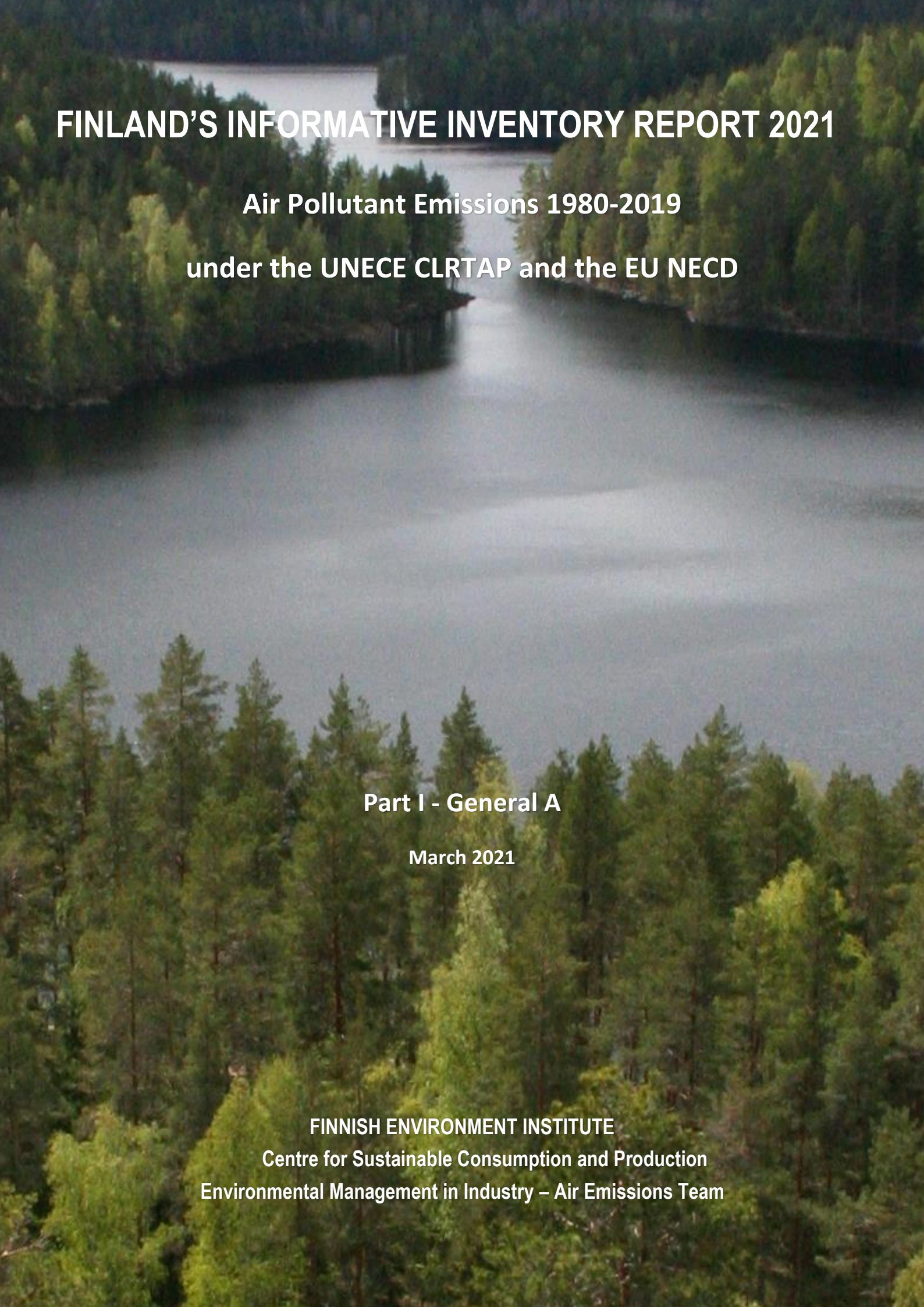

FINLAND'S INFORMATIVE INVENTORY REPORT 2021

Air Pollutant Emissions 1980-2019

under the UNECE CLRTAP and the EU NECD

Part I - General A

March 2021

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) 2021 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 1980-2019.

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

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 at the latest with the latest data and reports.

Tools and maps to explore air pollutant emissions are available on webpage https://www.ymparisto.fi/en-US/Maps_and_statistics/Air_pollutant_emissions .

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.

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Helsinki 15th March 2021

Requested information on the inclusion of the condensable part of PM emissions is summarized on the next page, page 4

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.

Table – Inclusion/exclusion of the condensable component from PM_{10} and $PM_{2.5}$ in the emission data

Source	Included	Excluded	Comments	Reference
Energy				
NFRs 1A1/1A2	see comments		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	see comments		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	see comments		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	see comments		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. Each NFR sub-category covers both data reported by plants and data calculated with Guidebook EFs.	Part 4 IPPU p. 5
Agriculture				
NFR 3F	see comments		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	see comments		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

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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.

i Background information on air pollutants inventories

Changes in chapter	
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. 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.

[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] https://www.ymparisto.fi/en-US/Maps_and_statistics/Air_pollutant_emissions/Finnish_air_pollutant_inventory_to_the_CLRTAP
https://www.ymparisto.fi/en-US/Maps_and_statistics/Air_pollutant_emissions

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	
February 2021	KS

Summaries of air pollutant emissions in Finland for the years 1980-2019 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 1980–2019. Corrections to data reported in 2021 to data reported in 2020 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	36					
1982	282	*	484	37	*	*	*	*	*
1983	273	*	372	37					
1984	269	*	368	37					
1985	287	*	382	37					
1986	289	*	331	36					
1987	300	229	328	36					
1988	303	240	302	35					
1989	310	233	244	33					
1990	306	233	249	35	770	47	74	98	10
1991	303	223	206	33	741	43	67	86	10
1992	288	217	156	32	721	39	61	79	9
1993	293	211	138	32	706	36	57	74	9
1994	294	210	123	33	692	35	56	74	9
1995	273	203	105	33	675	33	52	68	8
1996	277	196	109	33	670	32	50	66	8
1997	272	196	101	36	663	31	50	65	7
1998	257	191	93	35	658	29	46	59	7
1999	253	184	92	38	639	29	46	61	7
2000	241	178	82	35	601	26	43	57	7
2001	244	175	96	35	601	27	44	58	7
2002	242	166	90	36	583	27	44	60	7
2003	249	162	101	37	562	27	45	61	6
2004	237	157	84	37	547	27	44	59	6
2005	208	146	70	38	524	26	42	57	6
2006	224	140	83	37	504	26	43	59	6
2007	211	136	81	37	490	25	41	56	6
2008	194	120	67	36	457	23	39	53	5
2009	176	111	59	36	437	22	37	52	5

* 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
2010	187	113	66	37/34*	454	24	39	54	6
2011	171	104	60	35/33*	412	21	36	51	5
2012	162	102	50	35/33*	409	21	35	49	5
2013	158	96	48	35/33*	389	20	34	49	5
2014	151	94	44	35/33*	383	19	34	48	5
2015	139	89	41	34/32*	360	18	31	45	4
2016	135	90	40	33/32*	371	18	33	47	4
2017	130	87	35	32/31*	359	18	31	45	4
2018	127	85	33	32/*31**	350	18	31	45	4
2019	120	85	29	32/30*	345	17	30	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 1990–2019.

	Heavy Metals (t/a)								
	Pb	**Cd**	**Hg**	**As**	**Cr**	**Cu**	**Ni**	**Se**	**Zn**
1990	321	7	1	35	48	157	78		683
1991	237	4	1	24	60	149	61		473
1992	165	3	1	18	48	124	52		374
1993	105	3	1	16	38	112	46		349
1994	74	3	1	11	41	106	45		406
1995	73	2	1	5	36	117	47		405
1996	49	2	1	9	33	110	37		272
1997	32	2	1	13	29	128	38		148
1998	37	2	1	14	30	84	34		152
1999	34	2	1	5	31	68	37		142
2000	31	1	1	4	29	65	35		128
2001	30	2	1	5	26	66	32		131
2002	31	1	1	4	39	69	38		147
2003	25	1	1	4	29	62	35	NE*	127
2004	26	2	1	4	26	60	31		125
2005	21	1	1	3	20	58	26		119
2006	25	1	1	3	25	59	28		119
2007	22	1	1	3	29	44	25		108
2008	20	1	1	3	27	42	22		117
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		125
2012	16	1	1	3	19	41	19		129
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		118
2016	16	1	1	3	18	41	16		128
2017	16	1	1	2	17	41	15		120
2018	15	1	1	2	15	40	14		119
2019	13	1	1	2	14	40	12		130

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 1990–2019.

Year	Persistent Organic Pollutants			
	PCDD/F (g I-TEQ)	PAH-4 (Mg)	HCB (kg)	PCB (kg)
1990	18	19	36	29
1991	19	19	36	25
1992	17	19	36	26
1993	18	19	36	28
1994	18	20	36	29
1995	19	19	36	29
1996	17	21	38	28
1997	17	21	38	30
1998	17	21	38	32
1999	17	21	38	31
2000	18	19	39	30
2001	15	21	18	29
2002	15	21	12	29
2003	14	21	10	30
2004	14	22	26	31
2005	14	22	32	31
2006	14	21	36	32
2007	14	22	38	32
2008	14	22	19	31
2009	12	23	27	21
2010	16	26	9	28
2011	14	22	26	28
2012	15	25	10	25
2013	15	23	17	23
2014	16	23	22	25
2015	14	21	16	24
2016	15	24	60	26
2017	13	23	33	26
2018	13	23	32	26
2019	12	22	23	23

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

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The sources of air pollutants are discussed in detail 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 NH_3 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

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1.1.1 National circumstances relevant to air pollutant emissions

Population and geography
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.

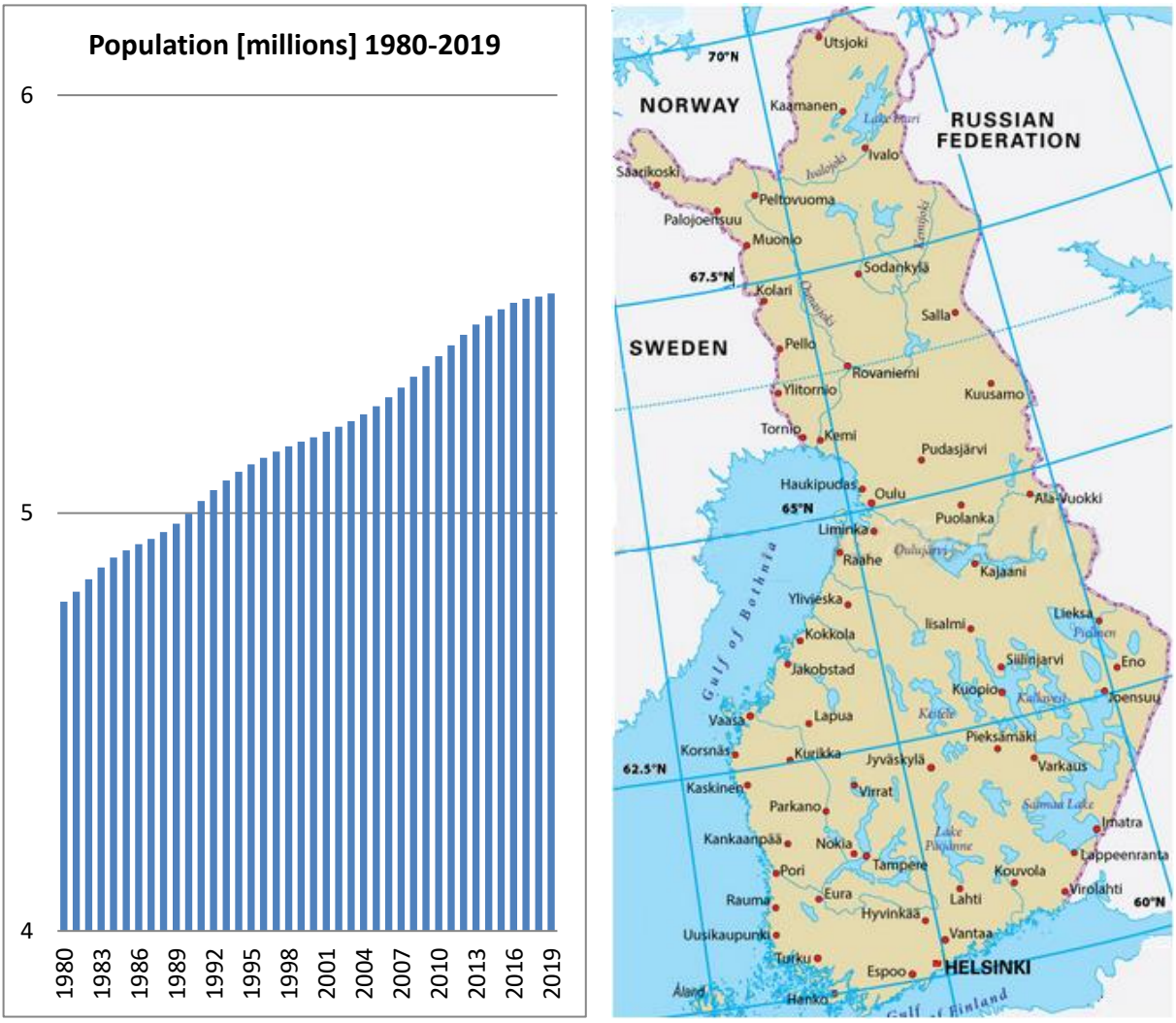

Figure 1.1 Population and geographical location of Finland

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).

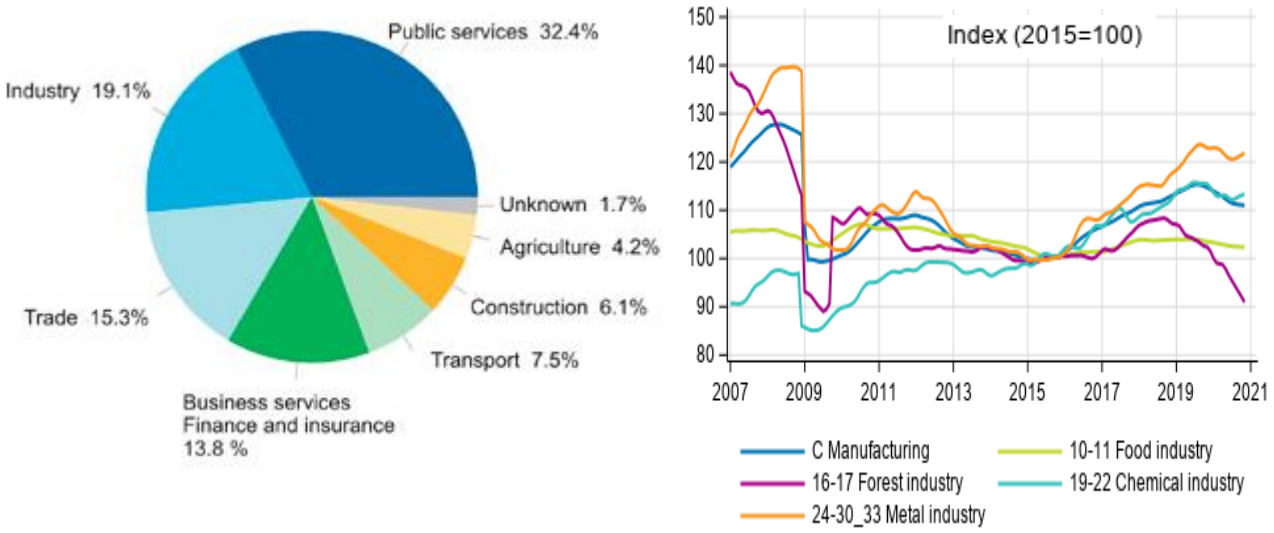

Figure 1.2 Economic Structure Finland (Statistics Finland 2021)

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)

Finland joined the EU in 1995 and the Euro zone in 2001.

*Figure 1.3 GDP evolution 1970-2019 (*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 decreased 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

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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). The task is included in the national legislation and in agreements between the MoE and SYKE.

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.

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

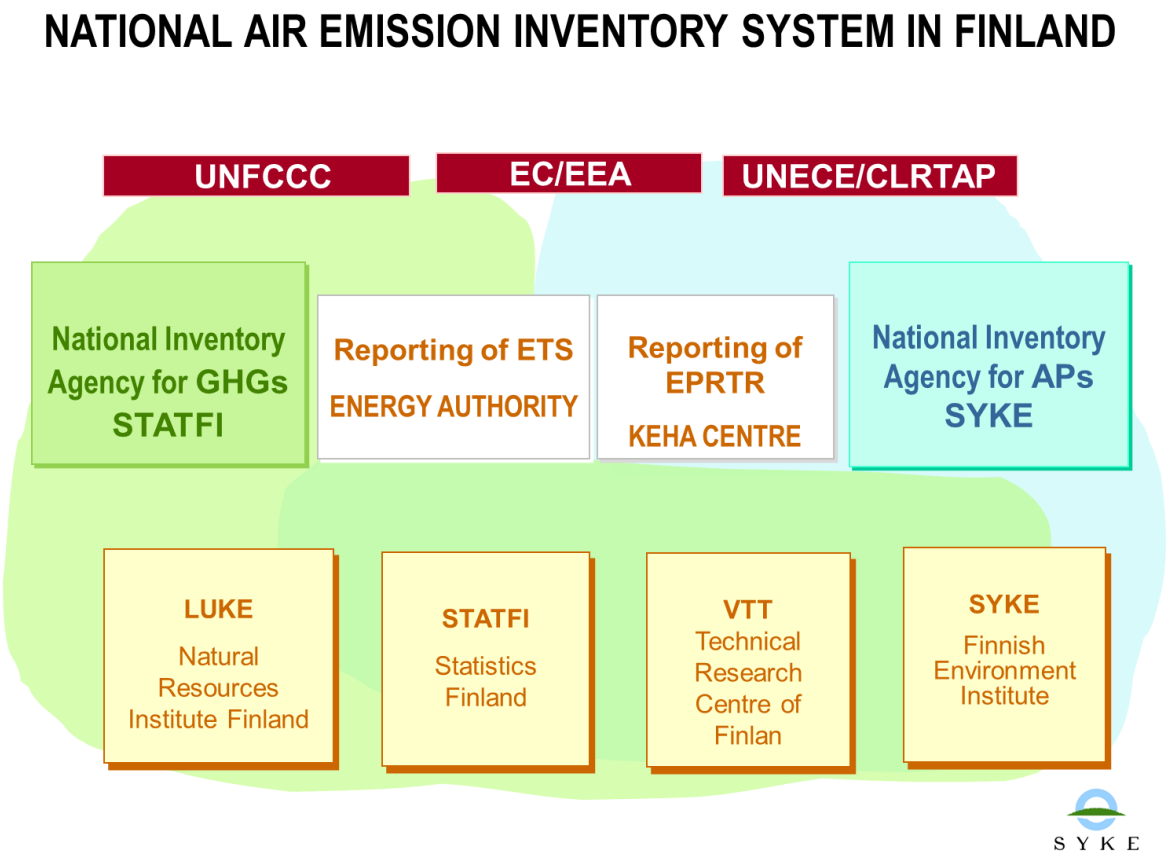

Figure 1.5. National systems for air emission inventories in Finland.

1.3 Brief description of the process of inventory preparation

1.3.1 Organization of the air pollutant inventory

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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; Finnish Energy Industries Finergy, Finnish Food and Drinks Industries' Federation ETL; Finnish Forest Industries Federation; 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.

In 2020 an agreement was made between SYKE and VTT to transfer the emission inventory of all the remaining transport sector emission sources to VTT (i.e. heavy metals, POPs, particles as well as volatile and abrasion emissions).

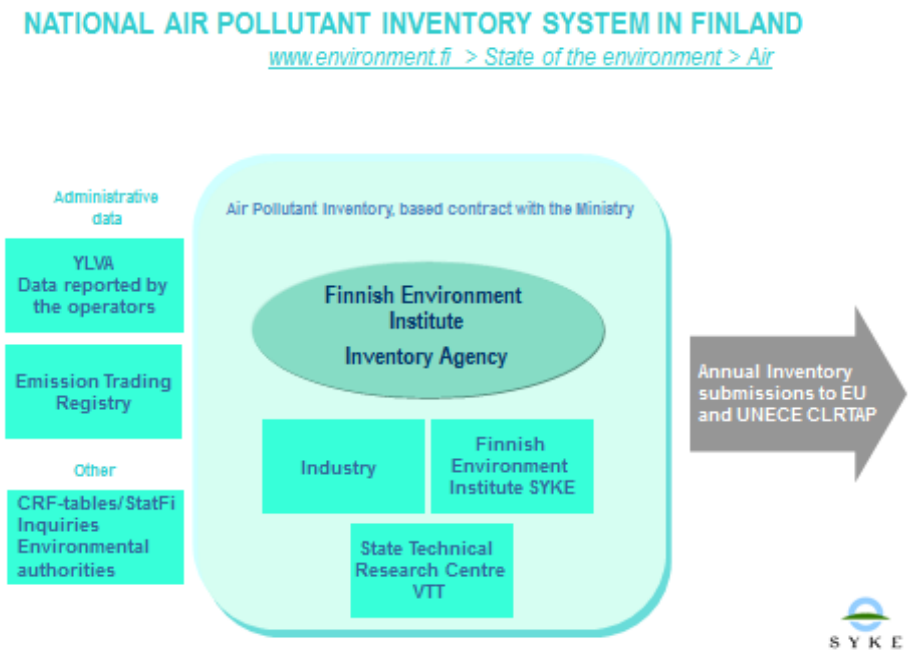

Figure 1.6 Organization of the air pollutant emission inventory in Finland.

1.3.2 Preparation of the inventory

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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. The team also prepares as the NMVOC emission inventory under the CLRTAP and the NECD to be in the format 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.

Other services

The Air Emissions Team develops and maintains national release estimation techniques for air pollutants and maintains this information available on to the operators of industrial installations and to environmental authorities on the environmental administration's website [8]. The Team, in addition, develops tools for estimating greenhouse gases on the level of municipalities.

The Air Emissions Team provides expert services and technical support to the Ministry of the Environment.

Participation in national and international cooperation and research projects with research institutes, universities and industry is an essential tool to further develop the knowledge and expertice.

The Team members also participates in international work under the UNECE TFEIP, IPCC, OECD and the Nordic Council of Ministers as well as in the inventory review programmes under the UNFCCC and CLRTAP/NECD.

Bilateral cooperation and development projects as well as EU Twinning projects are included in the annual work of experts where resources allow.

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

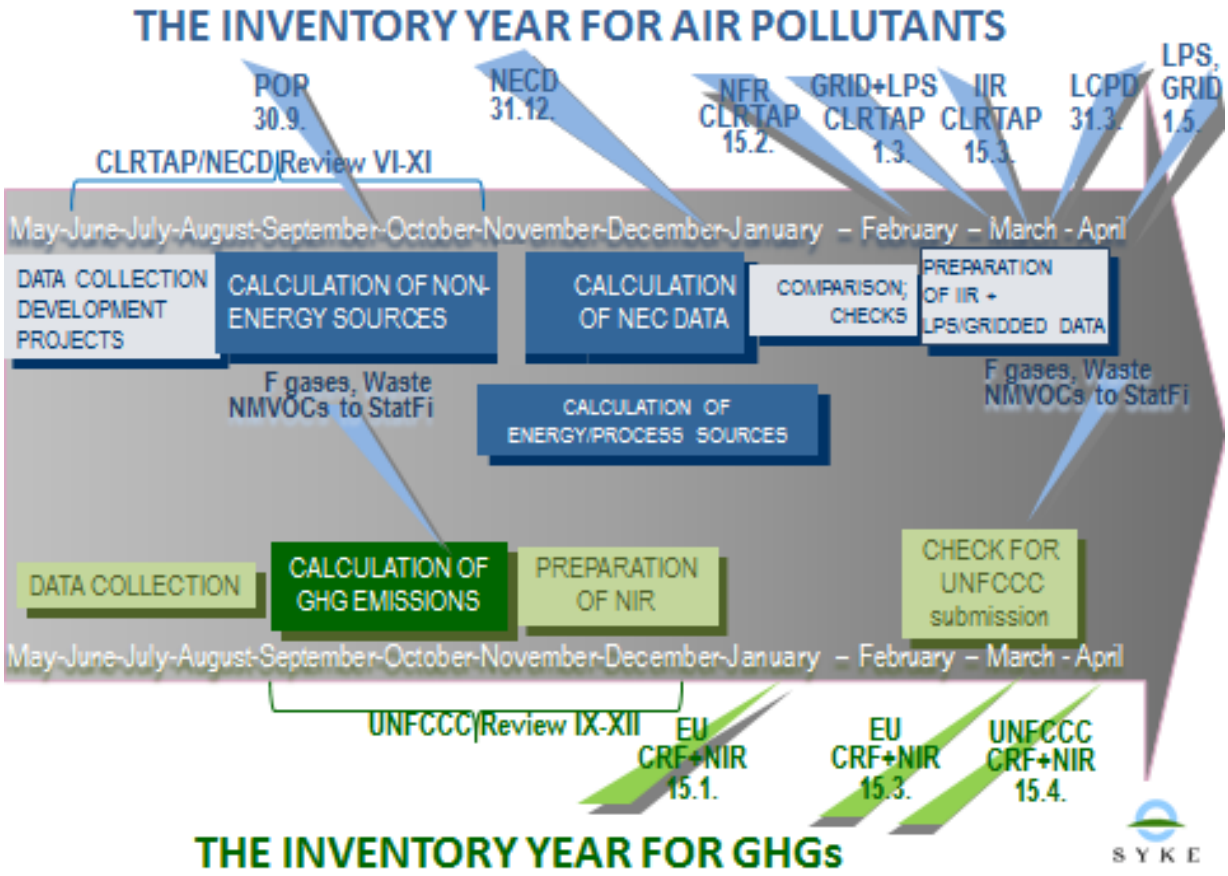

Figure 1.7. Annual schedule of inventory work at SYKE.

1.3.3 Reporting tool IPTJ

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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 1990 – 2019 while data for 1980-1989 are based on manual documentation and the earlier data system SIPS[9].

During the year 2013 the data compilation system was upgraded and 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.

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

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 (0.1° * 0.1° 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).

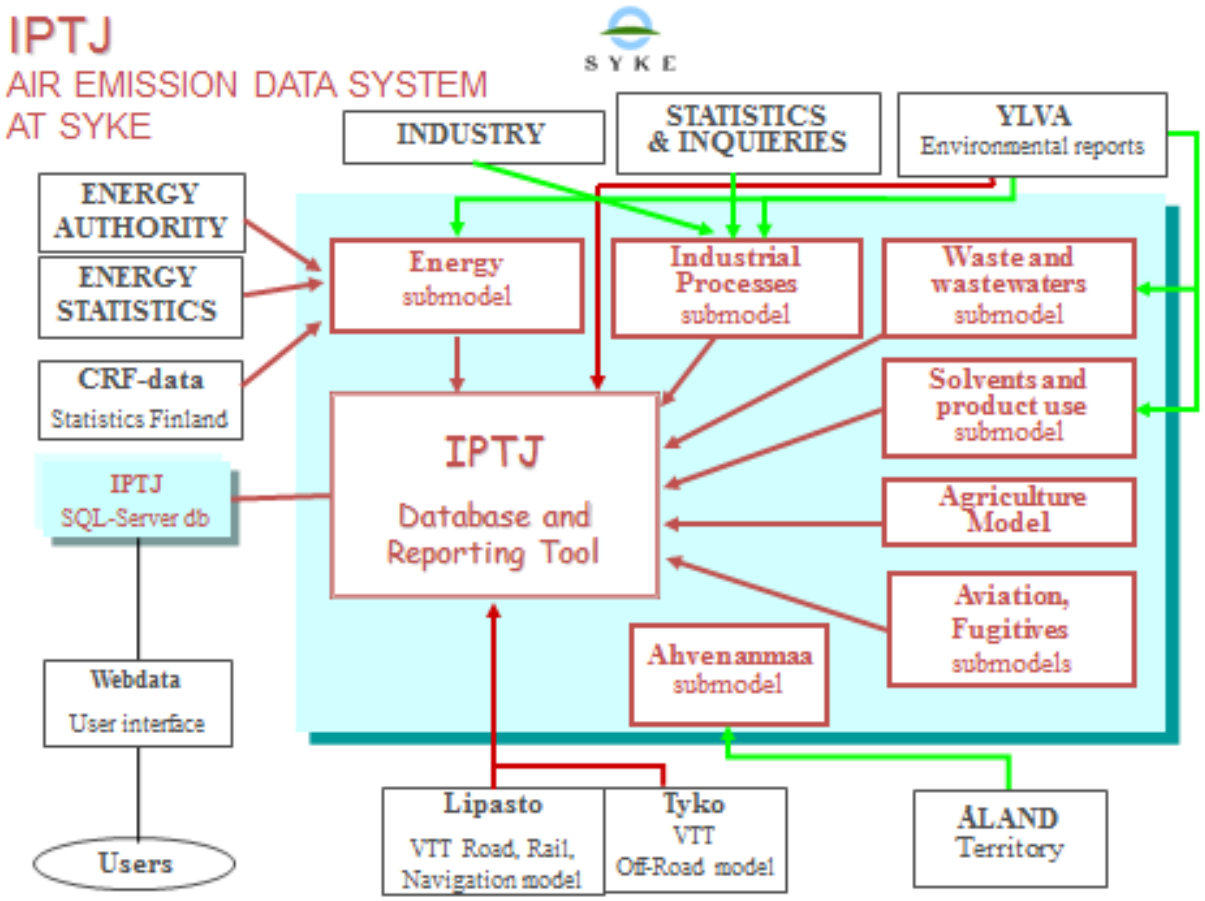

Figure 1.8. Structure of the air pollutant emission data system IPTJ at the Finnish Environment Institute SYKE.

1.3.4 Use of bottom-Up Data in the Emission Inventories

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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.

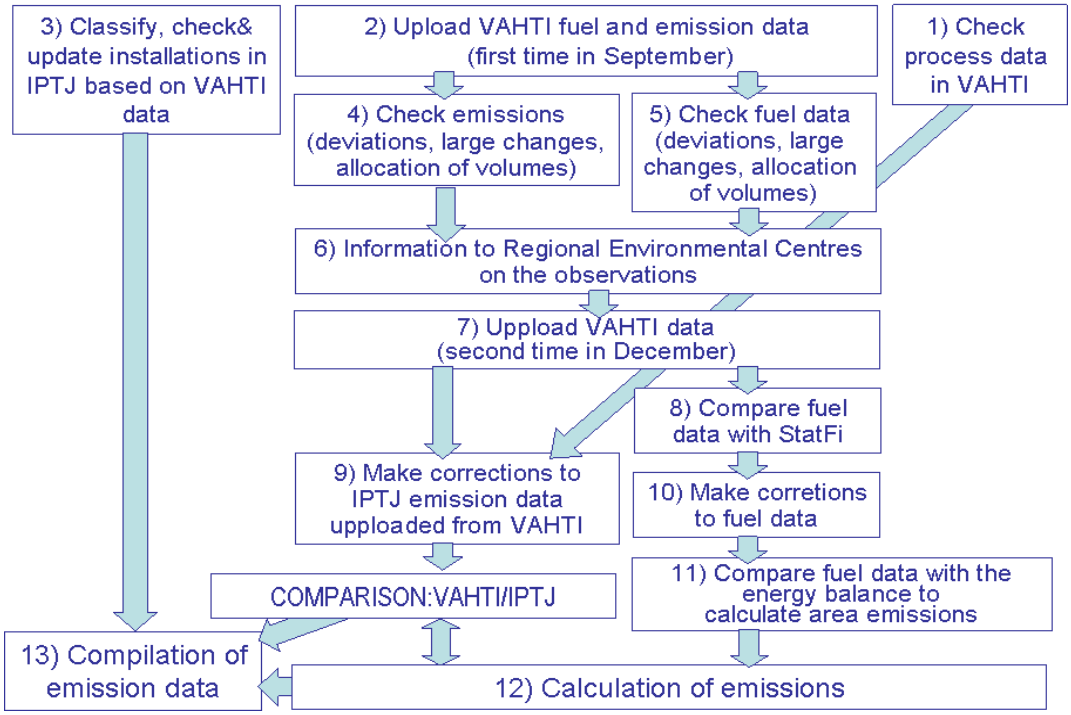


Figure 1.9. Processing of emission data reported by the plants for use in the air pollutant emission inventory, Part 1. (Note; the name of VAHTI has been changed to YLVA in 2018)

[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.

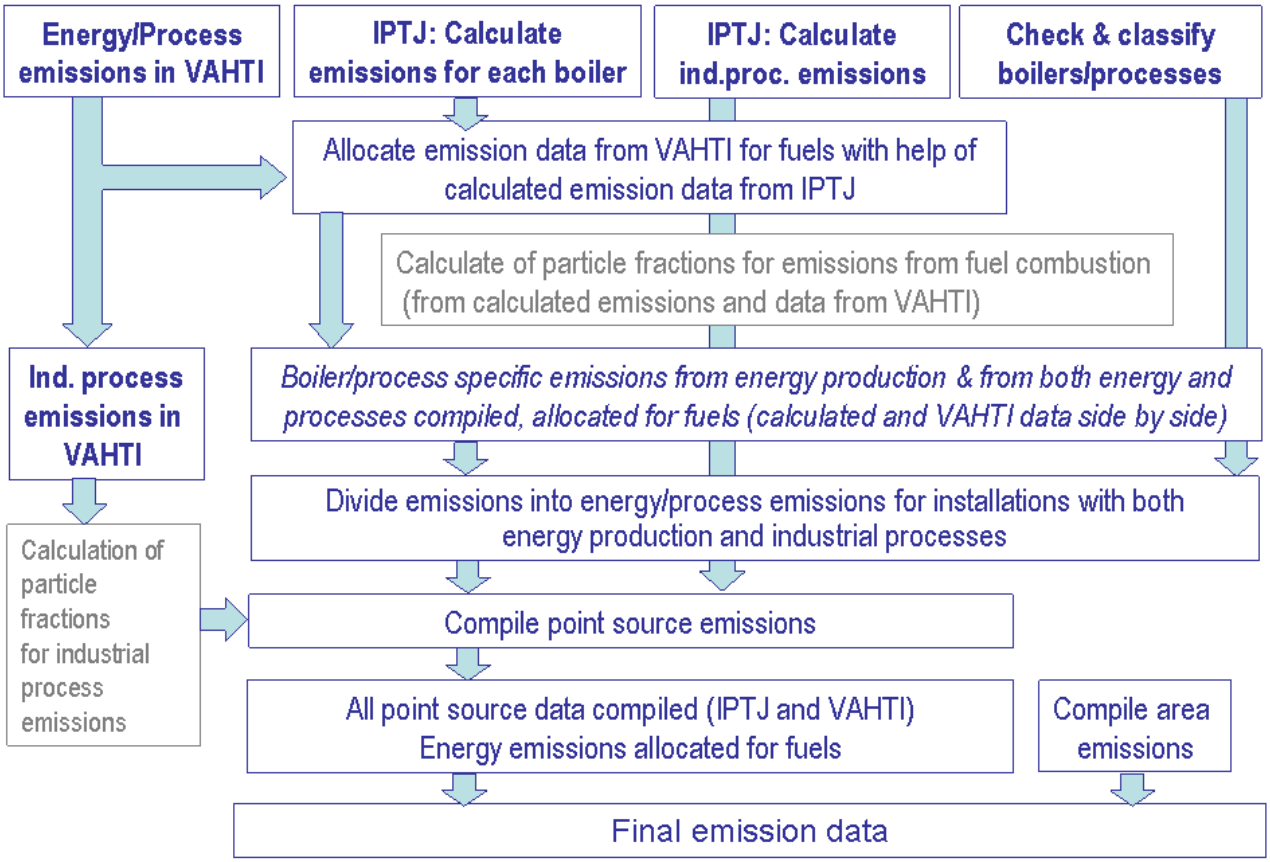


Figure 1.10. Processing of emission data reported by the plants for use in the air pollutant emission inventory, Part 2. (Note; the name of VAHTI has been changed to YLVA in 2018)

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

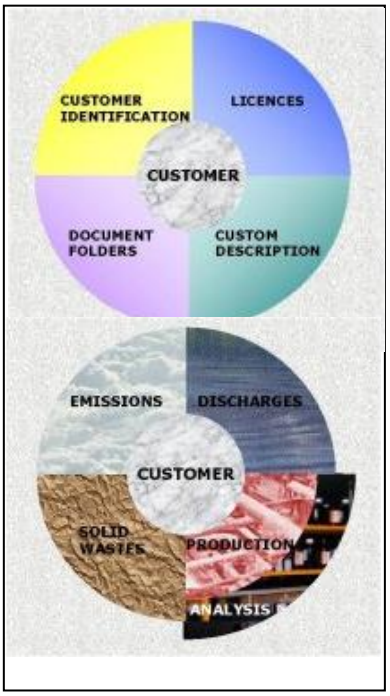


Figure 1.11. Structure of the YLVA database

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 use systems that 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.

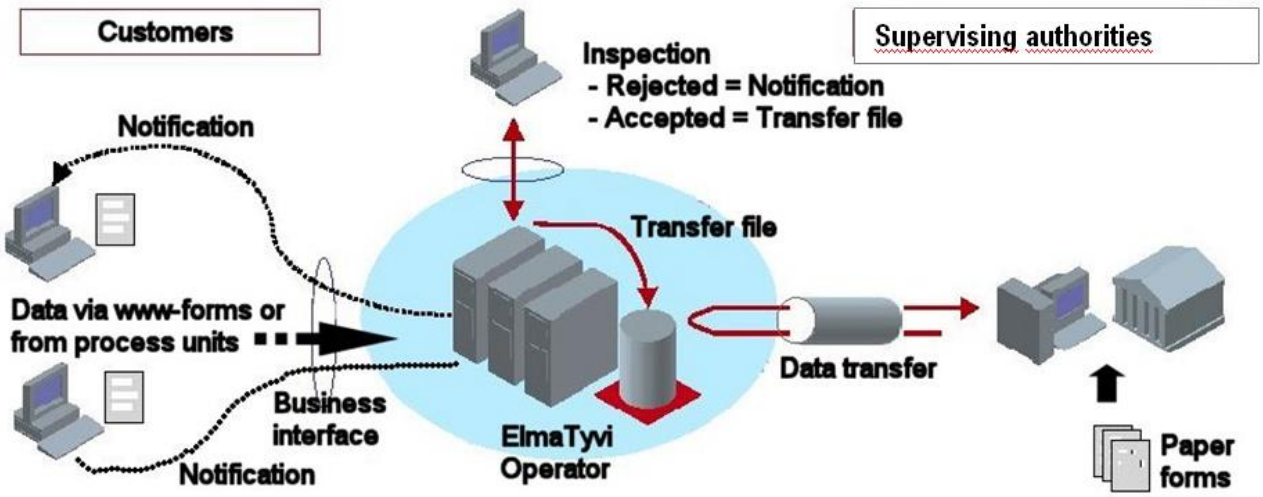


Figure 1.12. Reporting options for the operators.

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.

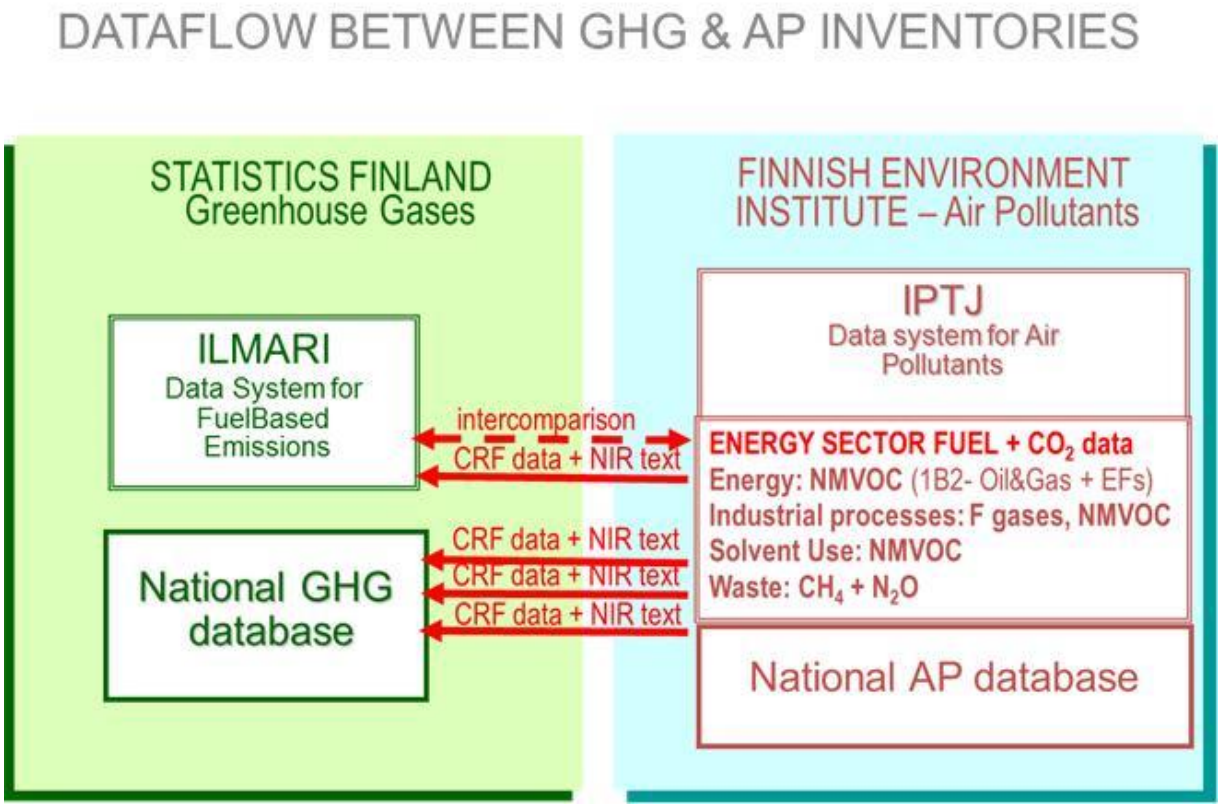


Figure 1.13. Inter-comparison of air emissions inventory data between Statistics Finland and SYKE.

1.4 Methods and data sources

1.4.1 Methodology

Changes in chapter	
February 2021	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 whenever 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 2019 is described in detail 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 2020 and in 2021

Changes in chapter
February 2021 KS

There are no major differences in methods used in the previous inventories and the one submitted in 2021. Some updates and improvements are made as detailed in the sector specific chapters 4-9 and summarised in Chapter 14.

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

Changes in chapter
February 2021 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 CO_2 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 in 2021 submissions for year 2019 emissions

Submissions				Difference %		
2021	UNFCCC	CLRTAP	NECD	UNFCCC-CLRTAP	UNFCCC-NECD	CLRTAP-NECD
SOx	29.69	28.94	28.94	2.5	2.5	0
NOx	114.30	119.82	119.82	4.8	4.8	0
NMVOC	83.16	84.89	84.89	2.1	2.1	0
CO	344.48	346.86	346.86	0.7	0.7	0

The differences for NO_x 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. NMVOC emissions from agriculture are not included in the greenhouse gas inventory.

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 approaches 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 emission data 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 Possible differences between the emission inventory reports under the UNECE CLRTAP and the EU NECD

Changes in chapter
February 2021 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
February 2021 TF

According to the EMEP/EEA emission inventory guidebook 2019, "a key category is one that is prioritised within the national inventory system because it is significantly important for one or a number of air pollutants in a country's national inventory of air pollutants in terms of the absolute level, the trend, or the uncertainty in emissions".

The results of the key category analysis are used in prioritizing the inventory improvements. For the Finnish 2021 submission inventory, the Approach 1 methodology presented in the EMEP/EEA emission inventory guidebook 2019, including the level and the trend assessment, has been used to identify key categories for each pollutant. Key source categories are sources that together contribute with either 80 % of the level or 80 % of the overall trend of reported emissions.

The combined results of the level and trend analysis for the 2021 submission are presented below and the Level and Trend analysis in Appendix 1A *"Results of the Key Category Analysis, Level and Trend"*, at the end of IIR Part 1A General.

NOx

NFR Code	Fuel	Pollutant	Identification criteria
1A2d	Liquid	NOx	L1, T1
1A3biii	Diesel oil	NOx	L1, T1
1A3bi	Diesel oil	NOx	L1, T1
1A1a	Biomass	NOx	L1, T1
1A3dii	Liquid	NOx	L1, T1
3Da1		NOx	L1, T1
1A1a	Solid	NOx	L1, T1
1A3bii	Diesel oil	NOx	L1, T1
1A4bi	Biomass	NOx	L1, T1
1A2d	Biomass	NOx	L1, T1
1A3bi	Gasoline	NOx	L1, T1
1A4cii	Liquid	NOx	L1, T1
1A5a	Biomass	NOx	L1, T1

1A1a	Gaseous	NOx	L1, T1
1A2gvii	Liquid	NOx	L1
1A1a	Peat	NOx	L1
3Da2a		NOx	L1
1A4ciii	Liquid	NOx	L1
1A1b	Gaseous	NOx	L1
1A2a	Gaseous	NOx	L1
1A3c	Liquid	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
2D3i		NMVOC	L1, T1
1A3bi	Gasoline	NMVOC	L1, T1
1A3dii	Liquid	NMVOC	L1
1B2av		NMVOC	L1
1B2aiv		NMVOC	L1
1A4bii	Liquid	NMVOC	L1
2B10a		NMVOC	L1
3Da2a		NMVOC	L1
2H2		NMVOC	L1
2D3g		NMVOC	L1
2H1		NMVOC	L1
1A4cii	Liquid	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
2B10a		SOx	L1, T1
1A2b	Solid	SOx	L1, T1
1A1a	Biomass	SOx	L1, T1
1A2b	Liquid	SOx	L1, T1
2H1		SOx	L1, T1
1A2d	Liquid	SOx	L1, T1

2C1		SOx	L1, T1
1A1a	Liquid	SOx	L1, T1
1A5a	Biomass	SOx	L1, T1
1A4ai	Liquid	SOx	L1
1A5a	Liquid	SOx	L1
1A2d	Peat	SOx	L1
1A4bi	Liquid	SOx	L1
1A2c	Liquid	SOx	L1
1A1b	Solid	SOx	T1
1A2d	Solid	SOx	T1
1A2a	Solid	SOx	T1
1A2gviii	Liquid	SOx	T1
1A4ci	Peat	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
3B4gii		NH3	T1
1A3bi	Gasoline	NH3	T1
2H1		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
1A3dii	Liquid	PM2.5	L1
1A2gvii	Liquid	PM2.5	L1
1A3bii	Diesel oil	PM2.5	L1
2B10a		PM2.5	L1
1A5a	Biomass	PM2.5	L1
1A3biii	Diesel oil	PM2.5	T1
2C1		PM2.5	T1
1A4cii	Liquid	PM2.5	T1
1A1a	Solid	PM2.5	T1

2H1		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
1A2d	Liquid	PM10	L1, T1
1A3bvi		PM10	L1, T1
1A5a	Biomass	PM10	L1, T1
1B1c		PM10	L1
1A1a	Biomass	PM10	L1
2H2		PM10	L1
1A3dii	Liquid	PM10	L1
1A1a	Solid	PM10	T1
1A3biii	Diesel oil	PM10	T1
2C1		PM10	T1
1A3bi	Diesel oil	PM10	T1
1A2d	Biomass	PM10	T1
2H1		PM10	T1
1A4cii	Liquid	PM10	T1
1A1a	Liquid	PM10	T1
1A2f	Solid	PM10	T1

TSP

NFR Code	Fuel	Pollutant	Identification criteria
1A3bvii		TSP	L1, T1
1A4bi	Biomass	TSP	L1, T1
1A5a	Biomass	TSP	L1, T1
3Dc		TSP	L1, T1
1A3bvi		TSP	L1, T1
1A2d	Liquid	TSP	L1, T1
1A1a	Biomass	TSP	L1, T1
1A4ci	Peat	TSP	L1, T1
1B1c		TSP	L1
1A1a	Peat	TSP	L1
1A1a	Solid	TSP	T1
2C1		TSP	T1
1A3biii	Diesel oil	TSP	T1
1A2d	Biomass	TSP	T1
1A3bi	Diesel oil	TSP	T1
1A2f	Solid	TSP	T1
2H1		TSP	T1
1A4cii	Liquid	TSP	T1

BC

NFR Code	Fuel	Pollutant	Identification criteria
1A4bi	Biomass	BC	L1, T1
1A2gvii	Liquid	BC	L1, T1
1A3bvi		BC	L1, T1
1A3bi	Diesel oil	BC	L1, T1
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	Gasoline	CO	L1, T1
1A1a	Biomass	CO	L1, T1
1A3dii	Liquid	CO	L1
1A4aii	Liquid	CO	L1
1A2d	Liquid	CO	L1
1A5a	Biomass	CO	T1

Pb

NFR Code	Fuel	Pollutant	Identification criteria
1A1b	Solid	Pb	L1, T1
1A2d	Liquid	Pb	L1, T1
1A5a	Biomass	Pb	L1, T1
1A1a	Peat	Pb	L1, T1
2G		Pb	L1, T1
1A1a	Biomass	Pb	L1
1A2f	Solid	Pb	L1
1A4bi	Biomass	Pb	L1
1A3bvi		Pb	L1
1A3bi	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
1A5a	Biomass	Cd	L1, T1
1A1a	Biomass	Cd	L1, T1
1A1b	Solid	Cd	L1, T1
1A4ci	Biomass	Cd	L1

3F		Cd	L1
2C7c		Cd	T1
2C6		Cd	T1

Hg

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

As

NFR Code	Fuel	Pollutant	Identification criteria
1A1b	Solid	As	L1, T1
1A1a	Peat	As	L1, T1
2C7c		As	L1, T1
1A4ci	Peat	As	L1, T1
1A2d	Liquid	As	L1, T1
1A2f	Solid	As	L1
1A1a	Solid	As	L1
2C7a		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
1A5a	Biomass	Cr	L1, T1
1A2f	Solid	Cr	L1
1A1a	Peat	Cr	L1
1A1a	Solid	Cr	T1
1A2e	Solid	Cr	T1
1A1a	Biomass	Cr	T1

Cu

NFR Code	Fuel	Pollutant	Identification criteria
1A3bvi		Cu	L1, T1
1A1b	Solid	Cu	L1
1A1a	Peat	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
1A5a	Liquid	Ni	L1, T1
2C1		Ni	L1, T1
1A1a	Peat	Ni	L1, T1
1A2f	Solid	Ni	L1, T1
1A5a	Biomass	Ni	L1, T1
1A1a	Biomass	Ni	L1, T1
1A3dii	Liquid	Ni	L1, T1
1A4ci	Peat	Ni	L1, T1
1A4ai	Liquid	Ni	L1
1A1a	Liquid	Ni	L1
1A2c	Liquid	Ni	L1
2C7b		Ni	T1
1A1a	Solid	Ni	T1

Zn

NFR Code	Fuel	Pollutant	Identification criteria
1A4bi	Biomass	Zn	L1, T1
1A3bvi		Zn	L1, T1
1A5a	Biomass	Zn	L1, T1
1A1a	Biomass	Zn	L1, T1
2C6		Zn	L1
1A1b	Solid	Zn	L1
1A4ci	Biomass	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
1A4bi	Biomass	PCDD/F	L1, T1
5E		PCDD/F	L1, T1
2C1		PCDD/F	L1, T1

1A1a	Other	PCDD/F	L1, T1
1A5a	Biomass	PCDD/F	L1, T1
1A1a	Peat	PCDD/F	L1
1A2d	Biomass	PCDD/F	L1
1A3bi	Diesel oil	PCDD/F	L1
1A3bi	Gasoline	PCDD/F	T1

PAH-4

NFR Code	Fuel	Pollutant	Identification criteria
1A4bi	Biomass	PAH-4	L1, T1
1A1a	Other	PAH-4	T1
1A1a	Biomass	PAH-4	T1
2C1		PAH-4	T1
1B1b		PAH-4	T1
1A4bi	Liquid	PAH-4	T1
1A2gviii	Other	PAH-4	T1
1A5a	Biomass	PAH-4	T1
1A4ai	Liquid	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
2A1		PCB	L1
1A2d	Solid	PCB	T1
1A2f	Solid	PCB	T1
1A2a	Solid	PCB	T1
1A2c	Solid	PCB	T1

1.6 QA/QC, verification and treatment of confidentiality issues

Changes in chapter	
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

Internal review

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.

QA/QC tools

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.

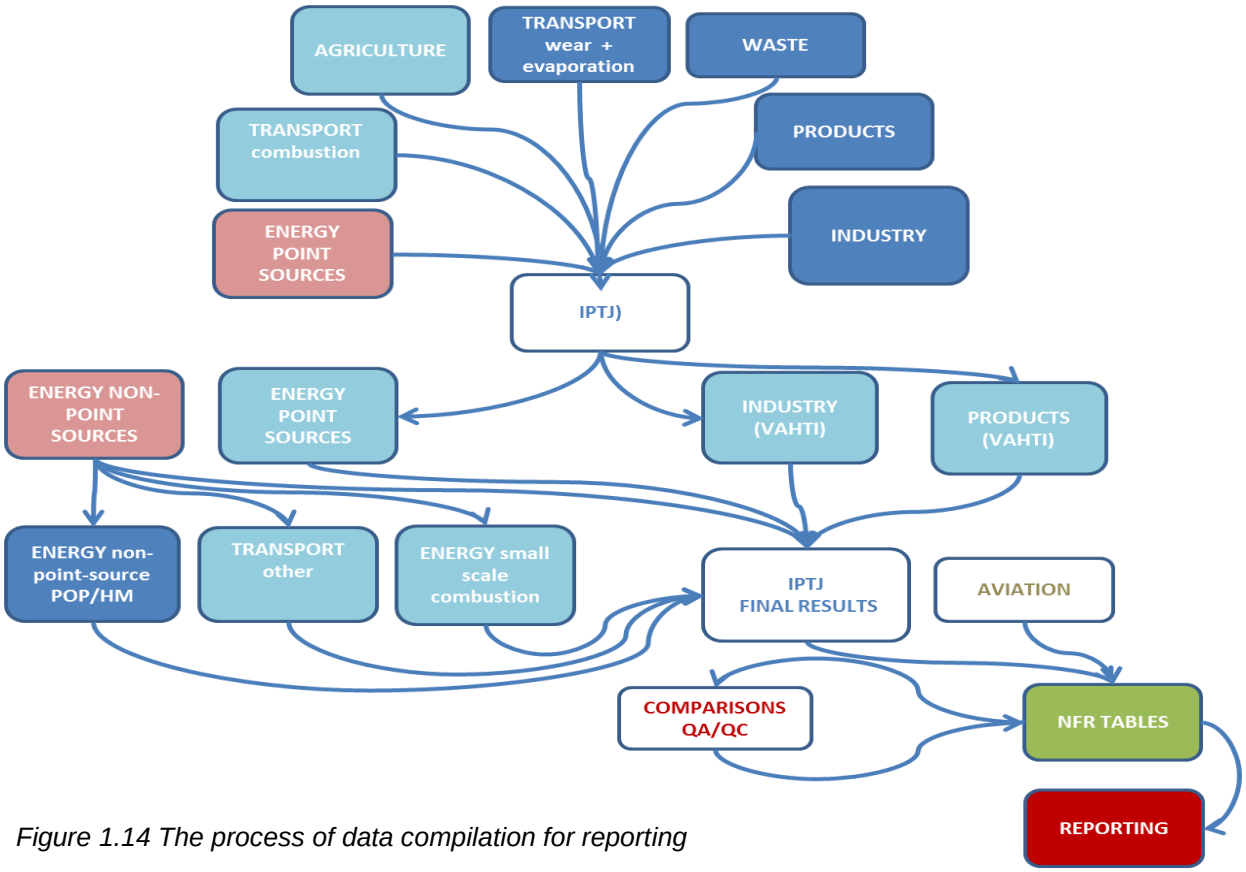


Figure 1.14 The process of data compilation for reporting

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	
March 2021	TF

1.7.1 Methodology

The uncertainty analysis for emission data is carried out following the Approach 1 methodology presented in the EMEP/EEA emission inventory guidebook 2019. The Approach 1 comprise estimation of uncertainties using the error propagation equations, and simple combination of uncertainties by source category to estimate overall uncertainty for one year and the uncertainty in the trend. The uncertainties of the input parameters (activity data and emission factors) 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. In the case of emissions reported by the plants, the total uncertainty of the reported emission is determined instead of separate uncertainties for AD and EF. The fuel use uncertainties are the same that Statistics Finland uses in the UC analysis for the Finnish greenhouse gas inventory. 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 will be further developed to the next submission by re-evaluating the input parameters.

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.

The complete results of the uncertainty analysis are presented in Annex 7. The uncertainty for the total emissions together with the uncertainty for the trend for all pollutants are presented in Table 1.7. The year 1990 has been used as a base year for all pollutants in the uncertainty analysis.

Table 1.7 Summary of uncertainties in total inventory by pollutant in 2019 and trend uncertainties 1990-2019.

Pollutant	Uncertainty in total inventory 2019 (%)	Uncertainty introduced into the trend 1990-2019 (%)
NO_x	12.6	6.9
NMVOC	41.0	21.1
SO_x	9.1	1.5
NH_3	65.7	84.5
$PM_{2.5}$	46.1	22.8
PM_{10}	29.7	19.1
TSP	42.0	24.1
BC	58.1	31.3
CO	34.9	22.1
Pb	33.3	1.9
Cd	35.4	5.9
Hg	39.1	29.8
As	28.2	2.4
Cr	27.5	11.6
Cu	76.0	27.5
Ni	18.0	3.7
Zn	30.8	8.3
PCDD/F	221.0	215.1
PAH-4	185.8	309.0
HCB	260.6	233.8
PCB	247.8	276.7

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

Table 1.8a Explanation of the use of the Notation key NE in NFR Tables submitted in 2021.

NFR14	Substance	Reason for not estimated
1A1a 1A1b 1A2a-f 1A2gviii 1B1b 2C1 2C2 2G	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

Allocation of emissions reported as included elsewhere (IE) is provided in Table 1.8b and explanation of sources reported under categories Other in Table 1.8c.

Table 1.8b Explanation of the use of the Notation key IE in NFR tables submitted in 2021.

NFR14	Substance	Included in
1A2a-f, gviii	NOx, SOx 1980-1989*	1A1a
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
1A3ei	NOx, SOx 1980-1989*	1A1a
1A4ai, bi, ci	NOx, SOx 1980-1989*	1A1a
1A5a	NOx, SOx 1980-1989*	1A1a
1B1a	Particles	2A5c
1B1b	NOx, CO	1A2a
1B2ai	NMVOC 1990-2019	1A3ei
1B2aiv	NOx, SOx, NH3, BC, CO, heavy metals, PCDD/PCDF	See IIR Part2Energy on page 27
1B2c	NOx, NMVOC, SOx, particles, heavy metals	1A1a
2A1	NOx, SOx, PM2.5, PM10, TSP, BC	1A2f
2A2	SOx	1A2f/1A2gviii
2A3	NOx	1A2f
2C1	NOx	1A2a, 1A2b or 1A2gviii
2C2	NMVOC 1990-2002, SOx 1990-2012	1A2a
2C3	NMVOC 1992-1996, 1998, 2001-2002, 2014-2019	1A2b or 1A2gviii
2C6	Hg 1990-1994, Cu 1990-2001, Ni 1990-1991	1A2b or 1A2c
2C6	PM2.5, PM10, TSP 2016-2017, 2019	1A2b
2C7a	NMVOC 1990-1995	1A2b
2C7b	PM2.5, PM10, TSP	1A2a
2D3f	NMVOC	2D3e
5C1bii	all	1A1a or 1A2gviii
5C1biii	NOx, NMVOC, SOx, NH3, particles, CO, Cr, Ni	1A1a or 1A2gviii
5C1biv	NOx, NMVOC, SOx, CO	1A1a or 1A2gviii

*will be verified to the next submissions

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 polymers
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
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

NFR14	Substance	SNAP	Sub-source description
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 57gricultural 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 - 2019	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 - 2019	
NH_3	1999 - 2019	
CO	1999 - 2019	
NMVOC	1999 - 2019	
PCDD/F	1999 - 2019	
PAH-4	1999 - 2019	
HCB	1999 - 2019	
PCB	1999 - 2019	
PCP	1999 – 2007*	
SCCP	-*	
TSP	1999 - 2019	
PM10	1999 - 2019	
PM2.5	1999 - 2019	
As	1999 - 2019	
BC	2018-2019	
Cd	1999 - 2019	
Cr	1999 - 2019	
Cu	1999 - 2019	
Hg	1999 - 2019	
Pb	1999 - 2019	
Ni	1999 - 2019	
Se	-**	
Zn	1999 - 2019	

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 1980-2019 with the following exceptions:

SO_x, NO_x, NH_3 and CO: Emission data has been reported for the years 1980-2019 and is complete in the details for the years 1990-2019.

Heavy metals: Emission data has been reported for the years 19980/1990 –-2019. The reporting requirement starts from the year 1990, the data is complete in details since 1990.

NMVOC: Emission data has been reported for the years 1988 –-2019. The reporting requirement starts from the base year of NMVOCs 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	1990-2019	1980-2019	National totals available for only those pollutants and Tiers for which reporting requirements existed
NO_X	1990-2019	1980-2019	
NH_3	1990-2019	1980-2019	The reporting requirement starts from 1990
CO	1990-2019	1990-2019	
NMVOCs	1988-2019	1988-2019	The reporting requirement starts from the base year for Finland 1988
PCDD/F	1990-2019	1990-2019	The reporting requirement starts from 1990
PAH-4 and indicator substances	1990-2019	1990-2019	The reporting requirement starts from 1990
HCB	1990-2019	1990-2019	The reporting requirement starts from 1990
PCB	1990-2019	1980-2019	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	1990-2019	198 –2019	The reporting requirement starts from 1990
Cd			
Cr			
Cu			
Hg			
Ni			
Pb			
Zn			
Se	1990-2019	(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, 2018-2021	EMEP Grid 50 km * 50 km
2012-2014, 2016, 2017-2021 (not in 2015-2018 submissions due to resource restrictions)	EMEP Grid 0.1 ° * 0.1 °

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, 2018-2019
NO_X	1999 – 2015, 2018-2019
NH_3	1999 – 2015, 2018-2019
CO	1999 – 2015, 2018-2019
NMVOCs	1999 – 2015, 2018-2019
PCDD/F	1999 – 2015, 2018-2019
PAHs	1999 – 2015, 2018-2019
HCB	1999 – 2015, 2018-2019
PCBs	1999 – 2015, 2018-2019
HCH	1999 – 2015, 2018-2019
Cd	1999 – 2015, 2018-2019
Pb	1999 – 2015, 2018-2019
Hg	1999 – 2015, 2018-2019
Additional heavy metals	1999 – 2015, 2018-2019
TSP, PM_{10}, $PM_{2.5}$	1999 – 2015, 2018-2019

1.8.5 Use of Notation Keys

Changes in chapter	
March 2021	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
February 2021 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[16], 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 detail in Chapter 12.

2.1.3 Meeting of reduction targets

Changes in chapter
February 2021 ks

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 (Suoheimo et al. 2015, update of NH_3 scenarios in the agriculture emissions calculation model).

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

The reduction target for nitrogen oxides will be achieved in all scenarios. NO_x emissions are generated in all combustion processes, which means that changes in the use of different fuels partly compensate

[16] 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.

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 NO_x target.

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 9.

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 NO_x emissions from agriculture the emissions in 1987 were 285 kt. The emission ceiling in the Gothenburg protocol 170 kt and has been met since 2012.

Non-methane volatile organic compounds
For NMVOC emissions the reduction target is 30 per cent from the year 1988 emissions (221 kt), without agricultural emissions, to 1999 (155 kt) and was achieved in 2005, when the emissions were 144 kt.

The emission ceiling in the Gothenburg protocol is 130 kt, which has been 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 has dropped by 10%. Also, 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 2019 were 31.593 kt, which is slightly above the 2020 national emission ceiling of 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 2010-2019 regarding ammonia emissions from small scale combustion and road transport as indicated in Appendix I of the IIR. Taking into account the granted adjustments (-1.402 kt in 2019), ammonia emissions in 2019 were 30.191 kt, which is below the ceiling of 31 kt. A detailed presentation of the adjustments reporting is presented in Appendix I.

The projections show that emissions in 2020-2029 will be near the -20% reduction obligation from year 2005 emissions, in 2019 calculated as 37.996 kt, resulting in a ceiling of 30 kt.

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 has been met since 1996.
- The PAH-4 reduction target to decrease the emission level below the 1994 level (20 t) has not yet been met (only in 1995, 1997 and 2000). 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: small-scale wood combustion is the main source of PAH emissions. In 2020 a research project was carried out to verify the national methodology and to check the results of data collection to the national wood use statistics. The project resulted in a considerable increase in the emission level as explained in detail under the Energy Sector chapter. PAH emissions are projected to decrease rapidly so that the 1994 level of 20 t will be met in 2022 due to the changes in small scale wood combustion equipment (Figure.

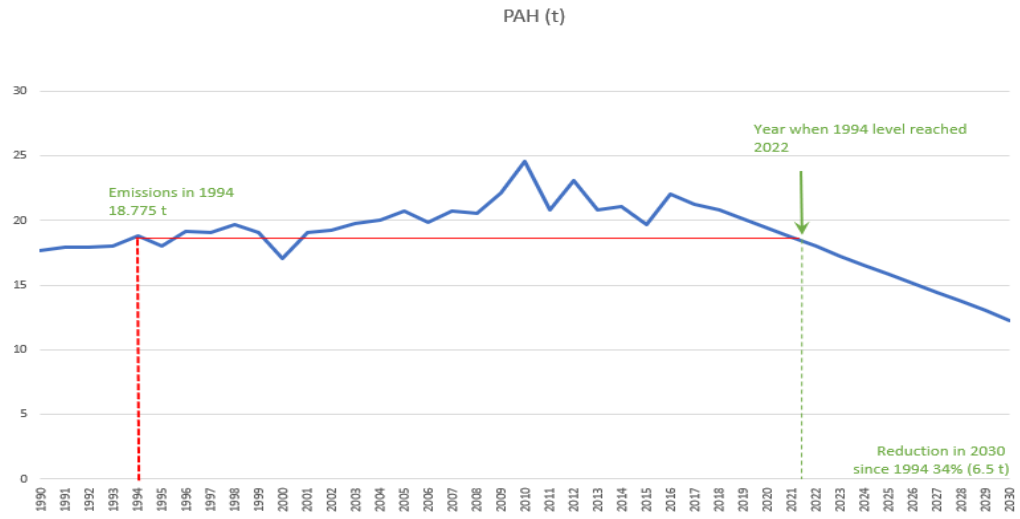


Figure 1.16. PAH-4 emissions scenario up to 2030. SSC stands for small scale wood combustion.

- The target to reduce HCB emissions below the level in 1994 (36 kt) has been met in 1996, in 2001-2006, 2008-2015 and since 2017.
- The target to reduce PCB emissions below the level in 1994 (28 kt) has been met in 1996 and since 2009.

2.1.5 4 Progress in meeting the reduction targets set in the National emission ceilings 2020 (EU NECD)

Finland is currently meeting all its emission ceilings as presented in Table 1.15 Annual variations in the emission levels occur depending on economic and climatic conditions.

Sulphur dioxide
SO_x emission ceiling of the old NECD directive of 110 kt 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 ceiling of 170 kt 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 kt for the year 2010 was met in 2007, when the emissions were 129 kt. In 2019 the emissions were 85 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 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. Finland applied adjustments for the small-scale combustion and transport sector ammonia emission inventories as explained in detail in Appendix I. The adjustments review teams under the CLRTAP and under the NECD accepted these adjustments for the Finnish inventory for 2010-2013 and also thereafter. If the adjustments review teams also accept the proposed adjustment for 2019, Finland is for the year 2019 in compliance with ammonia emissions reduction targets.

Table 1.17 Ammonia emissions and projections reported in 2019

NH_3 Inventory	2019 (kt)	Reduction from 1990 and 2005	Projections (kt) without adjustments		
			2020	2025	2030
INVENTORY 12.2.2021	31.593	-13% and 21%	31.193	28.862	27.759
PROPOSED ADJUSTMENT	-1.402				
TOTAL EMISSIONS WITH ADJUSTMENT	30.191				

$PM_{2.5}$
$PM_{2.5}$ emissions have been reduced since the base year of 2000 and were in 2019 (16.6 kt) already under the 2020-2029 NECD ceiling of 18 kt as well as the 2030 ceiling of 17 kt.

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 for many pollutants the methodologies have changed over the years and that there also are new sources that were not in the original inventories but have been included in later years.

CLRTAP	**Emission (kt) in 2019**	**Base year 1990**	**Emission (kt) in the base year**	**Target (kt), reduction-%**	**Year when target reached**
NO_x	119.817	1987	300.116	170 (-43%)	2011
SO_x	28.937	1980	584.393	116 (-55%)	1995
NMVOC	84.522	1988	239.760	130 (-38%)	2008
NH_3	31.593	1990 (original) 2005 (revised)	34.738 39	31 (-11%) 31 (-20%)	2017
adjustment	-1.402				
compliance	30.191				
TSP	44.952	2000	56.854	na	
PM_{10}	30.034	2000	42.931	na	
$PM_{2.5}$	16.622	2000	26.326	na	
BC	3.848	2000	6.500	na	

CLRTAP HM Protocol	**2019**	**Emissions (t) in the base year 1990**	**Target reached** (below the level of the base year)
Pb	13.220	321.435	1995
Cd	0.794	6.685	1991
Hg	0.587	1.086	1991
As	2.065	34.816	1991
Cr	14.286	47.670	1992
Cu	40.171	156.893	1992
Ni	11.541	78.439	1991
Zn	130.305	682.839	1991

CLRTAP POP Protocol	2019	Emissions in the base year 1994	**Target reached** (below the level of the base year)
PCDD/F	12.132	18	since 1992
HCB	22.637	36	1991, 1995, 2001-2006, 2010-2015, 2017-2019
PCB	22.780	29	1996, 2001, 2009-2019
PAH-4	22.309	20	1995, 2000 (the target is projected to be reached in 2022)

NECD	2019	NECD 2001	NECD 2016 (Base year 2005)				
		Ceiling 2010-2020		Ceiling 2020-2029		Ceiling from 2030	
		(kt)	Emissions in 2005 (kt)	(%)	(kt)	(%)	(kt)
NO_x	119.817	170	208	-35	135	-47	110
NOx agriculture excluded	109.945						
SO_2	28.937	110	70	-30	49	-34	46
NMVOC	84.522	130	146	-35	95	-48	76
NMVOC agriculture excluded	68.133						
$PM_{2,5}$	16.622		26	-30	18	-34	17
NH_3	31.593	31	37.996	-20	30	-20	30
NH_3 adjustment	-1.402						
Compliance NH_3	30.191						

2.3 Description and interpretation of emissions in 2019 and the trends by pollutant

Changes in chapter
February 2021 KS

This section describes the sources of air pollutants, emission trends and their spatial distribution. The maps are based on the new EMEP 0.1º* 0.1º grid and the intensity of the colouring is pollutant specific.

2.3.1 Main pollutants

The time series of the main pollutants SO_x, NO_x, NH_3, NMVOC and CO for 1980-2019 are presented in Figure 1.17.

- *Sulphur oxides* trend since 1980 has been 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.

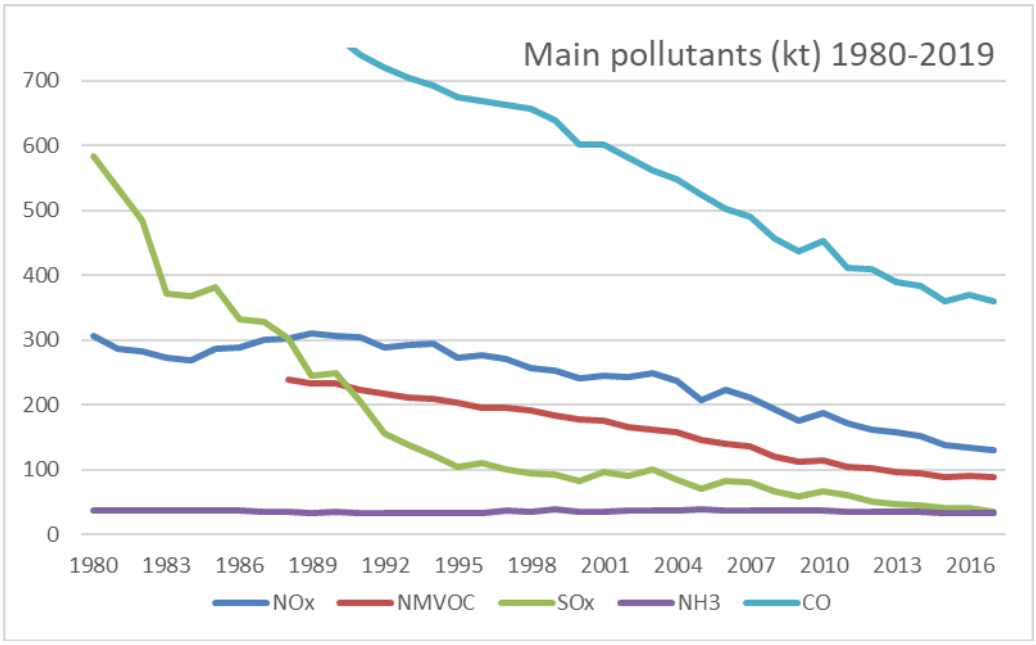


Figure 1.17. Emissions of main pollutants SO_2, NO_2, NH_3, NMVOC and CO in 1990–2019.

2.3.2 Nitrogen oxide emissions reported as nitrogen dioxide NO_2

Emission trend

Nitrogen oxides have been reduced from the base year 1987 emissions of 300 kt to 120 kt in 2019. The target to freeze emissions below the base year has been met since 2011.

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 NO_x emissions trend 1980-2019 is presented in Figure 1.18. Time series fluctuation are mostly 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.

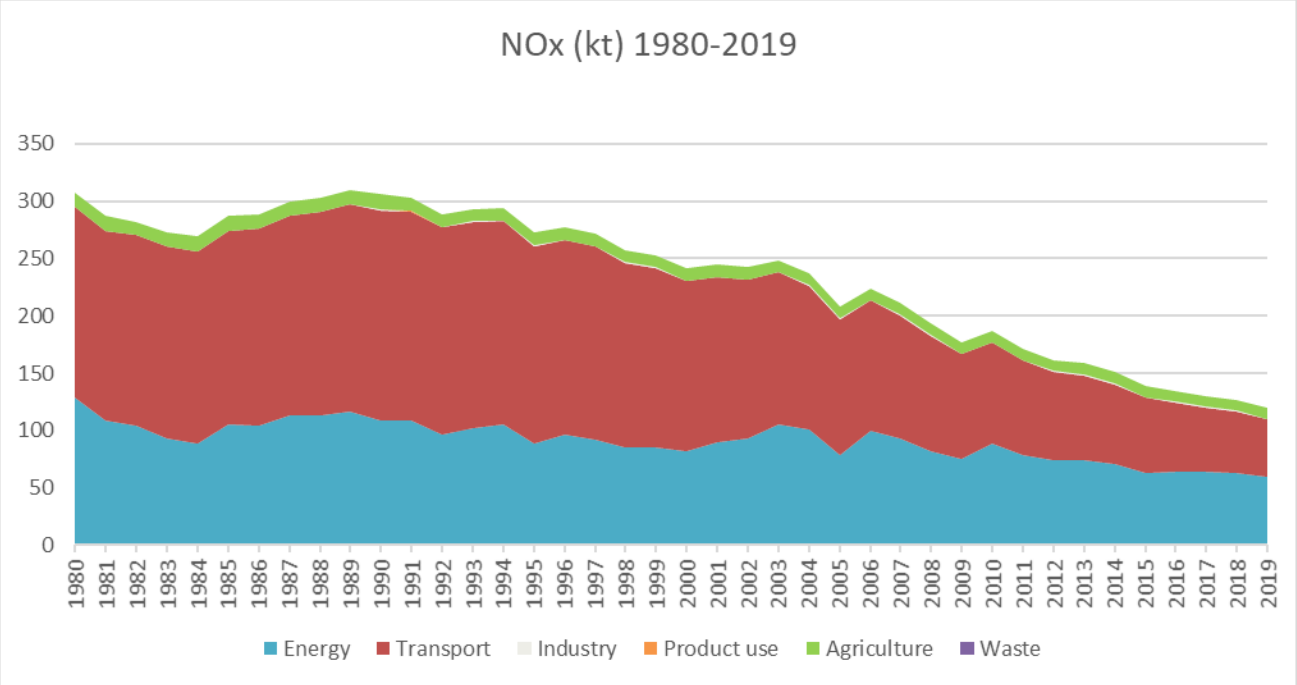
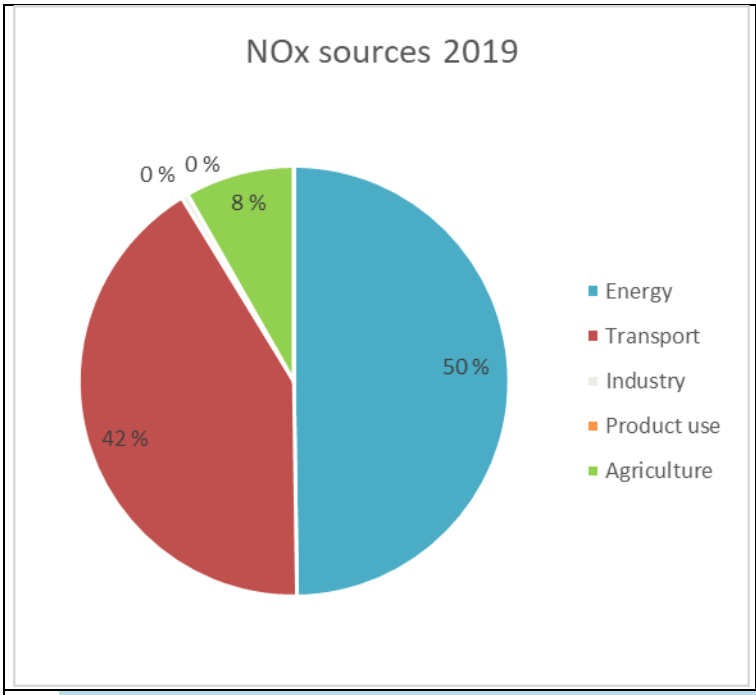
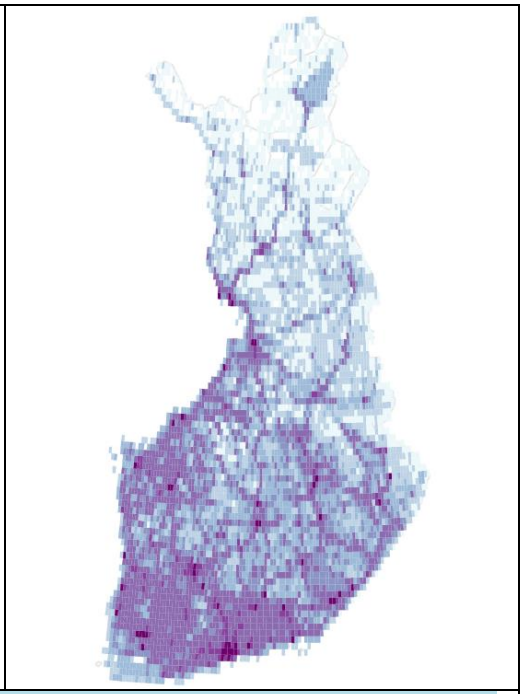


Figure 1.19 Emissions of nitrogen oxide (Gg) in 1980-2019.

The uncertainties of emission data in 2019 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 1.20.





Shares of data reported by the plants of total NMVOC emissions in 2019

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	1.7	1.411	19.2	2C1	0.2	0.21	100
1A1b	0.1	0.088	38.1	2C2	<0.1	<0.001	100
1A2a	<0.1	0.012	0	2C6	<0.1	0.001	0
1A2b	<0.1	0.001	9.1	2C7a	<0.1	<0.001	0
1A2c	<0.1	0.008	0	2C7b	<0.1	0.035	100
1A2d	0.4	0.351	4	2C7c	<0.1	0.007	100
1A2e	<0.1	0.027	0	2D3a	6	5.032	0
1A2f	<0.1	0.015	0	2D3b	0.3	0.263	0
1A2gvii	1.4	1.172	0	2D3c	0.2	0.181	0
1A2gviii	0.3	0.214	17.7	2D3d	8.7	7.363	14.2
1A3ai(i)	0.1	0.109	0	2D3e	0.6	0.521	5.6
1A3aii(i)	<0.1	0.033	0	2D3g	2.1	1.771	72.8
1A3bi	1.8	1.483	0	2D3h	0.6	0.546	56.3
1A3bii	0.4	0.298	0	2D3i	2.1	1.811	5
1A3biii	0.4	0.313	0	2G	<0.1	0.02	0
1A3biv	1.3	1.109	0	2H1	2	1.67	12.9
1A3bv	1.5	1.306	0	2H2	2.3	1.947	0.1
1A3c	<0.1	0.082	0	2I	1.4	1.17	33.6
1A3dii	3.4	2.885	0	2L	<0.1	0.002	100
1A3ei	<0.1	<0.001	0	3B1a	7.4	6.242	0
1A4ai	<0.1	0.083	0	3B1b	4.8	4.057	0
1A4aii	0.6	0.491	0	3B2	0.2	0.157	0
1A4bi	24.9	21.072	0	3B3	0.3	0.253	0
1A4bii	2.9	2.468	0	3B4d	<0.1	0.005	0
1A4ci	0.5	0.445	0	3B4e	0.3	0.249	0

1A4cii	1.6	1.364	0	3B4gi	0.2	0.207	0
1A4ciii	<0.1	0.083	0	3B4gii	0.8	0.705	0
1A5a	0.4	0.321	0	3B4giii	<0.1	0.031	0
1A5b	<0.1	0.058	0	3B4giv	<0.1	0.018	0
1B1b	<0.1	0.064	0	3B4h	1.3	1.078	0
1B2aiv	3.2	2.705	100	3Da2a	2.6	2.194	0
1B2av	3.3	2.767	5.7	3Da3	<0.1	0.064	0
1B2b	0.3	0.252	0	3De	1.2	0.995	0
2A1	<0.1	0.023	27.6	3F	0.2	0.135	0
2A3	<0.1	0.002	99.3	5A	<0.1	0.079	0
2B10a	2.6	2.219	100	5D1	<0.1	0.009	0
2B10b	0.2	0.137	100	5D2	<0.1	0.018	0
				Total	**100**	**84.522**	**10.9**

Figure 1.20 The contribution of different sources and data reported by the plants in the 2019 emissions.

2.3.3 Non-methane organic compounds emissions (NMVOC)

Emission trend

NMVOC emissions have been reduced from the base year 1988 emissions of 240 kt to 85 kt in 2019.

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 1.21 shows decreasing emissions since 1990. The time series is not consistent: especially for the years 1980-1987 for which not all sources are included. The calculation model for small scale combustion 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 2019 are included in Annex 7 of the IIR.

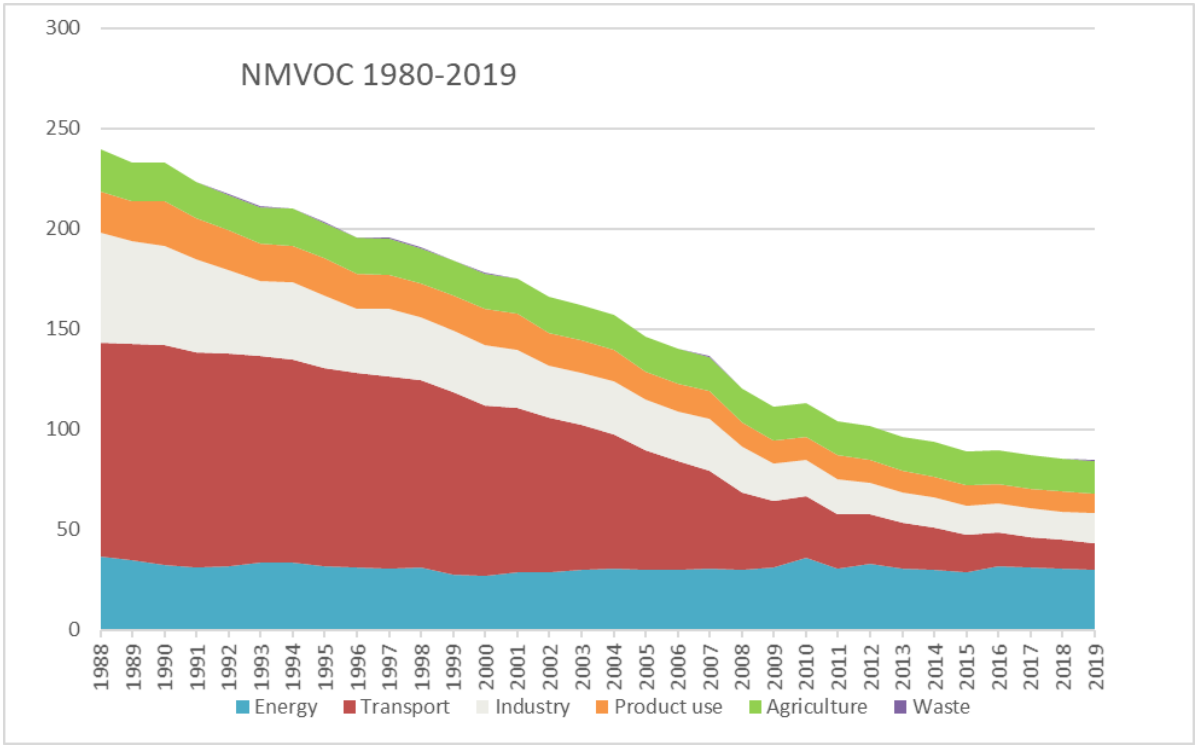
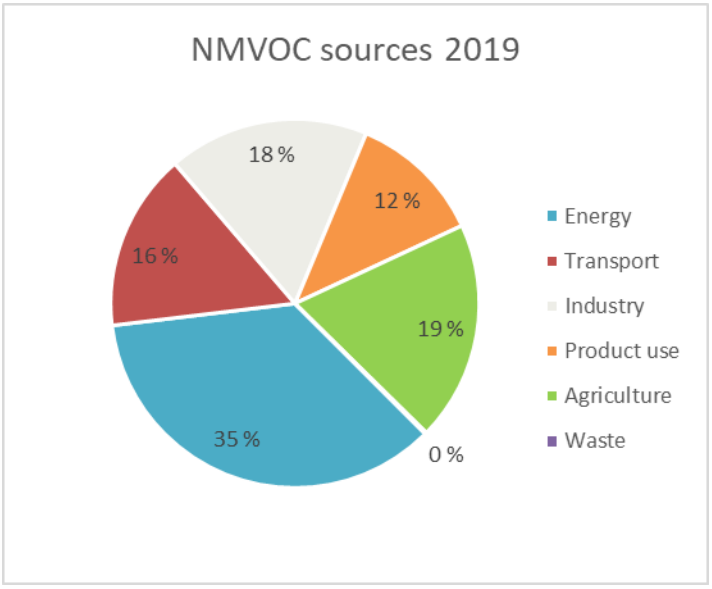


Figure 1.21. NMVOC emissions (Gg) in 1988-2019

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 1.22.



Shares of data reported by the plants of total NMVOC emissions in 2019							
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	1.7	1.411	19.2	2C1	0.2	0.21	100
1A1b	0.1	0.088	38.1	2C2	<0.1	<0.001	100
1A2a	<0.1	0.012	0	2C6	<0.1	0.001	0
1A2b	<0.1	0.001	9.1	2C7a	<0.1	<0.001	0
1A2c	<0.1	0.008	0	2C7b	<0.1	0.035	100
1A2d	0.4	0.351	4	2C7c	<0.1	0.007	100
1A2e	<0.1	0.027	0	2D3a	6	5.032	0
1A2f	<0.1	0.015	0	2D3b	0.3	0.263	0
1A2gvii	1.4	1.172	0	2D3c	0.2	0.181	0
1A2gviii	0.3	0.214	17.7	2D3d	8.7	7.363	14.2
1A3ai(i)	0.1	0.109	0	2D3e	0.6	0.521	5.6
1A3aii(i)	<0.1	0.033	0	2D3g	2.1	1.771	72.8
1A3bi	1.8	1.483	0	2D3h	0.6	0.546	56.3
1A3bii	0.4	0.298	0	2D3i	2.1	1.811	5
1A3biii	0.4	0.313	0	2G	<0.1	0.02	0
1A3biv	1.3	1.109	0	2H1	2	1.67	12.9
1A3bv	1.5	1.306	0	2H2	2.3	1.947	0.1
1A3c	<0.1	0.082	0	2I	1.4	1.17	33.6
1A3dii	3.4	2.885	0	2L	<0.1	0.002	100
1A3ei	<0.1	<0.001	0	3B1a	7.4	6.242	0
1A4ai	<0.1	0.083	0	3B1b	4.8	4.057	0
1A4aii	0.6	0.491	0	3B2	0.2	0.157	0
1A4bi	24.9	21.072	0	3B3	0.3	0.253	0
1A4bii	2.9	2.468	0	3B4d	<0.1	0.005	0
1A4ci	0.5	0.445	0	3B4e	0.3	0.249	0
1A4cii	1.6	1.364	0	3B4gi	0.2	0.207	0
1A4ciii	<0.1	0.083	0	3B4gii	0.8	0.705	0
1A5a	0.4	0.321	0	3B4giii	<0.1	0.031	0
1A5b	<0.1	0.058	0	3B4giv	<0.1	0.018	0
1B1b	<0.1	0.064	0	3B4h	1.3	1.078	0
1B2aiv	3.2	2.705	100	3Da2a	2.6	2.194	0
1B2av	3.3	2.767	5.7	3Da3	<0.1	0.064	0
1B2b	0.3	0.252	0	3De	1.2	0.995	0
2A1	<0.1	0.023	27.6	3F	0.2	0.135	0
2A3	<0.1	0.002	99.3	5A	<0.1	0.079	0
2B10a	2.6	2.219	100	5D1	<0.1	0.009	0
2B10b	0.2	0.137	100	5D2	<0.1	0.018	0
				Total	**100**	**84.522**	**10.9**

Figure 1.22. The contribution of different sources and data reported by the plants in the 2019 emissions.

2.3.4 Sulphur emissions as sulphur dioxide SO_2

Emission trend

Sulphur oxides emissions have been reduced from the base year 1980 emissions of 584 kt to 29 kt in 2019.

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.

SO_x 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 1.23)

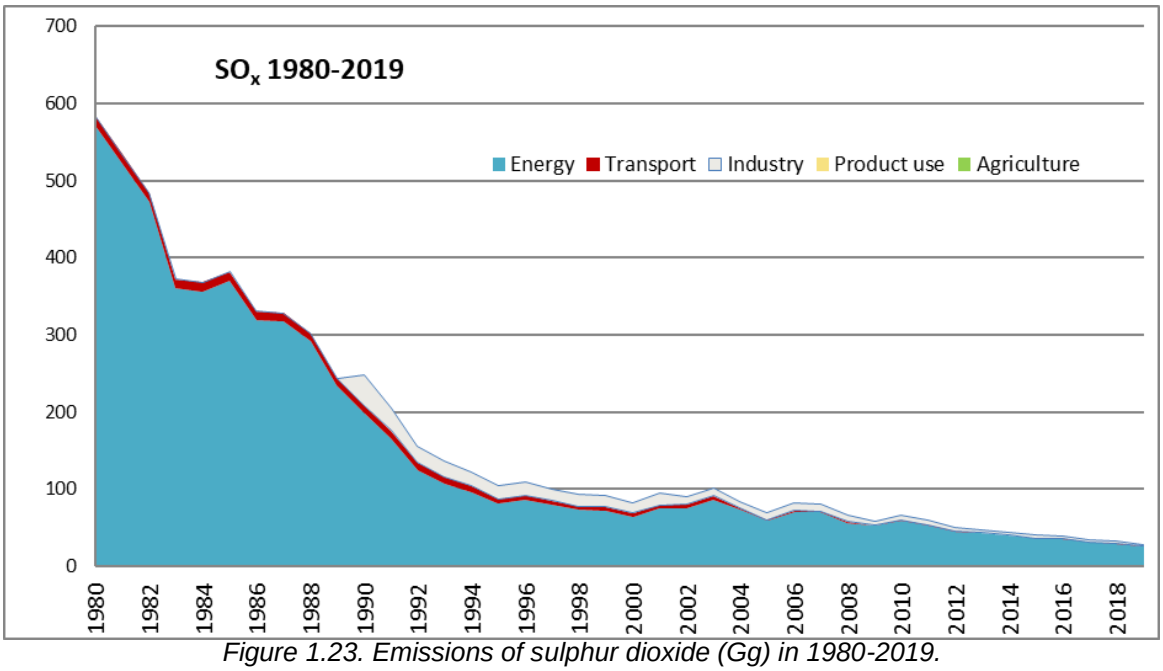
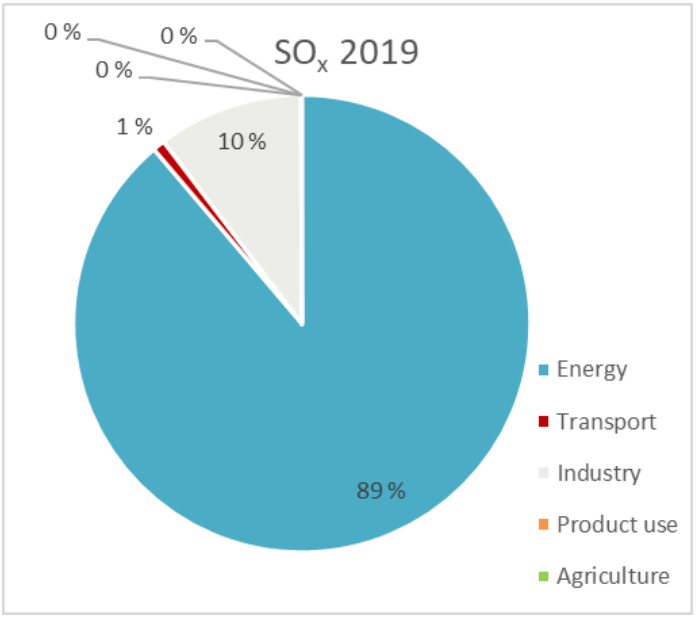


Figure 1.23. Emissions of sulphur dioxide (Gg) in 1980-2019.

The uncertainties of emission data in 2019 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 1.24.



Shares of data reported by the plants of total SOx emissions in 2019

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	34.7	10.03	87.5	1A4bi	2.6	0.762	0
1A1b	14.5	4.207	99.9	1A4bii	<0.1	<0.001	0
1A2a	1.8	0.527	99.1	1A4ci	2.5	0.72	0.1
1A2b	8.4	2.436	99.4	1A4cii	<0.1	0.003	0
1A2c	1.5	0.443	98.1	1A4ciii	<0.1	<0.001	0
1A2d	7.6	2.204	91	1A5a	4.9	1.422	0
1A2e	2.7	0.767	68.7	1A5b	0.2	0.044	0
1A2f	1.8	0.535	75.2	1B1b	0.2	0.053	100
1A2gvii	<0.1	0.004	0	2B10a	4.3	1.246	100
1A2gviii	1.8	0.511	48.3	2C1	2.5	0.734	100
1A3ai(i)	0.2	0.053	0	2C2	<0.1	0.002	100
1A3aii(i)	<0.1	0.013	0	2C7a	0.4	0.111	1.6
1A3bi	<0.1	0.026	0	2C7b	<0.1	<0.001	100
1A3bii	<0.1	0.003	0	2C7c	<0.1	<0.001	100
1A3biii	<0.1	0.015	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	0.003	0
1A3dii	0.3	0.085	0	2H1	3.1	0.885	100
1A3ei	<0.1	<0.001	0	2L	<0.1	<0.001	100
1A4ai	3.7	1.074	0	3F	<0.1	0.011	0
1A4aii	<0.1	0.001	0	**Total**	**100**	**28.937**	**77.6**

Figure 1.24 The contribution of different sources and data reported by the plants in the 2019 emissions.

2.3.5 Ammonia emissions

Emission trend

Ammonia emissions have been reduced from the 1990 level of 35 kt to 32 kt in 2019.

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 1.25.

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 a comprehensive recalculation in 2016. 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.

In 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. Earlier, ammonia emissions had been estimated as national totals only for 1980, 1985-1988, 1990, 1995 and 1997-1999 and in NFR format only from 2000 onwards. The recalculated time series is available in NFR format since 1980.

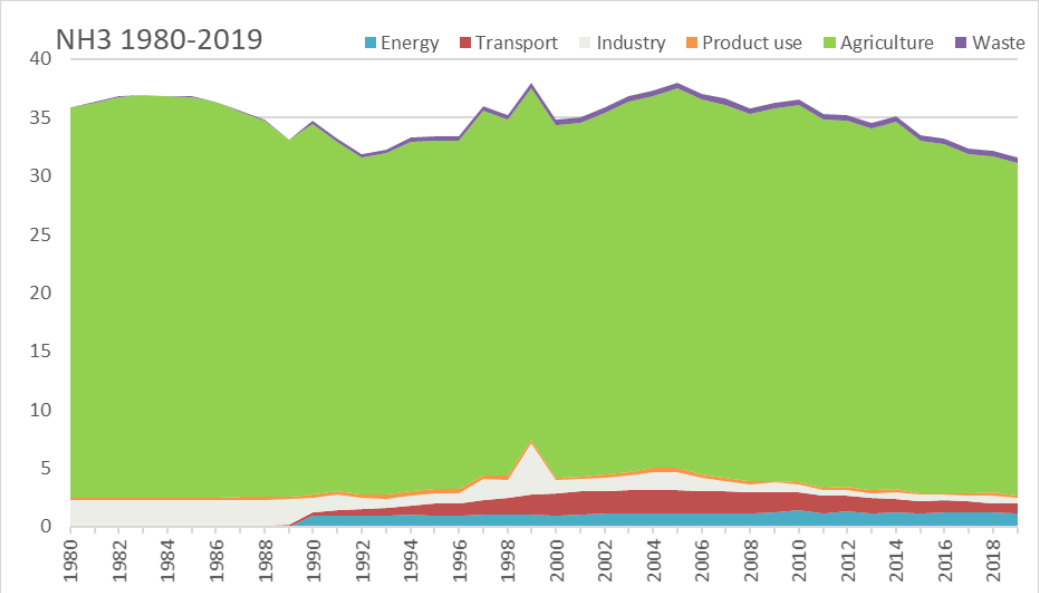
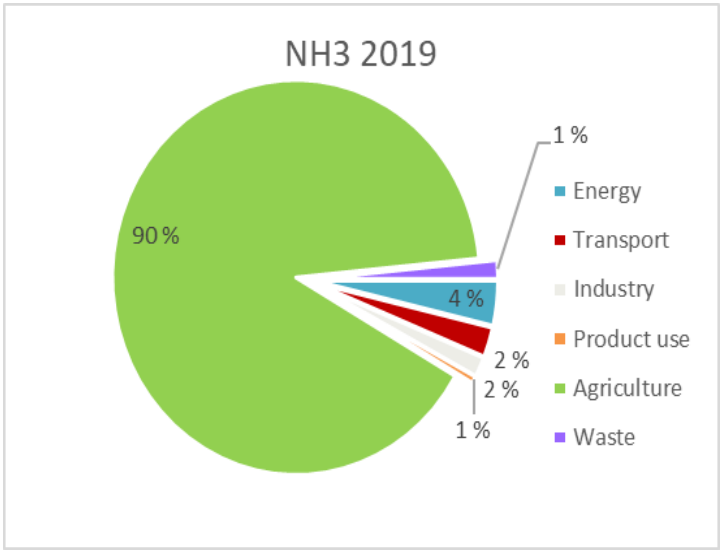


Figure 1.25. Ammonia emissions (Gg) in 1980-2019. Note, the peak NFR2 (Industry) in 1999 is due to an accidental emission reported by the plant to the environmental authorities.

The uncertainties of emission data in 2019 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 1.26.



Shares of data reported by the plants of total NH_3 emissions in 2019

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	0.003	100	2D3g	<0.1	0.004	22.8
1A2gvii	<0.1	0.003	0	2D3i	0.5	0.158	96.4
1A2gviii	<0.1	0.002	100	2G	<0.1	0.013	0
1A3bi	2.3	0.725	0	2H1	0.4	0.119	100
1A3bii	<0.1	0.011	0	2L	<0.1	0.006	100
1A3biii	<0.1	0.029	0	3B1a	17.7	5.58	0
1A3biv	<0.1	0.002	0	3B1b	15.8	5.003	0
1A3c	<0.1	<0.001	0	3B2	0.4	0.126	0
1A3dii	<0.1	<0.001	0	3B3	9.4	2.969	0
1A4ai	<0.1	0.005	0	3B4d	<0.1	0.007	0
1A4aii	<0.1	<0.001	0	3B4e	2.2	0.691	0
1A4bi	3.6	1.136	0	3B4gi	1.4	0.438	0
1A4bii	<0.1	<0.001	0	3B4gii	2.2	0.688	0
1A4ci	<0.1	0.012	0	3B4giii	0.2	0.065	0
1A4cii	<0.1	0.002	0	3B4giv	0.1	0.043	0
1A4ciii	<0.1	<0.001	0	3B4h	7.7	2.436	0
1A5a	<0.1	<0.001	0	3Da1	6.6	2.099	0
1B1b	<0.1	0.003	0	3Da2a	21.7	6.852	0
2B10a	1	0.309	100	3Da2b	0.2	0.066	0
2C1	0.1	0.038	100	3Da3	4.3	1.345	0
2C7b	0.1	0.041	100	3F	0.2	0.072	0
2C7c	<0.1	<0.001	100	5B1	0.3	0.099	0
2D3e	<0.1	0.004	0	5D1	1.2	0.387	1.1
				Total	**100**	**31.593**	**2.1**

Figure 1.26 The contribution of different sources and data reported by the plants in the 2017 emissions.

2.3.6 Carbon monoxide emissions

Emission trend

Carbon monoxide emissions have been reduced from the 1990 level of 770 kt to 345 kt in 2019.

The carbon monoxide emission trend is presented in Figure 1.27. The trend is decreasing 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.

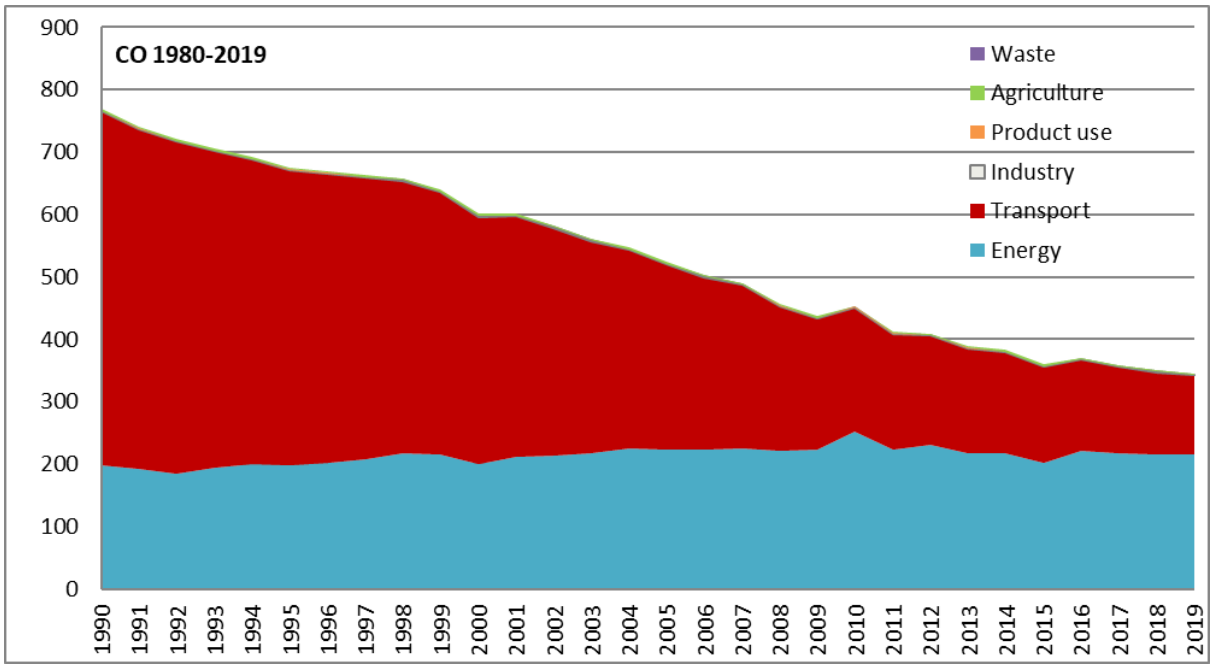
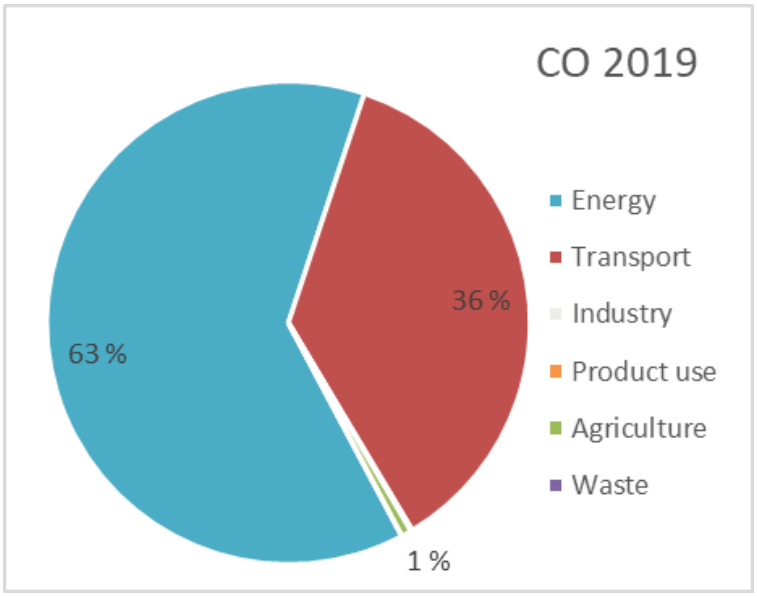


Figure 1.27. Emissions of carbon monoxide (Gg) in 1990-2019.

The uncertainties of emission data in 2019 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 1.28.



Shares of data reported by the plants of total CO emissions in 2019							
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	4.4	15.196	16.5	1A3c	<0.1	0.193	0
1A1b	0.4	1.309	12.8	1A3dii	5.7	19.777	0
1A2a	0.2	0.763	0.2	1A3ei	<0.1	0.002	0
1A2b	<0.1	0.106	79.3	1A4ai	0.3	0.995	0.1
1A2c	<0.1	0.329	3.2	1A4aii	4.6	15.717	0
1A2d	6	20.602	13.1	1A4bi	45.2	155.957	0
1A2e	<0.1	0.182	0.8	1A4bii	11.1	38.398	0
1A2f	1	3.409	7.5	1A4ci	0.6	2.107	0
1A2gvii	2.1	7.328	0	1A4cii	2.7	9.244	0
1A2gviii	1	3.421	7.5	1A4ciii	<0.1	0.277	0
1A3ai(i)	0.3	0.881	0	1A5a	3.4	11.759	0
1A3aii(i)	0.1	0.388	0	1A5b	0.2	0.809	0
1A3bi	6.8	23.347	0	2C1	<0.1	0.19	100
1A3bii	0.6	2.043	0	2C7a	<0.1	0.011	100
1A3biii	0.8	2.813	0	2G	<0.1	0.185	0
1A3biv	1.4	4.851	0	3F	0.7	2.343	0
				Total	**100**	**344.933**	**1.8**

Figure 1.28 The contribution of different sources and data reported by the plants in the 2019 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 1.29.

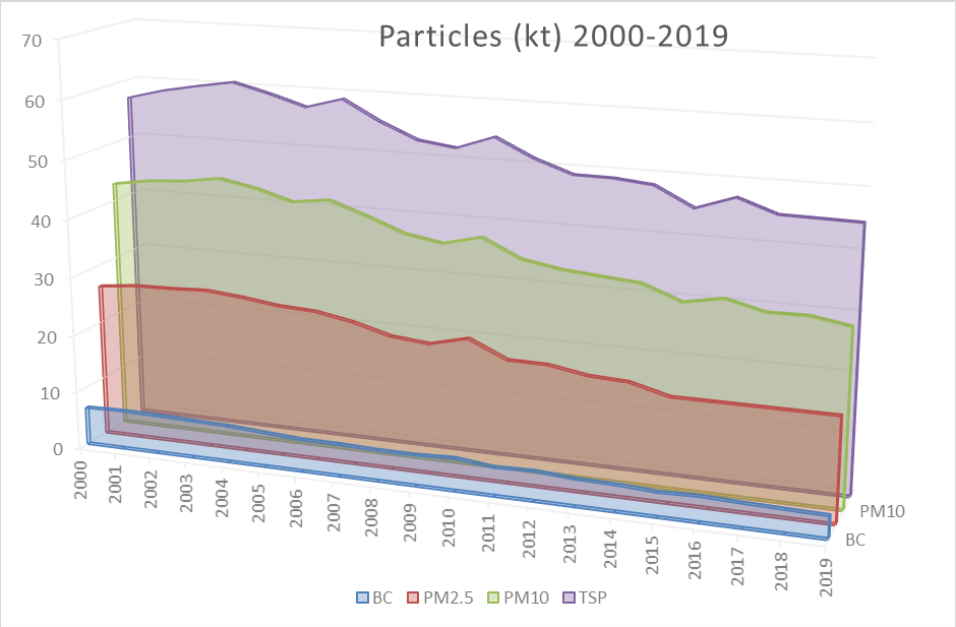


Figure 1.29 Particle emissions (TSP, PM_{10}, $PM_{2.5}$ and BC) in 2000-2019.

In 2019 particle emissions are below half of the level in 1990. In 1990 TSP emissions were 98 kt, PM_{10} emissions 74 kt, $PM_{2.5}$ emissions 47 and BC emissions 10 kt, while in 2019 they were 45 kt, 30 kt, 17 kt and 4 kt, respectively.

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 programs 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 1.30.

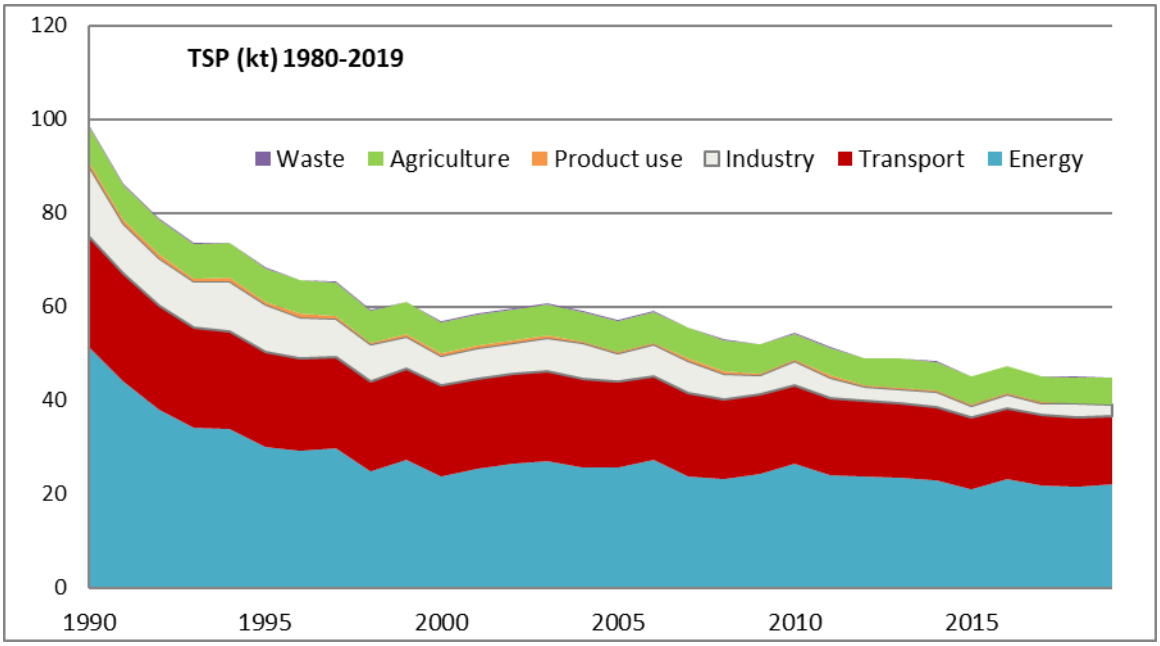
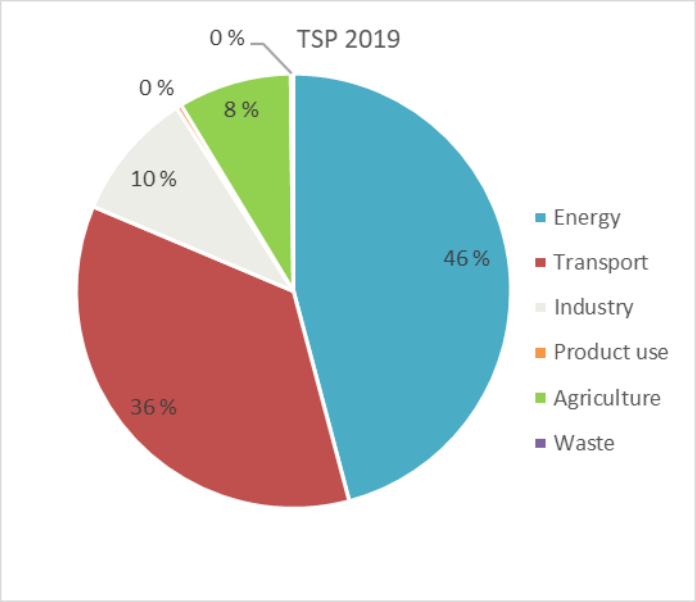


Figure 1.20. TSP emissions (kt) 1990-2019

The uncertainties of emission data in 2019 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 1.31.



Shares of total TSP emissions reported by the plants in 2019							
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	5.4	2.444	72	2A5c	1.3	0.57	0
1A1b	0.2	0.103	100	2B10a	0.8	0.377	100
1A2a	<0.1	0.022	100	2B10b	<0.1	0.037	0
1A2b	<0.1	0.009	100	2B6	<0.1	0.002	100
1A2c	<0.1	0.036	100	2C1	0.6	0.287	100
1A2d	3.9	1.752	100	2C2	0.3	0.115	100
1A2e	0.1	0.046	100	2C3	<0.1	<0.001	57.7
1A2f	0.3	0.116	100	2C7a	<0.1	<0.001	25.2
1A2gvii	0.7	0.308	0	2C7c	<0.1	0.009	100
1A2gviii	1	0.436	100	2C7d	<0.1	0.01	0
1A3ai(i)	<0.1	0.006	0	2D3b	0.2	0.094	0
1A3aii(i)	<0.1	0.001	0	2D3d	<0.1	0.002	100
1A3bi	0.6	0.262	0	2D3e	<0.1	<0.001	100
1A3bii	0.5	0.241	0	2D3g	<0.1	0.003	100
1A3biii	0.4	0.171	0	2D3i	0.1	0.049	100
1A3biv	<0.1	0.024	0	2G	0.2	0.087	0
1A3bvi	3.5	1.564	0	2H1	0.9	0.395	100
1A3bvii	24.9	11.178	0	2H2	1	0.429	17.9
1A3c	<0.1	0.03	0	2I	0.2	0.111	100
1A3dii	0.7	0.331	0	2L	<0.1	0.012	100
1A4ai	0.6	0.287	1.9	3B1a	0.4	0.202	0
1A4aii	0.2	0.1	0	3B1b	0.4	0.161	0
1A4bi	21.4	9.622	0	3B2	<0.1	0.01	0
1A4bii	0.3	0.134	0	3B3	0.7	0.302	0
1A4ci	2.2	0.987	0.4	3B4d	<0.1	<0.001	0
1A4cii	0.4	0.188	0	3B4e	<0.1	0.021	0

1A4ciii	0.1	0.046	0	3B4gi	1.4	0.626	0
1A5a	10.2	4.596	0	3B4gii	0.4	0.19	0
1A5b	<0.1	0.024	0	3B4giii	<0.1	0.014	0
1B1b	<0.1	0.016	100	3B4giv	0.2	0.078	0
1B1c	3.3	1.468	0	3B4h	0.1	0.051	0
1B2aiv	<0.1	0.008	100	3Dc	8.5	3.8	0
1B2av	<0.1	<0.001	100	3F	0.4	0.195	0
2A2	<0.1	0.002	100	5A	<0.1	0.001	0
2A3	<0.1	0.006	79.3	5C1bv	<0.1	0.001	0
2A5a	<0.1	0.006	83	5E	0.2	0.104	0
2A5b	<0.1	0.032	7	**Total**	**100**	**44.952**	**12.8**

Figure 1.31 The contribution of different sources and data reported by the plants in the 2019 emissions.

2.3.7.2 Particles PM_{10}

Emission Trend

For introduction to drivers behind the emission trend, please see the beginning of Chapter 3.1.12. The trend of PM_{10} emissions is presented in Figure 1.32.

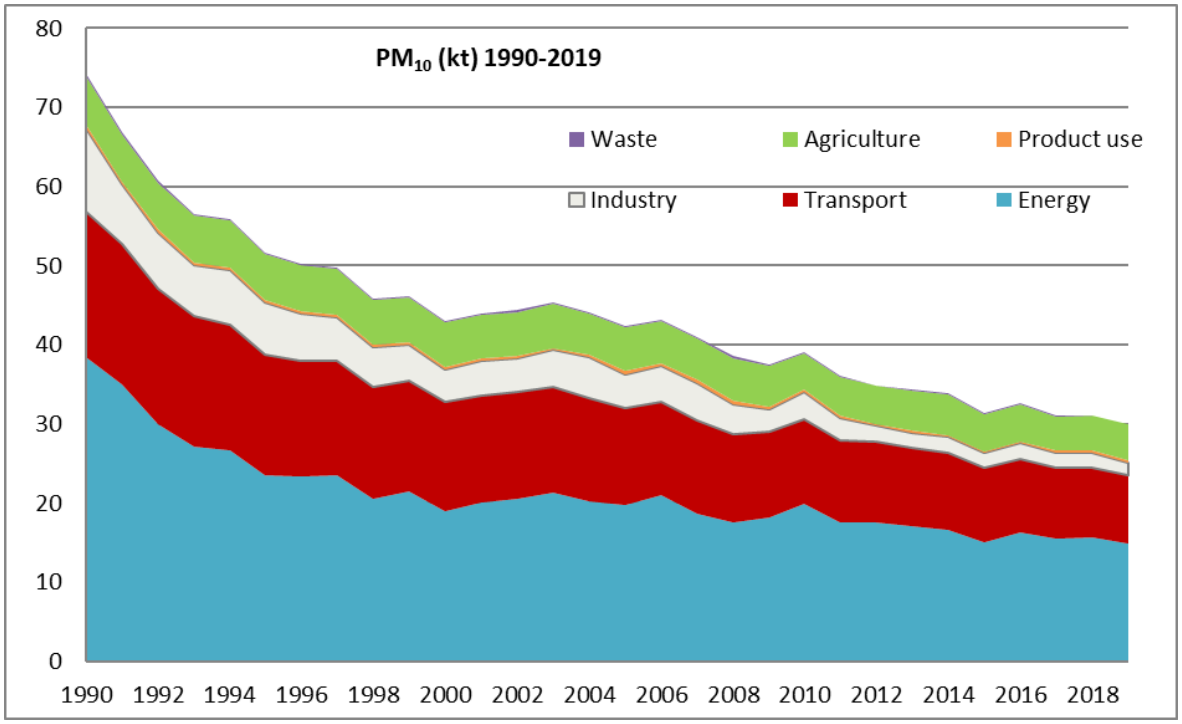
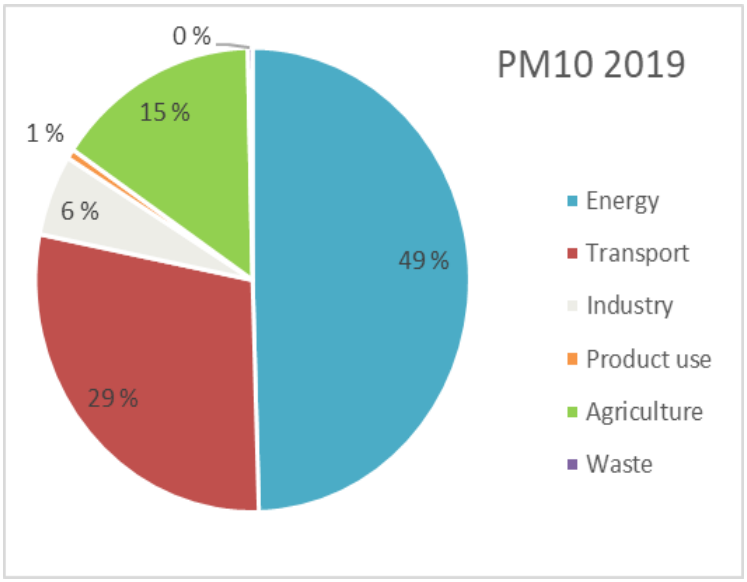


Figure 1.32. PM_{10} emissions (kt) in 2000-2019

The uncertainties of emission data in 2019 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 1.33



Shares of total PM_{10} emissions reported by the plants in 2019

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	3.4	1.026	0	2A5c	0.7	0.22	0
1A1b	<0.1	0.028	0	2B10a	1.1	0.326	0
1A2a	<0.1	0.012	0	2B10b	<0.1	0.012	0
1A2b	<0.1	0.005	0	2B6	<0.1	0.002	0
1A2c	<0.1	0.03	0	2C1	0.8	0.235	0
1A2d	5	1.49	0	2C2	0.3	0.098	0
1A2e	<0.1	0.026	0	2C3	<0.1	<0.001	0
1A2f	0.2	0.057	0	2C7a	<0.1	<0.001	0
1A2gvii	1	0.308	0	2C7c	<0.1	0.006	0
1A2gviii	0.6	0.18	0	2C7d	<0.1	0.005	0
1A3ai(i)	<0.1	0.006	0	2D3b	0.2	0.071	0
1A3aii(i)	<0.1	0.001	0	2D3d	<0.1	0.001	0
1A3bi	0.9	0.262	0	2D3e	<0.1	<0.001	0
1A3bii	0.8	0.241	0	2D3g	<0.1	0.003	0
1A3biii	0.6	0.171	0	2D3i	0.2	0.046	0
1A3biv	<0.1	0.024	0	2G	0.3	0.087	0
1A3bvi	3.9	1.16	0	2H1	0.9	0.277	0
1A3bvii	18.6	5.589	0	2H2	1.4	0.412	0
1A3c	<0.1	0.028	0	2I	<0.1	0.021	0
1A3dii	1.1	0.331	0	2L	<0.1	0.009	0
1A4ai	0.7	0.209	0	3B1a	0.3	0.092	0
1A4aii	0.3	0.1	0	3B1b	0.2	0.074	0
1A4bi	30.7	9.227	0	3B2	<0.1	0.004	0
1A4bii	0.4	0.134	0	3B3	0.2	0.047	0
1A4ci	1.2	0.363	0	3B4d	<0.1	<0.001	0

1A4cii	0.6	0.188	0	3B4e	<0.1	0.01	0
1A4ciii	0.2	0.046	0	3B4gi	0.4	0.132	0
1A5a	4.3	1.279	0	3B4gii	0.3	0.095	0
1A5b	<0.1	0.024	0	3B4giii	<0.1	0.014	0
1B1b	<0.1	0.007	0	3B4giv	0.3	0.076	0
1B1c	3.2	0.959	0	3B4h	<0.1	0.023	0
1B2aiv	<0.1	0.006	0	3Dc	12.7	3.8	0
1B2av	<0.1	<0.001	0	3F	0.6	0.192	0
2A2	<0.1	<0.001	0	5A	<0.1	<0.001	0
2A3	<0.1	0.005	0	5C1bv	<0.1	0.001	0
2A5a	<0.1	0.003	0	5E	0.3	0.104	0
2A5b	<0.1	0.011	0	**Total**	**100**	**30.034**	**0**

Figure 1.33 The contribution of different sources and data reported by the plants in the 2019 emissions.

2.3.7.3 Particles $PM_{2.5}$

Emission trend

The trend of $PM_{2.5}$ emissions is presented in Figure 1.34.

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

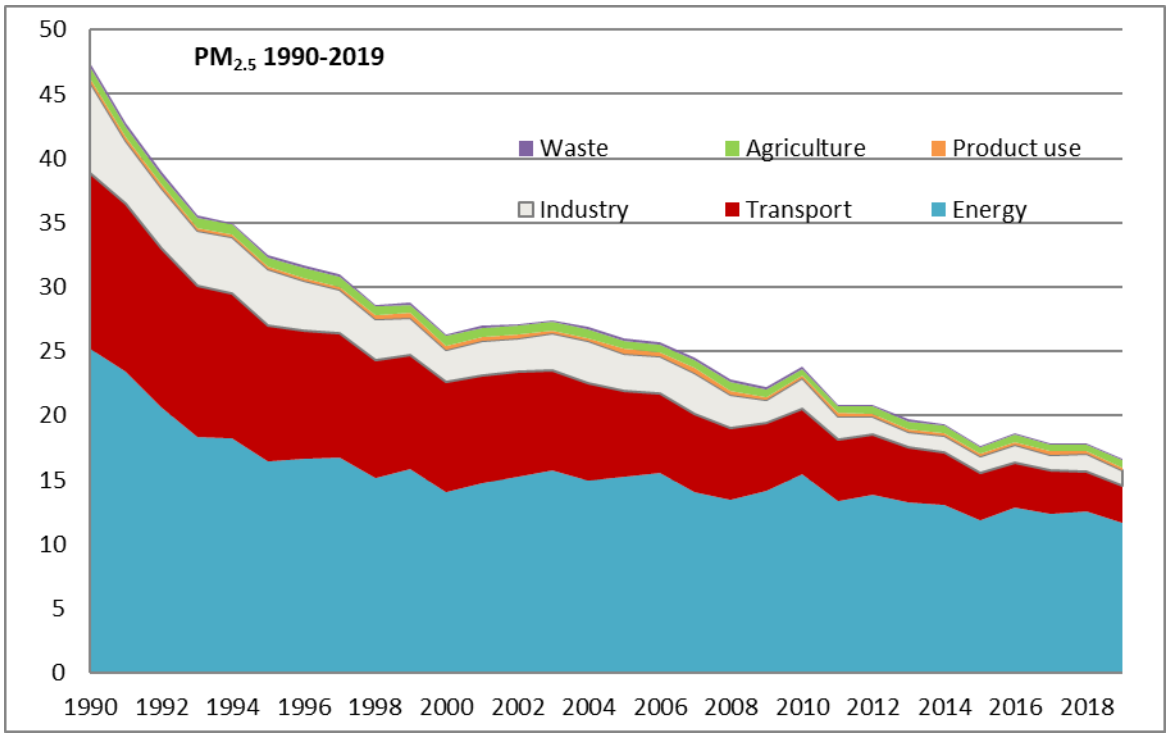
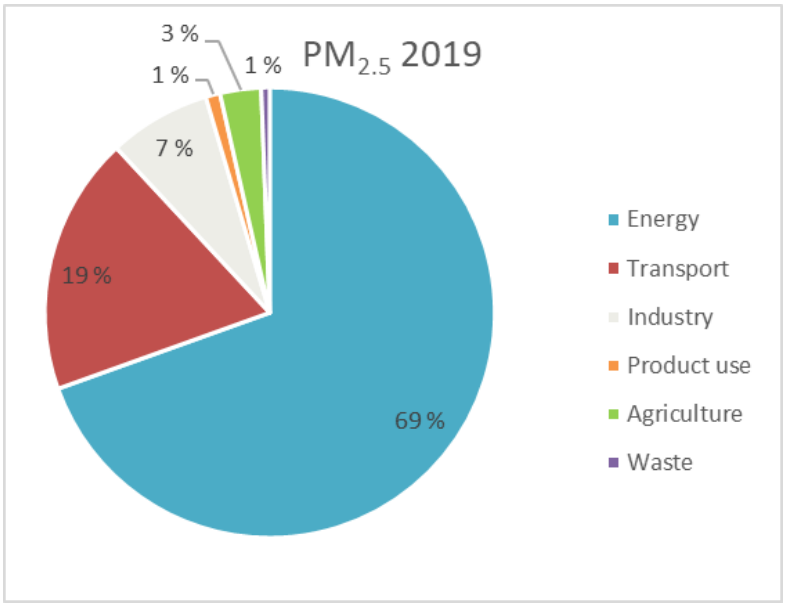


Figure 1.34. $PM_{2.5}$ emissions in 2000-2019

The uncertainties of emission data in 2019 are presented in Annex 7 of the IIR.

The contribution of different sources to $PM_{2.5}$ emissions, the spatial distribution of emissions and the shares of data reported by operators of industrial plants of total emissions are presented in in Figure 1.35.



Shares of total $PM_{2.5}$ emissions reported by the plants in 2019

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	1.7	0.277	0	2A5c	0.1	0.023	0
1A1b	<0.1	0.006	0	2B10a	1.3	0.223	0
1A2a	<0.1	0.006	0	2B10b	<0.1	0.001	0
1A2b	<0.1	0.003	0	2B6	<0.1	0.002	0
1A2c	0.1	0.019	0	2C1	1.3	0.219	0
1A2d	6.1	1.019	0	2C2	0.4	0.069	0
1A2e	<0.1	0.012	0	2C3	<0.1	<0.001	0
1A2f	0.2	0.028	0	2C7a	<0.1	<0.001	0
1A2gvii	1.9	0.308	0	2C7c	<0.1	0.005	0
1A2gviii	0.4	0.065	0	2C7d	<0.1	<0.001	0
1A3ai(i)	<0.1	0.006	0	2D3b	0.4	0.065	0
1A3aii(i)	<0.1	0.001	0	2D3d	<0.1	<0.001	0
1A3bi	1.6	0.262	0	2D3e	<0.1	<0.001	0
1A3bii	1.5	0.241	0	2D3g	<0.1	0.002	0
1A3biii	1	0.171	0	2D3i	0.3	0.042	0
1A3biv	0.1	0.024	0	2G	0.5	0.087	0
1A3bvi	3.8	0.639	0	2H1	1.3	0.21	0
1A3bvii	2.8	0.473	0	2H2	2.4	0.397	0
1A3c	0.2	0.027	0	2I	<0.1	<0.001	0
1A3dii	1.9	0.322	0	2L	<0.1	0.006	0
1A4ai	0.8	0.135	0	3B1a	0.4	0.06	0
1A4aii	0.6	0.1	0	3B1b	0.3	0.048	0
1A4bi	53.7	8.92	0	3B2	<0.1	0.001	0
1A4bii	0.8	0.134	0	3B3	<0.1	0.002	0

1A4ci	1	0.169	0	3B4d	<0.1	<0.001	0
1A4cii	1.1	0.188	0	3B4e	<0.1	0.006	0
1A4ciii	0.3	0.043	0	3B4gi	<0.1	0.01	0
1A5a	1.8	0.298	0	3B4gii	<0.1	0.01	0
1A5b	0.1	0.024	0	3B4giii	<0.1	0.003	0
1B1b	<0.1	0.003	0	3B4giv	<0.1	0.011	0
1B1c	4.1	0.674	0	3B4h	<0.1	0.011	0
1B2aiv	<0.1	0.004	0	3Dc	1.3	0.21	0
1B2av	<0.1	<0.001	0	3F	1.1	0.183	0
2A2	<0.1	<0.001	0	5A	<0.1	<0.001	0
2A3	<0.1	0.004	0	5C1bv	<0.1	0.001	0
2A5a	<0.1	<0.001	0	5E	0.6	0.104	0
2A5b	<0.1	0.003	0	**Total**	**100**	**16.622**	**0**

Figure 1.36 The contribution of different sources and data reported by the plants in the 2019 emissions.

2.3.7.4 Black carbon (BC)

Emission trend

The trend of black carbon emissions is presented in Figure 1.37.

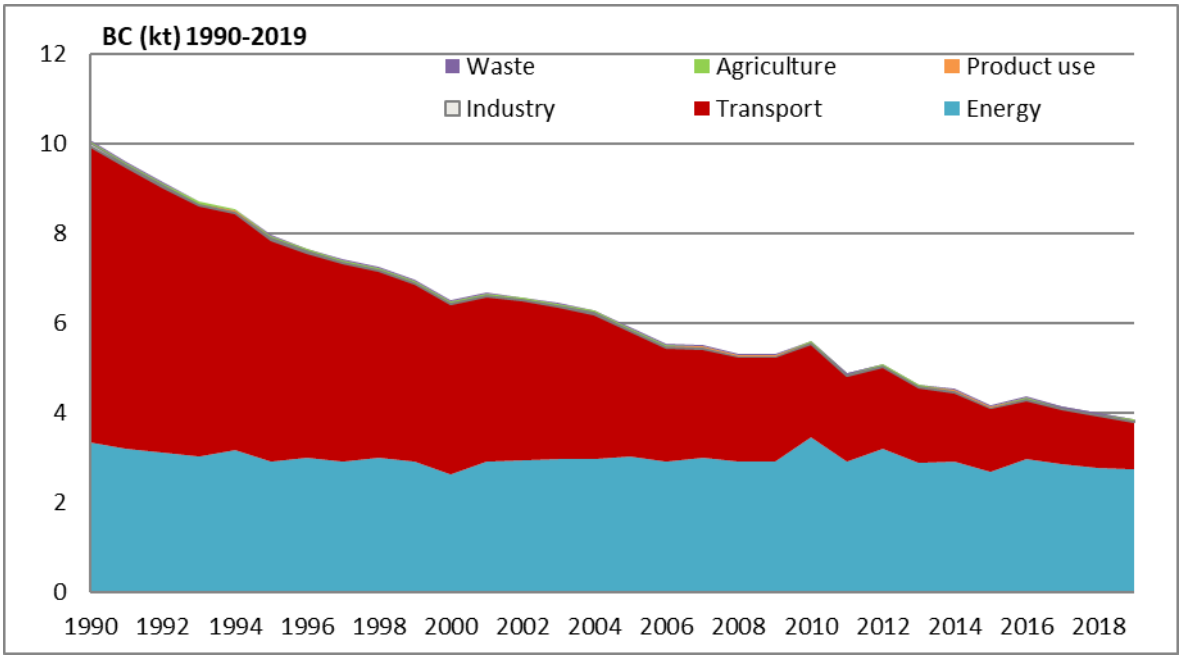
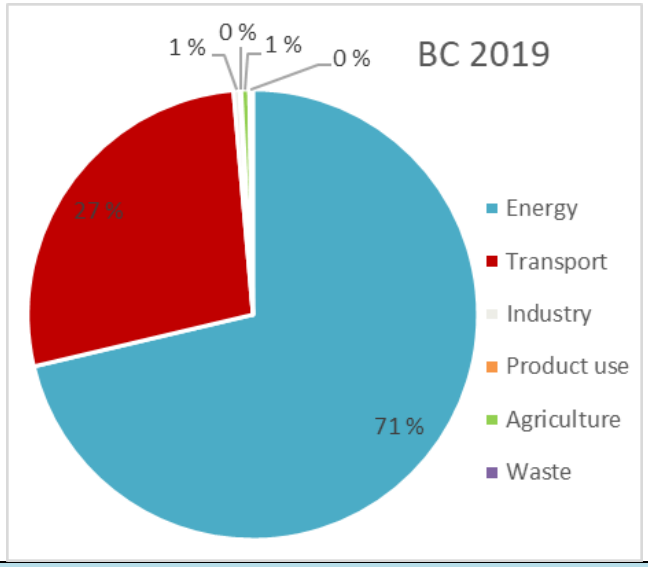


Figure 1.37. BC emissions (kt) in 2000-2019

The uncertainties of emission data in 2019 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 1.38.



Shares of total BC emissions reported by the plants in 2019							
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	0.5	0.018	0	1A4bii	0.6	0.022	0
1A1b	<0.1	<0.001	0	1A4ci	0.3	0.011	0
1A2a	<0.1	<0.001	0	1A4cii	2.2	0.085	0
1A2b	<0.1	<0.001	0	1A4ciii	0.4	0.014	0
1A2c	0.1	0.005	0	1A5a	2.2	0.085	0
1A2d	0.3	0.011	0	1A5b	0.3	0.011	0
1A2e	<0.1	0.003	0	1B1b	<0.1	<0.001	0
1A2f	<0.1	0.003	0	2A2	<0.1	<0.001	0
1A2gvii	4.9	0.187	0	2A3	<0.1	<0.001	0
1A2gviii	0.1	0.004	0	2B10a	0.1	0.004	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	3.5	0.134	0	2C2	0.2	0.007	0
1A3bii	3.4	0.133	0	2C3	<0.1	<0.001	0
1A3biii	2.3	0.09	0	2C7a	<0.1	<0.001	0
1A3biv	0.2	0.006	0	2D3b	<0.1	0.004	0
1A3bvi	4.3	0.165	0	2D3i	<0.1	<0.001	0
1A3bvii	2.4	0.093	0	2G	<0.1	<0.001	0
1A3c	0.5	0.018	0	2H1	0.1	0.005	0
1A3dii	1.6	0.061	0	3F	0.6	0.022	0
1A4ai	0.7	0.027	0	5C1bv	<0.1	<0.001	0
1A4aii	0.7	0.027	0	5E	0.2	0.009	0
1A4bi	66.9	2.576	0	**Total**	**100**	**3.848**	**0**

Figure 1.38 The contribution of different sources and data reported by the plants in the 2019 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 1990-2019 are presented in Figure 1.39.

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. Although a thorough recalculation of the time series has been carried out, there still is need to check the correct abatement techniques used especially for small boilers, currently part of these emissions are calculated as unabated. In addition, a project funded by the Nordic Council of Ministers is running in 2016-2022 to study emissions in the Nordic countries and to develop methodologies that better reflect the real emission levels.

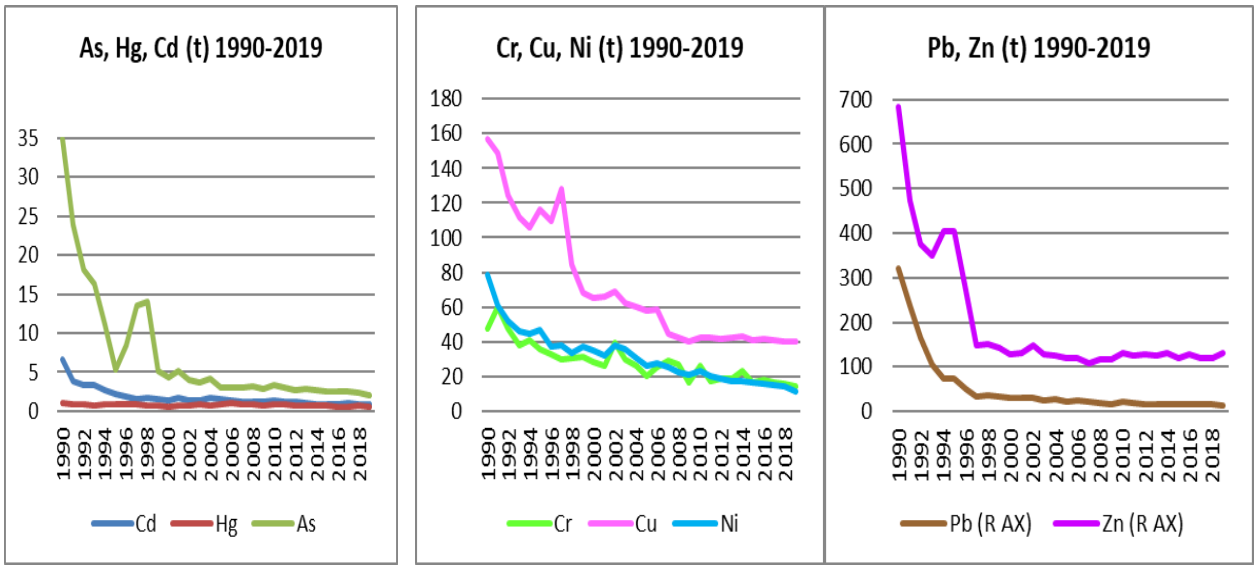


Figure 1.39. Heavy metal emission trends

The emission trends have been strongly decreasing (Figure 1.40) after the first reporting year 1990:

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.

2.3.8.1 Arsenic emissions

Emission trend

Arsenic emissions have been reduced from 35 t in 1990 to 2 t in 2019.

The main source in the beginning of the 1990's was industrial processes (mainly non-ferrous metals), where the emissions have dropped considerably. 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 1.41).

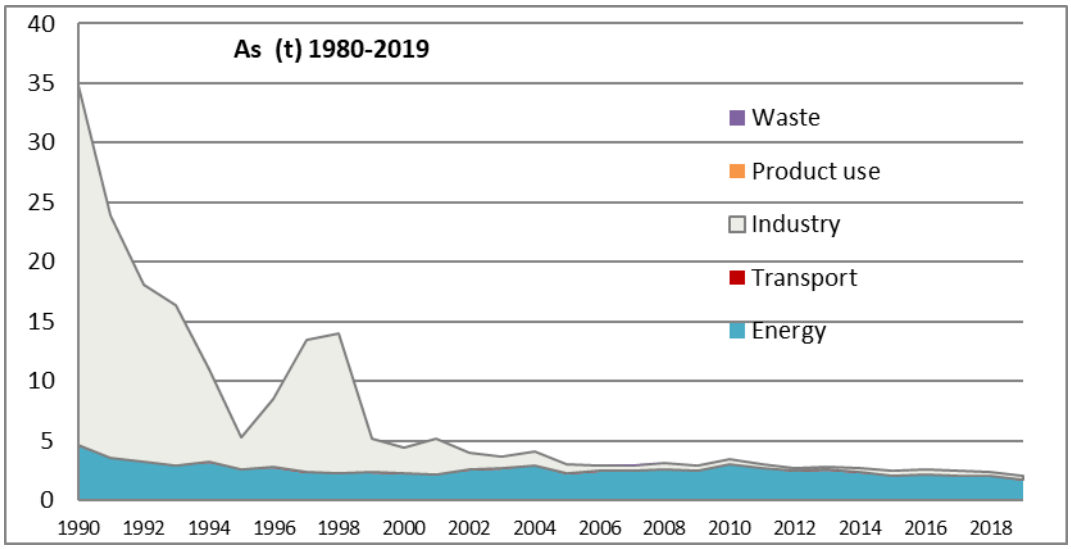
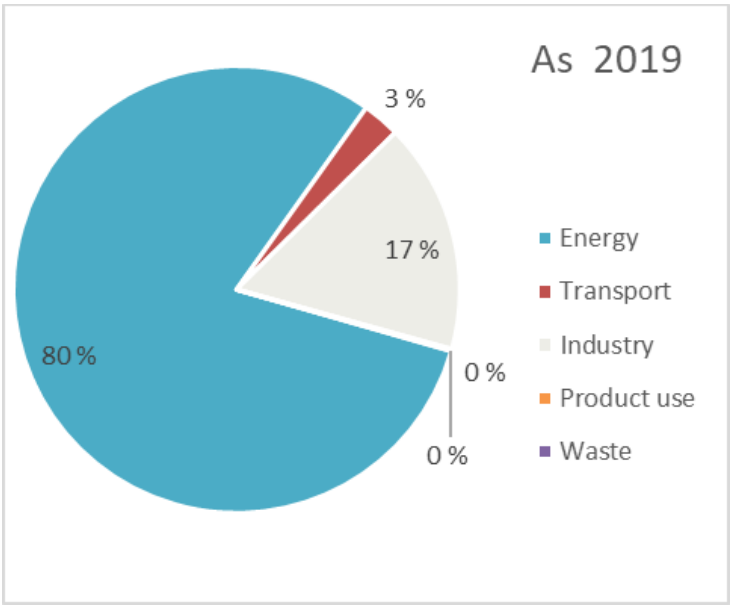


Figure 1.41. Arsenic emissions (t) in 1990-2019

The uncertainties of emission data in 2019 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	Shares of total As emissions reported by the plants in 2019						
	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	1A1a	27.5	0.567	18	1A4bi	3.1	0.065
1A1b	1A1b	23.9	0.493	0	1A4ci	8.4	0.173
1A2a	1A2a	<0.1	<0.001	98.7	1A4ciii	<0.1	0.001
1A2b	1A2b	<0.1	<0.001	0	1A5a	1.4	0.028
1A2c	1A2c	0.1	0.003	2.7	1B1b	0.1	0.002
1A2d	1A2d	6.5	0.135	9.7	2C1	2	0.042
1A2e	1A2e	2.8	0.057	11.1	2C2	<0.1	<0.001
1A2f	1A2f	5.6	0.115	2.2	2C3	<0.1	<0.001
1A2gviii	1A2gviii	0.3	0.007	26.3	2C6	0.5	0.009
1A3bi	1A3bi	<0.1	<0.001	0	2C7a	3.9	0.081
1A3bii	1A3bii	<0.1	<0.001	0	2C7c	10.3	0.212
1A3biii	1A3biii	<0.1	<0.001	0	2G	<0.1	0.002
1A3biv	1A3biv	<0.1	<0.001	0	3F	<0.1	<0.001
1A3bvi	1A3bvi	2.1	0.043	0	5C1bv	<0.1	<0.001
1A3dii	1A3dii	0.5	0.011	0	5E	<0.1	<0.001
1A4ai	1A4ai	0.7	0.014	0	**Total**	**100**	**2.065**

Figure 1.42(a) The contribution of different sources and data reported by the plants in the 2019 emissions.

2.3.8.2 Cadmium emissions

Emission trend

Cadmium emissions have been reduced from 7 t in 1990 to 0.8 t in 2019.

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 1.43).

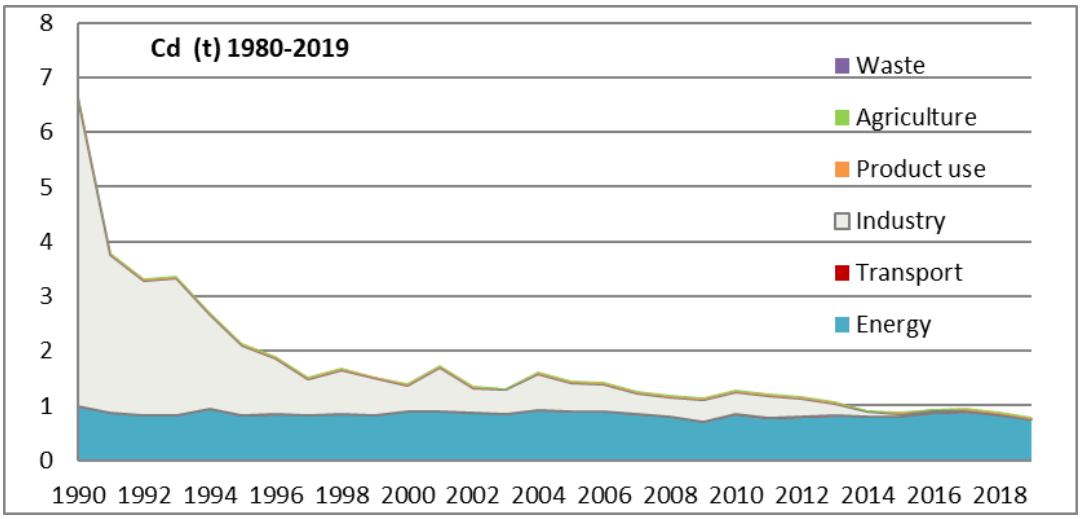
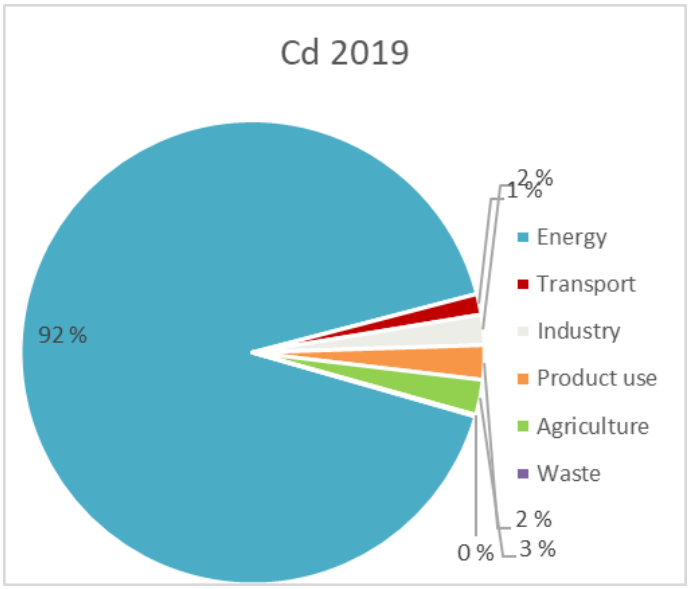


Figure 1.43. Emissions of cadmium (t) in 1990-2019.

The uncertainties of emission data in 2019 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 1.44.



Shares of total Cd emissions reported by the plants in 2019							
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	16.2	0.129	23.6	1A4aii	0.1	0.001	0
1A1b	8.6	0.068	0	1A4bi	19.5	0.155	0
1A2a	<0.1	<0.001	68.7	1A4bii	<0.1	<0.001	0
1A2b	<0.1	<0.001	0	1A4ci	3.4	0.027	0
1A2c	<0.1	<0.001	2.3	1A4cii	0.3	0.002	0
1A2d	23.5	0.187	3.7	1A4ciii	<0.1	<0.001	0
1A2e	0.4	0.003	6.2	1A5a	14.1	0.112	0
1A2f	2	0.016	2.4	1B1b	<0.1	<0.001	100
1A2gvii	0.4	0.004	0	2C1	0.5	0.004	100
1A2gviii	2.4	0.019	1.7	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	0.011	100
1A3biii	<0.1	<0.001	0	2C7a	<0.1	<0.001	100
1A3biv	<0.1	<0.001	0	2C7c	0.2	0.002	100
1A3bvi	0.2	0.002	0	2G	2.4	0.019	0
1A3c	<0.1	<0.001	0	3F	2.5	0.02	0
1A3dii	0.1	0.001	0	5C1bv	<0.1	<0.001	0
1A4ai	1.3	0.01	0	5E	<0.1	<0.001	0
				Total	**100**	**0.794**	**7**

Figure 1.44 (a) The contribution of different sources and data reported by the plants in the 2019 emissions.

2.3.8.3 Chromium emissions

Emission trend

Chromium emissions have been reduced from 48 t in 1990 to 14 t in 2019.

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 1.45).

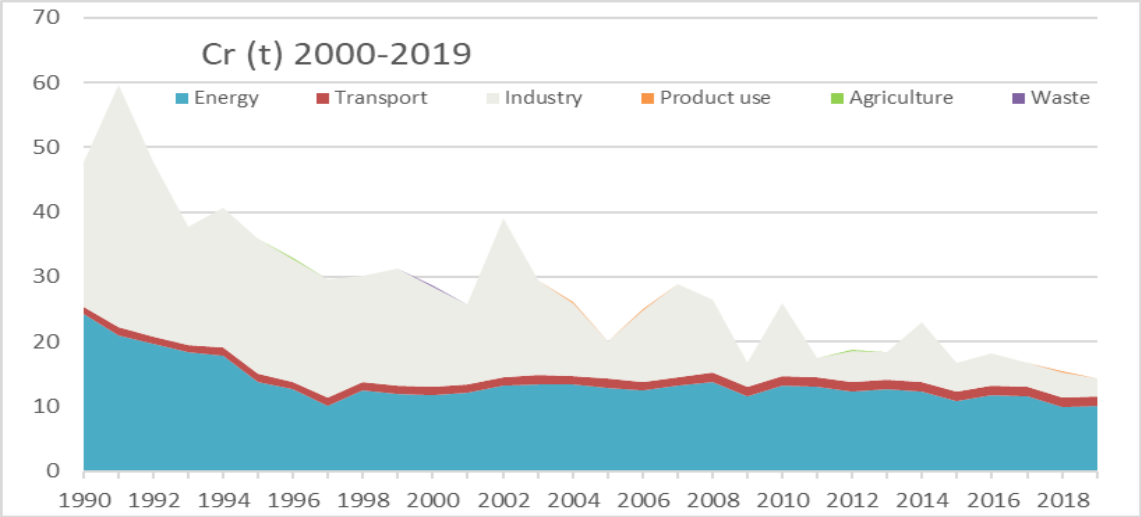
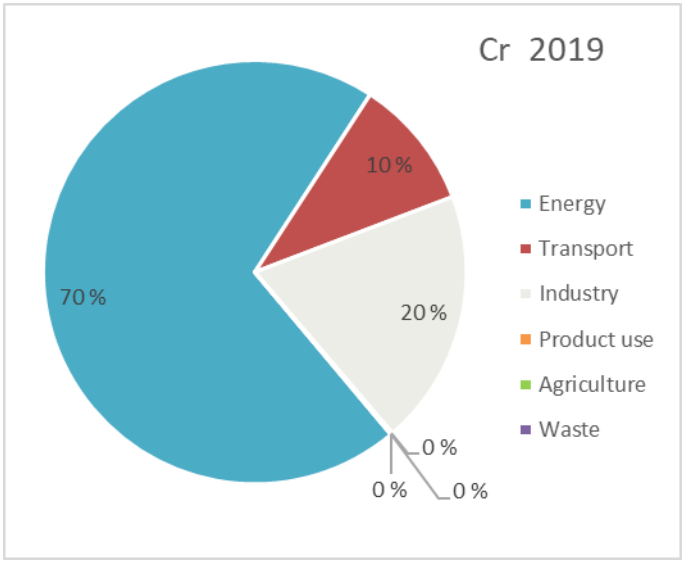


Figure 1.45. Emissions of chromium (t) in 1990-2019.

The uncertainties of emission data in 2019 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 1.46.



Shares of total Cr emissions reported by the plants in 2019							
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	10.6	1.508	17	1A4ai	0.9	0.127	0
1A1b	26.6	3.793	0	1A4aii	<0.1	0.005	0
1A2a	<0.1	<0.001	52	1A4bi	12.8	1.83	0
1A2b	1.3	0.188	0	1A4bii	<0.1	0.003	0
1A2c	<0.1	0.006	1.8	1A4ci	3.7	0.53	0
1A2d	1.1	0.163	46.4	1A4cii	<0.1	0.012	0
1A2e	0.8	0.112	3.6	1A4ciii	<0.1	0.002	0
1A2f	6.1	0.877	1.2	1A5a	5.5	0.779	0
1A2gvii	0.1	0.018	0	1B1b	<0.1	0.001	100
1A2gviii	0.9	0.127	3.6	2C1	16.1	2.297	100
1A3bi	0.1	0.015	0	2C2	3.4	0.487	100
1A3bii	<0.1	0.003	0	2C7a	<0.1	<0.001	100
1A3biii	<0.1	0.012	0	2C7c	<0.1	0.005	100
1A3biv	<0.1	<0.001	0	2G	0.1	0.018	0
1A3bvi	9.5	1.351	0	3F	<0.1	0.003	0
1A3c	<0.1	0.001	0	5C1bv	<0.1	<0.001	0
1A3dii	<0.1	0.013	0	5E	<0.1	<0.001	0
				Total	**100**	**14.286**	**22**

Figure 1.46 (a) The contribution of different sources and data reported by the plants in the 2019 emissions.

2.3.8.4 Copper emissions

Emission trend

Copper emissions have been reduced from 157 t in 1990 to 40 t in 2019.

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 (see Chapter x).

Emissions from the industry sector have been decreased due to improvements in processes and abatement technology.

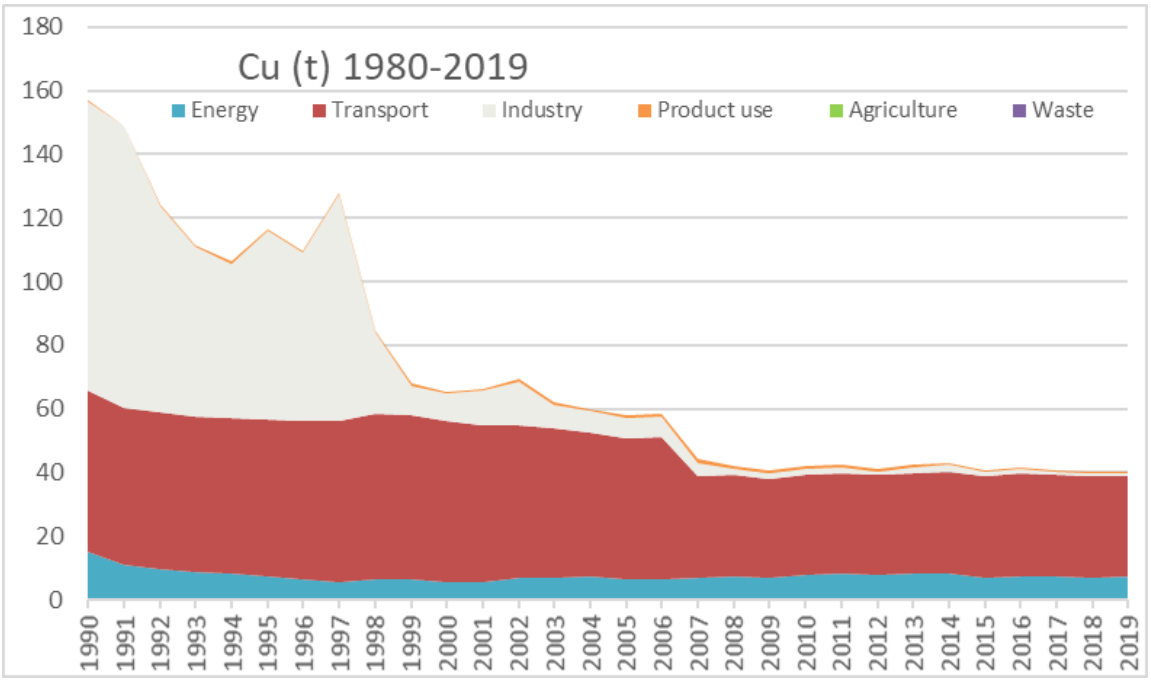
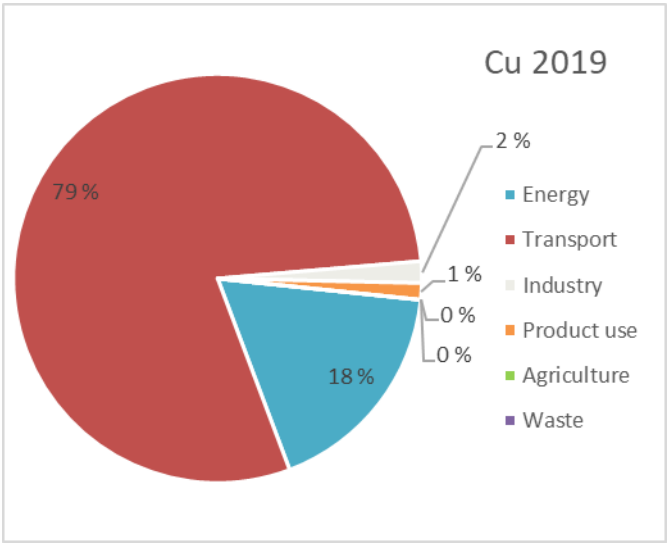


Figure 1.47. Emissions of copper (t) 1990-2019.

The uncertainties of emission data in 2019 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 1.48.



Shares of total Cu emissions reported by the plants in 2019							
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	2.518	16.5	1A4aii	0.4	0.177	0
1A1b	3.3	1.328	0	1A4bi	0.9	0.345	0
1A2a	<0.1	0.001	65.3	1A4bii	0.2	0.1	0
1A2b	<0.1	<0.001	0	1A4ci	1.2	0.492	0
1A2c	<0.1	0.005	2.6	1A4cii	1	0.418	0

1A2d	1.2	0.479	75.2	1A4ciii	<0.1	0.029	0
1A2e	0.4	0.148	2.3	1A5a	2.9	1.147	0
1A2f	0.9	0.367	17	1B1b	<0.1	0.004	100
1A2gvii	1.5	0.606	0	2B10a	<0.1	<0.001	100
1A2gviii	0.5	0.19	2.1	2C1	1	0.409	100
1A3bi	<0.1	0.01	0	2C2	<0.1	0.018	100
1A3bii	<0.1	0.002	0	2C6	<0.1	0.014	100
1A3biii	<0.1	0.008	0	2C7a	<0.1	<0.001	100
1A3biv	<0.1	<0.001	0	2C7c	0.6	0.246	100
1A3bvi	75.7	30.415	0	2G	1.3	0.522	0
1A3c	<0.1	0.036	0	3F	<0.1	0.001	0
1A3dii	0.2	0.088	0	5C1bv	<0.1	<0.001	0
1A4ai	0.1	0.045	0	5E	<0.1	0.002	0
				Total	**100**	**40.171**	**3.8**

Figure 1.48(a) The contribution of different sources and data reported by the plants in the 2017 emissions.

2.3.8.5 Lead emissions

Emission trend

Lead emissions have been reduced from 321 t in 1990 to 12 t in 2019.

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 1.49

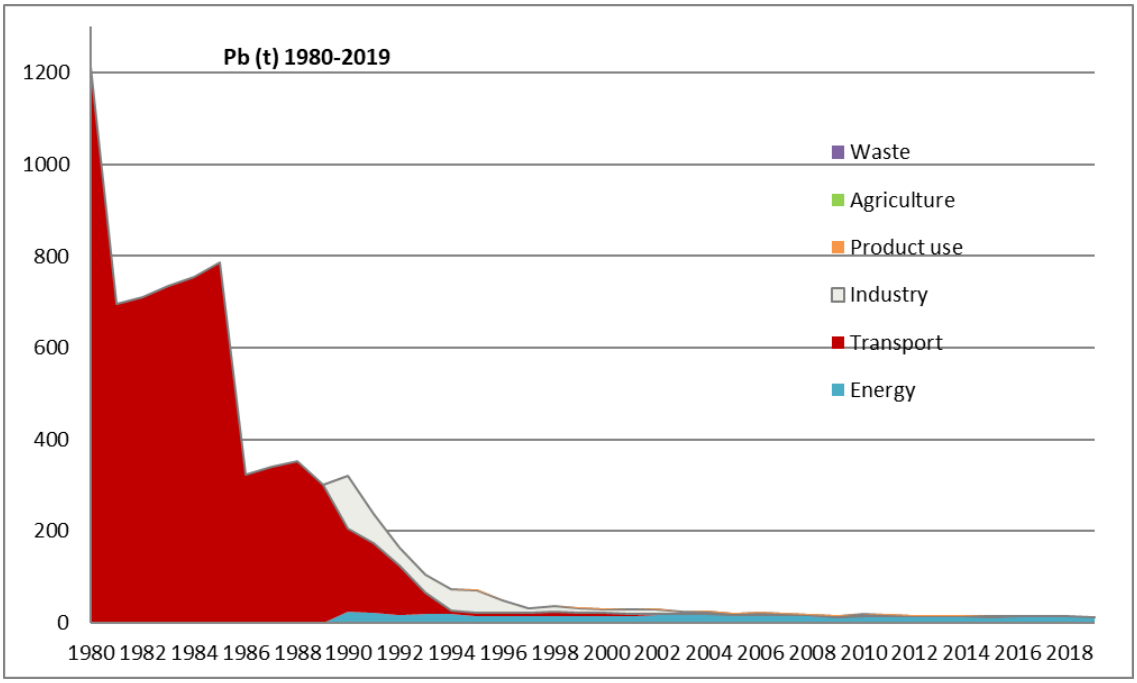
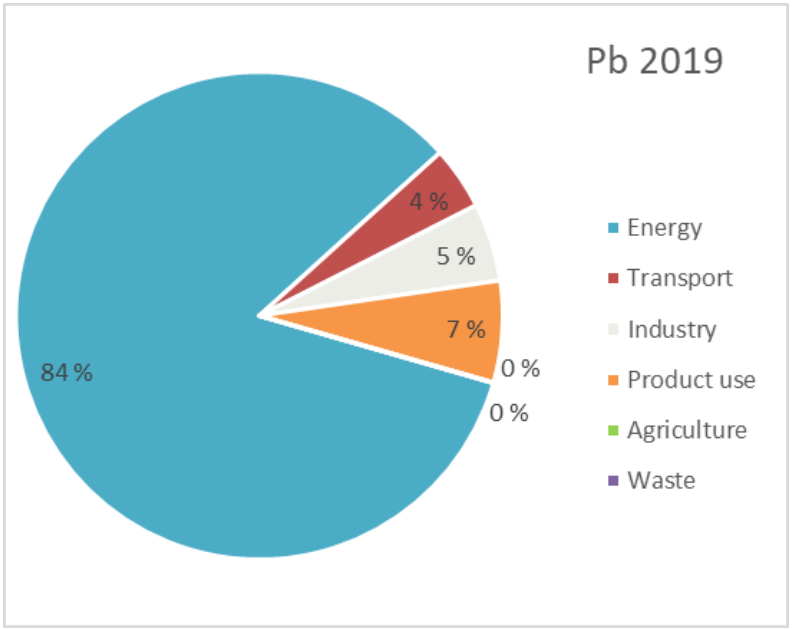
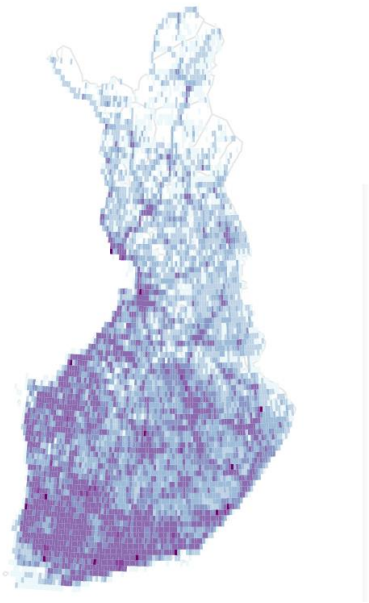


Figure 1.49. Pb emissions (Mg) in 1980-2019.

The uncertainties of emission data in 2019 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 1.50.





Shares of total Pb emissions reported by the plants in 2019							
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	14.8	1.963	19.5	1A4bi	4.1	0.547	0
1A1b	22.7	2.997	0	1A4ci	3.2	0.425	0
1A2a	<0.1	0.01	95.5	1A4ciii	<0.1	0.004	0
1A2b	<0.1	<0.001	0	1A5a	8.1	1.069	0
1A2c	0.2	0.029	0.4	1B1b	<0.1	0.004	100
1A2d	22.3	2.944	6.2	2B10a	<0.1	0.001	0
1A2e	1	0.133	3.5	2C1	3	0.395	100
1A2f	5.4	0.712	3.2	2C2	<0.1	0.01	100
1A2gviii	1.3	0.17	2.4	2C3	<0.1	<0.001	100
1A3aii(i)	0.4	0.048	0	2C6	<0.1	0.013	100
1A3bi	<0.1	0.002	0	2C7a	<0.1	0.002	7.3
1A3bii	<0.1	<0.001	0	2C7c	2	0.263	100
1A3biii	<0.1	<0.001	0	2G	6.7	0.891	0
1A3biv	<0.1	<0.001	0	3F	<0.1	0.002	0
1A3bvi	3.7	0.485	0	5C1bv	<0.1	<0.001	0
1A3dii	<0.1	0.013	0	5E	<0.1	<0.001	0
1A4ai	0.7	0.086	0	**Total**	**100**	**13.22**	**9.8**

Figure 1.50 The contribution of different sources and data reported by the plants in the 2019 emissions.

2.3.8.6 Mercury emissions

Emission trend

Mercury emissions have been reduced from 1 t in 1990 to 0.6 t in 2019.

The emissions are fluctuating annually depending on changes in the annual energy production structure and fluctuations in the industrial production volumes.

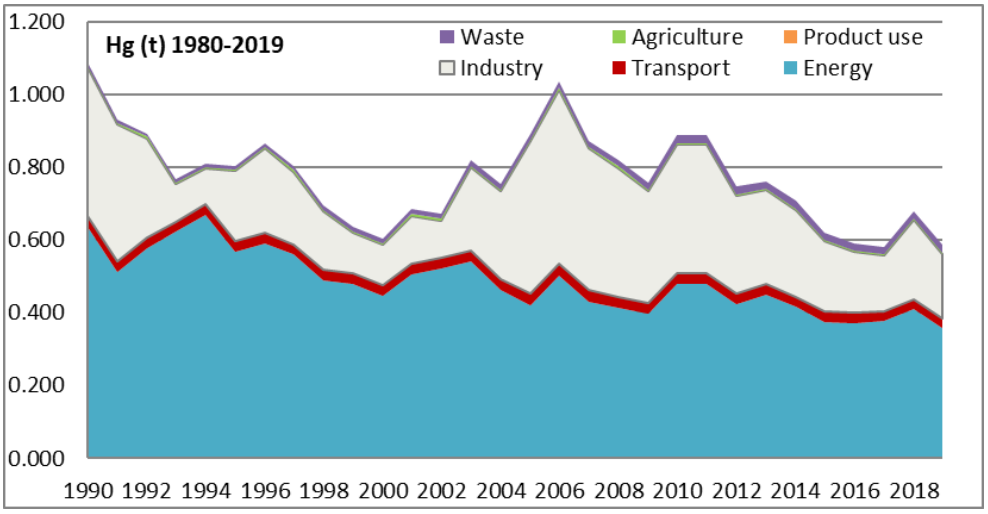
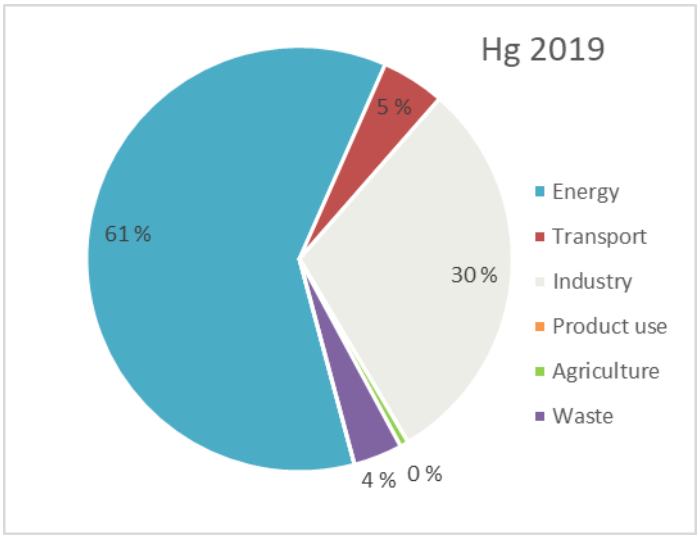


Figure 1.51. The emissions of mercury (t) in 1990-2019.

The uncertainties of emission data in 2019 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 1.52.



Shares of total Hg emissions reported by the plants in 2019							
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	26	0.153	62.6	1A4bi	4.5	0.026	0
1A1b	2.4	0.014	0	1A4ci	1.5	0.009	0
1A2a	<0.1	<0.001	0	1A4ciii	0.2	<0.001	0
1A2b	<0.1	<0.001	0	1A5a	1.9	0.011	0
1A2c	<0.1	<0.001	54.3	1B1b	<0.1	<0.001	0
1A2d	16.4	0.096	25.8	2B10a	6	0.035	1.1
1A2e	0.5	0.003	36.1	2C1	22.4	0.131	100
1A2f	5.8	0.034	90.5	2C2	0.3	0.002	100
1A2gviii	1.3	0.008	50.7	2C6	0.3	0.002	100
1A3bi	2.6	0.015	0	2C7a	<0.1	<0.001	0
1A3bii	0.3	0.002	0	2C7c	1.1	0.006	100
1A3biii	1.3	0.007	0	2G	<0.1	<0.001	0
1A3biv	<0.1	<0.001	0	3F	0.6	0.004	0
1A3dii	0.5	0.003	0	5C1bv	3.6	0.021	0
1A4ai	0.3	0.002	0	5E	0.1	<0.001	0
				Total	**100**	**0.587**	**50.8**

Figure 1.52 The contribution of different sources and data reported by the plants in the 2019 emissions.

2.3.8.7 Nickel emissions

Emission trend

Nickel emissions have been reduced from 78 t in 1990 to 12 t in 2019.

The emission trend is decreasing (Figure 1.53) and the emissions are fluctuating annually depending on the consumption of fossil fuels and production rates in the manufacturing industries (mainly non-ferrous metals).

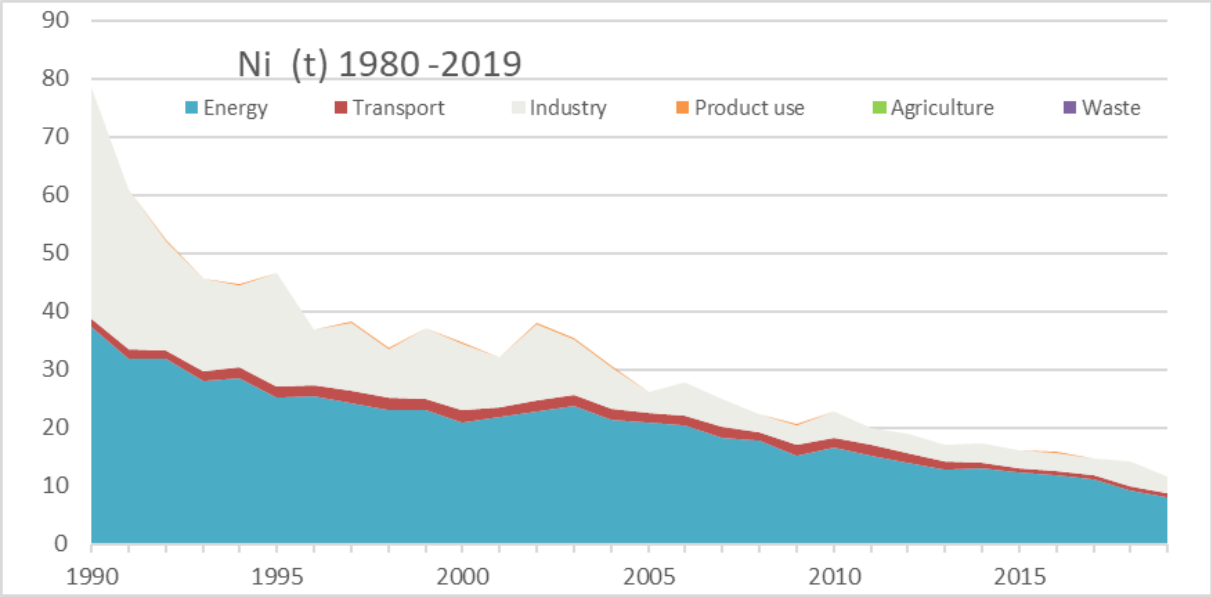
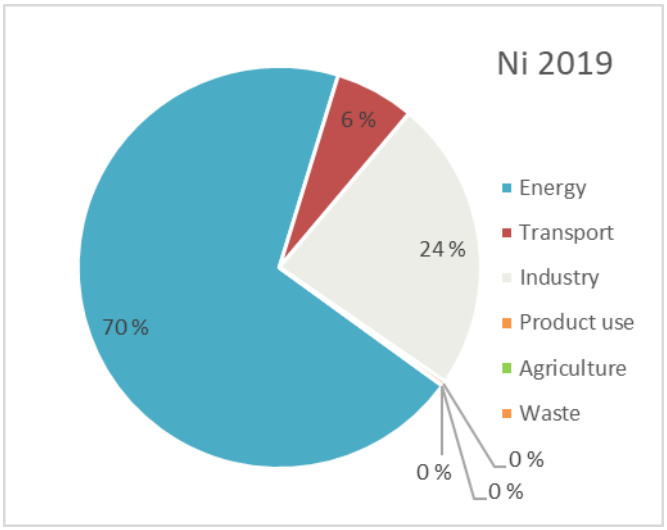


Figure 1.53. Nickel emissions (t) in 1990-2019.

The uncertainties of emission data in 2019 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 1.54.



Shares of total Ni emissions reported by the plants in 2019							
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	15.8	1.824	24	1A4aii	<0.1	0.007	0
1A1b	0.2	0.019	36.5	1A4bi	13.7	1.583	0
1A2a	1	0.116	99.7	1A4bii	<0.1	0.004	0
1A2b	0.3	0.034	0	1A4ci	5.2	0.598	0
1A2c	2.7	0.308	0.4	1A4cii	0.1	0.017	0
1A2d	3	0.346	26.3	1A4ciii	0.3	0.033	0
1A2e	1.7	0.196	11	1A5a	13.2	1.52	0
1A2f	6.5	0.749	1.5	1B1b	<0.1	0.009	100
1A2gvii	0.2	0.025	0	2B10a	1.5	0.177	100
1A2gviii	1.6	0.186	2.7	2C1	6.9	0.795	100
1A3bi	<0.1	0.003	0	2C2	0.2	0.027	100
1A3bii	<0.1	<0.001	0	2C7a	<0.1	<0.001	0
1A3biii	<0.1	<0.001	0	2C7b	14.7	1.691	100
1A3biv	<0.1	<0.001	0	2C7c	0.2	0.02	100
1A3bvi	1.7	0.194	0	2G	0.4	0.043	0
1A3c	<0.1	0.001	0	3F	<0.1	0.001	0
1A3dii	3.9	0.454	0	5C1bv	<0.1	<0.001	0
1A4ai	4.9	0.56	0	**Total**	**100**	**11.541**	**29.5**

Figure 1.54 The contribution of different sources and data reported by the plants in the 2019 emissions

2.3.8.8 Zinc emissions

Emission trend

Zinc emissions have been reduced from 682 t in 1990 to 130 t in 2019.

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.

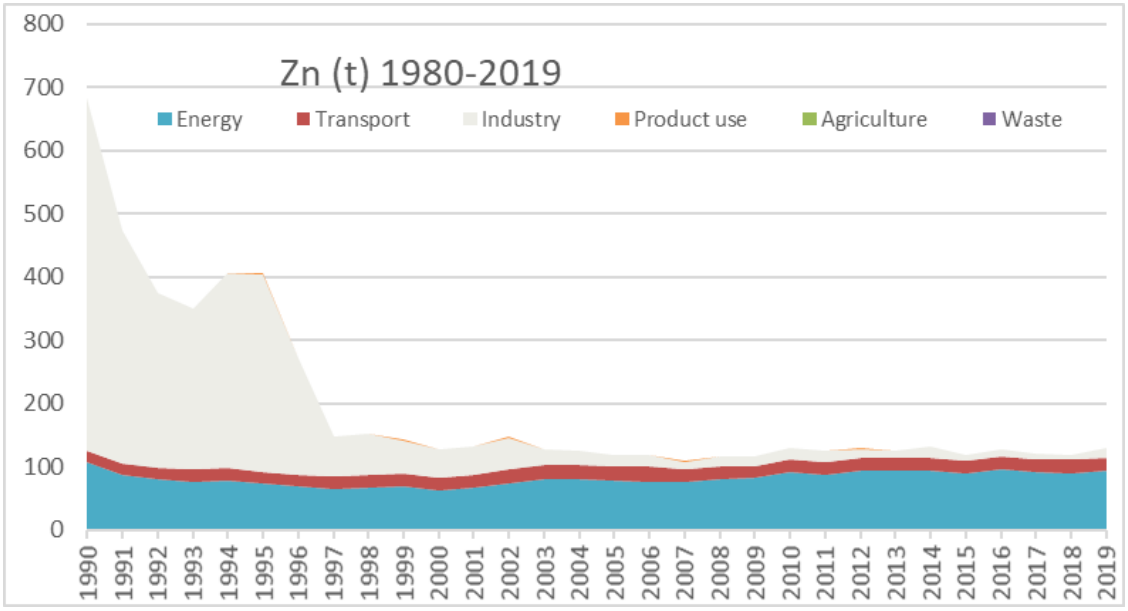
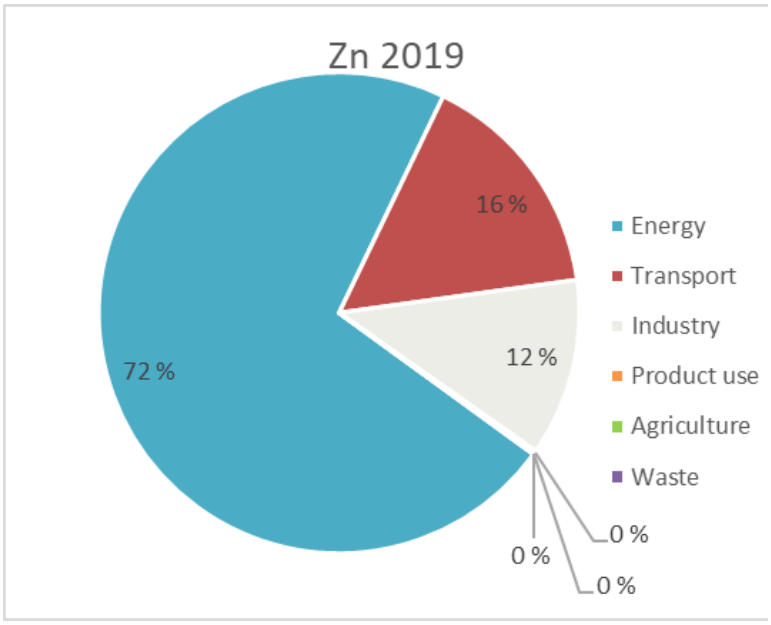


Figure 1.55. Emissions of zinc (t) in 1990-2019

The uncertainties of emission data in 2019 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 1.56



Shares of total Zn emissions reported by the plants in 2019							
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	14.9	19.408	9.2	1A4aii	<0.1	0.104	0
1A1b	4.4	5.69	0	1A4bi	27.7	36.108	0
1A2a	<0.1	0.012	39.8	1A4bii	<0.1	0.059	0
1A2b	<0.1	<0.001	0	1A4ci	4.3	5.561	0
1A2c	<0.1	0.026	3.2	1A4cii	0.2	0.246	0
1A2d	2.1	2.717	25.9	1A4ciii	<0.1	0.039	0
1A2e	0.3	0.405	16.7	1A5a	11.9	15.565	0
1A2f	2.7	3.51	0	1B1b	<0.1	0.012	100
1A2gvii	0.3	0.356	0	2B10a	0.2	0.25	0
1A2gviii	2.1	2.718	0	2C1	1.2	1.504	100
1A3bi	<0.1	0.056	0	2C2	0.4	0.489	100
1A3bii	<0.1	0.006	0	2C3	<0.1	0.089	100
1A3biii	<0.1	0.025	0	2C6	9.5	12.393	100
1A3biv	<0.1	0.001	0	2C7a	<0.1	<0.001	100
1A3bvi	14.9	19.382	0	2C7c	0.6	0.836	100
1A3c	<0.1	0.021	0	2G	0.2	0.304	0
1A3dii	<0.1	0.114	0	3F	<0.1	0.016	0
1A4ai	1.7	2.276	0	5C1bv	<0.1	0.005	0
				Total	**100**	**130.305**	**13.7**

Figure 1.56 The contribution of different sources and data reported by the plants in the 2019 emissions.

2.3.9 Persistent organic pollutants

The time series of PCDD/F, PAH-4, HCB and PCBs are presented in Figure 1.57.

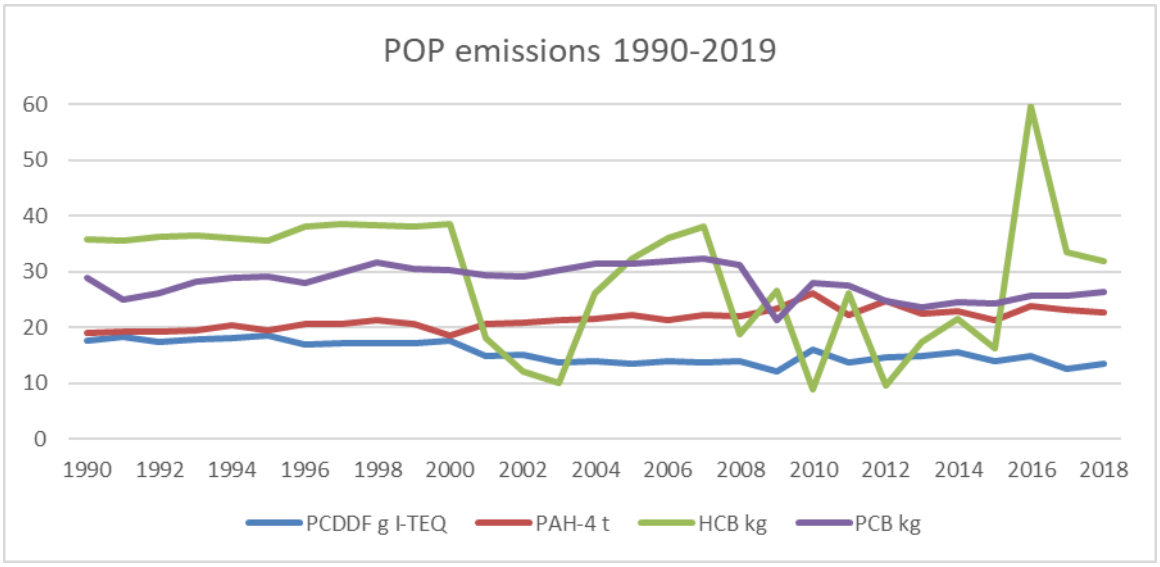


Figure 1.57 POP emissions (PCDD/F (gI-Teq), PAH-4 (t), HCB (kg) and PCB (kg)) emissions 1990–2019.

2.3.9.1 Polychlorinated dioxins and furanes, PCDD/F

Emission trend

PCDD/F emissions have been reduced from the level of 18 g I-Teq in 1990 to 12 g I-Teq in 2019.

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 1.59.

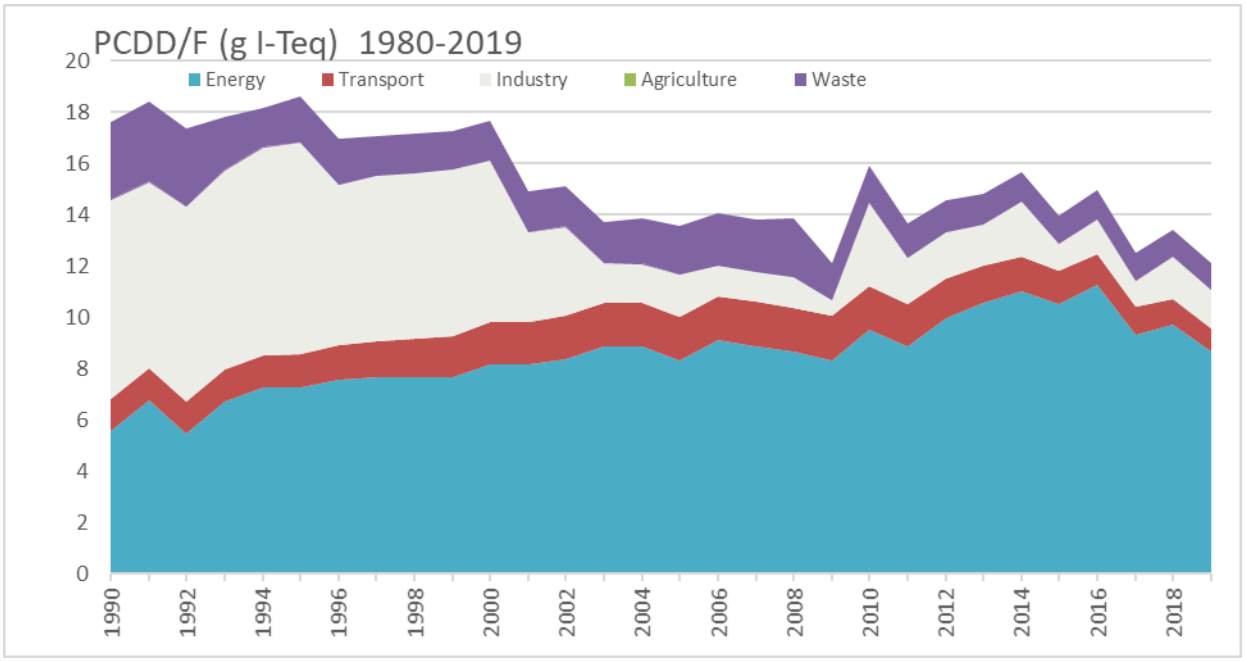
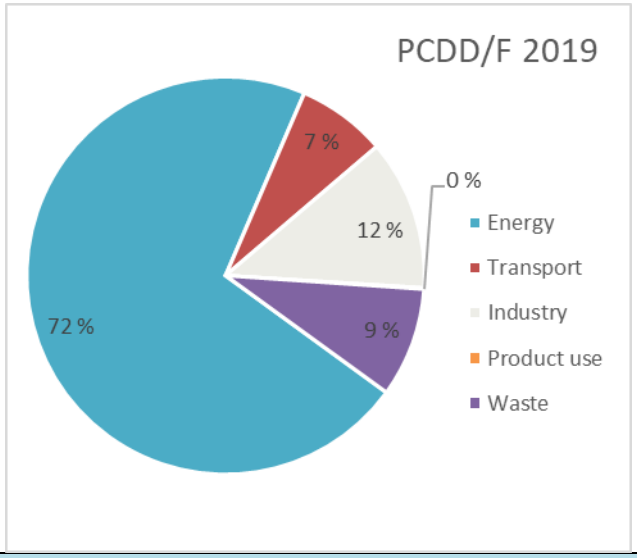


Figure 1.59. Emissions of PCDD/F (g I-Teq) in 1990-2019.



Shares of total PCDD/F emissions reported by the plants in 2019

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	26.2	3.173	14.2	1A4ci	1.5	0.184	0
1A1b	0.3	0.041	0	1A4ciii	<0.1	0.004	0
1A2a	<0.1	0.007	0	1A5a	3.9	0.475	0
1A2b	<0.1	0.001	0	1B1b	20.7	2.509	0
1A2c	<0.1	0.008	0	2A1	0.3	0.04	100
1A2d	7.2	0.879	29.9	2A2	1.1	0.129	0
1A2e	0.2	0.024	0	2A3	<0.1	<0.001	0
1A2f	0.1	0.017	46.7	2C1	8.9	1.076	100
1A2gviii	1.6	0.191	7.7	2C3	<0.1	<0.001	0
1A3bi	4.6	0.563	0	2C6	0.2	0.029	0
1A3bii	1.5	0.183	0	2C7a	1.7	0.2	0
1A3biii	0.8	0.093	0	2D3b	<0.1	0.012	0
1A3biv	0.2	0.023	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	5C1bv	<0.1	<0.001	0
1A4ai	0.6	0.074	0	5E	8.9	1.08	0
1A4bi	9	1.09	0	**Total**	**100**	**12.132**	**15.3**

Figure 1.60 The contribution of different sources and data reported by the plants in the 2019 emissions.

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

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 as well as separately for the individual indicator substances.

The inventory of PAH indicator species was completed for all sources to the 2021 submission as requested by the NECD ERT in 2020. The level of PAH-4 emissions has increased substantially since the last submission due to the revision of the emission factors for small scale combustion (explained in detail under the Energy sector).

Emission trend

PAH-4 emissions have increased from the level of 20 kt in 1990 to 22 kt in 2019. However, the emission trend is already decreasing and the emissions will be under the 1990 level in 2022 (2024 submission) as explained in detail under the Energy sector (NFR 1A4bi) and under Chapter 2.1.4 in Part 1A General of the IIR (page 65).

PAH-4 emissions time-series is presented in Figure 1.62.

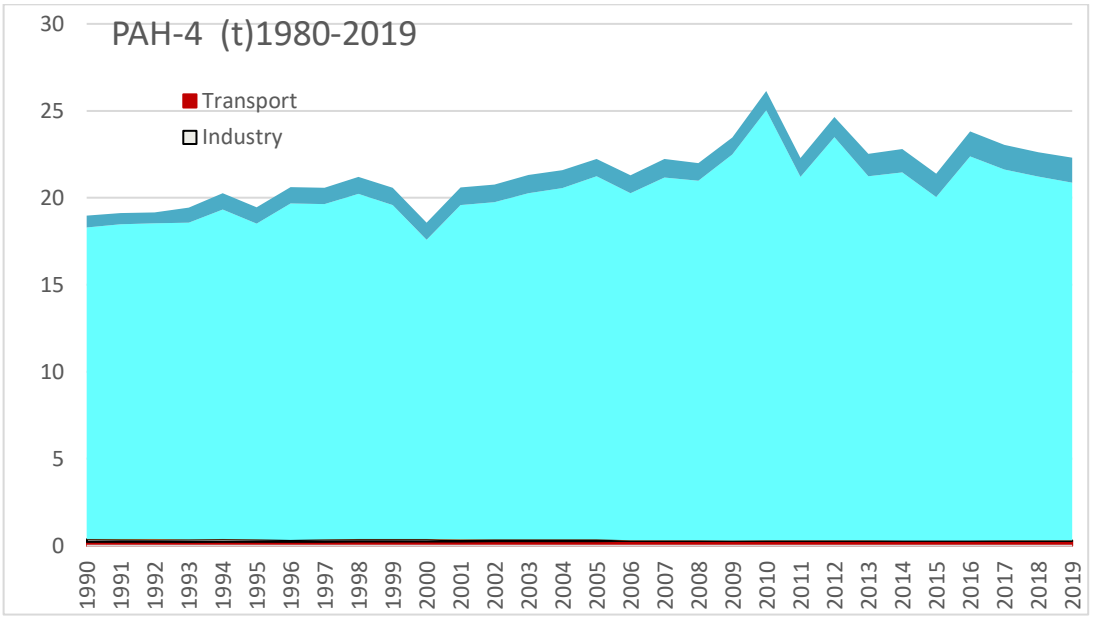
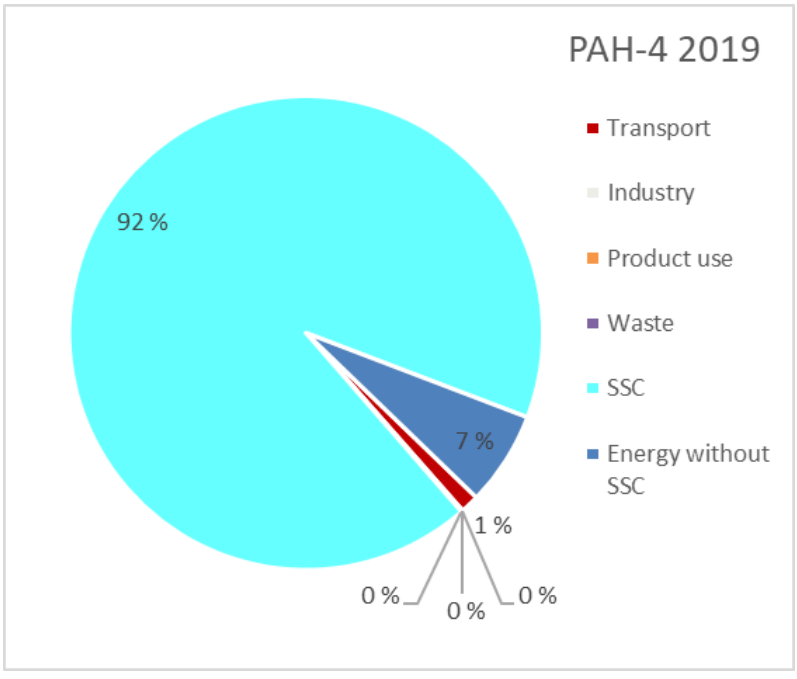


Figure 1.62. The emissions of PAH-4 (Mg) in 1990-2019 SSC stands for small scale wood combustion.

The uncertainties of emission data in 2019 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 1.63.



Shares of total PAH-4 emissions reported by the plants in 2019							
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	2.5	0.547	36.8	1A4ai	0.1	0.031	0
1A1b	<0.1	0.007	0	1A4aii	<0.1	0.008	0
1A2a	<0.1	0.001	0	1A4bi	92	20.519	0
1A2b	<0.1	0.002	0	1A4bii	<0.1	0.005	0
1A2c	<0.1	0.004	1	1A4ci	<0.1	0.014	0
1A2d	0.9	0.205	37	1A4cii	<0.1	0.02	0
1A2e	<0.1	0.003	0	1A5a	0.4	0.08	0
1A2f	<0.1	0.006	0	1B1b	2	0.443	0
1A2gvii	0.1	0.029	0	2A1	<0.1	<0.001	0
1A2gviii	0.6	0.136	0	2C1	<0.1	0.009	0
1A3bi	0.4	0.093	0	2C2	<0.1	<0.001	0
1A3bii	<0.1	0.018	0	2D3i	<0.1	0.016	0
1A3biii	0.5	0.109	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**	**22.309**	**1.2**

Figure 1.62 The contribution of different sources and data reported by the plants in the 2019 emissions.

2.3.9.3 Hexachlorobenzene, HCB

Emission trend

HCB emissions have been reduced from the 1990 level of 36 kt to 23 kt in 2019.

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 1.64).

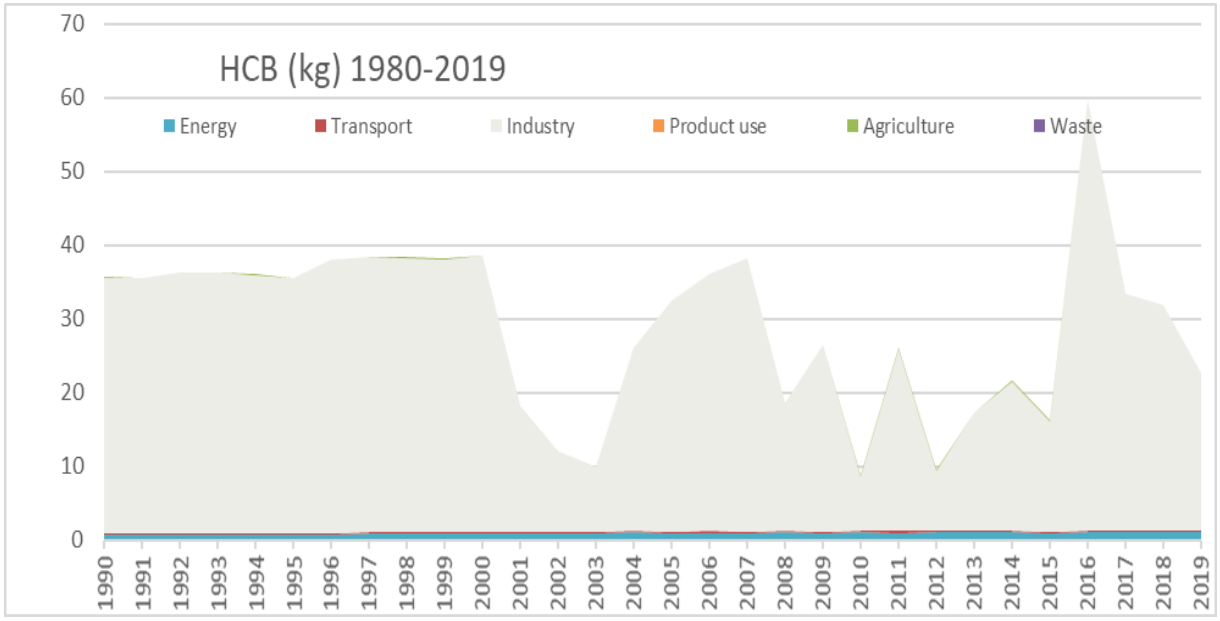
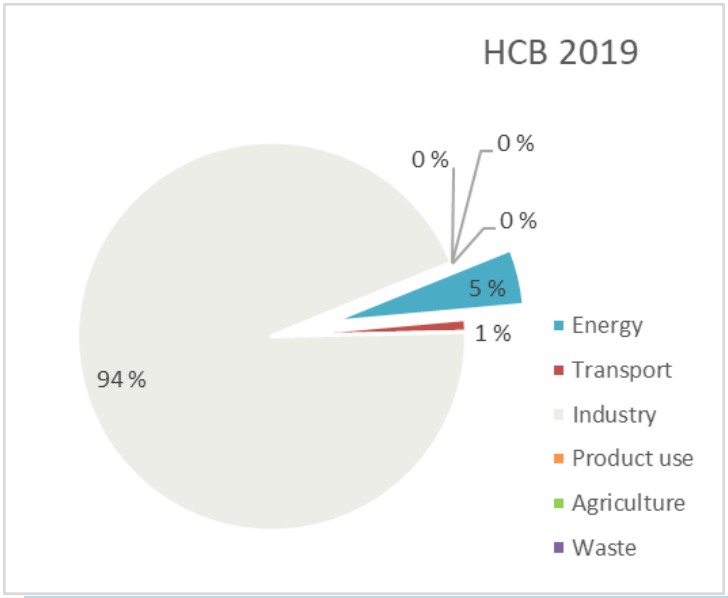
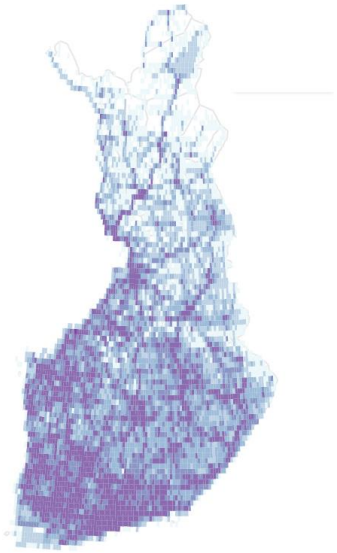


Figure 1.64. Emissions of HCB (kg) in 1990-2019

The uncertainties of emission data in 2019 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 1.65.





Shares of total HCB emissions reported by the plants in 2019							
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	2	0.444	0	1A4ai	<0.1	0.016	0
1A2a	<0.1	<0.001	0	1A4bi	1.1	0.258	0
1A2b	<0.1	<0.001	0	1A4ci	0.2	0.036	0
1A2c	<0.1	<0.001	0	1A4ciii	<0.1	0.003	0
1A2d	0.6	0.135	0	1A5a	0.1	0.023	0
1A2e	<0.1	0.002	0	2B10a	68.3	15.45	100
1A2f	<0.1	0.002	0	2C1	<0.1	0.016	0
1A2gviii	0.6	0.144	0	2C3	0.1	0.033	0
1A3bi	0.5	0.123	0	2C7a	25.7	5.821	0
1A3bii	<0.1	0.019	0	2D3i	<0.1	0.001	0
1A3biii	0.4	0.084	0	3Df	<0.1	0.011	0
1A3biv	<0.1	0.002	0	5C1bv	<0.1	0.005	0
1A3dii	<0.1	0.008	0	**Total**	**100**	**22.637**	**68.3**

Figure 1.65 The contribution of different sources and data reported by the plants in the 2019 emissions.

2.3.9.4 Polychlorinated biphenyls, PCBs

Emission trend

Emissions of PCBs have been reduced from the level of 29 kt in 1990 to 22 kt in 2019.

The PCB emission trend (Figure 1.66) is fluctuating mainly due to changes in emission levels in the IPPU sector.

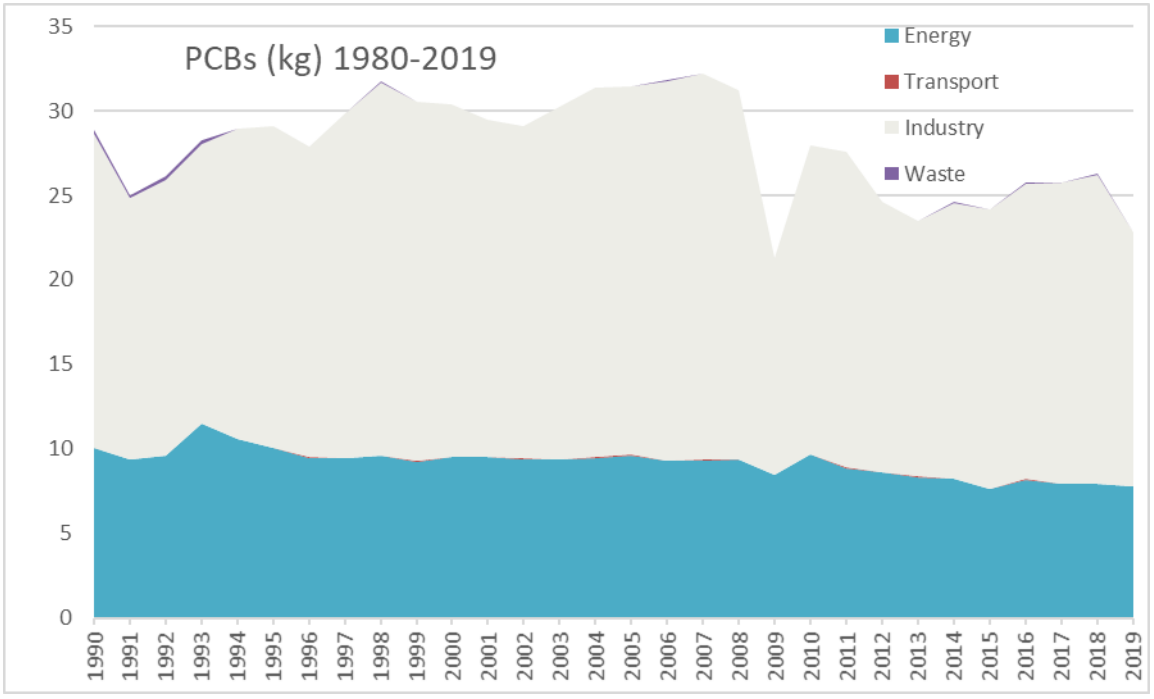
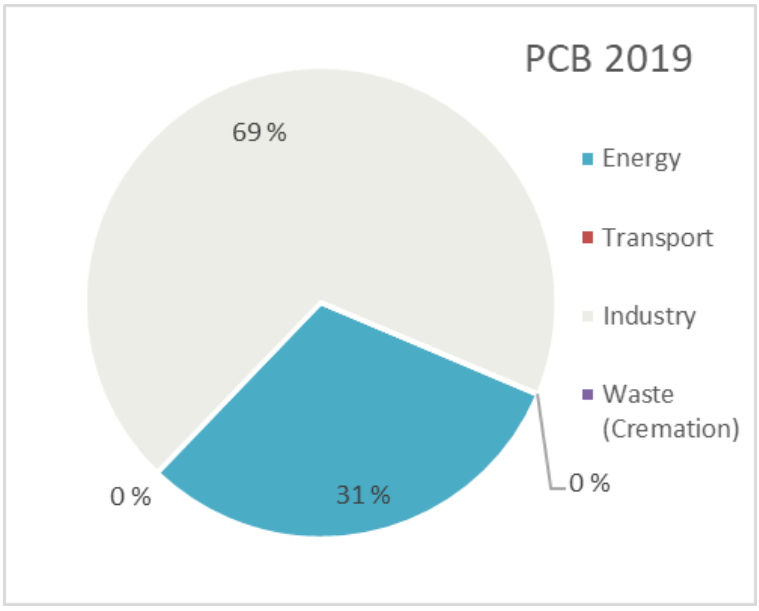


Figure 1.66. Emissions of PCB (kg) in 1990-2019.

The uncertainties of emission data in 2019 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 1.67.



Shares of total PCB emissions reported by the plants in 2019							
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	0.311	0	1A4ai	0.8	0.192	0
1A2a	0.5	0.118	0	1A4bi	13.6	3.091	0
1A2b	0.1	0.032	0	1A4ci	1.8	0.418	0
1A2c	<0.1	0.011	0	1A4ciii	<0.1	0.001	0
1A2d	0.4	0.085	0	1B1b	13.2	3.01	0
1A2e	0.6	0.139	0	2A1	12.5	2.846	0
1A2f	1.3	0.303	0	2A2	1.1	0.248	0
1A2gviii	0.2	0.036	0	2C1	51.9	11.814	30.5
1A3bi	<0.1	<0.001	0	2C3	0.4	0.087	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	0.01	0	**Total**	**100**	**22.78**	**15.8**

Figure 1.67 The contribution of different sources and data reported by the plants in the 2019 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 1.68).

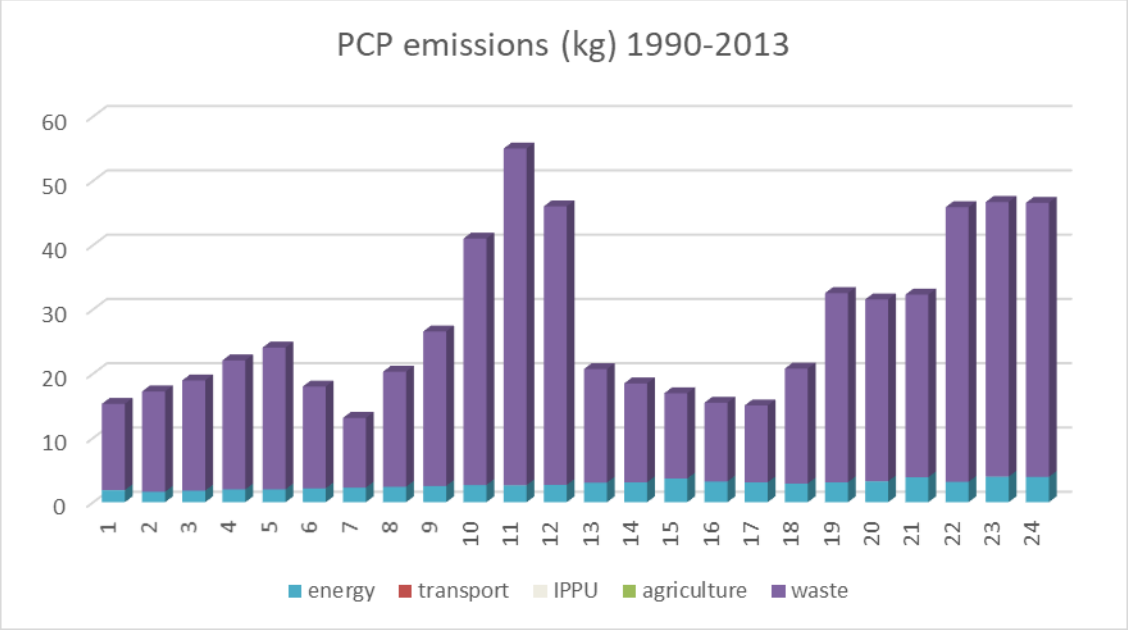


Figure 1.68. Emissions of PCP (kg) in 1990-2007.

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 1.19 (The information for PCP will be updated to the next submission)

Table 1.19. 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.

APPENDIX 1A

Level and Trend Key Category Analysis to the 2021 Submission

Level analysis

The key category assessment by level for the 2021 submission is presented below.

NOx

NFR Code	Fuel	contribution percentage	cumul percentage	key source	NFR Code	Fuel	contribution percentage	cumul percentage	key source
1A2d	Liquid	9.588	9.588	Yes	1A3aii(i)	Liquid	0.159	98.084	
1A3biii	Diesel oil	9.24	18.828	Yes	1A3biv	Gasoline	0.143	98.228	
1A3bi	Diesel oil	7.647	26.475	Yes	1A2f	Liquid	0.143	98.370	
1A1a	Biomass	6.121	32.596	Yes	2B10a		0.128	98.498	
1A3dii	Liquid	5.435	38.031	Yes	3B1b		0.115	98.613	
3Da1		4.903	42.934	Yes	1A1b	Liquid	0.108	98.720	
1A2gvii	Liquid	4.62	47.554	Yes	1A1b	Solid	0.101	98.822	
1A1a	Solid	3.884	51.439	Yes	1A2e	Solid	0.097	98.918	
1A1a	Peat	3.874	55.313	Yes	1A3bii	Gasoline	0.092	99.010	
1A3bii	Diesel oil	3.521	58.834	Yes	3Da2b		0.081	99.091	
1A4bi	Biomass	3.438	62.272	Yes	3B4gii		0.075	99.165	
1A2d	Biomass	2.679	64.951	Yes	1A2gvii	Gaseous	0.069	99.234	
3Da2a		2.396	67.347	Yes	1A2gviii	Peat	0.063	99.297	
1A3bi	Gasoline	2.365	69.712	Yes	3F		0.061	99.358	
1A4cii	Liquid	2.258	71.970	Yes	1A2e	Liquid	0.06	99.419	
1A5a	Biomass	1.850	73.820	Yes	1A2b	Liquid	0.059	99.477	
1A4ciii	Liquid	1.541	75.361	Yes	1A4bi	Gaseous	0.055	99.532	
1A1a	Gaseous	1.451	76.812	Yes	1A4ai	Gaseous	0.05	99.581	
1A1b	Gaseous	1.442	78.255	Yes	3B4h		0.045	99.626	
1A2a	Gaseous	1.412	79.667	Yes	1A3biv	Diesel oil	0.041	99.667	
1A3c	Liquid	1.264	80.931	Yes	3B4gi		0.033	99.700	
1A1a	Other	1.245	82.176		3B1a		0.031	99.732	
1A2d	Gaseous	1.178	83.354		1A2e	Biomass	0.031	99.763	
1A4aii	Liquid	1.175	84.529		1A2d	Solid	0.029	99.792	
1A1a	Liquid	1.035	85.564		3B4e		0.026	99.818	
1A2f	Solid	1.006	86.570		1A2b	Gaseous	0.021	99.838	
1A2d	Peat	0.954	87.524		1A2a	Liquid	0.017	99.855	
1A5a	Liquid	0.921	88.445		1A2f	Biomass	0.017	99.872	
1A4bii	Liquid	0.736	89.182		1A2e	Gaseous	0.016	99.888	
1A3ai(i)	Liquid	0.734	89.916		1A4bi	Peat	0.013	99.901	
1A4bi	Liquid	0.711	90.627		1A2b	Solid	0.013	99.914	
1A4ai	Liquid	0.708	91.336		1A4ci	Solid	0.012	99.926	
1A2gviii	Biomass	0.601	91.937		1A4ai	Peat	0.01	99.936	
1A2c	Liquid	0.534	92.470		1A2c	Solid	0.007	99.943	
1A4ci	Biomass	0.471	92.941		3B4giii		0.007	99.950	
1A2c	Gaseous	0.460	93.402		3B2		0.007	99.957	
3Da3		0.451	93.852		1A3biii	Gaseous	0.007	99.964	
1A5b	Liquid	0.444	94.296		1A4ci	Gaseous	0.007	99.970	
1A2a	Solid	0.412	94.708		1A3ei	Gaseous	0.006	99.976	
1A2gviii	Liquid	0.402	95.110		2G		0.005	99.981	
1A2gviii	Other	0.383	95.493		3B3		0.005	99.986	
1A5a	Gaseous	0.380	95.872		1A2e	Other	0.004	99.990	
2B2		0.360	96.232		3B4giv		0.003	99.994	
1A2f	Other	0.285	96.517		1A3bi	Gaseous	0.003	99.996	
1A2f	Gaseous	0.242	96.759		1A2a	Biomass	0.002	99.998	

1A2gviii	Gaseous	0.218	96.977	1A4bi	Solid	0.001	99.999
1A4ai	Biomass	0.212	97.189	3B4d		0.000	99.999
1A2d	Other	0.204	97.393	1A3bii	Gaseous	0.000	100
1A4ci	Liquid	0.200	97.594	1A2c	Biomass	0.000	100
1A4ci	Peat	0.170	97.764	1A4bi	Other	0.000	100
1A2e	Peat	0.161	97.925				

NMVOC

NFR Code	Fuel	contribution percentage	cumul percentage	key source	NFR Code	Fuel	contribution percentage	cumul percentage	key source
1A4bi	Biomass	24.822	24.822	Yes	1A3bii	Gasoline	0.042	99.343	
2D3d		8.711	33.533	Yes	1A2gviii	Gaseous	0.042	99.386	
3B1a		7.385	40.918	Yes	2C7b		0.041	99.427	
2D3a		5.954	46.872	Yes	1A3aii(i)	Liquid	0.040	99.467	
3B1b		4.800	51.672	Yes	3B4giii		0.037	99.503	
1A3dii	Liquid	3.414	55.085	Yes	1A4bi	Peat	0.036	99.539	
1B2av		3.274	58.359	Yes	2A1		0.027	99.567	
1B2aiv		3.200	61.559	Yes	1A2gviii	Other	0.026	99.593	
1A4bii	Liquid	2.920	64.479	Yes	1A4ci	Biomass	0.025	99.618	
2B10a		2.626	67.104	Yes	2G		0.024	99.642	
3Da2a		2.596	69.700	Yes	1A1a	Liquid	0.023	99.664	
2H2		2.304	72.004	Yes	1A2d	Peat	0.022	99.687	
2D3i		2.142	74.146	Yes	3B4giv		0.022	99.708	
2D3g		2.096	76.242	Yes	1A2d	Gaseous	0.021	99.730	
2H1		1.976	78.218	Yes	5D2		0.021	99.751	
1A3bi	Gasoline	1.630	79.849	Yes	1A4ai	Peat	0.019	99.770	
1A4cii	Liquid	1.614	81.463	Yes	1A1b	Solid	0.018	99.788	
1A3bv		1.545	83.008		1A4ci	Liquid	0.018	99.806	
2I		1.384	84.392		1A2e	Peat	0.017	99.823	
1A3biv	Gasoline	1.301	85.694		1A1b	Liquid	0.017	99.840	
3B4h		1.275	86.969		1A2a	Gaseous	0.013	99.853	
1A2gvii	Liquid	1.239	88.208		1A2d	Other	0.013	99.866	
3De		1.177	89.385		1A4ai	Biomass	0.011	99.877	
1A1a	Biomass	0.915	90.301		1A2gviii	Liquid	0.011	99.888	
3B4gii		0.834	91.135		5D1		0.011	99.899	
2D3h		0.646	91.780		1A3biv	Diesel oil	0.011	99.910	
2D3e		0.617	92.397		2C7c		0.008	99.918	
1A4aii	Liquid	0.581	92.978		1A4bi	Gaseous	0.008	99.926	
1A4ci	Peat	0.482	93.461		1A2c	Gaseous	0.007	99.933	
1A3biii	Diesel oil	0.370	93.830		1A2f	Other	0.007	99.941	
1A1a	Other	0.317	94.148		1A2e	Biomass	0.007	99.948	
2D3b		0.311	94.459		1A4ai	Gaseous	0.007	99.954	
1A3bii	Diesel oil	0.310	94.769		3B4d		0.006	99.960	
3B3		0.300	95.069		1A2e	Solid	0.004	99.964	
1B2b		0.298	95.367		1A2f	Solid	0.003	99.967	
3B4e		0.294	95.661		1A2f	Gaseous	0.003	99.970	
1A5a	Biomass	0.262	95.923		1A2gviii	Peat	0.003	99.973	
2C1		0.249	96.172		2L		0.003	99.976	
3B4gi		0.245	96.417		2A3		0.003	99.978	

1A1a	Peat	0.216	96.633		1A2e	Other	0.002	99.980
2D3c		0.214	96.848		1A2f	Liquid	0.002	99.982
3B2		0.186	97.034		1A3bi	Gaseous	0.002	99.984
1A2d	Biomass	0.180	97.214		1A2f	Biomass	0.002	99.986
1A2d	Liquid	0.178	97.391		1A2d	Solid	0.002	99.988
1A2gviii	Biomass	0.171	97.562		2C6		0.002	99.989
2B10b		0.162	97.724		1A2c	Liquid	0.001	99.991
3F		0.160	97.884		1A4bi	Solid	0.001	99.992
1A2gvii	Gaseous	0.147	98.031		1A2e	Liquid	0.001	99.993
1A3ai(i)	Liquid	0.129	98.160		1A4ci	Gaseous	0.001	99.994
1A3bi	Diesel oil	0.122	98.282		1A2b	Liquid	0.001	99.995
1A1a	Gaseous	0.100	98.383		2C2		0.001	99.996
1A4ciii	Liquid	0.098	98.481		2C7a		0.001	99.997
1A1a	Solid	0.097	98.579		1A2a	Biomass	0.001	99.997
1A3c	Liquid	0.097	98.675		1A3biii	Gaseous	0.001	99.998
5A		0.094	98.769		1A2a	Liquid	0.000	99.998
1B1b		0.076	98.845		1A4ci	Solid	0.000	99.999
3Da3		0.075	98.921		1A2b	Gaseous	0.000	99.999
1A1b	Gaseous	0.070	98.990		1A2e	Gaseous	0.000	99.999
1A5b	Liquid	0.069	99.059		1A3bii	Gaseous	0.000	100
1A5a	Liquid	0.064	99.124		1A2b	Solid	0.000	100
1A4bi	Liquid	0.063	99.187		1A3ei	Gaseous	0.000	100
1A4ai	Liquid	0.061	99.248		1A2c	Solid	0.000	100
1A5a	Gaseous	0.054	99.301		1A4bi	Other	0.000	100

SO_x

NFR Code	Fuel	contribution percentage	cumul percentage	key source	NFR Code	Fuel	contribution percentage	cumul percentage	key source
1A1a	Solid	15.324	15.324	Yes	1A4bi	Peat	0.095	99.331	
1A1a	Peat	12.207	27.531	Yes	1A2gviii	Gaseous	0.087	99.418	
1A1b	Gaseous	12.116	39.648	Yes	1A3bi	Gasoline	0.063	99.481	
2B10a		4.307	43.955	Yes	1A4ai	Peat	0.062	99.543	
1A2b	Solid	4.269	48.224	Yes	1A4ai	Biomass	0.055	99.598	
1A1a	Biomass	4.242	52.466	Yes	1A3biii	Diesel oil	0.051	99.650	
1A2b	Liquid	4.147	56.613	Yes	1A3aii(i)	Liquid	0.046	99.696	
1A4ai	Liquid	3.596	60.209	Yes	3F		0.037	99.733	
1A5a	Liquid	3.090	63.299	Yes	1A2e	Biomass	0.036	99.769	
2H1		3.059	66.358	Yes	1A2d	Solid	0.034	99.803	
1A2d	Peat	2.806	69.163	Yes	1A2c	Solid	0.030	99.832	
1A2d	Liquid	2.779	71.943	Yes	1A3bi	Diesel oil	0.029	99.861	
2C1		2.536	74.479	Yes	1A2f	Other	0.016	99.877	
1A1a	Liquid	2.008	76.487	Yes	1A2gvii	Liquid	0.015	99.892	
1A4bi	Liquid	1.636	78.123	Yes	1A2e	Other	0.015	99.906	
1A5a	Biomass	1.532	79.656	Yes	1A2c	Gaseous	0.014	99.921	
1A2c	Liquid	1.488	81.143	Yes	1A4bi	Solid	0.013	99.934	
1A2d	Biomass	1.300	82.443		2G		0.012	99.945	
1A4ci	Peat	1.268	83.711		1A3bii	Diesel oil	0.011	99.957	
1A1b	Solid	1.215	84.926		1A4cii	Liquid	0.010	99.967	
1A1b	Liquid	1.209	86.135		2C2		0.007	99.975	

1A2e	Solid	1.205	87.340
1A2f	Solid	1.143	88.483
1A2e	Liquid	1.032	89.515
1A4ci	Liquid	0.914	90.429
1A4bi	Biomass	0.890	91.319
1A2gviii	Biomass	0.709	92.028
1A1a	Other	0.692	92.720
1A2a	Gaseous	0.677	93.398
1A2gviii	Liquid	0.655	94.052
1A2a	Solid	0.618	94.671
1A2a	Liquid	0.526	95.197
1A2d	Gaseous	0.475	95.672
1A2f	Liquid	0.462	96.133
2C7a		0.384	96.517
1A2e	Peat	0.362	96.879
1A3dii	Liquid	0.294	97.173
1A5a	Gaseous	0.291	97.464
1A2f	Gaseous	0.223	97.687
1A2d	Other	0.222	97.909
1A2gviii	Peat	0.205	98.114
1A1a	Gaseous	0.188	98.303
1A4ci	Solid	0.184	98.487
1A3ai(i)	Liquid	0.183	98.670
1B1b		0.182	98.852
1A5b	Liquid	0.151	99.003
1A4ci	Biomass	0.123	99.127
1A2gviii	Other	0.109	99.236
1A2f	Biomass	0.005	99.979
1A4aii	Liquid	0.004	99.984
2C7b		0.003	99.987
1A4bii	Liquid	0.003	99.990
1A2b	Gaseous	0.002	99.992
1A3biv	Gasoline	0.002	99.994
2D3i		0.002	99.995
1A4ciii	Liquid	0.001	99.997
1A3c	Liquid	0.001	99.997
2C7c		0.000	99.998
1A2e	Gaseous	0.000	99.998
1A2a	Biomass	0.000	99.999
1A2c	Biomass	0.000	99.999
2D3g		0.000	99.999
1A3bii	Gasoline	0.000	99.999
1A4ai	Gaseous	0.000	100
1A4bi	Gaseous	0.000	100
1A3biv	Diesel oil	0.000	100
1A3bi	Gaseous	0.000	100
1A4bi	Other	0.000	100
2L		0.000	100
1A2gvii	Gaseous	0.000	100
1A3ei	Gaseous	0.000	100
1A4ci	Gaseous	0.000	100
1A3biii	Gaseous	0.000	100
1A3bii	Gaseous	0.000	100

NH_3

NFR Code	Fuel	contribution percentage	cumul percentage	key source	NFR Code	Fuel	contribution percentage	cumul percentage	key source
3Da2a		21.688	21.688	Yes	1A4ci	Biomass	0.037	99.813	
3B1a		17.663	39.351	Yes	1A3bii	Diesel oil	0.027	99.840	
3B1b		15.835	55.186	Yes	3B4d		0.023	99.863	
3B3		9.397	64.583	Yes	2L		0.020	99.883	
3B4h		7.710	72.293	Yes	1A4ai	Biomass	0.016	99.899	
3Da1		6.643	78.936	Yes	1A3bi	Gaseous	0.013	99.913	
3Da3		4.257	83.193	Yes	2D3e		0.013	99.926	
1A4bi	Biomass	3.596	86.789		2D3g		0.012	99.938	
1A3bi	Gasoline	2.197	88.986		1B1b		0.010	99.947	
3B4e		2.188	91.173		1A1a		0.009	99.957	
3B4gii		2.177	93.3500		1A2gvii	Liquid	0.009	99.966	
3B4gi		1.387	94.737		1A2gviii		0.007	99.973	
5D1		1.224	95.961		1A4cii	Liquid	0.006	99.979	
2B10a		0.978	96.94		1A3biv	Gasoline	0.006	99.985	
2D3i		0.500	97.439		1A3bii	Gasoline	0.005	99.990	
3B2		0.399	97.838		1A3dii	Liquid	0.003	99.993	
2H1		0.377	98.215		1A4aii	Liquid	0.002	99.995	
5B1		0.314	98.529		1A3bii	Gaseous	0.001	99.997	
3F		0.228	98.756		1A4bii	Liquid	0.001	99.998	
3Da2b		0.209	98.966		1A4ciii	Liquid	0.001	99.998	
3B4giii		0.204	99.170		1A3biii	Gaseous	0.000	99.999	
3B4giv		0.136	99.306		1A3c	Liquid	0.000	99.999	
2C7b		0.130	99.435		1A5a	Liquid	0.000	100	
2C1		0.120	99.556		1A3biv	Diesel oil	0.000	100	
1A3biii	Diesel oil	0.092	99.648		1A2gvii	Gaseous	0.000	100	
1A3bi	Diesel oil	0.085	99.733		2C7c		0.000	100	
2G		0.042	99.775		1A4bi	Solid	0.000	100	

$PM_{2.5}$

NFR Code	Fuel	contribution percentage	cumul percentage	key source	NFR Code	Fuel	contribution percentage	cumul percentage	key source
1A4bi	Biomass	53.043	53.043	Yes	1A2d	Gaseous	0.040	99.476	
1A2d	Liquid	5.600	58.643	Yes	1A3ai(i)	Liquid	0.038	99.513	
1B1c		4.053	62.696	Yes	3B4e		0.037	99.551	
1A3bvi		3.846	66.542	Yes	2L		0.036	99.587	
1A3bvii		2.847	69.389	Yes	1A1b	Solid	0.030	99.616	
2H2		2.390	71.779	Yes	1A2f	Liquid	0.028	99.645	
1A3dii	Liquid	1.936	73.715	Yes	2C7c		0.028	99.673	
1A2gvii	Liquid	1.848	75.563	Yes	1A2a	Liquid	0.027	99.699	
1A3bii	Diesel oil	1.451	77.015	Yes	1B2aiv		0.025	99.724	
1A3bi	Diesel oil	1.373	78.388	Yes	2A3		0.024	99.748	
2B10a		1.339	79.727	Yes	1A2f	Other	0.019	99.767	
1A5a	Biomass	1.334	81.061	Yes	2A5b		0.018	99.785	
2C1		1.317	82.377		1B1b		0.017	99.802	
2H1		1.265	83.642		1A2b	Liquid	0.016	99.818	
3Dc		1.262	84.904		3B4giii		0.016	99.834	
1A4cii	Liquid	1.131	86.035		3B3		0.013	99.846	
3F		1.103	87.138		2B6		0.012	99.859	
1A3biii	Diesel oil	1.026	88.165		1A2d	Other	0.012	99.871	

1A4bii	Liquid	0.803	88.968		1A4bi	Solid	0.012	99.882	
1A1a	Biomass	0.781	89.749		1A4ai	Peat	0.011	99.893	
1A4ci	Biomass	0.652	90.401		2D3g		0.010	99.902	
5E		0.627	91.028		2B10b		0.009	99.911	
1A4aii	Liquid	0.601	91.629		3B2		0.009	99.920	
2G		0.522	92.151		1A3aii(i)	Liquid	0.008	99.928	
1A4ai	Liquid	0.500	92.651		1A2a	Solid	0.007	99.935	
1A1a	Peat	0.470	93.122		5C1bv		0.006	99.942	
1A5a	Liquid	0.459	93.581		1A1b	Liquid	0.006	99.948	
2C2		0.415	93.996		1A2e	Solid	0.005	99.953	
1A2d	Biomass	0.412	94.408		2D3d		0.005	99.958	
2D3b		0.390	94.798		1A2e	Peat	0.004	99.962	
3B1a		0.361	95.160		1A2gvii	Gaseous	0.004	99.966	
1A2gviii	Biomass	0.340	95.499		1A2d	Solid	0.003	99.969	
1A4bi	Liquid	0.318	95.817		1A2e	Biomass	0.003	99.972	
1A4ai	Biomass	0.303	96.120		2C7d		0.003	99.975	
1A4bi	Peat	0.295	96.415		2I		0.003	99.979	
3B1b		0.291	96.706		1A2f	Biomass	0.003	99.982	
1A4ciii	Liquid	0.260	96.965		1A2gviii	Other	0.003	99.985	
2D3i		0.253	97.218		2C7a		0.003	99.987	
1A4ci	Peat	0.245	97.464		2A5a		0.002	99.989	
1A1a	Liquid	0.215	97.679		1A4ci	Solid	0.002	99.991	
1A3bi	Gasoline	0.200	97.879		1A2gviii	Peat	0.001	99.993	
1A3c	Liquid	0.163	98.041		1A2b	Solid	0.001	99.994	
1A1a	Solid	0.162	98.203		1A2c	Solid	0.001	99.995	
1A5b	Liquid	0.142	98.345		1A3bi	Gaseous	0.001	99.996	
2A5c		0.137	98.482		2A2		0.001	99.996	
1A2f	Solid	0.120	98.602		1A3bii	Gasoline	0.001	99.997	
1A4ci	Liquid	0.117	98.720		1B2av		0.001	99.998	
1A2c	Liquid	0.112	98.832		5A		0.000	99.998	
1A3biv	Gasoline	0.098	98.929		1A2a	Biomass	0.000	99.999	
3B4h		0.069	98.998		3B4d		0.000	99.999	
3B4giv		0.065	99.063		1A2e	Other	0.000	100	
1A2d	Peat	0.060	99.123		1A3bii	Gaseous	0.000	100	
3B4gi		0.059	99.183		1A3biii	Gaseous	0.000	100	
3B4gii		0.057	99.240		2C3		0.000	100	
1A2e	Liquid	0.057	99.296		1A2c	Biomass	0.000	100	
1A3biv	Diesel oil	0.050	99.346		2D3e		0.000	100	
1A2gviii	Liquid	0.048	99.394		1A4bi	Other	0.000	100	
1A1a	Other	0.041	99.435						

PM_{10}

NFR Code	Fuel	contribution percentage	cumul percentage	key source	NFR Code	Fuel	contribution percentage	cumul percentage	key source
1A4bi	Biomass	30.303	30.303	Yes	1A3biv	Gasoline	0.054	99.265	
1A3bvii		18.609	48.912	Yes	1A2e	Liquid	0.049	99.314	
3Dc		12.653	61.565	Yes	3B4giii		0.048	99.362	
1A2d	Liquid	4.331	65.896	Yes	2B10b		0.039	99.402	
1A3bvi		3.863	69.758	Yes	2A5b		0.037	99.439	
1A5a	Biomass	3.838	73.597	Yes	1A2f	Liquid	0.033	99.472	
1B1c		3.194	76.791	Yes	3B4e		0.033	99.504	
1A1a	Biomass	1.578	78.368	Yes	2L		0.031	99.535	

2H2		1.371	79.739	Yes	1A4ai	Peat	0.030	99.566
1A3dii	Liquid	1.101	80.840	Yes	1A3biv	Diesel oil	0.027	99.593
2B10a		1.086	81.926		1A2d	Gaseous	0.027	99.621
1A1a	Peat	1.027	82.953		1A2d	Solid	0.027	99.648
1A2gvii	Liquid	1.023	83.976		1A2a	Liquid	0.023	99.671
2H1		0.922	84.897		1A2f	Other	0.023	99.693
1A3bii	Diesel oil	0.803	85.701		1B1b		0.022	99.716
2C1		0.782	86.483		1B2aiv		0.022	99.737
1A3bi	Diesel oil	0.760	87.243		1A3ai(i)	Liquid	0.021	99.758
2A5c		0.733	87.976		1A2d	Other	0.019	99.777
1A4ci	Peat	0.706	88.681		2C7c		0.019	99.796
3F		0.640	89.322		2C7d		0.017	99.813
1A4cii	Liquid	0.626	89.948		1A2a	Solid	0.017	99.831
1A3biii	Diesel oil	0.568	90.516		2A3		0.015	99.846
1A2gviii	Biomass	0.527	91.043		1A2e	Solid	0.015	99.861
1A4ai	Liquid	0.490	91.533		3B2		0.014	99.875
1A2d	Biomass	0.482	92.015		1A2b	Liquid	0.014	99.889
1A4bii	Liquid	0.445	92.460		1A2e	Peat	0.011	99.900
3B4gi		0.439	92.899		2A5a		0.010	99.910
1A5a	Liquid	0.419	93.317		1A2e	Biomass	0.010	99.920
1A1a	Solid	0.407	93.724		2D3g		0.008	99.928
1A4ci	Biomass	0.379	94.103		1A2f	Biomass	0.008	99.936
5E		0.347	94.450		1A1b	Liquid	0.007	99.943
1A1a	Liquid	0.340	94.790		1A4bi	Solid	0.007	99.950
1A4aii	Liquid	0.333	95.123		2B6		0.007	99.957
2C2		0.325	95.448		1A4ci	Solid	0.005	99.962
3B4gii		0.317	95.765		1A3aii(i)	Liquid	0.005	99.967
3B1a		0.307	96.072		2D3d		0.004	99.971
2G		0.289	96.361		1A2b	Solid	0.004	99.975
3B4giv		0.253	96.614		1A2gviii	Other	0.004	99.979
3B1b		0.247	96.861		1A2gviii	Peat	0.004	99.982
2D3b		0.236	97.097		5C1bv		0.004	99.986
1A4bi	Liquid	0.230	97.327		2A2		0.002	99.988
1A4bi	Peat	0.183	97.510		1A2gvii	Gaseous	0.002	99.990
1A4ai	Biomass	0.173	97.684		2C7a		0.002	99.992
3B3		0.155	97.839		5A		0.002	99.994
1A4ciii	Liquid	0.154	97.993		1A2c	Solid	0.001	99.995
2D3i		0.153	98.146		1A2a	Biomass	0.001	99.996
1A2f	Solid	0.127	98.273		1A2e	Other	0.001	99.997
1A4ci	Liquid	0.119	98.392		3B4d		0.001	99.998
1A3bi	Gasoline	0.111	98.503		1A3bi	Gaseous	0.000	99.998
1A2c	Liquid	0.097	98.600		1A3bii	Gasoline	0.000	99.999
1A3c	Liquid	0.095	98.695		1B2av		0.000	99.999
1A1b	Solid	0.086	98.781		1A2c	Biomass	0.000	100
1A5b	Liquid	0.079	98.859		2C3		0.000	100
3B4h		0.076	98.936		2D3e		0.000	100
1A2d	Peat	0.076	99.011		1A3bii	Gaseous	0.000	100
2I		0.071	99.082		1A3biii	Gaseous	0.000	100
1A2gviii	Liquid	0.065	99.147		1A4bi	Other	0.000	100
1A1a	Other	0.064	99.211					

TSP

NFR Code	Fuel	contribution percentage	cumul percentage	key source	NFR Code	Fuel	contribution percentage	cumul percentage	key source
1A3bvii		24.867	24.867	Yes	1A3c	Liquid	0.067	99.177	
1A4bi	Biomass	21.090	45.957	Yes	1A2d	Peat	0.067	99.244	
1A5a	Biomass	9.864	55.821	Yes	1A5b	Liquid	0.053	99.296	
3Dc		8.454	64.275	Yes	3B4e		0.047	99.344	
1A3bvi		3.479	67.754	Yes	1A2e	Liquid	0.038	99.382	
1B1c		3.265	71.019	Yes	1A2f	Other	0.038	99.421	
1A2d	Liquid	3.208	74.227	Yes	1A3biv	Gasoline	0.036	99.457	
1A1a	Biomass	2.681	76.908	Yes	1B1b		0.036	99.492	
1A1a	Peat	1.947	78.855	Yes	1A2f	Liquid	0.033	99.526	
1A4ci	Peat	1.813	80.668	Yes	3B4giii		0.032	99.558	
3B4gi		1.393	82.061		1A2a	Solid	0.029	99.587	
2A5c		1.267	83.328		2L		0.028	99.615	
2H2		0.955	84.283		1A2e	Peat	0.027	99.641	
1A2gviii	Biomass	0.891	85.174		1A2d	Gaseous	0.025	99.666	
2H1		0.879	86.053		1A2d	Other	0.025	99.691	
2B10a		0.838	86.891		2C7d		0.023	99.714	
1A3dii	Liquid	0.735	87.626		3B2		0.022	99.736	
1A2gvii	Liquid	0.683	88.310		2C7c		0.021	99.757	
3B3		0.671	88.981		1A2e	Solid	0.019	99.776	
2C1		0.639	89.619		1A2f	Biomass	0.019	99.795	
1A2d	Biomass	0.569	90.188		1B2aiv		0.019	99.814	
1A3bii	Diesel oil	0.537	90.725		1A3biv	Diesel oil	0.018	99.832	
1A3bi	Diesel oil	0.508	91.233		1A2a	Liquid	0.018	99.850	
3B1a		0.449	91.682		1A2e	Biomass	0.015	99.865	
1A4ai	Liquid	0.439	92.121		2A3		0.014	99.879	
3F		0.435	92.556		1A3ai(i)	Liquid	0.014	99.893	
3B4gii		0.423	92.979		2A5a		0.013	99.906	
1A4cii	Liquid	0.418	93.397		1A2b	Liquid	0.011	99.918	
1A1a	Liquid	0.404	93.801		1A2b	Solid	0.010	99.927	
1A3biii	Diesel oil	0.380	94.180		1A1b	Liquid	0.008	99.935	
1A5a	Liquid	0.360	94.540		2D3g		0.007	99.942	
3B1b		0.357	94.897		1A4ci	Solid	0.007	99.948	
1A1a	Solid	0.339	95.236		1A4bi	Solid	0.005	99.954	
1A4bii	Liquid	0.297	95.534		1A2d	Solid	0.005	99.959	
1A4ci	Biomass	0.266	95.800		2B6		0.005	99.963	
2C2		0.256	96.055		1A2gviii	Other	0.004	99.967	
2I		0.247	96.303		2A2		0.004	99.971	
5E		0.232	96.535		1A2gviii	Peat	0.004	99.975	
1A4aii	Liquid	0.222	96.757		2D3d		0.004	99.979	
1A1b	Solid	0.221	96.978		1A3aii(i)	Liquid	0.003	99.982	
2D3b		0.210	97.188		1A2a	Biomass	0.003	99.985	
2G		0.193	97.381		5C1bv		0.003	99.987	
3B4giv		0.173	97.554		5A		0.002	99.990	
1A4bi	Liquid	0.173	97.727		1A2e	Other	0.002	99.992	
1A2f	Solid	0.167	97.894		2C7a		0.002	99.994	
1A4bi	Peat	0.136	98.030		1A2gvii	Gaseous	0.001	99.996	
1A4ai	Biomass	0.121	98.151		1A2c	Solid	0.001	99.997	
3B4h		0.115	98.265		1A2c	Biomass	0.001	99.998	

1A4ci	Liquid	0.110	98.375	3B4d		0.001	99.999
2D3i		0.110	98.485	1A3bi	Gaseous	0.000	99.999
1A4ciii	Liquid	0.103	98.588	1A3bii	Gasoline	0.000	99.999
2B10b		0.082	98.670	1B2av		0.000	100
1A4ai	Peat	0.078	98.749	2C3		0.000	100
1A2c	Liquid	0.078	98.826	2D3e		0.000	100
1A3bi	Gasoline	0.074	98.900	1A3bii	Gaseous	0.000	100
1A2gviii	Liquid	0.072	98.972	1A3biii	Gaseous	0.000	100
2A5b		0.072	99.044	1A4bi	Other	0.000	100
1A1a	Other	0.067	99.111				

BC

NFR Code	Fuel	contribution percentage	cumul percentage	key source	NFR Code	Fuel	contribution percentage	cumul percentage	key source
1A4bi	Biomass	66.447	66.447	Yes	1A2f	Liquid	0.034	99.807	
1A2gvii	Liquid	4.858	71.306	Yes	1A2f	Other	0.022	99.829	
1A3bvi		4.293	75.599	Yes	2C1		0.020	99.849	
1A3bii	Diesel oil	3.449	79.047	Yes	1A3aii(i)	Liquid	0.018	99.867	
1A3bi	Diesel oil	3.382	82.429	Yes	1A2b	Liquid	0.016	99.884	
1A3bvii		2.411	84.840		1A1a	Solid	0.015	99.899	
1A3biii	Diesel oil	2.350	87.190		1A2a	Liquid	0.014	99.913	
1A4cii	Liquid	2.201	89.391		5C1bv		0.014	99.927	
1A5a	Biomass	1.613	91.005		1A2d	Gaseous	0.012	99.939	
1A3dii	Liquid	1.590	92.594		1A2f	Solid	0.011	99.950	
1A4aii	Liquid	0.707	93.302		2G		0.010	99.960	
1A4ai	Liquid	0.655	93.957		1A2d	Peat	0.009	99.969	
1A5a	Liquid	0.598	94.555		1A1b	Liquid	0.008	99.976	
3F		0.585	95.140		1A1a	Other	0.007	99.983	
1A4bii	Liquid	0.568	95.708		1A2d	Other	0.004	99.988	
1A4bi	Liquid	0.459	96.167		1A1b	Solid	0.003	99.990	
1A3c	Liquid	0.457	96.624		1A4ai	Peat	0.002	99.992	
1A4ciii	Liquid	0.372	96.996		1A4bi	Solid	0.001	99.993	
1A5b	Liquid	0.294	97.291		1A2e	Other	0.001	99.994	
1A1a	Liquid	0.277	97.568		2B6		0.001	99.995	
5E		0.236	97.804		1A2gvii	Gaseous	0.001	99.996	
1A2d	Liquid	0.189	97.993		1A2a	Solid	0.001	99.996	
2C2		0.179	98.172		1A2e	Peat	0.001	99.997	
1A4ci	Liquid	0.154	98.326		1A2gviii	Other	0.000	99.997	
2H1		0.142	98.468		1A2e	Solid	0.000	99.998	
1A3biv	Diesel oil	0.122	98.591		1A2e	Biomass	0.000	99.998	
1A2c	Liquid	0.119	98.710		1A2f	Biomass	0.000	99.999	
1A1a	Biomass	0.111	98.821		1A2d	Solid	0.000	99.999	
2B10a		0.104	98.925		1A2gviii	Peat	0.000	99.999	
1A3bi	Gasoline	0.104	99.029		1A3bii	Gasoline	0.000	99.999	
2D3b		0.096	99.125		1A4ci	Solid	0.000	99.999	
1A4ci	Biomass	0.091	99.216		1A2b	Solid	0.000	100	
1A3ai(i)	Liquid	0.081	99.297		1A4bi	Other	0.000	100	
1A2e	Liquid	0.073	99.371		1A2c	Solid	0.000	100	
1A1a	Peat	0.067	99.438		2A3		0.000	100	
1A2gviii	Liquid	0.062	99.500		2D3i		0.000	100	
1A2d	Biomass	0.059	99.559		1A2a	Biomass	0.000	100	

1A2gviii	Biomass	0.049	99.607	1B1b		0.000	100
1A3biv	Gasoline	0.046	99.654	2C3		0.000	100
1A4ai	Biomass	0.042	99.696	2A2		0.000	100
1A4bi	Peat	0.042	99.738	1A2c	Biomass	0.000	100
1A4ci	Peat	0.035	99.773	2C7a		0.000	100

CO

NFR Code	Fuel	contribution percentage	cumul percentage	key source	NFR Code	Fuel	contribution percentage	cumul percentage	key source
1A4bi	Biomass	45.124	45.124	Yes	2G		0.054	99.470	
1A4bii	Liquid	11.132	56.256	Yes	1A1a	Liquid	0.049	99.520	
1A3bi	Gasoline	6.508	62.764	Yes	1A2gvii	Gaseous	0.043	99.563	
1A3dii	Liquid	5.734	68.497	Yes	1A2gviii	Gaseous	0.038	99.601	
1A4aii	Liquid	4.557	73.054	Yes	1A1b	Solid	0.038	99.638	
1A2d	Liquid	4.416	77.470	Yes	1A2f	Liquid	0.035	99.673	
1A1a	Biomass	3.266	80.735	Yes	1A2d	Other	0.033	99.706	
1A5a	Biomass	3.214	83.949		1A2b	Gaseous	0.025	99.732	
1A4cii	Liquid	2.680	86.629		1A2e	Peat	0.022	99.754	
1A2gvii	Liquid	2.082	88.711		1A2f	Gaseous	0.021	99.775	
1A3biv	Gasoline	1.389	90.100		1A4bi	Gaseous	0.019	99.794	
1A2d	Biomass	1.212	91.313		1A4ci	Liquid	0.017	99.812	
1A2gviii	Biomass	0.920	92.232		1A3biv	Diesel oil	0.017	99.829	
1A3biii	Diesel oil	0.815	93.047		1A2gviii	Liquid	0.017	99.845	
1A2f	Solid	0.742	93.789		1A4ai	Gaseous	0.017	99.862	
3F		0.679	94.468		1A2e	Biomass	0.016	99.878	
1A1a	Peat	0.657	95.125		1A2f	Biomass	0.016	99.894	
1A4ci	Biomass	0.472	95.597		1A1b	Liquid	0.015	99.909	
1A3bii	Diesel oil	0.416	96.013		1A3bi	Gaseous	0.013	99.922	
1A1b	Gaseous	0.327	96.340		1A2gviii	Peat	0.012	99.934	
1A3ai(i)	Liquid	0.256	96.595		1A2c	Liquid	0.011	99.945	
1A3bi	Diesel oil	0.248	96.843		1A4bi	Peat	0.009	99.954	
1A5b	Liquid	0.235	97.078		1A2e	Solid	0.007	99.961	
1A4ai	Biomass	0.206	97.284		1A2gviii	Other	0.006	99.967	
1A2d	Gaseous	0.176	97.460		1A4ai	Peat	0.005	99.972	
1A3bii	Gasoline	0.175	97.635		1A2b	Liquid	0.004	99.976	
1A2f	Other	0.173	97.808		1A2e	Liquid	0.003	99.979	
1A1a	Solid	0.169	97.978		2C7a		0.003	99.982	
1A1a	Gaseous	0.145	98.123		1A2e	Other	0.003	99.985	
1A2a	Solid	0.136	98.258		1A2a	Liquid	0.002	99.987	
1A2d	Peat	0.133	98.392		1A4ci	Gaseous	0.002	99.989	
1A5a	Gaseous	0.132	98.523		1A2d	Solid	0.002	99.991	
1A1a	Other	0.119	98.643		1A3bii	Gaseous	0.002	99.993	
1A4ci	Peat	0.118	98.761		1A2e	Gaseous	0.001	99.995	
1A3aii(i)	Liquid	0.112	98.873		1A4ci	Solid	0.001	99.996	
1A2c	Gaseous	0.083	98.957		1A2b	Solid	0.001	99.997	
1A2a	Gaseous	0.083	99.040		1A3biii	Gaseous	0.001	99.998	
1A4ciii	Liquid	0.080	99.120		1A3ei	Gaseous	0.001	99.999	
1A5a	Liquid	0.064	99.184		1A2c	Solid	0.001	99.999	
1A4bi	Liquid	0.062	99.245		1A4bi	Solid	0.000	100	
1A4ai	Liquid	0.060	99.306		1A2c	Biomass	0.000	100	
1A3c	Liquid	0.056	99.362		1A2a	Biomass	0.000	100	

2C1		0.055	99.417		1A4bi	Other	0.000	100	

Pb

NFR Code	Fuel	contribution percentage	cumul percentage	key source	NFR Code	Fuel	contribution percentage	cumul percentage	key source
1A1b	Solid	22.667	22.667	Yes	1A2e	Liquid	0.056	99.538	
1A2d	Liquid	20.381	43.048	Yes	1A2gviii	Liquid	0.048	99.586	
1A5a	Biomass	7.546	50.594	Yes	1A2d	Peat	0.046	99.632	
1A1a	Peat	7.293	57.888	Yes	1A2e	Biomass	0.039	99.672	
2G		6.736	64.624	Yes	1A4bi	Solid	0.036	99.707	
1A1a	Biomass	5.821	70.445	Yes	1A4ciii	Liquid	0.032	99.740	
1A2f	Solid	5.281	75.726	Yes	1A2f	Liquid	0.031	99.770	
1A4bi	Biomass	3.895	79.621	Yes	1B1b		0.030	99.801	
1A3bvi		3.669	83.290	Yes	1A2gviii	Other	0.026	99.827	
2C1		2.989	86.279		1A2c	Solid	0.025	99.852	
1A4ci	Peat	2.621	88.900		3F		0.016	99.868	
2C7c		1.989	90.889		1A3bi	Gasoline	0.015	99.884	
1A2d	Biomass	1.558	92.447		1A2e	Other	0.015	99.899	
1A2gviii	Biomass	1.198	93.644		1A2f	Biomass	0.012	99.911	
1A1a	Other	0.983	94.627		1A2gviii	Peat	0.011	99.922	
1A2e	Peat	0.758	95.385		2C7a		0.011	99.934	
1A5a	Liquid	0.542	95.927		1A2d	Solid	0.011	99.945	
1A1a	Solid	0.540	96.467		2B10a		0.008	99.952	
1A4ci	Biomass	0.528	96.995		1A4bi	Liquid	0.007	99.959	
1A3aii(i)	Liquid	0.360	97.355		5C1bv		0.007	99.966	
1A4ai	Liquid	0.284	97.639		1A2b	Liquid	0.006	99.972	
1A2d	Other	0.270	97.910		1A3biii	Diesel oil	0.005	99.977	
1A4ai	Biomass	0.240	98.150		1A1b	Liquid	0.004	99.981	
1A1a	Liquid	0.207	98.357		1A2a	Biomass	0.003	99.984	
1A4bi	Peat	0.197	98.554		1A2c	Biomass	0.003	99.988	
1A2c	Liquid	0.192	98.745		2C3		0.003	99.991	
1A2e	Solid	0.138	98.884		1A3bi	Diesel oil	0.003	99.994	
1A4ai	Peat	0.129	99.012		1A4ci	Solid	0.003	99.996	
2C6		0.098	99.111		5E		0.002	99.998	
1A3dii	Liquid	0.097	99.208		1A3bii	Diesel oil	0.001	99.999	
2C2		0.075	99.283		1A3biv	Gasoline	0.000	100	
1A2a	Liquid	0.073	99.356		1A3bii	Gasoline	0.000	100	
1A4ci	Liquid	0.065	99.421		1A3biv	Diesel oil	0.000	100	
1A2f	Other	0.061	99.482						

Cd

NFR Code	Fuel	contribution percentage	cumul percentage	key source	NFR Code	Fuel	contribution percentage	cumul percentage	key source
1A2d	Liquid	21.495	21.495	Yes	1A4ai	Peat	0.035	99.636	
1A4bi	Biomass	19.460	40.954	Yes	1A3bi	Gasoline	0.032	99.668	
1A5a	Biomass	13.963	54.917	Yes	1A2gviii	Other	0.028	99.696	
1A1a	Biomass	11.596	66.514	Yes	1A2e	Other	0.028	99.724	
1A1b	Solid	8.600	75.114	Yes	1A3c	Liquid	0.026	99.751	
1A4ci	Biomass	2.634	77.748	Yes	1A2f	Biomass	0.024	99.775	
3F		2.460	80.208	Yes	1A2f	Other	0.023	99.798	
2G		2.396	82.603		1B1b		0.019	99.818	

1A2gviii	Biomass	2.335	84.938	5C1bv		0.019	99.837
1A1a	Peat	2.036	86.974	2C2		0.018	99.855
1A2f	Solid	1.980	88.954	1A2a	Liquid	0.014	99.869
1A1a	Other	1.925	90.879	1A4bi	Solid	0.014	99.882
1A2d	Biomass	1.818	92.697	1A2gviii	Liquid	0.013	99.896
2C6		1.360	94.057	1A4ci	Liquid	0.013	99.909
1A4ai	Biomass	1.201	95.259	1A2e	Liquid	0.011	99.920
1A4ci	Peat	0.719	95.977	1A2c	Solid	0.010	99.930
1A1a	Solid	0.567	96.544	1A2d	Solid	0.009	99.939
2C1		0.508	97.052	1A3biii	Diesel oil	0.009	99.948
1A2gvii	Liquid	0.445	97.497	1A2f	Liquid	0.008	99.957
1A4cii	Liquid	0.309	97.806	1A2d	Peat	0.008	99.965
2C7c		0.228	98.034	1A2a	Biomass	0.006	99.971
1A3bvi		0.228	98.262	1A2c	Biomass	0.006	99.977
1A2e	Peat	0.208	98.470	1A3bi	Diesel oil	0.005	99.982
1A2d	Other	0.204	98.673	1A2gvii	Gaseous	0.004	99.986
1A3dii	Liquid	0.134	98.807	1A2gviii	Peat	0.003	99.990
1A4aii	Liquid	0.132	98.939	1A4ci	Solid	0.002	99.992
1A5a	Liquid	0.119	99.058	1A3bii	Diesel oil	0.002	99.994
5E		0.075	99.133	1A4bi	Liquid	0.001	99.995
1A2e	Biomass	0.075	99.208	2C3		0.001	99.997
1A4bii	Liquid	0.074	99.282	1A2b	Liquid	0.001	99.998
1A1a	Liquid	0.066	99.348	1A3biv	Gasoline	0.001	99.999
1A2e	Solid	0.063	99.411	1A1b	Liquid	0.001	99.999
1A4ai	Liquid	0.057	99.467	2C7a		0.001	100
1A4bi	Peat	0.054	99.521	1A3bii	Gasoline	0.000	100
1A4ciii	Liquid	0.041	99.563	1A3biv	Diesel oil	0.000	100
1A2c	Liquid	0.038	99.601				

Hg

NFR Code	Fuel	contribution percentage	cumul percentage	key source	NFR Code	Fuel	contribution percentage	cumul percentage	key source
2C1		22.411	22.411	Yes	1A4ciii	Liquid	0.168	99.359	
1A2d	Liquid	11.928	34.339	Yes	1A2d	Solid	0.106	99.465	
1A1a	Peat	11.420	45.760	Yes	5E		0.102	99.566	
1A1a	Biomass	7.489	53.248	Yes	1A2gviii	Peat	0.068	99.635	
1A1a	Solid	6.134	59.382	Yes	1A4bi	Peat	0.068	99.703	
2B10a		5.997	65.379	Yes	1A5a	Liquid	0.059	99.762	
1A2f	Solid	5.031	70.411	Yes	1A3biv	Gasoline	0.054	99.816	
1A4bi	Biomass	4.390	74.800	Yes	1A4ai	Peat	0.044	99.860	
5C1bv		3.604	78.405	Yes	1A4ci	Solid	0.020	99.881	
1A2d	Biomass	2.492	80.897	Yes	1A2e	Biomass	0.020	99.900	
1A1b	Solid	2.393	83.290		1A2c	Solid	0.013	99.913	
1A5a	Biomass	1.890	85.180		1A1a	Liquid	0.013	99.926	
1A3bi	Gasoline	1.883	87.063		1A2a	Solid	0.011	99.937	
1A2d	Peat	1.382	88.445		2G		0.011	99.948	
1A3biii	Diesel oil	1.264	89.709		1A2f	Biomass	0.011	99.959	
2C7c		1.060	90.769		1A4ai	Liquid	0.008	99.966	
1A1a	Other	0.964	91.733		1A3bii	Gasoline	0.007	99.973	
1A4ci	Peat	0.903	92.637		1A2c	Liquid	0.005	99.978	
1A2f	Other	0.732	93.368		1A2e	Other	0.004	99.982	

1A3bi	Diesel oil	0.702	94.071		1A4bi	Solid	0.004	99.986
1A2gviii	Biomass	0.636	94.706		1A2f	Liquid	0.002	99.988
3F		0.635	95.341		1A2a	Liquid	0.002	99.990
1A4ci	Biomass	0.594	95.936		1A4ci	Liquid	0.002	99.992
1A2d	Other	0.498	96.434		1B1b		0.002	99.994
1A3dii	Liquid	0.464	96.898		1A3biv	Diesel oil	0.002	99.995
1A2gviii	Other	0.446	97.344		1A2e	Liquid	0.002	99.997
2C6		0.324	97.668		1A2a	Biomass	0.001	99.998
1A2e	Peat	0.314	97.982		1A2c	Biomass	0.001	99.999
1A3bii	Diesel oil	0.281	98.263		2C7a		0.001	99.999
1A4ai	Biomass	0.271	98.534		1A2b	Liquid	0.000	100
2C2		0.256	98.790		1A4bi	Liquid	0.000	100
1A2e	Solid	0.209	98.999		1A1b	Liquid	0.000	100
1A2gviii	Liquid	0.192	99.191					

As

NFR Code	Fuel	contribution percentage	cumul percentage	key source	NFR Code	Fuel	contribution percentage	cumul percentage	key source
1A1b	Solid	23.881	23.881	Yes	1A4ciii	Liquid	0.063	99.513	
1A1a	Peat	21.806	45.687	Yes	5E		0.046	99.558	
2C7c		10.252	55.939	Yes	1A2d	Other	0.041	99.599	
1A4ci	Peat	7.994	63.934	Yes	1A4bi	Solid	0.038	99.637	
1A2d	Liquid	5.970	69.904	Yes	1A2gviii	Liquid	0.038	99.675	
1A2f	Solid	5.563	75.467	Yes	1A2a	Liquid	0.037	99.712	
1A1a	Solid	3.971	79.438	Yes	1A2gviii	Peat	0.036	99.748	
2C7a		3.913	83.352	Yes	2C2		0.034	99.782	
1A4bi	Biomass	2.494	85.846		1A4ci	Liquid	0.033	99.815	
1A2e	Peat	2.312	88.157		1A4ci	Solid	0.032	99.847	
1A3bvi		2.089	90.246		1A2c	Solid	0.029	99.876	
2C1		2.044	92.290		1A2e	Liquid	0.027	99.903	
1A1a	Biomass	1.356	93.646		5C1bv		0.020	99.923	
1A5a	Biomass	1.074	94.720		1A3bi	Gasoline	0.018	99.941	
1A4bi	Peat	0.600	95.320		1A2f	Liquid	0.015	99.956	
1A3dii	Liquid	0.543	95.863		1A3biii	Diesel oil	0.007	99.963	
2C6		0.455	96.318		3F		0.006	99.969	
1A2e	Solid	0.425	96.743		1A2e	Biomass	0.006	99.975	
1A4ai	Peat	0.392	97.135		1A4bi	Liquid	0.004	99.978	
1A4ci	Biomass	0.337	97.473		1A3bi	Diesel oil	0.004	99.982	
1A5a	Liquid	0.290	97.763		1A2f	Other	0.003	99.985	
1A2d	Biomass	0.248	98.011		1A2b	Liquid	0.003	99.988	
1A1a	Other	0.230	98.242		2C3		0.003	99.991	
1A2gviii	Biomass	0.178	98.420		1A2e	Other	0.002	99.993	
1A4ai	Biomass	0.154	98.574		1A1b	Liquid	0.002	99.995	
1A2d	Solid	0.146	98.72		1A2f	Biomass	0.002	99.997	
1A4ai	Liquid	0.145	98.866		1A3bii	Diesel oil	0.002	99.998	
1A2d	Peat	0.133	98.999		1A3biv	Gasoline	0.001	99.999	
1A1a	Liquid	0.109	99.108		1A2a	Biomass	0.000	99.999	
1B1b		0.105	99.212		1A2c	Biomass	0.000	100	
1A2c	Liquid	0.098	99.311		1A3bii	Gasoline	0.000	100	
2G		0.073	99.384		1A3biv	Diesel oil	0.000	100	

1A2gviii	Other	0.065	99.449						

Cr

NFR Code	Fuel	contribution percentage	cumul percentage	key source	NFR Code	Fuel	contribution percentage	cumul percentage	key source
1A1b	Solid	26.553	26.553	Yes	1A2e	Biomass	0.028	99.741	
2C1		16.079	42.632	Yes	1A5a	Liquid	0.023	99.765	
1A4bi	Biomass	12.617	55.249	Yes	1A2gviii	Other	0.022	99.787	
1A3bvi		9.454	64.703	Yes	3F		0.021	99.808	
1A2f	Solid	6.113	70.816	Yes	1A4bii	Liquid	0.021	99.829	
1A1a	Peat	5.517	76.332	Yes	1A3bii	Diesel oil	0.019	99.847	
1A5a	Biomass	5.432	81.764	Yes	1A2d	Solid	0.013	99.860	
1A1a	Biomass	3.659	85.422		1A2f	Biomass	0.012	99.872	
2C2		3.409	88.831		1A4ciii	Liquid	0.011	99.884	
1A4ci	Peat	1.997	90.829		1A2f	Other	0.011	99.895	
1A4ci	Biomass	1.707	92.536		1A2e	Other	0.011	99.906	
1A2b	Solid	1.311	93.847		1A4ai	Liquid	0.011	99.916	
1A2gviii	Biomass	0.849	94.696		1B1b		0.010	99.927	
1A4ai	Biomass	0.779	95.474		1A1a	Liquid	0.010	99.937	
1A1a	Solid	0.692	96.167		1A2gviii	Peat	0.009	99.946	
1A1a	Other	0.679	96.846		1A3c	Liquid	0.007	99.953	
1A2d	Biomass	0.675	97.521		1A2c	Liquid	0.007	99.960	
1A2e	Peat	0.577	98.098		1A2gviii	Liquid	0.007	99.967	
1A2d	Liquid	0.383	98.481		5E		0.006	99.973	
1A2e	Solid	0.163	98.645		1A2f	Liquid	0.003	99.976	
1A4bi	Peat	0.150	98.795		1A4ci	Solid	0.003	99.979	
2G		0.124	98.919		5C1bv		0.003	99.982	
1A2gvii	Liquid	0.124	99.042		1A2a	Liquid	0.003	99.985	
1A4ai	Peat	0.098	99.140		1A2a	Biomass	0.002	99.987	
1A3dii	Liquid	0.088	99.228		1A4ci	Liquid	0.002	99.989	
1A4cii	Liquid	0.086	99.314		1A2c	Biomass	0.002	99.992	
1A3biii	Diesel oil	0.083	99.397		1A2b	Liquid	0.002	99.994	
1A3bi	Gasoline	0.056	99.453		1A2e	Liquid	0.002	99.996	
1A3bi	Diesel oil	0.046	99.499		1A3biv	Gasoline	0.002	99.998	
1A2d	Other	0.045	99.545		1A2gvii	Gaseous	0.001	99.999	
1A4bi	Solid	0.042	99.587		2C7a		0.000	99.999	
1A4aii	Liquid	0.037	99.623		1A4bi	Liquid	0.000	100	
2C7c		0.033	99.656		1A3bii	Gasoline	0.000	100	
1A2c	Solid	0.029	99.686		1A1b	Liquid	0.000	100	
1A2d	Peat	0.028	99.714		1A3biv	Diesel oil	0.000	100	

Cu

NFR Code	Fuel	contribution percentage	cumul percentage	key source	NFR Code	Fuel	contribution percentage	cumul percentage	key source
1A3bvi		75.714	75.714	Yes	1A2e	Biomass	0.015	99.859	
1A1b	Solid	3.305	79.019	Yes	1A2gvii	Gaseous	0.014	99.873	
1A1a	Peat	3.114	82.134	Yes	1A3bi	Gasoline	0.014	99.888	
1A5a	Biomass	2.815	84.948		1A3bi	Diesel oil	0.011	99.899	
1A1a	Biomass	2.473	87.421		1B1b		0.011	99.910	
1A2gvii	Liquid	1.494	88.915		1A4ai	Liquid	0.009	99.919	
2G		1.299	90.214		1A1a	Liquid	0.009	99.927	
1A4ci	Peat	1.116	91.330		1A2gviii	Other	0.007	99.935	
1A4cii	Liquid	1.039	92.369		1A2c	Liquid	0.006	99.941	
2C1		1.019	93.389		1A2e	Other	0.006	99.947	
1A2d	Biomass	0.894	94.282		1A4bi	Solid	0.005	99.952	
1A2f	Solid	0.866	95.149		5E		0.005	99.957	
1A4bi	Biomass	0.769	95.918		1A2gviii	Peat	0.005	99.962	
2C7c		0.612	96.530		1A2f	Biomass	0.004	99.966	
1A2gviii	Biomass	0.458	96.988		1A3bii	Diesel oil	0.004	99.971	
1A4aii	Liquid	0.442	97.430		1A2c	Solid	0.004	99.975	
1A1a	Other	0.403	97.833		3F		0.004	99.978	
1A2e	Peat	0.323	98.155		1A2d	Solid	0.004	99.982	
1A1a	Solid	0.269	98.424		1A2a	Liquid	0.002	99.984	
1A4bii	Liquid	0.249	98.673		1A2gviii	Liquid	0.002	99.987	
1A3dii	Liquid	0.218	98.891		1A4ci	Liquid	0.002	99.989	
1A2d	Other	0.192	99.082		2B10a		0.002	99.991	
1A4ci	Biomass	0.104	99.187		1A2e	Liquid	0.002	99.992	
1A3c	Liquid	0.089	99.276		1A2a	Biomass	0.001	99.994	
1A2d	Liquid	0.084	99.360		1A2c	Biomass	0.001	99.995	
1A4bi	Peat	0.084	99.444		1A2f	Liquid	0.001	99.996	
1A4ciii	Liquid	0.072	99.516		5C1bv		0.001	99.997	
1A4ai	Peat	0.055	99.570		1A4ci	Solid	0.001	99.998	
1A4ai	Biomass	0.047	99.618		2C7a		0.001	99.999	
2C2		0.044	99.662		1A2b	Liquid	0.001	99.999	
1A2f	Other	0.042	99.704		1A3biv	Gasoline	0.000	100	
1A5a	Liquid	0.042	99.746		1A4bi	Liquid	0.000	100	
2C6		0.034	99.780		1A1b	Liquid	0.000	100	
1A2e	Solid	0.024	99.804		1A3bii	Gasoline	0.000	100	
1A2d	Peat	0.020	99.824		1A3biv	Diesel oil	0.000	100	
1A3biii	Diesel oil	0.020	99.844						

Ni

NFR Code	Fuel	contribution percentage	cumul percentage	key source	NFR Code	Fuel	contribution percentage	cumul percentage	key source
2C7b		14.652	14.652	Yes	1A4cii	Liquid	0.149	99.015	
1A4bi	Biomass	13.387	28.039	Yes	1A4ai	Peat	0.121	99.136	
1A5a	Liquid	7.412	35.451	Yes	1A1b	Solid	0.118	99.254	
2C1		6.887	42.338	Yes	1A4bi	Liquid	0.101	99.356	
1A1a	Peat	6.817	49.155	Yes	1B1b		0.076	99.432	
1A2f	Solid	6.056	55.211	Yes	1A4aii	Liquid	0.063	99.495	
1A5a	Biomass	5.763	60.974	Yes	1A2b	Solid	0.058	99.553	
1A1a	Biomass	4.179	65.153	Yes	1A2d	Other	0.055	99.607	
1A3dii	Liquid	3.936	69.089	Yes	1A1b	Liquid	0.048	99.655	
1A4ai	Liquid	3.904	72.994	Yes	1A4bi	Solid	0.042	99.697	
1A1a	Liquid	2.773	75.767	Yes	1A4bii	Liquid	0.036	99.733	
1A2c	Liquid	2.636	78.402	Yes	1A2d	Peat	0.035	99.768	
1A4ci	Peat	2.472	80.875	Yes	1A2c	Solid	0.034	99.802	
1A2d	Liquid	2.252	83.127		1A2gviii	Other	0.033	99.834	
1A4ci	Biomass	1.811	84.938		1A2e	Biomass	0.030	99.864	
1A3bvi		1.680	86.619		1A3bi	Gasoline	0.025	99.890	
2B10a		1.531	88.150		1A2f	Other	0.018	99.907	
1A1a	Solid	1.327	89.477		1A2f	Biomass	0.013	99.920	
1A2a	Liquid	1.004	90.481		1A3c	Liquid	0.013	99.933	
1A2gviii	Biomass	0.913	91.393		1A2d	Solid	0.012	99.946	
1A4ci	Liquid	0.892	92.285		1A2e	Other	0.012	99.957	
1A4ai	Biomass	0.826	93.111		1A2gviii	Peat	0.011	99.968	
1A2e	Liquid	0.776	93.888		3F		0.010	99.978	
1A2e	Peat	0.715	94.602		5C1bv		0.005	99.983	
1A1a	Other	0.709	95.311		1A4ci	Solid	0.003	99.986	
1A2gviii	Liquid	0.653	95.964		1A2a	Biomass	0.003	99.988	
1A2d	Biomass	0.642	96.606		1A2c	Biomass	0.003	99.991	
1A2f	Liquid	0.401	97.007		1A3biii	Diesel oil	0.002	99.993	
2G		0.370	97.377		2C7a		0.002	99.995	
1A4ciii	Liquid	0.284	97.661		1A2gvii	Gaseous	0.002	99.997	
1A2b	Liquid	0.240	97.901		1A3bi	Diesel oil	0.001	99.999	
2C2		0.234	98.135		1A3biv	Gasoline	0.001	99.999	
1A2gvii	Liquid	0.214	98.349		1A3bii	Diesel oil	0.001	100	
1A4bi	Peat	0.186	98.535		1A3bii	Gasoline	0.000	100	
2C7c		0.170	98.705		1A3biv	Diesel oil	0.000	100	
1A2e	Solid	0.162	98.866						

Se

NFR Code	Fuel	contribution percentage	cumul percentage	key source	NFR Code	Fuel	contribution percentage	cumul percentage	key source
1A4bi	Biomass	61.364	61.364	Yes	3F		0.191	99.535	
2C7a		12.774	74.138	Yes	5C1bv		0.145	99.680	
1A4ci	Biomass	8.298	82.436	Yes	1A4bii	Liquid	0.140	99.820	
1A3bvi		7.454	89.890		1A3bi	Gasoline	0.061	99.881	
1A4ai	Biomass	3.788	93.678		1A3c	Liquid	0.050	99.931	
1A3dii	Liquid	2.558	96.236		1A3biii	Diesel oil	0.033	99.964	
1A2gvii	Liquid	0.841	97.077		1A3bi	Diesel oil	0.019	99.983	
1A4ciii	Liquid	0.781	97.859		1A2gvii	Gaseous	0.008	99.991	
1A4cii	Liquid	0.585	98.444		1A3bii	Diesel oil	0.007	99.998	
2C7c		0.440	98.884		1A3biv	Gasoline	0.002	100	
1A4aii	Liquid	0.249	99.133		1A3bii	Gasoline	0.000	100	
1A5a	Liquid	0.211	99.344		1A3biv	Diesel oil	0.000	100	

Zn

NFR Code	Fuel	contribution percentage	cumul percentage	key source	NFR Code	Fuel	contribution percentage	cumul percentage	key source
1A4bi	Biomass	27.664	27.664	Yes	1A4ciii	Liquid	0.030	99.726	
1A3bvi		14.875	42.539	Yes	1A4ai	Peat	0.025	99.751	
1A5a	Biomass	11.91	54.449	Yes	1A2e	Other	0.024	99.775	
1A1a	Biomass	9.964	64.413	Yes	1A2d	Solid	0.024	99.799	
2C6		9.511	73.924	Yes	1A2f	Biomass	0.021	99.820	
1A1b	Solid	4.367	78.290	Yes	1A3biii	Diesel oil	0.019	99.839	
1A4ci	Biomass	3.743	82.033	Yes	1A2d	Peat	0.018	99.857	
1A1a	Other	2.654	84.687		1A3c	Liquid	0.016	99.873	
1A2f	Solid	2.049	86.736		1A4ai	Liquid	0.014	99.887	
1A2gviii	Biomass	1.895	88.631		3F		0.012	99.899	
1A1a	Peat	1.765	90.396		1A1a	Liquid	0.011	99.910	
1A4ai	Biomass	1.708	92.104		1A3bi	Diesel oil	0.011	99.921	
1A2d	Biomass	1.571	93.674		1B1b		0.010	99.931	
2C1		1.155	94.829		1A2c	Liquid	0.009	99.940	
2C7c		0.642	95.471		1A4bi	Solid	0.007	99.947	
1A2f	Other	0.621	96.091		1A4ci	Solid	0.005	99.952	
1A4ci	Peat	0.516	96.607		1A2a	Biomass	0.005	99.958	
1A1a	Solid	0.501	97.108		1A2c	Solid	0.005	99.963	
2C2		0.375	97.484		1A2c	Biomass	0.005	99.968	
1A2d	Liquid	0.318	97.802		1A3bii	Diesel oil	0.004	99.972	
1A2gvii	Liquid	0.271	98.073		1A2gviii	Peat	0.004	99.977	
2G		0.233	98.306		5C1bv		0.004	99.980	
2B10a		0.192	98.498		1A2a	Liquid	0.004	99.984	
1A4cii	Liquid	0.188	98.687		1A4ci	Liquid	0.003	99.987	
1A2gviii	Other	0.184	98.871		1A2f	Liquid	0.003	99.990	
1A2d	Other	0.154	99.025		1A2e	Liquid	0.003	99.993	
1A2e	Peat	0.150	99.176		1A2gvii	Gaseous	0.003	99.995	
1A3dii	Liquid	0.087	99.263		1A2gviii	Liquid	0.002	99.998	
1A4aii	Liquid	0.080	99.343		1A3biv	Gasoline	0.001	99.999	
1A2e	Solid	0.071	99.414		2C7a		0.000	99.999	

2C3		0.068	99.482		1A4bi	Liquid	0.000	99.999
1A2e	Biomass	0.062	99.544		1A2b	Liquid	0.000	100
1A4bii	Liquid	0.045	99.59		1A1b	Liquid	0.000	100
1A4bi	Peat	0.039	99.628		1A3bii	Gasoline	0.000	100
1A5a	Liquid	0.035	99.663		1A3biv	Diesel oil	0.000	100
1A3bi	Gasoline	0.032	99.695					

PCDD/F

NFR Code	Fuel	contribution percentage	cumul percentage	key source	NFR Code	Fuel	contribution percentage	cumul percentage	key source
1B1b		20.679	20.679	Yes	1A4ai	Liquid	0.041	99.573	
1A1a	Biomass	12.202	32.881	Yes	1A2e	Biomass	0.040	99.613	
1A4bi	Biomass	8.914	41.795	Yes	1A5a	Gaseous	0.037	99.650	
5E		8.904	50.699	Yes	1A5a	Liquid	0.036	99.686	
2C1		8.873	59.572	Yes	1A4ciii	Liquid	0.035	99.721	
1A1a	Other	7.307	66.879	Yes	1A3biv	Diesel oil	0.031	99.753	
1A1a	Peat	5.065	71.944	Yes	1A2e	Solid	0.027	99.780	
1A5a	Biomass	3.838	75.782	Yes	1A4bi	Peat	0.022	99.802	
1A2d	Biomass	3.685	79.467	Yes	1A2f	Biomass	0.020	99.822	
1A3bi	Diesel oil	2.961	82.428	Yes	1A1a	Liquid	0.019	99.841	
1A2d	Other	1.881	84.309		1A2d	Solid	0.016	99.857	
1A3bi	Gasoline	1.682	85.991		1A4ai	Peat	0.014	99.872	
2C7a		1.651	87.642		1A2gviii	Liquid	0.014	99.886	
1A3bii	Diesel oil	1.503	89.145		1A2f	Gaseous	0.013	99.899	
1A1a	Solid	1.414	90.558		1A4ci	Liquid	0.012	99.911	
1A2gviii	Biomass	1.360	91.918		1A1b	Liquid	0.010	99.921	
1A4ci	Biomass	1.207	93.126		1A3bii	Gasoline	0.008	99.929	
2A2		1.064	94.190		1A2e	Other	0.008	99.937	
1A2d	Peat	1.021	95.211		1A2gviii	Gaseous	0.008	99.944	
1A3biii	Diesel oil	0.763	95.974		5C1bv		0.007	99.951	
1A4ai	Biomass	0.550	96.525		1A2b	Solid	0.006	99.957	
1A2d	Liquid	0.422	96.946		1A2f	Liquid	0.006	99.963	
2A1		0.330	97.276		1A4bi	Gaseous	0.005	99.968	
1A4ci	Peat	0.294	97.570		1A4ai	Gaseous	0.005	99.973	
2C6		0.235	97.806		1A2c	Liquid	0.004	99.977	
1A2d	Gaseous	0.222	98.028		2A3		0.003	99.979	
1A1b	Gaseous	0.203	98.231		1A4ci	Solid	0.003	99.982	
1A3biv	Gasoline	0.158	98.389		2G		0.003	99.985	
1A1a	Gaseous	0.144	98.533		1A2c	Solid	0.002	99.987	
1A2gviii	Other	0.144	98.677		1A2b	Liquid	0.002	99.989	
1A3dii	Liquid	0.134	98.810		1A2a	Biomass	0.002	99.991	
1A1b	Solid	0.125	98.936		1A2c	Biomass	0.002	99.993	
1A2e	Peat	0.120	99.055		1A2e	Liquid	0.001	99.994	
2D3b		0.097	99.152		1A2a	Liquid	0.001	99.996	
2L		0.072	99.225		1A2e	Gaseous	0.001	99.997	
1A2a	Gaseous	0.056	99.281		2C3		0.001	99.998	
1A2c	Gaseous	0.056	99.337		1A2b	Gaseous	0.001	99.999	
1A2f	Other	0.054	99.391		1A4ci	Gaseous	0.001	99.999	
1A2gviii	Peat	0.052	99.443		1A3ei	Gaseous	0.001	100	
1A2f	Solid	0.045	99.488		1A4bi	Solid	0.000	100	

1A4bi	Liquid	0.044	99.532		1A4bi	Other	0.000	100	

PAH-4

NFR Code	Fuel	contribution percentage	cumul percentage	key source	NFR Code	Fuel	contribution percentage	cumul percentage	key source
1A4bi	Biomass	91.841	91.841	Yes	1A2f	Other	0.008	99.941	
1B1b		1.987	93.827		1A3c	Liquid	0.008	99.949	
1A1a	Other	1.078	94.905		1A4ai	Biomass	0.007	99.956	
1A1a	Biomass	0.935	95.840		1A3biv	Gasoline	0.006	99.962	
1A2d	Biomass	0.514	96.354		1A2a	Liquid	0.005	99.967	
1A3biii	Diesel oil	0.490	96.844		1A2e	Liquid	0.005	99.972	
1A2gviii	Other	0.486	97.330		5C1bv		0.005	99.977	
1A5a	Biomass	0.268	97.598		1A2e	Peat	0.004	99.980	
1A3bi	Diesel oil	0.268	97.866		2G		0.004	99.984	
1A1a	Liquid	0.247	98.113		1A2e	Biomass	0.003	99.987	
1A2d	Other	0.203	98.316		2A1		0.003	99.989	
1A1a	Peat	0.191	98.507		1A2gviii	Peat	0.002	99.991	
1A2d	Liquid	0.177	98.684		1A1a	Solid	0.002	99.993	
1A3bi	Gasoline	0.149	98.833		1A2f	Biomass	0.001	99.994	
1A4bi	Liquid	0.134	98.967		1A2gvii	Gaseous	0.001	99.996	
1A4ai	Liquid	0.130	99.097		1A4bi	Peat	0.001	99.996	
1A2gvii	Liquid	0.127	99.224		1A3biv	Diesel oil	0.001	99.997	
1A2gviii	Biomass	0.096	99.320		1A2e	Other	0.001	99.997	
1A5a	Liquid	0.089	99.409		2C2		0.001	99.998	
1A4cii	Liquid	0.088	99.497		3F		0.000	99.998	
1A3bii	Diesel oil	0.079	99.576		1A4ai	Peat	0.000	99.999	
2D3i		0.069	99.646		1A3bii	Gasoline	0.000	99.999	
2C1		0.041	99.687		1A1b	Solid	0.000	100	
1A4ci	Liquid	0.038	99.724		1A2f	Solid	0.000	100	
1A4aii	Liquid	0.037	99.762		1A2a	Biomass	0.000	100	
1A1b	Liquid	0.032	99.794		1A2c	Biomass	0.000	100	
1A2d	Peat	0.025	99.819		1A2e	Solid	0.000	100	
1A2gviii	Liquid	0.024	99.843		1A2d	Solid	0.000	100	
1A4bii	Liquid	0.021	99.864		1A4bi	Other	0.000	100	
1A2f	Liquid	0.018	99.882		1A2b	Solid	0.000	100	
1A2c	Liquid	0.018	99.900		1A4ci	Solid	0.000	100	
1A4ci	Biomass	0.016	99.916		1A2c	Solid	0.000	100	
1A4ci	Peat	0.009	99.925		1A2a	Solid	0.000	100	
1A2b	Liquid	0.009	99.933		1A4bi	Solid	0.000	100	

HCB

NFR Code	Fuel	contribution percentage	cumul percentage	key source	NFR Code	Fuel	contribution percentage	cumul percentage	key source
2B10a		68.251	68.251	Yes	1A4ci	Solid	0.007	99.965	
2C7a		25.713	93.964	Yes	2D3i		0.006	99.971	
1A1a	Biomass	1.961	95.924		1A2e	Biomass	0.005	99.977	
1A4bi	Biomass	1.137	97.062		1A2f	Solid	0.005	99.981	
1A2d	Biomass	0.594	97.656		1A5a	Liquid	0.003	99.984	
1A2gviii		0.464	98.120		1A2f	Biomass	0.003	99.987	

1A3biii	Diesel oil	0.371	98.490		1A2e	Solid	0.002	99.989
1A3bi	Gasoline	0.336	98.827		1A2a	Solid	0.002	99.991
1A3bi	Diesel oil	0.206	99.033		1A3bi	Gaseous	0.002	99.993
1A2gviii	Biomass	0.173	99.206		1A1a	Solid	0.002	99.995
1A4ci	Biomass	0.154	99.360		1A2d	Solid	0.001	99.996
2C3		0.146	99.506		1A3bii	Gasoline	0.001	99.997
1A5a	Biomass	0.098	99.604		1A4bi	Solid	0.001	99.998
1A3bii	Diesel oil	0.083	99.687		1A2b	Solid	0.001	99.998
2C1		0.073	99.760		1A3biv	Diesel oil	0.000	99.999
1A4ai	Biomass	0.070	99.830		1A3biii	Gaseous	0.000	99.999
3Df		0.050	99.880		1A3bii	Gaseous	0.000	99.999
1A3dii	Liquid	0.037	99.916		1A2a	Biomass	0.000	100
5C1bv		0.020	99.936		1A2c	Biomass	0.000	100
1A4ciii	Liquid	0.012	99.948		1A2c	Solid	0.000	100
1A3biv	Gasoline	0.010	99.958					

PCB

NFR Code	Fuel	contribution percentage	cumul percentage	key source	NFR Code	Fuel	contribution percentage	cumul percentage	key source
2C1		51.861	51.861	Yes	1A4ai	Liquid	0.004	99.994	
1A4bi	Biomass	13.564	65.424	Yes	1A2gviii	Biomass	0.002	99.996	
1B1b		13.215	78.640	Yes	2C7a		0.001	99.997	
2A1		12.494	91.134	Yes	1A1a	Solid	0.001	99.998	
1A4ci	Biomass	1.834	92.968		1A4ci	Peat	0.001	99.999	
1A1a	Biomass	1.364	94.332		1A4ci	Liquid	0.000	99.999	
1A2f	Solid	1.330	95.662		1A3bi	Diesel oil	0.000	99.999	
2A2		1.090	96.752		1A3bi	Gasoline	0.000	99.999	
1A4ai	Biomass	0.837	97.590		1A3bii	Diesel oil	0.000	100	
1A2e	Solid	0.610	98.199		1A3biii	Diesel oil	0.000	100	
1A2a	Solid	0.518	98.717		1A4ci	Solid	0.000	100	
2C3		0.382	99.099		1A2e	Biomass	0.000	100	
1A2d	Solid	0.366	99.465		1A4bi	Peat	0.000	100	
1A2gviii		0.154	99.620		1A2f	Biomass	0.000	100	
1A2b	Solid	0.140	99.759		1A4ai	Peat	0.000	100	
2C7c		0.068	99.827		1A3biv	Gasoline	0.000	100	
5C1bv		0.053	99.880		1A4bi	Solid	0.000	100	
1A2c	Solid	0.050	99.931		1A3biv	Diesel oil	0.000	100	
1A3dii	Liquid	0.043	99.974		1A2a	Biomass	0.000	100	
1A2d	Biomass	0.007	99.981		1A3bii	Gasoline	0.000	100	
1A4ciii	Liquid	0.005	99.986		1A2c	Biomass	0.000	100	
1A4bi	Liquid	0.004	99.990						

Trend analysis

The key category assessment by trend for the 2021 submission is presented below.

NOx

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2019 emission of the NFR category	Year 2019 total emission	Unit	Trend assessment	Contribution to trend, %	Cumulative total, %	Key source
1A3bi	Gasoline	62.636	306.224	2.834	119.817	Gg	0.071	21.063	21.063	Yes
1A3biii	Diesel oil	58.866	306.224	11.071	119.817	Gg	0.039	11.624	32.687	Yes
1A1a	Solid	36.204	306.224	4.654	119.817	Gg	0.031	9.243	41.930	Yes
1A2d	Liquid	7.012	306.224	11.488	119.817	Gg	0.029	8.498	50.428	Yes
1A1a	Biomass	0.805	306.224	7.334	119.817	Gg	0.023	6.821	57.249	Yes
1A3bi	Diesel oil	6.783	306.224	9.162	119.817	Gg	0.021	6.324	63.574	Yes
1A3dii	Liquid	9.130	306.224	6.512	119.817	Gg	0.010	2.857	66.430	Yes
1A4bi	Biomass	3.303	306.224	4.120	119.817	Gg	0.009	2.748	69.178	Yes
1A3bii	Diesel oil	4.439	306.224	4.219	119.817	Gg	0.008	2.412	71.590	Yes
1A4cii	Liquid	12.825	306.224	2.705	119.817	Gg	0.008	2.248	73.838	Yes
3Da1		9.143	306.224	5.875	119.817	Gg	0.008	2.233	76.070	Yes
1A5a	Biomass	0.032	306.224	2.217	119.817	Gg	0.007	2.142	78.213	Yes
1A2d	Biomass	3.752	306.224	3.210	119.817	Gg	0.006	1.693	79.905	Yes
1A1a	Gaseous	8.866	306.224	1.739	119.817	Gg	0.006	1.681	81.586	Yes
3Da2a		2.994	306.224	2.871	119.817	Gg	0.006	1.652	83.238	
1A1a	Other	0.006	306.224	1.491	119.817	Gg	0.005	1.447	84.685	
1A2a	Gaseous	1.090	306.224	1.692	119.817	Gg	0.004	1.230	85.915	
1A2d	Solid	2.455	306.224	0.035	119.817	Gg	0.003	0.900	86.815	
1A1a	Peat	9.791	306.224	4.642	119.817	Gg	0.003	0.788	87.603	
1A3ai(i)	Liquid	0.251	306.224	0.880	119.817	Gg	0.003	0.760	88.362	
1A4bii	Liquid	0.396	306.224	0.882	119.817	Gg	0.002	0.707	89.069	
1A2gvii	Liquid	12.486	306.224	5.536	119.817	Gg	0.002	0.632	89.701	
1A4aii	Liquid	5.216	306.224	1.408	119.817	Gg	0.002	0.615	90.316	
1A1b	Gaseous	2.857	306.224	1.728	119.817	Gg	0.002	0.593	90.910	
1A2d	Peat	1.476	306.224	1.143	119.817	Gg	0.002	0.550	91.459	
1A5b	Liquid	0.087	306.224	0.532	119.817	Gg	0.002	0.484	91.943	
1A3bii	Gasoline	1.532	306.224	0.110	119.817	Gg	0.002	0.476	92.419	
1A4ciii	Liquid	3.580	306.224	1.846	119.817	Gg	0.001	0.433	92.852	
1A2gviii	Biomass	0.803	306.224	0.720	119.817	Gg	0.001	0.394	93.246	
1A2gviii	Other	0.148	306.224	0.459	119.817	Gg	0.001	0.390	93.636	
1A4bi	Liquid	3.105	306.224	0.852	119.817	Gg	0.001	0.352	93.988	
1A4ci	Biomass	0.520	306.224	0.564	119.817	Gg	0.001	0.351	94.339	
1A2c	Liquid	0.713	306.224	0.640	119.817	Gg	0.001	0.350	94.689	
1A5a	Gaseous	0.247	306.224	0.455	119.817	Gg	0.001	0.348	95.038	
1A5a	Liquid	1.961	306.224	1.104	119.817	Gg	0.001	0.327	95.365	
1A2c	Gaseous	0.707	306.224	0.551	119.817	Gg	0.001	0.267	95.632	
1A1a	Liquid	3.867	306.224	1.240	119.817	Gg	0.001	0.265	95.897	
3Da3		0.727	306.224	0.540	119.817	Gg	0.001	0.249	96.145	
1A2f	Solid	3.724	306.224	1.205	119.817	Gg	0.001	0.245	96.390	
1A2d	Other	0.044	306.224	0.244	119.817	Gg	0.001	0.221	96.611	
1A2gviii	Gaseous	0.107	306.224	0.262	119.817	Gg	0.001	0.214	96.825	
1A4ai	Biomass	0.156	306.224	0.254	119.817	Gg	0.001	0.188	97.013	
1A4ci	Peat	0.040	306.224	0.204	119.817	Gg	0.001	0.183	97.196	

1A2e	Liquid	0.661	306.224	0.072	119.817	Gg	0.001	0.181	97.377
1A2a	Solid	1.661	306.224	0.494	119.817	Gg	0.001	0.152	97.528
1A2f	Gaseous	0.350	306.224	0.290	119.817	Gg	0.000	0.149	97.677
1A2b	Solid	0.422	306.224	0.015	119.817	Gg	0.000	0.146	97.823
1A3biv	Gasoline	0.065	306.224	0.172	119.817	Gg	0.000	0.142	97.965
2B2		0.744	306.224	0.431	119.817	Gg	0.000	0.136	98.101
1A3c	Liquid	4.212	306.224	1.515	119.817	Gg	0.000	0.129	98.230
2B10a		0.061	306.224	0.153	119.817	Gg	0.000	0.125	98.356
1A2e	Peat	0.165	306.224	0.193	119.817	Gg	0.000	0.125	98.481
1A2c	Solid	0.346	306.224	0.009	119.817	Gg	0.000	0.123	98.604
1A2f	Other	0.580	306.224	0.341	119.817	Gg	0.000	0.111	98.715
1A2a	Liquid	0.316	306.224	0.020	119.817	Gg	0.000	0.101	98.816
3B1b		0.118	306.224	0.137	119.817	Gg	0.000	0.089	98.904
3B4gii		0.027	306.224	0.089	119.817	Gg	0.000	0.077	98.981
1A2d	Gaseous	3.423	306.224	1.411	119.817	Gg	0.000	0.07	99.051
3Da2b		0.063	306.224	0.097	119.817	Gg	0.000	0.07	99.121
1A3aii(i)	Liquid	0.311	306.224	0.190	119.817	Gg	0.000	0.067	99.188
1A2gviii	Peat	0.046	306.224	0.075	119.817	Gg	0.000	0.056	99.243
1A4ai	Liquid	2.314	306.224	0.849	119.817	Gg	0.000	0.055	99.298
1A2f	Liquid	0.575	306.224	0.171	119.817	Gg	0.000	0.053	99.351
1A4bi	Gaseous	0.039	306.224	0.065	119.817	Gg	0.000	0.049	99.400
1A3biv	Diesel oil		306.224	0.049	119.817	Gg	0.000	0.048	99.447
1A4ci	Liquid	0.739	306.224	0.240	119.817	Gg	0.000	0.047	99.495
1A4ai	Gaseous	0.043	306.224	0.059	119.817	Gg	0.000	0.041	99.536
1A1b	Liquid	0.232	306.224	0.129	119.817	Gg	0.000	0.037	99.573
3B4h		0.041	306.224	0.054	119.817	Gg	0.000	0.037	99.610
1A1b	Solid	0.231	306.224	0.122	119.817	Gg	0.000	0.03	99.641
3F		0.113	306.224	0.073	119.817	Gg	0.000	0.028	99.669
1A2gviii	Liquid	1.295	306.224	0.481	119.817	Gg	0.000	0.025	99.693
3B4e		0.016	306.224	0.031	119.817	Gg	0.000	0.024	99.718
1A2e	Biomass	0.031	306.224	0.037	119.817	Gg	0.000	0.024	99.741
1A2c	Biomass	0.062	306.224	0.000	119.817	Gg	0.000	0.023	99.765
3B3		0.068	306.224	0.006	119.817	Gg	0.000	0.02	99.785
1A2f	Biomass	0.000	306.224	0.020	119.817	Gg	0.000	0.019	99.804
1A2e	Solid	0.247	306.224	0.116	119.817	Gg	0.000	0.019	99.823
3B4gi		0.052	306.224	0.040	119.817	Gg	0.000	0.019	99.842
1A2gvii	Gaseous	0.164	306.224	0.083	119.817	Gg	0.000	0.018	99.860
1A4ci	Gaseous	0.061	306.224	0.008	119.817	Gg	0.000	0.016	99.876
1A2e	Gaseous	0.090	306.224	0.020	119.817	Gg	0.000	0.015	99.891
3B1a		0.134	306.224	0.038	119.817	Gg	0.000	0.015	99.905
1A4bi	Solid	0.037	306.224	0.001	119.817	Gg	0.000	0.013	99.919
1A2b	Gaseous	0.036	306.224	0.025	119.817	Gg	0.000	0.010	99.929
1A4bi	Peat	0.065	306.224	0.015	119.817	Gg	0.000	0.010	99.939
1A2b	Liquid	0.205	306.224	0.070	119.817	Gg	0.000	0.010	99.948
1A3biii	Gaseous		306.224	0.008	119.817	Gg	0.000	0.008	99.956
3B4giii		0.001	306.224	0.008	119.817	Gg	0.000	0.008	99.964
1A4ai	Peat	0.015	306.224	0.012	119.817	Gg	0.000	0.006	99.970
3B2		0.006	306.224	0.008	119.817	Gg	0.000	0.006	99.976
1A2e	Other	0.001	306.224	0.005	119.817	Gg	0.000	0.005	99.981
1A4ci	Solid	0.024	306.224	0.014	119.817	Gg	0.000	0.005	99.986
1A3ei	Gaseous	0.009	306.224	0.007	119.817	Gg	0.000	0.004	99.989

1A3bi	Gaseous		306.224	0.003	119.817	Gg	0.000	0.003	99.992	
1A2a	Biomass		306.224	0.003	119.817	Gg	0.000	0.003	99.995	
2G		0.010	306.224	0.006	119.817	Gg	0.000	0.002	99.997	
1A4bi	Other	0.003	306.224	0.000	119.817	Gg	0.000	0.001	99.998	
3B4giv		0.007	306.224	0.004	119.817	Gg	0.000	0.001	99.999	
1A3bii	Gaseous		306.224	0.000	119.817	Gg	0.000	0.000	100	
3B4d		0.000	306.224	0.000	119.817	Gg	0.000	0.000	100	

NMVOC

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2019 emission of the NFR category	Year 2019 total emission	Unit	Trend assessment	Contribution to trend, %	Cumulative total, %	Key source
1A3bi	Gasoline	49.364	232.997	1.378	84.522	Gg	0.071	23.017	23.017	Yes
1A4bi	Biomass	15.697	232.997	20.98	84.522	Gg	0.066	21.285	44.302	Yes
2D3a		3.581	232.997	5.032	84.522	Gg	0.016	5.198	49.500	Yes
1A3bv		13.655	232.997	1.306	84.522	Gg	0.016	5.079	54.579	Yes
3B1a		7.634	232.997	6.242	84.522	Gg	0.015	4.836	59.415	Yes
3B1b		3.720	232.997	4.057	84.522	Gg	0.012	3.770	63.185	Yes
2D3h		8.800	232.997	0.546	84.522	Gg	0.011	3.685	66.87	Yes
2D3d		27.500	232.997	7.363	84.522	Gg	0.011	3.638	70.508	Yes
1A3biii	Diesel oil	7.843	232.997	0.312	84.522	Gg	0.011	3.527	74.035	Yes
2D3c		6.260	232.997	0.181	84.522	Gg	0.009	2.910	76.945	Yes
1A4aii	Liquid	6.267	232.997	0.491	84.522	Gg	0.008	2.482	79.427	Yes
2D3i		2.085	232.997	1.811	84.522	Gg	0.005	1.468	80.895	Yes
1A4cii	Liquid	6.642	232.997	1.364	84.522	Gg	0.004	1.456	82.351	
2H2		2.523	232.997	1.947	84.522	Gg	0.004	1.437	83.788	
2I		1.070	232.997	1.170	84.522	Gg	0.003	1.089	84.877	
1A1a	Biomass	0.094	232.997	0.774	84.522	Gg	0.003	1.030	85.906	
3Da2a		4.081	232.997	2.194	84.522	Gg	0.003	0.993	86.900	
3B4h		1.237	232.997	1.078	84.522	Gg	0.003	0.876	87.776	
3B4gii		0.224	232.997	0.705	84.522	Gg	0.003	0.868	88.644	
2B10a		7.836	232.997	2.219	84.522	Gg	0.003	0.868	89.512	
1A3dii	Liquid	9.646	232.997	2.885	84.522	Gg	0.003	0.855	90.366	
3De		1.062	232.997	0.995	84.522	Gg	0.003	0.850	91.216	
2H1		2.966	232.997	1.670	84.522	Gg	0.003	0.828	92.044	
1A3bii	Gasoline	1.669	232.997	0.036	84.522	Gg	0.002	0.793	92.837	
2D3e		2.638	232.997	0.521	84.522	Gg	0.002	0.607	93.444	
1A3bi	Diesel oil	1.332	232.997	0.103	84.522	Gg	0.002	0.529	93.973	
1A4ci	Peat	0.080	232.997	0.408	84.522	Gg	0.002	0.527	94.500	
2D3g		3.956	232.997	1.771	84.522	Gg	0.001	0.469	94.969	
1B2aiv		6.600	232.997	2.705	84.522	Gg	0.001	0.433	95.401	
1A2gvii	Liquid	2.115	232.997	1.047	84.522	Gg	0.001	0.390	95.791	
1A1a	Other	0.001	232.997	0.268	84.522	Gg	0.001	0.373	96.164	
1A5a	Biomass	0.014	232.997	0.222	84.522	Gg	0.001	0.302	96.466	
3B4e		0.153	232.997	0.249	84.522	Gg	0.001	0.269	96.735	
2C1		1.027	232.997	0.210	84.522	Gg	0.001	0.226	96.961	
1B2b		0.255	232.997	0.252	84.522	Gg	0.001	0.222	97.183	
3B2		0.105	232.997	0.157	84.522	Gg	0.001	0.166	97.348	
3B4gi		0.256	232.997	0.207	84.522	Gg	0.000	0.159	97.507	
1A1a	Peat	0.199	232.997	0.183	84.522	Gg	0.000	0.154	97.661	
3B3		0.428	232.997	0.253	84.522	Gg	0.000	0.136	97.798	
1A3biv	Gasoline	2.767	232.997	1.100	84.522	Gg	0.000	0.134	97.932	

1A3ai(i)	Liquid	0.056	232.997	0.109	84.522	Gg	0.000	0.124	98.056
2B10b		0.134	232.997	0.137	84.522	Gg	0.000	0.123	98.179
1B2av		7.411	232.997	2.767	84.522	Gg	0.000	0.109	98.288
1A4bii	Liquid	6.597	232.997	2.468	84.522	Gg	0.000	0.104	98.392
1A2gviii	Biomass	0.199	232.997	0.144	84.522	Gg	0.000	0.101	98.493
1A1a	Gaseous	0.042	232.997	0.085	84.522	Gg	0.000	0.097	98.590
2D3b		0.900	232.997	0.263	84.522	Gg	0.000	0.088	98.678
1A1b	Gaseous	0.009	232.997	0.059	84.522	Gg	0.000	0.077	98.755
1A2d	Liquid	0.271	232.997	0.150	84.522	Gg	0.000	0.072	98.828
1B1b		0.037	232.997	0.064	84.522	Gg	0.000	0.071	98.899
1A5b	Liquid	0.028	232.997	0.058	84.522	Gg	0.000	0.067	98.966
3F		0.253	232.997	0.135	84.522	Gg	0.000	0.060	99.026
1A1a	Solid	0.117	232.997	0.082	84.522	Gg	0.000	0.055	99.081
1A5a	Gaseous	0.025	232.997	0.045	84.522	Gg	0.000	0.051	99.132
1A2gviii	Gaseous	0.002	232.997	0.036	84.522	Gg	0.000	0.048	99.180
1A2a	Gaseous	0.124	232.997	0.011	84.522	Gg	0.000	0.047	99.228
1A2gvii	Gaseous	0.251	232.997	0.124	84.522	Gg	0.000	0.046	99.274
2C7b		0.010	232.997	0.035	84.522	Gg	0.000	0.044	99.318
1A2d	Biomass	0.333	232.997	0.152	84.522	Gg	0.000	0.043	99.361
1A4ciii	Liquid	0.144	232.997	0.083	84.522	Gg	0.000	0.043	99.404
3B4giii		0.007	232.997	0.031	84.522	Gg	0.000	0.040	99.444
1A3bii	Diesel oil	0.796	232.997	0.262	84.522	Gg	0.000	0.037	99.480
3Da3		0.104	232.997	0.064	84.522	Gg	0.000	0.036	99.517
1A4bi	Solid	0.074	232.997	0.001	84.522	Gg	0.000	0.036	99.552
1A5a	Liquid	0.099	232.997	0.054	84.522	Gg	0.000	0.026	99.578
1A2gviii	Other	0.011	232.997	0.022	84.522	Gg	0.000	0.025	99.603
1A4bi	Liquid	0.194	232.997	0.053	84.522	Gg	0.000	0.024	99.627
1A4bi	Peat	0.130	232.997	0.031	84.522	Gg	0.000	0.023	99.650
1A1b	Solid		232.997	0.015	84.522	Gg	0.000	0.021	99.671
1A4ci	Biomass	0.020	232.997	0.021	84.522	Gg	0.000	0.019	99.691
1A1b	Liquid	0.002	232.997	0.014	84.522	Gg	0.000	0.019	99.710
1A3aii(i)	Liquid	0.057	232.997	0.033	84.522	Gg	0.000	0.018	99.727
1A2d	Peat	0.018	232.997	0.019	84.522	Gg	0.000	0.017	99.745
1A2d	Solid	0.038	232.997	0.001	84.522	Gg	0.000	0.017	99.762
1A4ai	Peat	0.016	232.997	0.016	84.522	Gg	0.000	0.015	99.777
1A2d	Other	0.000	232.997	0.011	84.522	Gg	0.000	0.015	99.791
1A2e	Peat	0.012	232.997	0.015	84.522	Gg	0.000	0.015	99.806
1A2d	Gaseous	0.077	232.997	0.018	84.522	Gg	0.000	0.014	99.820
2G		0.027	232.997	0.020	84.522	Gg	0.000	0.014	99.834
5D2		0.022	232.997	0.018	84.522	Gg	0.000	0.014	99.848
1A3biv	Diesel oil		232.997	0.009	84.522	Gg	0.000	0.013	99.861
1A1a	Liquid	0.029	232.997	0.019	84.522	Gg	0.000	0.012	99.873
5D1		0.003	232.997	0.009	84.522	Gg	0.000	0.011	99.884
1A4ai	Biomass	0.007	232.997	0.010	84.522	Gg	0.000	0.010	99.894
1A2f	Other		232.997	0.006	84.522	Gg	0.000	0.009	99.903
1A4ai	Liquid	0.125	232.997	0.052	84.522	Gg	0.000	0.009	99.912
5A		0.234	232.997	0.079	84.522	Gg	0.000	0.008	99.920
1A4bi	Gaseous	0.004	232.997	0.007	84.522	Gg	0.000	0.007	99.927
1A2c	Gaseous	0.003	232.997	0.006	84.522	Gg	0.000	0.007	99.934
1A4ai	Gaseous	0.003	232.997	0.006	84.522	Gg	0.000	0.006	99.94
3B4giv		0.041	232.997	0.018	84.522	Gg	0.000	0.005	99.945

2A1		0.054	232.997	0.023	84.522	Gg	0.000	0.005	99.950
1A2gviii	Liquid	0.017	232.997	0.009	84.522	Gg	0.000	0.004	99.954
3B4d		0.004	232.997	0.005	84.522	Gg	0.000	0.004	99.959
1A2e	Biomass	0.007	232.997	0.006	84.522	Gg	0.000	0.004	99.963
1A3c	Liquid	0.234	232.997	0.082	84.522	Gg	0.000	0.004	99.967
2L		0.013	232.997	0.002	84.522	Gg	0.000	0.004	99.971
2C7c		0.025	232.997	0.007	84.522	Gg	0.000	0.003	99.974
1A2e	Other	0.000	232.997	0.002	84.522	Gg	0.000	0.003	99.977
2A3		0.001	232.997	0.002	84.522	Gg	0.000	0.002	99.979
1A3bi	Gaseous		232.997	0.002	84.522	Gg	0.000	0.002	99.981
1A2f	Biomass	0.000	232.997	0.001	84.522	Gg	0.000	0.002	99.983
1A2gviii	Peat	0.002	232.997	0.002	84.522	Gg	0.000	0.002	99.985
1A2c	Solid	0.004	232.997	0.000	84.522	Gg	0.000	0.002	99.987
1A2f	Gaseous	0.004	232.997	0.003	84.522	Gg	0.000	0.002	99.989
2C6		0.001	232.997	0.001	84.522	Gg	0.000	0.001	99.990
1A2e	Liquid	0.005	232.997	0.001	84.522	Gg	0.000	0.001	99.991
1A4ci	Liquid	0.043	232.997	0.015	84.522	Gg	0.000	0.001	99.993
1A2e	Solid	0.007	232.997	0.003	84.522	Gg	0.000	0.001	99.994
2C2			232.997	0.001	84.522	Gg	0.000	0.001	99.994
2C7a			232.997	0.001	84.522	Gg	0.000	0.001	99.995
1A2a	Biomass		232.997	0.001	84.522	Gg	0.000	0.001	99.996
1A3biii	Gaseous		232.997	0.000	84.522	Gg	0.000	0.001	99.996
1A2f	Solid	0.009	232.997	0.003	84.522	Gg	0.000	0.001	99.997
1A2f	Liquid	0.004	232.997	0.002	84.522	Gg	0.000	0.000	99.998
1A2b	Liquid	0.001	232.997	0.001	84.522	Gg	0.000	0.000	99.998
1A2b	Gaseous	0.000	232.997	0.000	84.522	Gg	0.000	0.000	99.998
1A2a	Liquid	0.002	232.997	0.000	84.522	Gg	0.000	0.000	99.999
1A3bii	Gaseous		232.997	0.000	84.522	Gg	0.000	0.000	99.999
1A2c	Liquid	0.003	232.997	0.001	84.522	Gg	0.000	0.000	99.999
1A4ci	Solid	0.001	232.997	0.000	84.522	Gg	0.000	0.000	99.999
1A3ei	Gaseous	0.000	232.997	0.000	84.522	Gg	0.000	0.000	100
1A4ci	Gaseous	0.002	232.997	0.001	84.522	Gg	0.000	0.000	100
1A2e	Gaseous	0.001	232.997	0.000	84.522	Gg	0.000	0.000	100
1A4bi	Other	0.000	232.997	0.000	84.522	Gg	0.000	0.000	100
1A2b	Solid	0.000	232.997	0.000	84.522	Gg	0.000	0.000	100

SO_x

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2019 emission of the NFR category	Year 2019 total emission	Unit	Trend assessment	Contribution to trend, %	Cumulative total, %	Key source
1A1b	Gaseous	1.599	248.793	3.506	28.937	Gg	0.013	13.457	13.457	Yes
1A1a	Peat	8.877	248.793	3.532	28.937	Gg	0.010	10.132	23.589	Yes
1A2d	Liquid	24.674	248.793	0.804	28.937	Gg	0.008	8.372	31.961	Yes
2H1		22.811	248.793	0.885	28.937	Gg	0.007	7.166	39.127	Yes
1A1b	Solid	15.681	248.793	0.352	28.937	Gg	0.006	5.967	45.094	Yes
1A1a	Solid	50.545	248.793	4.434	28.937	Gg	0.006	5.855	50.948	Yes
1A1a	Liquid	16.690	248.793	0.581	28.937	Gg	0.005	5.513	56.461	Yes
1A1a	Biomass	0.547	248.793	1.228	28.937	Gg	0.005	4.718	61.179	Yes
1A2b	Solid	4.034	248.793	1.235	28.937	Gg	0.003	3.105	64.284	Yes
1A2b	Liquid	4.045	248.793	1.200	28.937	Gg	0.003	2.958	67.241	Yes
1A2d	Solid	6.141	248.793	0.010	28.937	Gg	0.003	2.855	70.097	Yes
1A2a	Solid	6.995	248.793	0.179	28.937	Gg	0.003	2.573	72.669	Yes

1A5a	Biomass	0.008	248.793	0.443	28.937	Gg	0.002	1.793	74.462	Yes
2C1		2.867	248.793	0.734	28.937	Gg	0.002	1.623	76.085	Yes
1A2gviii	Liquid	4.979	248.793	0.189	28.937	Gg	0.002	1.579	77.665	Yes
2B10a		13.894	248.793	1.246	28.937	Gg	0.001	1.498	79.163	Yes
1A4ci	Peat	0.072	248.793	0.367	28.937	Gg	0.001	1.453	80.616	Yes
1A3biii	Diesel oil	2.738	248.793	0.015	28.937	Gg	0.001	1.230	81.846	
1A2e	Solid	0.783	248.793	0.349	28.937	Gg	0.001	1.044	82.891	
1A2d	Biomass	1.155	248.793	0.376	28.937	Gg	0.001	0.980	83.871	
1A4bi	Biomass	0.206	248.793	0.257	28.937	Gg	0.001	0.946	84.817	
1A2c	Gaseous	1.839	248.793	0.004	28.937	Gg	0.001	0.850	85.667	
1A5a	Liquid	5.951	248.793	0.894	28.937	Gg	0.001	0.819	86.486	
1A2f	Solid	1.111	248.793	0.331	28.937	Gg	0.001	0.817	87.303	
1A1a	Other	0.027	248.793	0.200	28.937	Gg	0.001	0.799	88.102	
1A1b	Liquid	4.507	248.793	0.350	28.937	Gg	0.001	0.707	88.810	
1A2gviii	Biomass	0.276	248.793	0.205	28.937	Gg	0.001	0.701	89.511	
1A2a	Gaseous	0.271	248.793	0.196	28.937	Gg	0.001	0.667	90.178	
1A4ai	Liquid	10.103	248.793	1.040	28.937	Gg	0.001	0.546	90.723	
1A2d	Peat	5.876	248.793	0.812	28.937	Gg	0.001	0.520	91.244	
1A2gvii	Liquid	1.003	248.793	0.004	28.937	Gg	0.000	0.455	91.699	
1A4cii	Liquid	0.986	248.793	0.003	28.937	Gg	0.000	0.453	92.152	
1A4ci	Liquid	3.231	248.793	0.265	28.937	Gg	0.000	0.451	92.603	
2C7a		0.000	248.793	0.111	28.937	Gg	0.000	0.450	93.053	
1A2d	Gaseous	0.239	248.793	0.137	28.937	Gg	0.000	0.444	93.497	
1A3dii	Liquid	1.650	248.793	0.085	28.937	Gg	0.000	0.434	93.931	
1A2c	Solid	0.962	248.793	0.009	28.937	Gg	0.000	0.419	94.350	
1A3bi	Diesel oil	0.909	248.793	0.008	28.937	Gg	0.000	0.395	94.745	
1A5a	Gaseous	0.000	248.793	0.084	28.937	Gg	0.000	0.341	95.086	
1A3bi	Gasoline	0.86	248.793	0.018	28.937	Gg	0.000	0.332	95.418	
1A2f	Liquid	1.827	248.793	0.134	28.937	Gg	0.000	0.320	95.738	
1A2e	Liquid	3.245	248.793	0.299	28.937	Gg	0.000	0.320	96.058	
1A3bii	Diesel oil	0.705	248.793	0.003	28.937	Gg	0.000	0.319	96.376	
1A2e	Peat	0.230	248.793	0.105	28.937	Gg	0.000	0.316	96.692	
1A2a	Liquid	1.958	248.793	0.152	28.937	Gg	0.000	0.306	96.998	
1A2gviii	Peat	0.019	248.793	0.059	28.937	Gg	0.000	0.232	97.230	
1A2f	Gaseous	0.064	248.793	0.064	28.937	Gg	0.000	0.231	97.461	
1A1a	Gaseous	0.002	248.793	0.054	28.937	Gg	0.000	0.220	97.681	
1A3c	Liquid	0.438	248.793	0.000	28.937	Gg	0.000	0.205	97.886	
1A3ai(i)	Liquid	0.021	248.793	0.053	28.937	Gg	0.000	0.205	98.091	
1A4aii	Liquid	0.409	248.793	0.001	28.937	Gg	0.000	0.188	98.279	
1A2c	Liquid	3.311	248.793	0.430	28.937	Gg	0.000	0.184	98.463	
1A5b	Liquid	0.007	248.793	0.044	28.937	Gg	0.000	0.174	98.637	
1A4ci	Solid	0.093	248.793	0.053	28.937	Gg	0.000	0.172	98.809	
1B1b		0.795	248.793	0.053	28.937	Gg	0.000	0.161	98.970	
1A4ci	Biomass	0.033	248.793	0.036	28.937	Gg	0.000	0.129	99.099	
1A4bi	Solid	0.290	248.793	0.004	28.937	Gg	0.000	0.121	99.221	
1A4ciii	Liquid	0.195	248.793	0.000	28.937	Gg	0.000	0.090	99.311	
1A2gviii	Gaseous	0.028	248.793	0.025	28.937	Gg	0.000	0.089	99.400	
1A2d	Other	0.390	248.793	0.064	28.937	Gg	0.000	0.077	99.477	
1A4bi	Liquid	4.226	248.793	0.473	28.937	Gg	0.000	0.073	99.550	
1A4ai	Peat	0.016	248.793	0.018	28.937	Gg	0.000	0.065	99.615	
1A4ai	Biomass	0.010	248.793	0.016	28.937	Gg	0.000	0.060	99.675	

1A4bi	Peat	0.117	248.793	0.028	28.937	Gg	0.000	0.056	99.731
1A3aii(i)	Liquid	0.021	248.793	0.013	28.937	Gg	0.000	0.044	99.776
2D3i		0.089	248.793	0.000	28.937	Gg	0.000	0.040	99.816
3F		0.015	248.793	0.011	28.937	Gg	0.000	0.037	99.852
1A2e	Biomass	0.025	248.793	0.010	28.937	Gg	0.000	0.031	99.883
1A2c	Biomass	0.038	248.793	0.000	28.937	Gg	0.000	0.017	99.900
1A2e	Other	0.001	248.793	0.004	28.937	Gg	0.000	0.017	99.917
1A2gviii	Other	0.307	248.793	0.032	28.937	Gg	0.000	0.017	99.933
1A3bii	Gasoline	0.032	248.793	0.000	28.937	Gg	0.000	0.015	99.948
2G		0.001	248.793	0.003	28.937	Gg	0.000	0.013	99.961
1A4bii	Liquid	0.032	248.793	0.001	28.937	Gg	0.000	0.012	99.973
2C2			248.793	0.002	28.937	Gg	0.000	0.009	99.982
1A2f	Biomass	0.000	248.793	0.001	28.937	Gg	0.000	0.006	99.988
1A2f	Other	0.033	248.793	0.005	28.937	Gg	0.000	0.003	99.991
1A2b	Gaseous	0.000	248.793	0.001	28.937	Gg	0.000	0.002	99.993
2C7b		0.004	248.793	0.001	28.937	Gg	0.000	0.002	99.995
1A2e	Gaseous	0.005	248.793	0.000	28.937	Gg	0.000	0.002	99.997
1A3biv	Gasoline	0.007	248.793	0.001	28.937	Gg	0.000	0.001	99.998
2D3g		0.002	248.793	0.000	28.937	Gg	0.000	0.001	99.999
1A2a	Biomass		248.793	0.000	28.937	Gg	0.000	0.000	99.999
2C7c		0.001	248.793	0.000	28.937	Gg	0.000	0.000	99.999
1A4ai	Gaseous	0.000	248.793	0.000	28.937	Gg	0.000	0.000	99.999
1A4bi	Gaseous	0.000	248.793	0.000	28.937	Gg	0.000	0.000	100
1A4bi	Other	0.000	248.793	0.000	28.937	Gg	0.000	0.000	100
1A3biv	Diesel oil		248.793	0.000	28.937	Gg	0.000	0.000	100
1A2gvii	Gaseous	0.000	248.793	0.000	28.937	Gg	0.000	0.000	100
1A3bi	Gaseous		248.793	0.000	28.937	Gg	0.000	0.000	100
2L			248.793	0.000	28.937	Gg	0.000	0.000	100
1A3ei	Gaseous	0.000	248.793	0.000	28.937	Gg	0.000	0.000	100
1A3biii	Gaseous		248.793	0.000	28.937	Gg	0.000	0.000	100
1A3bii	Gaseous		248.793	0.000	28.937	Gg	0.000	0.000	100
1A4ci	Gaseous	0.000	248.793	0.000	28.937	Gg	0.000	0.000	100

NH_3

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2019 emission of the NFR category	Year 2019 total emission	Unit	Trend assessment	Contribution to trend, %	Cumulative total, %	Key source
3Da2a		9.422	34.738	6.852	31.593	Gg	0.049	18.263	18.263	Yes
3Da1		3.733	34.738	2.099	31.593	Gg	0.037	13.791	32.055	Yes
3B1b		4.210	34.738	5.003	31.593	Gg	0.034	12.486	44.541	Yes
3B4h		1.837	34.738	2.436	31.593	Gg	0.022	8.140	52.681	Yes
3B3		3.979	34.738	2.969	31.593	Gg	0.019	6.908	59.589	Yes
3B1a		5.425	34.738	5.580	31.593	Gg	0.019	6.878	66.467	Yes
3B4gii		0.206	34.738	0.688	31.593	Gg	0.014	5.322	71.789	Yes
1A3bi	Gasoline	0.235	34.738	0.694	31.593	Gg	0.014	5.109	76.898	Yes
2H1		0.542	34.738	0.119	31.593	Gg	0.011	3.977	80.875	Yes
3B4e		0.386	34.738	0.691	31.593	Gg	0.010	3.618	84.492	
1A4bi	Biomass	0.946	34.738	1.136	31.593	Gg	0.008	2.936	87.429	
2B10a		0.582	34.738	0.309	31.593	Gg	0.006	2.342	89.770	
3Da3		1.640	34.738	1.345	31.593	Gg	0.004	1.564	91.334	
5D1		0.275	34.738	0.387	31.593	Gg	0.004	1.449	92.783	

3B2		0.062	34.738	0.126	31.593	Gg	0.002	0.743	93.525
2D3i		0.097	34.738	0.158	31.593	Gg	0.002	0.742	94.267
5B1		0.035	34.738	0.099	31.593	Gg	0.002	0.716	94.983
3B4giii		0.009	34.738	0.065	31.593	Gg	0.002	0.595	95.578
2D3e		0.061	34.738	0.004	31.593	Gg	0.001	0.546	96.124
3B4giv		0.103	34.738	0.043	31.593	Gg	0.001	0.546	96.670
2C7b		0.100	34.738	0.041	31.593	Gg	0.001	0.531	97.201
3B4gi		0.535	34.738	0.438	31.593	Gg	0.001	0.516	97.717
2C1		0.003	34.738	0.038	31.593	Gg	0.001	0.375	98.092
3F		0.109	34.738	0.072	31.593	Gg	0.001	0.291	98.383
3Da2b		0.043	34.738	0.066	31.593	Gg	0.001	0.284	98.667
2G		0.042	34.738	0.013	31.593	Gg	0.001	0.268	98.936
1A3bi	Diesel oil	0.005	34.738	0.027	31.593	Gg	0.001	0.236	99.172
1A3biii	Diesel oil	0.010	34.738	0.029	31.593	Gg	0.001	0.213	99.384
2D3g		0.026	34.738	0.004	31.593	Gg	0.001	0.211	99.596
2L		0.020	34.738	0.006	31.593	Gg	0.000	0.129	99.725
1A3bii	Diesel oil	0.003	34.738	0.009	31.593	Gg	0.000	0.059	99.783
1A3bi	Gaseous		34.738	0.004	31.593	Gg	0.000	0.044	99.828
3B4d		0.005	34.738	0.007	31.593	Gg	0.000	0.027	99.855
1A4ai	Biomass	0.003	34.738	0.005	31.593	Gg	0.000	0.024	99.878
1A2gviii			34.738	0.002	31.593	Gg	0.000	0.023	99.902
1A1a		0.001	34.738	0.003	31.593	Gg	0.000	0.022	99.923
1A4ci	Biomass	0.011	34.738	0.012	31.593	Gg	0.000	0.019	99.942
1B1b		0.002	34.738	0.003	31.593	Gg	0.000	0.015	99.958
1A3biv	Gasoline	0.001	34.738	0.002	31.593	Gg	0.000	0.013	99.971
1A2gvii	Liquid	0.002	34.738	0.003	31.593	Gg	0.000	0.008	99.979
1A3bii	Gaseous		34.738	0.000	31.593	Gg	0.000	0.005	99.983
1A3c	Liquid	0.000	34.738	0.000	31.593	Gg	0.000	0.003	99.986
1A3bii	Gasoline	0.002	34.738	0.002	31.593	Gg	0.000	0.002	99.988
2C7c		0.000	34.738	0.000	31.593	Gg	0.000	0.002	99.990
1A4cii	Liquid	0.002	34.738	0.002	31.593	Gg	0.000	0.002	99.992
1A3biii	Gaseous		34.738	0.000	31.593	Gg	0.000	0.002	99.994
1A4ciii	Liquid	0.000	34.738	0.000	31.593	Gg	0.000	0.001	99.995
1A4aii	Liquid	0.001	34.738	0.001	31.593	Gg	0.000	0.001	99.996
1A4bii	Liquid	0.000	34.738	0.000	31.593	Gg	0.000	0.001	99.998
1A3dii	Liquid	0.001	34.738	0.001	31.593	Gg	0.000	0.001	99.999
1A3biv	Diesel oil		34.738	0.000	31.593	Gg	0.000	0.001	99.999
1A2gvii	Gaseous	0.000	34.738	0.000	31.593	Gg	0.000	0.000	100
1A5a	Liquid	0.000	34.738	0.000	31.593	Gg	0.000	0.000	100
1A4bi	Solid	0000	34.738	0.000	31.593	Gg	0.000	0.000	100

$PM_{2.5}$

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2019 emission of the NFR category	Year 2019 total emission	Unit	Trend assessment	Contribution to trend, %	Cumulative total, %	Key source
1A4bi	Biomass	7.541	47.384	8.817	16.622	Gg	0.130	35.677	35.677	Yes
1A2d	Liquid	9.021	47.384	0.931	16.622	Gg	0.047	12.912	48.589	Yes
1A3biii	Diesel oil	4.287	47.384	0.171	16.622	Gg	0.028	7.707	56.296	Yes
2C1		3.152	47.384	0.219	16.622	Gg	0.019	5.126	61.422	Yes
1A3bi	Diesel oil	2.366	47.384	0.228	16.622	Gg	0.013	3.479	64.901	Yes
1A3bvi		0.542	47.384	0.639	16.622	Gg	0.009	2.597	67.498	Yes
1A4cii	Liquid	1.620	47.384	0.188	16.622	Gg	0.008	2.199	69.697	Yes
1A1a	Solid	1.103	47.384	0.027	16.622	Gg	0.008	2.082	71.779	Yes
1A3bvii		0.404	47.384	0.473	16.622	Gg	0.007	1.916	73.695	Yes
1B1c		1.085	47.384	0.674	16.622	Gg	0.006	1.695	75.390	Yes
2H2		0.303	47.384	0.397	16.622	Gg	0.006	1.683	77.073	Yes
2H1		1.420	47.384	0.210	16.622	Gg	0.006	1.665	78.738	Yes
1A1a	Liquid	0.810	47.384	0.036	16.622	Gg	0.005	1.436	80.173	Yes
1A5a	Biomass	0.002	47.384	0.222	16.622	Gg	0.005	1.277	81.450	
1A2gvii	Liquid	1.421	47.384	0.307	16.622	Gg	0.004	1.106	82.556	
2A5b		0.504	47.384	0.003	16.622	Gg	0.004	1.005	83.561	
1A2f	Solid	0.526	47.384	0.020	16.622	Gg	0.003	0.951	84.512	
1A4aii	Liquid	0.746	47.384	0.100	16.622	Gg	0.003	0.936	85.448	
1A2gviii	Liquid	0.471	47.384	0.008	16.622	Gg	0.003	0.909	86.357	
1A2d	Biomass	0.637	47.384	0.069	16.622	Gg	0.003	0.896	87.253	
1A3bii	Diesel oil	1.074	47.384	0.241	16.622	Gg	0.003	0.783	88.036	
1A3dii	Liquid	0.548	47.384	0.322	16.622	Gg	0.003	0.749	88.785	
3Dc		0.268	47.384	0.210	16.622	Gg	0.002	0.668	89.453	
1A4ai	Liquid	0.506	47.384	0.083	16.622	Gg	0.002	0.546	89.999	
1A1a	Peat	0.467	47.384	0.078	16.622	Gg	0.002	0.495	90.494	
2B6		0.248	47.384	0.002	16.622	Gg	0.002	0.491	90.985	
3F		0.287	47.384	0.183	16.622	Gg	0.002	0.478	91.463	
1A1a	Biomass	0.145	47.384	0.130	16.622	Gg	0.002	0.456	91.919	
1A4ci	Biomass	0.101	47.384	0.108	16.622	Gg	0.002	0.422	92.341	
1A2f	Liquid	0.219	47.384	0.005	16.622	Gg	0.002	0.418	92.758	
2C7c		0.201	47.384	0.005	16.622	Gg	0.001	0.380	93.138	
2C2		0.014	47.384	0.069	16.622	Gg	0.001	0.371	93.509	
1B2aiv		0.189	47.384	0.004	16.622	Gg	0.001	0.360	93.869	
1A4bii	Liquid	0.242	47.384	0.134	16.622	Gg	0.001	0.282	94.151	
1A2c	Liquid	0.184	47.384	0.019	16.622	Gg	0.001	0.265	94.416	
2I		0.131	47.384	0.001	16.622	Gg	0.001	0.264	94.679	
1A2d	Peat	0.154	47.384	0.010	16.622	Gg	0.001	0.255	94.934	
1A2e	Liquid	0.143	47.384	0.009	16.622	Gg	0.001	0.236	95.170	
1A4ai	Biomass	0.030	47.384	0.050	16.622	Gg	0.001	0.231	95.401	
1A4bi	Solid	0.118	47.384	0.002	16.622	Gg	0.001	0.229	95.630	
2A3		0.124	47.384	0.004	16.622	Gg	0.001	0.228	95.858	
1A4ci	Liquid	0.167	47.384	0.020	16.622	Gg	0.001	0.227	96.085	
1A4ci	Peat	0.008	47.384	0.041	16.622	Gg	0.001	0.219	96.304	
1A2d	Solid	0.110	47.384	0.001	16.622	Gg	0.001	0.219	96.523	
2B10a		0.738	47.384	0.223	16.622	Gg	0.001	0.211	96.734	
2D3b		0.087	47.384	0.065	16.622	Gg	0.001	0.199	96.933	
2G		0.153	47.384	0.087	16.622	Gg	0.001	0.191	97.124	

1A5a	Liquid	0.304	47.384	0.076	16.622	Gg	0.001	0.176	97.299
1A2a	Solid	0.087	47.384	0.001	16.622	Gg	0.001	0.170	97.470
1A3bi	Gasoline	0.174	47.384	0.033	16.622	Gg	0.001	0.160	97.630
1A1b	Liquid	0.076	47.384	0.001	16.622	Gg	0.001	0.149	97.779
1A2c	Solid	0.073	47.384	0.000	16.622	Gg	0.001	0.147	97.926
1A4bi	Liquid	0.219	47.384	0.053	16.622	Gg	0.001	0.140	98.065
1A4bi	Peat	0.208	47.384	0.049	16.622	Gg	0.001	0.139	98.204
2A5a		0.068	47.384	0.000	16.622	Gg	0.000	0.137	98.341
1A5b	Liquid	0.004	47.384	0.024	16.622	Gg	0.000	0.129	98.470
3B1b		0.079	47.384	0.048	16.622	Gg	0.000	0.119	98.588
1A2a	Liquid	0.069	47.384	0.004	16.622	Gg	0.000	0.113	98.702
2D3i		0.064	47.384	0.042	16.622	Gg	0.000	0.113	98.815
1A4ciii	Liquid	0.072	47.384	0.043	16.622	Gg	0.000	0.104	98.919
1A2gviii	Biomass	0.203	47.384	0.056	16.622	Gg	0.000	0.085	99.005
3B1a		0.132	47.384	0.060	16.622	Gg	0.000	0.079	99.083
2L		0.054	47.384	0.006	16.622	Gg	0.000	0.076	99.159
1A2d	Gaseous	0.052	47.384	0.007	16.622	Gg	0.000	0.067	99.226
1A2b	Liquid	0.038	47.384	0.003	16.622	Gg	0.000	0.062	99.288
2A2		0.026	47.384	0.000	16.622	Gg	0.000	0.052	99.340
2C7a		0.026	47.384	0.000	16.622	Gg	0.000	0.049	99.389
3B4gii		0.003	47.384	0.010	16.622	Gg	0.000	0.049	99.438
1A3biv	Diesel oil		47.384	0.008	16.622	Gg	0.000	0.048	99.486
1A2e	Peat	0.023	47.384	0.001	16.622	Gg	0.000	0.043	99.529
3B4h		0.013	47.384	0.011	16.622	Gg	0.000	0.040	99.568
1A1a	Other	0.001	47.384	0.007	16.622	Gg	0.000	0.039	99.607
2A5c		0.049	47.384	0.023	16.622	Gg	0.000	0.033	99.640
1A3ai(i)	Liquid	0.003	47.384	0.006	16.622	Gg	0.000	0.029	99.669
3B4gi		0.014	47.384	0.010	16.622	Gg	0.000	0.028	99.698
3B4e		0.004	47.384	0.006	16.622	Gg	0.000	0.028	99.725
1A2b	Solid	0.014	47.384	0.000	16.622	Gg	0.000	0.027	99.752
2D3g		0.016	47.384	0.002	16.622	Gg	0.000	0.023	99.776
1A3biv	Gasoline	0.057	47.384	0.016	16.622	Gg	0.000	0.021	99.797
1A2e	Solid	0.013	47.384	0.001	16.622	Gg	0.000	0.020	99.817
1A2e	Biomass	0.011	47.384	0.001	16.622	Gg	0.000	0.019	99.836
1A2f	Other		47.384	0.003	16.622	Gg	0.000	0.018	99.855
1A2gviii	Other	0.009	47.384	0.000	16.622	Gg	0.000	0.016	99.871
1A3c	Liquid	0.084	47.384	0.027	16.622	Gg	0.000	0.015	99.885
3B4giii		0.001	47.384	0.003	16.622	Gg	0.000	0.014	99.899
1A1b	Solid	0.020	47.384	0.005	16.622	Gg	0.000	0.011	99.911
1A3bii	Gasoline	0.006	47.384	0.000	16.622	Gg	0.000	0.011	99.921
1B1b		0.003	47.384	0.003	16.622	Gg	0.000	0.009	99.931
1B2av		0.005	47.384	0.000	16.622	Gg	0.000	0.008	99.939
1A4ai	Peat	0.002	47.384	0.002	16.622	Gg	0.000	0.007	99.946
3B2		0.001	47.384	0.001	16.622	Gg	0.000	0.007	99.953
2B10b		0.001	47.384	0.001	16.622	Gg	0.000	0.007	99.959
5C1bv		0.000	47.384	0.001	16.622	Gg	0.000	0.006	99.965
2D3d		0.000	47.384	0.001	16.622	Gg	0.000	0.004	99.969
3B3		0.004	47.384	0.002	16.622	Gg	0.000	0.004	99.973
5E		0.299	47.384	0.104	16.622	Gg	0.000	0.004	99.977
1A3aii(i)	Liquid	0.002	47.384	0.001	16.622	Gg	0.000	0.004	99.981
3B4giv		0.032	47.384	0.011	16.622	Gg	0.000	0.003	99.984

1A2f	Biomass	0.000	47.384	0.001	16.622	Gg	0.000	0.003	99.986	
1A2c	Biomass	0.001	47.384	0.000	16.622	Gg	0.000	0.002	99.989	
1A2d	Other	0.005	47.384	0.002	16.622	Gg	0.000	0.002	99.991	
2C7d		0.001	47.384	0.001	16.622	Gg	0.000	0.002	99.993	
2D3e		0.001	47.384	0.000	16.622	Gg	0.000	0.001	99.994	
2C3		0.001	47.384	0.000	16.622	Gg	0.000	0.001	99.995	
1A2gvii	Gaseous	0.001	47.384	0.001	16.622	Gg	0.000	0.001	99.996	
1A2gviii	Peat	0.001	47.384	0.000	16.622	Gg	0.000	0.001	99.998	
1A3bi	Gaseous		47.384	0.000	16.622	Gg	0.000	0.001	99.998	
1A4bi	Other	0.000	47.384	0.000	16.622	Gg	0.000	0.000	99.999	
1A2a	Biomass		47.384	0.000	16.622	Gg	0.000	0.000	99.999	
3B4d		0.000	47.384	0.000	16.622	Gg	0.000	0.000	99.999	
1A2e	Other	0.000	47.384	0.000	16.622	Gg	0.000	0.000	100	
1A3bii	Gaseous		47.384	0.000	16.622	Gg	0.000	0.000	100	
1A3biii	Gaseous		47.384	0.000	16.622	Gg	0.000	0.000	100	
1A4ci	Solid	0.001	47.384	0.000	16.622	Gg	0.000	0.000	100	
5A		0.000	47.384	0.000	16.622	Gg	0.000	0.000	100	

PM_{10}

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2019 emission of the NFR category	Year 2019 total emission	Unit	Trend assessment	Contribution to trend, %	Cumulative total, %	Key source
1A4bi	Biomass	7.784	74.109	9.101	30.034	Gg	0.080	19.523	19.523	Yes
1A3bvii		4.766	74.109	5.589	30.034	Gg	0.049	12.009	31.533	Yes
1A2d	Liquid	11.187	74.109	1.301	30.034	Gg	0.044	10.615	42.148	Yes
1A1a	Solid	4.794	74.109	0.122	30.034	Gg	0.025	5.978	48.126	Yes
3Dc		4.905	74.109	3.800	30.034	Gg	0.024	5.951	54.076	Yes
1A3biii	Diesel oil	4.287	74.109	0.171	30.034	Gg	0.021	5.144	59.220	Yes
2C1		4.059	74.109	0.235	30.034	Gg	0.019	4.630	63.850	Yes
1A5a	Biomass	0.012	74.109	1.153	30.034	Gg	0.015	3.769	67.619	Yes
1A3bvi		0.982	74.109	1.160	30.034	Gg	0.010	2.502	70.121	Yes
1A3bi	Diesel oil	2.366	74.109	0.228	30.034	Gg	0.010	2.399	72.519	Yes
1A2d	Biomass	1.700	74.109	0.145	30.034	Gg	0.007	1.787	74.306	Yes
2H1		1.965	74.109	0.277	30.034	Gg	0.007	1.705	76.011	Yes
1A4cii	Liquid	1.620	74.109	0.188	30.034	Gg	0.006	1.539	77.550	Yes
1A1a	Liquid	1.218	74.109	0.102	30.034	Gg	0.005	1.285	78.834	Yes
1A2f	Solid	0.971	74.109	0.038	30.034	Gg	0.005	1.167	80.001	Yes
1B1c		1.544	74.109	0.959	30.034	Gg	0.004	1.094	81.096	
1A1a	Biomass	0.396	74.109	0.474	30.034	Gg	0.004	1.029	82.125	
2A5b		0.796	74.109	0.011	30.034	Gg	0.004	1.023	83.148	
1A2gviii	Liquid	0.747	74.109	0.019	30.034	Gg	0.004	0.930	84.078	
2H2		0.320	74.109	0.412	30.034	Gg	0.004	0.926	85.003	
1A2gvii	Liquid	1.421	74.109	0.307	30.034	Gg	0.004	0.882	85.886	
1A1a	Peat	1.337	74.109	0.308	30.034	Gg	0.003	0.767	86.653	
1A4aii	Liquid	0.746	74.109	0.100	30.034	Gg	0.003	0.665	87.318	
1A4ci	Peat	0.042	74.109	0.212	30.034	Gg	0.003	0.641	87.959	
1A3bii	Diesel oil	1.074	74.109	0.241	30.034	Gg	0.003	0.637	88.595	
1A2d	Solid	0.493	74.109	0.008	30.034	Gg	0.003	0.629	89.224	
1A4ai	Liquid	0.814	74.109	0.147	30.034	Gg	0.002	0.599	89.823	
2C7c		0.408	74.109	0.006	30.034	Gg	0.002	0.524	90.347	
1A2a	Solid	0.394	74.109	0.005	30.034	Gg	0.002	0.508	90.855	

2B10a		1.156	74.109	0.326	30.034	Gg	0.002	0.467	91.322
1A2f	Liquid	0.358	74.109	0.010	30.034	Gg	0.002	0.444	91.766
1B2aiv		0.312	74.109	0.006	30.034	Gg	0.002	0.393	92.159
1A2gviii	Biomass	0.666	74.109	0.158	30.034	Gg	0.002	0.367	92.526
1A2d	Peat	0.326	74.109	0.023	30.034	Gg	0.001	0.359	92.885
1A3dii	Liquid	0.565	74.109	0.331	30.034	Gg	0.001	0.333	93.218
2B6		0.248	74.109	0.002	30.034	Gg	0.001	0.323	93.541
1A2c	Solid	0.243	74.109	0.000	30.034	Gg	0.001	0.322	93.863
2A5a		0.230	74.109	0.003	30.034	Gg	0.001	0.296	94.159
2C2		0.020	74.109	0.098	30.034	Gg	0.001	0.295	94.453
2I		0.271	74.109	0.021	30.034	Gg	0.001	0.291	94.744
1A2c	Liquid	0.289	74.109	0.029	30.034	Gg	0.001	0.288	95.033
3B4gii		0.031	74.109	0.095	30.034	Gg	0.001	0.271	95.304
1A2e	Liquid	0.221	74.109	0.015	30.034	Gg	0.001	0.246	95.550
1A4ci	Liquid	0.269	74.109	0.036	30.034	Gg	0.001	0.240	95.791
1A4ci	Biomass	0.104	74.109	0.114	30.034	Gg	0.001	0.235	96.026
3F		0.301	74.109	0.192	30.034	Gg	0.001	0.231	96.257
1A5a	Liquid	0.481	74.109	0.126	30.034	Gg	0.001	0.227	96.484
1A4bi	Liquid	0.336	74.109	0.069	30.034	Gg	0.001	0.220	96.705
3B4gi		0.189	74.109	0.132	30.034	Gg	0.001	0.181	96.886
2A3		0.142	74.109	0.005	30.034	Gg	0.001	0.174	97.060
1A4bi	Solid	0.133	74.109	0.002	30.034	Gg	0.001	0.170	97.231
1A1b	Liquid	0.123	74.109	0.002	30.034	Gg	0.001	0.156	97.387
1A2e	Peat	0.111	74.109	0.003	30.034	Gg	0.001	0.136	97.523
1A2a	Liquid	0.117	74.109	0.007	30.034	Gg	0.001	0.133	97.656
1A4bi	Peat	0.234	74.109	0.055	30.034	Gg	0.001	0.131	97.787
1A4ai	Biomass	0.032	74.109	0.052	30.034	Gg	0.001	0.128	97.915
1A3bi	Gasoline	0.174	74.109	0.033	30.034	Gg	0.001	0.122	98.037
1A4bii	Liquid	0.242	74.109	0.134	30.034	Gg	0.000	0.117	98.154
2D3b		0.095	74.109	0.071	30.034	Gg	0.000	0.106	98.260
2D3i		0.187	74.109	0.046	30.034	Gg	0.000	0.099	98.359
2A2		0.072	74.109	0.001	30.034	Gg	0.000	0.093	98.452
1A2b	Solid	0.072	74.109	0.001	30.034	Gg	0.000	0.092	98.544
2A5c		0.478	74.109	0.220	30.034	Gg	0.000	0.087	98.630
3B1b		0.122	74.109	0.074	30.034	Gg	0.000	0.081	98.712
2G		0.153	74.109	0.087	30.034	Gg	0.000	0.081	98.793
2L		0.081	74.109	0.009	30.034	Gg	0.000	0.077	98.870
1A5b	Liquid	0.004	74.109	0.024	30.034	Gg	0.000	0.073	98.943
1A2e	Solid	0.065	74.109	0.004	30.034	Gg	0.000	0.072	99.015
1A2d	Gaseous	0.074	74.109	0.008	30.034	Gg	0.000	0.071	99.086
1A2b	Liquid	0.059	74.109	0.004	30.034	Gg	0.000	0.064	99.150
1A1a	Other	0.002	74.109	0.019	30.034	Gg	0.000	0.061	99.211
1A2gviii	Other	0.048	74.109	0.001	30.034	Gg	0.000	0.061	99.272
5E		0.299	74.109	0.104	30.034	Gg	0.000	0.056	99.327
3B4giv		0.227	74.109	0.076	30.034	Gg	0.000	0.053	99.38
1A1b	Solid	0.103	74.109	0.026	30.034	Gg	0.000	0.052	99.432
1A4ciii	Liquid	0.077	74.109	0.046	30.034	Gg	0.000	0.050	99.482
1A2e	Biomass	0.040	74.109	0.003	30.034	Gg	0.000	0.044	99.526
3B4giii		0.003	74.109	0.014	30.034	Gg	0.000	0.043	99.569
2C7a		0.034	74.109	0.001	30.034	Gg	0.000	0.043	99.611
3B4h		0.026	74.109	0.023	30.034	Gg	0.000	0.040	99.652

3B3		0.086	74.109	0.047	30.034	Gg	0.000	0.039	99.691	
3B1a		0.203	74.109	0.092	30.034	Gg	0.000	0.032	99.723	
2B10b		0.007	74.109	0.012	30.034	Gg	0.000	0.029	99.752	
1A3biv	Diesel oil		74.109	0.008	30.034	Gg	0.000	0.027	99.779	
1A3c	Liquid	0.089	74.109	0.028	30.034	Gg	0.000	0.025	99.804	
3B4e		0.006	74.109	0.010	30.034	Gg	0.000	0.024	99.827	
1A2f	Other		74.109	0.007	30.034	Gg	0.000	0.022	99.85	
1A3biv	Gasoline	0.057	74.109	0.016	30.034	Gg	0.000	0.022	99.872	
1A4ai	Peat	0.009	74.109	0.009	30.034	Gg	0.000	0.018	99.890	
1A3ai(i)	Liquid	0.003	74.109	0.006	30.034	Gg	0.000	0.016	99.906	
2D3g		0.017	74.109	0.003	30.034	Gg	0.000	0.014	99.921	
1B1b		0.008	74.109	0.007	30.034	Gg	0.000	0.011	99.932	
3B2		0.002	74.109	0.004	30.034	Gg	0.000	0.011	99.943	
2C7d		0.006	74.109	0.005	30.034	Gg	0.000	0.009	99.952	
1A3bii	Gasoline	0.006	74.109	0.000	30.034	Gg	0.000	0.007	99.959	
1A2f	Biomass	0.000	74.109	0.002	30.034	Gg	0.000	0.007	99.966	
1B2av		0.005	74.109	0.000	30.034	Gg	0.000	0.006	99.972	
1A2d	Other	0.011	74.109	0.006	30.034	Gg	0.000	0.004	99.976	
2D3d		0.000	74.109	0.001	30.034	Gg	0.000	0.004	99.980	
1A2c	Biomass	0.003	74.109	0.000	30.034	Gg	0.000	0.004	99.983	
1A2gviii	Peat	0.005	74.109	0.001	30.034	Gg	0.000	0.003	99.987	
5C1bv		0.000	74.109	0.001	30.034	Gg	0.000	0.003	99.990	
2D3e		0.002	74.109	0.000	30.034	Gg	0.000	0.002	99.992	
2C3		0.002	74.109	0.000	30.034	Gg	0.000	0.002	99.994	
1A3aii(i)	Liquid	0.002	74.109	0.001	30.034	Gg	0.000	0.002	99.996	
1A2a	Biomass		74.109	0.000	30.034	Gg	0.000	0.001	99.997	
1A2e	Other	0.000	74.109	0.000	30.034	Gg	0.000	0.001	99.998	
1A3bi	Gaseous		74.109	0.000	30.034	Gg	0.000	0.000	99.998	
3B4d		0.000	74.109	0.000	30.034	Gg	0.000	0.000	99.999	
1A2gvii	Gaseous	0.001	74.109	0.001	30.034	Gg	0.000	0.000	99.999	
1A4ci	Solid	0.003	74.109	0.002	30.034	Gg	0.000	0.000	100	
1A4bi	Other	0.000	74.109	0.000	30.034	Gg	0.000	0.000	100	
1A3bii	Gaseous		74.109	0.000	30.034	Gg	0.000	0.000	100	
1A3biii	Gaseous		74.109	0.000	30.034	Gg	0.000	0.000	100	
5A		0.001	74.109	0.001	30.034	Gg	0.000	0.000	100	

TSP

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2019 emission of the NFR category	Year 2019 total emission	Unit	Trend assessment	Contribution to trend, %	Cumulative total, %	Key source
1A3bvii		9.531	98.635	11.178	44.952	Gg	0.069	15.024	15.024	Yes
1A4bi	Biomass	8.108	98.635	9.480	44.952	Gg	0.059	12.717	27.741	Yes
1A5a	Biomass	0.046	98.635	4.434	44.952	Gg	0.045	9.701	37.443	Yes
1A2d	Liquid	12.179	98.635	1.442	44.952	Gg	0.042	9.031	46.474	Yes
1A1a	Solid	7.164	98.635	0.152	44.952	Gg	0.032	6.843	53.316	Yes
2C1		5.545	98.635	0.287	44.952	Gg	0.023	4.924	58.240	Yes
1A3biii	Diesel oil	4.287	98.635	0.171	44.952	Gg	0.018	3.920	62.160	Yes
3Dc		4.905	98.635	3.800	44.952	Gg	0.016	3.440	65.600	Yes
1A2d	Biomass	3.264	98.635	0.256	44.952	Gg	0.012	2.708	68.308	Yes
1A3bvi		1.325	98.635	1.564	44.952	Gg	0.010	2.111	70.419	Yes
1A3bi	Diesel oil	2.366	98.635	0.228	44.952	Gg	0.009	1.869	72.287	Yes

1A2f	Solid	1.954	98.635	0.075	44.952	Gg	0.008	1.793	74.080	Yes
1A1a	Biomass	0.876	98.635	1.205	44.952	Gg	0.008	1.771	75.851	Yes
1A4ci	Peat	0.160	98.635	0.815	44.952	Gg	0.008	1.632	77.483	Yes
2H1		2.389	98.635	0.395	44.952	Gg	0.007	1.525	79.008	Yes
1A4cii	Liquid	1.620	98.635	0.188	44.952	Gg	0.006	1.210	80.218	Yes
1A1a	Liquid	1.398	98.635	0.182	44.952	Gg	0.005	1.002	81.220	
2A5b		1.014	98.635	0.032	44.952	Gg	0.004	0.945	82.165	
1A2a	Solid	0.932	98.635	0.013	44.952	Gg	0.004	0.905	83.070	
1B1c		2.363	98.635	1.468	44.952	Gg	0.004	0.859	83.929	
2C7c		0.855	98.635	0.009	44.952	Gg	0.004	0.836	84.766	
1A2gviii	Liquid	0.832	98.635	0.032	44.952	Gg	0.004	0.762	85.528	
1A2gvii	Liquid	1.421	98.635	0.307	44.952	Gg	0.003	0.748	86.277	
1A2d	Solid	0.715	98.635	0.002	44.952	Gg	0.003	0.712	86.988	
1A2gviii	Biomass	1.572	98.635	0.401	44.952	Gg	0.003	0.695	87.683	
2H2		0.329	98.635	0.429	44.952	Gg	0.003	0.614	88.298	
2B10a		1.409	98.635	0.377	44.952	Gg	0.003	0.584	88.881	
1A4ai	Liquid	0.994	98.635	0.197	44.952	Gg	0.003	0.562	89.443	
1A3bii	Diesel oil	1.074	98.635	0.241	44.952	Gg	0.003	0.545	89.988	
1A4aii	Liquid	0.746	98.635	0.100	44.952	Gg	0.002	0.528	90.516	
2D3i		0.598	98.635	0.049	44.952	Gg	0.002	0.490	91.007	
3B4gi		0.897	98.635	0.626	44.952	Gg	0.002	0.477	91.484	
1B2aiv		0.442	98.635	0.008	44.952	Gg	0.002	0.425	91.909	
1A2f	Liquid	0.449	98.635	0.015	44.952	Gg	0.002	0.417	92.326	
2A5a		0.400	98.635	0.006	44.952	Gg	0.002	0.388	92.714	
1A1a	Peat	2.295	98.635	0.875	44.952	Gg	0.002	0.375	93.089	
1A2d	Peat	0.435	98.635	0.030	44.952	Gg	0.002	0.370	93.459	
3B4gii		0.061	98.635	0.190	44.952	Gg	0.002	0.357	93.815	
2I		0.590	98.635	0.111	44.952	Gg	0.002	0.347	94.162	
1A2c	Solid	0.291	98.635	0.001	44.952	Gg	0.001	0.291	94.453	
1A2b	Solid	0.277	98.635	0.004	44.952	Gg	0.001	0.268	94.721	
1A4bi	Liquid	0.425	98.635	0.078	44.952	Gg	0.001	0.255	94.975	
1A2c	Liquid	0.325	98.635	0.035	44.952	Gg	0.001	0.249	95.224	
2B6		0.248	98.635	0.002	44.952	Gg	0.001	0.244	95.468	
1A5a	Liquid	0.588	98.635	0.162	44.952	Gg	0.001	0.233	95.701	
1A2e	Solid	0.251	98.635	0.009	44.952	Gg	0.001	0.232	95.934	
2C2		0.023	98.635	0.115	44.952	Gg	0.001	0.229	96.163	
1A2e	Liquid	0.260	98.635	0.017	44.952	Gg	0.001	0.222	96.385	
1A4ci	Liquid	0.329	98.635	0.049	44.952	Gg	0.001	0.221	96.606	
1A2gviii	Other	0.189	98.635	0.002	44.952	Gg	0.001	0.185	96.791	
1A1b	Solid	0.395	98.635	0.099	44.952	Gg	0.001	0.178	96.969	
2A2		0.174	98.635	0.002	44.952	Gg	0.001	0.171	97.139	
1A3dii	Liquid	0.565	98.635	0.331	44.952	Gg	0.001	0.160	97.300	
1A4ci	Biomass	0.108	98.635	0.120	44.952	Gg	0.001	0.154	97.454	
3B3		0.518	98.635	0.302	44.952	Gg	0.001	0.145	97.599	
2A3		0.158	98.635	0.006	44.952	Gg	0.001	0.145	97.744	
1A4bi	Solid	0.148	98.635	0.002	44.952	Gg	0.001	0.143	97.887	
1A2e	Peat	0.169	98.635	0.012	44.952	Gg	0.001	0.143	98.030	
1A1b	Liquid	0.150	98.635	0.003	44.952	Gg	0.001	0.143	98.172	
1A2a	Liquid	0.157	98.635	0.008	44.952	Gg	0.001	0.139	98.312	
1A4bi	Peat	0.260	98.635	0.061	44.952	Gg	0.001	0.126	98.438	
3F		0.305	98.635	0.195	44.952	Gg	0.001	0.124	98.561	

1A3bi	Gasoline	0.174	98.635	0.033	44.952	Gg	0.000	0.101	98.662
3B1b		0.264	98.635	0.161	44.952	Gg	0.000	0.089	98.751
1A4ai	Biomass	0.037	98.635	0.054	44.952	Gg	0.000	0.082	98.833
2D3b		0.126	98.635	0.094	44.952	Gg	0.000	0.081	98.914
5E		0.299	98.635	0.104	44.952	Gg	0.000	0.070	98.985
2L		0.093	98.635	0.012	44.952	Gg	0.000	0.066	99.050
1A2d	Gaseous	0.088	98.635	0.011	44.952	Gg	0.000	0.064	99.114
3B4giv		0.234	98.635	0.078	44.952	Gg	0.000	0.064	99.178
2B10b		0.023	98.635	0.037	44.952	Gg	0.000	0.058	99.236
1A2b	Liquid	0.069	98.635	0.005	44.952	Gg	0.000	0.058	99.293
1A2e	Biomass	0.073	98.635	0.007	44.952	Gg	0.000	0.058	99.351
3B4h		0.059	98.635	0.051	44.952	Gg	0.000	0.054	99.405
1A1a	Other	0.013	98.635	0.030	44.952	Gg	0.000	0.053	99.458
1A4bii	Liquid	0.242	98.635	0.134	44.952	Gg	0.000	0.051	99.510
1A5b	Liquid	0.004	98.635	0.024	44.952	Gg	0.000	0.048	99.558
1A4ai	Peat	0.034	98.635	0.035	44.952	Gg	0.000	0.044	99.601
2C7a		0.043	98.635	0.001	44.952	Gg	0.000	0.041	99.643
2G		0.153	98.635	0.087	44.952	Gg	0.000	0.037	99.680
3B4e		0.014	98.635	0.021	44.952	Gg	0.000	0.033	99.713
2A5c		1.218	98.635	0.570	44.952	Gg	0.000	0.031	99.744
3B4giii		0.003	98.635	0.014	44.952	Gg	0.000	0.028	99.773
1A3c	Liquid	0.094	98.635	0.030	44.952	Gg	0.000	0.028	99.800
1A4ciii	Liquid	0.077	98.635	0.046	44.952	Gg	0.000	0.025	99.825
1A3biv	Gasoline	0.057	98.635	0.016	44.952	Gg	0.000	0.021	99.846
1A3biv	Diesel oil		98.635	0.008	44.952	Gg	0.000	0.018	99.865
1A2f	Biomass	0.001	98.635	0.008	44.952	Gg	0.000	0.017	99.882
3B2		0.005	98.635	0.010	44.952	Gg	0.000	0.017	99.899
1B1b		0.019	98.635	0.016	44.952	Gg	0.000	0.016	99.915
2D3g		0.019	98.635	0.003	44.952	Gg	0.000	0.012	99.926
2C7d		0.012	98.635	0.010	44.952	Gg	0.000	0.011	99.937
1A3ai(i)	Liquid	0.003	98.635	0.006	44.952	Gg	0.000	0.010	99.948
1A2f	Other	0.029	98.635	0.017	44.952	Gg	0.000	0.009	99.956
1A2d	Other	0.017	98.635	0.011	44.952	Gg	0.000	0.007	99.963
1A3bii	Gasoline	0.006	98.635	0.000	44.952	Gg	0.000	0.005	99.969
1B2av		0.005	98.635	0.000	44.952	Gg	0.000	0.004	99.973
1A2gviii	Peat	0.007	98.635	0.002	44.952	Gg	0.000	0.004	99.977
2D3e		0.003	98.635	0.000	44.952	Gg	0.000	0.003	99.980
2D3d		0.001	98.635	0.002	44.952	Gg	0.000	0.003	99.983
1A2a	Biomass		98.635	0.001	44.952	Gg	0.000	0.003	99.986
1A2c	Biomass	0.003	98.635	0.000	44.952	Gg	0.000	0.003	99.988
2C3		0.003	98.635	0.000	44.952	Gg	0.000	0.002	99.991
5C1bv		0.000	98.635	0.001	44.952	Gg	0.000	0.002	99.993
3B1a		0.445	98.635	0.202	44.952	Gg	0.000	0.002	99.995
1A2e	Other	0.001	98.635	0.001	44.952	Gg	0.000	0.001	99.996
1A4ci	Solid	0.008	98.635	0.003	44.952	Gg	0.000	0.001	99.997
1A3aii(i)	Liquid	0.002	98.635	0.001	44.952	Gg	0.000	0.001	99.998
3B4d		0.000	98.635	0.000	44.952	Gg	0.000	0.001	99.999
1A3bi	Gaseous		98.635	0.000	44.952	Gg	0.000	0.000	99.999
1A4bi	Other	0.000	98.635	0.000	44.952	Gg	0.000	0.000	100
5A		0.003	98.635	0.001	44.952	Gg	0.000	0.000	100
1A2gvii	Gaseous	0.001	98.635	0.001	44.952	Gg	0.000	0.000	100

1A3bii	Gaseous		98.635	0.000	44.952	Gg	0.000	0.000	100
1A3biii	Gaseous		98.635	0.000	44.952	Gg	0.000	0.000	100

BC

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2019 emission of the NFR category	Year 2019 total emission	Unit	Trend assessment	Contribution to trend, %	Cumulative total, %	Key source
1A4bi	Biomass	2.223	10.100	2.557	3.848	Gg	0.169	41.853	41.853	Yes
1A3biii	Diesel oil	2.272	10.100	0.090	3.848	Gg	0.077	18.973	60.826	Yes
1A3bi	Diesel oil	1.349	10.100	0.130	3.848	Gg	0.038	9.391	70.217	Yes
1A4cii	Liquid	0.877	10.100	0.085	3.848	Gg	0.025	6.102	76.319	Yes
1A2gvii	Liquid	0.877	10.100	0.187	3.848	Gg	0.015	3.601	79.92	Yes
1A3bvi		0.140	10.100	0.165	3.848	Gg	0.011	2.738	82.658	Yes
1A3bii	Diesel oil	0.591	10.100	0.133	3.848	Gg	0.009	2.259	84.917	
1A3bvii		0.079	10.100	0.093	3.848	Gg	0.006	1.533	86.451	
1A5a	Biomass	0.000	10.100	0.062	3.848	Gg	0.006	1.519	87.970	
1A4aii	Liquid	0.230	10.100	0.027	3.848	Gg	0.006	1.480	89.449	
1A1a	Liquid	0.177	10.100	0.011	3.848	Gg	0.006	1.394	90.843	
1A2gviii	Liquid	0.140	10.100	0.002	3.848	Gg	0.005	1.246	92.088	
1A2d	Liquid	0.113	10.100	0.007	3.848	Gg	0.004	0.871	92.959	
1A3dii	Liquid	0.069	10.100	0.061	3.848	Gg	0.003	0.851	93.811	
1A4ai	Liquid	0.152	10.100	0.025	3.848	Gg	0.003	0.804	94.614	
1A2f	Liquid	0.066	10.100	0.001	3.848	Gg	0.002	0.583	95.198	
1A2c	Liquid	0.051	10.100	0.005	3.848	Gg	0.001	0.361	95.558	
1A2e	Liquid	0.043	10.100	0.003	3.848	Gg	0.001	0.332	95.890	
1A4ci	Liquid	0.050	10.100	0.006	3.848	Gg	0.001	0.325	96.215	
2H1		0.046	10.100	0.005	3.848	Gg	0.001	0.299	96.513	
1A5a	Liquid	0.092	10.100	0.023	3.848	Gg	0.001	0.293	96.806	
1A4bii	Liquid	0.027	10.100	0.022	3.848	Gg	0.001	0.286	97.091	
1A5b	Liquid	0.002	10.100	0.011	3.848	Gg	0.001	0.261	97.353	
1A4bi	Liquid	0.072	10.100	0.018	3.848	Gg	0.001	0.240	97.593	
3F		0.034	10.100	0.022	3.848	Gg	0.001	0.232	97.825	
1A1a	Solid	0.024	10.100	0.001	3.848	Gg	0.001	0.212	98.037	
2C2		0.001	10.100	0.007	3.848	Gg	0.001	0.156	98.193	
1A2d	Biomass	0.021	10.100	0.002	3.848	Gg	0.001	0.141	98.333	
1A4ciii	Liquid	0.024	10.100	0.014	3.848	Gg	0.001	0.129	98.462	
1A2a	Liquid	0.015	10.100	0.001	3.848	Gg	0.001	0.127	98.590	
1A3biv	Diesel oil		10.100	0.005	3.848	Gg	0.000	0.115	98.705	
1A2f	Solid	0.012	10.100	0.000	3.848	Gg	0.000	0.097	98.802	
1A3bi	Gasoline	0.021	10.100	0.004	3.848	Gg	0.000	0.097	98.899	
1A2b	Liquid	0.011	10.100	0.001	3.848	Gg	0.000	0.091	98.990	
2C1		0.012	10.100	0.001	3.848	Gg	0.000	0.090	99.080	
1A1b	Liquid	0.010	10.100	0.000	3.848	Gg	0.000	0.088	99.168	
1A3c	Liquid	0.055	10.100	0.018	3.848	Gg	0.000	0.081	99.249	
1A1a	Peat	0.015	10.100	0.003	3.848	Gg	0.000	0.080	99.329	
1A3ai(i)	Liquid	0.002	10.100	0.003	3.848	Gg	0.000	0.061	99.390	
1A1a	Biomass	0.005	10.100	0.004	3.848	Gg	0.000	0.056	99.447	
1A4ci	Biomass	0.003	10.100	0.003	3.848	Gg	0.000	0.055	99.502	
2D3b		0.005	10.100	0.004	3.848	Gg	0.000	0.044	99.546	
2B6		0.004	10.100	0.000	3.848	Gg	0.000	0.041	99.587	
1A2d	Peat	0.005	10.100	0.000	3.848	Gg	0.000	0.039	99.626	

1A4ai	Biomass	0.001	10.100	0.002	3.848	Gg	0.000	0.031	99.657	
1A4ci	Peat	0.000	10.100	0.001	3.848	Gg	0.000	0.030	99.687	
5E		0.027	10.100	0.009	3.848	Gg	0.000	0.026	99.713	
2B10a		0.013	10.100	0.004	3.848	Gg	0.000	0.026	99.738	
1A4bi	Peat	0.007	10.100	0.002	3.848	Gg	0.000	0.024	99.763	
1A4bi	Solid	0.003	10.100	0.000	3.848	Gg	0.000	0.023	99.786	
1A2d	Gaseous	0.004	10.100	0.000	3.848	Gg	0.000	0.023	99.809	
1A2gviii	Other	0.002	10.100	0.000	3.848	Gg	0.000	0.023	99.832	
1A2d	Solid	0.002	10.100	0.000	3.848	Gg	0.000	0.022	99.854	
1A2f	Other		10.100	0.001	3.848	Gg	0.000	0.020	99.874	
1A2gviii	Biomass	0.007	10.100	0.002	3.848	Gg	0.000	0.017	99.891	
1A2a	Solid	0.002	10.100	0.000	3.848	Gg	0.000	0.016	99.908	
1A2c	Solid	0.002	10.100	0.000	3.848	Gg	0.000	0.015	99.922	
1A3biv	Gasoline	0.006	10.100	0.002	3.848	Gg	0.000	0.015	99.937	
5C1bv		0.000	10.100	0.001	3.848	Gg	0.000	0.012	99.949	
1A2d	Other	0.002	10.100	0.000	3.848	Gg	0.000	0.010	99.959	
1A3aii(i)	Liquid	0.001	10.100	0.001	3.848	Gg	0.000	0.007	99.966	
1A2e	Peat	0.001	10.100	0.000	3.848	Gg	0.000	0.007	99.973	
1A1a	Other	0.000	10.100	0.000	3.848	Gg	0.000	0.006	99.979	
2G		0.001	10.100	0.000	3.848	Gg	0.000	0.003	99.982	
1A2e	Biomass	0.000	10.100	0.000	3.848	Gg	0.000	0.003	99.985	
1A2b	Solid	0.000	10.100	0.000	3.848	Gg	0.000	0.003	99.988	
1A3bii	Gasoline	0.000	10.100	0.000	3.848	Gg	0.000	0.002	99.990	
1A2e	Solid	0.000	10.100	0.000	3.848	Gg	0.000	0.002	99.992	
1A4bi	Other	0.000	10.100	0.000	3.848	Gg	0.000	0.001	99.994	
1A1b	Solid	0.000	10.100	0.000	3.848	Gg	0.000	0.001	99.995	
2A2		0.000	10.100	0.000	3.848	Gg	0.000	0.001	99.996	
1A4ai	Peat	0.000	10.100	0.000	3.848	Gg	0.000	0.001	99.997	
1A2e	Other	0.000	10.100	0.000	3.848	Gg	0.000	0.001	99.998	
2A3		0.000	10.100	0.000	3.848	Gg	0.000	0.001	99.998	
1A2f	Biomass	0.000	10.100	0.000	3.848	Gg	0.000	0.000	99.999	
1A2c	Biomass	0.000	10.100	0.000	3.848	Gg	0.000	0.000	99.999	
2C7a		0.000	10.100	0.000	3.848	Gg	0.000	0.000	99.999	
1A2gvii	Gaseous	0.000	10.100	0.000	3.848	Gg	0.000	0.000	100	
1A2gviii	Peat	0.000	10.100	0.000	3.848	Gg	0.000	0.000	100	
2C3		0.000	10.100	0.000	3.848	Gg	0.000	0.000	100	
2D3i		0.000	10.100	0.000	3.848	Gg	0.000	0.000	100	
1A2a	Biomass		10.100	0.000	3.848	Gg	0.000	0.000	100	
1A4ci	Solid	0.000	10.100	0.000	3.848	Gg	0.000	0.000	100	
1B1b		0.000	10.100	0.000	3.848	Gg	0.000	0.000	100	

CO

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2019 emission of the NFR category	Year 2019 total emission	Unit	Trend assessment	Contribution to trend, %	Cumulative total, %	Key source
1A3bi	Gasoline	412.338	769.102	22.448	344.933	Gg	0.211	43.601	43.601	Yes
1A4bi	Biomass	129.562	769.102	155.647	344.933	Gg	0.127	26.175	69.776	Yes
1A4bii	Liquid	34.909	769.102	38.398	344.933	Gg	0.030	6.103	75.878	Yes
1A5a	Biomass	0.130	769.102	11.085	344.933	Gg	0.014	2.959	78.837	Yes
1A1a	Biomass	0.858	769.102	11.265	344.933	Gg	0.014	2.920	81.757	Yes
1A4aii	Liquid	11.336	769.102	15.717	344.933	Gg	0.014	2.853	84.610	
1A3dii	Liquid	22.554	769.102	19.777	344.933	Gg	0.013	2.593	87.203	

1A3bii	Gasoline	18.286	769.102	0.602	344.933	Gg	0.010	2.039	89.242
1A2d	Liquid	19.466	769.102	15.231	344.933	Gg	0.008	1.744	90.987
1A3biii	Diesel oil	15.069	769.102	2.809	344.933	Gg	0.005	1.060	92.046
1A3bi	Diesel oil	9.979	769.102	0.855	344.933	Gg	0.005	0.972	93.018
1A2gvii	Liquid	8.124	769.102	7.180	344.933	Gg	0.005	0.949	93.967
1A2f	Solid	12.941	769.102	2.560	344.933	Gg	0.004	0.871	94.838
1A2a	Solid	6.570	769.102	0.469	344.933	Gg	0.003	0.665	95.502
1A1a	Peat	1.544	769.102	2.266	344.933	Gg	0.002	0.422	95.925
1A2gviii	Biomass	3.840	769.102	3.172	344.933	Gg	0.002	0.389	96.314
1A3biv	Gasoline	7.906	769.102	4.792	344.933	Gg	0.002	0.335	96.648
1A2d	Biomass	6.834	769.102	4.182	344.933	Gg	0.001	0.300	96.948
1A2f	Gaseous	2.421	769.102	0.074	344.933	Gg	0.001	0.271	97.220
1A4ci	Biomass	1.515	769.102	1.627	344.933	Gg	0.001	0.254	97.474
1A1b	Gaseous	0.480	769.102	1.128	344.933	Gg	0.001	0.245	97.719
1A4cii	Liquid	18.799	769.102	9.244	344.933	Gg	0.001	0.218	97.937
1A3ai(i)	Liquid	0.231	769.102	0.881	344.933	Gg	0.001	0.209	98.146
3F		3.695	769.102	2.343	344.933	Gg	0.001	0.184	98.330
1A2f	Other		769.102	0.598	344.933	Gg	0.001	0.161	98.490
1A4ai	Biomass	0.455	769.102	0.711	344.933	Gg	0.001	0.136	98.627
1A1a	Other	0.008	769.102	0.412	344.933	Gg	0.001	0.110	98.736
1A3bii	Diesel oil	4.107	769.102	1.434	344.933	Gg	0.001	0.109	98.846
1A4ci	Peat	0.080	769.102	0.408	344.933	Gg	0.000	0.100	98.945
1A5a	Gaseous	0.246	769.102	0.455	344.933	Gg	0.000	0.092	99.038
1A2d	Solid	0.645	769.102	0.008	344.933	Gg	0.000	0.076	99.113
1A2c	Gaseous	0.081	769.102	0.288	344.933	Gg	0.000	0.067	99.181
1A1a	Solid	0.793	769.102	0.584	344.933	Gg	0.000	0.061	99.242
1A2d	Gaseous	1.849	769.102	0.609	344.933	Gg	0.000	0.059	99.301
1A2f	Liquid	0.748	769.102	0.121	344.933	Gg	0.000	0.058	99.359
1A1a	Gaseous	0.780	769.102	0.500	344.933	Gg	0.000	0.040	99.399
1A2d	Peat	0.700	769.102	0.459	344.933	Gg	0.000	0.039	99.438
1A4bi	Liquid	0.776	769.102	0.213	344.933	Gg	0.000	0.036	99.474
1A5b	Liquid	1.532	769.102	0.809	344.933	Gg	0.000	0.033	99.507
1A2d	Other	0.008	769.102	0.114	344.933	Gg	0.000	0.030	99.537
1A2gviii	Other	0.279	769.102	0.019	344.933	Gg	0.000	0.029	99.565
1A1b	Solid	0.053	769.102	0.130	344.933	Gg	0.000	0.028	99.594
1A2gviii	Gaseous	0.059	769.102	0.131	344.933	Gg	0.000	0.028	99.622
1A3aii(i)	Liquid	0.631	769.102	0.388	344.933	Gg	0.000	0.028	99.650
1A2a	Gaseous	0.408	769.102	0.286	344.933	Gg	0.000	0.028	99.678
2C7a		0.223	769.102	0.011	344.933	Gg	0.000	0.024	99.702
1A2a	Liquid	0.214	769.102	0.008	344.933	Gg	0.000	0.023	99.725
1A2b	Gaseous	0.001	769.102	0.088	344.933	Gg	0.000	0.023	99.749
1A4ciii	Liquid	0.442	769.102	0.277	344.933	Gg	0.000	0.021	99.770
1A3biv	Diesel oil		769.102	0.059	344.933	Gg	0.000	0.016	99.785
1A2f	Biomass	0.000	769.102	0.056	344.933	Gg	0.000	0.015	99.801
1A5a	Liquid	0.368	769.102	0.219	344.933	Gg	0.000	0.015	99.815
1A3c	Liquid	0.548	769.102	0.193	344.933	Gg	0.000	0.014	99.829
1A4bi	Gaseous	0.039	769.102	0.065	344.933	Gg	0.000	0.013	99.842
2G		0.315	769.102	0.185	344.933	Gg	0.000	0.012	99.854
1A3bi	Gaseous		769.102	0.044	344.933	Gg	0.000	0.012	99.866
1A4ai	Gaseous	0.031	769.102	0.057	344.933	Gg	0.000	0.012	99.877
1A2c	Solid	0.095	769.102	0.002	344.933	Gg	0.000	0.011	99.888

1A2gviii	Liquid	0.204	769.102	0.057	344.933	Gg	0.000	0.009	99.897	
1A2c	Liquid	0.162	769.102	0.039	344.933	Gg	0.000	0.009	99.906	
1A1b	Liquid	0.042	769.102	0.052	344.933	Gg	0.000	0.009	99.915	
1A4bi	Solid	0.074	769.102	0.001	344.933	Gg	0.000	0.009	99.924	
1A2b	Solid	0.079	769.102	0.004	344.933	Gg	0.000	0.008	99.932	
1A2gviii	Peat	0.024	769.102	0.040	344.933	Gg	0.000	0.008	99.940	
1A2e	Liquid	0.089	769.102	0.011	344.933	Gg	0.000	0.008	99.948	
1A4ai	Liquid	0.527	769.102	0.209	344.933	Gg	0.000	0.007	99.955	
1A4bi	Peat	0.130	769.102	0.031	344.933	Gg	0.000	0.007	99.963	
1A2e	Biomass	0.077	769.102	0.057	344.933	Gg	0.000	0.006	99.969	
1A4ci	Liquid	0.178	769.102	0.060	344.933	Gg	0.000	0.005	99.974	
2C1		0.464	769.102	0.190	344.933	Gg	0.000	0.005	99.979	
1A2gvii	Gaseous	0.300	769.102	0.148	344.933	Gg	0.000	0.004	99.982	
1A2e	Peat	0.143	769.102	0.075	344.933	Gg	0.000	0.003	99.985	
1A4ai	Peat	0.018	769.102	0.018	344.933	Gg	0.000	0.003	99.988	
1A2e	Other	0.002	769.102	0.009	344.933	Gg	0.000	0.002	99.990	
1A2c	Biomass	0.017	769.102	0.001	344.933	Gg	0.000	0.002	99.992	
1A3bii	Gaseous		769.102	0.006	344.933	Gg	0.000	0.002	99.994	
1A2b	Liquid	0.019	769.102	0.014	344.933	Gg	0.000	0.001	99.995	
1A4ci	Gaseous	0.027	769.102	0.008	344.933	Gg	0.000	0.001	99.996	
1A2e	Gaseous	0.019	769.102	0.005	344.933	Gg	0.000	0.001	99.997	
1A3biii	Gaseous		769.102	0.003	344.933	Gg	0.000	0.001	99.998	
1A3ei	Gaseous	0.001	769.102	0.002	344.933	Gg	0.000	0.001	99.999	
1A1a	Liquid	0.383	769.102	0.170	344.933	Gg	0.000	0.001	99.999	
1A2e	Solid	0.053	769.102	0.025	344.933	Gg	0.000	0.000	100	
1A4ci	Solid	0.007	769.102	0.004	344.933	Gg	0.000	0.000	100	
1A4bi	Other	0.001	769.102	0.000	344.933	Gg	0.000	0.000	100	
1A2a	Biomass		769.102	0.000	344.933	Gg	0.000	0.000	100	

Pb

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2019 emission of the NFR category	Year 2019 total emission	Unit	Trend assessment	Contribution to trend, %	Cumulative total, %	Key source
1A3bi	Gasoline	166.003	321.374	0.002	13.220	Mg	0.021	29.606	29.606	Yes
2C7c		80.081	321.374	0.263	13.220	Mg	0.009	13.146	42.752	Yes
1A1b	Solid	2.081	321.374	2.997	13.220	Mg	0.009	12.624	55.376	Yes
1A2d	Liquid	3.984	321.374	2.694	13.220	Mg	0.008	10.974	66.351	Yes
2C1		34.463	321.374	0.395	13.220	Mg	0.003	4.435	70.785	Yes
1A5a	Biomass	0.015	321.374	0.998	13.220	Mg	0.003	4.324	75.109	Yes
1A1a	Peat	1.291	321.374	0.964	13.220	Mg	0.003	3.951	79.060	Yes
2G		0.310	321.374	0.891	13.220	Mg	0.003	3.807	82.867	Yes
1A1a	Biomass	0.097	321.374	0.770	13.220	Mg	0.002	3.320	86.187	
1A2f	Solid	2.811	321.374	0.698	13.220	Mg	0.002	2.526	88.713	
1A4bi	Biomass	0.413	321.374	0.515	13.220	Mg	0.002	2.160	90.873	
1A4ci	Peat	0.068	321.374	0.346	13.220	Mg	0.001	1.490	92.363	
1A3bii	Gasoline	6.40	321.374	0.000	13.220	Mg	0.001	1.142	93.505	
1A3bvi		7.22	321.374	0.485	13.220	Mg	0.001	0.815	94.320	
1A2d	Biomass	0.691	321.374	0.206	13.220	Mg	0.001	0.770	95.090	
1A1a	Solid	5.751	321.374	0.071	13.220	Mg	0.001	0.716	95.807	
1A2gviii	Biomass	0.319	321.374	0.158	13.220	Mg	0.000	0.630	96.436	
1A1a	Other	0.001	321.374	0.13	13.220	Mg	0.000	0.563	97.000	

1A2e	Peat	0.167	321.374	0.100	13.220	Mg	0.000	0.405	97.404
1A4ci	Biomass	0.065	321.374	0.070	13.220	Mg	0.000	0.291	97.695
1A5a	Liquid	0.211	321.374	0.072	13.220	Mg	0.000	0.273	97.968
1A3biv	Gasoline	1.30	321.374	0.000	13.220	Mg	0.000	0.232	98.200
1A2d	Solid	1.025	321.374	0.001	13.220	Mg	0.000	0.177	98.377
1A2e	Solid	1.384	321.374	0.018	13.220	Mg	0.000	0.168	98.544
1A2d	Other	0.001	321.374	0.036	13.220	Mg	0.000	0.155	98.699
1A3aii(i)	Liquid	0.297	321.374	0.048	13.220	Mg	0.000	0.154	98.853
1A4ai	Biomass	0.020	321.374	0.032	13.220	Mg	0.000	0.134	98.987
1A4ai	Liquid	0.261	321.374	0.038	13.220	Mg	0.000	0.116	99.103
1A2c	Liquid	0.082	321.374	0.025	13.220	Mg	0.000	0.095	99.198
1A4bi	Peat	0.111	321.374	0.026	13.220	Mg	0.000	0.093	99.292
1A4ai	Peat	0.020	321.374	0.017	13.220	Mg	0.000	0.070	99.362
1A2d	Peat	0.499	321.374	0.006	13.220	Mg	0.000	0.063	99.425
2C7a		0.374	321.374	0.002	13.220	Mg	0.000	0.060	99.485
1A1a	Liquid	0.340	321.374	0.027	13.220	Mg	0.000	0.058	99.543
2C6		0.000	321.374	0.013	13.220	Mg	0.000	0.056	99.599
1A3dii	Liquid	0.015	321.374	0.013	13.220	Mg	0.000	0.053	99.652
2C2		0.001	321.374	0.010	13.220	Mg	0.000	0.043	99.695
1A2a	Liquid	0.036	321.374	0.010	13.220	Mg	0.000	0.035	99.730
1A2f	Other		321.374	0.008	13.220	Mg	0.000	0.035	99.765
1A4bi	Solid	0.292	321.374	0.005	13.220	Mg	0.000	0.032	99.797
1A4ci	Liquid	0.081	321.374	0.009	13.220	Mg	0.000	0.023	99.820
1A2c	Solid	0.201	321.374	0.003	13.220	Mg	0.000	0.022	99.841
1A2e	Biomass	0.008	321.374	0.005	13.220	Mg	0.000	0.021	99.862
1A2e	Liquid	0.083	321.374	0.007	13.220	Mg	0.000	0.018	99.880
1A4ciii	Liquid	0.007	321.374	0.004	13.220	Mg	0.000	0.017	99.897
1B1b		0.022	321.374	0.004	13.220	Mg	0.000	0.014	99.911
2C3		0.066	321.374	0.000	13.220	Mg	0.000	0.0100	99.921
3F		0.003	321.374	0.002	13.220	Mg	0.000	0.009	99.930
1A2e	Other	0.003	321.374	0.002	13.220	Mg	0.000	0.008	99.938
1A2gviii	Liquid	0.113	321.374	0.006	13.220	Mg	0.000	0.008	99.945
1A2f	Biomass	0.000	321.374	0.002	13.220	Mg	0.000	0.007	99.952
1A2f	Liquid	0.062	321.374	0.004	13.220	Mg	0.000	0.006	99.959
1A2gviii	Other	0.049	321.374	0.003	13.220	Mg	0.000	0.006	99.965
1A2gviii	Peat	0.003	321.374	0.002	13.220	Mg	0.000	0.006	99.971
1A4ci	Solid	0.035	321.374	0.000	13.220	Mg	0.000	0.005	99.976
2B10a		0.001	321.374	0.001	13.220	Mg	0.000	0.004	99.980
1A4bi	Liquid	0.046	321.374	0.001	13.220	Mg	0.000	0.004	99.984
5C1bv		0.000	321.374	0.001	13.220	Mg	0.000	0.004	99.988
1A3biii	Diesel oil	0.000	321.374	0.001	13.220	Mg	0.000	0.003	99.991
1A2a	Biomass		321.374	0.000	13.220	Mg	0.000	0.002	99.993
1A3bi	Diesel oil	0.000	321.374	0.000	13.220	Mg	0.000	0.002	99.995
1A2b	Liquid	0.010	321.374	0.001	13.220	Mg	0.000	0.001	99.996
1A2c	Biomass	0.003	321.374	0.000	13.220	Mg	0.000	0.001	99.997
5E		0.001	321.374	0.000	13.220	Mg	0.000	0.001	99.999
1A1b	Liquid	0.015	321.374	0.000	13.220	Mg	0.000	0.001	99.999
1A3bii	Diesel oil	0.000	321.374	0.000	13.220	Mg	0.000	0.001	100
1A3biv	Diesel oil		321.374	0.000	13.220	Mg	0.000	0	100

Cd

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2019 emission of the NFR category	Year 2019 total emission	Unit	Trend assessment	Contribution to trend, %	Cumulative total, %	Key source
2C7c		4.203	6.678	0.002	0.794	Mg	0.075	37.112	37.112	Yes
1A2d	Liquid	0.240	6.678	0.171	0.794	Mg	0.021	10.591	47.703	Yes
1A4bi	Biomass	0.124	6.678	0.154	0.794	Mg	0.021	10.419	58.122	Yes
1A5a	Biomass	0.002	6.678	0.111	0.794	Mg	0.017	8.249	66.371	Yes
1A1a	Biomass	0.011	6.678	0.092	0.794	Mg	0.014	6.767	73.138	Yes
2C6		0.850	6.678	0.011	0.794	Mg	0.014	6.728	79.866	Yes
1A1b	Solid	0.047	6.678	0.068	0.794	Mg	0.009	4.670	84.536	Yes
2C1		0.390	6.678	0.004	0.794	Mg	0.006	3.158	87.693	
1A4ci	Biomass	0.020	6.678	0.021	0.794	Mg	0.003	1.386	89.079	
3F		0.027	6.678	0.020	0.794	Mg	0.002	1.218	90.297	
2G		0.028	6.678	0.019	0.794	Mg	0.002	1.172	91.469	
1A1a	Other	0.000	6.678	0.015	0.794	Mg	0.002	1.138	92.607	
1A2gviii	Biomass	0.036	6.678	0.019	0.794	Mg	0.002	1.065	93.672	
1A1a	Solid	0.155	6.678	0.004	0.794	Mg	0.002	1.041	94.713	
1A1a	Peat	0.023	6.678	0.016	0.794	Mg	0.002	1.004	95.717	
1A4ai	Biomass	0.006	6.678	0.010	0.794	Mg	0.001	0.659	96.376	
1A2f	Solid	0.068	6.678	0.016	0.794	Mg	0.001	0.568	96.944	
1A4ci	Peat	0.001	6.678	0.006	0.794	Mg	0.001	0.415	97.360	
1A2d	Biomass	0.080	6.678	0.014	0.794	Mg	0.001	0.369	97.729	
1A2e	Solid	0.032	6.678	0.000	0.794	Mg	0.000	0.242	97.971	
1A2gvii	Liquid	0.003	6.678	0.004	0.794	Mg	0.000	0.238	98.208	
1A2gviii	Other	0.028	6.678	0.000	0.794	Mg	0.000	0.232	98.441	
1A2d	Solid	0.024	6.678	0.000	0.794	Mg	0.000	0.207	98.648	
2C3		0.023	6.678	0.000	0.794	Mg	0.000	0.203	98.851	
1A4cii	Liquid	0.003	6.678	0.002	0.794	Mg	0.000	0.157	99.008	
1A3bvi		0.002	6.678	0.002	0.794	Mg	0.000	0.121	99.129	
1A2d	Other	0.000	6.678	0.002	0.794	Mg	0.000	0.119	99.248	
1A2e	Peat	0.003	6.678	0.002	0.794	Mg	0.000	0.099	99.347	
1A2d	Peat	0.008	6.678	0.000	0.794	Mg	0.000	0.068	99.415	
1A3dii	Liquid	0.001	6.678	0.001	0.794	Mg	0.000	0.067	99.483	
1A4aii	Liquid	0.001	6.678	0.001	0.794	Mg	0.000	0.066	99.549	
1A4bi	Solid	0.007	6.678	0.000	0.794	Mg	0.000	0.051	99.600	
1A5a	Liquid	0.003	6.678	0.001	0.794	Mg	0.000	0.047	99.647	
1A4bii	Liquid	0.000	6.678	0.001	0.794	Mg	0.000	0.040	99.687	
1A2e	Biomass	0.001	6.678	0.001	0.794	Mg	0.000	0.036	99.723	
5E		0.002	6.678	0.001	0.794	Mg	0.000	0.029	99.752	
1A4ciii	Liquid	0.001	6.678	0.000	0.794	Mg	0.000	0.020	99.771	
1A1a	Liquid	0.006	6.678	0.001	0.794	Mg	0.000	0.018	99.789	
1A4ai	Peat	0.000	6.678	0.000	0.794	Mg	0.000	0.018	99.807	
2C2		0.003	6.678	0.000	0.794	Mg	0.000	0.017	99.825	
1A4bi	Peat	0.002	6.678	0.000	0.794	Mg	0.000	0.016	99.840	
1A3bi	Gasoline	0.000	6.678	0.000	0.794	Mg	0.000	0.016	99.856	
1A2e	Other	0.000	6.678	0.000	0.794	Mg	0.000	0.015	99.872	
1A2f	Biomass	0.000	6.678	0.000	0.794	Mg	0.000	0.014	99.886	
1A2c	Liquid	0.001	6.678	0.000	0.794	Mg	0.000	0.014	99.899	
1A2f	Other		6.678	0.000	0.794	Mg	0.000	0.014	99.913	
5C1bv		0.000	6.678	0.000	0.794	Mg	0.000	0.011	99.924	
1B1b		0.000	6.678	0.000	0.794	Mg	0.000	0.011	99.936	

1A3c	Liquid	0.001	6.678	0.000	0.794	Mg	0.000	0.010	99.946
1A4ci	Solid	0.001	6.678	0.000	0.794	Mg	0.000	0.006	99.952
1A4ai	Liquid	0.003	6.678	0.000	0.794	Mg	0.000	0.006	99.957
1A3biii	Diesel oil	0.000	6.678	0.000	0.794	Mg	0.000	0.005	99.962
1A2gviii	Liquid	0.001	6.678	0.000	0.794	Mg	0.000	0.004	99.967
1A2a	Liquid	0.000	6.678	0.000	0.794	Mg	0.000	0.004	99.971
1A4bi	Liquid	0.001	6.678	0.000	0.794	Mg	0.000	0.004	99.975
1A2a	Biomass		6.678	0.000	0.794	Mg	0.000	0.004	99.978
1A3bi	Diesel oil	0.000	6.678	0.000	0.794	Mg	0.000	0.003	99.981
1A2c	Solid	0.000	6.678	0.000	0.794	Mg	0.000	0.003	99.984
1A2c	Biomass	0.000	6.678	0.000	0.794	Mg	0.000	0.002	99.986
1A2e	Liquid	0.001	6.678	0.000	0.794	Mg	0.000	0.002	99.989
1A1b	Liquid	0.000	6.678	0.000	0.794	Mg	0.000	0.002	99.991
1A2gvii	Gaseous	0.000	6.678	0.000	0.794	Mg	0.000	0.002	99.993
1A2gviii	Peat	0.000	6.678	0.000	0.794	Mg	0.000	0.002	99.994
2C7a		0.000	6.678	0.000	0.794	Mg	0.000	0.001	99.996
1A2f	Liquid	0.001	6.678	0.000	0.794	Mg	0.000	0.001	99.997
1A3bii	Diesel oil	0.000	6.678	0.000	0.794	Mg	0.000	0.001	99.998
1A4ci	Liquid	0.001	6.678	0.000	0.794	Mg	0.000	0.001	99.999
1A3biv	Gasoline	0.000	6.678	0.000	0.794	Mg	0.000	0.001	100
1A2b	Liquid	0.000	6.678	0.000	0.794	Mg	0.000	0.000	100
1A3bii	Gasoline	0.000	6.678	0.000	0.794	Mg	0.000	0.000	100
1A3biv	Diesel oil		6.678	0.000	0.794	Mg	0.000	0.000	100

Hg

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2019 emission of the NFR category	Year 2019 total emission	Unit	Trend assessment	Contribution to trend, %	Cumulative total, %	Key source
2B10a		0.369	1.085	0.035	0.587	Mg	0.151	23.325	23.325	Yes
2C1		0.005	1.085	0.131	0.587	Mg	0.119	18.285	41.610	Yes
1A2gviii	Other	0.171	1.085	0.003	0.587	Mg	0.083	12.779	54.389	Yes
1A1a	Solid	0.172	1.085	0.036	0.587	Mg	0.053	8.122	62.511	Yes
1A1a	Biomass	0.003	1.085	0.044	0.587	Mg	0.039	6.009	68.520	Yes
1A1a	Peat	0.062	1.085	0.067	0.587	Mg	0.031	4.784	73.304	Yes
1A2d	Liquid	0.071	1.085	0.070	0.587	Mg	0.029	4.463	77.768	Yes
1A2f	Solid	0.017	1.085	0.030	0.587	Mg	0.019	2.895	80.663	Yes
5C1bv		0.006	1.085	0.021	0.587	Mg	0.017	2.549	83.212	
1A4bi	Biomass	0.021	1.085	0.026	0.587	Mg	0.013	2.072	85.284	
1A5a	Biomass	0.000	1.085	0.011	0.587	Mg	0.010	1.561	86.845	
1A2d	Solid	0.018	1.085	0.001	0.587	Mg	0.009	1.328	88.173	
2C7c		0.028	1.085	0.006	0.587	Mg	0.008	1.266	89.439	
1A2a	Solid	0.017	1.085	0.000	0.587	Mg	0.008	1.260	90.698	
1A1b	Solid	0.010	1.085	0.014	0.587	Mg	0.008	1.245	91.943	
1A1a	Other	0.000	1.085	0.006	0.587	Mg	0.005	0.801	92.745	
1A2d	Biomass	0.018	1.085	0.015	0.587	Mg	0.005	0.698	93.442	
1A4ci	Peat	0.001	1.085	0.005	0.587	Mg	0.004	0.673	94.115	
1A3biii	Diesel oil	0.005	1.085	0.007	0.587	Mg	0.004	0.650	94.765	
1A2f	Other		1.085	0.004	0.587	Mg	0.004	0.610	95.375	
2C7a		0.007	1.085	0.000	0.587	Mg	0.003	0.498	95.873	
1A3bi	Diesel oil	0.002	1.085	0.004	0.587	Mg	0.003	0.451	96.324	
1A2d	Other	0.000	1.085	0.003	0.587	Mg	0.003	0.406	96.730	
1A3bi	Gasoline	0.016	1.085	0.011	0.587	Mg	0.002	0.372	97.102	
1A2c	Solid	0.005	1.085	0.000	0.587	Mg	0.002	0.370	97.473	
1A2e	Solid	0.006	1.085	0.001	0.587	Mg	0.002	0.323	97.796	
2C6			1.085	0.002	0.587	Mg	0.002	0.270	98.066	
1A4ci	Biomass	0.003	1.085	0.003	0.587	Mg	0.002	0.246	98.312	
2C2		0.000	1.085	0.002	0.587	Mg	0.001	0.201	98.512	
1A3dii	Liquid	0.003	1.085	0.003	0.587	Mg	0.001	0.192	98.705	
1A2gviii	Biomass	0.005	1.085	0.004	0.587	Mg	0.001	0.177	98.882	
1A4ai	Biomass	0.001	1.085	0.002	0.587	Mg	0.001	0.151	99.034	
1A2gviii	Liquid	0.000	1.085	0.001	0.587	Mg	0.001	0.149	99.183	
1A3bii	Diesel oil	0.001	1.085	0.002	0.587	Mg	0.001	0.131	99.313	
3F		0.005	1.085	0.004	0.587	Mg	0.001	0.110	99.423	
1A4bi	Solid	0.001	1.085	0.000	0.587	Mg	0.001	0.102	99.525	
1A4bi	Peat	0.002	1.085	0.000	0.587	Mg	0.000	0.073	99.598	
1A1a	Liquid	0.001	1.085	0.000	0.587	Mg	0.000	0.056	99.654	
5E		0.002	1.085	0.001	0.587	Mg	0.000	0.049	99.703	
1A2d	Peat	0.016	1.085	0.008	0.587	Mg	0.000	0.043	99.747	
1A2gviii	Peat	0.000	1.085	0.000	0.587	Mg	0.000	0.040	99.787	
1A3bii	Gasoline	0.001	1.085	0.000	0.587	Mg	0.000	0.038	99.825	
1A3biv	Gasoline	0.000	1.085	0.000	0.587	Mg	0.000	0.036	99.861	
1A4ai	Liquid	0.000	1.085	0.000	0.587	Mg	0.000	0.018	99.879	
1A2c	Biomass	0.000	1.085	0.000	0.587	Mg	0.000	0.015	99.894	
1A4ai	Peat	0.000	1.085	0.000	0.587	Mg	0.000	0.013	99.907	

1A5a	Liquid	0.000	1.085	0.000	0.587	Mg	0.000	0.013	99.919	
1A4ciii	Liquid	0.002	1.085	0.001	0.587	Mg	0.000	0.012	99.931	
1A4ci	Solid	0.000	1.085	0.000	0.587	Mg	0.000	0.009	99.940	
1A2f	Biomass	0.000	1.085	0.000	0.587	Mg	0.000	0.009	99.949	
2G		0.000	1.085	0.000	0.587	Mg	0.000	0.007	99.956	
1A2e	Liquid	0.000	1.085	0.000	0.587	Mg	0.000	0.007	99.963	
1A4ci	Liquid	0.000	1.085	0.000	0.587	Mg	0.000	0.006	99.969	
1A2e	Biomass	0.000	1.085	0.000	0.587	Mg	0.000	0.004	99.973	
1A2e	Peat	0.003	1.085	0.002	0.587	Mg	0.000	0.004	99.978	
1A4bi	Liquid	0.000	1.085	0.000	0.587	Mg	0.000	0.004	99.982	
1A2c	Liquid	0.000	1.085	0.000	0.587	Mg	0.000	0.004	99.985	
1A2f	Liquid	0.000	1.085	0.000	0.587	Mg	0.000	0.004	99.989	
1A2e	Other	0.000	1.085	0.000	0.587	Mg	0.000	0.003	99.992	
1A1b	Liquid	0.000	1.085	0.000	0.587	Mg	0.000	0.003	99.995	
1A2a	Liquid	0.000	1.085	0.000	0.587	Mg	0.000	0.002	99.997	
1A3biv	Diesel oil		1.085	0.000	0.587	Mg	0.000	0.001	99.998	
1A2a	Biomass		1.085	0.000	0.587	Mg	0.000	0.001	99.999	
1B1b		0.000	1.085	0.000	0.587	Mg	0.000	0.001	99.999	
1A2b	Liquid	0.000	1.085	0.000	0.587	Mg	0.000	0.001	100	

As

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2019 emission of the NFR category	Year 2019 total emission	Unit	Trend assessment	Contribution to trend, %	Cumulative total, %	Key source
2C7c		28.000	34.815	0.212	2.065	Mg	0.042	45.624	45.624	Yes
1A1b	Solid	0.342	34.815	0.493	2.065	Mg	0.014	14.887	60.511	Yes
1A1a	Peat	0.628	34.815	0.450	2.065	Mg	0.012	13.004	73.516	Yes
1A4ci	Peat	0.032	34.815	0.165	2.065	Mg	0.005	5.137	78.653	Yes
1A2d	Liquid	0.163	34.815	0.123	2.065	Mg	0.003	3.578	82.231	Yes
2C6		1.700	34.815	0.009	2.065	Mg	0.003	2.879	85.109	
1A2f	Solid	0.491	34.815	0.115	2.065	Mg	0.002	2.700	87.809	
2C7a		0.113	34.815	0.081	2.065	Mg	0.002	2.333	90.142	
1A4bi	Biomass	0.041	34.815	0.051	2.065	Mg	0.001	1.544	91.687	
1A2e	Peat	0.080	34.815	0.048	2.065	Mg	0.001	1.354	93.041	
1A3bvi		0.036	34.815	0.043	2.065	Mg	0.001	1.290	94.331	
1A1a	Biomass	0.002	34.815	0.028	2.065	Mg	0.001	0.878	95.208	
1A5a	Biomass	0.000	34.815	0.022	2.065	Mg	0.001	0.697	95.906	
2C1		0.411	34.815	0.042	2.065	Mg	0.001	0.561	96.467	
1A1a	Solid	1.618	34.815	0.082	2.065	Mg	0.000	0.440	96.907	
1A2d	Peat	0.238	34.815	0.003	2.065	Mg	0.000	0.359	97.266	
1A2d	Solid	0.229	34.815	0.003	2.065	Mg	0.000	0.333	97.599	
1A3dii	Liquid	0.028	34.815	0.011	2.065	Mg	0.000	0.300	97.899	
1A4bi	Peat	0.053	34.815	0.012	2.065	Mg	0.000	0.292	98.191	
1A4ai	Peat	0.010	34.815	0.008	2.065	Mg	0.000	0.237	98.428	
1A4ci	Biomass	0.007	34.815	0.007	2.065	Mg	0.000	0.207	98.635	
1A5a	Liquid	0.017	34.815	0.006	2.065	Mg	0.000	0.157	98.792	
1A1a	Other	0.000	34.815	0.005	2.065	Mg	0.000	0.150	98.941	
1A2e	Solid	0.228	34.815	0.009	2.065	Mg	0.000	0.149	99.090	
1A2d	Biomass	0.016	34.815	0.005	2.065	Mg	0.000	0.132	99.222	
1A2gviii	Biomass	0.007	34.815	0.004	2.065	Mg	0.000	0.103	99.325	
1A4ai	Biomass	0.002	34.815	0.003	2.065	Mg	0.000	0.096	99.421	

1A4bi	Solid	0.048	34.815	0.001	2.065	Mg	0.000	0.065	99.487	
1B1b		0.004	34.815	0.002	2.065	Mg	0.000	0.061	99.547	
1A4ai	Liquid	0.021	34.815	0.003	2.065	Mg	0.000	0.056	99.603	
1A2c	Liquid	0.007	34.815	0.002	2.065	Mg	0.000	0.052	99.654	
2G		0.001	34.815	0.002	2.065	Mg	0.000	0.047	99.701	
1A2gviii	Other	0.001	34.815	0.001	2.065	Mg	0.000	0.041	99.742	
1A4ciii	Liquid	0.002	34.815	0.001	2.065	Mg	0.000	0.037	99.779	
1A2d	Other	0.000	34.815	0.001	2.065	Mg	0.000	0.027	99.806	
5E		0.003	34.815	0.001	2.065	Mg	0.000	0.025	99.830	
1A2gviii	Peat	0.001	34.815	0.001	2.065	Mg	0.000	0.021	99.851	
1A2a	Liquid	0.003	34.815	0.001	2.065	Mg	0.000	0.019	99.870	
2C2		0.002	34.815	0.001	2.065	Mg	0.000	0.018	99.888	
1A1a	Liquid	0.030	34.815	0.002	2.065	Mg	0.000	0.014	99.903	
2C3		0.008	34.815	0.000	2.065	Mg	0.000	0.013	99.916	
5C1bv		0.000	34.815	0.000	2.065	Mg	0.000	0.013	99.929	
1A3bi	Gasoline	0.001	34.815	0.000	2.065	Mg	0.000	0.011	99.940	
1A4ci	Liquid	0.006	34.815	0.001	2.065	Mg	0.000	0.010	99.949	
1A4ci	Solid	0.006	34.815	0.001	2.065	Mg	0.000	0.009	99.958	
1A2gviii	Liquid	0.009	34.815	0.001	2.065	Mg	0.000	0.007	99.966	
1A2e	Liquid	0.007	34.815	0.001	2.065	Mg	0.000	0.005	99.971	
1A4bi	Liquid	0.004	34.815	0.000	2.065	Mg	0.000	0.004	99.975	
1A3biii	Diesel oil	0.000	34.815	0.000	2.065	Mg	0.000	0.004	99.979	
3F		0.000	34.815	0.000	2.065	Mg	0.000	0.004	99.983	
1A2e	Biomass	0.000	34.815	0.000	2.065	Mg	0.000	0.003	99.986	
1A3bi	Diesel oil	0.000	34.815	0.000	2.065	Mg	0.000	0.002	99.989	
1A2f	Other		34.815	0.000	2.065	Mg	0.000	0.002	99.991	
1A2c	Solid	0.011	34.815	0.001	2.065	Mg	0.000	0.002	99.993	
1A1b	Liquid	0.001	34.815	0.000	2.065	Mg	0.000	0.002	99.994	
1A2e	Other	0.000	34.815	0.000	2.065	Mg	0.000	0.001	99.996	
1A2f	Biomass	0.000	34.815	0.000	2.065	Mg	0.000	0.001	99.997	
1A3bii	Diesel oil	0.000	34.815	0.000	2.065	Mg	0.000	0.001	99.998	
1A2f	Liquid	0.005	34.815	0.000	2.065	Mg	0.000	0.001	99.999	
1A2b	Liquid	0.001	34.815	0.000	2.065	Mg	0.000	0.001	99.999	
1A3biv	Gasoline	0.000	34.815	0.000	2.065	Mg	0.000	0.000	99.999	
1A2a	Biomass		34.815	0.000	2.065	Mg	0.000	0.000	100	
1A2c	Biomass	0.000	34.815	0.000	2.065	Mg	0.000	0.000	100	
1A3biv	Diesel oil		34.815	0.000	2.065	Mg	0.000	0.000	100	
1A3bii	Gasoline	0.000	34.815	0.000	2.065	Mg	0.000	0.000	100	

Cr

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2019 emission of the NFR category	Year 2019 total emission	Unit	Trend assessment	Contribution to trend, %	Cumulative total, %	Key source
2C1		19.554	47.623	2.297	14.286	Mg	0.075	22.933	22.933	Yes
1A1b	Solid	2.634	47.623	3.793	14.286	Mg	0.063	19.299	42.232	Yes
1A1a	Solid	6.765	47.623	0.099	14.286	Mg	0.041	12.405	54.637	Yes
1A4bi	Biomass	1.445	47.623	1.802	14.286	Mg	0.029	8.797	63.434	Yes
1A3bvi		1.143	47.623	1.351	14.286	Mg	0.021	6.477	69.910	Yes
1A5a	Biomass	0.012	47.623	0.776	14.286	Mg	0.016	4.964	74.874	Yes
1A2e	Solid	1.752	47.623	0.023	14.286	Mg	0.011	3.227	78.101	Yes
1A1a	Biomass	0.069	47.623	0.523	14.286	Mg	0.011	3.226	81.326	Yes

1A1a	Peat	1.076	47.623	0.788	14.286	Mg	0.010	2.991	84.317
1A2d	Solid	1.263	47.623	0.002	14.286	Mg	0.008	2.424	86.741
1A2b	Solid	1.845	47.623	0.187	14.286	Mg	0.008	2.353	89.094
1A4ci	Peat	0.056	47.623	0.285	14.286	Mg	0.006	1.726	90.820
1A4ci	Biomass	0.228	47.623	0.244	14.286	Mg	0.004	1.129	91.948
2C7c		0.520	47.623	0.005	14.286	Mg	0.003	0.972	92.920
1A2f	Solid	3.365	47.623	0.873	14.286	Mg	0.003	0.876	93.796
1A2gviii	Biomass	0.817	47.623	0.121	14.286	Mg	0.003	0.796	94.592
1A2d	Peat	0.411	47.623	0.004	14.286	Mg	0.003	0.766	95.358
2C2		2.000	47.623	0.487	14.286	Mg	0.002	0.726	96.084
1A4bi	Solid	0.370	47.623	0.006	14.286	Mg	0.002	0.675	96.759
1A1a	Other	0.001	47.623	0.097	14.286	Mg	0.002	0.622	97.381
1A4ai	Biomass	0.068	47.623	0.111	14.286	Mg	0.002	0.584	97.966
1A2d	Biomass	0.525	47.623	0.096	14.286	Mg	0.001	0.393	98.358
2C7a		0.145	47.623	0.000	14.286	Mg	0.001	0.280	98.638
1A2d	Liquid	0.042	47.623	0.055	14.286	Mg	0.001	0.271	98.909
1A2e	Peat	0.138	47.623	0.082	14.286	Mg	0.001	0.265	99.174
2G		0.006	47.623	0.018	14.286	Mg	0.000	0.102	99.276
1A2gvii	Liquid	0.014	47.623	0.018	14.286	Mg	0.000	0.086	99.361
1A4ci	Solid	0.044	47.623	0.000	14.286	Mg	0.000	0.082	99.444
1A3biii	Diesel oil	0.008	47.623	0.012	14.286	Mg	0.000	0.060	99.504
1A4ai	Peat	0.017	47.623	0.014	14.286	Mg	0.000	0.058	99.562
1A4cii	Liquid	0.015	47.623	0.012	14.286	Mg	0.000	0.051	99.612
1A2d	Other	0.001	47.623	0.006	14.286	Mg	0.000	0.040	99.653
1A4bi	Peat	0.091	47.623	0.021	14.286	Mg	0.000	0.038	99.691
1A3bi	Diesel oil	0.003	47.623	0.007	14.286	Mg	0.000	0.037	99.728
1A3bi	Gasoline	0.011	47.623	0.008	14.286	Mg	0.000	0.030	99.757
1A2gviii	Other	0.024	47.623	0.003	14.286	Mg	0.000	0.027	99.784
1A2gviii	Liquid	0.016	47.623	0.001	14.286	Mg	0.000	0.025	99.809
1A3dii	Liquid	0.030	47.623	0.013	14.286	Mg	0.000	0.022	99.830
1A4aii	Liquid	0.007	47.623	0.005	14.286	Mg	0.000	0.021	99.851
1A1a	Liquid	0.015	47.623	0.001	14.286	Mg	0.000	0.019	99.870
1A4bii	Liquid	0.002	47.623	0.003	14.286	Mg	0.000	0.015	99.885
1A2e	Biomass	0.006	47.623	0.004	14.286	Mg	0.000	0.014	99.899
1A3bii	Diesel oil	0.002	47.623	0.003	14.286	Mg	0.000	0.013	99.912
1A2f	Biomass	0.000	47.623	0.002	14.286	Mg	0.000	0.011	99.922
1A4ai	Liquid	0.010	47.623	0.002	14.286	Mg	0.000	0.010	99.933
1A2f	Other		47.623	0.002	14.286	Mg	0.000	0.010	99.943
3F		0.005	47.623	0.003	14.286	Mg	0.000	0.010	99.953
1A4ciii	Liquid	0.003	47.623	0.002	14.286	Mg	0.000	0.005	99.958
1A2e	Liquid	0.003	47.623	0.000	14.286	Mg	0.000	0.005	99.963
1A5a	Liquid	0.009	47.623	0.003	14.286	Mg	0.000	0.004	99.967
1A4ci	Liquid	0.003	47.623	0.000	14.286	Mg	0.000	0.004	99.971
1A2gviii	Peat	0.002	47.623	0.001	14.286	Mg	0.000	0.004	99.975
1B1b		0.003	47.623	0.001	14.286	Mg	0.000	0.004	99.979
1A4bi	Liquid	0.002	47.623	0.000	14.286	Mg	0.000	0.003	99.982
5C1bv		0.000	47.623	0.000	14.286	Mg	0.000	0.002	99.985
1A2e	Other	0.006	47.623	0.002	14.286	Mg	0.000	0.002	99.987
1A2a	Biomass		47.623	0.000	14.286	Mg	0.000	0.002	99.989
1A2f	Liquid	0.002	47.623	0.000	14.286	Mg	0.000	0.002	99.991
1A2c	Biomass	0.000	47.623	0.000	14.286	Mg	0.000	0.001	99.992

1A2c	Solid	0.013	47.623	0.004	14.286	Mg	0.000	0.001	99.994	
1A3biv	Gasoline	0.000	47.623	0.000	14.286	Mg	0.000	0.001	99.995	
1A1b	Liquid	0.001	47.623	0.000	14.286	Mg	0.000	0.001	99.996	
1A3c	Liquid	0.003	47.623	0.001	14.286	Mg	0.000	0.001	99.997	
5E		0.003	47.623	0.001	14.286	Mg	0.000	0.001	99.998	
1A3bii	Gasoline	0.000	47.623	0.000	14.286	Mg	0.000	0.001	99.999	
1A2gvii	Gaseous	0.000	47.623	0.000	14.286	Mg	0.000	0.000	99.999	
1A2a	Liquid	0.001	47.623	0.000	14.286	Mg	0.000	0.000	99.999	
1A2b	Liquid	0.001	47.623	0.000	14.286	Mg	0.000	0.000	100	
1A2c	Liquid	0.003	47.623	0.001	14.286	Mg	0.000	0.000	100	
1A3biv	Diesel oil		47.623	0.000	14.286	Mg	0.000	0.000	100	

Cu

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2019 emission of the NFR category	Year 2019 total emission	Unit	Trend assessment	Contribution to trend, %	Cumulative total, %	Key source
2C7c		80.257	156.824	0.246	40.171	Mg	0.130	41.351	41.351	Yes
1A3bvi		49.238	156.824	30.415	40.171	Mg	0.114	36.242	77.592	Yes
1A1a	Solid	5.471	156.824	0.108	40.171	Mg	0.008	2.633	80.226	Yes
2C7a		4.803	156.824	0.000	40.171	Mg	0.008	2.504	82.730	
1A5a	Biomass	0.017	156.824	1.131	40.171	Mg	0.007	2.293	85.022	
1A1b	Solid	0.922	156.824	1.328	40.171	Mg	0.007	2.222	87.244	
2C1		5.540	156.824	0.409	40.171	Mg	0.006	2.056	89.300	
1A1a	Biomass	0.105	156.824	0.993	40.171	Mg	0.006	1.968	91.268	
1A1a	Peat	1.662	156.824	1.251	40.171	Mg	0.005	1.680	92.948	
1A2gvii	Liquid	0.491	156.824	0.600	40.171	Mg	0.003	0.965	93.913	
2G		0.203	156.824	0.522	40.171	Mg	0.003	0.956	94.870	
1A4ci	Peat	0.088	156.824	0.448	40.171	Mg	0.003	0.867	95.736	
1A4cii	Liquid	0.499	156.824	0.418	40.171	Mg	0.002	0.590	96.327	
1A4bi	Biomass	0.248	156.824	0.309	40.171	Mg	0.002	0.500	96.826	
1A2d	Solid	0.648	156.824	0.001	40.171	Mg	0.001	0.335	97.161	
1A1a	Other	0.001	156.824	0.162	40.171	Mg	0.001	0.329	97.490	
1A2d	Peat	0.646	156.824	0.008	40.171	Mg	0.001	0.321	97.811	
1A2d	Biomass	0.813	156.824	0.359	40.171	Mg	0.001	0.307	98.118	
1A2e	Solid	0.613	156.824	0.010	40.171	Mg	0.001	0.300	98.418	
1A4aii	Liquid	0.227	156.824	0.177	40.171	Mg	0.001	0.243	98.660	
1A4bii	Liquid	0.075	156.824	0.100	40.171	Mg	0.001	0.165	98.825	
1A2d	Other	0.001	156.824	0.077	40.171	Mg	0.000	0.156	98.981	
1A2e	Peat	0.216	156.824	0.130	40.171	Mg	0.000	0.151	99.132	
2B10a		0.270	156.824	0.001	40.171	Mg	0.000	0.139	99.271	
1A3dii	Liquid	0.100	156.824	0.088	40.171	Mg	0.000	0.126	99.398	
1A4ci	Biomass	0.039	156.824	0.042	40.171	Mg	0.000	0.065	99.463	
1A4bi	Solid	0.130	156.824	0.002	40.171	Mg	0.000	0.063	99.526	
1A2d	Liquid	0.022	156.824	0.034	40.171	Mg	0.000	0.057	99.584	
1A2f	Solid	1.280	156.824	0.348	40.171	Mg	0.000	0.041	99.624	
1A2f	Other		156.824	0.017	40.171	Mg	0.000	0.035	99.659	
2C2		0.003	156.824	0.018	40.171	Mg	0.000	0.034	99.693	
1A4ciii	Liquid	0.049	156.824	0.029	40.171	Mg	0.000	0.033	99.727	
1A4ai	Biomass	0.013	156.824	0.019	40.171	Mg	0.000	0.032	99.759	
1A4ai	Peat	0.026	156.824	0.022	40.171	Mg	0.000	0.031	99.790	
2C6			156.824	0.014	40.171	Mg	0.000	0.028	99.818	

1A3c	Liquid	0.103	156.824	0.036	40.171	Mg	0.000	0.019	99.837	
1A5a	Liquid	0.029	156.824	0.017	40.171	Mg	0.000	0.019	99.856	
1A3biii	Diesel oil	0.006	156.824	0.008	40.171	Mg	0.000	0.013	99.869	
1A2gviii	Other	0.037	156.824	0.003	40.171	Mg	0.000	0.013	99.882	
1A1a	Liquid	0.034	156.824	0.003	40.171	Mg	0.000	0.011	99.893	
1A2gviii	Biomass	0.699	156.824	0.184	40.171	Mg	0.000	0.010	99.903	
1A2gviii	Liquid	0.022	156.824	0.001	40.171	Mg	0.000	0.010	99.913	
1A3bi	Diesel oil	0.002	156.824	0.004	40.171	Mg	0.000	0.008	99.921	
1A2e	Biomass	0.009	156.824	0.006	40.171	Mg	0.000	0.008	99.929	
1A4ci	Solid	0.016	156.824	0.000	40.171	Mg	0.000	0.007	99.936	
1A3bi	Gasoline	0.008	156.824	0.006	40.171	Mg	0.000	0.007	99.944	
1B1b		0.004	156.824	0.004	40.171	Mg	0.000	0.007	99.950	
1A4bi	Peat	0.143	156.824	0.034	40.171	Mg	0.000	0.006	99.956	
1A4ai	Liquid	0.026	156.824	0.004	40.171	Mg	0.000	0.006	99.962	
1A2gvii	Gaseous	0.012	156.824	0.006	40.171	Mg	0.000	0.006	99.968	
1A2e	Other	0.000	156.824	0.002	40.171	Mg	0.000	0.004	99.973	
1A2f	Biomass	0.000	156.824	0.002	40.171	Mg	0.000	0.004	99.976	
1A3bii	Diesel oil	0.001	156.824	0.002	40.171	Mg	0.000	0.003	99.979	
1A2e	Liquid	0.008	156.824	0.001	40.171	Mg	0.000	0.003	99.982	
1A4ci	Liquid	0.008	156.824	0.001	40.171	Mg	0.000	0.002	99.984	
1A2gviii	Peat	0.003	156.824	0.002	40.171	Mg	0.000	0.002	99.987	
1A4bi	Liquid	0.005	156.824	0.000	40.171	Mg	0.000	0.002	99.989	
1A2f	Liquid	0.006	156.824	0.000	40.171	Mg	0.000	0.002	99.991	
3F		0.002	156.824	0.001	40.171	Mg	0.000	0.002	99.993	
1A2c	Solid	0.010	156.824	0.002	40.171	Mg	0.000	0.002	99.995	
5E		0.006	156.824	0.002	40.171	Mg	0.000	0.001	99.996	
1A2a	Biomass		156.824	0.001	40.171	Mg	0.000	0.001	99.997	
1A2c	Liquid	0.008	156.824	0.003	40.171	Mg	0.000	0.001	99.998	
5C1bv		0.000	156.824	0.000	40.171	Mg	0.000	0.001	99.998	
1A1b	Liquid	0.002	156.824	0.000	40.171	Mg	0.000	0.001	99.999	
1A2c	Biomass	0.001	156.824	0.000	40.171	Mg	0.000	0.000	99.999	
1A3biv	Gasoline	0.000	156.824	0.000	40.171	Mg	0.000	0.000	100	
1A3bii	Gasoline	0.000	156.824	0.000	40.171	Mg	0.000	0.000	100	
1A2a	Liquid	0.004	156.824	0.001	40.171	Mg	0.000	0.000	100	
1A3biv	Diesel oil		156.824	0.000	40.171	Mg	0.000	0.000	100	
1A2b	Liquid	0.001	156.824	0.000	40.171	Mg	0.000	0.000	100	

Ni

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2019 emission of the NFR category	Year 2019 total emission	Unit	Trend assessment	Contribution to trend, %	Cumulative total, %	Key source
2C7c		31.000	78.398	0.020	11.541	Mg	0.058	32.978	32.978	Yes
1A4bi	Biomass	1.239	78.398	1.545	11.541	Mg	0.017	9.889	42.867	Yes
2C7b		5.000	78.398	1.691	11.541	Mg	0.012	6.931	49.798	Yes
1A5a	Biomass	0.010	78.398	0.665	11.541	Mg	0.008	4.816	54.614	Yes
1A1a	Solid	5.396	78.398	0.153	11.541	Mg	0.008	4.654	59.268	Yes
1A1a	Peat	1.066	78.398	0.787	11.541	Mg	0.008	4.571	63.839	Yes
2C1		2.002	78.398	0.795	11.541	Mg	0.006	3.629	67.468	Yes
1A5a	Liquid	2.531	78.398	0.855	11.541	Mg	0.006	3.504	70.972	Yes
1A1a	Biomass	0.060	78.398	0.482	11.541	Mg	0.006	3.436	74.408	Yes
1A2f	Solid	2.771	78.398	0.699	11.541	Mg	0.004	2.112	76.520	Yes

1A4ci	Peat	0.056	78.398	0.285	11.541	Mg	0.004	2.011	78.531	Yes
1A3dii	Liquid	1.280	78.398	0.454	11.541	Mg	0.003	1.929	80.460	Yes
1A1b	Liquid	1.729	78.398	0.006	11.541	Mg	0.003	1.807	82.266	
1A1a	Liquid	3.688	78.398	0.320	11.541	Mg	0.003	1.617	83.883	
1A2e	Solid	1.401	78.398	0.019	11.541	Mg	0.002	1.362	85.245	
1A2c	Liquid	0.833	78.398	0.304	11.541	Mg	0.002	1.318	86.563	
1A4ci	Biomass	0.195	78.398	0.209	11.541	Mg	0.002	1.309	87.872	
1A3bvi		0.164	78.398	0.194	11.541	Mg	0.002	1.232	89.104	
1A2b	Solid	1.115	78.398	0.007	11.541	Mg	0.002	1.143	90.247	
1A2d	Solid	1.036	78.398	0.001	11.541	Mg	0.002	1.096	91.343	
1A2gviii	Liquid	1.361	78.398	0.075	11.541	Mg	0.002	0.907	92.250	
1A4ai	Biomass	0.058	78.398	0.095	11.541	Mg	0.001	0.630	92.881	
1A1a	Other	0.001	78.398	0.082	11.541	Mg	0.001	0.593	93.473	
2C7a		0.508	78.398	0.000	11.541	Mg	0.001	0.541	94.014	
1A2gviii	Biomass	0.212	78.398	0.105	11.541	Mg	0.001	0.538	94.552	
1A2d	Liquid	2.254	78.398	0.260	11.541	Mg	0.001	0.522	95.074	
1A4bi	Liquid	0.555	78.398	0.012	11.541	Mg	0.001	0.508	95.582	
1A2e	Peat	0.138	78.398	0.082	11.541	Mg	0.001	0.452	96.034	
1A2e	Liquid	1.007	78.398	0.090	11.541	Mg	0.001	0.426	96.460	
1A2d	Peat	0.412	78.398	0.004	11.541	Mg	0.001	0.411	96.871	
1A2f	Liquid	0.676	78.398	0.046	11.541	Mg	0.001	0.386	97.257	
1A2a	Liquid	0.435	78.398	0.116	11.541	Mg	0.001	0.376	97.633	
1A4ci	Liquid	0.971	78.398	0.103	11.541	Mg	0.001	0.290	97.923	
2G		0.025	78.398	0.043	11.541	Mg	0.000	0.283	98.206	
1A4bi	Solid	0.296	78.398	0.005	11.541	Mg	0.000	0.281	98.487	
1A4ciii	Liquid	0.056	78.398	0.033	11.541	Mg	0.000	0.178	98.666	
2C2		0.017	78.398	0.027	11.541	Mg	0.000	0.178	98.844	
2B10a		1.052	78.398	0.177	11.541	Mg	0.000	0.159	99.002	
1A2gvii	Liquid	0.020	78.398	0.025	11.541	Mg	0.000	0.158	99.160	
1A4cii	Liquid	0.021	78.398	0.017	11.541	Mg	0.000	0.103	99.263	
1A4ai	Peat	0.017	78.398	0.014	11.541	Mg	0.000	0.084	99.346	
1A4ai	Liquid	3.134	78.398	0.451	11.541	Mg	0.000	0.078	99.425	
1A2b	Liquid	0.124	78.398	0.028	11.541	Mg	0.000	0.069	99.494	
1A1b	Solid	0.150	78.398	0.014	11.541	Mg	0.000	0.062	99.555	
1B1b		0.002	78.398	0.009	11.541	Mg	0.000	0.062	99.617	
1A4bi	Peat	0.091	78.398	0.021	11.541	Mg	0.000	0.058	99.675	
1A2d	Biomass	0.455	78.398	0.074	11.541	Mg	0.000	0.052	99.727	
1A2d	Other	0.001	78.398	0.006	11.541	Mg	0.000	0.045	99.772	
1A4aii	Liquid	0.009	78.398	0.007	11.541	Mg	0.000	0.043	99.815	
1A4ci	Solid	0.035	78.398	0.000	11.541	Mg	0.000	0.035	99.850	
1A4bii	Liquid	0.003	78.398	0.004	11.541	Mg	0.000	0.027	99.877	
1A2e	Biomass	0.005	78.398	0.003	11.541	Mg	0.000	0.019	99.896	
1A2c	Solid	0.010	78.398	0.004	11.541	Mg	0.000	0.018	99.914	
1A3bi	Gasoline	0.004	78.398	0.003	11.541	Mg	0.000	0.017	99.931	
1A2f	Other		78.398	0.002	11.541	Mg	0.000	0.015	99.945	
1A2f	Biomass	0.000	78.398	0.002	11.541	Mg	0.000	0.011	99.956	
1A2gviii	Peat	0.002	78.398	0.001	11.541	Mg	0.000	0.007	99.963	
3F		0.002	78.398	0.001	11.541	Mg	0.000	0.007	99.970	
1A2e	Other	0.003	78.398	0.001	11.541	Mg	0.000	0.006	99.976	
1A3c	Liquid	0.004	78.398	0.001	11.541	Mg	0.000	0.006	99.982	
1A2gviii	Other	0.021	78.398	0.004	11.541	Mg	0.000	0.005	99.987	

5C1bv		0.000	78.398	0.001	11.541	Mg	0.000	0.004	99.991	
1A2a	Biomass		78.398	0.000	11.541	Mg	0.000	0.002	99.993	
1A3biii	Diesel oil	0.000	78.398	0.000	11.541	Mg	0.000	0.002	99.995	
1A2c	Biomass	0.000	78.398	0.000	11.541	Mg	0.000	0.002	99.997	
1A2gvii	Gaseous	0.000	78.398	0.000	11.541	Mg	0.000	0.001	99.998	
1A3bi	Diesel oil	0.000	78.398	0.000	11.541	Mg	0.000	0.001	99.999	
1A3biv	Gasoline	0.000	78.398	0.000	11.541	Mg	0.000	0.001	100	
1A3bii	Diesel oil	0.000	78.398	0.000	11.541	Mg	0.000	0.000	100	
1A3bii	Gasoline	0.000	78.398	0.000	11.541	Mg	0.000	0.000	100	
1A3biv	Diesel oil		78.398	0.000	11.541	Mg	0.000	0.000	100	

Zn

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2019 emission of the NFR category	Year 2019 total emission	Unit	Trend assessment	Contribution to trend, %	Cumulative total, %	Key source
2C1		303.559	681.894	1.504	130.305	Mg	0.083	28.779	28.779	Yes
1A4bi	Biomass	28.903	681.894	36.048	130.305	Mg	0.045	15.547	44.327	Yes
2C7c		160.391	681.894	0.836	130.305	Mg	0.044	15.185	59.512	Yes
1A3bvi		18.42	681.894	19.382	130.305	Mg	0.023	8.079	67.591	Yes
1A5a	Biomass	0.238	681.894	15.519	130.305	Mg	0.023	7.881	75.473	Yes
1A1a	Biomass	1.382	681.894	12.983	130.305	Mg	0.019	6.479	81.951	Yes
1A1b	Solid	3.951	681.894	5.690	130.305	Mg	0.007	2.514	84.465	
2C6		90.174	681.894	12.393	130.305	Mg	0.007	2.464	86.929	
1A1a	Solid	28.018	681.894	0.653	130.305	Mg	0.007	2.395	89.324	
1A4ci	Biomass	4.550	681.894	4.877	130.305	Mg	0.006	2.041	91.365	
1A1a	Other	0.016	681.894	3.458	130.305	Mg	0.005	1.760	93.125	
1A4ai	Biomass	1.355	681.894	2.225	130.305	Mg	0.003	1.002	94.126	
1A1a	Peat	2.706	681.894	2.299	130.305	Mg	0.003	0.908	95.034	
1A2f	Solid	5.497	681.894	2.670	130.305	Mg	0.002	0.825	95.859	
1A2gviii	Biomass	4.949	681.894	2.470	130.305	Mg	0.002	0.776	96.635	
1A2f	Other		681.894	0.809	130.305	Mg	0.001	0.412	97.047	
1A4ci	Peat	0.132	681.894	0.673	130.305	Mg	0.001	0.330	97.377	
1A2d	Solid	3.342	681.894	0.031	130.305	Mg	0.001	0.309	97.686	
2C7a		2.563	681.894	0.001	130.305	Mg	0.001	0.249	97.936	
2C2		0.100	681.894	0.489	130.305	Mg	0.001	0.239	98.175	
1A2e	Solid	2.627	681.894	0.093	130.305	Mg	0.001	0.209	98.383	
1A2d	Liquid	0.110	681.894	0.415	130.305	Mg	0.001	0.201	98.584	
1A2gvii	Liquid	0.289	681.894	0.353	130.305	Mg	0.000	0.152	98.736	
2G		0.116	681.894	0.304	130.305	Mg	0.000	0.144	98.879	
2B10a		0.010	681.894	0.250	130.305	Mg	0.000	0.126	99.006	
1A2c	Solid	1.219	681.894	0.007	130.305	Mg	0.000	0.115	99.121	
1A2d	Other	0.016	681.894	0.201	130.305	Mg	0.000	0.101	99.222	
1A2gviii	Other	0.221	681.894	0.240	130.305	Mg	0.000	0.101	99.322	
1A4cii	Liquid	0.293	681.894	0.246	130.305	Mg	0.000	0.097	99.419	
1A2d	Peat	0.999	681.894	0.023	130.305	Mg	0.000	0.085	99.504	
1A2e	Peat	0.328	681.894	0.196	130.305	Mg	0.000	0.068	99.572	
1A4bi	Solid	0.555	681.894	0.009	130.305	Mg	0.000	0.049	99.622	
1A3dii	Liquid	0.117	681.894	0.114	130.305	Mg	0.000	0.046	99.668	
1A4aii	Liquid	0.134	681.894	0.104	130.305	Mg	0.000	0.040	99.708	
2C3		0.127	681.894	0.089	130.305	Mg	0.000	0.033	99.741	
1A2f	Liquid	0.327	681.894	0.004	130.305	Mg	0.000	0.030	99.771	
1A2e	Biomass	0.123	681.894	0.081	130.305	Mg	0.000	0.029	99.801	

1A4bii	Liquid	0.044	681.894	0.059	130.305	Mg	0.000	0.026	99.826
1A2e	Other	0.004	681.894	0.031	130.305	Mg	0.000	0.016	99.842
1A3bi	Gasoline	0.059	681.894	0.042	130.305	Mg	0.000	0.016	99.858
1A2f	Biomass	0.003	681.894	0.027	130.305	Mg	0.000	0.014	99.871
1A4ciii	Liquid	0.067	681.894	0.039	130.305	Mg	0.000	0.014	99.885
1A4ai	Peat	0.040	681.894	0.033	130.305	Mg	0.000	0.013	99.898
1A5a	Liquid	0.111	681.894	0.046	130.305	Mg	0.000	0.012	99.910
1A3biii	Diesel oil	0.018	681.894	0.025	130.305	Mg	0.000	0.011	99.921
1B1b		0.160	681.894	0.012	130.305	Mg	0.000	0.009	99.930
1A1a	Liquid	0.170	681.894	0.014	130.305	Mg	0.000	0.009	99.939
1A3bi	Diesel oil	0.006	681.894	0.014	130.305	Mg	0.000	0.007	99.946
3F		0.024	681.894	0.016	130.305	Mg	0.000	0.006	99.952
1A4bi	Peat	0.215	681.894	0.050	130.305	Mg	0.000	0.005	99.957
1A3c	Liquid	0.060	681.894	0.021	130.305	Mg	0.000	0.005	99.961
1A2d	Biomass	10.754	681.894	2.047	130.305	Mg	0.000	0.004	99.966
1A2gviii	Liquid	0.055	681.894	0.003	130.305	Mg	0.000	0.004	99.969
1A2a	Biomass		681.894	0.007	130.305	Mg	0.000	0.004	99.973
1A4ci	Solid	0.072	681.894	0.007	130.305	Mg	0.000	0.003	99.976
1A4ai	Liquid	0.125	681.894	0.018	130.305	Mg	0.000	0.003	99.979
1A3bii	Diesel oil	0.005	681.894	0.006	130.305	Mg	0.000	0.002	99.982
5C1bv		0.001	681.894	0.005	130.305	Mg	0.000	0.002	99.984
1A2c	Liquid	0.040	681.894	0.012	130.305	Mg	0.000	0.002	99.987
1A2gviii	Peat	0.005	681.894	0.005	130.305	Mg	0.000	0.002	99.989
1A2e	Liquid	0.040	681.894	0.004	130.305	Mg	0.000	0.002	99.991
1A2c	Biomass	0.014	681.894	0.007	130.305	Mg	0.000	0.002	99.993
1A4bi	Liquid	0.022	681.894	0.000	130.305	Mg	0.000	0.002	99.995
1A4ci	Liquid	0.039	681.894	0.004	130.305	Mg	0.000	0.002	99.997
1A2gvii	Gaseous	0.007	681.894	0.003	130.305	Mg	0.000	0.001	99.998
1A1b	Liquid	0.009	681.894	0.000	130.305	Mg	0.000	0.001	99.998
1A2a	Liquid	0.018	681.894	0.005	130.305	Mg	0.000	0.001	99.999
1A3biv	Gasoline	0.000	681.894	0.001	130.305	Mg	0.000	0.001	100
1A2b	Liquid	0.005	681.894	0.000	130.305	Mg	0.000	0.000	100
1A3bii	Gasoline	0.002	681.894	0.000	130.305	Mg	0.000	0.000	100
1A3biv	Diesel oil		681.894	0.000	130.305	Mg	0.000	0.000	100

PCDD/F

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2019 emission of the NFR category	Year 2019 total emission	Unit	Trend assessment	Contribution to trend, %	Cumulative total, %	Key source
2C1		4.552	17.597	1.076	12.132	g I-Teq	0.117	20.247	20.247	Yes
1B1b		1.461	17.597	2.509	12.132	g I-Teq	0.085	14.746	34.994	Yes
1A1a	Biomass	0.122	17.597	1.480	12.132	g I-Teq	0.079	13.709	48.703	Yes
5E		3.034	17.597	1.080	12.132	g I-Teq	0.057	9.937	58.640	Yes
1A1a	Other	0.002	17.597	0.886	12.132	g I-Teq	0.050	8.694	67.333	Yes
1A4bi	Biomass	0.867	17.597	1.081	12.132	g I-Teq	0.027	4.750	72.084	Yes
1A5a	Biomass	0.007	17.597	0.466	12.132	g I-Teq	0.026	4.524	76.608	Yes
1A3bi	Gasoline	0.962	17.597	0.204	12.132	g I-Teq	0.026	4.512	81.120	Yes
1A3bi	Diesel oil	0.008	17.597	0.359	12.132	g I-Teq	0.020	3.475	84.595	
1A2d	Other	0.009	17.597	0.228	12.132	g I-Teq	0.013	2.178	86.774	
2C7a		0.001	17.597	0.200	12.132	g I-Teq	0.011	1.961	88.734	
1A3bii	Diesel oil	0.004	17.597	0.182	12.132	g I-Teq	0.010	1.762	90.497	

1A2gviii	Other	0.192	17.597	0.017	12.132	g I-Teq	0.007	1.131	91.628
1A1a	Solid	0.411	17.597	0.172	12.132	g I-Teq	0.006	1.099	92.726
1A2d	Biomass	0.808	17.597	0.447	12.132	g I-Teq	0.006	1.078	93.804
1A1a	Peat	0.747	17.597	0.614	12.132	g I-Teq	0.006	0.978	94.783
1A3biii	Diesel oil	0.217	17.597	0.093	12.132	g I-Teq	0.003	0.558	95.340
1A4ci	Biomass	0.137	17.597	0.146	12.132	g I-Teq	0.003	0.514	95.855
1A2d	Liquid	0.006	17.597	0.051	12.132	g I-Teq	0.003	0.464	96.319
1A4ai	Biomass	0.041	17.597	0.067	12.132	g I-Teq	0.002	0.381	96.700
1A4ci	Peat	0.007	17.597	0.036	12.132	g I-Teq	0.002	0.303	97.003
1A2d	Solid	0.045	17.597	0.002	12.132	g I-Teq	0.002	0.285	97.287
1A2gviii	Biomass	0.199	17.597	0.165	12.132	g I-Teq	0.002	0.272	97.559
2A2		0.152	17.597	0.129	12.132	g I-Teq	0.001	0.238	97.797
1A2d	Peat	0.149	17.597	0.124	12.132	g I-Teq	0.001	0.205	98.002
2A1		0.029	17.597	0.040	12.132	g I-Teq	0.001	0.193	98.196
2C6		0.017	17.597	0.029	12.132	g I-Teq	0.001	0.164	98.360
1A1b	Gaseous	0.012	17.597	0.025	12.132	g I-Teq	0.001	0.161	98.521
1A2d	Gaseous	0.016	17.597	0.027	12.132	g I-Teq	0.001	0.159	98.680
1A3bii	Gasoline	0.024	17.597	0.001	12.132	g I-Teq	0.001	0.155	98.834
1A2f	Solid	0.024	17.597	0.005	12.132	g I-Teq	0.001	0.111	98.946
1A3biv	Gasoline	0.014	17.597	0.019	12.132	g I-Teq	0.001	0.093	99.038
1A2c	Solid	0.013	17.597	0.000	12.132	g I-Teq	0.000	0.083	99.121
1A2c	Biomass	0.012	17.597	0.000	12.132	g I-Teq	0.000	0.079	99.200
1A4bi	Liquid	0.019	17.597	0.005	12.132	g I-Teq	0.000	0.078	99.278
1A1b	Solid	0.011	17.597	0.015	12.132	g I-Teq	0.000	0.078	99.356
1A2f	Other		17.597	0.007	12.132	g I-Teq	0.000	0.065	99.420
1A4bi	Peat	0.011	17.597	0.003	12.132	g I-Teq	0.000	0.051	99.471
1A2e	Peat	0.028	17.597	0.015	12.132	g I-Teq	0.000	0.045	99.516
1A3biv	Diesel oil		17.597	0.004	12.132	g I-Teq	0.000	0.038	99.553
1A2c	Gaseous	0.004	17.597	0.007	12.132	g I-Teq	0.000	0.037	99.590
1A1a	Gaseous	0.020	17.597	0.017	12.132	g I-Teq	0.000	0.036	99.626
1A2gviii	Peat	0.004	17.597	0.006	12.132	g I-Teq	0.000	0.036	99.662
2A3		0.005	17.597	0.000	12.132	g I-Teq	0.000	0.033	99.695
1A4ai	Liquid	0.012	17.597	0.005	12.132	g I-Teq	0.000	0.033	99.728
1A5a	Gaseous	0.002	17.597	0.005	12.132	g I-Teq	0.000	0.028	99.756
1A1a	Liquid	0.007	17.597	0.002	12.132	g I-Teq	0.000	0.026	99.781
1A2f	Biomass	0.000	17.597	0.002	12.132	g I-Teq	0.000	0.023	99.805
2L		0.016	17.597	0.009	12.132	g I-Teq	0.000	0.020	99.825
1A2a	Gaseous	0.008	17.597	0.007	12.132	g I-Teq	0.000	0.016	99.841
1A2e	Solid	0.007	17.597	0.003	12.132	g I-Teq	0.000	0.015	99.856
1A3dii	Liquid	0.026	17.597	0.016	12.132	g I-Teq	0.000	0.014	99.870
1A4ci	Liquid	0.004	17.597	0.001	12.132	g I-Teq	0.000	0.013	99.884
1A5a	Liquid	0.008	17.597	0.004	12.132	g I-Teq	0.000	0.012	99.896
1A4bi	Solid	0.001	17.597	0.000	12.132	g I-Teq	0.000	0.010	99.905
2D3b		0.016	17.597	0.012	12.132	g I-Teq	0.000	0.009	99.915
1A2e	Other	0.000	17.597	0.001	12.132	g I-Teq	0.000	0.009	99.923
1A2e	Liquid	0.002	17.597	0.000	12.132	g I-Teq	0.000	0.009	99.932
1A4ciii	Liquid	0.007	17.597	0.004	12.132	g I-Teq	0.000	0.007	99.939
5C1bv		0.000	17.597	0.001	12.132	g I-Teq	0.000	0.007	99.946
1A2c	Liquid	0.002	17.597	0.000	12.132	g I-Teq	0.000	0.006	99.952
1A1b	Liquid	0.001	17.597	0.001	12.132	g I-Teq	0.000	0.006	99.957
1A2gviii	Gaseous	0.001	17.597	0.001	12.132	g I-Teq	0.000	0.006	99.963

1A2f	Gaseous	0.001	17.597	0.002	12.132	g I-Teq	0.000	0.005	99.968
1A2b	Solid	0.002	17.597	0.001	12.132	g I-Teq	0.000	0.005	99.974
1A4bi	Gaseous	0.000	17.597	0.001	12.132	g I-Teq	0.000	0.004	99.977
1A2a	Liquid	0.001	17.597	0.000	12.132	g I-Teq	0.000	0.004	99.981
1A4ai	Gaseous	0.000	17.597	0.001	12.132	g I-Teq	0.000	0.003	99.984
1A4ai	Peat	0.002	17.597	0.002	12.132	g I-Teq	0.000	0.003	99.987
1A2e	Biomass	0.007	17.597	0.005	12.132	g I-Teq	0.000	0.002	99.990
1A2a	Biomass		17.597	0.000	12.132	g I-Teq	0.000	0.002	99.992
1A2e	Gaseous	0.000	17.597	0.000	12.132	g I-Teq	0.000	0.002	99.993
1A4ci	Gaseous	0.000	17.597	0.000	12.132	g I-Teq	0.000	0.002	99.995
1A2f	Liquid	0.001	17.597	0.001	12.132	g I-Teq	0.000	0.002	99.996
1A2gviii	Liquid	0.003	17.597	0.002	12.132	g I-Teq	0.000	0.001	99.997
2G		0.001	17.597	0.000	12.132	g I-Teq	0.000	0.001	99.998
1A2b	Gaseous	0.000	17.597	0.000	12.132	g I-Teq	0.000	0.001	99.999
1A4ci	Solid	0.001	17.597	0.000	12.132	g I-Teq	0.000	0.000	99.999
1A3ei	Gaseous	0.000	17.597	0.000	12.132	g I-Teq	0.000	0.000	99.999
2C3		0.000	17.597	0.000	12.132	g I-Teq	0.000	0.000	100
1A4bi	Other	0.000	17.597	0.000	12.132	g I-Teq	0.000	0.000	100
1A2b	Liquid	0.000	17.597	0.000	12.132	g I-Teq	0.000	0.000	100

PAH-4

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2019 emission of the NFR category	Year 2019 total emission	Unit	Trend assessment	Contribution to trend, %	Cumulative total, %	Key source
1A4bi	Biomass	17.694	18.964	20.489	22.309	Mg	0.017	19.898	19.898	Yes
1A1a	Other	0.000	18.964	0.241	22.309	Mg	0.013	14.689	34.588	Yes
1A1a	Biomass	0.015	18.964	0.209	22.309	Mg	0.010	11.634	46.222	Yes
2C1		0.132	18.964	0.009	22.309	Mg	0.008	8.925	55.147	Yes
1B1b		0.258	18.964	0.443	22.309	Mg	0.007	8.529	63.676	Yes
1A4bi	Liquid	0.109	18.964	0.030	22.309	Mg	0.005	5.989	69.665	Yes
1A2gviii	Other	0.017	18.964	0.108	22.309	Mg	0.005	5.405	75.070	Yes
1A5a	Biomass	0.001	18.964	0.060	22.309	Mg	0.003	3.592	78.662	Yes
1A4ai	Liquid	0.074	18.964	0.029	22.309	Mg	0.003	3.526	82.188	Yes
1A2d	Other	0.001	18.964	0.045	22.309	Mg	0.002	2.731	84.919	
1A5a	Liquid	0.045	18.964	0.020	22.309	Mg	0.002	2.013	86.932	
1A3bi	Diesel oil	0.025	18.964	0.060	22.309	Mg	0.002	1.832	88.764	
1A3bi	Gasoline	0.047	18.964	0.033	22.309	Mg	0.001	1.343	90.107	
1A4ci	Liquid	0.025	18.964	0.008	22.309	Mg	0.001	1.275	91.382	
1A3biii	Diesel oil	0.077	18.964	0.109	22.309	Mg	0.001	1.116	92.498	
1A2gviii	Liquid	0.016	18.964	0.005	22.309	Mg	0.001	0.825	93.323	
1A2e	Liquid	0.010	18.964	0.001	22.309	Mg	0.001	0.682	94.006	
1A2gviii	Biomass	0.026	18.964	0.021	22.309	Mg	0.000	0.533	94.538	
1A4cii	Liquid	0.023	18.964	0.020	22.309	Mg	0.000	0.486	95.024	
2D3i		0.020	18.964	0.016	22.309	Mg	0.000	0.476	95.500	
1A1a	Peat	0.043	18.964	0.043	22.309	Mg	0.000	0.459	95.959	
1A2c	Liquid	0.010	18.964	0.004	22.309	Mg	0.000	0.451	96.410	
1A2d	Biomass	0.103	18.964	0.115	22.309	Mg	0.000	0.418	96.828	
1A2d	Liquid	0.039	18.964	0.039	22.309	Mg	0.000	0.401	97.229	
1A2f	Liquid	0.008	18.964	0.004	22.309	Mg	0.000	0.341	97.570	
1A2d	Peat	0.009	18.964	0.006	22.309	Mg	0.000	0.275	97.845	
1A2a	Liquid	0.005	18.964	0.001	22.309	Mg	0.000	0.272	98.117	

1A4aii	Liquid	0.011	18.964	0.008	22.309	Mg	0.000	0.258	98.374
1A3c	Liquid	0.005	18.964	0.002	22.309	Mg	0.000	0.245	98.619
1A1a	Liquid	0.050	18.964	0.055	22.309	Mg	0.000	0.237	98.856
1A2f	Other		18.964	0.002	22.309	Mg	0.000	0.110	98.965
1A2c	Biomass	0.002	18.964	0.000	22.309	Mg	0.000	0.109	99.074
1A4ci	Peat	0.000	18.964	0.002	22.309	Mg	0.000	0.096	99.170
1A3bii	Gasoline	0.001	18.964	0.000	22.309	Mg	0.000	0.090	99.260
1A2b	Liquid	0.003	18.964	0.002	22.309	Mg	0.000	0.079	99.339
1A2gvii	Liquid	0.023	18.964	0.028	22.309	Mg	0.000	0.063	99.402
1A1a	Solid	0.001	18.964	0.000	22.309	Mg	0.000	0.063	99.465
1A2e	Peat	0.002	18.964	0.001	22.309	Mg	0.000	0.063	99.528
2G		0.001	18.964	0.001	22.309	Mg	0.000	0.052	99.580
5C1bv		0.000	18.964	0.001	22.309	Mg	0.000	0.045	99.625
1A3biv	Gasoline	0.000	18.964	0.001	22.309	Mg	0.000	0.043	99.668
1A3bii	Diesel oil	0.015	18.964	0.018	22.309	Mg	0.000	0.039	99.707
1A4bi	Peat	0.001	18.964	0.000	22.309	Mg	0.000	0.037	99.744
1A4bii	Liquid	0.004	18.964	0.005	22.309	Mg	0.000	0.035	99.779
2A1		0.000	18.964	0.001	22.309	Mg	0.000	0.026	99.805
1A2e	Biomass	0.001	18.964	0.001	22.309	Mg	0.000	0.024	99.828
1A4ai	Biomass	0.001	18.964	0.002	22.309	Mg	0.000	0.024	99.852
1A2gvii	Gaseous	0.001	18.964	0.000	22.309	Mg	0.000	0.023	99.875
1A4ci	Biomass	0.003	18.964	0.004	22.309	Mg	0.000	0.019	99.894
1A2f	Biomass	0.000	18.964	0.000	22.309	Mg	0.000	0.018	99.912
1A1b	Liquid	0.006	18.964	0.007	22.309	Mg	0.000	0.017	99.929
1A2gviii	Peat	0.000	18.964	0.000	22.309	Mg	0.000	0.010	99.939
1A2d	Solid	0.000	18.964	0.000	22.309	Mg	0.000	0.009	99.948
1A4bi	Other	0.000	18.964	0.000	22.309	Mg	0.000	0.008	99.957
1A3biv	Diesel oil		18.964	0.000	22.309	Mg	0.000	0.008	99.965
2C2			18.964	0.000	22.309	Mg	0.000	0.007	99.973
1A2e	Other	0.000	18.964	0.000	22.309	Mg	0.000	0.006	99.979
3F		0.000	18.964	0.000	22.309	Mg	0.000	0.006	99.985
1A2f	Solid	0.000	18.964	0.000	22.309	Mg	0.000	0.003	99.989
1A2c	Solid	0.000	18.964	0.000	22.309	Mg	0.000	0.003	99.991
1A4ai	Peat	0.000	18.964	0.000	22.309	Mg	0.000	0.003	99.994
1A2a	Biomass		18.964	0.000	22.309	Mg	0.000	0.002	99.996
1A2b	Solid	0.000	18.964	0.000	22.309	Mg	0.000	0.001	99.997
1A2a	Solid	0.000	18.964	0.000	22.309	Mg	0.000	0.001	99.998
1A2e	Solid	0.000	18.964	0.000	22.309	Mg	0.000	0.001	99.999
1A1b	Solid	0.000	18.964	0.000	22.309	Mg	0.000	0.001	100
1A4bi	Solid	0.000	18.964	0.000	22.309	Mg	0.000	0.000	100
1A4ci	Solid	0.000	18.964	0.000	22.309	Mg	0.000	0.000	100

HCB

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2019 emission of the NFR category	Year 2019 total emission	Unit	Trend assessment	Contribution to trend, %	Cumulative total, %	Key source
2B10a		29.000	35.677	15.450	22.637	kg	0.083	48.291	48.291	Yes
2C7a		5.514	35.677	5.821	22.637	kg	0.065	37.995	86.286	Yes
1A1a	Biomass	0.037	35.677	0.444	22.637	kg	0.012	6.885	93.171	
1A4bi	Biomass	0.206	35.677	0.257	22.637	kg	0.004	2.070	95.241	
1A3biii	Diesel oil	0.059	35.677	0.084	22.637	kg	0.001	0.756	95.997	

2C1		0.096	35.677	0.016	22.637	kg	0.001	0.725	96.722
1A3bi	Diesel oil	0.020	35.677	0.047	22.637	kg	0.001	0.558	97.280
3Df		0.057	35.677	0.011	22.637	kg	0.001	0.410	97.690
1A5a	Biomass		35.677	0.022	22.637	kg	0.001	0.363	98.053
1A2gviii		0.143	35.677	0.105	22.637	kg	0.000	0.233	98.286
1A4ci	Biomass	0.033	35.677	0.035	22.637	kg	0.000	0.232	98.519
1A2d	Biomass	0.191	35.677	0.134	22.637	kg	0.000	0.212	98.731
2C3		0.033	35.677	0.033	22.637	kg	0.000	0.203	98.934
1A4ai	Biomass	0.010	35.677	0.016	22.637	kg	0.000	0.161	99.095
1A3bii	Diesel oil	0.015	35.677	0.019	22.637	kg	0.000	0.147	99.242
1A2gviii	Biomass	0.049	35.677	0.039	22.637	kg	0.000	0.133	99.374
1A3bi	Gasoline	0.108	35.677	0.076	22.637	kg	0.000	0.130	99.504
1A4bi	Solid	0.007	35.677	0.000	22.637	kg	0.000	0.073	99.578
1A2d	Solid	0.007	35.677	0.000	22.637	kg	0.000	0.067	99.645
5C1bv		0.001	35.677	0.005	22.637	kg	0.000	0.064	99.709
1A3bii	Gasoline	0.004	35.677	0.000	22.637	kg	0.000	0.037	99.745
1A3dii	Liquid	0.010	35.677	0.008	22.637	kg	0.000	0.031	99.776
1A2c	Biomass	0.003	35.677	0.000	22.637	kg	0.000	0.029	99.805
1A4ci	Solid		35.677	0.002	22.637	kg	0.000	0.027	99.832
1A3biv	Gasoline	0.001	35.677	0.002	22.637	kg	0.000	0.027	99.859
1A2a	Solid	0.003	35.677	0.000	22.637	kg	0.000	0.023	99.882
2D3i		0.004	35.677	0.001	22.637	kg	0.000	0.022	99.904
1A2f	Solid	0.004	35.677	0.001	22.637	kg	0.000	0.021	99.925
1A2c	Solid	0.002	35.677	0.000	22.637	kg	0.000	0.020	99.945
1A2b	Solid	0.002	35.677	0.000	22.637	kg	0.000	0.019	99.964
1A2f	Biomass	0.000	35.677	0.001	22.637	kg	0.000	0.009	99.973
1A3bi	Gaseous		35.677	0.000	22.637	kg	0.000	0.007	99.980
1A5a	Liquid	0.001	35.677	0.001	22.637	kg	0.000	0.005	99.985
1A4ciii	Liquid	0.004	35.677	0.003	22.637	kg	0.000	0.003	99.988
1A2e	Solid	0.001	35.677	0.001	22.637	kg	0.000	0.003	99.991
1A2e	Biomass	0.002	35.677	0.001	22.637	kg	0.000	0.002	99.993
1A3biv	Diesel oil		35.677	0.000	22.637	kg	0.000	0.002	99.995
1A3biii	Gaseous		35.677	0.000	22.637	kg	0.000	0.002	99.997
1A1a	Solid	0.001	35.677	0.000	22.637	kg	0.000	0.001	99.998
1A3bii	Gaseous		35.677	0.000	22.637	kg	0.000	0.001	99.999
1A2a	Biomass		35.677	0.000	22.637	kg	0.000	0.001	100

PCB

NFR Code	Fuel	Base year emission of the NFR category	Base year total emission	Year 2019 emission of the NFR category	Year 2019 total emission	Unit	Trend assessment	Contribution to trend, %	Cumulative total, %	Key source
1B1b		1.753	28.850	3.010	22.780	kg	0.056	19.872	19.872	Yes
1A2d	Solid	1.907	28.850	0.083	22.780	kg	0.049	17.380	37.252	Yes
2C1		13.464	28.850	11.814	22.780	kg	0.041	14.450	51.702	Yes
1A4bi	Biomass	2.477	28.850	3.090	22.780	kg	0.039	13.854	65.556	Yes
1A2f	Solid	1.037	28.850	0.303	22.780	kg	0.018	6.300	71.856	Yes
1A2a	Solid	0.784	28.850	0.118	22.780	kg	0.017	6.125	77.982	Yes
1A2c	Solid	0.538	28.850	0.011	22.780	kg	0.014	5.048	83.030	Yes
1A2b	Solid	0.551	28.850	0.032	22.780	kg	0.014	4.924	87.954	
1A1a	Biomass	0.026	28.850	0.311	22.780	kg	0.010	3.550	91.504	
2A1		3.298	28.850	2.846	22.780	kg	0.008	2.954	94.458	

1A4ci	Biomass	0.390	28.850	0.418	22.780	kg	0.004	1.343	95.801
1A4ai	Biomass	0.115	28.850	0.191	22.780	kg	0.003	1.225	97.027
1A2e	Solid	0.298	28.850	0.139	22.780	kg	0.003	1.176	98.203
1A2gviii		0.135	28.850	0.035	22.780	kg	0.002	0.872	99.074
2C3		0.083	28.850	0.087	22.780	kg	0.001	0.261	99.335
2A2		0.293	28.850	0.248	22.780	kg	0.001	0.212	99.547
2C7c		0.002	28.850	0.015	22.780	kg	0.000	0.172	99.719
5C1bv		0.003	28.850	0.012	22.780	kg	0.000	0.118	99.837
1A3dii	Liquid	0.024	28.850	0.010	22.780	kg	0.000	0.112	99.949
1A4bi	Liquid	0.003	28.850	0.001	22.780	kg	0.000	0.021	99.969
1A4ai	Liquid	0.002	28.850	0.001	22.780	kg	0.000	0.010	99.979
1A4ciii	Liquid	0.002	28.850	0.001	22.780	kg	0.000	0.005	99.984
1A4ci	Liquid	0.001	28.850	0.000	22.780	kg	0.000	0.004	99.988
1A2d	Biomass	0.002	28.850	0.002	22.780	kg	0.000	0.002	99.991
2C7a		0.001	28.850	0.000	22.780	kg	0.000	0.002	99.993
1A4ci	Peat	0.000	28.850	0.000	22.780	kg	0.000	0.002	99.994
1A3bi	Gasoline	0.000	28.850	0.000	22.780	kg	0.000	0.001	99.996
1A1a	Solid	0.000	28.850	0.000	22.780	kg	0.000	0.001	99.997
1A3bi	Diesel oil	0.000	28.850	0.000	22.780	kg	0.000	0.001	99.998
1A4bi	Solid	0.000	28.850	0.000	22.780	kg	0.000	0.001	99.998
1A3bii	Diesel oil	0.000	28.850	0.000	22.780	kg	0.000	0.000	99.999
1A2c	Biomass	0.000	28.850	0.000	22.780	kg	0.000	0.000	99.999
1A4bi	Peat	0.000	28.850	0.000	22.780	kg	0.000	0.000	99.999
1A3bii	Gasoline	0.000	28.850	0.000	22.780	kg	0.000	0.000	99.999
1A4ci	Solid		28.850	0.000	22.780	kg	0.000	0.000	100
1A3biii	Diesel oil	0.000	28.850	0.000	22.780	kg	0.000	0.000	100
1A2f	Biomass	0.000	28.850	0.000	22.780	kg	0.000	0.000	100
1A2gviii	Biomass	0.001	28.850	0.000	22.780	kg	0.000	0.000	100
1A3biv	Gasoline	0.000	28.850	0.000	22.780	kg	0.000	0.000	100
1A4ai	Peat	0.000	28.850	0.000	22.780	kg	0.000	0.000	100
1A2e	Biomass	0.000	28.850	0.000	22.780	kg	0.000	0.000	100
1A3biv	Diesel oil		28.850	0.000	22.780	kg	0.000	0.000	100
1A2a	Biomass		28.850	0.000	22.780	kg	0.000	0.000	100