gg	0.001	0.106	98.892	
1A4ci	Peat	0.080	753.386	0.413	350.531	Gg	0.0005	0.098	98.991	
1A2f	Liquid	0.748	753.386	0.712	350.531	Gg	0.0005	0.095	99.086	
1A2d	Solid	0.645	753.386	0.002	350.531	Gg	0.0004	0.078	99.164	

1A3bii	Diesel oil	4.107	753.386	1.615	350.531	Gg	0.0004	0.078	99.242
1A2a	Gaseous	0.408	753.386	0.462	350.531	Gg	0.0004	0.071	99.313
1A2d	Other	0.008	753.386	0.251	350.531	Gg	0.0003	0.065	99.378
1A1a	Gaseous	0.780	753.386	0.555	350.531	Gg	0.0003	0.050	99.429
3F		3.694	753.386	1.902	350.531	Gg	0.0002	0.048	99.477
1A2d	Peat	0.700	753.386	0.481	350.531	Gg	0.0002	0.041	99.517
1A3biv	Diesel oil	NO	753.386	0.141	350.531	Gg	0.0002	0.037	99.554
1A2d	Gaseous	1.849	753.386	0.728	350.531	Gg	0.0002	0.035	99.589
1A4bi	Liquid	0.776	753.386	0.236	350.531	Gg	0.0002	0.033	99.622
2C7a		0.223	753.386	0.006	350.531	Gg	0.0001	0.026	99.647
1A2gviii	Gaseous	0.059	753.386	0.124	350.531	Gg	0.0001	0.025	99.673
1A2a	Liquid	0.214	753.386	0.003	350.531	Gg	0.0001	0.025	99.698
1A1b	Solid	0.053	753.386	0.118	350.531	Gg	0.0001	0.024	99.723
1A3c	Liquid	0.548	753.386	0.181	350.531	Gg	0.0001	0.020	99.742
1A3aii(i)	Liquid	0.605	753.386	0.353	350.531	Gg	0.0001	0.019	99.761
1A2gviii	Other	0.279	753.386	0.065	350.531	Gg	0.0001	0.017	99.778
1A2b	Gaseous	0.001	753.386	0.059	350.531	Gg	0.0001	0.015	99.793
1A2f	Biomass	0.0001	753.386	0.049	350.531	Gg	0.0001	0.013	99.806
1A5a	Liquid	0.368	753.386	0.220	350.531	Gg	0.0001	0.013	99.819
1A4bi	Gaseous	0.039	753.386	0.064	350.531	Gg	0.0001	0.012	99.831
1A2c	Solid	0.095	753.386	0.003	350.531	Gg	0.0001	0.011	99.842
2G		0.315	753.386	0.187	350.531	Gg	0.0001	0.011	99.852
1A4ai	Gaseous	0.031	753.386	0.054	350.531	Gg	0.0001	0.010	99.863
1A2c	Liquid	0.162	753.386	0.036	350.531	Gg	0.0001	0.010	99.873
1A4ciii	Liquid	0.442	753.386	0.244	350.531	Gg	0.0001	0.010	99.883
1A1b	Liquid	0.042	753.386	0.057	350.531	Gg	0.00005	0.010	99.893
1A4ai	Liquid	0.527	753.386	0.210	350.531	Gg	0.00005	0.009	99.902
1A2e	Liquid	0.089	753.386	0.008	350.531	Gg	0.00004	0.009	99.911
1A4bi	Solid	0.074	753.386	0.002	350.531	Gg	0.00004	0.009	99.919
1A2b	Solid	0.079	753.386	0.005	350.531	Gg	0.00004	0.008	99.928
1A4bi	Peat	0.130	753.386	0.030	350.531	Gg	0.00004	0.008	99.936
1A2gviii	Peat	0.024	753.386	0.041	350.531	Gg	0.00004	0.008	99.943
1A3bi	Gaseous	NO	753.386	0.026	350.531	Gg	0.00003	0.007	99.950
1A4ci	Liquid	0.178	753.386	0.057	350.531	Gg	0.00003	0.007	99.957
1A5b	Liquid	1.532	753.386	0.689	350.531	Gg	0.00003	0.006	99.963
1A2c	Gaseous	0.081	753.386	0.061	350.531	Gg	0.00003	0.006	99.970
1A2gviii	Liquid	0.204	753.386	0.072	350.531	Gg	0.00003	0.006	99.976
1A2e	Biomass	0.077	753.386	0.052	350.531	Gg	0.00002	0.004	99.980
1A4ai	Peat	0.018	753.386	0.022	350.531	Gg	0.00002	0.004	99.984
1A2e	Peat	0.143	753.386	0.077	350.531	Gg	0.00001	0.003	99.986
1A1a	Liquid	0.383	753.386	0.170	350.531	Gg	0.00001	0.002	99.988
1A4ci	Gaseous	0.027	753.386	0.006	350.531	Gg	0.00001	0.002	99.990
1A2b	Liquid	0.019	753.386	0.015	350.531	Gg	0.00001	0.002	99.992
1A2gvii	Gaseous	0.3	753.386	0.145	350.531	Gg	0.00001	0.001	99.993
1A3bii	Gaseous	NO	753.386	0.005	350.531	Gg	0.00001	0.001	99.994
1A2gviii	Solid	0.007	753.386	0.0001	350.531	Gg	0.000004	0.001	99.995
1A2c	Biomass	0.017	753.386	0.005	350.531	Gg	0.000004	0.001	99.996
1A2e	Other	0.002	753.386	0.004	350.531	Gg	0.000004	0.001	99.997
1A3biii	Gaseous	NO	753.386	0.003	350.531	Gg	0.000003	0.001	99.998
1A2e	Gaseous	0.019	753.386	0.006	350.531	Gg	0.000003	0.001	99.998
1A3ei	Gaseous	0.001	753.386	0.002	350.531	Gg	0.000003	0.001	99.999
1A4ci	Solid	0.007	753.386	0.005	350.531	Gg	0.000002	0.0005	99.999
1A2a	Other	NO	753.386	0.002	350.531	Gg	0.000002	0.0004	100
1A2e	Solid	0.053	753.386	0.023	350.531	Gg	0.000001	0.0003	100
1A4bi	Other	0.001	753.386	0.00002	350.531	Gg	0.000001	0.0001	100
1A2a	Biomass	NO	753.386	0.0003	350.531	Gg	0.0000004	0.0001	100
1A4ci	Other	NO	753.386	0.00002	350.531	Gg	3E-08	0.00001	100

Pb

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2018 emission of the NFR category	Year 2018 total emission	Unit	Trend assessment	Contribution to trend. %	Cumulative total. %	Key source
1A3bi	Motor	166.003	321.309	0.002	15.410	Mg	0.025	29.405	29.405	Yes
1A2d	Liquid	3.984	321.309	4.880	15.410	Mg	0.015	17.322	46.728	Yes
2C7c		80.081	321.309	0.298	15.410	Mg	0.011	13.090	59.817	Yes
1A1b	Solid	2.081	321.309	2.738	15.410	Mg	0.008	9.747	69.564	Yes
2C1		34.463	321.309	0.376	15.410	Mg	0.004	4.716	74.280	Yes
2G		0.310	321.309	1.113	15.410	Mg	0.003	4.058	78.338	Yes
1A1a	Peat	1.291	321.309	1.130	15.410	Mg	0.003	3.947	82.285	Yes
1A1a	Biomass	0.097	321.309	0.805	15.410	Mg	0.002	2.957	85.242	
1A2f	Solid	2.811	321.309	0.910	15.410	Mg	0.002	2.862	88.104	
1A4bi	Biomass	0.363	321.309	0.524	15.410	Mg	0.002	1.871	89.975	
1A5a	Biomass	0.015	321.309	0.434	15.410	Mg	0.001	1.599	91.574	
1A4ci	Peat	0.068	321.309	0.350	15.410	Mg	0.001	1.282	92.856	
1A3bii	Motor	6.400	321.309	0.00001	15.410	Mg	0.001	1.134	93.990	
1A2d	Biomass	0.691	321.309	0.213	15.410	Mg	0.001	0.665	94.655	
1A1a	Solid	5.751	321.309	0.102	15.410	Mg	0.001	0.643	95.298	
1A2gviii	Biomass	0.319	321.309	0.171	15.410	Mg	0.0005	0.574	95.872	
1A3bvi		7.220	321.309	0.488	15.410	Mg	0.0004	0.525	96.397	
1A1a	Other	0.001	321.309	0.128	15.410	Mg	0.0004	0.472	96.869	
1A2e	Peat	0.167	321.309	0.098	15.410	Mg	0.0003	0.332	97.201	
1A2gviii	Other	0.049	321.309	0.085	15.410	Mg	0.0003	0.304	97.505	
1A4ci	Biomass	0.065	321.309	0.070	15.410	Mg	0.0002	0.249	97.754	
1A3biv	Motor	1.300	321.309	0.00006	15.410	Mg	0.0002	0.230	97.984	
1A2e	Solid	1.384	321.309	0.014	15.410	Mg	0.0002	0.195	98.180	
1A5a	Liquid	0.211	321.309	0.061	15.410	Mg	0.0002	0.188	98.368	
1A2d	Solid	1.025	321.309	0.0001	15.410	Mg	0.0002	0.181	98.549	
1A1b	Liquid	0.015	321.309	0.047	15.410	Mg	0.0001	0.172	98.721	
1A2d	Other	0.001	321.309	0.043	15.410	Mg	0.0001	0.159	98.879	
1A4ai	Biomass	0.020	321.309	0.032	15.410	Mg	0.0001	0.115	98.994	
1A2c	Liquid	0.082	321.309	0.031	15.410	Mg	0.0001	0.099	99.093	
1A4ai	Liquid	0.261	321.309	0.038	15.410	Mg	0.0001	0.093	99.186	
1A3aii(i)	Liquid	0.282	321.309	0.036	15.410	Mg	0.0001	0.084	99.270	
2C2		0.001	321.309	0.021	15.410	Mg	0.0001	0.077	99.348	
1A4bi	Peat	0.111	321.309	0.026	15.410	Mg	0.0001	0.075	99.422	
1A4ai	Peat	0.020	321.309	0.021	15.410	Mg	0.0001	0.074	99.496	
1A2d	Peat	0.499	321.309	0.004	15.410	Mg	0.0001	0.073	99.569	
2C7a		0.374	321.309	0.002	15.410	Mg	0.0001	0.061	99.629	
1A3dii	Liquid	0.015	321.309	0.013	15.410	Mg	0.00004	0.044	99.673	
1A2c	Solid	0.201	321.309	0.00004	15.410	Mg	0.00003	0.035	99.709	
2C6		0.0004	321.309	0.008	15.410	Mg	0.00002	0.030	99.738	
1A4bi	Solid	0.292	321.309	0.006	15.410	Mg	0.00002	0.028	99.767	
1A1a	Liquid	0.340	321.309	0.024	15.410	Mg	0.00002	0.028	99.795	
1A2f	Other	NO	321.309	0.007	15.410	Mg	0.00002	0.026	99.821	
1A2gviii	Solid	0.14	321.309	0.0005	15.410	Mg	0.00002	0.023	99.844	
1A2e	Biomass	0.008	321.309	0.007	15.410	Mg	0.00002	0.023	99.867	
1A4ci	Liquid	0.081	321.309	0.009	15.410	Mg	0.00002	0.018	99.885	
1A2gviii	Liquid	0.113	321.309	0.010	15.410	Mg	0.00001	0.015	99.901	
1A4ciii	Liquid	0.007	321.309	0.004	15.410	Mg	0.00001	0.012	99.913	
1B1b		0.022	321.309	0.004	15.410	Mg	0.00001	0.011	99.924	
2C3		0.066	321.309	0.0003	15.410	Mg	0.00001	0.011	99.935	
1A2e	Liquid	0.083	321.309	0.007	15.410	Mg	0.00001	0.010	99.944	
1A2f	Biomass	0.0002	321.309	0.002	15.410	Mg	0.00001	0.008	99.952	
1A2a	Liquid	0.036	321.309	0.004	15.410	Mg	0.00001	0.007	99.959	
3F	0	0.003	321.309	0.002	15.410	Mg	0.000004	0.005	99.964	
1A2gviii	Peat	0.003	321.309	0.001	15.410	Mg	0.000004	0.005	99.969	
1A4ci	Solid	0.035	321.309	0.0004	15.410	Mg	0.000004	0.005	99.974	

1A2e	Other	0.003	321.309	0.001	15.410	Mg	0.000004	0.004	99.978	
2B10a		0.001	321.309	0.001	15.410	Mg	0.000003	0.004	99.982	
5C1bv		0.0002	321.309	0.001	15.410	Mg	0.000003	0.003	99.985	
1A2f	Liquid	0.062	321.309	0.004	15.410	Mg	0.000003	0.003	99.988	
1A3biii	Diesel oil	0.0005	321.309	0.001	15.410	Mg	0.000002	0.003	99.991	
1A4bi	Liquid	0.046	321.309	0.003	15.410	Mg	0.000002	0.002	99.993	
1A2a	Biomass	NO	321.309	0.0005	15.410	Mg	0.000001	0.002	99.994	
1A2c	Biomass	0.003	321.309	0.001	15.410	Mg	0.000001	0.002	99.996	
1A3bi	Diesel oil	0.0002	321.309	0.0004	15.410	Mg	0.000001	0.001	99.998	
1A2b	Liquid	0.01	321.309	0.001	15.410	Mg	0.000001	0.001	99.998	
5E		0.001	321.309	0.0003	15.410	Mg	0.000001	0.001	99.999	
1A3bii	Diesel oil	0.0001	321.309	0.0002	15.410	Mg	0.0000005	0.001	100	
1A4ci	Other	NO	321.309	0.00001	15.410	Mg	2E-08	0.00002	100	
1A3biv	Diesel oil	NO	321.309	0.000001	15.410	Mg	4E-09	0.000004	100	

Cd

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2018 emission of the NFR category	Year 2018 total emission	Unit	Trend assessment	Contribution to trend. %	Cumulative total. %	Key source
2C7c		4.203	6.663	0.007	0.883	Mg	0.083	37.167	37.167	Yes
1A2d	Liquid	0.240	6.663	0.302	0.883	Mg	0.041	18.238	55.405	Yes
1A4bi	Biomass	0.109	6.663	0.157	0.883	Mg	0.021	9.637	65.042	Yes
2C6		0.85	6.663	0.012	0.883	Mg	0.015	6.796	71.839	Yes
1A1a	Biomass	0.011	6.663	0.093	0.883	Mg	0.014	6.174	78.013	Yes
1A1b	Solid	0.047	6.663	0.062	0.883	Mg	0.008	3.788	81.801	Yes
1A5a	Biomass	0.002	6.663	0.048	0.883	Mg	0.007	3.237	85.038	
2C1		0.390	6.663	0.006	0.883	Mg	0.007	3.112	88.150	
1A4ci	Biomass	0.020	6.663	0.021	0.883	Mg	0.003	1.251	89.402	
1A1a	Peat	0.023	6.663	0.019	0.883	Mg	0.002	1.090	90.492	
2G		0.028	6.663	0.019	0.883	Mg	0.002	1.064	91.556	
1A1a	Other	0.0001	6.663	0.016	0.883	Mg	0.002	1.047	92.603	
1A2gviii	Biomass	0.036	6.663	0.020	0.883	Mg	0.002	1.011	93.614	
1A1a	Solid	0.155	6.663	0.006	0.883	Mg	0.002	0.961	94.575	
1A2f	Solid	0.068	6.663	0.021	0.883	Mg	0.002	0.791	95.366	
3F		0.027	6.663	0.015	0.883	Mg	0.002	0.746	96.112	
1A2d	Biomass	0.080	6.663	0.021	0.883	Mg	0.002	0.693	96.805	
1A4ai	Biomass	0.006	6.663	0.010	0.883	Mg	0.001	0.598	97.402	
1A4ci	Peat	0.001	6.663	0.006	0.883	Mg	0.001	0.379	97.782	
1A2e	Solid	0.032	6.663	0.0004	0.883	Mg	0.001	0.257	98.038	
1A2gvii	Liquid	0.003	6.663	0.004	0.883	Mg	0.0005	0.222	98.260	
1A2d	Solid	0.024	6.663	0.00001	0.883	Mg	0.0005	0.213	98.474	
2C3		0.023	6.663	0.00002	0.883	Mg	0.0005	0.204	98.678	
1A2gviii	Other	0.028	6.663	0.001	0.883	Mg	0.0004	0.198	98.876	
1A4cii	Liquid	0.003	6.663	0.002	0.883	Mg	0.0003	0.142	99.018	
1A2d	Other	0.0001	6.663	0.002	0.883	Mg	0.0003	0.133	99.151	
1A3bvi		0.002	6.663	0.002	0.883	Mg	0.0002	0.109	99.260	
1A2e	Peat	0.003	6.663	0.002	0.883	Mg	0.0002	0.084	99.345	
1A2d	Peat	0.008	6.663	0.0001	0.883	Mg	0.0002	0.069	99.413	
1A4aii	Liquid	0.001	6.663	0.001	0.883	Mg	0.0001	0.060	99.473	
1A3dii	Liquid	0.001	6.663	0.001	0.883	Mg	0.0001	0.058	99.531	
1A4bi	Solid	0.007	6.663	0.0001	0.883	Mg	0.0001	0.050	99.581	
1A2e	Biomass	0.001	6.663	0.001	0.883	Mg	0.0001	0.041	99.622	
1A1b	Liquid	0.0003	6.663	0.001	0.883	Mg	0.0001	0.040	99.663	
1A4bii	Liquid	0.0004	6.663	0.001	0.883	Mg	0.0001	0.037	99.700	
1A5a	Liquid	0.003	6.663	0.001	0.883	Mg	0.0001	0.032	99.731	
1A1a	Liquid	0.006	6.663	0.0004	0.883	Mg	0.0001	0.029	99.760	
1A2gviii	Solid	0.003	6.663	0.00001	0.883	Mg	0.0001	0.028	99.788	
5E		0.002	6.663	0.001	0.883	Mg	0.0001	0.024	99.812	

1A2f	Biomass	0.00002	6.663	0.0003	0.883	Mg	0.00005	0.021	99.833	
1A4ai	Peat	0.0003	6.663	0.0003	0.883	Mg	0.00005	0.020	99.854	
1A2c	Liquid	0.001	6.663	0.0004	0.883	Mg	0.00004	0.016	99.869	
1A4ciii	Liquid	0.001	6.663	0.0003	0.883	Mg	0.00003	0.014	99.884	
1A3bi	Motor	0.0004	6.663	0.0003	0.883	Mg	0.00003	0.014	99.898	
1A4bi	Peat	0.002	6.663	0.0004	0.883	Mg	0.00003	0.012	99.910	
1B1b		0.0001	6.663	0.0002	0.883	Mg	0.00002	0.010	99.920	
5C1bv		0.00004	6.663	0.0001	0.883	Mg	0.00002	0.010	99.930	
1A2e	Other	0.0001	6.663	0.0001	0.883	Mg	0.00002	0.009	99.939	
1A2f	Other	NO	6.663	0.0001	0.883	Mg	0.00002	0.008	99.947	
1A3c	Liquid	0.001	6.663	0.0002	0.883	Mg	0.00002	0.008	99.955	
1A4ci	Solid	0.001	6.663	0.00002	0.883	Mg	0.00001	0.006	99.961	
1A3biii	Diesel oil	0.00005	6.663	0.0001	0.883	Mg	0.00001	0.004	99.965	
1A2c	Solid	0.0004	6.663	0.000002	0.883	Mg	0.00001	0.003	99.969	
1A2a	Biomass	NO	6.663	0.0001	0.883	Mg	0.00001	0.003	99.972	
1A2c	Biomass	0.0001	6.663	0.0001	0.883	Mg	0.00001	0.003	99.975	
1A2gviii	Liquid	0.001	6.663	0.0001	0.883	Mg	0.00001	0.003	99.979	
1A2e	Liquid	0.001	6.663	0.0001	0.883	Mg	0.00001	0.003	99.982	
1A4bi	Liquid	0.001	6.663	0.00003	0.883	Mg	0.00001	0.003	99.984	
1A3bi	Diesel oil	0.00002	6.663	0.00004	0.883	Mg	0.00001	0.003	99.987	
1A4ai	Liquid	0.003	6.663	0.0005	0.883	Mg	0.00001	0.002	99.989	
1A2gvii	Gaseous	0.00007	6.663	0.00003	0.883	Mg	0.000004	0.002	99.991	
1A4ci	Liquid	0.001	6.663	0.0001	0.883	Mg	0.000004	0.002	99.993	
1A2gviii	Peat	0.00004	6.663	0.00003	0.883	Mg	0.000003	0.001	99.994	
2C7a		0.0002	6.663	0.00001	0.883	Mg	0.000003	0.001	99.995	
1A2f	Liquid	0.001	6.663	0.0001	0.883	Mg	0.000003	0.001	99.996	
2C2		0.003	6.663	0.0004	0.883	Mg	0.000003	0.001	99.998	
1A3bii	Diesel oil	0.00001	6.663	0.00002	0.883	Mg	0.000002	0.001	99.998	
1A2b	Liquid	0.0001	6.663	0.00001	0.883	Mg	0.000001	0.0005	99.999	
1A3biv	Motor	0.000003	6.663	0.00001	0.883	Mg	0.000001	0.0005	99.999	
1A2a	Liquid	0.0005	6.663	0.0001	0.883	Mg	0.000001	0.0005	100	
1A3bii	Motor	0.00001	6.663	0.000001	0.883	Mg	0.0000001	0.0001	100	
1A4ci	Other	NO	6.663	0.000001	0.883	Mg	0.0000001	0.0001	100	
1A3biv	Diesel oil	NO	6.663	0.0000001	0.883	Mg	2E-08	0.00001	100	

Hg

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2018 emission of the NFR category	Year 2018 total emission	Unit	Trend assessment	Contribution to trend. %	Cumulative total. %	Key source
2B10a		0.369	1.083	0.035	0.677	Mg	0.181	24.354	24.354	Yes
1A2gviii	Other	0.171	1.083	0.003	0.677	Mg	0.097	13.009	37.363	Yes
2C1		0.005	1.083	0.102	0.677	Mg	0.091	12.269	49.633	Yes
1A1a	Solid	0.172	1.083	0.046	0.677	Mg	0.057	7.655	57.288	Yes
2C7c		0.028	1.083	0.078	0.677	Mg	0.056	7.565	64.853	Yes
1A2d	Liquid	0.071	1.083	0.102	0.677	Mg	0.053	7.142	71.995	Yes
1A1a	Biomass	0.003	1.083	0.041	0.677	Mg	0.036	4.840	76.835	Yes
1A2f	Solid	0.017	1.083	0.042	0.677	Mg	0.029	3.902	80.737	Yes
1A1a	Peat	0.062	1.083	0.067	0.677	Mg	0.026	3.505	84.243	
1A4bi	Biomass	0.018	1.083	0.026	0.677	Mg	0.014	1.847	86.090	
5C1bv		0.006	1.083	0.018	0.677	Mg	0.013	1.722	87.812	
1A2d	Solid	0.018	1.083	0.0002	0.677	Mg	0.010	1.411	89.223	
1A2f	Other	NO	1.083	0.011	0.677	Mg	0.010	1.401	90.624	
1A2a	Solid	0.017	1.083	0.0001	0.677	Mg	0.009	1.278	91.902	
1A1b	Solid	0.010	1.083	0.013	0.677	Mg	0.006	0.837	92.739	
1A1a	Other	0.00002	1.083	0.006	0.677	Mg	0.006	0.767	93.507	
1A5a	Biomass	0.0002	1.083	0.005	0.677	Mg	0.004	0.586	94.093	
1A4ci	Peat	0.001	1.083	0.005	0.677	Mg	0.004	0.586	94.678	
1A3biii	Diesel oil	0.005	1.083	0.008	0.677	Mg	0.004	0.535	95.213	

1A2d	Biomass	0.018	1.083	0.015	0.677	Mg	0.004	0.523	95.736	
2C7a		0.007	1.083	0.000004	0.677	Mg	0.004	0.505	96.241	
1A2d	Other	0.0001	1.083	0.003	0.677	Mg	0.003	0.424	96.665	
1A3bi	Diesel oil	0.002	1.083	0.004	0.677	Mg	0.003	0.384	97.049	
1A2c	Solid	0.005	1.083	0.0001	0.677	Mg	0.003	0.376	97.424	
1A2e	Solid	0.006	1.083	0.001	0.677	Mg	0.003	0.364	97.789	
2C2		0.0002	1.083	0.002	0.677	Mg	0.001	0.187	97.976	
1A4ci	Biomass	0.003	1.083	0.004	0.677	Mg	0.001	0.186	98.162	
1A3bi	Motor	0.016	1.083	0.011	0.677	Mg	0.001	0.186	98.348	
1A2d	Peat	0.016	1.083	0.008	0.677	Mg	0.001	0.185	98.533	
2C6		NO	1.083	0.001	0.677	Mg	0.001	0.184	98.717	
1A3dii	Liquid	0.003	1.083	0.003	0.677	Mg	0.001	0.137	98.854	
1A4ai	Biomass	0.001	1.083	0.002	0.677	Mg	0.001	0.124	98.978	
1A2gviii	Liquid	0.0001	1.083	0.001	0.677	Mg	0.001	0.117	99.096	
1A2gviii	Biomass	0.005	1.083	0.004	0.677	Mg	0.001	0.104	99.200	
1A4bi	Solid	0.001	1.083	0.00003	0.677	Mg	0.001	0.103	99.303	
1A3bii	Diesel oil	0.001	1.083	0.002	0.677	Mg	0.001	0.102	99.405	
1A4bi	Peat	0.002	1.083	0.0004	0.677	Mg	0.001	0.083	99.488	
3F		0.005	1.083	0.003	0.677	Mg	0.0005	0.065	99.553	
5E		0.002	1.083	0.001	0.677	Mg	0.0005	0.063	99.616	
1A1a	Liquid	0.001	1.083	0.0001	0.677	Mg	0.0004	0.06	99.676	
1A2gviii	Solid	0.001	1.083	0.000002	0.677	Mg	0.0004	0.051	99.727	
1A3bii	Motor	0.001	1.083	0.00004	0.677	Mg	0.0003	0.039	99.766	
1A2gviii	Peat	0.0002	1.083	0.0004	0.677	Mg	0.0002	0.032	99.798	
1A2e	Peat	0.003	1.083	0.002	0.677	Mg	0.0002	0.032	99.830	
1A3biv	Motor	0.0001	1.083	0.0003	0.677	Mg	0.0002	0.031	99.861	
1A4ciii	Liquid	0.002	1.083	0.001	0.677	Mg	0.0002	0.023	99.884	
1A4ai	Liquid	0.0003	1.083	0.00005	0.677	Mg	0.0001	0.019	99.903	
1A4ai	Peat	0.0003	1.083	0.0003	0.677	Mg	0.0001	0.016	99.919	
1A2c	Biomass	0.0002	1.083	0.00001	0.677	Mg	0.0001	0.014	99.933	
1A4ci	Solid	0.0003	1.083	0.0001	0.677	Mg	0.0001	0.009	99.942	
2G		0.00002	1.083	0.0001	0.677	Mg	0.0001	0.008	99.950	
1A2e	Liquid	0.0001	1.083	0.00001	0.677	Mg	0.0001	0.007	99.958	
1A4ci	Liquid	0.0001	1.083	0.00001	0.677	Mg	0.00005	0.006	99.964	
1A1b	Liquid	0.00004	1.083	0.0001	0.677	Mg	0.00004	0.006	99.970	
1A2f	Biomass	0.000002	1.083	0.00005	0.677	Mg	0.00004	0.006	99.976	
1A5a	Liquid	0.0005	1.083	0.0003	0.677	Mg	0.00003	0.004	99.981	
1A4bi	Liquid	0.0001	1.083	0.000003	0.677	Mg	0.00003	0.004	99.984	
1A2c	Liquid	0.0001	1.083	0.00004	0.677	Mg	0.00003	0.003	99.988	
1A2a	Liquid	0.0001	1.083	0.000004	0.677	Mg	0.00002	0.003	99.991	
1A2f	Liquid	0.0001	1.083	0.0001	0.677	Mg	0.00002	0.002	99.994	
1A2e	Other	0.000003	1.083	0.00002	0.677	Mg	0.00001	0.002	99.995	
1A3biv	Diesel oil	NO	1.083	0.00001	0.677	Mg	0.00001	0.002	99.997	
1A2e	Biomass	0.0002	1.083	0.0001	0.677	Mg	0.00001	0.001	99.998	
1A2a	Biomass	NO	1.083	0.00001	0.677	Mg	0.000005	0.001	99.999	
1A2b	Liquid	0.00001	1.083	0.000003	0.677	Mg	0.000004	0.001	100	
1B1b		0.00001	1.083	0.00001	0.677	Mg	0.000003	0.0005	100	
1A4ci	Other	NO	1.083	0.0000001	0.677	Mg	0.0000001	0.00001	100	

As

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2018 emission of the NFR category	Year 2018 total emission	Unit	Trend assessment	Contribution to trend. %	Cumulative total. %	Key source
2C7c		28.000	34.810	0.230	2.415	Mg	0.049	45.763	45.763	Yes
1A1a	Peat	0.628	34.810	0.634	2.415	Mg	0.017	15.780	61.543	Yes
1A1b	Solid	0.342	34.810	0.451	2.415	Mg	0.012	11.410	72.953	Yes
1A2d	Liquid	0.163	34.810	0.203	2.415	Mg	0.006	5.134	78.087	Yes
1A4ci	Peat	0.032	34.810	0.167	2.415	Mg	0.005	4.401	82.488	Yes

1A2f	Solid	0.491	34.810	0.150	2.415	Mg	0.003	3.108	85.596
2C6		1.700	34.810	0.006	2.415	Mg	0.003	2.995	88.591
2C7a		0.113	34.810	0.082	2.415	Mg	0.002	1.993	90.584
1A1a	Biomass	0.002	34.810	0.057	2.415	Mg	0.002	1.521	92.105
1A4bi	Biomass	0.036	34.810	0.052	2.415	Mg	0.001	1.333	93.438
1A2e	Peat	0.080	34.810	0.047	2.415	Mg	0.001	1.099	94.537
1A3bvi		0.036	34.810	0.043	2.415	Mg	0.001	1.093	95.630
1A1a	Solid	1.618	34.810	0.142	2.415	Mg	0.001	0.794	96.425
1A2d	Solid	0.229	34.810	0.001	2.415	Mg	0.0004	0.405	96.829
1A2d	Peat	0.238	34.810	0.002	2.415	Mg	0.0004	0.384	97.213
2C1		0.411	34.810	0.041	2.415	Mg	0.0004	0.331	97.544
1A5a	Biomass	0.0003	34.810	0.010	2.415	Mg	0.0003	0.257	97.801
1A4ai	Peat	0.010	34.810	0.010	2.415	Mg	0.0003	0.248	98.050
1A3dii	Liquid	0.028	34.810	0.011	2.415	Mg	0.0002	0.229	98.278
1A4bi	Peat	0.053	34.810	0.012	2.415	Mg	0.0002	0.227	98.505
1A2e	Solid	0.228	34.810	0.008	2.415	Mg	0.0002	0.217	98.722
1A4ci	Biomass	0.007	34.810	0.007	2.415	Mg	0.0002	0.176	98.898
1A1a	Other	0.00002	34.810	0.004	2.415	Mg	0.0001	0.108	99.006
1A5a	Liquid	0.017	34.810	0.005	2.415	Mg	0.0001	0.106	99.112
1A1b	Liquid	0.001	34.810	0.004	2.415	Mg	0.0001	0.103	99.215
1A2gviii	Biomass	0.007	34.810	0.004	2.415	Mg	0.0001	0.093	99.307
1A2d	Biomass	0.016	34.810	0.004	2.415	Mg	0.0001	0.089	99.397
1A4ai	Biomass	0.002	34.810	0.003	2.415	Mg	0.0001	0.082	99.479
1A4bi	Solid	0.048	34.810	0.001	2.415	Mg	0.0001	0.061	99.540
1A2c	Liquid	0.007	34.810	0.002	2.415	Mg	0.0001	0.053	99.594
1B1b		0.004	34.810	0.002	2.415	Mg	0.0001	0.050	99.644
2G		0.001	34.810	0.002	2.415	Mg	0.0001	0.050	99.693
1A4ai	Liquid	0.021	34.810	0.003	2.415	Mg	0.00005	0.042	99.735
1A2gviii	Solid	0.023	34.810	0.0001	2.415	Mg	0.00004	0.041	99.776
1A2gviii	Other	0.001	34.810	0.001	2.415	Mg	0.00003	0.028	99.804
1A4ciii	Liquid	0.002	34.810	0.001	2.415	Mg	0.00003	0.026	99.831
5E		0.003	34.810	0.001	2.415	Mg	0.00002	0.020	99.850
1A2d	Other	0.00003	34.810	0.001	2.415	Mg	0.00002	0.018	99.869
1A2c	Solid	0.011	34.810	0.0001	2.415	Mg	0.00002	0.018	99.887
2C2		0.002	34.810	0.001	2.415	Mg	0.00002	0.018	99.905
1A2gviii	Peat	0.001	34.810	0.001	2.415	Mg	0.00002	0.017	99.922
5C1bv		0.0001	34.810	0.0004	2.415	Mg	0.00001	0.011	99.932
1A4ci	Solid	0.006	34.810	0.001	2.415	Mg	0.00001	0.010	99.942
1A3bi	Motor	0.001	34.810	0.0004	2.415	Mg	0.00001	0.009	99.951
2C3		0.008	34.810	0.0003	2.415	Mg	0.00001	0.008	99.959
1A4ci	Liquid	0.006	34.810	0.001	2.415	Mg	0.00001	0.007	99.966
1A2gviii	Liquid	0.009	34.810	0.001	2.415	Mg	0.00001	0.006	99.972
1A1a	Liquid	0.030	34.810	0.002	2.415	Mg	0.00001	0.005	99.977
1A3biii	Diesel oil	0.0001	34.810	0.0001	2.415	Mg	0.000004	0.004	99.981
1A2e	Biomass	0.0002	34.810	0.0001	2.415	Mg	0.000004	0.004	99.984
1A2e	Liquid	0.007	34.810	0.001	2.415	Mg	0.000003	0.003	99.987
1A2a	Liquid	0.003	34.810	0.0003	2.415	Mg	0.000002	0.002	99.990
3F		0.0002	34.810	0.0001	2.415	Mg	0.000002	0.002	99.992
1A3bi	Diesel oil	0.00003	34.810	0.0001	2.415	Mg	0.000002	0.002	99.994
1A2f	Biomass	0.000004	34.810	0.00005	2.415	Mg	0.000001	0.001	99.995
1A2f	Other	NO	34.810	0.00004	2.415	Mg	0.000001	0.001	99.996
1A4bi	Liquid	0.004	34.810	0.0002	2.415	Mg	0.000001	0.001	99.997
1A3bii	Diesel oil	0.00003	34.810	0.00003	2.415	Mg	0.000001	0.001	99.998
1A2e	Other	0.00001	34.810	0.00003	2.415	Mg	0.000001	0.001	99.999
1A2c	Biomass	0.00001	34.810	0.00002	2.415	Mg	0.0000005	0.0004	99.999
1A3biv	Motor	0.000004	34.810	0.00001	2.415	Mg	0.0000003	0.0003	99.999
1A2a	Biomass	NO	34.810	0.00001	2.415	Mg	0.0000003	0.0003	100
1A2b	Liquid	0.001	34.810	0.0001	2.415	Mg	0.0000003	0.0002	100
1A2f	Liquid	0.005	34.810	0.0003	2.415	Mg	0.0000001	0.0001	100
1A3biv	Diesel oil	NO	34.810	0.0000002	2.415	Mg	1E-08	0.00001	100
1A4ci	Other	NO	34.810	0.0000002	2.415	Mg	4E-09	0.000004	100

1A3bii	Motor	0.00002	34.810	0.000001	2.415	Mg	2E-09	0.000002	100	

Cr

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2018 emission of the NFR category	Year 2018 total emission	Unit	Trend assessment	Contribution to trend. %	Cumulative total. %	Key source
2C1		19.554	47.448	2.698	15.344	Mg	0.076	23.185	23.185	Yes
1A1b	Solid	2.634	47.448	3.466	15.344	Mg	0.055	16.718	39.903	Yes
1A1a	Solid	6.765	47.448	0.150	15.344	Mg	0.043	13.031	52.934	Yes
1A4bi	Biomass	1.270	47.448	1.834	15.344	Mg	0.030	9.100	62.034	Yes
1A3bvi		1.143	47.448	1.360	15.344	Mg	0.021	6.333	68.367	Yes
1A1a	Biomass	0.069	47.448	0.621	15.344	Mg	0.013	3.828	72.195	Yes
1A1a	Peat	1.076	47.448	0.926	15.344	Mg	0.012	3.696	75.891	Yes
1A2e	Solid	1.752	47.448	0.017	15.344	Mg	0.012	3.512	79.403	Yes
2C2		2.000	47.448	1.181	15.344	Mg	0.011	3.416	82.819	Yes
1A2d	Solid	1.263	47.448	0.0005	15.344	Mg	0.009	2.610	85.428	
1A2b	Solid	1.845	47.448	0.252	15.344	Mg	0.007	2.202	87.630	
1A5a	Biomass	0.012	47.448	0.337	15.344	Mg	0.007	2.132	89.762	
1A4ci	Peat	0.056	47.448	0.288	15.344	Mg	0.006	1.729	91.491	
1A4ci	Biomass	0.228	47.448	0.246	15.344	Mg	0.004	1.104	92.595	
2C7c		0.520	47.448	0.020	15.344	Mg	0.003	0.948	93.543	
1A2gviii	Biomass	0.817	47.448	0.131	15.344	Mg	0.003	0.852	94.394	
1A2d	Peat	0.411	47.448	0.005	15.344	Mg	0.003	0.819	95.213	
1A4bi	Solid	0.370	47.448	0.008	15.344	Mg	0.002	0.714	95.927	
1A1a	Other	0.001	47.448	0.095	15.344	Mg	0.002	0.603	96.531	
1A4ai	Biomass	0.068	47.448	0.112	15.344	Mg	0.002	0.578	97.109	
1A2d	Biomass	0.525	47.448	0.109	15.344	Mg	0.001	0.391	97.500	
1A2f	Solid	3.365	47.448	1.149	15.344	Mg	0.001	0.390	97.890	
1A2gviii	Solid	0.177	47.448	0.001	15.344	Mg	0.001	0.362	98.253	
1A2d	Liquid	0.042	47.448	0.062	15.344	Mg	0.001	0.311	98.564	
2C7a		0.145	47.448	0.0001	15.344	Mg	0.001	0.300	98.863	
1A2e	Peat	0.138	47.448	0.081	15.344	Mg	0.001	0.231	99.094	
2G		0.006	47.448	0.022	15.344	Mg	0.0004	0.129	99.223	
1A4ci	Solid	0.044	47.448	0.001	15.344	Mg	0.0003	0.088	99.311	
1A2gvii	Liquid	0.014	47.448	0.018	15.344	Mg	0.0003	0.087	99.399	
1A4ai	Peat	0.017	47.448	0.017	15.344	Mg	0.0002	0.075	99.474	
1A3biii	Diesel oil	0.008	47.448	0.012	15.344	Mg	0.0002	0.060	99.535	
1A4bi	Peat	0.091	47.448	0.021	15.344	Mg	0.0002	0.054	99.588	
1A4cii	Liquid	0.015	47.448	0.012	15.344	Mg	0.0002	0.049	99.638	
1A3bi	Diesel oil	0.003	47.448	0.007	15.344	Mg	0.0001	0.037	99.675	
1A2d	Other	0.001	47.448	0.005	15.344	Mg	0.0001	0.034	99.709	
1A2gviii	Other	0.024	47.448	0.013	15.344	Mg	0.0001	0.032	99.740	
1A3bi	Motor	0.011	47.448	0.008	15.344	Mg	0.0001	0.029	99.769	
1A2c	Solid	0.013	47.448	0.0001	15.344	Mg	0.0001	0.027	99.796	
1A1a	Liquid	0.015	47.448	0.001	15.344	Mg	0.0001	0.023	99.818	
1A4aii	Liquid	0.007	47.448	0.005	15.344	Mg	0.0001	0.020	99.839	
1A2e	Biomass	0.006	47.448	0.005	15.344	Mg	0.0001	0.020	99.859	
1A4bii	Liquid	0.002	47.448	0.003	15.344	Mg	0.00005	0.015	99.874	
1A3bii	Diesel oil	0.002	47.448	0.003	15.344	Mg	0.00004	0.013	99.886	
1A2f	Biomass	0.0001	47.448	0.002	15.344	Mg	0.00004	0.013	99.899	
1A3dii	Liquid	0.03	47.448	0.012	15.344	Mg	0.00004	0.012	99.911	
1A4ai	Liquid	0.010	47.448	0.002	15.344	Mg	0.00004	0.012	99.923	
1A1b	Liquid	0.001	47.448	0.002	15.344	Mg	0.00004	0.011	99.934	
1A2f	Other	NO	47.448	0.001	15.344	Mg	0.00003	0.009	99.943	
1A2gviii	Liquid	0.016	47.448	0.004	15.344	Mg	0.00002	0.007	99.950	
1A2e	Other	0.006	47.448	0.001	15.344	Mg	0.00002	0.007	99.957	
3F		0.005	47.448	0.002	15.344	Mg	0.00002	0.006	99.962	
1A2e	Liquid	0.003	47.448	0.0002	15.344	Mg	0.00002	0.005	99.968	

1A4ci	Liquid	0.003	47.448	0.0004	15.344	Mg	0.00001	0.004	99.972	
1A4ciii	Liquid	0.003	47.448	0.001	15.344	Mg	0.00001	0.003	99.976	
1A2gviii	Peat	0.002	47.448	0.001	15.344	Mg	0.00001	0.003	99.979	
1B1b		0.003	47.448	0.001	15.344	Mg	0.00001	0.003	99.982	
1A4bi	Liquid	0.002	47.448	0.0001	15.344	Mg	0.00001	0.003	99.985	
1A2f	Liquid	0.002	47.448	0.0003	15.344	Mg	0.00001	0.003	99.988	
1A2c	Biomass	0.0004	47.448	0.0005	15.344	Mg	0.00001	0.002	99.990	
5C1bv		0.0001	47.448	0.0004	15.344	Mg	0.00001	0.002	99.993	
1A2a	Biomass	NO	47.448	0.0004	15.344	Mg	0.00001	0.002	99.995	
1A3biv	Motor ..	0.0001	47.448	0.0002	15.344	Mg	0.000004	0.001	99.996	
1A2c	Liquid	0.003	47.448	0.001	15.344	Mg	0.000003	0.001	99.997	
1A2b	Liquid	0.001	47.448	0.0004	15.344	Mg	0.000003	0.001	99.998	
1A3bii	Motor ..	0.0004	47.448	0.00003	15.344	Mg	0.000002	0.001	99.999	
1A2gvii	Gaseous	0.0003	47.448	0.0002	15.344	Mg	0.000001	0.0004	99.999	
1A5a	Liquid	0.009	47.448	0.003	15.344	Mg	0.000001	0.0002	99.999	
5E		0.003	47.448	0.001	15.344	Mg	0.000001	0.0002	100	
1A2a	Liquid	0.001	47.448	0.001	15.344	Mg	0.000001	0.0002	100	
1A3biv	Diesel oil	NO	47.448	0.00002	15.344	Mg	0.0000004	0.0001	100	
1A3c	Liquid	0.003	47.448	0.001	15.344	Mg	0.0000003	0.0001	100	
1A4ci	Other	NO	47.448	0.00001	15.344	Mg	0.0000001	0.00003	100	

Cu

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2018 emission of the NFR category	Year 2018 total emission	Unit	Trend assessment	Contribution to trend. %	Cumulative total. %	Key source
2C7c		80.257	156.794	0.274	40.173	Mg	0.129	41.218	41.218	Yes
1A3bvi		49.238	156.794	30.623	40.173	Mg	0.115	36.585	77.802	Yes
1A1a	Solid	5.471	156.794	0.168	40.173	Mg	0.008	2.508	80.310	Yes
2C7a		4.803	156.794	0.004	40.173	Mg	0.008	2.493	82.802	
2C1		5.540	156.794	0.277	40.173	Mg	0.007	2.322	85.124	
1A1a	Peat	1.662	156.794	1.484	40.173	Mg	0.007	2.150	87.274	
1A1a	Biomass	0.105	156.794	1.025	40.173	Mg	0.006	2.028	89.302	
1A1b	Solid	0.922	156.794	1.213	40.173	Mg	0.006	1.985	91.287	
2G		0.203	156.794	0.648	40.173	Mg	0.004	1.211	92.498	
1A2gvii	Liquid	0.491	156.794	0.624	40.173	Mg	0.003	1.012	93.510	
1A5a	Biomass	0.017	156.794	0.491	40.173	Mg	0.003	0.989	94.499	
1A4ci	Peat	0.088	156.794	0.453	40.173	Mg	0.003	0.875	95.374	
1A4cii	Liquid	0.499	156.794	0.423	40.173	Mg	0.002	0.601	95.975	
1A4bi	Biomass	0.218	156.794	0.314	40.173	Mg	0.002	0.525	96.500	
1A1a	Other	0.001	156.794	0.168	40.173	Mg	0.001	0.341	96.841	
1A2d	Solid	0.648	156.794	0.0004	40.173	Mg	0.001	0.336	97.177	
1A2d	Peat	0.646	156.794	0.007	40.173	Mg	0.001	0.322	97.500	
1A2d	Biomass	0.813	156.794	0.363	40.173	Mg	0.001	0.314	97.814	
1A2e	Solid	0.613	156.794	0.008	40.173	Mg	0.001	0.304	98.117	
1A4aii	Liquid	0.227	156.794	0.182	40.173	Mg	0.001	0.251	98.368	
1A4bii	Liquid	0.075	156.794	0.103	40.173	Mg	0.001	0.169	98.538	
2C2		0.003	156.794	0.080	40.173	Mg	0.001	0.161	98.699	
1A2d	Other	0.001	156.794	0.076	40.173	Mg	0.0005	0.154	98.853	
1A2f	Solid	1.280	156.794	0.402	40.173	Mg	0.0005	0.151	99.003	
1A2e	Peat	0.216	156.794	0.127	40.173	Mg	0.0005	0.145	99.148	
2B10a		0.27	156.794	0.003	40.173	Mg	0.0004	0.134	99.282	
1A3dii	Liquid	0.100	156.794	0.086	40.173	Mg	0.0004	0.122	99.405	
1A4ci	Biomass	0.039	156.794	0.042	40.173	Mg	0.0002	0.066	99.470	
1A2d	Liquid	0.022	156.794	0.037	40.173	Mg	0.0002	0.065	99.535	
1A4bi	Solid	0.130	156.794	0.003	40.173	Mg	0.0002	0.062	99.597	
1A4ai	Peat	0.026	156.794	0.027	40.173	Mg	0.0001	0.041	99.638	
1A2gviii	Biomass	0.699	156.794	0.198	40.173	Mg	0.0001	0.039	99.677	
2C6		NO	156.794	0.019	40.173	Mg	0.0001	0.038	99.715	

1A4ai	Biomass	0.013	156.794	0.019	40.173	Mg	0.0001	0.032	99.747	
1A2gviii	Solid	0.062	156.794	0.0002	40.173	Mg	0.0001	0.032	99.779	
1A4ciii	Liquid	0.049	156.794	0.025	40.173	Mg	0.0001	0.026	99.805	
1A2gvii	Other	0.037	156.794	0.021	40.173	Mg	0.0001	0.023	99.828	
1A5a	Liquid	0.029	156.794	0.016	40.173	Mg	0.0001	0.017	99.844	
1A3c	Liquid	0.103	156.794	0.034	40.173	Mg	0.00005	0.015	99.859	
1A3biii	Diesel oil	0.006	156.794	0.008	40.173	Mg	0.00004	0.014	99.873	
1A1a	Liquid	0.034	156.794	0.003	40.173	Mg	0.00003	0.011	99.884	
1A2e	Biomass	0.009	156.794	0.008	40.173	Mg	0.00003	0.011	99.894	
1A1b	Liquid	0.002	156.794	0.005	40.173	Mg	0.00003	0.009	99.903	
1A3bi	Diesel oil	0.002	156.794	0.004	40.173	Mg	0.00003	0.008	99.911	
1A3bi	Motor	0.008	156.794	0.006	40.173	Mg	0.00002	0.008	99.919	
1A4bi	Peat	0.143	156.794	0.033	40.173	Mg	0.00002	0.007	99.926	
1A4ci	Solid	0.016	156.794	0.0004	40.173	Mg	0.00002	0.007	99.934	
1A2gviii	Liquid	0.022	156.794	0.002	40.173	Mg	0.00002	0.007	99.941	
1B1b		0.004	156.794	0.004	40.173	Mg	0.00002	0.007	99.947	
1A4ai	Liquid	0.026	156.794	0.004	40.173	Mg	0.00002	0.006	99.953	
1A2f	Other	NO	156.794	0.003	40.173	Mg	0.00002	0.005	99.959	
1A2gvii	Gaseous	0.012	156.794	0.006	40.173	Mg	0.00002	0.005	99.964	
1A2f	Biomass	0.0002	156.794	0.003	40.173	Mg	0.00002	0.005	99.969	
1A2c	Solid	0.01	156.794	0.0001	40.173	Mg	0.00002	0.005	99.974	
1A2e	Liquid	0.008	156.794	0.001	40.173	Mg	0.00001	0.003	99.977	
1A2e	Other	0.0003	156.794	0.002	40.173	Mg	0.00001	0.003	99.980	
1A3bii	Diesel oil	0.001	156.794	0.002	40.173	Mg	0.00001	0.003	99.983	
1A4ci	Liquid	0.008	156.794	0.001	40.173	Mg	0.00001	0.002	99.986	
1A2gviii	Peat	0.003	156.794	0.002	40.173	Mg	0.00001	0.002	99.988	
1A2f	Liquid	0.006	156.794	0.0005	40.173	Mg	0.00001	0.002	99.990	
1A2c	Liquid	0.008	156.794	0.003	40.173	Mg	0.00001	0.002	99.992	
1A4bi	Liquid	0.005	156.794	0.0003	40.173	Mg	0.00001	0.002	99.994	
1A2a	Liquid	0.004	156.794	0.0004	40.173	Mg	0.000004	0.001	99.995	
3F		0.002	156.794	0.001	40.173	Mg	0.000004	0.001	99.996	
1A2a	Biomass	NO	156.794	0.001	40.173	Mg	0.000003	0.001	99.997	
5E		0.006	156.794	0.002	40.173	Mg	0.000003	0.001	99.998	
1A2c	Biomass	0.001	156.794	0.001	40.173	Mg	0.000002	0.001	99.999	
5C1bv		0.0001	156.794	0.0004	40.173	Mg	0.000002	0.001	100	
1A3biv	Motor	0.0001	156.794	0.0002	40.173	Mg	0.000001	0.0003	100	
1A3bii	Motor	0.0003	156.794	0.00002	40.173	Mg	0.0000003	0.0001	100	
1A3biv	Diesel oil	NO	156.794	0.00001	40.173	Mg	0.0000001	0.00003	100	
1A4ci	Other	NO	156.794	0.00001	40.173	Mg	5E-08	0.00002	100	
1A2b	Liquid	0.001	156.794	0.0002	40.173	Mg	4E-08	0.00001	100	

Ni

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2018 emission of the NFR category	Year 2018 total emission	Unit	Trend assessment	Contribution to trend. %	Cumulative total. %	Key source
2C7c		31.000	78.248	0.034	14.139	Mg	0.071	33.129	33.129	Yes
2C7b		5.000	78.248	2.998	14.139	Mg	0.027	12.463	45.592	Yes
1A4bi	Biomass	1.089	78.248	1.572	14.139	Mg	0.018	8.182	53.774	Yes
1A1a	Solid	5.396	78.248	0.194	14.139	Mg	0.010	4.645	58.419	Yes
1A1a	Peat	1.066	78.248	0.928	14.139	Mg	0.009	4.377	62.795	Yes
1A1b	Liquid	1.729	78.248	0.875	14.139	Mg	0.007	3.348	66.144	Yes
2C1		2.002	78.248	0.921	14.139	Mg	0.007	3.329	69.472	Yes
1A1a	Biomass	0.060	78.248	0.523	14.139	Mg	0.007	3.049	72.521	Yes
1A2f	Solid	2.771	78.248	0.920	14.139	Mg	0.005	2.494	75.015	Yes
1A1a	Liquid	3.688	78.248	0.273	14.139	Mg	0.005	2.339	77.355	Yes
1A5a	Biomass	0.010	78.248	0.289	14.139	Mg	0.004	1.709	79.064	Yes
1A4ci	Peat	0.056	78.248	0.288	14.139	Mg	0.004	1.656	80.720	Yes
1A5a	Liquid	2.531	78.248	0.728	14.139	Mg	0.003	1.610	82.330	

1A2e	Solid	1.401	78.248	0.014	14.139	Mg	0.003	1.425	83.754
1A2c	Liquid	0.833	78.248	0.362	14.139	Mg	0.003	1.261	85.015
1A2b	Solid	1.115	78.248	0.007	14.139	Mg	0.002	1.160	86.175
1A3dii	Liquid	1.280	78.248	0.423	14.139	Mg	0.002	1.138	87.313
1A2d	Solid	1.036	78.248	0.0002	14.139	Mg	0.002	1.112	88.425
1A4ci	Biomass	0.195	78.248	0.211	14.139	Mg	0.002	1.046	89.472
1A3bvi		0.164	78.248	0.195	14.139	Mg	0.002	0.985	90.457
1A2gviii	Liquid	1.361	78.248	0.104	14.139	Mg	0.002	0.843	91.300
1A4ai	Liquid	3.134	78.248	0.452	14.139	Mg	0.001	0.678	91.978
1A2e	Liquid	1.007	78.248	0.080	14.139	Mg	0.001	0.608	92.586
2C7a		0.508	78.248	0.0003	14.139	Mg	0.001	0.545	93.131
2C2		0.017	78.248	0.094	14.139	Mg	0.001	0.541	93.672
1A4ai	Biomass	0.058	78.248	0.096	14.139	Mg	0.001	0.510	94.182
1A2f	Liquid	0.676	78.248	0.039	14.139	Mg	0.001	0.496	94.679
1A1a	Other	0.001	78.248	0.083	14.139	Mg	0.001	0.494	95.172
1A2gviii	Other	0.021	78.248	0.085	14.139	Mg	0.001	0.481	95.653
1A2gviii	Biomass	0.212	78.248	0.114	14.139	Mg	0.001	0.449	96.103
1A2d	Peat	0.412	78.248	0.003	14.139	Mg	0.001	0.423	96.526
1A4ci	Liquid	0.971	78.248	0.105	14.139	Mg	0.001	0.419	96.945
1A4bi	Liquid	0.555	78.248	0.033	14.139	Mg	0.001	0.400	97.345
1A2d	Liquid	2.254	78.248	0.465	14.139	Mg	0.001	0.340	97.685
1A2e	Peat	0.138	78.248	0.081	14.139	Mg	0.001	0.332	98.017
1A4bi	Solid	0.296	78.248	0.006	14.139	Mg	0.001	0.280	98.297
2G		0.025	78.248	0.051	14.139	Mg	0.001	0.278	98.575
1A2a	Liquid	0.435	78.248	0.043	14.139	Mg	0.0005	0.212	98.787
2B10a		1.052	78.248	0.162	14.139	Mg	0.0004	0.167	98.954
1A2gviii	Solid	0.142	78.248	0.0005	14.139	Mg	0.0003	0.150	99.103
1A2gvii	Liquid	0.020	78.248	0.026	14.139	Mg	0.0003	0.131	99.234
1A4ciii	Liquid	0.056	78.248	0.029	14.139	Mg	0.0002	0.110	99.345
1A1b	Solid	0.150	78.248	0.011	14.139	Mg	0.0002	0.098	99.443
1A4ai	Peat	0.017	78.248	0.017	14.139	Mg	0.0002	0.084	99.527
1A4cii	Liquid	0.021	78.248	0.017	14.139	Mg	0.0002	0.082	99.609
1A2d	Biomass	0.455	78.248	0.093	14.139	Mg	0.0001	0.065	99.674
1B1b		0.002	78.248	0.009	14.139	Mg	0.0001	0.050	99.724
1A2b	Liquid	0.124	78.248	0.029	14.139	Mg	0.0001	0.042	99.766
1A4ci	Solid	0.035	78.248	0.0004	14.139	Mg	0.0001	0.036	99.801
1A4aii	Liquid	0.009	78.248	0.007	14.139	Mg	0.0001	0.034	99.836
1A2d	Other	0.001	78.248	0.005	14.139	Mg	0.0001	0.030	99.866
1A4bi	Peat	0.091	78.248	0.021	14.139	Mg	0.0001	0.027	99.893
1A4bii	Liquid	0.003	78.248	0.004	14.139	Mg	0.00005	0.022	99.914
1A2e	Biomass	0.005	78.248	0.004	14.139	Mg	0.00004	0.020	99.935
1A3bi	Motor	0.004	78.248	0.003	14.139	Mg	0.00003	0.013	99.948
1A2c	Solid	0.010	78.248	0.00004	14.139	Mg	0.00002	0.011	99.959
1A2f	Biomass	0.0001	78.248	0.002	14.139	Mg	0.00002	0.010	99.969
1A2f	Other	NO	78.248	0.001	14.139	Mg	0.00001	0.006	99.975
1A2gviii	Peat	0.002	78.248	0.001	14.139	Mg	0.00001	0.005	99.980
1A3c	Liquid	0.004	78.248	0.001	14.139	Mg	0.00001	0.004	99.984
3F		0.002	78.248	0.001	14.139	Mg	0.00001	0.003	99.987
5C1bv		0.0001	78.248	0.001	14.139	Mg	0.00001	0.003	99.990
1A2c	Biomass	0.0003	78.248	0.0004	14.139	Mg	0.000005	0.002	99.992
1A2e	Other	0.003	78.248	0.001	14.139	Mg	0.000004	0.002	99.994
1A2a	Biomass	NO	78.248	0.0003	14.139	Mg	0.000004	0.002	99.996
1A3biii	Diesel oil	0.0002	78.248	0.0003	14.139	Mg	0.000003	0.001	99.997
1A2gvii	Gaseous	0.0005	78.248	0.0002	14.139	Mg	0.000002	0.001	99.998
1A3bi	Diesel oil	0.0001	78.248	0.0002	14.139	Mg	0.000002	0.001	99.999
1A3biv	Motor	0.00003	78.248	0.0001	14.139	Mg	0.000001	0.0005	100
1A3bii	Diesel oil	0.0001	78.248	0.0001	14.139	Mg	0.000001	0.0003	100
1A3bii	Motor	0.0002	78.248	0.00001	14.139	Mg	0.0000002	0.0001	100
1A4ci	Other	NO	78.248	0.000005	14.139	Mg	0.0000001	0.00003	100
1A3biv	Diesel oil	NO	78.248	0.0000005	14.139	Mg	1E-08	0.000003	100

Se

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2018 emission of the NFR category	Year 2018 total emission	Unit	Trend assessment	Contribution to trend. %	Cumulative total. %	Key source
2C7c		1.400	1.815	0.002	0.472	Mg	0.199	48.518	48.518	Yes
1A4bi	Biomass	0.181	1.815	0.262	0.472	Mg	0.118	28.802	77.320	Yes
2C7a		0.050	1.815	0.101	0.472	Mg	0.049	11.814	89.134	Yes
1A4ci	Biomass	0.033	1.815	0.035	0.472	Mg	0.015	3.583	92.717	
1A3bvi		0.026	1.815	0.032	0.472	Mg	0.014	3.303	96.020	
1A4ai	Biomass	0.010	1.815	0.016	0.472	Mg	0.007	1.819	97.839	
1A3dii	Liquid	0.014	1.815	0.010	0.472	Mg	0.004	0.918	98.757	
1A2gvii	Liquid	0.003	1.815	0.004	0.472	Mg	0.002	0.391	99.148	
1A4cii	Liquid	0.003	1.815	0.002	0.472	Mg	0.001	0.232	99.380	
1A4ciii	Liquid	0.006	1.815	0.003	0.472	Mg	0.001	0.189	99.569	
1A4aii	Liquid	0.001	1.815	0.001	0.472	Mg	0.0004	0.097	99.666	
1A5a	Liquid	0.001	1.815	0.001	0.472	Mg	0.0004	0.092	99.758	
5C1bv		0.0002	1.815	0.001	0.472	Mg	0.0003	0.073	99.831	
1A4bii	Liquid	0.0004	1.815	0.001	0.472	Mg	0.0003	0.066	99.897	
3F		0.001	1.815	0.001	0.472	Mg	0.0002	0.044	99.940	
1A3bi	Motor	0.0004	1.815	0.0003	0.472	Mg	0.0001	0.022	99.963	
1A3biii	Diesel oil	0.0001	1.815	0.0001	0.472	Mg	0.0001	0.016	99.978	
1A3bi	Diesel oil	0.00003	1.815	0.0001	0.472	Mg	0.00004	0.009	99.988	
1A3c	Liquid	0.001	1.815	0.0002	0.472	Mg	0.00002	0.006	99.993	
1A3bii	Diesel oil	0.00003	1.815	0.00003	0.472	Mg	0.00001	0.003	99.997	
1A2gvii	Gaseous	0.0001	1.815	0.00003	0.472	Mg	0.00001	0.002	99.999	
1A3biv	Motor	0.000003	1.815	0.00001	0.472	Mg	0.000004	0.001	100	
1A3bii	Motor	0.00001	1.815	0.000001	0.472	Mg	0.000001	0.0003	100	
1A3biv	Diesel oil	NO	1.815	0.0000002	0.472	Mg	0.0000001	0.00003	100	

Zn

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2018 emission of the NFR category	Year 2018 total emission	Unit	Trend assessment	Contribution to trend. %	Cumulative total. %	Key source
2C1		303.559	678.394	1.811	118.644	Mg	0.076	26.594	26.594	Yes
1A4bi	Biomass	25.403	678.394	36.675	118.644	Mg	0.048	16.716	43.311	Yes
2C7c		160.391	678.394	0.504	118.644	Mg	0.041	14.286	57.597	Yes
1A3bvi		18.420	678.394	19.543	118.644	Mg	0.024	8.465	66.062	Yes
1A1a	Biomass	1.382	678.394	15.438	118.644	Mg	0.022	7.881	73.943	Yes
2C6		90.174	678.394	3.982	118.644	Mg	0.017	6.114	80.057	Yes
1A5a	Biomass	0.238	678.394	6.744	118.644	Mg	0.010	3.476	83.533	
1A1b	Solid	3.951	678.394	5.199	118.644	Mg	0.007	2.338	85.871	
1A4ci	Biomass	4.550	678.394	4.926	118.644	Mg	0.006	2.142	88.013	
1A1a	Solid	28.018	678.394	1.255	118.644	Mg	0.005	1.890	89.903	
1A1a	Other	0.016	678.394	3.141	118.644	Mg	0.005	1.627	91.530	
1A1a	Peat	2.706	678.394	2.678	118.644	Mg	0.003	1.143	92.674	
1A2f	Solid	5.497	678.394	3.013	118.644	Mg	0.003	1.064	93.738	
1A4ai	Biomass	1.355	678.394	2.246	118.644	Mg	0.003	1.042	94.780	
1A2gviii	Biomass	4.949	678.394	2.689	118.644	Mg	0.003	0.945	95.725	
1A2f	Other	NO	678.394	1.565	118.644	Mg	0.002	0.811	96.537	
2C2		0.100	678.394	1.013	118.644	Mg	0.001	0.516	97.053	
1A4ci	Peat	0.132	678.394	0.680	118.644	Mg	0.001	0.341	97.394	
1A2d	Solid	3.342	678.394	0.004	118.644	Mg	0.001	0.301	97.695	
1A2d	Biomass	10.754	678.394	2.425	118.644	Mg	0.001	0.282	97.977	
2C7a		2.563	678.394	0.002	118.644	Mg	0.001	0.231	98.209	
1A2e	Solid	2.627	678.394	0.083	118.644	Mg	0.001	0.195	98.404	

2G		0.116	678.394	0.378	118.644	Mg	0.001	0.185	98.589
1A2gvii	Liquid	0.289	678.394	0.367	118.644	Mg	0.0005	0.164	98.754
1A2d	Liquid	0.110	678.394	0.290	118.644	Mg	0.0004	0.140	98.894
2B10a		0.010	678.394	0.250	118.644	Mg	0.0004	0.129	99.023
1A2d	Other	0.016	678.394	0.220	118.644	Mg	0.0003	0.113	99.135
1A2c	Solid	1.219	678.394	0.0003	118.644	Mg	0.0003	0.110	99.246
1A4cii	Liquid	0.293	678.394	0.249	118.644	Mg	0.0003	0.103	99.349
1A2d	Peat	0.999	678.394	0.037	118.644	Mg	0.0002	0.071	99.420
1A2e	Peat	0.328	678.394	0.192	118.644	Mg	0.0002	0.070	99.489
1A2gviii	Other	0.221	678.394	0.158	118.644	Mg	0.0002	0.062	99.551
1A3dii	Liquid	0.117	678.394	0.112	118.644	Mg	0.0001	0.047	99.599
1A4bi	Solid	0.555	678.394	0.012	118.644	Mg	0.0001	0.044	99.643
1A4aii	Liquid	0.134	678.394	0.107	118.644	Mg	0.0001	0.043	99.686
1A2e	Biomass	0.123	678.394	0.103	118.644	Mg	0.0001	0.042	99.728
1A4bii	Liquid	0.044	678.394	0.060	118.644	Mg	0.0001	0.027	99.756
1A2f	Liquid	0.327	678.394	0.005	118.644	Mg	0.0001	0.027	99.783
1A2gviii	Solid	0.266	678.394	0.001	118.644	Mg	0.0001	0.024	99.806
1A2f	Biomass	0.003	678.394	0.037	118.644	Mg	0.0001	0.019	99.825
1A4ai	Peat	0.040	678.394	0.041	118.644	Mg	0.00005	0.017	99.843
1A3bi	Motor ..	0.059	678.394	0.043	118.644	Mg	0.00005	0.017	99.859
1A3biii	Diesel oil	0.018	678.394	0.026	118.644	Mg	0.00003	0.012	99.871
1A4ciii	Liquid	0.067	678.394	0.034	118.644	Mg	0.00003	0.012	99.883
1A1b	Liquid	0.009	678.394	0.024	118.644	Mg	0.00003	0.011	99.894
1A5a	Liquid	0.111	678.394	0.040	118.644	Mg	0.00003	0.011	99.905
1A2e	Other	0.004	678.394	0.021	118.644	Mg	0.00003	0.011	99.916
2C3		0.127	678.394	0.002	118.644	Mg	0.00003	0.010	99.926
1A1a	Liquid	0.170	678.394	0.013	118.644	Mg	0.00003	0.009	99.935
1B1b		0.160	678.394	0.012	118.644	Mg	0.00002	0.008	99.943
1A3bi	Diesel oil	0.006	678.394	0.014	118.644	Mg	0.00002	0.007	99.950
1A4bi	Peat	0.215	678.394	0.050	118.644	Mg	0.00002	0.006	99.956
1A3c	Liquid	0.060	678.394	0.020	118.644	Mg	0.00001	0.005	99.961
3F		0.024	678.394	0.013	118.644	Mg	0.00001	0.004	99.965
1A2c	Liquid	0.040	678.394	0.015	118.644	Mg	0.00001	0.004	99.969
1A2a	Biomass	NO	678.394	0.007	118.644	Mg	0.00001	0.004	99.973
1A2c	Biomass	0.014	678.394	0.009	118.644	Mg	0.00001	0.003	99.976
1A2gviii	Liquid	0.055	678.394	0.004	118.644	Mg	0.00001	0.003	99.979
1A2a	Liquid	0.018	678.394	0.008	118.644	Mg	0.00001	0.003	99.982
1A3bii	Diesel oil	0.005	678.394	0.006	118.644	Mg	0.00001	0.003	99.984
1A2gviii	Peat	0.005	678.394	0.006	118.644	Mg	0.00001	0.002	99.987
5C1bv		0.001	678.394	0.005	118.644	Mg	0.00001	0.002	99.989
1A4ci	Solid	0.072	678.394	0.009	118.644	Mg	0.00001	0.002	99.991
1A2e	Liquid	0.040	678.394	0.003	118.644	Mg	0.00001	0.002	99.993
1A4ai	Liquid	0.125	678.394	0.018	118.644	Mg	0.00001	0.002	99.995
1A4ci	Liquid	0.039	678.394	0.004	118.644	Mg	0.000004	0.001	99.997
1A4bi	Liquid	0.022	678.394	0.001	118.644	Mg	0.000004	0.001	99.998
1A2gvii	Gaseous	0.007	678.394	0.003	118.644	Mg	0.000003	0.001	99.999
1A3biv	Motor ..	0.0005	678.394	0.001	118.644	Mg	0.000002	0.001	100
1A2b	Liquid	0.005	678.394	0.0004	118.644	Mg	0.000001	0.0003	100
1A3bii	Motor ..	0.002	678.394	0.0002	118.644	Mg	0.0000003	0.0001	100
1A4ci	Other	NO	678.394	0.0001	118.644	Mg	0.0000002	0.0001	100
1A3biv	Diesel oil	NO	678.394	0.00004	118.644	Mg	0.0000001	0.00002	100

PCDD/F

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2018 emission of the NFR category	Year 2018 total emission	Unit	Trend assessment	Contribution to trend. %	Cumulative total. %	Key source
2C1		4.552	18.041	1.196	14.356	g I-Teq	0.134	17.321	17.321	Yes
2B10a		3.000	18.041	0.031	14.356	g I-Teq	0.131	16.826	34.147	Yes
1A1a	Biomass	0.122	18.041	1.737	14.356	g I-Teq	0.091	11.710	45.857	Yes
1B1b		1.461	18.041	2.582	14.356	g I-Teq	0.079	10.137	55.994	Yes
5E		3.034	18.041	1.068	14.356	g I-Teq	0.075	9.617	65.611	Yes
1A1a	Other	0.002	18.041	0.925	14.356	g I-Teq	0.051	6.593	72.204	Yes
1A3bi	Motor	0.962	18.041	0.233	14.356	g I-Teq	0.030	3.808	76.012	Yes
1A4bi	Biomass	0.762	18.041	1.100	14.356	g I-Teq	0.027	3.526	79.539	Yes
2C3		0.526	18.041	0.900	14.356	g I-Teq	0.027	3.434	82.973	Yes
1A2gviii	Other	0.192	18.041	0.550	14.356	g I-Teq	0.022	2.836	85.809	
1A3bi	Diesel oil	0.008	18.041	0.400	14.356	g I-Teq	0.022	2.812	88.620	
2C7a		0.001	18.041	0.221	14.356	g I-Teq	0.012	1.572	90.192	
1A2d	Other	0.009	18.041	0.211	14.356	g I-Teq	0.011	1.451	91.643	
1A3bii	Diesel oil	0.004	18.041	0.202	14.356	g I-Teq	0.011	1.415	93.058	
1A5a	Biomass	0.007	18.041	0.202	14.356	g I-Teq	0.011	1.404	94.462	
1A1a	Peat	0.747	18.041	0.767	14.356	g I-Teq	0.010	1.235	95.697	
1A1a	Solid	0.411	18.041	0.248	14.356	g I-Teq	0.004	0.563	96.260	
1A3biii	Diesel oil	0.217	18.041	0.111	14.356	g I-Teq	0.003	0.437	96.697	
1A4ci	Biomass	0.137	18.041	0.148	14.356	g I-Teq	0.002	0.283	96.980	
1A4ai	Biomass	0.041	18.041	0.067	14.356	g I-Teq	0.002	0.250	97.231	
1A2d	Solid	0.045	18.041	0.001	14.356	g I-Teq	0.002	0.245	97.476	
1A4ci	Peat	0.007	18.041	0.036	14.356	g I-Teq	0.002	0.218	97.694	
1A2d	Liquid	0.006	18.041	0.033	14.356	g I-Teq	0.002	0.207	97.901	
1A2d	Biomass	0.808	18.041	0.616	14.356	g I-Teq	0.002	0.194	98.095	
2A1		0.029	18.041	0.050	14.356	g I-Teq	0.001	0.189	98.284	
1A2d	Peat	0.149	18.041	0.143	14.356	g I-Teq	0.001	0.172	98.456	
1A3bii	Motor	0.024	18.041	0.001	14.356	g I-Teq	0.001	0.129	98.585	
2C6		0.017	18.041	0.029	14.356	g I-Teq	0.001	0.109	98.694	
1A2f	Solid	0.024	18.041	0.006	14.356	g I-Teq	0.001	0.094	98.788	
1A2gviii	Liquid	0.003	18.041	0.013	14.356	g I-Teq	0.001	0.078	98.866	
1A3biv	Motor	0.014	18.041	0.022	14.356	g I-Teq	0.001	0.077	98.943	
1A1b	Gaseous	0.012	18.041	0.020	14.356	g I-Teq	0.001	0.072	99.015	
1A2c	Solid	0.013	18.041	0.0004	14.356	g I-Teq	0.001	0.069	99.084	
1A4bi	Liquid	0.019	18.041	0.006	14.356	g I-Teq	0.001	0.067	99.151	
1A2c	Biomass	0.012	18.041	0.0004	14.356	g I-Teq	0.001	0.065	99.216	
2A2		0.152	18.041	0.129	14.356	g I-Teq	0.0004	0.058	99.274	
1A1a	Gaseous	0.020	18.041	0.023	14.356	g I-Teq	0.0004	0.054	99.328	
1A2e	Peat	0.028	18.041	0.015	14.356	g I-Teq	0.0004	0.052	99.379	
1A4bi	Peat	0.011	18.041	0.003	14.356	g I-Teq	0.0004	0.046	99.425	
3F		0.023	18.041	0.012	14.356	g I-Teq	0.0003	0.044	99.470	
1A2f	Other	NO	18.041	0.006	14.356	g I-Teq	0.0003	0.043	99.513	
1A1b	Solid	0.011	18.041	0.014	14.356	g I-Teq	0.0003	0.039	99.552	
1A3dii	Liquid	0.026	18.041	0.016	14.356	g I-Teq	0.0003	0.033	99.586	
1A4ai	Liquid	0.012	18.041	0.005	14.356	g I-Teq	0.0003	0.033	99.618	
1A3biv	Diesel oil	NO	18.041	0.004	14.356	g I-Teq	0.0002	0.031	99.649	
1A5a	Gaseous	0.002	18.041	0.006	14.356	g I-Teq	0.0002	0.030	99.679	
2A3		0.005	18.041	0.0003	14.356	g I-Teq	0.0002	0.029	99.708	
1A2gviii	Biomass	0.199	18.041	0.162	14.356	g I-Teq	0.0002	0.027	99.735	
2L		0.016	18.041	0.009	14.356	g I-Teq	0.0002	0.027	99.762	
1A1a	Liquid	0.007	18.041	0.003	14.356	g I-Teq	0.0002	0.020	99.781	
1A2e	Solid	0.007	18.041	0.003	14.356	g I-Teq	0.0001	0.018	99.799	
1A2f	Biomass	0.0001	18.041	0.002	14.356	g I-Teq	0.0001	0.017	99.816	
1A2a	Gaseous	0.008	18.041	0.008	14.356	g I-Teq	0.0001	0.015	99.832	
1A5a	Liquid	0.008	18.041	0.004	14.356	g I-Teq	0.0001	0.015	99.846	
1A4ciii	Liquid	0.007	18.041	0.004	14.356	g I-Teq	0.0001	0.015	99.861	

1A2d	Gaseous	0.016	18.041	0.014	14.356	g I-Teq	0.0001	0.014	99.875	
2D3b		0.016	18.041	0.011	14.356	g I-Teq	0.0001	0.014	99.889	
1A4ci	Liquid	0.004	18.041	0.001	14.356	g I-Teq	0.0001	0.014	99.902	
1A2gviii	Peat	0.004	18.041	0.005	14.356	g I-Teq	0.0001	0.013	99.915	
1A2e	Biomass	0.007	18.041	0.004	14.356	g I-Teq	0.0001	0.012	99.927	
1A4bi	Solid	0.001	18.041	0.00003	14.356	g I-Teq	0.0001	0.008	99.935	
1A2e	Liquid	0.002	18.041	0.0002	14.356	g I-Teq	0.0001	0.007	99.942	
1A2f	Liquid	0.001	18.041	0.0002	14.356	g I-Teq	0.00004	0.006	99.948	
1A2c	Liquid	0.002	18.041	0.001	14.356	g I-Teq	0.00004	0.005	99.953	
5C1bv		0.0002	18.041	0.001	14.356	g I-Teq	0.00004	0.005	99.957	
1A2gviii	Solid	0.001	18.041	0.000002	14.356	g I-Teq	0.00003	0.004	99.961	
1A2a	Liquid	0.001	18.041	0.0001	14.356	g I-Teq	0.00003	0.004	99.965	
1A2e	Other	0.0001	18.041	0.001	14.356	g I-Teq	0.00003	0.004	99.969	
1A2f	Gaseous	0.001	18.041	0.002	14.356	g I-Teq	0.00003	0.004	99.973	
1A4ai	Peat	0.002	18.041	0.002	14.356	g I-Teq	0.00003	0.003	99.976	
1A2b	Solid	0.002	18.041	0.001	14.356	g I-Teq	0.00003	0.003	99.979	
1A2c	Gaseous	0.004	18.041	0.003	14.356	g I-Teq	0.00002	0.003	99.983	
1A1b	Liquid	0.001	18.041	0.001	14.356	g I-Teq	0.00002	0.003	99.986	
1A2gviii	Gaseous	0.001	18.041	0.001	14.356	g I-Teq	0.00002	0.003	99.989	
1A4bi	Gaseous	0.0004	18.041	0.001	14.356	g I-Teq	0.00002	0.002	99.991	
1A4ai	Gaseous	0.0003	18.041	0.001	14.356	g I-Teq	0.00002	0.002	99.993	
1A4ci	Gaseous	0.0003	18.041	0.0001	14.356	g I-Teq	0.00001	0.002	99.995	
1A2a	Biomass	NO	18.041	0.0002	14.356	g I-Teq	0.00001	0.002	99.996	
1A2e	Gaseous	0.0005	18.041	0.0002	14.356	g I-Teq	0.00001	0.001	99.997	
2G		0.001	18.041	0.0003	14.356	g I-Teq	0.00001	0.001	99.998	
1A2b	Gaseous	0.0001	18.041	0.0002	14.356	g I-Teq	0.00001	0.001	99.999	
1A3ei	Gaseous	0.00002	18.041	0.0001	14.356	g I-Teq	0.000003	0.0003	99.999	
1A4ci	Solid	0.001	18.041	0.0004	14.356	g I-Teq	0.000002	0.0003	100	
1A2b	Liquid	0.0004	18.041	0.0003	14.356	g I-Teq	0.000001	0.0002	100	
1A4bi	Other	0.00002	18.041	0.000001	14.356	g I-Teq	0.000001	0.0001	100	
1A4ci	Other	NO	18.041	0.000003	14.356	g I-Teq	0.0000002	0.00002	100	

PAH-4

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2018 emission of the NFR category	Year 2018 total emission	Unit	Trend assessment	Contribution to trend. %	Cumulative total. %	Key source
1A1a	Other	0.0001	7.113	0.241	9.991	Mg	0.034	16.506	16.506	Yes
1A1a	Biomass	0.015	7.113	0.240	9.991	Mg	0.031	14.976	31.482	Yes
2C1		0.132	7.113	0.011	9.991	Mg	0.024	11.919	43.401	Yes
1A4bi	Liquid	0.109	7.113	0.033	9.991	Mg	0.017	8.199	51.600	Yes
1B1b		0.258	7.113	0.456	9.991	Mg	0.013	6.426	58.026	Yes
1A4ai	Liquid	0.074	7.113	0.029	9.991	Mg	0.010	5.097	63.123	Yes
1A2gviii	Other	0.017	7.113	0.082	9.991	Mg	0.008	3.985	67.109	Yes
1A1a	Liquid	0.050	7.113	0.016	9.991	Mg	0.008	3.751	70.859	Yes
1A2d	Other	0.001	7.113	0.049	9.991	Mg	0.007	3.287	74.147	Yes
1A5a	Liquid	0.045	7.113	0.020	9.991	Mg	0.006	2.966	77.113	Yes
1A2d	Biomass	0.103	7.113	0.109	9.991	Mg	0.005	2.458	79.571	Yes
1A3bi	Motor	0.047	7.113	0.034	9.991	Mg	0.005	2.201	81.772	Yes
1A4ci	Liquid	0.025	7.113	0.008	9.991	Mg	0.004	1.854	83.626	
1A3bi	Diesel oil	0.025	7.113	0.060	9.991	Mg	0.004	1.716	85.341	
1A5a	Biomass	0.001	7.113	0.026	9.991	Mg	0.003	1.696	87.037	
1A4ci	Biomass	0.065	7.113	0.070	9.991	Mg	0.003	1.432	88.470	
1A2gviii	Liquid	0.016	7.113	0.004	9.991	Mg	0.003	1.292	89.762	
2D3i		0.020	7.113	0.011	9.991	Mg	0.002	1.181	90.943	
1A2gviii	Biomass	0.026	7.113	0.021	9.991	Mg	0.002	1.010	91.952	
1A2e	Liquid	0.010	7.113	0.001	9.991	Mg	0.002	0.930	92.882	
1A4cii	Liquid	0.023	7.113	0.020	9.991	Mg	0.002	0.893	93.776	
1A1a	Peat	0.043	7.113	0.049	9.991	Mg	0.002	0.743	94.519	

1A2f	Liquid	0.008	7.113	0.002	9.991	Mg	0.001	0.637	95.156	
1A2c	Liquid	0.010	7.113	0.005	9.991	Mg	0.001	0.590	95.745	
1A4aii	Liquid	0.011	7.113	0.009	9.991	Mg	0.001	0.443	96.188	
1A2a	Liquid	0.005	7.113	0.0005	9.991	Mg	0.001	0.427	96.615	
1A3c	Liquid	0.005	7.113	0.002	9.991	Mg	0.001	0.357	96.972	
1A4bi	Biomass	5.763	7.113	8.099	9.991	Mg	0.001	0.326	97.298	
1A2d	Peat	0.009	7.113	0.008	9.991	Mg	0.001	0.286	97.584	
1A2d	Liquid	0.039	7.113	0.059	9.991	Mg	0.001	0.276	97.860	
1A4ai	Biomass	0.019	7.113	0.031	9.991	Mg	0.001	0.259	98.119	
1A2gvii	Liquid	0.023	7.113	0.029	9.991	Mg	0.0004	0.213	98.332	
1A3biii	Diesel oil	0.077	7.113	0.112	9.991	Mg	0.0004	0.213	98.545	
1A3bii	Diesel oil	0.015	7.113	0.018	9.991	Mg	0.0003	0.169	98.715	
1A2f	Other	NO	7.113	0.002	9.991	Mg	0.0003	0.165	98.880	
1A2c	Biomass	0.002	7.113	0.0001	9.991	Mg	0.0003	0.144	99.024	
1A3bii	Motor ..	0.001	7.113	0.0001	9.991	Mg	0.0002	0.121	99.145	
1A2b	Liquid	0.003	7.113	0.002	9.991	Mg	0.0002	0.121	99.266	
1A4ci	Peat	0.0004	7.113	0.002	9.991	Mg	0.0002	0.103	99.369	
1A2e	Peat	0.002	7.113	0.001	9.991	Mg	0.0002	0.094	99.463	
2G		0.001	7.113	0.001	9.991	Mg	0.0002	0.080	99.544	
1A1a	Solid	0.001	7.113	0.001	9.991	Mg	0.0001	0.073	99.617	
1A4bi	Peat	0.001	7.113	0.0002	9.991	Mg	0.0001	0.052	99.669	
1A2e	Biomass	0.001	7.113	0.0005	9.991	Mg	0.0001	0.050	99.719	
5C1bv		0.0003	7.113	0.001	9.991	Mg	0.0001	0.044	99.763	
1A3biv	Motor ..	0.0005	7.113	0.001	9.991	Mg	0.0001	0.042	99.805	
1A2gvii	Gaseous	0.001	7.113	0.0003	9.991	Mg	0.0001	0.034	99.840	
2A1		0.0001	7.113	0.001	9.991	Mg	0.0001	0.031	99.870	
1A1b	Liquid	0.006	7.113	0.008	9.991	Mg	0.0001	0.027	99.898	
1A2f	Biomass	0.00001	7.113	0.0003	9.991	Mg	0.00004	0.021	99.919	
1A2d	Solid	0.0001	7.113	0.000003	9.991	Mg	0.00003	0.013	99.931	
1A3biv	Diesel oil	NO	7.113	0.0002	9.991	Mg	0.00003	0.012	99.944	
1A2gviii	Peat	0.0002	7.113	0.0005	9.991	Mg	0.00002	0.012	99.956	
1A4bi	Other	0.0001	7.113	0.000003	9.991	Mg	0.00002	0.011	99.967	
1A4bii	Liquid	0.004	7.113	0.005	9.991	Mg	0.00002	0.008	99.975	
1A2f	Solid	0.0001	7.113	0.00003	9.991	Mg	0.00001	0.005	99.979	
1A2e	Other	0.00001	7.113	0.0001	9.991	Mg	0.00001	0.004	99.984	
1A2c	Solid	0.00004	7.113	0.000001	9.991	Mg	0.00001	0.004	99.987	
1A4ai	Peat	0.0001	7.113	0.0001	9.991	Mg	0.00001	0.003	99.990	
1A2b	Solid	0.00002	7.113	0.000003	9.991	Mg	0.000004	0.002	99.992	
1A2a	Biomass	NO	7.113	0.00003	9.991	Mg	0.000004	0.002	99.994	
1A2a	Solid	0.00002	7.113	0.000001	9.991	Mg	0.000003	0.002	99.996	
1A2e	Solid	0.00002	7.113	0.00001	9.991	Mg	0.000003	0.001	99.997	
3F		0.00002	7.113	0.00001	9.991	Mg	0.000003	0.001	99.998	
2C2		NO	7.113	0.00001	9.991	Mg	0.000001	0.001	99.999	
1A4bi	Solid	0.000004	7.113	0.0000001	9.991	Mg	0.000001	0.0004	99.999	
1A2gviii	Solid	0.000002	7.113	1E-08	9.991	Mg	0.0000004	0.0002	100	
1A1b	Solid	0.00003	7.113	0.00004	9.991	Mg	0.0000004	0.0002	100	
1A4ci	Solid	0.000002	7.113	0.000001	9.991	Mg	0.0000002	0.0001	100	
1A4ci	Other	NO	7.113	0.0000004	9.991	Mg	0.0000001	0.00003	100	

HCB

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2018 emission of the NFR category	Year 2018 total emission	Unit	Trend assessment	Contribution to trend. %	Cumulative total. %	Key source
2B10a		29.000	35.684	23.900	32.024	kg	0.060	46.171	46.171	Yes
2C7a		5.514	35.684	6.541	32.024	kg	0.045	34.570	80.741	Yes
1A1a	Biomass	0.037	35.684	0.456	32.024	kg	0.012	9.201	89.942	
1A4bi	Biomass	0.181	35.684	0.262	32.024	kg	0.003	2.153	92.095	
2C1		0.096	35.684	0.016	32.024	kg	0.002	1.524	93.618	

1A2gviii	Other	0.143	35.684	0.196	32.024	kg	0.002	1.460	95.078	
2C7c		0.032	35.684	0.067	32.024	kg	0.001	0.833	95.910	
1A3biii	Diesel oil	0.059	35.684	0.086	32.024	kg	0.001	0.706	96.617	
1A3bi	Diesel oil	0.020	35.684	0.047	32.024	kg	0.001	0.642	97.258	
1A3bi	Motor	0.108	35.684	0.078	32.024	kg	0.001	0.412	97.670	
3Df		0.057	35.684	0.034	32.024	kg	0.0005	0.375	98.045	
1A5a	Biomass	NO	35.684	0.010	32.024	kg	0.0003	0.220	98.264	
1A2gviii	Biomass	0.049	35.684	0.034	32.024	kg	0.0003	0.214	98.478	
1A4ai	Biomass	0.010	35.684	0.016	32.024	kg	0.0002	0.162	98.641	
1A4bi	Solid	0.007	35.684	0.0002	32.024	kg	0.0002	0.138	98.779	
1A2d	Solid	0.007	35.684	0.0002	32.024	kg	0.0002	0.131	98.910	
1A4ci	Biomass	0.033	35.684	0.035	32.024	kg	0.0002	0.130	99.040	
1A2d	Biomass	0.191	35.684	0.166	32.024	kg	0.0002	0.119	99.159	
2C3		0.033	35.684	0.035	32.024	kg	0.0001	0.113	99.272	
1A3bii	Diesel oil	0.015	35.684	0.019	32.024	kg	0.0001	0.112	99.384	
5C1bv		0.001	35.684	0.004	32.024	kg	0.0001	0.074	99.458	
1A3bii	Motor	0.004	35.684	0.0003	32.024	kg	0.0001	0.071	99.529	
2D3i		0.004	35.684	0.001	32.024	kg	0.0001	0.061	99.590	
1A2c	Biomass	0.003	35.684	0.0001	32.024	kg	0.0001	0.053	99.643	
1A2a	Solid	0.003	35.684	0.0004	32.024	kg	0.0001	0.047	99.690	
1A2f	Solid	0.004	35.684	0.001	32.024	kg	0.0001	0.046	99.736	
1A4ci	Solid	NO	35.684	0.002	32.024	kg	0.0001	0.043	99.780	
1A4ciii	Liquid	0.004	35.684	0.002	32.024	kg	0.00005	0.037	99.817	
1A2c	Solid	0.002	35.684	0.0001	32.024	kg	0.00005	0.037	99.854	
1A2b	Solid	0.002	35.684	0.0002	32.024	kg	0.00005	0.036	99.889	
1A3biv	Motor	0.001	35.684	0.002	32.024	kg	0.00004	0.032	99.922	
1A3dii	Liquid	0.010	35.684	0.008	32.024	kg	0.00003	0.021	99.942	
1A2e	Biomass	0.002	35.684	0.001	32.024	kg	0.00002	0.013	99.955	
1A2f	Biomass	0.00002	35.684	0.001	32.024	kg	0.00002	0.012	99.968	
1A2e	Solid	0.001	35.684	0.0005	32.024	kg	0.00001	0.011	99.978	
1A3bi	Gaseous	NO	35.684	0.0003	32.024	kg	0.00001	0.005	99.984	
1A1a	Solid	0.001	35.684	0.0004	32.024	kg	0.000005	0.004	99.987	
1A5a	Liquid	0.001	35.684	0.001	32.024	kg	0.000005	0.003	99.991	
1A3biv	Diesel oil	NO	35.684	0.0001	32.024	kg	0.000004	0.003	99.994	
1A2gviii	Solid	0.0001	35.684	0.0000004	32.024	kg	0.000003	0.002	99.996	
1A3biii	Gaseous	NO	35.684	0.0001	32.024	kg	0.000002	0.002	99.998	
1A2a	Biomass	NO	35.684	0.0001	32.024	kg	0.000001	0.001	99.999	
1A3bii	Gaseous	NO	35.684	0.00004	32.024	kg	0.000001	0.001	100	

PCB

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2018 emission of the NFR category	Year 2018 total emission	Unit	Trend assessment	Contribution to trend. %	Cumulative total. %	Key source
2C1		13.464	28.55	15.025	26.346	kg	0.091	26.275	26.275	Yes
1A2d	Solid	1.907	28.55	0.057	26.346	kg	0.060	17.208	43.483	Yes
1B1b		1.753	28.55	3.099	26.346	kg	0.052	14.961	58.445	Yes
1A4bi	Biomass	2.177	28.55	3.144	26.346	kg	0.040	11.461	69.905	Yes
1A2f	Solid	1.037	28.55	0.345	26.346	kg	0.021	6.181	76.087	Yes
1A2a	Solid	0.784	28.55	0.112	26.346	kg	0.021	6.178	82.264	Yes
1A2c	Solid	0.538	28.55	0.017	26.346	kg	0.017	4.844	87.109	
1A2b	Solid	0.551	28.55	0.043	26.346	kg	0.016	4.701	91.810	
1A1a	Biomass	0.026	28.55	0.319	26.346	kg	0.010	2.990	94.799	
1A2e	Solid	0.298	28.55	0.131	26.346	kg	0.005	1.449	96.248	
2A1		3.298	28.55	2.932	26.346	kg	0.004	1.125	97.374	
1A4ai	Biomass	0.115	28.55	0.193	26.346	kg	0.003	0.877	98.251	
1A4ci	Biomass	0.390	28.55	0.422	26.346	kg	0.002	0.628	98.879	
1A2gviii	Solid	0.030	28.55	0.0001	26.346	kg	0.001	0.280	99.158	
2A2		0.293	28.55	0.248	26.346	kg	0.001	0.219	99.377	

2C3		0.083	28.55	0.092	26.346	kg	0.001	0.153	99.530
2C7c		0.002	28.55	0.015	26.346	kg	0.0005	0.140	99.670
1A3dii	Liquid	0.024	28.55	0.009	26.346	kg	0.0005	0.131	99.801
5C1bv		0.003	28.55	0.012	26.346	kg	0.0003	0.093	99.894
1A2gviii	Other	0.135	28.55	0.122	26.346	kg	0.0001	0.028	99.922
1A2c	Other	NO	28.55	0.002	26.346	kg	0.0001	0.023	99.945
1A4bi	Liquid	0.003	28.55	0.001	26.346	kg	0.0001	0.020	99.965
1A4ai	Liquid	0.002	28.55	0.001	26.346	kg	0.00004	0.011	99.976
1A4ciii	Liquid	0.002	28.55	0.001	26.346	kg	0.00003	0.009	99.985
1A4ci	Liquid	0.001	28.55	0.0001	26.346	kg	0.00002	0.004	99.989
2C7a		0.001	28.55	0.0003	26.346	kg	0.00001	0.002	99.991
1A3bi	Motor	0.0002	28.55	0.00005	26.346	kg	0.000005	0.001	99.992
1A2gviii	Biomass	0.001	28.55	0.0004	26.346	kg	0.000005	0.001	99.993
1A2d	Biomass	0.002	28.55	0.002	26.346	kg	0.000004	0.001	99.995
1A4ci	Peat	0.00003	28.55	0.0002	26.346	kg	0.000004	0.001	99.996
1A1a	Solid	0.0003	28.55	0.0002	26.346	kg	0.000003	0.001	99.997
1A3bi	Diesel oil	0.00001	28.55	0.0001	26.346	kg	0.000003	0.001	99.998
1A4bi	Solid	0.0001	28.55	0.000001	26.346	kg	0.000002	0.001	99.998
1A3bii	Diesel oil	0.000004	28.55	0.00004	26.346	kg	0.000001	0.0004	99.999
1A4bi	Peat	0.00005	28.55	0.00001	26.346	kg	0.000001	0.0003	99.999
1A2c	Biomass	0.00003	28.55	0.000001	26.346	kg	0.000001	0.0003	99.999
1A3bii	Motor	0.00002	28.55	0.000001	26.346	kg	0.000001	0.0002	99.999
1A4ci	Solid	NO	28.55	0.00002	26.346	kg	0.000001	0.0002	100
1A3biii	Diesel oil	0.00004	28.55	0.00002	26.346	kg	0.0000004	0.0001	100
1A2e	Biomass	0.00002	28.55	0.00001	26.346	kg	0.0000003	0.0001	100
1A2f	Biomass	0.0000002	28.55	0.00001	26.346	kg	0.0000002	0.0001	100
1A3biv	Motor	0.00001	28.55	0.00001	26.346	kg	0.0000002	0.0001	100
1A4ai	Peat	0.00001	28.55	0.00001	26.346	kg	0.0000001	0.00002	100
1A3biv	Diesel oil	NO	28.55	0.000001	26.346	kg	3E-08	0.00001	100
1A2a	Biomass	NO	28.55	0.000001	26.346	kg	2E-08	0.00001	100

1.6 QA/QC, verification and treatment of confidentiality issues

Changes in chapter	
Update of text	May 2018 KS, JM

1.6.1 Quality system

A quality management system is used to support the preparation of the air pollutant emissions inventory. QA/QC procedures have been implemented in the inventory work since the inventory of the year 2003 emissions carried out in 2005 they follow the principles carried out in the Finnish greenhouse gas emission inventory http://tilastokeskus.fi/tup/khkinv/khkaasut_laadunhallinta_en.html.

Due to the pending recalculation of energy sector emissions, there are currently constrains in following the QA/QC practices in many quality checks, e.g. where data for the previous years would need to be corrected due to the fact that it is impossible to track the data where the desired corrections should be made. After the finalization of the recalculation of energy sector emissions, these corrections will be carried out.

1.6.2 Quality plan and QA/QC procedures

Quality plan

The QA/QC plan covers quality objectives and the planned general quality control and quality assurance procedures regarding all sectors. The checklist in Table 1.6 specifies the actions, schedules and responsibilities in order to attain the quality objectives and to provide confidence in the preparation of high-quality inventories.

The QC procedures comply with those set in the EMEP/EEA Emission Inventory Guidebook 2009. General inventory QC procedures include routine checks of the integrity, correctness and completeness of the data, identification of errors and deficiencies, documentation and archiving of the inventory data as well as quality control actions.

Table 1.6 Quality objectives (* means restricted applications due to availability of resources)

Inventory principle	Quality objectives
1.Continuous improvement	1.1. Treatment of review feedback is systematic 1.2. Improvements are indicated in Informative Inventory Report and carried out* 1.3. Improvement of the inventory is systematic * 1.4. Inventory quality control procedures meet the requirements * 1.5. Inventory quality assurance is appropriate and sufficient*
2. Transparency	2.1. Archiving of the inventory is systematic and complete 2.2. Internal documentation of calculations supports emission and removal estimates 2.3. NFR tables and Informative Inventory Report include transparent and appropriate descriptions of emission estimates and of their preparation
3. Consistency	3.1. The time series are consistent * 3.2. Data have been used in a consistent manner in the inventory *
4. Comparability	4.1. The methodologies and formats used in the inventory meet comparability requirements

5. Completeness	5.1. The inventory covers all emission sources, pollutants and geographic areas
6. Accuracy	6.1. Estimates are systematically neither higher nor lower than the true emissions or removals 6.2. Calculations are performed correctly 6.3. Inventory uncertainties are estimated
7. Timeliness	7.1. Inventory reports submitted within the set time

Applied QA/QC procedures

<u>Internal review</u>

Normal statistical quality checks and comparisons to the previous years' data are implemented in the preparation of the inventory.

For the energy and industrial processes sectors compliance data reported by the plants have been used where applicable. The quality checks performed to the compliance data are explained in Chapter 2.4. The corrections made to the year 2014 compliance data are documented in Annex 4 of Part 2 of the IIR.

Category-specific QC checks including technical reviews of the source categories, activity data, emission factors and methods are applied on a case-by-case basis focusing on key categories and on categories where significant methodological and data revisions have taken place.

QA reviews performed after the implementation of QC procedures concerning the finalised inventory comprise comparisons and checks to assess procedures already taken and to identify areas where improvements could be made. Specific QA actions include basic reviews of the draft report, data verification with other available datasets and information sources. The data and documentation are cross-checked by several experts not involved in the area where they do the checks.

<u>QA/QC tools</u>

In 2017-2018 a series of tools was developed to manage the data in the IPTJ and to compile, analyse and correct the NFR output data. The tools were applied in the recalculation of the time series 1990-2016 reported on 13th April 2018.

The tools consist of a variation of solutions, techniques and manual routines to manage the content of over two million rows or air emission data. The tools connect directly to the IPTJ and allow the latest information to be always available in a comprehensive format. The embedded check-ups find inconsistent notation keys, strongly deviating values, gaps in emission data and trend progression analysis (remark on sudden decrease or increase) and general value validity. Also notation key management tools are included.

The tools enable comparisons between datasets by highlighting emission rates that increase or decrease over a selected tolerance. It also highlights cells to which IPTJ contains updated values. In such cases, the changes can be exported to the NFR reporting sheet instantaneously for the selected year, range of years or all years. This enables agile and adjustable control over the whole time series.

The time series for national totals or individual NFR-categories can be evaluated with an index value that is constructed by analysing the standard deviation of the series and the count of points of discontinuity. The indexing helps in directing focus into the most relevant subjects. All values are also visually enhanced to create a visual overview of series consistency. A more detailed description of the tools is presented in Annex 6.

Inter-comparisons

Close cooperation is carried out with the Finnish Greenhouse Gas Inventory Unit at Statistics Finland, to maintain comparability and to discuss improvements and their impacts on both air pollutant and greenhouse gas inventories. Annual inventories are compared and possible differences discussed and corrective actions made in both inventories where relevant.

External review

CLRTAP S1 and S2 review results by the review conducted by the CEIP are used to identify deficiencies and errors in the data. Due to resource constraints, this part will be re-introduced to the quality checks only when the time series has been recalculated

CLRTAP 2009 and 2018 S3 review results as well as NECD Technical Reviews' results 2017 and 2018 have been addressed in Chapter Recalculations

1.6.3 Implementation of the QA/QC plan in the preparation of the 2016 data

The leading principle has been that certain source categories or certain types of quality measures to solve systematic errors are taken under work during one inventory year.

Implementation of quality control and assurance measures has seriously been restricted the last years due to the lack of time between the finalization of the inventory and the reporting date, which should preferably cover one month or at the minimum two weeks, instead of the current few days.

QA/QC measures are carried out separately for each of the boxes illustrated in Figure 1.14 as follows:

1. dark blue boxes cover calculation in MSExcel sheets where data checking and comparison is mostly visual but rather straight forward, and the data used comes from statistics, industrial organizations or research
2. light blue boxes cover database tables within the IPTJ data system with inbuilt check operations; these data are also compared, where possible, against environmental reports by plants and E-PRTR data, both of which are also used in the inventory, as well as statistics and expert institutes
3. light red boxes include data, which is cross-checked between Statistics Finland data sets for fuels and emissions at CRF classification level, as well as comparisons to EU ETS data, which is also used in the inventory
4. the final results are manually compiled for 1980-19889 into the NFR table; for 1990-2016 the IPTJ QA/QC tool is use both to compile the NFR tables and to check the data.
5. Manual comparison against CRF data is carried out before the reporting, Deviations larger than 5% are explained in the IIR Chapter x.

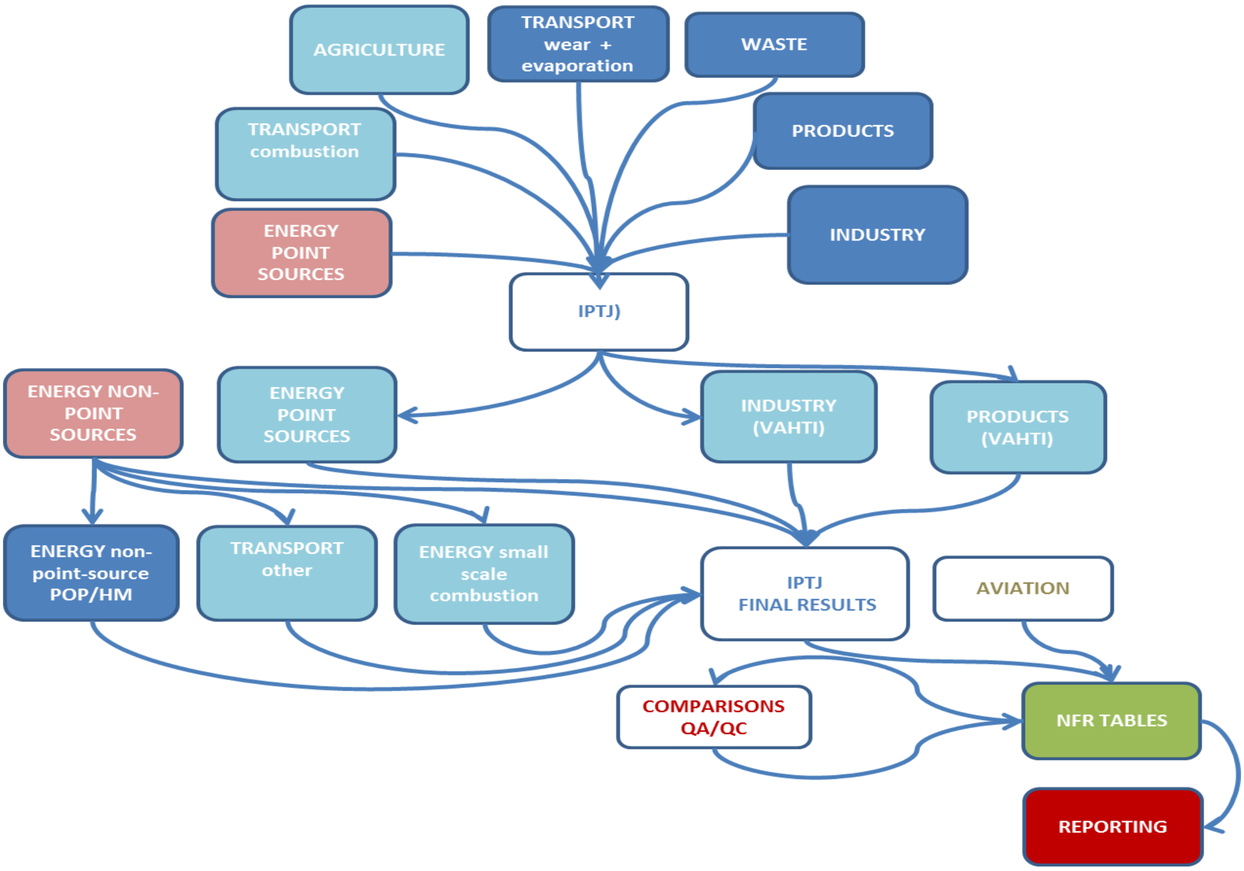

Figure 1.14 The process of data compilation for reporting

1.6.4 Documentation

Documentation of the calculation methods is updated whenever there are changes in the methods or new sources are included in the inventory. The documentation is carried out in the working guidelines available for each source sector (in Finnish). Notes and explanations for deviating values are recorded in the calculation sheets.

A summary of improvements made in the inventory submitted in February 2019 is presented in Chapter 14.

1.6.5 Archiving of the inventory

The annually reported NFR tables, calculation sheets and documentation of the methods together with the records of the original data are archived at the Finnish Environment Institute. The original data sets and calculation results are stored in databases on a SQL server.

1.6.6 Verification

The inter-comparison explained in Chapter 1.4 is carried out annually. The inventory has not yet been verified by a third party.

1.6.7 Treatment of confidential issues

When confidential information is used for the preparation of the inventory, this data is handled and stored in a way that ensures the confidentiality to remain. When confidential data is included in the reported emissions, the emissions are aggregated so that disclosure of confidential information is not possible.

1.7 Uncertainties

Changes in chapter	
May 2018	TF KS

1.7.1 Methodology

The uncertainty analysis for emission data is carried out at NFR subcategory 3 level for the actual emission sources. The method is Monte Carlo simulation (Tier 2) using @Risk software. The uncertainties of the input parameters are estimated by experts compiling the inventories and those of the measured emissions by the competent authorities that supervise emission monitoring carried out at the individual plants. The emissions of some pollutants from certain sources are poorly understood, for instance some POP compounds from fuel combustion and industrial processes, and therefore estimation of their uncertainty is found to be very challenging at the moment.

The uncertainty analysis covers all emission sources included in the inventory and represents thus the uncertainty of the reported emission data. The possible lack of completeness of emission sources is, however, not reflected in the uncertainty analysis. Information of the completeness of the inventory is presented in Chapter 2.8.

The uncertainty analysis is carried out at the country-level, i.e. uncertainties in emissions by region are not assessed.

Uncertainties are expressed as bounds of 95% confidence interval as percent relative to the mean value as recommended in the GPG.

In this uncertainty analysis, two different types of distributions are used. These are

- Normal distribution, which is used in case uncertainties are symmetrical and <±100%.
- Beta distribution, which are used in case uncertainty is asymmetric, because the upper boundary exceeded 100% (positively skewed Beta distribution)

In cases where positively skewed Beta distribution was used, the uncertainty was high the upper boundary (>100% and up to 1000%) lower boundary close to 0 (-100%) and mean significantly closer to the lower boundary than the higher one. The distribution function that fitted all these conditions was found to be Beta distribution (@Risk function RiskBetaGeneral) with parameters as specified below:

> Alpha1=1 (this shape parameter was kept constant)
> Alpha2 defined using mean, Alpha1 and min and max
> Min=0
> Max=upper boundary.

This distribution type was used for all positively skewed uncertainties. Examples of a RiskBetaGeneral functions are presented below in Figures 1.15 for a cases where the upper bound of uncertainty is +1000% and +120%, respectively. The distribution function is inside Excel's If-function (the user language is Finnish; JOS means IF).

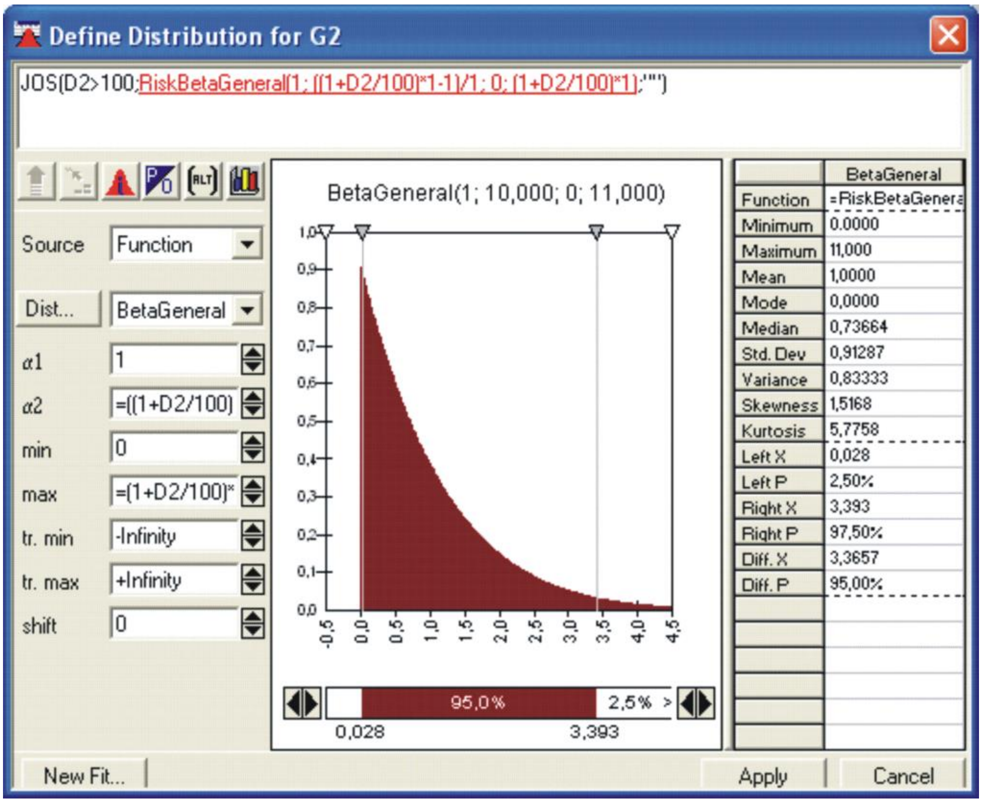

Figure 1.15. An example of the applied beta distribution. The function used can be seen on the top of the picture (JOS = IF in Finnish and cell D2 contains the uncertainty percentage).

Appropriate aggregation of data for the uncertainty analysis is important to avoid over- or underestimation of uncertainty due to correlations. The following assumptions are used in the aggregation level:

- Point source data reported by the plants: emission estimates reported by the operators are considered to be independent. Therefore, uncertainties have been applied separately to the emission estimates of each plant.
- Calculated emissions: Before calculation of uncertainty, those emission sources (e.g. point sources) having the same emission factor were grouped together, and the same uncertainty applied to the whole group. This reflects the situation that the emission factor uncertainties are correlated across, for instance, different plants. This may overestimate uncertainty when the same emission factor is used for different plants and the real emissions vary notably between these plants (uncertainties potentially cancelling each other) because there are also other factors than technology and fuel affecting the emissions (such as plant operation).
- Emission factors are considered independent across the different sectors, technologies and fuels. This may underestimate uncertainties in the case the emission factors for different

technologies are derived from the same data. It can roughly be assumed that this underestimation cancels potential overestimation presented in previous bullet.

- Emission estimates of different pollutants are considered to be independent.
- Activity data are considered to be as independent.
- The fuel use uncertainties are the same Statistics Finland uses in the UC analysis for the Finnish greenhouse gas inventory. Thus the fuels are grouped - and the fuel consumption summed up - using the same grouping as Statistics Finland: Solid, Liquid, Gaseous, Biomass and Other fuels.

1.7.2 Uncertainty of the trend

Finland has not yet carried out a trend UC assessment due to inconsistency of methods used throughout the time series. However, the principles for such an analysis for the Finnish data are presented below.

For the purposes of the trend uncertainty analysis, uncertainty of the base year emissions and the current year are needed. The base year depends on the emission compound as presented in the Table 1.7 below. In addition, to ensure comparability between compounds, the uncertainties were also estimated for the year 1990 for all the compounds.

Table 1.7 Base years for Finland for the pollutants regulated under the UNECE Convention of Long-Range Transboundary Air Pollution.

Compound	Base year
SO_2	1980
NO_x	1987
CO	1980 *
NH_3	1980 *

Compound	Base year
NMVOC	1988
HM	1990
TSP	2000 *
POP	1994

* For CO, NH_3 and TSP there is no Protocol base

The methodology to be used for calculating the trend uncertainty will follow, when implemented, the assumptions listed below:

- activity data were estimated independent between years
- emission data reported by the plants were estimated independent between years
- emission factors were assumed to correlate between years in case the same emission factors were used, and uncertainties for both years were estimated equal
- emissions which were estimated using completely different system (e.g. emissions for the year 1980) were assumed independent from the latest year estimate
- to simplify the calculation and also due to lack of detailed data, partial correlations were not used

Detailed information of the uncertainty analysis as well as the results of the analysis carried out for the 2014 emission data are presented in Annex 7 to this IIR. The annex will be published in May 2016 and uploaded to the EIONET CDR together with the LPS data and gridded emissions.

1.7.3 Point source data reported by the plants

Emissions of SO_2, NO_x and particulate matter (TSP) are generally included in the emission monitoring programmes of the plants. As this emission monitoring data is being supervised by competent authorities, they can be considered highly reliable.

Those plants that fall under the IPPC installation categories (Integrated Pollution Prevention and Control Directive) report also emissions included in the EPER (European Pollutant Release and Transfer Register) pollutant list. Uncertainty of the EPER pollutant data depend on the estimation method used (measured, calculated by national default emission factors or estimated by plant specific engineering calculations). The methods used in quantifying emissions and their uncertainties are not always known.

Sulphur dioxide, nitrogen oxide and particle emissions

SO_2 NO_X and TSP emissions reported by the operators are produced according to the reporting obligations determined in their environmental permit, which also stipulates the emission data production methods for these pollutants. The emission data reports are checked and approved by the supervising authorities and can therefore be considered to be the best known data in the inventory. Under NFR 1 around 95%, under NFR 2 and 3 100% and under NFR 6 around 20% of the emissions are reported by the plants.

For small particles, PM_{10} and $PM_{2,5}$, an additional uncertainty is caused by the uncertainty of coefficients used for deriving the small particle fractions from TSP values. This uncertainty is taken into account in the Monte Carlo analysis by adding a separate uncertainty percentage into the calculation: for PM_{10} 30% and for $PM_{2,5}$ 100%.

1.7.4 QC and planned improvements in uncertainty estimation

For the majority of the calculated data, the activity data uncertainty and emission factor uncertainty have been defined separately. However, for some emissions, the uncertainty has been already combined before importing it to the uncertainty calculation system.

The following improvements should be carried out every 5 years:

- Uncertainty percentages need to be re-evaluated for activity data and emission factors.
- Uncertainty percentages need to be re-evaluated for emission data reported by the plants

The following QA/QC procedures were carried out for the uncertainty analysis in 2011:
- All uncertainty estimates used in the previous submission were evaluated by an external consultant[16], and many of the estimates were revised in collaboration with the inventory agency.
- The uncertainty estimates were compared with the uncertainty estimates presented the Good Practice Guidance for CLRTAP Inventories.
- Order-of-magnitude comparisons were carried out with other data sources and uncertainty analysis documentations provided by other parties to the CLRTAP conventions.
- Results of these QA/QC procedures lead to notable changes in some of the inventory uncertainty estimates when compared with the previous submission.

The following QA/QC procedures were carried in the UC analysis carried out in 2016 for 2014 data:
- Uncertainty percentages for activity data and emission factors were re-evaluated.
- Uncertainty percentages for emission data reported by the plants were re-evaluated

1.8 General assessment of completeness

Changes in chapter	
February 2018	JMP, ks

The completeness by emission sources and the geographical and timely coverage of the inventory is explained in this chapter.

The annual submissions of LPS data are presented in Chapter 11 and of projected emissions in Chapter 13.

The figures in the NFR tables are given with an accuracy of three decimals from the inventory calculations.

1.8.1 Completeness by emission sources

The inventory is almost complete regarding the emission sources and substances and it can be estimated that the total emission levels are representative to the actual emissions. However, there are still a few cases where either the lack of methodology or activity data has prevented quantifying the emissions, for instance, in the product use sector.

Sources that are reported as not estimated (NE) are listed in Table 1.8

[16] Suvi Monni from Benviroc Ltd

Table 1.8a Explanation of the use of the Notation key NE in NFR Tables submitted in 2019.

NFR14	Substance	Reason for not estimated
All	Se	A comprehensive inventory of all sources of Se is not yet available, however, bottom-up data reported by the plants is included in the inventory
5 C a1	Se	
5 C 1bi	Se	

Allocation of emissions reported as included elsewhere (IE) and explanation of sources reported under categories Other are explained under Chapter 1.8.5.

Table 1.8b Explanation of the use of the Notation key IE in NFR tables submitted in 2019.

NFR14	Substance	Included in
Several	benzo (a) pyrene, benzo(b) fluoranthene, benzo(k) fluoranthene, Indeno (1,2,3-cd) pyrene	Included in PAH-4 of the same NFR
1A1c	NOx, NMVOC, Sox, PCDD/PCDF, HCB	IE depending on the year reported (use of NA/IE will be checked when the recalculation is finalized)
1A2f	NH3	USE of notation keys and allocation will be checked when the
1B1a	Particles	2A5c
1B1b	PM2.5, PM10, TSP, Hg	USE of notation keys and allocation will be checked when the
1B1c	All (wood pellets)	1A2gviii
1B2aiv, aiv	CO	USE of notation keys and allocation will be checked when the
2A1	NOx,SOx, PM2.5, PM10, TSP,	USE of notation keys and allocation will be checked when the recalculation is finalized
2A2	NOx, Sox, Cd	
2A3	NOx	USE of notation keys and allocation will be checked when the recalculation is finalized
2A5a	CO	
2B6	all (except PM2.5, PM10, TSP)	1A2c
2B10a	CO	1A2c
2C5	PM2.5, PM10, TSP	1A2a
2C6	Zn	1A2a
2C7b	PM2.5, PM10, TSP	1A2a
2D3e	CO	1A2gviii- NK will be checked during recalculation
2D3f	NMVOC	2D3e
2D3g	CO	1A2gviii - NK will be checked during recalculation
2H1	CO	1A2d
2H2	all	1A2gviii - NK will be checked during recalculation
2I	SOx	1A2gviii - NK will be checked during recalculation
5B1	all except NMVOC, NH3	NK will be checked during recalculation
5B2	all	? NK will be checked during recalculation
5C1bii	all	1A1a
5C1biii	all	1A1a
5C1biv	all	1A1a
5D1	all except NMVOC, NH3	NK will be checked during recalculation
5D2	all except NMVOC	NK will be checked during recalculation
5E	NMVOC	NK will be checked during recalculation

Table 1.8c Sub-categories reported under "Other" in 2017 for the year 2019 (updated every 5 yrs).

NFR14	Substance	SNAP	Sub-source description
1 A 2 g viii	all	030101 030102 030103a 030103b	Combustion plants in - manufacturing of fishing equipment - dry cleaners - rock wool manufacturing - concrete production - limestone production - car production - testing of engines - shipyards - quarrying and crushing - manufacturing of textiles - reparation of railway vehicles - starch modification - pellet production - manufacturing of zip production machines - light gravel manufacturing - manufacturing of gypsium products - manufacturing of tiles - glass production - talc manufacturing
1 A 2 g viii	all	030105	Stationary engines in - crushing
1 A 2 g viii	all	030204	Gas turbines in - manufacturing of gypsium products
1 A 2 gviii	all	030205	Other furnaces - crushing
		030326	Other - boiler plants in food industry, mines tc
2C1		040210	Other metal production -foundries
2C7c		040306 040307	allied metal manufacturing galvanizing
2C7c		040309z	smelteries, surface treatment plants
2C7d		040211	ferrous metals storage and handling
2 B10 a	all	040401	Sulfuric acid
2 B 10 a	all	040406	Ammonium phosphate
2 B 10 a	all	040407	NPK fertilisers
2 B 10 a	all	040413	Chlorine production
2 B 10 a	all	040414	Phosphate fertilizers
2 B 10 a	all	040416	Calcium Carbonate manufacturing
2 B 10 a	all	040416	Silicon wafer manufacturing
2 B 10 a	all	040416	Production of oxygen, nitrogen and hydrogen
2 B 10 a	all	040416	Al- and Fe-chemicals manufacturing
2 B 10 a	all	040416	Manufacturing of ion exchange and chromatographic resins and special
2 B 10 a	all	040416	Pigments manufacturing
2 B 10 a	all	040416	Manufacturing of explosives
2 B 10 a	all	040416	Fertilizer manufacturing
2 B 10 a	all	040416	Manufacturing of cobolt based special chemicals
2 B 10 a	all	040416	Hydrogen peroxide plant
2 B 10 a	all	040416	Manufacturing of natrium silicate
2 B 10 a	all	040416	Potassium sulphate manufacturing
2 B 10 a	all	040416	Formic acid and hydrogen peroxide manufacturing

NFR14	Substance	SNAP	Sub-source description
2 B 10 a	all	040416	Manufacturing of viscose staple fibres and by-products
2 B 10 a	all	040501	Ethylene
2 B 10 a	all	040506	Polyethylene Low Density
2 B 10 a	all	040507	Polyethylene High Density
2 B 10 a	all	040509	Polypropylene
2 B 10 a	all	040511	Polystyrene
2 B 10 a	all	040512	Styrene butadiene
2 B 10 a	all	040513	Styrene-butadiene latex
2 B 10 a	all	040527	Enzyme production
2 B 10 a	all	040527	Manufacturing of techno-chemical products
2 B 10 a	all	040527	Manufacturing of benzene, cumene and phenols
2 B 10 a	all	040527	Drag reducing additive production
2 B 10 a	all	040527	Manufacturing of prganic base chemicals
2 B 10 a	all	040527	Manufacturing of tall oil
2 B 10 a	all	040527	Manufacturing of organic fine chemicals
2 B 10 a	all	040527	Manufacturing of pharmaceuticals
2 B 10 a	all	040527	Manufacturing of titanium dioxide pigments
2 B 10 a	all	040527	Manufacturing of lignosulphonate products
2 B 10 a	all	040527	Cleaning of solvents and manufacturing of solvent mixtures
2 B 10 a	all	040527	Manufacturing of biocides and other 93gricultural chemicals
2 B 10 a	all	040527	Manufacturing of carboxymethylcellulose
2 A 6		040618	Limestone and Dolomite use
2 B 10 b	all	040522	Storage and handling of organic products
2 B 10 b	all	040415	Storage and handling of inorganic chemical products
2 L	all	040617	Light gravel manufacturing
2 L	all	040617	Talc manufacturing
2 L	all	040617	Ceramic household and decorative products manufacturing
2 L	all	040617	Tile manufacturing
2 L	all	040617	Gypsium product manufacturing
2 L	all	040617	Quarrying and crushing
2 L	all	040617	Manufacturing of electricity distribution and monitoring devices
2 L	all	040617	Starch modification
3 B 4 h	all	100510	Fur animals and reindeer
3 B 4 g iv	all	100509z	other poultry
5 E	all	091101	Unintentional house fires
5 E	all	091102	Unintentional car fires
5 E	all	091103	Unintentional landfill fires
5 E	all	091007	Latrines

1.8.2 Completeness by geographical coverage

The inventory includes emissions from the autonomic territory of Åland (Ahvenanmaa). Information on national emissions allocated for the territory of Åland is underway and will be available later at the website *http://www.environment.fi > Maps and statistics Air pollutant emissions in Finland* >.

The gridded emissions data over the national territory are illustrated by maps for each substance in Chapter 3.2.

As a result from the project to prepare geographical presentation of emission data in 1 km *1 km resolution, Finland reported in May 2015 gridded data in the new 0.1^{O} * 0.1^{O} EMEP grid. The new EMEP grid equals approximately 7 km * 7 km resolution in Finland. The submission of gridded data is available in the EIONET CDR.

Table 1.9 Finnish submissions of gridded data.

Pollutants	For the year	Comments
SO_X	1999 - 2018	Gridded data for earlier years has been submitted year by year by their due dates. Updated gridded data will be sent when recalculation of time-series is finalized *excluded from NFR tables in 2009 ** inventory not complete, Se not one of the obligatory heavy metals
NO_X	1999 - 2018	
NH_3	1999 - 2018	
CO	1999 - 2018	
NMVOC	1999 - 2018	
PCDD/F	1999 - 2018	
PAH-4	1999 - 2018	
HCB	1999 - 2018	
PCB	1999 - 2018	
PCP	1999 – 2007*	
SCCP	-*	
TSP	1999 - 2018	
PM10	1999 - 2018	
PM2.5	1999 - 2018	
As	1999 - 2018	
BC	2018	
Cd	1999 - 2018	
Cr	1999 - 2018	
Cu	1999 - 2018	
Hg	1999 - 2018	
Pb	1999 - 2018	
Ni	1999 - 2018	
Se	-**	
Zn	1999 - 2018	

1.8.3. Completeness by coverage of years

The annual inventory submissions under the UNECE CLRTAP include emission estimates since 1980 as presented in Tables 1.9 and 1.10.

Complete emission data sets for all substances have been reported for the years 1980-2017 with the following exceptions:

Sox, NOx and CO: Emission data has been reported for the years 1980-2016.

Heavy metals: Emission data has been reported for the years 1990 –-2016. The reporting requirement for particles starts from the year 1990.

NMVOC: Emission data has been reported for the years 1988 –-2016. The reporting requirement for particles starts from the base year for Finland 1988.

Particles: Emission data has been reported for the years 1990 –-2016. The reporting requirement for particles starts from the year 2000..

Table 1.11 presents Finland’s official submissions.

Table 1.10 Finnish official submissions of emission data – the years indicate the year of emissions (not the submission).

Pollutants	Data per sector	National Totals	Comments
SO_X	1990-2018	1980-2018	National totals available for only those pollutants and tears for which reporting requirements existed
NO_X	1990-2018	1980-2018	
NH_3	1990-2018	1980-2018	The reporting requirement starts from 1990
CO	1990-2018	1980-2018	
NMVOCs	1988-2018	1988-2018	The reporting requirement starts from the base year for Finland 1988
PCDD/F	1990-2018	1980-2018	The reporting requirement starts from 1990
PAH-4	1990-2018	1980-2018	The reporting requirement starts from 1990
HCB	1990-2018	1980-2018	The reporting requirement starts from 1990
PCB	1990-2018	1980-2018	The reporting requirement starts from 1990
PCP	1990-2007	1990-2007	Available separately and in the old submissions
SCCP	1990-2007	1990-2007	Available separately and in the old submissions
As	1990-2018	1980 – 2018	The reporting requirement starts from 1990
Cd			
Cr			
Cu			
Hg			
Ni			
Pb			
Zn			
Se	1990-2018	(inventory is not complete)	

Table 1.11 Finnish projected data (submitted annually).

Pollutants	Per sector for years	National totals for years	Based on
SO_X	2020, 2025, 2030	2020, 2025, 2030	WM
NO_X	2020, 2025, 2030	2020, 2025, 2030	WM
NH_3	2020, 2025, 2030, 2050	2020, 2025, 2030, 2050	WM
NMVOCs	2020, 2025, 2030	2020, 2025, 2030	WM
PM2.5	2020, 2025, 2030	2020, 2025, 2030	WM
PM10	2020, 2025, 2030	2020, 2025, 2030	WM

1.8.4 Completeness of information reported

In addition to emissions and projections data presented in Chapter 2.13.4. Finland reports gridded data as presented in Table 1.12 and data for large point sources (LPSs) as presented in Table 1.13.

Table 1.12 Finnish submissions of gridded data – the years indicate the year of emissions (not the submission.

LPS data submitted	Format
1999-2015, 2018	EMEP Grid 50 km * 50 km
2012-2014. 2016 (not in 2015-2018 submissions due to resource restrictions)	EMEP Grid 0.1 º * 0.1 º

Table 1.13 Finnish submissions of LPS data. - the years indicate the year of emissions (not the submission.

Main Pollutants	LPS data submitted
SO_X	1999 – 2015, 2018
NO_X	1999 – 2015, 2018
NH_3	1999 – 2015, 2018
CO	1999 – 2015, 2018
NMVOCs	1999 – 2015, 2018
PCDD/F	1999 – 2015, 2018
PAHs	1999 – 2015, 2018
HCB	1999 – 2015, 2018
PCBs	1999 – 2015, 2018
HCH	1999 – 2015, 2018
Cd	1999 – 2015, 2018
Pb	1999 – 2015, 2018
Hg	1999 – 2015, 2018
Additional heavy metals	1999 – 2015, 2018
TSP, PM10, PM2.5	1999 – 2015, 2018

1.8.5 Use of Notation Keys

Changes in chapter	
Update of text	March 2018 ks, jmp

The application of notation keys is reported on Reporting Table IV extension sheet. Notation keys are used and understood in the Finnish inventory as follows:

IE — Included elsewhere – Emissions for this source are estimated and included in the inventory but not presented separately for this source (the source where included is indicated in 0).

In the Finnish inventory IE is used when it is not possible to give disaggregated values.

NA — Not applicable – The source exists but relevant emissions are considered never to occur.

In certain cases, mainly in the Energy and Industrial Processes sectors, ***instead of using NA, the actual emissions*** are presented for categories where both the sources and their emissions are well-known due to availability of bottom-up data. When pointing the value "0.000" with the cursor, the actual emissions can be seen. The value "0.000" is shown in the NFR table due to the rounding of data to three significant decimals.

Summing up of these below 0.000 values often results in emissions of > 1 reporting unit and would thus cause inaccuracies in the sums as well as when compared to e.g. gridded or LPS data.

NE Not estimated – Emissions occur, but have not been estimated or reported.

In the Finnish inventory NE is used when the source exists and it can be assumed that emissions occur, but the emissions have not been estimated.

NO Not occurring – A source or process does not exist within the country.

The source does not exist in Finland

C Confidential information – Emissions are aggregated and included elsewhere in the inventory because reporting at a disaggregated level could lead to the disclosure of confidential information.

NR Not relevant - According to paragraph 9 in the Emission Reporting Guidelines, emission inventory reporting should cover all years from 1980 onwards if data are available. However, "NR" (not relevant) is introduced to ease the reporting where emissions are not strictly required by the different protocols, e.g. for some Parties emissions of NMVOCs prior to 1988.

NR is not in use in the Finnish inventory report.

1.8.6 Basis for estimating emissions from mobile sources

The basis for estimating emissions from mobile sources is presented in Table 1.14 Fuel statistics for mobile sources is providing in the NRF reporting tables.

Table 1.14 Basis for estimating emissions from mobile sources.

NFR09	Description	Fuel sold	Fuel used
1 A 3 a i (i)	International aviation (LTO)	x	
1 A 3 a i (ii)	International aviation (Cruise)	x	
1 A 3 a ii (i)	1 A 3 a ii Civil aviation (Domestic, LTO)	x	
1 A 3 a ii (ii)	1 A 3 a ii Civil Aviation (Domestic, Cruise)	x	
1A3b	Road transport	x	
1A3c	Railways	x	
1A3di (i)	International maritime navigation	x	
1A3di (ii)	International inland waterways	x	
1A3dii	National navigation	x	
1A4ci	Agriculture	x	
1A4cii	Off-road vehicles and other machinery	x	
1A4ciii	National fishing	x	
1 A 5 b	Other mobile (Including military)	x	

2 KEY EMISSION TRENDS

Changes in chapter	
March 2020	KS

2.1 Description and interpretation of emission trends for air pollutants emissions

2.1.1 Overview of factors having impact on the emission trends

Fluctuations in the economic and climatic conditions are reflected in the different emission source sectors. For instance, changes in electricity imports and production of fossil fuel based condensing power cause annual variation in the energy sector emissions and emissions from industrial processes are influenced each by the economic situation. The main industrial sectors in Finland are energy intensive. In addition, weather conditions and the volumes of energy produced with renewable energy sources vary annually.

Information by individual air pollutants is provided under Chapter 3.2 and by emission sources under Chapter 3.

2.1.2 Air pollutant emission time-series

The air pollutant emission inventory includes estimates of the so called main pollutants, i.e. sulphur dioxide, nitrogen oxides, carbon monoxide and ammonia since year 1980 and non-methane volatile organic compounds (NMVOC) since 1988.

Heavy metal emissions have been estimated since 1990 for lead, cadmium, mercury, arsenic, chromium, copper, nickel, vanadium and zinc. There is not yet a comprehensive emission inventory covering all sources of selene. Vanadium is not included in the international reporting obligations, but an annual inventory is prepared for domestic purposes. Information on cobolt emissions from point sources is collected annually but a comprehensive inventory has not been established.

Persistent organic pollutants (POPs) are estimated since 1990 and include PCDD/F, PAH-4, HCB, HCH, PCB. In addition, PCP and SCCP which no more are included in the reporting obligations are covered by annual inventories for domestic purposes. In addition, studies were carried out in 1990-2006 on emissions of the following POP compounds: HBCD, HBCDD, HCBD, DeBDE, OBDE, PeBDE PeCB, PCN, PFAS/PFOS.

Particulate matter emissions have been estimated since year 2000 for total particles and particle sizes smaller than 10 μm and 2.5 μm as well as for black carbon (BC).

The time series has not yet been completely recalculated for any substances. Recalculations are already finished for several subcategories, but the completion of the work is waiting for the energy sector recalculations to be finalized.

Air pollutant emission trends by pollutant are discussed in Chapter 3.1.5 and illustrated in Figures 1.16 and 1.17. Although the time series have not fully been recalculated[17], it is obvious that the emission levels are generally decreasing. The annual variations mainly depend on economic trends for the energy intensive sectors, the production level of hydropower, the level of imported electricity and the availability of alternative non-carbon energy sources. In Finland, the level of imported electricity is highly affected by the annual rainfall situation in the neighboring countries, Sweden and Norway, which have significant hydropower capacities.

Future emissions of air pollutants have been estimated by using national integrated models and scenarios as explained in details in Chapter 12.

2.1.3 Reduction targets

2010 Ceilings

According to the National Air Pollution Control Programme 2010 (Ministry of the Environment, 2002) the reduction targets adopted in the EU Directive on national emission ceilings as well as in the Gothenburg Protocol were anticipated to be met by 2010 by applying already adopted national and international measures to reduce emissions from both stationary and mobile sources. However, when approaching the year 2010 it become clear that the national emission ceiling for ammonia (31 kt in 2010) would not be met as explained in Chapter 3.1.4.

To meet the best science practise inventories and to show more compliance towards the reduction targets of ammonia emissions, Finland applied for adjustments for (1) manure management, (2) small scale combustion and (3) transport sector emissions. The adjustment application is presented as Appendix 3 to the Finnish IIR 2015.

The Adjustments Expert Review Team in 2015 accepted two of the applied adjustments (small scale combustion and transport) but rejected the application for manure management. Finland disagrees with the conclusions of the ERT and continues to discuss the reasons for the current level of ammonia emissions from manure management. The ERT Review Report is presented in Appendix 3D of the IIR.

Finland changed the calculation in the national agriculture emissions calculation model in 2015-2016 closer to follow the method presented in the Guidebook. As a result from that, ammonia emissions decreased to a level which enabled Finland to meet the 2010 ceiling with the help of the granted adjustments already in 2015.

2020 ceilings

The 2020 reduction targets are expected to be achieved without additional measures bearing in mind some uncertainties (Suoheimo et al. 2015, update of NH3 scenarios in the agriculture emissions calculation model).

The reduction target for sulphur dioxide seems possible to be reached in all the different scenarios.

The reduction target for nitrogen oxides would be narrowly achieved in all scenarios. NOx emissions are generated in all combustion processes, which means that changes in the use of different fuels partly compensate each other while the use of solid fuels and a decrease of plant size increase the average emissions. The renewal rate of the car fleet also contributes to the NOx target.

[17] Recalculations have been carried out for several subcategories in the latest years but the complete recalculation and reporting of the full the time-series is waiting for the finalization of the energy sector emission recalculations.

Measures defined in the action plan for reduction of atmospheric emissions of ammonia from agriculture are needed to meet ammonia reduction targets.

The achievement of the target set for fine particulate matter depends on the development of peat use and residential wood combustion. According to the preliminary assessment of the impacts of the proposed new emission limits set for the medium combustion plants additional investments to flue gas cleaning technologies would be necessary especially in small combustion plants burning solid fuel. Combustion and traffic are the central activities releasing fine particles to air and consequently causing harmful human health effects in Finland. The emission reduction measures need to be focused on these sectors.

Further information on the preparation of national emission projections is presented in Chapter 12.

2.1.4 Progress in meeting the reduction targets set in the CLRTAP Protocols, especially in the Gothenburg Protocol

Follow up of meeting the reduction targets set in Gothenburg Protocol and the respective emission levels in 2010 are presented in Table 1.15. Note that for some pollutants progress in decreasing emissions is not straightforward due to the pending recalculation of time series as the years are not calculated with consistent methodologies. However, the only pollutant, where Finland currently does not comply with the reduction targets is ammonia, and the time series of ammonia emissions has been recalculated as for this pollutant there is no interdependency in emissions from the energy sector, where the pending recalculation creates challenges for the other pollutants.

Sulphur dioxide

The reduction target of 80 per cent for sulphur dioxide from the 1980 level (584 kt), as well as the Gothenburg emission ceiling of 116 kt, were achieved already in 1995, when the emissions were 104 kt.

Nitrogen oxides

The Sophia Protocol target was to reduce nitrogen oxides below the 1987 level, when the Finnish NO_x emissions were 297 kt including emissions from agriculture. Without NOx emissions from agriculture the emissions in 1987 were 285 kt, which target has been met in since 1995.

The emission ceiling in the Gothenburg protocol is 170 kt, and has been met since 2012.

Non-methane volatile organic compounds

For NMVOC emissions the reduction target of 30 per cent from the year 1988 emissions of 221 kt, without agricultural emissions, to 1999 (to 155 kt) was achieved in 2005, when the emissions were 144 kt.

The emission ceiling in the Gothenburg protocol is 130 kt, which was met since 2008.

Due to the recent introduction of the results of a new calculation model for small scale wood combustion, the level of NMVOC emissions dropped by 10%. New sources have been added to the NMVOC emissions inventory since the 1980’s.

Ammonia

Ammonia emissions have been reduced since 1990 but not as rapidly as expected.

Finland carried out a profound recalculation of the agriculture sector emissions in 2015-2016 to more closely follow the guidance provided in the EMEP EEA Guidebook. As a result of the revised calculations, ammonia emissions in 2016 were 31.027 kt, which is slightly above the 2010 national emission ceiling of NH3 for Finland (31 kt), both under the UNECE CLRTAP Gothenburg Protocol and the EU NEC Directive.

The adjustments review team under the CLRTAP accepted adjustments for the Finnish inventory for the years after 2010 regarding ammonia emissions from small scale combustion and road transport as indicated in Appendix I of the IIR. Taking into account the granted Finnish ammonia emissions are currently below the ceiling of 31 kt. A detailed presentation of the adjustments reporting is presented in Annex x.

The projections show that emissions in 2020-2030 will be near the -20% reduction obligation of 29.223 kt.

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Heavy metals

Reduction targets set for the three priority heavy metals lead, cadmium and mercury, to reduce the emissions below 1990 level have been achieved since 1991.

POP emissions

The PCDD/F reduction target to decrease the emission level below the 1994 level was met in 1996.

The PAH-4 reduction target to decrease the emission level below the 1994 level (7.5 t) has not yet been met. During the time of setting the reduction target, PAH-4 emissions were calculated in a different method than currently and the increase of wood use in combustion was not foreseen at that time.

The target to reduce HCB emissions below the level in 1994 (37 kt) has been met in 1995, 2001-2006, 2008-2015 and in 2017.

The target to reduce PCB emissions below the level in 1994 (28 kt) has been met in 1996 and since 2009.

Table 1.15 Emission ceilings, reduction targets and emissions. Substances in bold have specified reduction targets.
The values in red italics are currently above the reduction targets. Note that the pending recalculation of the time series introduces certain uncertainties in the current emission levels. ***NOx and NMVOC emissions are presented without agricultural emissions***

	Air pollutant (pollutants with reduction requirements in **bold**)	CLRTAP base year	Emissions (kt): **In the base year**	1980	1990	2005	2010	**2018**	Change %: 1980-1990	1990-2017	2005-2017	1980-2017	Since base yr (7	Targets: **2020 Gothenburg Protocol targets**		Year when reached	Old Gothenburg: Targets kt / %	Year when reached	CLRTAP: Reduction obligation	Year when reached
Main pollutants	**SO_2**	1980	**584**	584	249	70	66	**33**	-57	-87	-53	-94	**-94**	**49 kt**	-30%	2013	116 / -55	1995	-30% by 1993 and 116 kt by 2010	1983 & 1994
	NO_x	1987	***285***	*292*	*292*	*198*	*177*	***127***	1	-58	-38	-58	**-56**	**129**	-35%	2015	170 / -43	2008-	Freeze on 1987	since 1987
	NMVOC	1988	**222**	*NE*	*213*	*128*	*97*	**85**	NE	-64	-41	NE	**-68**	**83 kt**	-35%	2013	130 / -38	since	-30% by 1999	2001
	NH_3	1990	**34**	35	34	37	***35/33***	***32*/30**	0	-6	-14	-6	**-6**	**30 kt**	-20%	2017	31 / -11	2015	31 kt in 2010	2015
	CO			NE	721	470	400	**350**	NE	-51	-26	NE	NA							
Partic-les	TSP	2000	**55**	NE	NE	55	54	**45**	NE	NE	-22	NE	-22							
	PM_{10}	2000	**40**	NE	NE	39	38	**31**	NE	NE	-28	NE	-30							
	$PM_{2,5}$	2000	**26**	NE	NE	25	24	**18**	NE	NE	-36	NE	-38	18 kt	-30%	2014				
	BC		**6**	NE	NE	6	6	**4**	NE	NE	-43	NE	-50							
Heavy metals	Pb	1990	314	NE	314	21	21	**15**	NE	-95	-32	NE	-90						Below 1990 level	1995
	Cd	1990	13	NE	13	2	2	**1**	NE	-89	-6	NE	-81						Below 1990 level	1991
	Hg	1990	1	NE	3	1	1	**1**	NE	-41	20	NE	-41						Below 1990 level	1991
	As		35	NE	35	3	3	**2**	NE	-94	-33	NE	-94							
	Cr		47	NE	47	20	26	**15**	NE	-67	-12	NE	-67							
	Cu		150	NE	150	52	38	**41**	NE	-76	-29	NE	-76							
	Ni		78	NE	78	36	23	**14**	NE	-82	-46	NE	-82							
	Zn		677	NE	677	114	129	**119**	NE	-83	-4	NE	-83							

Note: In the NH_3 row, "35/33" (2010) and "32" (2018) are printed in red. The "/30" after "32" is in black.

Table 3.1. Emission ceilings, reduction targets and emissions. Substances in bold have specified reduction targets (continued) Note that the pending recalculation of the time series introduces certain uncertainties in the current emission levels.

Air pollutant (pollutants with reduction requirements in **bold**)		CLRTAP base year	Emissions (kt): In the base year: Original	Emissions (kt): In the base year: Recalc 2019	Emissions (kt): 1980	Emissions (kt): 1990	Emissions (kt): 2005	Emissions (kt): 2010	Emissions (kt): **2018**	Change %: 1980-1990	Change %: 1990-2016	Change %: 2005-2016	Change %: 1980-2016	Change %: Since base yr (2018)	Targets: New Gothenburg Protocol		Targets: Old Gothenburg: Targets	Targets: Old Gothenburg: Year when reached*	Targets: CLRTAP: Reduction obligation	Targets: CLRTAP: Year when reached
Persistent organic compounds	PCDD/F	1994	33	19	NE	18	14	16	**14**	NE	-22	0	NE	-26			Below 1994 level		Below 1994 level	since 1996
	PAH-4	1994	17	7	NE	7	9	11	**10**	NE	43	11	NE	43			Below 1994 level		Below 1994 level	Not yet
	HCB	1994	36	36	NE	36	32	8	**32**	NE	-11	0	NE	-1129			Below 1994 level		Below 1994 level	1995, 2001-2005, 2008-2015, 2017, 2018
	PCB		292	36	NE	33	31	28	**26**	NE	-21	-37	NE	-28						

***New sources were not in the original inventories but have been included in the inventory due to the development of the Guidebook for whole time series.**

2.1.5 National emission ceilings 2020 (EU NECD)

National emission ceilings set in the EU Directive 2001/81/EC and the respective emission levels are presented in Table 1.16 for SO_2, NO_x, NMVOC, NH_3 and $PM_{2.5}$. Annual variations in the emission levels occur depending on economic and climatic conditions.

Finland is currently meeting all its emission ceilings as presented in Table 1.16

Table 1.16 Development of emissions related to the 2020 ceilings
The values in red italics are currently above the reduction targets. Note that the pending recalculation of the time series introduces certain uncertainties in the current emission levels.

Air pollutant	Emission Ceiling 2020 Kt	%	Emissions in kt 1980	1990	2005	2010	2018	Reductions % 2005-2018	1990-2010	1990-2018
SO_2	49	-30	584	249	70	66	33	-53	-6	-655
NO_x	129	-35	287	306	205	184	127	-38	-11	-141
NMVOC	83	-35	NE	233	145	116	85	-41	-25	-174
NH_3	29	-20	*34*	*34*	***37***	***35/33***	***32***/30	-14	-6	-6
$PM_{2.5}$	18	-30	NA	NA	28	26	18	-36	NA	NA

Sulphur dioxide The SO_x emission ceiling of the old NECD directive of 110 kilotonnes for the year 2010 was met in 1995, when the emissions were 95 kt. In 2010 the emissions were 68 kt. The emissions have also been under the emission ceiling of 49 kt of the revised NECD for 2020 since 2013.

Nitrogen oxides The NO_x emission emission ceiling of 170 kilotonnes in the old NECD for the year 2010 has been met since 2008. New sources have recently been added to the Inventory for the whole time series and annual variations in emissions are common due to variations in both economic and climatic conditions. The emission ceiling of 131 kt of the revised NECD for 2020 was met in 2016.

Non-methane volatile organic compounds NMVOC emission ceiling of 130 kilotonnes for the year 2010 was met in 2007, when the emissions were 129 kt. In 2010 the emissions were 117 kt. Slight variations in the emissions are possible depending on economic and climatic conditions. Finland has implemented and fulfilled the requirements on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations (EU Solvents Emissions Directive (1999/13/EC) and Paint Directive (2004/42/EC) and reports regularly on the environmental permits and registrations under this directive.

Due to the revised calculation of small scale wood combustion the level of emissions decreased by 10%. New sources have been added to the NMVOC emissions inventory since the 1980’s, and slight variations in emissions are possible depending on the climatic conditions. The emission ceiling of 98 kt of the revised NECD has been met since 2013.

Ammonia Ammonia emissions have been reduced since 1990 but not as rapidly as expected. Finland revised the agriculture sector emissions calculation model in 2015-2016 to more closely follow the guidance provided in the EMEP EEA Guidebook. As a result of the revised calculations, ammonia emissions in 2016 were 31.0275 kt, which is above the 2020 national emission ceiling of NH3 for Finland (30 kt). (Table 1.17)

The adjustments review team under the CLRTAP accepted adjustments for the Finnish inventory for the years after 2010 regarding ammonia emissions from small scale combustion and road transport as indicated in Appendix I of the IIR. Taking into account the granted adjustments for 2016 (-1.3095kt), Finnish ammonia emissions in 2016 are below the ceiling of 30 kt, being 29.7180.

The projections also show that emissions in 2020-2030 will be close to the -20% reduction obligation.

Table 1.17 Ammonia emissions and projections reported in 2020

NH3 Inventory	2005 (kt)	2018 (kt)	Reduction from 2005 (kt)	Projections (kt) without adjustments		
				2020	2025	2030
INVENTORY 13.3.2020	37.972	32.189	-14%	30.435	28.561	27.736
GRANTED ADJUSTMENTS*	NA	-1.476	*to be accepted by TERT/ERT later in 2020			
TOTAL EMISSIONS WITH ADJUSTMENTS	NA	30.714				

$PM_{2.5}$ PM2.5 emissions have been reduced since the base year of 2000 and have been under the emission ceiling of 20 kt of the revised NECD since 2015.

2.3 Description and interpretation of emission in 2018 and the trends by pollutant

Changes in chapter	
March 2020	KS

This section describes the sources of air pollutants, emission trends and their spatial distribution[18].

The emission levels of the gridded air pollutants are indicated with the colour scales presented in Figure 1.16. The emissions of sulphur dioxide, nitrogen oxides, carbon monoxide and NMVOC are presented in kilotonnes (kt). Ammonia and particle emissions are presented in tonnes (t). The emissions of heavy metals are presented in kilogrammes (kg). Out of POP emissions PAH-4, HCB and PCB are presented in kilogrammes (kg), PCP in grammes (g) and PCDD/F emissions in toxicity equivalents (mg I-Teq).

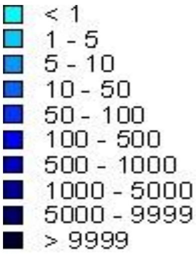


Figure 1.16. Colour scale to indicate emission levels in the figures for spatial distribution of emissions in Chapter 3.1. ***(note: the maps are currently in greyshade)***

[18] Finland has reported gridded emissions data in the new EMEP 0.1o* 0.1o grid since May 2015. However, the mapping tool for the new grid is still in progress and new maps are expected to be included in the IIR 2018. The spatial distribution of the pollutants in 2012 in the EMEP 50 km * 50 km grid are presented therefore instead of the 0.1o * 0.1o grid. The maps are produced according to the method provided in Posch (2006).

2.3.1 Main pollutants

The time series of the main pollutants SO_x, NO_x, NH_3, NMVOC and CO for 1980-2013 are presented in Figure 1.17.

- *Sulphur oxides* trend since 1980 is strongly declining.
- *Nitrogen oxides* trend since 1980 is declining. New sources have been included in the inventory over the years.
- *NMVOC* emissions have been continuously decreasing since the base year of 1988. New sources have been included in the inventory over the years.
- *Ammonia* emissions have been slightly decreasing since 1980. There was an unexpected change in the emission levels regarding especially dairy cows when the animal-specific emissions started gradually grow in the 1990's with the increased animal size and productivity while the number of animals decreased drastically. New sources have been included in the inventory over the years.
- The annual fluctuations in the *carbon monoxide* emissions are related to fluctuations in the energy use in fuel combustion and transport sectors, but the trend is generally declining. Full emission inventories have been carried out since 1990.

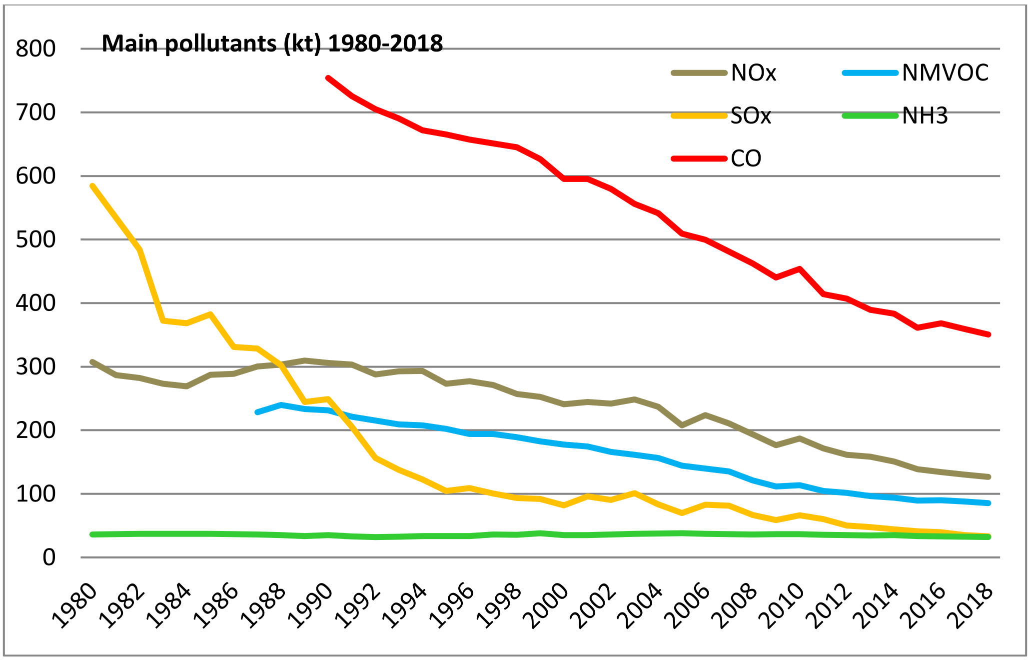


Figure 1.17. Emissions of main pollutants SO_2, NO_2, NH_3, NMVOC and CO in 1990–2018.

2.3.2 Nitrogen oxide emissions reported as nitrogen dioxide NO_2

Emission trend

In 2017 emissions of nitrogen oxides have been reduced by 56% since the year 1987 emissions to which level the emissions should be freezed.

The Finnish inventory covers all nitrogen oxide emissions converted into nitrogen dioxide (NO_2). Other nitrogen compounds include, for instance, nitric acid (HNO_3), nitrogen oxide (NO) and nitrogen trioxide (NO_3). The main sources of NO_2 in Finland are energy production and transport.

Nitrogen oxide emissions have decreased since the 1980's. In 1991 the government issued general guidelines restricting emissions from boilers and gas turbines, and, in 1988 a resolution on the reduction of emissions from road transport. New petrol-engine vehicles were required to be equipped with three-way catalytic converters since 1991 and emissions from diesel-engine vehicles were to be reduced through new engine construction and after-treatment equipment. Follow-up of how Finland has met the reduction targets under the UN and EU legislation is presented in Chapters 3.1.4 – 3.1.5.

The NOx emissions trend 1980-2015 is presented in Figure 1.18. Fluctuations in the time series are mainly driven by changes in fuel combustion. Emission data reported by the plants according to their monitoring programmes in their environmental permits is used in the inventory, so energy and industry sector emissions are considered to be quite accurate.

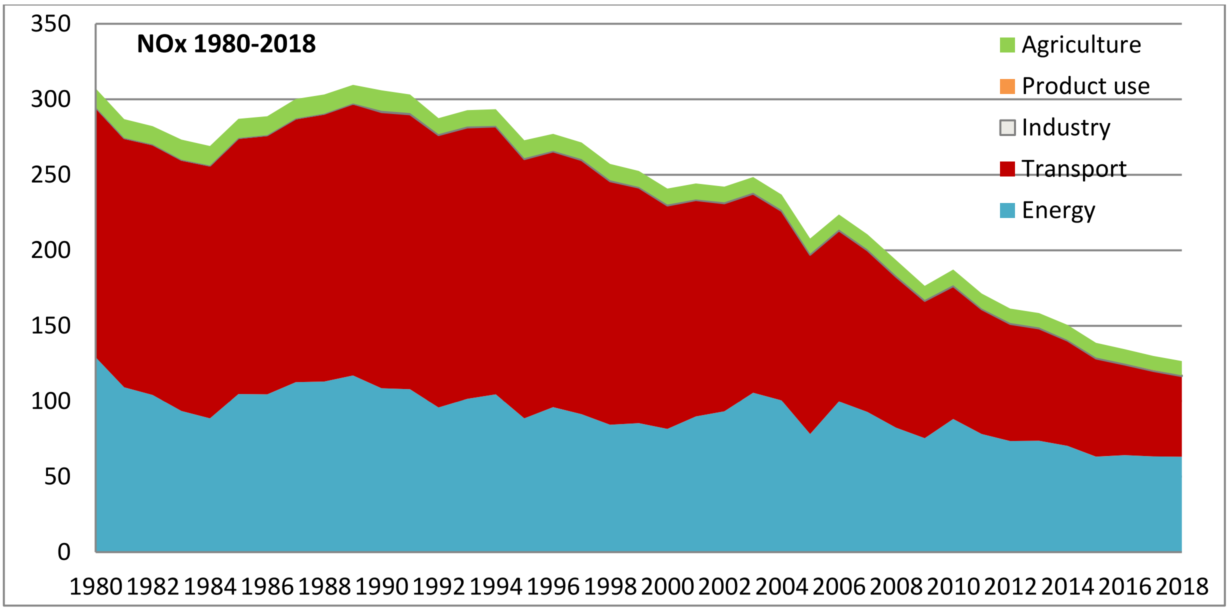
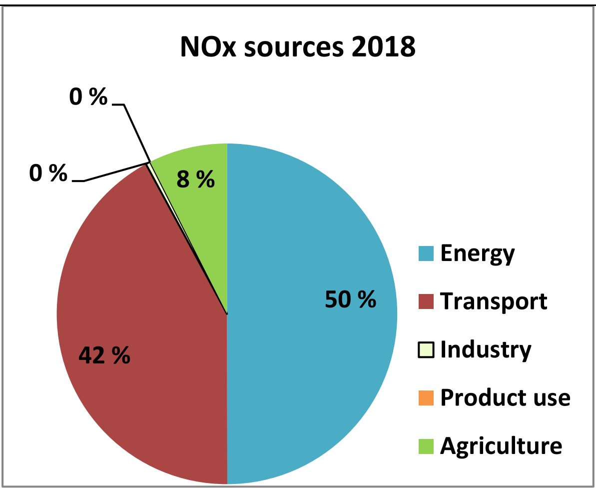


Figure 1.18 Emissions of nitrogen oxide (Gg) in 1980-2018.

The uncertainties of emission data in 2017 are presented in Annex 7 of the IIR.

The contribution of different sources to emissions, the spatial distribution of emissions and the shares of data reported by operators of industrial plants of total emissions are presented in Figure 1.19.



NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants	NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants
1A1a	19.2	24.358	89.9	1A4cii	2.5	3.131	0
1A1b	1.5	1.956	99.4	1A4ciii	1.3	1.645	0
1A2a	2.2	2.842	99.7	1A5a	2.1	2.679	0
1A2b	0.2	0.216	93.3	1A5b	0.3	0.390	0
1A2c	1.0	1.284	94.9	2B10a	<0.1	0.123	100
1A2d	14.4	18.171	97.2	2B2	0.3	0.428	100
1A2e	0.3	0.419	92.5	2G	<0.1	0.006	0
1A2f	1.6	2.022	90.1	3B1a	<0.1	0.039	0
1A2gvii	5.0	6.392	0	3B1b	0.1	0.138	0
1A2gviii	1.5	1.886	79.1	3B2	<0.1	0.011	0
1A3ai(i)	0.6	0.821	0	3B3	<0.1	0.006	0
1A3aii(i)	0.2	0.197	0	3B4d	<0.1	<0.001	0
1A3bi	10.1	12.765	0	3B4e	<0.1	0.031	0
1A3bii	3.6	4.560	0	3B4gi	<0.1	0.042	0
1A3biii	10.2	12.903	0	3B4gii	<0.1	0.087	0
1A3biv	0.2	0.201	0	3B4giii	<0.1	0.009	0
1A3c	1.1	1.412	0	3B4giv	<0.1	0.004	0
1A3dii	5.1	6.473	0	3B4h	<0.1	0.055	0
1A3ei	<0.1	0.008	100	3Da1	4.4	5.538	0
1A4ai	0.9	1.181	1.7	3Da2a	2.3	2.878	0
1A4aii	1.2	1.557	0	3Da2b	<0.1	0.003	0
1A4bi	4.1	5.217	0	3Da3	0.4	0.543	0
1A4bii	0.7	0.887	0	3F	<0.1	0.059	0
1A4ci	0.8	1.021	0.1	**Total**	**100**	**126.595**	**39.5**

Figure 1.19 The contribution of different sources and data reported by the plants in the 2018 emissions.

2.3.3 Non-methane organic compounds emissions (NMVOC)

Emission trend

Non-methane organic compounds emissions have been reduced by 63% since the base year 1988.

NMVOC emissions originate in energy production, transport and product use and have been decreased since the 1990s. In its time, the CLRTAP VOC protocol requirement to reduce emissions by 30% from the 1988 level by 1999 proved to be difficult, because emissions in the transport sector did not decrease as expected, particularly concerning non-road machinery and equipment, as vehicles had not been replaced at the rate that was earlier foreseen. Strict emission limits have been applied to new vehicles since 1990 and their impact on emissions can be seen through the gradual renewal of the passenger car fleet. With the aid of differential taxes, there was a transition in the 1990s toward reformulated traffic fuels, which helped reduce evaporative emissions from petrol engine vehicles as well as CO and VOC emissions from vehicle flue gases.

Finland has implemented EU Directives on the control of volatile organic compound emissions from storage and distribution of petrol and from industrial solvents. Decreased NMVOC content in paints and the introduction of better abatement techniques in several industrial processes have contributed emission reductions in addition to the economic depression resulting in lower production volumes. The most important emission sources for the decreased NMVOC emissions after 2007 are paint application and printing industry. Low-NMVOC containing and waterborne paint products were introduced during the 1990's and their market-share rapidly increased, typically in indoor paints and road marking paints, leading to source specific emission reductions of 20- 50%. At the same time, also the sales of thinners for paint products decreased, printing processes were improved and new abatement technologies as well as substitution and recovery of NMVOC containing substances took place.

Follow-up of how Finland has met the reduction targets under the UN and EU legislation is presented in Chapters 3.1.4 – 3.1.5.

The NMVOC emission trend presented in Figure 1.20 shows decreasing emissions since 1990. The time series is not consistent: especially for the years 1980-1987 for which not all sources are included. A revised time series is under work. The smallscale combustion calculation was revised in 2016 resulting in a sharp drop of NMVOC emissions and transport sector emissions have been updated according to the revision of the national transport sector calculation model LIPASTO.

The uncertainties of emission data in 2017 are included in Annex 7 of the IIR.

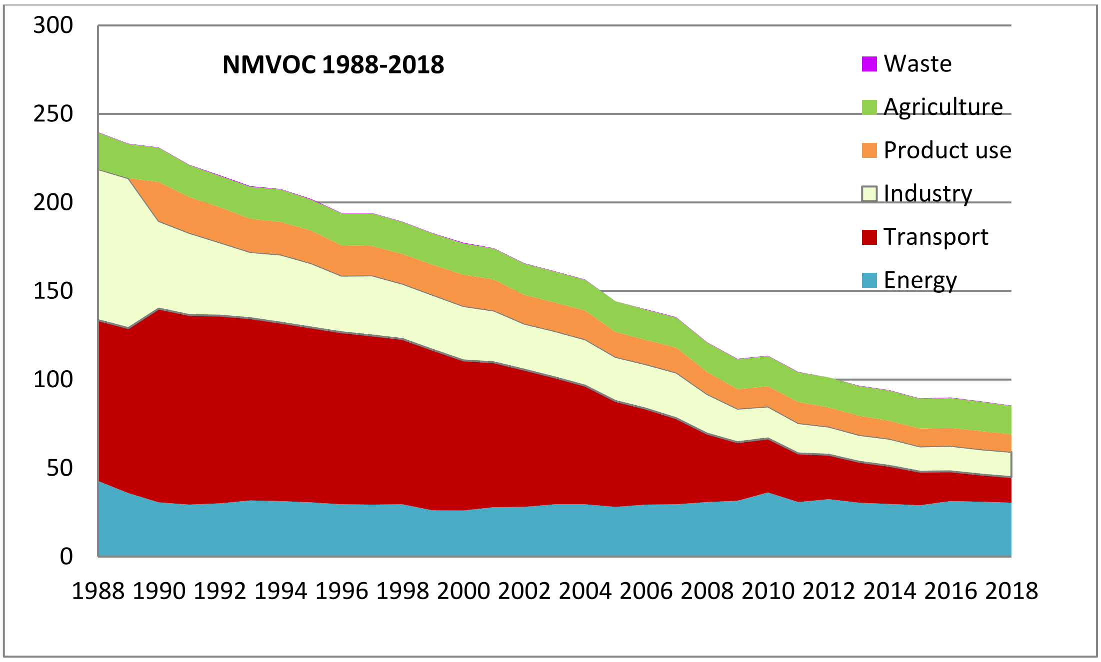
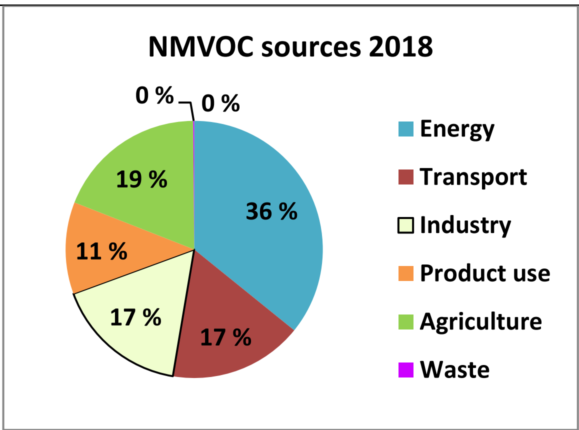


Figure 1.20. NMVOC emissions (Gg) in 1988-2018

The contribution of different sources to emissions, the spatial distribution of emissions and the shares of data reported by operators of industrial plants of total emissions are presented in Figure 1.21.



NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants	NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants
1A1a	1.9	1.603	23.1	2C1	0.2	0.181	100
1A1b	<0.1	0.076	44.2	2C2	<0.1	0.002	100
1A2a	<0.1	0.018	0	2C6	<0.1	0.001	0
1A2b	<0.1	0.001	8.9	2C7a	<0.1	<0.001	100
1A2c	<0.1	0.011	0	2C7b	<0.1	0.029	100
1A2d	0.5	0.400	5.8	2C7c	<0.1	0.006	100
1A2e	<0.1	0.025	0	2D3a	5.9	5.031	0
1A2f	<0.1	0.018	0	2D3b	0.4	0.359	0
1A2gvii	1.5	1.312	0	2D3c	0.2	0.202	0
1A2gviii	0.2	0.204	15.5	2D3d	7.7	6.538	17.0
1A3ai(i)	0.1	0.107	0	2D3e	0.5	0.439	6.7

1A3aii(i)	<0.1	0.033	0	2D3g	2.2	1.856	75.5
1A3bi	2.0	1.726	0	2D3h	0.8	0.661	82.8
1A3bii	0.4	0.346	0	2D3i	1.8	1.493	7.5
1A3biii	0.4	0.365	0	2G	<0.1	0.020	0
1A3biv	1.6	1.325	0	2H1	2.1	1.759	13.7
1A3bv	1.6	1.349	0	2H2	2.0	1.661	0.2
1A3c	<0.1	0.076	0	2I	1.6	1.322	28.5
1A3dii	3.5	2.937	0	2L	<0.1	<0.001	100
1A3ei	<0.1	<0.001	0	3B1a	7.4	6.294	0
1A4ai	0.1	0.088	0	3B1b	4.6	3.939	0
1A4aii	0.6	0.526	0	3B2	0.2	0.168	0
1A4bi	25.2	21.382	0	3B3	0.3	0.257	0
1A4bii	3.2	2.702	0	3B4d	<0.1	0.004	0
1A4ci	0.5	0.448	0	3B4e	0.3	0.249	0
1A4cii	1.7	1.438	0	3B4gi	0.2	0.212	0
1A4ciii	<0.1	0.073	0	3B4gii	0.8	0.686	0
1A5a	0.2	0.212	0	3B4giii	<0.1	0.035	0
1A5b	<0.1	0.044	0	3B4giv	<0.1	0.017	0
1B1b	<0.1	0.066	0	3B4h	1.3	1.116	0
1B2aiv	3.5	2.948	100	3Da2a	2.6	2.245	0
1B2av	3.3	2.841	6.5	3Da3	<0.1	0.062	0
1B2b	0.3	0.220	0	3De	0.9	0.732	0
2A1	<0.1	0.022	18.3	3F	0.1	0.122	0
2A3	<0.1	<0.001	97.3	5A	<0.1	0.079	0
2B10a	2.8	2.403	100	5D1	<0.1	0.009	0
2B10b	0.2	0.158	100	5D2	<0.1	0.018	0
				Total	**100**	**85.317**	**12.0**

Figure 1.21 The contribution of different sources and data reported by the plants in the 2018 emissions.

2.3.4 Sulphur emissions as sulphur dioxide SO_2

Emission trend

Emissions of sulphur have been reduced by 94% since the base year 1980.

The main sources of sulphur emissions in Finland are energy production and industrial processes. All sulphur compounds converted into sulphur dioxide (SO_2) are included in the inventory, such as sulphur trioxide (SO_3), sulphuric acid (H_2SO4), and reduced sulphur compounds, e.g. hydrogen sulphide (H_2S), mercaptans and dimethyl sulphides. Emissions of sulphur compounds other than SO_2 originate, for instance, from petroleum refineries, tank farms for unrefined petroleum products, natural gas plants, petrochemical plants, oil sands plants, sewage treatment facilities, kraft pulp and paper plants and animal feedlots.

Sulphur emissions have been dramatically decreased since the beginning of1980's due to successful national programmes to reduce emissions. A Government resolution was issued in 1986 for a 50% reduction of emissions from the 1980 level, and in 1990, the aim was set at an 80% reduction over the next ten years. Emissions from energy production, pulp mills, sulphur acid plants and refineries were limited as was the sulphur content of coal and oil products. The industry branch specific reduction targets were regularly followed and re-examined. Investments, including desulphurization units for existing coal-fired power stations, were made in the beginning of the 1990's to implement these decisions. Follow-up on how Finland meets the reduction targets under the UN and EU legislation is presented in Chapters 3.1.4 – 5.

SOx emissions are regarded rather accurate as emission data reported by the plants according to their monitoring programmes in environmental permits is used in the inventory. Fluctuations in annual emission levels are related to economic conditions and changes in energy production (Figure 1.22)

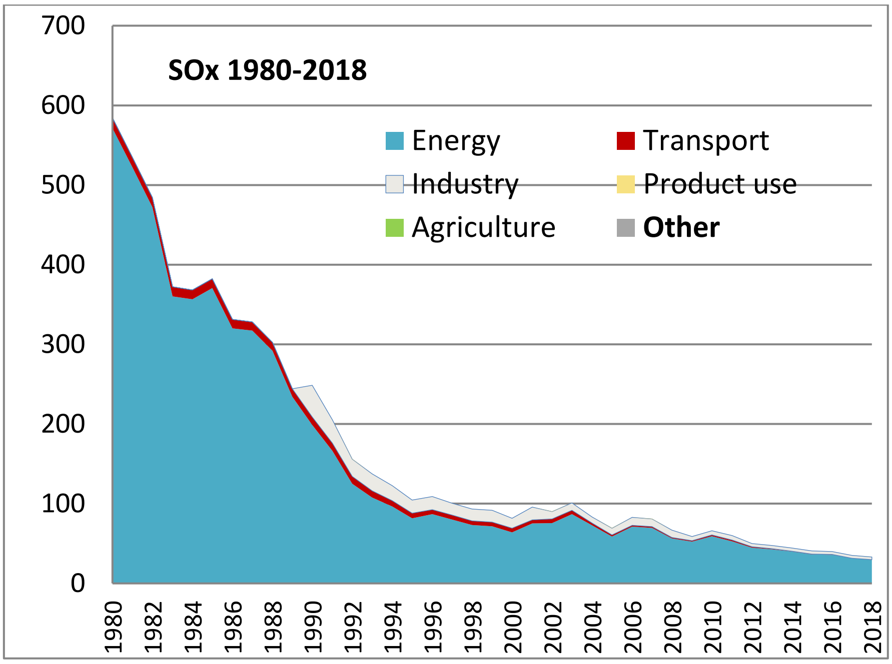
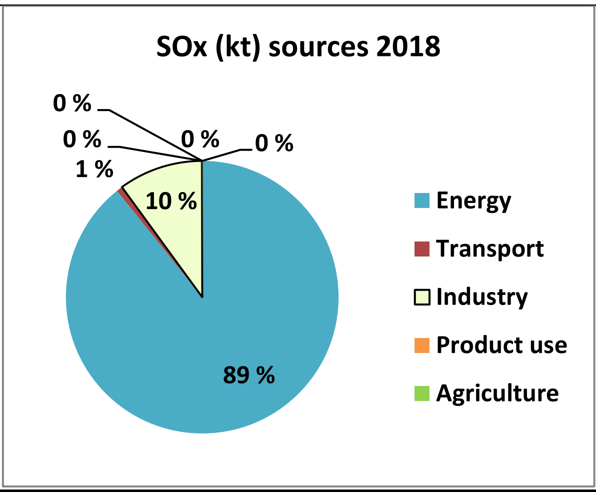
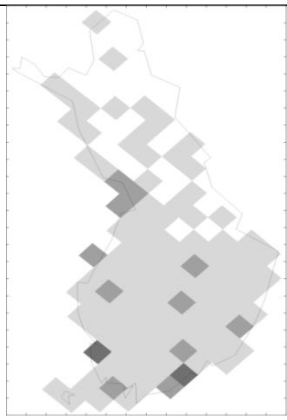


Figure 1.22. Emissions of sulphur dioxide (Gg) in 1980-2018.

The uncertainties of emission data in 2016 are presented in Annex 7 of the IIR.

The contribution of different sources to emissions, the spatial distribution of emissions and the shares of data reported by operators of industrial plants of total emissions are presented in Figure 1.23.





NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants	NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants
1A1a	37.6	12.457	88.3	1A4bi	2.6	0.846	0
1A1b	14.0	4.628	99.9	1A4bii	<0.1	<0.001	0
1A2a	1.1	0.366	98.8	1A4ci	2.2	0.733	0.1
1A2b	9.9	3.284	99.6	1A4cii	<0.1	0.003	0
1A2c	1.9	0.630	68.6	1A4ciii	<0.1	<0.001	0
1A2d	8.2	2.714	79.9	1A5a	3.0	1.006	0
1A2e	2.0	0.671	67.6	1A5b	<0.1	0.032	0
1A2f	1.6	0.542	73.4	1B1b	0.2	0.053	100
1A2gvii	<0.1	0.004	0	2B10a	4.6	1.538	100
1A2gviii	1.7	0.554	57.2	2C1	2.2	0.739	100
1A3ai(i)	0.2	0.050	0	2C2	<0.1	0.002	100
1A3aii(i)	<0.1	0.014	0	2C7a	0.3	0.111	1.7
1A3bi	<0.1	0.027	0	2C7b	<0.1	0.015	100
1A3bii	<0.1	0.003	0	2C7c	<0.1	<0.001	100
1A3biii	<0.1	0.016	0	2D3g	<0.1	<0.001	100
1A3biv	<0.1	<0.001	0	2D3i	<0.1	<0.001	100
1A3c	<0.1	<0.001	0	2G	<0.1	0.004	0
1A3dii	0.3	0.084	0	2H1	2.7	0.903	100
1A3ei	<0.1	<0.001	0	2L	<0.1	0.001	100
1A4ai	3.3	1.083	0	3F	<0.1	0.008	0
1A4aii	<0.1	0.001	0	**Total**	**100**	**33.127**	**79.3**

Figure 1.23 The contribution of different sources and data reported by the plants in the 2018 emissions.

2.3.5 Ammonia emissions

Emission trend

Ammonia emissions have been reduced by 9% from 1990. The main ammonia source is agriculture, while transport and industrial processes contribute to 10% of emissions. The emissions decreased from early 1980's by 1990, however, after that the emission trend has been rather consistent. Ammonia emission trend is presented in Figure 1.24.

According to the current understanding, the emissions are expected to stay at the present level, or even slightly increase. Follow-up of how Finland has met the reduction targets under the UN and EU legislation is presented in Chapters 3.1.4 – 3.1.5. A project to closer study manure management practices and present options to reduce emissions from this source is underway.

Understanding of ammonia emission sources and levels has gradually been improved during the 2000's. Still in 2002 not all sources of ammonia emissions were identified and the emissions from the major source, agriculture, were underestimated. While the Gothenburg protocol which limits NH3 emissions had not yet entered into force, it was understood that further assessment of the inventory was necessary. A new calculation model to improve the agriculture sector inventory was developed in 2006-2008. Based on the results of this work, it was concluded that the earlier estimates, especially for dairy cows, did not take into account the increased specific emissions following the growth of the animals while the number of the animals had significantly decreased. The time series has been revised several times since, while the latest comprehensive recalculation was carried out in 2013. After that, minor corrections and inclusion of minor new sources have been carried out. A detailed description of ammonia emissions is presented in Appendix 1.

During the year 2014 new sources were identified (residential combustion, leather tanning, coke production and use of latrines) and ammonia emissions from the new sources were included in the inventories from the year 1990 onward.

Ammonia emissions had earlier been estimated as national totals only for 1980, 1985-1988, 1990, 1995 and 1997-1999 and in NFR format only from 2000 onwards. At the moment, the recalculated time series is available in NFR format since 1980.

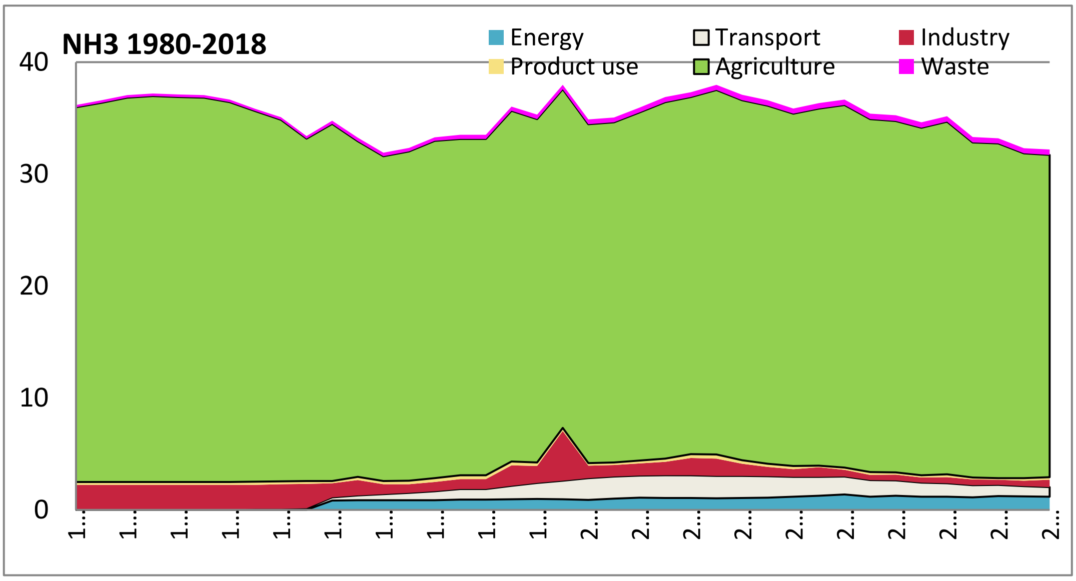
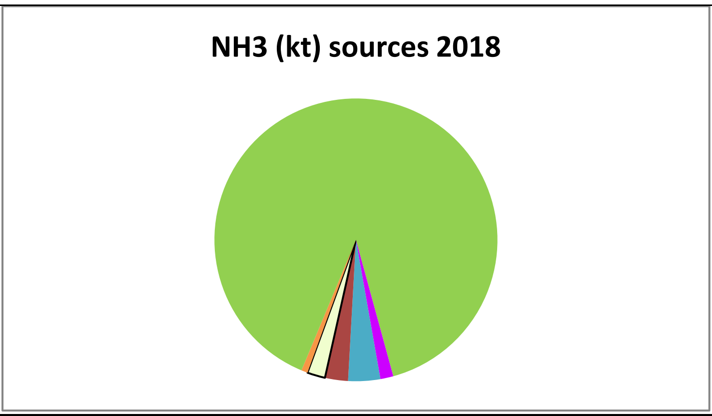


Figure 1.24. Ammonia emissions (Gg) in 1980-2018. Note, The peak NFR2 (Industry) in 1999 is due to an accidental emission reported by the plant to the environmental authorities.

The uncertainties of emission data in 2016 are presented in Annex 7 of the IIR.

The contribution of different sources to emissions, the spatial distribution of emissions and the shares of data reported by operators of industrial plants of total emissions are presented in Figure 1.25.



NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants	NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants
1A1a	<0.1	0.004	100	2D3g	<0.1	0.004	21.6
1A2b	<0.1	<0.001	100	2D3i	0.7	0.213	97.3
1A2gvii	<0.1	0.003	0	2G	<0.1	0.013	0
1A2gviii	<0.1	0.001	100	2H1	0.6	0.199	100
1A3bi	2.5	0.797	0	2L	<0.1	0.025	2.8
1A3bii	<0.1	0.010	0	3B1a	17.6	5.676	0
1A3biii	<0.1	0.028	0	3B1b	15.4	4.964	0
1A3biv	<0.1	0.002	0	3B2	0.6	0.177	0
1A3c	<0.1	<0.001	0	3B3	9.6	3.075	0
1A3dii	<0.1	<0.001	0	3B4d	<0.1	0.007	0
1A4ai	<0.1	0.005	0	3B4e	2.2	0.693	0
1A4aii	<0.1	<0.001	0	3B4gi	1.4	0.463	0
1A4bi	3.6	1.155	0	3B4gii	2.1	0.669	0
1A4bii	<0.1	<0.001	0	3B4giii	0.2	0.072	0
1A4ci	<0.1	0.012	0	3B4giv	0.1	0.040	0
1A4cii	<0.1	0.002	0	3B4h	7.7	2.487	0
1A4ciii	<0.1	<0.001	0	3Da1	6.4	2.058	0
1A5a	<0.1	<0.001	0	3Da2a	21.8	7.008	0
1B1b	<0.1	0.003	0	3Da2b	<0.1	0.002	0
2B10a	1.0	0.306	100	3Da3	4.2	1.347	0
2C1	0.1	0.044	100	3F	0.2	0.057	0
2C7b	0.3	0.084	100	5B1	0.3	0.091	0
2C7c	<0.1	<0.001	100	5D1	<0.1	0.003	100
2D3e	<0.1	0.004	0	5E	1.2	0.381	0
				Total	**100**	**32.189**	**2.6**

Figure 1.25 The contribution of different sources and data reported by the plants in the 2018 emissions.

2.3.6 Carbon monoxide emissions

Emission trend

Carbon monoxide emissions have been reduced by 55% since 1990. The carbon monoxide emission trend is presented in Figure 1.26. The trend is declining and the main sources are fuel combustion in the energy production and transport sectors. CO emission data reported by the plants is used in the inventory. CO emission levels are well known due to the use of CO as process parameter.

CO emission data is available as national totals since the year 1980 and in NFR format since the year 2000. However, the earlier reported CO emissions are not consistent with those data after 1990, e.g. emissions from off-road machinery are not included in them. A revised time series for the 1980's is under work.

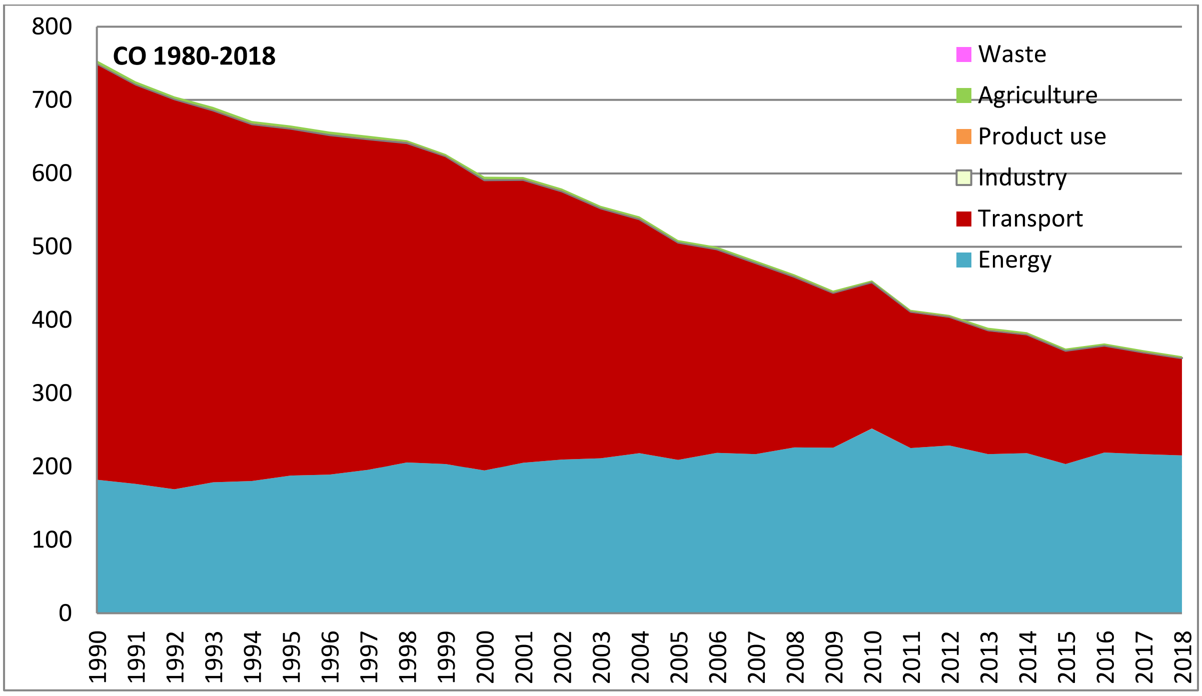
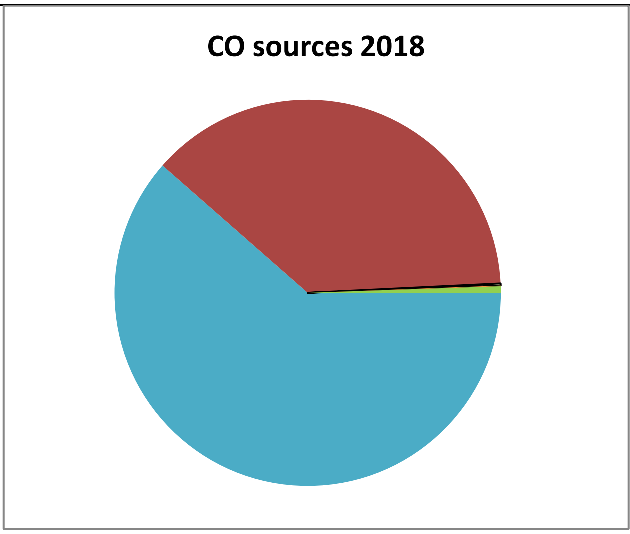
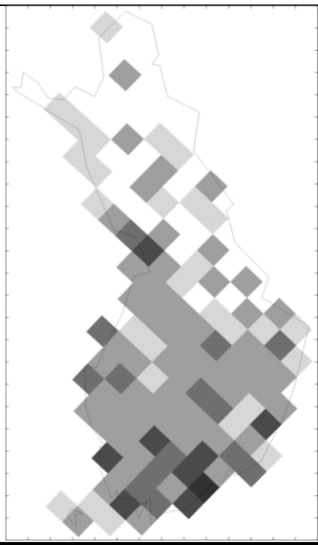


Figure 1.26. Emissions of carbon monoxide (Gg) in 1990-2018.

The uncertainties of emission data in 2017 are presented in Annex 7 of the IIR.

The contribution of different sources to emissions, the spatial distribution of emissions and the shares of data reported by operators of industrial plants of total emissions are presented in Figure 1.27.





NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants	NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants
1A1a	4.5	15.647	19.6	1A3c	<0.1	0.181	0
1A1b	0.3	1.090	16.1	1A3dii	5.6	19.565	0
1A2a	0.3	0.910	0.2	1A3ei	<0.1	0.002	0
1A2b	<0.1	0.079	67.6	1A4ai	0.3	1.004	0.1
1A2c	<0.1	0.105	3.3	1A4aii	4.6	16.077	0
1A2d	6.2	21.878	10.7	1A4bi	45.2	158.601	0
1A2e	<0.1	0.170	0.3	1A4bii	11.4	39.906	0
1A2f	1.4	4.873	4.7	1A4ci	0.6	2.127	0
1A2gvii	2.2	7.827	0	1A4cii	2.7	9.522	0
1A2gviii	0.9	3.309	8.3	1A4ciii	<0.1	0.244	0
1A3ai(i)	0.2	0.852	0	1A5a	1.6	5.651	0
1A3aii(i)	0.1	0.353	0	1A5b	0.2	0.689	0
1A3bi	7.4	25.833	0	2C1	0.2	0.620	100
1A3bii	0.7	2.363	0	2C7a	<0.1	0.006	100
1A3biii	0.9	3.222	0	2G	<0.1	0.187	0
1A3biv	1.6	5.736	0	3F	0.5	1.902	0
				Total	**100**	**350.531**	**1.9**

Figure 1.27 The contribution of different sources and data reported by the plants in the 2018 emissions.

2.3.7 Particulate matter emissions

Particulate matter emissions have been estimated since 2000 and the trend is slightly decreasing. The main sources for particle emissions in Finland are energy, road transport and industrial processes sectors. The emission trend is presented in Figure 1.28.

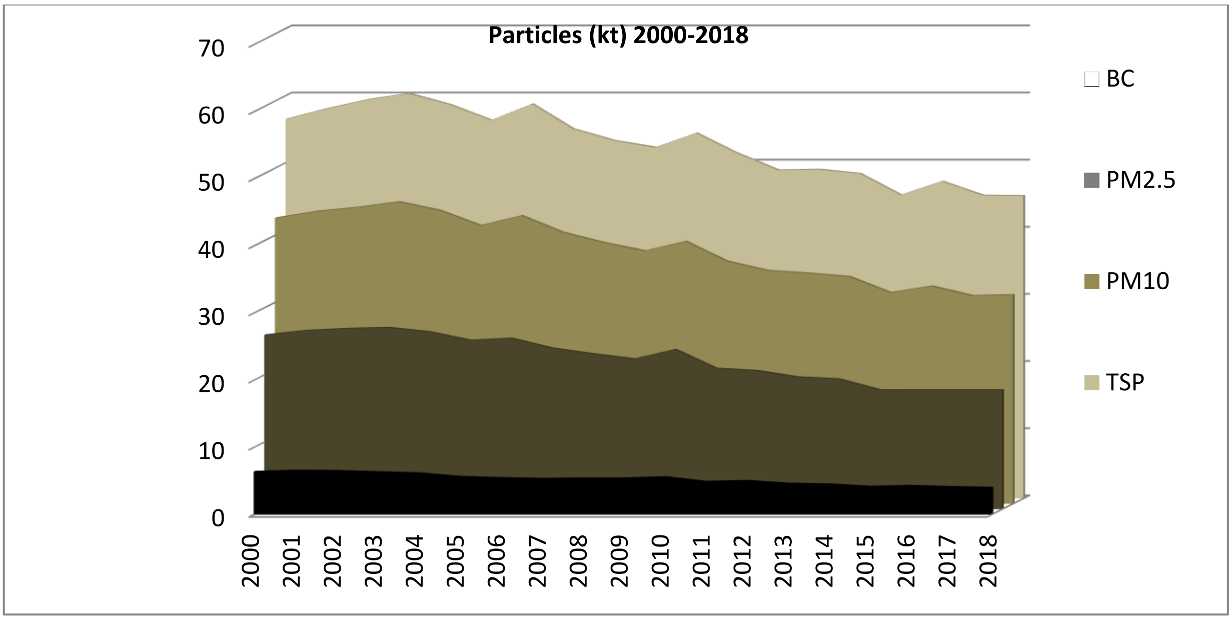


Figure 1.28 Particle emissions (TSP, PM10, PM2.5 and BC) in 2000-2018.

TSP emissions have been reduced by 36%, PM10 emissions by 42%, PM2.5 emissions by 44% and BC emissions by 31% since 1990.

Particulate matter emissions fluctuate largely from year to year due to changes in energy consumption, which is affected by the level of annually imported electricity and fossil fuel based condensing power in annual energy production. Energy consumption reflects the energy intensity of the Finnish industry (forest industry, chemical industry and manufacture of basic metals), extensive consumption during the long heating period, as well as energy consumption in the transport sector due to long distances in the sparsely inhabited country. During the last decades large decreases in specific emissions have been achieved through implementation of abatement techniques especially in peat and oil combustion.

The especially high peat production volumes in summer 2006 can be seen as a peak in the emission trend. The drop in emissions in 2014 is due to introduction of small scale combustion calculation model, the results of which have not been possible to integrate over the whole time series due to pending recalculation of the energy sector emissions. The recalculation of emissions from small scale combustion sources decreased significantly particle emissions as the new inventory system more accurately defines the wood amounts used in small scale combustion equipment and larger boilers.

Reporting of TSP emissions is traditionally included in the monitoring programmes of environmental permits and emission data for LCPs can therefore be regarded quite accurate. This data as well as PM10 emission data reported under the ETS and the E-PRTR are used in the inventory. Particle emissions from energy production are efficiently abated in the centralized electricity and power production using electrostatic precipitators and scrubbers.

However, the current particle emissions time series are strongly affected by smaller boilers, where the inventory does not reflect implemented abatement technology. These emissions are calculated as unabated due to the fact that information is not available of the implemented abatement technology in smaller district heating plants.

Note: the sources for $PM_{2.5}$ and BC are not equal: peat production (NFR 1B3) is a significant source for $PM_{2.5}$ but is not a source of BC. In the black carbon emission inventory, the main sources are transport (road transport and off-road machinery) and energy production, mainly residential combustion. The preliminary BC time series for 2000-2012, reported on a separate sheet in the NFR table submission in February 2014, the technology-specific calculation method was already used.

The new calculation model for small scale wood combustion that has been implemented since the 2016 submission decreased the level of particle emissions substantially. Detailed information on the model and methods are presented under the Chapter for NFR 1A4bi.

2.3.7.1 Particles TSP

Emission trend

The trend of TSP emissions is presented in Figure 1.29.

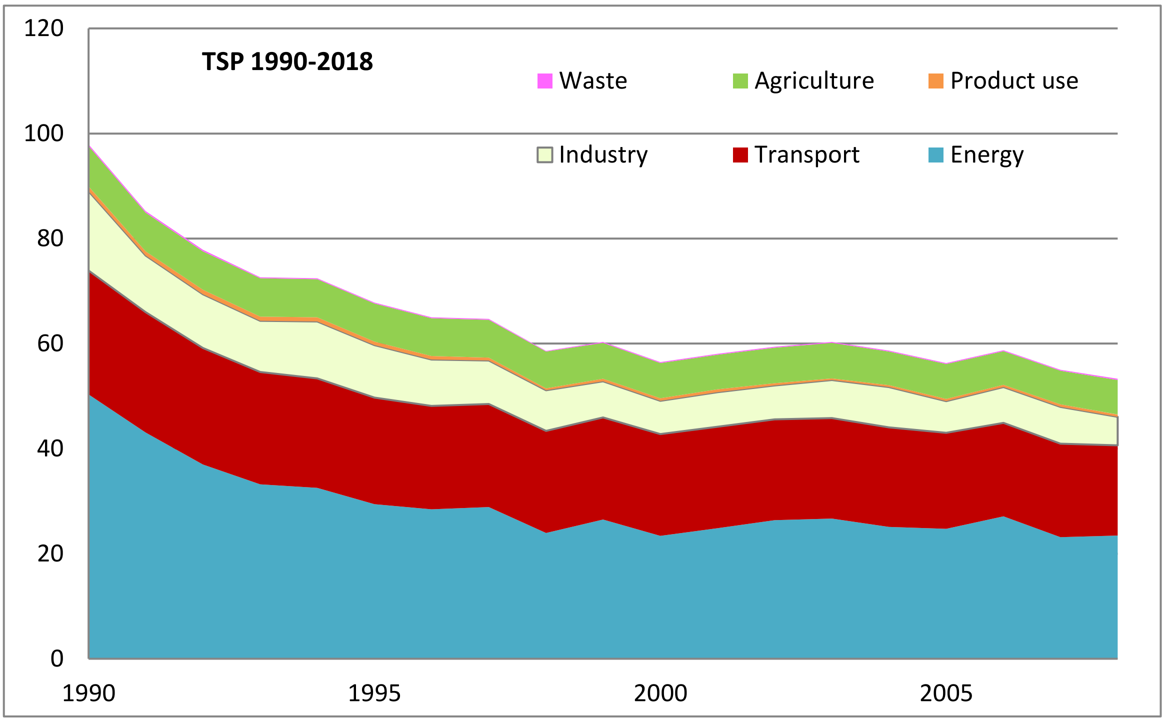
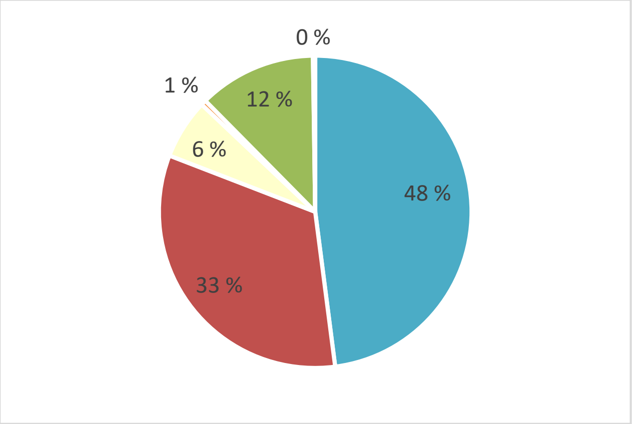


Figure 1.29. TSP emissions (kt) 1990-2018

The uncertainties of emission data in 2018 are presented in Annex 7 of the IIR.

The contribution of different sources to emissions, the spatial distribution of emissions and the shares of data reported by operators of industrial plants of total emissions are presented in Figure 1.30.



NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants	NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants
1A1a	6.3	2.849	71.9	2A5c	1.6	0.709	0
1A1b	0.2	0.105	100	2B10a	1.1	0.491	100
1A2a	<0.1	0.018	100	2B10b	<0.1	0.037	0
1A2b	<0.1	0.016	100	2B6	<0.1	<0.001	100
1A2c	0.2	0.080	100	2C1	0.6	0.275	100
1A2d	4.8	2.168	100	2C2	0.7	0.299	100
1A2e	<0.1	0.039	100	2C3	<0.1	<0.001	58
1A2f	0.3	0.142	100	2C6	<0.1	<0.001	100
1A2gvii	0.8	0.356	0	2C7a	<0.1	<0.001	4.4
1A2gviii	1.0	0.447	100	2C7c	<0.1	0.012	100
1A3ai(i)	<0.1	0.006	0	2C7d	<0.1	0.015	0
1A3aii(i)	<0.1	0.001	0	2D3b	0.2	0.085	0
1A3bi	0.6	0.290	0	2D3d	<0.1	0.002	100
1A3bii	0.6	0.277	0	2D3e	<0.1	<0.001	100
1A3biii	0.5	0.204	0	2D3g	<0.1	0.005	100
1A3biv	<0.1	0.021	0	2D3i	0.1	0.065	100
1A3bvi	3.5	1.576	0	2G	0.2	0.087	0
1A3bvii	24.8	11.198	0	2H1	0.6	0.262	100
1A3c	<0.1	0.028	0	2H2	1.0	0.430	19.6
1A3dii	0.7	0.330	0	2I	0.3	0.122	100
1A4ai	0.7	0.297	1.8	2L	0.1	0.056	100
1A4aii	0.3	0.113	0	3B1a	0.5	0.211	0
1A4bi	21.7	9.798	0	3B1b	0.4	0.165	0
1A4bii	0.3	0.142	0	3B2	<0.1	0.011	0
1A4ci	2.2	0.995	0.2	3B3	0.7	0.295	0
1A4cii	0.5	0.230	0	3B4d	<0.1	<0.001	0
1A4ciii	<0.1	0.041	0	3B4e	<0.1	0.021	0
1A5a	4.6	2.061	0	3B4gi	1.4	0.640	0
1A5b	<0.1	0.017	0	3B4gii	0.4	0.184	0
1B1b	<0.1	0.016	100	3B4giii	<0.1	0.016	0
1B1c	5.7	2.578	0	3B4giv	0.2	0.073	0

1B2aiv	<0.1	0.007	100	3B4h	0.1	0.053	0
1B2av	<0.1	<0.001	100	3Dc	8.1	3.658	0
2A2	<0.1	0.003	100	3F	0.3	0.158	0
2A3	<0.1	0.007	100	5A	<0.1	0.001	0
2A5a	<0.1	0.007	76.4	5C1bv	<0.1	0.001	0
2A5b	0.1	0.061	1.7	5E	0.2	0.103	0
				Total	**100**	**45.069**	**15.1**

Figure 1.30 The contribution of different sources and data reported by the plants in the 2018 emissions.

2.3.7.2 Particles PM10

Emission Trend

For introduction to drivers behind the emission trend, please see the beginning of Chapter 3.1.12. The trend of PM10 emissions is presented in Figure 1.31.

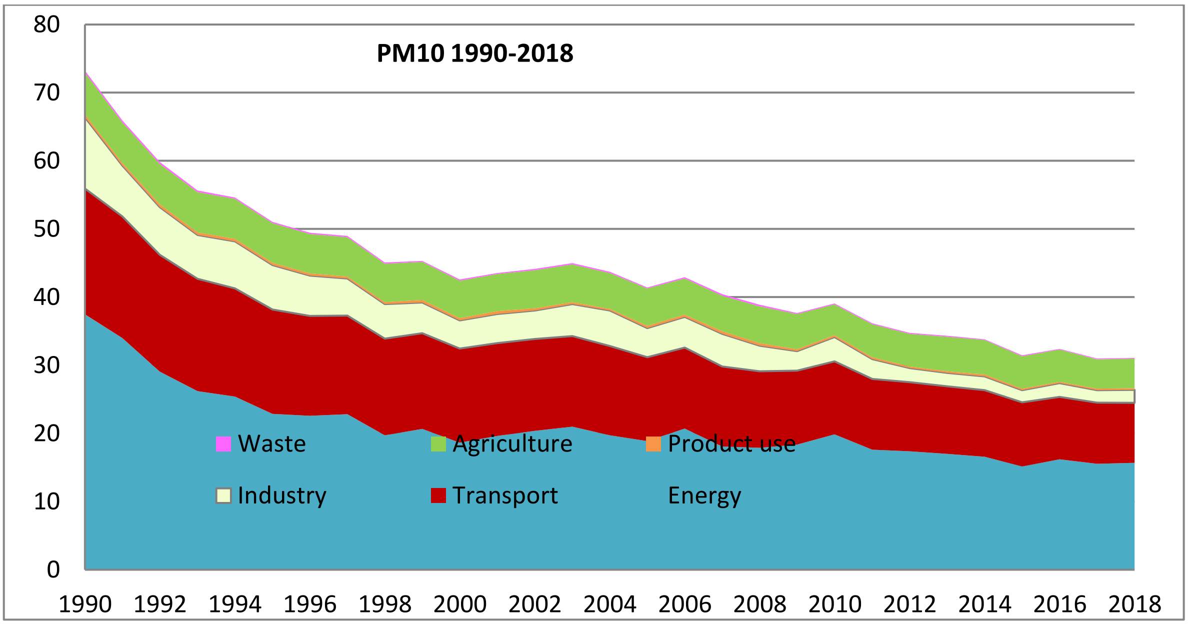
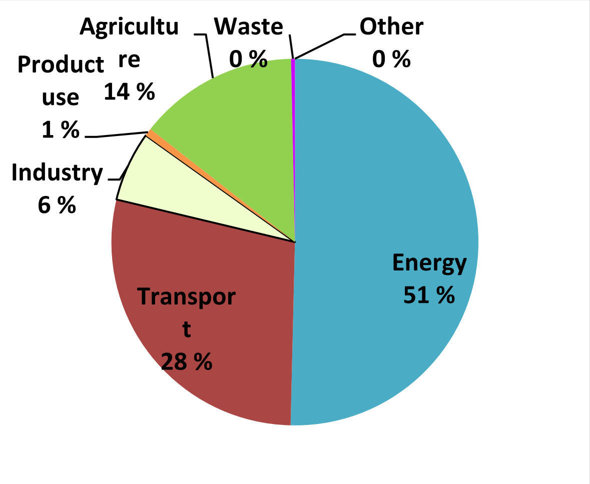


Figure 1.31. PM10 emissions (kt) in 2000-2018

The uncertainties of emission data in 2018 are presented in Annex 7 of the IIR.

The contribution of different sources to emissions, the spatial distribution of emissions and the shares of data reported by operators of industrial plants of total emissions are presented in Figure 1.32.



NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants	NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants
1A1a	3.8	1.178	0	2A5c	0.9	0.277	0
1A1b	0.1	0.037	0	2B10a	1.4	0.425	0
1A2a	<0.1	0.008	0	2B10b	<0.1	0.012	0
1A2b	<0.1	0.007	0	2B6	<0.1	<0.001	0
1A2c	0.2	0.067	0	2C1	0.7	0.225	0
1A2d	5.9	1.841	0	2C2	0.8	0.254	0
1A2e	<0.1	0.021	0	2C3	<0.1	<0.001	0
1A2f	0.2	0.065	0	2C6	<0.1	<0.001	0
1A2gvii	1.1	0.356	0	2C7a	<0.1	<0.001	0
1A2gviii	0.6	0.179	0	2C7c	<0.1	0.007	0
1A3ai(i)	<0.1	0.006	0	2C7d	<0.1	0.008	0
1A3aii(i)	<0.1	0.001	0	2D3b	0.2	0.064	0
1A3bi	0.9	0.290	0	2D3d	<0.1	0.001	0
1A3bii	0.9	0.277	0	2D3e	<0.1	<0.001	0
1A3biii	0.7	0.204	0	2D3g	<0.1	0.004	0
1A3biv	<0.1	0.021	0	2D3i	0.2	0.060	0
1A3bvi	3.8	1.169	0	2G	0.3	0.087	0
1A3bvii	18.0	5.599	0	2H1	0.6	0.196	0
1A3c	<0.1	0.027	0	2H2	1.3	0.411	0
1A3dii	1.1	0.330	0	2I	<0.1	0.024	0
1A4ai	0.7	0.212	0	2L	0.1	0.043	0
1A4aii	0.4	0.113	0	3B1a	0.3	0.096	0
1A4bi	30.2	9.394	0	3B1b	0.2	0.076	0
1A4bii	0.5	0.142	0	3B2	<0.1	0.005	0
1A4ci	1.2	0.367	0	3B3	0.1	0.046	0
1A4cii	0.7	0.230	0	3B4d	<0.1	<0.001	0
1A4ciii	0.1	0.041	0	3B4e	<0.1	0.010	0
1A5a	1.9	0.602	0	3B4gi	0.4	0.135	0
1A5b	<0.1	0.017	0	3B4gii	0.3	0.092	0
1B1b	<0.1	0.007	0	3B4giii	<0.1	0.016	0

1B1c	5.4	1.685	0	3B4giv	0.2	0.072	0
1B2aiv	<0.1	0.005	0	3B4h	<0.1	0.024	0
1B2av	<0.1	<0.001	0	3Dc	11.8	3.658	0
2A2	<0.1	0.001	0	3F	0.5	0.155	0
2A3	<0.1	0.006	0	5A	<0.1	<0.001	0
2A5a	<0.1	0.004	0	5C1bv	<0.1	0.001	0
2A5b	<0.1	0.019	0	5E	0.3	0.103	0
				Total	**100**	**31.116**	**0**

Figure 1.32 The contribution of different sources and data reported by the plants in the 2018 emissions.

2.3.7.3 Particles PM2.5

Emission trend

The trend of PM2.5 emissions is presented in Figure 1.33.

For introduction to drivers behind the emission trend, please see the beginning of Chapter 3.1.12.

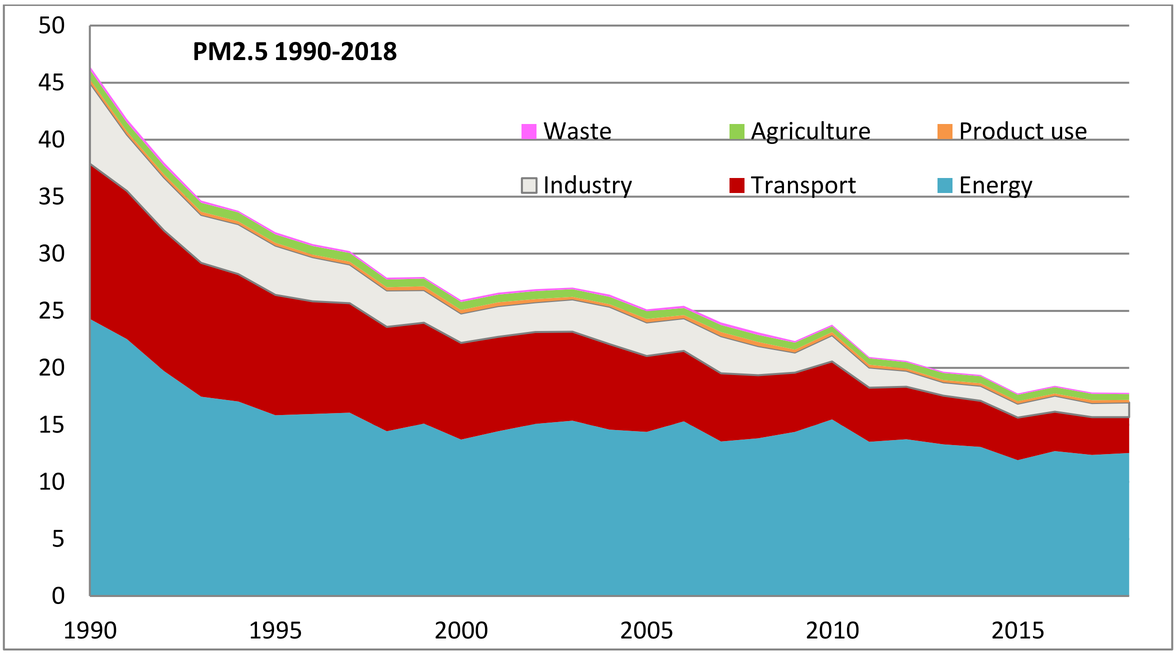
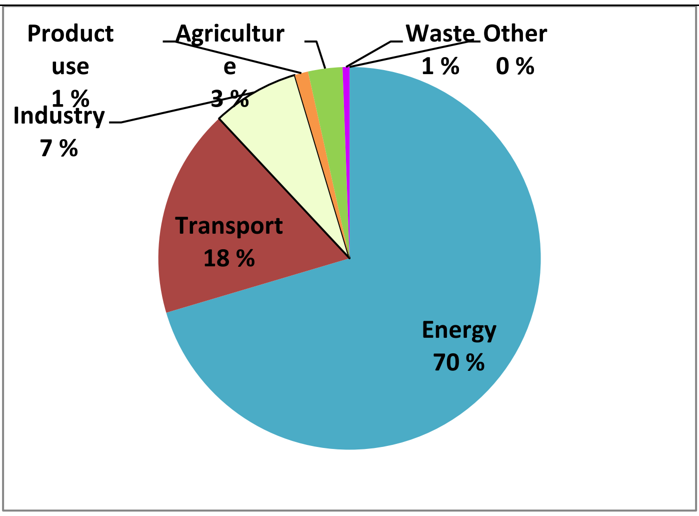


Figure 1.33. PM2.5 emissions in 2000-2018

The uncertainties of emission data in 2018 are presented in Annex 7 of the IIR.

The contribution of different sources to PM2.5 emissions in 2015, the spatial distribution of emi The contribution of different sources to emissions, the spatial distribution of emissions and the shares of data reported by operators of industrial plants of total emissions are presented in emissions in 2012 and the shares of data reported by operators of industrial plants of total emissions in 2015 are presented in Figure 1.34.



NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants	NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants
1A1a	1.9	0.336	0	2A5c	0.2	0.028	0
1A1b	<0.1	0.013	0	2B10a	1.6	0.289	0
1A2a	<0.1	0.003	0	2B10b	<0.1	0.001	0
1A2b	<0.1	0.004	0	2B6	<0.1	<0.001	0
1A2c	0.2	0.043	0	2C1	1.2	0.208	0
1A2d	7.3	1.295	0	2C2	1.0	0.179	0
1A2e	<0.1	0.009	0	2C3	<0.1	<0.001	0
1A2f	0.2	0.031	0	2C6	<0.1	<0.001	0
1A2gvii	2.0	0.356	0	2C7a	<0.1	<0.001	0
1A2gviii	0.4	0.066	0	2C7c	<0.1	0.006	0
1A3ai(i)	<0.1	0.006	0	2C7d	<0.1	<0.001	0
1A3aii(i)	<0.1	0.001	0	2D3b	0.3	0.058	0
1A3bi	1.6	0.290	0	2D3d	<0.1	<0.001	0
1A3bii	1.6	0.277	0	2D3e	<0.1	<0.001	0
1A3biii	1.1	0.204	0	2D3g	<0.1	0.003	0
1A3biv	0.1	0.021	0	2D3i	0.3	0.056	0
1A3bvi	3.6	0.644	0	2G	0.5	0.087	0
1A3bvii	2.7	0.476	0	2H1	0.9	0.157	0
1A3c	0.1	0.026	0	2H2	2.2	0.396	0
1A3dii	1.7	0.298	0	2I	<0.1	<0.001	0
1A4ai	0.8	0.137	0	2L	0.2	0.028	0
1A4aii	0.6	0.113	0	3B1a	0.4	0.063	0
1A4bi	51.0	9.078	0	3B1b	0.3	0.050	0
1A4bii	0.8	0.142	0	3B2	<0.1	0.002	0
1A4ci	1.0	0.171	0	3B3	<0.1	0.002	0
1A4cii	1.3	0.230	0	3B4d	<0.1	<0.001	0
1A4ciii	0.2	0.037	0	3B4e	<0.1	0.006	0
1A5a	0.9	0.156	0	3B4gi	<0.1	0.010	0
1A5b	<0.1	0.017	0	3B4gii	<0.1	0.009	0
1B1b	<0.1	0.003	0	3B4giii	<0.1	0.003	0

1B1c	6.6	1.183	0	3B4giv	<0.1	0.010	0
1B2aiv	<0.1	0.003	0	3B4h	<0.1	0.012	0
1B2av	<0.1	<0.001	0	3Dc	1.1	0.202	0
2A2	<0.1	<0.001	0	3F	0.8	0.148	0
2A3	<0.1	0.005	0	5A	<0.1	<0.001	0
2A5a	<0.1	<0.001	0	5C1bv	<0.1	0.001	0
2A5b	<0.1	0.003	0	5E	0.6	0.103	0
				Total	**100**	**17.798**	**0**

Figure 1.35 The contribution of different sources and data reported by the plants in the 2018 emissions.

2.3.7.4 Black carbon (BC)

Emission trend

The trend of black carbon emissions is presented in Figure 1.36.

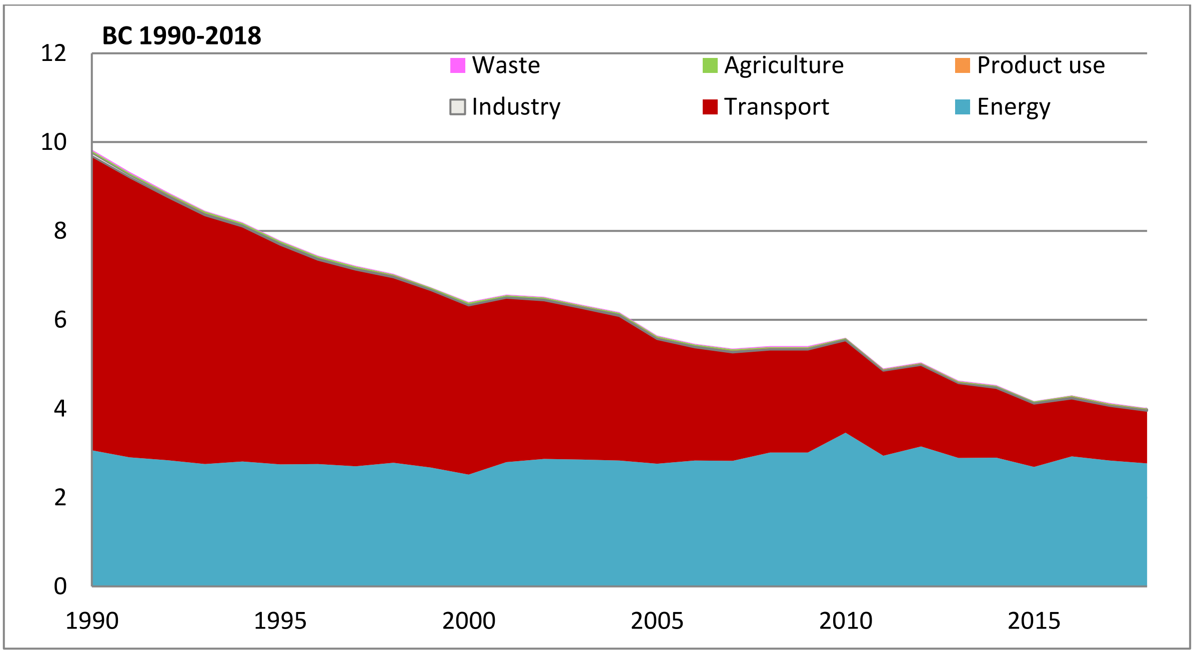
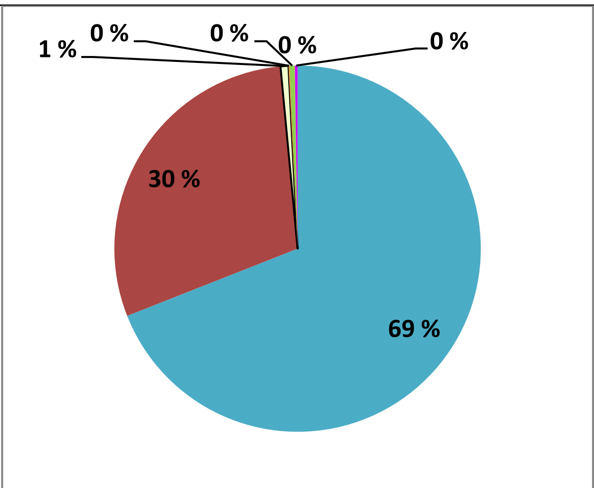
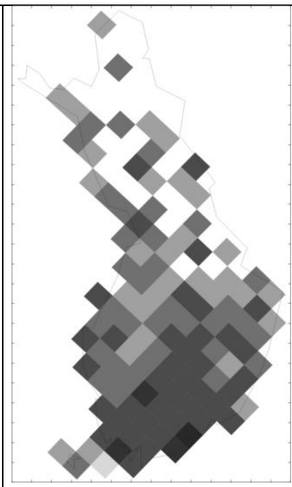


Figure 1.36. BC emissions (kt) in 2000-2018

The uncertainties of emission data in 2018 are presented in Annex 7 of the IIR.

The contribution of different sources to emissions, the spatial distribution of emissions and the shares of data reported by operators of industrial plants of total emissions are presented in Figure 1.37.





NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants	NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants
1A1a	0.4	0.018	0	1A4bii	0.5	0.022	0
1A1b	<0.1	<0.001	0	1A4ci	0.3	0.011	0
1A2a	<0.1	<0.001	0	1A4cii	2.7	0.108	0
1A2b	<0.1	<0.001	0	1A4ciii	0.3	0.013	0
1A2c	0.3	0.012	0	1A5a	1.1	0.045	0
1A2d	0.6	0.023	0	1A5b	0.2	0.008	0
1A2e	<0.1	0.002	0	1B1b	<0.1	<0.001	0
1A2f	<0.1	0.003	0	2A2	<0.1	<0.001	0
1A2gvii	5.4	0.216	0	2A3	<0.1	<0.001	0
1A2gviii	0.1	0.005	0	2B10a	0.1	0.005	0
1A3ai(i)	<0.1	0.003	0	2B6	<0.1	<0.001	0
1A3aii(i)	<0.1	<0.001	0	2C1	<0.1	<0.001	0
1A3bi	3.7	0.150	0	2C2	0.4	0.018	0
1A3bii	3.8	0.152	0	2C3	<0.1	<0.001	0
1A3biii	2.7	0.108	0	2C7a	<0.1	<0.001	0
1A3biv	<0.1	0.003	0	2D3b	<0.1	0.003	0
1A3bvi	4.1	0.167	0	2D3i	<0.1	<0.001	0
1A3bvii	3.1	0.124	0	2G	<0.1	<0.001	0
1A3c	0.4	0.017	0	2H1	0.1	0.004	0
1A3dii	1.5	0.061	0	3F	0.5	0.019	0
1A4ai	0.7	0.027	0	5C1bv	<0.1	<0.001	0
1A4aii	0.8	0.031	0	5E	0.2	0.009	0
1A4bi	65.3	2.622	0	**Total**	**100**	**4.014**	**0**

Figure 1.37 The contribution of different sources and data reported by the plants in the 2018 emissions.

2.3.8 Heavy metals

The following heavy metals are included in the Finnish inventory: primary heavy metals, lead, cadmium and mercury, and in addition, arsenic, chromium, copper, nickel and zinc. The time series 1990-2015 are presented in Figure 1.38.

Selene is one of the non-obligatory heavy metals for reporting and as a full inventory has not yet been performed for selene, the national total is reported as NE although sector specific values exist and are reported. The same applies also to all other heavy metals prior to the year 1990 when the obligation for inventories starts.

The inventory includes bottom-up data, i.e. data reported by the plants on basis of reporting obligations in their environmental permits. However, as the inventory time-series has not been updated, it has not been possible to check possible errors. Also, the emission factors used in the old time-series may not reflect the actual emission trends and emissions from small combustion plants may be highly overestimated as, in lack of information for the applied abatement techniques, these emissions are calculated as unabated. Due to lack of resources in calculation of the energy sector emissions, an update of the time series is still pending but anticipated to be finalized for the submission in 2018. The time series fluctuation is also impacted by different allocation of sources under NFR codes between the years, for the above mentioned reasons.

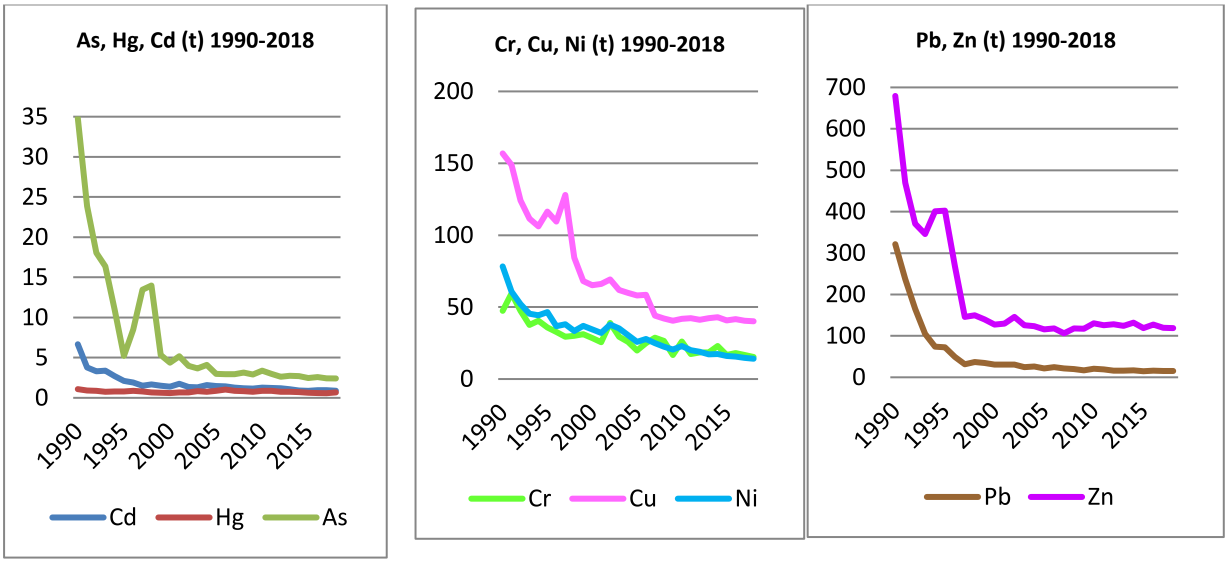


Figure 1.38. Heavy metal emission trends

The emission trends have been strongly decreasing (Figure 1.40) after the first reporting year 1990. Lead emissions have decreased by 95%, cadmium by 81%, mercury by 41%, arsenic by 91%, chromium by 38%, copper by 64%, nickel by 74% and zinc emissions by 77%.

The main sources of heavy metal emissions in Finland are industrial processes and energy production. In both sources there can be large annual variations. For industrial processes the variations are due to changes in the production capacities and in the energy sector, the energy supply structure causes fluctuations. In the integrated Nordic electricity market the annual rainfall and accordingly the availability of cheap hydropower decreased the Finnish emissions in the early 1990's as well as in the turn of the millennium. After that, in years with limited availability of Nordic hydropower, coal and peat fuelled condensing power generation has increased and impacted emission levels.

Annual variations in the emissions are mainly due to fluctuations in the production of non-ferrous metals. In the energy sector, emissions are more stable though affected by the variations in energy production. Heavy metal emissions may be overestimated for small combustion plants as these emissions are calculated as unabated because no information of abatement technique is available.

Heavy metal emissions are likely overestimated due to rather high emission factors compared to e.g. other Nordic countries, and due to the fact that for the small combustion plants from which no information of abatement technique is available, the emissions are calculated as unabated. A project funded by the Nordic Council of Ministers is running in 2016-2018 to study emissions in the Nordic countries and to develop methodologies that better reflect the real emission levels.

2.3.8.1 Arsenic emissions

Arsenic emissions have been reduced by 91% since the base year 1990. The main source in the beginning of the 1990's was industrial processes (mainly non-ferrous metals), where the emissions have dropped considerably. Between 1995 and 1999 there have been actual changes in emissions due to varying production rates. The largest source at the moment is energy production where the energy supply structure causes fluctuations. The main source currently is combustion of wood in the residential sector (Figure 1.39).

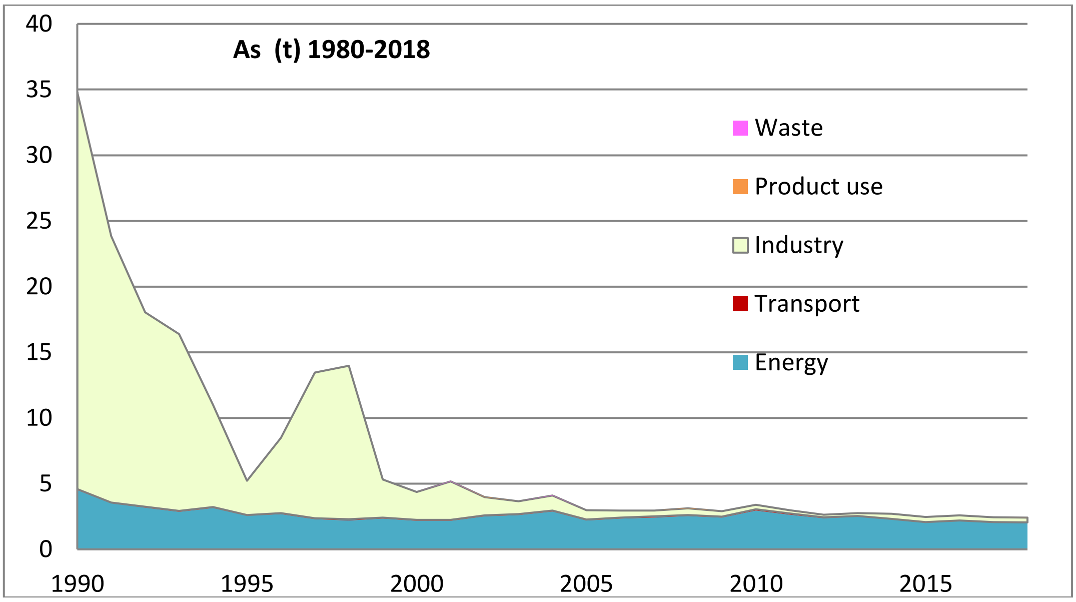
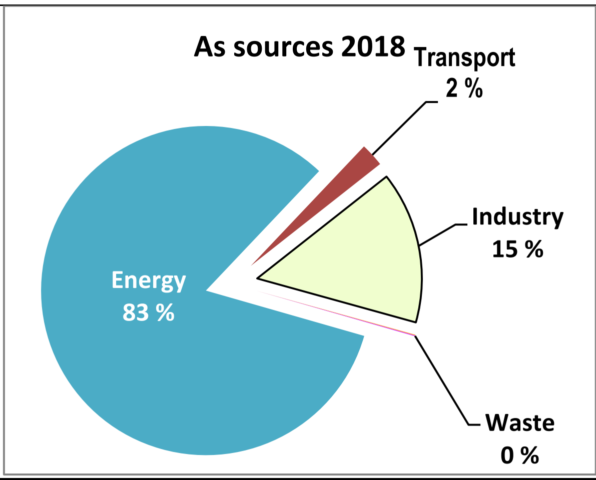
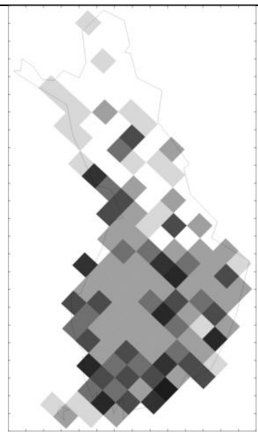


Figure 1.39. Arsenic emissions (t) in 1990-2018

The uncertainties of emission data in 2018 are presented in Annex 7 of the IIR.

The contribution of different sources to emissions, the spatial distribution of emissions and the shares of data reported by operators of industrial plants of total emissions are presented in Figure 1.40.





NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants	NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants
1A1a	34.8	0.839	22.2	1A4bi	2.7	0.066	0
1A1b	18.8	0.455	0	1A4ci	7.3	0.175	0
1A2a	<0.1	<0.001	95.3	1A4ciii	<0.1	0.001	0
1A2b	<0.1	<0.001	0	1A5a	0.6	0.015	0
1A2c	0.1	0.003	4.3	1B1b	<0.1	0.002	100
1A2d	8.8	0.211	3.2	2C1	1.7	0.041	100
1A2e	2.3	0.055	11.2	2C2	<0.1	<0.001	100
1A2f	6.2	0.151	1.2	2C3	<0.1	<0.001	100
1A2gviii	0.3	0.007	21.1	2C6	0.2	0.006	100
1A3bi	<0.1	<0.001	0	2C7a	3.4	0.082	86.9
1A3bii	<0.1	<0.001	0	2C7c	9.5	0.230	100
1A3biii	<0.1	<0.001	0	2G	<0.1	0.002	0
1A3biv	<0.1	<0.001	0	3F	<0.1	<0.001	0
1A3bvi	1.8	0.043	0	5C1bv	<0.1	<0.001	0
1A3dii	0.4	0.011	0	5E	<0.1	<0.001	0
1A4ai	0.7	0.016	0	**Total**	**100**	**2.415**	**23.0**

Figure 1.40) The contribution of different sources and data reported by the plants in the 2018 emissions.

2.3.8.2 Cadmium emissions

Emission trend

Cadmium emissions have been reduced by 79% since the base year 1990. The main sources of cadmium are industrial processes and energy production. The emissions fluctuate annually depending on the consumption of fossil fuels and production rates in manufacturing industries. (Figure 1.41). There is an incorrect value for the IPPU sector in 1999 in the NFR table as can be seen in the figure below, this will be corrected to the next submission.

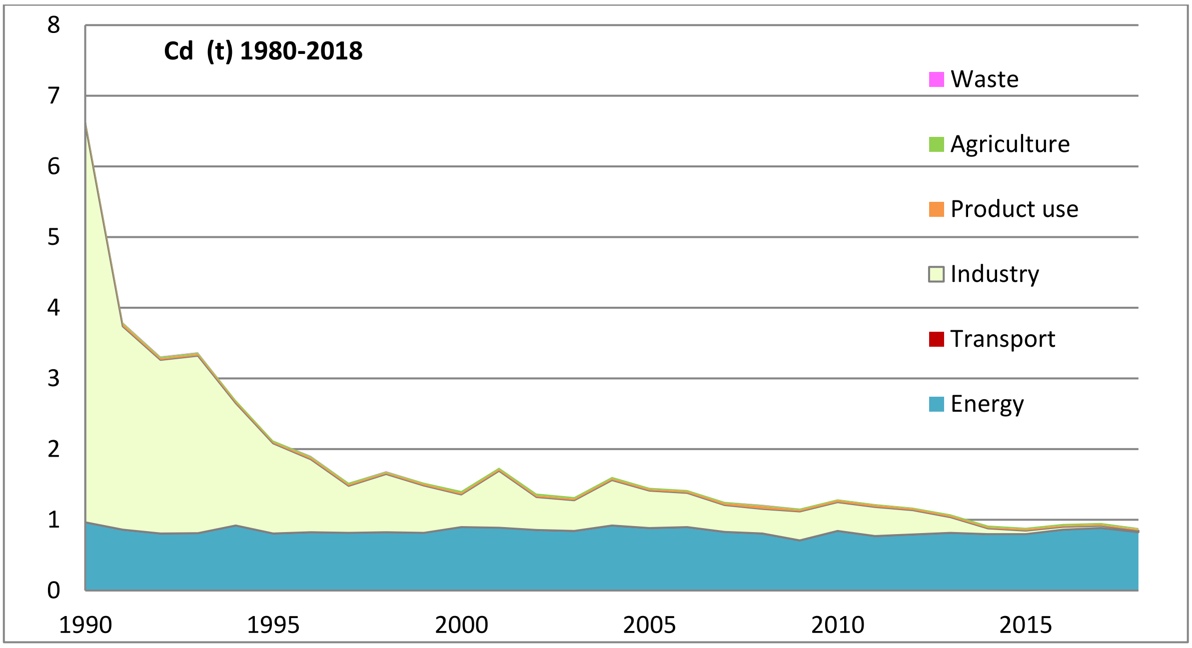
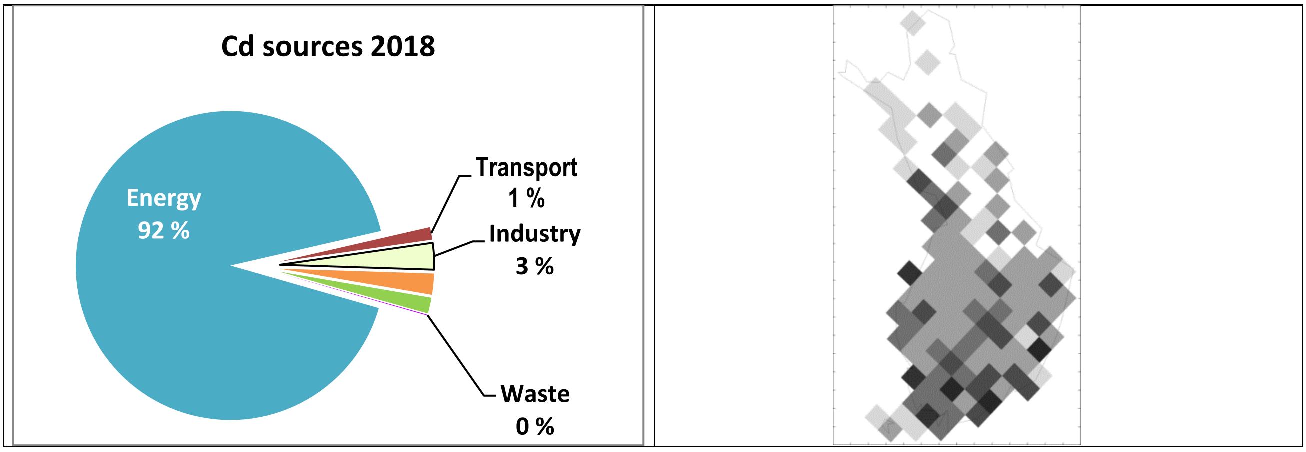


Figure 1.41. Emissions of cadmium (t) in 1990-2018.

The uncertainties of emission data in 2018 are presented in Annex 7 of the IIR.

The contribution of different sources to emissions, the spatial distribution of emissions and the shares of data reported by operators of industrial plants of total emissions are presented in Figure 1.42.



NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants	NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants
1A1a	15.2	0.134	24.3	1A4aii	0.1	0.001	0
1A1b	7.1	0.063	0	1A4bi	17.9	0.158	0
1A2a	<0.1	<0.001	49.5	1A4bii	<0.1	<0.001	0
1A2b	<0.1	<0.001	0	1A4ci	3.1	0.027	0
1A2c	<0.1	<0.001	2.3	1A4cii	0.3	0.002	0
1A2d	36.8	0.325	1.9	1A4ciii	<0.1	<0.001	0
1A2e	0.3	0.003	6.3	1A5a	5.5	0.049	0
1A2f	2.4	0.021	2.1	1B1b	<0.1	<0.001	100
1A2gvii	0.4	0.004	0	2C1	0.6	0.006	100
1A2gviii	2.3	0.021	2.3	2C2	<0.1	<0.001	100
1A3bi	<0.1	<0.001	0	2C3	<0.1	<0.001	100
1A3bii	<0.1	<0.001	0	2C6	1.4	0.012	100
1A3biii	<0.1	<0.001	0	2C7a	<0.1	<0.001	100
1A3biv	<0.1	<0.001	0	2C7c	0.7	0.007	100
1A3bvi	0.2	0.002	0	2G	2.2	0.019	0
1A3c	<0.1	<0.001	0	3F	1.7	0.015	0
1A3dii	0.1	0.001	0	5C1bv	<0.1	<0.001	0
1A4ai	1.2	0.010	0	5E	<0.1	<0.001	0
				Total	**100**	**0.883**	**7.3**

Figure 1.43 The contribution of different sources and data reported by the plants in the 2018 emissions.

2.3.8.3 Chromium emissions

Emission trend

Chromium emissions have been reduced by 38% since the base year 1990. Both energy production and industrial processes contribute the annual releases. Emissions from industrial processes have large annual variations due to variations in the production volumes, also the energy supply structure causes fluctuations. (Figure 1.44).

Emissions from industry fluctuate according to fluctuating production volumes.

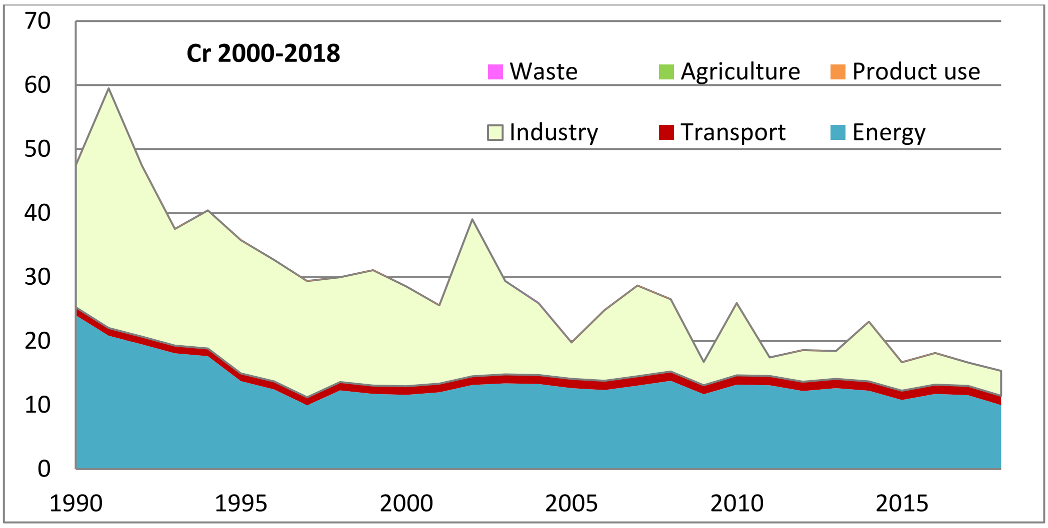
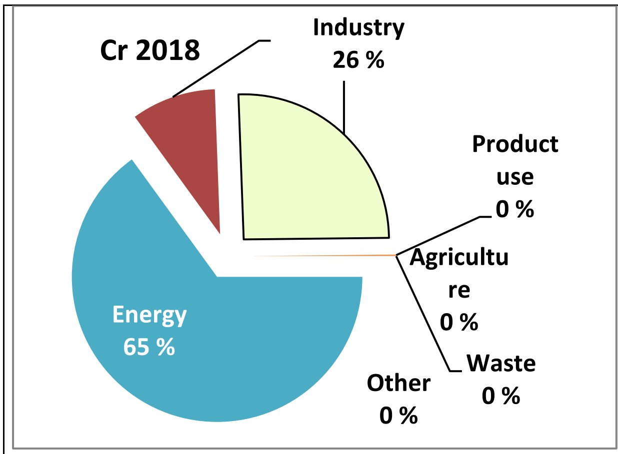
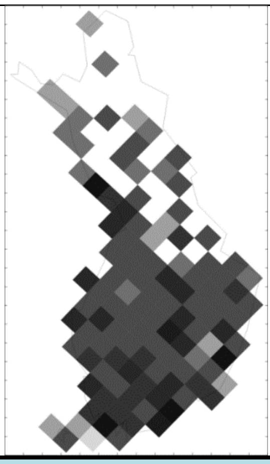


Figure 1.44. Emissions of chromium (t) in 1990-2018.

The uncertainties of emission data in 2017 are presented in Annex 7 of the IIR.

The contribution of different sources to emissions, the spatial distribution of emissions and the shares of data reported by operators of industrial plants of total emissions are presented in Figure 1.45.





NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants	NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants
1A1a	11.7	1.792	19.2	1A4ai	0.9	0.131	0
1A1b	22.6	3.468	0	1A4aii	<0.1	0.005	0
1A2a	<0.1	<0.001	58.6	1A4bi	12.1	1.863	0
1A2b	1.6	0.253	0	1A4bii	<0.1	0.003	0
1A2c	<0.1	0.002	8.4	1A4ci	3.5	0.536	0
1A2d	1.2	0.181	24.3	1A4cii	<0.1	0.012	0
1A2e	0.7	0.104	3.8	1A4ciii	<0.1	0.001	0
1A2f	7.5	1.153	0.7	1A5a	2.2	0.340	0
1A2gvii	0.1	0.019	0	1B1b	<0.1	0.001	100
1A2gviii	1.0	0.150	10.8	2C1	17.6	2.698	100
1A3bi	<0.1	0.015	0	2C2	7.7	1.181	100
1A3bii	<0.1	0.003	0	2C7a	<0.1	<0.001	100

1A3biii	<0.1	0.012	0	2C7c	0.1	0.020	100
1A3biv	<0.1	<0.001	0	2G	0.1	0.022	0
1A3bvi	8.9	1.360	0	3F	<0.1	0.002	0
1A3c	<0.1	<0.001	0	5C1bv	<0.1	<0.001	0
1A3dii	<0.1	0.012	0	5E	<0.1	<0.001	0
				Total	**100**	**15.344**	**28.1**

Figure 1.45 The contribution of different sources and data reported by the plants in the 2018 emissions.

2.3.8.4 Copper emissions

Emission trend

Copper emissions have been reduced by 63% since the base year 1990 (Figure 1.46)

The main sources of copper emissions are industrial processes and transport. In the industrial processes sector emissions from metal industry have the largest contribution and the emissions vary depending on the annual production rates. Also, the national energy supply structure causes fluctuations to emissions.

Emissions from the industry sector have been decreased due to improvements in processes and abatement technology. Since 2000 emissions from small scale combustion have been included in the inventory and in 2014 the emission factor for copper was revised, however, only for 2014. Recalculation of the time series has not yet been carried out.

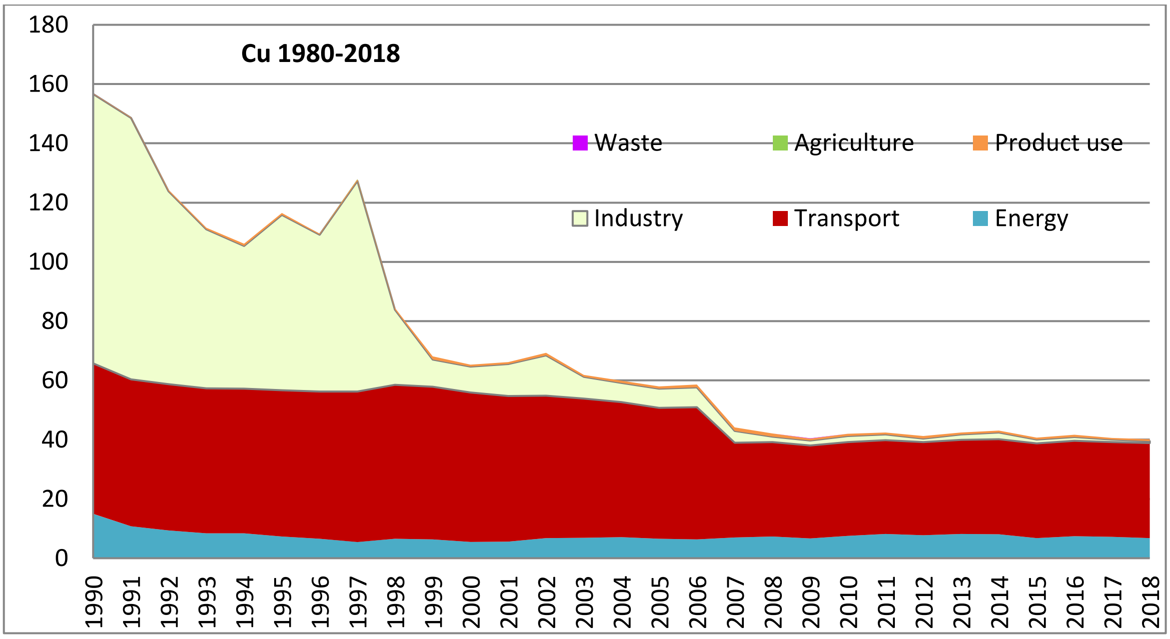
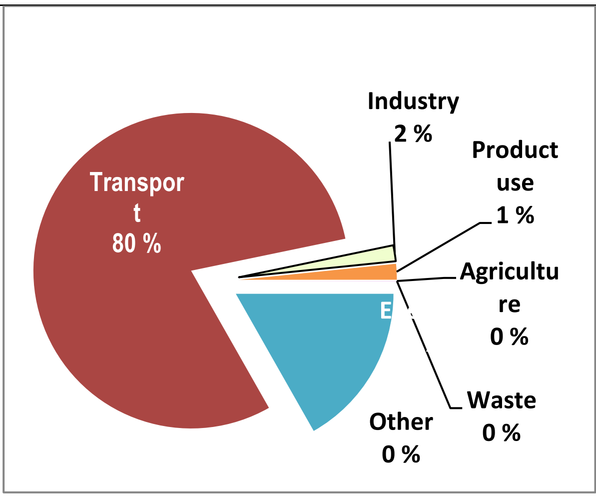
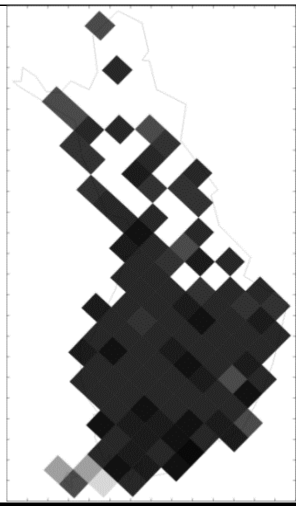


Figure 1.46. Emissions of copper (t) 1990-2018.

The uncertainties of emission data in 2018 are presented in Annex 7 of the IIR.

The contribution of different sources to emissions, the spatial distribution of emissions and the shares of data reported by operators of industrial plants of total emissions are presented in Figure 1.47.





NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants	NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants
1A1a	7.1	2.848	14.8	1A4aii	0.5	0.182	0
1A1b	3.0	1.218	0	1A4bi	0.9	0.350	0
1A2a	<0.1	<0.001	39.9	1A4bii	0.3	0.103	0
1A2b	<0.1	<0.001	0	1A4ci	1.2	0.497	0
1A2c	<0.1	0.004	4.4	1A4cii	1.1	0.423	0
1A2d	1.2	0.484	62.2	1A4ciii	<0.1	0.025	0
1A2e	0.4	0.144	2.3	1A5a	1.3	0.507	0
1A2f	1.0	0.408	1.2	1B1b	<0.1	0.004	100
1A2gvii	1.6	0.630	0	2B10a	<0.1	0.003	100
1A2gviii	0.6	0.223	8.4	2C1	0.7	0.277	100
1A3bi	<0.1	0.010	0	2C2	0.2	0.080	100
1A3bii	<0.1	0.002	0	2C6	<0.1	0.019	100
1A3biii	<0.1	0.008	0	2C7a	<0.1	0.004	100
1A3biv	<0.1	<0.001	0	2C7c	0.7	0.274	100
1A3bvi	76.2	30.623	0	2G	1.6	0.648	0
1A3c	<0.1	0.034	0	3F	<0.1	0.001	0
1A3dii	0.2	0.086	0	5C1bv	<0.1	<0.001	0
1A4ai	0.1	0.050	0	5E	<0.1	0.002	0
				Total	**100**	**40.173**	**3.5**

Figure 1.47 The contribution of different sources and data reported by the plants in the 2018 emissions.

2.3.8.5 Lead emissions

Emission trend

Lead emissions have been reduced by 94% since the base year 1990.

The main source of lead in the beginning of the 1990's was the use of lead added to gasoline being 1211 tonnes in 1980 and 192 tonnes in 1990 and coming down to 0 tonnes in 1994. Lead is still emitted from lubricant use in vehicles. Lead emissions from industrial processes (metal industry) have been significantly decreased since the mid-1990's. The largest source of lead at the moment is combustion of fuels and the emissions vary annually depending on changes in the annual energy supply structure.

The time series is presented in Figure 1.48.

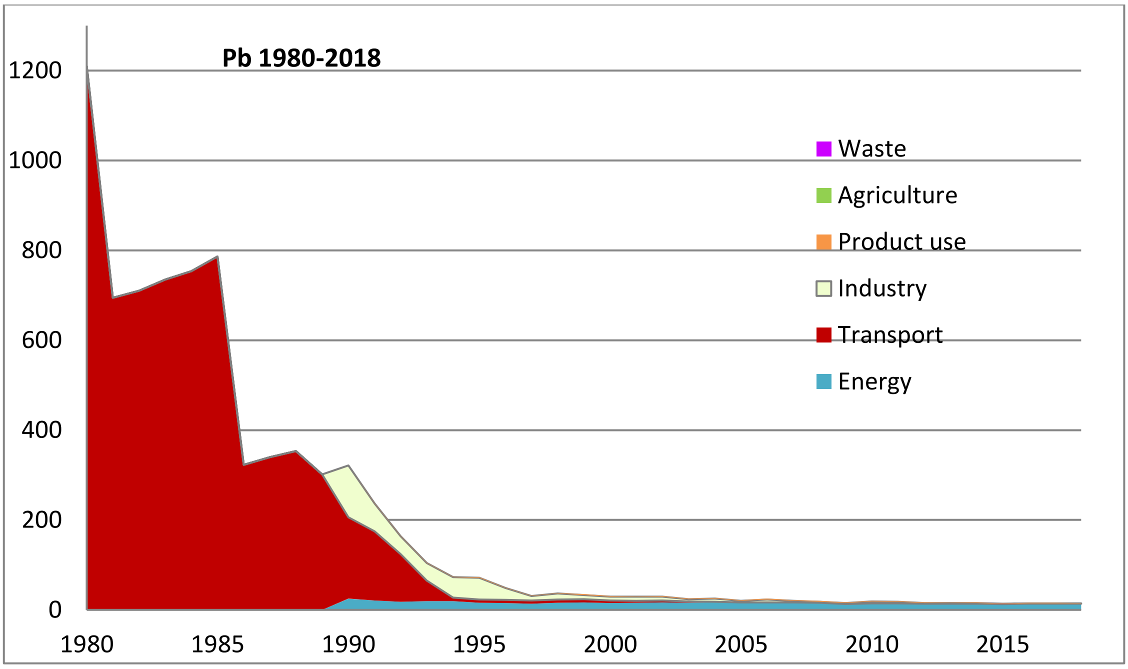
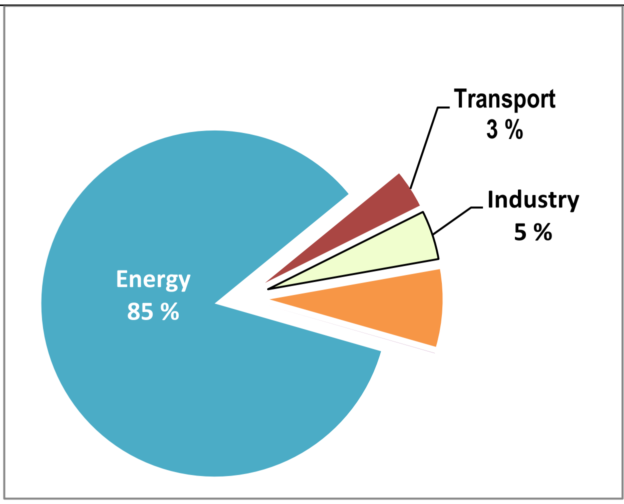
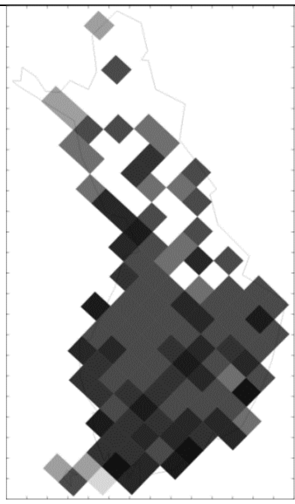


Figure 1.48. Pb emissions (Mg) in 1980-2018.

The uncertainties of emission data in 2017 are presented in Annex 7 of the IIR.

The contribution of different sources to emissions, the spatial distribution of emissions and the shares of data reported by operators of industrial plants of total emissions are presented in Figure 1.49.





NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants	NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants
1A1a	14.2	2.189	16.9	1A4bi	3.6	0.559	0
1A1b	18.1	2.785	0	1A4ci	2.8	0.430	0
1A2a	<0.1	0.004	86.6	1A4ciii	<0.1	0.004	0
1A2b	<0.1	<0.001	0	1A5a	3.2	0.495	0
1A2c	0.2	0.031	0.7	1B1b	<0.1	0.004	100
1A2d	33.4	5.140	3.3	2B10a	<0.1	0.001	0
1A2e	0.8	0.126	4.1	2C1	2.4	0.376	100
1A2f	6.0	0.923	1.5	2C2	0.1	0.021	100
1A2gviii	1.7	0.267	31.6	2C3	<0.1	<0.001	100
1A3aii(i)	0.2	0.036	0	2C6	<0.1	0.008	100
1A3bi	<0.1	0.002	0	2C7a	<0.1	0.002	9.1
1A3bii	<0.1	<0.001	0	2C7c	1.9	0.298	100
1A3biii	<0.1	<0.001	0	2G	7.2	1.113	0
1A3biv	<0.1	<0.001	0	3F	<0.1	0.002	0
1A3bvi	3.2	0.488	0	5C1bv	<0.1	<0.001	0
1A3dii	<0.1	0.013	0	5E	<0.1	<0.001	0
1A4ai	0.6	0.091	0	**Total**	**100**	**15.410**	**8.8**

Figure 1.49 The contribution of different sources and data reported by the plants in the 2018 emissions.

2.3.8.6 Mercury emissions

Emission trend

The emissions are fluctuating annually depending on changes in the annual energy production structure and fluctuations in the industrial production volumes. Mercury emissions have been reduced by 33% since the base year 1990 (Figure 1.50).

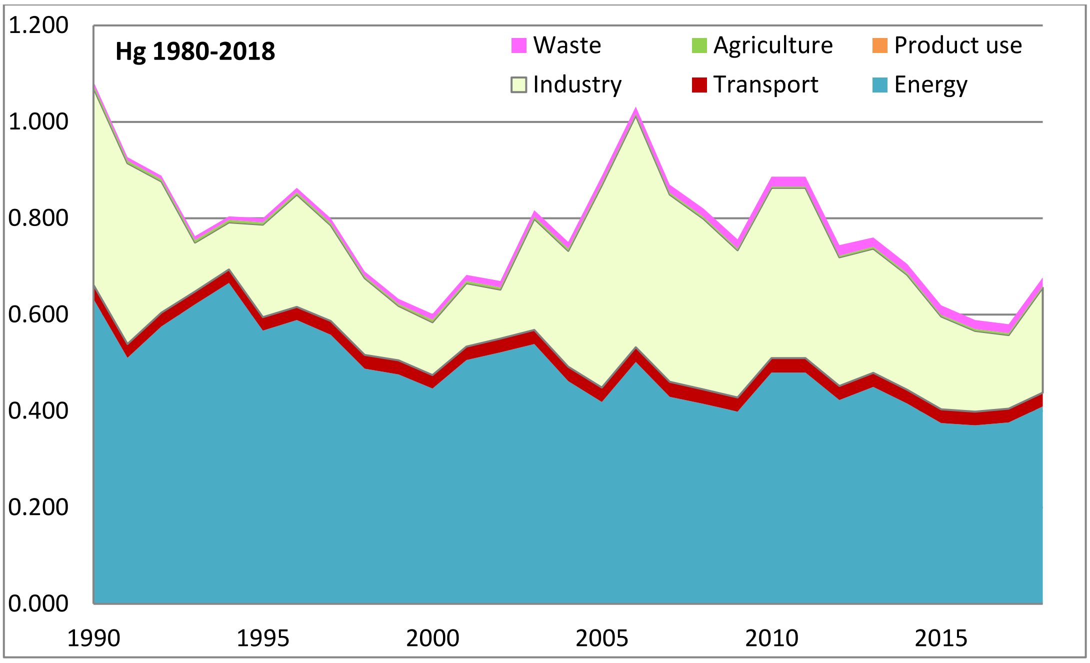
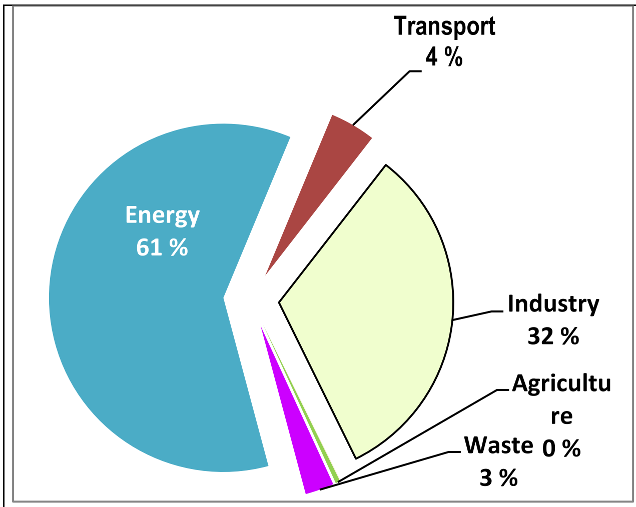


Figure 1.50. The emissions of mercury (t) in 1990-2018.

The uncertainties of emission data in 2017 are presented in Annex 7 of the IIR.

The contribution of different sources to emissions, the spatial distribution of emissions and the shares of data reported by operators of industrial plants of total emissions are presented in Figure 1.51.



NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants	NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants
1A1a	23.6	0.160	59.3	1A4bi	3.9	0.027	0
1A1b	1.9	0.013	0	1A4ci	1.3	0.009	0
1A2a	<0.1	<0.001	0.3	1A4ciii	0.1	<0.001	0
1A2b	<0.1	<0.001	0	1A5a	0.8	0.005	0
1A2c	<0.1	<0.001	67.8	1B1b	<0.1	<0.001	0
1A2d	19.1	0.129	13.0	2B10a	5.2	0.035	100
1A2e	0.5	0.003	35.2	2C1	15.0	0.102	100

1A2f	7.9	0.053	92.0	2C2	0.2	0.002	100
1A2gviii	1.1	0.008	49.5	2C6	0.2	0.001	100
1A3bi	2.3	0.015	0	2C7a	<0.1	<0.001	0
1A3bii	0.3	0.002	0	2C7c	11.6	0.078	100
1A3biii	1.1	0.008	0	2G	<0.1	<0.001	0
1A3biv	<0.1	<0.001	0	3F	0.4	0.003	0
1A3dii	0.4	0.003	0	5C1bv	2.6	0.018	0
1A4ai	0.3	0.002	0	5E	<0.1	<0.001	0
				Total	**100**	**0.677**	**56.7**

Figure 1.51 The contribution of different sources and data reported by the plants in the 2018 emissions.

2.3.8.7 Nickel emissions

Emission trend

The emission trend is decreasing (Figure 1.52) and the emissions are fluctuating annually depending on the consumption of fossil fuels and production rates in the manufacturing industries (mainly non-ferrous metals). Nickel emissions have been reduced by 69% since the base year 1990.

It is not possible to indicate the current reduction level from the base year emissions due to the pending recalculation of the time series.

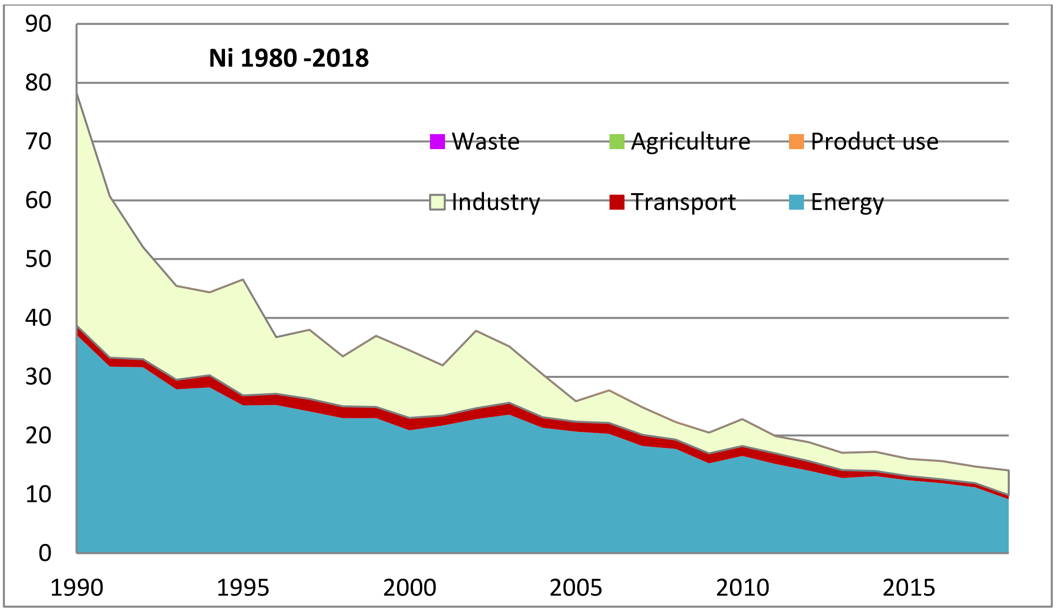
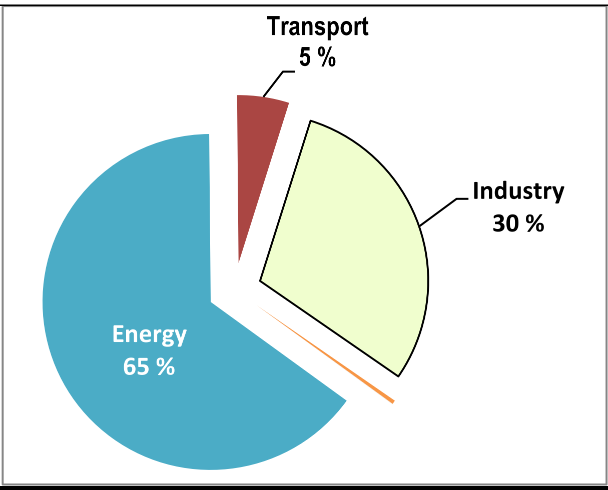
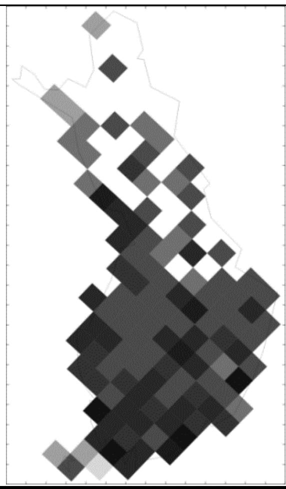


Figure 1.52. Nickel emissions (t) in 1990-2018.

The uncertainties of emission data in 2016 are presented in Annex 7 of the IIR.

The contribution of different sources to emissions, the spatial distribution of emissions and the shares of data reported by operators of industrial plants of total emissions are presented in Figure 1.53.





NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants	NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants
1A1a	14.2	2.002	20.6	1A4aii	<0.1	0.007	0
1A1b	6.3	0.886	98.8	1A4bi	11.5	1.632	0
1A2a	0.3	0.043	99.3	1A4bii	<0.1	0.004	0
1A2b	0.3	0.036	0	1A4ci	4.3	0.605	0
1A2c	2.6	0.363	0.4	1A4cii	0.1	0.017	0
1A2d	4.0	0.566	9.5	1A4ciii	0.2	0.029	0
1A2e	1.3	0.180	16.3	1A5a	7.2	1.017	0
1A2f	6.8	0.961	0.8	1B1b	<0.1	0.009	100
1A2gvii	0.2	0.026	0	2B10a	1.1	0.162	100
1A2gviii	2.2	0.304	28.2	2C1	6.5	0.921	100
1A3bi	<0.1	0.003	0	2C2	0.7	0.094	100
1A3bii	<0.1	<0.001	0	2C7a	<0.1	<0.001	0
1A3biii	<0.1	<0.001	0	2C7b	21.2	2.998	100
1A3biv	<0.1	<0.001	0	2C7c	0.2	0.034	100
1A3bvi	1.4	0.195	0	2G	0.4	0.051	0
1A3c	<0.1	0.001	0	3F	<0.1	<0.001	0
1A3dii	3.0	0.423	0	5C1bv	<0.1	<0.001	0
1A4ai	4.0	0.566	0	**Total**	**100**	**14.139**	**40.5**

Figure 1.53 The contribution of different sources and data reported by the plants in the 2018 emissions.

2.3.8.8 Zinc emissions

Emission trend

The emissions have been significantly reduced since the base year 1990 (Figure 1.54). The main source until 1998 was industrial processes (metal industry), where significant reductions occurred annually after 1990. Emissions from energy production have been fluctuating due to changes in the annual energy supply structure. However, the time series in the energy production sector has not been recalculated and emissions before 2000 may be underestimated

Emissions from tyre and brake wear have been recalculated for the whole time series since 1990.

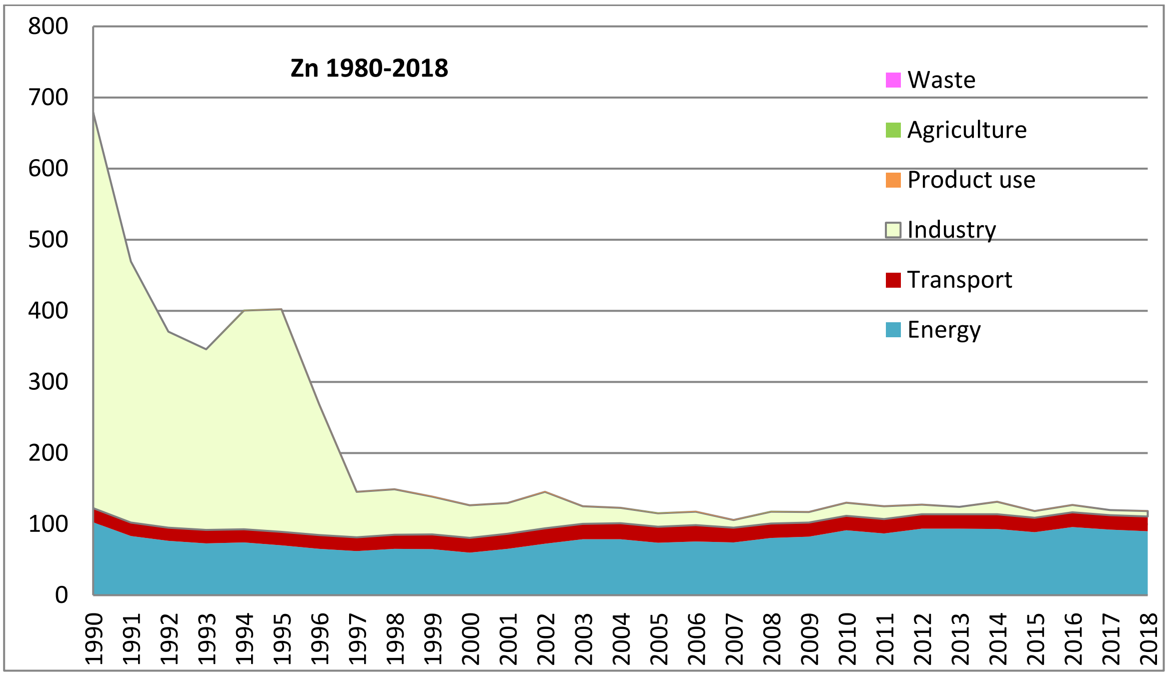
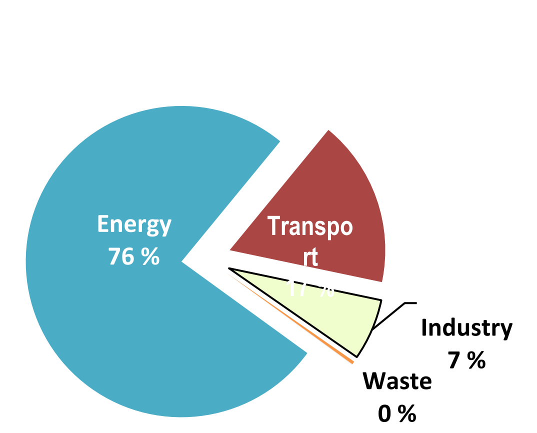
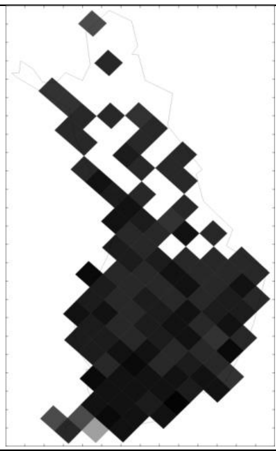


Figure 1.54. Emissions of zinc (t) in 1990-2018.

The uncertainties of emission data in 2017 are presented in Annex 7 of the IIR.

The contribution of different sources to emissions, the spatial distribution of emissions and the shares of data reported by operators of industrial plants of total emissions are presented in Figure 1.55.





NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants	NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants
1A1a	19.0	22.525	13.1	1A4aii	<0.1	0.107	0
1A1b	4.4	5.223	0	1A4bi	31.0	36.738	0
1A2a	<0.1	0.015	53.2	1A4bii	<0.1	0.060	0
1A2b	<0.1	<0.001	0	1A4ci	4.7	5.619	0
1A2c	<0.1	0.024	4.9	1A4cii	0.2	0.249	0
1A2d	2.5	2.976	19.9	1A4ciii	<0.1	0.034	0
1A2e	0.3	0.401	16.3	1A5a	5.7	6.785	0
1A2f	3.9	4.620	0	1B1b	<0.1	0.012	100
1A2gvii	0.3	0.370	0	2B10a	0.2	0.250	0
1A2gviii	2.4	2.858	0	2C1	1.5	1.811	100
1A3bi	<0.1	0.057	0	2C2	0.9	1.013	100
1A3bii	<0.1	0.006	0	2C3	<0.1	0.002	100
1A3biii	<0.1	0.026	0	2C6	3.4	3.982	100
1A3biv	<0.1	0.001	0	2C7a	<0.1	0.002	100
1A3bvi	16.5	19.543	0	2C7c	0.4	0.504	100
1A3c	<0.1	0.020	0	2G	0.3	0.378	0
1A3dii	<0.1	0.112	0	3F	<0.1	0.013	0
1A4ai	1.9	2.305	0	5C1bv	<0.1	0.005	0
				Total	**100**	**118.644**	**9.2**

Figure 1.55 The contribution of different sources and data reported by the plants in the 2018 emissions.

2.3.9 Persistent organic pollutants

The time series 1990-2015 of PCDD/F, PAH-4, HCB and PCBs are presented in Figure 1.56.

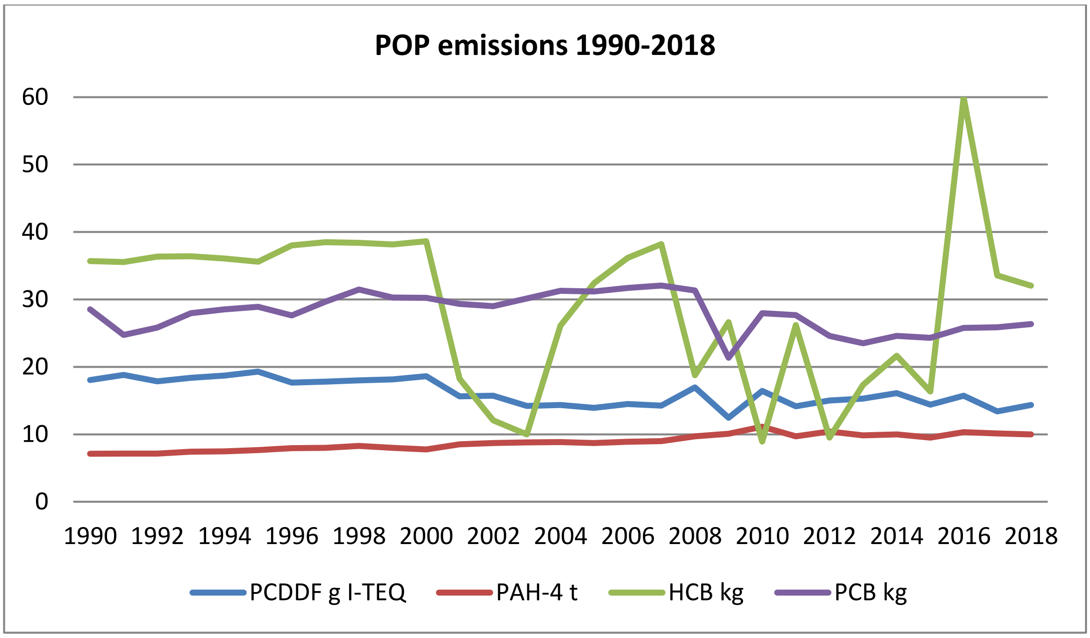


Figure 1.56 POP emissions (PCDD/F (gI-Teq), PAH-4 (t), HCB (kg) and PCB (kg)) emissions 1990–2018.

2.3.9.1 Polychlorinated dioxins and furanes, PCDD/F

Emission trend

The time series since 1990 is inconsistent (Figure 1.57) due to changes of methodologies in several sectors where understanding of the generation of emissions has increased during the years. The recalculation has not yet been possible but is scheduled for the submission in 2018.

In 2005 and 2014 the emission factors for small scale combustion were revised and used since for the annual inventories. Recalculation of the earlier years emissions has not yet been carried out. which can be seen in the change of the emission levels, especially in 1995.

For the IPPU sector emissions from the year 2005 onwards are not comparable with the earlier years due to the changes in the methodologies: the emission estimates for the earlier years are calculated on basis of activity data and emission factors, while emissions after 2005 are based on data reported by the plants.

The uncertainties of emission data in 2017 are presented in Annex 7 of the IIR.

The contribution of different sources to emissions, the spatial distribution of emissions and the shares of data reported by operators of industrial plants of total emissions are presented in Figure 1.58.

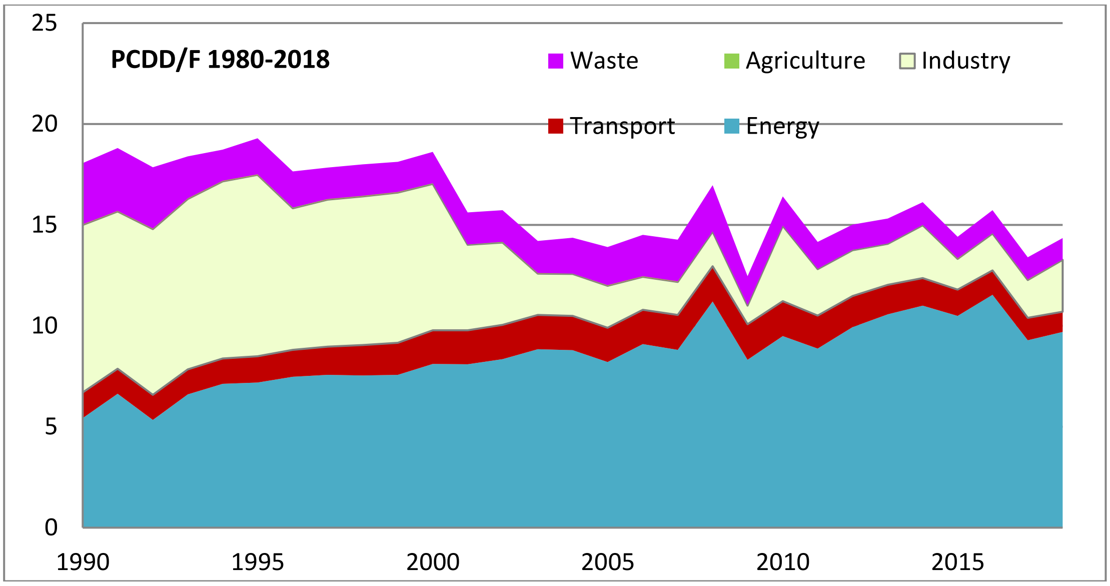
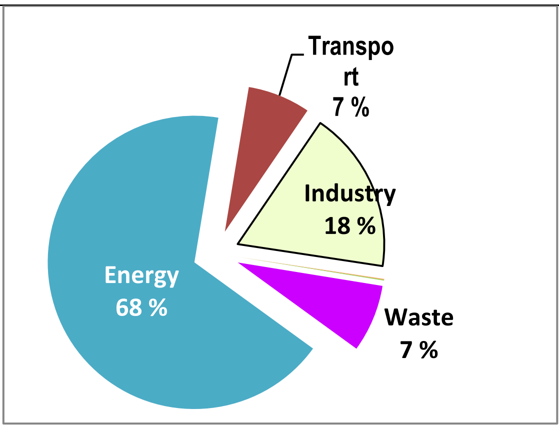


Figure 1.57. Emissions of PCDD/F (g I-Teq) in 1990-2018.



NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants	NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants
1A1a	25.8	3.704	12.0	1A4ciii	<0.1	0.004	0
1A1b	0.2	0.035	0	1A5a	1.5	0.213	0
1A2a	<0.1	0.008	8.3	1B1b	18.0	2.582	0
1A2b	<0.1	0.001	0	2A1	0.3	0.050	100
1A2c	<0.1	0.004	0	2A2	0.9	0.129	0
1A2d	7.1	1.018	16.3	2A3	<0.1	<0.001	0
1A2e	0.2	0.023	0	2B10a	0.2	0.031	0
1A2f	0.1	0.017	42	2C1	8.3	1.196	100
1A2gviii	5.1	0.731	28.1	2C3	6.3	0.900	0
1A3bi	4.4	0.633	0	2C6	0.2	0.029	0
1A3bii	1.4	0.203	0	2C7a	1.5	0.221	0
1A3biii	0.8	0.111	0	2D3b	<0.1	0.011	0
1A3biv	0.2	0.026	0	2G	<0.1	<0.001	0
1A3dii	0.1	0.016	0	2L	<0.1	0.009	0
1A3ei	<0.1	<0.001	0	3F	<0.1	0.012	0
1A4ai	0.5	0.075	0	5C1bv	<0.1	<0.001	0
1A4bi	7.7	1.109	0	5E	7.4	1.068	0
1A4ci	1.3	0.186	0	**Total**	**100**	**14.356**	**14.4**

Figure 1.58 The contribution of different sources and data reported by the plants in the 2018 emissions.

2.3.9.2 Polyaromatic hydrocarbons, PAH

Polyaromatic hydrocarbons under the CLRTAP convention are reported as the sum of four indicator substances (PAH-4), i.e. benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3_cd)pyrene.

Emission trend

PAH-4 emissions are increasing, however there are uncertainties included in the time series and there might be an underestimate of wood use in certain small-scale combustion devices (around 7-8 PJ) statistics before the year 2008. The possible statistical error will be studied by the end of 2020.

In addition, research is been carried out during 2020 to check the current emission factors in small scale wood combustion.

PAH-4 emissions time-series is presented in Figure 1.59.

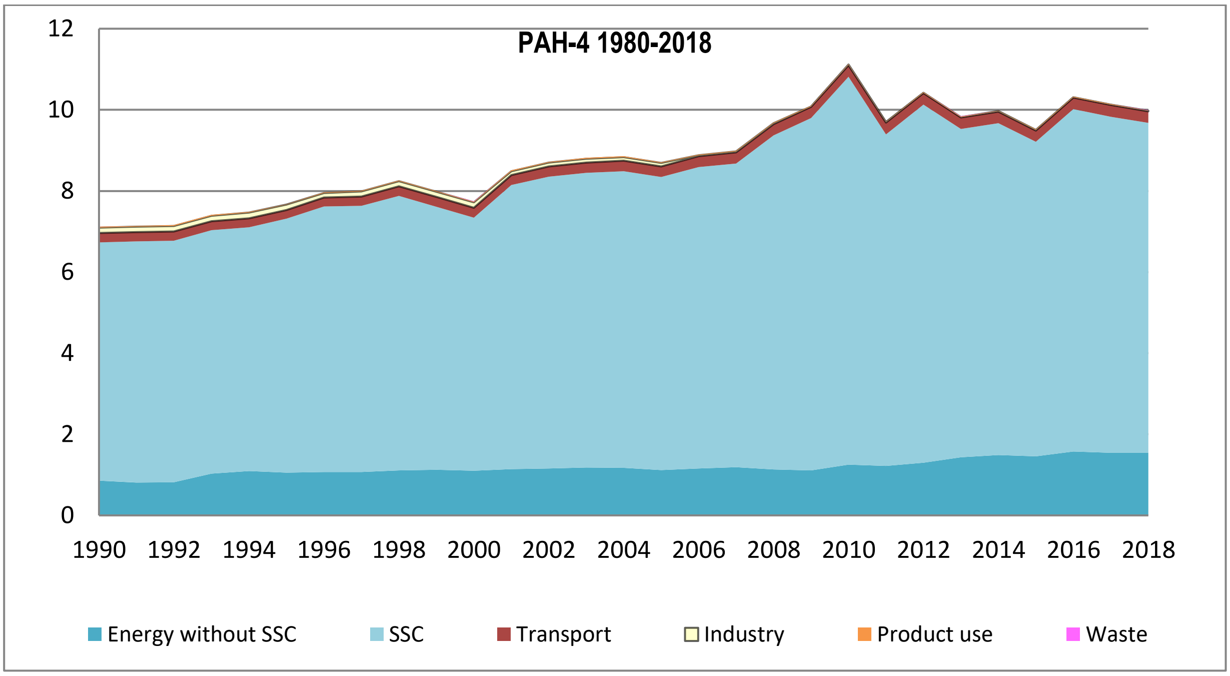
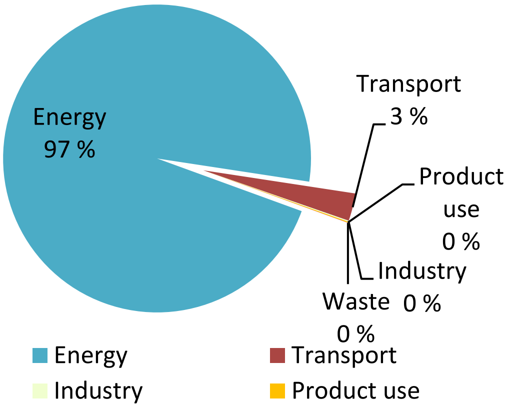
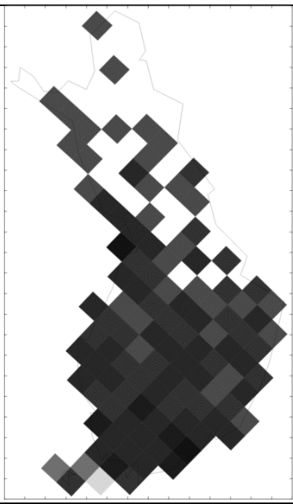


Figure 1.59. The emissions of PAH-4 (Mg) in 1990-2018.

The uncertainties of emission data in 2017 are presented in Annex 7 of the IIR.

The contribution of different sources to emissions, the spatial distribution of emissions and the shares of data reported by operators of industrial plants of total emissions are presented in Figure 1.60.





NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants	NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants
1A1a	5.5	0.546	25.3	1A4ai	0.6	0.060	0
1A1b	<0.1	0.008	0	1A4aii	<0.1	0.009	0
1A2a	<0.1	<0.001	0	1A4bi	81.4	8.132	0
1A2b	<0.1	0.002	0	1A4bii	<0.1	0.005	0
1A2c	<0.1	0.005	5.4	1A4ci	0.8	0.080	0
1A2d	2.2	0.225	25.8	1A4cii	0.2	0.020	0
1A2e	<0.1	0.003	0	1A5a	0.5	0.046	0
1A2f	<0.1	0.005	0	1B1b	4.6	0.456	0
1A2gvii	0.3	0.030	0	2A1	<0.1	<0.001	0
1A2gviii	1.1	0.107	0	2C1	0.1	0.011	4.4
1A3bi	0.9	0.094	0	2C2	<0.1	<0.001	0
1A3bii	0.2	0.018	0	2D3i	0.1	0.011	0
1A3biii	1.1	0.112	0	2G	<0.1	<0.001	0
1A3biv	<0.1	0.001	0	3F	<0.1	<0.001	0
1A3c	<0.1	0.002	0	5C1bv	<0.1	<0.001	0
				Total	**100**	**9.991**	**2.0**

Figure 1.60 The contribution of different sources and data reported by the plants in the 2018 emissions.

2.3.9.3 Hexachlorobenzene, HCB

HCB emissions were reported for the first time in the 2007 submission.

Emission trend

HCB emissions have been reduced by 60% from the base year 1994. The emission trend is dominated by the fluctuations in the industrial processes sector and may be overestimated for the other sources due to the highly uncertain methods. (Figure 1.61).

Emissions in the other sectors may be overestimated due to the fact that many estimation methods are highly uncertain.

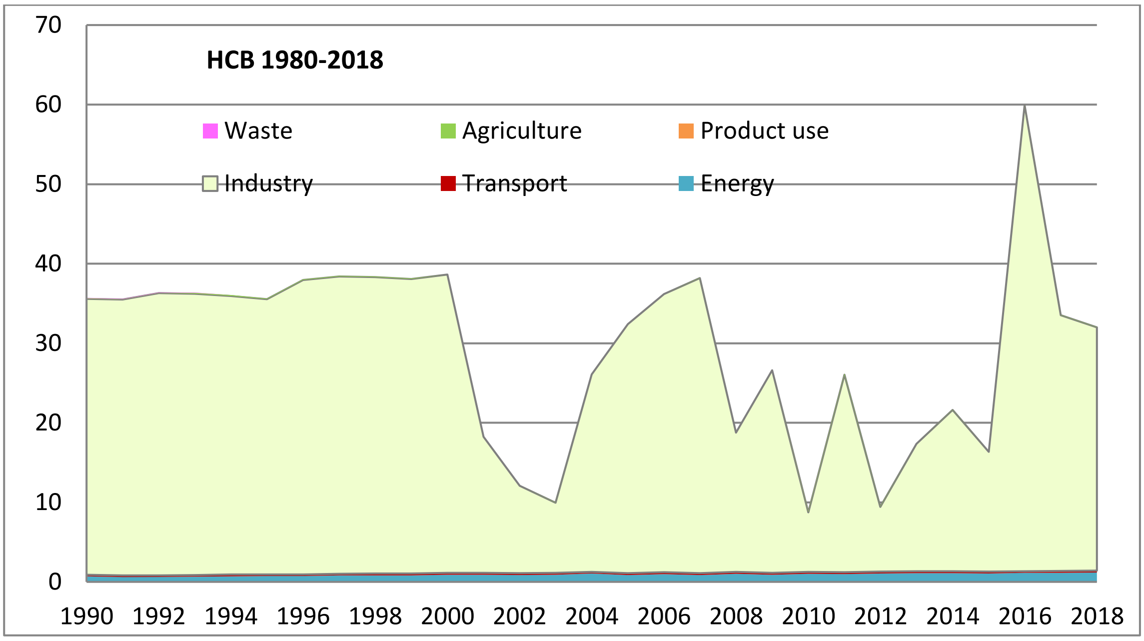
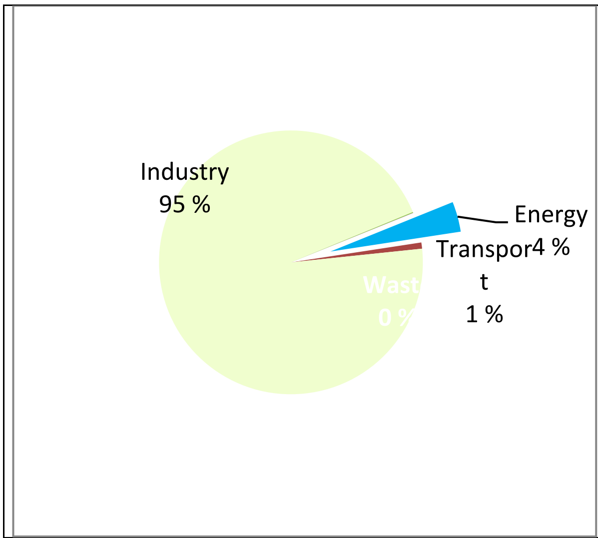


Figure 1.61. Emissions of HCB (kg) in 1990-2018

The uncertainties of emission data in 2018 are presented in Annex 7 of the IIR.

The contribution of different sources to emissions, the spatial distribution of emissions and the shares of data reported by operators of industrial plants of total emissions are presented in Figure 1.62.



NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants	NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants
1A1a	1.4	0.457	0	1A4ai	<0.1	0.016	0
1A2a	<0.1	<0.001	0	1A4bi	0.8	0.262	0
1A2b	<0.1	<0.001	0	1A4ci	0.1	0.037	0
1A2c	<0.1	<0.001	0	1A4ciii	<0.1	0.002	0
1A2d	0.5	0.167	0	1A5a	<0.1	0.011	0
1A2e	<0.1	0.001	0	2B10a	74.6	23.900	100
1A2f	<0.1	0.002	0	2C1	<0.1	0.016	0
1A2gviii	0.7	0.230	0	2C3	0.1	0.035	0
1A3bi	0.4	0.125	0	2C7a	20.4	6.541	0
1A3bii	<0.1	0.019	0	2C7c	0.2	0.067	0
1A3biii	0.3	0.086	0	2D3i	<0.1	0.001	0
1A3biv	<0.1	0.002	0	3Df	0.1	0.034	0
1A3dii	<0.1	0.008	0	5C1bv	<0.1	0.004	0
				Total	**100**	**32.024**	**74.6**

Figure 1.62 The contribution of different sources and data reported by the plants in the 2018 emissions.

2.3.9.4 Polychlorinated biphenyls, PCBs

PCB emissions have been included in the inventory since 2008.

Emission trend

The PCB emission trend (Figure 1.63) is fluctuating mainly due to changes in the IPPU sector but not decreasing at the moment. The drop in 2009 was due to decrease in production.

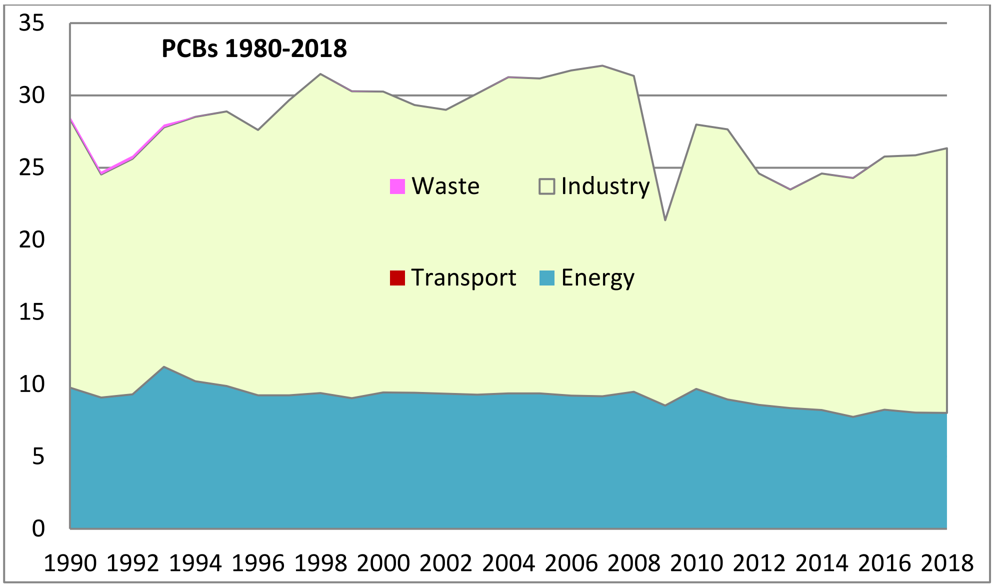
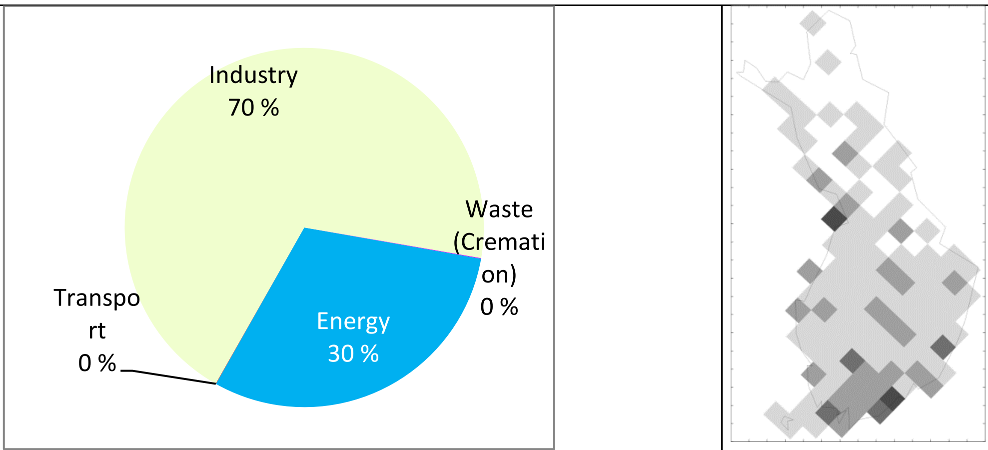


Figure 1.63. Emissions of PCB (kg) in 1990-2018.

The uncertainties of emission data in 2017 are presented in Annex 7 of the IIR.

The contribution of different sources to emissions, the spatial distribution of emissions and the shares of data reported by operators of industrial plants of total emissions are presented in Figure 1.64.



NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants	NFR	Percentage of national total	Total release [Gg]	Percentage reported by the plants
1A1a	1.2	0.320	0	1A4ai	0.7	0.193	0
1A2a	0.4	0.112	0	1A4bi	11.9	3.145	0
1A2b	0.2	0.043	0	1A4ci	1.6	0.422	0
1A2c	<0.1	0.019	12.0	1A4ciii	<0.1	0.001	0
1A2d	0.2	0.059	0	1B1b	11.8	3.099	0
1A2e	0.5	0.131	0	2A1	11.1	2.932	0
1A2f	1.3	0.345	0	2A2	0.9	0.248	0
1A2gviii	0.5	0.122	0	2C1	57	15.025	35.3
1A3bi	<0.1	<0.001	0	2C3	0.3	0.092	0
1A3bii	<0.1	<0.001	0	2C7a	<0.1	<0.001	0
1A3biii	<0.1	<0.001	0	2C7c	<0.1	0.015	0
1A3biv	<0.1	<0.001	0	5C1bv	<0.1	0.012	0
1A3dii	<0.1	0.009	0	**Total**	**100**	**26.346**	**20.1**

Figure 1.64 The contribution of different sources and data reported by the plants in the 2018 emissions.

2.3.9.5 *Polychlorinated biphenols PCP*

Emission trend

PCP emissions were earlier, but not currently requested to be reported under the CLRTAP. Emissions of PCP originate mainly in the waste sector (Figure 1.65).

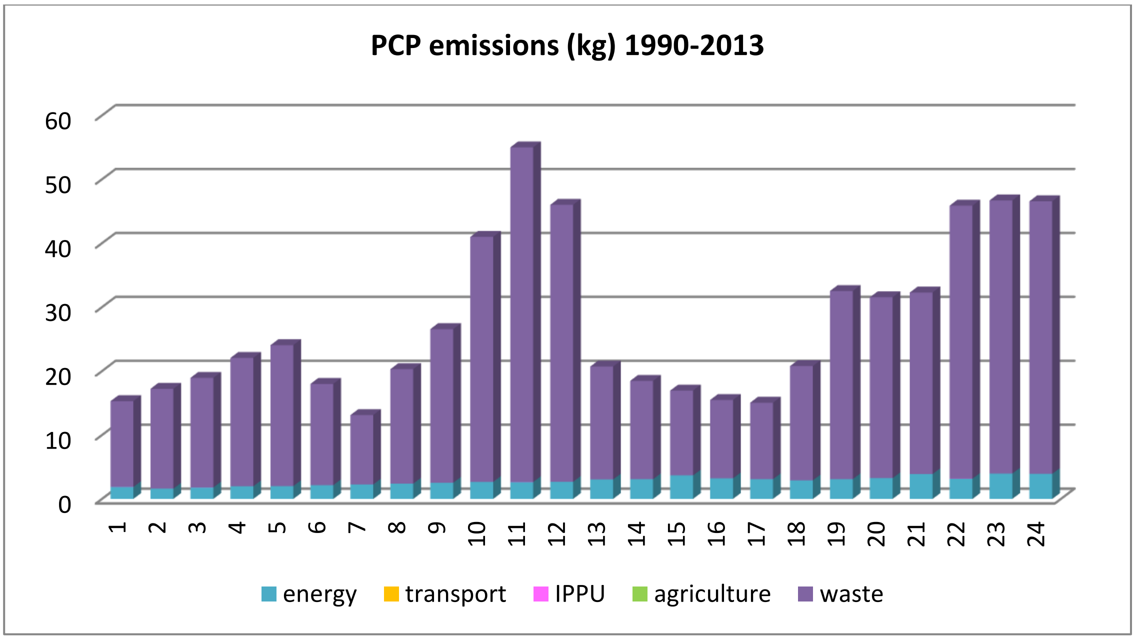


Figure 1.65. Emissions of PCP (kg) in 1990-2007.

Emissions in 2007

PCP emissions in 2013 emissions were 46.6 kg. The contribution of different sources to emissions and the shares of data reported by operators of industrial plants of total emissions are presented in Table 1.18 (The information for PCP will be updated to the next submission)

Table 1.18. PCP emissions, the share of emissions reported by the plants of the total emissions by NFR categories in 2007.

NFR	Percentage of national total	Total release [kg]	Percentage reported by the plants	NFR	Percentage of national total	Total release [kg]	Percentage reported by the plants
1A1a	4.3	2.025	0	1A4ci	0.4	0.170	0
1A2gviii	1.3	0.590	0	2C7c	<0.1	0.003	0
1A4ai	<0.1	0.004	0	5C1a	91.5	42.595	0
1A4bi	2.4	1.140	0	5C1bi	<0.1	0.040	0
				Total	**100**	**152.046**	**2.6**

2.3.9.6 *Short chain chlorinated paraffins, SCCP*

According to studies carried out at the Finnish Environment Institute SCCP emissions from the industrial processes sector deceased after 1995 totalling around 0.02 kilogrammes during 1990-1995. SCCP emissions from the use of products were not included in the inventory because no methodology exists at the moment. Further work to develop estimation methods and quantify emissions will be carried out when resources allow.

2.4 Description and interpretation of emissions by source

The sources of the air pollutant emissions are reported in the NFR (Nomenclature for Reporting) classification: energy (NFR 1), industrial processes (NFR 2), solvent and other product use (NFR 3), agriculture (NFR 4) and waste (NFR 6).

More detailed information of the contribution of different sources to the emissions of the specific air pollutants is provided in Chapter 3.2 Description and interpretation of emission trends by pollutants.

NFR 1 Sulphur dioxide (SO_2) emissions are mainly due to fuel combustion in the energy industries. Nitrogen oxides (NO_2) and carbon monoxide (CO) are generated both in the energy industries and in the traffic sector. NMVOC and POP emissions are released mainly from small combustion processes in the energy sector.

The emissions in the energy sector have varied considerably throughout the 1990's with an overall slightly increasing trend being visible.

NFR 2 Industrial processes release mainly heavy metals and POP compounds from production of iron, steel and non-ferrous metals as well as SO_2 from wood processing industries and NMVOC from the chemical industry.

The trends are in general decreasing but variations due to fluctuations in production occur annually.

Solvent and other product use emit mainly NMVOC compounds. Paint application and printing are the most significant NMVOC sources. Small amounts of particles are generated in spray painting, barbeques, meat frying, tobacco smoking, fires and fire works. The trends of both NMVOC and particulate matter emissions are decreasing.

NFR 3 Agriculture is the main source of ammonia emissions in Finland. The main sources of NH_3 are manure management and application of fertilizers. The annual emissions have been reduced compered to emissions level in 1990 due to strong decreases in the number of livestock, and in nitrogen fertilisation. The decreasing emission trend will be safeguarded in the EU common agricultural policy by adopting support measures encouraging production that minimises the burden on the greenhouse gas balance.

NFR 5 The emissions from the waste sector include NMVOC emissions from solid waste disposal on land, from wastewater treatment and composting. Particulate matter emissions from waste incineration are included. Emissions from waste incineration (reported by the operators) are included (NO_x, CO, NMVOC, SO_2, particles, heavy metals, PCB, PCDD/F, and PAH-4).

Detailed information of the emissions under the NFR categories is presented in Sections 4-10 as well as information of the source sector specific emissions and the calculation methodologies.