

# **Informative Inventory Report (IIR) 2021 of Montenegro**

submission under  
UNECE Convention on  
Long-range Transboundary Air Pollution (LRTAP)

**DRAFT**

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# 1 Introduction

## 1.1 National Inventory background - International commitments

Reporting of emission data to the Executive Body (EB) of the Convention on Long-range Transboundary Air Pollution (CLRTAP) is required in order to fulfill the obligations regarding strategies and policies in compliance with the implementation of Protocols under the Convention. Parties should use the reporting procedures and are required to submit annual national emissions of nitrogen oxides (NO<sub>x</sub>), non-methane volatile organic compounds (NMVOC), sulphur dioxide (SO<sub>x</sub>), ammonia (NH<sub>3</sub>), carbon monoxide (CO), particulate matter (PM), various heavy metals (HM) and persistent organic pollutants (POP)s.

The United Nations, Economic Commission for Europe (UNECE), adopted the LRTAP Convention in 1979. The LRTAP Convention came into force in 1983 and has been extended by eight specific protocols. For Montenegro, status of ratification to LRTAP Convention and its Protocols is shown below:

### **Convention on Long-Range Transboundary Air Pollution (LRTAP) (Geneva, 1979)<sup>1</sup>:**

The Convention was

- ratified by means of the Law on Ratification  
*„Official Gazette of the SFRY” No. 11/86.*
- taken over by the Montenegro by means of succession with the date of effect of 23. Oct. 2006 (The Law on the Confirmation of the 1979 Convention on Long-range Transboundary Air Pollution)  
*Official Gazette of Montenegro - International Agreements 11/86.*
  - Law on Ratification of the Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on long-term financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP)  
*Official Gazette of Montenegro – International Agreements 11/86*
  - Law on Ratification of the Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on heavy metals  
*Official Gazette of Montenegro – International Agreements 8/11.*
  - Law on the Confirmation of the Protocol on POPs with the 1979 Convention on Long-Range Transboundary Air Pollution  
*Official Gazette of Montenegro – International Agreements 8/11*

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<sup>1</sup> <https://unece.org/DAM/env/lrtap/full%20text/1979.CLRTAP.e.pdf>



**Table 1.1 Protocols of UNECE Convention on Long-range Transboundary Air Pollution (LRTAP)**

	Tools of UNECE Convention on Long-range Transboundary Air Pollution (LRTAP)	Parties	entered into force	Signed (S) / Ratified (R) / Succession (d) / Accession (a) by Montenegro
1979	Convention on Long-range Transboundary Air Pollution (in Geneva)	51	16.03.1983	23. 10. 2006. (d) <sup>2</sup>
1984	Geneva Protocol on Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) <sup>3</sup>	47	28.01.1988	23. 10. 2006. (d) <sup>4</sup>
1998	Aarhus Protocol on Heavy Metals <sup>5</sup>	36	29.12.2003	01.07.2011 (a) <sup>6</sup>
1998	Aarhus Protocol on Persistent Organic Pollutants (POPs) <sup>7</sup>	36	23.10.2003	01.07.2011 (a) <sup>8</sup>

## 1.2 Institutional, legal and procedural arrangements

According to the Law on air protection (*Official Gazette of Montenegro 25/10 and 43/15*) the Nature and Environmental Protection Agency (NEPA) of Montenegro is the Single National Entity (SNE) responsible for the preparation of emission inventories. NEPA has the overall responsibility and submits the inventory report to the Convention on Long-range Transboundary Air Pollution (CLRTAP).

Within the NEPA, experts from different departments are contributing, whereby experts from the Sector for nature protection, monitoring, analysis and reporting are compiling and reporting the inventory. Data needed for the preparation of the inventory are provided by either

- Industrial operators,
- Statistical office (MONSTAT),
- Ministry of Economy,
- Ministry of Agriculture and rural development,
- Ministry of Internal affairs,
- Ministry of transport and maritime affairs,
- Institute of hydrometeorology and seismology.

NEPA has signed memorandum of understanding on mutual cooperation data with the MONSTAT.

The institutional arrangements for the inventory system currently used in Montenegro are presented in following figure.

<sup>2</sup> <https://unece.org/DAM/env/lrtap/status/Status%20of%20the%20Convention.pdf>

<sup>3</sup> <https://unece.org/DAM/env/lrtap/full%20text/1984.EMEP.e.pdf>

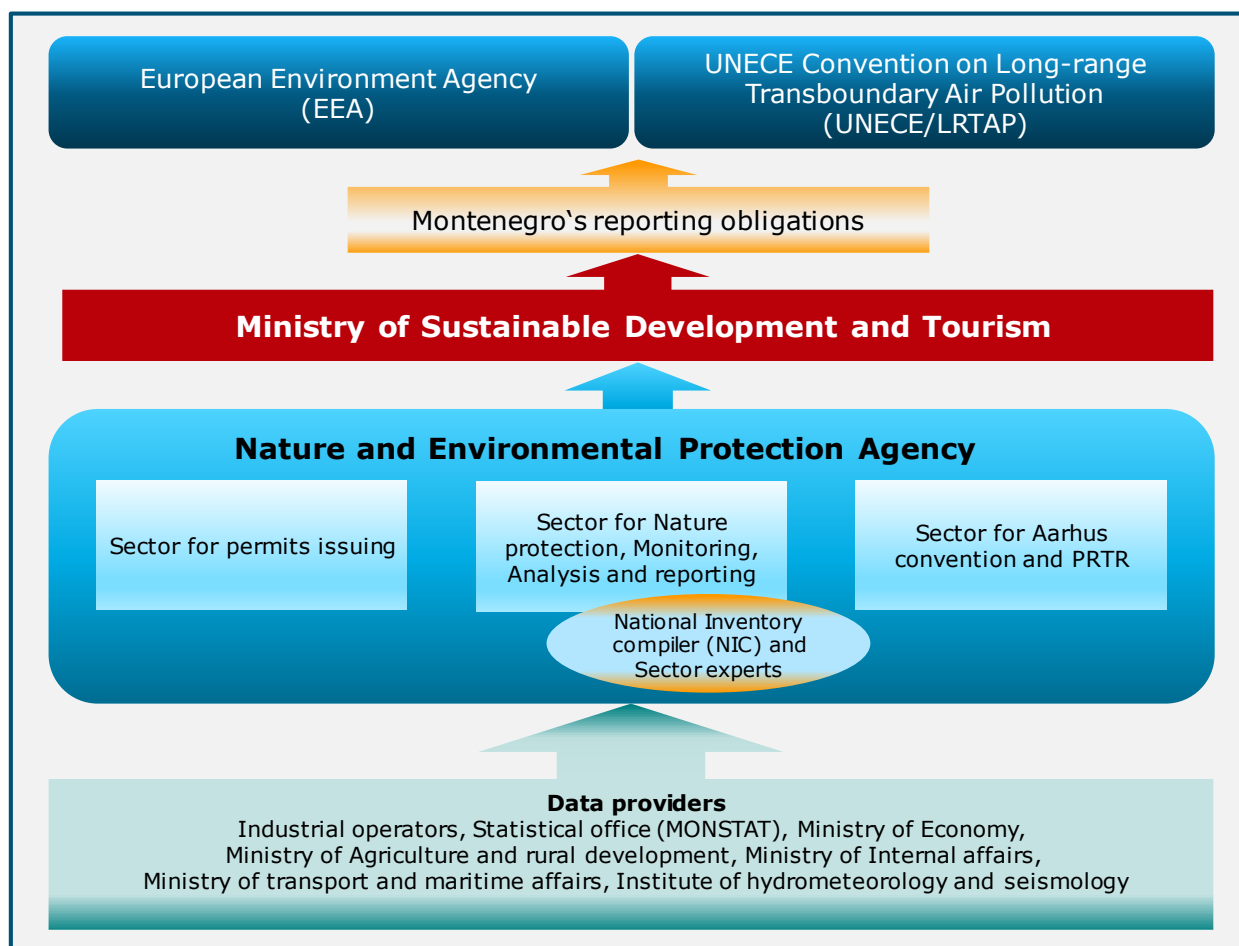
<sup>4</sup> [https://unece.org/DAM/env/lrtap/status/84e\\_st.htm](https://unece.org/DAM/env/lrtap/status/84e_st.htm)

<sup>5</sup> <https://unece.org/DAM/env/lrtap/full%20text/1998.Heavy.Metals.e.pdf>

<sup>6</sup> [https://unece.org/DAM/env/lrtap/status/98hm\\_st.htm](https://unece.org/DAM/env/lrtap/status/98hm_st.htm)

<sup>7</sup> <https://unece.org/DAM/env/lrtap/full%20text/1998.POPs.e.pdf>

<sup>8</sup> [https://unece.org/DAM/env/lrtap/status/98pop\\_st.htm](https://unece.org/DAM/env/lrtap/status/98pop_st.htm)



**Figure 1.1 International obligations**

The other ministries/institutions mentioned above are delivering the data on voluntary basis and upon our requirements. The plant operators are reporting the data due to their obligation under European Pollutant Release and Transfer Register (PRTR) and national sub legislation under the Law on air protection.

### National legislation

In accordance with Law on air protection (*Official Gazette of Montenegro 25/10, 43/15<sup>9</sup>*), the Air Pollutant Emissions inventory for the territory of Montenegro is performed through:

- 1) Calculation of emission quantities of pollutants in the air in Montenegro;
- 2) Preparation of report on the annual emission inventory;
- 3) Preparation of report on implementation of emission reduction measures in order to fulfill the requirements toward the 1979 Convention on Long-Range trans-boundary Air Pollution and its amendments (hereinafter: LRTAP convention).

<sup>9</sup> <http://www.epa.org.me/images/zakoni/zakon%20o%20zastiti%20vazduha.pdf>

### 1.2.1 Overview of legal, institutional, and procedural arrangements for compiling emission inventory

In the following figure the *draft* MRV framework for the GHG and Air pollution emission inventory of Montenegro is illustrated. In the following (sub-)chapters below a description of the various roles and responsibilities are provided.

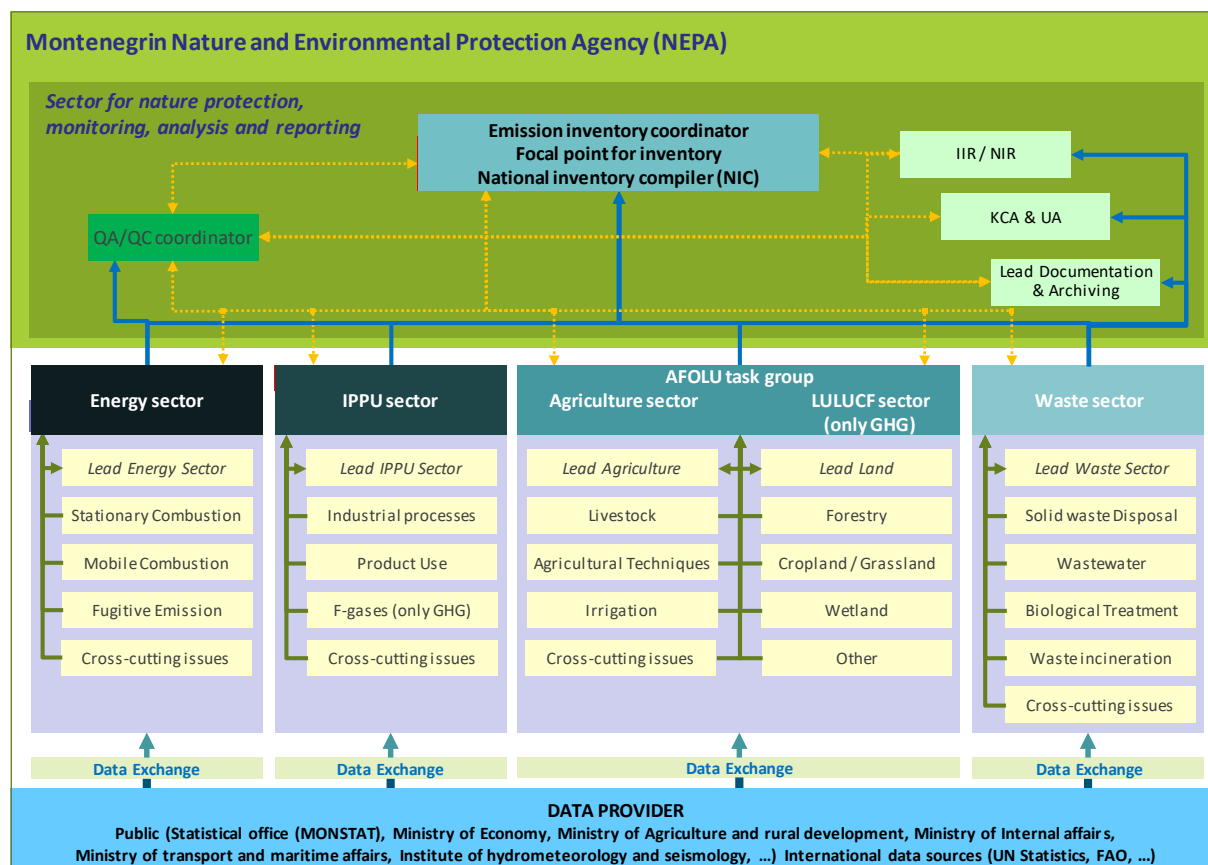


Figure 1.2 Draft MRV framework for the GHG and Air pollution emission inventory

Emissions shall be estimated by *sector experts* for

(a) all sectors of the Air pollutants inventory according to the EMEP/EEA Air pollutant Emission Inventory Guidebook 2019

- IPCC/NFR sector 1      Energy
- IPCC/NFR sector 2      Industrial Processes and Product Use (IPPU)
- IPCC/NFR sector 3      Agriculture
- IPCC sector 4          Land Use, Land use Change and Forestry (LULUCF)
- IPCC/NFR sector 5      Waste
- IPCC/NFR sector 6      Other

The IPCC sector AFOLU – Agriculture, Forestry and Other Land Use - is divided into two ‘sectors’ but with close linkage.

(b) Emissions of air pollutants should be estimated by sector experts for

	Abbreviation	Pollutants
<b>Main Pollutants</b>	NO <sub>x</sub> (as NO <sub>2</sub> )	nitrogen oxides
	NM VOC	non-methane volatile organic compounds
	SO <sub>x</sub> (as SO <sub>2</sub> )	sulphur dioxide
	NH <sub>3</sub>	ammonia
<b>Particulate Matter</b>	PM <sub>2.5</sub>	particulate matter
	PM <sub>10</sub>	
	TSP	
	BC	black carbon
<b>Other</b>	CO	carbon monoxide
<b>Priority Heavy Metals</b>	Pb	lead
	Cd	cadmium
	Hg	mercury
<b>Additional Heavy Metals</b>	As	arsen
	Cr	chromium
	Cu	copper
	Ni	nickel
	Se	selen
	Zn	zinc
<b>Persistent Organic Pollutants (POPs)</b>	PCDD/ PCDF	dioxins and furans
	PAHs	benzo(a) pyrene
		benzo(b) fluoranthene
		benzo(k) fluoranthene
		indeno (1,2,3-cd) pyrene
		Total (1-4)
	HCB	hexachlorobenzene
	PCBs	polychlorinated biphenyls

Table 1.2 Overview on reporting obligation

Greenhouse gases (GHG) and Air pollutants emission inventory																													
	GHG										Air pollutants																		
							Main pollutants				Particulate matter (PM)				Persistent organic pollutants (POPs)				Heavy Metals (HMs)										
							Precursors												Priority HMs		Additional HMs								
	CO <sub>2</sub>	N <sub>2</sub> O	CH <sub>4</sub>	SF <sub>6</sub>	HFC	PFC	NF <sub>3</sub>	SO <sub>x</sub>	NO <sub>x</sub>	NM/OC	CO	NH <sub>3</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	BC	PCDD/PCDF	HCB	DIOX	PAH	PCB	Pb	Cd	Hg	As	Cr	Cu	Ni	Se
IPCC / NFR Sectors																													
1. Energy																													
2. Industrial processes and product use (IPPU)																													
AFOLU 3. Agriculture																													
4. LULUCF																													
5. Waste																													
6. Other																													
Reporting obligation																													
UNFCCC - Greenhouse gas (GHG) inventory under the Convention, the Kyoto protocol and under the Paris Agreement																													
Data – CRF or Non-Annex I Tables																													
National Inventory report (NIR)																													
EU MMR - Regulation 525/2013 and Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action*																													
Data – CRF																													
National Inventory report (NIR)																													
UNECE / LRTAP - Air pollution emissions inventory																													
NFR tables																													
Informative Inventory Report (IIR)																													
EU National Emission Ceilings Directive (EU) 2016/2284*																													
NFR tables																													
Informative Inventory Report (IIR)																													
Pops under the Stockholm Convention																													
National reports																													
Short-lived climate pollutants (SLCPs)*																													
Climate and Clean Air Coalition																													
Batumi Action for Cleaner Air (BACA)*																													
Reporting																													
* Not (yet) signed or ratified by Montenegro																													

Table 1.3 Reporting obligation and related reporting guidelines

	Reporting obligation	Reporting guidelines
GHG emissions	United Nations Framework Convention on Climate Change <sup>10</sup>	Decision 17/CP.8 <sup>11</sup> : <b>Guidelines for the preparation of national communications</b> from Parties not included in Annex I to the Convention
		Decision 2/CP.17 <sup>12</sup> Annex III: <b>UNFCCC biennial update reporting guidelines</b> for Parties not included in Annex I to the Convention
	Paris Agreement <sup>13</sup>	Decision 18/CMA.1 <sup>14</sup> on <b>Modalities, procedures and guidelines for the transparency framework for action and support (MPGs)</b>
	EU Regulation No 525/2013 <sup>15</sup> on mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change ( <b>MMR Regulation</b> ) *	Commission <b>Implementing Regulation (EU) No 749/2014</b> <sup>16</sup> on <b>structure, format, submission processes and review of information reported by Member States</b> pursuant to Regulation (EU) No 525/2013
	EU Regulation 2018/1999 <sup>17</sup> on the Governance of the Energy Union and Climate Action *	<b>Implementing Regulation (EU) No 2020/1208</b> <sup>18</sup> on structure, format, submission processes and review of information reported by Member States pursuant to Governance Regulation (EU) No 2018/1999
Air pollutants emissions	Convention on Long-range Transboundary Air Pollution (LRTAP) <sup>19</sup> of the United Nations Economic Commission for Europe (UNECE) <sup>20</sup>	<b>Guidelines for Reporting Emissions and Projections Data</b> under the Convention on Long-range Transboundary Air Pollution (LRTAP) <sup>21</sup>
	Directive (EU) 2016/2284 <sup>22</sup> on the reduction of national emissions of certain atmospheric pollutants ( <b>NEC-Directive</b> ) *	

<sup>10</sup> [https://unfccc.int/sites/default/files/convention\\_text\\_with\\_annexes\\_english\\_for\\_posting.pdf](https://unfccc.int/sites/default/files/convention_text_with_annexes_english_for_posting.pdf)

<sup>11</sup> [https://unfccc.int/sites/default/files/17\\_cp.8.pdf](https://unfccc.int/sites/default/files/17_cp.8.pdf)

<sup>12</sup> <https://unfccc.int/resource/docs/2011/cop17/eng/09a01.pdf#page=39>

<sup>13</sup> [https://unfccc.int/sites/default/files/english\\_paris\\_agreement.pdf](https://unfccc.int/sites/default/files/english_paris_agreement.pdf)

<sup>14</sup> [https://unfccc.int/sites/default/files/resource/CMA2018\\_03a02E.pdf](https://unfccc.int/sites/default/files/resource/CMA2018_03a02E.pdf)

<sup>15</sup> Regulation (EU) No 525/2013 of the European Parliament and of the Council of 21 May 2013 on a mechanism for monitoring and reporting GHG emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC. This Regulation has been replaced by the Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action as of 2021.

<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32013R0525>

<sup>16</sup> Commission Implementing Regulation (EU) No 749/2014 of 30 June 2014 on structure, format, submission processes and review of information reported by Member States pursuant to Regulation (EU) No 525/2013

<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32014R0749>

<sup>17</sup> Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action, amending Regulations (EC) No 663/2009 and (EC) No 715/2009 of the European Parliament and of the Council, Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council

[https://eur-lex.europa.eu/legal-content/EN/TXT/?toc=OJ:L:2018:328:TOC&uri=uriserv:OJ.L\\_.2018.328.01.0001.01.ENG](https://eur-lex.europa.eu/legal-content/EN/TXT/?toc=OJ:L:2018:328:TOC&uri=uriserv:OJ.L_.2018.328.01.0001.01.ENG)

<sup>18</sup> COMMISSION IMPLEMENTING REGULATION (EU) 2020/1208 of 7 August 2020 on structure, format, submission processes and review of information reported by Member States pursuant to Regulation (EU) 2018/1999 of the European Parliament and of the Council and repealing Commission Implementing Regulation (EU) No 749/2014.

<https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32020R1208&from=EN>

<sup>19</sup> <https://www.unece.org/env/lrtap/welcome.html>

<sup>20</sup> <http://www.unece.org>

<sup>21</sup> [https://www.ceip.at/fileadmin/inhalte/ceip/1\\_reporting\\_guidelines2014/ece.eb.air.125\\_advance\\_version\\_reporting\\_guidelines\\_2014.pdf](https://www.ceip.at/fileadmin/inhalte/ceip/1_reporting_guidelines2014/ece.eb.air.125_advance_version_reporting_guidelines_2014.pdf)

<sup>22</sup> Directive (EU) 2016/2284 on the reduction of national emissions of certain atmospheric pollutants (NEC-Directive) of the European Parliament and of the Council of 14.12.2016, amending Directive 2003/35/EC and repealing Directive 2001/81/EC.

<http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016L2284&from=EN>

\* Not (yet) signed or ratified by Montenegro

### 1.3 Inventory preparation process

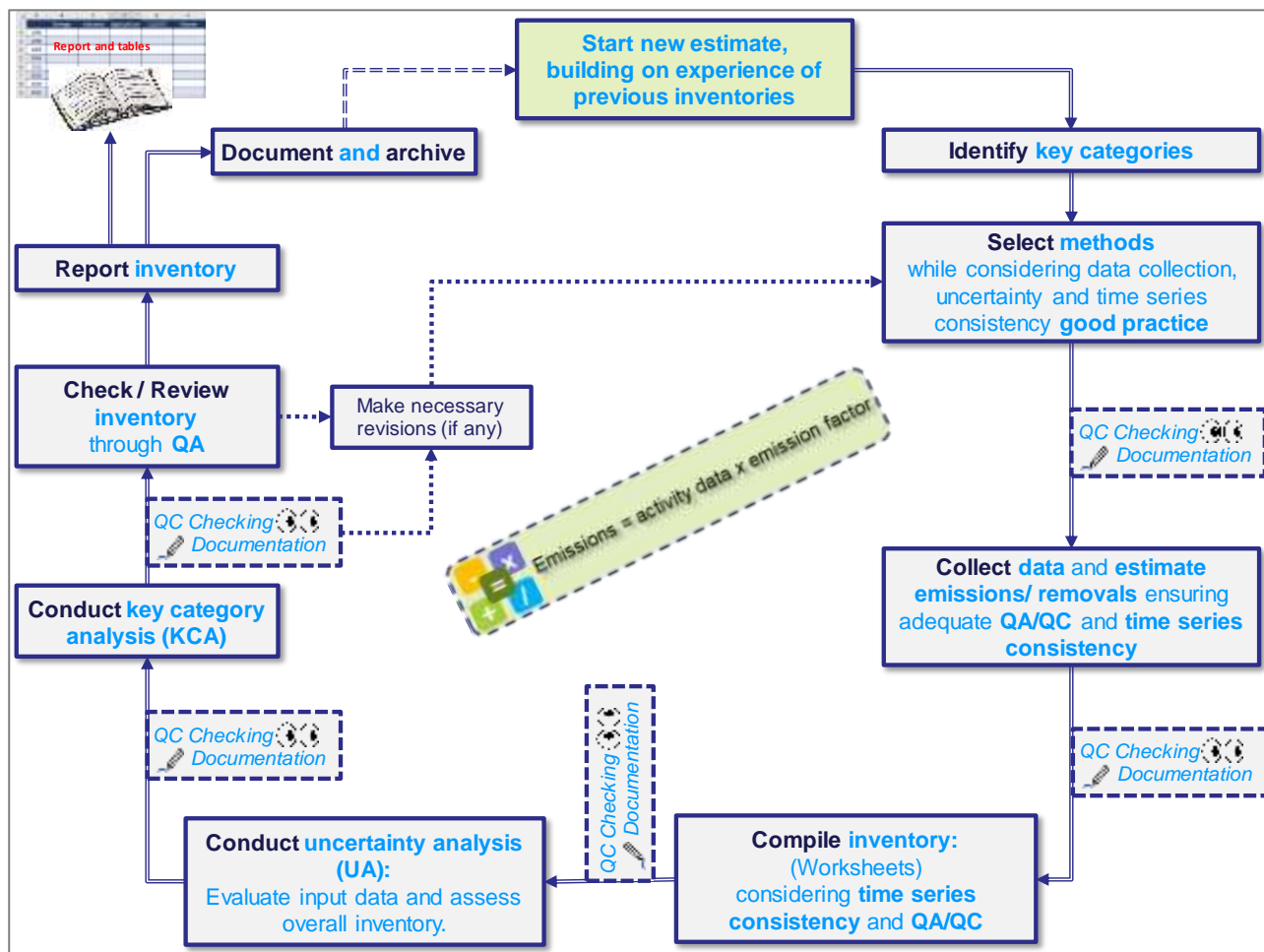


Figure 1.3 Inventory preparation process

#### Inventory preparation

The preparation of the Inventory includes the following stages:

- Planning
- Preparation
- Data management
- Reporting

#### Ad a) Inventory planning

The planning of the Inventory includes organizational aspects, related to: appointment of the team of key and deputy key experts within the department, description of specific tasks and responsibilities, development of operational procedures with regard to data collection and data calculation on the activity rate and emission factors included in the database of the National Emission Inventory. Currently only two persons are involved in emission inventory process as primary task (Inventory compiler and sector experts).

Improvement and safe sustainability of the inventory will be entirely ensured by increasing of the trained staff and dedication of the experts to inventory work as their primary task

#### **Ad b) Inventory preparation**

In the context of this Inventory preparation, each of 2 experts are involved in the identification of the sources of pollution, definition of the relevant data sources and data collection (activity data). All other activities concerning the Inventory preparation and development have been organized through this approach. During the Inventory preparation, recommendations given from Stage 3 review were followed and were of great use regarding the improvements made in the NFR, this IIR and improvements in general.

#### **Ad c) Identification of sources of pollution**

In the framework of the Inventory preparation, great attention has been devoted to the identification of the sources of pollution.

##### *Data sources*

Data from several sources have been used on the different sectors, including:

- Data on special requests, energies balances and Statistical Yearbooks of MONSTAT 1990-2018;
- Publications from different areas (Transport, Industry ,Energy, Livestock, Agriculture and Forestry);
- Planed Energy Balance by Ministry of economy
- International web page databases (FAO, Eurostat and etc.).
- Data from relevant national ministries and agencies c)

Emission factors and activity data for different source categories are collected and calculated in separate NFR excel tables, for the period from 1990 to 2018. NFR tables are categorized in separate folders (ENERGY, INDUSTRY and PRODUCT USE, AGICULTURE, WASTE, TRANSPORT, NATURAL SOURCES). During each inventory preparation cycle, evaluation and update of selected emission factors of previous years is conducted, if there is an available updated version of EMEP/EEA Guidebook. No changes emission factors were done during this reporting round.

The basic approach in the selection of the methodology used in the calculation of emissions and selection of emission factors for each source, is driven by availability of activity data.

#### **Ad d) Reporting**

For reporting of emissions, data from separated calculated sheets tables per NFR, containing EFs, activity data and calculated emissions per pollutant, were linked to the NFR table for reporting.



## 1.4 Brief general description of methodologies and data sources used

The main sources for activity data are national statistics as well as international statistics like Eurostat, FAO and UNSD.

The main sources for emission factors of

- air pollutants is the EMEP/EEA air pollutant emission inventory guidebook 2019<sup>23</sup>
- GHG are the 2006 IPCC Guidelines for National Greenhouse Gas Inventories<sup>24</sup>

is used.

For key categories, the most accurate methods for the preparation of the greenhouse gas inventory should be used. Due to lack of data and resources, it was not possible to estimate all emissions according to the sectoral decision trees. Where the methodological choice is not in line with the sectoral decision tree, actions are defined and listed in the inventory improvement plan.

The following table briefly presents the activity data (AD) sources, the types of emission factors (EF) used, and the methods applied for estimating GHG emissions reported in this NIR. Detailed information on applied methodology, used activity data (AD) and emission factors (EF) are presented in the relevant sectoral chapters.

The preparation of the inventory starts always with identification of the key categories of the previous inventory followed by the selection of the appropriate identify the appropriate method for estimation for each category according to the **decision tree** of each source presented in

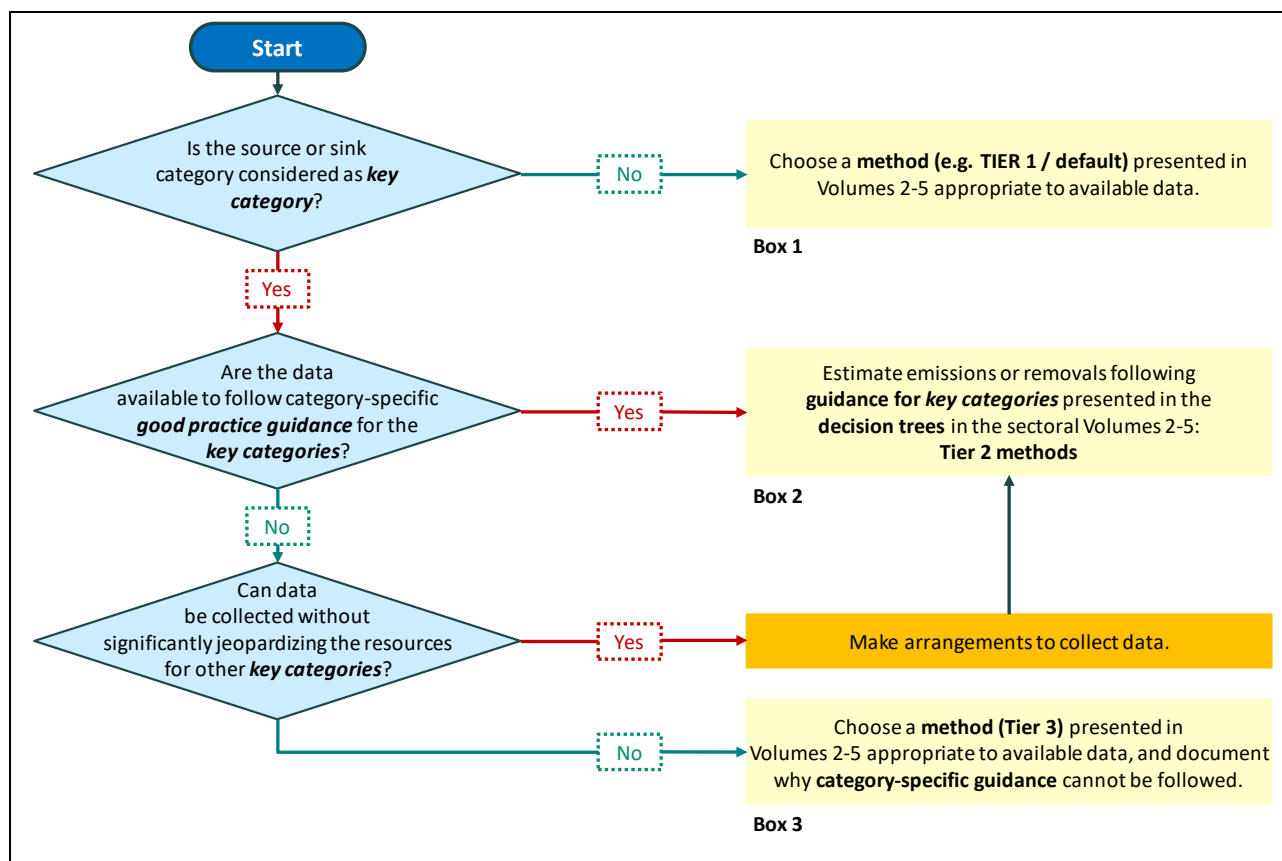
- Part B of the EMEP/EEA air pollutant emission inventory guidebook 2019
- Volume 2 – 5 of the 2006 IPCC guidelines.

In the following Figure the general Decision Tree to choose a **Good Practice method** is presented.

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<sup>23</sup> [file:///C:/Users/koether/Downloads/A.1%20EMEP-EEA%20guidebook%20Introduction%202019%20\(1\).pdf](file:///C:/Users/koether/Downloads/A.1%20EMEP-EEA%20guidebook%20Introduction%202019%20(1).pdf)

<sup>24</sup> <https://www.ipcc-nggip.iges.or.jp/public/2006gl/>



**Figure 1.4** Decision Tree to choose a Good Practice method

Source: 2006 IPCC guidelines, Vol. 1: General Guidance and Reporting, Chap. 1: Introduction to the 2006 Guidelines, sub-chap. 4.1.2 Purpose of the key category analysis, Figure 4.1, p. 4.6.

**Table 1.4 Summary report for methods and emission factors used and source of activity data**

Source	Main Pollutants (NO <sub>x</sub> , SO <sub>x</sub> , NMVOC, NH <sub>3</sub> , CO)			Particulate Matter (TSP, PM <sub>10</sub> ; PM <sub>2.5</sub> , BC)			Heavy metals (Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn)			Persistent Organic Pollutants (POPs) (PCDD/ PCDF, PAHs, HCB, PCB)		
	Method applied	Emission factor	Activity data	Method applied	Emission factor	Activity data	Method applied	Emission factor	Activity data	Method applied	Emission factor	Activity data
<b>1. Energy</b>												
A. Fuel combustion												
1. Energy industries	T1	D	MONSTAT	T1	D	MONSTAT	T1	D	MONSTAT	T1	D	MONSTAT
2. Manufacturing industries and construction	T1	D	MONSTAT	T1	D	MONSTAT	T1	D	MONSTAT	T1	D	MONSTAT
3. Transport	T1	D	MONSTAT	T1	D	MONSTAT	T1	D	MONSTAT	T1	D	MONSTAT
4. Other sectors	T1	D	MONSTAT	T1	D	MONSTAT	T1	D	MONSTAT	T1	D	MONSTAT
5. Other (please specify)	NE	NE	NE	NE	NE	NE	NE	NE	NE			
B. Fugitive emissions from fuels												
1. Solid fuels	T1	D	MONSTAT	T1	D	MONSTAT	NA	NA	NA	NA	NA	NA
2. Oil and natural gas	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>2. Industrial processes process and Product Use (IPPU)</b>												
A. Mineral products	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Chemical industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Metal production	T1	D	PS/MONSTAT	T1	D	PS/MONSTAT	NA	NA	NA	T1	D	PS/MONSTAT
D. Other production	T1	D	PS/MONSTAT									
G. Other												
H.2 Food and beverages industry	T1	D	PS/MONSTAT									

Source	Main Pollutants (NO <sub>x</sub> , SO <sub>x</sub> , NMVOC, NH <sub>3</sub> , CO)			Particulate Matter (TSP, PM <sub>10</sub> ; PM <sub>2.5</sub> , BC)			Heavy metals (Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn)			Persistent Organic Pollutants (POPs) (PCDD/ PCDF, PAHs, HCB, PCB)		
	Method applied	Emission factor	Activity data	Method applied	Emission factor	Activity data	Method applied	Emission factor	Activity data	Method applied	Emission factor	Activity data
I. Wood processing	NO											
J. Production of POPs	NA	NA	NA									
K. Consumption of POPs and heavy metals	NA	NA	NA									
L. Other production, consumption, storage, transportation or handling of bulk products	NA	NA	NA	NE	NE	NE						
<b>3. Agriculture</b>												
A. Enteric fermentation												
B. Manure management												
C. Rice cultivation												
D. Agricultural soils												
E. Prescribed burning of savannahs												
F. Field burning of agricultural residues												
G. Other (Urea application)												
<b>5. Waste</b>												
A. Solid waste disposal on land												
B. Waste-water handling												

Source	Main Pollutants (NO <sub>x</sub> , SO <sub>x</sub> , NMVOC, NH <sub>3</sub> , CO)			Particulate Matter (TSP, PM <sub>10</sub> ; PM <sub>2.5</sub> , BC)			Heavy metals (Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn)			Persistent Organic Pollutants (POPs) (PCDD/ PCDF, PAHs, HCB, PCB)		
	Method applied	Emission factor	Activity data	Method applied	Emission factor	Activity data	Method applied	Emission factor	Activity data	Method applied	Emission factor	Activity data
C. Waste incineration												
D. Other - Composting												
<b>6. Other</b>												
Other												
<b>Memo items</b>												
<b>International bunkers</b>												
Aviation												
Marine												

Notation keys		Notation keys to specify the method applied				Notation keys to specify the emission factor used				Notation keys to specify the activity data used			
<b>NA</b>	Not applicable	<b>D</b>	IPCC default	<b>CS</b>	Country Specific	<b>D</b>	IPCC default			<b>Q</b>	Specific Questionnaire	<b>PS</b>	Plant specific
<b>NO</b>	Not occurring	<b>T1</b>	IPCC Tier 1	<b>CR</b>	CORINAIR	<b>CS</b>	Country specific			<b>NSIA /CSO</b>	National Statistics and Information Authority (NSIA)	<b>EJ</b>	Expert Judgement
<b>NE</b>	Not estimated	<b>T1a, T1b, T1c</b>	IPCC Tier 1a, Tier 1b and Tier 1c, respectively	<b>RA</b>	Reference Approach	<b>PS</b>	Plant specific			<b>ALCS</b>	Montenegro Living Condition survey (ALCS)		
<b>IE</b>	Included elsewhere	<b>T2</b>	IPCC Tier 2	<b>OTH</b>	Other	<b>OTH</b>	Other			<b>UNSD</b>	United Nations Statistics Division (UNSD)		
<b>C</b>	Confidential	<b>T3</b>	IPCC Tier 3	<b>M</b>	Model	<b>M</b>	Model			<b>FAO</b>	FAO Statistics Division (FAOSTAT)		

## 1.5 Brief description of key categories

The identification of key categories (KCA) is prepared in accordance with EMEP/EEA air pollutant emission inventory guidebook 2019<sup>25</sup>. It stipulates that a key category is one that is prioritized within the National System because its estimate has a significant influence on a country's total inventory of air pollutants emissions in terms of the absolute level of emissions, the trend in emissions, or both.

*Key categories* according to the following equation are those that, when summed together in descending order of magnitude, add up to 80% of the sum of all  $L_{x,t}$  or any category meeting the 80% threshold in any year of the Level Assessment (LA) or in the Trend Assessment (TA) is considered a *key category*.

The identification of key categories consists in general of six steps. However, for the current submission a KCA no qualitative considerations were included.

- Identifying categories
- Level Assessment (Approach 1)
- Trend Assessment (Approach 1)
- Qualitative considerations

### 1.5.1 Level of disaggregation and identification of key categories

Following *good practice* in determining the appropriate level of disaggregation of categories to identify key categories:

• The analysis is performed at the level of categories or subcategories at which different methods are applied in the inventory	✓
• Each pollutant level emitted from each category is considered separately.	✓

### 1.5.2 Level Assessment

The Tier 1 approach of the EMEP/EEA air pollutant emission inventory guidebook 2019 has been applied: contribution of each source category to the total national inventory.

*Equation 4.1: Level Assessment (EMEP/EEA GB, Part A, Chap. 2)*

$$\text{Key category level assessment} = \frac{|\text{source category estimate}|}{|\text{total contribution}|} \Rightarrow L_{x,t} = \frac{|E_{x,t}|}{\sum |E_{y,t}|}$$

Where:

$L_{x,t}$  = level assessment for source x in latest inventory year (year t)

$|E_{x,t}|$  = absolute value of emission estimate of source category x in year t

$\sum |E_{y,t}|$  = total contribution, which is the sum of the absolute values of emissions in year t calculated using the aggregation level chosen by the country for key category analysis.

<sup>25</sup> EMEP/EEA GB (2019). *Key category analysis and methodological choice 2019. Part A.*

### 1.5.3 Trend Assessment

The Tier 1 approach of the EMEP/EEA air pollutant emission inventory guidebook 2019 has been applied:

- The trend assessment identifies categories whose trend is different from the trend of the total inventory, regardless whether category trend is increasing or decreasing, or is a source.
- Categories whose trend diverges most from the total trend should be identified as **key**, when this difference is weighted by the level of emissions of the category in the base year.

*Equation 4.2: Trend assessment (EMEP/EEA GB, Part A, Chap. 2)*

$$\text{Key category Trend assessment} = T_{x,0} = \frac{|E_{x,0}|}{\sum_y |E_{y,0}|} \times \left| \left[ \frac{(E_{x,t} - E_{x,0})}{|E_{x,0}|} \right] - \frac{(\sum_y E_{y,t} - \sum_y E_{y,0})}{\sum_y |E_{y,0}|} \right|$$

Category  
Significance

Category  
Trend

Overall  
Trend

Where:

$T_{x,0}$  = trend assessment of source category x in year t as compared to the base year (year 0)

$|E_{x,0}|$  = absolute value of emission estimate of source or sink category x in year 0

$E_{x,t}$  and  $E_{x,0}$  = real values of estimates of source category x in years t and 0, respectively

$\sum_y E_{y,t}$ , and  $\sum_y E_{y,0}$  = total inventory estimates in years t and 0, respectively

### 1.5.4 Summary of Results of the Key Categories Analysis (KCA) 2019

	Key Categories						Cumulative Total
<b>NO<sub>x</sub></b>	1A3biii	1A1a	1A2gviii				84.5%
<b>NM VOC</b>	1A4bi	1B1a	2D3a	1A3biii	5A	3B1a	84.6%
<b>SO<sub>2</sub></b>	1A1a						98.4%
<b>NH<sub>3</sub></b>	3B1a	3B4gii	3Da3	3Da2a	3B4gi		83.7%
<b>PM<sub>2.5</sub></b>	1A4bi						85.3%
<b>PM<sub>10</sub></b>	1A4bi						85.0%
<b>TSP</b>	1A4bi	1A1a					83.3%
<b>CO</b>	1A4bi	2C3	1A3biii				88.2%
<b>Pb</b>	1A1a	1A4bi	2C1				93.7%
<b>Cd</b>	1A4bi	1A1a					85.3%
<b>Hg</b>	1A1a						87.5%
<b>As</b>	1A1a						99.0%
<b>Cr</b>	1A1a	1A4bi					92.1%
<b>Cu</b>	1A4bi	1A1a					89.0%
<b>Ni</b>	1A1a	1A4ai					81.7%
<b>Se</b>	1A1a						99.5%
<b>Zn</b>	1A4bi	1A1a					84.7%

	Key Categories						Cumulative Total
DIOX	2C1						96.6%
PAH	1A1a	1A4cii	1A3biii				88.9%
HCB	1A1a	1A4bi					97.7%
PCBs	1A1a						92.7%



### 1.5.5 Results of the Key Categories Analysis (KCA) of Main Pollutants

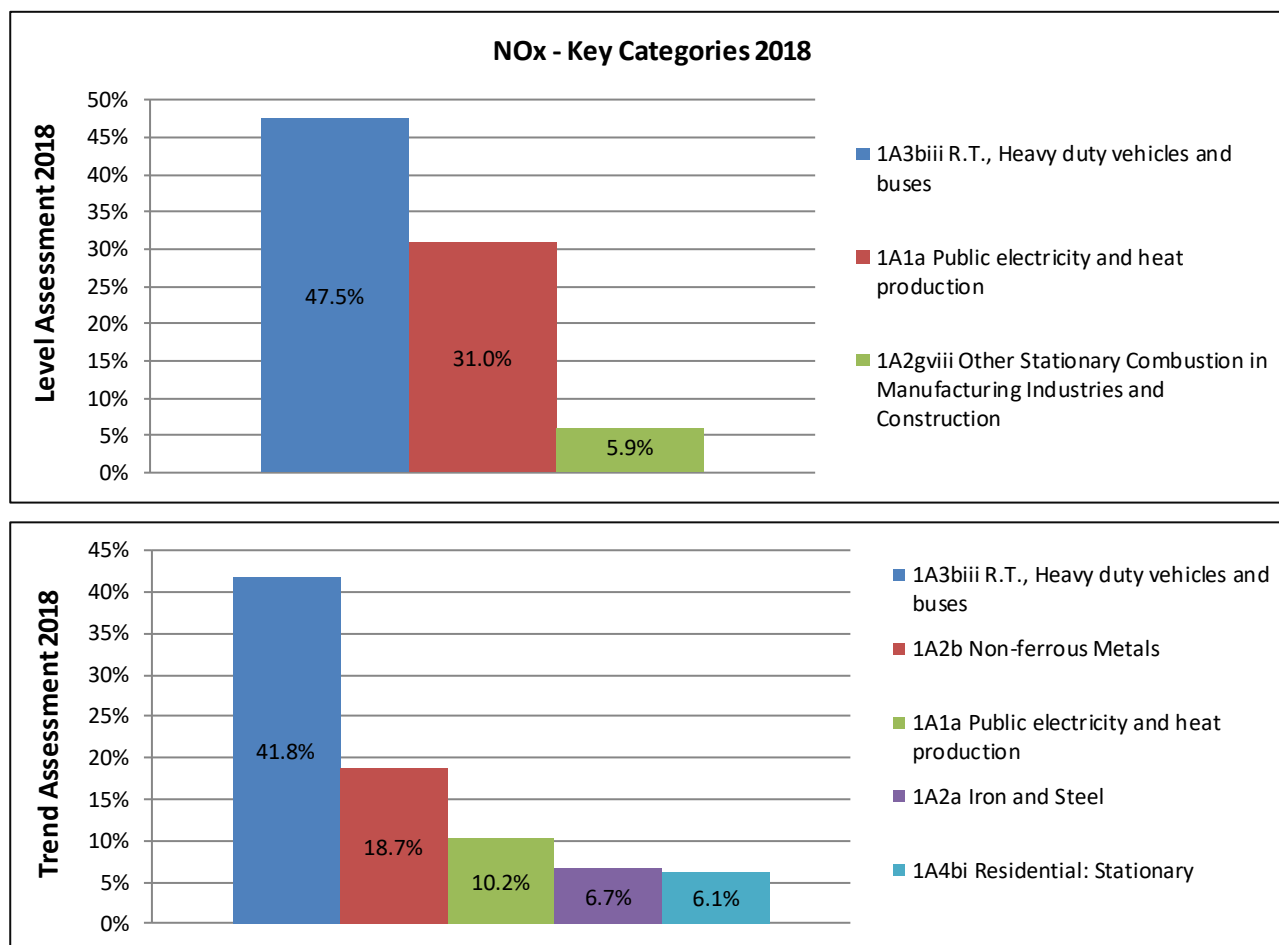


Figure 1.5 NOx – Key Categories 2019

Table 1.5 Key categories of NOx emissions due to Level and Trend Assessment Analysis

Level Assessment - NOx				Pollutant		Latest Year (2018) Estimate [kt]		Level Assessment		Cumulative Total of L <sub>x,t</sub>	
NFR Code	NFR Category					E <sub>x,t</sub>		L <sub>x,t</sub>			
1A3biii	R.T., Heavy duty vehicles and buses			NOX		6.13		47.5%		47.5%	
1A1a	Public electricity and heat production			NOX		4.01		31.0%		78.6%	
1A2gviii	Other Stationary Combustion in Manufacturing Industries and Construction			NOX		0.76		5.9%		84.5%	
Trend Assessment - NOx				Pollutant	Base Year (1990) Estimate [kt]	Latest Year (2018) Estimate [kt]	Trend Assessment t	% Contribution to the trend		Cumulative Total of L <sub>x,t</sub>	
NFR Code	NFR Category				E <sub>x,0</sub>	E <sub>x,t</sub>	L <sub>x,t</sub>				
1A3biii	R.T., Heavy duty vehicles and buses			NOX	1.42	6.13	0.272	41.8%		41.8%	
1A2b	Non-ferrous Metals			NOX	1.60	0.04	0.122	18.7%		60.5%	
1A1a	Public electricity and heat production			NOX	4.08	4.01	0.066	10.2%		70.7%	
1A2a	Iron and Steel			NOX	0.57	0.01	0.044	6.7%		77.4%	

1A4bi	Residential: Stationary	NOX	0.75	0.29	0.040	6.1%	83.5%
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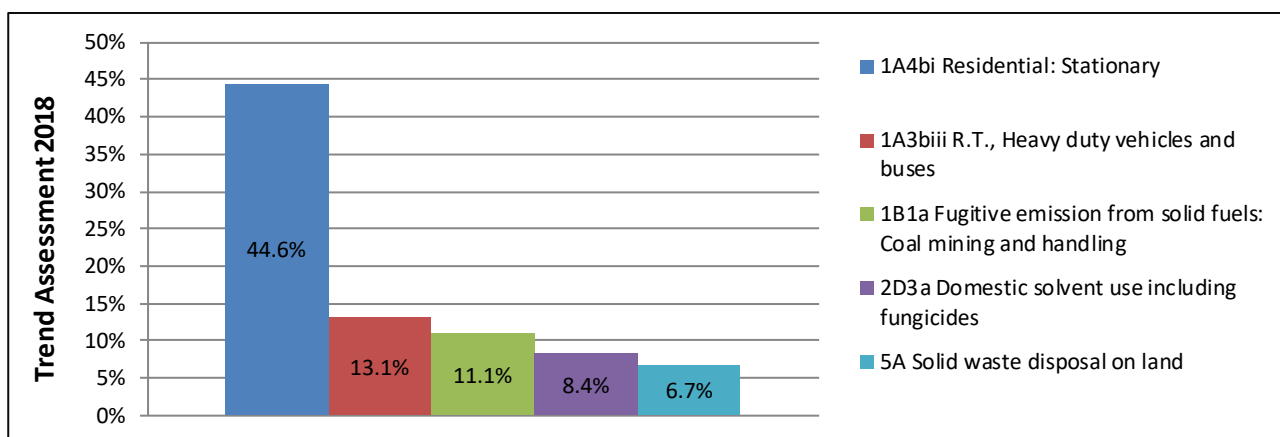
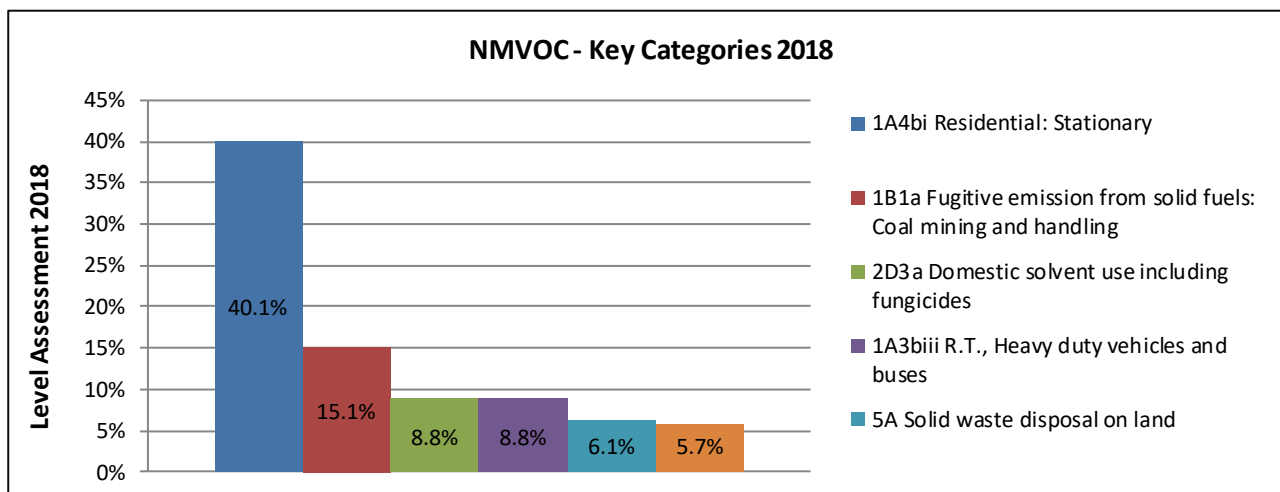


Figure 1.6 NMVOC – Key Categories 2019

Table 1.6 Key categories of NMVOC emissions due to Level and Trend Assessment Analysis

Level Assessment - NMVOC		Pollutant	Latest Year (2018) Estimate [kt]	Level Assessment	Cumulative Total of $L_{x,t}$
NFR Code	NFR Category		$E_{x,t}$	$L_{x,t}$	
1A4bi	Residential: Stationary	NMVOC	3.39	40.1%	40.1%
1B1a	Fugitive emission from solid fuels: Coal mining and handling	NMVOC	1.28	15.1%	55.2%
2D3a	Domestic solvent use including fungicides	NMVOC	0.75	8.8%	64.0%
1A3biii	R.T., Heavy duty vehicles and buses	NMVOC	0.74	8.8%	72.8%
5A	Solid waste disposal on land	NMVOC	0.52	6.1%	78.9%
3B1a	Manure management - Dairy cattle	NMVOC	0.48	5.7%	84.6%

Trend Assessment - NMVOC		Pollutant	Base Year (1990) Estimate [kt]	Latest Year (2018) Estimate [kt]	Trend Assessment	% Contribution to the trend	Cumulative Total of $L_{x,t}$
NFR Code	NFR Category		$E_{x,0}$	$E_{x,t}$	$L_{x,t}$		
1A4bi	Residential: Stationary	NMVOC	8.57	3.39	0.344	44.6%	44.6%
1A3biii	R.T., Heavy duty vehicles and buses	NMVOC	0.38	0.74	0.101	13.1%	57.7%
1B1a	Fugitive emission from solid fuels: Coal mining and handling	NMVOC	1.40	1.28	0.086	11.1%	68.8%
2D3a	Domestic solvent use including fungicides	NMVOC	0.70	0.75	0.065	8.4%	77.2%
5A	Solid waste disposal on land	NMVOC	0.43	0.52	0.051	6.7%	83.9%

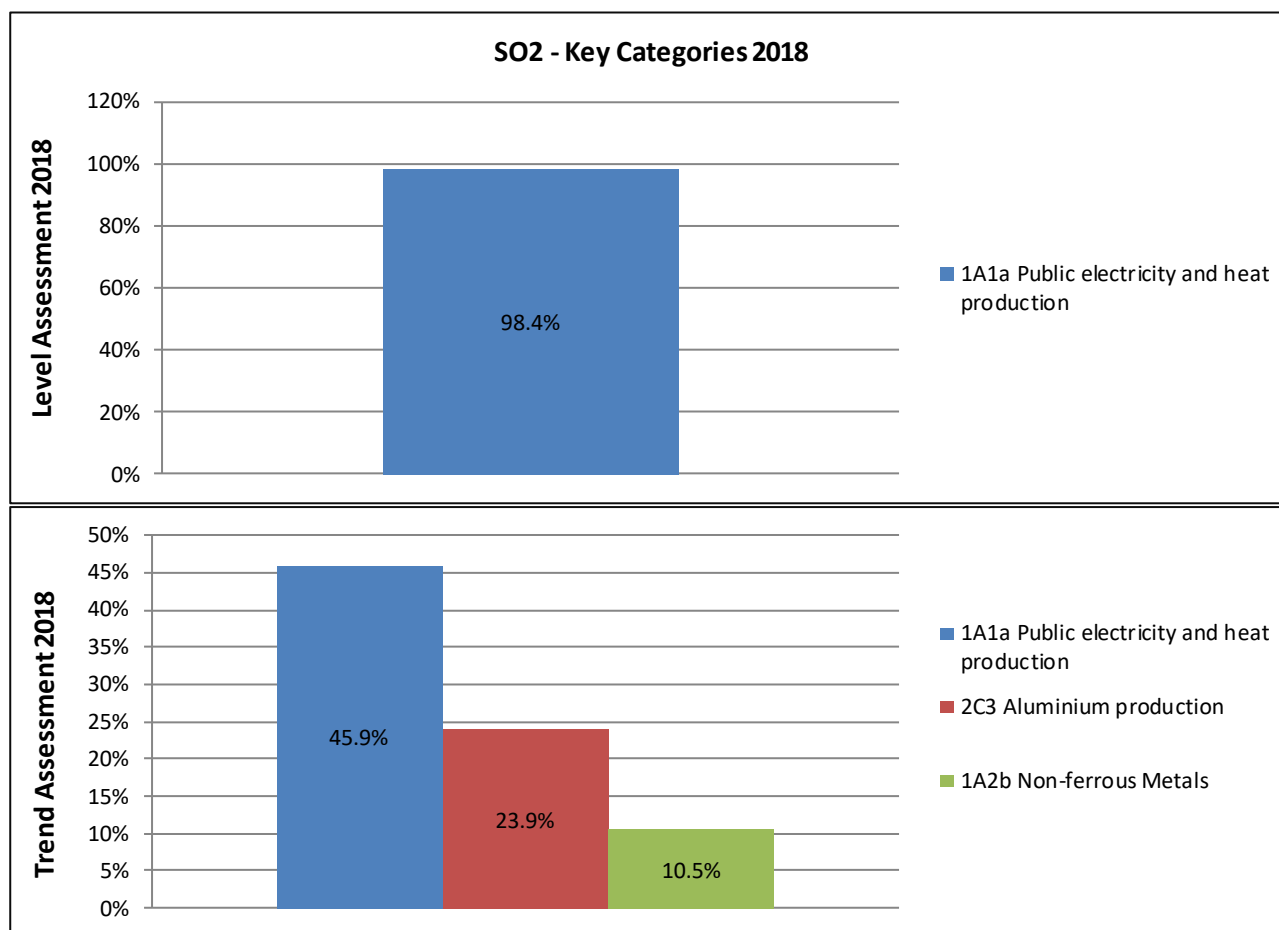
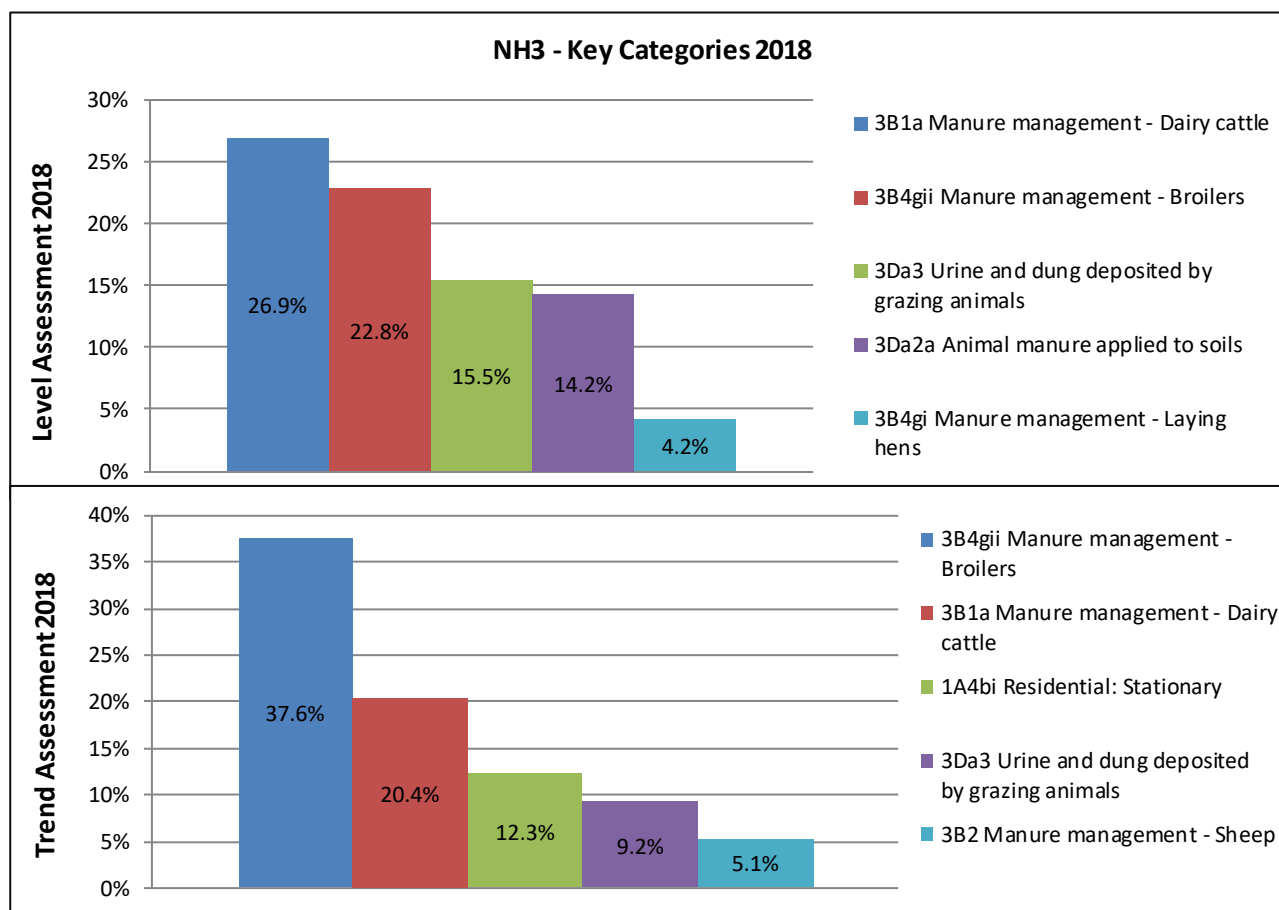


Figure 1.7 SO2 – Key Categories 2019

Table 1.7 Key categories of SO2 emissions due to Level and Trend Assessment Analysis

Level Assessment - SO2		Pollutant	Latest Year (2018) Estimate [kt]		Level Assessment	Cumulative Total of L <sub>x,t</sub>	
NFR Code	NFR Category		E <sub>x,t</sub>		L <sub>x,t</sub>		
1A1a	Public electricity and heat production	SO2	26.45		98.4%	98.4%	
Trend Assessment - SO2		Pollutant	Base Year (1990) Estimate [kt]	Latest Year (2018) Estimate [kt]	Trend Assessment	% Contribution to the trend	Cumulative Total of L <sub>x,t</sub>
NFR Code	NFR Category		E <sub>x,0</sub>	E <sub>x,t</sub>	L <sub>x,t</sub>		
1A1a	Public electricity and heat production	SO2	25.81	26.45	0.023	45.9%	45.9%
2C3	Aluminium production	SO2	0.53	0.20	0.012	23.9%	69.8%
1A2b	Non-ferrous Metals	SO2	0.15	0.00	0.005	10.5%	80.3%

Figure 1.8 NH<sub>3</sub> – Key Categories 2019Table 1.8 Key categories of NH<sub>3</sub> emissions due to Level and Trend Assessment Analysis

Level Assessment - NH3			Pollutant	Latest Year (2018)		Level		Cumulative Total of L <sub>x,t</sub>
NFR Code	NFR Category			Estimate [kt]		Assessment		
				E <sub>x,t</sub>		L <sub>x,t</sub>		
3B1a	Manure management - Dairy cattle		NH3	1.71		26.9%	26.9%	
3B4gii	Manure management - Broilers		NH3	1.45		22.8%	49.7%	
3Da3	Urine and dung deposited by grazing animals		NH3	0.99		15.5%	65.2%	
3Da2a	Animal manure applied to soils		NH3	0.91		14.2%	79.5%	
3B4gi	Manure management - Laying hens		NH3	0.27		4.2%	83.7%	
Trend Assessment - NH3			Pollutant	Base Year (1990)	Latest Year (2018)	Trend	%	Cumulative Total of L <sub>x,t</sub>
NFR Code	NFR Category			Estimate [kt]	Estimate [kt]	Assessment	Contribution to the trend	
			E <sub>x,0</sub>	E <sub>x,t</sub>		L <sub>x,t</sub>		
3B4gii	Manure management - Broilers	NH3	0.10	1.45	0.329	37.6%	37.6%	
3B1a	Manure management - Dairy cattle	NH3	3.72	1.71	0.178	20.4%	58.0%	
1A4bi	Residential: Stationary	NH3	1.00	0.21	0.107	12.3%	70.3%	
3Da3	Urine and dung deposited by grazing animals	NH3	0.98	0.99	0.081	9.2%	79.5%	

3B2	Manure management - Sheep	NH3	0.68	0.26	0.045	5.1%	84.7%
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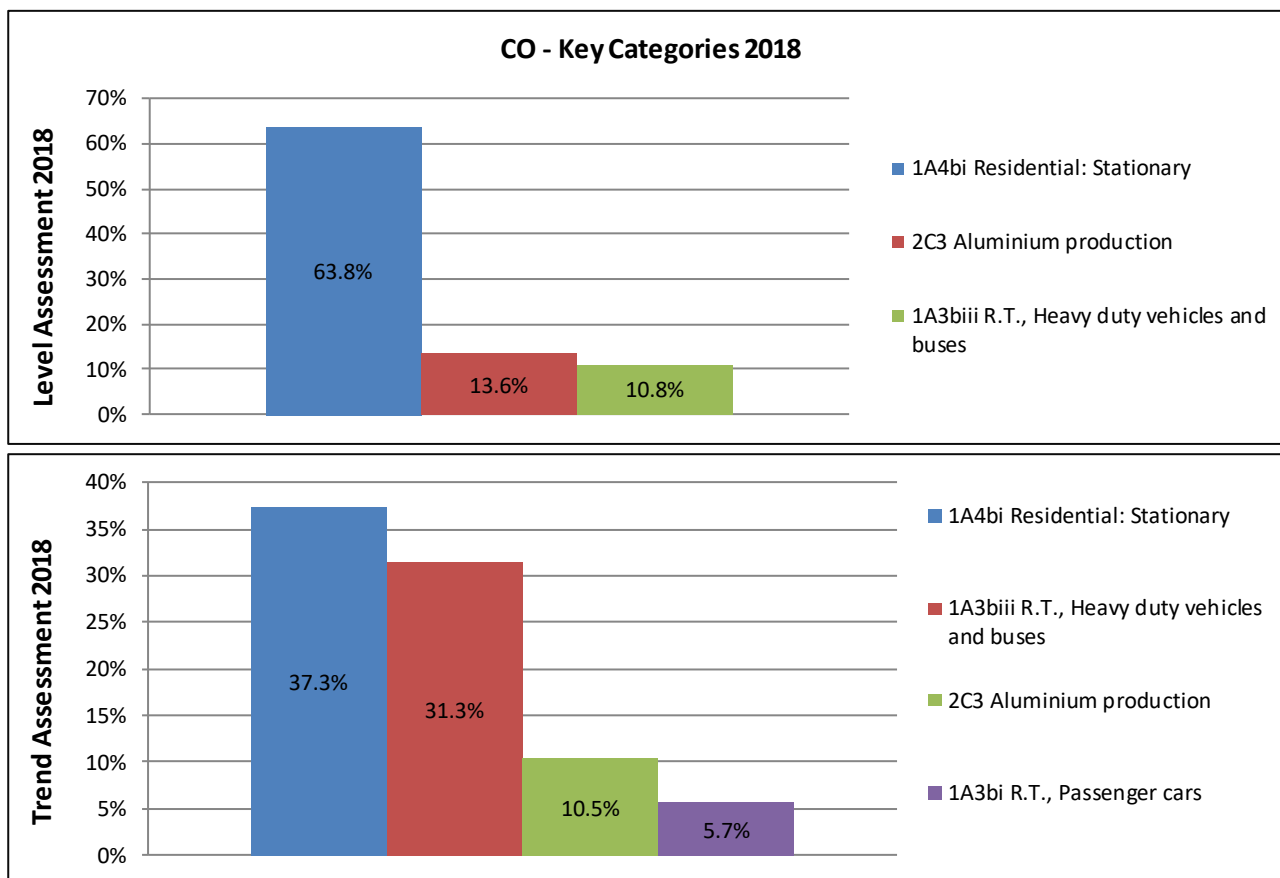


Figure 1.9 CO – Key Categories 2019

Table 1.9 Key categories of CO emissions due to Level and Trend Assessment Analysis

Level Assessment - CO							
NFR Category Code	NFR Category	Pollutant	Latest Year (2018) Estimate [kt]	Level Assessment	Cumulative Total of L <sub>x,t</sub>		
			E <sub>x,t</sub>	L <sub>x,t</sub>			
1A4bi	Residential: Stationary	CO	22.62	63.8%	63.8%		
2C3	Aluminium production	CO	4.82	13.6%	77.4%		
1A3biii	R.T., Heavy duty vehicles and buses	CO	3.81	10.8%	88.2%		
Trend Assessment - CO							
NFR Category Code	NFR Category	Pollutant	Base Year (1990) Estimate [kt]	Latest Year (2018) Estimate [kt]	Trend Assessment	% Contribution to the trend	Cumulative Total of L <sub>x,t</sub>
			E <sub>x,0</sub>	E <sub>x,t</sub>	L <sub>x,t</sub>		
1A4bi	Residential: Stationary	CO	57.13	22.62	0.200	37.3%	37.3%

1A3biii	R.T., Heavy duty vehicles and buses	CO	2.48	3.81	0.168	31.3%	68.6%
2C3	Aluminium production	CO	12.65	4.82	0.056	10.5%	79.1%
1A3bi	R.T., Passenger cars	CO	4.82	2.67	0.031	5.7%	84.8%

### 1.5.6 Results of the Key Categories Analysis (KCA) of Particulate Matter

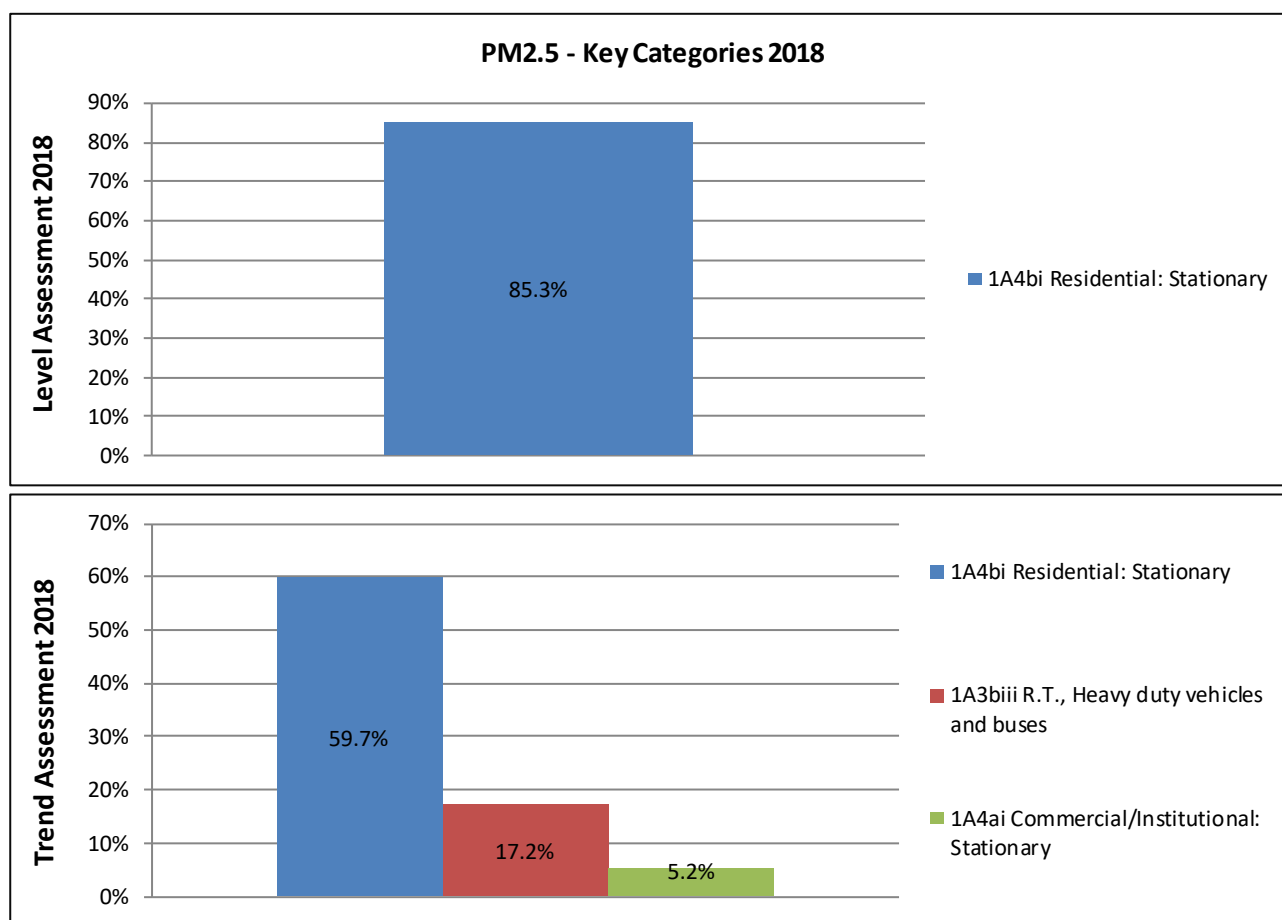


Figure 1.10 PM2.5 – Key Categories 2019

Table 1.10 Key categories of PM2.5 emissions due to Level and Trend Assessment Analysis

Level Assessment - PM2.5					
NFR Category Code	NFR Category	Pollutant	Latest Year (2018) Estimate [kt]	Level Assessment	Cumulative Total of $L_{x,t}$
			$E_{x,t}$	$L_{x,t}$	
1A4bi	Residential: Stationary	PM2.5	4.18	85.3%	85.3%
Trend Assessment - PM2.5					

NFR Category Code	NFR Category	Pollutant	Base Year (1990) Estimate [kt]	Latest Year (2018) Estimate [kt]	Trend Assessment	% Contribution to the trend	Cumulative Total of $L_{x,t}$
			$E_{x,0}$	$E_{x,t}$	$L_{x,t}$		
1A4bi	Residential: Stationary	PM2.5	10.57	4.18	0.236	59.7%	59.7%
1A3biii	R.T., Heavy duty vehicles and buses	PM2.5	0.03	0.16	0.068	17.2%	76.9%
1A4ai	Commercial/Institutional: Stationary	PM2.5	0.02	0.05	0.020	5.2%	82.1%

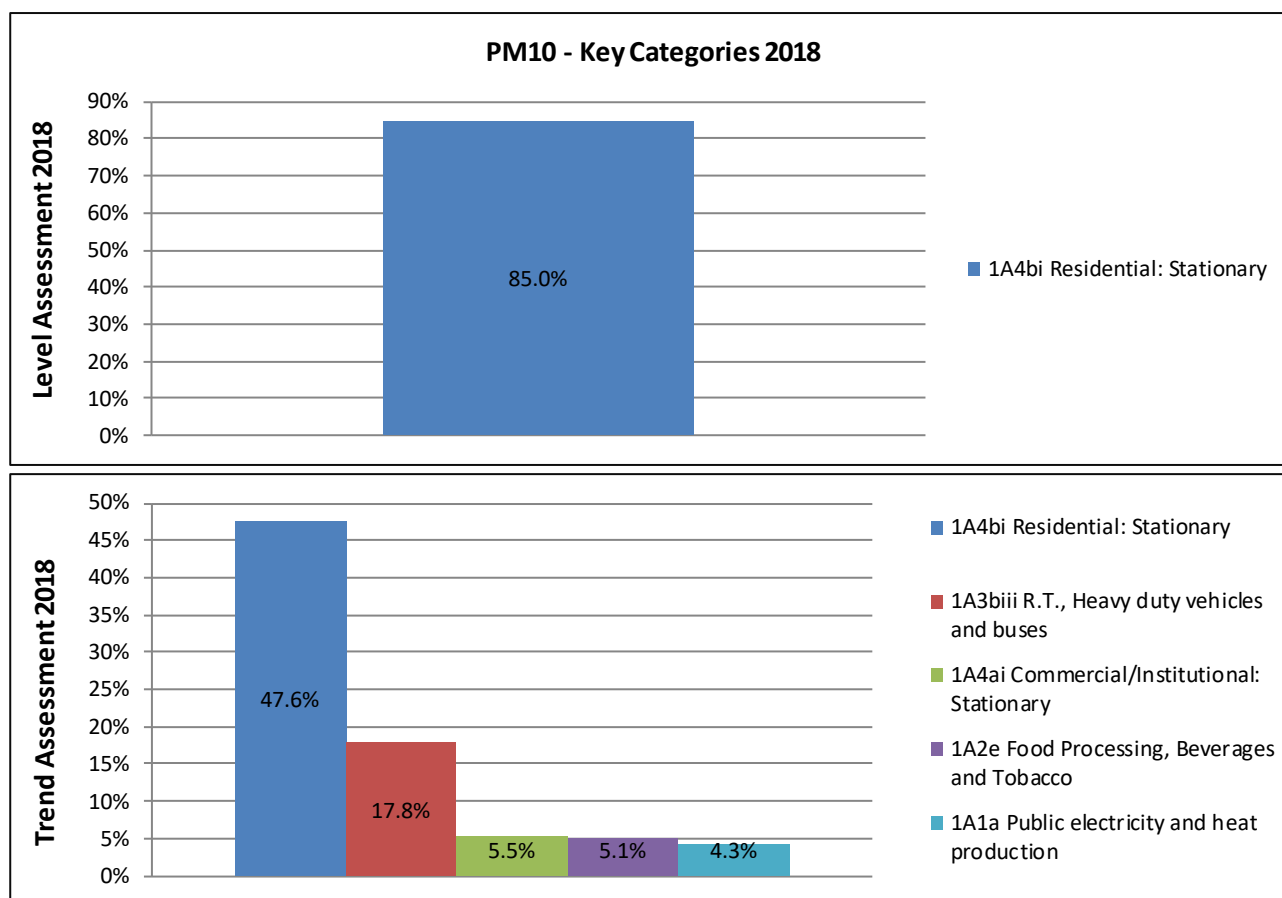


Figure 1.11 PM10 – Key Categories 2019

Table 1.11 Key categories of PM10 emissions due to Level and Trend Assessment Analysis

Level Assessment – PM10			Pollutant	Latest Year (2018) Estimate [kt]	Level Assessment	Cumulative Total of L <sub>x,t</sub>	
NFR Code	NFR Category			E <sub>x,t</sub>	L <sub>x,t</sub>		
1A4bi	Residential: Stationary		PM10	4.30	85.0%	85.0%	
Trend Assessment – PM10		Pollutant	Base Year (1990) Estimate [kt]	Latest Year (2018) Estimate [kt]	Trend Assessment	% Contribution to the trend	Cumulative Total of L <sub>x,t</sub>



NFR Code	NFR Category		$E_{x,0}$	$E_{x,t}$	$L_{x,t}$		
1A4bi	Residential: Stationary	PM10	10.85	4.30	0.181	47.6%	47.6%
1A3biii	R.T., Heavy duty vehicles and buses	PM10	0.03	0.16	0.068	17.8%	65.4%
1A4ai	Commercial/Institutional: Stationary	PM10	0.02	0.06	0.021	5.5%	70.9%
1A2e	Food Processing, Beverages and Tobacco	PM10	0.00	0.04	0.019	5.1%	75.9%
1A1a	Public electricity and heat production	PM10	0.21	0.13	0.016	4.3%	80.3%

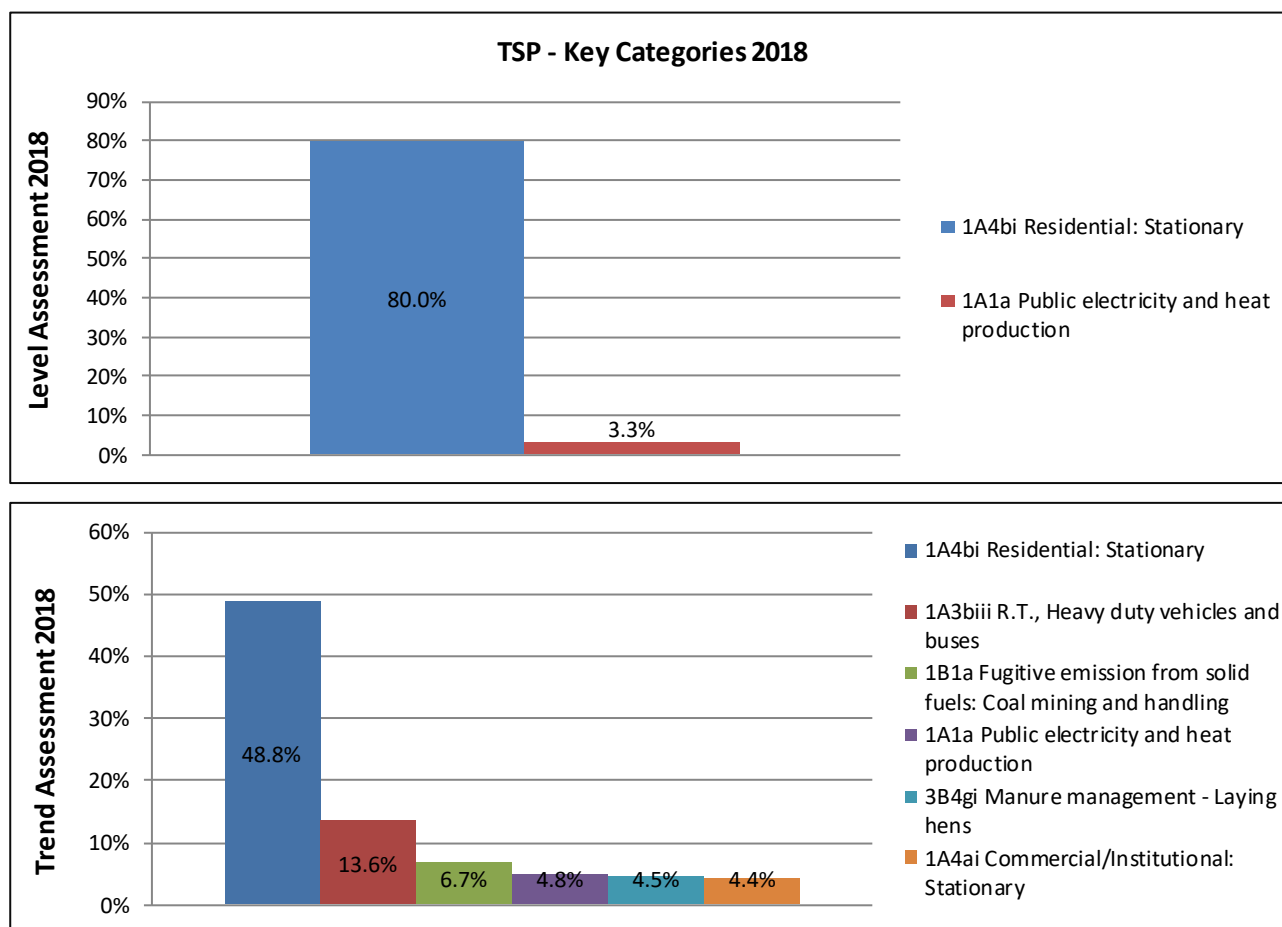


Figure 1.12 TSP – Key Categories 2019

Table 1.12 Key categories of TSP emissions due to Level and Trend Assessment Analysis

Level Assessment - TSP		Pollutant	Latest Year (2018) Estimate [kt]	Level Assessment	Cumulative Total of $L_{x,t}$
NFR Code	NFR Category		$E_{x,t}$	$L_{x,t}$	
1A4bi	Residential: Stationary	TSP	4.52	80.0%	80.0%
1A1a	Public electricity and heat production	TSP	0.19	3.3%	83.3%

Trend Assessment - TSP		Pollutant	Base Year (1990) Estimate [kt]	Latest Year (2018) Estimate [kt]	Trend Assessment	% Contribution to the trend	Cumulative Total of $L_{x,t}$
NFR Code	NFR Category		$E_{x,0}$	$E_{x,t}$	$L_{x,t}$		
1A4bi	Residential: Stationary	TSP	11.42	4.52	0.211	48.8%	48.8%
1A3biii	R.T., Heavy duty vehicles and buses	TSP	0.03	0.16	0.059	13.6%	62.4%
1B1a	Fugitive emission from solid fuels: Coal mining and handling	TSP	0.16	0.14	0.029	6.7%	69.2%
1A1a	Public electricity and heat production	TSP	0.30	0.19	0.021	4.8%	74.0%
3B4gi	Manure management - Laying hens	TSP	0.13	0.11	0.019	4.5%	78.5%
1A4ai	Commercial/Institutional: Stationary	TSP	0.02	0.06	0.019	4.4%	82.8%

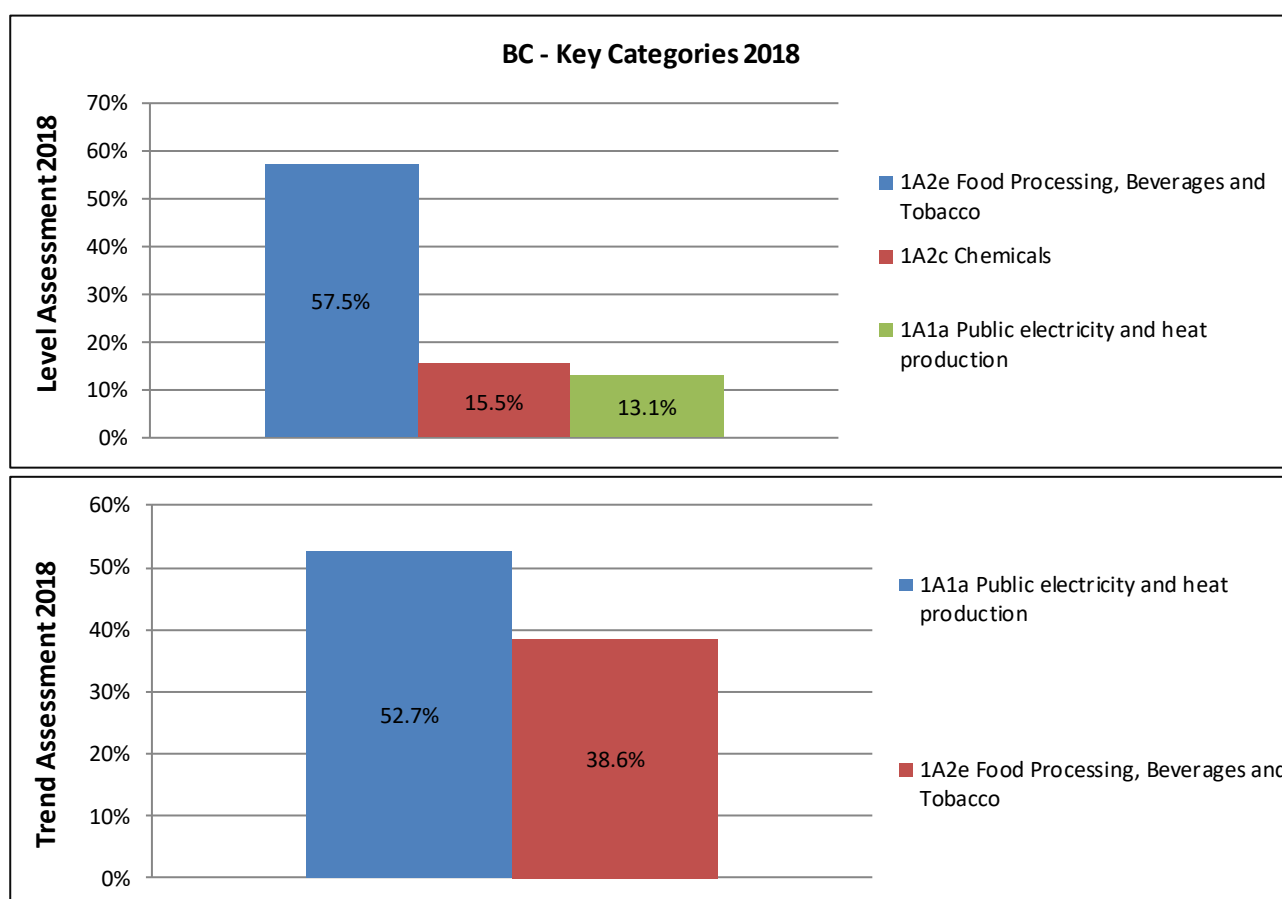


Figure 1.13 BC – Key Categories 2019

Table 1.13 Key categories of BC emissions due to Level and Trend Assessment Analysis

Level Assessment - BC
-----------------------

NFR Category Code	NFR Category	Pollutant	Latest Year (2018) Estimate [kt]	Level Assessment	Cumulative Total of $L_{x,t}$		
			$E_{x,t}$	$L_{x,t}$			
1A2e	Food Processing, Beverages and Tobacco	BC	0.22	57.5%	57.5%		
1A2c	Chemicals	BC	0.06	15.5%	73.0%		
1A1a	Public electricity and heat production	BC	0.05	13.1%	86.0%		
Trend Assessment - BC							
NFR Category Code	NFR Category	Pollutant	Base Year (1990) Estimate [kt]	Latest Year (2018) Estimate [kt]	Trend Assessment	% Contribution to the trend	Cumulative Total of $L_{x,t}$
			$E_{x,0}$	$E_{x,t}$	$L_{x,t}$		
1A1a	Public electricity and heat production	BC	0.04	0.05	0.091	52.7%	52.7%
1A2e	Food Processing, Beverages and Tobacco	BC	0.00	0.22	0.066	38.6%	91.3%

### 1.5.7 Results of the Key Categories Analysis (KCA) of Heavy Metals

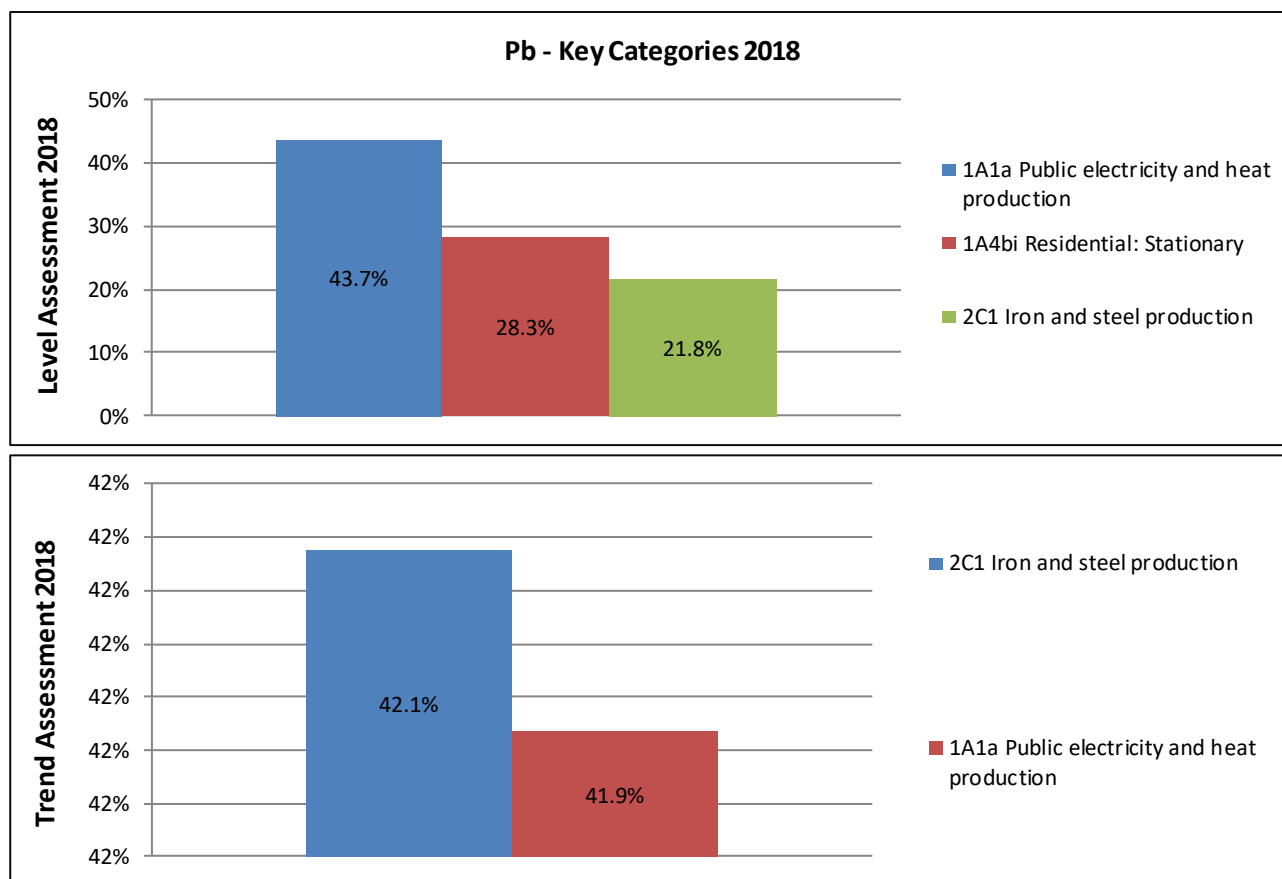


Figure 1.14 Pb – Key Categories 2019

Table 1.14 Key categories of Pb emissions due to Level and Trend Assessment Analysis

Level Assessment - Pb				Pollutant	Latest Year (2018) Estimate [kt]		Level Assessment		Cumulative Total of L <sub>x,t</sub>			
NFR Code	NFR Category				E <sub>x,t</sub>		L <sub>x,t</sub>					
1A1a	Public electricity and heat production			Pb	0.24		43.7%		43.7%			
1A4bi	Residential: Stationary			Pb	0.15		28.3%		72.0%			
2C1	Iron and steel production			Pb	0.12		21.8%		93.7%			
Trend Assessment - Pb				Pollutant	Base Year (1990) Estimate [kt]		Latest Year (2018) Estimate [kt]		Trend Assessment t		% Contribution to the trend	Cumulative Total of L <sub>x,t</sub>
NFR Code	NFR Category				E <sub>x,0</sub>		E <sub>x,t</sub>		L <sub>x,t</sub>			
2C1	Iron and steel production			Pb	0.54		0.12		0.53		42.1%	42.1%
1A1a	Public electricity and heat production			Pb	0.23		0.24		0.52		41.9%	84.0%

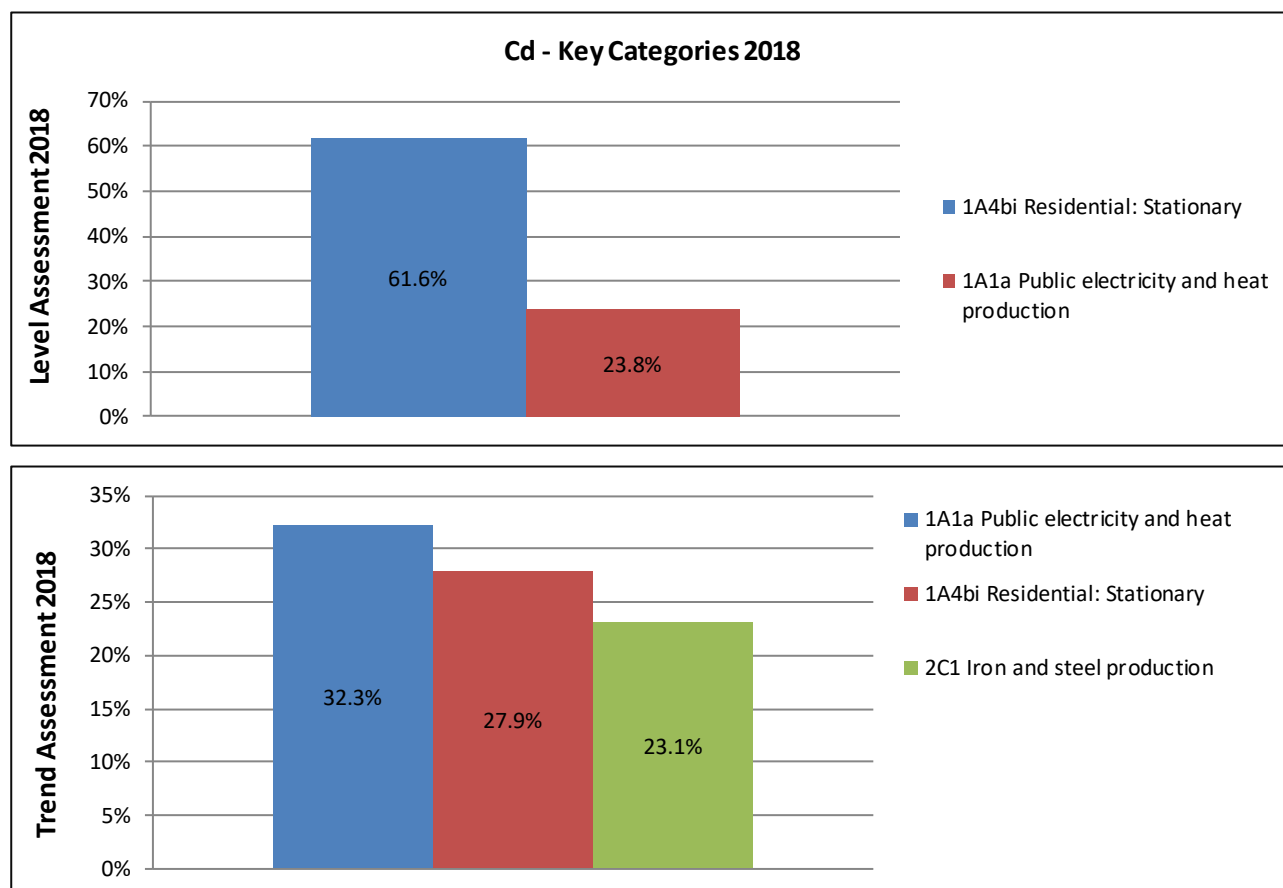


Figure 1.15 Cd – Key Categories 2019

Table 1.15 Key categories of Cd emissions due to Level and Trend Assessment Analysis

Level Assessment - Cd		Pollutant	Latest Year (2018) Estimate [kt]	Level Assessment	Cumulative Total of $L_{x,t}$
NFR Code	NFR Category		$E_{x,t}$	$L_{x,t}$	

1A4bi	Residential: Stationary			Cd	0.07	61.6%	61.6%
1A1a	Public electricity and heat production			Cd	0.03	23.8%	85.3%
Trend Assessment - Cd		Pollutant	Base Year (1990) Estimate [kt]	Latest Year (2018) Estimate [kt]	Trend Assessment	% Contribution to the trend	Cumulative Total of L <sub>x,t</sub>
NFR Code	NFR Category		E <sub>x,0</sub>	E <sub>x,t</sub>	L <sub>x,t</sub>		
1A1a	Public electricity and heat production	Cd	0.03	0.03	0.258	32.3%	32.3%
1A4bi	Residential: Stationary	Cd	0.19	0.07	0.223	27.9%	60.2%
2C1	Iron and steel production	Cd	0.04	0.01	0.184	23.1%	83.2%

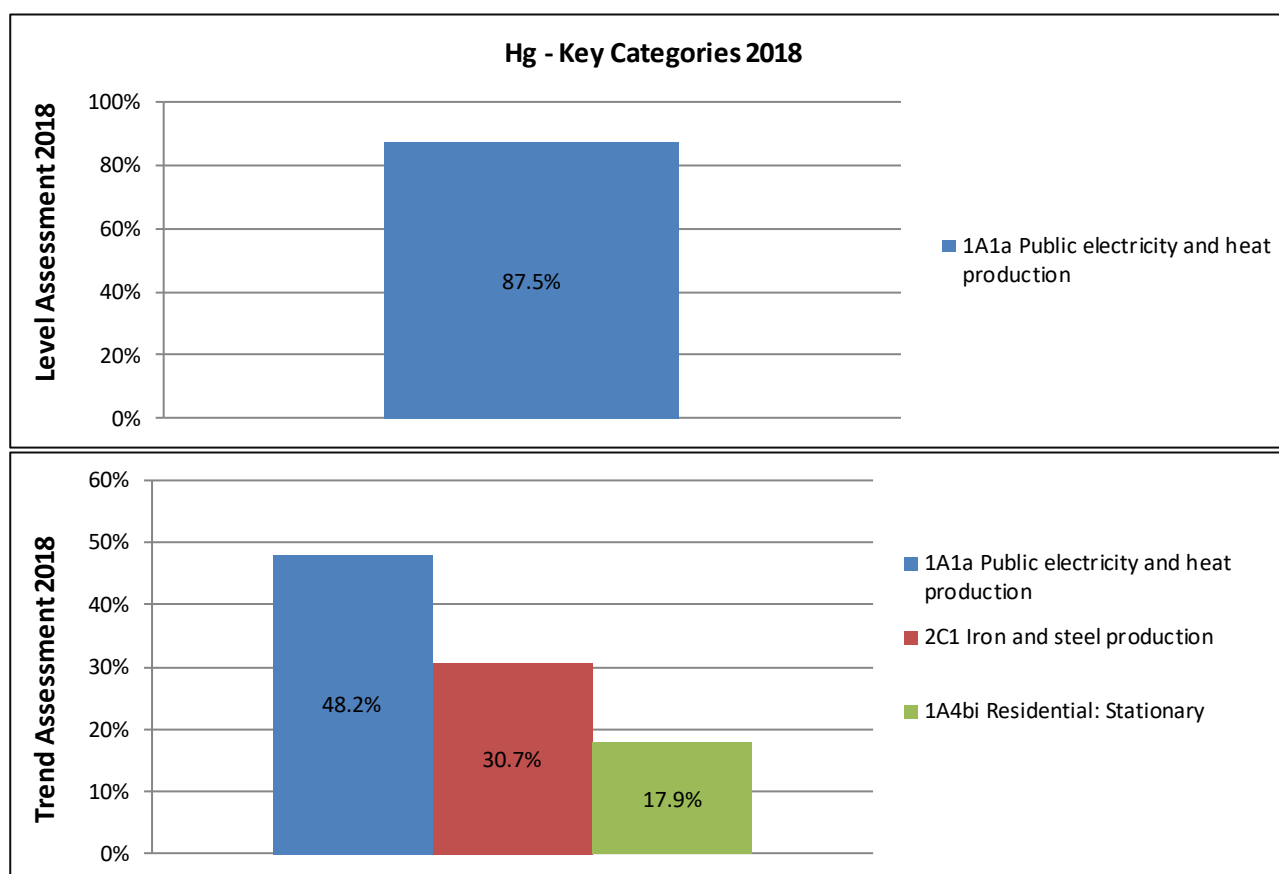


Figure 1.16 Hg – Key Categories 2019

Table 1.16 Key categories of Hg emissions due to Level and Trend Assessment Analysis

Level Assessment - Hg		Pollutant	Latest Year (2018) Estimate [kt]		Level Assessment	Cumulative Total of $L_{x,t}$	
NFR Code	NFR Category		$E_{x,t}$		$L_{x,t}$		
1A1a	Public electricity and heat production	Hg	0.05		87.5%	87.5%	
Trend Assessment - Hg		Pollutant	Base Year (1990) Estimate [kt]	Latest Year (2018) Estimate [kt]	Trend Assessment	% Contribution to the trend	Cumulative Total of $L_{x,t}$
NFR Code	NFR Category		$E_{x,0}$	$E_{x,t}$	$L_{x,t}$		
1A1a	Public electricity and heat production	Hg	0.04	0.05	0.230	48.2%	48.2%
2C1	Iron and steel production	Hg	0.01	0.00	0.147	30.7%	78.9%
1A4bi	Residential: Stationary	Hg	0.01	0.00	0.086	17.9%	96.8%

### 1.5.8 Results of the Key Categories Analysis (KCA) of Persistent Organic Pollutants

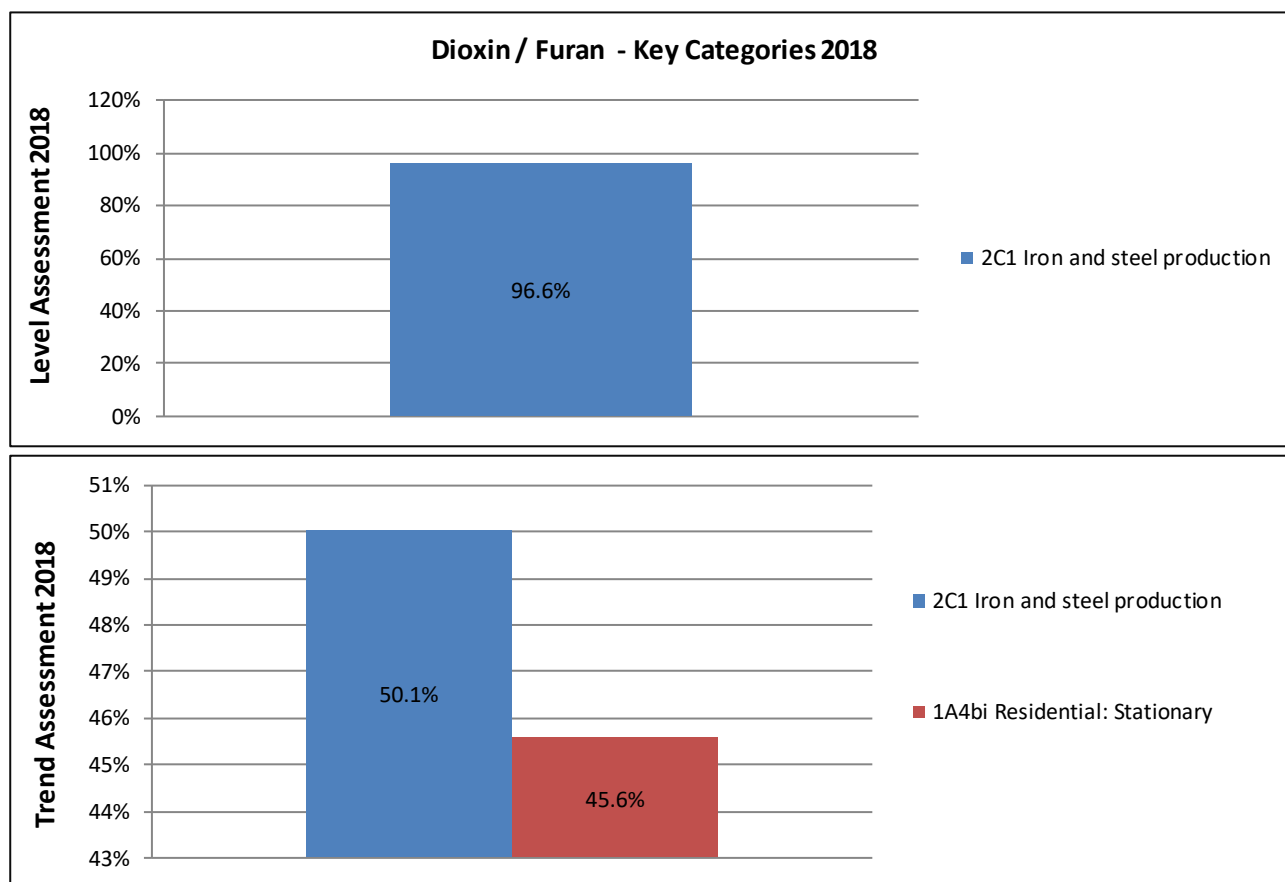


Figure 1.17 Dioxin / Furan – Key Categories 2019

Table 1.17 Key categories of NH<sub>3</sub> emissions due to Level and Trend Assessment Analysis

Level Assessment - Dioxin / Furan			Pollutant	Latest Year (2018) Estimate [kt]	Level Assessment	Cumulative Total of L <sub>x,t</sub>		
NFR Code	NFR Category			E <sub>x,t</sub>	L <sub>x,t</sub>			
2C1	Iron and steel production		PCDD/F	0.14	96.6%	96.6%		
Trend Assessment - Dioxin / Furan		Pollutant	Base Year (1990) Estimate [kt]	Latest Year (2018) Estimate [kt]	Trend Assessment	% Contribution to the trend	Cumulative Total of L <sub>x,t</sub>	
NFR Code	NFR Category		E <sub>x,0</sub>	E <sub>x,t</sub>	L <sub>x,t</sub>			
2C1	Iron and steel production		PCDD/F	0.62	0.14	0.071	50.1%	50.1%
1A4bi	Residential: Stationary		PCDD/F	0.01	0.00	0.064	45.6%	95.6%

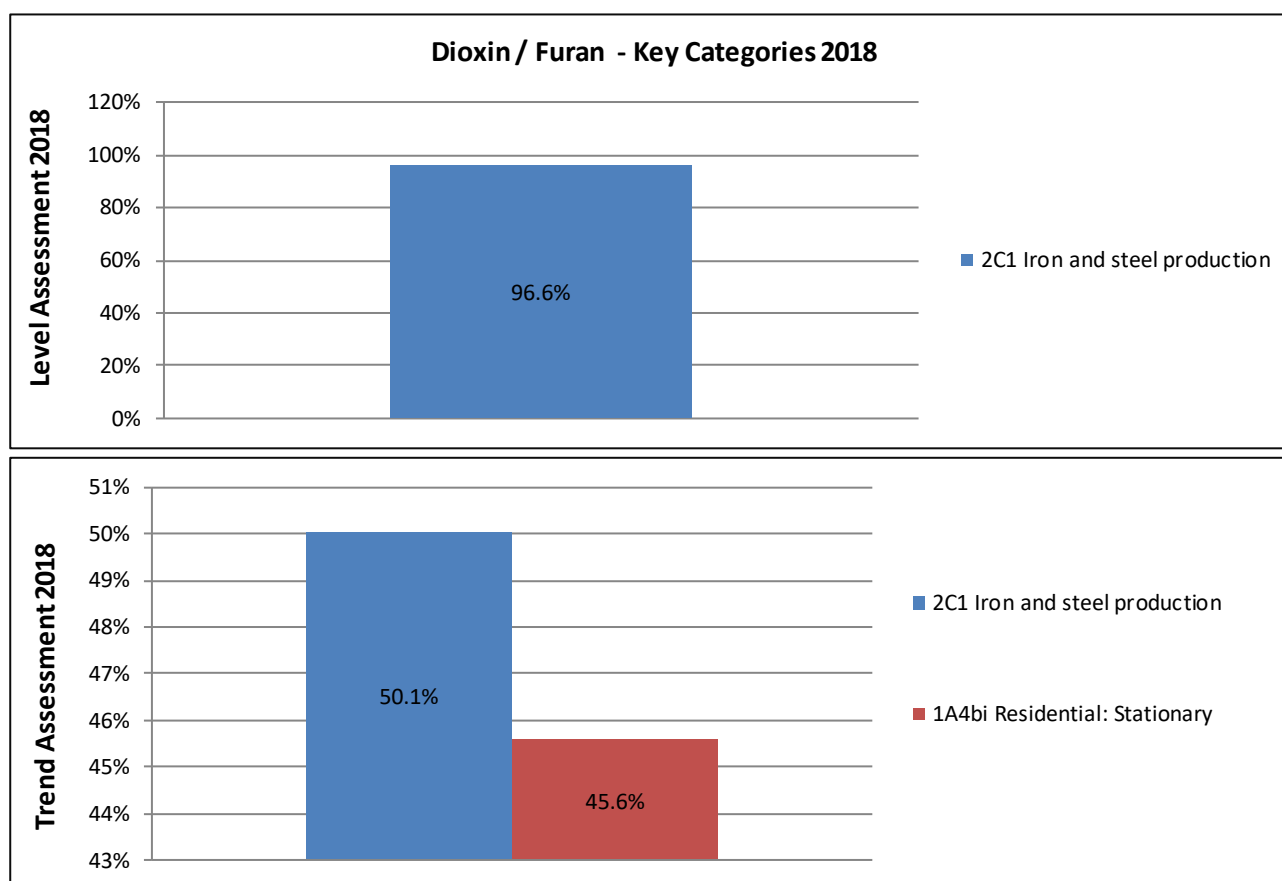


Figure 1.18 Dioxin / Furan – Key Categories 2019

Table 1.18 Key categories of Dioxin / Furan emissions due to Level and Trend Assessment Analysis

Level Assessment - Dioxin / Furan			Pollutant	Latest Year (2018) Estimate [kt]	Level Assessment	Cumulative Total of L <sub>x,t</sub>		
NFR Code	NFR Category			E <sub>x,t</sub>	L <sub>x,t</sub>			
2C1	Iron and steel production		PCDD/F	0.14	96.6%	96.6%		
Trend Assessment - Dioxin / Furan		Pollutant	Base Year (1990) Estimate [kt]	Latest Year (2018) Estimate [kt]	Trend Assessment	% Contribution to the trend	Cumulative Total of L <sub>x,t</sub>	
NFR Code	NFR Category		E <sub>x,0</sub>	E <sub>x,t</sub>	L <sub>x,t</sub>			
2C1	Iron and steel production		PCDD/F	0.62	0.14	0.071	50.1%	50.1%
1A4bi	Residential: Stationary		PCDD/F	0.01	0.00	0.064	45.6%	95.6%



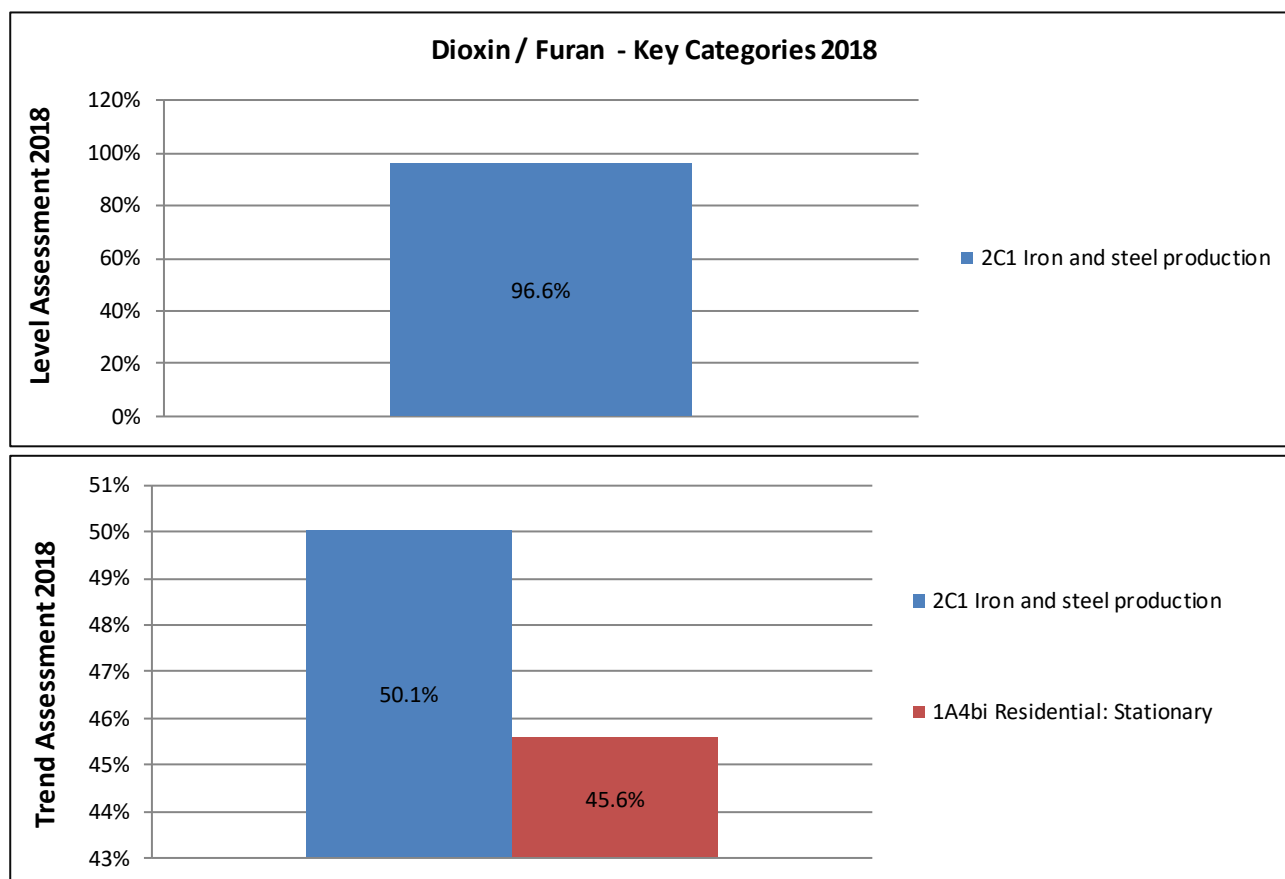


Figure 1.19 PAH – Key Categories 2019

Table 1.19 Key categories of PAH emissions due to Level and Trend Assessment Analysis

Level Assessment - PAH		Pollutant	Latest Year (2018) Estimate [kt]		Level Assessment	Cumulative Total of L <sub>x,t</sub>	
NFR Code	NFR Category		E <sub>x,t</sub>		L <sub>x,t</sub>		
1A1a	Public electricity and heat production	PAH	0.03		47.4%	47.4%	
1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	PAH	0.02		22.5%	69.9%	
1A3biii	R.T., Heavy duty vehicles and buses	PAH	0.01		19.0%	88.9%	
Trend Assessment - PAH		Pollutant	Base Year (1990) Estimate [kt]	Latest Year (2018) Estimate [kt]	Trend Assessment	% Contribution to the trend	Cumulative Total of L <sub>x,t</sub>
NFR Code	NFR Category		E <sub>x,0</sub>	E <sub>x,t</sub>	L <sub>x,t</sub>		
1A1a	Public electricity and heat production	PAH	0.09	0.03	0.491	36.5%	36.5%
1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	PAH	0.00	0.02	0.359	26.7%	63.2%
1A3biii	R.T., Heavy duty vehicles and buses	PAH	0.00	0.01	0.269	20.0%	83.2%

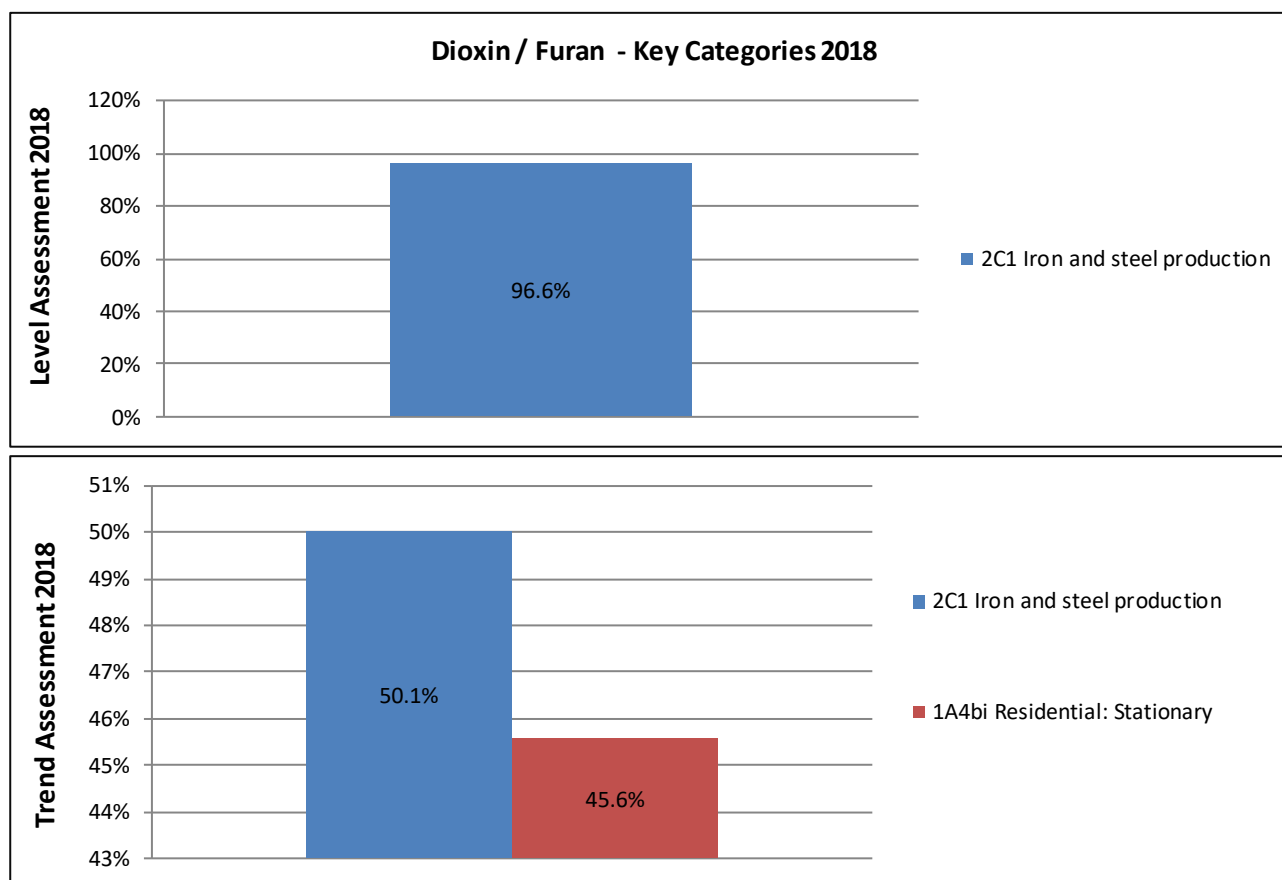


Figure 1.20 Dioxin / Furan – Key Categories 2019

Table 1.20 Key categories of NH<sub>3</sub> emissions due to Level and Trend Assessment Analysis

Level Assessment - Dioxin / Furan			Pollutant	Latest Year (2018) Estimate [kt]	Level Assessment	Cumulative Total of L <sub>x,t</sub>	
NFR Code	NFR Category			E <sub>x,t</sub>	L <sub>x,t</sub>		
2C1	Iron and steel production		PCDD/F	0.14	96.6%	96.6%	
Trend Assessment - Dioxin / Furan		Pollutant	Base Year (1990) Estimate [kt]	Latest Year (2018) Estimate [kt]	Trend Assessment	% Contribution to the trend	Cumulative Total of L <sub>x,t</sub>
NFR Code	NFR Category		E <sub>x,0</sub>	E <sub>x,t</sub>	L <sub>x,t</sub>		
2C1	Iron and steel production	PCDD/F	0.62	0.14	0.071	50.1%	50.1%
1A4bi	Residential: Stationary	PCDD/F	0.01	0.00	0.064	45.6%	95.6%

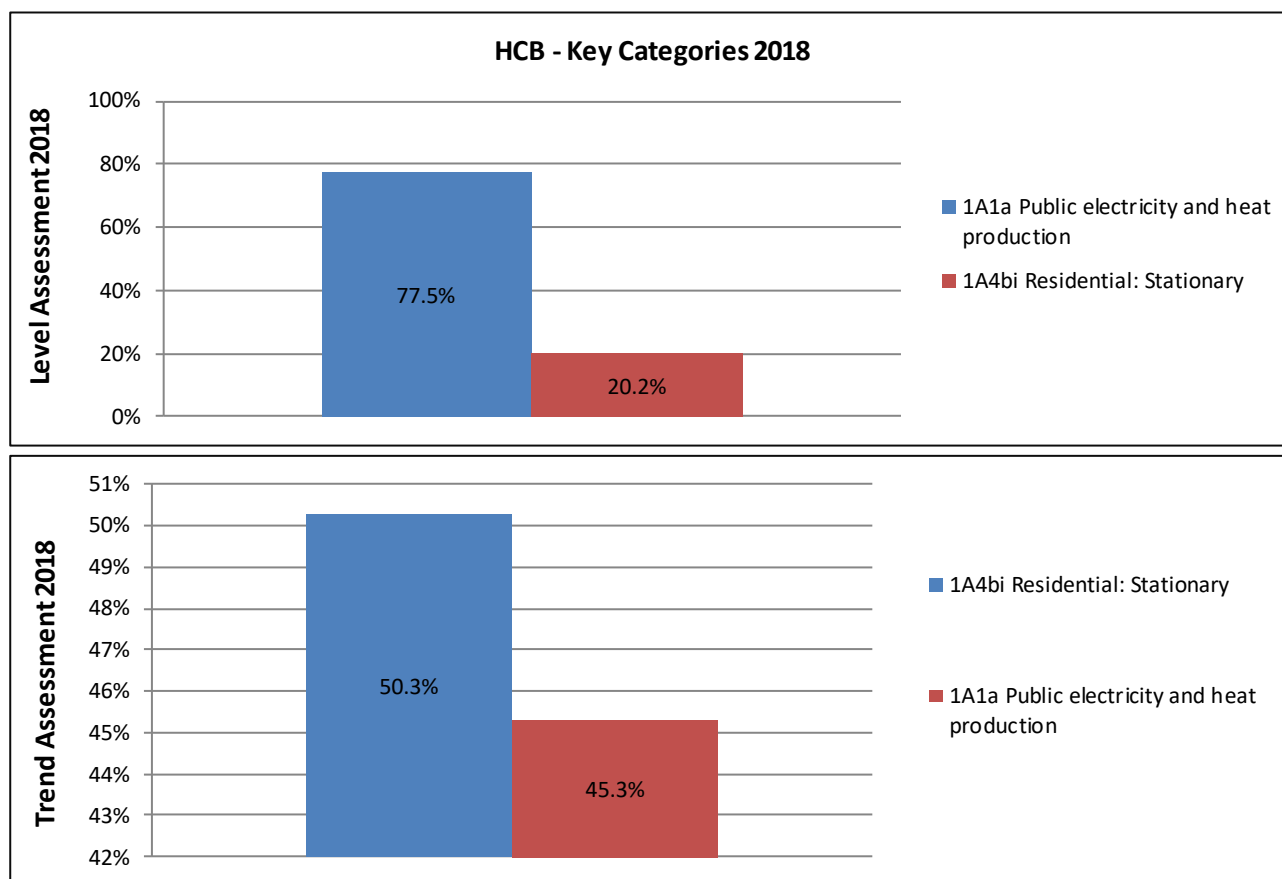


Figure 1.21 HCB – Key Categories 2019

Table 1.21 Key categories of HCB emissions due to Level and Trend Assessment Analysis

Level Assessment - Dioxin / Furan		Pollutant	Latest Year (2018) Estimate [kt]	Level Assessment	Cumulative Total of $L_{x,t}$
NFR Code	NFR Category		$E_{x,t}$	$L_{x,t}$	
1A1a	Public electricity and heat production	HCB	0.11	77.5%	77.5%
1A4bi	Residential: Stationary	HCB	0.03	20.2%	97.7%

Trend Assessment - Dioxin / Furan		Pollutant	Base Year (1990) Estimate [kt]	Latest Year (2018) Estimate [kt]	Trend Assessment	% Contribution to the trend	Cumulative Total of $L_{x,t}$
NFR Code	NFR Category		$E_{x,0}$	$E_{x,t}$	$L_{x,t}$		
1A4bi	Residential: Stationary	HCB	0.07	0.03	0.269	50.3%	50.3%
1A1a	Public electricity and heat production	HCB	0.10	0.11	0.243	45.3%	95.6%

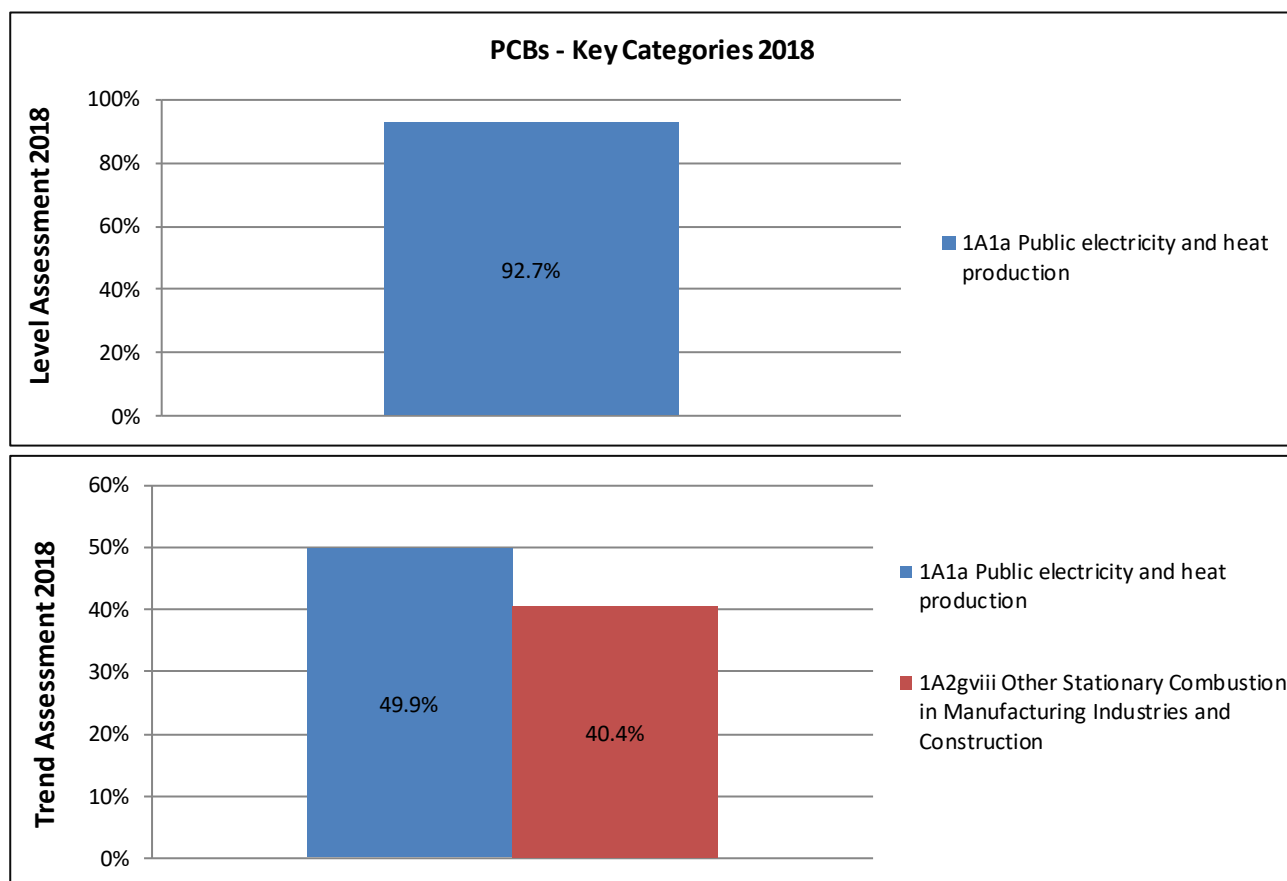


Figure 1.22 PCBs – Key Categories 2019

Table 1.22 Key categories of PCBs emissions due to Level and Trend Assessment Analysis

Level Assessment - PAH		Pollutant	Latest Year (2018) Estimate [kt]	Level Assessment	Cumulative Total of L <sub>x,t</sub>		
NFR Code	NFR Category		E <sub>x,t</sub>	L <sub>x,t</sub>			
1A1a	Public electricity and heat production	PCBs	0.04	92.7%	92.7%		
Trend Assessment - PAH		Pollutant	Base Year (1990) Estimate [kt]	Latest Year (2018) Estimate [kt]	Trend Assessment	% Contribution to the trend	Cumulative Total of L <sub>x,t</sub>
NFR Code	NFR Category		E <sub>x,0</sub>	E <sub>x,t</sub>	L <sub>x,t</sub>		
1A1a	Public electricity and heat production	PCBs	0.03	0.04	0.19	49.9%	49.9%
1A2gviii	Other Stationary Combustion in Manufacturing Industries and Construction	PCBs	0.01	0.00	0.15	40.4%	90.3%



## 1.6 Information on the QA/QC plan including verification and treatment of confidentiality issues

The the EMEP/EEA air pollutant emission inventory guidebook 2019 and 2006 IPCC Guidelines set out the major elements of a QA/QC system to be implemented by inventory compilers

- (1) inventory agency responsible for coordinating QA/QC activities and definition of roles and responsibilities,
- (2) a QA/QC plan,
- (3) general QC procedures (Tier 1) and source category-specific QC procedures (Tier 2)
- (4) QA and review procedures, and verification activities,
- (5) QA/QC system interaction with uncertainty analysis (see chapter on uncertainties),
- (6) reporting, documentation and archiving.

The first steps to carry out **quality assurance (QA) and quality control (QC) procedures** have already been undertaken but need further improvement. The current status and planned improvements are described in the following sub-sections.

### 1.6.1 QA/QC plan

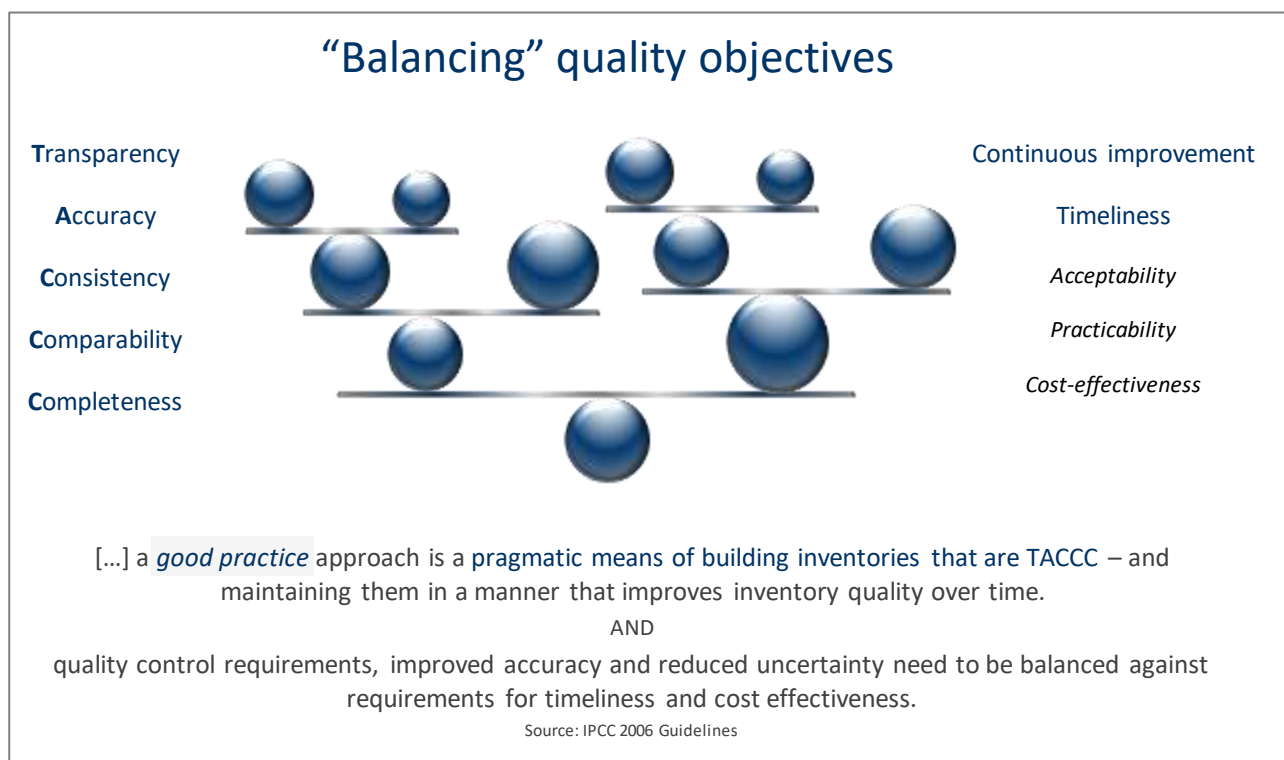
As described in the 2006 IPCC Guidelines, Chapter 6.5, a **QA/QC plan** is a **fundamental element of a QA/QC and verification system**. The QA/QC plan

- outlines the QA/QC and verification activities;
- include a scheduled time frame for the QA/QC activities;
- is an internal document to organize and implement QA/QC and verification activities that ensure the inventory is fit for purpose and allow for improvement.
  - QC activities
  - procedures for country specific methodologies
  - internal/external audits (QM specific)
  - inventory improvement plan
  - documentation and archiving
  - treatment of confidential data

#### 1.6.1.1 Quality objectives

A **key component** of a QA/QC plan is the list of data **quality objectives**, against which an inventory can be measured in a review. However, a *good practice* approach is a pragmatic means of building inventories that are TACCC – and maintaining them in a manner that improves inventory quality over time. This means that the *good practice* approach reflects the national circumstances regarding financial and technical resources and capacities.

However, the GHG inventory - estimation of GHG emissions and removals including reporting elements - is subject to continuous improvement.



**Figure 1.23**      **Balancing quality objectives**

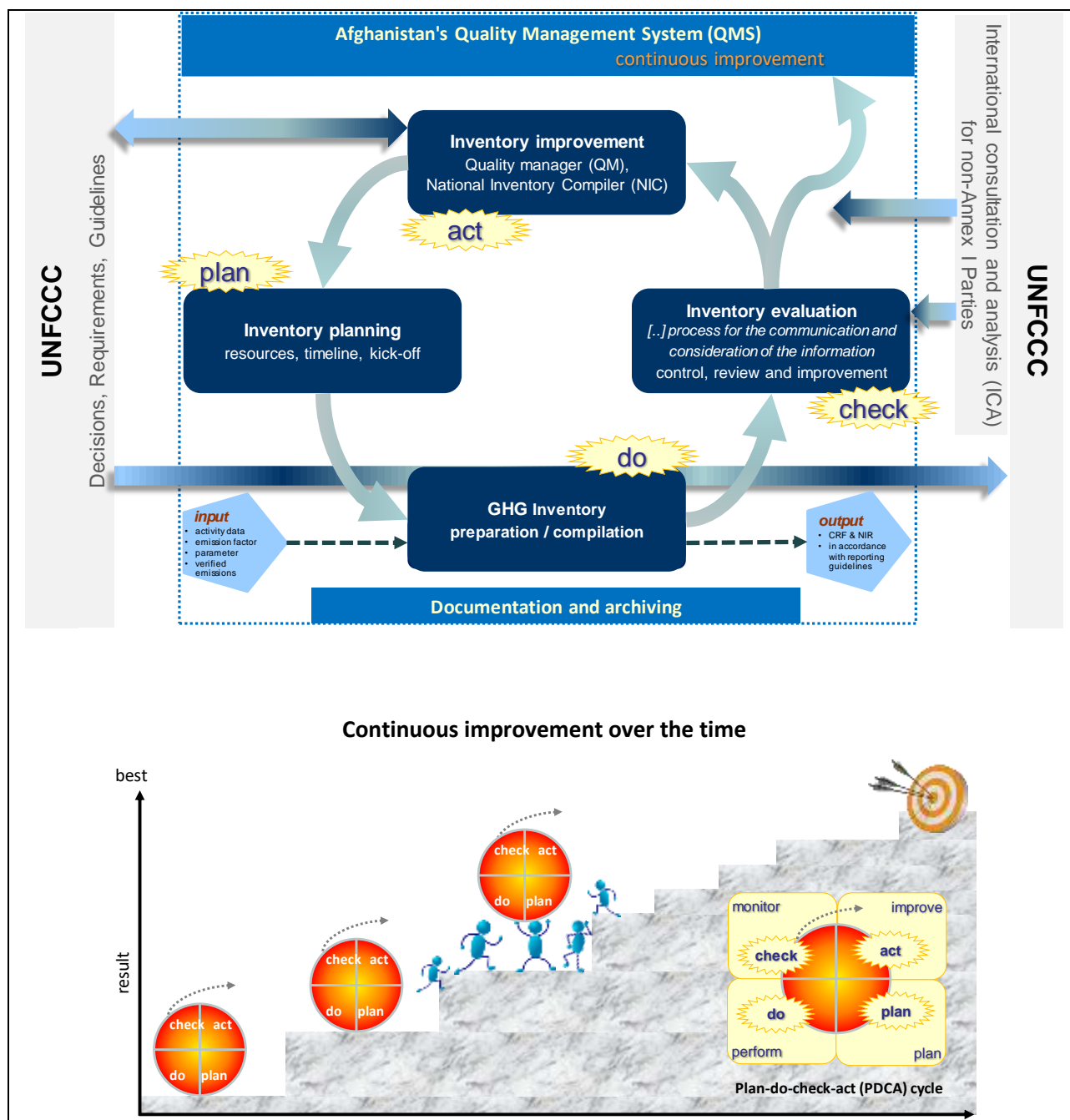
### 1.6.1.2 Inventory improvement plan

The planning of the GHG inventory preparation of each inventory cycle start with thoroughly analysis of the **QA/QC plan** and **Inventory improvement plan** in order to prioritize the tasks and available resources.

- QA/QC plan: bases on findings of internal and external audits; it also includes a training plan for sector experts;
- Inventory improvement plan: bases on findings of the International Consultation and Analysis (ICA), (peer-) reviews, audits of the GHG inventory.

The QA/QC plan and the improvement of the GHG inventory follows a Plan-Do-Check-Act-Cycle (PDCA-cycle)<sup>26</sup>, which is an accepted model for pursuing a continual improvement of a process, product or service according to international standards and is in line with in the General Guidance and Reporting of the 2006 IPCC Guidelines.

<sup>26</sup> <https://asq.org/quality-resources/pdca-cycle>



**Figure 1.24** Continuous improvement

The results from internal/external audits, expert peer reviews and UNFCCC international consultation and analysis (ICA) are merged in the inventory improvement plan and Quality improvement plan. These plans lists the relevant sector, recommendations for improvement (reference and citation), priorities, responsibilities, deadlines and confirmation of implementation.

The following table presents the template of the inventory improvement plan which is prepared for each sector, QA/QC plan and Institutional arrangements.

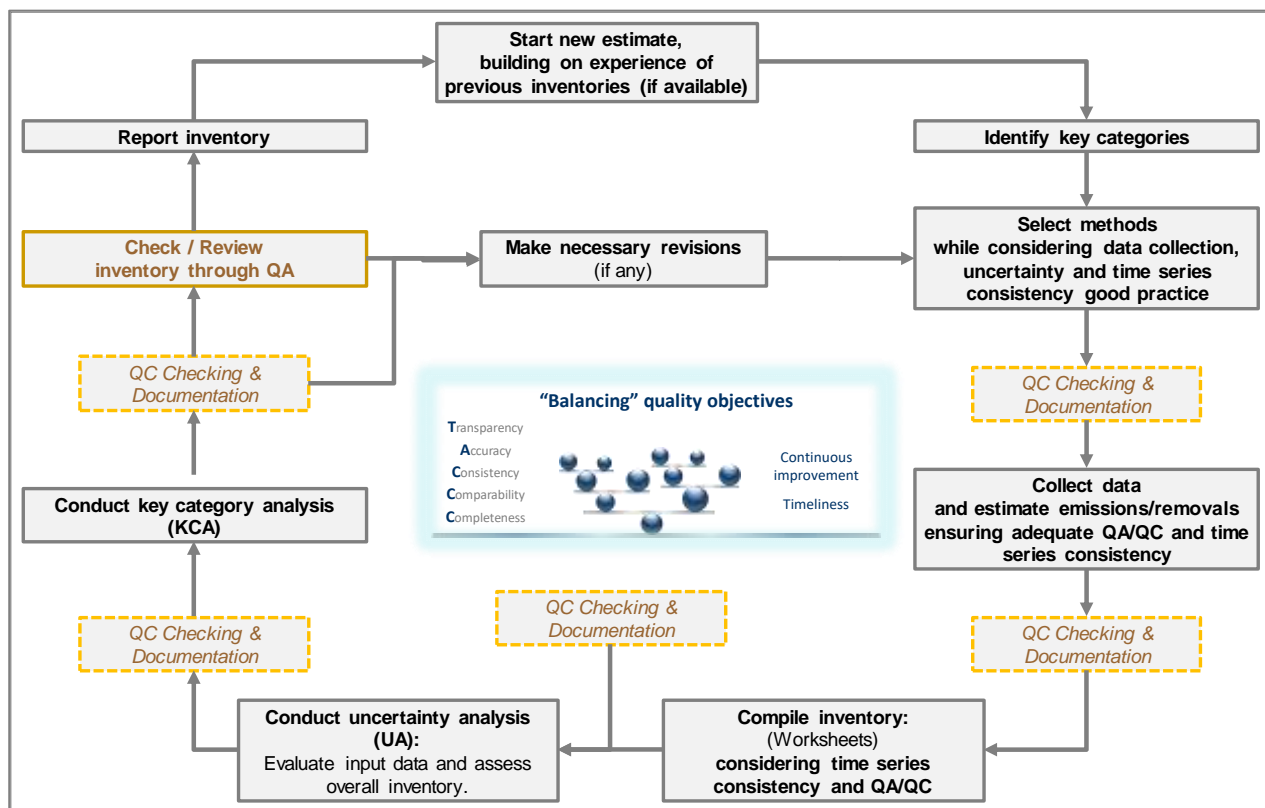


Table 23 Template of the inventory improvement plan

Area covered (example IPCC 2 IPPU, or QMS or INVENTORY general)													
Name of sector expert / responsible person for the relevant activity (e.g. quality manger)!													
No	IPCC category	Source	Citation	Issue	Urgency	Ressources	Timeline	responsible person (s)	Finished	Check NIC	Improvement made		
				<div>Original quote of the (review) reports!</div> <div>summary (in non-technical /informal language) of PROBLEM and MEASURE</div> <div> <b>1 - urgent / high</b> e.g. finding were several times topic or recommendation; SHALL requirements  <b>2 - important / medium</b> new topic, might be urgent topic in the future, Key Category (KCA) related, SHOULD requirement  <b>3 - low</b> for non-urgent topics, Non-Key Category related; ENCOURAGEMENT  --&gt; does not need a schedule </div> <div> <b>Estimates of time frame for NEPA and UNFCCC focal point!</b>  <b>NEPA:</b> more financial resouces are needed for research  <b>UNFCCC Focal point:</b> more resouces are neededs is needed  <b>GHG inventory 20XX:</b> can be solved within the 'normal' framework of inventory preparation (ususal planning run) </div>									Text for NIR!
<b>Review / Technical analysis:</b> Desk Review (DR) / Centralized Review (CR) / In Country Review (ICR), year, paragraph and/or page: e.g. "UNFCCC CR 2001, §34 Facilitative Sharing of Views (FSV) workshop under International Consultation and Analysis (ICA), round 1,2,..., year, paragraph and/or page; e.g. FSVR.1 ICA 2016, year, § 10 <b>Archive:</b> email, mail, (oral) complaints documented expl. with protocol "Pxxx" <b>Inventory team / Personal:</b> "Name, date" <b>Audit protocol:</b> "Audit_No" <b>!!! Each finding, which is <u>not</u> identified by responsible inventory person, have to be available in written form!!!</b>			<b>name of responsible experts/persons</b> (and name of institutions)			<b>- GHG inventory 20XX if related to numbers</b> <b>- NIR 20XX if related to transparency</b> !! In case of delay: crossing out of date (Format Cells box, under Effects, click Strikethrough) and adding new time line. Add comment with reason of delay!!!		<b>- GHG inventory 20XX if related to numbers</b> <b>- NIR 20XX if related to transparency</b> !!!Remarks or links (e.g. NIR 2019, page 213) as a comment!!!					
1													
2													

### 1.6.1.3 Inventory development cycle and guidance

The biennial and/or annual preparation of the GHG inventory follows in general the **inventory development cycle** presented in the following figure and described in Chapter 1 *Introduction to the 2006 Guidelines* of Volume 1: General Guidance and Reporting (GGR).



**Figure 1.25 Inventory development cycle**

Source: 2006 IPCC guidelines, Vol. 1: General Guidance and Reporting, Chap. 1: Introduction to the 2006 Guidelines, sub-chap. 1.5 Compiling an inventory, Figure 1.1, p. 1.9.

The preparation of the inventory starts always with identification of the key categories of the previous inventory followed by the selection of the appropriate identify the appropriate method for estimation for each category according to the **decision tree** of each source presented in Volume 2 – 5 of the 2006 IPCC guidelines.

The collection of activity data and relevant parameters and the estimation of emission by sources and removals by sinks should be follow the selection of the appropriate methods. As stated in the 2006 IPCC Guidelines the data collection activities should consider time series consistency and establish and maintain good verification, documentation and checking procedures (QA/QC) to minimize errors and inconsistencies in the inventory estimates.<sup>27</sup> Information and data on uncertainties should if possible be collected at the same time. The relevant QC Checking and documentation is done according to the QC TIER 1 & 2 Checklist which is presented in Chapter 1.6.2 (**Error! Reference source not found.- Error! Reference source not found.**).

<sup>27</sup> 2006 IPCC guidelines, Vol. 1: General Guidance and Reporting, Chap. 1: Introduction to the 2006 Guidelines, 1.5 Compiling an inventory, p. 1.9.

The following table presents relevant inventory tasks which are based on each other. It is also indicated which documents (chapter and/or sheet) are required for the respective work steps. The relevant responsible experts involved in each step are also identified.

Table 24 National Inventory preparation schedule / guidance

	When	Task	Where / What	Emission inventory coordinator	Focal point Air pollutants emission inventory	National Inventory Compiler (NIC)	QA/QC coordinator	IIR coordinator	Documentation & Archiving Lead	KCA & UA coordinator	Sector experts	Data provider	QA experts	tbd
1.		Start new estimate, building on experience of previous inventories												
2.		Meeting of Emission inventory coordinator, Focal point Air pollutants emission inventory, National Inventory Compiler (NIC) and QA/QC Coordinator: <ul style="list-style-type: none"> <li>Analyzing the QA/QC plan &amp; Inventory improvement plan</li> <li>Prioritizing the recommended improvements (including a timeline and responsibilities)</li> <li>planning relevant resources.</li> </ul>	Protocol (template) Inventory improvement plan.xlsx QA-QC improvement plan.xlsx											
3.		Kick-off meeting – GHG inventory team (News, deadlines, changes, etc.)	Protocol (template) Inventory improvement plan.xlsx QA-QC improvement plan.xlsx											
4.		Conducting Capacity trainings and/or refreshing general issues, sector-specific topics, QC activities	Training plan Inventory improvement plan											
5.		Identify key categories	IIR 2021 chapter 1.5.docx ME_KCA_2021.xlsx											
6.		Select methods while considering data collection, uncertainty and time series consistency good practice	2006 IPCC GL, Volume 2 – 5 IIR – sectoral chapters											
7.		QC Checking & Documentation, updating Inventory improvement plan	ME_Inventory improvement plan.xlsx QC checks according to part 1 of QC TIER 1 & 2 Checklist											
8.		Kick-off meeting – with data provider (with all / in groups)	Protocol (template)											
9.		Collection of activity data and relevant parameters ensuring adequate <ul style="list-style-type: none"> <li>QC Checking (completeness, transparency, accuracy)</li> <li>time series consistency</li> </ul>	Data collection using data collection files (template) (source-specific) from data provider											
10.		documentation (if discrepancies, delay, etc.)	Archiving response (letter, Email, etc.) in folder 04_Archive											
11.		Preparation/Updating of calculation sheets <ul style="list-style-type: none"> <li>adding new year</li> <li>modification if higher TIER methodology will be applied</li> <li>updating IIR tables templates</li> </ul>	source-specific calculation sheets, e.g. 1A1a_InventoryTool_ME.xlsx											

	When	Task	Where / What	Emission inventory coordinator	Focal point Air pollutants emission inventory	National Inventory Compiler (NIC)	QA/QC coordinator	IIR coordinator	Documentation & Archiving Lead	KCA & UA coordinator	Sector experts	Data provider	QA experts	tbd
		<ul style="list-style-type: none"> <li>updating graphs</li> </ul>												
12.		Estimate emissions/removals ensuring adequate QA/QC and time series consistency	Inserting activity data or linking data collection files with calculation files											
13.		QC Checking & Documentation, updating Inventory improvement plan	<ul style="list-style-type: none"> <li>Documentation in column Update of each "source-specific" calculation file, sheet AD</li> <li>QC checks according to part 1,2,3 and 6 of QC TIER 1 &amp; 2 Checklist</li> </ul>											
14.		Preparation/Updating of Inventory file <ul style="list-style-type: none"> <li>adding new year</li> <li>adding new calculation file, if needed</li> <li>updating IIR tables templates</li> <li>updating graphs</li> </ul>	CTR-CommonReportingTables_ME.xlsx											
15.		Compile inventory considering time series consistency and QA/QC: update links of all calculation sheets	CTR-CommonReportingTables_ME.xlsx QC checks according to part 2b of QC TIER 1 & 2 Checklist											
16.		Sharing results with inventory team and QC check of Inventory file by sector experts and if needed revision of Inventory file	QC checks according to part 1, 2 and 3 of QC TIER 1 & 2 Checklist											
17.		Make necessary revisions (if any)												
18.		Conduct uncertainty analysis (UA): Evaluation of input data: AD and EF.	"source-specific" calculation files, sheet uncertainties											
19.		Conduct uncertainty analysis (UA): assessment of overall inventory uncertainty.	ME_Uncertainties_Table6.1.xlsx QC checks according to part 4 and 5 of QC TIER 1 & 2 Checklist											
20.		QC Checking & Documentation, updating Inventory improvement plan	QC checks according to part 7 of QC TIER 1 & 2 Checklist											
21.		Sharing results with inventory team and QC check of UA file by sector experts and IIR coordinator												
22.		Make necessary revisions (if any)												
23.		Conduct key category analysis (KCA) <ul style="list-style-type: none"> <li>Update formula for new inventory year</li> </ul>	ME-KCA-2021.xlsx CTR-CommonReportingTables_ME.xlsx											

	When	Task	Where / What	Emission inventory coordinator	Focal point Air pollutants emission inventory	National Inventory Compiler (NIC)	QA/QC coordinator	IIR coordinator	Documentation & Archiving Lead	KCA & UA coordinator	Sector experts	Data provider	QA experts	tbd
		• Update link with CTR-CommonReportingTables_AFG.xlsx												
24.		QC Checking & Documentation, updating Inventory improvement plan	QC checks according to part 1 of <i>QC TIER 1 &amp; 2 Checklist</i>											
25.		Sharing results with inventory team and QC check of KCA file by sector experts and IIR coordinator	ME-KCA-2021.xlsx											
26.		Make necessary revisions of emission estimation if higher TIER methodology has to be applied according to decision tree of relevant source (if any)												
27.		Repeat step 14. to – 25. in case of revision												
28.		<ul style="list-style-type: none"> <li>Add new year in IPCC software</li> <li>Update of timeseries entry files for IPCC software</li> <li>Update database (sector)</li> </ul>												
29.		QC Checking & Documentation, updating Inventory improvement plan	QC checks according to part 2 and 3 of <i>QC TIER 1 &amp; 2 Checklist</i>											
30.		Compile inventory with IPCC software as QC activity												
31.		QC Checking & Documentation, updating Inventory improvement plan	QC checks according to part 2 and 3 of <i>QC TIER 1 &amp; 2 Checklist</i>											
32.		Update IIR sectoral chapter												
33.		QC Checking & Documentation, Cross-checking with Inventory improvement plan	QC checks according to part 2 and 3 of <i>QC TIER 1 &amp; 2 Checklist</i>											
34.		Update IIR chapter 1 Introduction												
35.		QC Checking & Documentation, Cross-checking with Inventory improvement plan	QC checks according to part 2 and 3 of <i>QC TIER 1 &amp; 2 Checklist</i>											
36.		Update IIR chapter 1.6 KCA												
37.		QC Checking & Documentation, Cross-checking with Inventory improvement plan	QC checks according to part 2 and 3 of <i>QC TIER 1 &amp; 2 Checklist</i>											
38.		Update IIR chapter 1.7 Uncertainties												
39.		QC Checking & Documentation, Cross-checking with Inventory improvement plan	QC checks according to part 2 and 3 of <i>QC TIER 4 &amp; 5 Checklist</i>											

	When	Task	Where / What	Emission inventory coordinator	Focal point Air pollutants emission inventory	National Inventory Compiler (NIC)	QA/QC coordinator	IIR coordinator	Documentation & Archiving Lead	KCA & UA coordinator	Sector experts	Data provider	QA experts	tbd
40.		Finalization of Inventory Improvement Plan and QA-QC improvement plan Finalization of IIR Chapter 9 Recalculation and Improvement	Inventory improvement plan.xlsx QA-QC improvement plan.xlsx											
41.		Update IIR chapter 1.6 QA/QC												
42.		QC Checking & Documentation, Cross-checking with Inventory improvement plan	QC checks according to part 2, 3, and 7 of <i>QC TIER 1 &amp; 2 Checklist</i>											
43.		Update IIR chapter 2 Trend												
44.		QC Checking & Documentation, Cross-checking with Inventory improvement plan	QC checks according to part 2 of <i>QC TIER 1 &amp; 2 Checklist</i>											
45.		Treatment of confidentiality issues	Checklist - Confidential data											
46.		Update IIR chapter # References												
47.		QC Checking & Documentation, Cross-checking with Inventory improvement plan	QC checks according to part 7 of <i>QC TIER 1 &amp; 2 Checklist</i>											
48.		Check / Review inventory and IIR through QA	QA checks using the <i>QC TIER 1 &amp; 2 Checklist</i>											
49.		Make necessary revisions of emission estimation and /or IIR based on findings and recommendations of QA (if any)												
50.		Repeat step 14. to – 47. in case of revision												
51.		Finalize National GHG Inventory and National Inventory Report (IIR) for approval												
52.		Reporting of National Inventory and National Inventory Report (IIR)												
53.		Collection of QC documents, QA documents, Inventory Improvement Plan												
54.		Archiving calculations files, Inventory files, KCA & UA file, IIR, QC documents, QA documents, Inventory Improvement Plan	05_QA-QC\04_InventoryImprovementList 06_Inventory\2021\Submission 07_IIR\2021_IIR\02_Submission_LRTAP											

## 1.6.2 Quality control (QC) procedures

As stated in the 2006 IPCC Guidelines, Chapter 6.6, and presented in the following figure,

- general QC procedures include generic quality checks related to calculations, data processing, completeness, and documentation that are applicable to all inventory source and sink categories.
- category-specific QC complements general inventory QC procedures and is directed at specific types of data used in the methods for individual source or sink categories. These procedures require knowledge of the specific category, the types of data available and the parameters associated with emissions or removals, and are performed in addition to the general QC checks

does NOT require knowledge of the emission source category ↓ general		requires knowledge of the emission source category ↓ source specific	
QC procedures sector experts (1st party) performed throughout preparation of inventory			
TIER 1		TIER 2	
data validation, calculation sheet (check of formal aspects)		preparation of IIR, comparison with IPCC Guidelines (check of applicability, comparisons)	
QA procedures quality manager (2nd or 3rd party; staff not directly involved, preferably independent) performed at different levels or after inventory work has finished			
TIER 1 basic, before submission			
		expert peer review internal audit / expert peer review evaluate if TIER2 QC is effectively performed (check if methodologies are applicable)	
TIER 2 extensive			
(quality management) system audit  evaluate if TIER 2 QC is effectively performed		expert peer review International Consultation and Analysis (ICA) <ul style="list-style-type: none"><li>A technical analysis of BUR by a team of experts (TTE)</li><li>A facilitative sharing of views in the form of workshop under the SBI</li></ul> evaluate if TIER 2 QC is effectively performed (check if methodologies are applicable)	

**Figure 26** General overview of QA/QC procedures

QC procedures are performed as defined in the QC TIER 1 & 2 Checklist which is prepared according to IPCC 2006 Guidelines,

- Table 6.1 General inventory QC procedures
- A1. General QC checklist
- A2. Category-specific QC checklist



## 1.6.3 Documentation and archiving

### 1.6.3.1 Documentation

For each sector the documentation of the methodology and actual emission calculation (e.g. 1A2m\_OtherTool\_AFG.xlsx) includes:

- Description (source/sink category, emissions, key source, completeness, uncertainty),
- Methodology (decision tree).
- „Logbook” (who did what and when) (see **Table 24** National Inventory preparation schedule / guidance)
- References for activity data, emission factors and/or emissions, respectively,
- Documentation of assumptions, sources of data and information, expert judgements etc. to allow full reproduction and understanding of choices made,
- Recalculations,
- Planned improvements,
- QC activities.

**Table 1.25** ReadMe of emission calculation sheets

A		B		C		D	E	F	G
1		This calculation tool is prepared by <b>umweltbundesamt</b>		© Umweltbundesamt GmbH (Environmental Agency Austria) The Inventory Tool is Umweltbundesamt copyright may not be modified or reproduced without permission from Umweltbundesamt.					
2		Integrated inventory for Greenhouse gas (GHG) and Air pollutant emission				Feedback and questions can be sent to <a href="mailto:trainingcenter@umweltbundesamt.at">trainingcenter@umweltbundesamt.at</a>			
3		project-name: Integrated inventory for GHG and Air pollutants Emissions							
4		project-number:							
5		prepared by: Traute Köther							
6		Last changes: 11.03.2020							
7		QM-link:							
8		file name: 1A2a_InventoryTool_MNE.xls							
9		status: in progress				older versions always with date; e.g. 1A2a_InventoryTool_MNE_20200214.xlsx			
10		timeseries: 1990-2018				drop down			
11		IPCC-Sources: 1 A 2 a - Manufacturing Industries and Construction - Iron and Steel							
12		file linked to: MNE_EnergyBalance_1990-2018-v1.xlsx							
13		description/content: MNE_NCV-data.xlsx							
14									
15		Sheet name		Content		Content description		Susanne2018	
16								Password	
17		ChangeLog		Information regarding updating / modification / changes		Information		unprotected worksheet	
18		worksheet_1A		Activity data for transfer to IPCC software		Activity data		protected worksheet	
19		1A2a_CRT		GHG emissions (automatised) for CRT reporting		(intermediate) result		protected worksheet	
20		1A2a_NFR		Air Pollutants emissions (automatised) for NFR		(intermediate) result		protected worksheet	
21		1A2a_AD		Calculation of emissions by fuel and GHG / Pollutants		Input data		unprotected worksheet but occasional protected cells	
22		Uncertainty		Information related to Uncertainties for transfer to Uncertainty_MNE.xlsx NIR sectoral Chapter		Uncertainty data		unprotected worksheet	
23		PlannedImprovements		Information related to Planned improvements for transfer to NIR sectoral Chapter for transfer to Chapter Recalculation & Planned improvements		Planned improvements		unprotected worksheet	
24		Recalculation		Information related to Recalculation for transfer to NIR sectoral Chapter for transfer to Chapter Recalculation & Planned improvements		Recalculation		unprotected worksheet	
25		EF IPCC		Emission factors of 2006 IPCC GL for sector 1A		Emission factors		protected worksheet	
26		ExcelSupport		Excel support regarding used formulas		Information		unprotected worksheet	
27		EF EMEP-EEA 1A1		Emission factors of EMEP/EEA GB for sector 1A.1		Emission factors		protected worksheet	
28		Matrix_EBxCRF		Correspondance of activities of Energy Balance (IEA/EUROSTAT Questionnaire) and CRF sub categories		Information		unprotected worksheet	
29		DropDown&Definition		List for DropDown and Definitions of sectors and fuels		Information		protected worksheet	

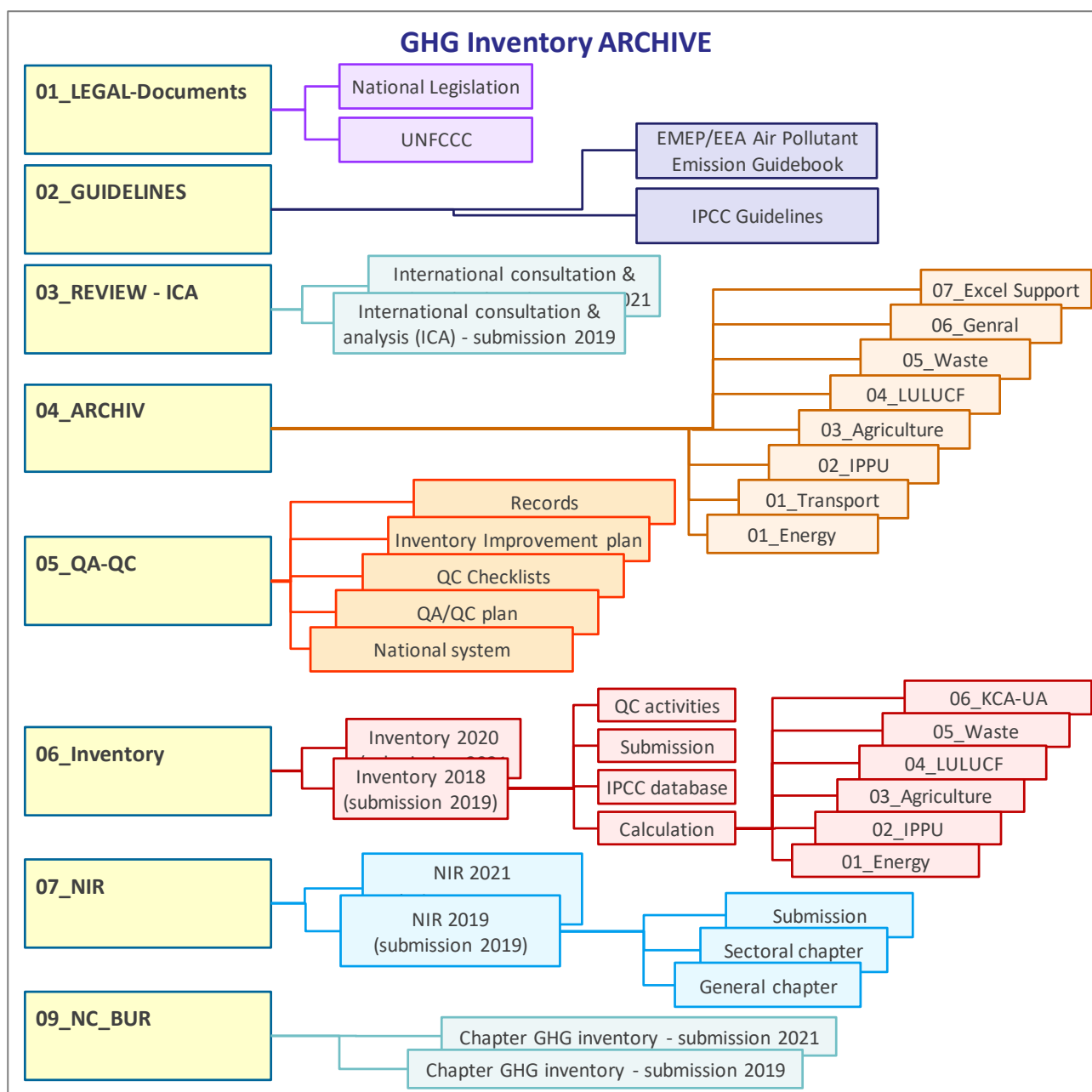
### 1.6.3.2 Expert judgements

The documentation of expert judgements in line with the IPCC 2006 Guidelines should include:

- Name of the expert and institution/department,
- Date,
- Basis of judgement (references to relevant studies etc.),
- Underlying assumptions

### 1.6.3.3 Archiving

Archiving takes place on a central server within the folder 'GHG inventory' and relevant subfolders. The structure of the 'GHG inventory' is provided in the next Figure. Relevant literature has to be archived and references to be stated in the internal documentation as well as in the IIR.



**Figure 1.27** GHG Inventory Archive

### 1.6.4 Treatment of confidentiality issues

## 1.7 General uncertainty evaluation

According to the EMEP/EEA air pollutant emission inventory guidebook 2019, Part A, Chapter 3 Uncertainty estimates are an essential element of a complete inventory of Air pollutant emissions and requires a detailed understanding of the uncertainties of the respective input parameters. They should be derived for both the national level and the trend estimate, as well as for the component parts such as emission factors, activity data and other estimation parameters for each category.

A qualitative uncertainty assessment has been carried out. Information on methodology and data sources used is provided in the following sections.

In order to estimate the overall uncertainty, the uncertainty of activity data and emission factor, respectively, has to be quantified. The uncertainties of activity data on sectoral level are mainly based on the GHG uncertainty analysis according to the 2006 IPCC Guidelines.

The quality of estimates for all relevant pollutants has been rated using qualitative indicators as suggested in Chapter 5 of the EMEP/EEA air pollutant emission inventory guidebook 2019. The definition of the ratings is given in the following table. The uncertainties associated with activity data and emission factors are presented in the related chapter of each category and source.

**Table 1.26**                      **Rating definitions**

Rating	Definition	Typical Error Range	Average
A	An estimate based on a large number of measurements made at a large number of facilities that fully represent the sector	10 to 30%	20%
B	An estimate based on a large number of measurements made at a large number of facilities that represent a large part of the sector	20 to 60%	40%
C	An estimate based on a number of measurements made at a small number of representative facilities, or an engineering judgement based on a number of relevant facts	50 to 200%	125%
D	An estimate based on single measurements, or an engineering calculation derived from a number of relevant facts	100 to 300%	200%
E	An estimate based on an engineering calculation derived from assumptions only	order of magnitude	750%
<i>Source: Table 3-2 Rating definitions, Chapter 5 of the EMEP/EEA emission inventory guidebook 2019.</i>			

### 1.8 General assessment of the completeness

The sources not considered in the inventory but included in the EMEP/EEA Air pollutants emission Guidebook 2019 are clearly indicated, the reasons for such exclusion are explained. Notation keys - NA, NO, NE, IE – used, and presented in the following tables, are in accordance with the *Guidelines for Reporting Emissions and Projections*<sup>28</sup>, para 12, page 7.

<b>Sources and sinks</b>	All sources included in the EMEP/EEA Air pollutants emission Guidebook 2019 are addressed. No additional sources specific to Montenegro have been identified.  The source listed in the following table could not be estimated due to lack of data and resources. The estimation of these sources are planned for next inventory cycle.
<b>Pollutants</b>	All Air pollutants are covered by the Air pollutant emission inventory of Montenegro.
<b>Geographic coverage</b>	The geographic coverage is complete. There is no part of the Montenegro’s territory not covered by the inventory.

<sup>28</sup> ECE/EB.AIR/125: Guidelines for Reporting Emissions and Projections Data under the Convention on Long-range Transboundary Air Pollution

Table 1.27 Overview of notation keys used

NFR Code	Description	Main Pollutants				Particulate Matter				CO	Priority Heavy Metals			Additional Heavy Metals						Persistent Organic Pollutants (POPs)			
		NO <sub>x</sub>	NM/VOC	SO <sub>x</sub>	NH <sub>3</sub>	PM <sub>2.5</sub>	PM <sub>10</sub>	TSP	BC		Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	PCDD/ PCDF	PAH	HCB	PCBs
1A1a	Public electricity and heat production	✓	✓	✓	NA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1A1b	Petroleum refining	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1A1c	Manufacture of solid fuels and other energy industries	NA	NA	NA	NA	NE	NE	NE	NA	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1A2a	Iron and steel	✓	✓	✓	IE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1A2b	Non-ferrous metals	✓	✓	✓	IE	✓	✓	✓	IE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	IE	IE
1A2c	Chemicals	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
1A2d	Pulp, Paper and Print	IE	IE	IE	NA	IE	IE	IE	NA	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
1A2e	Food processing, beverages and tobacco	✓	✓	✓	IE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1A2f	Non-metallic minerals	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
1A2gvii	Mobile combustion in manu-facturing industries & constr.	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
1A2gviii	Other	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1A3ai(i)	International aviation LTO (civil)	✓	✓	✓	NE	✓	✓	✓	NE	✓	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
1A3aii(i)	Domestic aviation LTO (civil)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1A3bi	Road: Passenger cars	✓	✓	NE	✓	✓	✓	✓	NE	✓	✓	NE	NE	NE	NE	NE	NE	NE	NE	NE	✓	NE	NE
1A3bii	Road: Light duty vehicles	✓	✓	NE	✓	✓	✓	✓	NE	✓	✓	NE	NE	NE	NE	NE	NE	NE	NE	NE	✓	NE	NE
1A3biii	Road: Heavy duty vehicles and buses	✓	✓	NE	✓	✓	✓	✓	NE	✓	✓	NE	NE	NE	NE	NE	NE	NE	NE	NE	✓	NE	NE
1A3biv	Road: Mopeds & motorcycles	✓	✓	NE	✓	✓	✓	✓	NE	✓	✓	NE	NE	NE	NE	NE	NE	NE	NE	NE	✓	NE	NE
1A3bv	Road: Gasoline evaporation	NA	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1A3bvi	Road: Automobile tyre and brake wear	NA	NA	NA	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1A3bvii	Road: Automobile road abrasion	NA	NA	NA	NA	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1A3c	Railways	✓	✓	IE	✓	✓	✓	✓	NE	✓	NE	✓	NE	NE	✓	✓	✓	✓	✓	NE	✓	NA	NA
1A3di(ii)	International inland waterways	IE	IE	IE	IE	IE	IE	IE	NE	IE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA
1A3dii	National navigation (shipping)	✓	✓	IE	✓	✓	✓	✓	NE	✓	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NA	NA

NFR Code	Description	Main Pollutants				Particulate Matter					Priority Heavy Metals			Additional Heavy Metals						Persistent Organic Pollutants (POPs)			
		NO <sub>x</sub>	NM <sub>10</sub> VO <sub>C</sub>	SO <sub>x</sub>	NH <sub>3</sub>	PM <sub>2.5</sub>	PM <sub>10</sub>	TSP	BC		Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	PCDD/ PCDF	PAH	HCB	PCBs
1A3ei	Pipeline transport	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1A3eii	Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1A4ai	Commercial/Institutional: Stationary	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1A4aii	Commercial/Institutional: Mobile	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
1A4bi	Residential: Stationary	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1A4bii	Residential: Household and gardening (mobile)	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
1A4ci	Agriculture/Forestry/Fishing: Stationary	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	✓	✓	✓	✓	✓	NA	✓	NA	NA
1A4ciii	Agriculture/Forestry/Fishing: National fishing	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
1A5a	Other stationary (including military)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
1A5b	Other, Mobile	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
1B1a	Fugitive emission f. solid fuels: Coal mining & handling	NA	✓	NA	NA	✓	✓	✓	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1B1b	Fugitive emission from solid fuels: Solid fuel transformation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NA	NA
1B1c	Other fugitive emissions from solid fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1B2ai	Fugitive emissions oil: Exploration, production, transport	NA	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1B2aiv	Fugitive emissions oil: Refining and storage	NO	NO	NO	NO	NO	NO	NO	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1B2av	Distribution of oil products	NA	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1B2b	Fugitive emissions from natural gas	NA	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1B2c	Venting and flaring	NO	NO	NO	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NA	NO
1B2d	Other fugitive emissions from energy production	NA	NA	NA	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA

NFR Code	Description	Main Pollutants				Particulate Matter				CO	Priority Heavy Metals			Additional Heavy Metals						Persistent Organic Pollutants (POPs)			
		NO <sub>x</sub>	NM VOC	SO <sub>x</sub>	NH <sub>3</sub>	PM <sub>2.5</sub>	PM <sub>10</sub>	TSP	BC		Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	PCDD/ PCDF	PAH	HCB	PCBs
2A1	Cement production	NA	NA	NA	NA	NO	NO	NO	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2A2	Lime production	NA	NA	NA	NA	✓	✓	✓	✓	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2A3	Glass production	NA	NO	NA	NO	NO	NO	NO	NO	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NA	NA	NA	NA
2A5a	Quarrying and mining of minerals other than coal	NA	NA	NA	NA	✓	✓	✓	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2A5b	Construction and demolition	NA	NA	NA	NA	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2A5c	Storage, handling and transport of mineral products	NA	NA	NA	NA	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2A6	Other mineral products	NA	NA	NA	NA	NO	NO	NO	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2B1	Ammonia production	NO	NO	NA	NO	NA	NA	NA	NA	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2B2	Nitric acid production	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2B3	Adipic acid production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2B5	Carbide production	NA	NA	NA	NA	NA	NA	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2B6	Titanium dioxide production	NO	NA	NO	NA	NA	NA	NO	NA	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2B7	Soda ash production	NA	NA	NA	NO	NA	NA	NO	NA	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2B10a	Chemical industry: Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NA	NA	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2B10b	Storage, handling and transport of chemical products	NO	NO	NO	NO	NO	NO	NO	NO	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2C1	Iron and steel production	✓	✓	✓	NA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	✓	✓	✓	NA	✓
2C2	Ferroalloys production	NA	NA	NA	NA	NO	NO	NO	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2C3	Aluminium production	✓	NA	✓	NA	✓	✓	✓	✓	✓	NA	NA	NA	NA	NA	NA	NA	NA	NA	NE	✓	NE	NA
2C4	Magnesium production	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2C5	Lead production	NA	NA	NO	NA	NO	NO	NO	NA	NA	NO	NO	NO	NO	NA	NA	NO	NA	NO	NO	NA	NA	NO
2C6	Zinc production	NA	NA	NO	NA	NO	NO	NO	NA	NA	NO	NO	NO	NO	NA	NA	NO	NA	NO	NO	NA	NA	NO
2C7a	Copper production	NA	NA	NO	NA	NO	NO	NO	NO	NA	NO	NO	NO	NO	NO	NO	NO	NA	NA	NO	NA	NA	NO
2C7b	Nickel production	NA	NA	NO	NA	NA	NA	NO	NA	NA	NA	NA	NA	NA	NA	NA	NO	NA	NA	NA	NA	NA	NA

NFR Code	Description	Main Pollutants				Particulate Matter				CO	Priority Heavy Metals			Additional Heavy Metals						Persistent Organic Pollutants (POPs)			
		NO <sub>x</sub>	NM <sub>10</sub> VOC	SO <sub>x</sub>	NH <sub>3</sub>	PM <sub>2.5</sub>	PM <sub>10</sub>	TSP	BC		Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	PCDD/ PCDF	PAH	HCB	PCBs
2C7c	Other metal production	NA	NA	NO	NA	NA	NA	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2C7d	Storage, handling and transport of metal products	NA	NA	NA	NA	NO	NO	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2D3a	Domestic solvent use including fungicides	NA	✓	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2D3b	Road paving with asphalt	NA	NE	NA	NA	NO	NO	NO	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2D3c	Asphalt roofing	NA	NE	NA	NA	NO	NO	NO	NO	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2D3d	Coating applications	NA	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2D3e	Degreasing	NA	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2D3f	Dry cleaning	NA	NO	NA	NO	NA	NA	NO	NA	NA	NO	NA	NO	NO	NA	NA	NO	NO	NA	NA	NO	NA	NA
2D3g	Chemical products	NA	NO	NA	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2D3h	Printing	NA	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2D3i	Other solvent use	NA	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2G	Other product use	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NA	NE	NE	NE	NA	NA
2H1	Pulp and paper industry	NO	NO	NO	NA	NO	NO	NO	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2H2	Food and beverages industry	NA	✓	NA	NA	NA	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2H3	Other industrial processes	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2I	Wood processing	NA	NA	NA	NA	NA	NA	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2J	Production of POPs	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NE
2K	Consumption of POPs and heavy metals	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2L	Other production, consumption, storage, transportation / handling of bulk products	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3B1a	Dairy cattle	✓	✓	NA	✓	✓	✓	✓	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3B1b	Non-dairy cattle	✓	✓	NA	✓	✓	✓	✓	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3B2	Sheep	✓	✓	NA	✓	✓	✓	✓	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3B3	Swine	✓	✓	NA	✓	✓	✓	✓	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3B4a	Buffalo	NO	NO	NA	NO	NO	NO	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA



NFR Code	Description	Main Pollutants				Particulate Matter				CO	Priority Heavy Metals			Additional Heavy Metals						Persistent Organic Pollutants (POPs)			
		NO <sub>x</sub>	NMVOC	SO <sub>x</sub>	NH <sub>3</sub>	PM <sub>2.5</sub>	PM <sub>10</sub>	TSP	BC		Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	PCDD/ PCDF	PAH	HCB	PCBs
3B4d	Goats	✓	✓	NA	✓	✓	✓	✓	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3B4e	Horses	✓	✓	NA	✓	✓	✓	✓	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3B4f	Mules and asses	IE	IE	NA	NO	IE	IE	IE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3B4gi	Laying hens	✓	✓	NA	✓	✓	✓	✓	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3B4gii	Broilers	✓	✓	NA	✓	✓	✓	✓	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3B4giii	Turkeys	IE	IE	NA	IE	IE	IE	IE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3B4giv	Other poultry	IE	IE	NA	IE	IE	IE	IE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3B4h	Other animals	NO	NO	NA	NO	NO	NO	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3Da1	Inorganic N-fertilizers	✓	NA	NA	✓	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3Da2a	Animal manure applied to soils	✓	NA	NA	✓	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3Da2b	Sewage sludge applied to soils	NE	NA	NA	NE	NO	NO	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3Da2c	Other organic fertilisers applied to soils	NE	NA	NA	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3Da3	Urine and dung deposited by grazing animals	NE	NE	NA	✓	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3Da4	Crop residues applied to soils	NA	NA	NA	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3Db	Indirect emissions from managed soils	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3Dc	Farm-level agricultural operations	NA	NA	NA	NA	NO	NO	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3Dd	Off-farm storage, handling and transport of bulk agricultural products	NA	NA	NA	NA	NO	NO	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3De	Cultivated crops	NA	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3Df	Use of pesticides	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NE	NA	NA
3F	Field burning of agricultural residues	NE	NE	NE	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3I	Agriculture other	NO	NO	NO	NO	NO	NO	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5A	Biological treatment of waste - Solid waste disposal on land	NA	✓	NA	NA	✓	✓	✓	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5B1	Biological treatment of waste - Composting	NA	NA	NA	NO	NA	NA	NA	NA	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NFR Code	Description	Main Pollutants				Particulate Matter				CO	Priority Heavy Metals			Additional Heavy Metals						Persistent Organic Pollutants (POPs)			
		NO <sub>x</sub>	NMVOC	SO <sub>x</sub>	NH <sub>3</sub>	PM <sub>2.5</sub>	PM <sub>10</sub>	TSP	BC		Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	PCDD/ PCDF	PAH	HCB	PCBs
5B2	Biological treatment of waste - Anaerobic digestion at biogas facilities	NA	NA	NA	NO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5C1a	Municipal waste incineration	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5C1bi	Industrial waste incineration	NO	NO	NO	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NA	NA	NO	NA	NO	NA
5C1bii	Hazardous waste incineration	NO	NO	NO	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NA	NA	NO	NA	NO	NA
5C1biii	Clinical waste incineration	NO	NO	NO	NA	NO	NO	NO	NA	NO	NO	NO	NO	NO	NO	NO	NO	NA	NA	NO	NA	NO	NO
5C1biv	Sewage sludge incineration	NA	NA	NA	NA	NO	NO	NO	NA	NO	NO	NO	NO	NO	NO	NO	NO	NA	NA	NO	NO	NO	NO
5C1bv	Cremation	NO	NO	NO	NA	NO	NO	NO	NA	NO	NO	NO	NO	NO	NO	NO	NO	NA	NA	NO	NO	NO	NO
5C1bvi	Other waste incineration	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5C2	Open burning of waste	NE	NE	NE	NA	NE	NE	NE	NE	NE	NE	NE	NA	NE	NE	NE	NA	NE	NE	NE	NE	NA	NA
5D1	Domestic wastewater handling	NA	NA	NA	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5D2	Industrial wastewater handling	NA	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5D3	Other wastewater handling	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5E	Other waste	NA	NA	NA	NO	NO	NO	NO	NA	NA	NO	NO	NO	NO	NO	NO	NA	NA	NA	NO	NA	NA	NA
6A	Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

## 2 Trend

### 2.1 Trend of emissions of main pollutants

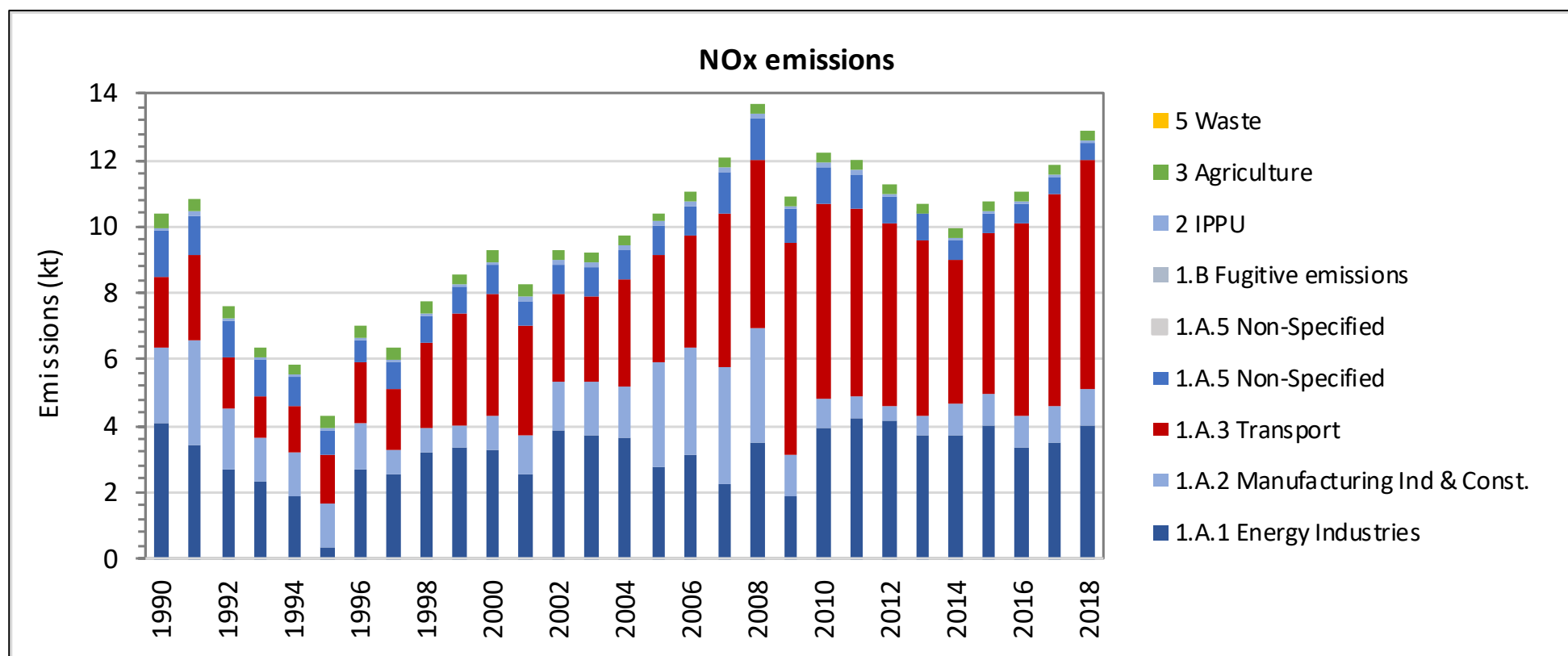


Figure 2.1 Nitrogen oxides (NOx) Emissions 1990 - 2019

Table 2.1 Nitrogen oxides (NOx) Emissions 1990 - 2019

NOx		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
kt	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
1990	10.37	9.85	4.08	2.29	2.09	1.39	NE	NA/NO	0.13	0.39	0.0552	0.33	NE	NA	NE/NA	NA
1991	10.87	10.35	3.39	3.21	2.52	1.22	NE	NA/NO	0.13	0.39	0.0550	0.34	NE	NA	NE/NA	NA
1992	7.59	7.13	2.66	1.88	1.53	1.07	NE	NA/NO	0.11	0.35	0.0515	0.29	NE	NA	NE/NA	NA
1993	6.36	5.98	2.29	1.35	1.22	1.12	NE	NA/NO	0.05	0.33	0.0493	0.28	NE	NA	NE/NA	NA
1994	5.86	5.50	1.89	1.35	1.36	0.90	NE	NA/NO	0.03	0.33	0.0502	0.28	NE	NA	NE/NA	NA
1995	4.30	3.88	0.32	1.31	1.47	0.77	NE	NA/NO	0.04	0.38	0.0513	0.33	NE	NA	NE/NA	NA
1996	7.01	6.58	2.69	1.41	1.82	0.66	NE	NA/NO	0.06	0.36	0.0512	0.31	NE	NA	NE/NA	NA
1997	6.35	5.92	2.52	0.78	1.83	0.79	NE	NA/NO	0.10	0.33	0.0501	0.28	NE	NA	NE/NA	NA
1998	7.73	7.32	3.22	0.70	2.62	0.79	NE	NA/NO	0.09	0.31	0.0499	0.26	NE	NA	NE/NA	NA
1999	8.57	8.16	3.36	0.64	3.41	0.75	NE	NA/NO	0.09	0.32	0.0495	0.27	NE	NA	NE/NA	NA
2000	9.26	8.82	3.30	1.03	3.68	0.82	NE	NA/NO	0.11	0.33	0.0481	0.29	NE	NA	NE/NA	NA
2001	8.24	7.78	2.56	1.11	3.37	0.73	NE	NA/NO	0.12	0.33	0.0477	0.28	NE	NA	NE/NA	NA
2002	9.30	8.88	3.89	1.42	2.66	0.90	NE	NA/NO	0.13	0.29	0.0488	0.24	NE	NA	NE/NA	NA
2003	9.23	8.80	3.70	1.62	2.58	0.90	NE	NA/NO	0.13	0.30	0.0485	0.25	NE	NA	NE/NA	NA
2004	9.70	9.28	3.62	1.55	3.23	0.88	NE	NA/NO	0.14	0.29	0.0326	0.25	NE	NA	NE/NA	NA
2005	10.43	10.01	2.74	3.21	3.19	0.87	NE	NA/NO	0.13	0.28	0.0320	0.25	NE	NA	NE/NA	NA
2006	11.05	10.63	3.12	3.23	3.42	0.86	NE	NA/NO	0.14	0.28	0.0314	0.25	NE	NA	NE/NA	NA
2007	12.06	11.63	2.25	3.55	4.57	1.26	NE	NA/NO	0.15	0.28	0.0294	0.26	NE	NA	NE/NA	NA
2008	13.68	13.26	3.52	3.42	5.05	1.27	NE	NA/NO	0.14	0.29	0.0285	0.26	NE	NA	NE/NA	NA
2009	10.93	10.57	1.84	1.28	6.39	1.05	NE	NA/NO	0.08	0.28	0.0276	0.26	NE	NA	NE/NA	NA

NO <sub>x</sub>		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
kt	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
2010	12.21	11.77	3.93	0.90	5.85	1.10	NE	NA/NO	0.13	0.31	0.0267	0.28	NE	NA	NE/NA	NA
2011	11.98	11.61	4.24	0.62	5.66	1.09	NE	NA/NO	0.10	0.27	0.0261	0.25	NE	NA	NE/NA	NA
2012	11.24	10.90	4.16	0.43	5.54	0.77	NE	NA/NO	0.08	0.27	0.0261	0.24	NE	NA	NE/NA	NA
2013	10.68	10.36	3.70	0.61	5.30	0.75	NE	NA/NO	0.05	0.27	0.0276	0.25	NE	NA	NE/NA	NA
2014	9.92	9.59	3.71	0.99	4.28	0.62	NE	NA/NO	0.04	0.29	0.0282	0.26	NE	NA	NE/NA	NA
2015	10.77	10.43	4.03	0.93	4.82	0.65	NE	NA/NO	0.05	0.29	0.0285	0.26	NE	NA	NE/NA	NA
2016	11.04	10.69	3.36	0.93	5.83	0.57	NE	NA/NO	0.05	0.30	0.0311	0.27	NE	NA	NE/NA	NA
2017	11.87	11.52	3.48	1.11	6.36	0.56	NE	NA/NO	0.05	0.30	0.0280	0.28	NE	NA	NE/NA	NA
2018	12.91	12.56	4.01	1.07	6.92	0.56	NE	NA/NO	0.05	0.30	0.0265	0.27	NE	NA	NE/NA	NA
2019																
Trend																
1990 - 2019	24.5%	27.6%	-1.7%	-53.2%	231.5%	-59.9%	NA	NA	-65.2%	-22.5%	-52.0%	-17.6%	NA	NA	NA	NA
2005 - 2019	23.8%	25.5%	46.3%	-66.5%	117.0%	-36.2%	NA	NA	-65.6%	6.1%	-17.3%	9.1%	NA	NA	NA	NA
2018 - 2019	8.7%	9.0%	15.0%	-3.6%	8.9%	-1.2%	NA	NA	-0.7%	-1.4%	-5.4%	-1.0%	NA	NA	NA	NA
Share in National Total																
1990	100%	95.0%	39.3%	22.1%	20.1%	13.4%	NA	NA	1.3%	3.7%	0.5%	3.2%	NA	NA	NA	NA
2005	100%	96.0%	26.3%	30.8%	30.6%	8.4%	NA	NA	1.3%	2.7%	0.3%	2.4%	NA	NA	NA	NA
2019	100%	97.3%	31.0%	8.3%	53.6%	4.3%	NA	NA	0.4%	2.3%	0.2%	2.1%	NA	NA	NA	NA

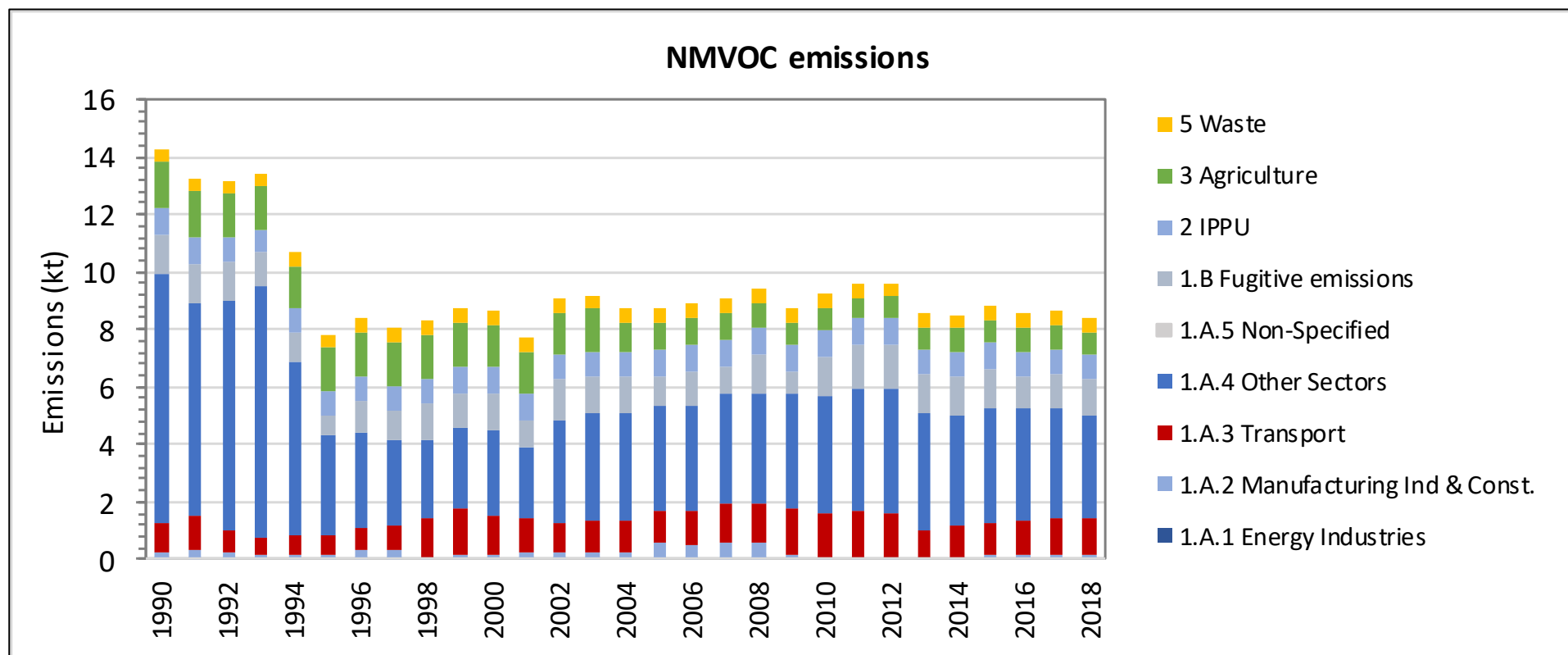


Figure 2.2 Non-Methane Volatile Organic Compounds (NMVOC) Emissions 1990 – 2019

Table 2.2 Non-Methane Volatile Organic Compounds (NMVOC) Emissions 1990 - 2019

NMVOC		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
kt	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
1990	14.11	11.17	0.03	0.12	0.99	8.63	NE	1.40	0.89	1.63	1.63	NE	NE	NA	0.43	NA
1991	13.05	10.11	0.02	0.16	1.16	7.38	NE	1.39	0.88	1.62	1.62	NE	NE	NA	0.43	NA
1992	13.01	10.21	0.02	0.10	0.78	7.97	NE	1.35	0.84	1.52	1.52	NE	NE	NA	0.44	NA
1993	13.28	10.57	0.02	0.07	0.56	8.77	NE	1.15	0.80	1.46	1.46	NE	NE	NA	0.44	NA
1994	10.57	7.78	0.01	0.07	0.62	6.07	NE	1.00	0.84	1.49	1.49	NE	NE	NA	0.46	NA
1995	7.73	4.87	0.00	0.07	0.66	3.48	NE	0.67	0.85	1.52	1.52	NE	NE	NA	0.48	NA
1996	8.17	5.31	0.02	0.09	0.79	3.29	NE	1.12	0.85	1.51	1.51	NE	NE	NA	0.50	NA
1997	7.80	4.95	0.02	0.06	0.85	2.99	NE	1.03	0.85	1.48	1.48	NE	NE	NA	0.51	NA
1998	8.28	5.39	0.02	0.04	1.35	2.72	NE	1.27	0.87	1.49	1.49	NE	NE	NA	0.53	NA
1999	8.59	5.67	0.02	0.04	1.58	2.81	NE	1.21	0.90	1.49	1.49	NE	NE	NA	0.54	NA
2000	8.62	5.73	0.02	0.05	1.44	2.96	NE	1.25	0.91	1.45	1.45	NE	NE	NA	0.53	NA
2001	7.58	4.70	0.02	0.06	1.19	2.47	NE	0.95	0.93	1.43	1.43	NE	NE	NA	0.52	NA
2002	8.94	6.11	0.03	0.08	0.97	3.59	NE	1.44	0.86	1.46	1.46	NE	NE	NA	0.51	NA
2003	9.10	6.23	0.03	0.08	1.13	3.70	NE	1.29	0.91	1.46	1.46	NE	NE	NA	0.50	NA
2004	8.61	6.24	0.03	0.08	1.14	3.77	NE	1.22	0.90	0.98	0.98	NE	NE	NA	0.49	NA
2005	8.33	5.97	0.02	0.19	1.10	3.63	NE	1.04	0.91	0.97	0.97	NE	NE	NA	0.48	NA
2006	8.62	6.30	0.02	0.18	1.20	3.69	NE	1.21	0.92	0.94	0.94	NE	NE	NA	0.46	NA
2007	8.67	6.35	0.01	0.20	1.36	3.81	NE	0.96	0.93	0.88	0.88	NE	NE	NA	0.51	NA
2008	9.07	6.79	0.02	0.20	1.37	3.81	NE	1.39	0.93	0.86	0.86	NE	NE	NA	0.48	NA
2009	8.67	6.45	0.01	0.07	1.63	3.97	NE	0.77	0.91	0.82	0.82	NE	NE	NA	0.50	NA

NMVOC		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
kt	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
2010	9.23	7.05	0.02	0.05	1.49	4.08	NE	1.40	0.89	0.80	0.80	NE	NE	NA	0.50	NA
2011	9.68	7.54	0.02	0.12	1.60	4.25	NE	1.55	0.89	0.74	0.74	NE	NE	NA	0.51	NA
2012	9.68	7.55	0.02	0.11	1.56	4.28	NE	1.58	0.89	0.77	0.77	NE	NE	NA	0.48	NA
2013	8.64	6.49	0.02	0.12	0.93	4.06	NE	1.35	0.88	0.79	0.79	NE	NE	NA	0.48	NA
2014	8.59	6.43	0.02	0.17	1.05	3.87	NE	1.32	0.87	0.81	0.81	NE	NE	NA	0.47	NA
2015	8.90	6.72	0.02	0.17	1.13	3.98	NE	1.42	0.88	0.81	0.81	NE	NE	NA	0.49	NA
2016	8.66	6.44	0.02	0.17	1.24	3.90	NE	1.12	0.88	0.84	0.84	NE	NE	NA	0.50	NA
2017	8.67	6.48	0.02	0.17	1.27	3.84	NE	1.18	0.88	0.80	0.80	NE	NE	NA	0.51	NA
2018	8.46	6.30	0.02	0.17	1.33	3.51	NE	1.28	0.88	0.76	0.76	NE	NE	NA	0.52	NA
2019																
Trend																
1990 - 2019	-40.0%	-43.6%	-23.7%	41.8%	34.2%	-59.3%	NA	-9.1%	-1.3%	-53.0%	-53.0%	NA	NA	NA	21.2%	NA
2005 - 2019	1.6%	5.5%	40.8%	-11.3%	20.5%	-3.4%	NA	23.0%	-3.7%	-20.9%	-20.9%	NA	NA	NA	8.6%	NA
2018 - 2019	-2.4%	-2.7%	15.2%	-0.7%	4.5%	-8.6%	NA	8.2%	-0.5%	-4.8%	-4.8%	NA	NA	NA	2.1%	NA
Share in National Total																
1990	100%	79.2%	0.2%	0.8%	7.0%	61.2%	NA	10.0%	6.3%	11.5%	11.5%	NA	NA	NA	3.0%	NA
2005	100%	71.7%	0.2%	2.3%	13.2%	43.6%	NA	12.5%	11.0%	11.6%	11.6%	NA	NA	NA	5.7%	NA
2019	100%	74.5%	0.3%	2.0%	15.7%	41.5%	NA	15.1%	10.4%	9.0%	9.0%	NA	NA	NA	6.1%	NA



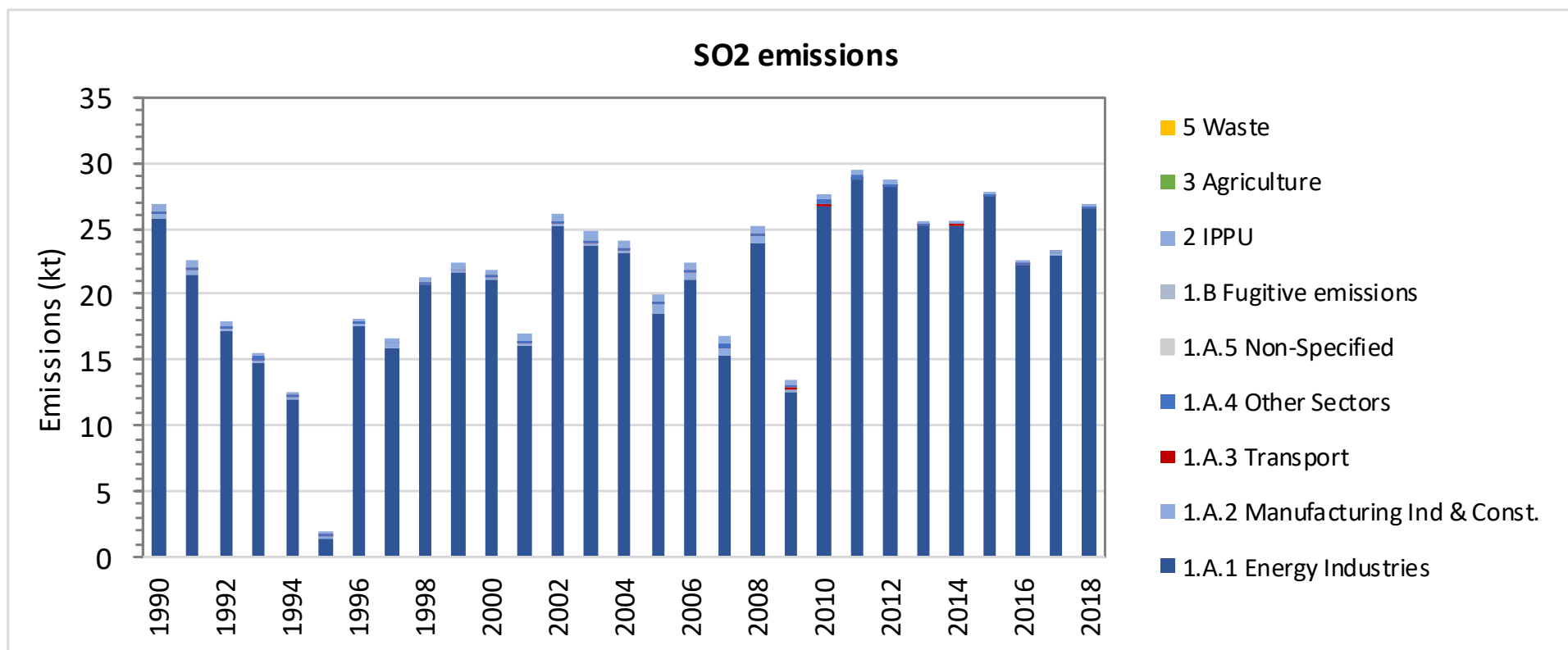


Figure 2.3 Sulphur dioxide (SO<sub>2</sub>) Emissions 1990 - 2019

Table 2.3 Sulphur dioxide (SO<sub>2</sub>) Emissions 1990 - 2019

SO <sub>2</sub>		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
kt	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
1990	26.87	26.33	25.81	0.25	0.00	0.26	NE	NA/NO	0.54	NA	NA	NA	NA	NA	NE/NA	NA
1991	22.61	22.09	21.52	0.34	0.00	0.23	NE	NA/NO	0.52	NA	NA	NA	NA	NA	NE/NA	NA
1992	18.01	17.55	17.14	0.22	0.00	0.20	NE	NA/NO	0.45	NA	NA	NA	NA	NA	NE/NA	NA
1993	15.46	15.26	14.87	0.18	0.00	0.21	NE	NA/NO	0.20	NA	NA	NA	NA	NA	NE/NA	NA
1994	12.47	12.40	12.08	0.17	0.00	0.16	NE	NA/NO	0.06	NA	NA	NA	NA	NA	NE/NA	NA
1995	1.90	1.76	1.46	0.18	0.00	0.13	NE	NA/NO	0.14	NA	NA	NA	NA	NA	NE/NA	NA
1996	18.21	17.95	17.53	0.32	0.00	0.10	NE	NA/NO	0.26	NA	NA	NA	NA	NA	NE/NA	NA
1997	16.73	16.31	15.89	0.29	0.00	0.13	NE	NA/NO	0.41	NA	NA	NA	NA	NA	NE/NA	NA
1998	21.33	20.94	20.74	0.06	0.00	0.14	NE	NA/NO	0.39	NA	NA	NA	NA	NA	NE/NA	NA
1999	22.32	21.91	21.60	0.18	0.00	0.13	NE	NA/NO	0.41	NA	NA	NA	NA	NA	NE/NA	NA
2000	21.88	21.40	21.15	0.09	0.00	0.15	NE	NA/NO	0.48	NA	NA	NA	NA	NA	NE/NA	NA
2001	16.92	16.38	16.00	0.19	0.05	0.13	NE	NA/NO	0.55	NA	NA	NA	NA	NA	NE/NA	NA
2002	26.17	25.59	25.14	0.25	0.02	0.17	NE	NA/NO	0.59	NA	NA	NA	NA	NA	NE/NA	NA
2003	24.74	24.14	23.75	0.19	0.02	0.17	NE	NA/NO	0.60	NA	NA	NA	NA	NA	NE/NA	NA
2004	24.08	23.46	23.09	0.19	0.02	0.17	NE	NA/NO	0.61	NA	NA	NA	NA	NA	NE/NA	NA
2005	20.01	19.40	18.59	0.59	0.06	0.17	NE	NA/NO	0.61	NA	NA	NA	NA	NA	NE/NA	NA
2006	22.48	21.86	21.20	0.44	0.05	0.16	NE	NA/NO	0.62	NA	NA	NA	NA	NA	NE/NA	NA
2007	16.82	16.19	15.27	0.58	0.10	0.24	NE	NA/NO	0.63	NA	NA	NA	NA	NA	NE/NA	NA
2008	25.24	24.67	23.89	0.53	0.01	0.25	NE	NA/NO	0.57	NA	NA	NA	NA	NA	NE/NA	NA
2009	13.38	13.06	12.51	0.16	0.17	0.22	NE	NA/NO	0.32	NA	NA	NA	NA	NA	NE/NA	NA

SO <sub>2</sub>		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
kt	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
2010	27.71	27.17	26.64	0.08	0.22	0.23	NE	NA/NO	0.54	NA	NA	NA	NA	NA	NE/NA	NA
2011	29.50	29.03	28.75	0.06	0.01	0.22	NE	NA/NO	0.47	NA	NA	NA	NA	NA	NE/NA	NA
2012	28.81	28.44	28.21	0.04	0.01	0.18	NE	NA/NO	0.37	NA	NA	NA	NA	NA	NE/NA	NA
2013	25.64	25.39	25.16	0.05	0.01	0.17	NE	NA/NO	0.24	NA	NA	NA	NA	NA	NE/NA	NA
2014	25.62	25.40	25.20	0.09	0.01	0.10	NE	NA/NO	0.21	NA	NA	NA	NA	NA	NE/NA	NA
2015	27.82	27.61	27.39	0.11	0.01	0.11	NE	NA/NO	0.21	NA	NA	NA	NA	NA	NE/NA	NA
2016	22.62	22.42	22.20	0.10	0.01	0.11	NE	NA/NO	0.20	NA	NA	NA	NA	NA	NE/NA	NA
2017	23.39	23.19	22.95	0.11	0.01	0.11	NE	NA/NO	0.21	NA	NA	NA	NA	NA	NE/NA	NA
2018	26.88	26.68	26.45	0.11	0.01	0.11	NE	NA/NO	0.20	NA	NA	NA	NA	NA	NE/NA	NA
2019																
Trend																
1990 - 2019	0.0%	1.3%	2.5%	-56.5%	272.5%	-59.8%	NA	NA	-62.3%	NA	NA	NA	NA	NA	NA	NA
2005 - 2019	34.3%	37.5%	42.3%	-81.2%	-78.8%	-38.1%	NA	NA	-66.5%	NA	NA	NA	NA	NA	NA	NA
2018 - 2019	14.9%	15.1%	15.2%	-3.5%	2.7%	-3.3%	NA	NA	-0.7%	NA	NA	NA	NA	NA	NA	NA
Share in National Total																
1990	100%	98.0%	96.1%	0.9%	0.0%	1.0%	NA	NA	2.0%	NA	NA	NA	NA	NA	NA	NA
2005	100%	97.0%	92.9%	2.9%	0.3%	0.8%	NA	NA	3.0%	NA	NA	NA	NA	NA	NA	NA
2019	100%	99.2%	98.4%	0.4%	0.0%	0.4%	NA	NA	0.8%	NA	NA	NA	NA	NA	NA	NA

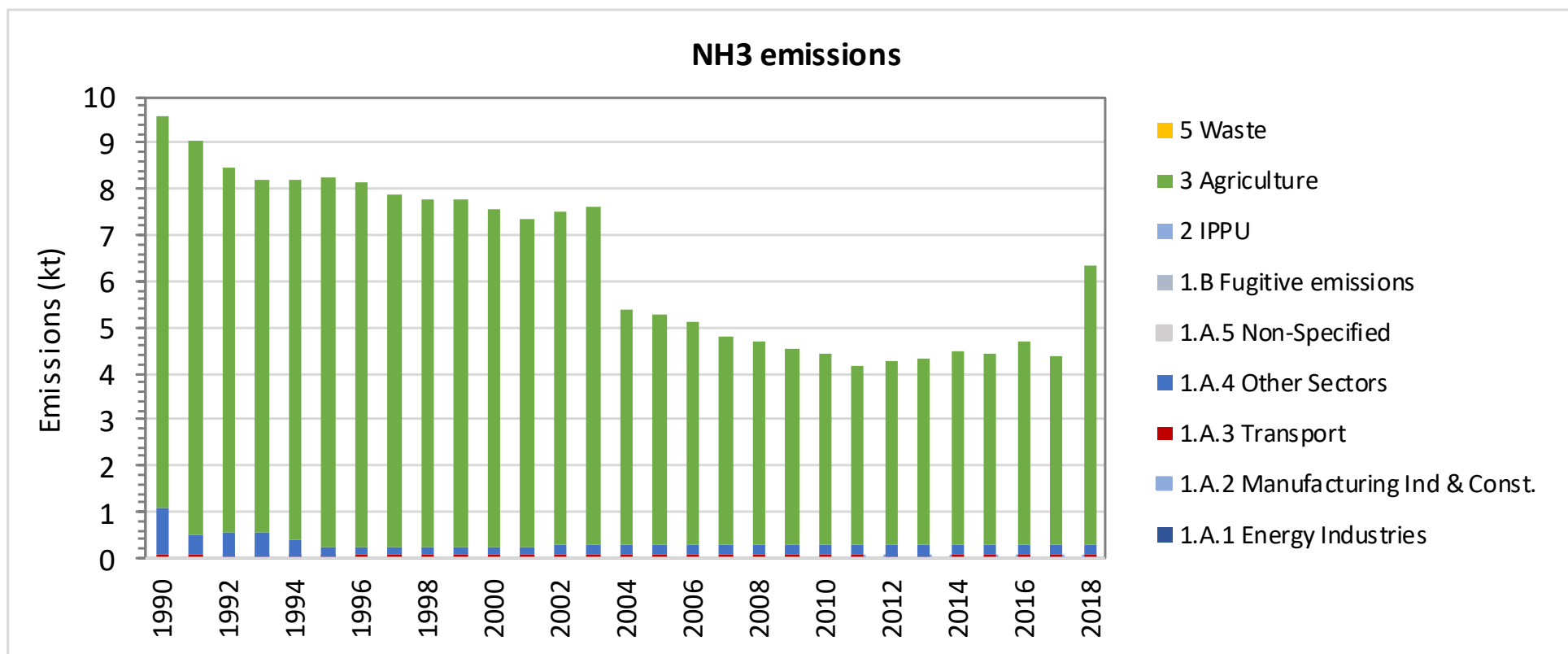


Figure 2.4 Ammonia (NH3) Emissions 1990 - 2019

Table 2.4 Ammonia (NH3) Emissions 1990 - 2019

NH3		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
kt	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
1990	9.60	1.07	NO	NO	0.07	1.00	NE	NA/NO	NA	8.53	5.889	2.64	NE	NO	NA	NA
1991	9.05	0.52	NO	NO	0.07	0.45	NE	NA/NO	NA	8.53	5.882	2.64	NE	NO	NA	NA
1992	8.47	0.54	NO	NO	0.05	0.49	NE	NA/NO	NA	7.94	5.504	2.43	NE	NO	NA	NA
1993	8.20	0.57	NO	NO	0.03	0.54	NE	NA/NO	NA	7.63	5.299	2.33	NE	NO	NA	NA
1994	8.18	0.41	NO	NO	0.04	0.37	NE	NA/NO	NA	7.77	5.394	2.37	NE	NO	NA	NA
1995	8.23	0.25	NO	NO	0.04	0.21	NE	NA/NO	NA	7.98	5.502	2.47	NE	NO	NA	NA
1996	8.16	0.25	NO	NO	0.05	0.20	NE	NA/NO	NA	7.91	5.478	2.43	NE	NO	NA	NA
1997	7.91	0.24	NO	NO	0.06	0.18	NE	NA/NO	NA	7.67	5.345	2.32	NE	NO	NA	NA
1998	7.79	0.24	NO	NO	0.08	0.16	NE	NA/NO	NA	7.55	5.304	2.25	NE	NO	NA	NA
1999	7.79	0.26	NO	NO	0.09	0.17	NE	NA/NO	NA	7.54	5.291	2.24	NE	NO	NA	NA
2000	7.55	0.25	NO	NO	0.07	0.18	NE	NA/NO	NA	7.30	5.111	2.19	NE	NO	NA	NA
2001	7.36	0.21	NO	NO	0.06	0.15	NE	NA/NO	NA	7.14	5.023	2.12	NE	NO	NA	NA
2002	7.52	0.27	NO	NO	0.05	0.22	NE	NA/NO	NA	7.25	5.127	2.12	NE	NO	NA	NA
2003	7.61	0.28	NO	NO	0.06	0.23	NE	NA/NO	NA	7.33	5.163	2.16	NE	NO	NA	NA
2004	5.39	0.29	NO	NO	0.06	0.23	NE	NA/NO	NA	5.10	3.551	1.55	NE	NO	NA	NA
2005	5.27	0.27	NO	NO	0.05	0.22	NE	NA/NO	NA	4.99	3.476	1.52	NE	NO	NA	NA
2006	5.12	0.28	NO	NO	0.05	0.23	NE	NA/NO	NA	4.84	3.371	1.47	NE	NO	NA	NA
2007	4.81	0.29	NO	NO	0.05	0.24	NE	NA/NO	NA	4.52	3.151	1.37	NE	NO	NA	NA
2008	4.69	0.29	NO	NO	0.05	0.24	NE	NA/NO	NA	4.41	3.069	1.34	NE	NO	NA	NA

NH3		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
kt	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
2009	4.54	0.31	NO	NO	0.06	0.25	NE	NA/NO	NA	4.23	2.946	1.28	NE	NO	NA	NA
2010	4.45	0.30	NO	NO	0.06	0.25	NE	NA/NO	NA	4.14	2.867	1.28	NE	NO	NA	NA
2011	4.18	0.31	NO	0.01	0.04	0.26	NE	NA/NO	NA	3.87	2.701	1.17	NE	NO	NA	NA
2012	4.29	0.31	NO	0.01	0.03	0.27	NE	NA/NO	NA	3.98	2.786	1.19	NE	NO	NA	NA
2013	4.33	0.29	NO	0.01	0.03	0.25	NE	NA/NO	NA	4.03	2.824	1.21	NE	NO	NA	NA
2014	4.48	0.29	NO	0.01	0.03	0.24	NE	NA/NO	NA	4.19	2.926	1.26	NE	NO	NA	NA
2015	4.45	0.30	NO	0.01	0.03	0.25	NE	NA/NO	NA	4.16	2.911	1.25	NE	NO	NA	NA
2016	4.67	0.29	NO	0.01	0.04	0.24	NE	NA/NO	NA	4.38	3.111	1.27	NE	NO	NA	NA
2017	4.38	0.29	NO	0.01	0.04	0.24	NE	NA/NO	NA	4.09	2.872	1.22	NE	NO	NA	NA
2018	6.36	0.27	NO	0.01	0.04	0.22	NE	NA/NO	NA	6.09	4.157	1.93	NE	NO	NA	NA
2019																
Trend																
1990 - 2019	-33.8%	-74.7%	NA	NA	-44.9%	-78.0%	NA	NA	NA	-28.7%	-29.4%	-27.0%	NA	NA	NA	NA
2005 - 2019	20.7%	-1.0%	NA	NA	-27.7%	-0.7%	NA	NA	NA	21.9%	19.6%	27.2%	NA	NA	NA	NA
2018 - 2019	45.1%	-6.8%	NA	0.0%	1.4%	-8.4%	NA	NA	NA	48.7%	44.8%	58.1%	NA	NA	NA	NA
Share in National Total																
1990	100%	11.1%	NA	NA	0.7%	10.4%	NA	NA	NA	88.9%	61.3%	27.5%	NA	NA	NA	NA
2005	100%	5.2%	NA	NA	1.0%	4.2%	NA	NA	NA	94.8%	66.0%	28.8%	NA	NA	NA	NA
2019	100%	4.2%	NA	0.2%	0.6%	3.5%	NA	NA	NA	95.8%	65.4%	30.4%	NA	NA	NA	NA

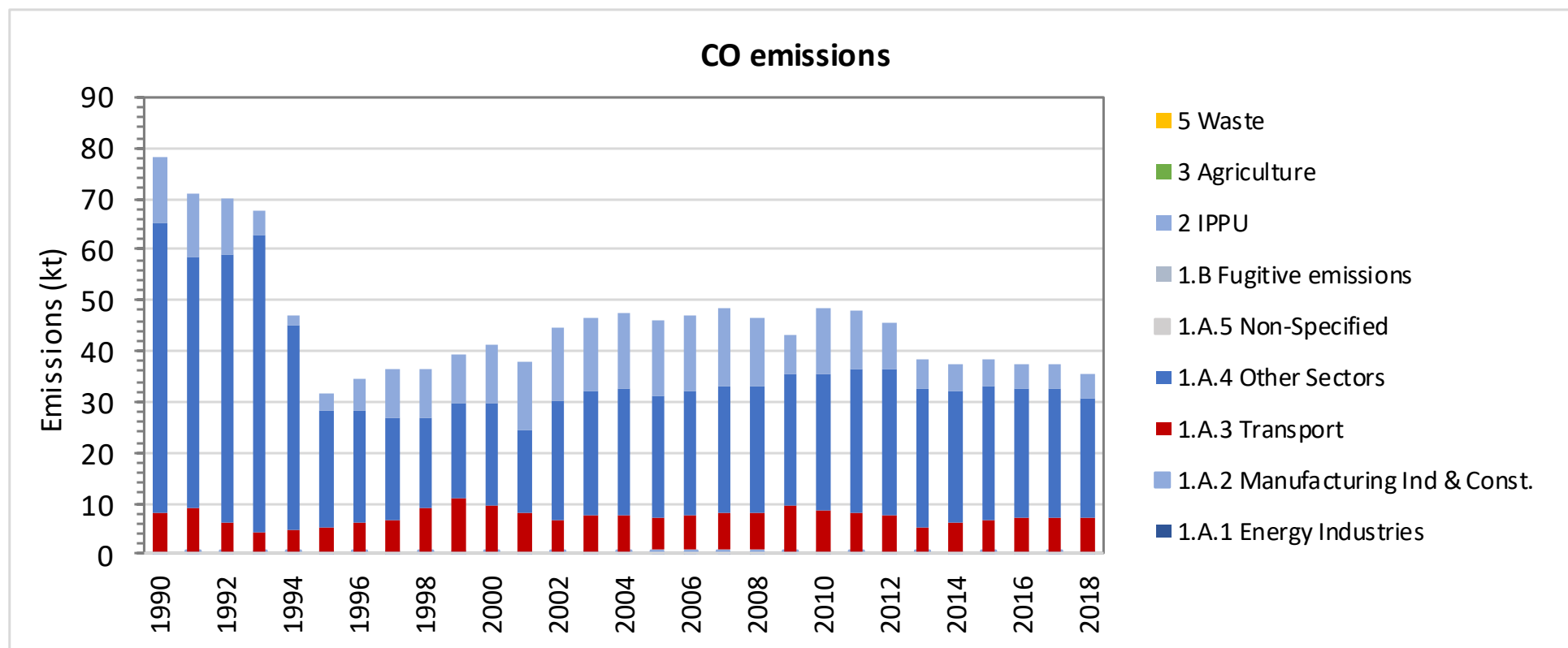


Figure 2.5 Carbon monoxide (CO) Emissions 1990 - 2019

Table 2.5 Carbon monoxide (CO) Emissions 1990 - 2019

CO		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
kt	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
1990	78.39	65.38	0.19	0.34	7.51	57.34	NE	NA	13.00	NA	NA	NA	NA	NA	NO	NA
1991	70.97	58.36	0.15	0.46	8.70	49.05	NE	NA	12.61	NA	NA	NA	NA	NA	NO	NA
1992	70.13	59.19	0.11	0.29	5.80	52.99	NE	NA	10.94	NA	NA	NA	NA	NA	NO	NA
1993	67.67	62.90	0.10	0.23	4.19	58.38	NE	NA	4.77	NA	NA	NA	NA	NA	NO	NA
1994	46.86	45.29	0.08	0.22	4.64	40.35	NE	NA	1.57	NA	NA	NA	NA	NA	NO	NA
1995	31.41	28.13	0.03	0.23	4.86	23.01	NE	NA	3.28	NA	NA	NA	NA	NA	NO	NA
1996	34.47	28.16	0.11	0.38	5.85	21.82	NE	NA	6.30	NA	NA	NA	NA	NA	NO	NA
1997	36.51	26.62	0.12	0.33	6.37	19.80	NE	NA	9.90	NA	NA	NA	NA	NA	NO	NA
1998	36.25	26.82	0.14	0.09	8.62	17.97	NE	NA	9.43	NA	NA	NA	NA	NA	NO	NA
1999	39.43	29.57	0.15	0.21	10.59	18.62	NE	NA	9.86	NA	NA	NA	NA	NA	NO	NA
2000	41.40	29.80	0.14	0.13	9.24	20.28	NE	NA	11.61	NA	NA	NA	NA	NA	NO	NA
2001	37.63	24.47	0.12	0.24	7.76	16.35	NE	NA	13.16	NA	NA	NA	NA	NA	NO	NA
2002	44.38	30.26	0.17	0.31	6.02	23.76	NE	NA	14.12	NA	NA	NA	NA	NA	NO	NA
2003	46.62	32.10	0.16	0.26	7.15	24.53	NE	NA	14.53	NA	NA	NA	NA	NA	NO	NA
2004	47.44	32.69	0.16	0.25	7.29	24.99	NE	NA	14.75	NA	NA	NA	NA	NA	NO	NA
2005	46.01	31.39	0.10	0.72	6.54	24.03	NE	NA	14.62	NA	NA	NA	NA	NA	NO	NA
2006	46.88	31.99	0.11	0.57	6.96	24.34	NE	NA	14.89	NA	NA	NA	NA	NA	NO	NA
2007	48.23	33.03	0.08	0.72	7.46	24.77	NE	NA	15.20	NA	NA	NA	NA	NA	NO	NA
2008	46.59	32.89	0.13	0.68	7.31	24.78	NE	NA	13.70	NA	NA	NA	NA	NA	NO	NA



CO		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
kt	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
2009	43.16	35.38	0.07	0.22	9.18	25.92	NE	NA	7.78	NA	NA	NA	NA	NA	NO	NA
2010	48.58	35.58	0.14	0.12	8.38	26.94	NE	NA	13.00	NA	NA	NA	NA	NA	NO	NA
2011	47.91	36.61	0.15	0.24	7.72	28.50	NE	NA	11.29	NA	NA	NA	NA	NA	NO	NA
2012	45.46	36.49	0.15	0.22	7.38	28.74	NE	NA	8.97	NA	NA	NA	NA	NA	NO	NA
2013	38.21	32.37	0.13	0.24	4.73	27.28	NE	NA	5.83	NA	NA	NA	NA	NA	NO	NA
2014	37.16	32.00	0.13	0.35	5.61	25.91	NE	NA	5.16	NA	NA	NA	NA	NA	NO	NA
2015	38.28	33.12	0.14	0.37	6.01	26.60	NE	NA	5.16	NA	NA	NA	NA	NA	NO	NA
2016	37.62	32.79	0.12	0.36	6.49	25.82	NE	NA	4.82	NA	NA	NA	NA	NA	NO	NA
2017	37.45	32.51	0.12	0.36	6.67	25.36	NE	NA	4.93	NA	NA	NA	NA	NA	NO	NA
2018	35.45	30.55	0.14	0.36	6.88	23.17	NE	NA	4.90	NA	NA	NA	NA	NA	NO	NA
2019																
Trend																
1990 - 2019	-54.8%	-53.3%	-24.1%	4.2%	-8.4%	-59.6%	NA	NA	-62.3%	NA	NA	NA	NA	NA	NA	NA
2005 - 2019	-23.0%	-2.7%	45.0%	-50.5%	5.2%	-3.6%	NA	NA	-66.5%	NA	NA	NA	NA	NA	NA	NA
2018 - 2019	-5.3%	-6.0%	15.0%	-1.2%	3.1%	-8.6%	NA	NA	-0.7%	NA	NA	NA	NA	NA	NA	NA
Share in National Total																
1990	100%	83.4%	0.2%	0.4%	9.6%	73.2%	NA	NA	16.6%	NA	NA	NA	NA	NA	NA	NA
2005	100%	68.2%	0.2%	1.6%	14.2%	52.2%	NA	NA	31.8%	NA	NA	NA	NA	NA	NA	NA
2019	100%	86.2%	0.4%	1.0%	19.4%	65.4%	NA	NA	13.8%	NA	NA	NA	NA	NA	NA	NA

## 2.2 Trend of emissions of particulate matter (PM)

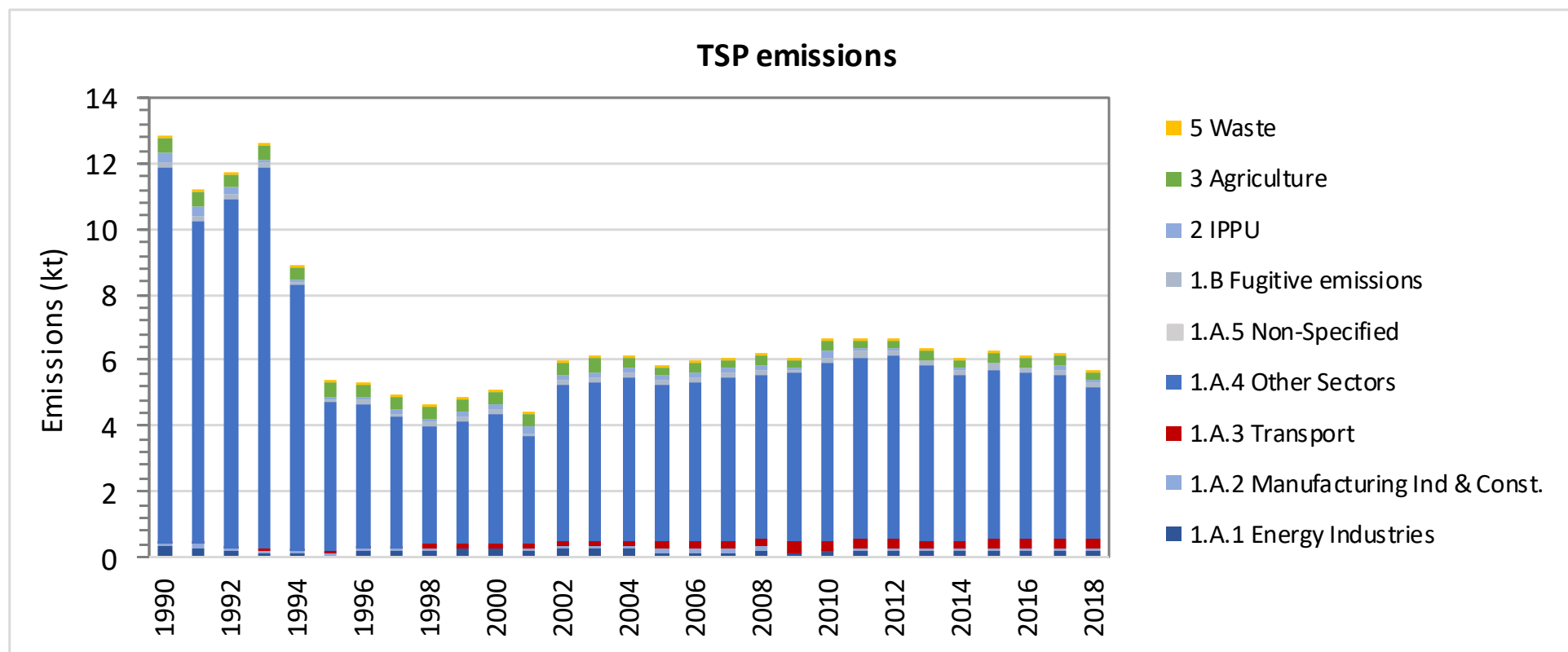


Figure 2.6 TSP Emissions 1990 - 2019

Table 2.6 TSP Emissions 1990 - 2019

TSP		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
kt	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
1990	12.79	12.06	0.30	0.10	0.05	11.46	NE	0.16	0.26	0.46	0.46	NA/NO	NE	NA	0.0001	NA
1991	11.12	10.40	0.25	0.13	0.05	9.81	NE	0.15	0.27	0.46	0.46	NA/NO	NE	NA	0.0001	NA
1992	11.68	11.04	0.18	0.08	0.03	10.60	NE	0.15	0.21	0.43	0.43	NA/NO	NE	NA	0.0001	NA
1993	12.53	12.04	0.15	0.06	0.03	11.68	NE	0.13	0.08	0.41	0.41	NA/NO	NE	NA	0.0001	NA
1994	8.84	8.41	0.13	0.06	0.03	8.07	NE	0.11	0.02	0.41	0.41	NA/NO	NE	NA	0.0001	NA
1995	5.30	4.83	0.06	0.06	0.03	4.60	NE	0.07	0.05	0.42	0.42	NA/NO	NE	NA	0.0001	NA
1996	5.29	4.78	0.17	0.08	0.04	4.36	NE	0.13	0.10	0.41	0.41	NA/NO	NE	NA	0.0001	NA
1997	4.90	4.37	0.19	0.06	0.04	3.96	NE	0.11	0.13	0.40	0.40	NA/NO	NE	NA	0.0002	NA
1998	4.62	4.11	0.22	0.03	0.13	3.59	NE	0.14	0.10	0.40	0.40	NA/NO	NE	NA	0.0002	NA
1999	4.80	4.28	0.24	0.04	0.15	3.72	NE	0.13	0.13	0.39	0.39	NA/NO	NE	NA	0.0002	NA
2000	5.02	4.48	0.23	0.04	0.17	3.90	NE	0.14	0.15	0.39	0.39	NA/NO	NE	NA	0.0002	NA
2001	4.35	3.78	0.21	0.06	0.15	3.27	NE	0.11	0.18	0.39	0.39	NA/NO	NE	NA	0.0002	NA
2002	5.95	5.38	0.26	0.07	0.13	4.75	NE	0.16	0.17	0.39	0.39	NA/NO	NE	NA	0.0002	NA
2003	6.06	5.50	0.26	0.07	0.13	4.91	NE	0.14	0.16	0.40	0.40	NA/NO	NE	NA	0.0001	NA
2004	6.04	5.60	0.26	0.07	0.15	5.00	NE	0.14	0.18	0.26	0.26	NA/NO	NE	NA	0.0001	NA
2005	5.80	5.38	0.13	0.16	0.16	4.81	NE	0.12	0.16	0.26	0.26	NA/NO	NE	NA	0.0001	NA
2006	5.90	5.48	0.15	0.14	0.18	4.87	NE	0.13	0.17	0.25	0.25	NA/NO	NE	NA	0.0001	NA
2007	6.02	5.60	0.11	0.17	0.24	4.97	NE	0.11	0.17	0.25	0.25	NA/NO	NE	NA	0.0002	NA
2008	6.11	5.71	0.17	0.16	0.25	4.97	NE	0.15	0.18	0.23	0.23	NA/NO	NE	NA	0.0001	NA
2009	6.02	5.74	0.09	0.06	0.31	5.20	NE	0.09	0.06	0.22	0.22	NA/NO	NE	NA	0.0001	NA

TSP		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
kt	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
2010	6.56	6.07	0.19	0.03	0.30	5.39	NE	0.16	0.26	0.23	0.23	NA/NO	NE	NA	0.0001	NA
2011	6.57	6.27	0.20	0.06	0.27	5.56	NE	0.17	0.09	0.21	0.21	NA/NO	NE	NA	0.0002	NA
2012	6.61	6.32	0.20	0.06	0.28	5.61	NE	0.18	0.05	0.24	0.24	NA/NO	NE	NA	0.0001	NA
2013	6.26	5.97	0.18	0.06	0.27	5.32	NE	0.15	0.04	0.25	0.25	NA/NO	NE	NA	0.0001	NA
2014	6.02	5.72	0.18	0.09	0.22	5.08	NE	0.15	0.04	0.26	0.26	NA/NO	NE	NA	0.0001	NA
2015	6.19	5.89	0.19	0.10	0.24	5.21	NE	0.16	0.03	0.26	0.26	NA/NO	NE	NA	0.0001	NA
2016	6.11	5.77	0.16	0.10	0.28	5.11	NE	0.12	0.03	0.32	0.32	NA/NO	NE	NA	0.0001	NA
2017	6.12	5.72	0.16	0.10	0.29	5.04	NE	0.13	0.12	0.28	0.28	NA/NO	NE	NA	0.0002	NA
2018	5.66	5.32	0.19	0.09	0.31	4.59	NE	0.14	0.07	0.26	0.26	NA/NO	NE	NA	0.0002	NA
2019																
Trend																
1990 - 2019	-55.8%	-55.9%	-38.5%	-0.8%	584.6%	-60.0%	NA	-9.1%	-72.1%	-43.4%	-43.4%	NA	NA	NA	21.2%	21.2%
2005 - 2019	-2.6%	-1.1%	40.8%	-42.5%	91.0%	-4.5%	NA	23.0%	-55.6%	0.9%	0.9%	NA	NA	NA	8.6%	8.6%
2018 - 2019	-7.6%	-6.9%	15.1%	-1.7%	8.0%	-9.0%	NA	8.2%	-39.1%	-8.2%	-8.2%	NA	NA	NA	2.1%	2.1%
Share in National Total																
1990	100%	94.4%	2.4%	0.7%	0.4%	89.7%	NA	1.2%	2.1%	3.6%	3.6%	NA	NA	NA	0.0%	0.0%
2005	100%	92.7%	2.3%	2.8%	2.8%	82.8%	NA	2.0%	2.8%	4.4%	4.4%	NA	NA	NA	0.0%	0.0%
2019	100%	94.1%	3.3%	1.7%	5.5%	81.1%	NA	2.5%	1.3%	4.6%	4.6%	NA	NA	NA	0.0%	0.0%

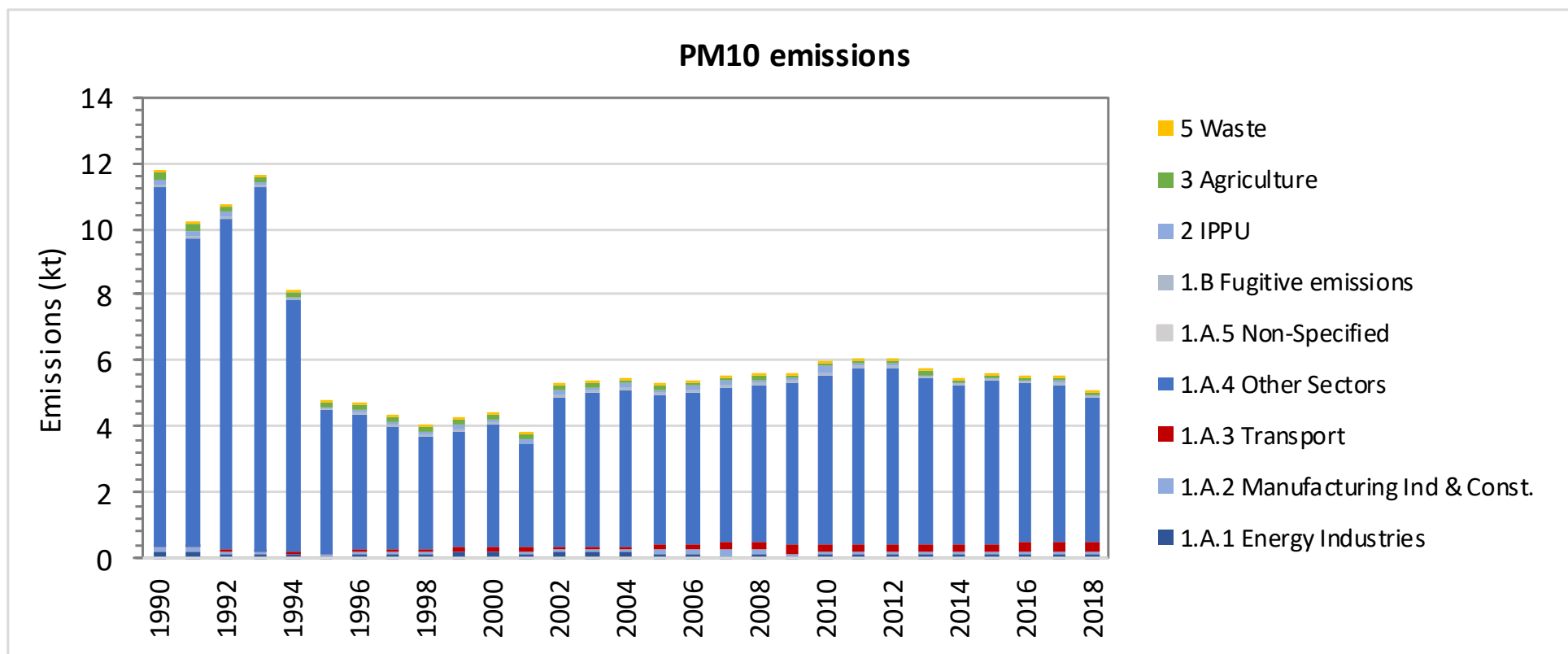


Figure 2.7 PM10 Emissions 1990 - 2019

Table 2.7 PM10 Emissions 1990 - 2019

PM10		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
kt	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
1990	11.70	11.32	0.21	0.09	0.05	10.89	NE	0.07	0.21	0.17	0.171	NE	NE	NA	0.0001	NA
1991	10.13	9.75	0.17	0.13	0.05	9.32	NE	0.07	0.21	0.17	0.171	NE	NE	NA	0.0001	NA
1992	10.70	10.37	0.12	0.08	0.03	10.07	NE	0.07	0.16	0.16	0.160	NE	NE	NA	0.0001	NA
1993	11.57	11.34	0.10	0.06	0.03	11.09	NE	0.06	0.07	0.15	0.153	NE	NE	NA	0.0001	NA
1994	8.08	7.90	0.09	0.06	0.03	7.67	NE	0.05	0.02	0.16	0.155	NE	NE	NA	0.0001	NA
1995	4.74	4.54	0.04	0.06	0.03	4.37	NE	0.04	0.04	0.16	0.158	NE	NE	NA	0.0001	NA
1996	4.67	4.44	0.12	0.08	0.04	4.14	NE	0.06	0.07	0.16	0.157	NE	NE	NA	0.0001	NA
1997	4.30	4.05	0.13	0.06	0.04	3.76	NE	0.05	0.09	0.15	0.152	NE	NE	NA	0.0001	NA
1998	4.00	3.77	0.15	0.03	0.11	3.41	NE	0.07	0.08	0.15	0.151	NE	NE	NA	0.0001	NA
1999	4.18	3.93	0.16	0.04	0.13	3.54	NE	0.06	0.10	0.15	0.148	NE	NE	NA	0.0001	NA
2000	4.37	4.12	0.16	0.04	0.15	3.71	NE	0.07	0.11	0.15	0.145	NE	NE	NA	0.0001	NA
2001	3.76	3.49	0.14	0.05	0.13	3.11	NE	0.05	0.13	0.14	0.142	NE	NE	NA	0.0001	NA
2002	5.24	4.96	0.18	0.07	0.12	4.52	NE	0.08	0.13	0.15	0.145	NE	NE	NA	0.0001	NA
2003	5.35	5.09	0.18	0.07	0.11	4.66	NE	0.07	0.12	0.15	0.147	NE	NE	NA	0.0001	NA
2004	5.42	5.19	0.18	0.07	0.13	4.75	NE	0.06	0.13	0.10	0.100	NE	NE	NA	0.0001	NA
2005	5.24	5.02	0.09	0.16	0.15	4.57	NE	0.05	0.12	0.10	0.098	NE	NE	NA	0.0001	NA
2006	5.32	5.10	0.10	0.14	0.16	4.63	NE	0.06	0.13	0.10	0.095	NE	NE	NA	0.0001	NA
2007	5.45	5.24	0.07	0.17	0.22	4.73	NE	0.05	0.12	0.09	0.091	NE	NE	NA	0.0001	NA
2008	5.51	5.30	0.11	0.16	0.22	4.73	NE	0.07	0.13	0.09	0.087	NE	NE	NA	0.0001	NA
2009	5.52	5.38	0.06	0.05	0.28	4.94	NE	0.04	0.05	0.08	0.083	NE	NE	NA	0.0001	NA

PM10		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
kt	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
2010	5.93	5.64	0.13	0.03	0.27	5.12	NE	0.07	0.21	0.08	0.084	NE	NE	NA	0.0001	NA
2011	5.96	5.81	0.14	0.06	0.25	5.28	NE	0.08	0.07	0.08	0.078	NE	NE	NA	0.0001	NA
2012	5.98	5.86	0.14	0.05	0.25	5.33	NE	0.08	0.04	0.09	0.086	NE	NE	NA	0.0001	NA
2013	5.66	5.54	0.12	0.06	0.24	5.05	NE	0.07	0.03	0.09	0.087	NE	NE	NA	0.0001	NA
2014	5.42	5.31	0.12	0.09	0.20	4.83	NE	0.07	0.03	0.09	0.089	NE	NE	NA	0.0001	NA
2015	5.58	5.46	0.13	0.10	0.22	4.95	NE	0.07	0.02	0.09	0.089	NE	NE	NA	0.0001	NA
2016	5.49	5.37	0.11	0.09	0.25	4.86	NE	0.06	0.02	0.10	0.098	NE	NE	NA	0.0001	NA
2017	5.47	5.31	0.11	0.09	0.26	4.79	NE	0.06	0.07	0.09	0.092	NE	NE	NA	0.0001	NA
2018	5.06	4.93	0.13	0.09	0.28	4.36	NE	0.07	0.04	0.09	0.086	NE	NE	NA	0.0001	NA
2019																
Trend																
1990 - 2019	-56.8%	-56.5%	-39.5%	-3.1%	521.8%	-60.0%	NA	-9.1%	-78.9%	-49.5%	-49.5%	NA	NA	NA	21.2%	NA
2005 - 2019	-3.4%	-1.8%	41.3%	-43.2%	93.6%	-4.6%	NA	23.0%	-62.0%	-12.1%	-12.1%	NA	NA	NA	8.6%	NA
2018 - 2019	-7.6%	-7.3%	15.1%	-1.8%	8.4%	-8.9%	NA	8.2%	-34.2%	-6.5%	-6.5%	NA	NA	NA	2.1%	NA
Share in National Total																
1990	100%	96.7%	1.8%	0.8%	0.4%	93.1%	NA	0.6%	1.8%	1.5%	1.5%	NA	NA	NA	0.0%	NA
2005	100%	95.9%	1.7%	3.1%	2.8%	87.2%	NA	1.0%	2.2%	1.9%	1.9%	NA	NA	NA	0.0%	NA
2019	100%	97.4%	2.5%	1.8%	5.6%	86.2%	NA	1.3%	0.9%	1.7%	1.7%	NA	NA	NA	0.0%	NA

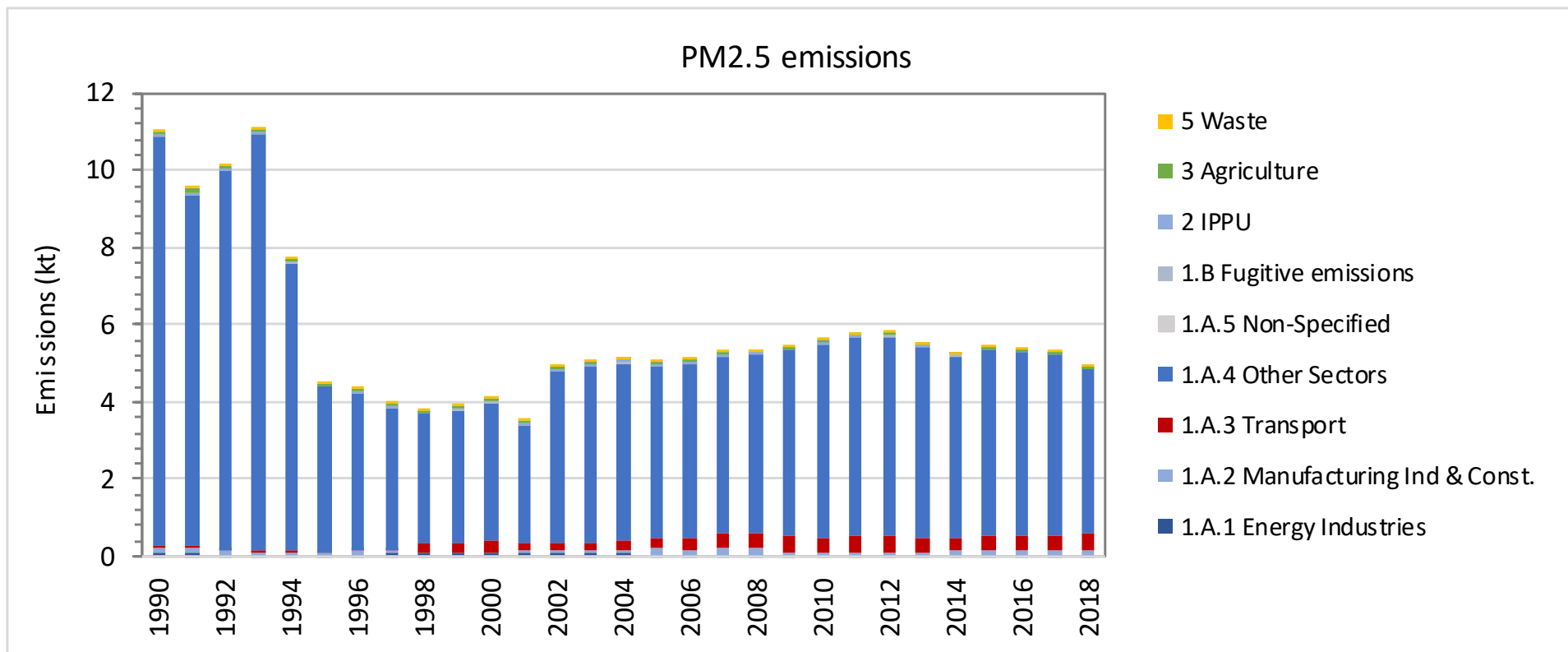


Figure 2.8 PM2.5 Emissions 1990 - 2019



Table 2.8 PM2.5 Emissions 1990 - 2019

PM2.5		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
kt	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
1990	11.03	10.87	0.12	0.10	0.05	10.60	NE	0.01	0.07	0.08	0.08	NA	NA	NA	<0.01	NA
1991	9.51	9.36	0.10	0.13	0.05	9.07	NE	0.01	0.07	0.08	0.08	NA	NA	NA	<0.01	NA
1992	10.12	9.99	0.07	0.08	0.03	9.80	NE	0.01	0.06	0.08	0.08	NA	NA	NA	<0.01	NA
1993	11.05	10.95	0.05	0.06	0.03	10.80	NE	0.01	0.03	0.07	0.07	NA	NA	NA	<0.01	NA
1994	7.70	7.61	0.05	0.06	0.03	7.46	NE	0.01	0.01	0.07	0.07	NA	NA	NA	<0.01	NA
1995	4.48	4.38	0.03	0.06	0.03	4.26	NE	0.00	0.02	0.08	0.08	NA	NA	NA	<0.01	NA
1996	4.33	4.22	0.06	0.08	0.04	4.03	NE	0.01	0.03	0.08	0.08	NA	NA	NA	<0.01	NA
1997	3.96	3.84	0.08	0.06	0.04	3.66	NE	0.01	0.04	0.07	0.07	NA	NA	NA	<0.01	NA
1998	3.80	3.69	0.08	0.03	0.25	3.32	NE	0.01	0.04	0.07	0.07	NA	NA	NA	<0.01	NA
1999	3.92	3.81	0.09	0.04	0.23	3.44	NE	0.01	0.04	0.07	0.07	NA	NA	NA	<0.01	NA
2000	4.12	4.00	0.09	0.04	0.26	3.61	NE	0.01	0.05	0.07	0.07	NA	NA	NA	<0.01	NA
2001	3.51	3.38	0.08	0.05	0.21	3.02	NE	0.01	0.06	0.07	0.07	NA	NA	NA	<0.01	NA
2002	4.90	4.77	0.10	0.07	0.20	4.39	NE	0.01	0.06	0.07	0.07	NA	NA	NA	<0.01	NA
2003	5.05	4.92	0.10	0.07	0.21	4.54	NE	0.01	0.06	0.07	0.07	NA	NA	NA	<0.01	NA
2004	5.13	5.02	0.10	0.07	0.22	4.62	NE	0.01	0.06	0.05	0.05	NA	NA	NA	<0.01	NA
2005	5.01	4.91	0.04	0.16	0.26	4.45	NE	0.01	0.06	0.05	0.05	NA	NA	NA	<0.01	NA
2006	5.10	5.00	0.04	0.14	0.30	4.51	NE	0.01	0.06	0.05	0.05	NA	NA	NA	<0.01	NA
2007	5.30	5.19	0.03	0.17	0.39	4.60	NE	0.01	0.06	0.04	0.04	NA	NA	NA	<0.01	NA
2008	5.32	5.21	0.05	0.16	0.40	4.60	NE	0.01	0.06	0.04	0.04	NA	NA	NA	<0.01	NA
2009	5.41	5.33	0.02	0.05	0.44	4.81	NE	0.00	0.03	0.04	0.04	NA	NA	NA	<0.01	NA

PM2.5		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
kt	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
2010	5.61	5.50	0.05	0.03	0.42	4.99	NE	0.01	0.07	0.04	0.04	NA	NA	NA	<0.01	NA
2011	5.75	5.67	0.06	0.06	0.40	5.14	NE	0.01	0.04	0.04	0.04	NA	NA	NA	<0.01	NA
2012	5.78	5.71	0.06	0.05	0.41	5.19	NE	0.01	0.03	0.04	0.04	NA	NA	NA	<0.01	NA
2013	5.49	5.44	0.05	0.06	0.40	4.92	NE	0.01	0.02	0.04	0.04	NA	NA	NA	<0.01	NA
2014	5.26	5.20	0.05	0.09	0.35	4.70	NE	0.01	0.02	0.04	0.04	NA	NA	NA	<0.01	NA
2015	5.40	5.34	0.05	0.09	0.37	4.82	NE	0.01	0.02	0.04	0.04	NA	NA	NA	<0.01	NA
2016	5.34	5.29	0.04	0.09	0.41	4.73	NE	0.01	0.02	0.04	0.04	NA	NA	NA	<0.01	NA
2017	5.29	5.23	0.05	0.09	0.42	4.66	NE	0.01	0.02	0.04	0.04	NA	NA	NA	<0.01	NA
2018	4.90	4.85	0.05	0.09	0.45	4.24	NE	0.01	0.02	0.04	0.04	NA	NA	NA	<0.01	NA
2019																
Trend																
1990 - 2019	-55.5%	-55.4%	-56.4%	-5.7%	896.4%	-60.0%	NA	-9.1%	-73.6%	-55.5%	-55.5%	NA	NA	NA	21.2%	NA
2005 - 2019	-2.2%	-1.2%	39.9%	-42.9%	75.0%	-4.5%	NA	23.0%	-66.6%	-25.9%	-25.9%	NA	NA	NA	8.6%	NA
2018 - 2019	-7.3%	-7.3%	15.0%	-1.8%	7.1%	-8.9%	NA	8.2%	-11.1%	-3.3%	-3.3%	NA	NA	NA	2.1%	NA
Share in National Total																
1990	100%	98.6%	1.1%	0.9%	0.4%	96.2%	NA	0.1%	0.7%	0.7%	0.73%	NA	NA	NA	0.0%	NA
2005	100%	97.9%	0.7%	3.2%	5.2%	88.7%	NA	0.1%	1.2%	1.0%	0.96%	NA	NA	NA	0.0%	NA
2019	100%	98.9%	1.1%	1.9%	9.2%	86.6%	NA	0.2%	0.4%	0.7%	0.73%	NA	NA	NA	0.0%	NA

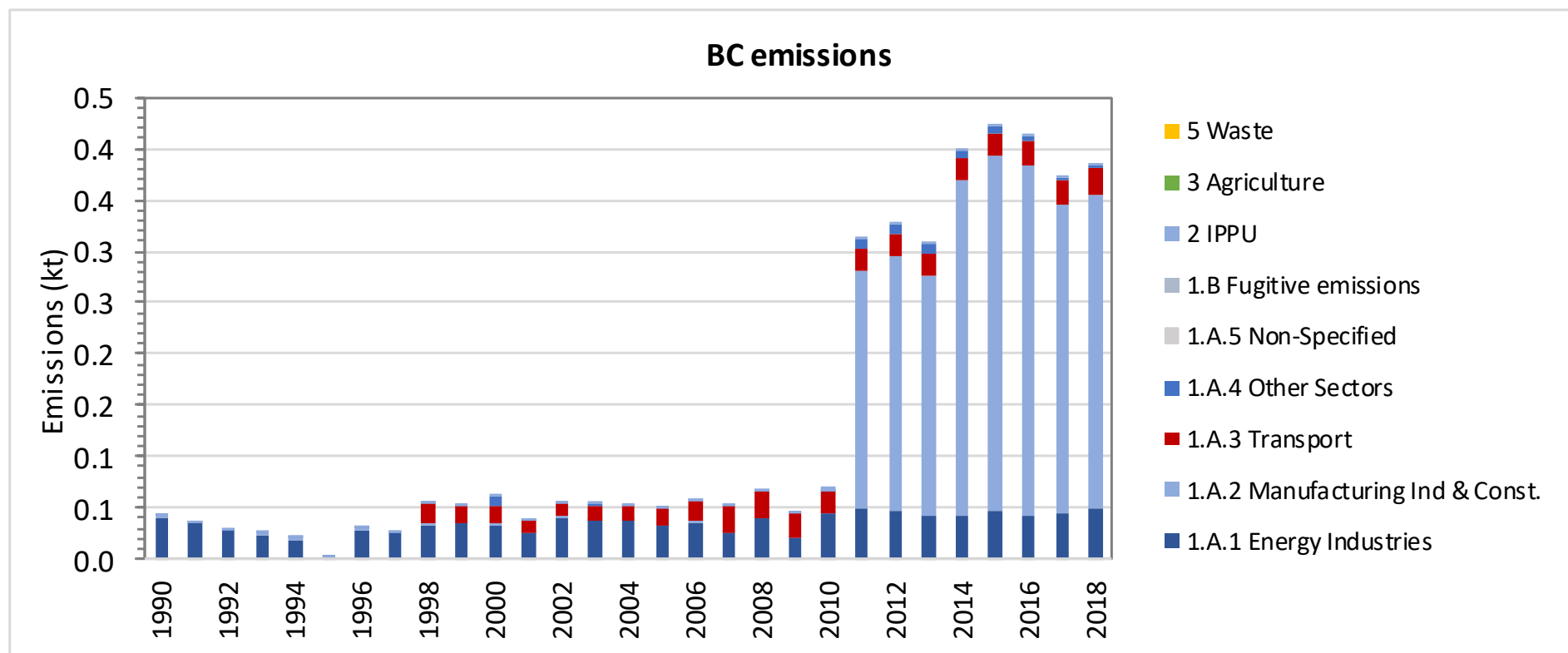


Figure 2.9 Black carbon (BC) Emissions 1990 - 2019

Table 2.9 Black carbon (BC) Emissions 1990 - 2019

BC		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
kt	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
1990	0.04	0.04	0.04	0.00	0.00	0.00	NE	NA/NO	0.00	NE	NA/NO	NA/NO	NE	NO	NA	NA
1991	0.04	0.03	0.03	0.00	0.00	0.00	NE	NA/NO	0.00	NE	NA/NO	NA/NO	NE	NO	NA	NA
1992	0.03	0.03	0.03	0.00	0.00	0.00	NE	NA/NO	0.00	NE	NA/NO	NA/NO	NE	NO	NA	NA
1993	0.03	0.02	0.02	0.00	0.00	0.00	NE	NA/NO	0.00	NE	NA/NO	NA/NO	NE	NO	NA	NA
1994	0.02	0.02	0.02	0.00	0.00	0.00	NE	NA/NO	0.00	NE	NA/NO	NA/NO	NE	NO	NA	NA
1995	0.00	0.00	0.00	0.00	0.00	0.00	NE	NA/NO	0.00	NE	NA/NO	NA/NO	NE	NO	NA	NA
1996	0.03	0.03	0.03	0.00	0.00	0.00	NE	NA/NO	0.00	NE	NA/NO	NA/NO	NE	NO	NA	NA
1997	0.03	0.03	0.02	0.00	0.00	0.00	NE	NA/NO	0.00	NE	NA/NO	NA/NO	NE	NO	NA	NA
1998	0.06	0.05	0.03	0.00	0.02	0.00	NE	NA/NO	0.00	NE	NA/NO	NA/NO	NE	NO	NA	NA
1999	0.05	0.05	0.03	0.00	0.02	0.00	NE	NA/NO	0.00	NE	NA/NO	NA/NO	NE	NO	NA	NA
2000	0.06	0.06	0.03	0.00	0.02	0.01	NE	NA/NO	0.00	NE	NA/NO	NA/NO	NE	NO	NA	NA
2001	0.04	0.04	0.02	0.00	0.01	0.00	NE	NA/NO	0.00	NE	NA/NO	NA/NO	NE	NO	NA	NA
2002	0.06	0.05	0.04	0.00	0.01	0.00	NE	NA/NO	0.00	NE	NA/NO	NA/NO	NE	NO	NA	NA
2003	0.05	0.05	0.04	0.00	0.01	0.00	NE	NA/NO	0.00	NE	NA/NO	NA/NO	NE	NO	NA	NA
2004	0.05	0.05	0.04	0.00	0.01	0.00	NE	NA/NO	0.00	NE	NA/NO	NA/NO	NE	NO	NA	NA
2005	0.05	0.05	0.03	0.00	0.02	0.00	NE	NA/NO	0.00	NE	NA/NO	NA/NO	NE	NO	NA	NA
2006	0.06	0.06	0.04	0.00	0.02	0.00	NE	NA/NO	0.00	NE	NA/NO	NA/NO	NE	NO	NA	NA
2007	0.05	0.05	0.03	0.00	0.02	0.00	NE	NA/NO	0.00	NE	NA/NO	NA/NO	NE	NO	NA	NA
2008	0.07	0.07	0.04	0.00	0.03	0.00	NE	NA/NO	0.00	NE	NA/NO	NA/NO	NE	NO	NA	NA
2009	0.05	0.04	0.02	0.00	0.02	0.00	NE	NA/NO	0.00	NE	NA/NO	NA/NO	NE	NO	NA	NA

BC		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
kt	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
2010	0.07	0.07	0.05	0.00	0.02	0.00	NE	NA/NO	0.00	NE	NA/NO	NA/NO	NE	NO	NA	NA
2011	0.31	0.31	0.05	0.23	0.02	0.01	NE	NA/NO	0.00	NE	NA/NO	NA/NO	NE	NO	NA	NA
2012	0.33	0.33	0.05	0.25	0.02	0.01	NE	NA/NO	0.00	NE	NA/NO	NA/NO	NE	NO	NA	NA
2013	0.31	0.31	0.04	0.23	0.02	0.01	NE	NA/NO	0.00	NE	NA/NO	NA/NO	NE	NO	NA	NA
2014	0.40	0.40	0.04	0.33	0.02	0.01	NE	NA/NO	0.00	NE	NA/NO	NA/NO	NE	NO	NA	NA
2015	0.42	0.42	0.05	0.35	0.02	0.01	NE	NA/NO	0.00	NE	NA/NO	NA/NO	NE	NO	NA	NA
2016	0.41	0.41	0.04	0.34	0.02	0.00	NE	NA/NO	0.00	NE	NA/NO	NA/NO	NE	NO	NA	NA
2017	0.37	0.37	0.04	0.30	0.02	0.00	NE	NA/NO	0.00	NE	NA/NO	NA/NO	NE	NO	NA	NA
2018	0.39	0.38	0.05	0.30	0.03	0.00	NE	NA/NO	0.00	NE	NA/NO	NA/NO	NE	NO	NA	NA
2019																
Trend																
1990 - 2019	766.0%	819.0%	23.6%	45992.2 %	NA	672.5%	NA	NA	-73.1%	NA	NA	NA	NA	NA	NA	NA
2005 - 2019	664.0%	692.5%	59.5%	83703.9 %	57.5%	957.6%	NA	NA	-62.6%	NA	NA	NA	NA	NA	NA	NA
2018 - 2019	3.1%	3.1%	14.4%	1.0%	5.0%	30.7%	NA	NA	-0.4%	NA	NA	NA	NA	NA	NA	NA
Share in National Total																
1990	100%	94.1%	91.5%	1.5%	0.0%	1.1%	NA	NA	5.9%	NA	NA	NA	NA	NA	NA	NA
2005	100%	96.2%	62.6%	0.7%	32.2%	0.7%	NA	NA	3.8%	NA	NA	NA	NA	NA	NA	NA
2019	100%	99.8%	13.1%	79.2%	6.6%	1.0%	NA	NA	0.2%	NA	NA	NA	NA	NA	NA	NA

## 2.3 Trend of emissions of heavy metals (HM)

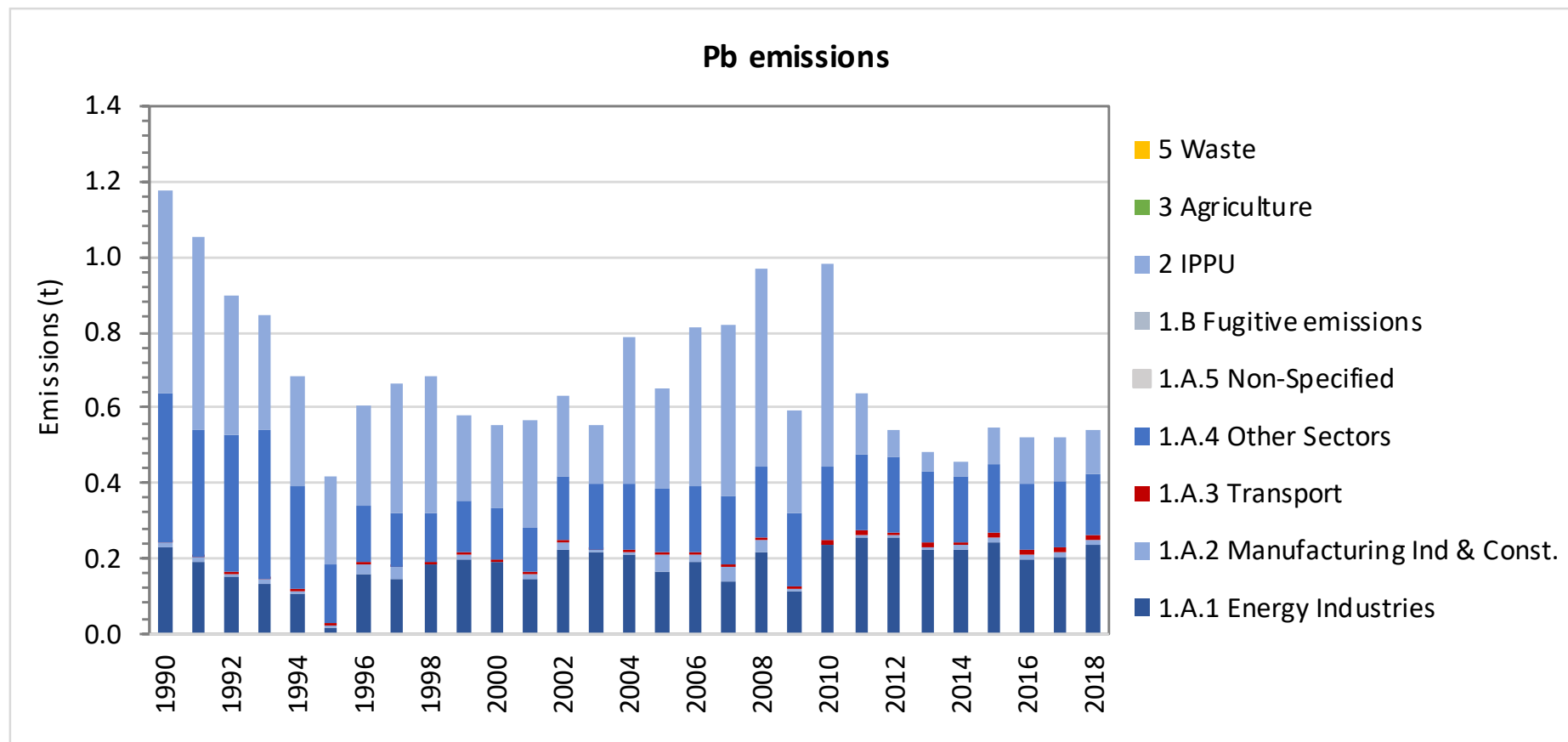


Figure 2.10 Lead (Pb) Emissions 1990 - 2019

Table 2.10 Lead (Pb) Emissions 1990 - 2019

Pb		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
kt	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
1990	1.18	0.64	0.23	0.01	0.00	0.39	NE	NA/NO	0.54	NA	NA	NA	NE	NA	NE	NA
1991	1.05	0.54	0.19	0.01	0.00	0.34	NE	NA/NO	0.51	NA	NA	NA	NE	NA	NE	NA
1992	0.90	0.53	0.15	0.01	0.00	0.36	NE	NA/NO	0.37	NA	NA	NA	NE	NA	NE	NA
1993	0.84	0.54	0.13	0.01	0.00	0.40	NE	NA/NO	0.30	NA	NA	NA	NE	NA	NE	NA
1994	0.68	0.39	0.11	0.01	0.00	0.28	NE	NA/NO	0.29	NA	NA	NA	NE	NA	NE	NA
1995	0.42	0.19	0.01	0.01	0.00	0.16	NE	NA/NO	0.23	NA	NA	NA	NE	NA	NE	NA
1996	0.61	0.34	0.16	0.03	0.00	0.15	NE	NA/NO	0.27	NA	NA	NA	NE	NA	NE	NA
1997	0.66	0.32	0.14	0.03	0.00	0.14	NE	NA/NO	0.34	NA	NA	NA	NE	NA	NE	NA
1998	0.69	0.32	0.19	0.00	0.01	0.13	NE	NA/NO	0.37	NA	NA	NA	NE	NA	NE	NA
1999	0.58	0.35	0.19	0.02	0.01	0.13	NE	NA/NO	0.23	NA	NA	NA	NE	NA	NE	NA
2000	0.56	0.34	0.19	0.00	0.01	0.14	NE	NA/NO	0.22	NA	NA	NA	NE	NA	NE	NA
2001	0.57	0.28	0.14	0.01	0.01	0.12	NE	NA/NO	0.29	NA	NA	NA	NE	NA	NE	NA
2002	0.63	0.42	0.23	0.02	0.00	0.17	NE	NA/NO	0.22	NA	NA	NA	NE	NA	NE	NA
2003	0.55	0.40	0.21	0.01	0.00	0.17	NE	NA/NO	0.15	NA	NA	NA	NE	NA	NE	NA
2004	0.79	0.40	0.21	0.01	0.01	0.18	NE	NA/NO	0.39	NA	NA	NA	NE	NA	NE	NA
2005	0.65	0.39	0.17	0.05	0.01	0.17	NE	NA/NO	0.27	NA	NA	NA	NE	NA	NE	NA
2006	0.81	0.39	0.19	0.02	0.01	0.17	NE	NA/NO	0.42	NA	NA	NA	NE	NA	NE	NA
2007	0.82	0.37	0.14	0.04	0.01	0.19	NE	NA/NO	0.45	NA	NA	NA	NE	NA	NE	NA
2008	0.97	0.44	0.21	0.03	0.01	0.19	NE	NA/NO	0.52	NA	NA	NA	NE	NA	NE	NA

Pb		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
kt	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
2009	0.59	0.32	0.11	0.01	0.01	0.19	NE	NA/NO	0.27	NA	NA	NA	NE	NA	NE	NA
2010	0.98	0.44	0.24	0.00	0.01	0.20	NE	NA/NO	0.54	NA	NA	NA	NE	NA	NE	NA
2011	0.63	0.48	0.26	0.01	0.01	0.20	NE	NA/NO	0.16	NA	NA	NA	NE	NA	NE	NA
2012	0.54	0.47	0.25	0.01	0.01	0.20	NE	NA/NO	0.07	NA	NA	NA	NE	NA	NE	NA
2013	0.48	0.43	0.22	0.01	0.01	0.19	NE	NA/NO	0.05	NA	NA	NA	NE	NA	NE	NA
2014	0.46	0.42	0.23	0.01	0.01	0.18	NE	NA/NO	0.04	NA	NA	NA	NE	NA	NE	NA
2015	0.54	0.45	0.24	0.01	0.01	0.18	NE	NA/NO	0.10	NA	NA	NA	NE	NA	NE	NA
2016	0.52	0.40	0.20	0.01	0.01	0.18	NE	NA/NO	0.12	NA	NA	NA	NE	NA	NE	NA
2017	0.52	0.41	0.20	0.01	0.01	0.18	NE	NA/NO	0.12	NA	NA	NA	NE	NA	NE	NA
2018	0.54	0.42	0.24	0.01	0.01	0.16	NE	NA/NO	0.12	NA	NA	NA	NE	NA	NE	NA
2019																
Trend																
1990 - 2019	-54.1%	-33.7%	1.7%	58.7%	173.9%	-58.5%	NA	NA	-78.2%	NA	NA	NA	NA	NA	NA	NA
2005 - 2019	-17.2%	9.3%	42.3%	-75.0%	127.0%	-3.9%	NA	NA	-55.8%	NA	NA	NA	NA	NA	NA	NA
2018 - 2019	3.3%	4.3%	15.2%	-0.2%	9.0%	-8.2%	NA	NA	-0.1%	NA	NA	NA	NA	NA	NA	NA
Share in National Total																
1990	100%	54.1%	19.7%	0.6%	0.4%	33.5%	NA	NA	45.9%	NA	NA	NA	NA	NA	NA	NA
2005	100%	59.3%	25.4%	7.0%	0.8%	26.1%	NA	NA	40.7%	NA	NA	NA	NA	NA	NA	NA
2019	100%	78.2%	43.7%	2.1%	2.2%	30.3%	NA	NA	21.8%	NA	NA	NA	NA	NA	NA	NA



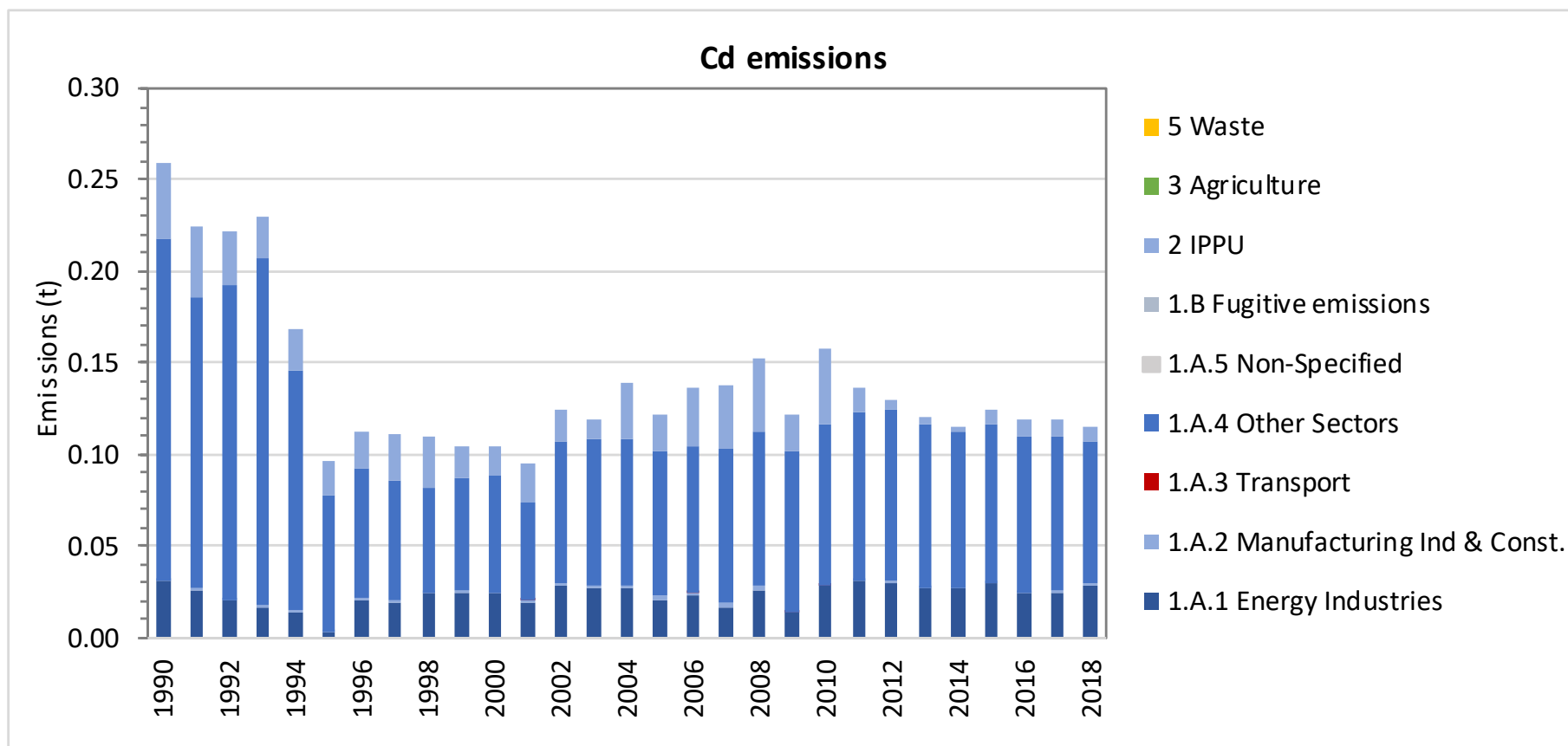


Figure 2.11 Cadmium (Cd) Emissions 1990 - 2019

Table 2.11 Cadmium (Cd) Emissions 1990 - 2019

Cd		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
t	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
1990	0.26	0.22	0.031	0.000	0.000	0.186	NE	NA/NO	0.04	NA	NA/NO	NE	NE	NA	NE	NA
1991	0.22	0.18	0.025	0.000	0.000	0.159	NE	NA/NO	0.04	NA	NA/NO	NE	NE	NA	NE	NA
1992	0.22	0.19	0.020	0.000	0.000	0.172	NE	NA/NO	0.03	NA	NA/NO	NE	NE	NA	NE	NA
1993	0.23	0.21	0.017	0.000	0.000	0.190	NE	NA/NO	0.02	NA	NA/NO	NE	NE	NA	NE	NA
1994	0.17	0.15	0.014	0.000	0.000	0.131	NE	NA/NO	0.02	NA	NA/NO	NE	NE	NA	NE	NA
1995	0.10	0.08	0.003	0.000	0.000	0.075	NE	NA/NO	0.02	NA	NA/NO	NE	NE	NA	NE	NA
1996	0.11	0.09	0.020	0.000	0.000	0.071	NE	NA/NO	0.02	NA	NA/NO	NE	NE	NA	NE	NA
1997	0.11	0.08	0.019	0.000	0.000	0.064	NE	NA/NO	0.03	NA	NA/NO	NE	NE	NA	NE	NA
1998	0.11	0.08	0.024	0.000	0.000	0.058	NE	NA/NO	0.03	NA	NA/NO	NE	NE	NA	NE	NA
1999	0.10	0.09	0.025	0.000	0.000	0.060	NE	NA/NO	0.02	NA	NA/NO	NE	NE	NA	NE	NA
2000	0.10	0.09	0.025	0.000	0.000	0.063	NE	NA/NO	0.02	NA	NA/NO	NE	NE	NA	NE	NA
2001	0.09	0.07	0.019	0.000	0.000	0.053	NE	NA/NO	0.02	NA	NA/NO	NE	NE	NA	NE	NA
2002	0.12	0.11	0.029	0.000	0.000	0.077	NE	NA/NO	0.02	NA	NA/NO	NE	NE	NA	NE	NA
2003	0.12	0.11	0.028	0.000	0.000	0.080	NE	NA/NO	0.01	NA	NA/NO	NE	NE	NA	NE	NA
2004	0.14	0.11	0.027	0.000	0.000	0.081	NE	NA/NO	0.03	NA	NA/NO	NE	NE	NA	NE	NA
2005	0.12	0.10	0.020	0.001	0.000	0.078	NE	NA/NO	0.02	NA	NA/NO	NE	NE	NA	NE	NA
2006	0.14	0.10	0.023	0.000	0.000	0.080	NE	NA/NO	0.03	NA	NA/NO	NE	NE	NA	NE	NA
2007	0.14	0.10	0.016	0.001	0.000	0.083	NE	NA/NO	0.03	NA	NA/NO	NE	NE	NA	NE	NA
2008	0.15	0.11	0.026	0.000	0.000	0.083	NE	NA/NO	0.04	NA	NA/NO	NE	NE	NA	NE	NA
2009	0.12	0.10	0.013	0.000	0.000	0.087	NE	NA/NO	0.02	NA	NA/NO	NE	NE	NA	NE	NA

Cd		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
t	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
2010	0.16	0.12	0.029	0.000	0.000	0.088	NE	NA/NO	0.04	NA	NA/NO	NE	NE	NA	NE	NA
2011	0.14	0.13	0.031	0.003	0.000	0.092	NE	NA/NO	0.01	NA	NA/NO	NE	NE	NA	NE	NA
2012	0.13	0.13	0.030	0.004	0.000	0.093	NE	NA/NO	0.01	NA	NA/NO	NE	NE	NA	NE	NA
2013	0.12	0.12	0.027	0.003	0.000	0.089	NE	NA/NO	0.00	NA	NA/NO	NE	NE	NA	NE	NA
2014	0.12	0.12	0.027	0.005	0.000	0.084	NE	NA/NO	0.00	NA	NA/NO	NE	NE	NA	NE	NA
2015	0.13	0.12	0.029	0.005	0.000	0.087	NE	NA/NO	0.01	NA	NA/NO	NE	NE	NA	NE	NA
2016	0.12	0.11	0.024	0.005	0.000	0.086	NE	NA/NO	0.01	NA	NA/NO	NE	NE	NA	NE	NA
2017	0.12	0.11	0.025	0.005	0.000	0.085	NE	NA/NO	0.01	NA	NA/NO	NE	NE	NA	NE	NA
2018	0.12	0.11	0.028	0.005	0.000	0.077	NE	NA/NO	0.01	NA	NA/NO	NE	NE	NA	NE	NA
2019																
Trend																
1990 - 2019	-53.8%	-49.1%	-7.3%	3758.4 %	-100.0%	-58.4%	NA	NA	-78.2%	NA	NA	NA	NA	NA	NA	NA
2005 - 2019	0.2%	11.8%	42.0%	612.0%	-100.0%	-0.9%	NA	NA	-55.8%	NA	NA	NA	NA	NA	NA	NA
2018 - 2019	-2.7%	-3.0%	15.2%	0.0%	NA	-8.4%	NA	NA	-0.1%	NA	NA	NA	NA	NA	NA	NA
Share in National Total																
1990	100%	83.9%	11.8%	0.0%	0.0%	72.0%	NA	NA	16.1%	NA	NA	NA	NA	NA	NA	NA
2005	100%	82.8%	16.8%	0.5%	0.0%	65.5%	NA	NA	17.2%	NA	NA	NA	NA	NA	NA	NA
2019	100%	92.4%	23.8%	3.8%	0.0%	64.9%	NA	NA	7.6%	NA	NA	NA	NA	NA	NA	NA

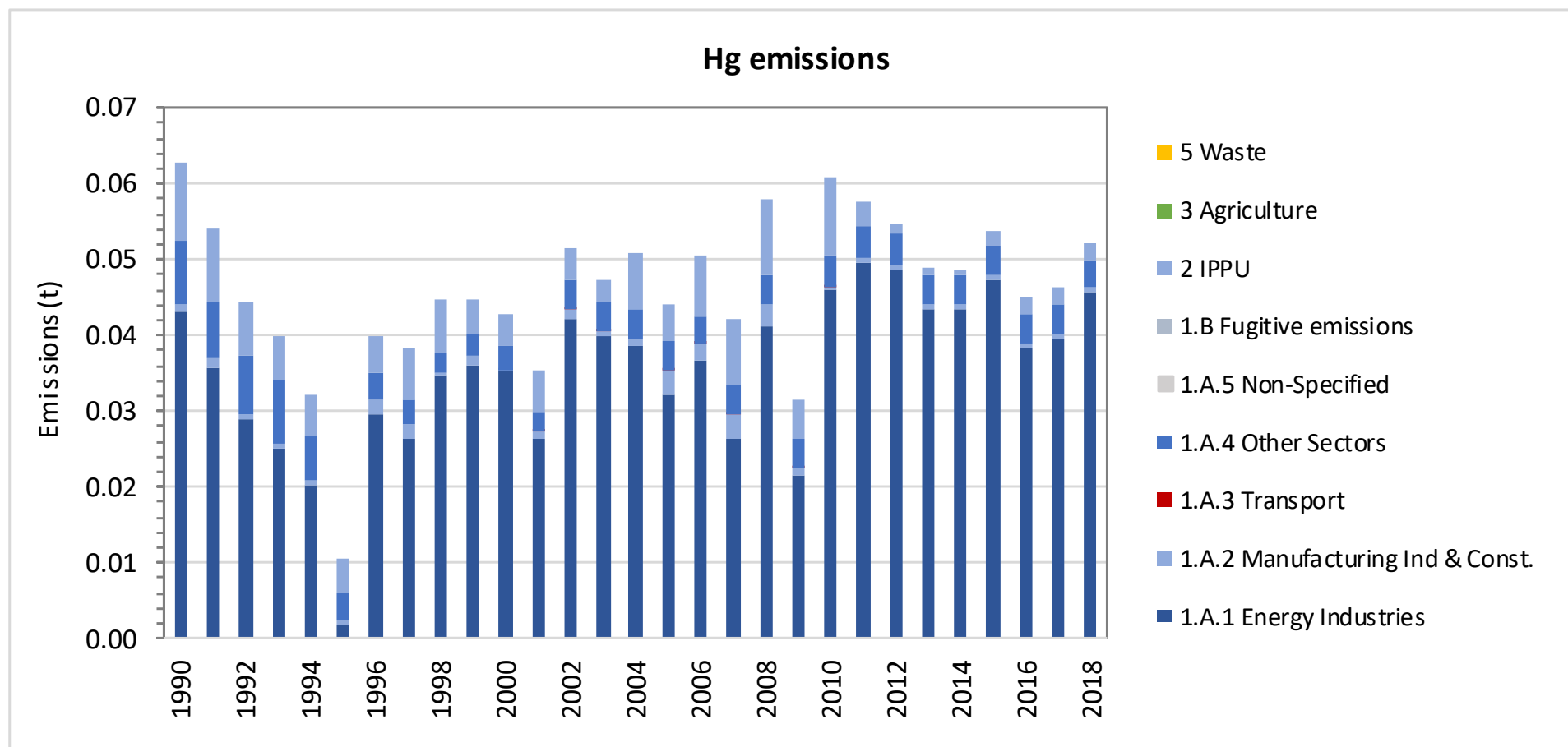


Figure 2.12 Mercury (Hg) Emissions 1990 - 2019

Table 2.12 Mercury (Hg) Emissions 1990 - 2019

Hg		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
t	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
1990	0.063	0.053	0.043	0.001	0.000	0.009	NE	NA/NO	0.010	NA	NA	NA	NA	NA	NE	NA
1991	0.054	0.044	0.036	0.001	0.000	0.007	NE	NA/NO	0.010	NA	NA	NA	NA	NA	NE	NA
1992	0.044	0.037	0.029	0.001	0.000	0.008	NE	NA/NO	0.007	NA	NA	NA	NA	NA	NE	NA
1993	0.040	0.034	0.025	0.001	0.000	0.008	NE	NA/NO	0.006	NA	NA	NA	NA	NA	NE	NA
1994	0.032	0.027	0.020	0.001	0.000	0.006	NE	NA/NO	0.006	NA	NA	NA	NA	NA	NE	NA
1995	0.010	0.006	0.002	0.001	0.000	0.003	NE	NA/NO	0.004	NA	NA	NA	NA	NA	NE	NA
1996	0.040	0.035	0.030	0.002	0.000	0.003	NE	NA/NO	0.005	NA	NA	NA	NA	NA	NE	NA
1997	0.038	0.032	0.026	0.002	0.000	0.003	NE	NA/NO	0.007	NA	NA	NA	NA	NA	NE	NA
1998	0.045	0.038	0.035	0.000	0.000	0.003	NE	NA/NO	0.007	NA	NA	NA	NA	NA	NE	NA
1999	0.045	0.040	0.036	0.001	0.000	0.003	NE	NA/NO	0.004	NA	NA	NA	NA	NA	NE	NA
2000	0.043	0.039	0.035	0.000	0.000	0.003	NE	NA/NO	0.004	NA	NA	NA	NA	NA	NE	NA
2001	0.035	0.030	0.026	0.001	0.000	0.003	NE	NA/NO	0.005	NA	NA	NA	NA	NA	NE	NA
2002	0.051	0.047	0.042	0.001	0.000	0.004	NE	NA/NO	0.004	NA	NA	NA	NA	NA	NE	NA
2003	0.047	0.044	0.040	0.001	0.000	0.004	NE	NA/NO	0.003	NA	NA	NA	NA	NA	NE	NA
2004	0.051	0.043	0.039	0.001	0.000	0.004	NE	NA/NO	0.008	NA	NA	NA	NA	NA	NE	NA
2005	0.044	0.039	0.032	0.004	0.000	0.004	NE	NA/NO	0.005	NA	NA	NA	NA	NA	NE	NA
2006	0.051	0.043	0.037	0.002	0.000	0.004	NE	NA/NO	0.008	NA	NA	NA	NA	NA	NE	NA
2007	0.042	0.033	0.026	0.003	0.000	0.004	NE	NA/NO	0.009	NA	NA	NA	NA	NA	NE	NA
2008	0.058	0.048	0.041	0.003	0.000	0.004	NE	NA/NO	0.010	NA	NA	NA	NA	NA	NE	NA
2009	0.032	0.026	0.022	0.001	0.000	0.004	NE	NA/NO	0.005	NA	NA	NA	NA	NA	NE	NA

Hg		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
t	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
2010	0.061	0.050	0.046	0.000	0.000	0.004	NE	NA/NO	0.010	NA	NA	NA	NA	NA	NE	NA
2011	0.058	0.054	0.050	0.001	0.000	0.004	NE	NA/NO	0.003	NA	NA	NA	NA	NA	NE	NA
2012	0.055	0.053	0.049	0.000	0.000	0.004	NE	NA/NO	0.001	NA	NA	NA	NA	NA	NE	NA
2013	0.049	0.048	0.043	0.001	0.000	0.004	NE	NA/NO	0.001	NA	NA	NA	NA	NA	NE	NA
2014	0.049	0.048	0.044	0.001	0.000	0.004	NE	NA/NO	0.001	NA	NA	NA	NA	NA	NE	NA
2015	0.054	0.052	0.047	0.001	0.000	0.004	NE	NA/NO	0.002	NA	NA	NA	NA	NA	NE	NA
2016	0.045	0.043	0.038	0.001	0.000	0.004	NE	NA/NO	0.002	NA	NA	NA	NA	NA	NE	NA
2017	0.046	0.044	0.040	0.001	0.000	0.004	NE	NA/NO	0.002	NA	NA	NA	NA	NA	NE	NA
2018	0.052	0.050	0.046	0.001	0.000	0.003	NE	NA/NO	0.002	NA	NA	NA	NA	NA	NE	NA
2019																
Trend																
1990 - 2019	-17.0%	-4.9%	6.2%	-18.3%	NA	-59.2%	NA	NA	-78.2%	NA	NA	NA	NA	NA	NA	NA
2005 - 2019	17.9%	27.6%	42.4%	-77.1%	-100.0%	-2.9%	NA	NA	-55.8%	NA	NA	NA	NA	NA	NA	NA
2018 - 2019	12.4%	13.0%	15.2%	1.3%	NA	-7.9%	NA	NA	-0.1%	NA	NA	NA	NA	NA	NA	NA
Share in National Total																
1990	100%	83.5%	68.4%	1.6%	0.0%	13.6%	NA	NA	16.5%	NA	NA	NA	NA	NA	NA	NA
2005	100%	88.4%	72.4%	7.9%	0.0%	8.1%	NA	NA	11.6%	NA	NA	NA	NA	NA	NA	NA
2019	100%	95.7%	87.5%	1.5%	0.0%	6.7%	NA	NA	4.3%	NA	NA	NA	NA	NA	NA	NA

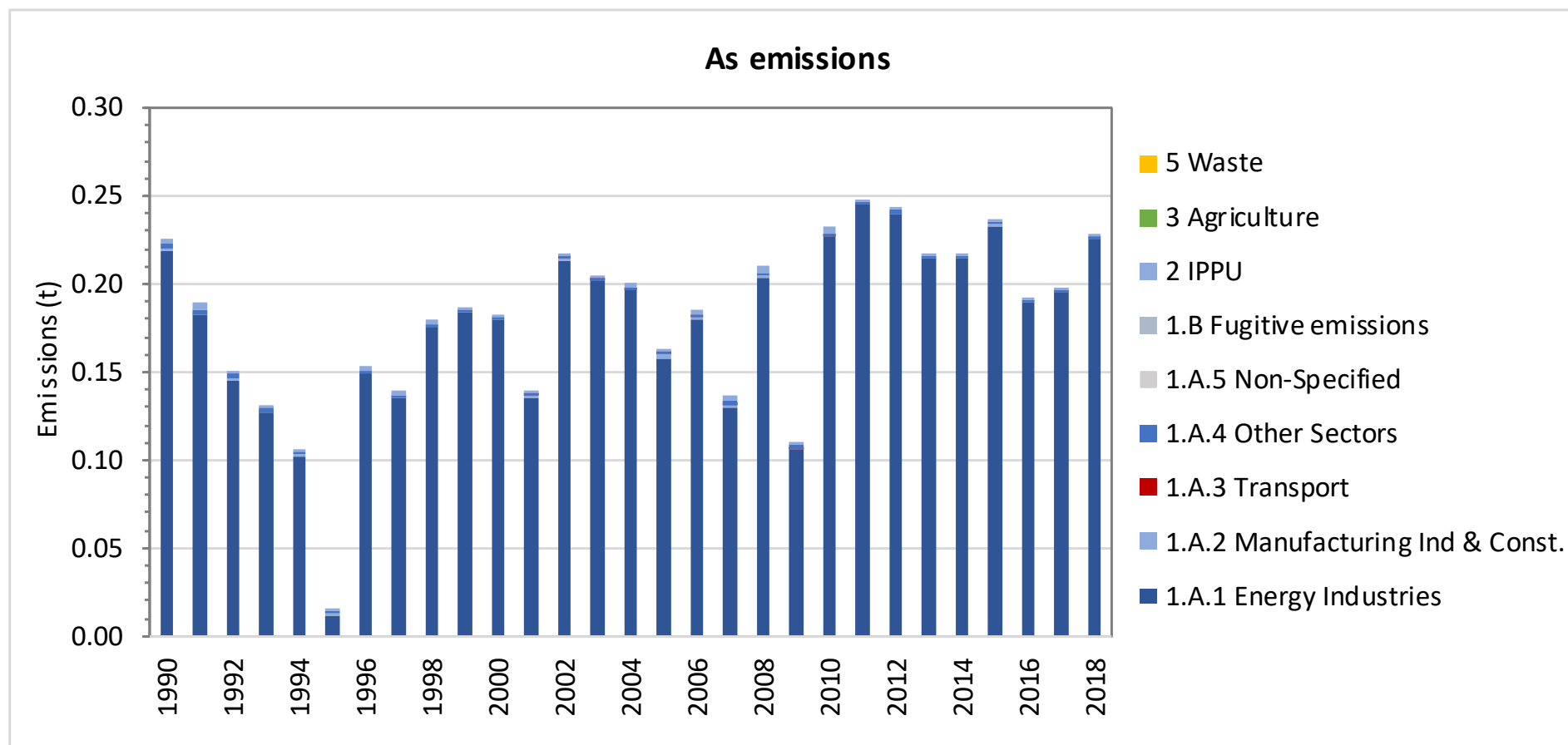


Figure 2.13 Arsen (As) Emissions 1990 - 2019

Table 2.13 Arsen (As) Emissions 1990 - 2019

As		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
t	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
1990	0.226	0.223	0.219	0.000	NE	0.003	NE	NA/NO	0.003	NA	NA/NO	NA/NO	NE	NA	NE	NA
1991	0.189	0.186	0.183	0.000	NE	0.003	NE	NA/NO	0.003	NA	NA/NO	NA/NO	NE	NA	NE	NA
1992	0.151	0.149	0.146	0.000	NE	0.003	NE	NA/NO	0.002	NA	NA/NO	NA/NO	NE	NA	NE	NA
1993	0.131	0.130	0.126	0.000	NE	0.003	NE	NA/NO	0.002	NA	NA/NO	NA/NO	NE	NA	NE	NA
1994	0.107	0.105	0.102	0.000	NE	0.002	NE	NA/NO	0.002	NA	NA/NO	NA/NO	NE	NA	NE	NA
1995	0.015	0.014	0.012	0.000	NE	0.001	NE	NA/NO	0.001	NA	NA/NO	NA/NO	NE	NA	NE	NA
1996	0.153	0.151	0.149	0.001	NE	0.001	NE	NA/NO	0.002	NA	NA/NO	NA/NO	NE	NA	NE	NA
1997	0.139	0.137	0.135	0.001	NE	0.001	NE	NA/NO	0.002	NA	NA/NO	NA/NO	NE	NA	NE	NA
1998	0.180	0.177	0.176	0.000	NE	0.001	NE	NA/NO	0.002	NA	NA/NO	NA/NO	NE	NA	NE	NA
1999	0.187	0.185	0.183	0.001	NE	0.001	NE	NA/NO	0.001	NA	NA/NO	NA/NO	NE	NA	NE	NA
2000	0.182	0.181	0.180	0.000	NE	0.001	NE	NA/NO	0.001	NA	NA/NO	NA/NO	NE	NA	NE	NA
2001	0.139	0.137	0.136	0.000	0.000	0.001	NE	NA/NO	0.002	NA	NA/NO	NA/NO	NE	NA	NE	NA
2002	0.217	0.216	0.213	0.001	0.000	0.002	NE	NA/NO	0.001	NA	NA/NO	NA/NO	NE	NA	NE	NA
2003	0.205	0.204	0.202	0.000	0.000	0.002	NE	NA/NO	0.001	NA	NA/NO	NA/NO	NE	NA	NE	NA
2004	0.200	0.198	0.196	0.000	0.000	0.002	NE	NA/NO	0.002	NA	NA/NO	NA/NO	NE	NA	NE	NA
2005	0.163	0.161	0.158	0.002	0.000	0.002	NE	NA/NO	0.002	NA	NA/NO	NA/NO	NE	NA	NE	NA
2006	0.185	0.183	0.180	0.001	0.000	0.002	NE	NA/NO	0.002	NA	NA/NO	NA/NO	NE	NA	NE	NA
2007	0.136	0.133	0.130	0.001	0.000	0.002	NE	NA/NO	0.003	NA	NA/NO	NA/NO	NE	NA	NE	NA
2008	0.210	0.207	0.203	0.001	NE	0.002	NE	NA/NO	0.003	NA	NA/NO	NA/NO	NE	NA	NE	NA
2009	0.110	0.109	0.106	0.000	0.000	0.002	NE	NA/NO	0.002	NA	NA/NO	NA/NO	NE	NA	NE	NA



As		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
t	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
2010	0.232	0.229	0.227	0.000	0.000	0.002	NE	NA/NO	0.003	NA	NA/NO	NA/NO	NE	NA	NE	NA
2011	0.248	0.247	0.245	0.000	NE	0.002	NE	NA/NO	0.001	NA	NA/NO	NA/NO	NE	NA	NE	NA
2012	0.242	0.242	0.240	0.000	NE	0.002	NE	NA/NO	0.000	NA	NA/NO	NA/NO	NE	NA	NE	NA
2013	0.216	0.216	0.214	0.000	NE	0.002	NE	NA/NO	0.000	NA	NA/NO	NA/NO	NE	NA	NE	NA
2014	0.216	0.216	0.215	0.000	NE	0.001	NE	NA/NO	0.000	NA	NA/NO	NA/NO	NE	NA	NE	NA
2015	0.235	0.235	0.233	0.000	NE	0.001	NE	NA/NO	0.001	NA	NA/NO	NA/NO	NE	NA	NE	NA
2016	0.191	0.191	0.189	0.000	NE	0.001	NE	NA/NO	0.001	NA	NA/NO	NA/NO	NE	NA	NE	NA
2017	0.198	0.197	0.195	0.000	NE	0.001	NE	NA/NO	0.001	NA	NA/NO	NA/NO	NE	NA	NE	NA
2018	0.227	0.227	0.225	0.000	NE	0.001	NE	NA/NO	0.001	NA	NA/NO	NA/NO	NE	NA	NE	NA
2019																
Trend																
1990 - 2019	0.7%	1.8%	2.7%	-33.8%	NA	-59.6%	NA	NA	-78.2%	NA	NA	NA	NA	NA	NA	NA
2005 - 2019	39.6%	40.5%	42.4%	-85.2%	NA	-20.7%	NA	NA	-55.8%	NA	NA	NA	NA	NA	NA	NA
2018 - 2019	15.0%	15.1%	15.2%	0.4%	NA	-6.5%	NA	NA	-0.1%	NA	NA	NA	NA	NA	NA	NA
Share in National Total																
1990	100%	98.6%	97.0%	0.2%	NA	1.5%	NA	NA	1.4%	NA	NA	NA	NA	NA	NA	NA
2005	100%	99.1%	97.1%	1.0%	0.0%	1.0%	NA	NA	0.9%	NA	NA	NA	NA	NA	NA	NA
2019	100%	99.7%	99.0%	0.1%	NA	0.6%	NA	NA	0.3%	NA	NA	NA	NA	NA	NA	NA

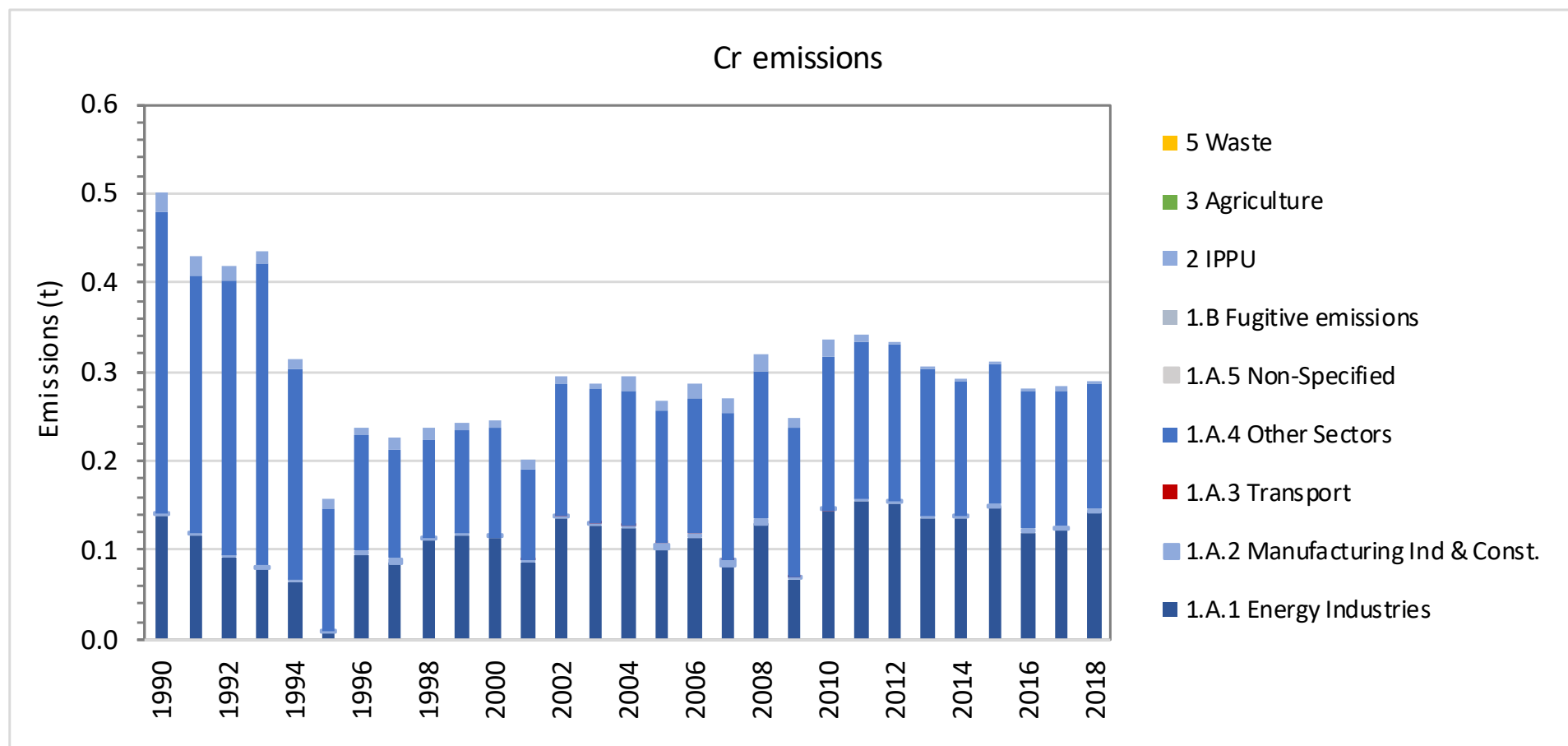


Figure 2.14 Chromium (Cr) Emissions 1990 - 2019

Table 2.14 Chromium (Cr) Emissions 1990 - 2019

Cr		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
t	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
1990	0.501	0.480	0.140	0.002	0.000	0.339	NE	NA/NO	0.021	NA	NA/NO	NE	NE	NA	NE	NA
1991	0.428	0.409	0.116	0.002	0.000	0.290	NE	NA/NO	0.020	NA	NA/NO	NE	NE	NA	NE	NA
1992	0.418	0.404	0.093	0.001	0.000	0.309	NE	NA/NO	0.014	NA	NA/NO	NE	NE	NA	NE	NA
1993	0.434	0.423	0.080	0.001	0.000	0.341	NE	NA/NO	0.012	NA	NA/NO	NE	NE	NA	NE	NA
1994	0.314	0.303	0.065	0.001	0.000	0.236	NE	NA/NO	0.011	NA	NA/NO	NE	NE	NA	NE	NA
1995	0.156	0.147	0.008	0.001	0.000	0.138	NE	NA/NO	0.009	NA	NA/NO	NE	NE	NA	NE	NA
1996	0.238	0.227	0.095	0.003	0.000	0.129	NE	NA/NO	0.010	NA	NA/NO	NE	NE	NA	NE	NA
1997	0.224	0.211	0.086	0.004	0.000	0.121	NE	NA/NO	0.013	NA	NA/NO	NE	NE	NA	NE	NA
1998	0.238	0.224	0.112	0.000	0.000	0.111	NE	NA/NO	0.014	NA	NA/NO	NE	NE	NA	NE	NA
1999	0.242	0.234	0.117	0.002	0.000	0.115	NE	NA/NO	0.009	NA	NA/NO	NE	NE	NA	NE	NA
2000	0.245	0.236	0.114	0.000	0.000	0.122	NE	NA/NO	0.008	NA	NA/NO	NE	NE	NA	NE	NA
2001	0.202	0.191	0.086	0.002	0.000	0.102	NE	NA/NO	0.011	NA	NA/NO	NE	NE	NA	NE	NA
2002	0.294	0.285	0.136	0.002	0.000	0.147	NE	NA/NO	0.008	NA	NA/NO	NE	NE	NA	NE	NA
2003	0.287	0.281	0.129	0.001	0.000	0.151	NE	NA/NO	0.006	NA	NA/NO	NE	NE	NA	NE	NA
2004	0.294	0.279	0.125	0.001	0.000	0.153	NE	NA/NO	0.015	NA	NA/NO	NE	NE	NA	NE	NA
2005	0.265	0.255	0.101	0.006	0.000	0.148	NE	NA/NO	0.010	NA	NA/NO	NE	NE	NA	NE	NA
2006	0.285	0.269	0.115	0.004	0.000	0.151	NE	NA/NO	0.016	NA	NA/NO	NE	NE	NA	NE	NA
2007	0.270	0.252	0.083	0.005	0.000	0.164	NE	NA/NO	0.017	NA	NA/NO	NE	NE	NA	NE	NA
2008	0.319	0.299	0.129	0.005	0.000	0.165	NE	NA/NO	0.020	NA	NA/NO	NE	NE	NA	NE	NA

Cr		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
t	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
2009	0.247	0.237	0.068	0.001	0.000	0.168	NE	NA/NO	0.010	NA	NA/NO	NE	NE	NA	NE	NA
2010	0.337	0.316	0.144	0.000	0.000	0.171	NE	NA/NO	0.021	NA	NA/NO	NE	NE	NA	NE	NA
2011	0.345	0.339	0.156	0.006	NE	0.177	NE	NA/NO	0.006	NA	NA/NO	NE	NE	NA	NE	NA
2012	0.337	0.335	0.153	0.006	NE	0.175	NE	NA/NO	0.003	NA	NA/NO	NE	NE	NA	NE	NA
2013	0.311	0.309	0.136	0.006	NE	0.166	NE	NA/NO	0.002	NA	NA/NO	NE	NE	NA	NE	NA
2014	0.299	0.297	0.137	0.009	NE	0.152	NE	NA/NO	0.001	NA	NA/NO	NE	NE	NA	NE	NA
2015	0.319	0.315	0.148	0.010	NE	0.157	NE	NA/NO	0.004	NA	NA/NO	NE	NE	NA	NE	NA
2016	0.289	0.284	0.120	0.010	NE	0.154	NE	NA/NO	0.005	NA	NA/NO	NE	NE	NA	NE	NA
2017	0.290	0.286	0.124	0.009	NE	0.153	NE	NA/NO	0.005	NA	NA/NO	NE	NE	NA	NE	NA
2018	0.297	0.292	0.143	0.009	NE	0.140	NE	NA/NO	0.005	NA	NA/NO	NE	NE	NA	NE	NA
2019																
Trend																
1990 - 2019	-40.7%	-39.1%	2.6%	445.4%	NA	-58.6%	NA	NA	-78.2%	NA	NA	NA	NA	NA	NA	NA
2005 - 2019	12.0%	14.8%	42.4%	49.4%	NA	-5.3%	NA	NA	-55.8%	NA	NA	NA	NA	NA	NA	NA
2018 - 2019	2.3%	2.3%	15.2%	-0.2%	NA	-8.1%	NA	NA	-0.1%	NA	NA	NA	NA	NA	NA	NA
Share in National Total																
1990	100%	95.9%	27.9%	0.3%	0.0%	67.6%	NA	NA	4.1%	NA	NA	NA	NA	NA	NA	NA
2005	100%	96.1%	38.0%	2.2%	0.0%	56.0%	NA	NA	3.9%	NA	NA	NA	NA	NA	NA	NA
2019	100%	98.5%	48.3%	2.9%	NA	47.3%	NA	NA	1.5%	NA	NA	NA	NA	NA	NA	NA

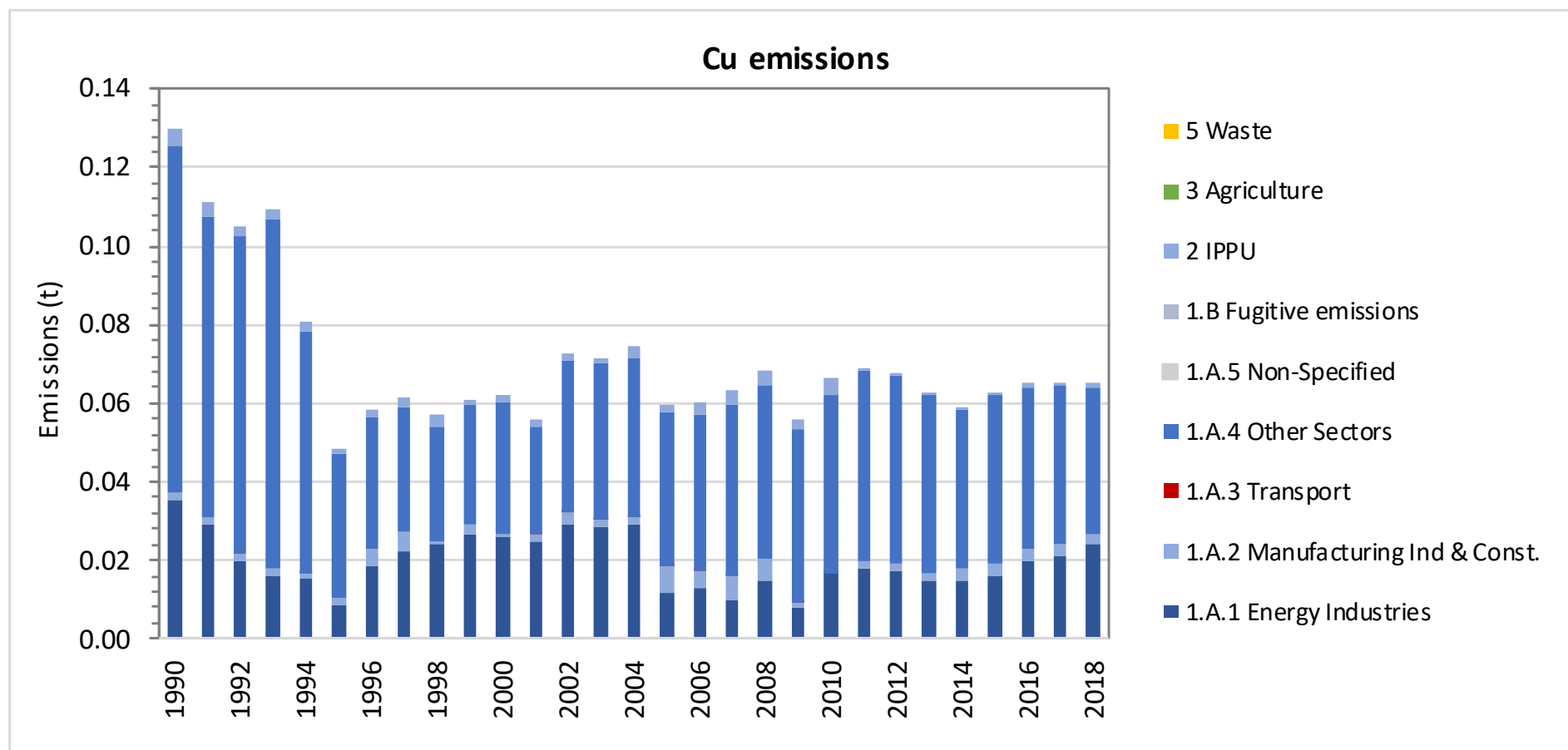


Figure 2.15 Copper (Cu) Emissions 1990 - 2019

Table 2.15 Copper (Cu) Emissions 1990 - 2019

Cu		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
t	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
1990	0.130	0.126	0.035	0.002	0.000	0.089	NE	NA/NO	0.004	NA	NA	NA	NA	NA	NE	NA
1991	0.111	0.107	0.029	0.002	0.000	0.076	NE	NA/NO	0.004	NA	NA	NA	NA	NA	NE	NA
1992	0.105	0.102	0.020	0.002	0.000	0.081	NE	NA/NO	0.003	NA	NA	NA	NA	NA	NE	NA
1993	0.109	0.107	0.016	0.002	0.000	0.089	NE	NA/NO	0.002	NA	NA	NA	NA	NA	NE	NA
1994	0.081	0.079	0.015	0.001	0.000	0.062	NE	NA/NO	0.002	NA	NA	NA	NA	NA	NE	NA
1995	0.049	0.047	0.009	0.002	0.000	0.036	NE	NA/NO	0.002	NA	NA	NA	NA	NA	NE	NA
1996	0.059	0.057	0.018	0.004	0.000	0.034	NE	NA/NO	0.002	NA	NA	NA	NA	NA	NE	NA
1997	0.062	0.059	0.022	0.005	0.000	0.032	NE	NA/NO	0.003	NA	NA	NA	NA	NA	NE	NA
1998	0.057	0.054	0.024	0.000	0.000	0.029	NE	NA/NO	0.003	NA	NA	NA	NA	NA	NE	NA
1999	0.061	0.059	0.026	0.003	0.000	0.030	NE	NA/NO	0.002	NA	NA	NA	NA	NA	NE	NA
2000	0.062	0.060	0.026	0.000	0.000	0.034	NE	NA/NO	0.002	NA	NA	NA	NA	NA	NE	NA
2001	0.056	0.054	0.025	0.002	0.000	0.027	NE	NA/NO	0.002	NA	NA	NA	NA	NA	NE	NA
2002	0.072	0.071	0.029	0.003	0.000	0.039	NE	NA/NO	0.002	NA	NA	NA	NA	NA	NE	NA
2003	0.071	0.070	0.029	0.002	0.000	0.040	NE	NA/NO	0.001	NA	NA	NA	NA	NA	NE	NA
2004	0.074	0.071	0.029	0.002	0.000	0.040	NE	NA/NO	0.003	NA	NA	NA	NA	NA	NE	NA
2005	0.060	0.058	0.012	0.007	0.000	0.039	NE	NA/NO	0.002	NA	NA	NA	NA	NA	NE	NA
2006	0.060	0.057	0.013	0.004	0.000	0.040	NE	NA/NO	0.003	NA	NA	NA	NA	NA	NE	NA
2007	0.063	0.060	0.010	0.006	0.000	0.044	NE	NA/NO	0.003	NA	NA	NA	NA	NA	NE	NA
2008	0.068	0.064	0.015	0.006	0.000	0.044	NE	NA/NO	0.004	NA	NA	NA	NA	NA	NE	NA

Cu		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
t	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
2009	0.056	0.054	0.008	0.001	0.000	0.044	NE	NA/NO	0.002	NA	NA	NA	NA	NA	NE	NA
2010	0.066	0.062	0.016	0.000	0.000	0.045	NE	NA/NO	0.004	NA	NA	NA	NA	NA	NE	NA
2011	0.069	0.068	0.018	0.002	NE	0.048	NE	NA/NO	0.001	NA	NA	NA	NA	NA	NE	NA
2012	0.068	0.067	0.017	0.002	NE	0.048	NE	NA/NO	0.001	NA	NA	NA	NA	NA	NE	NA
2013	0.063	0.062	0.015	0.002	NE	0.045	NE	NA/NO	0.000	NA	NA	NA	NA	NA	NE	NA
2014	0.059	0.059	0.015	0.003	NE	0.041	NE	NA/NO	0.000	NA	NA	NA	NA	NA	NE	NA
2015	0.063	0.062	0.016	0.003	NE	0.042	NE	NA/NO	0.001	NA	NA	NA	NA	NA	NE	NA
2016	0.065	0.064	0.020	0.003	NE	0.041	NE	NA/NO	0.001	NA	NA	NA	NA	NA	NE	NA
2017	0.065	0.064	0.021	0.003	NE	0.040	NE	NA/NO	0.001	NA	NA	NA	NA	NA	NE	NA
2018	0.065	0.064	0.024	0.003	NE	0.037	NE	NA/NO	0.001	NA	NA	NA	NA	NA	NE	NA
2019																
Trend																
1990 - 2019	-50.0%	-49.1%	-32.2%	48.2%	NA	-57.8%	NA	NA	-78.2%	NA	NA	NA	NA	NA	NA	NA
2005 - 2019	8.5%	10.8%	107.2%	-61.6%	NA	-4.3%	NA	NA	-55.8%	NA	NA	NA	NA	NA	NA	NA
2018 - 2019	-0.7%	-0.7%	12.4%	-0.7%	NA	-7.5%	NA	NA	-0.1%	NA	NA	NA	NA	NA	NA	NA
Share in National Total																
1990	100%	96.8%	27.1%	1.4%	0.0%	68.3%	NA	NA	3.2%	NA	NA	NA	NA	NA	NA	NA
2005	100%	96.6%	19.2%	12.1%	0.0%	65.3%	NA	NA	3.4%	NA	NA	NA	NA	NA	NA	NA
2019	100%	98.6%	36.7%	4.3%	NA	57.6%	NA	NA	1.4%	NA	NA	NA	NA	NA	NA	NA

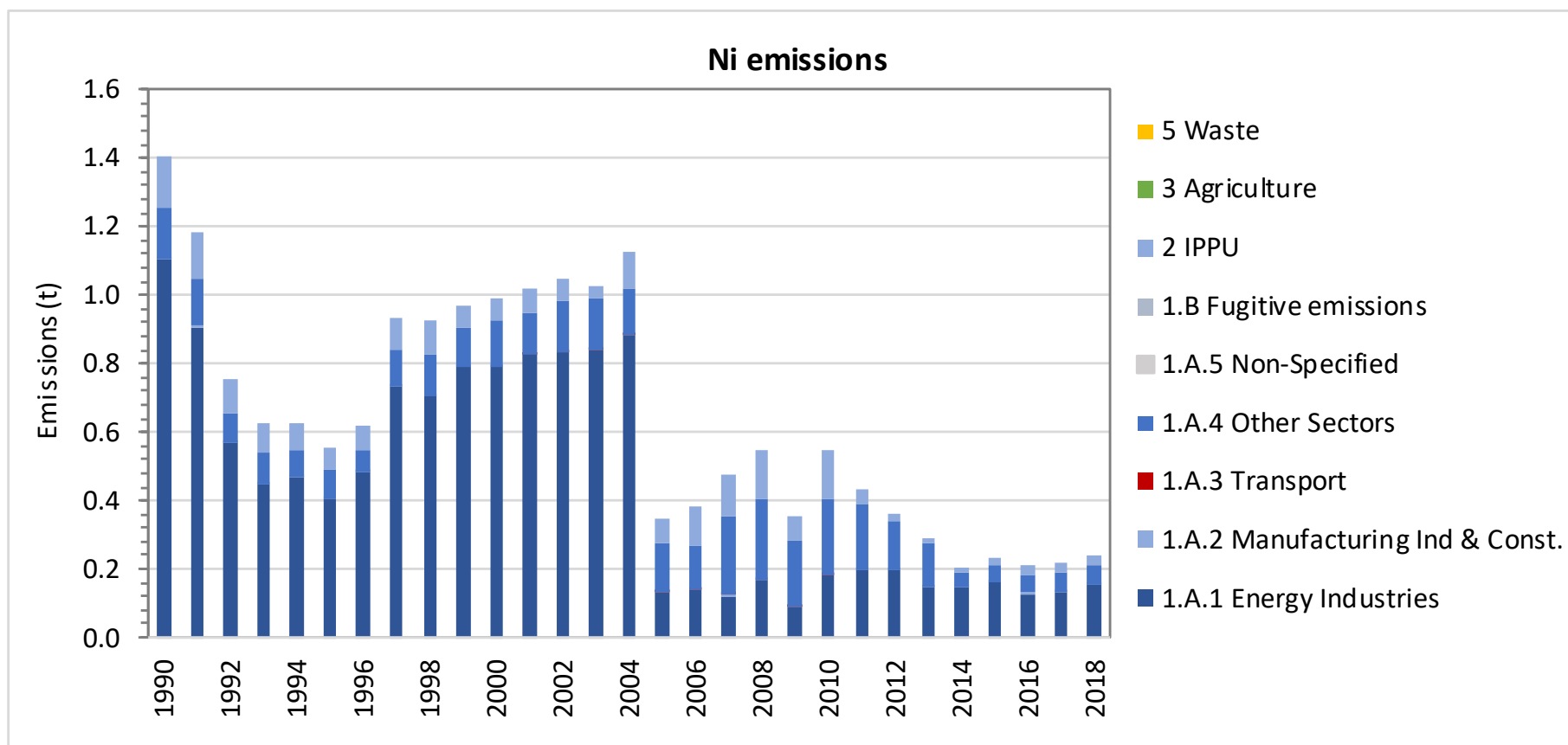


Figure 2.16 Nickel (Ni) Emissions 1990 - 2019



Table 2.16 Nickel (Ni) Emissions 1990 - 2019

Ni		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
t	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
1990	1.403	1.258	1.106	0.001	0.000	0.151	NE	NA/NO	0.145	NA	NA/NO	NA/NO	NE	NA	NE	NA
1991	1.185	1.047	0.908	0.001	0.000	0.139	NE	NA/NO	0.137	NA	NA/NO	NA/NO	NE	NA	NE	NA
1992	0.755	0.655	0.566	0.001	0.000	0.089	NE	NA/NO	0.100	NA	NA/NO	NA/NO	NE	NA	NE	NA
1993	0.623	0.543	0.445	0.001	0.000	0.096	NE	NA/NO	0.081	NA	NA/NO	NA/NO	NE	NA	NE	NA
1994	0.625	0.547	0.469	0.001	0.000	0.077	NE	NA/NO	0.078	NA	NA/NO	NA/NO	NE	NA	NE	NA
1995	0.555	0.493	0.403	0.001	0.000	0.089	NE	NA/NO	0.062	NA	NA/NO	NA/NO	NE	NA	NE	NA
1996	0.621	0.549	0.484	0.003	0.000	0.063	NE	NA/NO	0.072	NA	NA/NO	NA/NO	NE	NA	NE	NA
1997	0.936	0.843	0.730	0.003	0.000	0.110	NE	NA/NO	0.093	NA	NA/NO	NA/NO	NE	NA	NE	NA
1998	0.924	0.825	0.707	0.000	0.000	0.118	NE	NA/NO	0.099	NA	NA/NO	NA/NO	NE	NA	NE	NA
1999	0.969	0.907	0.792	0.002	0.000	0.114	NE	NA/NO	0.062	NA	NA/NO	NA/NO	NE	NA	NE	NA
2000	0.989	0.929	0.792	0.000	0.000	0.137	NE	NA/NO	0.059	NA	NA/NO	NA/NO	NE	NA	NE	NA
2001	1.022	0.945	0.825	0.001	0.000	0.119	NE	NA/NO	0.077	NA	NA/NO	NA/NO	NE	NA	NE	NA
2002	1.044	0.986	0.834	0.002	0.000	0.151	NE	NA/NO	0.058	NA	NA/NO	NA/NO	NE	NA	NE	NA
2003	1.029	0.988	0.840	0.001	0.000	0.148	NE	NA/NO	0.041	NA	NA/NO	NA/NO	NE	NA	NE	NA
2004	1.127	1.022	0.885	0.001	0.000	0.137	NE	NA/NO	0.105	NA	NA/NO	NA/NO	NE	NA	NE	NA
2005	0.347	0.276	0.130	0.004	0.000	0.141	NE	NA/NO	0.072	NA	NA/NO	NA/NO	NE	NA	NE	NA
2006	0.384	0.271	0.137	0.002	0.000	0.132	NE	NA/NO	0.113	NA	NA/NO	NA/NO	NE	NA	NE	NA
2007	0.478	0.356	0.121	0.004	0.000	0.231	NE	NA/NO	0.122	NA	NA/NO	NA/NO	NE	NA	NE	NA
2008	0.546	0.405	0.166	0.003	0.000	0.236	NE	NA/NO	0.141	NA	NA/NO	NA/NO	NE	NA	NE	NA
2009	0.356	0.283	0.087	0.001	0.000	0.195	NE	NA/NO	0.072	NA	NA/NO	NA/NO	NE	NA	NE	NA

Ni		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
t	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
2010	0.547	0.402	0.185	0.000	0.000	0.216	NE	NA/NO	0.145	NA	NA/NO	NA/NO	NE	NA	NE	NA
2011	0.430	0.387	0.197	0.001	NE	0.190	NE	NA/NO	0.043	NA	NA/NO	NA/NO	NE	NA	NE	NA
2012	0.360	0.341	0.197	0.001	NE	0.144	NE	NA/NO	0.018	NA	NA/NO	NA/NO	NE	NA	NE	NA
2013	0.287	0.273	0.145	0.001	NE	0.127	NE	NA/NO	0.014	NA	NA/NO	NA/NO	NE	NA	NE	NA
2014	0.202	0.192	0.146	0.001	NE	0.046	NE	NA/NO	0.010	NA	NA/NO	NA/NO	NE	NA	NE	NA
2015	0.235	0.210	0.158	0.001	NE	0.050	NE	NA/NO	0.026	NA	NA/NO	NA/NO	NE	NA	NE	NA
2016	0.213	0.181	0.128	0.001	NE	0.052	NE	NA/NO	0.032	NA	NA/NO	NA/NO	NE	NA	NE	NA
2017	0.218	0.187	0.133	0.001	NE	0.053	NE	NA/NO	0.032	NA	NA/NO	NA/NO	NE	NA	NE	NA
2018	0.240	0.208	0.153	0.001	NE	0.055	NE	NA/NO	0.032	NA	NA/NO	NA/NO	NE	NA	NE	NA
2019																
Trend																
1990 - 2019	-82.9%	-83.4%	-86.2%	28.2%	NA	-63.7%	NA	NA	-78.2%	NA	NA	NA	NA	NA	NA	NA
2005 - 2019	-30.8%	-24.4%	17.4%	-79.7%	NA	-61.2%	NA	NA	-55.8%	NA	NA	NA	NA	NA	NA	NA
2018 - 2019	10.0%	11.6%	15.2%	-0.2%	NA	2.9%	NA	NA	-0.1%	NA	NA	NA	NA	NA	NA	NA
Share in National Total																
1990	100%	89.6%	78.8%	0.0%	0.0%	10.7%	NA	NA	10.4%	NA	NA	NA	NA	NA	NA	NA
2005	100%	79.4%	37.5%	1.3%	0.0%	40.6%	NA	NA	20.6%	NA	NA	NA	NA	NA	NA	NA
2019	100%	86.8%	63.7%	0.4%	NA	22.8%	NA	NA	13.2%	NA	NA	NA	NA	NA	NA	NA

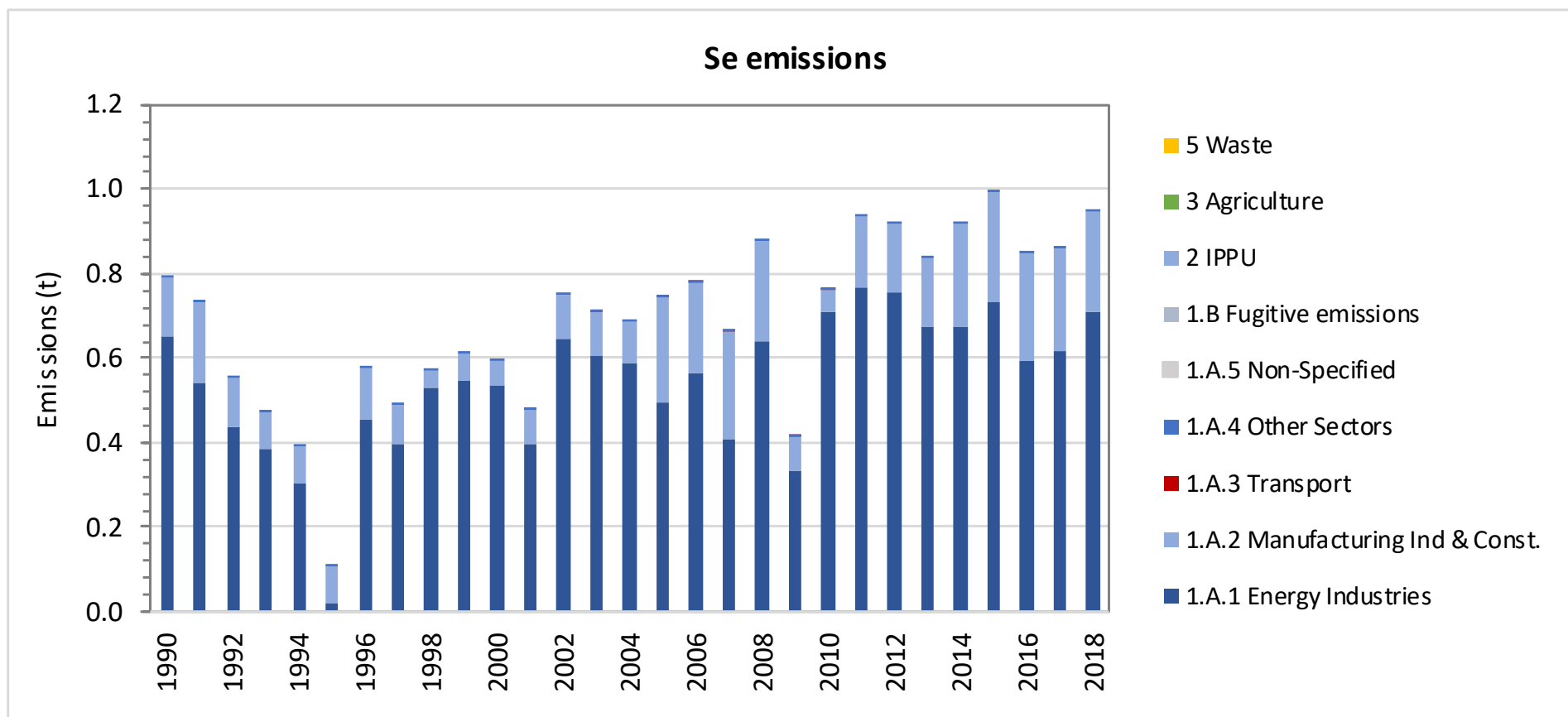


Figure 2.17 Selen (Se) Emissions 1990 - 2019

Table 2.17 Selen (Se) Emissions 1990 - 2019

Se		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
t	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
1990	0.658	0.658	0.651	0.001	0.000	0.007	NE	NA/NO	NE	NA	NA/NO	NE	NE	NA	NE	NA
1991	0.550	0.550	0.543	0.001	0.000	0.006	NE	NA/NO	NE	NA	NA/NO	NE	NE	NA	NE	NA
1992	0.446	0.446	0.439	0.000	0.000	0.007	NE	NA/NO	NE	NA	NA/NO	NE	NE	NA	NE	NA
1993	0.390	0.390	0.383	0.000	0.000	0.007	NE	NA/NO	NE	NA	NA/NO	NE	NE	NA	NE	NA
1994	0.311	0.311	0.306	0.000	0.000	0.005	NE	NA/NO	NE	NA	NA/NO	NE	NE	NA	NE	NA
1995	0.025	0.025	0.022	0.000	0.000	0.003	NE	NA/NO	NE	NA	NA/NO	NE	NE	NA	NE	NA
1996	0.456	0.456	0.453	0.001	0.000	0.003	NE	NA/NO	NE	NA	NA/NO	NE	NE	NA	NE	NA
1997	0.401	0.401	0.398	0.001	0.000	0.003	NE	NA/NO	NE	NA	NA/NO	NE	NE	NA	NE	NA
1998	0.532	0.532	0.530	0.000	0.000	0.002	NE	NA/NO	NE	NA	NA/NO	NE	NE	NA	NE	NA
1999	0.552	0.552	0.549	0.000	0.000	0.002	NE	NA/NO	NE	NA	NA/NO	NE	NE	NA	NE	NA
2000	0.540	0.540	0.537	0.000	0.000	0.003	NE	NA/NO	NE	NA	NA/NO	NE	NE	NA	NE	NA
2001	0.400	0.400	0.397	0.000	0.000	0.002	NE	NA/NO	NE	NA	NA/NO	NE	NE	NA	NE	NA
2002	0.647	0.647	0.643	0.001	0.000	0.003	NE	NA/NO	NE	NA	NA/NO	NE	NE	NA	NE	NA
2003	0.610	0.610	0.606	0.000	0.000	0.003	NE	NA/NO	NE	NA	NA/NO	NE	NE	NA	NE	NA
2004	0.590	0.590	0.587	0.000	0.000	0.003	NE	NA/NO	NE	NA	NA/NO	NE	NE	NA	NE	NA
2005	0.501	0.501	0.497	0.001	0.000	0.003	NE	NA/NO	NE	NA	NA/NO	NE	NE	NA	NE	NA
2006	0.571	0.571	0.567	0.001	0.000	0.003	NE	NA/NO	NE	NA	NA/NO	NE	NE	NA	NE	NA
2007	0.412	0.412	0.408	0.001	0.000	0.003	NE	NA/NO	NE	NA	NA/NO	NE	NE	NA	NE	NA
2008	0.643	0.643	0.639	0.001	0.000	0.003	NE	NA/NO	NE	NA	NA/NO	NE	NE	NA	NE	NA
2009	0.338	0.338	0.334	0.000	0.000	0.003	NE	NA/NO	NE	NA	NA/NO	NE	NE	NA	NE	NA

Se		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
t	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
2010	0.716	0.716	0.712	0.000	0.000	0.004	NE	NA/NO	NE	NA	NA/NO	NE	NE	NA	NE	NA
2011	0.773	0.773	0.769	0.000	NE	0.004	NE	NA/NO	NE	NA	NA/NO	NE	NE	NA	NE	NA
2012	0.758	0.758	0.754	0.000	NE	0.004	NE	NA/NO	NE	NA	NA/NO	NE	NE	NA	NE	NA
2013	0.678	0.678	0.674	0.000	NE	0.004	NE	NA/NO	NE	NA	NA/NO	NE	NE	NA	NE	NA
2014	0.679	0.679	0.675	0.000	NE	0.003	NE	NA/NO	NE	NA	NA/NO	NE	NE	NA	NE	NA
2015	0.737	0.737	0.734	0.000	NE	0.003	NE	NA/NO	NE	NA	NA/NO	NE	NE	NA	NE	NA
2016	0.599	0.599	0.596	0.000	NE	0.003	NE	NA/NO	NE	NA	NA/NO	NE	NE	NA	NE	NA
2017	0.619	0.619	0.616	0.000	NE	0.003	NE	NA/NO	NE	NA	NA/NO	NE	NE	NA	NE	NA
2018	0.713	0.713	0.709	0.000	NE	0.003	NE	NA/NO	NE	NA	NA/NO	NE	NE	NA	NE	NA
2019																
Trend																
1990 - 2019	8.3%	8.3%	9.0%	-23.6%	NA	-58.4%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2005 - 2019	42.2%	42.2%	42.8%	-65.3%	NA	-2.7%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2018 - 2019	15.1%	15.1%	15.2%	-1.6%	NA	-8.2%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Share in National Total																
1990	100%	100.0%	98.8%	0.1%	0.0%	1.1%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2005	100%	100.0%	99.1%	0.3%	0.0%	0.6%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2019	100%	100.0%	99.5%	0.1%	NA	0.4%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

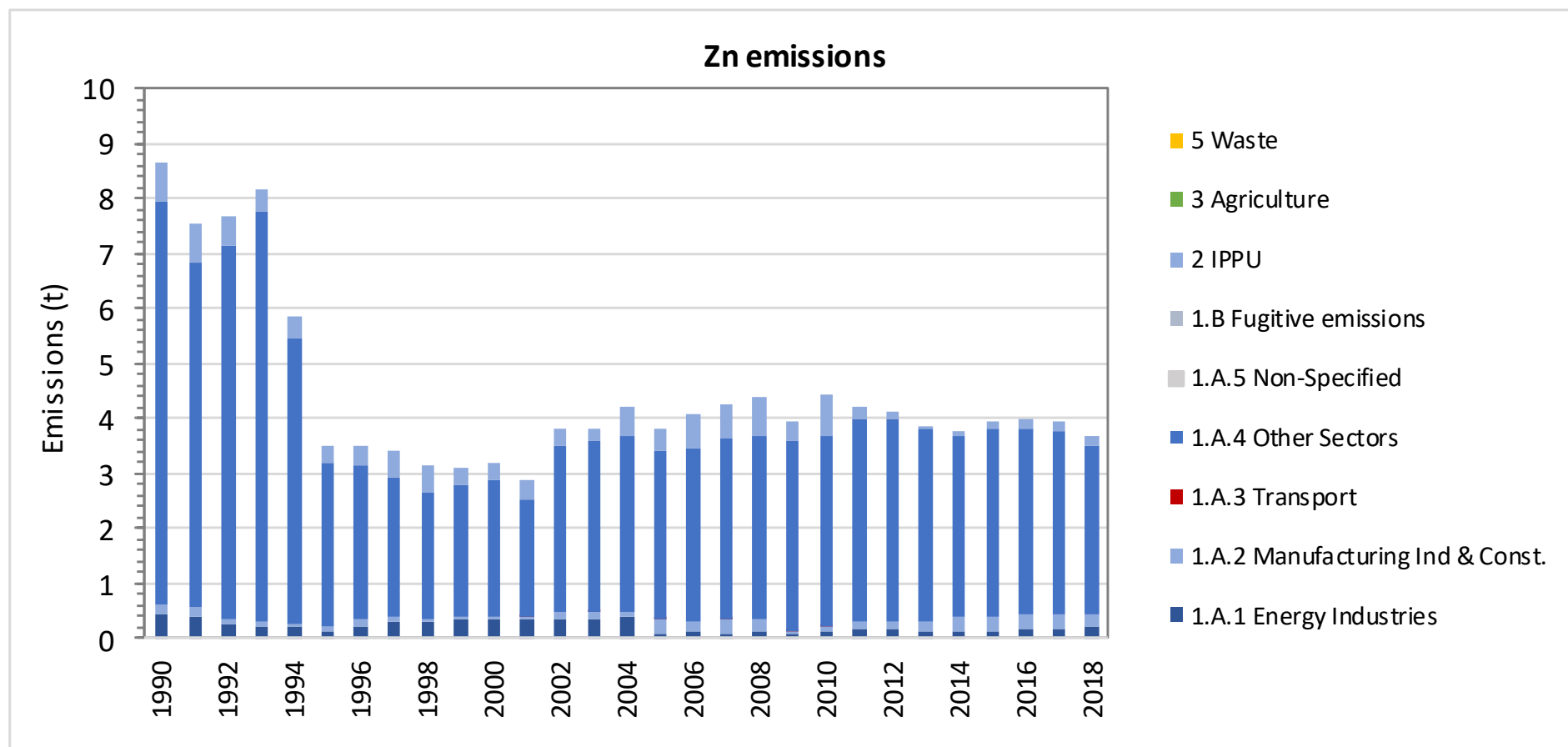


Figure 2.18 Zinc (Zn) Emissions 1990 - 2019

Table 2.18 Zinc (Zn) Emissions 1990 - 2019

Zn		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
t	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
1990	8.683	7.936	0.459	0.139	0.000	7.338	NE	NA/NO	0.748	NA	NA	NA	NA	NA	8.683	7.936
1991	7.554	6.847	0.378	0.191	0.000	6.278	NE	NA/NO	0.707	NA	NA	NA	NA	NA	7.554	6.847
1992	7.662	7.148	0.248	0.116	0.000	6.785	NE	NA/NO	0.514	NA	NA	NA	NA	NA	7.662	7.148
1993	8.179	7.763	0.199	0.089	0.000	7.475	NE	NA/NO	0.415	NA	NA	NA	NA	NA	8.179	7.763
1994	5.853	5.451	0.198	0.086	0.000	5.167	NE	NA/NO	0.403	NA	NA	NA	NA	NA	5.853	5.451
1995	3.496	3.177	0.141	0.087	0.000	2.949	NE	NA/NO	0.319	NA	NA	NA	NA	NA	3.496	3.177
1996	3.499	3.130	0.221	0.121	0.000	2.788	NE	NA/NO	0.369	NA	NA	NA	NA	NA	3.499	3.130
1997	3.402	2.926	0.299	0.092	0.000	2.535	NE	NA/NO	0.477	NA	NA	NA	NA	NA	3.402	2.926
1998	3.153	2.644	0.307	0.039	0.000	2.298	NE	NA/NO	0.509	NA	NA	NA	NA	NA	3.153	2.644
1999	3.100	2.783	0.339	0.062	0.000	2.383	NE	NA/NO	0.317	NA	NA	NA	NA	NA	3.100	2.783
2000	3.198	2.893	0.337	0.058	0.000	2.497	NE	NA/NO	0.305	NA	NA	NA	NA	NA	3.198	2.893
2001	2.905	2.510	0.332	0.082	0.000	2.096	NE	NA/NO	0.395	NA	NA	NA	NA	NA	2.905	2.510
2002	3.814	3.516	0.365	0.106	0.000	3.045	NE	NA/NO	0.298	NA	NA	NA	NA	NA	3.814	3.516
2003	3.824	3.611	0.362	0.101	0.000	3.148	NE	NA/NO	0.213	NA	NA	NA	NA	NA	3.824	3.611
2004	4.216	3.676	0.375	0.097	0.000	3.203	NE	NA/NO	0.541	NA	NA	NA	NA	NA	4.216	3.676
2005	3.806	3.438	0.105	0.245	0.000	3.088	NE	NA/NO	0.368	NA	NA	NA	NA	NA	3.806	3.438
2006	4.064	3.483	0.116	0.213	0.000	3.154	NE	NA/NO	0.581	NA	NA	NA	NA	NA	4.064	3.483
2007	4.272	3.646	0.091	0.254	0.000	3.301	NE	NA/NO	0.626	NA	NA	NA	NA	NA	4.272	3.646
2008	4.401	3.675	0.135	0.240	0.000	3.301	NE	NA/NO	0.726	NA	NA	NA	NA	NA	4.401	3.675
2009	3.970	3.597	0.071	0.081	0.000	3.446	NE	NA/NO	0.373	NA	NA	NA	NA	NA	3.970	3.597

Zn		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
t	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
2010	4.428	3.681	0.150	0.050	0.000	3.481	NE	NA/NO	0.748	NA	NA	NA	NA	NA	4.428	3.681
2011	4.201	3.981	0.161	0.165	NE	3.655	NE	NA/NO	0.220	NA	NA	NA	NA	NA	4.201	3.981
2012	4.107	4.013	0.159	0.163	NE	3.691	NE	NA/NO	0.094	NA	NA	NA	NA	NA	4.107	4.013
2013	3.879	3.808	0.132	0.164	NE	3.512	NE	NA/NO	0.071	NA	NA	NA	NA	NA	3.879	3.808
2014	3.757	3.705	0.132	0.246	NE	3.328	NE	NA/NO	0.052	NA	NA	NA	NA	NA	3.757	3.705
2015	3.963	3.831	0.143	0.260	NE	3.428	NE	NA/NO	0.132	NA	NA	NA	NA	NA	3.963	3.831
2016	3.974	3.812	0.184	0.255	NE	3.373	NE	NA/NO	0.163	NA	NA	NA	NA	NA	3.974	3.812
2017	3.934	3.771	0.196	0.242	NE	3.333	NE	NA/NO	0.163	NA	NA	NA	NA	NA	3.934	3.771
2018	3.676	3.514	0.220	0.239	NE	3.054	NE	NA/NO	0.163	NA	NA	NA	NA	NA	3.676	3.514
2019																
Trend																
1990 - 2019	-57.7%	-55.7%	-52.0%	72.2%	NA	-58.4%	NA	NA	-78.2%	NA	NA	NA	NA	NA	-57.7%	-55.7%
2005 - 2019	-3.4%	2.2%	109.7%	-2.1%	NA	-1.1%	NA	NA	-55.8%	NA	NA	NA	NA	NA	-3.4%	2.2%
2018 - 2019	-6.6%	-6.8%	12.2%	-1.0%	NA	-8.4%	NA	NA	-0.1%	NA	NA	NA	NA	NA	-6.6%	-6.8%
Share in National Total																
1990	100%	91.4%	5.3%	1.6%	0.0%	84.5%	NA	NA	8.6%	NA	NA	NA	NA	NA	100%	91.4%
2005	100%	90.3%	2.8%	6.4%	0.0%	81.1%	NA	NA	9.7%	NA	NA	NA	NA	NA	100%	90.3%
2019	100%	95.6%	6.0%	6.5%	NA	83.1%	NA	NA	4.4%	NA	NA	NA	NA	NA	100%	95.6%



## 2.4 Trend of emissions of Persistent Organic Pollutants (POPs)

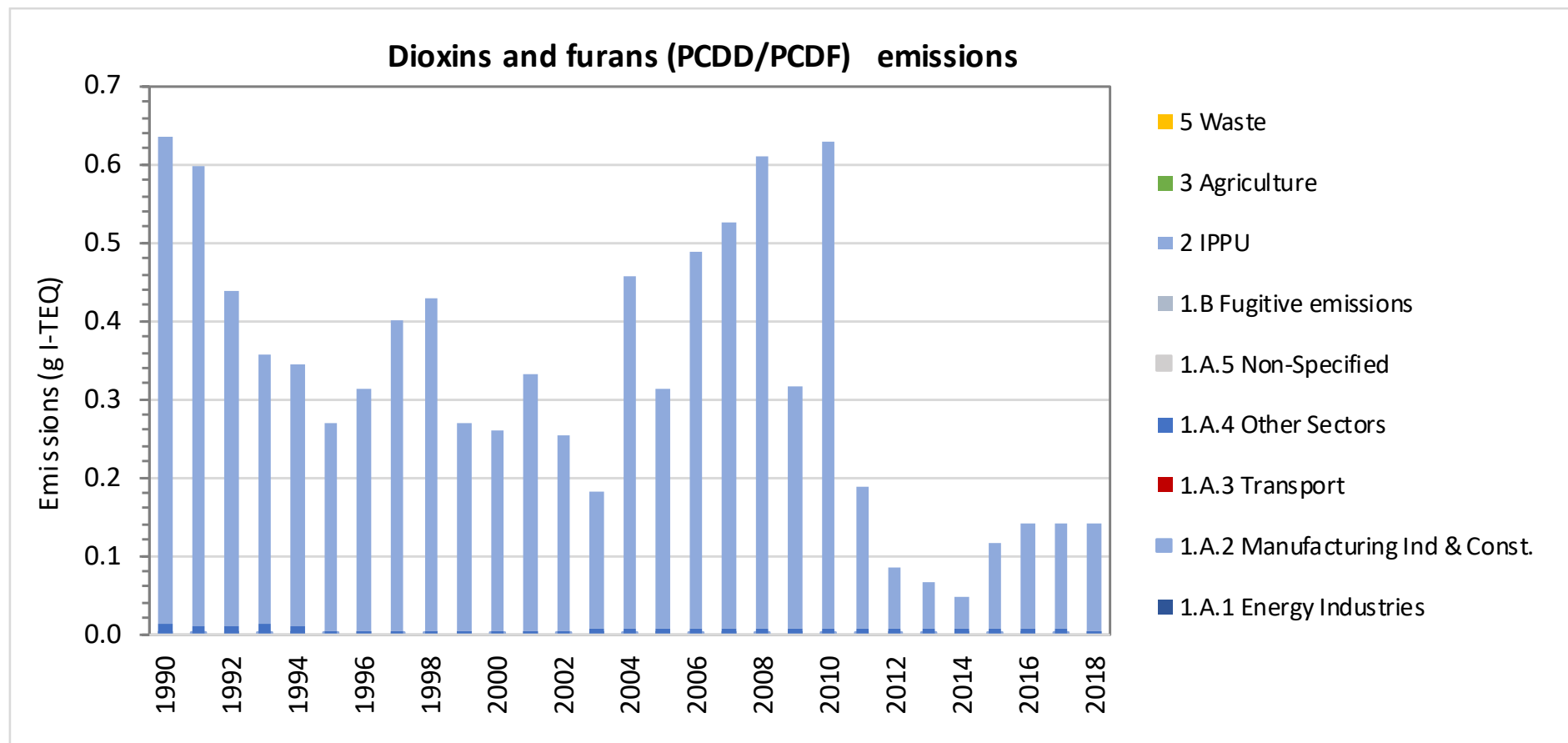


Figure 2.19 Dioxins and furans (PCDD/ PCDF) Emissions 1990 - 2019

Table 2.19 Dioxins and furans (PCDD/ PCDF) Emissions 1990 - 2019

PCDD/ PCDF		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
g I-TEQ	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
1990	0.635	0.012	0.000	0.000	NE	0.011	NE	NA/NO	0.62	NA	NA/NO	NA/NO	NE	NA	NE	NA
1991	0.599	0.010	0.000	0.000	NE	0.010	NE	NA/NO	0.59	NA	NA/NO	NA/NO	NE	NA	NE	NA
1992	0.439	0.011	0.000	0.000	NE	0.011	NE	NA/NO	0.43	NA	NA/NO	NA/NO	NE	NA	NE	NA
1993	0.358	0.012	0.000	0.000	NE	0.012	NE	NA/NO	0.35	NA	NA/NO	NA/NO	NE	NA	NE	NA
1994	0.344	0.008	0.000	0.000	NE	0.008	NE	NA/NO	0.34	NA	NA/NO	NA/NO	NE	NA	NE	NA
1995	0.270	0.005	0.000	0.000	NE	0.005	NE	NA/NO	0.27	NA	NA/NO	NA/NO	NE	NA	NE	NA
1996	0.312	0.004	0.000	0.000	NE	0.004	NE	NA/NO	0.31	NA	NA/NO	NA/NO	NE	NA	NE	NA
1997	0.401	0.004	0.000	0.000	NE	0.004	NE	NA/NO	0.40	NA	NA/NO	NA/NO	NE	NA	NE	NA
1998	0.428	0.004	0.000	0.000	NE	0.004	NE	NA/NO	0.42	NA	NA/NO	NA/NO	NE	NA	NE	NA
1999	0.268	0.004	0.000	0.000	NE	0.004	NE	NA/NO	0.26	NA	NA/NO	NA/NO	NE	NA	NE	NA
2000	0.258	0.004	0.000	0.000	NE	0.004	NE	NA/NO	0.25	NA	NA/NO	NA/NO	NE	NA	NE	NA
2001	0.333	0.003	0.000	0.000	0.000	0.003	NE	NA/NO	0.33	NA	NA/NO	NA/NO	NE	NA	NE	NA
2002	0.253	0.005	0.000	0.000	0.000	0.005	NE	NA/NO	0.25	NA	NA/NO	NA/NO	NE	NA	NE	NA
2003	0.182	0.005	0.000	0.000	0.000	0.005	NE	NA/NO	0.18	NA	NA/NO	NA/NO	NE	NA	NE	NA
2004	0.456	0.005	0.000	0.000	0.000	0.005	NE	NA/NO	0.45	NA	NA/NO	NA/NO	NE	NA	NE	NA
2005	0.312	0.005	0.000	0.000	0.000	0.005	NE	NA/NO	0.31	NA	NA/NO	NA/NO	NE	NA	NE	NA
2006	0.489	0.005	0.000	0.000	0.000	0.005	NE	NA/NO	0.48	NA	NA/NO	NA/NO	NE	NA	NE	NA
2007	0.527	0.005	0.000	0.000	0.000	0.005	NE	NA/NO	0.52	NA	NA/NO	NA/NO	NE	NA	NE	NA
2008	0.610	0.005	0.000	0.000	NE	0.005	NE	NA/NO	0.61	NA	NA/NO	NA/NO	NE	NA	NE	NA
2009	0.316	0.005	0.000	0.000	0.000	0.005	NE	NA/NO	0.31	NA	NA/NO	NA/NO	NE	NA	NE	NA

PCDD/ PCDF		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
g I-TEQ	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
2010	0.628	0.006	0.000	0.000	0.000	0.005	NE	NA/NO	0.62	NA	NA/NO	NA/NO	NE	NA	NE	NA
2011	0.189	0.006	0.000	0.000	NE	0.006	NE	NA/NO	0.18	NA	NA/NO	NA/NO	NE	NA	NE	NA
2012	0.084	0.006	0.000	0.000	NE	0.006	NE	NA/NO	0.08	NA	NA/NO	NA/NO	NE	NA	NE	NA
2013	0.065	0.005	0.000	0.000	NE	0.005	NE	NA/NO	0.06	NA	NA/NO	NA/NO	NE	NA	NE	NA
2014	0.048	0.005	0.000	0.000	NE	0.005	NE	NA/NO	0.04	NA	NA/NO	NA/NO	NE	NA	NE	NA
2015	0.115	0.005	0.000	0.000	NE	0.005	NE	NA/NO	0.11	NA	NA/NO	NA/NO	NE	NA	NE	NA
2016	0.141	0.005	0.000	0.000	NE	0.005	NE	NA/NO	0.14	NA	NA/NO	NA/NO	NE	NA	NE	NA
2017	0.141	0.005	0.000	0.000	NE	0.005	NE	NA/NO	0.14	NA	NA/NO	NA/NO	NE	NA	NE	NA
2018	0.140	0.005	0.000	0.000	NE	0.005	NE	NA/NO	0.14	NA	NA/NO	NA/NO	NE	NA	NE	NA
2019																
Trend																
1990 - 2019	-77.9%	-59.0%	6.8%	144.9%	NA	-60.1%	NA	NA	-78.2%	NA	NA	NA	NA	NA	NA	NA
2005 - 2019	-55.0%	-4.1%	46.8%	-47.1%	NA	-4.6%	NA	NA	-55.8%	NA	NA	NA	NA	NA	NA	NA
2018 - 2019	-0.4%	-8.3%	15.0%	-0.3%	NA	-9.1%	NA	NA	-0.1%	NA	NA	NA	NA	NA	NA	NA
Share in National Total																
1990	100%	1.8%	0.02%	0.0%	NA	1.8%	NA	NA	98.2%	NA	NA	NA	NA	NA	NA	NA
2005	100%	1.6%	0.04%	0.0%	0.0%	1.5%	NA	NA	98.4%	NA	NA	NA	NA	NA	NA	NA
2019	100%	3.4%	0.12%	0.0%	NA	3.2%	NA	NA	96.6%	NA	NA	NA	NA	NA	NA	NA

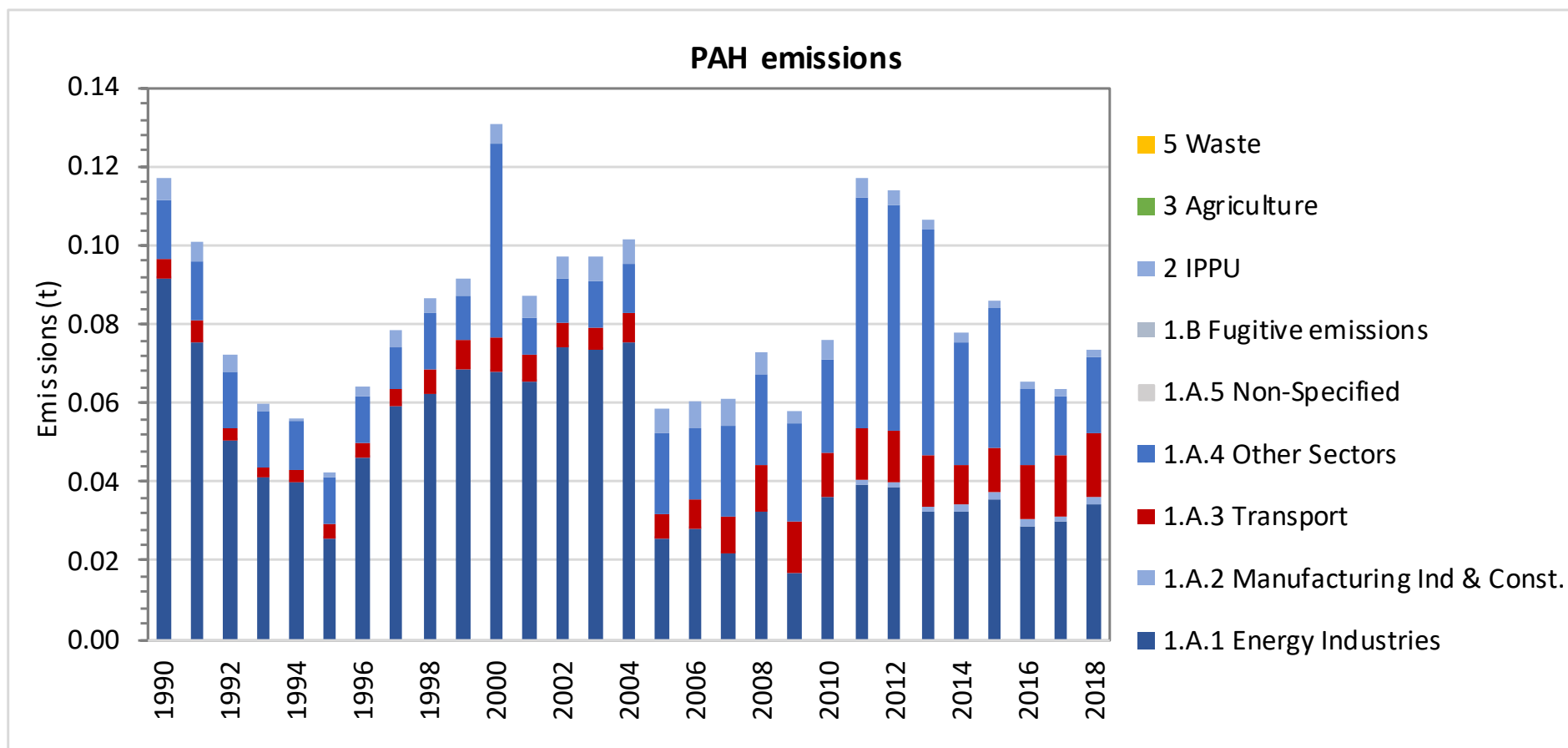


Figure 2.20 Polycyclic aromatic hydrocarbons (PAH) Emissions 1990 - 2019

Table 2.20 Polycyclic aromatic hydrocarbons (PAH) Emissions 1990 - 2019

PAH		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
t	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
1990	0.118	0.113	0.092	0.001	0.005	0.015	NE	NA/NO	0.01	NA	NA/NO	NE	NE	NA	NE	NA
1991	0.102	0.097	0.075	0.001	0.006	0.015	NE	NA/NO	0.01	NA	NA/NO	NE	NE	NA	NE	NA
1992	0.073	0.069	0.050	0.001	0.003	0.014	NE	NA/NO	0.00	NA	NA/NO	NE	NE	NA	NE	NA
1993	0.061	0.059	0.041	0.001	0.003	0.014	NE	NA/NO	0.00	NA	NA/NO	NE	NE	NA	NE	NA
1994	0.057	0.057	0.040	0.001	0.003	0.013	NE	NA/NO	0.00	NA	NA/NO	NE	NE	NA	NE	NA
1995	0.043	0.042	0.026	0.001	0.003	0.012	NE	NA/NO	0.00	NA	NA/NO	NE	NE	NA	NE	NA
1996	0.068	0.065	0.046	0.004	0.004	0.011	NE	NA/NO	0.00	NA	NA/NO	NE	NE	NA	NE	NA
1997	0.083	0.079	0.059	0.005	0.004	0.010	NE	NA/NO	0.00	NA	NA/NO	NE	NE	NA	NE	NA
1998	0.087	0.083	0.062	0.000	0.006	0.014	NE	NA/NO	0.00	NA	NA/NO	NE	NE	NA	NE	NA
1999	0.094	0.090	0.068	0.003	0.008	0.011	NE	NA/NO	0.00	NA	NA/NO	NE	NE	NA	NE	NA
2000	0.131	0.126	0.068	0.000	0.008	0.049	NE	NA/NO	0.00	NA	NA/NO	NE	NE	NA	NE	NA
2001	0.089	0.084	0.065	0.002	0.007	0.009	NE	NA/NO	0.01	NA	NA/NO	NE	NE	NA	NE	NA
2002	0.100	0.094	0.074	0.003	0.006	0.011	NE	NA/NO	0.01	NA	NA/NO	NE	NE	NA	NE	NA
2003	0.098	0.092	0.073	0.001	0.006	0.012	NE	NA/NO	0.01	NA	NA/NO	NE	NE	NA	NE	NA
2004	0.102	0.096	0.076	0.001	0.007	0.012	NE	NA/NO	0.01	NA	NA/NO	NE	NE	NA	NE	NA
2005	0.065	0.058	0.025	0.006	0.006	0.020	NE	NA/NO	0.01	NA	NA/NO	NE	NE	NA	NE	NA
2006	0.063	0.057	0.028	0.003	0.007	0.019	NE	NA/NO	0.01	NA	NA/NO	NE	NE	NA	NE	NA
2007	0.066	0.060	0.022	0.005	0.009	0.023	NE	NA/NO	0.01	NA	NA/NO	NE	NE	NA	NE	NA
2008	0.078	0.072	0.033	0.005	0.011	0.023	NE	NA/NO	0.01	NA	NA/NO	NE	NE	NA	NE	NA

PAH		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
t	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
2009	0.059	0.056	0.017	0.001	0.013	0.025	NE	NA/NO	0.00	NA	NA/NO	NE	NE	NA	NE	NA
2010	0.076	0.071	0.036	0.000	0.011	0.023	NE	NA/NO	0.01	NA	NA/NO	NE	NE	NA	NE	NA
2011	0.116	0.111	0.039	0.000	0.013	0.059	NE	NA/NO	0.00	NA	NA/NO	NE	NE	NA	NE	NA
2012	0.113	0.109	0.038	0.000	0.013	0.057	NE	NA/NO	0.00	NA	NA/NO	NE	NE	NA	NE	NA
2013	0.105	0.103	0.032	0.000	0.013	0.057	NE	NA/NO	0.00	NA	NA/NO	NE	NE	NA	NE	NA
2014	0.076	0.074	0.033	0.000	0.010	0.031	NE	NA/NO	0.00	NA	NA/NO	NE	NE	NA	NE	NA
2015	0.085	0.082	0.035	0.000	0.011	0.035	NE	NA/NO	0.00	NA	NA/NO	NE	NE	NA	NE	NA
2016	0.064	0.062	0.029	0.000	0.014	0.019	NE	NA/NO	0.00	NA	NA/NO	NE	NE	NA	NE	NA
2017	0.062	0.060	0.030	0.000	0.015	0.015	NE	NA/NO	0.00	NA	NA/NO	NE	NE	NA	NE	NA
2018	0.072	0.070	0.034	0.000	0.017	0.019	NE	NA/NO	0.00	NA	NA/NO	NE	NE	NA	NE	NA
2019																
Trend																
1990 - 2019	-39.0%	-37.8%	-62.6%	-71.9%	248.8%	22.5%	NA	NA	-62.2%	NA	NA	NA	NA	NA	NA	NA
2005 - 2019	11.9%	20.3%	34.9%	-95.7%	156.9%	-6.0%	NA	NA	-66.6%	NA	NA	NA	NA	NA	NA	NA
2018 - 2019	15.7%	16.3%	15.2%	-0.8%	9.4%	25.7%	NA	NA	-0.7%	NA	NA	NA	NA	NA	NA	NA
Share in National Total																
1990	100%	95.3%	77.4%	0.8%	4.0%	13.1%	NA	NA	4.7%	NA	NA	NA	NA	NA	NA	NA
2005	100%	90.3%	39.3%	9.7%	10.0%	31.2%	NA	NA	9.7%	NA	NA	NA	NA	NA	NA	NA
2019	100%	97.1%	47.4%	0.4%	23.1%	26.3%	NA	NA	2.9%	NA	NA	NA	NA	NA	NA	NA

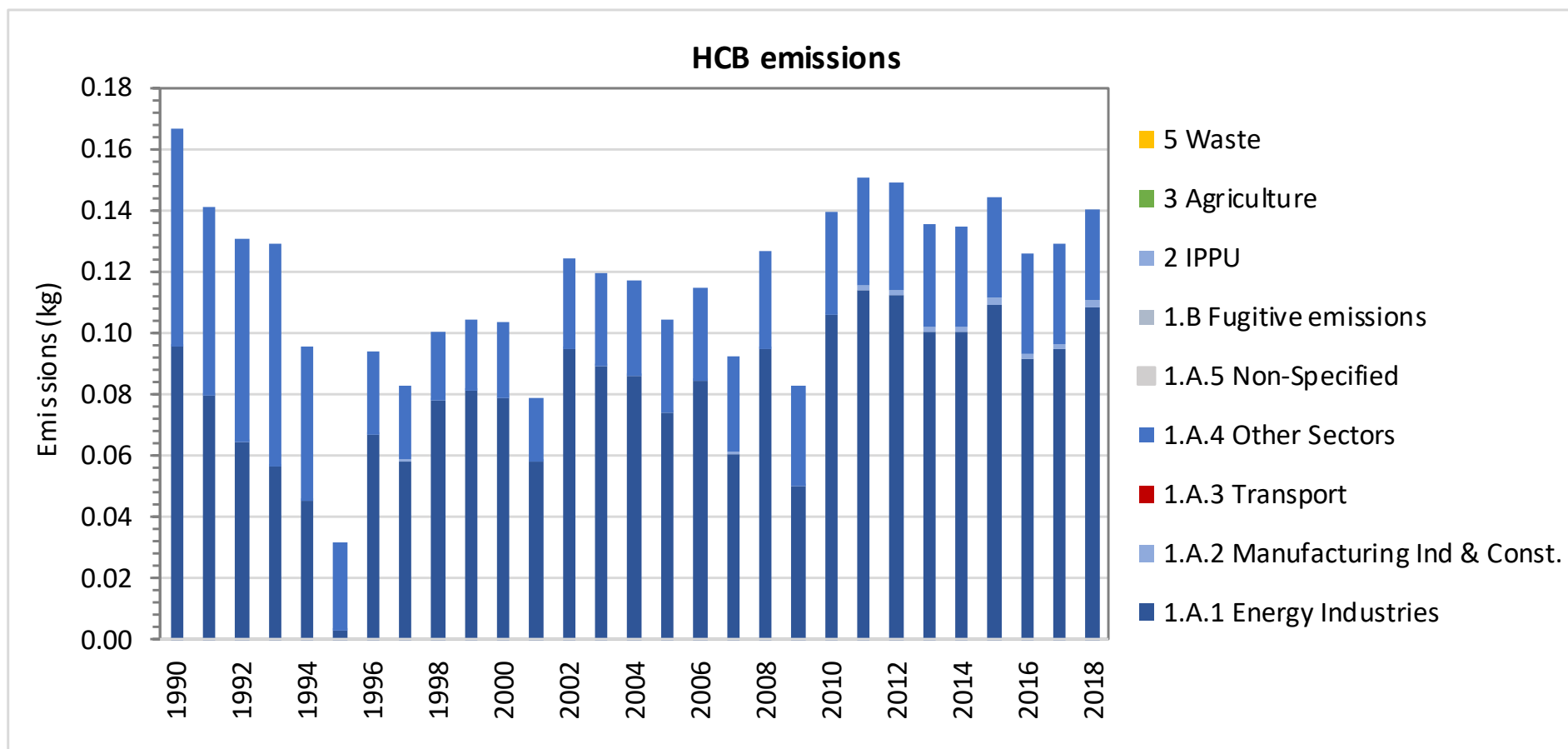


Figure 2.21 Hexachlorobenzene (HCB) Emissions 1990 - 2019

Table 2.21 Hexachlorobenzene (HCB) Emissions 1990 - 2019

HCB		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
kg	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
1990	0.167	0.167	0.095	0.000	NE	0.071	NE	NA/NO	NA	NA	NA	NA	NA	NA	NE	NA
1991	0.141	0.141	0.080	0.000	NE	0.061	NE	NA/NO	NA	NA	NA	NA	NA	NA	NE	NA
1992	0.131	0.131	0.065	0.000	NE	0.066	NE	NA/NO	NA	NA	NA	NA	NA	NA	NE	NA
1993	0.129	0.129	0.056	0.000	NE	0.073	NE	NA/NO	NA	NA	NA	NA	NA	NA	NE	NA
1994	0.095	0.095	0.045	0.000	NE	0.050	NE	NA/NO	NA	NA	NA	NA	NA	NA	NE	NA
1995	0.031	0.031	0.003	0.000	NE	0.029	NE	NA/NO	NA	NA	NA	NA	NA	NA	NE	NA
1996	0.094	0.094	0.067	0.000	NE	0.027	NE	NA/NO	NA	NA	NA	NA	NA	NA	NE	NA
1997	0.083	0.083	0.058	0.000	NE	0.025	NE	NA/NO	NA	NA	NA	NA	NA	NA	NE	NA
1998	0.100	0.100	0.078	0.000	NE	0.022	NE	NA/NO	NA	NA	NA	NA	NA	NA	NE	NA
1999	0.104	0.104	0.081	0.000	NE	0.023	NE	NA/NO	NA	NA	NA	NA	NA	NA	NE	NA
2000	0.103	0.103	0.079	0.000	NE	0.024	NE	NA/NO	NA	NA	NA	NA	NA	NA	NE	NA
2001	0.078	0.078	0.058	0.000	NE	0.020	NE	NA/NO	NA	NA	NA	NA	NA	NA	NE	NA
2002	0.124	0.124	0.095	0.000	NE	0.030	NE	NA/NO	NA	NA	NA	NA	NA	NA	NE	NA
2003	0.120	0.120	0.089	0.000	NE	0.031	NE	NA/NO	NA	NA	NA	NA	NA	NA	NE	NA
2004	0.117	0.117	0.086	0.000	NE	0.031	NE	NA/NO	NA	NA	NA	NA	NA	NA	NE	NA
2005	0.104	0.104	0.074	0.000	NE	0.030	NE	NA/NO	NA	NA	NA	NA	NA	NA	NE	NA
2006	0.115	0.115	0.084	0.000	NE	0.031	NE	NA/NO	NA	NA	NA	NA	NA	NA	NE	NA
2007	0.093	0.093	0.061	0.000	NE	0.032	NE	NA/NO	NA	NA	NA	NA	NA	NA	NE	NA
2008	0.127	0.127	0.095	0.000	NE	0.032	NE	NA/NO	NA	NA	NA	NA	NA	NA	NE	NA



HCB		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
kg	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
2009	0.083	0.083	0.050	0.000	NE	0.033	NE	NA/NO	NA	NA	NA	NA	NA	NA	NE	NA
2010	0.140	0.140	0.106	0.000	NE	0.034	NE	NA/NO	NA	NA	NA	NA	NA	NA	NE	NA
2011	0.151	0.151	0.114	0.001	NE	0.035	NE	NA/NO	NA	NA	NA	NA	NA	NA	NE	NA
2012	0.149	0.149	0.112	0.001	NE	0.036	NE	NA/NO	NA	NA	NA	NA	NA	NA	NE	NA
2013	0.136	0.136	0.100	0.001	NE	0.034	NE	NA/NO	NA	NA	NA	NA	NA	NA	NE	NA
2014	0.135	0.135	0.101	0.002	NE	0.032	NE	NA/NO	NA	NA	NA	NA	NA	NA	NE	NA
2015	0.145	0.145	0.109	0.002	NE	0.033	NE	NA/NO	NA	NA	NA	NA	NA	NA	NE	NA
2016	0.126	0.126	0.091	0.002	NE	0.033	NE	NA/NO	NA	NA	NA	NA	NA	NA	NE	NA
2017	0.129	0.129	0.095	0.002	NE	0.032	NE	NA/NO	NA	NA	NA	NA	NA	NA	NE	NA
2018	0.140	0.140	0.109	0.002	NE	0.030	NE	NA/NO	NA	NA	NA	NA	NA	NA	NE	NA
2019																
Trend																
1990 - 2019	-16.0%	-16.0%	14.0%	5449.8 %	NA	-58.4%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2005 - 2019	34.7%	34.7%	47.1%	740.9%	NA	-0.7%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2018 - 2019	8.9%	8.9%	15.0%	0.0%	NA	-8.4%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Share in National Total																
1990	100%	100.0%	57.2%	0.0%	NA	42.8%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2005	100%	100.0%	71.0%	0.2%	NA	28.8%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2019	100%	100.0%	77.5%	1.2%	NA	21.2%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

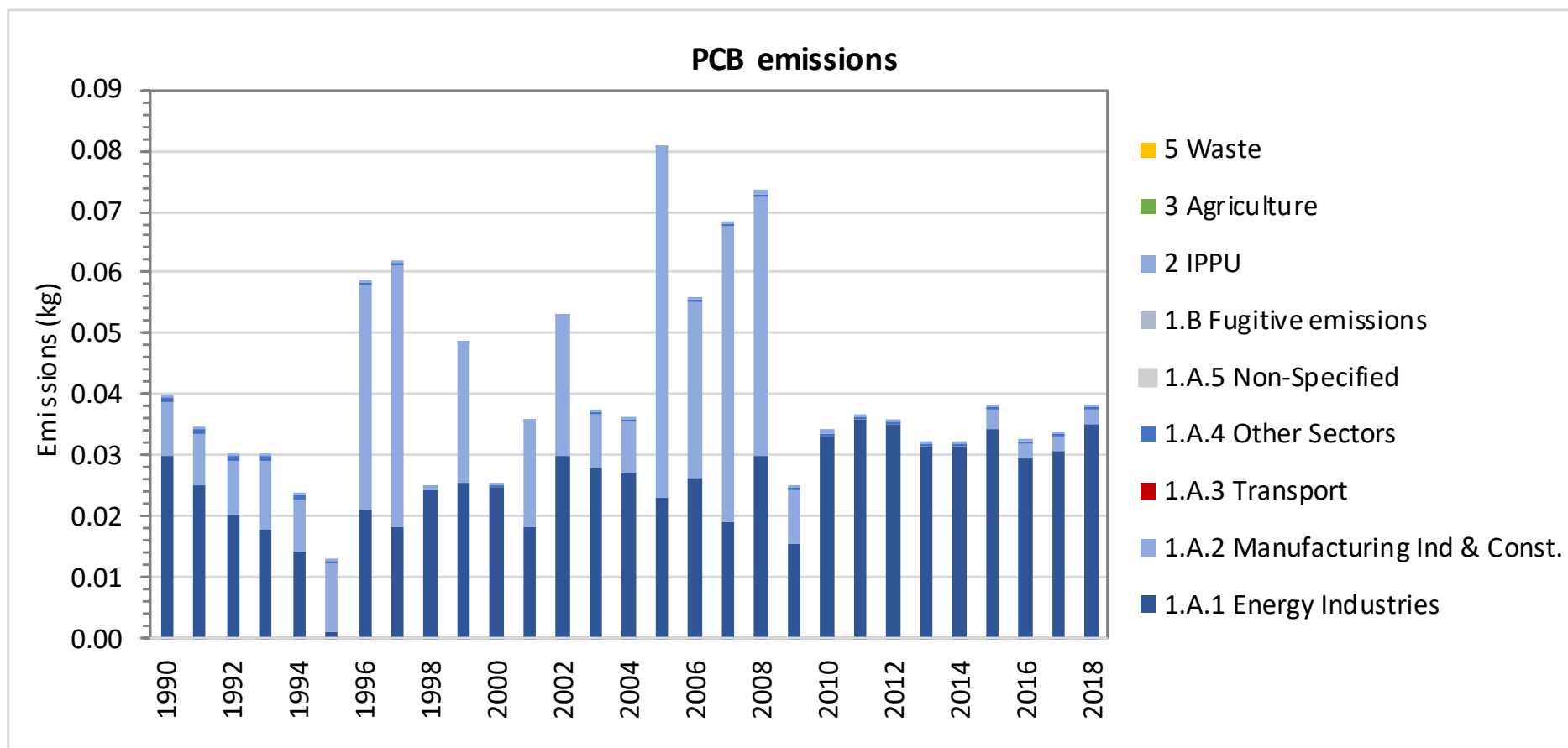


Figure 2.22 Polychlorinated biphenyls (PCBs) Emissions 1990 - 2019

Table 2.22 Polychlorinated biphenyls (PCBs) Emissions 1990 - 2019

PCBs		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
kg	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
1990	0.040	0.039	0.030	0.009	NE	0.001	NE	NA/NO	0.00	NA	NA/NO	NA/NO	NE	NO	NA	NA
1991	0.035	0.034	0.025	0.009	NE	0.001	NE	NA/NO	0.00	NA	NA/NO	NA/NO	NE	NO	NA	NA
1992	0.030	0.030	0.020	0.009	NE	0.001	NE	NA/NO	0.00	NA	NA/NO	NA/NO	NE	NO	NA	NA
1993	0.030	0.030	0.018	0.011	NE	0.001	NE	NA/NO	0.00	NA	NA/NO	NA/NO	NE	NO	NA	NA
1994	0.024	0.023	0.014	0.009	NE	0.001	NE	NA/NO	0.00	NA	NA/NO	NA/NO	NE	NO	NA	NA
1995	0.013	0.013	0.001	0.011	NE	0.000	NE	NA/NO	0.00	NA	NA/NO	NA/NO	NE	NO	NA	NA
1996	0.059	0.058	0.021	0.037	NE	0.000	NE	NA/NO	0.00	NA	NA/NO	NA/NO	NE	NO	NA	NA
1997	0.062	0.061	0.018	0.043	NE	0.000	NE	NA/NO	0.00	NA	NA/NO	NA/NO	NE	NO	NA	NA
1998	0.025	0.025	0.024	0.000	NE	0.000	NE	NA/NO	0.00	NA	NA/NO	NA/NO	NE	NO	NA	NA
1999	0.049	0.049	0.025	0.023	NE	0.000	NE	NA/NO	0.00	NA	NA/NO	NA/NO	NE	NO	NA	NA
2000	0.025	0.025	0.025	0.000	NE	0.000	NE	NA/NO	0.00	NA	NA/NO	NA/NO	NE	NO	NA	NA
2001	0.036	0.036	0.018	0.017	NE	0.000	NE	NA/NO	0.00	NA	NA/NO	NA/NO	NE	NO	NA	NA
2002	0.053	0.053	0.030	0.023	NE	0.000	NE	NA/NO	0.00	NA	NA/NO	NA/NO	NE	NO	NA	NA
2003	0.037	0.037	0.028	0.009	NE	0.000	NE	NA/NO	0.00	NA	NA/NO	NA/NO	NE	NO	NA	NA
2004	0.036	0.036	0.027	0.009	NE	0.000	NE	NA/NO	0.00	NA	NA/NO	NA/NO	NE	NO	NA	NA
2005	0.081	0.081	0.023	0.057	NE	0.000	NE	NA/NO	0.00	NA	NA/NO	NA/NO	NE	NO	NA	NA
2006	0.056	0.055	0.027	0.029	NE	0.000	NE	NA/NO	0.00	NA	NA/NO	NA/NO	NE	NO	NA	NA
2007	0.068	0.068	0.019	0.048	NE	0.000	NE	NA/NO	0.00	NA	NA/NO	NA/NO	NE	NO	NA	NA
2008	0.073	0.073	0.030	0.043	NE	0.000	NE	NA/NO	0.00	NA	NA/NO	NA/NO	NE	NO	NA	NA

PCBs		1	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	2	3	3.B	3.D	3F	3I	5	6
kg	Total	Energy	Energy Industries	Manufacturing Industries & Const.	Transport	Other Sectors	Non-Specified	Fugitive emissions	IPPU	Agriculture	Manure Management	Emission from soil	Field burning	Agriculture other	Waste	Other
2009	0.025	0.025	0.016	0.009	NE	0.000	NE	NA/NO	0.00	NA	NA/NO	NA/NO	NE	NO	NA	NA
2010	0.034	0.034	0.033	0.000	NE	0.000	NE	NA/NO	0.00	NA	NA/NO	NA/NO	NE	NO	NA	NA
2011	0.036	0.036	0.036	0.000	NE	0.000	NE	NA/NO	0.00	NA	NA/NO	NA/NO	NE	NO	NA	NA
2012	0.036	0.036	0.035	0.000	NE	0.000	NE	NA/NO	0.00	NA	NA/NO	NA/NO	NE	NO	NA	NA
2013	0.032	0.032	0.031	0.000	NE	0.000	NE	NA/NO	0.00	NA	NA/NO	NA/NO	NE	NO	NA	NA
2014	0.032	0.032	0.032	0.000	NE	0.000	NE	NA/NO	0.00	NA	NA/NO	NA/NO	NE	NO	NA	NA
2015	0.038	0.038	0.034	0.003	NE	0.000	NE	NA/NO	0.00	NA	NA/NO	NA/NO	NE	NO	NA	NA
2016	0.032	0.032	0.030	0.002	NE	0.000	NE	NA/NO	0.00	NA	NA/NO	NA/NO	NE	NO	NA	NA
2017	0.034	0.033	0.031	0.002	NE	0.000	NE	NA/NO	0.00	NA	NA/NO	NA/NO	NE	NO	NA	NA
2018	0.038	0.038	0.035	0.002	NE	0.000	NE	NA/NO	0.00	NA	NA/NO	NA/NO	NE	NO	NA	NA
2019																
Trend																
1990 - 2019	-5.0%	-4.0%	17.4%	-73.2%	NA	-58.4%	NA	NA	-78.2%	NA	NA	NA	NA	NA	NA	NA
2005 - 2019	-53.0%	-53.0%	51.7%	-95.9%	NA	-0.7%	NA	NA	-55.8%	NA	NA	NA	NA	NA	NA	NA
2018 - 2019	13.3%	13.4%	14.7%	-0.9%	NA	-8.4%	NA	NA	-0.1%	NA	NA	NA	NA	NA	NA	NA
Share in National Total																
1990	100%	98.7%	75.0%	21.6%	NA	2.1%	NA	NA	1.3%	NA	NA	NA	NA	NA	NA	NA
2005	100%	99.7%	28.7%	70.5%	NA	0.4%	NA	NA	0.3%	NA	NA	NA	NA	NA	NA	NA
2019	100%	99.7%	92.7%	6.1%	NA	0.9%	NA	NA	0.3%	NA	NA	NA	NA	NA	NA	NA

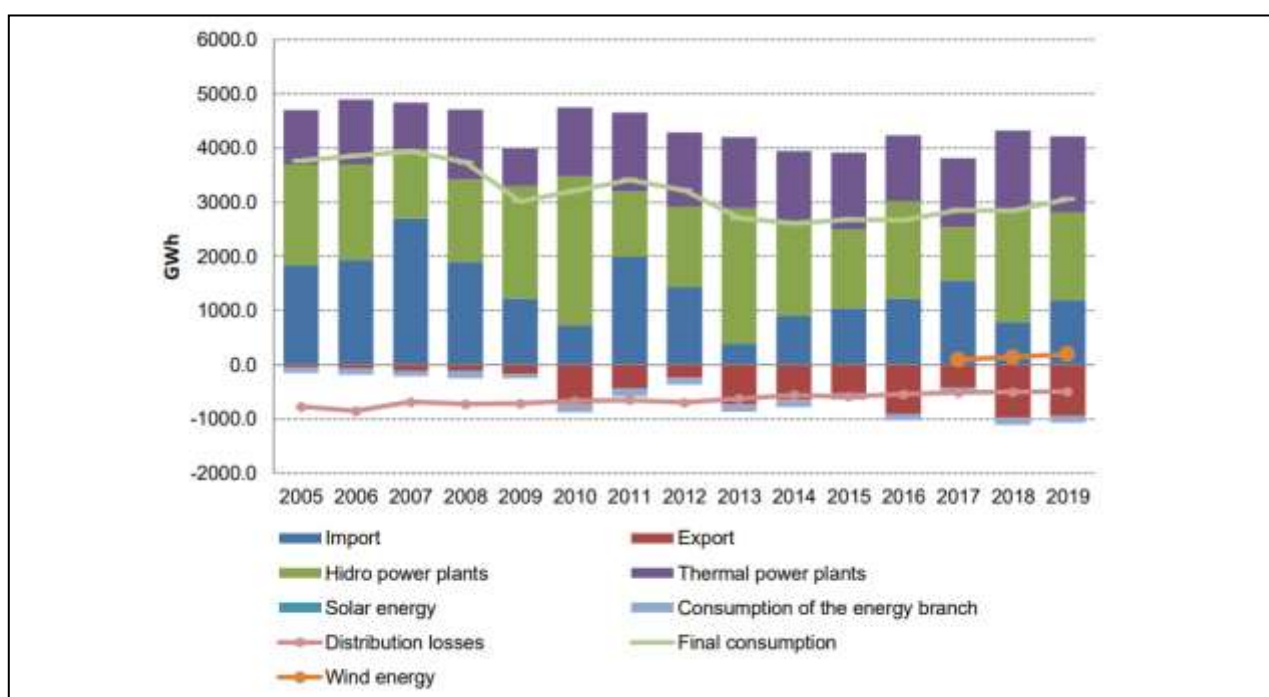
### 3 Energy (IPCC sector 1)

#### 3.1 Fuel Combustion Activities (category 1.A)

##### 3.1.1 Country-specific issues

##### 3.1.1.1 Electricity and heat production

About one third of electricity in Montenegro is generated by the sole operating thermo power-plant in the country, while hydropower plants generate approximately the remaining two thirds. As stated in the Release No. 185<sup>29</sup> of in the Montenegro Statistical Office (MONSTAT) the primary production of electricity in Montenegro in 2019 was 1 916.8 GWh, transformation output was 1 390.1 GWh. The total import of electricity was 1 195.5 GWh and total export was 942.9 GWh. Consumption of the energy branch was 128.7 GWh and distribution losses 492.9 GWh. Total final consumption of electricity in 2019 was 3 054.2 GWh. The highest ratio in total consumption of electricity was in households 42.2%, in other sectors 34.9% and industrial activities 22.9%.



**Figure 3.1 Electricity supply (GWh) – National Production aswell Exports and Imports: 2005 – 2019**

Source: [http://monstat.org/uploads/files/Energetika/struja/2019/Balance\\_of\\_electricity\\_2019.pdf](http://monstat.org/uploads/files/Energetika/struja/2019/Balance_of_electricity_2019.pdf)

In the last years focus has been put on

- energy loss reduction;
- hydro-electric generation,
- developing and improving renewable energy resources – wind and solar.

<sup>29</sup> [http://monstat.org/uploads/files/Energetika/struja/2019/Balance\\_of\\_electricity\\_2019.pdf](http://monstat.org/uploads/files/Energetika/struja/2019/Balance_of_electricity_2019.pdf)

### 3.1.2 Energy Industries (category 1.A.1)

Energy industries are defined as consisting of economic units whose principal activity is primary energy production, transformation of energy or distribution<sup>30</sup>. This section describes air pollutants emissions resulting from fuel combustion activities (fuel extraction or energy-producing industries) in energy industries, which, originate from

- public electricity and heat production plants (IPCC/NFR category 1.A.1.a);
- petroleum refining (IPCC/NFR category 1.A.1.b);
- manufacturing of solid fuels (IPCC/NFR category 1.A.1.c).

#### 3.1.2.1 Main Activity Electricity and Heat Production (category 1.A.1.a)

##### 3.1.2.1.1 Source category description

Table 3.1 Overview on reported emissions from sub categories 1.A.1.a.i, 1.A.1.a.ii and 1.A.1.a.iii

Air pollutants	1.A.1.a.i						1.A.1.a.ii						1.A.1.a.iii						Key Category
	liquid	solid	gaseous	Other fossil fuel	Peat	biomass	liquid	solid	gaseous	Other fossil fuel	Peat	biomass	liquid	solid	Gaseous	Other fossil fuel	Peat	biomass	
NO <sub>x</sub>	✓*	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	✓**	✓***	NO	NO	NO	NO	LA 2017
CO	✓*	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	✓**	✓***	NO	NO	NO	NO	
NM <sub>2</sub> VOC	✓*	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	✓**	✓***	NO	NO	NO	NO	
SO <sub>x</sub>	✓*	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	✓**	✓***	NO	NO	NO	NO	LA 2017
NH <sub>3</sub>	✓*	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	✓**	✓***	NO	NO	NO	NO	
TSP	✓*	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	✓**	✓***	NO	NO	NO	NO	LA 2017
PM <sub>10</sub>	✓*	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	✓**	✓***	NO	NO	NO	NO	
PM <sub>2.5</sub>	✓*	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	✓**	✓***	NO	NO	NO	NO	
BC	✓*	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	✓**	✓***	NO	NO	NO	NO	-
Pb	✓*	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	✓**	✓***	NO	NO	NO	NO	LA 2017
Cd	✓*	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	✓**	✓***	NO	NO	NO	NO	LA 2017
Hg	✓*	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	✓**	✓***	NO	NO	NO	NO	LA 2017
As	✓*	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	✓**	✓***	NO	NO	NO	NO	LA 2017
Cr	✓*	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	✓**	✓***	NO	NO	NO	NO	LA 2017
Cu	✓*	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	✓**	✓***	NO	NO	NO	NO	LA 2017
Ni	✓*	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	✓**	✓***	NO	NO	NO	NO	LA 2017
Se	✓*	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	✓**	✓***	NO	NO	NO	NO	LA 2017
Zn	✓*	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	✓**	✓***	NO	NO	NO	NO	LA 2017
PCB	✓*	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	✓**	✓***	NO	NO	NO	NO	LA 2017
PCDD/F	✓*	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	✓**	✓***	NO	NO	NO	NO	
PAH	✓*	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	✓**	✓***	NO	NO	NO	NO	
Benzo(a)pyrene	✓*	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	✓**	✓***	NO	NO	NO	NO	
Benzo(b)fluoranthene	✓*	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	✓**	✓***	NO	NO	NO	NO	

<sup>30</sup> For more information see <https://unstats.un.org/unsd/energy/ires/IRES-web.pdf>

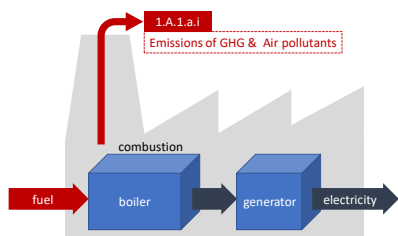
Air pollutants	1.A.1.a.i						1.A.1.a.ii						1.A.1.a.iii						Key Category
	liquid	solid	gaseous	Other fossil fuel	Peat	biomass	liquid	solid	gaseous	Other fossil fuel	Peat	biomass	liquid	solid	Gaseous	Other fossil fuel	Peat	biomass	
Benzo(k)fluoranthene	✓*	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	✓**	✓***	NO	NO	NO	NO	
Indeno(1,2,3-cd)pyrene	✓*	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	✓**	✓***	NO	NO	NO	NO	
HCB	✓*	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	✓**	✓***	NO	NO	NO	NO	
<p>A '✓' indicates: emissions from this sub-category have been estimated.</p> <p>Notation keys: IE - included elsewhere, NO – not occurred, NE - not estimated, NA - not applicable, C – confidential</p> <p>* Until 2012      **until 2004      ***until 2011</p> <p>LA XX - Level Assessment in year XX</p> <p>TA XX - Trend Assessment in year XX</p>																			

This section describes air pollutants emissions resulting from fuel combustion activities in energy industries which, originate from public electricity and heat production plants. Two types of producers can be distinguished: Main activity producer and auto-producer. According to EMEP/EEA air pollutant emission inventory guidebook main activity producers are defined as those undertakings whose primary activity is to supply the public.

Type of producer	1.A.1.a.i	1.A.1.a.iii	Remark
	Electricity plant	Heat plant	
<b>Main activity producer</b>	<ul style="list-style-type: none"> <li>units that produce electricity or heat as their principal activity;</li> </ul>		They may be in public or private ownership. Emissions from own on-site use of fuel are also included.
<b>Auto-producer</b>	<ul style="list-style-type: none"> <li>units that produce electricity but for which the production is not their principal activity;</li> </ul>	<ul style="list-style-type: none"> <li>units that produce heat for sale but for which the production is not their principal activity;</li> </ul>	

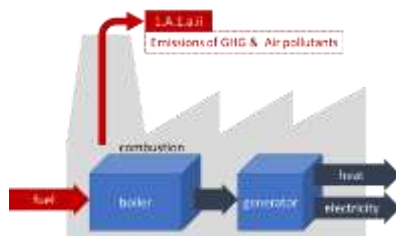
The following sub-categories are defined in the 2006 IPCC Guidelines and EMEP/EEA air pollutant emission inventory guidebook 2019:

#### 1.A.1.a.i Electricity Generation



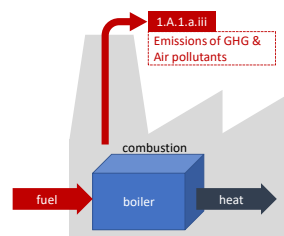
Comprises emissions from all fuel use for electricity generation from main activity producers except those from combined heat and power plants.

#### 1.A.1.a.ii Combined Heat and Power Generation (CHP)



Emissions from production of both heat and electrical power from main activity producers for sale to the public, at a single CHP facility.

#### 1.A.1.a.iii Heat Plants



Production of heat from main activity producers for sale by pipe network.

The majority of electricity in Montenegro is produced at the Pljevlja coal-fired Thermal Power Plant, the Perucica, and the Piva Hydro Plants. Currently no combined heat and power generation (CHP) and heat plants were in Montenegro.

An overview of the GHG emission from fuel combustion in sub-category 1.A.1.a *Main Activity Electricity and Heat Production* is provided in the following figures and tables:

- annual emissions of air pollutants;
- trend of the periods 1990 – 2019, 2005 – 2019, 2018 – 2019.

Fluctuation of emissions are due to

- general stopped/shut-down of the only thermal power plant;
- reconstruction / modernisation in 2009;
- reduced energy needs by the general stopped/shut-down industrial production, and
- limited public life during the time of
  - breakup of Yugoslavia, Bosnian war, Croatian War, and Kosovo War
  - embargo and NATO air-campaign
  - break-up of the union with Serbia.

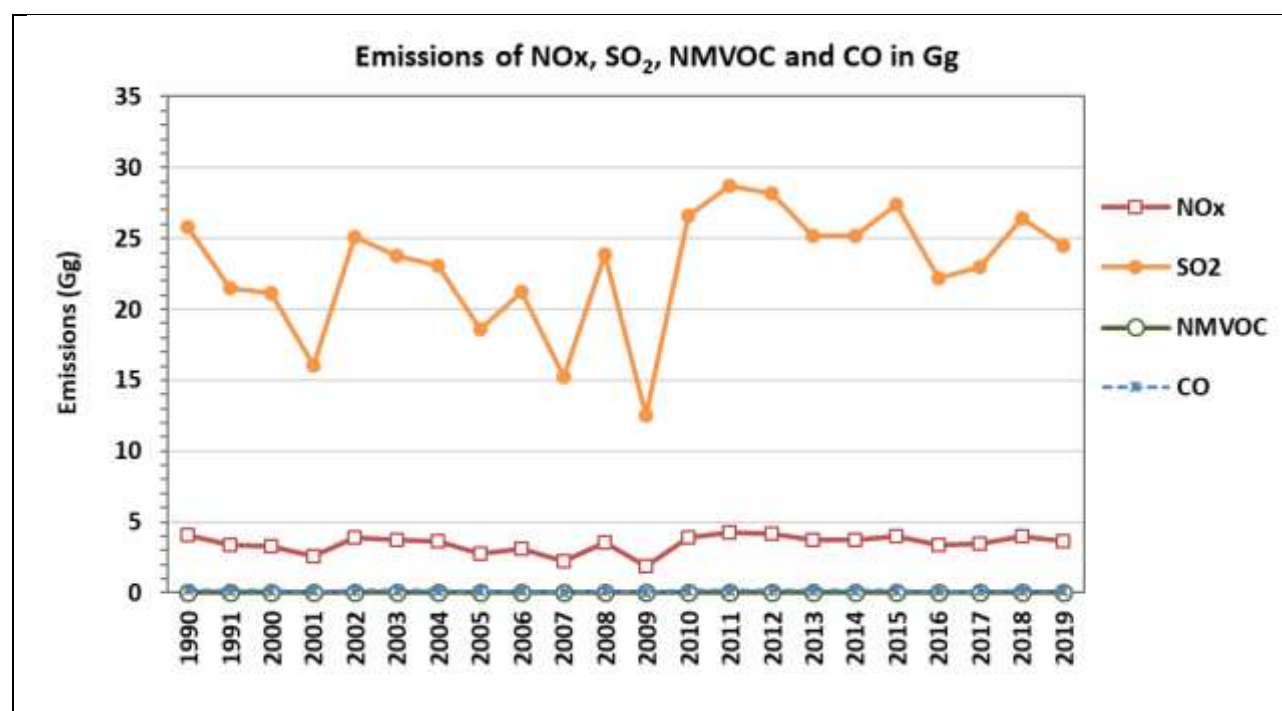


Figure 3.2 Emissions of main pollutants (NOx, SO<sub>2</sub>, NMVOC and CO) from sub-category 1.A.1.a Main Activity Electricity and Heat Production



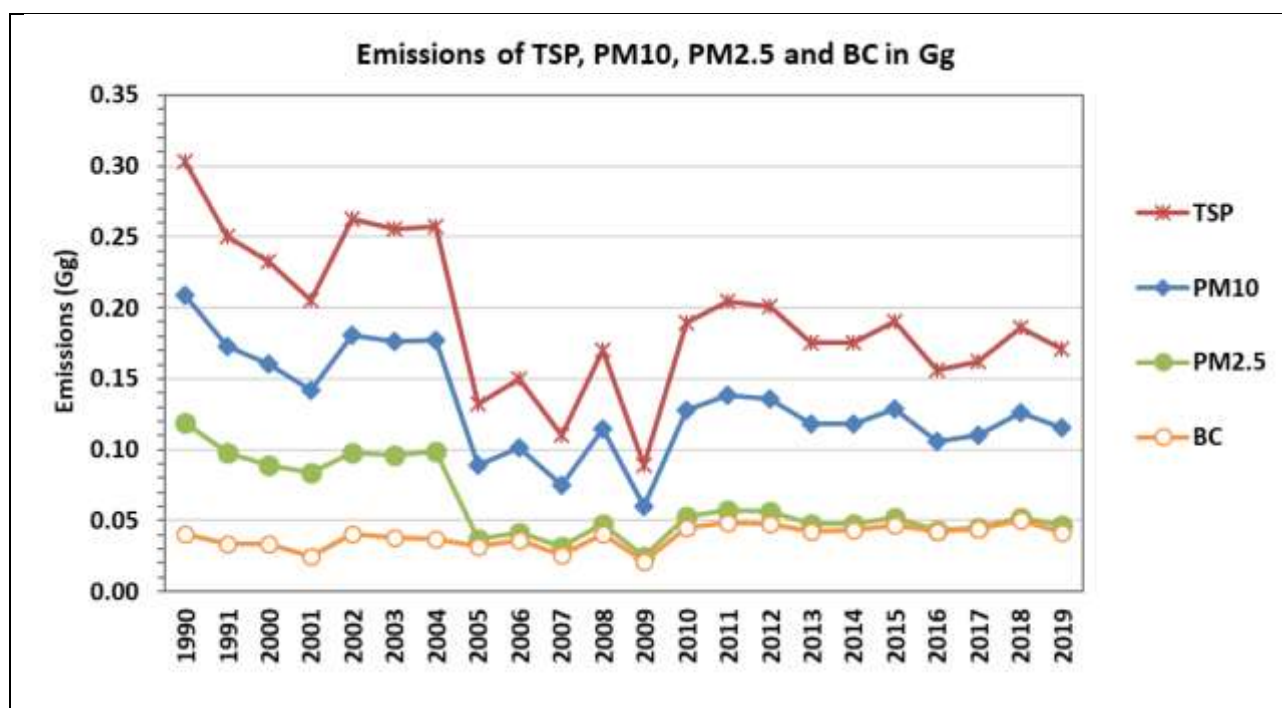


Figure 3.3 Emissions of TSP PM10 and PM2.5 from sub-category 1.A.1.a Main Activity Electricity and Heat Production

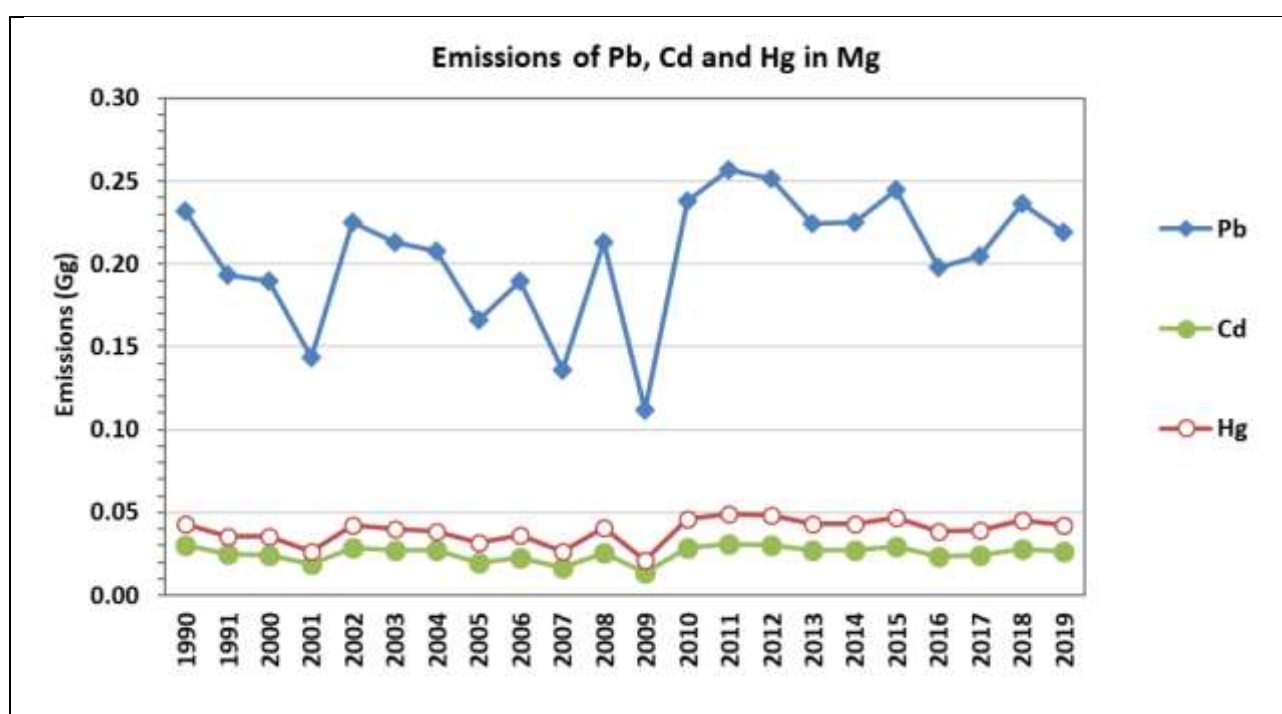


Figure 3.4 Emissions of Pb, Cd and Hg from sub-category 1.A.1.a Main Activity Electricity and Heat Production

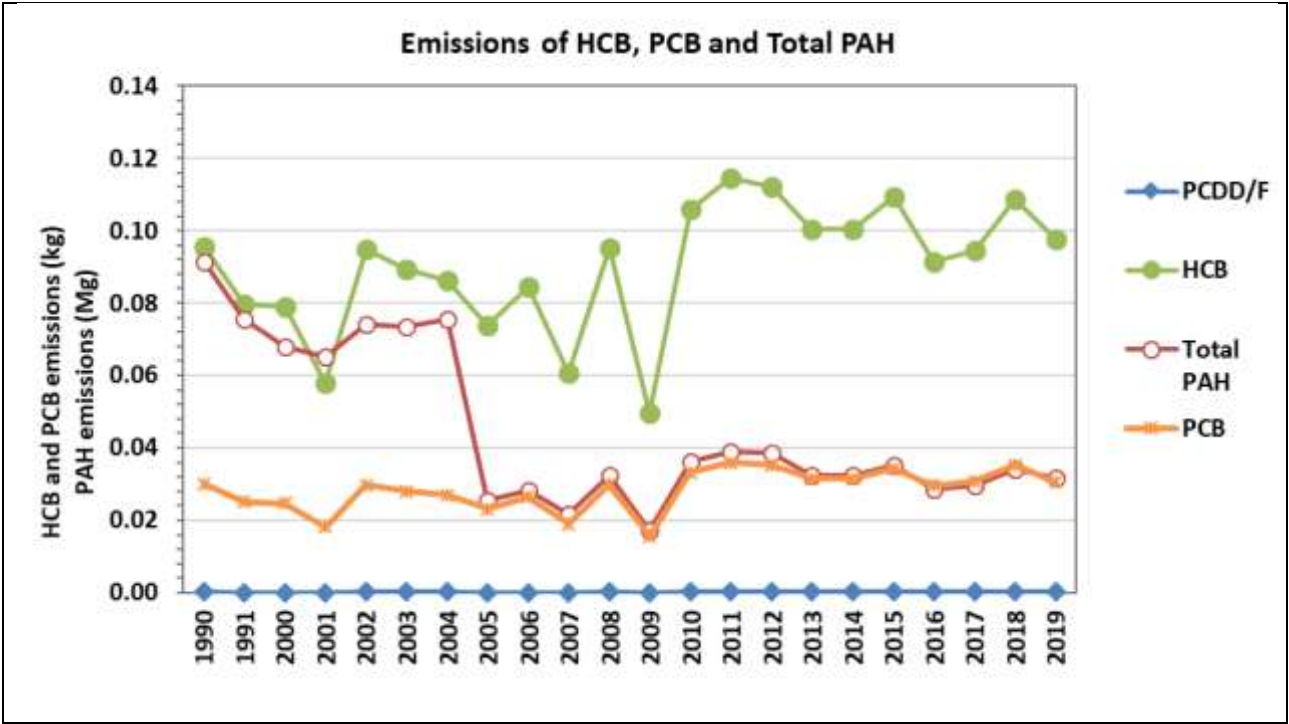


Figure 3.5 Emissions of HCB, PCB, and Total PAH from sub-category 1.A.1.a Main Activity Electricity and Heat Production

**Table 3.2 Emissions of main pollutants (NO<sub>x</sub>, SO<sub>2</sub>, NMVOC and CO) from Sub-category 1.A.1.a Main Activity Electricity and Heat Production**

Emissions	NO <sub>x</sub>	NMVOC	SO <sub>2</sub>	CO	NH <sub>3</sub>
	Gg	Gg	Gg	Gg	Gg
1990	4.075	0.029	25.813	0.186	NO
1991	3.391	0.024	21.520	0.154	NO
1992	2.655	0.018	17.141	0.114	NO
1993	2.289	0.015	14.867	0.096	NO
1994	1.887	0.013	12.076	0.083	NO
1995	0.325	0.004	1.456	0.028	NO
1996	2.686	0.018	17.525	0.111	NO
1997	2.517	0.018	15.888	0.116	NO
1998	3.215	0.022	20.737	0.138	NO
1999	3.364	0.023	21.599	0.147	NO
2000	3.299	0.023	21.148	0.144	NO
2001	2.563	0.019	16.004	0.122	NO
2002	3.891	0.026	25.139	0.166	NO
2003	3.697	0.025	23.750	0.161	NO
2004	3.616	0.025	23.087	0.161	NO
2005	2.739	0.016	18.589	0.097	NO
2006	3.121	0.018	21.201	0.111	NO
2007	2.255	0.013	15.273	0.081	NO
2008	3.520	0.020	23.888	0.125	NO
2009	1.843	0.011	12.509	0.066	NO
2010	3.926	0.022	26.643	0.140	NO
2011	4.235	0.024	28.747	0.150	NO
2012	4.157	0.024	28.208	0.148	NO
2013	3.700	0.021	25.164	0.130	NO
2014	3.705	0.021	25.201	0.131	NO
2015	4.026	0.023	27.385	0.142	NO
2016	3.362	0.019	22.204	0.118	NO
2017	3.484	0.019	22.951	0.123	NO
2018	4.006	0.022	26.449	0.141	NO
2019	3.604	0.020	24.514	0.127	NO
<i>Trend</i>					
1990 – 2019	-11.6%	-29.3%	-5.0%	-31.8%	NA
2005 – 2019	31.6%	30.4%	31.9%	30.3%	NA
2018 – 2019	11.2%	8.0%	7.9%	11.2%	NA

**Table 3.3 Emissions of particulate matter (PMs) from sub-category 1.A.1.a Main Activity Electricity and Heat Production**

Emissions	PM2.5	PM10	TSP	BC
	Gg	Gg	Gg	Gg
1990	0.119	0.209	0.303	0.041
1991	0.098	0.173	0.250	0.034
1992	0.067	0.123	0.179	0.028
1993	0.055	0.103	0.150	0.024
1994	0.052	0.093	0.135	0.019
1995	0.032	0.043	0.060	0.001
1996	0.061	0.117	0.171	0.029
1997	0.077	0.133	0.192	0.025
1998	0.082	0.151	0.219	0.033
1999	0.090	0.162	0.236	0.035
2000	0.089	0.161	0.233	0.034
2001	0.084	0.142	0.205	0.025
2002	0.098	0.181	0.263	0.040
2003	0.097	0.176	0.256	0.038
2004	0.099	0.177	0.258	0.037
2005	0.037	0.089	0.132	0.032
2006	0.041	0.101	0.149	0.036
2007	0.032	0.075	0.111	0.026
2008	0.048	0.115	0.170	0.041
2009	0.025	0.060	0.089	0.021
2010	0.053	0.128	0.190	0.045
2011	0.057	0.138	0.204	0.049
2012	0.056	0.136	0.201	0.048
2013	0.048	0.118	0.175	0.043
2014	0.048	0.119	0.176	0.043
2015	0.052	0.129	0.191	0.047
2016	0.044	0.106	0.156	0.042
2017	0.045	0.110	0.162	0.044
2018	0.052	0.126	0.186	0.050
2019	0.047	0.115	0.171	0.042
<i>Trend</i>				
1990 – 2019	-60.8%	-44.9%	-43.6%	2.5%
2005 – 2019	26.0%	28.8%	29.0%	32.2%
2018 – 2019	11.0%	9.7%	9.2%	20.6%

**Table 3.4 Emissions of Heavy Metals (HM) from sub-category 1.A.1.a Main Activity Electricity and Heat Production**

Emissions	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg
1990	0.232	0.031	0.043	0.219	0.140	0.035	1.106	0.651	0.459
1991	0.193	0.025	0.036	0.183	0.116	0.029	0.908	0.543	0.378
1992	0.154	0.020	0.029	0.146	0.093	0.020	0.566	0.439	0.248
1993	0.133	0.017	0.025	0.126	0.080	0.016	0.445	0.383	0.199
1994	0.108	0.014	0.020	0.102	0.065	0.015	0.469	0.306	0.198
1995	0.013	0.003	0.002	0.012	0.008	0.009	0.403	0.022	0.141
1996	0.157	0.020	0.030	0.149	0.095	0.018	0.484	0.453	0.221
1997	0.143	0.019	0.026	0.135	0.086	0.022	0.730	0.398	0.299
1998	0.186	0.024	0.035	0.176	0.112	0.024	0.707	0.530	0.307
1999	0.194	0.025	0.036	0.183	0.117	0.026	0.792	0.549	0.339
2000	0.190	0.025	0.035	0.180	0.114	0.026	0.792	0.537	0.337
2001	0.144	0.019	0.026	0.136	0.086	0.025	0.825	0.397	0.332
2002	0.225	0.029	0.042	0.213	0.136	0.029	0.834	0.643	0.365
2003	0.213	0.028	0.040	0.202	0.129	0.029	0.840	0.606	0.362
2004	0.208	0.027	0.039	0.196	0.125	0.029	0.885	0.587	0.375
2005	0.166	0.020	0.032	0.158	0.101	0.012	0.130	0.497	0.105
2006	0.189	0.023	0.037	0.180	0.115	0.013	0.137	0.567	0.116
2007	0.136	0.016	0.026	0.130	0.083	0.010	0.121	0.408	0.091
2008	0.213	0.026	0.041	0.203	0.129	0.015	0.166	0.639	0.135
2009	0.112	0.013	0.022	0.106	0.068	0.008	0.087	0.334	0.071
2010	0.238	0.029	0.046	0.227	0.144	0.016	0.185	0.712	0.150
2011	0.257	0.031	0.050	0.245	0.156	0.018	0.197	0.769	0.161
2012	0.252	0.030	0.049	0.240	0.153	0.017	0.197	0.754	0.159
2013	0.225	0.027	0.043	0.214	0.136	0.015	0.145	0.674	0.132
2014	0.225	0.027	0.044	0.215	0.137	0.015	0.146	0.675	0.132
2015	0.245	0.029	0.047	0.233	0.148	0.016	0.158	0.734	0.143
2016	0.198	0.024	0.038	0.189	0.120	0.020	0.128	0.596	0.184
2017	0.205	0.025	0.040	0.195	0.124	0.021	0.133	0.616	0.196
2018	0.236	0.028	0.046	0.225	0.143	0.024	0.153	0.709	0.220
2019	0.219	0.026	0.042	0.209	0.133	0.015	0.142	0.657	0.128
<i>Trend</i>									
1990 – 2019	-5.7%	-14.1%	-1.6%	-4.8%	-4.9%	-58.6%	-87.2%	0.9%	-72.0%
2005 – 2019	31.9%	31.5%	32.1%	31.9%	31.9%	26.7%	8.7%	32.1%	22.2%
2018 – 2019	7.9%	8.0%	7.9%	7.9%	7.9%	63.6%	8.0%	8.0%	71.6%

**Table 3.5 Emissions of Persistent Organic Pollutants (POPs) from sub-category 1.A.1.a Main Activity Electricity and Heat Production**

Emissions	PCDD/F	Benzo(a)-pyrene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Indeno (1,2,3-cd) pyrene	Total PAH	HCB	PCB
	g I-TEQ	Mg	Mg	Mg	Mg	Mg	kg	Kg
1990	<0.001	<0.001	0.018	NO	0.056	0.092	0.095	0.030
1991	<0.001	<0.001	0.014	NO	0.047	0.075	0.080	0.025
1992	<0.001	<0.001	0.009	NO	0.033	0.050	0.065	0.020
1993	<0.001	<0.001	0.007	NO	0.028	0.041	0.056	0.018
1994	<0.001	<0.001	0.007	NO	0.025	0.040	0.045	0.014
1995	<0.001	<0.001	0.007	NO	0.012	0.026	0.003	0.001
1996	<0.001	<0.001	0.007	NO	0.032	0.046	0.067	0.021
1997	<0.001	<0.001	0.012	NO	0.036	0.059	0.058	0.018
1998	<0.001	<0.001	0.011	NO	0.041	0.062	0.078	0.024
1999	<0.001	<0.001	0.012	NO	0.044	0.068	0.081	0.025
2000	<0.001	<0.001	0.012	NO	0.043	0.068	0.079	0.025
2001	<0.001	<0.001	0.013	NO	0.038	0.065	0.058	0.018
2002	<0.001	<0.001	0.013	NO	0.049	0.074	0.095	0.030
2003	<0.001	<0.001	0.013	NO	0.047	0.073	0.089	0.028
2004	<0.001	<0.001	0.014	NO	0.048	0.076	0.086	0.027
2005	<0.001	<0.001	0.001	NO	0.024	0.025	0.074	0.023
2006	<0.001	<0.001	0.001	NO	0.027	0.028	0.084	0.027
2007	<0.001	<0.001	0.001	NO	0.020	0.022	0.061	0.019
2008	<0.001	<0.001	0.001	NO	0.031	0.033	0.095	0.030
2009	<0.001	<0.001	0.001	NO	0.016	0.017	0.050	0.016
2010	<0.001	<0.001	0.001	NO	0.034	0.036	0.106	0.033
2011	<0.001	<0.001	0.001	NO	0.037	0.039	0.114	0.036
2012	<0.001	<0.001	0.001	NO	0.036	0.038	0.112	0.035
2013	<0.001	<0.001	0.001	NO	0.031	0.032	0.100	0.031
2014	<0.001	<0.001	0.001	NO	0.032	0.033	0.101	0.032
2015	<0.001	<0.001	0.001	NO	0.034	0.035	0.109	0.034
2016	<0.001	<0.001	0.001	NO	0.028	0.029	0.091	0.030
2017	<0.001	<0.001	0.001	NO	0.029	0.030	0.095	0.031
2018	<0.001	<0.001	0.001	NO	0.033	0.034	0.109	0.035
2019	<0.001	<0.001	0.001	NO	0.031	0.032	0.098	0.031
<i>Trend</i>								
1990 – 2019	-4.0%	2.5%	-96.9%	NA	-45.7%	-65.4%	2.5%	2.1%
2005 – 2019	31.9%	29.3%	-33.9%	NA	28.7%	24.7%	32.2%	31.9%
2018 – 2019	11.2%	8.2%	11.2%	NA	8.1%	8.2%	11.2%	15.0%

### 3.1.2.1.2 Methodological issues

#### 3.1.2.1.2.1 Choice of methods

For estimating the air pollutants emissions the Tier 1 approach<sup>31</sup> of the EMEP/EEA air pollutant emission inventory guidebook 2019 has been applied:

*Equation: emissions from stationary combustion*

$$Emissions_{pollutant} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{pollutant, fuel}$$

Where:

Emissions <sub>pollutant</sub>	= emissions of a given pollutant by type of fuel (kg pollutant)
Fuel consumption <sub>fuel</sub>	= amount of fuel combusted (TJ)
Emission factor <sub>pollutant, fuel</sub>	= default emission factor of a given pollutant by type of fuel (g <sub>pollutant</sub> /GJ).
Pollutant	= main pollutants: NO <sub>x</sub> , CO, NMVOC, SO <sub>2</sub> particulate matter: TSP, OM10, PM2.5, BC heavy metals: Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn persistent organic pollutants: PCDD/F, Benzo(a) pyrene, Benzo(b)fluor, anthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene, Total PAH, HCB, PCB
Fuel	= liquid fuels, solid fuels, gaseous fuels, other fossil fuel, biomass, peat

#### 3.1.2.1.2.2 Choice of activity data

The following fuels are used for electricity production:

- Liquid fuels:**
- Residual fuel oil
- Solid fuels:**
- Lignite
  - Sub-Bituminous Coal

An overview of Pljevlja coal-fired Thermal Power Plant which is a condensation power plant, the capacity and the type of engine is provided in the following table.

**Table 3.6 Thermal Power plants, capacity and output**

Name	Year Built	Unit	Unit configuration	Capacity		Type of Engine	Type of fuel
				Installed	Operating		
			(MW)				
Pljevlja coal-fired Thermal Power Plant (condensation power plant)	1982	1	210	180	180	Steam boiler	Coal
After reconstruction	2009	1	225	191	191	Steam boiler	Coal

Source: Termoelektrana Pljevlja, Pljevlja

<sup>31</sup> Source: EMEP/EEA air pollutant emission inventory guidebook 2019, 1.A.1 Energy industries, sub-chapter 3.4.2 Tier 1 default approach.

Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2019 are **plant specific data** and were taken from prepared by Statistical Office of Montenegro (MONSTAT).

The total fuel consumption decreased by 20.4% in the period 1990 – 2019. From 2005 to 2019 the total fuel consumption increased by 31.1%. From 2018 to 2019 the total fuel consumption decreased by 10.1% due to decreased production of electricity by the thermal power plant and at the same time increased imports and use of wind energy. The fluctuation of the fuel consumption are mainly due to increased electricity consumption for heating coupled with non-availability of hydropower in winter and during droughts and other way around. And finally the fluctuation in energy consumption is a result of the political and economic situation after the break-up of the Socialist Federal Republic of Yugoslavia, Bosnian War, Croatian War (1991–1995), UN embargo, Kosovo War (1998/1999), Independency (2006) and political disturbance (2016).

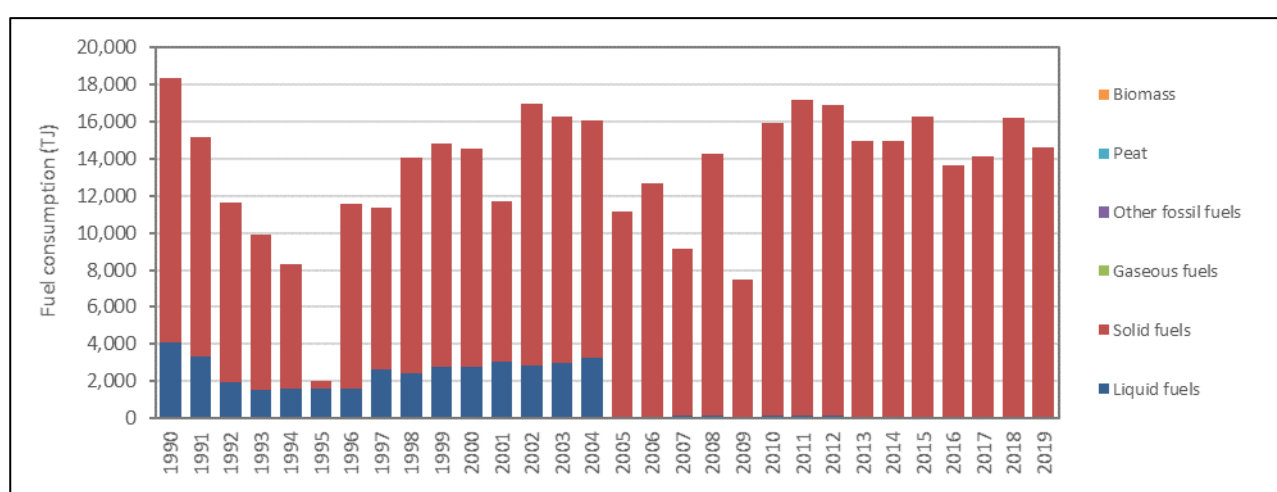


Figure 3.6 Activity data for sub-category 1.A.1.a Main Activity Electricity and Heat Production

Table 3.7 Activity data for sub-category 1.A.1.a Main Activity Electricity and Heat Production

Activity data 1.A.1.a	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
1990	18 334	4 096	14 238	NO	NO	NO	NO
1991	15 196	3 307	11 889	NO	NO	NO	NO
1992	11 625	1 970	9 654	NO	NO	NO	NO
1993	9 933	1 506	8 427	NO	NO	NO	NO
1994	8 343	1 622	6 721	NO	NO	NO	NO
1995	2 010	1 606	404	NO	NO	NO	NO
1996	11 579	1 597	9 983	NO	NO	NO	NO
1997	11 335	2 626	8 709	NO	NO	NO	NO
1998	14 075	2 420	11 655	NO	NO	NO	NO
1999	14 816	2 741	12 075	NO	NO	NO	NO
2000	14 556	2 754	11 803	NO	NO	NO	NO
2001	11 723	3 057	8 666	NO	NO	NO	NO
2002	16 996	2 840	14 156	NO	NO	NO	NO



Activity data 1.A.1.a	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
2003	16 312	3 002	13 310	NO	NO	NO	NO
2004	16 101	3 244	12 857	NO	NO	NO	NO
2005	11 129	91	11 038	NO	NO	NO	NO
2006	12 660	58	12 602	NO	NO	NO	NO
2007	9 184	132	9 052	NO	NO	NO	NO
2008	14 297	111	14 186	NO	NO	NO	NO
2009	7 488	59	7 428	NO	NO	NO	NO
2010	15 946	124	15 823	NO	NO	NO	NO
2011	17 199	124	17 075	NO	NO	NO	NO
2012	16 886	136	16 750	NO	NO	NO	NO
2013	14 979	NO	14 979	NO	NO	NO	NO
2014	15 001	NO	15 001	NO	NO	NO	NO
2015	16 301	NO	16 301	NO	NO	NO	NO
2016	13 620	NO	13 620	NO	NO	NO	NO
2017	14 117	NO	14 117	NO	NO	NO	NO
2018	16 232	NO	16 232	NO	NO	NO	NO
2019	14 592	NO	14 592	NO	NO	NO	NO
<i>Trend</i>							
1990 – 2019	-20.4%	NA	2.5%	NA	NA	NA	NA
2005 – 2019	31.1%	NA	32.2%	NA	NA	NA	NA
2018 – 2019	-10.1%	NA	-10.1%	NA	NA	NA	NA

In energy statistics, production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units, e.g. in tonnes or cubic metres. To convert these data to energy units, in this case terajoules, requires calorific values. The emission calculations are based on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in sub-category 1.A.1.a *Main Activity Electricity and Heat Production*.

**Table 3.8 Net calorific values (NCVs) applied for conversion to energy units in sub-category 1.A.1.a Main Activity Electricity and Heat Production**

Fuel		Fuel type	Net calorific value (NCV) (TJ/Gg)		Source
			NCV	type	
Lignite		solid	10.28	PS	Pljevlja coal-fired Thermal Power Plant (annual average)
Sub-Bituminous Coal		solid	16.75	PS	
Residual fuel oil		liquid	41.20	PS	
Note:					
D	Default	CS	Country specific	PS	Plant specific

### 3.1.2.1.2.3 Choice of emission factors

Default emission factors for air pollutant were taken from the EMEP/EEA air pollutant emission inventory Guidebook 2019 and are presented in the following table.

**Table 3.9 Emission factors (EF) for Main pollutants, Particulate Matter (PM), Heavy metals (HM) and Persistent Organic Pollutants (POPs) for sub-category 1.A.1.a Main Activity Electricity and Heat Production**

Fuel Type	UNIT	Hard Coal		Brown Coal		Heavy fuel oil	
Associated fuel types		Sub-bituminous coal		Lignite		Residual fuel oil	
Pollutant		EF	type	EF	type	EF	Type
NOx	g/GJ	209.00	D	247.00	D	142.00	D
CO	g/GJ	8.70	D	8.70	D	15.10	D
NMVOC	g/GJ	1.00	D	1.40	D	2.30	D
SOx	g/GJ	820.00	D	1680.00	D	495.00	D
TSP	g/GJ	11.40	D	11.70	D	35.40	D
PM10	g/GJ	7.70	D	7.90	D	25.20	D
PM2.5	g/GJ	3.40	D	3.20	D	19.30	D
BC	% of PM2.5	2.20	D	1.00	D	5.60	D
Pb	mg/GJ	7.30	D	15.00	D	4.56	D
Cd	mg/GJ	0.90	D	1.80	D	1.20	D
Hg	mg/GJ	1.40	D	2.90	D	0.34	D
As	mg/GJ	7.10	D	14.30	D	3.98	D
Cr	mg/GJ	4.50	D	9.10	D	2.55	D
Cu	mg/GJ	7.80	D	1.00	D	5.31	D
Ni	mg/GJ	4.90	D	9.70	D	255.00	D
Se	mg/GJ	23.00	D	45.00	D	2.06	D
Zn	mg/GJ	19.00	D	8.80	D	87.80	D
PCB	ng WHO-TEG/GJ	3.30	D	3.30	D	2.50	D
PCDD/F	ng I-TEQ/GJ	10.00	D	10.00	D	4.50	D
Benzo(a)pyrene	µg/GJ	0.70	D	1.30	D	4.50	D
Benzo(b)fluoranthene	µg/GJ	37.00	D	37.00	D	6.92	D
Benzo(k)fluoranthene	µg/GJ	29.00	D	29.00	D	142.00	D
Indeno(1,2,3-cd)pyrene	µg/GJ	1.10	D	2.10	D	15.10	D
HCB	µg/GJ	6.70	D	6.70	D	2.30	D
Source		Table 3.2, section 3.4, page 15.		Table 3.3, section 3.4, page 16.		Table 3.5, section 3.4, page 18.	
		EMEP/EEA air pollutant emission inventory guidebook 2019, Part B, Chapter 1.A.1 Energy industries.					
Note:							
D	Default	CS	Country specific	PS	Plant specific	IEF	Implied emission factor

### 3.1.2.1.3 Uncertainties and time-series consistency

The uncertainties for activity data and emission factors used for IPCC/NFR category 1.A.1.a *Main Activity Electricity and Heat Production* are presented in the following table.

**Table 3.10 Uncertainty for sub-category 1.A.1.a Main Activity Electricity and Heat Production.**

Uncertainty	Hard Coal	Brown Coal	Gaseous fuels	Heavy Fuel Oil	Gas oil	Biomass	Reference
Activity data (AD)	2%	2%		5%	5%	-	Table 2.15, 2006 IPCC GL, Vol. 2, Chap. 2 (2.4.2)
Emission factor (EF)	Rating	Typical error range		Average		Reference	
NOx	B	20% to 60%		40%		Table 2 2 Rating definitions  Table 2 3 Main NFR source categories with applicable quality data ratings  EMEP EEA GB 2019, Part A, Chapter 5 Uncertainties.v	
CO	B	20% to 60%		40%			
NM VOC	C	50% to 200%		125%			
SOx	A	10% to 30%		20%			
NH3	E	order of magnitude		750%			
TSP, PM10, PM2.5, BC	C	50% to 200%		125%			
Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn	D	100% to 300%		200%			
PCBs, PCDD/F, HCB, PAH (Benzo(a)pyrene, Benzo(b)-fluoranthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene)	D	100% to 300%		200%			

The time-series are considered to be consistent as the same methodology is applied to the whole period. Activity data are considered to be consistent as national and international data were always compared.

### 3.1.2.1.4 Source-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
  - consistent use of energy balance data (energy statistic questionnaires),
  - documented sources,
  - use of units,
  - strictly defined interfaces between spreadsheets/calculation modules,
  - unique structure of sheets which do the same,
  - record keeping, use of write protection,
  - unique use of formulas, special cases are documented/highlighted,
  - quick-control checks for data consistency through all steps of calculation.
- cross-checked from two sources: national statistic, EUROSTAT and international energy statistics of UN
- cross checks with other relevant sectors are performed to avoid double counting or omissions;
- time series consistency - plausibility checks of dips and jumps;
- indicators and analysis – produced, imported and consumed electricity.

### 3.1.2.1.5 Source-specific recalculations

The following table presents the main revisions and recalculations done since the last submission in 2013 and 2020 and relevant to sub-category 1.A.1.a Main Activity Electricity and Heat Production.

**Table 3.11** Recalculations done in sub-category 1.A.1.a Main Activity Electricity and Heat Production

source category	Revisions of data	Type of revision	Type of improvement
1.A.1.a	application of EMEP/EEA air pollutant emission inventory guidebook 2019	method	Comparability
1.A.1.a	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019	EF	Comparability
1.A.1.a	use of PS NCV	AD	Accuracy
1.A.1.a	Fuel consumption data (activity data) was revised due to revised fuel consumption data – plant specific data	AD	Accuracy

### 3.1.2.1.6 Source-specific planned improvements

Considering the potential contribution of identified improvements in the total emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

**Table 3.12** Planned improvements for sub-category 1.A.1.a Main Activity Electricity and Heat Production

source category	Planned improvement	Type of improvement		Priority
1.A.1.a.iii	Survey on use of fuels in Heat Plants: The amount of fuel consumption is not known yet.	AD	Completeness	High
1.A.1.a	Sulphur content in used fuel for preparing country specific emission factor (CS EF) $\Rightarrow CS EF_{SO_2} [g/GJ] = (S [\%] \cdot 20000) / (NCV [GJ/t])$	EF	Accuracy Transparency	High
1.A.1.a	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF	Accuracy Transparency	High
1.A.1.a	Data obtained from measurements made on the emission of air pollutants <ul style="list-style-type: none"> <li>Determination of the <ul style="list-style-type: none"> <li>temperature in waste gases [°C];</li> <li>static pressure and the dynamic pressure [kPa];</li> <li>flow rate [m/s];</li> <li>volume flow rate [m³/h and Nm³/h];</li> <li>concentration of CO, SO<sub>2</sub>, NO<sub>x</sub> in the exhaust gases [mg/Nm³]; and</li> <li>Gravimetric extraction of solid particles (TSP) from gases and determination by applying a gravimetric method (mg/Nm³).</li> </ul> </li> </ul>	EF	Accuracy Transparency	High
1.A.1.a	Improvement of tie series consistency	EF	Accuracy Transparency	High

### 3.1.2.2 Petroleum refining (IPCC/NFR category 1.A.1.b)

**Table 3.13** Overview on reported emissions from sub categories 1.A.1.b

Air pollutants	1.A.1.b						Key Category
	liquid	solid	gaseous	Other fossil fuel	Peat	biomass	
All air pollutants	NO	NO	NO	NO	NO	NO	
<p>A '✓' indicates: emissions from this sub-category have been estimated.</p> <p>Notation keys: IE -included elsewhere, NO – not occurrent, NE -not estimated, NA -not applicable, C – confidential</p>							

The IPCC subcategory 1.A.1.b *Petroleum refining* does not exist in Montenegro.

### 3.1.2.3 Manufacture of Solid Fuels and Other Energy Industries (IPCC/NFR category 1.A.1.c)

The IPCC/NFR category 1.A.1.c *Manufacture of Solid Fuels and Other Energy Industries* is divided in two sub-categories:

1.A.1.c.i *Manufacture of Solid Fuels*

1.A.1.c.ii *Other Energy Industries*

#### 3.1.2.3.1 Source category description

**Table 3.14** Overview on reported emissions from sub categories 1.A.1.c.i and 1.A.1.c.ii

Air pollutants	1.A.1.c.i						1.A.1.c.ii						Key Category
	liquid	solid	gaseous	Other fossil fuel	Peat	biomass <i>Charcoal production</i>	liquid	solid	gaseous	Other fossil fuel	Peat	biomass	
NO <sub>x</sub>	NO	NO	NO	NO	NO	NE	NO	NO	NO	NO	NO	NO	
CO	NO	NO	NO	NO	NO	NE	NO	NO	NO	NO	NO	NO	
NM VOC	NO	NO	NO	NO	NO	NE	NO	NO	NO	NO	NO	NO	
SO <sub>x</sub>	NO	NO	NO	NO	NO	NA	NO	NO	NO	NO	NO	NO	
NH <sub>3</sub>	NO	NO	NO	NO	NO	NA	NO	NO	NO	NO	NO	NO	
TSP	NO	NO	NO	NO	NO	NE	NO	NO	NO	NO	NO	NO	
PM <sub>10</sub>	NO	NO	NO	NO	NO	NE	NO	NO	NO	NO	NO	NO	
PM <sub>2.5</sub>	NO	NO	NO	NO	NO	NE	NO	NO	NO	NO	NO	NO	
BC	NO	NO	NO	NO	NO	NE	NO	NO	NO	NO	NO	NO	

Air pollutants	1.A.1.c.i						1.A.1.c.ii						Key Category
	liquid	solid	gaseous	Other fossil fuel	Peat	biomass <i>Charcoal production</i>	liquid	solid	gaseous	Other fossil fuel	Peat	biomass	
Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn	NO	NO	NO	NO	NO	NA	NO	NO	NO	NO	NO	NO	
PCBs, PCDD/F, HCB, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene,	NO	NO	NO	NO	NO	NA	NO	NO	NO	NO	NO	NO	
<p>A '✓' indicates: emissions from this sub-category have been estimated.</p> <p>Notation keys: IE - included elsewhere, NO – not occurring, NE - not estimated, NA - not applicable, C – confidential</p> <p>LA XX - Level Assessment in year XX</p> <p>TA XX - Trend Assessment in year XX</p>													

The emissions from charcoal production were not estimated as the activity data were not consistent as different sources provided various activity data.

### 3.1.2.3.2 Source-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

**Table 3.15** Planned improvements for Sub-category 1.A.1.c.i Manufacture of Solid Fuels

source	Planned improvement	Type of improvement		Priority
1.A.1.c.i	Cross-check of national and international data sources (FAO, EUROSTAT and UN) on charcoal production	AD	Consistency Transparency	high
1.A.1.c.i	Analysis of charcoal production (1) Raw materials for carbonization. • Fuelwood & wood fuel: type of wood and wood waste • Agricultural residues • bark waste (2) charcoal making technologies (3) efficiencies of various types of kiln			high
1.A.1.c.i	Country specific Net Caloric Value (NCV) for fuels of national production: charcoal ⇒ conversion from mass unit to energy unit (unit EF is kg /TJ)	AD EF	Accuracy Transparency	medium
1.A.1.c.i	Estimation of carbon monoxide (CO), sulphur dioxide (SO <sub>2</sub> ), nitrogen dioxide (NO <sub>2</sub> ) and particulate matter (PM <sub>2.5</sub> )		Completeness	high

### 3.1.3 Manufacturing Industries and Construction (IPCC/NFR category 1.A.2)

This section describes emissions resulting from fuel combustion activities in manufacturing industries and construction, which originate from the following sources:

IPCC/NFR code	Description	Occurrent		Not occurrent (NO)
		Estimated	Not estimated (NE)	
1.A.2.a	Iron and Steel	✓		
1.A.2.b	Non-Ferrous Metals	✓		
1.A.2.c	Chemicals	✓		
1.A.2.d	Pulp, Paper and Print	✓		
1.A.2.e	Food Processing, Beverages and Tobacco	✓		
1.A.2.f	Non-Metallic Minerals	✓		
1.A.2.g	Manufacturing of transport equipment	✓		
1.A.2.h	Manufacturing of machinery	✓		
1.A.2.i	Mining (excluding fuels) and Quarrying	✓		
1.A.2.j	Wood and wood products	✓		
1.A.2.k	Construction	✓		
1.A.2.l	Textile and Leather	✓		
1.A.2.m	Other	✓		
A '✓' indicates: emissions from this sub-category have been estimated.				
Notation keys: IE - included elsewhere, NO – not occurrent, NE - not estimated, NA - not applicable, C – confidential				

### 3.1.3.1 Iron and Steel (IPCC/NFR category 1.A.2.a)

#### 3.1.3.1.1 Source category description

This section describes emissions resulting from fuel combustion activities in *Manufacturing Industries and Construction - Iron and Steel* -.

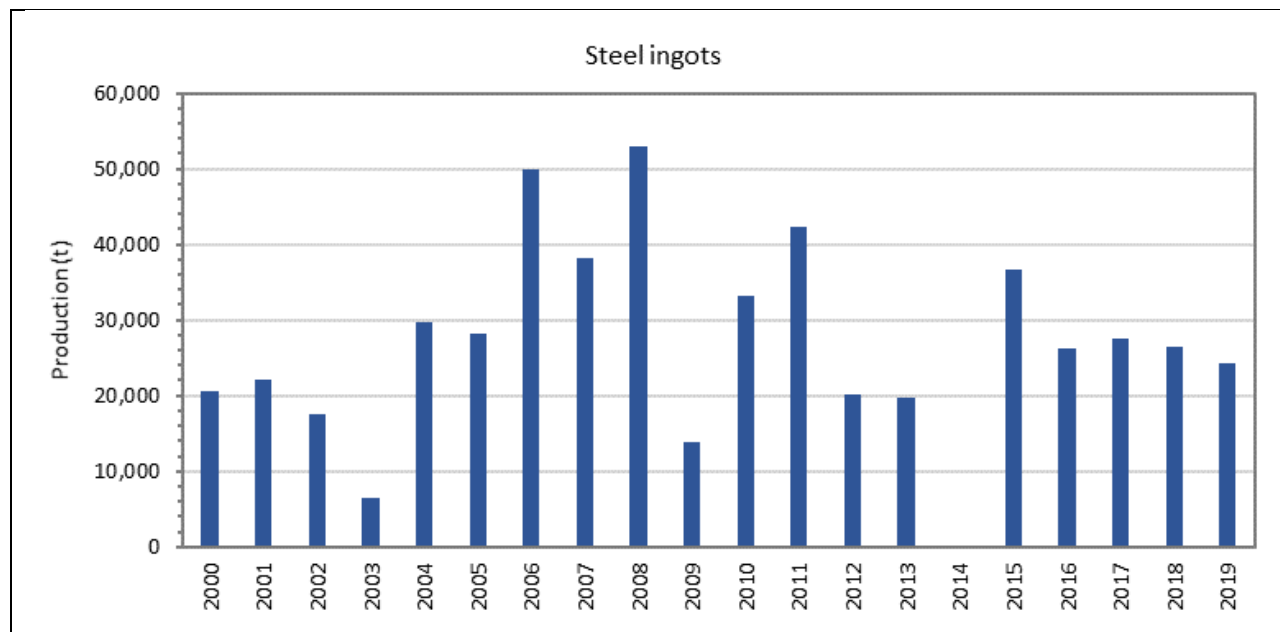


Figure 3.7 Production of steel ingots 2000 - 2019

Table 3.16 Overview on reported emissions from sub categories 1.A.2.a Iron and Steel

Air pollutants	1.A.2.a						Key Category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
NOx	✓	✓	✓**	NO	NO	NO**	Trend 2018
CO	✓	✓	✓**	NO	NO	NO**	-
NM VOC	✓	✓	✓**	NO	NO	NO**	-
SOx	✓	✓	✓**	NO	NO	NO**	-
NH3	✓	✓	✓**	NO	NO	✓	-
TSP	✓	✓	✓**	NO	NO	NO**	-
PM10	✓	✓	✓**	NO	NO	NO**	-
PM2.5	✓	✓	✓**	NO	NO	NO**	-
BC	✓	✓	✓**	NO	NO	NO**	-
Pb	✓	✓	✓**	NO	NO	NO**	-
Cd	✓	✓	✓**	NO	NO	NO**	-
Hg	✓	✓	✓**	NO	NO	NO**	-
As	✓	✓	✓**	NO	NO	NO**	-
Cr	✓	✓	✓**	NO	NO	NO**	-
Cu	✓	✓	✓**	NO	NO	NO**	-
Ni	✓	✓	✓**	NO	NO	NO**	-
Se	✓	✓	✓**	NO	NO	NO**	-
Zn	✓	✓	✓**	NO	NO	NO**	-
PCB	✓	✓	✓**	NO	NO	NO**	-



Air pollutants	1.A.2.a						Key Category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
PCDD/F	✓	✓	✓**	NO	NO	NO**	-
PAH	✓	✓	✓**	NO	NO	NO**	-
Benzo(a)pyrene	✓	✓	✓**	NO	NO	NO**	-
Benzo(b)fluoranthene	✓	✓	✓**	NO	NO	NO**	-
Benzo(k)fluoranthene	✓	✓	✓**	NO	NO	NO**	-
Indeno(1,2,3-cd)pyrene	✓	✓	✓**	NO	NO	NO**	-
HCB	✓	✓	✓**	NO	NO	NO**	-
A '✓' indicates: emissions from this sub-category have been estimated.							
Notation keys: IE -included elsewhere, NO – not occurrent, NE -not estimated, NA -not applicable, C – confidential							
* Until 2016: IE      **until 2013: IE							
LA XX - Level Assessment in year XX							
TA XX - Trend Assessment in year XX							

### Use of notation key

- IE 1.A.2.a (gaseous, biomass) The energy statistics is still under development; a split of the fuel combustion for this subcategory has to be reviewed for the entire timeseries. Emissions are currently allocated in IPCC/NFR subcategory 1.A.2.m *Other*.

An overview of the emission from fuel combustion in IPCC/NFR sub-category 1.A.2.a *Iron and Steel* is provided in the following figures and tables:

- annual emissions of air pollutants;
- trend of the periods 1990 – 2019, 2005 – 2019, 2017 – 2019;
- share of sector 1.A.2.a of each pollutants in the related National total emissions.

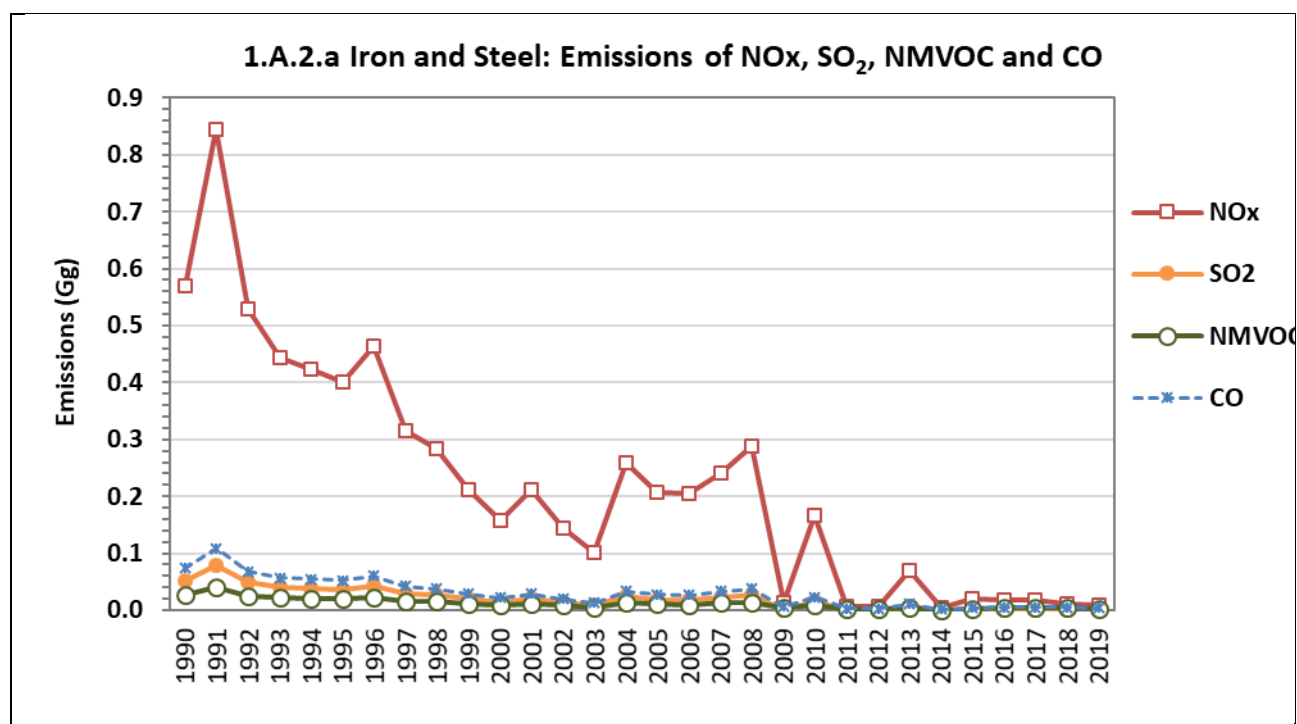


Figure 3.8 Emissions of main pollutants (NO<sub>x</sub>, SO<sub>2</sub>, NMVOC and CO) from sub-category 1.A.2.a Iron and Steel

Table 3.17 Emissions of main pollutants (NO<sub>x</sub>, SO<sub>2</sub>, NMVOC and CO) from sub-category 1.A.2.a Iron and Steel

Emissions	NO <sub>x</sub>	NMVOC	SO <sub>x</sub>	CO	NH <sub>3</sub>
	Gg	Gg	Gg	Gg	Gg
1990	0.571	0.028	0.052	0.074	IE
1991	0.845	0.041	0.078	0.109	IE
1992	0.528	0.026	0.049	0.068	IE
1993	0.444	0.022	0.041	0.057	IE
1994	0.423	0.021	0.039	0.055	IE
1995	0.402	0.020	0.037	0.052	IE
1996	0.465	0.023	0.043	0.060	IE
1997	0.315	0.016	0.029	0.042	IE
1998	0.285	0.015	0.026	0.038	IE
1999	0.211	0.011	0.019	0.028	IE
2000	0.158	0.009	0.014	0.021	IE
2001	0.213	0.011	0.019	0.028	IE
2002	0.145	0.008	0.013	0.020	IE
2003	0.102	0.005	0.010	0.013	IE
2004	0.258	0.013	0.024	0.033	IE
2005	0.206	0.011	0.019	0.028	IE
2006	0.205	0.010	0.019	0.027	IE
2007	0.242	0.014	0.022	0.033	IE
2008	0.287	0.014	0.026	0.037	IE
2009	0.014	0.004	0.000	0.006	IE
2010	0.167	0.010	0.015	0.023	IE
2011	0.007	0.002	0.000	0.003	IE
2012	0.007	0.002	0.000	0.003	IE
2013	0.070	0.005	0.006	0.011	IE
2014	0.005	0.001	0.000	0.002	<0.001
2015	0.020	0.002	0.002	0.004	<0.001
2016	0.017	0.004	0.001	0.005	IE
2017	0.018	0.004	0.001	0.005	IE
2018	0.011	0.004	0.000	0.005	IE
2019	0.009	0.003	0.000	0.004	IE
<i>Trend</i>					
1990 – 2019	-98.3%	-89.4%	-99.7%	-94.9%	NA
2005 – 2019	-95.4%	-73.2%	-99.3%	-86.4%	NA
2018 – 2019	-17.4%	-17.4%	-7.6%	-17.1%	NA

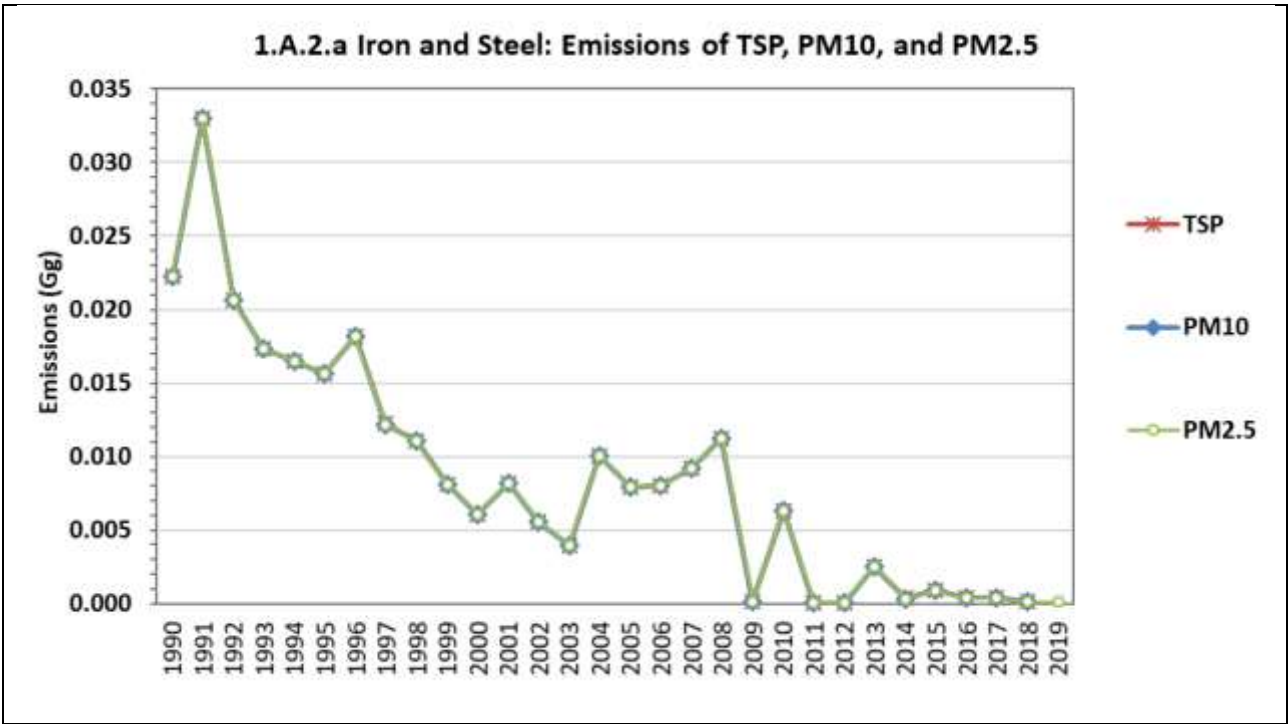


Figure 3.9 Emissions of TSP PM10 and PM2.5 from sub-category 1.A.2.a Iron and Steel

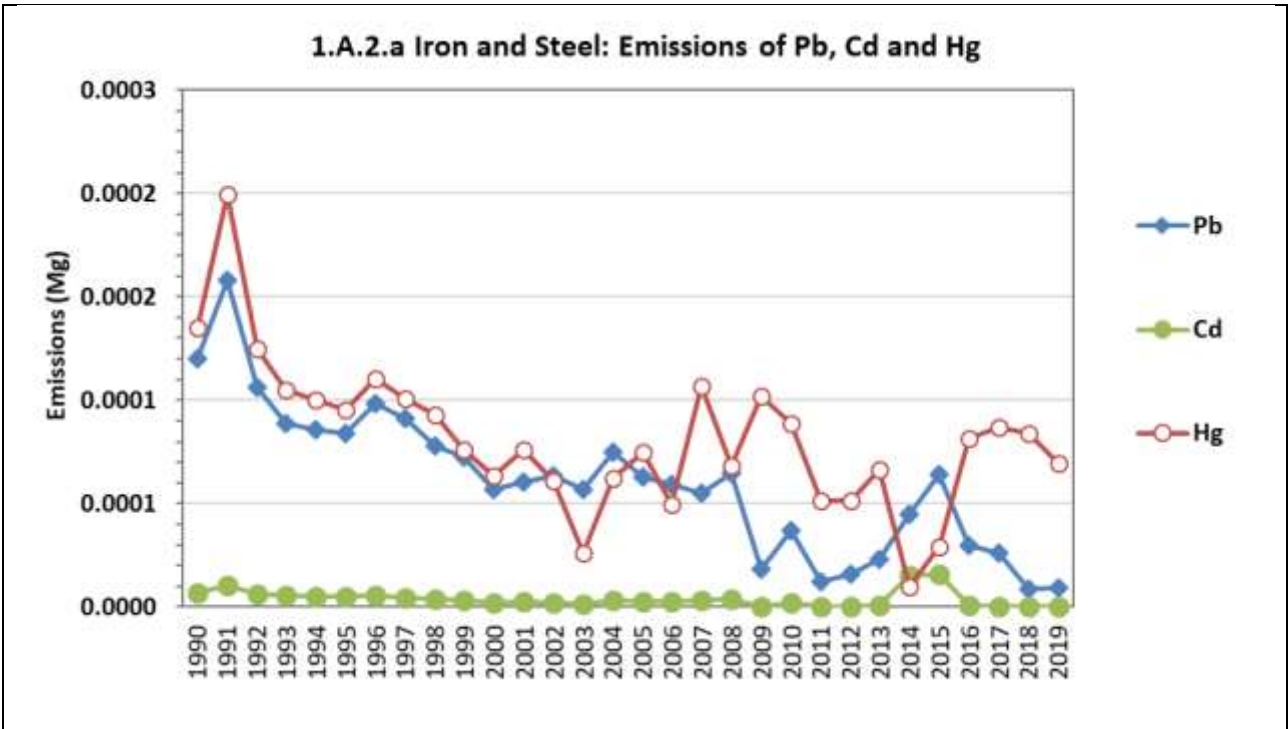


Figure 3.10 Emissions of Heavy Metals (HM) from sub-category 1.A.2.a Iron and Steel

**Table 3.18 Emissions of particulate matter (PM) from sub-category 11.A.2.a Iron and Steel**

Emissions	PM2.5	PM10	TSP	BC
	Gg	Gg	Gg	Gg
1990	0.0223	0.0223	0.0223	0.0003
1991	0.0330	0.0330	0.0330	0.0002
1992	0.0206	0.0206	0.0206	0.0002
1993	0.0173	0.0173	0.0173	0.0002
1994	0.0165	0.0165	0.0165	0.0002
1995	0.0157	0.0157	0.0157	0.0002
1996	0.0181	0.0182	0.0182	0.0002
1997	0.0122	0.0122	0.0122	0.0004
1998	0.0110	0.0110	0.0110	0.0003
1999	0.0081	0.0081	0.0081	0.0004
2000	0.0061	0.0061	0.0061	0.0003
2001	0.0082	0.0082	0.0082	0.0002
2002	0.0056	0.0056	0.0056	0.0004
2003	0.0040	0.0040	0.0040	0.0004
2004	0.0101	0.0101	0.0101	0.0003
2005	0.0080	0.0080	0.0080	0.0003
2006	0.0080	0.0080	0.0080	0.0002
2007	0.0092	0.0092	0.0092	0.0002
2008	0.0112	0.0112	0.0112	0.0002
2009	0.0002	0.0002	0.0002	0.0001
2010	0.0063	0.0063	0.0063	0.0001
2011	0.0001	0.0001	0.0001	0.0001
2012	0.0001	0.0001	0.0001	0.0001
2013	0.0026	0.0026	0.0026	0.0001
2014	0.0004	0.0004	0.0004	0.0010
2015	0.0009	0.0009	0.0009	0.0012
2016	0.0004	0.0004	0.0004	0.0002
2017	0.0004	0.0004	0.0004	0.0002
2018	0.0001	0.0001	0.0001	0.0001
2019	<0.0001	<0.0001	<0.0001	<0.0001
<i>Trend</i>				
1990 – 2019	-99.5%	-99.5%	-99.5%	-74.4%
2005 – 2019	-98.7%	-98.7%	-98.7%	-74.4%
2018 – 2019	-16.0%	-15.9%	-15.8%	14.3%

**Table 3.19 Emissions of Heavy Metals (HM) from sub-category 1.A.2.a Iron and Steel**

Emissions	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
	kg	kg	kg	kg	kg	kg	kg	kg	kg
1990	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1991	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1992	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1993	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1994	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1995	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1996	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1997	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1998	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1999	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2000	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2001	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2002	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2003	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2004	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2005	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2006	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2007	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2008	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2009	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2010	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2011	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2012	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2013	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2014	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2015	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2016	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2017	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2018	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2019	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
<i>Trend</i>									
1990 – 2019	-92.2%	-96.9%	-48.6%	-62.0%	-98.9%	-99.5%	-79.6%	-93.9%	-99.7%
2005 – 2019	-85.2%	-92.2%	-6.8%	-25.5%	-97.0%	-98.5%	-64.1%	-83.9%	-99.1%
2018 – 2019	8.0%	-4.7%	-17.3%	-17.0%	-9.3%	4.5%	-9.5%	-17.1%	-14.8%

**Table 3.20 Emissions of Persistent Organic Pollutants (POPs) from sub-category 1.A.2.a Iron and Steel**

Emissions	PCDD/F	Benzo(a)-pyrene	Benzo(b)-fluoranthene	Benzo(k)-fluor-anthene	Indeno (1,2,3-cd) pyrene	Total PAH	HCB	PCB
	g I-TEQ	Mg	Mg	Mg	Mg	Mg	kg	Kg
1990	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
1991	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
1992	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
1993	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
1994	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
1995	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
1996	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
1997	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
1998	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
1999	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2000	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2001	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2002	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2003	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2004	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2005	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2006	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2007	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2008	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2009	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2010	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2011	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2012	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2013	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2014	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2015	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2016	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2017	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2018	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2019	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
<i>Trend</i>								
1990 – 2019	-95.1%	650.4%	-87.3%	NA	-79.3%	-77.8%	-74.4%	-74.4%
2005 – 2019	-87.4%	110.5%	-80.4%	NA	-74.9%	-73.3%	-74.4%	-74.4%
2018 – 2019	-13.8%	-16.8%	10.2%	NA	9.6%	7.2%	14.3%	14.3%

### 3.1.3.1.2 Methodological issues

#### 3.1.3.1.2.1 Choice of methods

For estimating the air pollutants emissions the Tier 1 approach<sup>32</sup> of the EMEP/EEA air pollutant emission inventory guidebook 2019 has been applied:

*Equation: emissions from stationary combustion*

$$Emissions_{pollutant} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{pollutant, fuel}$$

Where:

Emissions <sub>pollutant</sub>	= emissions of a given pollutant by type of fuel (kg pollutant)
Fuel consumption <sub>fuel</sub>	= amount of fuel combusted (TJ)
Emission factor <sub>pollutant, fuel</sub>	= default emission factor of a given pollutant by type of fuel (g <sub>pollutant</sub> /GJ).
Pollutant	= main pollutants: NO <sub>x</sub> , CO, NMVOC, SO <sub>2</sub> particulate matter: TSP, OM10, PM2.5, BC heavy metals: Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn persistent organic pollutants: PCDD/F, Benzo(a) pyrene, Benzo(b)fluor, anthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene, Total PAH, HCB, PCB
Fuel	= liquid fuels, solid fuels, gaseous fuels, other fossil fuel, biomass, peat

#### 3.1.3.1.2.2 Choice of activity data

The following fuels are used for electricity and heat production (autoproducer):

Tier 1 fuel type	Associated fuel types	Source
Liquid fuels	<ul style="list-style-type: none"> <li>Residual fuel oil</li> </ul>	Summary of fuel aggregations at Tier 1 according to EMEP/EEA air pollutant emission inventory guidebook 2019, Part B, Chapter 1.A.2, Table 3 23
Solid fuels	<ul style="list-style-type: none"> <li>Lignite</li> </ul>	
Gaseous fuels	<ul style="list-style-type: none"> <li>Natural Gas</li> <li>Liquefied Petroleum Gases (LPG)</li> </ul>	
Biomass	<ul style="list-style-type: none"> <li>Wood pellets</li> </ul>	

Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2019 were taken from prepared by Statistical Office of Montenegro (MONSTAT).

The total fuel consumption decreased by 88.5% in the period 1990 – 2019. From 2005 to 2019 the total fuel consumption decreased by 71.1%. From 2018 to 2019 the total fuel consumption decreased by 17.4%. Furthermore, there has been a switch from coal to natural gas which has led to a reduction in emissions.

<sup>32</sup> Source: EMEP/EEA air pollutant emission inventory guidebook 2019, 1.A.2 Manufacturing industries and construction (combustion), sub-chapter 3.2 Tier 1 default approach.

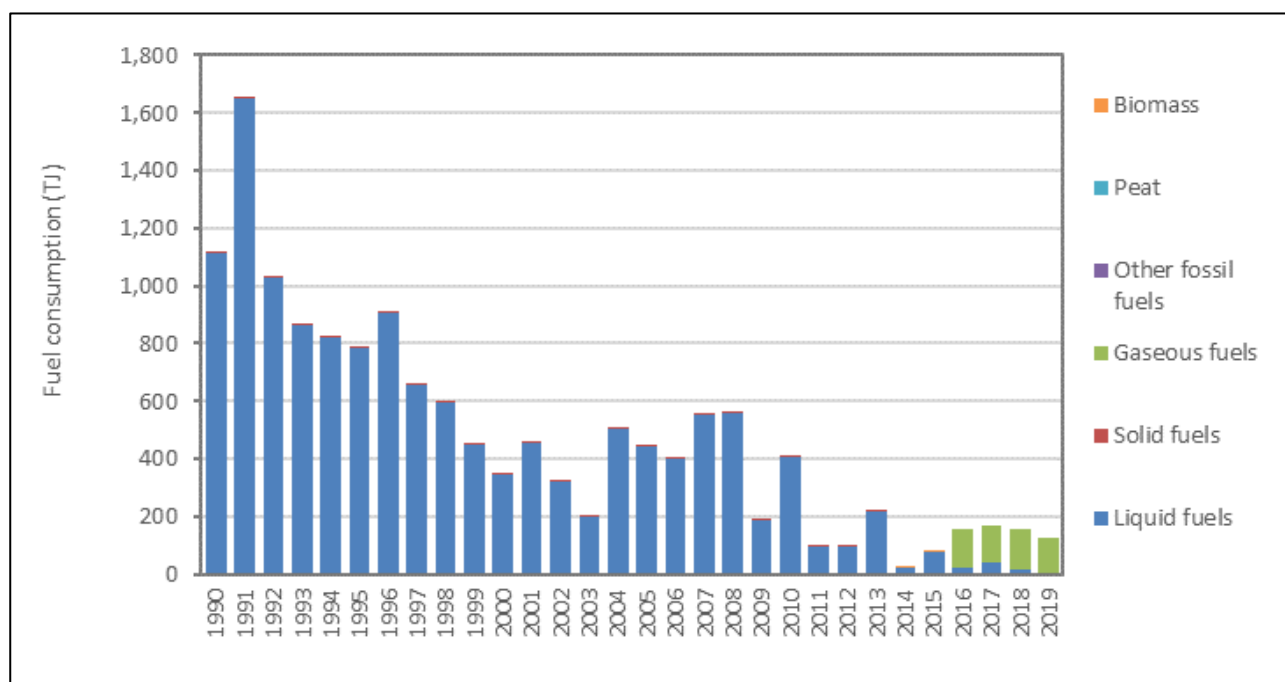


Figure 3.11 Activity data for sub-category 1.A.2.a Iron and Steel

Table 3.21 Activity data for sub-category 1.A.2.a Iron and Steel

Activity data 1.A.1.a	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
1990	1,112.63	1,112.40	0.23	IE	NO	NO	IE
1991	1,648.19	1,648.00	0.19	IE	NO	NO	IE
1992	1,030.18	1,030.00	0.18	IE	NO	NO	IE
1993	865.35	865.20	0.15	IE	NO	NO	IE
1994	824.15	824.00	0.15	IE	NO	NO	IE
1995	782.96	782.80	0.16	IE	NO	NO	IE
1996	906.59	906.40	0.19	IE	NO	NO	IE
1997	654.12	653.81	0.31	IE	NO	NO	IE
1998	595.51	595.26	0.25	IE	NO	NO	IE
1999	450.95	450.65	0.30	IE	NO	NO	IE
2000	347.89	347.65	0.24	IE	NO	NO	IE
2001	454.97	454.77	0.20	IE	NO	NO	IE
2002	323.24	322.93	0.31	IE	NO	NO	IE
2003	198.07	197.76	0.31	IE	NO	NO	IE
2004	502.90	502.64	0.26	IE	NO	NO	IE
2005	442.64	442.41	0.23	IE	NO	NO	IE
2006	399.84	399.64	0.20	IE	NO	NO	IE
2007	551.23	551.10	0.13	IE	NO	NO	IE
2008	560.47	560.32	0.15	IE	NO	NO	IE
2009	187.68	187.56	0.12	IE	NO	NO	IE
2010	406.32	406.24	0.08	IE	NO	NO	IE



Activity data 1.A.1.a	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
2011	93.86	93.78	0.08	IE	NO	NO	IE
2012	93.89	93.78	0.11	IE	NO	NO	IE
2013	217.47	217.38	0.09	IE	NO	NO	IE
2014	23.57	22.31	0.09	IE	NO	NO	1.18
2015	76.56	75.16	0.22	IE	NO	NO	1.18
2016	158.34	21.74	0.20	136.40	NO	NO	NO
2017	168.27	40.49	0.17	127.60	NO	NO	NO
2018	154.92	14.07	0.05	140.80	NO	NO	NO
2019	127.95	4.69	0.06	123.20	NO	NO	127.95
<i>Trend</i>							
1990 – 2019	-88.5%	-99.6%	-74.4%	NA	NA	NA	NA
2005 – 2019	-71.1%	-98.9%	-74.4%	NA	NA	NA	NA
2018 – 2019	-17.4%	-66.7%	14.3%	-12.5%	NA	NA	NA

In energy statistics, production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units, e.g. in tonnes or cubic metres. To convert these data to energy units, in this case terajoules, requires calorific values. The emission calculations are based on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in IPCC/NFR sub-category 1.A.2.a Iron and Steel.

**Table 3.22 Net calorific values (NCVs) applied for conversion to energy units in sub-category 1.A.2.a Iron and Steel**

Fuel		Fuel type	Net calorific value (NCV) (TJ/Gg)		Source
			NCV	type	
Lignite		solid	9.21	CS	Statistical Office of Montenegro (MONSTAT)
Residual fuel oil		liquid	41.20	CS	
Liquefied Petroleum Gases (LPG)		liquid	46.89	CS	
Natural Gas		gaseous	46.00	CS	
Wood pellets		biomass	16.85	CS	
Note:					
D	Default	CS	Country specific	PS	Plant specific

### 3.1.3.1.2.3 Choice of emission factors

Default emission factors for air pollutant were taken from the EMEP/EEA air pollutant emission inventory Guidebook 2019<sup>33</sup> and are presented in the following table.

<sup>33</sup> Source: EMEP/EEA air pollutant emission inventory guidebook 2019, 1.A.2 Manufacturing industries and construction (combustion), sub-chapter 3.2.2 Default emission factors.

**Table 3.23 Emission factors (EF) for Main pollutants, Particulate Matter (PM), Heavy metals (HM) and Persistent Organic Pollutants (POPs) for sub-category 1.A.2.a Iron and Steel**

Fuel Type	UNIT	Solid Fuels		Liquid fuels		Gaseous Fuels		Biomass	
Associated fuel types		Lignite		Residual fuel oil		• Natural Gas • LPG		Wood pellets	
Pollutant		EF	type	EF	type	EF	type	EF	type
NOx	g/GJ	173	D	513.0	D	74	D	91	D
CO	g/GJ	931	D	66	D	29	D	570	D
NMVOC	g/GJ	88.8	D	25	D	23	D	300	D
SOx	g/GJ	900	D	47	D	0.67	D	11	D
TSP	g/GJ	124	D	20	D	0.78	D	1.2	D
NH3	g/GJ	NE		NE		NE		150	D
PM10	g/GJ	117	D	20	D	0.78	D	143	D
PM2.5	g/GJ	108	D	20	D	0.78	D	140	D
BC	% of PM2.5	6.4	D	56	D	4	D	28	D
Pb	mg/GJ	134	D	0.08	D	0.011	D	27	D
Cd	mg/GJ	1.8	D	0.006	D	0.0009	D	13	D
Hg	mg/GJ	7.9	D	0.12	D	0.54	D	0.56	D
As	mg/GJ	4	D	0.03	D	0.1	D	0.19	D
Cr	mg/GJ	13.5	D	0.2	D	0.013	D	23	D
Cu	mg/GJ	17.5	D	0.22	D	0.0026	D	6	D
Ni	mg/GJ	13	D	0.008	D	0.013	D	2	D
Se	mg/GJ	1.8	D	0.11	D	0.058	D	0.5	D
Zn	mg/GJ	200	D	29	D	0.73	D	512	D
PCB	ng WHO-TEG/GJ	170	D	NE	D	NE	D	0.06	D
PCDD/F	ng I-TEQ/GJ	203	D	1.4	D	0.52	D	100	D
Benzo(a)pyrene	µg/GJ	45.5	D	0.0019	D	0.72	D	0.01	D
Benzo(b)fluoranthene	µg/GJ	58.9	D	0.015	D	0.0029	D	0.016	D
Benzo(k)fluoranthene	µg/GJ	23.7	D	0.0017	D	0.0011	D	0.005	D
Indeno(1,2,3-cd)pyrene	µg/GJ	18.5	D	0.0015	D	0.00108	D	0.004	D
HCB	µg/GJ	0.62	D	NE	D	NE	D	5	D
Source		Table 3.2, section 3.4, page 15.		Table 3.3, section 3.4, page 16.		Table 3.4, section 3.4, page 17.		Table 3.5, section 3.4, page 17.	
		EMEP/EEA air pollutant emission inventory guidebook 2019, Part B, Chapter 1.A.2 Manufacturing industries and construction (combustion).							
Note:									
D	Default	CS Country specific		PS Plant specific		IEF Implied emission factor			

### 3.1.3.1.3 Uncertainties and time-series consistency

The uncertainties for activity data and emission factors used for IPCC/NFR category 1.A.2.a Iron and Steel are presented in the following table.

**Table 3.24 Uncertainty for sub-category 1.A.2.a Iron and Steel .**

Uncertainty	Hard Coal	Brown Coal	Gaseous fuels	Heavy Fuel Oil	Gas oil	Biomass	Reference
Activity data (AD)	3%	3%	5%	5%	5%	-	Table 2.15, 2006 IPCC GL, Vol. 2, Chap. 2 (2.4.2)
Emission factor (EF)	Rating	Typical error range		Average		Reference	
NO <sub>x</sub>	B	20% to 60%		40%		Table 2 2 Rating definitions Table 2 3 Main NFR source categories with applicable quality data ratings EMEP EEA GB 2019, Part A, Chapter 5 Uncertainties.	
CO	C	50% to 200%		125%			
NM <sub>VOC</sub>	D	100% to 300%		200%			
SO <sub>x</sub>	A	10% to 30%		20%			
NH <sub>3</sub>	E	order of magnitude		750%			
TSP, PM <sub>10</sub> , PM <sub>2.5</sub> , BC	C	50% to 200%		125%			
Hg	B	20% to 60%		40%			
Pb, Cd, As, Cr, Cu, Ni, Se, Zn	C	50% to 200%		125%			
PCDD/F	E	order of magnitude		750%			
PAH (Benzo(a)pyrene, Benzo(b)-fluoranthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene)	C	50% to 200%		125%			
HCB, PCBs	D	100% to 300%		200%			

The time-series are considered to be consistent as the same methodology is applied to the whole period. Activity data are considered to be consistent as national and international data were always compared.

### 3.1.3.1.4 Source-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
  - consistent use of energy balance data (energy statistic questionnaires),
  - documented sources,
  - use of units,
  - strictly defined interfaces between spreadsheets/calculation modules,
  - unique structure of sheets which do the same,
  - record keeping, use of write protection,
  - unique use of formulas, special cases are documented/highlighted,
  - quick-control checks for data consistency through all steps of calculation.
- cross-checked from two sources: national statistic, Eurostat and international energy statistics of UN
- cross checks with other relevant sectors are performed to avoid double counting or omissions;
- time series consistency - plausibility checks of dips and jumps.

### 3.1.3.1.5 Source-specific recalculations

The following table presents the main revisions and recalculations done since the last submission in 2003 and 2020 and relevant to sub-category 1.A.2.a Iron and Steel.

**Table 3.25 Recalculations done in sub-category 1.A.2.a Iron and Steel**

source category	Revisions of data	Type of revision	Type of improvement
1.A.2.a	application of EMEP/EEA air pollutant emission inventory guidebook 2019	method	Comparability
1.A.2.a	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019	EF	Comparability
1.A.2.a	use of CS NCV	AD	Accuracy
1.A.2.a	Fuel consumption data (activity data) was revised due to revised fuel consumption data – plant specific data	AD	Accuracy

### 3.1.3.1.6 Source-specific planned improvements

Considering the potential contribution of identified improvements in the total emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

**Table 3.26 Planned improvements for sub-category 1.A.2.a Iron and Steel**

source category	Planned improvement	Type of improvement		Priority
1.A.2.a	Sulphur content in used fuel for preparing country specific emission factor (CS EF) $\Rightarrow \text{CS EF}_{\text{SO}_2} [\text{g/GJ}] = (\text{S} [\%] \cdot 20000) / (\text{NCV} [\text{GJ/t}])$	EF	Accuracy Transparency	High
1.A.2.a	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF	Accuracy Transparency	High
1.A.2.a	Data obtained from measurements made on the emission of air pollutants <ul style="list-style-type: none"> <li>Determination of the <ul style="list-style-type: none"> <li>temperature in waste gases [°C];</li> <li>static pressure and the dynamic pressure [kPa];</li> <li>flow rate [m/s];</li> <li>volume flow rate [m³/h and Nm³/h];</li> <li>concentration of CO, SO<sub>2</sub>, NO<sub>x</sub> in the exhaust gases [mg/Nm³]; and</li> <li>Gravimetric extraction of solid particles (TSP) from gases and determination by applying a gravimetric method (mg/Nm³).</li> </ul> </li> </ul>	EF	Accuracy Transparency	High
1.A.2.a	Improvement of time series consistency and split of fuels: the energy statistics is still under development; a split of the fuel combustion for this subcategory has to be reviewed for the entire timeseries. Emissions are allocated in IPCC/NFR subcategory 1.A.2.m Other.	AD	Accuracy Transparency	High

### 3.1.3.2 Non-Ferrous Metals (IPCC/NFR category 1.A.2.b)

#### 3.1.3.2.1 Source category description

This section describes emissions resulting from fuel combustion activities in *Manufacturing Industries and Construction -Non-Ferrous Metals -*.

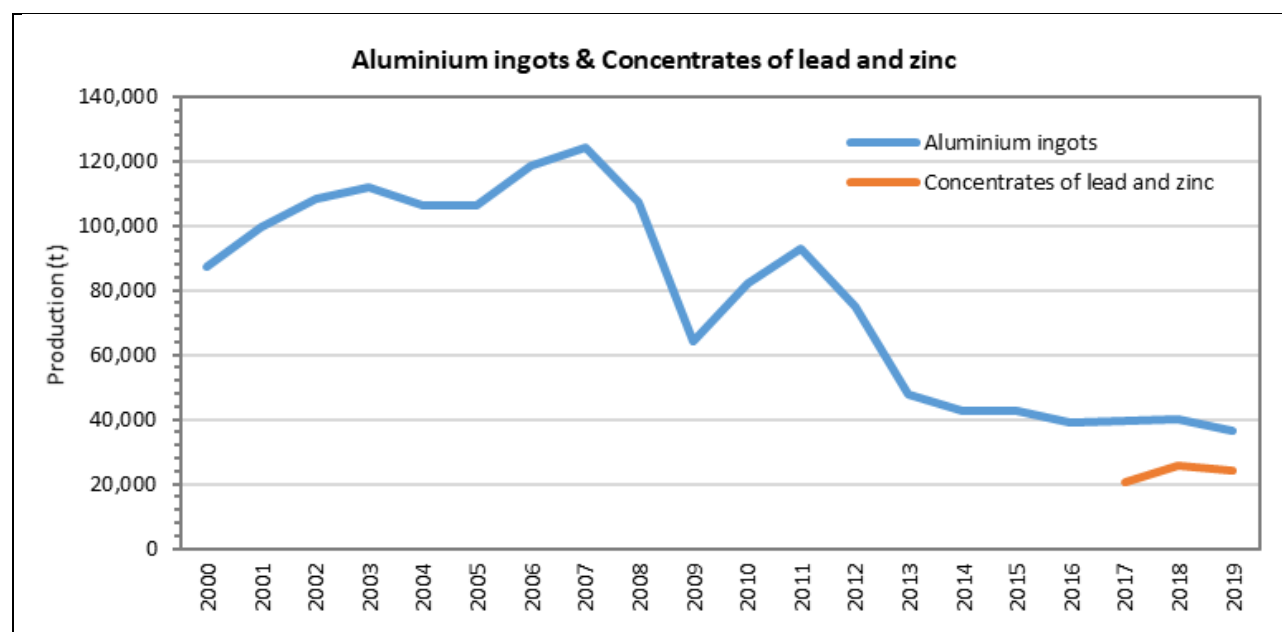


Figure 3.12 Production of Aluminium ingots & Concentrates of lead and zinc 2000 - 2019

Table 3.27 Overview on reported emissions from sub categories 1.A.2.b Non-Ferrous Metals

Air pollutants	1.A.2.b						Key Category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
NO <sub>x</sub>	✓	✓	✓	NO	NO	IE*	Trend 2018
CO	✓	✓	✓	NO	NO	IE*	-
NM <sub>VOC</sub>	✓	✓	✓	NO	NO	IE*	-
SO <sub>x</sub>	✓	✓	✓	NO	NO	IE*	Trend 2018
NH <sub>3</sub>	✓	✓	✓	NO	NO	IE*	-
TSP	✓	✓	✓	NO	NO	IE*	-
PM <sub>10</sub>	✓	✓	✓	NO	NO	IE*	-
PM <sub>2.5</sub>	✓	✓	✓	NO	NO	IE*	-
BC	✓	✓	✓	NO	NO	IE*	-
Pb	✓	✓	✓	NO	NO	IE*	-
Cd	✓	✓	✓	NO	NO	IE*	-
Hg	✓	✓	✓	NO	NO	IE*	-
As	✓	✓	✓	NO	NO	IE*	-
Cr	✓	✓	✓	NO	NO	IE*	-
Cu	✓	✓	✓	NO	NO	IE*	-
Ni	✓	✓	✓	NO	NO	IE*	-
Se	✓	✓	✓	NO	NO	IE*	-
Zn	✓	✓	✓	NO	NO	IE*	-
PCB	✓	✓	✓	NO	NO	IE*	-

Air pollutants	1.A.2.b						Key Category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
PCDD/F	✓	✓	✓	NO	NO	IE*	-
PAH	✓	✓	✓	NO	NO	IE*	-
Benzo(a)pyrene	✓	✓	✓	NO	NO	IE*	-
Benzo(b)fluoranthene	✓	✓	✓	NO	NO	IE*	-
Benzo(k)fluoranthene	✓	✓	✓	NO	NO	IE*	-
Indeno(1,2,3-cd)pyrene	✓	✓	✓	NO	NO	IE*	-
HCB	✓	✓	✓	NO	NO	IE*	-
A '✓' indicates: emissions from this sub-category have been estimated.							
Notation keys: IE - included elsewhere, NO – not occurrent, NE - not estimated, NA - not applicable, C – confidential							
* data provided only in the period 2014-2016							
LA XX - Level Assessment in year XX							
TA XX - Trend Assessment in year XX							

### Use of notation key

IE 1.A.2.b (gaseous, biomass)	The energy statistics is still under development; a split of the fuel combustion for this subcategory has to be reviewed for the entire timeseries. Emissions are currently allocated in IPCC/NFR subcategory 1.A.2.m <i>Other</i> .
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An overview of the emission from fuel combustion in IPCC/NFR sub-category 1.A.2.b *Non-Ferrous Metals* is provided in the following figures and tables:

- annual emissions of air pollutants;
- Trend of the periods 1990 – 2019, 2005 – 2019, 2017 – 2019.

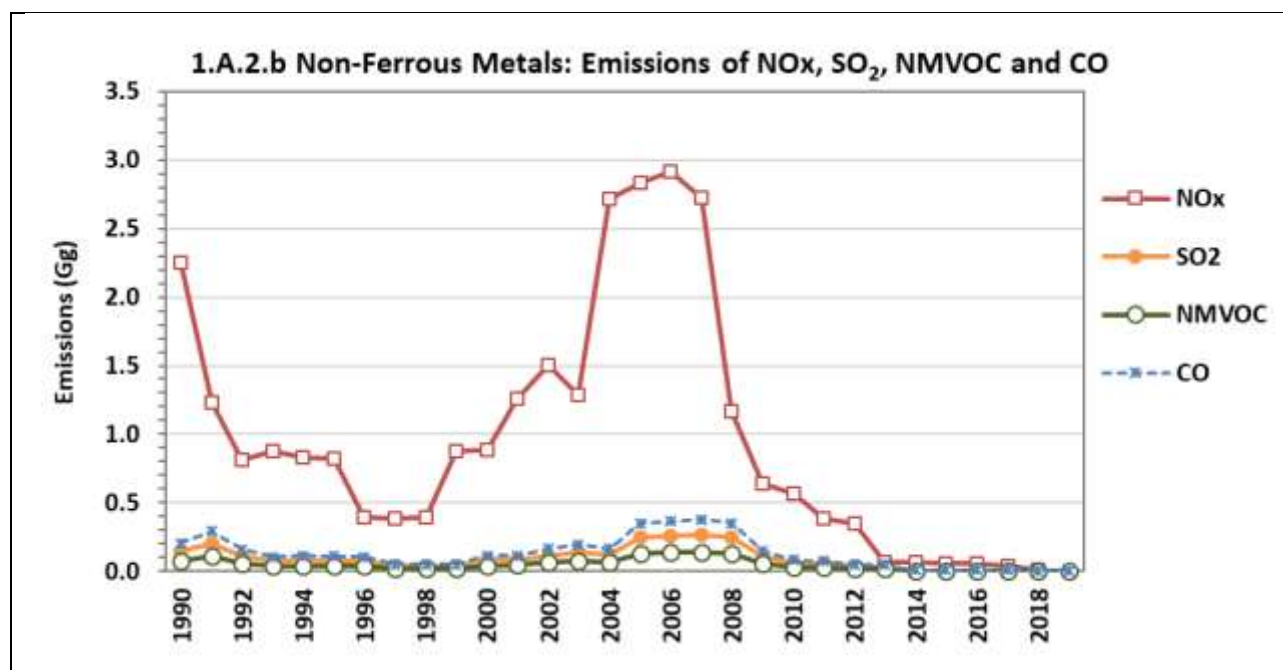


Figure 3.13 Emissions of main pollutants (NO<sub>x</sub>, SO<sub>2</sub>, NMVOC and CO) from sub-category 1.A.2.b Non-Ferrous Metals

Table 3.28 Emissions of main pollutants (NO<sub>x</sub>, SO<sub>2</sub>, NMVOC and CO) from sub-category 1.A.2.b Non-Ferrous Metals

Emissions	NO <sub>x</sub>	NMVOC	SO <sub>x</sub>	CO	NH <sub>3</sub>
	Gg	Gg	Gg	Gg	Gg
1990	1.603	0.078	0.147	0.206	IE
1991	2.251	0.110	0.206	0.290	IE
1992	1.234	0.060	0.113	0.159	IE
1993	0.808	0.039	0.074	0.104	IE
1994	0.873	0.043	0.080	0.112	IE
1995	0.830	0.040	0.076	0.107	IE
1996	0.826	0.040	0.076	0.106	IE
1997	0.395	0.019	0.036	0.051	IE
1998	0.382	0.019	0.035	0.049	IE
1999	0.397	0.019	0.036	0.051	IE
2000	0.874	0.043	0.080	0.112	IE
2001	0.889	0.043	0.081	0.114	IE
2002	1.257	0.061	0.115	0.162	IE
2003	1.501	0.073	0.138	0.193	IE
2004	1.285	0.063	0.118	0.165	IE
2005	2.715	0.132	0.249	0.349	IE
2006	2.832	0.138	0.260	0.364	IE
2007	2.918	0.142	0.267	0.375	IE
2008	2.723	0.133	0.249	0.350	IE
2009	1.167	0.057	0.107	0.150	IE
2010	0.643	0.031	0.059	0.083	IE
2011	0.567	0.028	0.052	0.073	IE
2012	0.383	0.019	0.035	0.049	IE
2013	0.350	0.017	0.032	0.045	IE
2014	0.064	0.003	0.006	0.009	<0.001
2015	0.066	0.003	0.006	0.009	<0.001
2016	0.057	0.003	0.005	0.007	<0.001
2017	0.057	0.003	0.005	0.007	IE
2018	0.039	0.003	0.003	0.006	IE
2019	0.009	0.002	0.000	0.003	IE
<i>Trend</i>					
1990 – 2019	-99.4%	-97.0%	-99.8%	-98.5%	NA
2005 – 2019	-99.7%	-98.2%	-99.9%	-99.1%	NA
2018 – 2019	-76.0%	-9.3%	-92.2%	-45.6%	NA

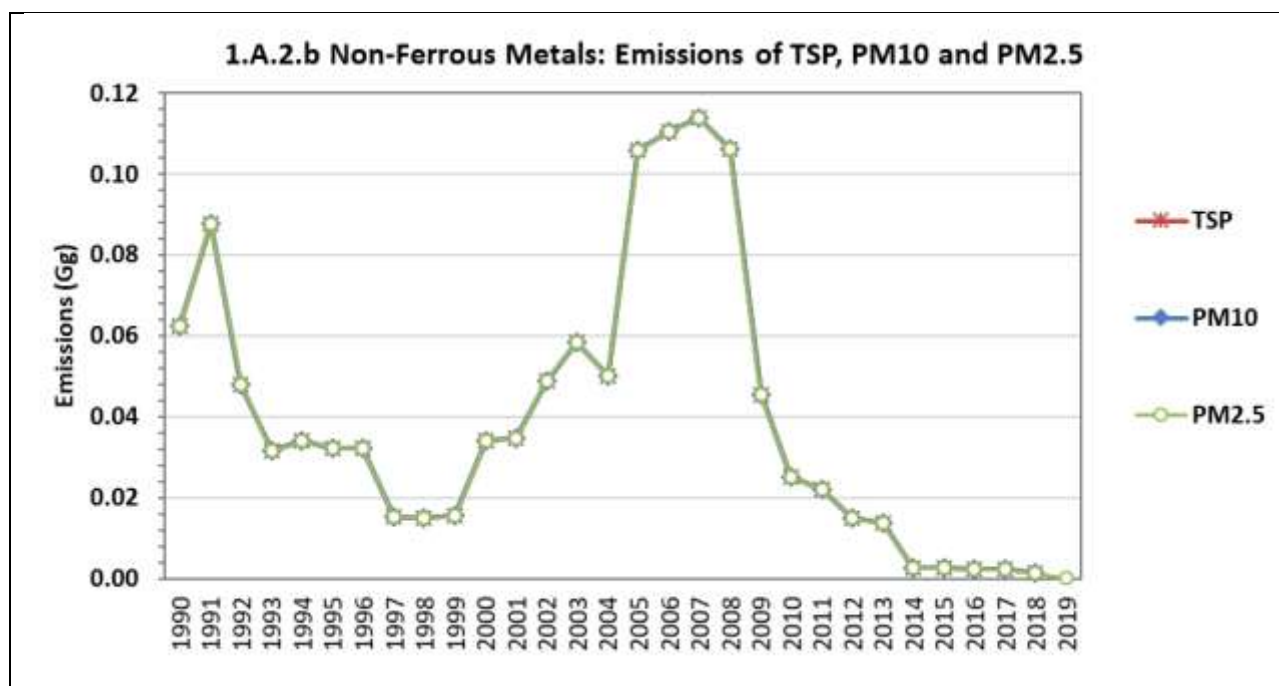


Figure 3.14 Emissions of TSP, PM10 and PM2.5 from sub-category 1.A.2.b Non-Ferrous Metals

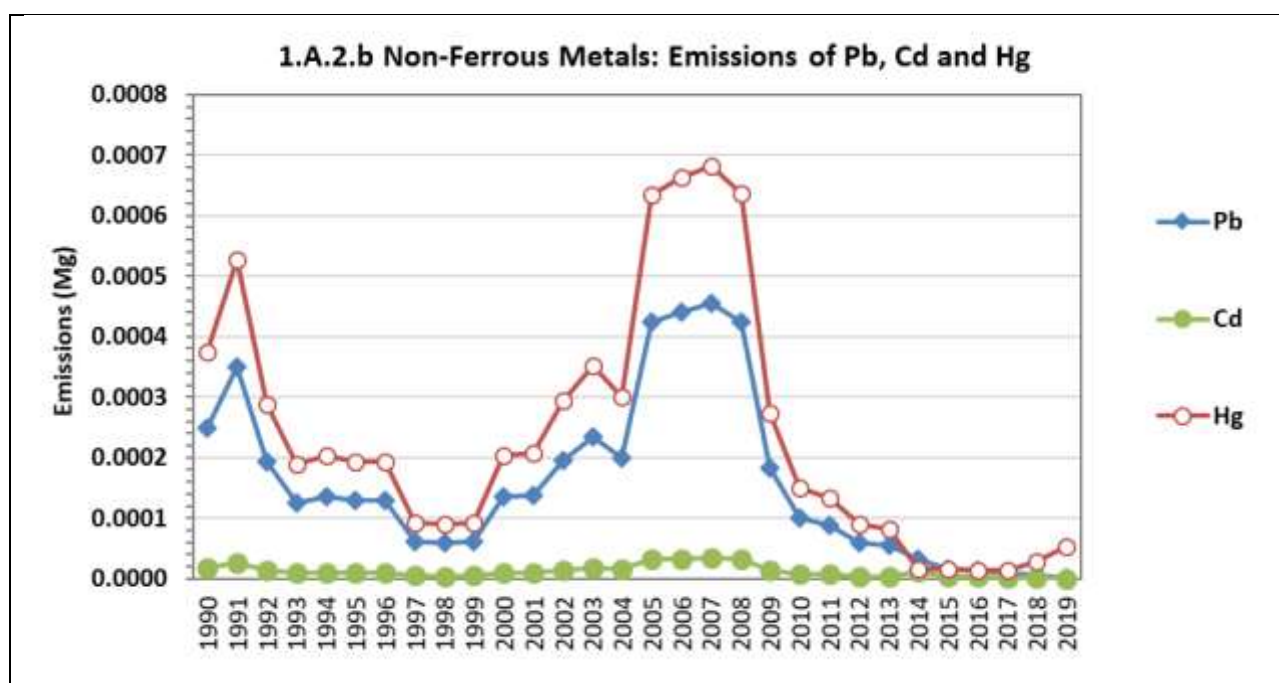


Figure 3.15 Emissions of Heavy Metals (HM) (Pb, Cd, Hg) from sub-category 1.A.2.b Non-Ferrous Metals



**Table 3.29 Emissions of particulate matter (PM) from sub-category 1.A.2.b Non-Ferrous Metals**

Emissions	PM2.5	PM10	TSP	BC
	Gg	Gg	Gg	Gg
1990	0.062	0.062	0.062	IE
1991	0.088	0.088	0.088	IE
1992	0.048	0.048	0.048	IE
1993	0.032	0.032	0.032	IE
1994	0.034	0.034	0.034	IE
1995	0.032	0.032	0.032	IE
1996	0.032	0.032	0.032	IE
1997	0.015	0.015	0.015	IE
1998	0.015	0.015	0.015	IE
1999	0.015	0.015	0.015	IE
2000	0.034	0.034	0.034	IE
2001	0.035	0.035	0.035	IE
2002	0.049	0.049	0.049	IE
2003	0.059	0.059	0.059	IE
2004	0.050	0.050	0.050	IE
2005	0.106	0.106	0.106	IE
2006	0.110	0.110	0.110	IE
2007	0.114	0.114	0.114	IE
2008	0.106	0.106	0.106	IE
2009	0.045	0.045	0.045	IE
2010	0.025	0.025	0.025	IE
2011	0.022	0.022	0.022	IE
2012	0.015	0.015	0.015	IE
2013	0.014	0.014	0.014	IE
2014	0.003	0.003	0.003	<0.001
2015	0.003	0.003	0.003	<0.001
2016	0.002	0.002	0.002	<0.001
2017	0.002	0.002	0.002	IE
2018	0.001	0.001	0.001	IE
2019	<0.001	<0.001	<0.001	IE
<i>Trend</i>				
1990 – 2019	-99.7%	-99.7%	-99.7%	NA
2005 – 2019	-99.9%	-99.9%	-99.9%	NA
2018 – 2019	-89.0%	-89.0%	-89.0%	NA

**Table 3.30 Emissions of Heavy Metals (HM) from sub-category 1.A.2.b Non-Ferrous Metals**

Emissions	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
	kg	kg	kg	kg	kg	kg	kg	kg	kg
1990	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1991	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1992	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1993	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1994	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1995	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1996	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1997	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1998	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1999	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2000	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2001	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2002	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2003	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2004	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2005	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2006	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2007	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2008	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2009	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2010	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2011	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2012	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2013	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2014	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2015	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2016	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2017	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2018	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2019	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
<i>Trend</i>									
1990 – 2019	-99.4%	-99.4%	-85.9%	-89.5%	-99.7%	-99.8%	-94.8%	-98.2%	-99.8%
2005 – 2019	-99.7%	-99.6%	-91.7%	-93.8%	-99.8%	-99.9%	-96.9%	-99.0%	-99.9%
2018 – 2019	-76.8%	-75.4%	92.2%	74.1%	-85.7%	-92.6%	26.6%	-38.0%	-90.8%

**Table 3.31 Emissions of Persistent Organic Pollutants (POPs) from sub-category 1.A.2.b Non-Ferrous Metals**

Emissions	PCDD/F	Benzo(a)-pyrene	Benzo(b)-fluor-anthene	Benzo(k)-fluor-anthene	Indeno (1,2,3-cd) pyrene	Total PAH	HCB	PCB
	g I-TEQ	Mg	Mg	Mg	Mg	Mg	kg	Kg
1990	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
1991	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
1992	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
1993	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
1994	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
1995	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
1996	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
1997	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
1998	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
1999	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2000	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2001	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2002	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2003	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2004	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2005	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2006	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2007	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2008	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2009	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2010	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2011	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2012	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2013	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2014	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2015	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2016	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2017	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2018	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2019	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
<i>Trend</i>								
1990 – 2019	-98.7%	1074.3%	-99.3%	NA	-97.6%	-96.2%	-98.7%	1074.3%
2005 – 2019	-99.2%	593.3%	-99.6%	NA	-98.6%	-97.7%	-99.2%	593.3%
2018 – 2019	-52.0%	173.6%	-70.4%	NA	-22.9%	6.2%	-52.0%	173.6%

### 3.1.3.2.2 Methodological issues

#### 3.1.3.2.2.1 Choice of methods

For estimating the air pollutants emissions the Tier 1 approach<sup>34</sup> of the EMEP/EEA air pollutant emission inventory guidebook 2019 has been applied:

*Equation: emissions from stationary combustion*

$$Emissions_{pollutant} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{pollutant, fuel}$$

Where:

Emissions <sub>pollutant</sub>	= emissions of a given pollutant by type of fuel (kg pollutant)
Fuel consumption <sub>fuel</sub>	= amount of fuel combusted (TJ)
Emission factor <sub>pollutant, fuel</sub>	= default emission factor of a given pollutant by type of fuel (g <sub>pollutant</sub> /GJ).
Pollutant	= main pollutants: NO <sub>x</sub> , CO, NMVOC, SO <sub>2</sub> particulate matter: TSP, OM10, PM2.5, BC heavy metals: Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn persistent organic pollutants: PCDD/F, Benzo(a) pyrene, Benzo(b)fluor, anthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene, Total PAH, HCB, PCB
Fuel	= liquid fuels, solid fuels, gaseous fuels, other fossil fuel, biomass, peat

#### 3.1.3.2.2.2 Choice of activity data

The following fuels are used for electricity and heat production (autoproducer):

Tier 1 fuel type	Associated fuel types	Source
Liquid fuels	<ul style="list-style-type: none"> <li>Residual fuel oil</li> <li>Gas/Diesel Oil</li> <li>Petroleum Coke</li> </ul>	Summary of fuel aggregations at Tier 1 according to EMEP/EEA air pollutant emission inventory guidebook 2019, Part B, Chapter 1.A.2, Table 3 35
Gaseous fuels	<ul style="list-style-type: none"> <li>Natural Gas</li> </ul>	
Biomass	<ul style="list-style-type: none"> <li>Wood / Fuelwood</li> <li>Wood pellets</li> </ul>	

Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2019 were taken from prepared by Statistical Office of Montenegro (MONSTAT).

The total fuel consumption decreased by 96.8% in the period 1990 – 2019. From 2005 to 2019 the total fuel consumption increased by -98.1%. From 2018 to 2019 the total fuel consumption decreased by 4.4%.

<sup>34</sup> Source: EMEP/EEA air pollutant emission inventory guidebook 2019, 1.A.2 Manufacturing industries and construction (combustion), sub-chapter 3.2 Tier 1 default approach.

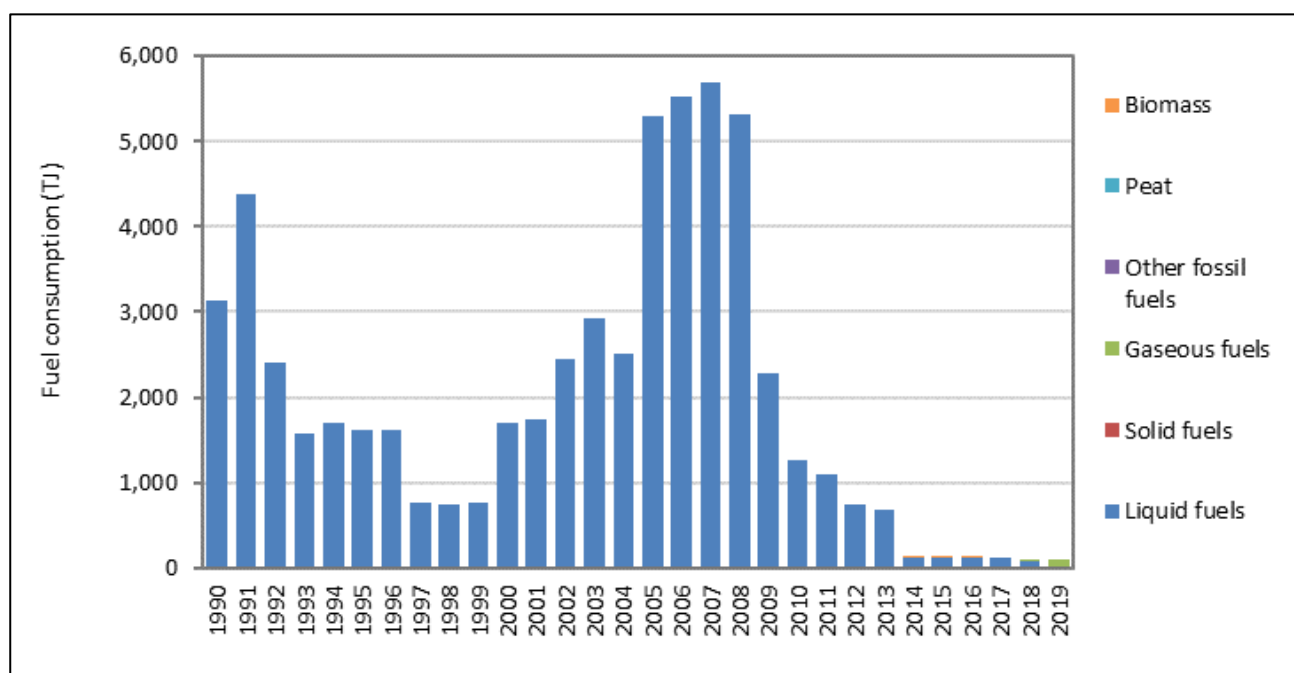


Figure 3.16 Activity data for sub-category 1.A.2.b Non-Ferrous Metals

Table 3.32 Activity data for sub-category 1.A.2.b Non-Ferrous Metals

Activity data 1.A.1.b	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
1990	3,123.99	3,123.99	NO	NO	NO	NO	IE
1991	4,387.63	4,387.63	NO	NO	NO	NO	IE
1992	2,404.92	2,404.92	NO	NO	NO	NO	IE
1993	1,575.31	1,575.31	NO	NO	NO	NO	IE
1994	1,701.21	1,701.21	NO	NO	NO	NO	IE
1995	1,618.81	1,618.81	NO	NO	NO	NO	IE
1996	1,610.11	1,610.11	NO	NO	NO	NO	IE
1997	769.34	769.34	NO	NO	NO	NO	IE
1998	744.62	744.62	NO	NO	NO	NO	IE
1999	773.46	773.46	NO	NO	NO	NO	IE
2000	1,703.31	1,703.31	NO	NO	NO	NO	IE
2001	1,732.15	1,732.15	NO	NO	NO	NO	IE
2002	2,450.22	2,450.22	NO	NO	NO	NO	IE
2003	2,925.82	2,925.82	NO	NO	NO	NO	IE
2004	2,504.32	2,504.32	NO	NO	NO	NO	IE
2005	5,291.85	5,291.85	NO	NO	NO	NO	IE
2006	5,521.37	5,521.37	NO	NO	NO	NO	IE
2007	5,687.58	5,687.58	NO	NO	NO	NO	IE
2008	5,308.09	5,308.09	NO	NO	NO	NO	IE
2009	2,274.74	2,274.74	NO	NO	NO	NO	IE
2010	1,253.01	1,253.01	NO	NO	NO	NO	IE

Activity data 1.A.1.b	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
TJ							
2011	1,105.00	1,105.00	NO	NO	NO	NO	IE
2012	747.50	747.50	NO	NO	NO	NO	IE
2013	682.50	682.50	NO	NO	NO	NO	IE
2014	124.61	123.75	NO	NO	NO	NO	0.86
2015	128.07	127.87	NO	NO	NO	NO	0.20
2016	111.57	111.39	NO	NO	NO	NO	0.18
2017	111.39	111.39	NO	NO	NO	NO	IE
2018	105.54	70.34	NO	35.20	NO	NO	IE
2019	100.92	4.12	NO	96.80	NO	NO	IE
Trend							
1990 – 2019	-96.8%	-99.9%	NA	NA	NA	NA	NA
2005 – 2019	-98.1%	-99.9%	NA	NA	NA	NA	NA
2018 – 2019	-4.4%	-94.1%	NA	175.0%	NA	NA	NA

In energy statistics, production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units, e.g. in tonnes or cubic metres. To convert these data to energy units, in this case terajoules, requires calorific values. The emission calculations are based on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in IPCC/NFR sub-category 1.A.2.b Non-Ferrous Metals .

**Table 3.33 Net calorific values (NCVs) applied for conversion to energy units in sub-category 1.A.2.b Non-Ferrous Metals**

Fuel		Fuel type	Net calorific value (NCV) (TJ/Gg) or *(TJ/m3)		Source
			NCV	type	
Gas/Diesel Oil		liquid	42.71	CS	Statistical Office of Montenegro (MONSTAT)
Residual fuel oil		liquid	41.20	CS	
Petroleum Coke		liquid	40.19	CS	
Natural Gas		gaseous	46.00	CS	
Wood / Fuelwood		biomass	9.18*	CS	
Wood pellets		biomass	16.85	CS	
Note:					
D	Default	CS	Country specific	PS	Plant specific

### 3.1.3.2.3 Choice of emission factors

Default emission factors for air pollutant were taken from the EMEP/EEA air pollutant emission inventory Guidebook 2019 and are presented in the following table.

**Table 3.34 Emission factors (EF) for Main pollutants, Particulate Matter (PM), Heavy metals (HM) and Persistent Organic Pollutants (POPs) for sub-category 1.A.2.b Non-Ferrous Metals**

Fuel Type	UNIT	Liquid fuels		Gaseous Fuels		Biomass	
Associated fuel types		Gas/Diesel Oil Residual fuel oil Petroleum Coke		Natural Gas		Wood / Fuelwood Wood pellets	
Pollutant		EF	type	EF	type	EF	type
NOx	g/GJ	513.0	D	74	D	91	D
CO	g/GJ	66	D	29	D	570	D
NMVOC	g/GJ	25	D	23	D	300	D
SOx	g/GJ	47	D	0.67	D	11	D
TSP	g/GJ	20	D	0.78	D	1.2	D
NH3	g/GJ	NE		NE		150	D
PM10	g/GJ	20	D	0.78	D	143	D
PM2.5	g/GJ	20	D	0.78	D	140	D
BC	% of PM2.5	56	D	4	D	28	D
Pb	mg/GJ	0.08	D	0.011	D	27	D
Cd	mg/GJ	0.006	D	0.0009	D	13	D
Hg	mg/GJ	0.12	D	0.54	D	0.56	D
As	mg/GJ	0.03	D	0.1	D	0.19	D
Cr	mg/GJ	0.2	D	0.013	D	23	D
Cu	mg/GJ	0.22	D	0.0026	D	6	D
Ni	mg/GJ	0.008	D	0.013	D	2	D
Se	mg/GJ	0.11	D	0.058	D	0.5	D
Zn	mg/GJ	29	D	0.73	D	512	D
PCB	ng WHO-TEG/GJ	NE	D	NE	D	0.06	D
PCDD/F	ng I-TEQ/GJ	1.4	D	0.52	D	100	D
Benzo(a)pyrene	µg/GJ	0.0019	D	0.72	D	0.01	D
Benzo(b)fluoranthene	µg/GJ	0.015	D	0.0029	D	0.016	D
Benzo(k)fluoranthene	µg/GJ	0.0017	D	0.0011	D	0.005	D
Indeno(1,2,3-cd)pyrene	µg/GJ	0.0015	D	0.00108	D	0.004	D
HCB	µg/GJ	NE	D	NE	D	5	D
Source		Table 3.3, section 3.4, page 16.		Table 3.4, section 3.4, page 17.		Table 3.5, section 3.4, page 17.	
		EMEP/EEA air pollutant emission inventory guidebook 2019, Part B, Chapter 1.A.2 Manufacturing industries and construction (combustion).					
Note:							
D	Default	CS Country specific		PS Plant specific		IEF Implied emission factor	

### 3.1.3.2.3 Uncertainties and time-series consistency

The uncertainties for activity data and emission factors used for IPCC/NFR category 1.A.2.b Non-Ferrous Metals are presented in the following table.

**Table 3.35 Uncertainty for sub-category 1.A.2.b Non-Ferrous Metals .**

Uncertainty	Hard Coal	Brown Coal	Gaseous fuels	Heavy Fuel Oil	Gas oil	Biomass	Reference
Activity data (AD)	3%	3%	5%	5%	5%	15%	Table 2.15, 2006 IPCC/NFR GL, Vol. 2, Chap. 2 (2.4.2)
Emission factor (EF)	Rating	Typical error range		Average		Reference	
NOx	B	20% to 60%		40%		Table 2 2 Rating definitions Table 2 3 Main NFR source categories with applicable quality data ratings EMEP EEA GB 2019, Part A, Chapter 5 Uncertainties.	
CO	C	50% to 200%		125%			
NMVOC	D	100% to 300%		200%			
SOx	A	10% to 30%		20%			
NH3	E	order of magnitude		750%			
TSP, PM10, PM2.5, BC	C	50% to 200%		125%			
Hg	B	20% to 60%		40%			
Pb, Cd, As, Cr, Cu, Ni, Se, Zn	C	50% to 200%		125%			
PCDD/F	E	order of magnitude		750%			
PAH (Benzo(a)pyrene, Benzo(b)-fluoranthene, Benzo(k)fluor-anthene, Indeno(1,2,3-cd)pyrene)	C	50% to 200%		125%			
HCB, PCBs	D	100% to 300%		200%			

The time-series are considered to be consistent as the same methodology is applied to the whole period. Activity data are considered to be consistent as national and international data were always compared.

### 3.1.3.2.4 Source-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
  - consistent use of energy balance data (energy statistic questionnaires),
  - documented sources,
  - use of units,
  - strictly defined interfaces between spreadsheets/calculation modules,
  - unique structure of sheets which do the same,
  - record keeping, use of write protection,
  - unique use of formulas, special cases are documented/highlighted,
  - quick-control checks for data consistency through all steps of calculation.
- cross-checked from two sources: national statistic, Eurostat and international energy statistics of UN
- cross checks with other relevant sectors are performed to avoid double counting or omissions;
- time series consistency - plausibility checks of dips and jumps.



### 3.1.3.2.5 Source-specific recalculations

The following table presents the main revisions and recalculations done since the last submission in 2020 and relevant to sub-category 1.A.2.b Non-Ferrous Metals .

**Table 3.36 Recalculations done in sub-category 1.A.2.b Non-Ferrous Metals**

source category	Revisions of data	Type of revision	Type of improvement
1.A.2.b	application of EMEP/EEA air pollutant emission inventory guidebook 2019	method	Comparability
1.A.2.b	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019	EF	Comparability
1.A.2.b	use of CS NCV	AD	Accuracy
1.A.2.b	Fuel consumption data (activity data) was revised due to revised fuel consumption data – plant specific data	AD	Accuracy

### 3.1.3.2.6 Source-specific planned improvements

Considering the potential contribution of identified improvements in the total emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

**Table 3.37 Planned improvements for sub-category 1.A.2.b Non-Ferrous Metals**

source category	Planned improvement	Type of improvement		Priority
1.A.2.b	Sulphur content in used fuel for preparing country specific emission factor (CS EF) $\Rightarrow CS EF_{SO_2} [g/GJ] = (S [\%] \cdot 20000) / (NCV [GJ/t])$	EF	Accuracy Transparency	Medium
1.A.2.b	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF	Accuracy Transparency	Medium
1.A.2.b	Data obtained from measurements made on the emission of air pollutants <ul style="list-style-type: none"> <li>Determination of the <ul style="list-style-type: none"> <li>temperature in waste gases [°C];</li> <li>static pressure and the dynamic pressure [kPa];</li> <li>flow rate [m/s];</li> <li>volume flow rate [m³/h and Nm³/h];</li> <li>concentration of CO, SO<sub>2</sub>, NO<sub>x</sub> in the exhaust gases [mg/Nm³]; and</li> <li>Gravimetric extraction of solid particles (TSP) from gases and determination by applying a gravimetric method (mg/Nm³).</li> </ul> </li> </ul>	EF	Accuracy Transparency	Medium
1.A.2.b	Improvement of time series consistency and split of fuels: the energy statistics is still under development; a split of the fuel combustion for this subcategory has to be reviewed for the entire timeseries. Emissions are allocated in IPCC/NFR subcategory 1.A.2.m Other.	AD	Accuracy Transparency	High

### 3.1.3.3 Chemical industry (IPCC/NFR category 1.A.2.c)

#### 3.1.3.3.1 Source category description

This section describes emissions resulting from fuel combustion activities in *Manufacturing Industries and Construction -Chemicals-*.

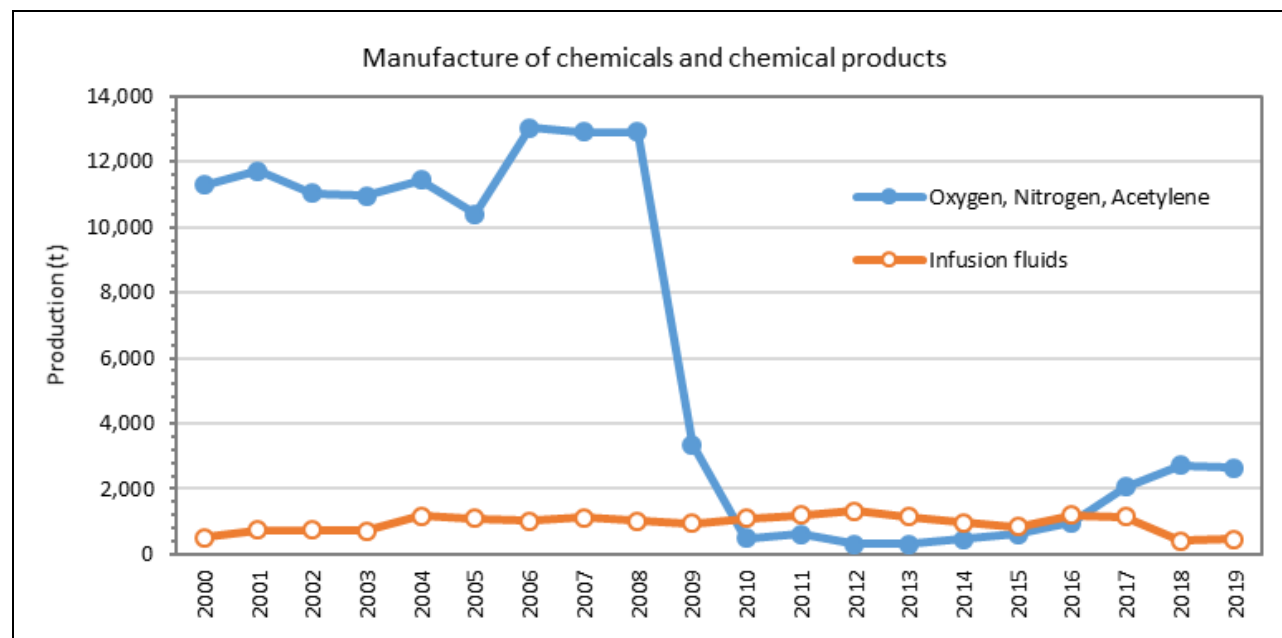


Figure 3.17 Production of Manufacture of chemicals and chemical products 2000 - 2019

Table 3.38 Overview on reported emissions from sub categories 1.A.2.c Chemicals

Air pollutants	1.A.2.c						Key Category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
NOx	✓	✓**	NO	NO	NO	IE*	-
CO	✓	✓**	NO	NO	NO	IE*	-
NM VOC	✓	✓**	NO	NO	NO	IE*	-
SOx	✓	✓**	NO	NO	NO	IE*	-
NH3	NO	✓**	NO	NO	NO	IE*	-
TSP	✓	✓**	NO	NO	NO	IE*	-
PM10	✓	✓**	NO	NO	NO	IE*	-
PM2.5	✓	✓**	NO	NO	NO	IE*	-
BC	✓	✓**	NO	NO	NO	IE*	-
Pb	✓	✓**	NO	NO	NO	IE*	-
Cd	✓	✓**	NO	NO	NO	IE*	-
Hg	✓	✓**	NO	NO	NO	IE*	-
As	✓	✓**	NO	NO	NO	IE*	-
Cr	✓	✓**	NO	NO	NO	IE*	-
Cu	✓	✓**	NO	NO	NO	IE*	-
Ni	✓	✓**	NO	NO	NO	IE*	-
Se	✓	✓**	NO	NO	NO	IE*	-
Zn	✓	✓**	NO	NO	NO	IE*	-
PCB	✓	✓**	NO	NO	NO	IE*	-
PCDD/F	✓	✓**	NO	NO	NO	IE*	-

Air pollutants	1.A.2.c						Key Category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
PAH	✓	✓**	NO	NO	NO	IE*	-
Benzo(a)pyrene	✓	✓**	NO	NO	NO	IE*	-
Benzo(b)fluoranthene	✓	✓**	NO	NO	NO	IE*	-
Benzo(k)fluoranthene	✓	✓**	NO	NO	NO	IE*	-
Indeno(1,2,3-cd)pyrene	✓	✓**	NO	NO	NO	IE*	-
HCB	✓	✓**	NO	NO	NO	IE*	-
<p>A '✓' indicates: emissions from this sub-category have been estimated.</p> <p>Notation keys: IE - included elsewhere, NO – not occurring, NE - not estimated, NA - not applicable, C – confidential</p> <p>* data provided only in the period 2005-2008, all other years IE; ** data provided only in the period 2014-2018, all other years IE;</p> <p>LA XX - Level Assessment in year XX</p> <p>TA XX - Trend Assessment in year XX</p>							

### Use of notation key

- IE 1.A.2.c The energy statistics is still under development; a split of the fuel combustion for this subcategory has to be reviewed for the entire timeseries. Emissions are currently allocated in IPCC/NFR subcategory 1.A.2.m *Other*.
- (solid, biomass)

An overview of the emission from fuel combustion in IPCC/NFR sub-category 1.A.2.c *Chemicals* is provided in the following figures and tables:

- annual emissions of air pollutants;
- Trend of the periods 1990 – 2019, 2005 – 2019, 2017 – 2019.

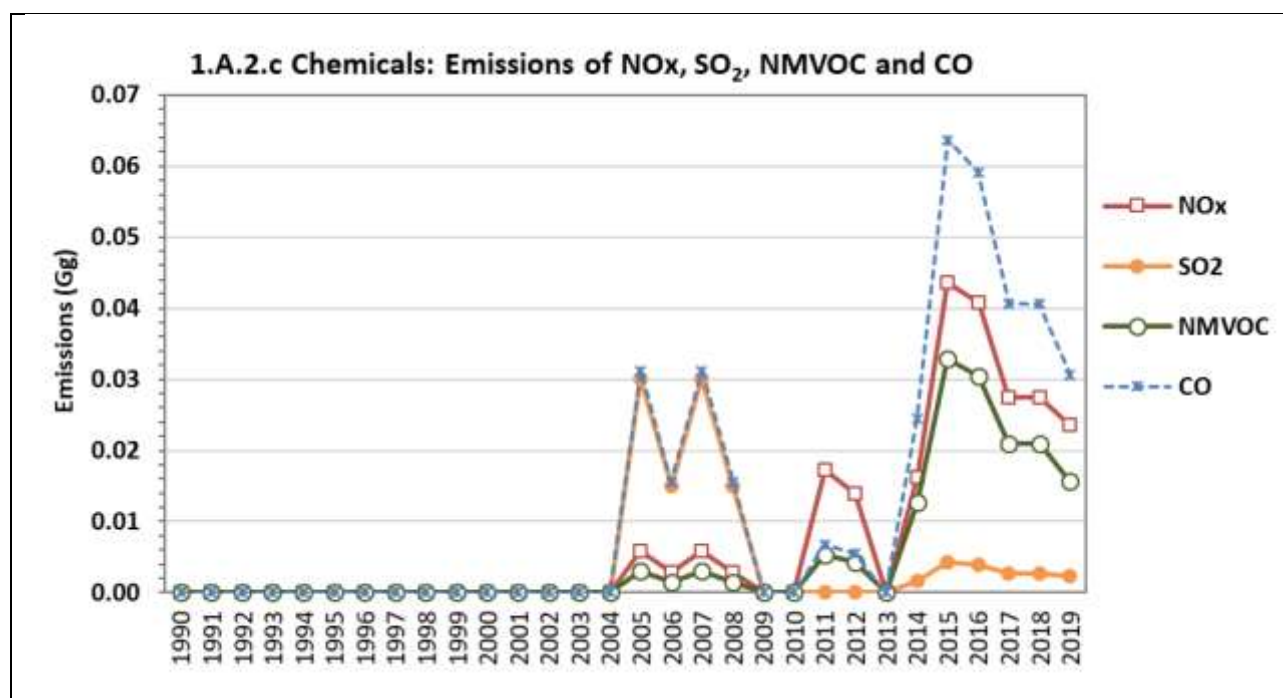


Figure 3.18 Emissions of main pollutants (NOx, SO2, NMVOC and CO) from sub-category 1.A.2.c Chemicals

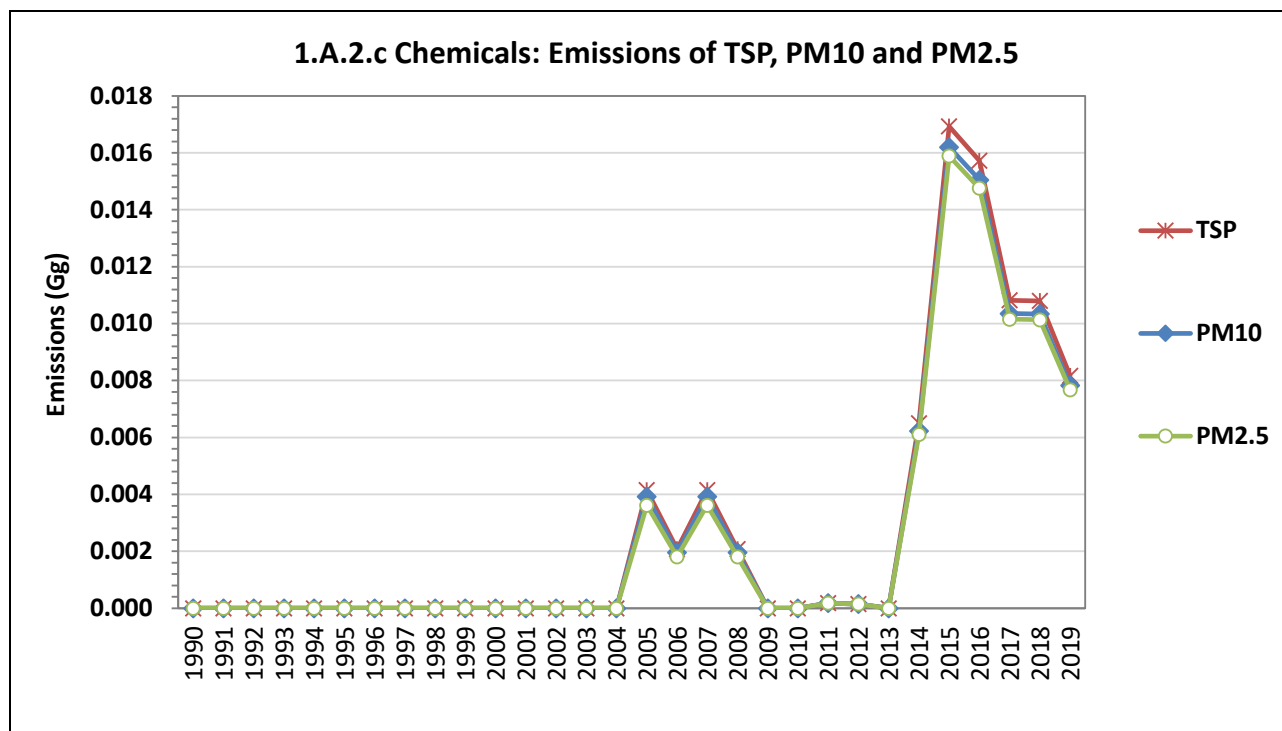


Figure 3.19 Emissions of TSP PM10 and PM2.5 from sub-category 1.A.2.c Chemicals

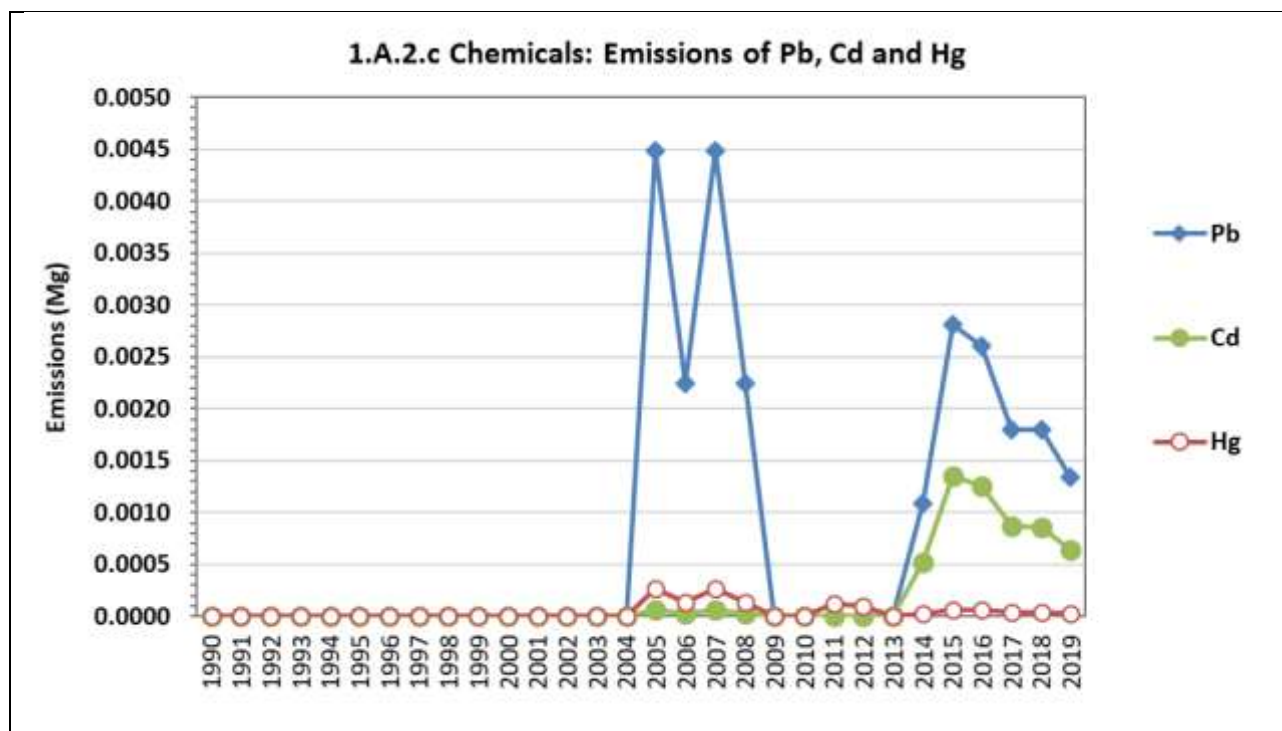


Figure 3.20 Emissions of Pb, Cd and Hg from sub-category 1.A.2.c Chemicals

Table 3.39 Emissions of main pollutants (NO<sub>x</sub>, SO<sub>2</sub>, NMVOC and CO) from sub-category 1.A.2.c Chemicals

Emissions	NO <sub>x</sub>	NMVOC	SO <sub>x</sub>	CO	NH <sub>3</sub>
	Gg	Gg	Gg	Gg	Gg
1990	IE	IE	IE	IE	IE
1991	IE	IE	IE	IE	IE
1992	IE	IE	IE	IE	IE
1993	IE	IE	IE	IE	IE
1994	IE	IE	IE	IE	IE
1995	IE	IE	IE	IE	IE
1996	IE	IE	IE	IE	IE
1997	IE	IE	IE	IE	IE
1998	IE	IE	IE	IE	IE
1999	IE	IE	IE	IE	IE
2000	IE	IE	IE	IE	IE
2001	IE	IE	IE	IE	IE
2002	IE	IE	IE	IE	IE
2003	IE	IE	IE	IE	IE
2004	IE	IE	IE	IE	IE
2005	0.006	0.003	0.030	0.031	IE
2006	0.003	0.001	0.015	0.016	IE
2007	0.006	0.003	0.030	0.031	IE
2008	0.003	0.001	0.015	0.016	IE
2009	IE	IE	IE	IE	IE
2010	IE	IE	IE	IE	IE
2011	0.017	0.005	0.000	0.007	IE
2012	0.014	0.004	0.000	0.005	IE
2013	IE	IE	IE	IE	IE
2014	0.016	0.013	0.002	0.024	0.001
2015	0.044	0.033	0.004	0.064	0.004
2016	0.041	0.031	0.004	0.059	0.004
2017	0.027	0.021	0.003	0.041	0.002
2018	0.027	0.021	0.003	0.041	0.002
2019	0.024	0.016	0.002	0.031	0.002
<i>Trend</i>					
1990 – 2019	NA	NA	NA	NA	NA
2005 – 2019	308.6%	430.7%	-92.4%	-1.6%	NA
2018 – 2019	-13.6%	-24.7%	-14.4%	-24.5%	-25.5%

Table 3.40 Emissions of particulate matter (PM) from sub-category 1.A.2.c Chemicals

Emissions	PM2.5	PM10	TSP	BC
	Gg	Gg	Gg	Gg
1990	IE	IE	IE	IE
1991	IE	IE	IE	IE
1992	IE	IE	IE	IE
1993	IE	IE	IE	IE
1994	IE	IE	IE	IE
1995	IE	IE	IE	IE
1996	IE	IE	IE	IE
1997	IE	IE	IE	IE
1998	IE	IE	IE	IE
1999	IE	IE	IE	IE
2000	IE	IE	IE	IE
2001	IE	IE	IE	IE
2002	IE	IE	IE	IE
2003	IE	IE	IE	IE
2004	IE	IE	IE	IE
2005	0.004	0.004	0.004	IE
2006	0.002	0.002	0.002	IE
2007	0.004	0.004	0.004	IE
2008	0.002	0.002	0.002	IE
2009	IE	IE	IE	IE
2010	IE	IE	IE	IE
2011	0.000	0.000	0.000	IE
2012	0.000	0.000	0.000	IE
2013	IE	IE	IE	IE
2014	0.006	0.006	0.007	0.036
2015	0.016	0.016	0.017	0.093
2016	0.015	0.015	0.016	0.086
2017	0.010	0.010	0.011	0.060
2018	0.010	0.010	0.011	0.060
2019	0.008	0.008	0.008	0.044
<i>Trend</i>				
1990 – 2019	NA	NA	NA	NA
2005 – 2019	112.2%	99.7%	96.8%	NA
2018 – 2019	-24.3%	-24.3%	-24.3%	-25.5%

**Table 3.41 Emissions of Heavy Metals (HM) from sub-category 1.A.2.c Chemicals**

Emissions	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
	kg	kg	kg	kg	kg	kg	kg	kg	kg
1990	IE	IE	IE	IE	IE	IE	IE	IE	IE
1991	IE	IE	IE	IE	IE	IE	IE	IE	IE
1992	IE	IE	IE	IE	IE	IE	IE	IE	IE
1993	IE	IE	IE	IE	IE	IE	IE	IE	IE
1994	IE	IE	IE	IE	IE	IE	IE	IE	IE
1995	IE	IE	IE	IE	IE	IE	IE	IE	IE
1996	IE	IE	IE	IE	IE	IE	IE	IE	IE
1997	IE	IE	IE	IE	IE	IE	IE	IE	IE
1998	IE	IE	IE	IE	IE	IE	IE	IE	IE
1999	IE	IE	IE	IE	IE	IE	IE	IE	IE
2000	IE	IE	IE	IE	IE	IE	IE	IE	IE
2001	IE	IE	IE	IE	IE	IE	IE	IE	IE
2002	IE	IE	IE	IE	IE	IE	IE	IE	IE
2003	IE	IE	IE	IE	IE	IE	IE	IE	IE
2004	IE	IE	IE	IE	IE	IE	IE	IE	IE
2005	0.004	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.007
2006	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003
2007	0.004	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.007
2008	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003
2009	IE	IE	IE	IE	IE	IE	IE	IE	IE
2010	IE	IE	IE	IE	IE	IE	IE	IE	IE
2011	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2012	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2013	IE	IE	IE	IE	IE	IE	IE	IE	IE
2014	0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.021
2015	0.003	0.001	<0.001	<0.001	0.002	0.001	<0.001	<0.001	0.055
2016	0.003	0.001	<0.001	<0.001	0.002	0.001	<0.001	<0.001	0.051
2017	0.002	0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	0.035
2018	0.002	0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	0.035
2019	0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.026
<i>Trend</i>									
1990 – 2019	NA	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2019	-70.2%	967.7%	-87.8%	-92.1%	153.4%	-47.9%	-77.2%	-52.1%	294.5%
2018 – 2019	-25.5%	-25.5%	-23.7%	-24.1%	-25.4%	-25.2%	-25.5%	-23.7%	-25.0%

**Table 3.42 Emissions of Persistent Organic Pollutants (POPs) from sub-category 1.A.2.c Chemicals**

Emissions	PCDD/F	Benzo(a)-pyrene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Indeno (1,2,3-cd) pyrene	Total PAH	HCB	PCB
	g I-TEQ	Mg	Mg	Mg	Mg	Mg	kg	Kg
1990	IE	IE	IE	NA	IE	IE	IE	IE
1991	IE	IE	IE	NA	IE	IE	IE	IE
1992	IE	IE	IE	NA	IE	IE	IE	IE
1993	IE	IE	IE	NA	IE	IE	IE	IE
1994	IE	IE	IE	NA	IE	IE	IE	IE
1995	IE	IE	IE	NA	IE	IE	IE	IE
1996	IE	IE	IE	NA	IE	IE	IE	IE
1997	IE	IE	IE	NA	IE	IE	IE	IE
1998	IE	IE	IE	NA	IE	IE	IE	IE
1999	IE	IE	IE	NA	IE	IE	IE	IE
2000	IE	IE	IE	NA	IE	IE	IE	IE
2001	IE	IE	IE	NA	IE	IE	IE	IE
2002	IE	IE	IE	NA	IE	IE	IE	IE
2003	IE	IE	IE	NA	IE	IE	IE	IE
2004	IE	IE	IE	NA	IE	IE	IE	IE
2005	<0.001	<0.001	<0.001	NA	0.001	0.001	<0.001	0.006
2006	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	0.003
2007	<0.001	<0.001	<0.001	NA	0.001	0.001	<0.001	0.006
2008	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	0.003
2009	IE	IE	IE	NA	IE	IE	IE	IE
2010	IE	IE	IE	NA	IE	IE	IE	IE
2011	<0.001	<0.001	<0.001	NA	0.000	0.000	IE	IE
2012	<0.001	<0.001	<0.001	NA	0.000	0.000	IE	IE
2013	IE	IE	IE	NA	IE	IE	IE	IE
2014	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2015	<0.001	<0.001	<0.001	NA	<0.001	<0.001	0.001	<0.001
2016	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2017	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2018	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2019	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
<i>Trend</i>								
1990 – 2019	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2019	-26.4%	-67.5%	-59.8%	NA	-100.0%	-99.7%	1091.8%	-99.9%
2018 – 2019	-25.4%	-25.5%	-25.5%	NA	-22.6%	-25.1%	-25.5%	-25.5%



### 3.1.3.3.2 Methodological issues

#### 3.1.3.3.2.1 Choice of methods

For estimating the air pollutants emissions the Tier 1 approach<sup>35</sup> of the EMEP/EEA air pollutant emission inventory guidebook 2019 has been applied:

*Equation: emissions from stationary combustion*

$$Emissions_{pollutant} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{pollutant, fuel}$$

Where:

Emissions <sub>pollutant</sub>	= emissions of a given pollutant by type of fuel (kg pollutant)
Fuel consumption <sub>fuel</sub>	= amount of fuel combusted (TJ)
Emission factor <sub>pollutant, fuel</sub>	= default emission factor of a given pollutant by type of fuel (g <sub>pollutant</sub> /GJ).
Pollutant	= main pollutants: NO <sub>x</sub> , CO, NMVOC, SO <sub>2</sub> particulate matter: TSP, OM10, PM2.5, BC heavy metals: Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn persistent organic pollutants: PCDD/F, Benzo(a) pyrene, Benzo(b)fluor, anthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene, Total PAH, HCB, PCB
Fuel	= liquid fuels, solid fuels, gaseous fuels, other fossil fuel, biomass, peat

#### 3.1.3.3.2.2 Choice of activity data

The following fuels are used for electricity and heat production (autoproducer):

Tier 1 fuel type	Associated fuel types	Source
Liquid fuels	<ul style="list-style-type: none"> <li>Residual fuel oil</li> <li>Gas/Diesel Oil</li> <li>Liquefied Petroleum Gases (LPG)</li> </ul>	Summary of fuel aggregations at Tier 1 according to EMEP/EEA air pollutant emission inventory guidebook 2019, Part B, Chapter 1.A.2, Table 3 47
Solid fuels	<ul style="list-style-type: none"> <li>Sub-Bituminous Coal</li> </ul>	
Biomass	<ul style="list-style-type: none"> <li>Wood / Fuelwood</li> </ul>	

Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2019 were taken from prepared by Statistical Office of Montenegro (MONSTAT).

The total fuel consumption increased by 159.4% in the period 2005 – 2018. From 2018 to 2019 the total fuel consumption decreased by 19.6%.

<sup>35</sup> Source: EMEP/EEA air pollutant emission inventory guidebook 2019, 1.A.2 Manufacturing industries and construction (combustion), sub-chapter 3.2 Tier 1 default approach.

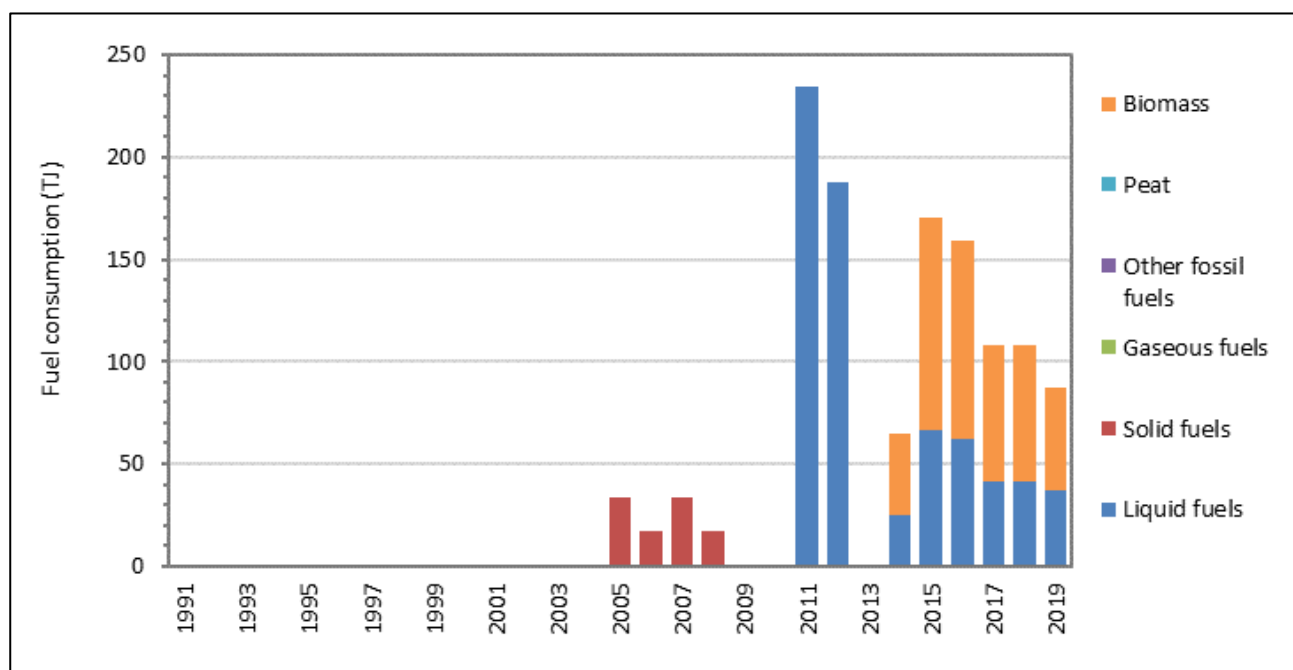


Figure 3.21 Activity data for sub-category 1.A.2.c Chemicals

Table 3.43 Activity data for sub-category 1.A.2.c Chemicals

Activity data 1.A.1.c	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
1990	IE	IE	IE	NO	NO	NO	IE
1991	IE	IE	IE	NO	NO	NO	IE
1992	IE	IE	IE	NO	NO	NO	IE
1993	IE	IE	IE	NO	NO	NO	IE
1994	IE	IE	IE	NO	NO	NO	IE
1995	IE	IE	IE	NO	NO	NO	IE
1996	IE	IE	IE	NO	NO	NO	IE
1997	IE	IE	IE	NO	NO	NO	IE
1998	IE	IE	IE	NO	NO	NO	IE
1999	IE	IE	IE	NO	NO	NO	IE
2000	IE	IE	IE	NO	NO	NO	IE
2001	IE	IE	IE	NO	NO	NO	IE
2002	IE	IE	IE	NO	NO	NO	IE
2003	IE	IE	IE	NO	NO	NO	IE
2004	IE	IE	IE	NO	NO	NO	IE
2005	33.50	IE	33.50	NO	NO	NO	IE
2006	16.75	IE	16.75	NO	NO	NO	IE
2007	33.50	IE	33.50	NO	NO	NO	IE
2008	16.75	IE	16.75	NO	NO	NO	IE
2009	IE	IE	IE	NO	NO	NO	IE
2010	IE	IE	IE	NO	NO	NO	IE

Activity data 1.A.1.c	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
2011	234.45	234.45	IE	NO	NO	NO	IE
2012	187.56	187.56	IE	NO	NO	NO	IE
2013	IE	IE	IE	NO	NO	NO	IE
2014	64.63	24.53	IE	NO	NO	NO	40.10
2015	170.65	66.68	IE	NO	NO	NO	103.98
2016	159.05	62.56	IE	NO	NO	NO	96.49
2017	108.24	41.65	IE	NO	NO	NO	66.58
2018	108.11	41.65	IE	NO	NO	NO	66.46
2019	86.89	37.38	IE	NO	NO	NO	49.51
<i>Trend</i>							
1990 – 2019	NA	NA	NA	NA	NA	NA	NA
2005 – 2019	159.4%	NA	NA	NA	NA	NA	NA
2018 – 2019	-19.6%	-10.3%	NA	NA	NA	NA	-25.5%

In energy statistics, production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units, e.g. in tonnes or cubic metres. To convert these data to energy units, in this case terajoules, requires calorific values. The emission calculations are based on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in IPCC/NFR sub-category 1.A.2.c Chemicals.

**Table 3.44 Net calorific values (NCVs) applied for conversion to energy units in sub-category 1.A.2.c Chemicals**

Fuel	Fuel type	Net calorific value (NCV) (TJ/Gg) or *(TJ/m3)		Source	
		NCV	type		
Gas/Diesel Oil	liquid	42.71	CS	Statistical Office of Montenegro (MONSTAT)	
Residual fuel oil	liquid	41.20	CS		
Liquefied Petroleum Gases (LPG)	liquid	46.89	CS		
Sub-Bituminous Coal	solid	16.75	CS		
Wood / Fuelwood	biomass	9.18*	CS		
Note:					
D	Default	CS	Country specific	PS	Plant specific

### 3.1.3.3.3 Choice of emission factors

Default emission factors for air pollutant were taken from the EMEP/EEA air pollutant emission inventory Guidebook 2019 and are presented in the following table.

**Table 3.45 Emission factors (EF) for Main pollutants, Particulate Matter (PM), Heavy metals (HM) and Persistent Organic Pollutants (POPs) for sub-category 1.A.2.c Chemicals**

Fuel Type	UNIT	Solid Fuels		Liquid fuels		Biomass	
Associated fuel types		Lignite		Residual fuel oil		Wood pellets	
Pollutant		EF	type	EF	type	EF	type

Fuel Type	UNIT	Solid Fuels		Liquid fuels		Biomass	
Associated fuel types		Lignite		Residual fuel oil		Wood pellets	
NOx	g/GJ	173	D	513.0	D	91	D
CO	g/GJ	931	D	66	D	570	D
NMVOC	g/GJ	88.8	D	25	D	300	D
SOx	g/GJ	900	D	47	D	11	D
TSP	g/GJ	124	D	20	D	1.2	D
NH3	g/GJ	NE		NE		150	D
PM10	g/GJ	117	D	20	D	143	D
PM2.5	g/GJ	108	D	20	D	140	D
BC	% of PM2.5	6.4	D	56	D	28	D
Pb	mg/GJ	134	D	0.08	D	27	D
Cd	mg/GJ	1.8	D	0.006	D	13	D
Hg	mg/GJ	7.9	D	0.12	D	0.56	D
As	mg/GJ	4	D	0.03	D	0.19	D
Cr	mg/GJ	13.5	D	0.2	D	23	D
Cu	mg/GJ	17.5	D	0.22	D	6	D
Ni	mg/GJ	13	D	0.008	D	2	D
Se	mg/GJ	1.8	D	0.11	D	0.5	D
Zn	mg/GJ	200	D	29	D	512	D
PCB	ng WHO-TEG/GJ	170	D	NE	D	0.06	D
PCDD/F	ng I-TEQ/GJ	203	D	1.4	D	100	D
Benzo(a)pyrene	µg/GJ	45.5	D	0.0019	D	0.01	D
Benzo(b)fluoranthene	µg/GJ	58.9	D	0.015	D	0.016	D
Benzo(k)fluoranthene	µg/GJ	23.7	D	0.0017	D	0.005	D
Indeno(1,2,3-cd)pyrene	µg/GJ	18.5	D	0.0015	D	0.004	D
HCB	µg/GJ	0.62	D	NE	D	5	D
Source		Table 3.2, section 3.4, page 15.		Table 3.3, section 3.4, page 16.		Table 3.5, section 3.4, page 17.	
		EMEP/EEA air pollutant emission inventory guidebook 2019, Part B, Chapter 1.A.2 Manufacturing industries and construction (combustion).					
Note:							
D	Default	CS		PS		IEF	
		Country specific		Plant specific		Implied emission factor	

### 3.1.3.3.3 Uncertainties and time-series consistency

The uncertainties for activity data and emission factors used for IPCC/NFR category 1.A.2.c Chemicals are presented in the following table.

**Table 3.46 Uncertainty for sub-category 1.A.2.c Chemicals .**

Uncertainty	Hard Coal	Brown Coal	Gaseous fuels	Heavy Fuel Oil	Gas oil	Biomass	Reference
Activity data (AD)	3%	3%	5%	5%	5%	15%	Table 2.15, 2006 IPCC GL, Vol. 2, Chap. 2 (2.4.2)
Emission factor (EF)	Rating	Typical error range		Average		Reference	
NOx	B	20% to 60%		40%		Table 2 2 Rating definitions Table 2 3 Main NFR source categories with applicable quality data ratings EMEP EEA GB 2019, Part A, Chapter 5 Uncertainties.	
CO	C	50% to 200%		125%			
NMVOC	D	100% to 300%		200%			
SOx	A	10% to 30%		20%			
NH3	E	order of magnitude		750%			
TSP, PM10, PM2.5, BC	C	50% to 200%		125%			
Hg	B	20% to 60%		40%			
Pb, Cd, As, Cr, Cu, Ni, Se, Zn	C	50% to 200%		125%			
PCDD/F	E	order of magnitude		750%			
PAH (Benzo(a)pyrene, Benzo(b)-fluoranthene, Benzo(k)fluor-anthene, Indeno(1,2,3-cd)pyrene)	C	50% to 200%		125%			
HCB, PCBs	D	100% to 300%		200%			

The time-series are considered to be consistent as the same methodology is applied to the whole period. Activity data are considered to be consistent as national and international data were always compared.

### 3.1.3.3.4 Source-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
  - consistent use of energy balance data (energy statistic questionnaires),
  - documented sources,
  - use of units,
  - strictly defined interfaces between spreadsheets/calculation modules,
  - unique structure of sheets which do the same,
  - record keeping, use of write protection,
  - unique use of formulas, special cases are documented/highlighted,
  - quick-control checks for data consistency through all steps of calculation.
- cross-checked from two sources: national statistic, Eurostat and international energy statistics of UN
- cross checks with other relevant sectors are performed to avoid double counting or omissions;
- time series consistency - plausibility checks of dips and jumps.

### 3.1.3.3.5 Source-specific recalculations

The following table presents the main revisions and recalculations done since the last submission in 2013 and 2020 and relevant to sub-category 1.A.2.c Chemicals .

**Table 3.47 Recalculations done in sub-category 1.A.2.c Chemicals**

source category	Revisions of data	Type of revision	Type of improvement
1.A.2.C	application of EMEP/EEA air pollutant emission inventory guidebook 2019	method	Comparability
1.A.2.C	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019	EF	Comparability
1.A.2.c	use of CS NCV	AD	Accuracy
1.A.2.c	Fuel consumption data (activity data) was revised due to revised fuel consumption data – plant specific data	AD	Accuracy

### 3.1.3.3.6 Source-specific planned improvements

Considering the potential contribution of identified improvements in the total emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

**Table 3.48 Planned improvements for sub-category 1.A.2.c Chemicals**

source category	Planned improvement	Type of improvement		Priority
1.A.2.b	Sulphur content in used fuel for preparing country specific emission factor (CS EF) $\Rightarrow CS EF_{SO_2} [g/GJ] = (S [\%] \cdot 20000) / (NCV [GJ/t])$	EF	Accuracy Transparency	Medium
1.A.2.b	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF	Accuracy Transparency	Medium
1.A.2.b	Data obtained from measurements made on the emission of air pollutants <ul style="list-style-type: none"> <li>Determination of the <ul style="list-style-type: none"> <li>temperature in waste gases [°C];</li> <li>static pressure and the dynamic pressure [kPa];</li> <li>flow rate [m/s];</li> <li>volume flow rate [m³/h and Nm³/h];</li> <li>concentration of CO, SO<sub>2</sub>, NO<sub>x</sub> in the exhaust gases [mg/Nm³]; and</li> <li>Gravimetric extraction of solid particles (TSP) from gases and determination by applying a gravimetric method (mg/Nm³).</li> </ul> </li> </ul>	EF	Accuracy Transparency	Medium
1.A.2.b	Improvement of time series consistency and split of fuels: the energy statistics is still under development; a split of the fuel combustion for this subcategory has to be reviewed for the entire timeseries. Emissions are allocated in IPCC subcategory 1.A.2.m Other.	AD	Accuracy Transparency	High

### 3.1.3.4 Pulp, Paper and Print (IPCC/NFR category 1.A.2.d)

#### 3.1.3.4.1 Source category description

This section describes emissions resulting from fuel combustion activities in *Manufacturing Industries and Construction -Pulp, Paper and Print -*.

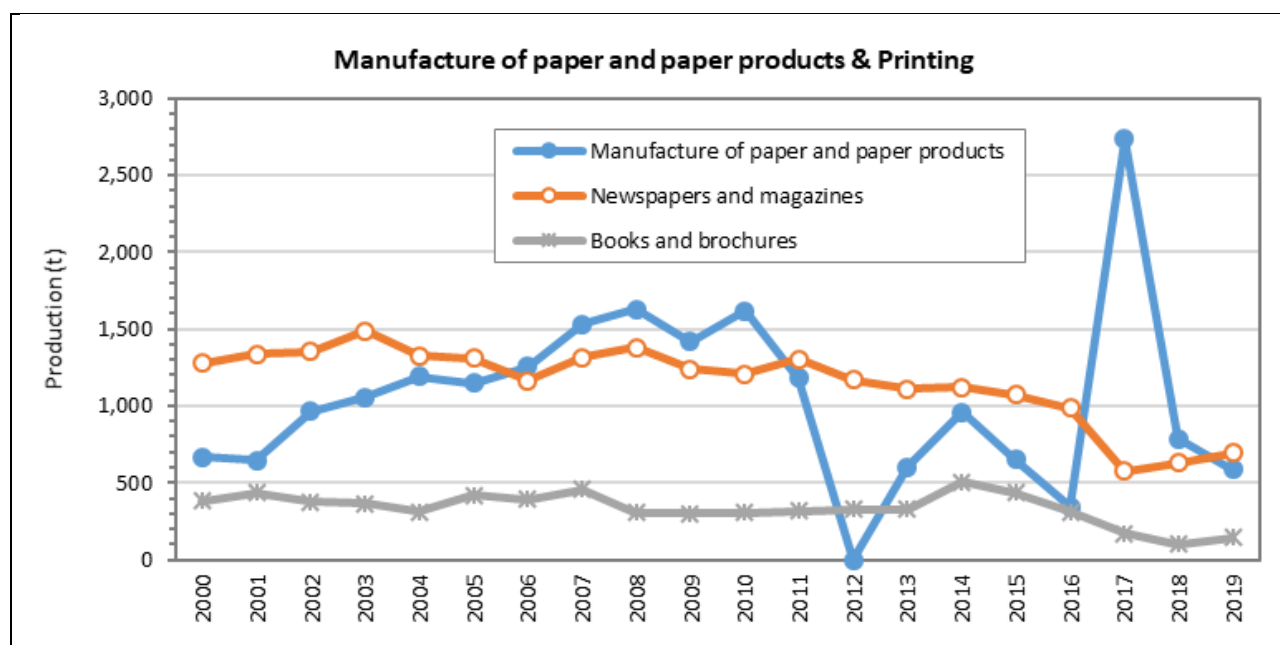


Figure 3.22 Production of Manufacture of paper and paper products as well as Printing 2000 - 2019

Table 3.49 Overview on reported emissions from sub categories 1.A.2.d Pulp, Paper and Print

Air pollutants	1.A.2.d						Key Category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
NOx	✓	✓	NO	NO	NO	NO	-
CO	✓	✓	NO	NO	NO	NO	-
NMVOC	✓	✓	NO	NO	NO	NO	-
SOx	✓	✓	NO	NO	NO	NO	-
NH3	NO	NO	NO	NO	NO	NO	-
TSP	✓	✓	NO	NO	NO	NO	-
PM10	✓	✓	NO	NO	NO	NO	-
PM2.5	✓	✓	NO	NO	NO	NO	-
BC	✓	✓	NO	NO	NO	NO	-
Pb	✓	✓	NO	NO	NO	NO	-
Cd	✓	✓	NO	NO	NO	NO	-
Hg	✓	✓	NO	NO	NO	NO	-
As	✓	✓	NO	NO	NO	NO	-
Cr	✓	✓	NO	NO	NO	NO	-
Cu	✓	✓	NO	NO	NO	NO	-
Ni	✓	✓	NO	NO	NO	NO	-
Se	✓	✓	NO	NO	NO	NO	-
Zn	✓	✓	NO	NO	NO	NO	-
PCB	✓	✓	NO	NO	NO	NO	-

Air pollutants	1.A.2.d						Key Category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
PCDD/F	✓	✓	NO	NO	NO	NO	-
PAH	✓	✓	NO	NO	NO	NO	-
Benzo(a)pyrene	✓	✓	NO	NO	NO	NO	-
Benzo(b)fluoranthene	✓	✓	NO	NO	NO	NO	-
Benzo(k)fluoranthene	✓	✓	NO	NO	NO	NO	-
Indeno(1,2,3-cd)pyrene	✓	✓	NO	NO	NO	NO	-
HCB	✓	✓	NO	NO	NO	NO	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE - included elsewhere, NO – not occurrent, NE -not estimated, NA -not applicable, C – confidential							
LA XX - Level Assessment in year XX TA XX - Trend Assessment in year XX							

An overview of the emission from fuel combustion in Sub-category 1.A.2.d *Pulp, Paper and Print* is provided in the following figures and tables:

- annual emissions of air pollutants;
- Trend of the periods 1990 – 2019, 2005 – 2019, 2017 – 2019.

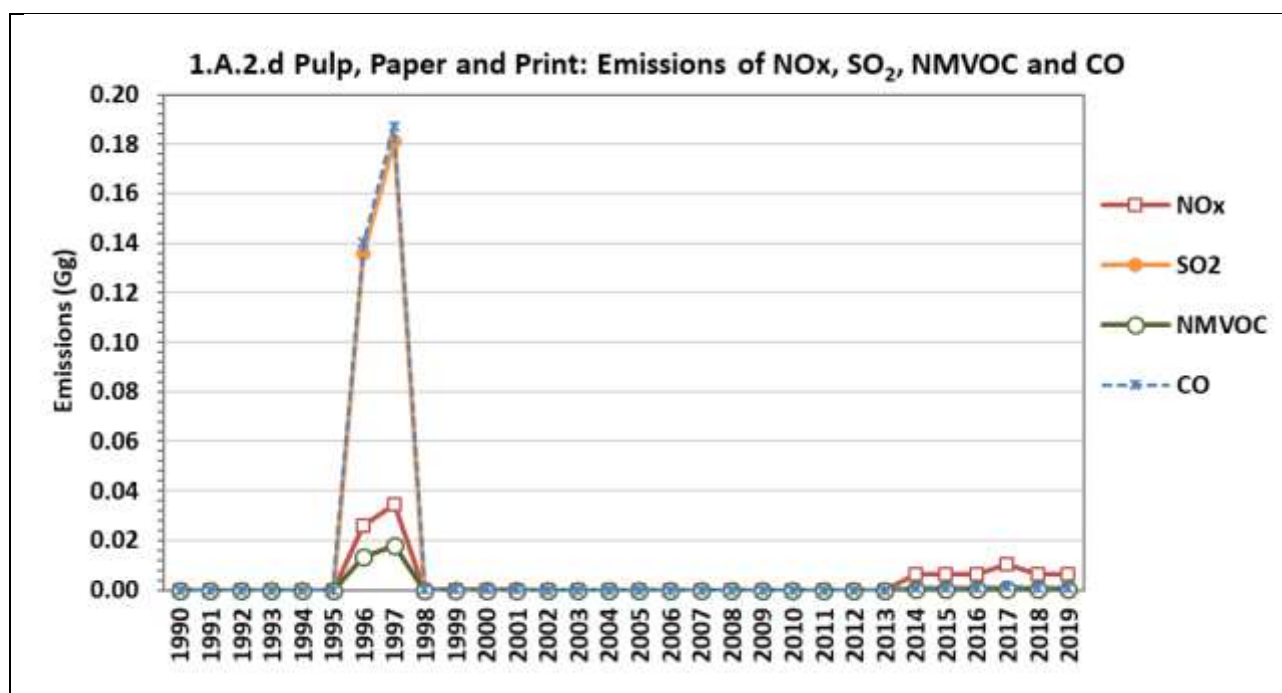


Figure 3.23 Emissions of main pollutants (NO<sub>x</sub>, SO<sub>2</sub>, NMVOC and CO) from sub-category 1.A.2.d Pulp, Paper and Print



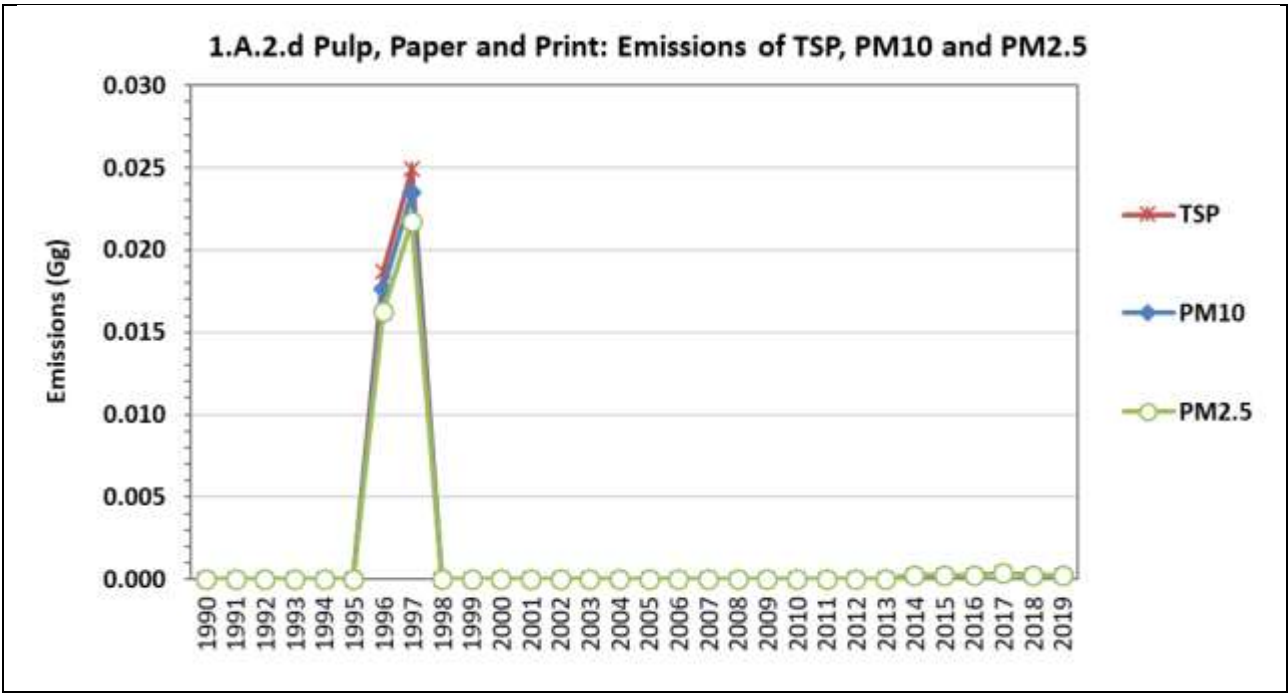


Figure 3.24 Emissions of TSP PM10 and PM2.5 from sub-category 1.A.2.d Pulp, Paper and Print

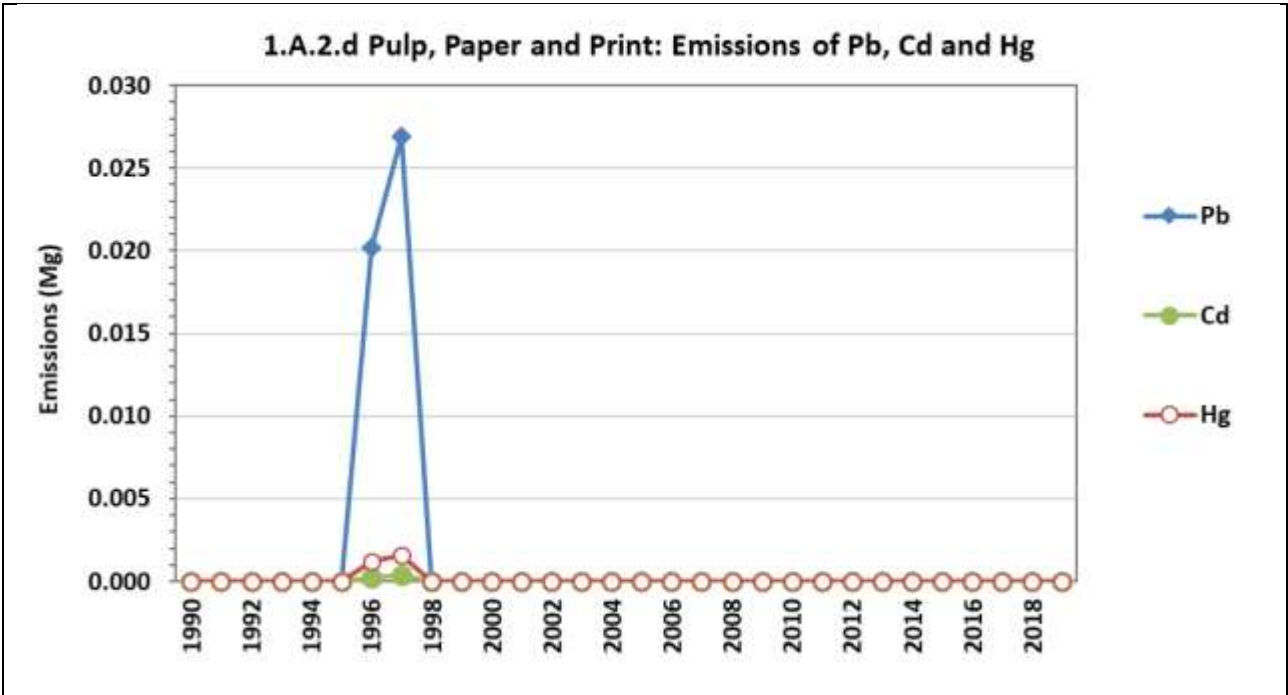


Figure 3.25 Emissions of Pb, Cd and Hg from sub-category 1.A.2.d Pulp, Paper and Print

Table 3.50 Emissions of main pollutants (NO<sub>x</sub>, SO<sub>2</sub>, NMVOC and CO) from sub-category 1.A.2.d Pulp, Paper and Print

Emissions	NO <sub>x</sub>	NMVOC	SO <sub>x</sub>	CO	NH <sub>3</sub>
	Gg	Gg	Gg	Gg	Gg
1990	IE	IE	IE	IE	NA
1991	IE	IE	IE	IE	NA
1992	IE	IE	IE	IE	NA
1993	IE	IE	IE	IE	NA
1994	IE	IE	IE	IE	NA
1995	IE	IE	IE	IE	NA
1996	0.026	0.013	0.136	0.140	NA
1997	0.035	0.018	0.181	0.187	NA
1998	<0.001	<0.001	<0.001	<0.001	NA
1999	<0.001	<0.001	<0.001	<0.001	NA
2000	<0.001	<0.001	<0.001	<0.001	NA
2001	<0.001	<0.001	<0.001	<0.001	NA
2002	<0.001	<0.001	<0.001	<0.001	NA
2003	<0.001	<0.001	<0.001	<0.001	NA
2004	<0.001	<0.001	<0.001	<0.001	NA
2005	<0.001	<0.001	<0.001	<0.001	NA
2006	<0.001	<0.001	<0.001	<0.001	NA
2007	<0.001	<0.001	<0.001	<0.001	NA
2008	<0.001	<0.001	<0.001	<0.001	NA
2009	IE	IE	IE	IE	NA
2010	IE	IE	IE	IE	NA
2011	IE	IE	IE	IE	NA
2012	IE	IE	IE	IE	NA
2013	IE	IE	IE	IE	NA
2014	0.006	<0.001	0.001	0.001	NA
2015	0.006	<0.001	0.001	0.001	NA
2016	0.006	<0.001	0.001	0.001	NA
2017	0.011	0.001	0.001	0.001	NA
2018	0.006	<0.001	0.001	0.001	NA
2019	0.006	<0.001	0.001	0.001	NA
<i>Trend</i>					
1990 – 2019	NA	NA	NA	NA	NA
2005 – 2019	198136%	18721%	3391%	4639%	NA
2018 – 2019	0.0%	0.0%	0.0%	0.0%	NA

**Table 3.51 Emissions of particulate matter (PM) from sub-category 1.A.2.d Pulp, Paper and Print**

Emissions	PM2.5	PM10	TSP	BC
	Gg	Gg	Gg	Gg
1990	IE	IE	IE	NA
1991	IE	IE	IE	NA
1992	IE	IE	IE	NA
1993	IE	IE	IE	NA
1994	IE	IE	IE	NA
1995	IE	IE	IE	NA
1996	0.0163	0.0176	0.0187	NA
1997	0.0217	0.0235	0.0249	NA
1998	<0.0001	<0.0001	<0.0001	0.0002
1999	<0.0001	<0.0001	<0.0001	0.0001
2000	<0.0001	<0.0001	<0.0001	0.0001
2001	<0.0001	<0.0001	<0.0001	0.0001
2002	<0.0001	<0.0001	<0.0001	<0.0001
2003	<0.0001	<0.0001	<0.0001	<0.0001
2004	<0.0001	<0.0001	<0.0001	<0.0001
2005	<0.0001	<0.0001	<0.0001	<0.0001
2006	<0.0001	<0.0001	<0.0001	<0.0001
2007	<0.0001	<0.0001	<0.0001	<0.0001
2008	<0.0001	<0.0001	<0.0001	<0.0001
2009	IE	IE	IE	NA
2010	IE	IE	IE	NA
2011	IE	IE	IE	NA
2012	IE	IE	IE	NA
2013	IE	IE	IE	NA
2014	0.0002	0.0002	0.0002	NA
2015	0.0002	0.0002	0.0002	NA
2016	0.0002	0.0002	0.0002	NA
2017	0.0004	0.0004	0.0004	NA
2018	0.0002	0.0002	0.0002	NA
2019	0.0002	0.0002	0.0002	NA
<i>Trend</i>				
1990 – 2019	NA	NA	NA	NA
2005 – 2019	12 280%	11 328%	10 682%	NA
2018 – 2019	0.0%	0.0%	0.0%	NA

**Table 3.52 Emissions of Heavy Metals (HM) from sub-category 1.A.2.d Pulp, Paper and Print**

Emissions	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
	kg	kg	kg	kg	kg	kg	kg	kg	kg
1990	IE	IE	IE	IE	IE	IE	IE	IE	IE
1991	IE	IE	IE	IE	IE	IE	IE	IE	IE
1992	IE	IE	IE	IE	IE	IE	IE	IE	IE
1993	IE	IE	IE	IE	IE	IE	IE	IE	IE
1994	IE	IE	IE	IE	IE	IE	IE	IE	IE
1995	IE	IE	IE	IE	IE	IE	IE	IE	IE
1996	0.0202	0.0003	0.0012	0.0006	0.0020	0.0026	0.0020	0.0003	0.0302
1997	0.0269	0.0004	0.0016	0.0008	0.0027	0.0035	0.0026	0.0004	0.0402
1998	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
1999	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
2000	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
2001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
2002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
2003	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
2004	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
2005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
2006	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
2007	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
2008	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
2009	IE	IE	IE	IE	IE	IE	IE	IE	IE
2010	IE	IE	IE	IE	IE	IE	IE	IE	IE
2011	IE	IE	IE	IE	IE	IE	IE	IE	IE
2012	IE	IE	IE	IE	IE	IE	IE	IE	IE
2013	IE	IE	IE	IE	IE	IE	IE	IE	IE
2014	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0004
2015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0004
2016	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0004
2017	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0006
2018	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0004
2019	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0004
<i>Trend</i>									
1990 – 2019	NA	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2019	-60%	123%	915%	401%	890%	740%	-59%	3 985%	9 593%
2018 – 2019	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

**Table 3.53 Emissions of Persistent Organic Pollutants (POPs) from sub-category 1.A.2.d Pulp, Paper and Print**

Emissions	PCDD/F	Benzo(a)-pyrene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Indeno (1,2,3-cd) pyrene	Total PAH	HCB	PCB
	g I-TEQ	Mg	Mg	Mg	Mg	Mg	kg	Kg
1990	IE	IE	IE	NA	IE	IE	IE	IE
1991	IE	IE	IE	NA	IE	IE	IE	IE
1992	IE	IE	IE	NA	IE	IE	IE	IE
1993	IE	IE	IE	NA	IE	IE	IE	IE
1994	IE	IE	IE	NA	IE	IE	IE	IE
1995	IE	IE	IE	NA	IE	IE	IE	IE
1996	<0.001	<0.001	<0.001	NA	0.003	0.003	<0.001	0.026
1997	<0.001	<0.001	<0.001	NA	0.004	0.004	<0.001	0.034
1998	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
1999	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2000	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2001	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2002	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2003	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2004	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2005	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2006	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2007	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2008	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2009	IE	IE	IE	NA	IE	IE	IE	IE
2010	IE	IE	IE	NA	IE	IE	IE	IE
2011	IE	IE	IE	NA	IE	IE	IE	IE
2012	IE	IE	IE	NA	IE	IE	IE	IE
2013	IE	IE	IE	NA	IE	IE	IE	IE
2014	<0.001	<0.001	<0.001	NA	<0.001	<0.001	IE	IE
2015	<0.001	<0.001	<0.001	NA	<0.001	<0.001	IE	IE
2016	<0.001	<0.001	<0.001	NA	<0.001	<0.001	IE	IE
2017	<0.001	<0.001	<0.001	NA	<0.001	<0.001	IE	IE
2018	<0.001	<0.001	<0.001	NA	<0.001	<0.001	IE	IE
2019	<0.001	<0.001	<0.001	NA	<0.001	<0.001	IE	IE
<i>Trend</i>								
1990 – 2019	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2019	361.0%	-97.2%	-83.0%	NA	-94.6%	-94.6%	NA	NA
2018 – 2019	0.0%	0.0%	0.0%	NA	0.0%	0.0%	NA	NA

### 3.1.3.4.2 Methodological issues

#### 3.1.3.4.2.1 Choice of methods

For estimating the air pollutants emissions the Tier 1 approach<sup>36</sup> of the EMEP/EEA air pollutant emission inventory guidebook 2019 has been applied:

*Equation: emissions from stationary combustion*

$$Emissions_{pollutant} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{pollutant, fuel}$$

Where:

Emissions <sub>pollutant</sub>	= emissions of a given pollutant by type of fuel (kg pollutant)
Fuel consumption <sub>fuel</sub>	= amount of fuel combusted (TJ)
Emission factor <sub>pollutant, fuel</sub>	= default emission factor of a given pollutant by type of fuel (g <sub>pollutant</sub> /GJ).
Pollutant	= main pollutants: NO <sub>x</sub> , CO, NMVOC, SO <sub>2</sub> particulate matter: TSP, OM10, PM2.5, BC heavy metals: Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn persistent organic pollutants: PCDD/F, Benzo(a) pyrene, Benzo(b)fluor, anthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene, Total PAH, HCB, PCB
Fuel	= liquid fuels, solid fuels, gaseous fuels, other fossil fuel, biomass, peat

#### 3.1.3.4.2.2 Choice of activity data

The following fuels are used for electricity and heat production (autoproducer):

Tier 1 fuel type	Associated fuel types	Source
Liquid fuels	<ul style="list-style-type: none"> <li>Residual fuel oil</li> <li>Gas/Diesel Oil</li> <li>Liquefied Petroleum Gases (LPG)</li> </ul>	Summary of fuel aggregations at Tier 1 according to EMEP/EEA air pollutant emission inventory guidebook 2019, Part B, Chapter 1.A.2, Table 3 59
Solid fuels	<ul style="list-style-type: none"> <li>Lignite</li> <li>Sub-Bituminous Coal</li> </ul>	

Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2019 were taken from prepared by Statistical Office of Montenegro (MONSTAT).

The total fuel consumption increased by 66751.5% in the period 2005 – 2019.

<sup>36</sup> Source: EMEP/EEA air pollutant emission inventory guidebook 2019, 1.A.2 Manufacturing industries and construction (combustion), sub-chapter 3.2 Tier 1 default approach.

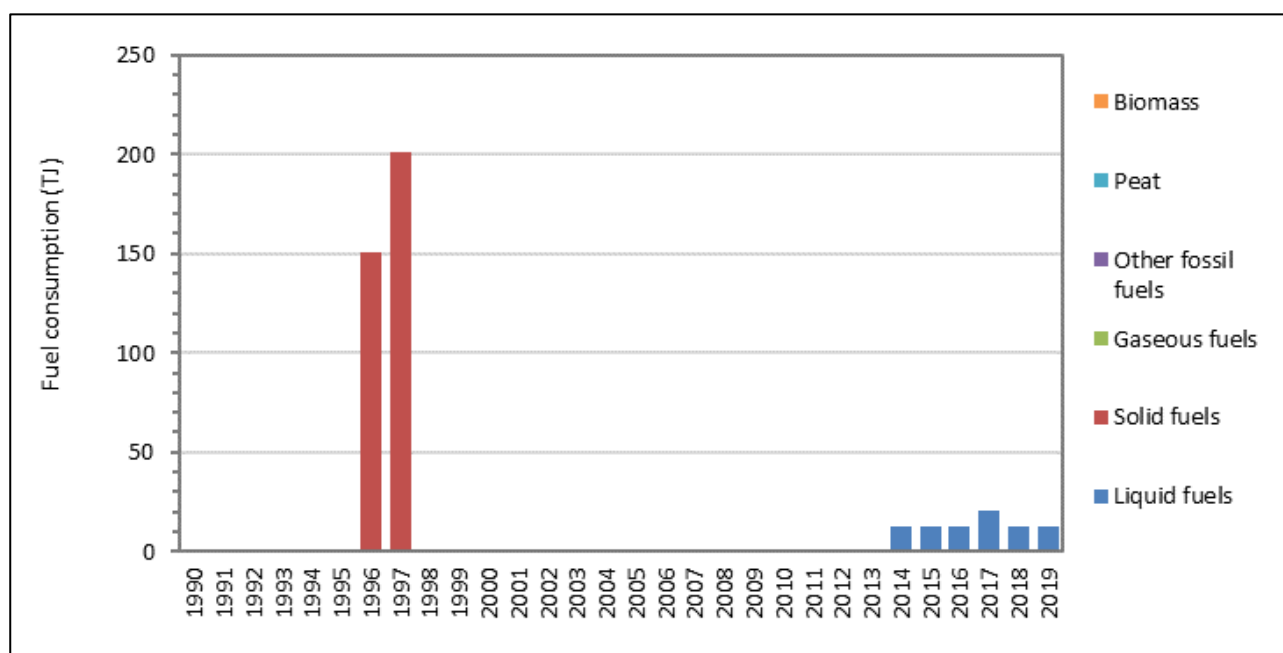


Figure 3.26 Activity data for sub-category 1.A.2.d Pulp, Paper and Print

Table 3.54 Activity data for sub-category 1.A.2.d Pulp, Paper and Print

Activity data 1.A.1.d	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
1990	NO	NO	NO	NO	NO	NO	NO
1991	NO	NO	NO	NO	NO	NO	NO
1992	NO	NO	NO	NO	NO	NO	NO
1993	NO	NO	NO	NO	NO	NO	NO
1994	NO	NO	NO	NO	NO	NO	NO
1995	NO	NO	NO	NO	NO	NO	NO
1996	150.75	NO	150.75	NO	NO	NO	NO
1997	201.00	NO	201.00	NO	NO	NO	NO
1998	0.14	NO	0.14	NO	NO	NO	NO
1999	0.11	NO	0.11	NO	NO	NO	NO
2000	0.06	NO	0.06	NO	NO	NO	NO
2001	0.06	NO	0.06	NO	NO	NO	NO
2002	0.03	NO	0.03	NO	NO	NO	NO
2003	0.02	NO	0.02	NO	NO	NO	NO
2004	0.02	NO	0.02	NO	NO	NO	NO
2005	0.02	NO	0.02	NO	NO	NO	NO
2006	0.01	NO	0.01	NO	NO	NO	NO
2007	0.01	NO	0.01	NO	NO	NO	NO
2008	0.02	NO	0.02	NO	NO	NO	NO
2009	IE	NO	IE	NO	NO	NO	NO
2010	IE	NO	IE	NO	NO	NO	NO

Activity data 1.A.1.d	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
TJ							
2011	IE	NO	IE	NO	NO	NO	NO
2012	IE	NO	IE	NO	NO	NO	NO
2013	IE	NO	IE	NO	NO	NO	NO
2014	12.17	12.17	IE	NO	NO	NO	NO
2015	12.36	12.36	IE	NO	NO	NO	NO
2016	12.36	12.36	IE	NO	NO	NO	NO
2017	20.60	20.60	IE	NO	NO	NO	NO
2018	12.36	12.36	IE	NO	NO	NO	NO
2019	12.36	12.36	IE	NO	NO	NO	NO
<i>Trend</i>							
1990 – 2019	NA	NA	NA	NA	NA	NA	NA
2005 – 2019	66751.5%	NA	NA	NA	NA	NA	NA
2018 – 2019	0.0%	0.0%	NA	NA	NA	NA	NA

In energy statistics, production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units, e.g. in tonnes or cubic metres. To convert these data to energy units, in this case terajoules, requires calorific values. The emission calculations are based on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in sub-category 1.A.2.d Pulp, Paper and Print .

**Table 3.55 Net calorific values (NCVs) applied for conversion to energy units in sub-category 1.A.2.d Pulp, Paper and Print**

Fuel		Fuel type	Net calorific value (NCV) (TJ/Gg)		Source
			NCV	type	
Gas/Diesel Oil		liquid	42.71	CS	Statistical Office of Montenegro (MONSTAT)
Residual fuel oil		liquid	41.20	CS	
Liquefied Petroleum Gases (LPG)		liquid	46.89	CS	
Sub-Bituminous Coal		solid	16.75	CS	
Lignite		solid	9.21	CS	
Note:					
D	Default	CS	Country specific	PS	Plant specific



### 3.1.3.4.2.3 Choice of emission factors

Default emission factors for air pollutant were taken from the EMEP/EEA air pollutant emission inventory Guidebook 2019 and are presented in the following table.

**Table 3.56 Emission factors (EF) for Main pollutants, Particulate Matter (PM), Heavy metals (HM) and Persistent Organic Pollutants (POPs) for sub-category 1.A.2.d Pulp, Paper and Print**

Fuel Type	UNIT	Solid Fuels		Liquid fuels	
Associated fuel types		Lignite		Residual fuel oil	
Pollutant		EF	type	EF	type
NOx	g/GJ	173	D	513.0	D
CO	g/GJ	931	D	66	D
NMVOC	g/GJ	88.8	D	25	D
SOx	g/GJ	900	D	47	D
TSP	g/GJ	124	D	20	D
NH3	g/GJ	NE		NE	
PM10	g/GJ	117	D	20	D
PM2.5	g/GJ	108	D	20	D
BC	% of PM2.5	6.4	D	56	D
Pb	mg/GJ	134	D	0.08	D
Cd	mg/GJ	1.8	D	0.006	D
Hg	mg/GJ	7.9	D	0.12	D
As	mg/GJ	4	D	0.03	D
Cr	mg/GJ	13.5	D	0.2	D
Cu	mg/GJ	17.5	D	0.22	D
Ni	mg/GJ	13	D	0.008	D
Se	mg/GJ	1.8	D	0.11	D
Zn	mg/GJ	200	D	29	D
PCB	ng WHO-TEG/GJ	170	D	NE	D
PCDD/F	ng I-TEQ/GJ	203	D	1.4	D
Benzo(a)pyrene	µg/GJ	45.5	D	0.0019	D
Benzo(b)fluoranthene	µg/GJ	58.9	D	0.015	D
Benzo(k)fluoranthene	µg/GJ	23.7	D	0.0017	D
Indeno(1,2,3-cd)pyrene	µg/GJ	18.5	D	0.0015	D
HCB	µg/GJ	0.62	D	NE	D
Source		Table 3.2, section 3.4, page 15.		Table 3.3, section 3.4, page 16.	
		EMEP/EEA air pollutant emission inventory guidebook 2019, Part B, Chapter 1.A.2 Manufacturing industries and construction (combustion).			
Note:					
D    Default	CS    Country specific	PS    Plant specific		IEF    Implied emission factor	

### 3.1.3.4.3 Uncertainties and time-series consistency

The uncertainties for activity data and emission factors used for IPCC/NFR category 1.A.2.d Pulp, Paper and Print are presented in the following table.

**Table 3.57 Uncertainty for sub-category 1.A.2.d Pulp, Paper and Print.**

Uncertainty	Hard Coal	Brown Coal	Gaseous fuels	Heavy Fuel Oil	Gas oil	Biomass	Reference
Activity data (AD)	3%	3%	5%	5%	5%	15%	Table 2.15, 2006 IPCC GL, Vol. 2, Chap. 2 (2.4.2)
Emission factor (EF)	Rating	Typical error range		Average		Reference	
NOx	B	20% to 60%		40%		Table 2 2 Rating definitions Table 2 3 Main NFR source categories with applicable quality data ratings EMEP EEA GB 2019, Part A, Chapter 5 Uncertainties.	
CO	C	50% to 200%		125%			
NM VOC	D	100% to 300%		200%			
SOx	A	10% to 30%		20%			
NH3	E	order of magnitude		750%			
TSP, PM10, PM2.5, BC	C	50% to 200%		125%			
Hg	B	20% to 60%		40%			
Pb, Cd, As, Cr, Cu, Ni, Se, Zn	C	50% to 200%		125%			
PCDD/F	E	order of magnitude		750%			
PAH (Benzo(a)pyrene, Benzo(b)-fluoranthene, Benzo(k)fluor-anthene, Indeno(1,2,3-cd)pyrene)	C	50% to 200%		125%			
HCB, PCBs	D	100% to 300%		200%			

The time-series are considered to be consistent as the same methodology is applied to the whole period. Activity data are considered to be consistent as national and international data were always compared.

### 3.1.3.4.4 Source-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
  - consistent use of energy balance data (energy statistic questionnaires),
  - documented sources,
  - use of units,
  - strictly defined interfaces between spreadsheets/calculation modules,
  - unique structure of sheets which do the same,
  - record keeping, use of write protection,
  - unique use of formulas, special cases are documented/highlighted,
  - quick-control checks for data consistency through all steps of calculation.
- cross-checked from two sources: national statistic, Eurostat and international energy statistics of UN
- cross checks with other relevant sectors are performed to avoid double counting or omissions;
- time series consistency - plausibility checks of dips and jumps.

### 3.1.3.4.5 Source-specific recalculations

The following table presents the main revisions and recalculations done since the last submission in 2013 and 2020 and relevant to sub-category 1.A.2.d Pulp, Paper and Print.

**Table 3.58 Recalculations done in sub-category 1.A.2.d Pulp, Paper and Print**

source category	Revisions of data	Type of revision	Type of improvement
1.A.2.C	application of EMEP/EEA air pollutant emission inventory guidebook 2019	method	Comparability
1.A.2.C	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019	EF	Comparability
1.A.2.c	use of CS NCV	AD	Accuracy
1.A.2.c	Fuel consumption data (activity data) was revised due to revised fuel consumption data – plant specific data	AD	Accuracy

### 3.1.3.4.6 Source-specific planned improvements

Considering the potential contribution of identified improvements in the total emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

**Table 3.59 Planned improvements for sub-category 1.A.2.d Pulp, Paper and Print**

source category	Planned improvement	Type of improvement		Priority
1.A.2.b	Sulphur content in used fuel for preparing country specific emission factor (CS EF) $\Rightarrow \text{CS EF}_{\text{SO}_2} [\text{g/GJ}] = (\text{S} [\%] \cdot 20000) / (\text{NCV} [\text{GJ/t}])$	EF	Accuracy Transparency	Medium
1.A.2.b	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF	Accuracy Transparency	Medium
1.A.2.b	Data obtained from measurements made on the emission of air pollutants <ul style="list-style-type: none"> <li>Determination of the <ul style="list-style-type: none"> <li>temperature in waste gases [°C];</li> <li>static pressure and the dynamic pressure [kPa];</li> <li>flow rate [m/s];</li> <li>volume flow rate [m³/h and Nm³/h];</li> <li>concentration of CO, SO₂, NOx in the exhaust gases [mg/Nm³]; and</li> <li>Gravimetric extraction of solid particles (TSP) from gases and determination by applying a gravimetric method (mg/Nm³).</li> </ul> </li> </ul>	EF	Accuracy Transparency	Medium
1.A.2.b	Improvement of time series consistency and split of fuels: the energy statistics is still under development; a split of the fuel combustion for this subcategory has to be reviewed for the entire timeseries. Emissions are allocated in IPCC subcategory 1.A.2.m Other.	AD	Accuracy Transparency	High

### 3.1.3.5 Food Processing, Beverages and Tobacco (IPCC/NFR category 1.A.2.e)

#### 3.1.3.5.1 Source category description

This section describes emissions resulting from fuel combustion activities in *Manufacturing Industries and Construction -Food Processing, Beverages and Tobacco-*. The subcategory 1.A.2.e Food Processing, Beverages and Tobacco includes the

##### (1) Manufacture of food products

- Processing and preserving of
  - meat
  - fish, crustaceans and molluscs
  - fruit and vegetables
- Manufacture of
  - vegetable and animal oils and fats
  - dairy products
  - grain mill products
  - starches and starch products
  - bakery products
  - prepared meals and dishes
  - other food products n.e.c.

##### (2) Manufacture of beverages

- Distilling, rectifying and blending of spirits
- Manufacture of
  - wines
  - malt liquors and malt
  - soft drinks; production of mineral waters and other bottled waters

##### (3) Manufacture of tobacco products

**Table 3.60 Overview on reported emissions from sub categories 1.A.2.e Food Processing, Beverages and Tobacco**

Air pollutants	1.A.2.e						Key Category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
NO <sub>x</sub>	✓	✓	NO	NO	NO	✓	-
CO	✓	✓	NO	NO	NO	✓	-
NM VOC	✓	✓	NO	NO	NO	✓	-
SO <sub>x</sub>	✓	✓	NO	NO	NO	✓	-
NH <sub>3</sub>	NO	NO	NO	NO	NO	✓	-
TSP	✓	✓	NO	NO	NO	✓	-
PM <sub>10</sub>	✓	✓	NO	NO	NO	✓	Trend 2018
PM <sub>2.5</sub>	✓	✓	NO	NO	NO	✓	-
BC	✓	✓	NO	NO	NO	✓	Trend 2018
Pb	✓	✓	NO	NO	NO	✓	-
Cd	✓	✓	NO	NO	NO	✓	-
Hg	✓	✓	NO	NO	NO	✓	-
As	✓	✓	NO	NO	NO	✓	-
Cr	✓	✓	NO	NO	NO	✓	-
Cu	✓	✓	NO	NO	NO	✓	Trend 2018
Ni	✓	✓	NO	NO	NO	✓	-
Se	✓	✓	NO	NO	NO	✓	-
Zn	✓	✓	NO	NO	NO	✓	Trend 2018
PCB	✓	✓	NO	NO	NO	✓	-
PCDD/F	✓	✓	NO	NO	NO	✓	-

Air pollutants	1.A.2.e						Key Category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
PAH	✓	✓	NO	NO	NO	✓	-
Benzo(a)pyrene	✓	✓	NO	NO	NO	✓	-
Benzo(b)fluoranthene	✓	✓	NO	NO	NO	✓	-
Benzo(k)fluoranthene	✓	✓	NO	NO	NO	✓	-
Indeno(1,2,3-cd)pyrene	✓	✓	NO	NO	NO	✓	-
HCB	✓	✓	NO	NO	NO	✓	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE - included elsewhere, NO – not occurred, NE - not estimated, NA - not applicable, C – confidential							
LA XX - Level Assessment in year XX TA XX - Trend Assessment in year XX							

An overview of the emission from fuel combustion in Sub-category 1.A.2.e *Food Processing, Beverages and Tobacco* is provided in the following figures and tables:

- annual emissions of air pollutants;
- Trend of the periods 1990 – 2019, 2005 – 2019, 2017 – 2019.

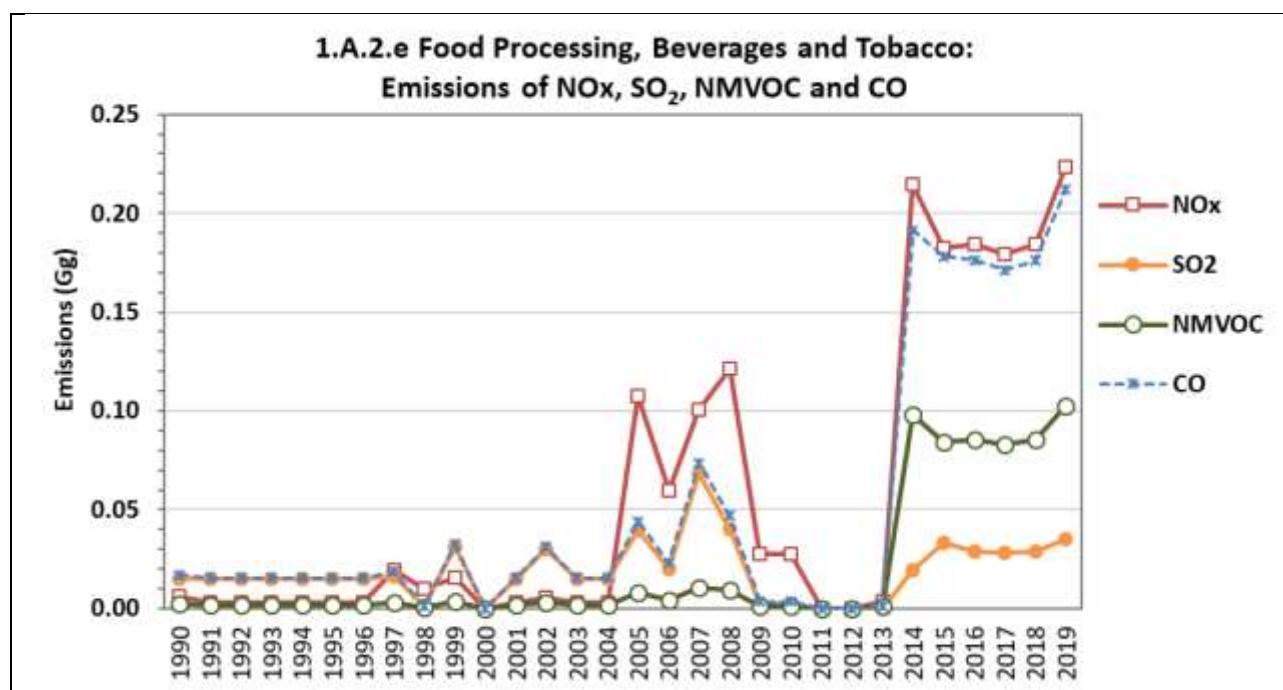


Figure 3.27 Emissions of main pollutants (NO<sub>x</sub>, SO<sub>2</sub>, NMVOC and CO) from sub-category 1.A.2.e Food Processing, Beverages and Tobacco

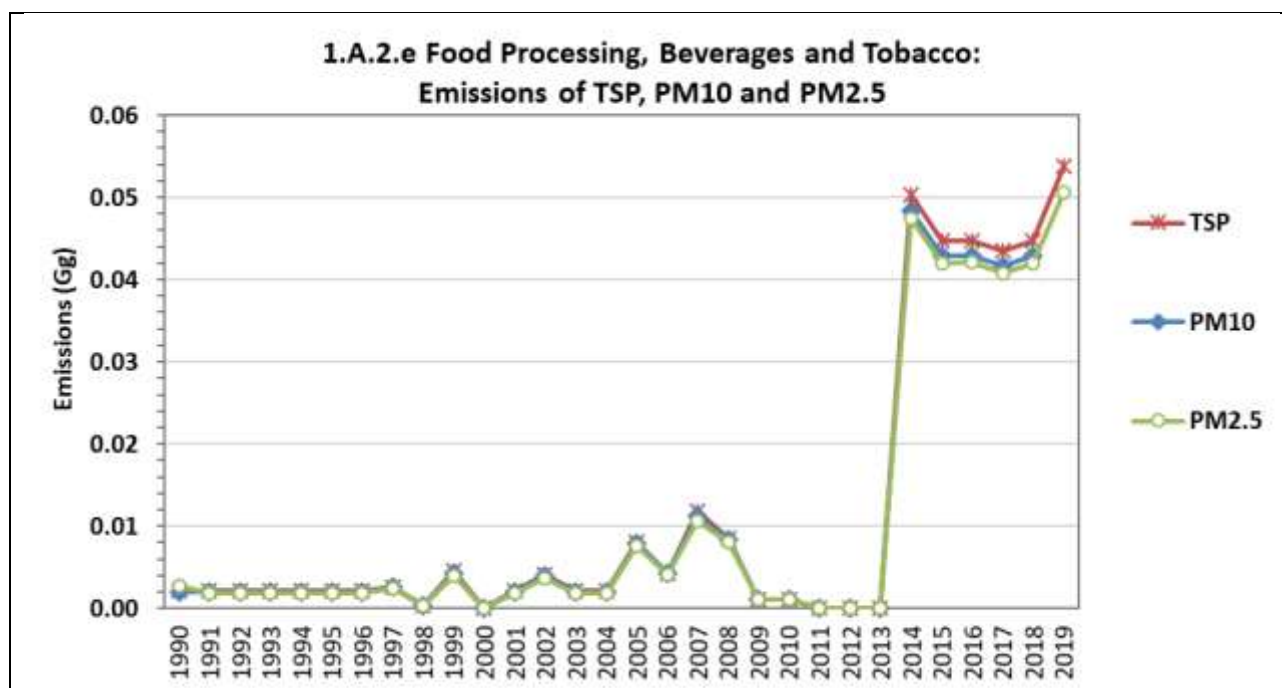


Figure 3.28 Emissions of TSP, PM10 and PM2.5 from sub-category 1.A.2.e Food Processing, Beverages and Tobacco

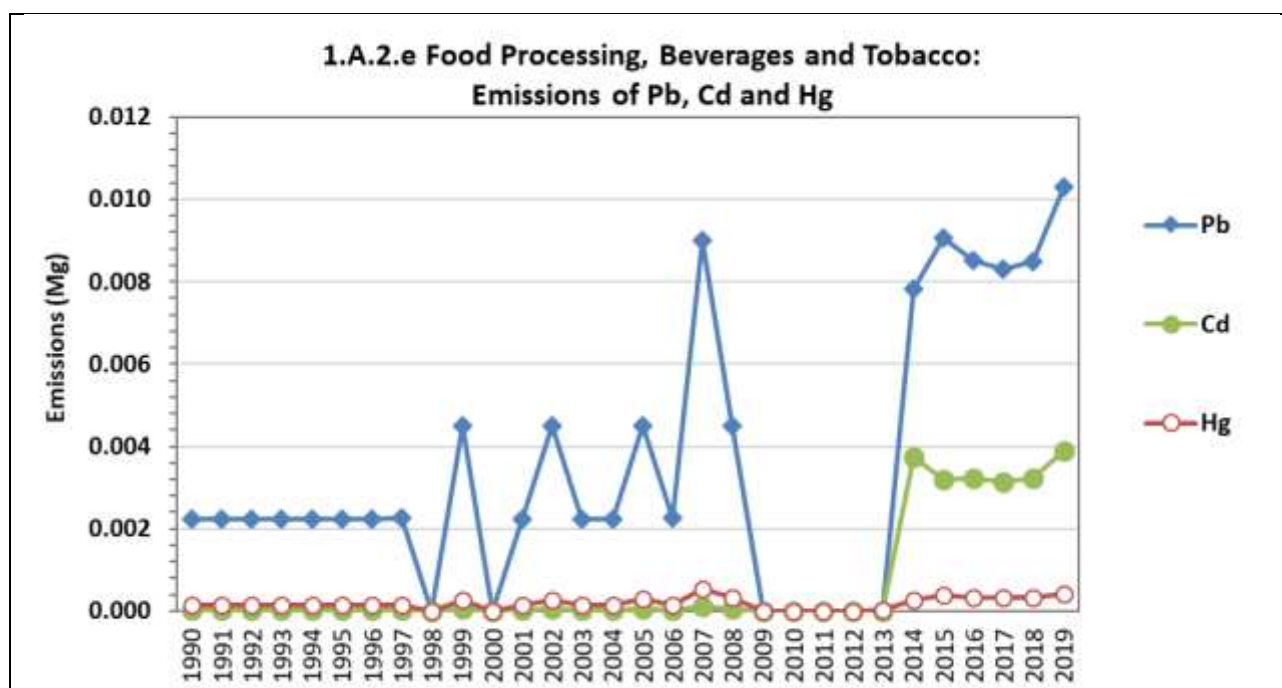


Figure 3.29 Emissions of Pb, Cd and Hg from sub-category 1.A.2.e Food Processing, Beverages and Tobacco

**Table 3.61 Emissions of main pollutants (NO<sub>x</sub>, SO<sub>2</sub>, NMVOC and CO) from sub-category 1.A.2.e Food Processing, Beverages and Tobacco**

Emissions	NO <sub>x</sub>	NMVOC	SO <sub>x</sub>	CO	NH <sub>3</sub>
	Gg	Gg	Gg	Gg	Gg
1990	0.006	0.003	0.015	0.017	IE
1991	0.003	0.001	0.015	0.016	IE
1992	0.003	0.001	0.015	0.016	IE
1993	0.003	0.001	0.015	0.016	IE
1994	0.003	0.001	0.015	0.016	IE
1995	0.003	0.001	0.015	0.016	IE
1996	0.003	0.001	0.015	0.016	IE
1997	0.020	0.003	0.016	0.019	IE
1998	0.010	0.000	0.001	0.001	IE
1999	0.016	0.003	0.031	0.032	IE
2000	0.000	0.000	0.000	0.000	IE
2001	0.003	0.001	0.015	0.016	IE
2002	0.006	0.003	0.030	0.031	IE
2003	0.003	0.001	0.015	0.016	IE
2004	0.003	0.001	0.015	0.016	IE
2005	0.107	0.008	0.039	0.044	IE
2006	0.060	0.004	0.020	0.023	IE
2007	0.100	0.010	0.068	0.074	IE
2008	0.121	0.010	0.040	0.047	IE
2009	0.027	0.001	0.003	0.004	IE
2010	0.027	0.001	0.003	0.004	IE
2011	IE	IE	IE	IE	IE
2012	0.000	0.000	0.000	0.000	IE
2013	0.003	0.001	0.000	0.001	IE
2014	0.214	0.098	0.020	0.191	0.011
2015	0.183	0.085	0.033	0.178	0.009
2016	0.184	0.085	0.029	0.176	0.009
2017	0.179	0.083	0.028	0.171	0.009
2018	0.184	0.085	0.029	0.176	0.009
2019					
<i>Trend</i>					
1990 – 2019	2794.2%	3222.5%	90.1%	937.9%	NA
2005 – 2019	71.9%	976.9%	-27.2%	298.0%	NA
2018 – 2019	3.0%	3.0%	1.7%	2.8%	3.0%

Table 3.62 Emissions of particulate matter (PM) from sub-category 1.A.2.e Food Processing, Beverages and Tobacco

Emissions	PM2.5	PM10	TSP	BC
	Gg	Gg	Gg	Gg
1990	0.003	0.002	0.002	<0.001
1991	0.002	0.002	0.002	<0.001
1992	0.002	0.002	0.002	<0.001
1993	0.002	0.002	0.002	<0.001
1994	0.002	0.002	0.002	<0.001
1995	0.002	0.002	0.002	<0.001
1996	0.002	0.002	0.002	<0.001
1997	0.002	0.003	0.003	<0.001
1998	<0.001	<0.001	0.000	<0.001
1999	0.004	0.004	0.005	<0.001
2000	<0.001	<0.001	<0.001	<0.001
2001	0.002	0.002	0.002	<0.001
2002	0.004	0.004	0.004	<0.001
2003	0.002	0.002	0.002	IE
2004	0.002	0.002	0.002	IE
2005	0.008	0.008	0.008	IE
2006	0.004	0.004	0.004	IE
2007	0.011	0.011	0.012	IE
2008	0.008	0.008	0.009	IE
2009	0.001	0.001	0.001	IE
2010	0.001	0.001	0.001	IE
2011	IE	IE	IE	IE
2012	<0.001	<0.001	<0.001	<0.001
2013	<0.001	<0.001	<0.001	<0.001
2014	0.047	0.048	0.050	0.259
2015	0.042	0.043	0.045	0.218
2016	0.042	0.043	0.045	0.222
2017	0.041	0.042	0.043	0.215
2018	0.042	0.043	0.045	0.221
2019				
<i>Trend</i>				
1990 – 2019	1429.5%	2047.2%	2014.3%	2008856.3%
2005 – 2019	454.9%	444.6%	451.4%	NA
2018 – 2019	2.9%	2.9%	2.9%	3.1%



**Table 3.63 Emissions of Heavy Metals (HM) from sub-category 1.A.2.e Food Processing, Beverages and Tobacco**

Emissions	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
	kg	kg	kg	kg	kg	kg	kg	kg	kg
1990	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
1991	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
1992	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
1993	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
1994	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
1995	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
1996	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
1997	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004
1998	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
1999	0.004	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.007
2000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2001	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
2002	0.004	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.007
2003	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
2004	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
2005	0.005	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.012
2006	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007
2007	0.009	0.000	0.001	0.000	0.001	0.001	0.001	0.000	0.018
2008	0.005	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.013
2009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
2010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
2011	IE	IE	IE	IE	IE	IE	IE	IE	IE
2012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2014	0.008	0.004	0.000	0.000	0.007	0.002	0.001	0.000	0.158
2015	0.009	0.003	0.000	0.000	0.006	0.002	0.001	0.000	0.137
2016	0.009	0.003	0.000	0.000	0.006	0.002	0.001	0.000	0.138
2017	0.008	0.003	0.000	0.000	0.006	0.002	0.001	0.000	0.134
2018	0.008	0.003	0.000	0.000	0.006	0.002	0.001	0.000	0.138
2019									
<i>Trend</i>									
1990 – 2019	278.2%	10619.9%	115.9%	68.3%	2511.7%	507.6%	207.8%	467.6%	3970.5%
2005 – 2019	88.6%	5166.8%	18.1%	-13.7%	1104.7%	183.1%	53.9%	127.5%	1008.4%
2018 – 2019	2.4%	3.0%	2.3%	1.8%	2.9%	2.6%	2.2%	2.6%	2.9%

**Table 3.64 Emissions of Persistent Organic Pollutants (POPs) from sub-category 1.A.2.e Food Processing, Beverages and Tobacco**

Emissions	PCDD/F	Benzo(a)-pyrene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Indeno (1,2,3-cd) pyrene	Total PAH	HCB	PCB
	g I-TEQ	Mg	Mg	Mg	Mg	Mg	kg	kg
1990	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	0.003
1991	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	0.003
1992	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	0.003
1993	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	0.003
1994	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	0.003
1995	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	0.003
1996	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	0.003
1997	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	0.003
1998	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
1999	<0.001	<0.001	<0.001	NA	0.001	0.001	0.000	0.006
2000	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2001	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	0.003
2002	<0.001	<0.001	<0.001	NA	0.001	0.001	0.000	0.006
2003	<0.001	<0.001	<0.001	NA	0.000	<0.001	<0.001	0.003
2004	<0.001	<0.001	<0.001	NA	0.000	<0.001	<0.001	0.003
2005	<0.001	<0.001	<0.001	NA	0.001	0.001	<0.001	0.006
2006	<0.001	<0.001	<0.001	NA	0.000	0.000	<0.001	0.003
2007	<0.001	<0.001	<0.001	NA	0.001	0.001	<0.001	0.011
2008	<0.001	<0.001	<0.001	NA	0.001	0.001	<0.001	0.006
2009	<0.001	<0.001	<0.001	NA	0.000	0.000	IE	IE
2010	<0.001	<0.001	<0.001	NA	0.000	0.000	IE	IE
2011	IE	IE	IE	NA	IE	IE	IE	IE
2012	<0.001	<0.001	<0.001	NA	<0.001	<0.001	0.000	0.000
2013	<0.001	<0.001	<0.001	NA	<0.001	<0.001	0.000	0.000
2014	<0.001	<0.001	<0.001	NA	<0.001	<0.001	0.001	0.000
2015	<0.001	<0.001	<0.001	NA	<0.001	<0.001	0.001	0.003
2016	<0.001	<0.001	<0.001	NA	<0.001	<0.001	0.001	0.002
2017	<0.001	<0.001	<0.001	NA	<0.001	<0.001	0.001	0.002
2018	<0.001	<0.001	<0.001	NA	<0.001	<0.001	0.001	0.002
2019	<0.001	<0.001	<0.001	NA	<0.001	<0.001	0.001	0.002
<i>Trend</i>								
1990 – 2019	714.4%	297.3%	381.0%	NA	-19.4%	-16.9%	11870.6%	-19.4%
2005 – 2019	294.3%	107.5%	140.3%	NA	-59.7%	-58.5%	5888.6%	-59.7%
2018 – 2019	2.7%	2.4%	2.5%	NA	0.0%	0.1%	3.0%	0.0%

### 3.1.3.5.2 Methodological issues

#### 3.1.3.5.2.1 Choice of methods

For estimating the air pollutants emissions the Tier 1 approach<sup>37</sup> of the EMEP/EEA air pollutant emission inventory guidebook 2019 has been applied:

*Equation: emissions from stationary combustion*

$$Emissions_{pollutant} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{pollutant, fuel}$$

Where:

Emissions <sub>pollutant</sub>	= emissions of a given pollutant by type of fuel (kg pollutant)
Fuel consumption <sub>fuel</sub>	= amount of fuel combusted (TJ)
Emission factor <sub>pollutant, fuel</sub>	= default emission factor of a given pollutant by type of fuel (g <sub>pollutant</sub> /GJ).
Pollutant	= main pollutants: NO <sub>x</sub> , CO, NMVOC, SO <sub>2</sub> particulate matter: TSP, OM10, PM2.5, BC heavy metals: Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn persistent organic pollutants: PCDD/F, Benzo(a) pyrene, Benzo(b)fluor, anthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene, Total PAH, HCB, PCB
Fuel	= liquid fuels, solid fuels, gaseous fuels, other fossil fuel, biomass, peat

#### 3.1.3.5.2.2 Choice of activity data

The following fuels are used for electricity and heat production (autoproducer):

Tier 1 fuel type	Associated fuel types	Source
<b>Liquid fuels</b>	<ul style="list-style-type: none"> <li>Residual fuel oil</li> <li>Gas/Diesel Oil</li> <li>Liquefied Petroleum Gases (LPG)</li> <li>Petroleum Coke</li> </ul>	Summary of fuel aggregations at Tier 1 according to EMEP/EEA air pollutant emission inventory guidebook 2019, Part B, Chapter 1.A.2,
<b>Solid fuels</b>	<ul style="list-style-type: none"> <li>Lignite</li> <li>Sub-Bituminous Coal</li> </ul>	
<b>Biomass</b>	<ul style="list-style-type: none"> <li>Wood / Fuelwood</li> <li>Wood pellets</li> <li>Charcoal</li> </ul>	

Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2019 were taken from prepared by Statistical Office of Montenegro (MONSTAT).

The total fuel consumption increased by 1161.2% in the period 1990 – 2019. From 2005 to 2019 the total fuel consumption increased by 247.1%. From 2018 to 2019 the total fuel consumption decreased by 20.2%.

<sup>37</sup> Source: EMEP/EEA air pollutant emission inventory guidebook 2019, 1.A.2 Manufacturing industries and construction (combustion), sub-chapter 3.2 Tier 1 default approach.

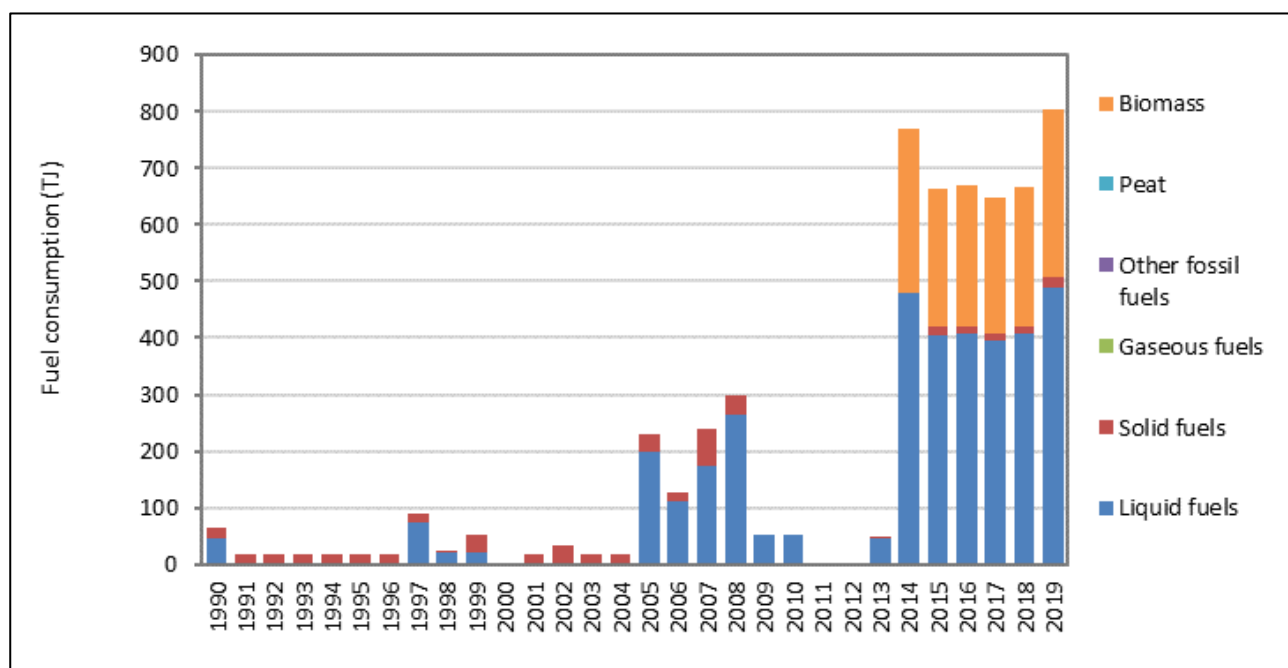


Figure 3.30 Activity data for sub-category 1.A.2.e Food Processing, Beverages and Tobacco

Table 3.65 Activity data for sub-category 1.A.2.e Food Processing, Beverages and Tobacco

Activity data 1.A.1.e	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
1990	63.65	46.89	16.76	NO	NO	NO	IE
1991	16.76	IE	16.76	NO	NO	NO	IE
1992	16.76	IE	16.76	NO	NO	NO	IE
1993	16.76	IE	16.76	NO	NO	NO	IE
1994	16.76	IE	16.76	NO	NO	NO	IE
1995	16.76	IE	16.76	NO	NO	NO	IE
1996	16.77	IE	16.77	NO	NO	NO	IE
1997	89.65	72.89	16.76	NO	NO	NO	IE
1998	19.52	19.50	0.02	NO	NO	NO	IE
1999	53.02	19.50	33.52	NO	NO	NO	IE
2000	0.02	IE	0.02	NO	NO	NO	IE
2001	16.76	IE	16.76	NO	NO	NO	IE
2002	33.51	IE	33.51	NO	NO	NO	IE
2003	16.75	IE	16.75	NO	NO	NO	IE
2004	16.75	IE	16.75	NO	NO	NO	IE
2005	231.26	197.76	33.50	NO	NO	NO	IE
2006	127.99	111.24	16.75	NO	NO	NO	IE
2007	240.04	173.04	67.00	NO	NO	NO	IE
2008	298.75	265.25	33.50	NO	NO	NO	IE
2009	53.56	53.56	IE	NO	NO	NO	IE

Activity data 1.A.1.e	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
2010	53.56	53.56	IE	NO	NO	NO	IE
2011	IE	IE	IE	NO	NO	NO	IE
2012	0.02	IE	0.02	NO	NO	NO	IE
2013	46.90	46.89	0.01	NO	NO	NO	IE
2014	767.97	479.17	0.03	NO	NO	NO	288.76
2015	664.88	403.01	18.44	NO	NO	NO	243.43
2016	668.27	407.28	13.42	NO	NO	NO	247.57
2017	647.51	394.20	13.42	NO	NO	NO	239.89
2018	667.80	407.28	13.42	NO	NO	NO	247.10
2019	802.74	489.19	16.78	NO	NO	NO	296.76
<i>Trend</i>							
1990 – 2019	1 161.2%	943.3%	0.1%	NA	NA	NA	NA
2005 – 2019	247.1%	147.4%	-49.9%	NA	NA	NA	NA
2018 – 2019	20.2%	20.1%	25.0%	NA	NA	NA	20.1%

In energy statistics, production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units, e.g. in tonnes or cubic metres. To convert these data to energy units, in this case terajoules, requires calorific values. The emission calculations are based on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in sub-category 1.A.2.e Food Processing, Beverages and Tobacco.

**Table 3.66 Net calorific values (NCVs) applied for conversion to energy units in sub-category 1.A.2.e Food Processing, Beverages and Tobacco**

Fuel	Fuel type	Net calorific value (NCV) (TJ/Gg) or *(TJ/m3)		Source	
		NCV	type		
Gas/Diesel Oil	liquid	42.71	CS	Statistical Office of Montenegro (MONSTAT)	
Residual fuel oil	liquid	41.20	CS		
Liquefied Petroleum Gases (LPG)	liquid	46.89	CS		
Petroleum Coke	liquid	40.19	CS		
Sub-Bituminous Coal	solid	16.75	CS		
Lignite	solid	9.21	CS		
Charcoal	biomass	29.30	CS		
Wood / Fuelwood	biomass	9.18*	CS		
Wood pellets	biomass	16.85	CS		
Note:					
D	Default	CS	Country specific	PS	Plant specific

### 3.1.3.5.2.3 Choice of emission factors

Default emission factors for air pollutant were taken from the EMEP/EEA air pollutant emission inventory Guidebook 2019 and are presented in the following table.

**Table 3.67 Emission factors (EF) for Main pollutants, Particulate Matter (PM), Heavy metals (HM) and Persistent Organic Pollutants (POPs) for sub-category 1.A.2.e Food Processing, Beverages and Tobacco**

Fuel Type	UNIT	Solid Fuels		Liquid fuels		Biomass	
Associated fuel types		Sub-Bituminous Coal Lignite		Gas/Diesel Oil Residual fuel oil Liquefied Petroleum Gases (LPG) Petroleum Coke		Charcoal Wood / Fuelwood Wood pellets	
Pollutant		EF	type	EF	type	EF	type
NOx	g/GJ	173	D	513.0	D	91	D
CO	g/GJ	931	D	66	D	570	D
NMVOC	g/GJ	88.8	D	25	D	300	D
SOx	g/GJ	900	D	47	D	11	D
TSP	g/GJ	124	D	20	D	1.2	D
NH3	g/GJ	NE		NE		150	D
PM10	g/GJ	117	D	20	D	143	D
PM2.5	g/GJ	108	D	20	D	140	D
BC	% of PM2.5	6.4	D	56	D	28	D
Pb	mg/GJ	134	D	0.08	D	27	D
Cd	mg/GJ	1.8	D	0.006	D	13	D
Hg	mg/GJ	7.9	D	0.12	D	0.56	D
As	mg/GJ	4	D	0.03	D	0.19	D
Cr	mg/GJ	13.5	D	0.2	D	23	D
Cu	mg/GJ	17.5	D	0.22	D	6	D
Ni	mg/GJ	13	D	0.008	D	2	D
Se	mg/GJ	1.8	D	0.11	D	0.5	D
Zn	mg/GJ	200	D	29	D	512	D
PCB	ng WHO-TEG/GJ	170	D	NE	D	0.06	D
PCDD/F	ng I-TEQ/GJ	203	D	1.4	D	100	D
Benzo(a)pyrene	µg/GJ	45.5	D	0.0019	D	0.01	D
Benzo(b)fluoranthene	µg/GJ	58.9	D	0.015	D	0.016	D
Benzo(k)fluoranthene	µg/GJ	23.7	D	0.0017	D	0.005	D
Indeno(1,2,3-cd)pyrene	µg/GJ	18.5	D	0.0015	D	0.004	D
HCB	µg/GJ	0.62	D	NE	D	5	D
Source		Table 3.2, section 3.4, page 15.		Table 3.3, section 3.4, page 16.		Table 3.5, section 3.4, page 17.	
		EMEP/EEA air pollutant emission inventory guidebook 2019, Part B, Chapter 1.A.2 Manufacturing industries and construction (combustion).					
Note:							
D	Default	CS	Country specific	PS	Plant specific	IEF	Implied emission factor

### 3.1.3.5.3 Uncertainties and time-series consistency

The uncertainties for activity data and emission factors used for IPCC/NFR category 1.A.2.e Food Processing, Beverages and Tobacco are presented in the following table.

**Table 3.68 Uncertainty for sub-category 1.A.2.e Food Processing, Beverages and Tobacco .**

Uncertainty	Hard Coal	Brown Coal	Gaseous fuels	Heavy Fuel Oil	Gas oil	Biomass	Reference
Activity data (AD)	3%	3%	5%	5%	5%	15%	Table 2.15, 2006 IPCC GL, Vol. 2, Chap. 2 (2.4.2)
Emission factor (EF)	Rating	Typical error range		Average		Reference	
NO <sub>x</sub>	B	20% to 60%		40%		Table 2 2 Rating definitions Table 2 3 Main NFR source categories with applicable quality data ratings EMEP EEA GB 2019, Part A, Chapter 5 Uncertainties.	
CO	C	50% to 200%		125%			
NM VOC	D	100% to 300%		200%			
SO <sub>x</sub>	A	10% to 30%		20%			
NH <sub>3</sub>	E	order of magnitude		750%			
TSP, PM <sub>10</sub> , PM <sub>2.5</sub> , BC	C	50% to 200%		125%			
Hg	B	20% to 60%		40%			
Pb, Cd, As, Cr, Cu, Ni, Se, Zn	C	50% to 200%		125%			
PCDD/F	E	order of magnitude		750%			
PAH (Benzo(a)pyrene, Benzo(b)-fluoranthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene)	C	50% to 200%		125%			
HCB, PCBs	D	100% to 300%		200%			

The time-series are considered to be consistent as the same methodology is applied to the whole period. Activity data are considered to be consistent as national and international data were always compared.

### 3.1.3.5.4 Source-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
  - consistent use of energy balance data (energy statistic questionnaires),
  - documented sources,
  - use of units,
  - strictly defined interfaces between spreadsheets/calculation modules,
  - unique structure of sheets which do the same,
  - record keeping, use of write protection,
  - unique use of formulas, special cases are documented/highlighted,
  - quick-control checks for data consistency through all steps of calculation.
- cross-checked from two sources: national statistic, Eurostat and international energy statistics of UN
- cross checks with other relevant sectors are performed to avoid double counting or omissions;
- time series consistency - plausibility checks of dips and jumps.

### 3.1.3.5.5 Source-specific recalculations

The following table presents the main revisions and recalculations done since the last submission in 2020 and relevant to sub-category 1.A.2.e Food Processing, Beverages and Tobacco .

**Table 3.69 Recalculations done in sub-category 1.A.2.e Food Processing, Beverages and Tobacco**

source category	Revisions of data	Type of revision	Type of improvement
1.A.2.e	application of EMEP/EEA air pollutant emission inventory guidebook 2019	method	Comparability
1.A.2.e	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019	EF	Comparability
1.A.2.e	use of CS NCV	AD	Accuracy
1.A.2.e	Fuel consumption data (activity data) was revised due to revised fuel consumption data – plant specific data	AD	Accuracy

### 3.1.3.5.6 Source-specific planned improvements

Considering the potential contribution of identified improvements in the total emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

**Table 3.70 Planned improvements for sub-category 1.A.2.e Food Processing, Beverages and Tobacco**

source category	Planned improvement	Type of improvement		Priority
1.A.2.e	Sulphur content in used fuel for preparing country specific emission factor (CS EF) $\Rightarrow \text{CS EF}_{\text{SO}_2} [\text{g/GJ}] = (\text{S} [\%] \cdot 20000) / (\text{NCV} [\text{GJ/t}])$	EF	Accuracy Transparency	Medium
1.A.2.e	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF	Accuracy Transparency	Medium
1.A.2.e	Data obtained from measurements made on the emission of air pollutants <ul style="list-style-type: none"> <li>Determination of the <ul style="list-style-type: none"> <li>temperature in waste gases [°C];</li> <li>static pressure and the dynamic pressure [kPa];</li> <li>flow rate [m/s];</li> <li>volume flow rate [m³/h and Nm³/h];</li> <li>concentration of CO, SO<sub>2</sub>, NO<sub>x</sub> in the exhaust gases [mg/Nm³]; and</li> <li>Gravimetric extraction of solid particles (TSP) from gases and determination by applying a gravimetric method (mg/Nm³).</li> </ul> </li> </ul>	EF	Accuracy Transparency	Medium
1.A.2.e	Improvement of time series consistency and split of fuels: the energy statistics is still under development; a split of the fuel combustion for this subcategory has to be reviewed for the entire timeseries. Emissions are allocated in IPCC subcategory 1.A.2.m Other.	AD	Accuracy Transparency	High



### 3.1.3.6 Non-Metallic Minerals (IPCC/NFR category 1.A.2.f)

#### 3.1.3.6.1 Source category description

This section describes emissions resulting from fuel combustion activities in *Manufacturing Industries and Construction -Non-Metallic Minerals-*. The subcategory 1.A.2.f *Non-Metallic Minerals* includes

- Manufacture of lime
- Cutting, shaping and finishing of stones

**Table 3.71 Overview on reported emissions from sub categories 1.A.2.f Non-Metallic Minerals**

Air pollutants	1.A.2.f						Key Category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
NO <sub>x</sub>	✓	✓	NO	NO	NO	✓	-
CO	✓	✓	NO	NO	NO	✓	-
NM VOC	✓	✓	NO	NO	NO	✓	-
SO <sub>x</sub>	✓	✓	NO	NO	NO	✓	-
NH <sub>3</sub>	NO	NO	NO	NO	NO	✓	-
TSP	✓	✓	NO	NO	NO	✓	-
PM <sub>10</sub>	✓	✓	NO	NO	NO	✓	-
PM <sub>2.5</sub>	✓	✓	NO	NO	NO	✓	-
BC	✓	✓	NO	NO	NO	✓	-
Pb	✓	✓	NO	NO	NO	✓	-
Cd	✓	✓	NO	NO	NO	✓	-
Hg	✓	✓	NO	NO	NO	✓	-
As	✓	✓	NO	NO	NO	✓	-
Cr	✓	✓	NO	NO	NO	✓	-
Cu	✓	✓	NO	NO	NO	✓	-
Ni	✓	✓	NO	NO	NO	✓	-
Se	✓	✓	NO	NO	NO	✓	-
Zn	✓	✓	NO	NO	NO	✓	-
PCB	✓	✓	NO	NO	NO	✓	-
PCDD/F	✓	✓	NO	NO	NO	✓	-
PAH	✓	✓	NO	NO	NO	✓	-
Benzo(a)pyrene	✓	✓	NO	NO	NO	✓	-
Benzo(b)fluoranthene	✓	✓	NO	NO	NO	✓	-
Benzo(k)fluoranthene	✓	✓	NO	NO	NO	✓	-
Indeno(1,2,3-cd)pyrene	✓	✓	NO	NO	NO	✓	-
HCB	✓	✓	NO	NO	NO	✓	-
A '✓' indicates: emissions from this sub-category have been estimated.							
Notation keys: IE - included elsewhere, NO – not occurrent, NE - not estimated, NA - not applicable, C – confidential							
LA XX - Level Assessment in year XX							
TA XX - Trend Assessment in year XX							

An overview of the emission from fuel combustion in Sub-category 1.A.2.f *Non-Metallic Minerals* is provided in the following figures and tables:

- annual emissions of air pollutants;
- Trend of the periods 1990 – 2019, 2005 – 2019, 2017 – 2019.

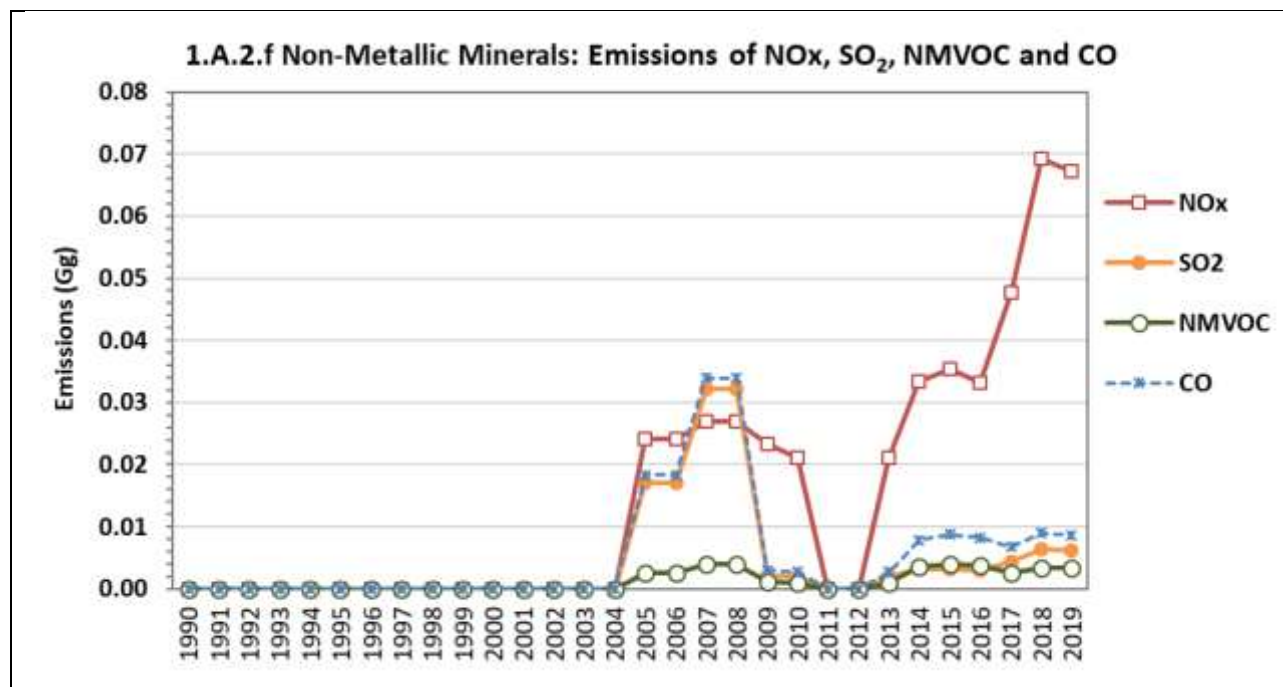


Figure 3.31 Emissions of main pollutants (NOx, SO<sub>2</sub>, NMVOC and CO) from sub-category 1.A.2.f Non-Metallic Minerals

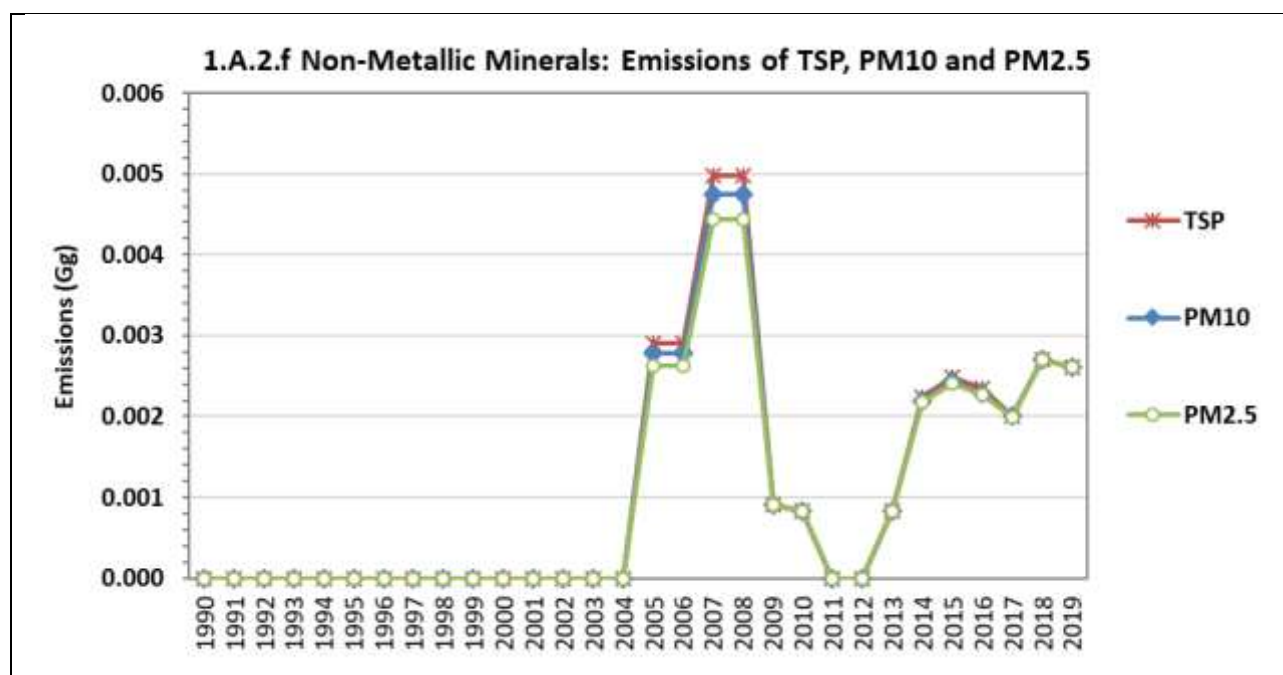


Figure 3.32 Emissions of TSP PM10 and PM2.5 from sub-category 1.A.2.f Non-Metallic Minerals

Table 3.72 Emissions of main pollutants (NO<sub>x</sub>, SO<sub>2</sub>, NMVOC and CO) from sub-category 1.A.2.f Non-Metallic Minerals

Emissions	NO <sub>x</sub>	NMVOC	SO <sub>x</sub>	CO	NH <sub>3</sub>
	Gg	Gg	Gg	Gg	Gg
1990	IE	IE	IE	IE	IE
1991	IE	IE	IE	IE	IE
1992	IE	IE	IE	IE	IE
1993	IE	IE	IE	IE	IE
1994	IE	IE	IE	IE	IE
1995	IE	IE	IE	IE	IE
1996	IE	IE	IE	IE	IE
1997	IE	IE	IE	IE	IE
1998	IE	IE	IE	IE	IE
1999	IE	IE	IE	IE	IE
2000	IE	IE	IE	IE	IE
2001	IE	IE	IE	IE	IE
2002	IE	IE	IE	IE	IE
2003	IE	IE	IE	IE	IE
2004	IE	IE	IE	IE	IE
2005	0.024	0.003	0.017	0.018	IE
2006	0.024	0.003	0.017	0.018	IE
2007	0.027	0.004	0.032	0.034	IE
2008	0.027	0.004	0.032	0.034	IE
2009	0.023	0.001	0.002	0.003	IE
2010	0.021	0.001	0.002	0.003	IE
2011	IE	IE	IE	IE	IE
2012	IE	IE	IE	IE	IE
2013	0.021	0.001	0.002	0.003	IE
2014	0.033	0.004	0.003	0.008	<0.001
2015	0.035	0.004	0.003	0.009	<0.001
2016	0.033	0.004	0.003	0.008	<0.001
2017	0.048	0.003	0.004	0.007	<0.001
2018	0.069	0.003	0.006	0.009	IE
2019	0.067	0.003	0.006	0.009	IE
<i>Trend</i>					
1990 – 2019	NA	NA	NA	NA	NA
2005 – 2019	179.4%	30.0%	-63.8%	-52.8%	NA
2018 – 2019	-3.2%	-3.2%	-3.2%	-3.2%	NA

Table 3.73 Emissions of particulate matter (PM) from sub-category 1.A.2.f Non-Metallic Minerals

Emissions	PM2.5	PM10	TSP	BC
	Gg	Gg	Gg	Gg
1990	IE	IE	IE	IE
1991	IE	IE	IE	IE
1992	IE	IE	IE	IE
1993	IE	IE	IE	IE
1994	IE	IE	IE	IE
1995	IE	IE	IE	IE
1996	IE	IE	IE	IE
1997	IE	IE	IE	IE
1998	IE	IE	IE	IE
1999	IE	IE	IE	IE
2000	IE	IE	IE	IE
2001	IE	IE	IE	IE
2002	IE	IE	IE	IE
2003	IE	IE	IE	IE
2004	IE	IE	IE	IE
2005	0.003	0.003	0.003	IE
2006	0.003	0.003	0.003	IE
2007	0.004	0.005	0.005	IE
2008	0.004	0.005	0.005	IE
2009	0.001	0.001	0.001	IE
2010	0.001	0.001	0.001	IE
2011	IE	IE	IE	IE
2012	IE	IE	IE	IE
2013	0.001	0.001	0.001	IE
2014	0.002	0.002	0.002	0.006
2015	0.002	0.002	0.002	0.006
2016	0.002	0.002	0.002	0.006
2017	0.002	0.002	0.002	IE
2018	0.003	0.003	0.003	IE
2019	0.003	0.003	0.003	IE
<i>Trend</i>				
1990 – 2019	NA	NA	NA	NA
2005 – 2019	-0.6%	-6.0%	-9.8%	NA
2018 – 2019	-3.2%	-3.2%	-3.2%	NA

**Table 3.74 Emissions of Heavy Metals (HM) from sub-category 1.A.2.f Non-Metallic Minerals**

Emissions	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
	kg	kg	kg	kg	kg	kg	kg	kg	kg
1990	IE	IE	IE	IE	IE	IE	IE	IE	IE
1991	IE	IE	IE	IE	IE	IE	IE	IE	IE
1992	IE	IE	IE	IE	IE	IE	IE	IE	IE
1993	IE	IE	IE	IE	IE	IE	IE	IE	IE
1994	IE	IE	IE	IE	IE	IE	IE	IE	IE
1995	IE	IE	IE	IE	IE	IE	IE	IE	IE
1996	IE	IE	IE	IE	IE	IE	IE	IE	IE
1997	IE	IE	IE	IE	IE	IE	IE	IE	IE
1998	IE	IE	IE	IE	IE	IE	IE	IE	IE
1999	IE	IE	IE	IE	IE	IE	IE	IE	IE
2000	IE	IE	IE	IE	IE	IE	IE	IE	IE
2001	IE	IE	IE	IE	IE	IE	IE	IE	IE
2002	IE	IE	IE	IE	IE	IE	IE	IE	IE
2003	IE	IE	IE	IE	IE	IE	IE	IE	IE
2004	IE	IE	IE	IE	IE	IE	IE	IE	IE
2005	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.005
2006	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.005
2007	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.008
2008	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.008
2009	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
2010	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
2011	IE	IE	IE	IE	IE	IE	IE	IE	IE
2012	IE	IE	IE	IE	IE	IE	IE	IE	IE
2013	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
2014	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.005
2015	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.006
2016	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.006
2017	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003
2018	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004
2019	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004
<i>Trend</i>									
1990 – 2019	NA	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2019	-99.5%	-97.4%	-88.6%	-94.2%	-88.8%	-90.5%	-99.5%	-58.5%	-16.5%
2018 – 2019	-3.2%	-3.2%	-3.2%	-3.2%	-3.2%	-3.2%	-3.2%	-3.2%	-3.2%

**Table 3.75 Emissions of Persistent Organic Pollutants (POPs) from sub-category 1.A.2.f Non-Metallic Minerals**

Emissions	PCDD/F	Benzo(a)-pyrene	Benzo(b)-fluoranthene	Benzo(k)-fluor-anthene	Indeno (1,2,3-cd) pyrene	Total PAH	HCB	PCB
	g I-TEQ	Mg	Mg	Mg	Mg	Mg	kg	Kg
1990	IE	IE	IE	NA	IE	IE	IE	IE
1991	IE	IE	IE	NA	IE	IE	IE	IE
1992	IE	IE	IE	NA	IE	IE	IE	IE
1993	IE	IE	IE	NA	IE	IE	IE	IE
1994	IE	IE	IE	NA	IE	IE	IE	IE
1995	IE	IE	IE	NA	IE	IE	IE	IE
1996	IE	IE	IE	NA	IE	IE	IE	IE
1997	IE	IE	IE	NA	IE	IE	IE	IE
1998	IE	IE	IE	NA	IE	IE	IE	IE
1999	IE	IE	IE	NA	IE	IE	IE	IE
2000	IE	IE	IE	NA	IE	IE	IE	IE
2001	IE	IE	IE	NA	IE	IE	IE	IE
2002	IE	IE	IE	NA	IE	IE	IE	IE
2003	IE	IE	IE	NA	IE	IE	IE	IE
2004	IE	IE	IE	NA	IE	IE	IE	IE
2005	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	0.003
2006	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	0.003
2007	<0.001	<0.001	<0.001	NA	0.001	0.001	0.000	0.006
2008	<0.001	<0.001	<0.001	NA	0.001	0.001	0.000	0.006
2009	<0.001	<0.001	<0.001	NA	<0.001	<0.001	IE	IE
2010	<0.001	<0.001	<0.001	NA	<0.001	<0.001	IE	IE
2011	IE	IE	IE	NA	IE	IE	IE	IE
2012	IE	IE	IE	NA	IE	IE	IE	IE
2013	<0.001	<0.001	<0.001	NA	<0.001	<0.001	IE	IE
2014	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2015	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2016	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2017	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2018	<0.001	<0.001	<0.001	NA	<0.001	<0.001	IE	IE
2019	<0.001	<0.001	<0.001	NA	<0.001	<0.001	IE	IE
<i>Trend</i>								
1990 – 2019	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2019	-94.7%	-99.9%	-99.8%	NA	-99.9%	-99.9%	NA	NA
2018 – 2019	-3.2%	-3.2%	-3.2%	NA	-3.2%	-3.2%	NA	NA

### 3.1.3.6.2 Methodological issues

#### 3.1.3.6.2.1 Choice of methods

For estimating the air pollutants emissions the Tier 1 approach<sup>38</sup> of the EMEP/EEA air pollutant emission inventory guidebook 2019 has been applied:

*Equation: emissions from stationary combustion*

$$Emissions_{pollutant} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{pollutant, fuel}$$

Where:

Emissions <sub>pollutant</sub>	= emissions of a given pollutant by type of fuel (kg pollutant)
Fuel consumption <sub>fuel</sub>	= amount of fuel combusted (TJ)
Emission factor <sub>pollutant, fuel</sub>	= default emission factor of a given pollutant by type of fuel (g <sub>pollutant</sub> /GJ).
Pollutant	= main pollutants: NO <sub>x</sub> , CO, NMVOC, SO <sub>2</sub> particulate matter: TSP, OM10, PM2.5, BC heavy metals: Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn persistent organic pollutants: PCDD/F, Benzo(a) pyrene, Benzo(b)fluor, anthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene, Total PAH, HCB, PCB
Fuel	= liquid fuels, solid fuels, gaseous fuels, other fossil fuel, biomass, peat

#### 3.1.3.6.2.2 Choice of activity data

The following fuels are used for electricity and heat production (autoproducer):

Tier 1 fuel type	Associated fuel types	Source
<b>Liquid fuels</b>	<ul style="list-style-type: none"> <li>Residual fuel oil</li> <li>Gas/Diesel Oil</li> <li>Liquefied Petroleum Gases (LPG)</li> <li>Petroleum Coke</li> </ul>	Summary of fuel aggregations at Tier 1 according to EMEP/EEA air pollutant emission inventory guidebook 2019, Part B, Chapter 1.A.2,
<b>Solid fuels</b>	<ul style="list-style-type: none"> <li>Lignite</li> <li>Sub-Bituminous Coal</li> </ul>	
<b>Biomass</b>	<ul style="list-style-type: none"> <li>Wood / Fuelwood</li> <li>Wood pellets</li> <li>Charcoal</li> </ul>	

Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2019 were taken from prepared by Statistical Office of Montenegro (MONSTAT).

The total fuel consumption increased by 125.9% in the period 2005 – 2018. From 2018 to 2019 the total fuel consumption decreased by 3.2%.

<sup>38</sup> Source: EMEP/EEA air pollutant emission inventory guidebook 2019, 1.A.2 Manufacturing industries and construction (combustion), sub-chapter 3.2 Tier 1 default approach.

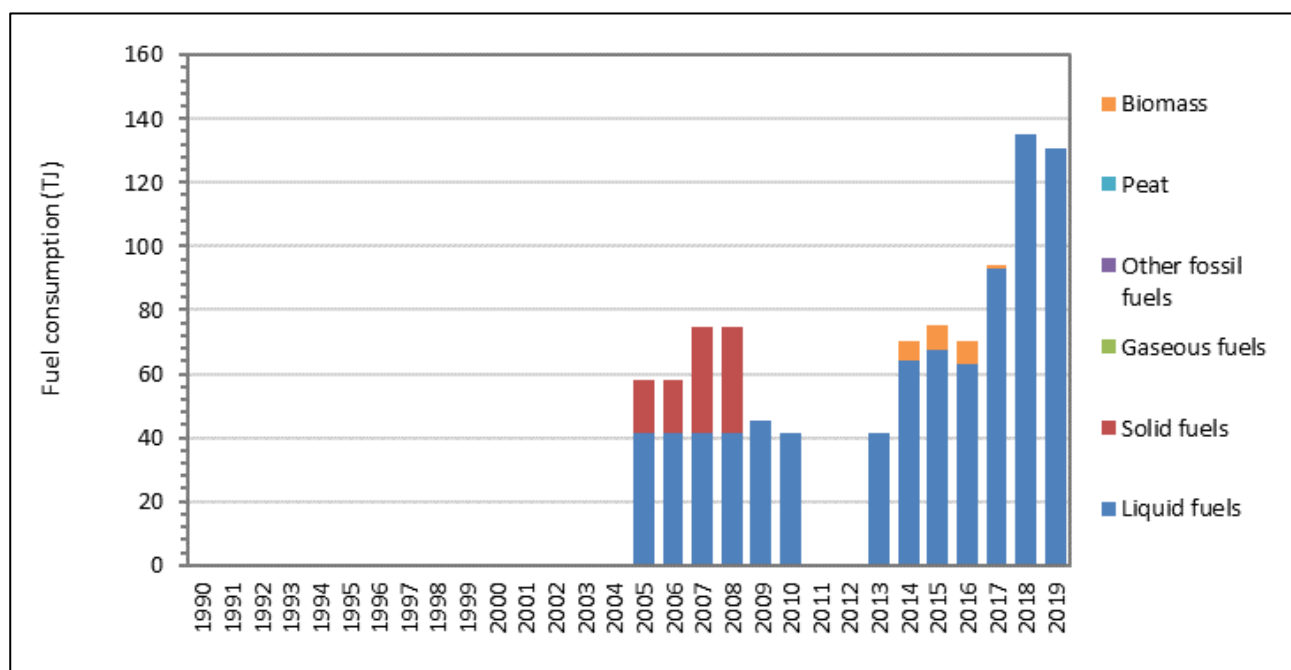


Figure 3.33 Activity data for sub-category 1.A.2.f Non-Metallic Minerals

Table 3.76 Activity data for sub-category 1.A.2.f Non-Metallic Minerals

Activity data 1.A.1.e	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
1990	IE	IE	NO	NO	NO	NO	IE
1991	IE	IE	NO	NO	NO	NO	IE
1992	IE	IE	NO	NO	NO	NO	IE
1993	IE	IE	NO	NO	NO	NO	IE
1994	IE	IE	NO	NO	NO	NO	IE
1995	IE	IE	NO	NO	NO	NO	IE
1996	IE	IE	NO	NO	NO	NO	IE
1997	IE	IE	NO	NO	NO	NO	IE
1998	IE	IE	NO	NO	NO	NO	IE
1999	IE	IE	NO	NO	NO	NO	IE
2000	IE	IE	NO	NO	NO	NO	IE
2001	IE	IE	NO	NO	NO	NO	IE
2002	IE	IE	NO	NO	NO	NO	IE
2003	IE	IE	NO	NO	NO	NO	IE
2004	IE	IE	NO	NO	NO	NO	IE
2005	57.95	41.20	16.75	NO	NO	NO	IE
2006	57.95	41.20	16.75	NO	NO	NO	IE
2007	74.70	41.20	33.50	NO	NO	NO	IE
2008	74.70	41.20	33.50	NO	NO	NO	IE
2009	45.32	45.32	NO	NO	NO	NO	IE



Activity data 1.A.1.e	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
2010	41.20	41.20	NO	NO	NO	NO	IE
2011	IE	IE	NO	NO	NO	NO	IE
2012	IE	IE	NO	NO	NO	NO	IE
2013	41.20	41.20	NO	NO	NO	NO	IE
2014	70.38	63.95	NO	NO	NO	NO	6.42
2015	75.18	67.58	NO	NO	NO	NO	7.60
2016	70.47	63.31	NO	NO	NO	NO	7.16
2017	93.90	92.91	NO	NO	NO	NO	1.00
2018	135.16	135.16	NO	NO	NO	NO	IE
2019	130.89	130.89	NO	NO	NO	NO	IE
<i>Trend</i>							
1990 – 2019	NA	NA	NA	NA	NA	NA	NA
2005 – 2019	125.9%	217.7%	NA	NA	NA	NA	NA
2018 – 2019	-3.2%	-3.2%	NA	NA	NA	NA	NA

In energy statistics, production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units, e.g. in tonnes or cubic metres. To convert these data to energy units, in this case terajoules, requires calorific values. The emission calculations are based on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in sub-category 1.A.2.f Non-Metallic Minerals.

**Table 3.77 Net calorific values (NCVs) applied for conversion to energy units in sub-category 1.A.2.f Non-Metallic Minerals**

Fuel	Fuel type	Net calorific value (NCV) (TJ/Gg) or *(TJ/m3)		Source	
		NCV	type		
Gas/Diesel Oil	liquid	42.71	CS	Statistical Office of Montenegro (MONSTAT)	
Residual fuel oil	liquid	41.20	CS		
Liquefied Petroleum Gases (LPG)	liquid	46.89	CS		
Petroleum Coke	liquid	40.19	CS		
Sub-Bituminous Coal	solid	16.75	CS		
Lignite	solid	9.21	CS		
Charcoal	biomass	29.30	CS		
Wood / Fuelwood	biomass	9.18*	CS		
Wood pellets	biomass	16.85	CS		
Note:					
D	Default	CS	Country specific	PS	Plant specific

### 3.1.3.6.2.3 Choice of emission factors

Default emission factors for air pollutant were taken from the EMEP/EEA air pollutant emission inventory Guidebook 2019 and are presented in the following table.

**Table 3.78 Emission factors (EF) for Main pollutants, Particulate Matter (PM), Heavy metals (HM) and Persistent Organic Pollutants (POPs) for sub-category 1.A.2.f Non-Metallic Minerals**

Fuel Type	UNIT	Solid Fuels		Liquid fuels		Biomass	
Associated fuel types		Sub-Bituminous Coal Lignite		Gas/Diesel Oil Residual fuel oil Liquefied Petroleum Gases (LPG) Petroleum Coke		Charcoal Wood / Fuelwood Wood pellets	
Pollutant		EF	type	EF	type	EF	type
NOx	g/GJ	173	D	513.0	D	91	D
CO	g/GJ	931	D	66	D	570	D
NM VOC	g/GJ	88.8	D	25	D	300	D
SOx	g/GJ	900	D	47	D	11	D
TSP	g/GJ	124	D	20	D	1.2	D
NH3	g/GJ	NE		NE		150	D
PM10	g/GJ	117	D	20	D	143	D
PM2.5	g/GJ	108	D	20	D	140	D
BC	% of PM2.5	6.4	D	56	D	28	D
Pb	mg/GJ	134	D	0.08	D	27	D
Cd	mg/GJ	1.8	D	0.006	D	13	D
Hg	mg/GJ	7.9	D	0.12	D	0.56	D
As	mg/GJ	4	D	0.03	D	0.19	D
Cr	mg/GJ	13.5	D	0.2	D	23	D
Cu	mg/GJ	17.5	D	0.22	D	6	D
Ni	mg/GJ	13	D	0.008	D	2	D
Se	mg/GJ	1.8	D	0.11	D	0.5	D
Zn	mg/GJ	200	D	29	D	512	D
PCB	ng WHO-TEG/GJ	170	D	NE	D	0.06	D
PCDD/F	ng I-TEQ/GJ	203	D	1.4	D	100	D
Benzo(a)pyrene	µg/GJ	45.5	D	0.0019	D	0.01	D
Benzo(b)fluoranthene	µg/GJ	58.9	D	0.015	D	0.016	D
Benzo(k)fluoranthene	µg/GJ	23.7	D	0.0017	D	0.005	D
Indeno(1,2,3-cd)pyrene	µg/GJ	18.5	D	0.0015	D	0.004	D
HCB	µg/GJ	0.62	D	NE	D	5	D
Source		Table 3.2, section 3.4, page 15.		Table 3.3, section 3.4, page 16.		Table 3.5, section 3.4, page 17.	
		EMEP/EEA air pollutant emission inventory guidebook 2019, Part B, Chapter 1.A.2 Manufacturing industries and construction (combustion).					
Note:							
D	Default	CS	Country specific	PS	Plant specific	IEF	Implied emission factor

### 3.1.3.6.3 Uncertainties and time-series consistency

The uncertainties for activity data and emission factors used for IPCC/NFR category 1.A.2.f Non-Metallic Minerals are presented in the following table.

**Table 3.79 Uncertainty for sub-category 1.A.2.f Non-Metallic Minerals .**

Uncertainty	Hard Coal	Brown Coal	Gaseous fuels	Heavy Fuel Oil	Gas oil	Biomass	Reference
Activity data (AD)	3%	3%	5%	5%	5%	15%	Table 2.15, 2006 IPCC GL, Vol. 2, Chap. 2 (2.4.2)
Emission factor (EF)	Rating	Typical error range		Average		Reference	
NO <sub>x</sub>	B	20% to 60%		40%		Table 2 2 Rating definitions Table 2 3 Main NFR source categories with applicable quality data ratings EMEP EEA GB 2019, Part A, Chapter 5 Uncertainties.	
CO	C	50% to 200%		125%			
NM VOC	D	100% to 300%		200%			
SO <sub>x</sub>	A	10% to 30%		20%			
NH <sub>3</sub>	E	order of magnitude		750%			
TSP, PM <sub>10</sub> , PM <sub>2.5</sub> , BC	C	50% to 200%		125%			
Hg	B	20% to 60%		40%			
Pb, Cd, As, Cr, Cu, Ni, Se, Zn	C	50% to 200%		125%			
PCDD/F	E	order of magnitude		750%			
PAH (Benzo(a)pyrene, Benzo(b)-fluoranthene, Benzo(k)fluor-anthene, Indeno(1,2,3-cd)pyrene)	C	50% to 200%		125%			
HCB, PCBs	D	100% to 300%		200%			

The time-series are considered to be consistent as the same methodology is applied to the whole period. Activity data are considered to be consistent as national and international data were always compared.

### 3.1.3.6.4 Source-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
  - consistent use of energy balance data (energy statistic questionnaires),
  - documented sources,
  - use of units,
  - strictly defined interfaces between spreadsheets/calculation modules,
  - unique structure of sheets which do the same,
  - record keeping, use of write protection,
  - unique use of formulas, special cases are documented/highlighted,
  - quick-control checks for data consistency through all steps of calculation.
- cross-checked from two sources: national statistic, Eurostat and international energy statistics of UN
- cross checks with other relevant sectors are performed to avoid double counting or omissions;
- time series consistency - plausibility checks of dips and jumps.

### 3.1.3.6.5 Source-specific recalculations

The following table presents the main revisions and recalculations done since the last submission in 2020 and relevant to sub-category 1.A.2.f Non-Metallic Minerals .

**Table 3.80 Recalculations done in sub-category 1.A.2.f Non-Metallic Minerals**

source category	Revisions of data	Type of revision	Type of improvement
1.A.2.f	application of EMEP/EEA air pollutant emission inventory guidebook 2019	method	Comparability
1.A.2.f	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019	EF	Comparability
1.A.2.f	use of CS NCV	AD	Accuracy
1.A.2.f	Fuel consumption data (activity data) was revised due to revised fuel consumption data – plant specific data	AD	Accuracy

### 3.1.3.6.6 Source-specific planned improvements

Considering the potential contribution of identified improvements in the total emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

**Table 3.81 Planned improvements for sub-category 1.A.2.f Non-Metallic Minerals**

source category	Planned improvement	Type of improvement		Priority
1.A.2.f	Sulphur content in used fuel for preparing country specific emission factor (CS EF) $\Rightarrow \text{CS EF}_{\text{SO}_2} [\text{g/GJ}] = (\text{S} [\%] \cdot 20000) / (\text{NCV} [\text{GJ/t}])$	EF	Accuracy Transparency	Medium
1.A.2.f	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF	Accuracy Transparency	Medium
1.A.2.f	Data obtained from measurements made on the emission of air pollutants <ul style="list-style-type: none"> <li>Determination of the <ul style="list-style-type: none"> <li>temperature in waste gases [°C];</li> <li>static pressure and the dynamic pressure [kPa];</li> <li>flow rate [m/s];</li> <li>volume flow rate [m³/h and Nm³/h];</li> <li>concentration of CO, SO<sub>2</sub>, NO<sub>x</sub> in the exhaust gases [mg/Nm³]; and</li> <li>Gravimetric extraction of solid particles (TSP) from gases and determination by applying a gravimetric method (mg/Nm³).</li> </ul> </li> </ul>	EF	Accuracy Transparency	Medium
1.A.2.f	Improvement of time series consistency and split of fuels: the energy statistics is still under development; a split of the fuel combustion for this subcategory has to be reviewed for the entire timeseries. Emissions are allocated in IPCC subcategory 1.A.2.m Other.	AD	Accuracy Transparency	High

### 3.1.3.7 Other (IPCC/NFR category 1.A.2.g.viii)

#### 3.1.3.7.1 Source category description

This section describes emissions resulting from fuel combustion activities in *Manufacturing Industries and Construction -Other-*. The subcategory 1.A.2.g.viii *Other* includes the

- **1A2g.viii Stationary combustion in manufacturing industries and construction: Other**
  - Mining (excluding fuels) and Quarrying (IPCC/NFR category 1.A.2.i)
  - Wood and wood products (IPCC/NFR category 1.A.2.j)
  - Construction (IPCC/NFR category 1.A.2.k)
  - Textile and Leather (IPCC/NFR category 1.A.2.l)
  - Other (IPCC/NFR category 1.A.2.m)
- **1A2g.vii Mobile combustion in manufacturing industries and construction**
  - All mobile combustion in category 1.A.2 Manufacturing Industries and Construction

**Table 3.82 Overview on reported emissions from sub categories 1.A.2.g.viii Other**

Air pollutants	1.A.2.g.viii						Key Category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
NO <sub>x</sub>	✓	✓	✓	NO	NO	IE*	Trend 2018
CO	✓	✓	✓	NO	NO	IE*	-
NM VOC	✓	✓	✓	NO	NO	IE*	-
SO <sub>x</sub>	✓	✓	✓	NO	NO	IE*	Trend 2018
NH <sub>3</sub>	✓	✓	✓	NO	NO	IE*	-
TSP	✓	✓	✓	NO	NO	IE*	-
PM <sub>10</sub>	✓	✓	✓	NO	NO	IE*	-
PM <sub>2.5</sub>	✓	✓	✓	NO	NO	IE*	-
BC	✓	✓	✓	NO	NO	IE*	-
Pb	✓	✓	✓	NO	NO	IE*	-
Cd	✓	✓	✓	NO	NO	IE*	-
Hg	✓	✓	✓	NO	NO	IE*	-
As	✓	✓	✓	NO	NO	IE*	-
Cr	✓	✓	✓	NO	NO	IE*	-
Cu	✓	✓	✓	NO	NO	IE*	-
Ni	✓	✓	✓	NO	NO	IE*	-
Se	✓	✓	✓	NO	NO	IE*	-
Zn	✓	✓	✓	NO	NO	IE*	-
PCB	✓	✓	✓	NO	NO	IE*	-
PCDD/F	✓	✓	✓	NO	NO	IE*	-
PAH	✓	✓	✓	NO	NO	IE*	-
Benzo(a)pyrene	✓	✓	✓	NO	NO	IE*	-
Benzo(b)fluoranthene	✓	✓	✓	NO	NO	IE*	-
Benzo(k)fluoranthene	✓	✓	✓	NO	NO	IE*	-
Indeno(1,2,3-cd)pyrene	✓	✓	✓	NO	NO	IE*	-
HCB	✓	✓	✓	NO	NO	IE*	-

Air pollutants	1.A.2.g.viii						Key Category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
A '✓' indicates: emissions from this sub-category have been estimated.							
Notation keys: IE -included elsewhere, NO - not occurrent, NE -not estimated, NA -not applicable, C – confidential							
* data provided only in the period 2014-2016							
LA XX - Level Assessment in year XX							
TA XX - Trend Assessment in year XX							

#### Use of notation key

IE 1.A.2.g.viii The energy statistics is still under development; a split of the fuel combustion for this subcategory has to be reviewed for the entire timeseries. Emissions are currently allocated in IPCC subcategory 1.A.2.m *Other*.

(gaseous, biomass)

An overview of the emission from fuel combustion in Sub-category 1.A.2.g.viii *Other* is provided in the following figures and tables:

- annual emissions of air pollutants;
- Trend of the periods 1990 – 2019, 2005 – 2019, 2017 – 2019.

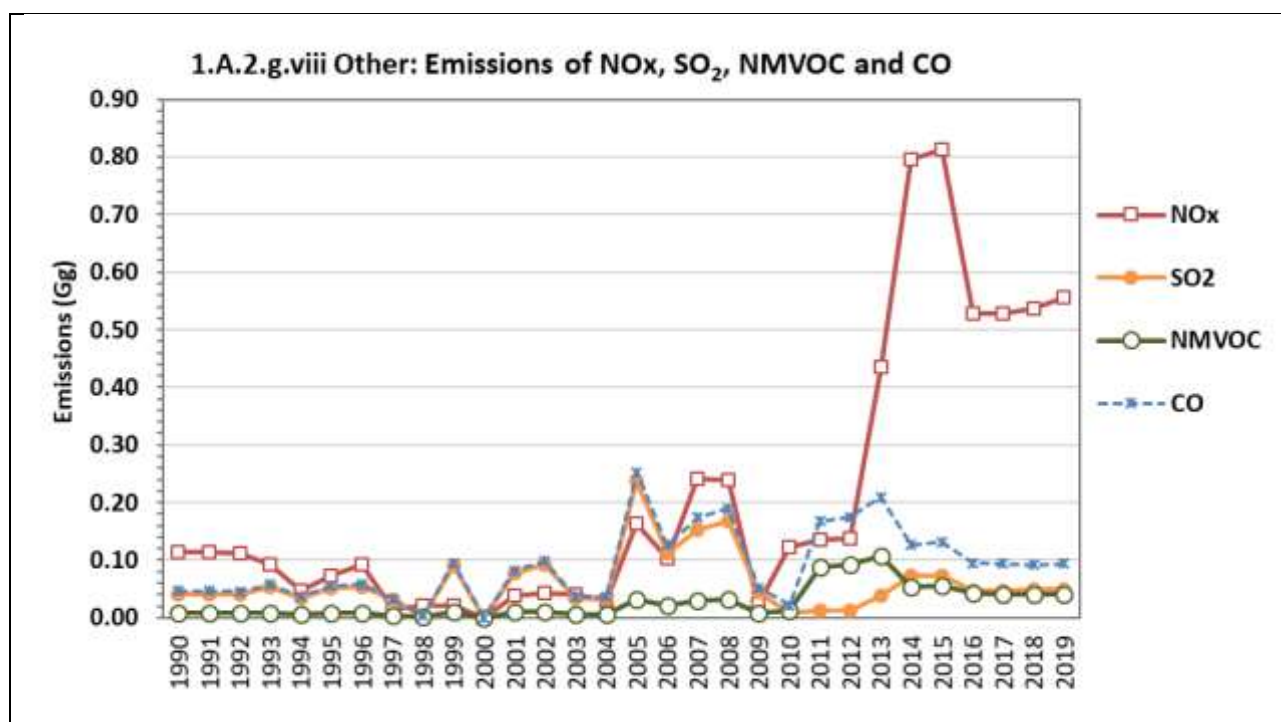


Figure 3.34 Emissions of main pollutants (NOx, SO2, NMVOC and CO) from sub-category 1.A.2.g.viii Other

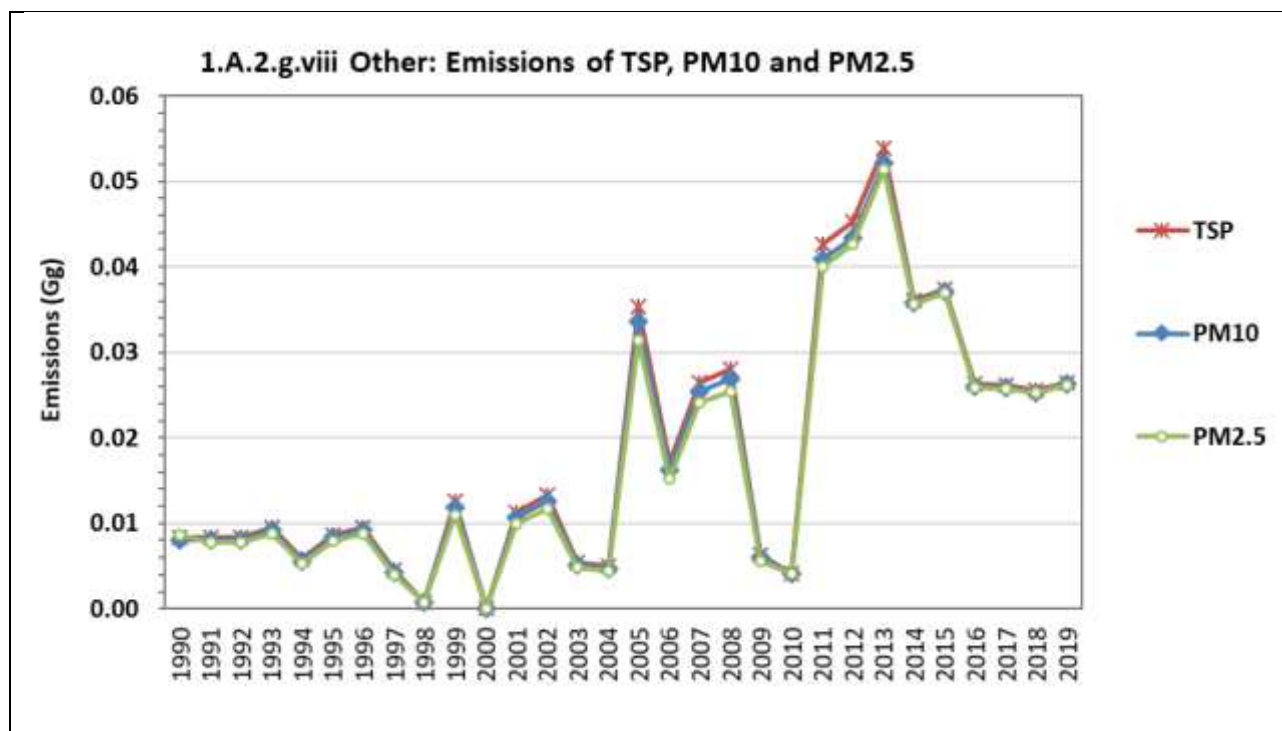


Figure 3.35 Emissions of TSP PM10 and PM2.5 from sub-category 1.A.2.g.viii Other

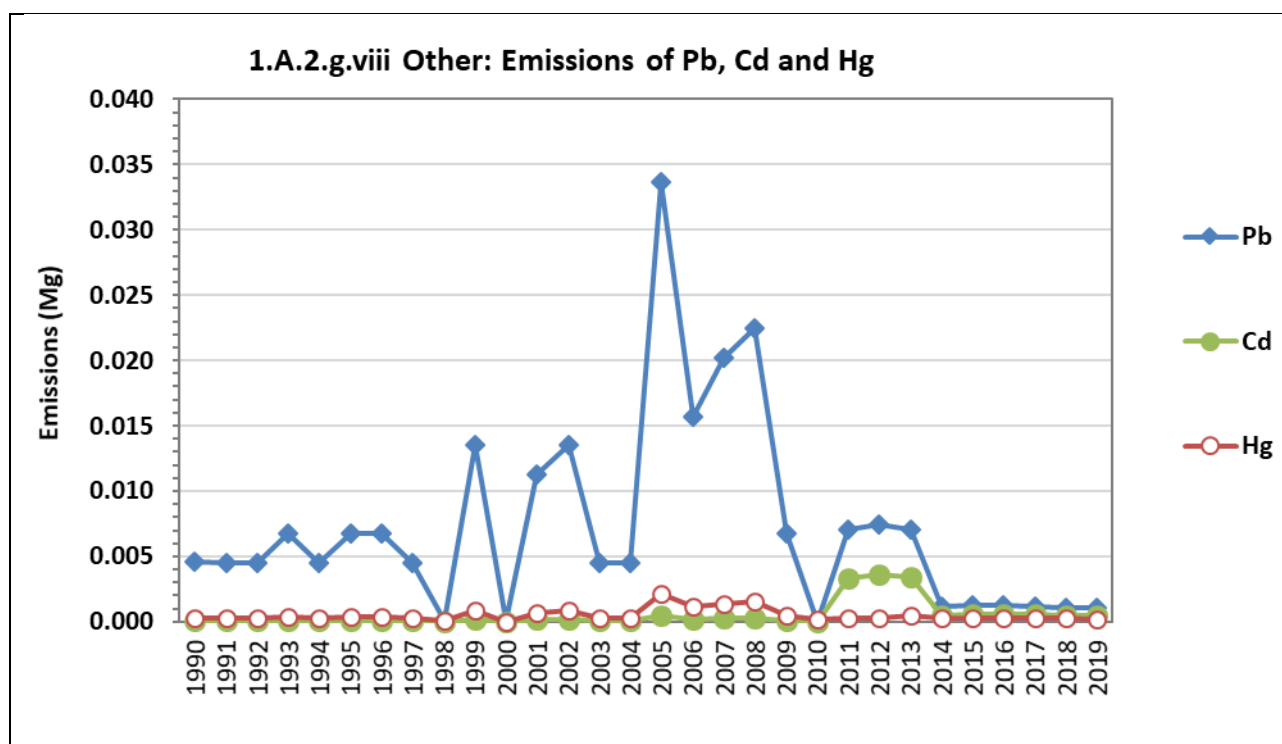


Figure 3.36 Emissions of Pb, Cd and Hg from sub-category 1.A.2.g.viii Other

**Table 3.83 Emissions of main pollutants (NO<sub>x</sub>, SO<sub>2</sub>, NMVOC and CO) from sub-category 1.A.2.g.viii Other**

Emissions	NO <sub>x</sub>	NMVOC	SO <sub>x</sub>	CO	NH <sub>3</sub>
	Gg	Gg	Gg	Gg	Gg
1990	0.115	0.009	0.040	0.046	IE
1991	0.115	0.009	0.040	0.046	IE
1992	0.112	0.008	0.040	0.045	IE
1993	0.093	0.009	0.053	0.058	IE
1994	0.048	0.005	0.034	0.037	IE
1995	0.072	0.008	0.051	0.055	IE
1996	0.093	0.009	0.053	0.058	IE
1997	0.014	0.003	0.031	0.033	IE
1998	0.020	0.002	0.002	0.004	IE
1999	0.021	0.010	0.091	0.095	IE
2000	0.000	0.000	0.000	0.000	IE
2001	0.039	0.010	0.078	0.082	IE
2002	0.042	0.011	0.093	0.098	IE
2003	0.041	0.006	0.033	0.037	IE
2004	0.030	0.005	0.032	0.035	IE
2005	0.163	0.032	0.236	0.253	IE
2006	0.104	0.021	0.111	0.126	IE
2007	0.241	0.029	0.154	0.174	IE
2008	0.238	0.032	0.168	0.190	IE
2009	0.023	0.009	0.045	0.052	IE
2010	0.123	0.012	0.009	0.022	IE
2011	0.136	0.089	0.011	0.168	0.010
2012	0.138	0.092	0.012	0.175	0.010
2013	0.436	0.107	0.038	0.210	0.010
2014	0.796	0.053	0.072	0.127	0.001
2015	0.533	0.042	0.048	0.096	0.002
2016	0.529	0.042	0.047	0.095	0.002
2017	0.529	0.041	0.047	0.094	0.001
2018	0.537	0.040	0.048	0.092	0.001
2019	0.557	0.040	0.050	0.094	0.001
<i>Trend</i>					
1990 – 2019	384.5%	336.9%	25.2%	102.5%	NA
2005 – 2019	241.8%	26.9%	-78.7%	-62.8%	NA
2018 – 2019	3.7%	1.1%	4.2%	2.3%	1.0%



Table 3.84 Emissions of particulate matter (PM) from sub-category 1.A.2.g.viii Other

Emissions	PM2.5	PM10	TSP	BC
	Gg	Gg	Gg	Gg
1990	0.009	0.008	0.008	<0.001
1991	0.008	0.008	0.008	<0.001
1992	0.008	0.008	0.008	<0.001
1993	0.009	0.009	0.010	<0.001
1994	0.005	0.006	0.006	<0.001
1995	0.008	0.008	0.009	<0.001
1996	0.009	0.009	0.010	<0.001
1997	0.004	0.004	0.005	<0.001
1998	0.001	0.001	0.001	<0.001
1999	0.011	0.012	0.013	<0.001
2000	0.000	0.000	0.000	<0.001
2001	0.010	0.011	0.011	<0.001
2002	0.012	0.013	0.013	<0.001
2003	0.005	0.005	0.005	<0.001
2004	0.004	0.005	0.005	<0.001
2005	0.031	0.034	0.035	<0.001
2006	0.015	0.016	0.017	<0.001
2007	0.024	0.025	0.026	IE
2008	0.025	0.027	0.028	IE
2009	0.006	0.006	0.006	<0.001
2010	0.004	0.004	0.004	<0.001
2011	0.040	0.041	0.043	0.232
2012	0.043	0.043	0.045	0.247
2013	0.051	0.052	0.054	0.232
2014	0.036	0.036	0.036	0.024
2015	0.026	0.026	0.027	0.028
2016	0.026	0.026	0.026	0.028
2017	0.026	0.026	0.026	0.027
2018	0.025	0.025	0.026	0.024
2019	0.026	0.026	0.026	0.025
<i>Trend</i>				
1990 – 2019	200.2%	223.6%	217.4%	6515.2%
2005 – 2019	-16.7%	-22.0%	-25.2%	37 386.0%
2018 – 2019	3.6%	3.5%	3.5%	4.2%

Table 3.85 Emissions of Heavy Metals (HM) from sub-category 1.A.2.g.viii Other

Emissions	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg
1990	0.005	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.013
1991	0.005	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.013
1992	0.005	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.013
1993	0.007	<0.001	<0.001	<0.001	0.001	0.001	0.001	<0.001	0.015
1994	0.005	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.009
1995	0.007	<0.001	<0.001	<0.001	0.001	0.001	0.001	<0.001	0.014
1996	0.007	<0.001	<0.001	<0.001	0.001	0.001	0.001	<0.001	0.015
1997	0.005	<0.001	<0.001	<0.001	0.000	0.001	0.000	<0.001	0.007
1998	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
1999	0.014	<0.001	0.001	<0.001	0.001	0.002	0.001	<0.001	0.020
2000	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2001	0.011	<0.001	0.001	<0.001	0.001	0.001	0.001	<0.001	0.018
2002	0.013	<0.001	0.001	<0.001	0.001	0.002	0.001	<0.001	0.021
2003	0.005	<0.001	<0.001	<0.001	<0.001	0.001	0.000	<0.001	0.009
2004	0.005	<0.001	<0.001	<0.001	<0.001	0.001	0.000	<0.001	0.008
2005	0.034	<0.001	0.002	0.001	0.003	0.004	0.003	<0.001	0.056
2006	0.016	<0.001	0.001	0.001	0.002	0.002	0.002	<0.001	0.027
2007	0.020	<0.001	0.001	0.001	0.002	0.003	0.002	<0.001	0.041
2008	0.022	<0.001	0.002	0.001	0.002	0.003	0.002	<0.001	0.044
2009	0.007	<0.001	<0.001	<0.001	0.001	0.001	0.001	<0.001	0.010
2010	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.006
2011	0.007	0.003	<0.001	<0.001	0.006	0.002	0.001	<0.001	0.138
2012	0.007	0.004	<0.001	<0.001	0.006	0.002	0.001	<0.001	0.147
2013	0.007	0.003	<0.001	<0.001	0.006	0.002	0.001	<0.001	0.154
2014	0.001	<0.001	<0.001	<0.001	0.001	0.001	<0.001	<0.001	0.063
2015	0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.051
2016	0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.050
2017	0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.050
2018	0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.047
2019	0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.049
Trend									
1990 – 2019	-77.4%	637.3%	-28.2%	-63.4%	103.3%	-30.6%	-81.8%	65.3%	280.5%
2005 – 2019	-96.9%	1.0%	-89.2%	-94.8%	-70.5%	-90.0%	-97.5%	-70.7%	-13.8%
2018 – 2019	1.2%	1.0%	-5.1%	-3.4%	1.6%	2.7%	0.8%	2.2%	3.0%

**Table 3.86 Emissions of Persistent Organic Pollutants (POPs) from sub-category 1.A.2.g.viii Other**

Emissions	PCDD/F	Benzo(a)-pyrene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Indeno (1,2,3-cd) pyrene	Total PAH	HCB	PCB
	g I-TEQ	kg	kg	kg	kg	kg	kg	Kg
1990	<0.001	<0.001	<0.001	NA	0.001	0.001	<0.001	0.006
1991	<0.001	<0.001	<0.001	NA	0.001	0.001	<0.001	0.006
1992	<0.001	<0.001	<0.001	NA	0.001	0.001	<0.001	0.006
1993	<0.001	<0.001	<0.001	NA	0.001	0.001	<0.001	0.009
1994	<0.001	<0.001	<0.001	NA	0.001	0.001	<0.001	0.006
1995	<0.001	<0.001	<0.001	NA	0.001	0.001	<0.001	0.009
1996	<0.001	<0.001	<0.001	NA	0.001	0.001	<0.001	0.009
1997	<0.001	<0.001	<0.001	NA	0.001	0.001	<0.001	0.006
1998	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
1999	<0.001	<0.001	<0.001	NA	0.002	0.002	<0.001	0.017
2000	<0.001	<0.001	<0.001	NA	0.000	0.000	<0.001	0.000
2001	<0.001	<0.001	<0.001	NA	0.002	0.002	<0.001	0.014
2002	<0.001	<0.001	<0.001	NA	0.002	0.002	<0.001	0.017
2003	<0.001	<0.001	<0.001	NA	0.001	0.001	<0.001	0.006
2004	<0.001	<0.001	<0.001	NA	0.001	0.001	<0.001	0.006
2005	<0.001	<0.001	<0.001	NA	0.005	0.005	<0.001	0.043
2006	<0.001	<0.001	<0.001	NA	0.002	0.002	<0.001	0.020
2007	<0.001	<0.001	<0.001	NA	0.003	0.003	<0.001	0.026
2008	<0.001	<0.001	<0.001	NA	0.003	0.003	<0.001	0.028
2009	<0.001	<0.001	<0.001	NA	0.001	0.001	<0.001	0.009
2010	<0.001	<0.001	<0.001	NA	0.000	0.000	<0.001	<0.001
2011	<0.001	<0.001	<0.001	NA	0.000	0.000	0.001	<0.001
2012	<0.001	<0.001	<0.001	NA	0.000	0.000	0.001	<0.001
2013	<0.001	<0.001	<0.001	NA	0.000	0.000	0.001	<0.001
2014	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2015	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2016	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2017	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2018	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
2019	<0.001	<0.001	<0.001	NA	<0.001	<0.001	<0.001	<0.001
<i>Trend</i>								
1990 – 2019	-99.6%	-99.4%	728.6%	-99.9%	-99.6%	-99.4%	728.6%	-99.9%
2005 – 2019	-99.9%	-99.9%	11.5%	-100.0%	-99.9%	-99.9%	11.5%	-100.0%
2018 – 2019	2.8%	1.5%	1.0%	5.1%	2.8%	1.5%	1.0%	5.1%

### 3.1.3.7.2 Methodological issues

#### 3.1.3.7.2.1 Choice of methods

For estimating the air pollutants emissions the Tier 1 approach<sup>39</sup> of the EMEP/EEA air pollutant emission inventory guidebook 2019 has been applied:

*Equation: emissions from stationary combustion*

$$Emissions_{pollutant} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{pollutant, fuel}$$

Where:

Emissions <sub>pollutant</sub>	= emissions of a given pollutant by type of fuel (kg pollutant)
Fuel consumption <sub>fuel</sub>	= amount of fuel combusted (TJ)
Emission factor <sub>pollutant, fuel</sub>	= default emission factor of a given pollutant by type of fuel (g <sub>pollutant</sub> /GJ).
Pollutant	= main pollutants: NO <sub>x</sub> , CO, NMVOC, SO <sub>2</sub> particulate matter: TSP, OM10, PM2.5, BC heavy metals: Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn persistent organic pollutants: PCDD/F, Benzo(a) pyrene, Benzo(b)fluor, anthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene, Total PAH, HCB, PCB
Fuel	= liquid fuels, solid fuels, gaseous fuels, other fossil fuel, biomass, peat

#### 3.1.3.7.2.2 Choice of activity data of sub-category 1.A.2.g.viii

The following fuels are used for electricity and heat production (autoproducer):

Tier 1 fuel type	Associated fuel types	Source
Liquid fuels	<ul style="list-style-type: none"> <li>Residual fuel oil</li> <li>Gas/Diesel Oil</li> <li>Motor Gasoline</li> <li>Petroleum Coke</li> <li>LPG</li> </ul>	Summary of fuel aggregations at Tier 1 according to EMEP/EEA air pollutant emission inventory guidebook 2019, Part B, Chapter 1.A.2,
Biomass	<ul style="list-style-type: none"> <li>Wood / Fuelwood</li> <li>Wood pellets</li> <li>Wood briquettes</li> </ul>	

Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2019 were taken from prepared by Statistical Office of Montenegro (MONSTAT).

The total fuel consumption decreased by 346.0% in the period 1990 – 2019. From 2005 to 2019 the total fuel consumption increased by 98.3%. From 2018 to 2019 the total fuel consumption increased by 0.2%.

<sup>39</sup> Source: EMEP/EEA air pollutant emission inventory guidebook 2019, 1.A.2 Manufacturing industries and construction (combustion), sub-chapter 3.2 Tier 1 default approach.

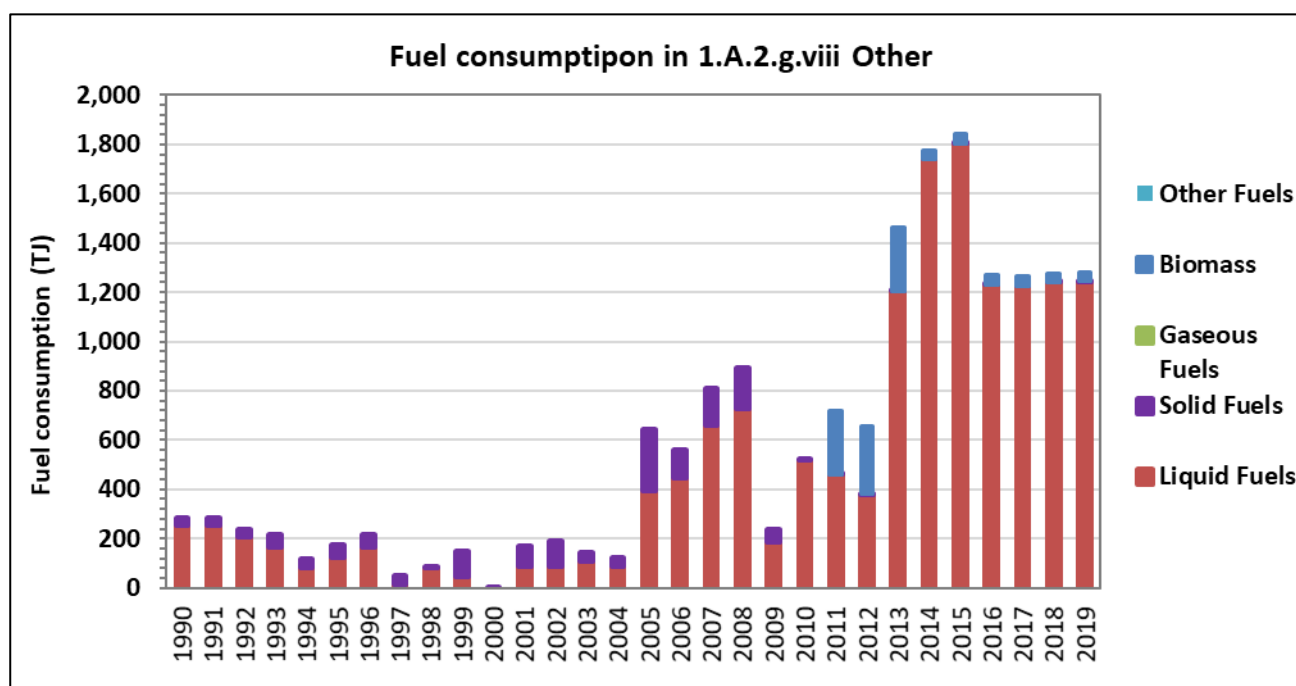


Figure 3.37 Activity data for sub-category 1.A.2.g.viii Other

Table 3.87 Activity data for sub-category 1.A.2.g.viii Other

Activity data 1.A.2.g. viii	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
1990	292.85	252.89	33.81	NO	NO	NO	IE
1991	286.67	252.89	33.78	NO	NO	NO	IE
1992	239.75	206.00	33.75	NO	NO	NO	IE
1993	215.24	164.80	50.44	NO	NO	NO	IE
1994	116.09	82.40	33.69	NO	NO	NO	IE
1995	174.03	123.60	50.43	NO	NO	NO	IE
1996	215.33	164.80	50.53	NO	NO	NO	IE
1997	50.05	16.25	33.80	NO	NO	NO	IE
1998	79.73	79.39	0.34	NO	NO	NO	IE
1999	147.66	46.89	100.77	NO	NO	NO	IE
2000	0.26	NO	0.26	NO	NO	NO	IE
2001	172.04	88.09	83.95	NO	NO	NO	IE
2002	188.74	88.09	100.65	NO	NO	NO	IE
2003	142.26	108.69	33.57	NO	NO	NO	IE
2004	121.65	88.09	33.56	NO	NO	NO	IE
2005	644.87	393.56	251.31	NO	NO	NO	IE
2006	560.90	443.59	117.31	NO	NO	NO	IE
2007	811.13	660.38	150.75	NO	NO	NO	IE
2008	896.02	728.52	167.50	NO	NO	NO	IE
2009	237.83	187.56	50.27	NO	NO	NO	IE

Activity data 1.A.2.g. viii	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
TJ							
2010	520.10	520.09	0.02	NO	NO	NO	IE
2011	719.83	460.72	0.02	NO	NO	NO	259.09
2012	655.47	379.76	0.01	NO	NO	NO	275.70
2013	1463.68	1204.50	0.02	NO	NO	NO	259.16
2014	1777.90	1741.79	0.00	NO	NO	NO	36.11
2015	1297.66	1256.53	0.03	NO	NO	NO	41.11
2016	1270.12	1229.34	0.03	NO	NO	NO	40.75
2017	1264.33	1224.80	0.03	NO	NO	NO	39.50
2018	1276.46	1242.04	0.03	NO	NO	NO	34.40
2019	1278.83	1244.07	0.03	NO	NO	NO	34.74
Trend							
1990 – 2019	346.0%	391.9%	-99.9%	NA	NA	NA	NA
2005 – 2019	98.3%	216.1%	-99.9%	NA	NA	NA	NA
2018 – 2019	0.2%	0.2%	6.9%	NA	NA	NA	1.0%

In energy statistics, production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units, e.g. in tonnes or cubic metres. To convert these data to energy units, in this case terajoules, requires calorific values. The emission calculations are based on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in sub-category 1.A.2.g.viii Other .

**Table 3.88 Net calorific values (NCVs) applied for conversion to energy units in sub-category 1.A.2.g.viii Other**

Fuel	Fuel type	Net calorific value (NCV) (TJ/Gg) or *(TJ/m3)		Source	
		NCV	type		
Gas/Diesel Oil	liquid	42.71	CS	Statistical Office of Montenegro (MONSTAT)	
Residual fuel oil	liquid	41.20	CS		
Motor Gasoline	liquid	44.59	CS		
Petroleum Coke	liquid	32.50	CS		
LPG	liquid	46.89	CS		
Wood / Fuelwood	biomass	9.18*	CS		
Wood pellets	biomass	16.85	CS		
Wood briquettes	biomass	16.38	CS		
Note:					
D	Default	CS	Country specific	PS	Plant specific

### 3.1.3.7.2.2.1 Mining (excluding fuels) and Quarrying (IPCC category 1.A.2.i)

#### Source category description

The IPCC subcategory 1.A.2.i *Mining (excluding fuels) and Quarrying* includes:

- (1) Other mining and quarrying
  - Quarrying of stone, sand and clay
  - Mining and quarrying n.e.c.
  - Other mining and quarrying n.e.c.
- (2) Mining support service activities
  - Support activities for other mining and quarrying

#### Choice of activity data

The following fuels are used for electricity and heat production (autoproducer):

Tier 1 fuel type	Associated fuel types	Source
Liquid fuels	<ul style="list-style-type: none"> <li>Residual fuel oil</li> <li>Gas/Diesel Oil</li> </ul>	Summary of fuel aggregations at Tier 1 according to EMEP/EEA air pollutant emission inventory guidebook 2019, Part B, Chapter 1.A.2,

Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2019 were taken from prepared by Statistical Office of Montenegro (MONSTAT).

The total fuel consumption increased by 1226.9% in the period 2005 to 2018. From 2018 to 2019 the total fuel consumption decreased by 24.3%.

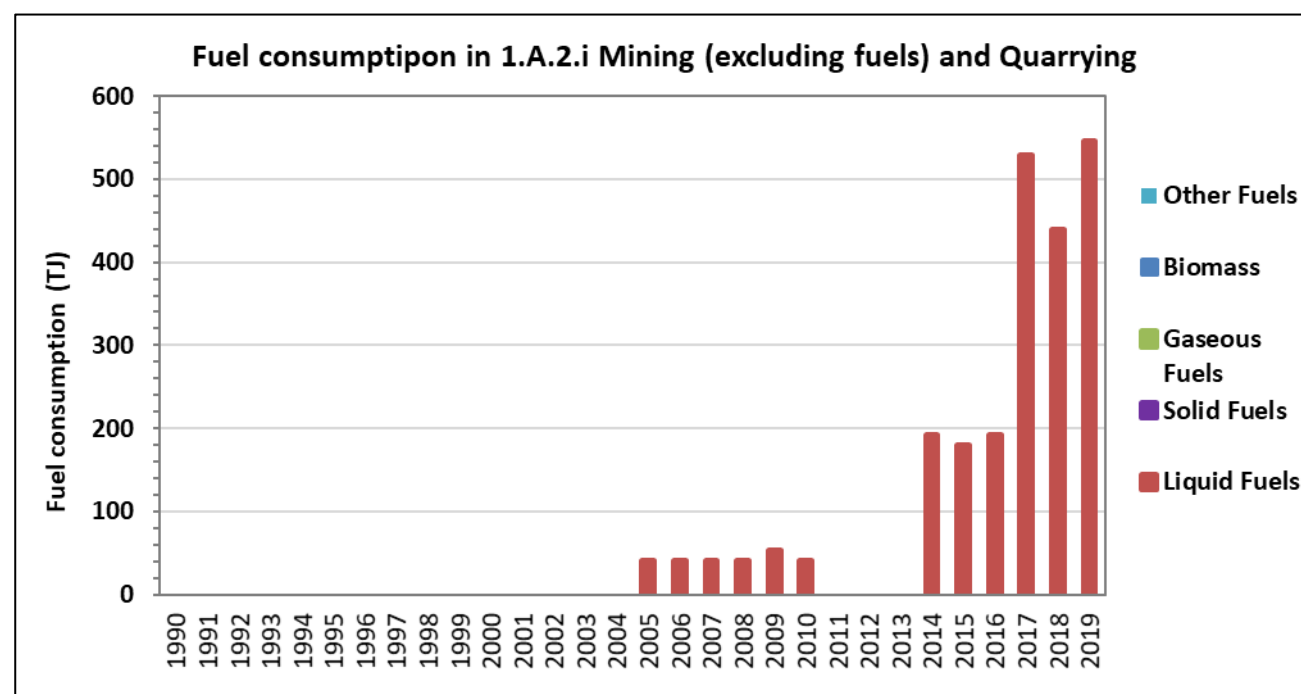


Figure 3.38 Activity data for sub-category 1.A.2.i Mining (excluding fuels) and Quarrying

Table 3.89 Activity data for sub-category 1.A.2.i Mining (excluding fuels) and Quarrying

Activity data 1.A.2.i	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
1990	IE	IE	NO	NO	NO	NO	NO
1991	IE	IE	NO	NO	NO	NO	NO
1992	IE	IE	NO	NO	NO	NO	NO
1993	IE	IE	NO	NO	NO	NO	NO
1994	IE	IE	NO	NO	NO	NO	NO
1995	IE	IE	NO	NO	NO	NO	NO
1996	IE	IE	NO	NO	NO	NO	NO
1997	IE	IE	NO	NO	NO	NO	NO
1998	IE	IE	NO	NO	NO	NO	NO
1999	IE	IE	NO	NO	NO	NO	NO
2000	IE	IE	NO	NO	NO	NO	NO
2001	IE	IE	NO	NO	NO	NO	NO
2002	IE	IE	NO	NO	NO	NO	NO
2003	IE	IE	NO	NO	NO	NO	NO
2004	IE	IE	NO	NO	NO	NO	NO
2005	41.20	41.20	NO	NO	NO	NO	NO
2006	41.20	41.20	NO	NO	NO	NO	NO
2007	41.20	41.20	NO	NO	NO	NO	NO
2008	41.20	41.20	NO	NO	NO	NO	NO
2009	53.56	53.56	NO	NO	NO	NO	NO
2010	41.20	41.20	NO	NO	NO	NO	NO
2011	IE	IE	NO	NO	NO	NO	NO
2012	IE	IE	NO	NO	NO	NO	NO
2013	IE	IE	NO	NO	NO	NO	NO
2014	191.86	191.86	NO	NO	NO	NO	NO
2015	179.38	179.38	NO	NO	NO	NO	NO
2016	192.20	192.20	NO	NO	NO	NO	NO
2017	529.60	529.60	NO	NO	NO	NO	NO
2018	439.91	439.91	NO	NO	NO	NO	NO
2019	546.69	546.69	NO	NO	NO	NO	NO
<i>Trend</i>							
1990 – 2019	NA	NA	NA	NA	NA	NA	NA
2005 – 2019	1 226.9%	1 226.9%	NA	NA	NA	NA	NA
2018 – 2019	24.3%	24.3%	NA	NA	NA	NA	NA



### 3.1.3.7.2.2.2 Wood and wood products (IPCC/NFR category 1.A.2.j)

#### Source category description

The IPCC subcategory 1.A.2.j *Wood and wood products* (ISCI 16) includes:

- (1) Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
  - Sawmilling and planing of wood
  - Manufacture of products of wood, cork, straw and plaiting materials
  - Manufacture of veneer sheets and wood-based panels
  - Manufacture of builders' carpentry and joinery
  - Manufacture of wooden containers
- (2) Manufacture of other products of wood.

#### Choice of activity data

The following fuels are used for electricity and heat production (autoproducer):

Tier 1 fuel type	Associated fuel types	Source
Liquid fuels	<ul style="list-style-type: none"> <li>Residual fuel oil</li> <li>Gas/Diesel Oil</li> <li>LPG</li> </ul>	Summary of fuel aggregations at Tier 1 according to EMEP/EEA air pollutant emission inventory guidebook 2019, Part B, Chapter 1.A.2,
Solid fuels	<ul style="list-style-type: none"> <li>Lignite</li> </ul>	
Biomass	<ul style="list-style-type: none"> <li>Wood / Fuelwood</li> </ul>	

Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2019 were taken from prepared by Statistical Office of Montenegro (MONSTAT).

The total fuel consumption increased by 30.4% in the period 2018 to 2019.

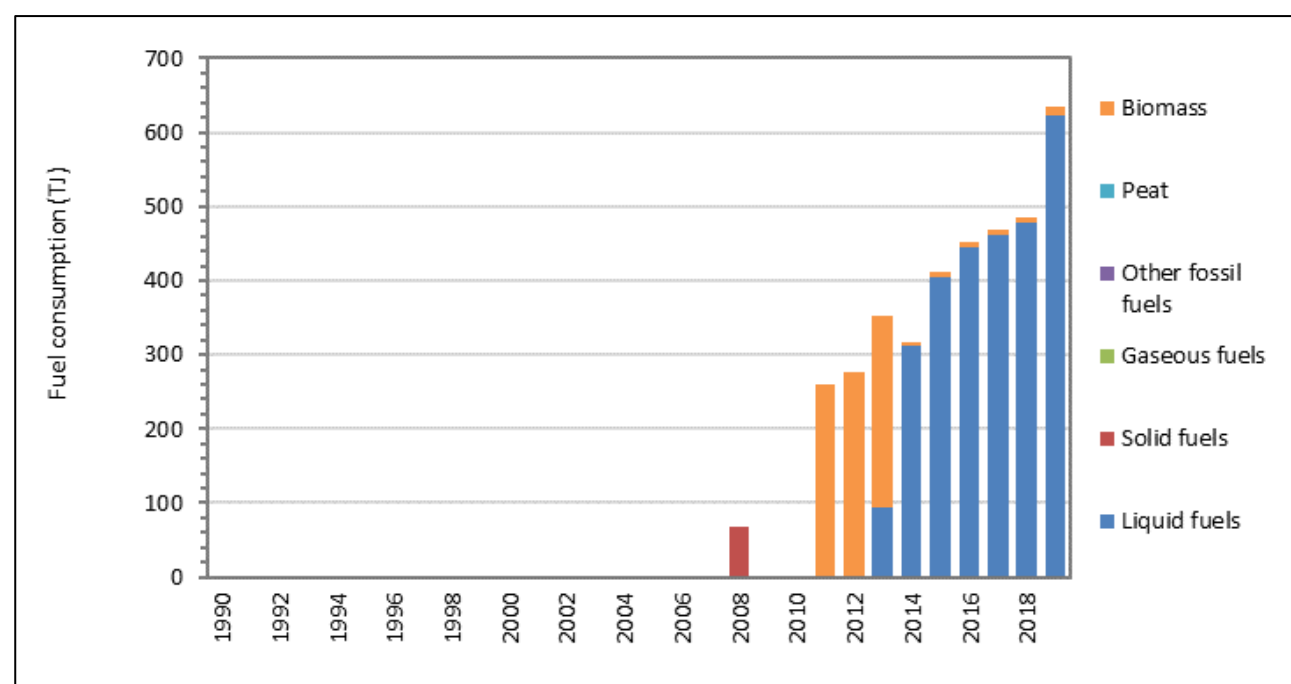


Figure 3.39 Activity data for sub-category 1.A.2.j *Wood and wood products*

Table 3.90 Activity data for sub-category 1.A.2.j Wood and wood products

Activity data 1.A.2.j	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
1990	IE	IE	IE	NO	NO	NO	IE
1991	IE	IE	IE	NO	NO	NO	IE
1992	IE	IE	IE	NO	NO	NO	IE
1993	IE	IE	IE	NO	NO	NO	IE
1994	IE	IE	IE	NO	NO	NO	IE
1995	IE	IE	IE	NO	NO	NO	IE
1996	IE	IE	IE	NO	NO	NO	IE
1997	IE	IE	IE	NO	NO	NO	IE
1998	IE	IE	IE	NO	NO	NO	IE
1999	IE	IE	IE	NO	NO	NO	IE
2000	IE	IE	IE	NO	NO	NO	IE
2001	IE	IE	IE	NO	NO	NO	IE
2002	IE	IE	IE	NO	NO	NO	IE
2003	IE	IE	IE	NO	NO	NO	IE
2004	IE	IE	IE	NO	NO	NO	IE
2005	IE	IE	IE	NO	NO	NO	IE
2006	IE	IE	IE	NO	NO	NO	IE
2007	IE	IE	IE	NO	NO	NO	IE
2008	67.00	IE	67.00	NO	NO	NO	IE
2009	NO	IE	IE	NO	NO	NO	IE
2010	NO	IE	IE	NO	NO	NO	IE
2011	259.09	IE	IE	NO	NO	NO	259.09
2012	275.70	IE	IE	NO	NO	NO	275.70
2013	352.94	93.78	IE	NO	NO	NO	259.16
2014	316.19	311.23	IE	NO	NO	NO	4.96
2015	412.21	405.75	0.01	NO	NO	NO	6.46
2016	451.29	444.18	0.01	NO	NO	NO	7.10
2017	468.62	461.27	0.01	NO	NO	NO	7.34
2018	485.97	478.35	0.01	NO	NO	NO	7.61
2019	633.50	623.57	0.01	NO	NO	NO	9.92
<i>Trend</i>							
1990 – 2019	NA	NA	NA	NA	NA	NA	NA
2005 – 2019	NA	NA	NA	NA	NA	NA	NA
2018 – 2019	30.4%	30.4%	40.0%	NA	NA	NA	30.4%

### 3.1.3.7.2.2.3 Construction (IPCC/NFR category 1.A.2.k)

#### Source category description

The IPCC subcategory 1.A.2.k Construction (ISCI 41) includes Construction of buildings, which is occurring in Montenegro.

#### Choice of activity data

The following fuels are used for electricity and heat production (autoproducer):

Tier 1 fuel type	Associated fuel types	Source
Solid fuels	<ul style="list-style-type: none"> <li>Sub-Bituminous Coal</li> </ul>	Summary of fuel aggregations at Tier 1 according to EMEP/EEA air pollutant emission inventory guidebook 2019, Part B, Chapter 1.A.2,

Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2019 were taken from prepared by Statistical Office of Montenegro (MONSTAT).

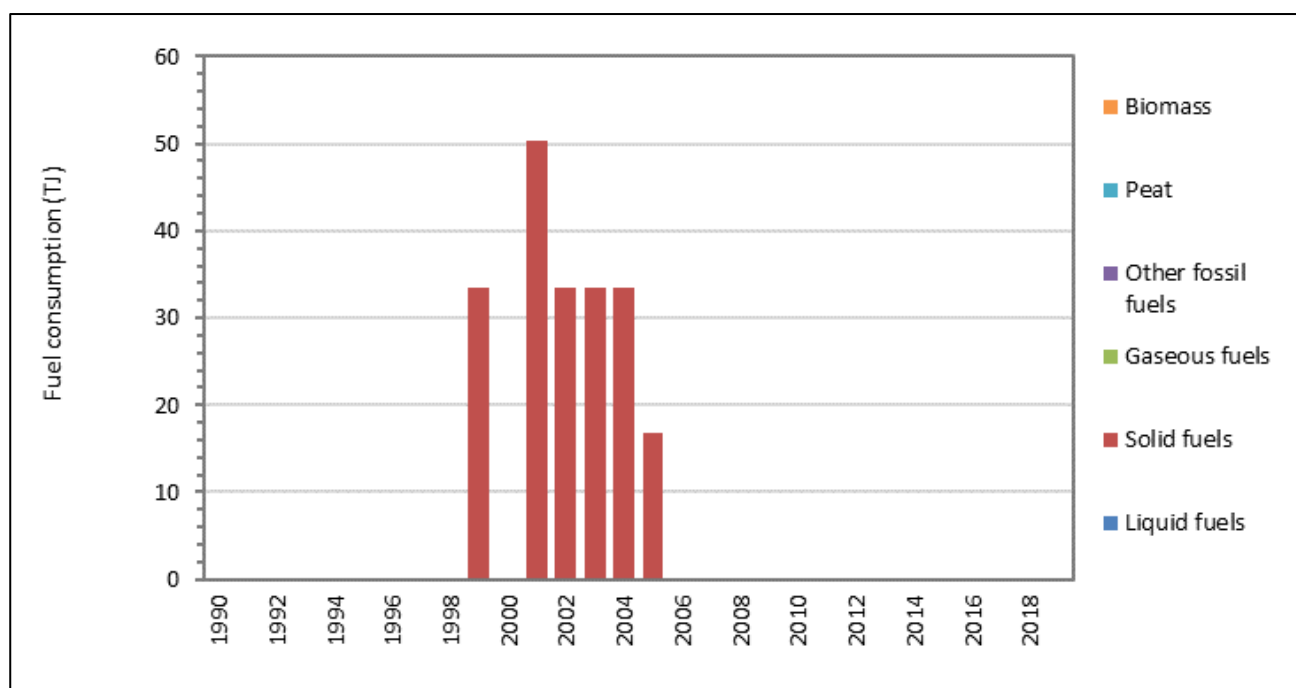


Figure 3.40 Activity data for sub-category 1.A.2.k Construction

Table 3.91 Activity data for sub-category 1.A.2.k Construction

Activity data 1.A.2.k	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
1990	IE	NO	IE	NO	NO	NO	NO
1991	IE	NO	IE	NO	NO	NO	NO
1992	IE	NO	IE	NO	NO	NO	NO
1993	IE	NO	IE	NO	NO	NO	NO
1994	IE	NO	IE	NO	NO	NO	NO
1995	IE	NO	IE	NO	NO	NO	NO
1996	IE	NO	IE	NO	NO	NO	NO
1997	IE	NO	IE	NO	NO	NO	NO
1998	IE	NO	IE	NO	NO	NO	NO
1999	33.50	NO	33.50	NO	NO	NO	NO
2000	IE	NO	IE	NO	NO	NO	NO
2001	50.25	NO	50.25	NO	NO	NO	NO
2002	33.50	NO	33.50	NO	NO	NO	NO
2003	33.50	NO	33.50	NO	NO	NO	NO
2004	33.50	NO	33.50	NO	NO	NO	NO
2005	16.75	NO	16.75	NO	NO	NO	NO
2006	IE	NO	IE	NO	NO	NO	NO
2007	IE	NO	IE	NO	NO	NO	NO
2008	IE	NO	IE	NO	NO	NO	NO
2009	IE	NO	IE	NO	NO	NO	NO
2010	IE	NO	IE	NO	NO	NO	NO
2011	IE	NO	IE	NO	NO	NO	NO
2012	IE	NO	IE	NO	NO	NO	NO
2013	IE	NO	IE	NO	NO	NO	NO
2014	IE	NO	IE	NO	NO	NO	NO
2015	IE	NO	IE	NO	NO	NO	NO
2016	IE	NO	IE	NO	NO	NO	NO
2017	IE	NO	IE	NO	NO	NO	NO
2018	IE	NO	IE	NO	NO	NO	NO
2019	IE	NO	IE	NO	NO	NO	NO
<i>Trend</i>							
1990 – 2019	NA	NA	NA	NA	NA	NA	NA
2005 – 2019	NA	NA	NA	NA	NA	NA	NA
2018 – 2019	NA	NA	NA	NA	NA	NA	NA

### 3.1.3.7.2.2.4 Textile and Leather (IPCC/NFR category 1.A.2.l)

#### Source category description

The IPCC subcategory 1.A.2.l *Textile and Leather* includes:

- (1) Manufacture of textiles (Finishing of textiles)
- (2) Manufacture of footwear

#### Choice of activity data

The following fuels are used for electricity and heat production (autoproducer):

Tier 1 fuel type	Associated fuel types	Source
<b>Liquid fuels</b>	<ul style="list-style-type: none"> <li>Residual fuel oil</li> <li>Gas/Diesel Oil</li> </ul>	Summary of fuel aggregations at Tier 1 according to EMEP/EEA air pollutant emission inventory guidebook 2019, Part B, Chapter 1.A.2,
<b>Solid fuels</b>	<ul style="list-style-type: none"> <li>Lignite</li> <li>Sub-Bituminous Coal</li> </ul>	
<b>Biomass</b>	<ul style="list-style-type: none"> <li>Wood / Fuelwood</li> </ul>	

Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2019 were taken from prepared by Statistical Office of Montenegro (MONSTAT).

The total fuel consumption increased by 4591.3% in the period 1990 – 2019. From 2005 to 2019 the total fuel consumption decreased by 96.5%. From 2018 to 2019 the total fuel consumption was constant.

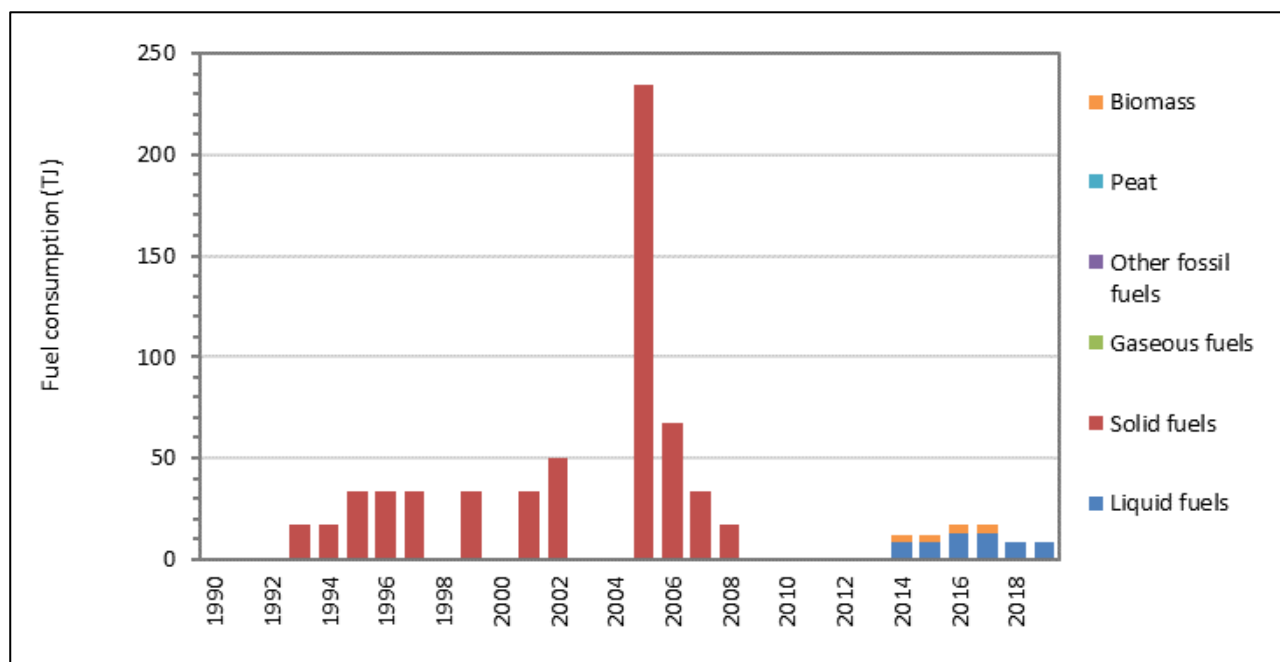


Figure 3.41 Activity data for sub-category 1.A.2.l Textile and Leather

Table 3.92 Activity data for sub-category 1.A.2.I Textile and Leather

Activity data 1.A.2.I	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
1990	0.18	IE	0.18	NO	NO	NO	IE
1991	0.14	IE	0.14	NO	NO	NO	IE
1992	0.13	IE	0.13	NO	NO	NO	IE
1993	16.85	IE	16.85	NO	NO	NO	IE
1994	16.85	IE	16.85	NO	NO	NO	IE
1995	33.60	IE	33.60	NO	NO	NO	IE
1996	33.64	IE	33.64	NO	NO	NO	IE
1997	33.57	IE	33.57	NO	NO	NO	IE
1998	0.08	IE	0.08	NO	NO	NO	IE
1999	33.56	IE	33.56	NO	NO	NO	IE
2000	0.05	IE	0.05	NO	NO	NO	IE
2001	33.53	IE	33.53	NO	NO	NO	IE
2002	50.28	IE	50.28	NO	NO	NO	IE
2003	0.01	IE	0.01	NO	NO	NO	IE
2004	IE	IE	IE	NO	NO	NO	IE
2005	234.50	IE	234.50	NO	NO	NO	IE
2006	67.00	IE	67.00	NO	NO	NO	IE
2007	33.50	IE	33.50	NO	NO	NO	IE
2008	16.75	IE	16.75	NO	NO	NO	IE
2009	IE	IE	IE	NO	NO	NO	IE
2010	IE	IE	IE	NO	NO	NO	IE
2011	IE	IE	IE	NO	NO	NO	IE
2012	IE	IE	IE	NO	NO	NO	IE
2013	IE	IE	IE	NO	NO	NO	IE
2014	11.71	8.11	IE	NO	NO	NO	3.60
2015	11.84	8.24	IE	NO	NO	NO	3.60
2016	17.45	12.36	IE	NO	NO	NO	5.09
2017	16.86	12.36	IE	NO	NO	NO	4.50
2018	8.24	8.24	IE	NO	NO	NO	IE
2019	8.24	8.24	IE	NO	NO	NO	IE
<i>Trend</i>							
1990 – 2019	4591.3%	NA	NA	NA	NA	NA	NA
2005 – 2019	-96.5%	NA	NA	NA	NA	NA	NA
2018 – 2019	0.0%	0.0%	NA	NA	NA	NA	NA

### 3.1.3.7.2.2.5 Other (IPCC/NFR category 1.A.2.m)

#### Source category description

This source - IPCC/NFR category 1.A.2.m **Other** - describes air pollutants emissions resulting from fuel combustion activities in manufacturing industries and construction which originate from electricity and heat production plants (autoproducer) but which could not be classified under any of the other subcategories from 1.A.2 subcategory.

#### Choice of activity data

The following fuels are used for electricity and heat production (autoproducer):

Tier 1 fuel type	Associated fuel types	Source
<b>Liquid fuels</b>	<ul style="list-style-type: none"> <li>Residual fuel oil</li> <li>Gas/Diesel Oil</li> <li>Motor Gasoline (Non-biogasoline)</li> <li>LPG</li> </ul>	Summary of fuel aggregations at Tier 1 according to EMEP/EEA air pollutant emission inventory guidebook 2019, Part B, Chapter 1.A.2,
<b>Solid fuels</b>	<ul style="list-style-type: none"> <li>Lignite</li> <li>Sub-Bituminous Coal</li> <li>Petroleum Coke</li> </ul>	
<b>Biomass</b>	<ul style="list-style-type: none"> <li>Wood pellets</li> <li>Wood Briquette</li> </ul>	

Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2019 were taken from prepared by Statistical Office of Montenegro (MONSTAT).

The total fuel consumption increased by 88.3% in the period 1990 – 2019. From 2005 to 2019 the total fuel consumption decreased by 58.7%. From 2018 to 2019 the total fuel consumption decreased by 22.6%.

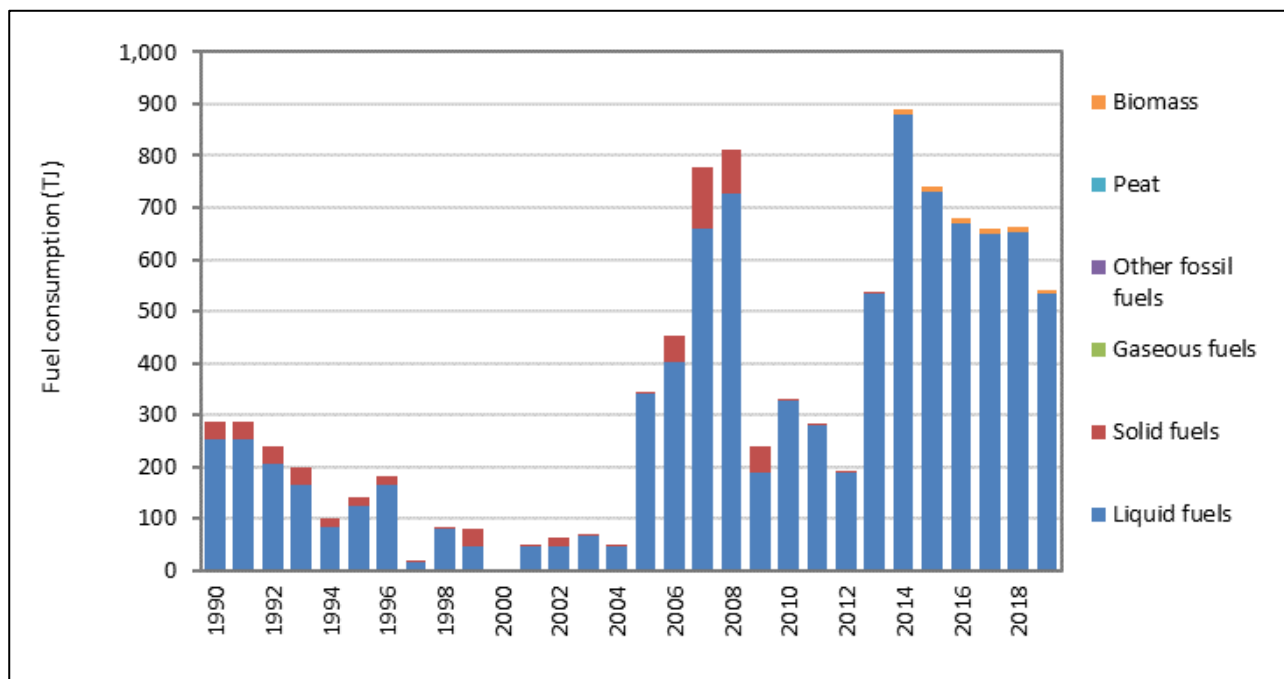


Figure 3.42 Activity data for sub-category 1.A.2.m Other

Table 3.93 Activity data for sub-category 1.A.2.m

Activity data 1.A.2.m	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
1990	286.53	252.89	33.64	NO	NO	NO	IE
1991	286.53	252.89	33.64	NO	NO	NO	IE
1992	239.62	206.00	33.62	NO	NO	NO	IE
1993	198.39	164.80	33.59	NO	NO	NO	IE
1994	99.24	82.40	16.84	NO	NO	NO	IE
1995	140.43	123.60	16.83	NO	NO	NO	IE
1996	181.69	164.80	16.89	NO	NO	NO	IE
1997	16.47	16.25	0.22	NO	NO	NO	IE
1998	79.65	79.39	0.26	NO	NO	NO	IE
1999	80.59	46.89	33.70	NO	NO	NO	IE
2000	0.21	IE	0.21	NO	NO	NO	IE
2001	47.07	46.89	0.18	NO	NO	NO	IE
2002	63.76	46.89	16.87	NO	NO	NO	IE
2003	67.55	67.49	0.06	NO	NO	NO	IE
2004	46.95	46.89	0.06	NO	NO	NO	IE
2005	340.06	340.00	0.06	NO	NO	NO	IE
2006	452.70	402.39	50.31	NO	NO	NO	IE
2007	777.63	660.38	117.25	NO	NO	NO	IE
2008	812.27	728.52	83.75	NO	NO	NO	IE
2009	237.83	187.56	50.27	NO	NO	NO	IE
2010	328.25	328.23	0.02	NO	NO	NO	IE
2011	281.36	281.34	0.02	NO	NO	NO	IE
2012	187.57	187.56	0.01	NO	NO	NO	IE
2013	534.25	534.23	0.02	NO	NO	NO	IE
2014	888.87	880.22	IE	NO	NO	NO	8.65
2015	741.90	731.77	0.01	NO	NO	NO	10.11
2016	680.21	670.99	0.01	NO	NO	NO	9.21
2017	658.30	649.37	0.01	NO	NO	NO	8.93
2018	661.53	653.64	0.01	NO	NO	NO	7.88
2019	539.61	532.49	0.01	NO	NO	NO	7.11
<i>Trend</i>							
1990 - 2019	88.3%	110.6%	-99.9%	NA	NA	NA	NA
2005 - 2019	58.7%	56.6%	-86.7%	NA	NA	NA	NA
2018 - 2019	22.6%	22.8%	25.0%	NA	NA	NA	NA



### 3.1.3.7.2.3 Choice of emission factors

Default emission factors for air pollutant were taken from the EMEP/EEA air pollutant emission inventory Guidebook 2019 and are presented in the following table.

**Table 3.94 Emission factors (EF) for Main pollutants, Particulate Matter (PM), Heavy metals (HM) and Persistent Organic Pollutants (POPs) for sub-category 1.A.2.g.viii Other**

Fuel Type	UNIT	Liquid fuels		Gaseous Fuels		Biomass	
Associated fuel types		Gas/Diesel Oil Residual fuel oil Petroleum Coke		Natural Gas		Wood / Fuelwood Wood pellets	
Pollutant		EF	type	EF	type	CS	CS
NOx	g/GJ	513.0	D	74	D	91	D
CO	g/GJ	66	D	29	D	570	D
NMVOC	g/GJ	25	D	23	D	300	D
SOx	g/GJ	47	D	0.67	D	11	D
TSP	g/GJ	20	D	0.78	D	1.2	D
NH3	g/GJ	NE		NE		150	D
PM10	g/GJ	20	D	0.78	D	143	D
PM2.5	g/GJ	20	D	0.78	D	140	D
BC	% of PM2.5	56	D	4	D	28	D
Pb	mg/GJ	0.08	D	0.011	D	27	D
Cd	mg/GJ	0.006	D	0.0009	D	13	D
Hg	mg/GJ	0.12	D	0.54	D	0.56	D
As	mg/GJ	0.03	D	0.1	D	0.19	D
Cr	mg/GJ	0.2	D	0.013	D	23	D
Cu	mg/GJ	0.22	D	0.0026	D	6	D
Ni	mg/GJ	0.008	D	0.013	D	2	D
Se	mg/GJ	0.11	D	0.058	D	0.5	D
Zn	mg/GJ	29	D	0.73	D	512	D
PCB	ng WHO-TEG/GJ	NE	D	NE	D	0.06	D
PCDD/F	ng I-TEQ/GJ	1.4	D	0.52	D	100	D
Benzo(a)pyrene	µg/GJ	0.0019	D	0.72	D	0.01	D
Benzo(b)fluoranthene	µg/GJ	0.015	D	0.0029	D	0.016	D
Benzo(k)fluoranthene	µg/GJ	0.0017	D	0.0011	D	0.005	D
Indeno(1,2,3-cd)pyrene	µg/GJ	0.0015	D	0.00108	D	0.004	D
HCB	µg/GJ	NE	D	NE	D	5	D
Source		Table 3.3, section 3.4, page 16.		Table 3.4, section 3.4, page 17.		Table 3.5, section 3.4, page 17.	
		EMEP/EEA air pollutant emission inventory guidebook 2019, Part B, Chapter 1.A.2 Manufacturing industries and construction (combustion).					
Note:							
D	Default	CS	Country specific	PS	Plant specific	IEF	Implied emission factor

### 3.1.3.7.3 Uncertainties and time-series consistency

The uncertainties for activity data and emission factors used for IPCC/NFR category 1.A.2.g.viii Other are presented in the following table.

**Table 3.95 Uncertainty for sub-category 1.A.2.g.viii Other .**

Uncertainty	Hard Coal	Brown Coal	Gaseous fuels	Heavy Fuel Oil	Gas oil	Biomass	Reference
Activity data (AD)	3%	3%	5%	5%	5%	15%	Table 2.15, 2006 IPCC GL, Vol. 2, Chap. 2 (2.4.2)
Emission factor (EF)	Rating	Typical error range		Average		Reference	
NO <sub>x</sub>	B	20% to 60%		40%		Table 2 2 Rating definitions Table 2 3 Main NFR source categories with applicable quality data ratings EMEP EEA GB 2019, Part A, Chapter 5 Uncertainties.	
CO	C	50% to 200%		125%			
NM VOC	D	100% to 300%		200%			
SO <sub>x</sub>	A	10% to 30%		20%			
NH <sub>3</sub>	E	order of magnitude		750%			
TSP, PM <sub>10</sub> , PM <sub>2.5</sub> , BC	C	50% to 200%		125%			
Hg	B	20% to 60%		40%			
Pb, Cd, As, Cr, Cu, Ni, Se, Zn	C	50% to 200%		125%			
PCDD/F	E	order of magnitude		750%			
PAH (Benzo(a)pyrene, Benzo(b)-fluoranthene, Benzo(k)fluor-anthene, Indeno(1,2,3-cd)pyrene)	C	50% to 200%		125%			
HCB, PCBs	D	100% to 300%		200%			

The time-series are considered to be consistent as the same methodology is applied to the whole period. Activity data are considered to be consistent as national and international data were always compared.

### 3.1.3.7.4 Source-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
  - consistent use of energy balance data (energy statistic questionnaires),
  - documented sources,
  - use of units,
  - strictly defined interfaces between spreadsheets/calculation modules,
  - unique structure of sheets which do the same,
  - record keeping, use of write protection,
  - unique use of formulas, special cases are documented/highlighted,
  - quick-control checks for data consistency through all steps of calculation.
- cross-checked from two sources: national statistic, Eurostat and international energy statistics of UN
- cross checks with other relevant sectors are performed to avoid double counting or omissions;
- time series consistency - plausibility checks of dips and jumps.

### 3.1.3.7.5 Source-specific recalculations

The following table presents the main revisions and recalculations done since the last submission in 2020 and relevant to sub-category 1.A.2.g.viii *Other*.

**Table 3.96 Recalculations done in sub-category 1.A.2.g.viii Other**

source category	Revisions of data	Type of revision	Type of improvement
1.A.2.g.viii	application of EMEP/EEA air pollutant emission inventory GB 2019	method	Comparability
1.A.2.g.viii	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019	EF	Comparability
1.A.2.g.viii	use of CS NCV	AD	Accuracy
1.A.2.g.viii	Fuel consumption data (activity data) was revised due to revised fuel consumption data – plant specific data	AD	Accuracy

### 3.1.3.7.6 Source-specific planned improvements

Considering the potential contribution of identified improvements in the total emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

**Table 3.97 Planned improvements for sub-category 1.A.2.g.viii Other**

Source category	Planned improvement	Type of improvement		Priority
1.A.2.g.viii	Survey on fuel used (solid, natural gas, liquid fuels, other fossil fuels, etc.) in all power and heat plants (autoproducer) per industry branch: <ul style="list-style-type: none"> <li>annual amount of fuel consumption by fuel type for combustion in different industries</li> <li>annual capacity</li> <li>annual production / output / quantity of products</li> </ul>	AD	Completeness	high
1.A.2.g.viii	Cross-check of national, Eurostat and international data sources and feedback	AD	Completeness	medium
1.A.2.g.viii	Time-series of fuel consumption ⇒ missing values in some years	AD	Consistency Completeness	high
1.A.2.g.viii	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF	Accuracy Transparency	Medium
1.A.2.g.viii	Data obtained from measurements made on the emission of air pollutants <ul style="list-style-type: none"> <li>Determination of the <ul style="list-style-type: none"> <li>temperature in waste gases [°C];</li> <li>static pressure and the dynamic pressure [kPa];</li> <li>flow rate [m/s];</li> <li>volume flow rate [m³/h and Nm³/h];</li> <li>concentration of CO, SO<sub>2</sub>, NO<sub>x</sub> in the exhaust gases [mg/Nm³]; and</li> <li>Gravimetric extraction of solid particles (TSP) from gases and determination by applying a gravimetric method (mg/Nm³).</li> </ul> </li> </ul>	EF	Accuracy Transparency	Medium

Source category	Planned improvement	Type of improvement		Priority
1.A.2.g.viii	Improvement of time series consistency and split of fuels: the energy statistics is still under development; a split of the fuel combustion for this subcategory has to be reviewed for the entire timeseries. Emissions are allocated in IPCC subcategory 1.A.2.m Other.	AD	Accuracy Transparency	High

### 3.1.4 Transport (IPCC/NFR category 1.A.3)

This section describes air pollutants emissions resulting from fuel combustion in transport sector, which originate from the following subcategories.

IPCC code	Description	Occurrent		Not occurrent
		Estimated	Not estimated	
1.A.3.a	Civil Aviation	✓		
1.A.3.b	Road Transportation	✓		
1.A.3.c	Railways	✓		
1.A.3.d	Water-borne Navigation	✓		
1.A.3.e	Other Transportation			✓

#### 3.1.4.1 Civil Aviation (IPCC/NFR category 1.A.3.a)

##### 3.1.4.1.1 Source category description

Table 3.98 Overview on reported emissions from sub categories 1A3ai(i) and 1A3aii(i)

Air pollutants	1A3aii(i) Domestic aviation LTO (civil)						1A3ai(i) International aviation LTO (civil)						Key Category
	liquid	solid	gaseous	Other fossil fuel	Peat	biomass	liquid	solid	gaseous	Other fossil fuel	Peat	biomass	
NOx	✓	NA	NA	NA	NA	NO	✓	NA	NA	NA	NA	NO	-
CO	✓	NA	NA	NA	NA	NO	✓	NA	NA	NA	NA	NO	-
NMVO	✓	NA	NA	NA	NA	NO	✓	NA	NA	NA	NA	NO	-
SOx	✓	NA	NA	NA	NA	NO	✓	NA	NA	NA	NA	NO	-
NH3	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
TSP	✓	NA	NA	NA	NA	NO	✓	NA	NA	NA	NA	NO	-
PM10	✓	NA	NA	NA	NA	NO	✓	NA	NA	NA	NA	NO	-
PM2.5	✓	NA	NA	NA	NA	NO	✓	NA	NA	NA	NA	NO	-
BC	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
Pb	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
Cd	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
Hg	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
As	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
Cr	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
Cu	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
Ni	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
Se	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
Zn	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
PCB	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-

Air pollutants	1A3aii(i) Domestic aviation LTO (civil)						1A3ai(i) International aviation LTO (civil)						Key Category
	liquid	solid	gaseous	Other fossil fuel	Peat	biomass	liquid	solid	gaseous	Other fossil fuel	Peat	biomass	
PCDD/F	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
PAH	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
Benzo(a)pyrene	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
Benzo(b)fluoranthene	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
Benzo(k)fluoranthene	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
Indeno(1,2,3-cd)pyrene	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
HCB	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE - included elsewhere, NO – not occurrent, NE -not estimated, NA -not applicable, C – confidential													
LA XX - Level Assessment in year XX TA XX - Trend Assessment in year XX													

**Table 3.99 Overview on reported emissions from sub categories 1A3ai(ii) and 1A3aii(ii)**

Air pollutants	1A3ai(ii) International aviation cruise (civil)						1A3aii(ii) Domestic aviation cruise (civil)						Key Category
	liquid	solid	gaseous	Other fossil fuel	Peat	biomass	liquid	solid	gaseous	Other fossil fuel	Peat	biomass	
NOx	✓	NA	NA	NA	NA	NO	✓	NA	NA	NA	NA	NO	-
CO	✓	NA	NA	NA	NA	NO	✓	NA	NA	NA	NA	NO	-
NM VOC	✓	NA	NA	NA	NA	NO	✓	NA	NA	NA	NA	NO	-
SOx	✓	NA	NA	NA	NA	NO	✓	NA	NA	NA	NA	NO	-
NH3	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
TSP	✓	NA	NA	NA	NA	NO	✓	NA	NA	NA	NA	NO	-
PM10	✓	NA	NA	NA	NA	NO	✓	NA	NA	NA	NA	NO	-
PM2.5	✓	NA	NA	NA	NA	NO	✓	NA	NA	NA	NA	NO	-
BC	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
Pb	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
Cd	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
Hg	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
As	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
Cr	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
Cu	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
Ni	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
Se	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
Zn	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
PCB	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
PCDD/F	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-

Air pollutants	1A3ai(ii) International aviation cruise (civil)						1A3ai(ii) Domestic aviation cruise (civil)						Key Category
	liquid	solid	gaseous	Other fossil fuel	Peat	biomass	liquid	solid	gaseous	Other fossil fuel	Peat	biomass	
PAH	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
Benzo(a)pyrene	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
Benzo(b)fluoranthene	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
Benzo(k)fluoranthene	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
Indeno(1,2,3-cd)pyrene	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
HCB	NE	NA	NA	NA	NA	NO	NE	NA	NA	NA	NA	NO	-
<p>A '✓' indicates: emissions from this sub-category have been estimated.</p> <p>Notation keys: IE - included elsewhere, NO – not occurrent, NE -not estimated, NA -not applicable, C – confidential</p> <p>LA XX - Level Assessment in year XX</p> <p>TA XX - Trend Assessment in year XX</p>													

### 3.1.4.1.2 Methodological issues

#### 3.1.4.1.2.1 Choice of methods

For estimating the air pollutants emissions (NO<sub>x</sub>, CO, NMVOC, SO<sub>2</sub>) the Tier 1 approach<sup>40</sup> of the Revised 1996 IPCC Guidelines has been applied:

*Equation: Air pollutant emissions from stationary combustion*

$$Emissions_{pollutant} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{pollutant, fuel}$$

Where:

Emissions<sub>pollutant</sub> = emissions of a given pollutant by type of fuel (kg pollutant)

Fuel consumption<sub>fuel</sub> = amount of fuel combusted (TJ)

Emission factor<sub>pollutant, fuel</sub> = default emission factor of a given pollutant by type of fuel (g<sub>pollutant</sub>/GJ).

Pollutant = main pollutants: NO<sub>x</sub>, CO, NMVOC, SO<sub>2</sub>

particulate matter: TSP, OM10, PM2.5, BC

heavy metals: Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn

persistent organic pollutants: PCDD/F, Benzo(a) pyrene, Benzo(b)fluor, anthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene, Total PAH, HCB, PCB

Fuel = liquid fuels

<sup>40</sup> Source: EMEP/EEA air pollutant emission inventory guidebook 2019, 1.A.3.a Aviation 2019

Table 3.100 Calculation of fuelconsumption per LTO and Cruise

	Number of LTO cycles			Source	Energy Balance		Fuel consumption Reference <sup>41</sup>				
						NCV	LTO [t]	LTO [GJ]	Cruise	Cruise [GJ]	Cruise
					Kersosene	43.96	825	43.96		43.96	0.0011
						[GJ/t]	[kg/LTO]	[GJ/t]	[t]	[GJ/t]	t/t Fuel
					International civil aviation	CS NCV		CS NCV	Difference (F_sold-Fuel for LTO`s)	CS NCV	1 A 3 a i (ii)
Airport	PDG LTO	TIV LTO	TOTAL LTO	t	GJ	t			t		
1990			3954	Calculated based on ratio to fuelconsumption to LTO in 2005	13,000	571,480	3,262	143,409	9,738	428,071	125
1991			4357		14,324	629,686	3,595	158,016	10,730	471,670	137
1992			608		2,000	87,920	502	22,063	1,498	65,857	19
1993			304		1,000	43,960	251	11,031	749	32,929	10
1994			304		1,000	43,960	251	11,031	749	32,929	10
1995			304		1,000	43,960	251	11,031	749	32,929	10
1996			304		1,000	43,960	251	11,031	749	32,929	10
1997			304		1,000	43,960	251	11,031	749	32,929	10
1998			1521		5,000	219,800	1,255	55,157	3,745	164,643	48
1999			3954		13,000	571,480	3,262	143,409	9,738	428,071	125
2000			3954		13,000	571,480	3,262	143,409	9,738	428,071	125
2001			4867		16,000	703,360	4,015	176,504	11,985	526,856	153
2002	2713	0	2713	Airprot statistics	15,000	659,400	2,238	98,392	12,762	561,008	163
2003	3256	0	3256		13,000	571,480	2,686	118,085	10,314	453,395	132
2004	3550	2321	5871		7,000	307,720	4,844	212,924	2,156	94,796	28
2005	3296	2450	5746		14,000	615,440	4,740	208,390	9,260	407,050	119
2006	3887	3261	7148		16,000	703,360	5,897	259,237	10,103	444,123	129

<sup>41</sup> EMEP/EEA GB 2013, Chapter Aviation 1.A.3.a, Page 18, Table 3–3 Emission factors and fuel use for the Tier 1 methodology using jet kerosene as fuel.



	Number of LTO cycles			Source	Energy Balance		Fuel consumption Reference <sup>41</sup>				
Airport	PDG LTO	TIV LTO	TOTAL LTO			NCV	LTO [t]	LTO [GJ]	Cruise	Cruise [GJ]	Cruise
					Kerosene	43.96	825	43.96		43.96	0.0011
						[GJ/t]	[kg/LTO]	[GJ/t]	[t]	[GJ/t]	t/t Fuel
					International civil aviation	CS NCV		CS NCV	Difference (F <sub>sold</sub> -Fuel for LTO's)	CS NCV	1 A 3 a i (ii)
					t	GJ	t	t	t	t	t
2007	4870	4079	8949		10,600	465,976	7,383	324,553	3,217	141,423	41
2008	5670	4608	10278		14,000	615,440	8,479	372,752	5,521	242,688	71
2009	5439	4230	9669		12,000	527,520	7,977	350,666	4,023	176,854	51
2010			10941		19,000	835,240	9,026	396,797	9,974	438,443	128
2011			10667		14,000	615,440	8,800	386,860	5,200	228,580	67
2012	5523	8095	13618		12,000	527,520	11,235	493,884	765	33,636	10
2013	5584	8134	13718		13,000	571,480	11,317	497,511	1,683	73,969	22
2014			10551		17,200	756,112	8,705	382,653	8,495	373,459	109
2015	5545	5433	10978		18,100	795,676	9,057	398,139	9,043	397,537	116
2016	5958	5933	11891		18,600	817,656	9,810	431,251	8,790	386,405	113
2017	8025.5	6323.5	14349		20,000	879,200	11,838	520,395	8,162	358,805	104
2018			14731		22,800	1,002,288	12,153	534,249	10,647	468,039	136
2019	13208	11268	24476		38611.87	1,697,378	20,193	887,671	18,419	809,707	

Table 3.101 Estimation of air pollutants per LTO and Cruise

	NO <sub>x</sub>		NMVOC		SO <sub>x</sub>		PM <sub>2.5</sub>		PM <sub>10</sub>		CO	
	LTO	Cruise	LTO	Cruise	LTO	Cruise	LTO	Cruise	LTO	Cruise	LTO	Cruise
EF	0.0083	0.0128	0.0005	0.0005	0.0008	0.001	0.00007	0.0002	0.00007	0.0002	0.0118	0.0011
Unit	t/LTO	t/t Fuel	t/LTO	t/t Fuel	t/LTO	t/t Fuel	t/LTO	t/t Fuel	t/LTO	t/t Fuel	t/LTO	t/t Fuel
	1 A 3 a i (i)	1 A 3 a i (ii)	1 A 3 a i (i)	1 A 3 a i (ii)	1 A 3 a i (i)	1 A 3 a i (ii)	1 A 3 a i (i)	1 A 3 a i (ii)	1 A 3 a i (i)	1 A 3 a i (ii)	1 A 3 a i (i)	1 A 3 a i (ii)
1990	33	125	2	5	3	10	0	2	0	2	47	125
1991	36	137	2	5	3	11	0	2	0	2	51	137
1992	5	19	0	1	0	1	0	0	0	0	7	19
1993	3	10	0	0	0	1	0	0	0	0	4	10
1994	3	10	0	0	0	1	0	0	0	0	4	10
1995	3	10	0	0	0	1	0	0	0	0	4	10
1996	3	10	0	0	0	1	0	0	0	0	4	10
1997	3	10	0	0	0	1	0	0	0	0	4	10
1998	13	48	1	2	1	4	0	1	0	1	18	48
1999	33	125	2	5	3	10	0	2	0	2	47	125
2000	33	125	2	5	3	10	0	2	0	2	47	125
2001	40	153	2	6	4	12	0	2	0	2	57	153
2002	23	163	1	6	2	13	0	3	0	3	32	163
2003	27	132	2	5	3	10	0	2	0	2	38	132
2004	49	28	3	1	5	2	0	0	0	0	69	28
2005	48	119	3	5	5	9	0	2	0	2	68	119
2006	59	129	4	5	6	10	1	2	1	2	84	129
2007	74	41	4	2	7	3	1	1	1	1	106	41
2008	85	71	5	3	8	6	1	1	1	1	121	71
2009	80	51	5	2	8	4	1	1	1	1	114	51
2010	91	128	5	5	9	10	1	2	1	2	129	128

	NO <sub>x</sub>		NMVOC		SO <sub>x</sub>		PM <sub>2.5</sub>		PM <sub>10</sub>		CO	
	LTO	Cruise	LTO	Cruise	LTO	Cruise	LTO	Cruise	LTO	Cruise	LTO	Cruise
EF	0.0083	0.0128	0.0005	0.0005	0.0008	0.001	0.00007	0.0002	0.00007	0.0002	0.0118	0.0011
Unit	t/LTO	t/t Fuel	t/LTO	t/t Fuel	t/LTO	t/t Fuel	t/LTO	t/t Fuel	t/LTO	t/t Fuel	t/LTO	t/t Fuel
	1 A 3 a i (i)	1 A 3 a i (ii)	1 A 3 a i (i)	1 A 3 a i (ii)	1 A 3 a i (i)	1 A 3 a i (ii)	1 A 3 a i (i)	1 A 3 a i (ii)	1 A 3 a i (i)	1 A 3 a i (ii)	1 A 3 a i (i)	1 A 3 a i (ii)
2011	89	67	5	3	9	5	1	1	1	1	126	67
2012	113	10	7	0	11	1	1	0	1	0	161	10
2013	114	22	7	1	11	2	1	0	1	0	162	22
2014	88	109	5	4	8	8	1	2	1	2	125	109
2015	91	116	5	5	9	9	1	2	1	2	130	116
2016	99	113	6	4	10	9	1	2	1	2	140	113
2017	119	104	7	4	11	8	1	2	1	2	169	104
2018	122	136	7	5	12	11	1	2	1	2	174	136
2019	203	236	12	9	20	18	2	4	2	4	289	236

### 3.1.4.1.3 Source-specific recalculations

The following table presents the main revisions and recalculations done since the last submission in 2020 and relevant to sub-category 1.A.3.a Aviation.

**Table 3.102 Recalculations done in sub-category 1.A.3.a Aviation**

source category	Revisions of data	Type of revision	Type of improvement
1.A.3.a	Application of EMEP/EEA air pollutant emission inventory guidebook 2013	method	Comparability
1.A.3.a	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2013	EF	Comparability
1.A.3.a	use of CS NCVd	AD	Accuracy
1.A.3.a	Fuel consumption data (activity data) was revised	AD	Accuracy

### 3.1.4.1.4 Source-specific planned improvements

Considering the potential contribution of identified improvements in the total emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

**Table 3.103 Planned improvements for sub-category 1.A.3.a Aviation**

Source category	Planned improvement	Type of improvement		Priority
1.A.3.a	Application of EMEP/EEA air pollutant emission inventory guidebook 2019, TIER 2	method	Comparability	high
1.A.3.a	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019, TIER 2	EF	Comparability	medium
1.A.3.a	Investigation on Flight movements Investigation on fleet	AD	Comparability	high

### 3.1.4.2 Road transport (IPCC/NFR category 1.A.3.b)

#### 3.1.4.2.1 Methodological issues

##### 3.1.4.2.1.1 Choice of methods

For estimating the air pollutants emissions (NO<sub>x</sub>, CO, NMVOC, SO<sub>2</sub>) the Tier 1 approach<sup>42</sup> of the EMEP/EEA air pollutant emission inventory guidebook 2016 has been applied:

*Equation: Air pollutant emissions from stationary combustion*

$$Emissions_{pollutant} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{pollutant, fuel}$$

Where:

Emissions <sub>pollutant</sub>	= emissions of a given pollutant by type of fuel (kg pollutant)
Fuel consumption <sub>fuel</sub>	= amount of fuel combusted (TJ)
Emission factor <sub>pollutant, fuel</sub>	= default emission factor of a given pollutant by type of fuel (g pollutant/GJ).
Pollutant	= main pollutants: NO <sub>x</sub> , CO, NMVOC, SO <sub>2</sub> particulate matter: TSP, OM10, PM2.5, BC heavy metals: Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn persistent organic pollutants: PCDD/F, Benzo(a) pyrene, Benzo(b)fluor, anthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene, Total PAH, HCB, PCB
Fuel	= liquid fuels, biomass

##### 3.1.4.2.1.2 Activity Data

#### Step1 Grouping existing vehicle categories from National Transport Statistics according to NFR categories

##### 1A3b Road Transport

NFR code	NFR	correlates which category in Statistics
1A3b1	Passenger cars	Passenger cars
1A3b2	Light duty vehicles	-
1A3b3	Heavy duty vehicles	Buses + Goods vehicles + Road tractors
1A3b4	Mopeds & Motorcycles	Motorcycles

##### Off-road

1A2g7	Mobile combustion in Manufacturing Industries and Construction	Work vehicles
1A4b2	Residential: Household and gardening (mobile)	not available
1A4c2	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	Tractors

<sup>42</sup> Source: EMEP/EEA air pollutant emission inventory guidebook 2016, 1.A.3.b.i-iv Road transport 201, sub-chapter 3.2.1 Tier 1 default approach.

**Step2** List all values (number) per vehicle category out of all available statistical sources and analyse which category is included in which one

	HDV	LDV	Motor-cycles	Off Road Agri	Off Road Industry	Cars	LDV	HDV	HDV	Trailer	TOTAL
	Buses	Van	Motor-cycles	Tractors	Work vehicles	Passenger cars	Special Passenger vehicle	Truck	Towing vehicle	Trailer	TOTAL
	Autobus	Kombi	Motocikl	Polj_ traktor	Radno vozilo	Putnički automobil	Specijalno putn. vozilo	Teretno vozilo	Vučno vozilo	priključno vozilo	Ukupno
1998	590	893	596	12	562	150220	663	10645	310	697	164491
1999	1127	813	365	22	883	118243	848	10612	568	1398	133481
2000	996	809	595	10	2719	128319	857	12116	916	2108	147337
2001	598	638	360	16	1616	93959	652	8147	539	1606	106525
2002	588	653	596	4	1550	100501	768	8637	522	1529	113819
2003	640	733	1445	23	1484	110047	814	8888	526	1395	124600
2004	588	689	995	3	1305	104220	718	8431	438	1333	117387
2005	741	721	1246	8	1293	126570	800	9189	422	1249	140990
2006	656	768	1425	10	992	154319	787	9623	349	1221	168929
2007	1210	832	3032	7	1592	193875	1118	13214	603	1519	215483
2008	1283	1224	4797	28	2059	199542	1608	14574	877	1827	225992
2009	1202	1265	4879	64	1808	179937	1854	12851	931	1477	204791
2010	1140	1040	4572	63	1830	164728	1857	12105	933	1422	188268
2011	1174	1048	4529	169	1859	166878	1957	12018	937	1751	190569
2012	1180	1003	4524	164	1898	170557	2140	12366	1003	1705	194835
2013	1238	953	5013	222	1884	177646	2395	12744	1030	2071	203125
2014	1234	764	3650	220	1976	172170	2411	11836	1055	1976	195316
2015	1242	649	4172	272	2125	174526	2663	12390	1157	2150	199196
2016	1309	622	4364	141	2401	184952	1110	14956	1290	2413	211145
2017	1370	562	4744	351	1046	187777	482	16426	1405	2524	214163
2018	1283	475	6710	645	1126	197213	494	17415	1442	2769	229572
2019	1490	468	6300	202		217959	585	17494	1681	3122	249301

### Step 3 Produce final fleet data per year (number of vehicles) per vehicle categories

	Passenger Cars	Motor cycles	HDV	Buses	Truck	Towing vehicle	Light duty vehicles	Van	Special Passenger vehicle	Work vehicles	Tractors
1998	150,220	596	11,545	590	10,645	310	1,556	893	663	12	562
1999	118,243	365	12,307	1,127	10,612	568	1,661	813	848	22	883
2000	128,319	595	14,028	996	12,116	916	1,666	809	857	10	2,719
2001	93,959	360	9,284	598	8,147	539	1,290	638	652	16	1,616
2002	100,501	596	9,747	588	8,637	522	1,421	653	768	4	1,550
2003	110,047	1,445	10,054	640	8,888	526	1,547	733	814	23	1,484
2004	104,220	995	9,457	588	8,431	438	1,407	689	718	3	1,305
2005	126,570	1,246	10,352	741	9,189	422	1,521	721	800	8	1,293
2006	154,319	1,425	10,628	656	9,623	349	1,555	768	787	10	992
2007	193,875	3,032	15,027	1,210	13,214	603	1,950	832	1,118	7	1,592
2008	199,542	4,797	16,734	1,283	14,574	877	2,832	1,224	1,608	28	2,059
2009	179,937	4,879	14,984	1,202	12,851	931	3,119	1,265	1,854	64	1,808
2010	164,728	4,572	14,178	1,140	12,105	933	2,897	1,040	1,857	63	1,830
2011	166,878	4,529	14,129	1,174	12,018	937	3,005	1,048	1,957	169	1,859
2012	170,557	4,524	14,549	1,180	12,366	1,003	3,143	1,003	2,140	164	1,898
2013	177,646	5,013	15,012	1,238	12,744	1,030	3,348	953	2,395	222	1,884
2014	172,170	3,650	14,125	1,234	11,836	1,055	3,175	764	2,411	220	1,976
2015	174,526	4,172	14,789	1,242	12,390	1,157	3,312	649	2,663	272	2,125
2016	184,952	4,364	17,555	1,309	14,956	1,290	1,732	622	1,110	141	2,401
2017	187,777	4,744	19,201	1,370	16,426	1,405	1,044	562	482	351	1,046
2018	197,213	6,710	20,140	1,283	17,415	1,442	969	475	494	645	1,126
2019	217,959	6,300	20,665	1,490	17,494	1,681	1,053	468	585	202	0

**Step4**

**Produce NFR compatible final fleet data per year (number of vehicles)  
per vehicle categories**

number of veh.	1A3b1	1A3b2	1A3b3	1A3b4
NFR	Passenger cars	Light duty vehicles	Heavy duty vehicles	Mopeds & Motorcycles
1998	150,220	1,556	11,545	596
1999	118,243	1,661	12,307	365
2000	128,319	1,666	14,028	595
2001	93,959	1,290	9,284	360
2002	100,501	1,421	9,747	596
2003	110,047	1,547	10,054	1,445
2004	104,220	1,407	9,457	995
2005	126,570	1,521	10,352	1,246
2006	154,319	1,555	10,628	1,425
2007	193,875	1,950	15,027	3,032
2008	199,542	2,832	16,734	4,797
2009	179,937	3,119	14,984	4,879
2010	164,728	2,897	14,178	4,572
2011	166,878	3,005	14,129	4,529
2012	170,557	3,143	14,549	4,524
2013	177,646	3,348	15,012	5,013
2014	172,170	3,175	14,125	3,650
2015	174,526	3,312	14,789	4,172
2016	184,952	1,732	17,555	4,364
2017	187,777	1,044	19,201	4,744
2018	197,213	969	20,140	6,710
2019	217,959	1,053	20,665	6,300



### 3.1.4.2.2 Source-specific recalculations

The following table presents the main revisions and recalculations done since the last submission in 2020 and relevant to sub-category 1.A.3.b Road transport.

**Table 3.104 Recalculations done in sub-category 1.A.3.b Road transport**

source category	Revisions of data	Type of revision	Type of improvement
1.A.3.a	Application of EMEP/EEA air pollutant emission inventory guidebook 2013	method	Comparability
1.A.3.a	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2013	EF	Comparability
1.A.3.a	use of CS NCV	AD	Accuracy
1.A.3.a	Fuel consumption data (activity data) was revised	AD	Accuracy

### 3.1.4.2.3 Source-specific planned improvements

Considering the potential contribution of identified improvements in the total emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

**Table 3.105 Planned improvements for sub-category 1.A.3.b Road transport**

Source category	Planned improvement	Type of improvement		Priority
1.A.3.b	Application of EMEP/EEA air pollutant emission inventory guidebook 2019, TIER 2/3 Use of COPERT model	method	Comparability	high
1.A.3.a	Investigation on vehicle movements (milage, age technology of vehicles) Investigation on vehicle fleet	AD	Comparability	high

### 3.1.5 Other Sectors (category 1.A.4)

Category 1.A.4 *Other sectors* comprise emissions from stationary fuel combustion in the small combustion sector including combustion for the generation of electricity and heat for own use in these sectors. It also includes emissions from mobile sources in households and gardening as well as from agriculture and forestry.

- 1.A.4.a Commercial/Institutional
  - 1.A.4.a.i stationary
  - 1.A.4.a.ii mobile
- 1.A.4.b Residential
  - 1.A.4.a.i stationary
  - 1.A.4.a.ii mobile
- 1.A.4.c Agriculture/Forestry/Fishing/Fish Farms
  - 1.A.4.c.i Stationary
  - 1.A.4.c.ii Off-road Vehicles and Other Machinery
  - 1.A.4.c.iii national fishing (mobile combustion)

### 3.1.5.1 Commercial/Institutional (category 1.A.4.a)

#### 3.1.5.1.1 Source category description

This section describes emissions resulting from small combustion compliances (> 50 kW: boilers, steam boiler, hot water boiler reciprocating engine; ovens, barbecue/grill, air (space) heater, ovens/hobs (cooking), drying/heating furnaces) that are used to provide thermal energy for

- institutional/commercial 1.A.4.a.i stationary
- small machineries e.g. for gardening 1.A.4.a.ii mobile

The emissions from 1.A.4.a.i Commercial/Institutional resulted from solid, liquid, and gaseous fuels as well as biomass are estimated.

**Table 3.106 Overview on reported emissions from sub categories 1.A.4.a.i and 1.A. 4.a.ii**

Air pollutants	1.A.4.a.i						1.A. 4.a.ii						Key Category
	liquid	solid	gaseous	Other fossil fuel	Peat	biomass	liquid	solid	gaseous	Other fossil fuel	Peat	biomass	
NO <sub>x</sub>	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
CO	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
NM VOC	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
SO <sub>x</sub>	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
NH <sub>3</sub>	NA	✓	NA	NO	NO	✓	IE	NO	IE	NO	NO	NO	
TSP	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
PM <sub>10</sub>	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
PM <sub>2.5</sub>	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
BC	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
Pb	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
Cd	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
Hg	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
As	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
Cr	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
Cu	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
Ni	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
Se	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
Zn	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
PCB	NA	✓	NA	NO	NO	✓	IE	NO	IE	NO	NO	NO	
PCDD/F	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
Benzo(a)pyrene	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
Benzo(b)fluoranthene	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
Benzo(k)fluoranthene	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
Indeno(1,2,3-cd)pyrene	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
HCB	NA	✓	NA	NO	NO	✓	IE	NO	IE	NO	NO	NO	

## Use of notation keys

1.A.4.a.ii	IE	The emissions are included in 1.A.4.c.ii Agriculture/Forestry/Fishing/Fish Farms - Off-road Vehicles and Other Machinery.
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An overview of the emission from fuel combustion in Sub-category *1.A.4.a.i Commercial/Institutional* is provided in the following figures and tables:

- annual emissions of air pollutants;
- Trend of the periods 1990 – 2019, 2005 – 2019, 2017 – 2019.

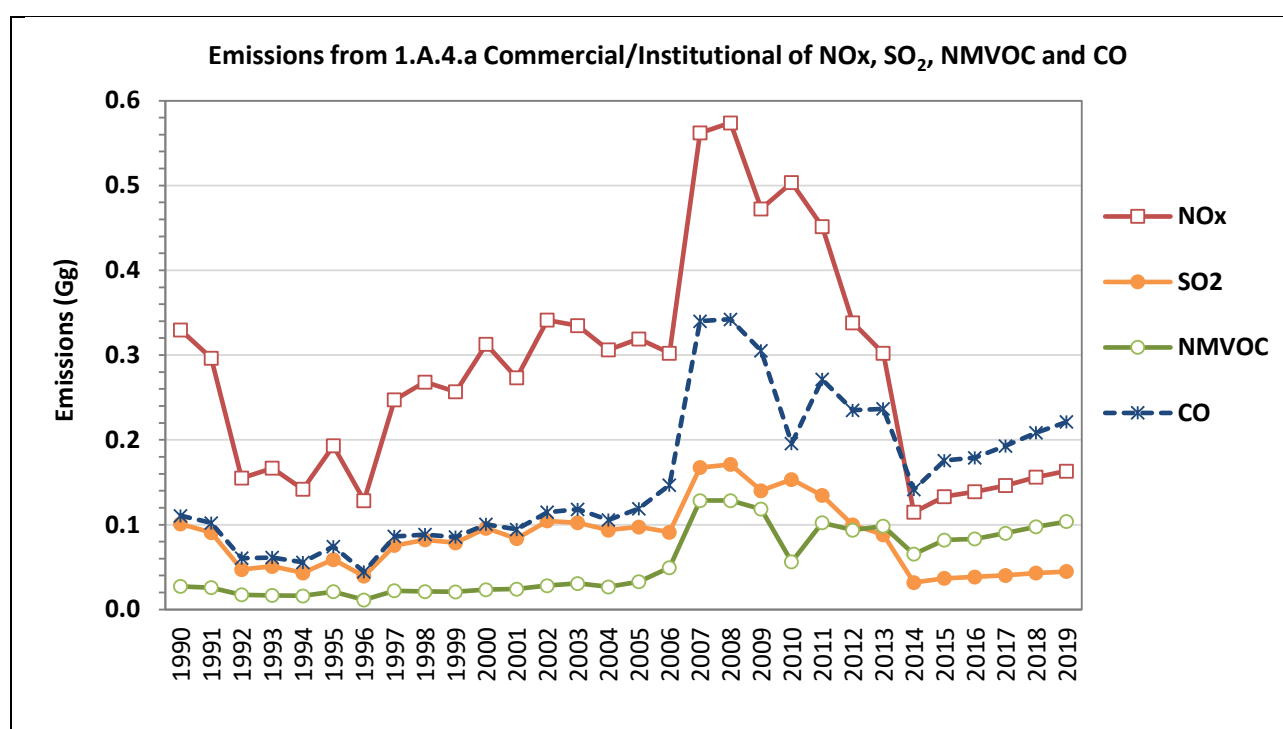


Figure 3.43 Emissions of main pollutants (NO<sub>x</sub>, SO<sub>2</sub>, NMVOC and CO) from sub-category 1.A.4.a.i Commercial/Institutional

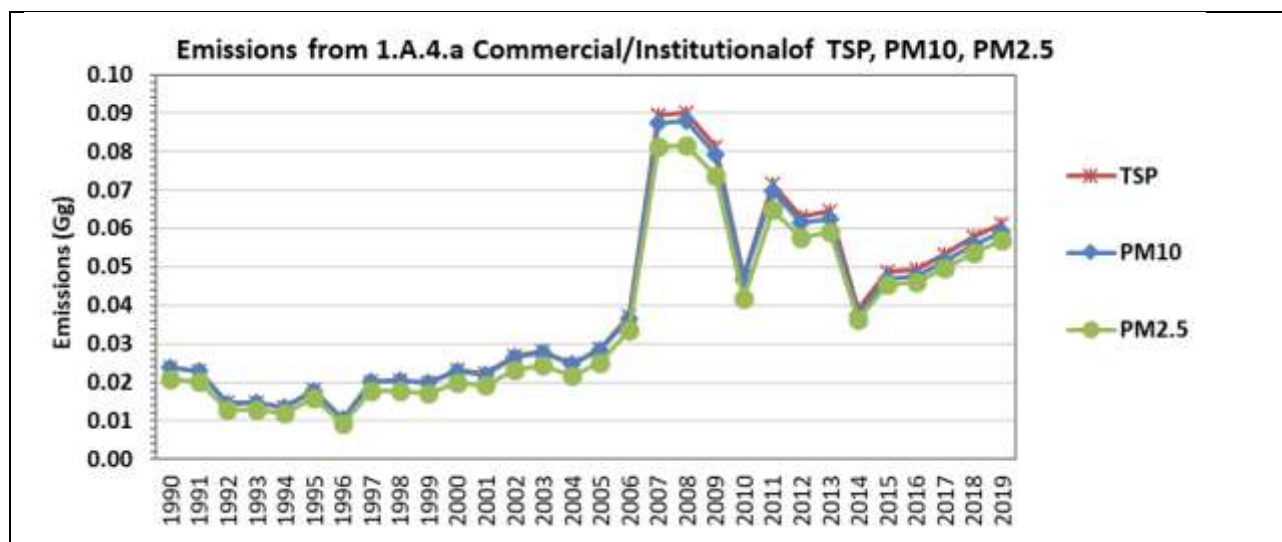


Figure 3.44 Emissions of TSP PM10 and PM2.5 from sub-category 1.A.4.a.i Commercial/Institutional

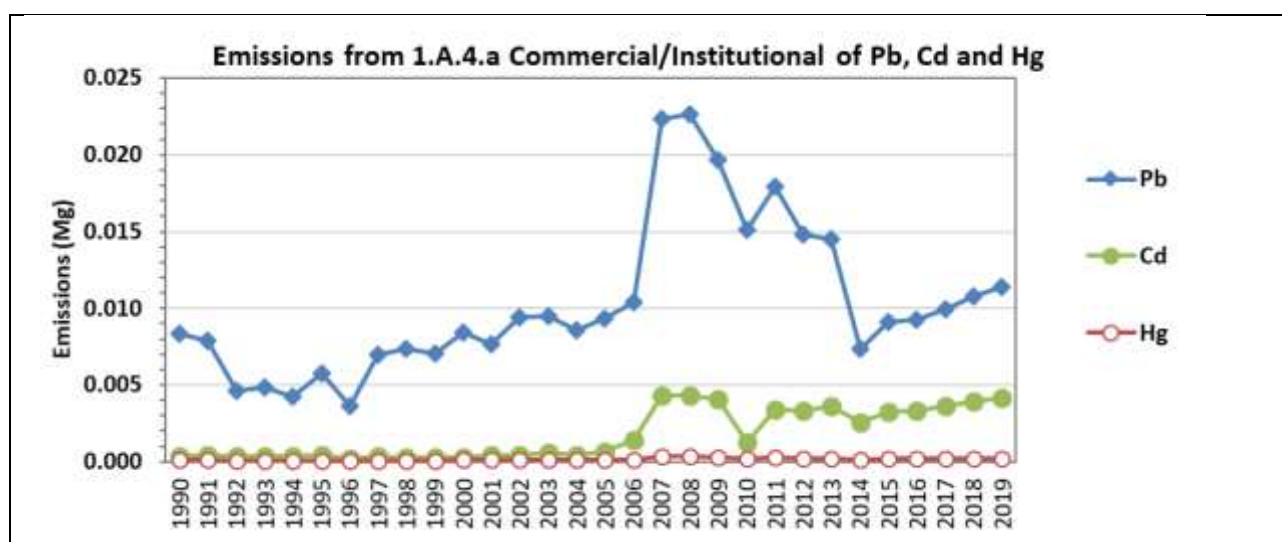


Figure 3.45 Emissions of Heavy Metals (HM) from sub-category 1.A.4.a.i Commercial/Institutional

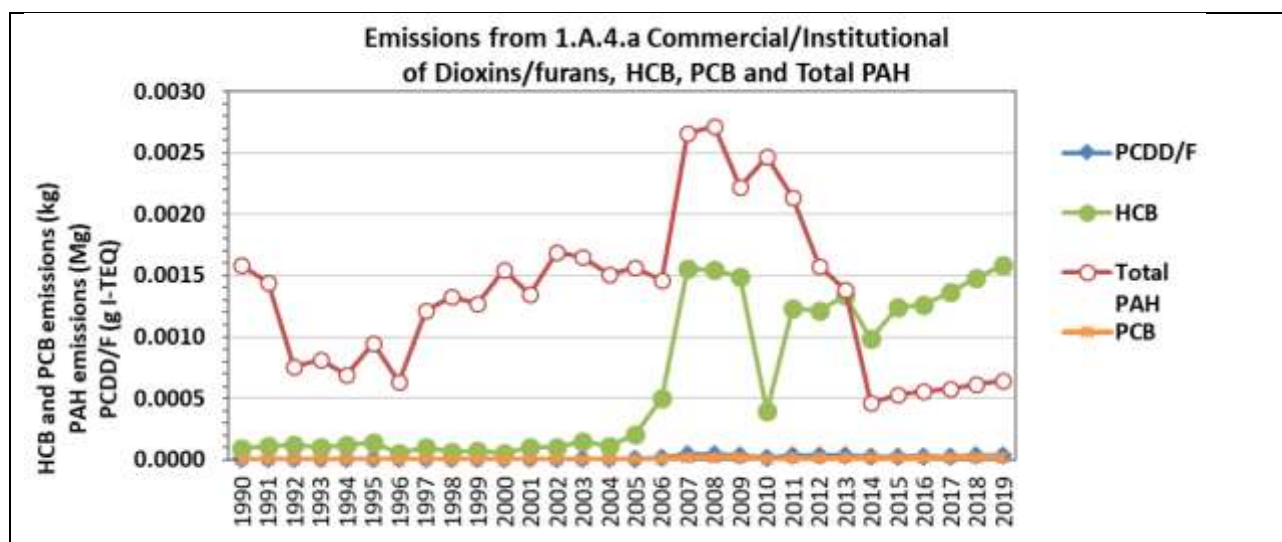


Figure 3.46 Emissions of Persistent Organic Pollutants (POPs) from sub-category 1.A.4.a.i Commercial/Institutional

Table 3.107 Emissions of main pollutants (NO<sub>x</sub>, SO<sub>2</sub>, NMVOC and CO) from sub-category 1.A.4.a.i Commercial/Institutional

Emissions	NO <sub>x</sub>	NMVOC	SO <sub>x</sub>	CO	NH <sub>3</sub>
	Gg	Gg	Gg	Gg	Gg
1990	0.330	0.027	0.101	0.111	0.001
1991	0.297	0.026	0.091	0.102	0.001
1992	0.155	0.017	0.047	0.060	0.001
1993	0.167	0.017	0.051	0.061	0.001
1994	0.142	0.016	0.043	0.056	0.001
1995	0.193	0.021	0.059	0.074	0.001
1996	0.128	0.011	0.039	0.044	<0.001
1997	0.247	0.022	0.076	0.086	0.001
1998	0.268	0.021	0.082	0.088	<0.001
1999	0.257	0.021	0.079	0.085	0.001
2000	0.313	0.023	0.096	0.101	<0.001
2001	0.273	0.024	0.084	0.094	0.001
2002	0.341	0.028	0.105	0.115	0.001
2003	0.335	0.031	0.102	0.118	0.001
2004	0.306	0.027	0.094	0.106	0.001
2005	0.319	0.033	0.097	0.119	0.001
2006	0.302	0.049	0.091	0.147	0.004
2007	0.562	0.128	0.167	0.340	0.012
2008	0.574	0.128	0.171	0.342	0.011
2009	0.473	0.118	0.140	0.305	0.011
2010	0.503	0.056	0.153	0.196	0.003
2011	0.452	0.102	0.135	0.271	0.009
2012	0.338	0.094	0.100	0.235	0.009
2013	0.302	0.098	0.088	0.237	0.010
2014	0.115	0.065	0.032	0.142	0.007
2015	0.133	0.082	0.037	0.176	0.009
2016	0.139	0.083	0.038	0.179	0.009
2017	0.146	0.090	0.040	0.193	0.010
2018	0.156	0.098	0.043	0.209	0.011
2019	0.163	0.104	0.045	0.221	0.012
<i>Trend</i>					
1990 – 2019	-50.5%	281.1%	-55.6%	100.0%	1541.7%
2005 – 2019	-48.9%	216.5%	-54.0%	85.9%	681.8%
2018 – 2019	-4.4%	-6.0%	-4.2%	-5.7%	-6.1%

**Table 3.108 Emissions of particulate matter (PM) from sub-category 1.A.4.a.i Commercial/Institutional**

Emissions	PM2.5	PM10	TSP	BC
	Gg	Gg	Gg	Gg
1990	0.021	0.024	0.024	<0.001
1991	0.020	0.023	0.023	<0.001
1992	0.013	0.015	0.015	<0.001
1993	0.013	0.015	0.015	<0.001
1994	0.012	0.013	0.014	<0.001
1995	0.016	0.018	0.018	<0.001
1996	0.009	0.010	0.010	<0.001
1997	0.018	0.020	0.020	<0.001
1998	0.018	0.020	0.020	<0.001
1999	0.017	0.020	0.020	<0.001
2000	0.020	0.023	0.023	<0.001
2001	0.019	0.022	0.022	<0.001
2002	0.023	0.027	0.027	<0.001
2003	0.024	0.028	0.028	<0.001
2004	0.022	0.025	0.025	<0.001
2005	0.025	0.028	0.029	<0.001
2006	0.033	0.037	0.037	<0.001
2007	0.081	0.087	0.090	<0.001
2008	0.082	0.088	0.090	<0.001
2009	0.074	0.079	0.081	<0.001
2010	0.042	0.047	0.047	<0.001
2011	0.065	0.070	0.071	<0.001
2012	0.058	0.061	0.063	IE
2013	0.059	0.063	0.064	IE
2014	0.036	0.038	0.039	<0.001
2015	0.045	0.047	0.049	<0.001
2016	0.046	0.048	0.049	<0.001
2017	0.050	0.051	0.053	<0.001
2018	0.054	0.056	0.058	<0.001
2019	0.057	0.059	0.061	<0.001
<i>Trend</i>				
1990 – 2019	175.1%	148.9%	156.8%	-79.8%
2005 – 2019	128.0%	109.1%	114.8%	-30.8%
2018 – 2019	-5.9%	-5.8%	-5.8%	-4.8%

**Table 3.109 Emissions of Heavy Metals (HM) from sub-category 1.A.4.a.i Commercial/Institutional**

Emissions	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
	kg	kg	kg	kg	kg	kg	kg	kg	kg
1990	0.008	<0.001	<0.001	0.001	0.010	0.003	0.122	<0.001	0.028
1991	0.008	<0.001	<0.001	<0.001	0.010	0.003	0.114	<0.001	0.028
1992	0.005	<0.001	<0.001	<0.001	0.006	0.002	0.062	<0.001	0.022
1993	0.005	<0.001	<0.001	<0.001	0.006	0.002	0.067	<0.001	0.020
1994	0.004	<0.001	<0.001	<0.001	0.005	0.002	0.057	<0.001	0.020
1995	0.006	<0.001	<0.001	<0.001	0.007	0.002	0.078	<0.001	0.026
1996	0.004	<0.001	<0.001	<0.001	0.004	0.001	0.052	<0.001	0.013
1997	0.007	<0.001	<0.001	<0.001	0.008	0.003	0.100	<0.001	0.025
1998	0.007	<0.001	<0.001	<0.001	0.009	0.003	0.109	<0.001	0.022
1999	0.007	<0.001	<0.001	<0.001	0.009	0.003	0.104	<0.001	0.022
2000	0.008	<0.001	<0.001	0.001	0.010	0.003	0.127	<0.001	0.024
2001	0.008	<0.001	<0.001	<0.001	0.009	0.003	0.111	<0.001	0.027
2002	0.009	<0.001	<0.001	0.001	0.012	0.003	0.139	<0.001	0.030
2003	0.009	0.001	<0.001	0.001	0.012	0.003	0.136	<0.001	0.035
2004	0.009	<0.001	<0.001	0.001	0.010	0.003	0.124	<0.001	0.030
2005	0.009	0.001	<0.001	0.001	0.011	0.003	0.129	<0.001	0.039
2006	0.010	0.001	<0.001	0.000	0.012	0.003	0.120	<0.001	0.069
2007	0.022	0.004	<0.001	0.001	0.025	0.007	0.219	<0.001	0.191
2008	0.023	0.004	<0.001	0.001	0.025	0.007	0.224	<0.001	0.190
2009	0.020	0.004	<0.001	0.001	0.021	0.006	0.183	<0.001	0.179
2010	0.015	0.001	<0.001	0.001	0.018	0.005	0.203	<0.001	0.070
2011	0.018	0.003	<0.001	0.001	0.020	0.006	0.176	<0.001	0.152
2012	0.015	0.003	<0.001	0.001	0.016	0.005	0.130	<0.001	0.143
2013	0.014	0.004	<0.001	0.001	0.015	0.004	0.114	<0.001	0.153
2014	0.007	0.003	<0.001	<0.001	0.007	0.002	0.033	<0.001	0.105
2015	0.009	0.003	<0.001	<0.001	0.009	0.002	0.037	<0.001	0.133
2016	0.009	0.003	<0.001	<0.001	0.009	0.002	0.039	<0.001	0.135
2017	0.010	0.004	<0.001	<0.001	0.010	0.003	0.041	<0.001	0.146
2018	0.011	0.004	<0.001	<0.001	0.010	0.003	0.043	<0.001	0.158
2019	0.011	0.004	<0.001	<0.001	0.011	0.003	0.045	<0.001	0.168
<i>Trend</i>									
1990 – 2019	36.5%	948.9%	87.5%	-51.0%	6.0%	-2.8%	-63.2%	76.0%	511.9%
2005 – 2019	21.8%	512.0%	75.8%	-53.0%	-3.7%	-11.2%	-65.1%	61.0%	328.8%
2018 – 2019	-5.5%	-6.1%	-5.7%	-4.3%	-5.3%	-5.2%	-3.6%	-5.7%	-6.0%



Table 3.110 Emissions of Persistent Organic Pollutants (POPs) from sub-category 1.A.4.a.i Commercial/Institutional

Emissions	PCDD/F	Benzo(a)-pyrene	Benzo(b)-fluor-anthene	Benzo(k)-fluor-anthene	Indeno (1,2,3-cd) pyrene	Total PAH	HCB	PCB
	g I-TEQ	Mg	Mg	Mg	Mg	Mg	kg	Kg
1990	<0.001	<0.001	<0.001	NA	0.002	0.002	<0.001	<0.001
1991	<0.001	<0.001	<0.001	NA	0.001	0.001	<0.001	<0.001
1992	<0.001	<0.001	<0.001	NA	0.001	0.001	<0.001	<0.001
1993	<0.001	<0.001	<0.001	NA	0.001	0.001	<0.001	<0.001
1994	<0.001	<0.001	<0.001	NA	0.001	0.001	<0.001	<0.001
1995	<0.001	<0.001	<0.001	NA	0.001	0.001	<0.001	<0.001
1996	<0.001	<0.001	<0.001	NA	0.001	0.001	<0.001	<0.001
1997	<0.001	<0.001	<0.001	NA	0.001	0.001	<0.001	<0.001
1998	<0.001	<0.001	<0.001	NA	0.001	0.001	<0.001	<0.001
1999	<0.001	<0.001	<0.001	NA	0.001	0.001	<0.001	<0.001
2000	<0.001	<0.001	<0.001	NA	0.002	0.002	<0.001	<0.001
2001	<0.001	<0.001	<0.001	NA	0.001	0.001	<0.001	<0.001
2002	<0.001	<0.001	<0.001	NA	0.002	0.002	<0.001	<0.001
2003	<0.001	<0.001	<0.001	NA	0.002	0.002	<0.001	<0.001
2004	<0.001	<0.001	<0.001	NA	0.001	0.002	<0.001	<0.001
2005	<0.001	<0.001	<0.001	NA	0.002	0.002	<0.001	<0.001
2006	<0.001	<0.001	<0.001	NA	0.001	0.001	0.001	<0.001
2007	<0.001	<0.001	<0.001	NA	0.003	0.003	0.002	<0.001
2008	<0.001	<0.001	<0.001	NA	0.003	0.003	0.002	<0.001
2009	<0.001	<0.001	<0.001	NA	0.002	0.002	0.001	<0.001
2010	<0.001	<0.001	<0.001	NA	0.002	0.002	<0.001	<0.001
2011	<0.001	<0.001	<0.001	NA	0.002	0.002	0.001	<0.001
2012	<0.001	<0.001	<0.001	NA	0.002	0.002	0.001	<0.001
2013	<0.001	<0.001	<0.001	NA	0.001	0.001	0.001	<0.001
2014	<0.001	<0.001	<0.001	NA	<0.001	<0.001	0.001	<0.001
2015	<0.001	<0.001	<0.001	NA	0.001	0.001	0.001	<0.001
2016	<0.001	<0.001	<0.001	NA	0.001	0.001	0.001	<0.001
2017	<0.001	<0.001	<0.001	NA	0.001	0.001	0.001	<0.001
2018	<0.001	<0.001	<0.001	NA	0.001	0.001	0.001	<0.001
2019	<0.001	<0.001	<0.001	NA	0.001	0.001	0.002	<0.001
<i>Trend</i>								
1990 – 2019	331.3%	84.2%	-30.2%	NA	-60.1%	-59.5%	1541.7%	1541.7%
2005 – 2019	230.4%	64.9%	-34.0%	NA	-59.5%	-59.0%	681.8%	681.8%
2018 – 2019	-6.0%	-5.7%	-4.9%	NA	-3.9%	-3.9%	-6.1%	-6.1%

### 3.1.5.1.2 Methodological issues

#### 3.1.5.1.2.1 Choice of methods

For estimating the air pollutants emissions the Tier 1 approach<sup>43</sup> of the EMEP/EEA air pollutant emission inventory guidebook 2019 has been applied:

*Equation: emissions from stationary combustion*

$$Emissions_{pollutant} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{pollutant, fuel}$$

Where:

Emissions <sub>pollutant</sub>	= emissions of a given pollutant by type of fuel (kg pollutant)
Fuel consumption <sub>fuel</sub>	= amount of fuel combusted (TJ)
Emission factor <sub>pollutant, fuel</sub>	= default emission factor of a given pollutant by type of fuel (g <sub>pollutant</sub> /GJ).
Pollutant	= main pollutants: NO <sub>x</sub> , CO, NMVOC, SO <sub>2</sub> particulate matter: TSP, OM10, PM2.5, BC heavy metals: Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn persistent organic pollutants: PCDD/F, Benzo(a) pyrene, Benzo(b)fluor, anthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene, Total PAH, HCB, PCB
Fuel	= liquid fuels, solid fuels, gaseous fuels, other fossil fuel, biomass, peat

#### 3.1.5.1.2.2 Choice of activity data

The following fuels are used for electricity and heat production (autoproducer):

Tier 1 fuel type	Associated fuel types	Source
Liquid fuels	<ul style="list-style-type: none"> <li>Residual fuel oil</li> <li>Gas/Diesel Oil</li> <li>Liquefied Petroleum Gases (LPG)</li> </ul>	Summary of fuel aggregations at Tier 1 according to EMEP/EEA air pollutant emission inventory guidebook 2019, Part B, Chapter 1.A.4,
Solid fuels	<ul style="list-style-type: none"> <li>Lignite</li> </ul>	
Biomass	<ul style="list-style-type: none"> <li>Charcoal</li> <li>Wood/ Fuelwood</li> <li>Wood Waste</li> <li>Wood pellets</li> <li>WoodBriquette</li> </ul>	

Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2019 were taken from prepared by Statistical Office of Montenegro (MONSTAT).

<sup>43</sup> Source: EMEP/EEA air pollutant emission inventory guidebook 2019, 1.A.2 Manufacturing industries and construction (combustion), sub-chapter 3.2 Tier 1 default approach.

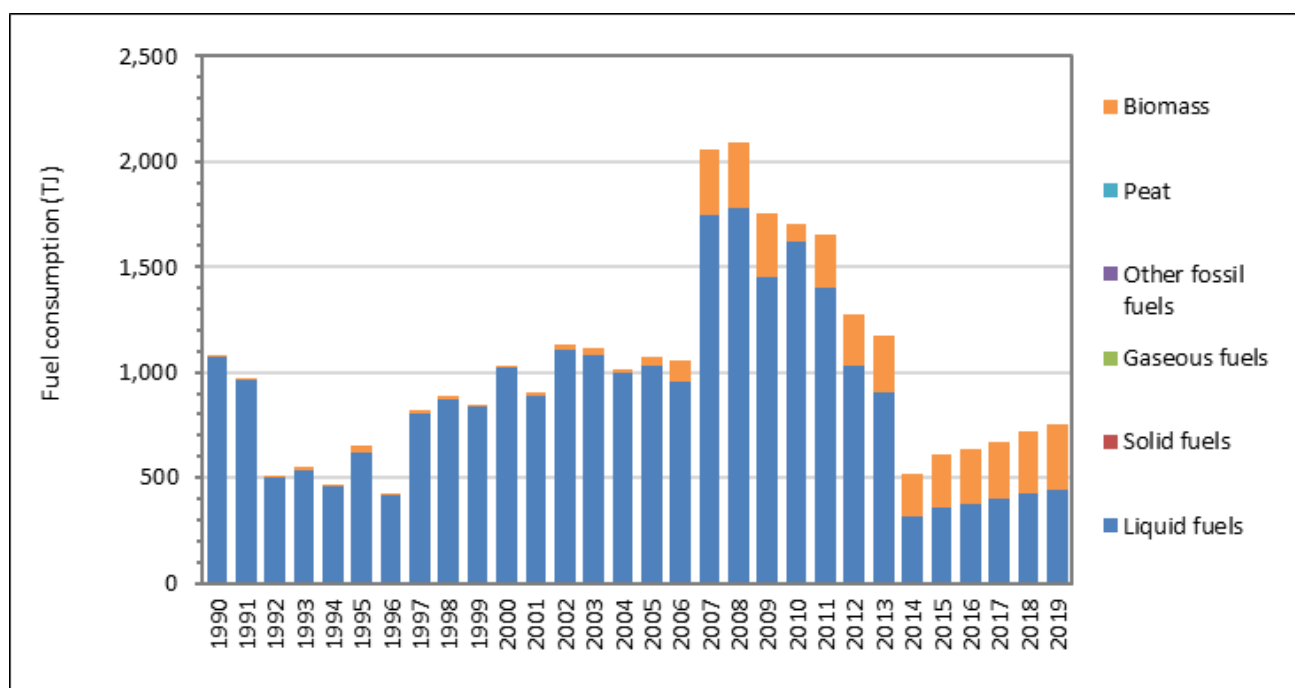


Figure 3.47 Activity data for sub-category 1.A.4.a.i Commercial/Institutional

Table 3.111 Activity data for sub-category 1.A.4.a.i Commercial/Institutional

Activity data 1.A.1.a	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
1990	1,081.05	1,071.04	0.38	NO	NO	NO	9.64
1991	973.69	962.35	0.33	NO	NO	NO	11.01
1992	511.56	498.93	0.29	NO	NO	NO	12.34
1993	548.72	538.62	0.20	NO	NO	NO	9.89
1994	468.05	456.22	0.19	NO	NO	NO	11.64
1995	651.57	622.53	0.20	NO	NO	NO	28.83
1996	426.74	416.53	0.30	NO	NO	NO	9.91
1997	822.34	801.61	0.44	NO	NO	NO	20.29
1998	886.25	873.16	0.45	NO	NO	NO	12.64
1999	848.82	834.57	0.49	NO	NO	NO	13.76
2000	1,029.24	1,018.87	0.28	NO	NO	NO	10.09
2001	908.00	886.62	0.28	NO	NO	NO	21.11
2002	1,130.02	1,109.51	0.32	NO	NO	NO	20.19
2003	1,115.37	1,084.79	0.30	NO	NO	NO	30.28
2004	1,016.93	993.74	0.25	NO	NO	NO	22.94
2005	1,071.81	1,031.23	0.11	NO	NO	NO	40.47
2006	1,059.46	958.17	0.25	NO	NO	NO	101.04
2007	2,056.09	1,743.99	0.12	NO	NO	NO	311.98
2008	2,093.03	1,783.68	0.10	NO	NO	NO	309.24
2009	1,753.48	1,455.59	0.17	NO	NO	NO	297.72

Activity data 1.A.1.a	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
TJ							
2010	1,700.95	1,621.90	0.13	NO	NO	NO	78.92
2011	1,649.63	1,402.31	0.13	NO	NO	NO	247.19
2012	1,276.60	1,033.02	IE	NO	NO	NO	243.58
2013	1,174.78	907.91	IE	NO	NO	NO	266.87
2014	515.14	316.34	0.05	NO	NO	NO	198.74
2015	612.97	361.45	0.06	NO	NO	NO	251.46
2016	633.19	378.80	0.07	NO	NO	NO	254.32
2017	672.15	396.15	0.07	NO	NO	NO	275.93
2018	718.91	421.89	0.07	NO	NO	NO	296.95
2019	755.84	439.39	0.08	NO	NO	NO	316.37
<i>Trend</i>							
1990–2019	-30.1%	-59.0%	-79.8%	NA	NA	NA	3183.5%
2005–2019	-29.5%	-57.4%	-30.8%	NA	NA	NA	681.8%
2018–2019	-4.9%	-4.0%	-4.8%	NA	NA	NA	-6.1%

In energy statistics, production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units, e.g. in tonnes or cubic metres. To convert these data to energy units, in this case terajoules, requires calorific values. The emission calculations are based on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in sub-category 1.A.4.a.i *Commercial/Institutional*.

**Table 3.112 Net calorific values (NCVs) applied for conversion to energy units in sub-category 1.A.4.a.i Commercial/Institutional**

Fuel	Fuel type	Net calorific value (NCV) (TJ/Gg) or * (TJ/m³)		Source	
		NCV	type		
Lignite	solid	9.21	CS	Statistical Office of Montenegro (MONSTAT)	
Residual fuel oil	liquid	41.20	CS		
Gas/Diesel Oil	liquid	42.71	CS		
Liquefied Petroleum Gases (LPG)	liquid	46.89	CS		
Charcoal	biomass	46.00	CS		
Wood/ Fuelwood*	biomass	9.1764	CS		
Wood Waste*	biomass	7.4124	CS		
Wood pellets	biomass	16.85	CS		
WoodBriquette	biomass	16.85	CS		
Note:					
D	Default	CS	Country specific	PS	Plant specific

### 3.1.5.1.2.3 Choice of emission factors

Default emission factors for air pollutant were taken from the EMEP/EEA air pollutant emission inventory Guidebook 2019<sup>44</sup> and are presented in the following table.

**Table 3.113 Emission factors (EF) for Main pollutants, Particulate Matter (PM), Heavy metals (HM) and Persistent Organic Pollutants (POPs) for sub-category 1.A.4.a.i Commercial/Institutional**

Fuel Type	UNIT	Solid Fuels		Liquid fuels		Gaseous Fuels		Biomass	
Associated fuel types		Lignite		Residual fuel oil Gas/Diesel Oil Liquefied Petroleum Gases (LPG)		•		Charcoal Wood/ Fuelwood Wood Waste Wood pellets WoodBriquette	
Pollutant		EF	type	EF	type	EF	type	CS	CS
NOx	g/GJ	173	D	306	D	74	D	91	D
CO	g/GJ	931	D	93	D	29	D	570	D
NMVOC	g/GJ	88.8	D	20	D	23	D	300	D
SOx	g/GJ	840	D	94	D	0.67	D	11	D
TSP	g/GJ	124	D	21	D	0.78	D	1.2	D
NH3	g/GJ	NE		NE		NE		150	D
PM10	g/GJ	117	D	21	D	0.78	D	143	D
PM2.5	g/GJ	108	D	18	D	0.78	D	140	D
BC	% of PM2.5	6.4	D	56	D	4	D	28	D
Pb	mg/GJ	134	D	8	D	0.011	D	27	D
Cd	mg/GJ	1.8	D	0.15	D	0.0009	D	13	D
Hg	mg/GJ	7.9	D	0.1	D	0.54	D	0.56	D
As	mg/GJ	4	D	0.5	D	0.1	D	0.19	D
Cr	mg/GJ	13.5	D	10	D	0.013	D	23	D
Cu	mg/GJ	17.5	D	3	D	0.0026	D	6	D
Ni	mg/GJ	13	D	125	D	0.013	D	2	D
Se	mg/GJ	1.8	D	0.1	D	0.058	D	0.5	D
Zn	mg/GJ	200	D	18	D	0.73	D	512	D
PCB	ng WHO-TEG/GJ	170	D	0.13	D	NE	D	0.06	D
PCDD/F	ng I-TEQ/GJ	203	D	1.4	D	0.52	D	100	D
Benzo(a)pyrene	µg/GJ	0.0455	D	1.9	D	0.72	D	0.01	D
Benzo(b)fluoranthene	µg/GJ	0.0589	D	15	D	2.9	D	0.016	D
Benzo(k)fluoranthene	µg/GJ	0.0237	D	1.7	D	1.1	D	0.005	D
Indeno(1,2,3-cd)pyrene	µg/GJ	0.0185	D	1.5	D	1.08	D	0.004	D
HCB	µg/GJ	0.62	D	0.22	D	NE	D	5	D
Source									
		Table 3.3, section 3.2.2, page 31.		Table 3.4, section 3.4, page 32.		Table 3.5, section 3.4, page 33.		Table 3.6, section 3.4, page 34.	

<sup>44</sup> Source: EMEP/EEA air pollutant emission inventory guidebook 2019, Chapter 1.A4 Small combustion, sub-chapter 3.2.2 Default emission factors.

Fuel Type	UNIT	Solid Fuels	Liquid fuels	Gasous Fuels	Biomass
Associated fuel types		Lignite	Residual fuel oil Gas/Diesel Oil Liquefied Petroleum Gases (LPG)	•	Charcoal Wood/ Fuelwood Wood Waste Wood pellets WoodBriquette
		EMEP/EEA air pollutant emission inventory guidebook 2019, Part B, Chapter 1.A4 Small combustion			
Note:					
D Default	CS Country specific	PS Plant specific		IEF Implied emission factor	

### 3.1.5.1.3 Uncertainties and time-series consistency

The uncertainties for activity data and emission factors used for IPCC/NFR category 1.A.4.a.i Commercial/Institutional are presented in the following table.

**Table 3.114 Uncertainty for sub-category 1.A.4.a.i Commercial/Institutional**

Uncertainty	Hard Coal	Brown Coal	Gaseous fuels	Heavy Fuel Oil	Gas oil	Biomass	Reference
Activity data (AD)	3%	3%	5%	5%	5%	-	Table 2.15, 2006 IPCC GL, Vol. 2, Chap. 2 (2.4.2)
Emission factor (EF)	Rating	Typical error range		Average		Reference	
NOx	B	20% to 60%		40%		Table 2 2 Rating definitions  Table 2 3 Main NFR source categories with applicable quality data ratings  EMEP EEA GB 2019, Part A, Chapter 5 Uncertainties.	
CO	C	50% to 200%		125%			
NM VOC	D	100% to 300%		200%			
SOx	A	10% to 30%		20%			
NH3	E	order of magnitude		750%			
TSP, PM10, PM2.5, BC	C	50% to 200%		125%			
Hg	B	20% to 60%		40%			
Pb, Cd, As, Cr, Cu, Ni, Se, Zn	C	50% to 200%		125%			
PCDD/F	E	order of magnitude		750%			
PAH (Benzo(a)pyrene, Benzo(b)-fluoranthene, Benzo(k)fluor-anthene, Indeno(1,2,3-cd)pyrene)	C	50% to 200%		125%			
HCB, PCBs	D	100% to 300%		200%			

The time-series are considered to be consistent as the same methodology is applied to the whole period. Activity data are considered to be consistent as national and international data were always compared.

### 3.1.5.1.4 Source-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
  - consistent use of energy balance data (energy statistic questionnaires),
  - documented sources,
  - use of units,
  - strictly defined interfaces between spreadsheets/calculation modules,
  - unique structure of sheets which do the same,
  - record keeping, use of write protection,
  - unique use of formulas, special cases are documented/highlighted,
  - quick-control checks for data consistency through all steps of calculation.
- cross-checked from two sources: national statistic, Eurostat and international energy statistics of UN
- cross checks with other relevant sectors are performed to avoid double counting or omissions;
- time series consistency - plausibility checks of dips and jumps.

### 3.1.5.1.5 Source-specific recalculations

The following table presents the main revisions and recalculations done since the last submission in 2013 and 2020 and relevant to sub-category 1.A.4.a.i *Commercial/Institutional*.

**Table 3.115** Recalculations done in sub-category 1.A.4.a.i Commercial/Institutional

source category	Revisions of data	Type of revision	Type of improvement
1.A.4.a	application of EMEP/EEA air pollutant emission inventory guidebook 2019	method	Comparability
1.A.4.a	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019	EF	Comparability
1.A.4.a	use of CS NCV	AD	Accuracy
1.A.4.a	Fuel consumption data (activity data) was revised due to revised fuel consumption data – plant specific data	AD	Accuracy

### 3.1.5.1.6 Source-specific planned improvements

Considering the potential contribution of identified improvements in the total emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 3.116 Planned improvements for sub-category 1.A.4.a.i Commercial/Institutional

Source category	Planned improvement	Type of improvement		Priority
1.A.4.a	Improvement of time series consistency and split of fuels: the energy statistics is still under development; a split of the fuel combustion for this subcategory has to be reviewed for the entire timeseries.	AD	Accuracy Transparency	High
1.A.4.a	Characterisation of <ul style="list-style-type: none"> <li>• residential heating :               <ul style="list-style-type: none"> <li>○ (open/partly open) fire places,</li> <li>○ water heaters,</li> <li>○ advanced/ conventional stoves,</li> <li>○ space heating,</li> <li>○ boilers                   <ul style="list-style-type: none"> <li>▪ Conventional boilers &gt;50kW</li> <li>▪ Standard boilers &gt;50KWth &lt;1MWth</li> <li>▪ Boilers &lt;1MWth – manual feed technology</li> <li>▪ Boilers &lt;1MWth – automatic feed technology</li> <li>▪ Standard boilers &gt;50KWth &lt;1MWth</li> <li>▪ Standard boilers &gt;1MWth &lt;50MWth</li> <li>▪ Gas turbines</li> </ul> </li> </ul> </li> <li>○ cookers;</li> <li>• non-residential heating:               <ul style="list-style-type: none"> <li>○ space heating,</li> <li>○ boilers                   <ul style="list-style-type: none"> <li>▪ Conventional boilers &gt;50kW</li> <li>▪ Conventional boilers &lt;50 kW</li> <li>▪ Standard boilers &gt;50KWth &lt;1MWth</li> <li>▪ Standard boilers &gt;1MWth &lt;50MWth</li> <li>▪ Boilers &lt;1MWth – manual feed technology</li> <li>▪ Boilers &lt;1MWth – automatic feed technology</li> <li>▪ Standard boilers &gt;50KWth &lt;1MWth</li> <li>▪ Standard boilers &gt;1MWth &lt;50MWth</li> <li>▪ Gas turbines</li> <li>▪ Stationary reciprocating engines</li> </ul> </li> </ul> </li> <li>• CHP</li> </ul>	AD	Accuracy Transparency	High
1.A.4.a	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF	Accuracy Transparency	Medium
1.A.4.a	Split of fuels to different sub categories (1A4ai and 1A4aii)	AD	Completeness /comparability	medium



### 3.1.5.2 Residential (category 1.A.4.b)

#### 3.1.5.2.1 Source category description

This section describes emissions resulting from small combustion compliances that are used to provide thermal energy for

- residential heating and cooking 1.A.4.b.i stationary
- small machineries e.g. for gardening 1.A.4.b.ii mobile

The emissions from 1.A.4.b.i Residential resulted from solid, liquid, and gaseous fuels as well as biomass are estimated.

**Table 3.117 Overview on reported emissions from sub categories 1.A.4.b.i, 1.A. 4.b.ii and 1.A. 4.b.iii**

Air pollutants	1.A.4.b.i						1.A. 4.b.ii						Key Category
	liquid	solid	gaseous	Other fossil fuel	Peat	biomass	liquid	solid	gaseous	Other fossil fuel	Peat	biomass	
NO <sub>x</sub>	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
CO	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
NM VOC	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
SO <sub>x</sub>	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
NH <sub>3</sub>	NA	✓	NA	NO	NO	✓	IE	NO	IE	NO	NO	NO	
TSP	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
PM <sub>10</sub>	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
PM <sub>2.5</sub>	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
BC	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
Pb	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
Cd	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
Hg	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
As	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
Cr	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
Cu	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
Ni	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
Se	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
Zn	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
PCB	NA	✓	NA	NO	NO	✓	IE	NO	IE	NO	NO	NO	
PCDD/F	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
Benzo(a)pyrene	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
Benzo(b)fluoranthene	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
Benzo(k)fluoranthene	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
Indeno(1,2,3-cd)pyrene	✓	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	
HCB	NA	✓	✓	NO	NO	✓	IE	NO	IE	NO	NO	NO	

# Use of notation keys

1.A. 4.b.ii IE The emissions are included in 1.A.4.c.ii Agriculture/Forestry/Fishing/Fish Farms - Off-road Vehicles and Other Machinery.

An overview of the emission from fuel combustion in Sub-category 1.A.4.b.i Residential is provided in the following figures and tables:

- annual emissions of air pollutants;
- Trend of the periods 1990 – 2019, 2005 – 2019, 2017 – 2019.

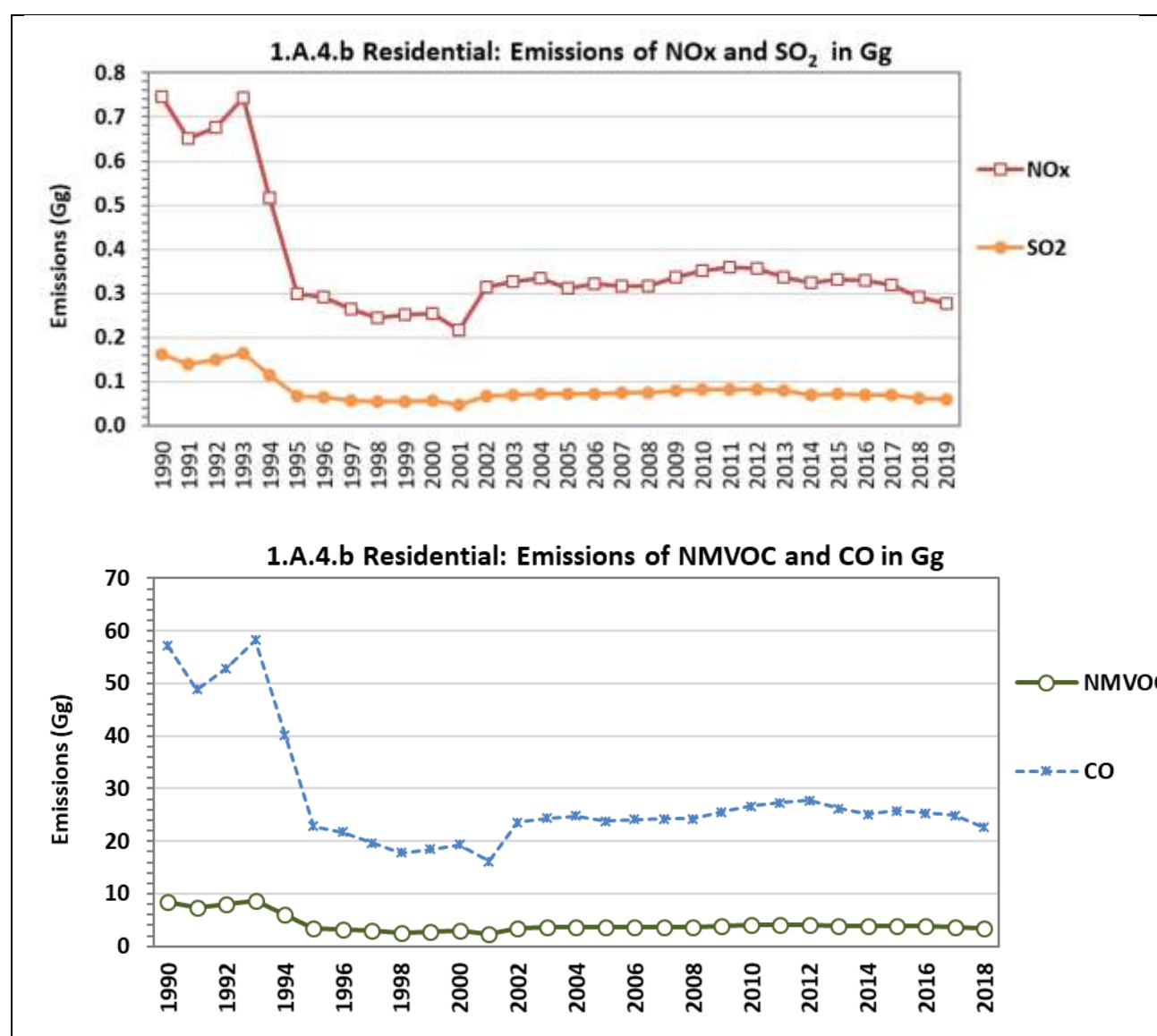


Figure 3.48 Emissions of main pollutants (NO<sub>x</sub>, SO<sub>2</sub>, NMVOC and CO) from sub-category 1.A.4.b.i Residential

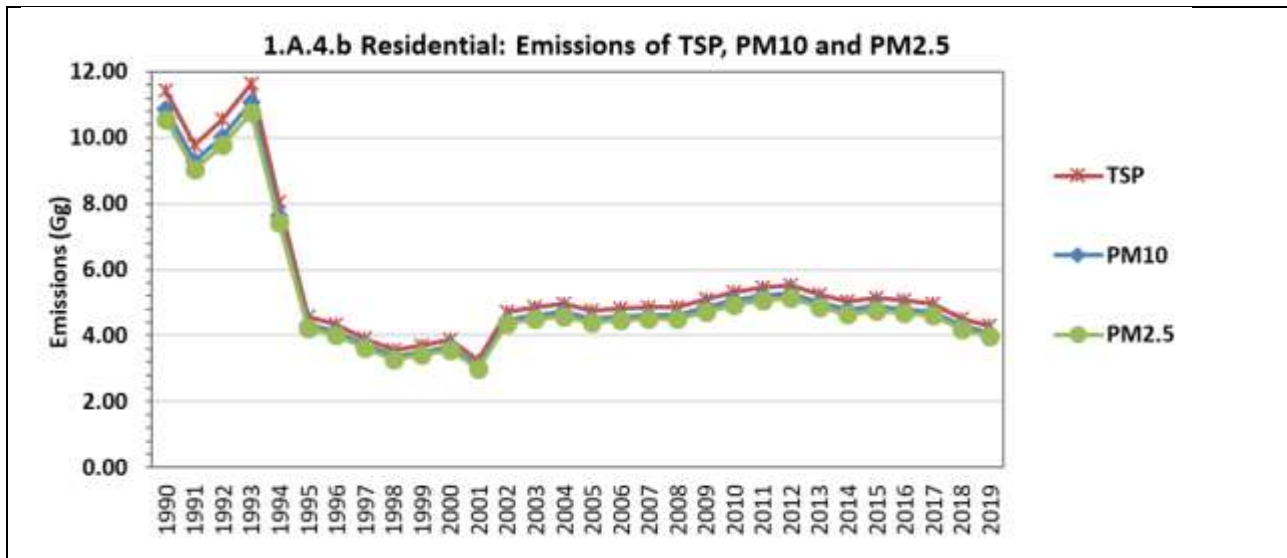


Figure 3.49 Emissions of TSP PM10 and PM2.5 from sub-category 1.A.4.b.i Residential

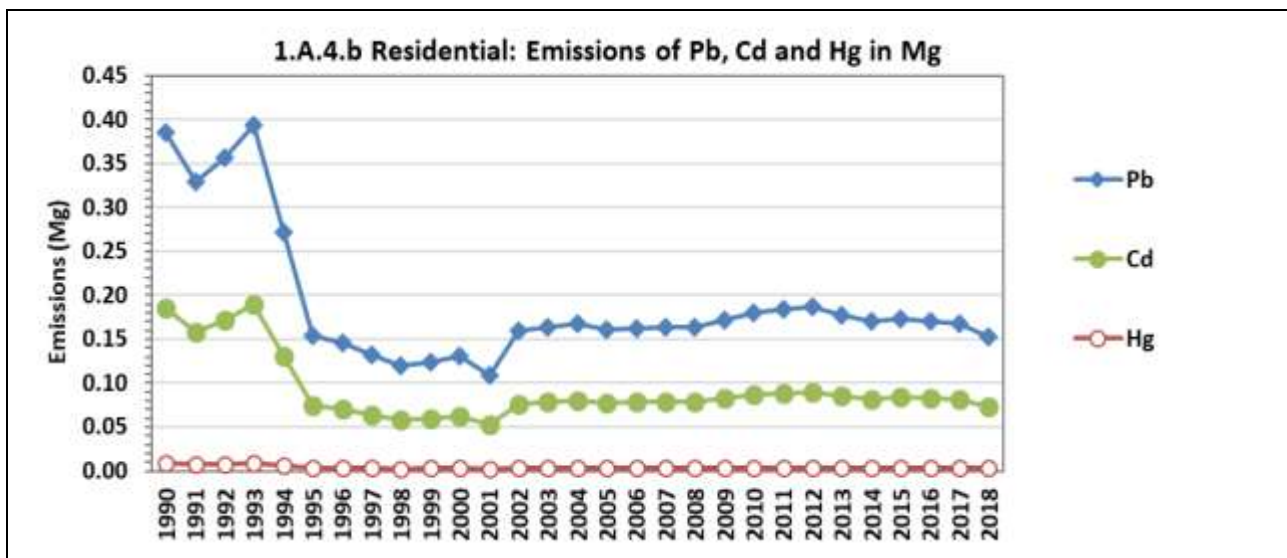
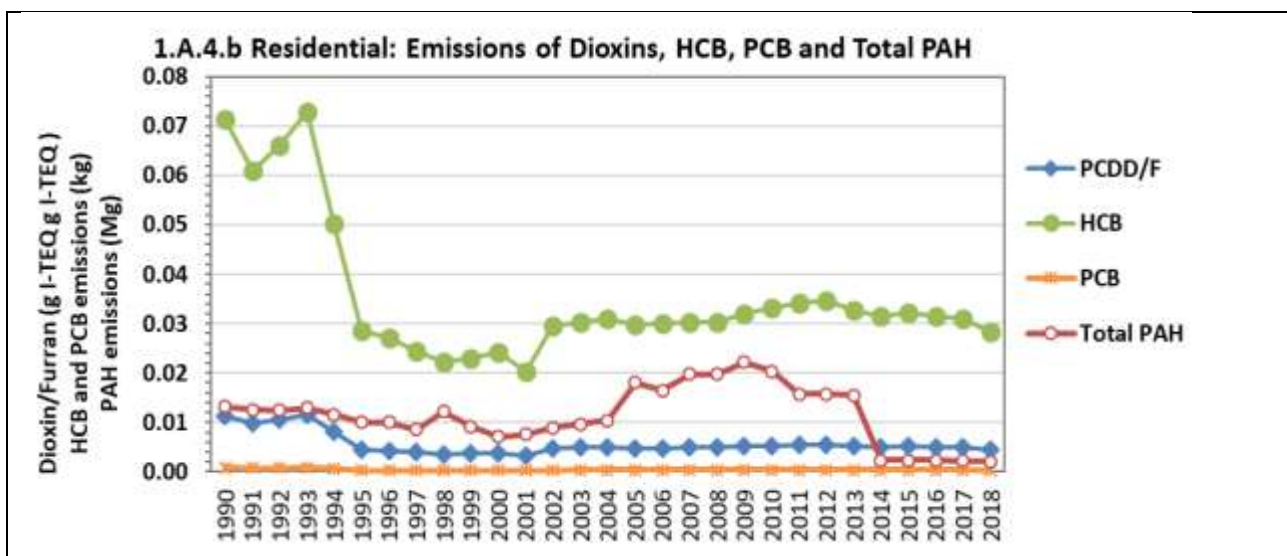


Figure 3.50 Emissions of TSP PM10 and PM2.5 from sub-category 1.A.4.b.i Residential



**Figure 3.51 Emissions of POPs from sub-category 1.A.4.b.i Residential**  
**Table 3.118 Emissions of main pollutants (NO<sub>x</sub>, SO<sub>2</sub>, NMVOC and CO) from sub-category 1.A.4.b.i Residential**

Emissions	NO <sub>x</sub>	NMVOC	SO <sub>x</sub>	CO	NH <sub>3</sub>
1.A.4.b.i	Gg	Gg	Gg	Gg	Gg
1990	0.75	8.57	0.16	57.13	1.00
1991	0.65	7.33	0.14	48.85	0.45
1992	0.68	7.93	0.15	52.85	0.49
1993	0.74	8.74	0.16	58.25	0.54
1994	0.52	6.03	0.11	40.22	0.37
1995	0.30	3.43	0.07	22.84	0.21
1996	0.29	3.25	0.06	21.69	0.20
1997	0.26	2.94	0.06	19.62	0.18
1998	0.24	2.67	0.05	17.79	0.16
1999	0.25	2.77	0.05	18.46	0.17
2000	0.25	2.90	0.06	19.32	0.18
2001	0.22	2.43	0.05	16.18	0.15
2002	0.31	3.53	0.07	23.57	0.22
2003	0.33	3.65	0.07	24.33	0.22
2004	0.33	3.72	0.07	24.81	0.23
2005	0.31	3.57	0.07	23.83	0.22
2006	0.32	3.62	0.07	24.11	0.22
2007	0.32	3.64	0.07	24.31	0.22
2008	0.32	3.64	0.07	24.31	0.22
2009	0.34	3.83	0.08	25.54	0.24
2010	0.35	4.00	0.08	26.66	0.25
2011	0.36	4.10	0.08	27.37	0.25
2012	0.36	4.16	0.08	27.71	0.26
2013	0.34	3.94	0.08	26.24	0.24
2014	0.32	3.78	0.07	25.17	0.23
2015	0.33	3.86	0.07	25.74	0.24
2016	0.33	3.79	0.07	25.30	0.23
2017	0.32	3.73	0.07	24.90	0.23
2018	0.29	3.39	0.06	22.62	0.21
2019	0.28	3.22	0.06	21.49	0.20
Trend					
1990 – 2019	-63.0%	-62.4%	-63.2%	-62.4%	-80.1%
2005 – 2019	-11.2%	-9.8%	-18.4%	-9.8%	-9.8%
2018 – 2019	5.1%	5.3%	5.3%	5.3%	5.3%

Table 3.119 Emissions of particulate matter (PM) from sub-category 1.A.4.b.i Residential

Emissions	PM2.5	PM10	TSP	BC
1.A.4.b.i	Gg	Gg	Gg	Gg
1990	10.57	10.85	11.42	<0.001
1991	9.04	9.28	9.77	<0.001
1992	9.78	10.04	10.57	<0.001
1993	10.78	11.07	11.65	<0.001
1994	7.44	7.64	8.04	<0.001
1995	4.22	4.34	4.57	<0.001
1996	4.01	4.12	4.34	<0.001
1997	3.63	3.73	3.92	<0.001
1998	3.29	3.38	3.56	<0.001
1999	3.41	3.51	3.69	<0.001
2000	3.57	3.67	3.86	<0.001
2001	2.99	3.07	3.23	<0.001
2002	4.36	4.48	4.71	<0.001
2003	4.50	4.62	4.86	<0.001
2004	4.59	4.71	4.96	<0.001
2005	4.41	4.53	4.76	<0.001
2006	4.46	4.58	4.82	<0.001
2007	4.50	4.62	4.86	<0.001
2008	4.50	4.62	4.86	<0.001
2009	4.72	4.85	5.11	<0.001
2010	4.93	5.06	5.33	<0.001
2011	5.06	5.20	5.47	<0.001
2012	5.13	5.26	5.54	<0.001
2013	4.85	4.98	5.25	<0.001
2014	4.66	4.78	5.03	<0.001
2015	4.76	4.89	5.15	<0.001
2016	4.68	4.81	5.06	<0.001
2017	4.61	4.73	4.98	<0.001
2018	4.18	4.30	4.52	<0.001
2019	3.98	4.08	4.30	<0.001
Trend				
1990 – 2019	-62.4%	-62.4%	-62.4%	-65.2%
2005 – 2019	-9.8%	-9.8%	-9.8%	-51.7%
2018 – 2019	5.3%	5.3%	5.3%	5.7%

**Table 3.120 Emissions of Heavy Metals (HM) from sub-category 1.A.4.b.i Residential**

Emissions	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
1.A.4.b.i	kg	kg	kg	kg	kg	kg	kg	kg	kg
1990	0.385	0.186	0.008	0.003	0.328	0.086	0.029	0.007	7.310
1991	0.330	0.159	0.007	0.002	0.281	0.073	0.024	0.006	6.251
1992	0.357	0.172	0.008	0.003	0.304	0.079	0.026	0.007	6.763
1993	0.393	0.189	0.008	0.003	0.335	0.087	0.029	0.007	7.455
1994	0.271	0.131	0.006	0.002	0.231	0.060	0.020	0.005	5.147
1995	0.154	0.074	0.003	0.001	0.131	0.034	0.011	0.003	2.923
1996	0.146	0.070	0.003	0.001	0.125	0.033	0.011	0.003	2.775
1997	0.132	0.064	0.003	0.001	0.113	0.029	0.010	0.002	2.510
1998	0.120	0.058	0.003	0.001	0.102	0.027	0.009	0.002	2.275
1999	0.125	0.060	0.003	0.001	0.106	0.028	0.009	0.002	2.361
2000	0.130	0.063	0.003	0.001	0.111	0.029	0.010	0.002	2.472
2001	0.109	0.053	0.002	0.001	0.093	0.024	0.008	0.002	2.069
2002	0.159	0.077	0.004	0.001	0.135	0.035	0.012	0.003	3.015
2003	0.164	0.079	0.004	0.001	0.140	0.036	0.012	0.003	3.113
2004	0.167	0.081	0.004	0.001	0.143	0.037	0.012	0.003	3.174
2005	0.161	0.077	0.003	0.001	0.137	0.036	0.012	0.003	3.049
2006	0.163	0.078	0.004	0.001	0.139	0.036	0.012	0.003	3.085
2007	0.164	0.079	0.004	0.001	0.140	0.036	0.012	0.003	3.110
2008	0.164	0.079	0.004	0.001	0.140	0.036	0.012	0.003	3.110
2009	0.172	0.083	0.004	0.001	0.147	0.038	0.013	0.003	3.267
2010	0.180	0.087	0.004	0.001	0.153	0.040	0.013	0.003	3.411
2011	0.185	0.089	0.004	0.001	0.157	0.041	0.014	0.003	3.502
2012	0.187	0.090	0.004	0.001	0.159	0.042	0.014	0.003	3.546
2013	0.177	0.085	0.004	0.001	0.151	0.039	0.013	0.003	3.358
2014	0.170	0.082	0.004	0.001	0.145	0.038	0.013	0.003	3.222
2015	0.174	0.084	0.004	0.001	0.148	0.039	0.013	0.003	3.294
2016	0.171	0.082	0.004	0.001	0.145	0.038	0.013	0.003	3.238
2017	0.168	0.081	0.004	0.001	0.143	0.037	0.012	0.003	3.187
2018	0.153	0.074	0.003	0.001	0.130	0.034	0.011	0.003	2.895
2019	0.145	0.070	0.003	0.001	0.124	0.032	0.011	0.003	2.750
<i>Trend</i>									
1990 – 2019	-62.4%	-62.4%	-63.0%	-62.7%	-62.4%	-62.4%	-62.4%	-62.4%	-62.4%
2005 – 2019	-9.8%	-9.8%	-10.0%	-9.7%	-9.8%	-9.8%	-9.8%	-9.8%	-9.8%
2018 – 2019	5.3%	5.3%	5.1%	5.2%	5.3%	5.3%	5.3%	5.3%	5.3%

Table 3.121 Emissions of Persistent Organic Pollutants (POPs) from sub-category 1.A.4.b.i Residential

Emissions	PCDD/F	Benzo(a)-pyrene	Benzo(b)-fluor-anthene	Benzo(k)-fluor-anthene	Indeno (1,2,3-cd) pyrene	Total PAH	HCB	PCB
1.A.4.b.i	g I-TEQ	Mg	Mg	Mg	Mg	Mg	kg	Kg
1990	0.011	0.002	0.002	NA	0.009	0.013	0.071	0.001
1991	0.010	0.001	0.001	NA	0.009	0.013	0.061	0.001
1992	0.011	0.002	0.001	NA	0.009	0.013	0.066	0.001
1993	0.012	0.002	0.002	NA	0.009	0.013	0.073	0.001
1994	0.008	0.001	0.001	NA	0.009	0.012	0.050	0.001
1995	0.005	0.001	0.001	NA	0.009	0.010	0.029	<0.001
1996	0.004	0.001	0.001	NA	0.009	0.010	0.027	<0.001
1997	0.004	0.001	0.001	NA	0.007	0.009	0.025	<0.001
1998	0.004	0.001	0.000	NA	0.011	0.012	0.022	<0.001
1999	0.004	0.001	0.001	NA	0.008	0.009	0.023	<0.001
2000	0.004	0.001	0.001	NA	0.006	0.007	0.024	<0.001
2001	0.003	0.000	0.000	NA	0.006	0.008	0.020	<0.001
2002	0.005	0.001	0.001	NA	0.007	0.009	0.029	<0.001
2003	0.005	0.001	0.001	NA	0.008	0.010	0.030	<0.001
2004	0.005	0.001	0.001	NA	0.009	0.010	0.031	<0.001
2005	0.005	0.001	0.001	NA	0.016	0.018	0.030	<0.001
2006	0.005	0.001	0.001	NA	0.015	0.016	0.030	<0.001
2007	0.005	0.001	0.001	NA	0.018	0.020	0.030	<0.001
2008	0.005	0.001	0.001	NA	0.018	0.020	0.030	<0.001
2009	0.005	0.001	0.001	NA	0.020	0.022	0.032	<0.001
2010	0.005	0.001	0.001	NA	0.019	0.020	0.033	<0.001
2011	0.005	0.001	0.001	NA	0.014	0.016	0.034	<0.001
2012	0.006	0.001	0.001	NA	0.014	0.016	0.035	<0.001
2013	0.005	0.001	0.001	NA	0.014	0.016	0.033	<0.001
2014	0.005	0.001	0.001	NA	0.001	0.002	0.031	<0.001
2015	0.005	0.001	0.001	NA	0.001	0.002	0.032	<0.001
2016	0.005	0.001	0.001	NA	0.001	0.002	0.032	<0.001
2017	0.005	0.001	0.001	NA	0.001	0.002	0.031	<0.001
2018	0.005	0.001	0.001	NA	0.001	0.002	0.028	<0.001
2019	0.004	0.001	0.001	NO	0.001	0.002	0.027	<0.001
<i>Trend</i>								
1990 – 2019	-62.4%	-62.5%	-62.4%	NA	-94.6%	-84.9%	-62.4%	-62.4%
2005 – 2019	-9.8%	-10.8%	-10.3%	NA	-96.9%	-89.0%	-9.8%	-9.8%
2018 – 2019	5.3%	5.3%	5.3%	NA	3.9%	4.9%	5.3%	5.3%

### 3.1.5.2.2 Methodological issues

#### 3.1.5.2.2.1 Choice of methods

For estimating the air pollutants emissions the Tier 1 approach<sup>45</sup> of the EMEP/EEA air pollutant emission inventory guidebook 2019 has been applied:

*Equation: emissions from stationary combustion*

$$Emissions_{pollutant} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{pollutant, fuel}$$

Where:

Emissions <sub>pollutant</sub>	= emissions of a given pollutant by type of fuel (kg pollutant)
Fuel consumption <sub>fuel</sub>	= amount of fuel combusted (TJ)
Emission factor <sub>pollutant, fuel</sub>	= default emission factor of a given pollutant by type of fuel (g <sub>pollutant</sub> /GJ).
Pollutant	= main pollutants: NO <sub>x</sub> , CO, NMVOC, SO <sub>2</sub> particulate matter: TSP, OM10, PM2.5, BC heavy metals: Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn persistent organic pollutants: PCDD/F, Benzo(a) pyrene, Benzo(b)fluor, anthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene, Total PAH, HCB, PCB
Fuel	= liquid fuels, solid fuels, gaseous fuels, other fossil fuel, biomass, peat

#### 3.1.5.2.2.2 Choice of activity data

The following fuels are used for electricity and heat production (autoproducer):

Tier 1 fuel type	Associated fuel types	Source
Liquid fuels	<ul style="list-style-type: none"> <li>Residual fuel oil</li> <li>Petroleum Coke</li> <li>Liquefied Petroleum Gases (LPG)</li> </ul>	Summary of fuel aggregations at Tier 1 according to EMEP/EEA air pollutant emission inventory guidebook 2019, Part B, Chapter 1.A.4,
Solid fuels	<ul style="list-style-type: none"> <li>Lignite</li> </ul>	
Biomass	<ul style="list-style-type: none"> <li>Charcoal</li> <li>Wood/ Fuelwood</li> <li>Wood Waste</li> <li>Wood pellets</li> <li>WoodBriquette</li> </ul>	

Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2019 were taken from prepared by Statistical Office of Montenegro (MONSTAT).

<sup>45</sup> Source: EMEP/EEA air pollutant emission inventory guidebook 2019, 1.A.4 Small Combustion, sub-chapter 3.2 Tier 1 default approach.



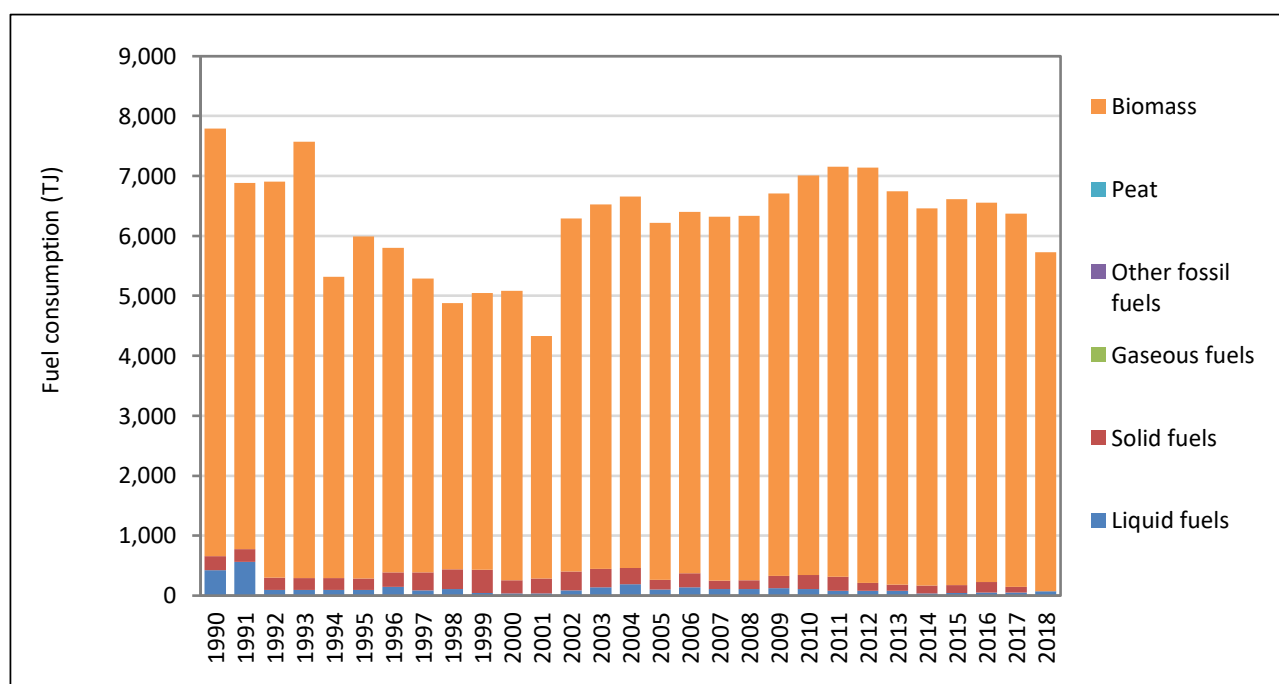


Figure 3.52 Activity data for sub-category 1.A.4.b.i Residential

Table 3.122 Activity data for sub-category 1.A.4.b.i Residential

Activity data 1.A.4.b	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
1990	7,794.44	424.56	231.11	NO	NO	NO	7,138.77
1991	6,881.96	565.23	212.62	NO	NO	NO	6,104.11
1992	6,904.48	96.33	203.38	NO	NO	NO	6,604.78
1993	7,570.84	96.33	194.13	NO	NO	NO	7,280.38
1994	5,316.54	96.33	194.13	NO	NO	NO	5,026.08
1995	5,990.14	96.33	184.89	NO	NO	NO	5,708.92
1996	5,804.07	143.22	240.35	NO	NO	NO	5,420.50
1997	5,286.69	87.86	295.82	NO	NO	NO	4,903.01
1998	4,879.02	111.48	323.55	NO	NO	NO	4,443.98
1999	5,044.63	45.09	388.26	NO	NO	NO	4,611.28
2000	5,083.89	32.96	221.86	NO	NO	NO	4,829.06
2001	4,328.52	37.08	249.60	NO	NO	NO	4,041.84
2002	6,291.34	88.09	314.31	NO	NO	NO	5,888.95
2003	6,523.88	139.10	305.06	NO	NO	NO	6,079.71
2004	6,656.87	190.11	268.09	NO	NO	NO	6,198.68
2005	6,219.89	98.88	166.40	NO	NO	NO	5,954.61
2006	6,401.09	135.31	240.35	NO	NO	NO	6,025.44
2007	6,321.84	109.26	138.67	NO	NO	NO	6,073.91
2008	6,331.66	109.39	147.91	NO	NO	NO	6,074.36
2009	6,707.58	123.39	203.38	NO	NO	NO	6,380.81

Activity data 1.A.4.b	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
TJ							
2010	7,005.57	111.78	231.11	NO	NO	NO	6,662.68
2011	7,153.00	82.40	231.11	NO	NO	NO	6,839.49
2012	7,138.07	82.40	129.42	NO	NO	NO	6,926.25
2013	6,742.73	82.40	101.69	NO	NO	NO	6,558.64
2014	6,458.44	37.51	128.50	NO	NO	NO	6,292.43
2015	6,612.69	42.20	134.04	NO	NO	NO	6,436.45
2016	6,553.09	46.89	180.27	NO	NO	NO	6,325.94
2017	6,372.83	51.58	94.29	NO	NO	NO	6,226.96
2018	5,809.84	70.34	85.05	NO	NO	NO	5,654.46
2019	5,527.52	75.02	80.43	NO	NO	NO	5,372.07
Trend							
1990 – 2019	-29.1%	-82.3%	-65.2%	NA	NA	NA	-24.7%
2005 – 2019	-11.1%	-24.1%	-51.7%	NA	NA	NA	-9.8%
2018 – 2019	5.1%	-6.3%	5.7%	NA	NA	NA	5.3%

In energy statistics, production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units, e.g. in tonnes or cubic metres. To convert these data to energy units, in this case terajoules, requires calorific values. The emission calculations are based on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in sub-category 1.A.4.b.i Residential.

**Table 3.123 Net calorific values (NCVs) applied for conversion to energy units in sub-category 1.A.4.b.i Residential**

Fuel	Fuel type	Net calorific value (NCV) (TJ/Gg) or * (TJ/m³)		Source	
		NCV	type		
Lignite	solid	9.24	CS	Statistical Office of Montenegro (MONSTAT)	
Sub-bituminous coal	solid	16.75	CS		
Residual fuel oil	liquid	41.20	CS		
Gas/Diesel Oil	liquid	42.71	CS		
Liquefied Petroleum Gases (LPG)	liquid	46.89	CS		
Charcoal	biomass	46.00	CS		
Wood/ Fuelwood*	biomass	9.1764	CS		
Wood Waste*	biomass	7.4124	CS		
Wood pellets	biomass	16.85	CS		
WoodBriquette	biomass	16.85	CS		
Note:					
D	Default	CS	Country specific	PS	Plant specific

### 3.1.5.2.2.3 Choice of emission factors

Default emission factors for air pollutant were taken from the EMEP/EEA air pollutant emission inventory Guidebook 2019<sup>46</sup> and are presented in the following table.

**Table 3.124 Emission factors (EF) for Main pollutants, Particulate Matter (PM), Heavy metals (HM) and Persistent Organic Pollutants (POPs) for sub- category 1.A.4.b.i Residential**

Fuel Type	UNIT	Solid Fuels		Liquid fuels		Gaseous Fuels		Biomass	
Associated fuel types		Lignite		Residual fuel oil, Gas/Diesel Oil, Liquefied Petroleum Gases (LPG)				Charcoal, Wood/ Fuelwood, Wood Waste, Wood pellets, WoodBriquette	
Pollutant		EF	type	EF	type	EF	type	CS	CS
NOx	g/GJ	173	D	306	D	74	D	91	D
CO	g/GJ	931	D	93	D	29	D	570	D
NMVOC	g/GJ	88.8	D	20	D	23	D	300	D
SOx	g/GJ	840	D	94	D	0.67	D	11	D
TSP	g/GJ	124	D	21	D	0.78	D	1.2	D
NH3	g/GJ	NE		NE		NE		150	D
PM10	g/GJ	117	D	21	D	0.78	D	143	D
PM2.5	g/GJ	108	D	18	D	0.78	D	140	D
BC	% of PM2.5	6.4	D	56	D	4	D	28	D
Pb	mg/GJ	134	D	8	D	0.011	D	27	D
Cd	mg/GJ	1.8	D	0.15	D	0.0009	D	13	D
Hg	mg/GJ	7.9	D	0.1	D	0.54	D	0.56	D
As	mg/GJ	4	D	0.5	D	0.1	D	0.19	D
Cr	mg/GJ	13.5	D	10	D	0.013	D	23	D
Cu	mg/GJ	17.5	D	3	D	0.0026	D	6	D
Ni	mg/GJ	13	D	125	D	0.013	D	2	D
Se	mg/GJ	1.8	D	0.1	D	0.058	D	0.5	D
Zn	mg/GJ	200	D	18	D	0.73	D	512	D
PCB	ng WHO-TEG/GJ	170	D	0.13	D	NE	D	0.06	D
PCDD/F	ng I-TEQ/GJ	203	D	1.4	D	0.52	D	100	D
Benzo(a)pyrene	µg/GJ	0.0455	D	1.9	D	0.72	D	0.01	D
Benzo(b)fluoranthene	µg/GJ	0.0589	D	15	D	2.9	D	0.016	D
Benzo(k)fluoranthene	µg/GJ	0.0237	D	1.7	D	1.1	D	0.005	D
Indeno(1,2,3-cd)pyrene	µg/GJ	0.0185	D	1.5	D	1.08	D	0.004	D
HCB	µg/GJ	0.62	D	0.22	D	NE	D	5	D
Source		Table 3.3, section 3.2.2, page 31.		Table 3.4, section 3.4, page 32.		Table 3.5, section 3.4, page 33.		Table 3.6, section 3.4, page 34.	
		EMEP/EEA air pollutant emission inventory guidebook 2019, Part B, Chapter 1.A4 Small combustion							
Note:									

<sup>46</sup> Source: EMEP/EEA air pollutant emission inventory guidebook 2019, Chapter 1.A4 Small combustion, sub-chapter 3.2.2 Default emission factors.

Fuel Type	UNIT	Solid Fuels	Liquid fuels	Gasous Fuels	Biomass
Associated fuel types		Lignite	Residual fuel oil, Gas/Diesel Oil, Liquefied Petroleum Gases (LPG)		Charcoal, Wood/Fuelwood, Wood Waste, Wood pellets, WoodBriquette
D Default	CS Country specific	PS Plant specific	IEF Implied emission factor		

### 3.1.5.2.3 Uncertainties and time-series consistency

The uncertainties for activity data and emission factors used for IPCC/NFR category 1.A.4.a.i Commercial/Institutional are presented in the following table.

**Table 3.125 Uncertainty for sub-category 1.A.4.b.i Residential**

Uncertainty	Hard Coal	Brown Coal	Gaseous fuels	Heavy Fuel Oil	Gas oil	Biomass	Reference
Activity data (AD)	3%	3%	5%	5%	5%	-	Table 2.15, 2006 IPCC GL, Vol. 2, Chap. 2 (2.4.2)
Emission factor (EF)	Rating	Typical error range		Average		Reference	
NOx	B	20% to 60%		40%		Table 2 2 Rating definitions  Table 2 3 Main NFR source categories with applicable quality data ratings  EMEP EEA GB 2019, Part A, Chapter 5 Uncertainties.	
CO	C	50% to 200%		125%			
NM VOC	D	100% to 300%		200%			
SOx	A	10% to 30%		20%			
NH3	E	order of magnitude		750%			
TSP, PM10, PM2.5, BC	C	50% to 200%		125%			
Hg	B	20% to 60%		40%			
Pb, Cd, As, Cr, Cu, Ni, Se, Zn	C	50% to 200%		125%			
PCDD/F	E	order of magnitude		750%			
PAH (Benzo(a)pyrene, Benzo(b)-fluoranthene, Benzo(k)fluor-anthene, Indeno(1,2,3-cd)pyrene)	C	50% to 200%		125%			
HCB, PCBs	D	100% to 300%		200%			

The time-series are considered to be consistent as the same methodology is applied to the whole period. Activity data are considered to be consistent as national and international data were always compared.

### 3.1.5.2.4 Source-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
  - consistent use of energy balance data (energy statistic questionnaires),
  - documented sources,
  - use of units,
  - strictly defined interfaces between spreadsheets/calculation modules,
  - unique structure of sheets which do the same,
  - record keeping, use of write protection,
  - unique use of formulas, special cases are documented/highlighted,

- quick-control checks for data consistency through all steps of calculation.
- cross-checked from two sources: national statistic, Eurostat and international energy statistics of UN
- cross checks with other relevant sectors are performed to avoid double counting or omissions;
- time series consistency - plausibility checks of dips and jumps.

### 3.1.5.2.5 Source-specific recalculations

The following table presents the main revisions and recalculations done since the last submission in 2020 and relevant to sub-category 1.A.4.b.i Residential.

**Table 3.126 Recalculations done in sub-category 1.A.4.b.i Residential**

source category	Revisions of data	Type of revision	Type of improvement
1.A.4.b	application of EMEP/EEA air pollutant emission inventory guidebook 2019	method	Comparability
1.A.4.b	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019	EF	Comparability
1.A.4.b	use of CS NCV	AD	Accuracy
1.A.4.b	Fuel consumption data (activity data) was revised due to revised fuel consumption data – plant specific data	AD	Accuracy

### 3.1.5.2.6 Source-specific planned improvements

Considering the potential contribution of identified improvements in the total emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

**Table 3.127 Planned improvements for sub-category 1.A.4.b.i Residential**

Source category	Planned improvement	Type of improvement		Priority
1.A.4.c	Improvement of time series consistency and split of fuels: the energy statistics is still under development; a split of the fuel combustion for this subcategory has to be reviewed for the entire timeseries.	AD	Accuracy Transparency	High
1.A.4.c	Characterisation of <ul style="list-style-type: none"> <li>• residential heating :               <ul style="list-style-type: none"> <li>○ (open/partly open) fire places,</li> <li>○ water heaters,</li> <li>○ advanced/ conventional stoves,</li> <li>○ space heating,</li> <li>○ boilers                   <ul style="list-style-type: none"> <li>▪ Conventional boilers &gt;50kW</li> <li>▪ Standard boilers &gt;50KWth &lt;1MWth</li> <li>▪ Boilers &lt;1MWth – manual feed technology</li> <li>▪ Boilers &lt;1MWth – automatic feed technology</li> <li>▪ Standard boilers &gt;50KWth &lt;1MWth</li> <li>▪ Standard boilers &gt;1MWth &lt;50MWth</li> <li>▪ Gas turbines</li> </ul> </li> </ul> </li> <li>○ cookers;</li> </ul>	AD	Accuracy Transparency	High

1.A.4.c	Split of fuels to different sub categories (1A4bi and 1A4bii)	AD	Completeness /comparability	Medium
1.A.4.c	Use of waste – biomass fraction/non-biomass fraction	AD	Completeness	high

### 3.1.5.3 Agriculture/Forestry/Fishing/Fish Farms (category 1.A.4.c)

#### 3.1.5.3.1 Source category description

This category comprises emissions from subcategory from liquid fuels:

- 1.A.4.c.ii off-road machinery and other vehicles in Agriculture/Forestry/Fishing/Fish Farms

Emissions from subcategory 1.A.4.c.i *Stationary* are included

in subcategory 1.A.4.b.i *Residential - stationary*.

Emissions from subcategory 1.A.4.c.iii *National fishing* are included

in subcategory 1.A.4.c.ii *Off-road vehicles*.

An overview of the emission from fuel combustion in Sub-category 1.A.4.c.ii *Agriculture/Forestry/Fishing/Fish Farms - Off-road* is provided in the following figures and tables:

- annual emissions of air pollutants;
- Trend of the periods 1990 – 2019, 2005 – 2019, 2017 – 2019.

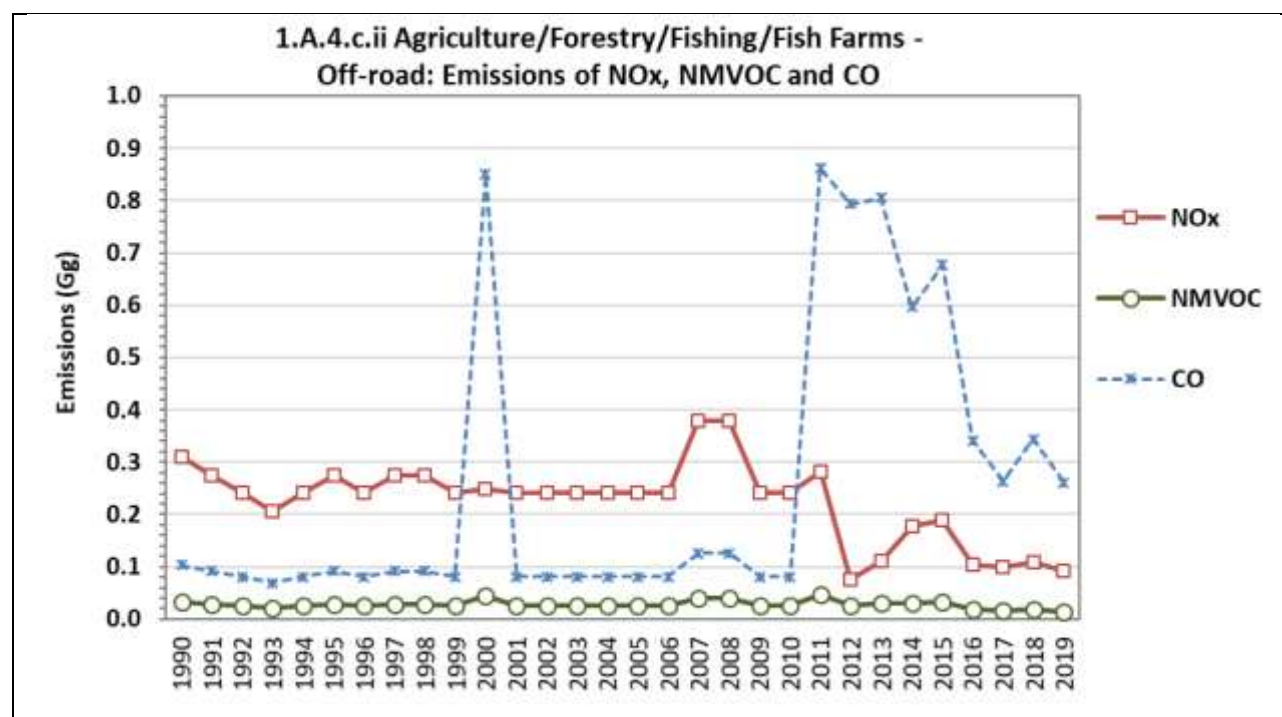


Figure 3.53 Emissions of main pollutants (NOx, NMVOC and CO) from sub-category 1.A.4.c.ii Agriculture/Forestry/Fishing/Fish Farms - Off-road

**Table 3.128 Emissions of main pollutants (NO<sub>x</sub>, NMVOC and CO) from sub-category 1.A.4.c.ii Agriculture/ Forestry/Fishing/Fish Farms - Off-road**

Emissions	NO <sub>x</sub>	NMVOC	SO <sub>x</sub>	CO	NH <sub>3</sub>
1.A.4.b.i	Gg	Gg	Gg	Gg	Gg
1990	0.310	0.032	NE	0.103	<0.001
1991	0.276	0.028	NE	0.092	<0.001
1992	0.241	0.025	NE	0.080	<0.001
1993	0.207	0.021	NE	0.069	<0.001
1994	0.241	0.025	NE	0.080	<0.001
1995	0.276	0.028	NE	0.092	<0.001
1996	0.241	0.025	NE	0.080	<0.001
1997	0.276	0.028	NE	0.092	<0.001
1998	0.276	0.028	NE	0.092	<0.001
1999	0.241	0.025	NE	0.080	<0.001
2000	0.248	0.044	NE	0.851	<0.001
2001	0.241	0.025	NE	0.080	<0.001
2002	0.241	0.025	NE	0.080	<0.001
2003	0.241	0.025	NE	0.080	<0.001
2004	0.241	0.025	NE	0.080	<0.001
2005	0.241	0.025	NE	0.080	<0.001
2006	0.241	0.025	NE	0.080	<0.001
2007	0.379	0.039	NE	0.126	<0.001
2008	0.379	0.039	NE	0.126	<0.001
2009	0.241	0.025	NE	0.080	<0.001
2010	0.241	0.025	NE	0.080	<0.001
2011	0.283	0.047	NE	0.862	<0.001
2012	0.076	0.026	NE	0.793	<0.001
2013	0.110	0.030	NE	0.805	<0.001
2014	0.177	0.031	NE	0.597	<0.001
2015	0.188	0.034	NE	0.677	<0.001
2016	0.103	0.018	NE	0.341	<0.001
2017	0.099	0.016	NE	0.263	<0.001
2018	0.110	0.019	NE	0.344	<0.001
2019	0.092	0.015	NE	0.261	<0.001
Trend					
1990 – 2019	-70.4%	-53.3%	NA	152.8%	-69.4%
2005 – 2019	-62.0%	-40.0%	NA	225.0%	-60.7%
2018 – 2019	19.6%	24.6%	NA	31.7%	20.0%



**Table 3.129 Emissions of particulate matter (PM) from sub-category 1.A.4.c.ii Agriculture/Forestry/Fishing/Fish Farms - Off-road**

Emissions	PM2.5	PM10	TSP	BC
1.A.4.b.i	Gg	Gg	Gg	Gg
1990	0.017	0.017	0.017	<0.001
1991	0.015	0.015	0.015	<0.001
1992	0.013	0.013	0.013	<0.001
1993	0.011	0.011	0.011	<0.001
1994	0.013	0.013	0.013	<0.001
1995	0.015	0.015	0.015	<0.001
1996	0.013	0.013	0.013	<0.001
1997	0.015	0.015	0.015	<0.001
1998	0.015	0.015	0.015	<0.001
1999	0.013	0.013	0.013	<0.001
2000	0.014	0.014	0.014	<0.001
2001	0.013	0.013	0.013	<0.001
2002	0.013	0.013	0.013	<0.001
2003	0.013	0.013	0.013	<0.001
2004	0.013	0.013	0.013	<0.001
2005	0.013	0.013	0.013	<0.001
2006	0.013	0.013	0.013	<0.001
2007	0.021	0.021	0.021	<0.001
2008	0.021	0.021	0.021	<0.001
2009	0.013	0.013	0.013	<0.001
2010	0.013	0.013	0.013	<0.001
2011	0.015	0.015	0.015	0.009
2012	0.004	0.004	0.004	0.009
2013	0.006	0.006	0.006	0.009
2014	0.010	0.010	0.010	0.006
2015	0.010	0.010	0.010	0.007
2016	0.006	0.006	0.006	0.004
2017	0.005	0.005	0.005	0.003
2018	0.006	0.006	0.006	0.004
2019	0.005	0.005	0.005	0.003
Trend				
1990 – 2019	-70.8%	-70.8%	-70.8%	2545.6%
2005 – 2019	-62.5%	-62.5%	-62.5%	3301.5%
2018 – 2019	19.4%	19.4%	19.4%	33.2%

**Table 3.130 Emissions of Heavy Metals (HM) from sub-category 1.A.4.c.ii Agriculture/Forestry/Fishing/Fish Farms - Off-road**

Emissions	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
1.A.4.b.i	kg	kg	kg	kg	kg	kg	kg	kg	kg
1990	NA	<0.001	NA	NA	<0.001	<0.001	<0.001	<0.001	<0.001
1991	NA	<0.001	NA	NA	<0.001	<0.001	<0.001	<0.001	<0.001
1992	NA	<0.001	NA	NA	<0.001	<0.001	<0.001	<0.001	<0.001
1993	NA	<0.001	NA	NA	<0.001	<0.001	<0.001	<0.001	<0.001
1994	NA	<0.001	NA	NA	<0.001	<0.001	<0.001	<0.001	<0.001
1995	NA	<0.001	NA	NA	<0.001	<0.001	<0.001	<0.001	<0.001
1996	NA	<0.001	NA	NA	<0.001	<0.001	<0.001	<0.001	<0.001
1997	NA	<0.001	NA	NA	<0.001	<0.001	<0.001	<0.001	<0.001
1998	NA	<0.001	NA	NA	<0.001	<0.001	<0.001	<0.001	<0.001
1999	NA	<0.001	NA	NA	<0.001	<0.001	<0.001	<0.001	<0.001
2000	NA	<0.001	NA	NA	<0.001	0.002	<0.001	<0.001	0.001
2001	NA	<0.001	NA	NA	<0.001	<0.001	<0.001	<0.001	<0.001
2002	NA	<0.001	NA	NA	<0.001	<0.001	<0.001	<0.001	<0.001
2003	NA	<0.001	NA	NA	<0.001	<0.001	<0.001	<0.001	<0.001
2004	NA	<0.001	NA	NA	<0.001	<0.001	<0.001	<0.001	<0.001
2005	NA	<0.001	NA	NA	<0.001	<0.001	<0.001	<0.001	<0.001
2006	NA	<0.001	NA	NA	<0.001	<0.001	<0.001	<0.001	<0.001
2007	NA	<0.001	NA	NA	<0.001	<0.001	<0.001	<0.001	<0.001
2008	NA	<0.001	NA	NA	<0.001	<0.001	<0.001	<0.001	<0.001
2009	NA	<0.001	NA	NA	<0.001	<0.001	<0.001	<0.001	<0.001
2010	NA	<0.001	NA	NA	<0.001	<0.001	<0.001	<0.001	<0.001
2011	NA	<0.001	NA	NA	<0.001	0.002	<0.001	<0.001	0.001
2012	NA	<0.001	NA	NA	<0.001	0.002	<0.001	<0.001	0.001
2013	NA	<0.001	NA	NA	<0.001	0.002	<0.001	<0.001	0.001
2014	NA	<0.001	NA	NA	<0.001	0.001	<0.001	<0.001	0.001
2015	NA	<0.001	NA	NA	<0.001	0.001	<0.001	<0.001	0.001
2016	NA	<0.001	NA	NA	<0.001	0.001	<0.001	<0.001	<0.001
2017	NA	<0.001	NA	NA	<0.001	0.001	<0.001	<0.001	<0.001
2018	NA	<0.001	NA	NA	<0.001	0.001	<0.001	<0.001	<0.001
2019	NA	<0.001	NA	NA	<0.001	0.001	<0.001	<0.001	<0.001
<i>Trend</i>									
1990 – 2019	NA	3262.2%	NA	NA	3262.2%	3262.2%	3262.2%	3262.2%	3262.2%
2005 – 2019	NA	4222.9%	NA	NA	4222.9%	4222.9%	4222.9%	4222.9%	4222.9%
2018 – 2019	NA	33.2%	NA	NA	33.2%	33.2%	33.2%	33.2%	33.2%

**Table 3.131 Emissions of Persistent Organic Pollutants (POPs) from sub-category 1.A.4.c.ii Agriculture/ Forestry/Fishing/Fish Farms - Off-road**

Emissions	PCDD/F	Benzo(a)-pyrene	Benzo(b)-fluor-anthene	Benzo(k)-fluor-anthene	Indeno (1,2,3-cd) pyrene	Total PAH	HCB	PCB
1.A.4.b.i	g I-TEQ	Mg	Mg	Mg	Mg	Mg	kg	Kg
1990	NA	<0.001	<0.001	NA	NA	0.001	NA	NA
1991	NA	<0.001	<0.001	NA	NA	0.001	NA	NA
1992	NA	<0.001	<0.001	NA	NA	0.001	NA	NA
1993	NA	<0.001	<0.001	NA	NA	<0.001	NA	NA
1994	NA	<0.001	<0.001	NA	NA	0.001	NA	NA
1995	NA	<0.001	<0.001	NA	NA	0.001	NA	NA
1996	NA	<0.001	<0.001	NA	NA	0.001	NA	NA
1997	NA	<0.001	<0.001	NA	NA	0.001	NA	NA
1998	NA	<0.001	<0.001	NA	NA	0.001	NA	NA
1999	NA	<0.001	<0.001	NA	NA	0.001	NA	NA
2000	NA	<0.001	0.040	NA	NA	0.041	NA	NA
2001	NA	<0.001	<0.001	NA	NA	0.001	NA	NA
2002	NA	<0.001	<0.001	NA	NA	0.001	NA	NA
2003	NA	<0.001	<0.001	NA	NA	0.001	NA	NA
2004	NA	<0.001	<0.001	NA	NA	0.001	NA	NA
2005	NA	<0.001	<0.001	NA	NA	0.001	NA	NA
2006	NA	<0.001	<0.001	NA	NA	0.001	NA	NA
2007	NA	<0.001	0.001	NA	NA	0.001	NA	NA
2008	NA	<0.001	0.001	NA	NA	0.001	NA	NA
2009	NA	<0.001	<0.001	NA	NA	0.001	NA	NA
2010	NA	<0.001	<0.001	NA	NA	0.001	NA	NA
2011	NA	<0.001	0.040	NA	NA	0.041	NA	NA
2012	NA	<0.001	0.040	NA	NA	0.040	NA	NA
2013	NA	<0.001	0.040	NA	NA	0.040	NA	NA
2014	NA	<0.001	0.028	NA	NA	0.028	NA	NA
2015	NA	<0.001	0.032	NA	NA	0.032	NA	NA
2016	NA	<0.001	0.016	NA	NA	0.016	NA	NA
2017	NA	<0.001	0.012	NA	NA	0.012	NA	NA
2018	NA	<0.001	0.016	NA	NA	0.016	NA	NA
2019	NA	<0.001	0.012	NA	NA	0.012	NA	NA
<i>Trend</i>								
1990 – 2019	NA	-71.1%	2595.6%	NA	NA	1595.6%	NA	NA
2005 – 2019	NA	-62.9%	3365.7%	NA	NA	2080.0%	NA	NA
2018 – 2019	NA	19.2%	33.2%	NA	NA	33.1%	NA	NA

### 3.1.5.3.2 Methodological issues

#### 3.1.5.3.2.1 Choice of methods

For estimating the air pollutants emissions the Tier 1 approach<sup>47</sup> of the EMEP/EEA air pollutant emission inventory guidebook 2019 has been applied:

*Equation: emissions from stationary combustion*

$$Emissions_{pollutant} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{pollutant, fuel}$$

Where:

Emissions <sub>pollutant</sub>	= emissions of a given pollutant by type of fuel (kg pollutant)
Fuel consumption <sub>fuel</sub>	= amount of fuel combusted (TJ)
Emission factor <sub>pollutant, fuel</sub>	= default emission factor of a given pollutant by type of fuel (g <sub>pollutant</sub> /GJ).
Pollutant	= main pollutants: NO <sub>x</sub> , CO, NMVOC, SO <sub>2</sub> particulate matter: TSP, OM10, PM2.5, BC heavy metals: Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn persistent organic pollutants: PCDD/F, Benzo(a) pyrene, Benzo(b)fluor, anthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene, Total PAH, HCB, PCB
Fuel	= liquid fuels, solid fuels, gaseous fuels, other fossil fuel, biomass, peat

#### 3.1.5.3.2.2 Choice of activity data

The following fuels are used for electricity and heat production (autoproducer):

Tier 1 fuel type	Associated fuel types	Source
Liquid fuels	<ul style="list-style-type: none"> <li>Residual fuel oil</li> <li>Gas/Diesel Oil</li> <li>motor gasoline</li> </ul>	Summary of fuel aggregations at Tier 1 according to EMEP/EEA air pollutant emission inventory guidebook 2019, Part B, Chapter 1.A.4,

Emissions from motor gasoline are included in sectors road transport (1.A.3) and Agriculture (3). Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2019 were taken from prepared by Statistical Office of Montenegro (MONSTAT).

<sup>47</sup> Source: EMEP/EEA air pollutant emission inventory guidebook 2019, 1.A.4 Small Combustion, sub-chapter 3.2 Tier 1 default approach.

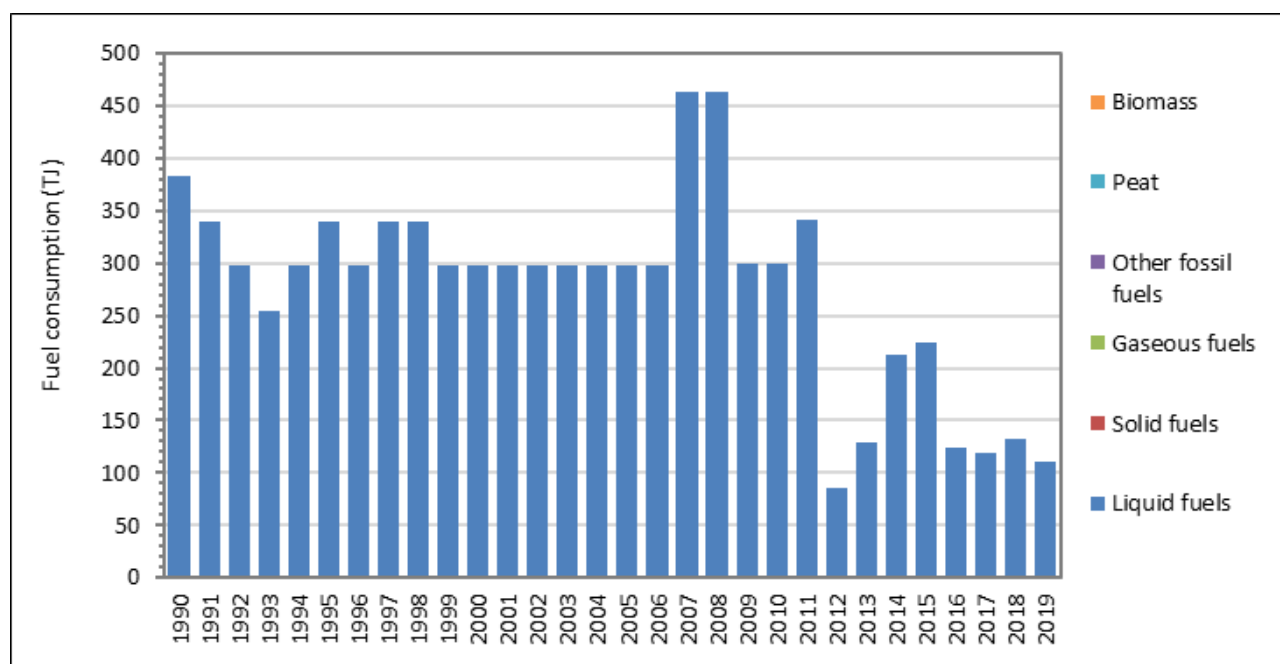


Figure 3.54 Activity data for sub-category 1.A.4.c.ii Agriculture/Forestry/Fishing/Fish Farms - Off-road

Table 3.132 Activity data for sub-category 1.A.4.c.ii Agriculture/Forestry/Fishing/Fish Farms - Off-road

Activity data 1.A.4.c.ii	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
1990	382.88	382.88	NO	NO	NO	NO	NO
1991	340.17	340.17	NO	NO	NO	NO	NO
1992	297.46	297.46	NO	NO	NO	NO	NO
1993	254.75	254.75	NO	NO	NO	NO	NO
1994	297.46	297.46	NO	NO	NO	NO	NO
1995	340.17	340.17	NO	NO	NO	NO	NO
1996	297.46	297.46	NO	NO	NO	NO	NO
1997	340.17	340.17	NO	NO	NO	NO	NO
1998	340.17	340.17	NO	NO	NO	NO	NO
1999	297.46	297.46	NO	NO	NO	NO	NO
2000	297.50	297.50	NO	NO	NO	NO	NO
2001	297.46	297.46	NO	NO	NO	NO	NO
2002	297.46	297.46	NO	NO	NO	NO	NO
2003	297.46	297.46	NO	NO	NO	NO	NO
2004	297.46	297.46	NO	NO	NO	NO	NO
2005	297.46	297.46	NO	NO	NO	NO	NO
2006	297.46	297.46	NO	NO	NO	NO	NO
2007	463.77	463.77	NO	NO	NO	NO	NO
2008	463.77	463.77	NO	NO	NO	NO	NO
2009	298.97	298.97	NO	NO	NO	NO	NO
2010	298.97	298.97	NO	NO	NO	NO	NO

Activity data 1.A.4.c.ii	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
TJ							
2011	341.72	341.72	NO	NO	NO	NO	NO
2012	85.46	85.46	NO	NO	NO	NO	NO
2013	128.17	128.17	NO	NO	NO	NO	NO
2014	212.06	212.06	NO	NO	NO	NO	NO
2015	224.44	224.44	NO	NO	NO	NO	NO
2016	123.88	123.88	NO	NO	NO	NO	NO
2017	119.60	119.60	NO	NO	NO	NO	NO
2018	132.42	132.42	NO	NO	NO	NO	NO
2019	111.06	111.06	NO	NO	NO	NO	NO
<i>Trend</i>							
1990 – 2019	-71.0%	-71.0%	NA	NA	NA	NA	NA
2005 – 2019	-62.7%	-62.7%	NA	NA	NA	NA	NA
2018 – 2019	19.2%	19.2%	NA	NA	NA	NA	NA

In energy statistics, production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units, e.g. in tonnes or cubic metres. To convert these data to energy units, in this case terajoules, requires calorific values. The emission calculations are based on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in sub-category 1.A.4.c.ii Agriculture/Forestry/Fishing/Fish Farms - Off-road.

**Table 3.133 Net calorific values (NCVs) applied for conversion to energy units in sub-category 1.A.4.c.ii Agriculture/Forestry/Fishing/Fish Farms - Off-road**

Fuel	Fuel type	Net calorific value (NCV) (TJ/Gg) or * (TJ/m³)		Source	
		NCV	type		
Residual fuel oil	liquid	41.20	CS	Statistical Office of Montenegro (MONSTAT)	
Gas/Diesel Oil	liquid	42.71	CS		
Motor gasoline	liquid		CS		
Note:					
D	Default	CS	Country specific	PS	Plant specific

### 3.1.5.3.2.3 Choice of emission factors

Default emission factors for air pollutant were taken from the EMEP/EEA air pollutant emission inventory Guidebook 2019<sup>48</sup> and are presented in the following table.

<sup>48</sup> Source: EMEP/EEA air pollutant emission inventory guidebook 2019, Chapter 1.A4 Small combustion, sub-chapter 3.2.2 Default emission factors.

**Table 3.134 Emission factors (EF) for Main pollutants, Particulate Matter (PM), Heavy metals (HM) and Persistent Organic Pollutants (POPs) for sub- category 1.A.4.c.ii Agriculture/Forestry/Fishing/Fish Farms - Off-road**

Fuel Type	UNIT	Liquid fuels		Liquid fuels		Liquid fuels	
Associated fuel types		Motor gasoline		Residual fuel oil Gas/Diesel Oil		LPG	
Pollutant		EF	type	EF	type	EF	type
NOx	g/GJ	7117	D	34457	D	28571	D
CO	g/GJ	770368	D	11469	D	4823	D
NM VOC	g/GJ	18893	D	3542	D	6720	D
SOx	g/GJ	NE	D	NE	D	NE	D
NH3	g/GJ	4	D	8	D	10	D
TSP	g/GJ	157		1913		225	D
PM10	g/GJ	157	D	1913	D	225	D
PM2.5	g/GJ	157	D	1913	D	225	D
BC	% of PM2.5	8	D	1111	D	11	D
Pb	mg/GJ	NE	D	NE	D	NE	D
Cd	mg/GJ	0.01	D	0.01	D	NE	D
Hg	mg/GJ	NE	D	NE	D	NE	D
As	mg/GJ	NE	D	NE	D	NE	D
Cr	mg/GJ	0.05	D	0.05	D	NE	D
Cu	mg/GJ	1.7	D	1.7	D	NE	D
Ni	mg/GJ	0.07	D	0.07	D	NE	D
Se	mg/GJ	0.01	D	0.01	D	NE	D
Zn	mg/GJ	1	D	1	D	NE	D
PCB	ng WHO-TEG/GJ	NE	D	NE	D	NE	D
PCDD/F	ng I-TEQ/GJ	NE	D	NE	D	NE	D
Benzo(a)pyrene	µg/GJ	40	D	30	D	NE	D
Benzo(b)fluoranthene	µg/GJ	40	D	50	D	NE	D
Benzo(k)fluoranthene	µg/GJ	NE	D	NE	D	NE	D
Indeno(1,2,3-cd)pyrene	µg/GJ	NE	D	NE	D	NE	D
HCB	µg/GJ	NE	D	NE	D	NE	D
Source		Table 3.3, section 3.2.2, page 31.		Table 3.4, section 3.4, page 32.		Table 3.6, section 3.4, page 34.	
		EMEP/EEA air pollutant emission inventory guidebook 2019, Part B, Chapter 1.A4 Small combustion					
Note:							
D    Default	CS    Country specific	PS    Plant specific		IEF    Implied emission factor			

### 3.1.5.3.3 Uncertainties and time-series consistency

The uncertainties for activity data and emission factors used for IPCC/NFR category 1.A.4.a.i Commercial/Institutional are presented in the following table.

**Table 3.135 Uncertainty for sub-category 1.A.4.c.ii Agriculture/Forestry/Fishing/Fish Farms - Off-road**

Uncertainty	Hard Coal	Brown Coal	Gaseous fuels	Heavy Fuel Oil	Gas oil	Biomass	Reference
Activity data (AD)	3%	3%	5%	5%	5%	-	Table 2.15, 2006 IPCC GL, Vol. 2, Chap. 2 (2.4.2)
Emission factor (EF)	Rating	Typical error range		Average		Reference	
NOx	B	20% to 60%		40%		Table 2 2 Rating definitions Table 2 3 Main NFR source categories with applicable quality data ratings EMEP EEA GB 2019, Part A, Chapter 5 Uncertainties.	
CO	C	50% to 200%		125%			
NMVOC	D	100% to 300%		200%			
SOx	A	10% to 30%		20%			
NH3	E	order of magnitude		750%			
TSP, PM10, PM2.5, BC	C	50% to 200%		125%			
Hg	B	20% to 60%		40%			
Pb, Cd, As, Cr, Cu, Ni, Se, Zn	C	50% to 200%		125%			
PCDD/F	E	order of magnitude		750%			
PAH (Benzo(a)pyrene, Benzo(b)-fluoranthene, Benzo(k)fluor-anthene, Indeno(1,2,3-cd)pyrene)	C	50% to 200%		125%			
HCB, PCBs	D	100% to 300%		200%			

The time-series are considered to be consistent as the same methodology is applied to the whole period. Activity data are considered to be consistent as national and international data were always compared.

### 3.1.5.3.4 Source-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
  - consistent use of energy balance data (energy statistic questionnaires),
  - documented sources,
  - use of units,
  - strictly defined interfaces between spreadsheets/calculation modules,
  - unique structure of sheets which do the same,
  - record keeping, use of write protection,
  - unique use of formulas, special cases are documented/highlighted,
  - quick-control checks for data consistency through all steps of calculation.
- cross-checked from two sources: national statistic, Eurostat and international energy statistics of UN
- cross checks with other relevant sectors are performed to avoid double counting or omissions;
- time series consistency - plausibility checks of dips and jumps.



### 3.1.5.3.5 Source-specific recalculations

The following table presents the main revisions and recalculations done since the last submission in 2020 and relevant to sub-category 1.A.4.c.ii Agriculture/Forestry/Fishing/Fish Farms - Off-road.

**Table 3.136 Recalculations done in sub-category 1.A.4.c.ii Agriculture/Forestry/Fishing/Fish Farms - Off-road**

source category	Revisions of data	Type of revision	Type of improvement
1.A.4.b	application of EMEP/EEA air pollutant emission inventory guidebook 2019	method	Comparability
1.A.4.b	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019	EF	Comparability
1.A.4.b	use of CS NCV	AD	Accuracy
1.A.4.b	Fuel consumption data (activity data) was revised due to revised fuel consumption data – plant specific data	AD	Accuracy

### 3.1.5.3.6 Source-specific planned improvements

Considering the potential contribution of identified improvements in the total emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

**Table 3.137 Planned improvements for sub-category 1.A.4.c.ii Agriculture/Forestry/Fishing/Fish Farms - Off-road**

Source category	Planned improvement	Type of improvement		Priority
1.A.4.b	Improvement of time series consistency and split of fuels: the energy statistics is still under development; a split of the fuel combustion for this subcategory has to be reviewed for the entire timeseries.	AD	Accuracy Transparency	High
1.A.4.b	Characterisation of <ul style="list-style-type: none"> <li>• residential heating :               <ul style="list-style-type: none"> <li>○ (open/partly open) fire places,</li> <li>○ water heaters,</li> <li>○ advanced/ conventional stoves,</li> <li>○ space heating,</li> <li>○ boilers                   <ul style="list-style-type: none"> <li>▪ Conventional boilers &gt;50kW</li> <li>▪ Standard boilers &gt;50KWth &lt;1MWth</li> <li>▪ Boilers &lt;1MWth – manual feed technology</li> <li>▪ Boilers &lt;1MWth – automatic feed technology</li> <li>▪ Standard boilers &gt;50KWth &lt;1MWth</li> <li>▪ Standard boilers &gt;1MWth &lt;50MWth</li> <li>▪ Gas turbines</li> </ul> </li> </ul> </li> <li>○ cookers;</li> </ul>	AD	Accuracy Transparency	High
1.A.4.c	Split of fuels to different sub categories (1A4ci and 1A4cii and 1A4ciii)	AD	Completeness /comparability	medium
1.A.4.b	Use of waste – biomass fraction/non-biomass fraction	AD	Completeness	high

### 3.1.6 Non-Specified (category 1.A.5)

This section describes emissions resulting from fuel combustion that are not specified elsewhere. This subcategory includes emissions from fuel delivered to the military in the country and delivered to the military of other countries that are not engaged in multilateral operations.

IPCC code	Description		Occurrent		Not occurrent (NO)
			Estimated	Not estimated (NE)	
1.A.5.a	Other stationary (including military)	Emissions from fuel combustion in stationary sources that are not specified elsewhere.		✓	
1.A.5.b	Other mobile (including military land based and recreational boats)	Emissions from vehicles and other machinery, marine and aviation (not included in 1 A 4 c ii or elsewhere).		✓	

The national energy statistics currently do not provide information regarding the use of fuels in the different subcategories.

## 3.2 Fugitive Emissions from Energy (sector 1.B)

### 3.3 Source category description

Montenegro is mining coal and has no natural gas grid, only in some iron & steel and aluminium production facilities natural gas is used.

The emissions are estimated from

- 1B1a Fugitive emission from solid fuels: Coal mining and handling

The emissions are not estimated from

- 1B2b Fugitive emissions from natural gas (exploration, production, processing, transmission, storage, distribution and other)

caused by small amount of natural gas in the production will be estimated in the future.

The following sources are not occurring in Montenegro:

- 1B1b Fugitive emission from solid fuels: Solid fuel transformation
- 1B1c Other fugitive emissions from solid fuels
- 1B2ai Fugitive emissions oil: Exploration, production, transport
- 1B2aiv Fugitive emissions oil: Refining and storage
- 1B2av Distribution of oil products
- 1B2c Venting and flaring (oil, gas, combined oil and gas)
- 1B2d Other fugitive emissions from energy production

The following table provides an overview on activity data and emissions from source category 1.B.

**Table 3.138 Activity data and emissions from coal mining and handling 1990 - 2019**

Year	lignite and Sub-bituminous coal	NMVOC	TSP	PM10	PM2.5
	1000 t	t	t	t	t
1990	1756	1405	156	74	8,8
1991	1736	1389	155	73	8,7
1992	1693	1354	151	71	8,5
1993	1434	1147	128	60	7,2
1994	1249	999	111	52	6,2
1995	834	667	74	35	4,2
1996	1406	1125	125	59	7,0
1997	1290	1032	115	54	6,5
1998	1591	1273	142	67	8,0
1999	1508	1206	134	63	7,5
2000	1565	1252	139	66	7,8
2001	1190	952	106	50	6,0
2002	1806	1445	161	76	9,0
2003	1618	1294	144	68	8,1
2004	1524	1219	136	64	7,6

Year	lignite and Sub-bituminous coal	NMVOC	TSP	PM10	PM2.5
	1000 t	t	t	t	t
2005	1297	1038	115	54	6,5
2006	1512	1210	135	64	7,6
2007	1203	962	107	51	6,0
2008	1740	1392	155	73	8,7
2009	957	766	85	40	4,8
2010	1938	1550	172	81	9,7
2011	1938	1550	172	81	9,7
2012	1973	1578	176	83	9,9
2013	1692	1354	151	71	8,5
2014	1655	1324	147	70	8,3
2015	1773	1418	158	74	8,9
2016	1398	1118	124	59	7,0
2017	1475	1180	131	62	7,4
2018	1596	1277	142	67	8,0
2019	1605	1284	143	67	8.0
Trend					
1990 – 2019	-8.6%	-8.6%	-8.6%	-8.6%	-8.6%
2005 – 2019	23.8%	23.8%	23.8%	23.8%	23.8%
2018 – 2019	0.6%	0.6%	0.6%	0.6%	0.6%

### 3.4 Methodological issue

#### 3.4.1 Choice of methods

For estimating the air pollutants emissions the Tier 1 approach of the EMEP/EEA air pollutant emission inventory guidebook 2019 has been applied:

$$E_{pollutant} = AR_{production} \times EF_{pollutant}$$

where:

$E_{pollutant}$  = Emission of the specified pollutant

$AR_{production}$  = activity data for the coal mine production

$EF_{pollutant}$  = the emission factor for this pollutant

#### 3.4.2 Choice of Activity data

Lignite and Brown coal is mined in Montenegro. The Lignite comes from surface mines and brown coal from underground mines. The activity data are taken from the national energy balances (Monstat, 2019b).

### 3.4.3 Choice of Emission factors

Default emission factors from the EMEP EEA Guidebook 2019, Table 3-1, are applied and are presented in the following table:

**Table 3.139 Tier 1 emission factors for source category 1.B.1.a Coal mining and handling**

Pollutant	Value	Unit
NMVOC	0.800	kg/Mg coal
TSP	0.089	kg/Mg coal
PM10	0.042	kg/Mg coal
PM2.5	0.005	kg/Mg coal

## 3.5 Source-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
  - consistent use of energy balance data (energy statistic questionnaires),
  - documented sources,
  - use of units,
  - strictly defined interfaces between spreadsheets/calculation modules,
  - unique structure of sheets which do the same,
  - record keeping, use of write protection,
  - unique use of formulas, special cases are documented/highlighted,
  - quick-control checks for data consistency through all steps of calculation.
- cross-checked from two sources: national statistic, EUROSTAT and international energy statistics of UN
- cross checks with other relevant sectors are performed to avoid double counting or omissions;
- time series consistency - plausibility checks of dips and jumps

## 3.6 Recalculations

The following table presents the main revisions and recalculations done since the last submission (in 2013 and 2020) to sub-category 1.B. *Fugitive Emissions*.

**Table 3.140 Recalculations done in sub-category 1.B.**

source category	Revisions of data	Type of revision	Type of improvement
1.B.	application of EMEP/EEA air pollutant emission inventory guidebook 2019	method	Comparability
1.B.	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019	EF	Comparability
1.B.	Fuel consumption data (activity data) was revised due to revised fuel consumption data – plant specific data	AD	Accuracy

### 3.7 Sector-specific planned improvements

Considering the potential contribution of identified improvements in the total emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

**Table 3.141** Planned improvements for sub-category 1.B Fugitive emissions.

GHG source & sink category	Planned improvement	Type of improvement		Priority
1B2b Fugitive emissions from natural gas	The steel and aluminium production sides uses natural gas, which is stored in gas tanks. It is planned to estimate the transmission or storage emissions caused by the minor amounts of natural gas used.	AD	Completeness	medium

## 4 Industrial Processes and Product Use (IPPU) (IPCC/NFR sector 2)

### 4.1 Source category description

The main industrial processes in Montenegro are mining and the metal industry. In the metal industry sector, the most prominent areas are aluminum and steel production. Other industrial facilities include the processing of food, beverages, tobacco, textile and agricultural lime.

In the following table the sources which have been **estimated** are indicated. An brought range of sources is **not occurring** in Montenegro, apart from the main emission sources in industrial processes, the facilities are only processing imported material. Due to lack of data and resouces several sources have not been estimated, as there are issues, which need to be investigated. It is planned to estimate these emissions from the following for one of the future inventories:

**Table 4.1 Overview on reported emissions from sector 2 Industrial Processes and Product Use (IPPU)**

Code	NFR description	Status			Key category
2A1	Cement production		NO		
2A2	Lime production	✓			
2A3	Glass production		NO		
2A5a	Quarrying and mining of minerals other than coal	✓			
2A5b	Construction and demolition			NE	
2A5c	Storage, handling and transport of mineral products		NO		
2A6	Other mineral products		NO		
2B1	Ammonia production		NO		
2B2	Nitric acid production		NO		
2B3	Adipic acid production		NO		
2B5	Carbide production		NO		
2B6	Titanium dioxide production		NO		
2B7	Soda ash production		NO		
2B10a	Chemical industry: Other		NO		
2B10b	Storage, handling and transport of chemical products		NO		
2C1	Iron and steel production	✓			LA: Pb, dioxin/furane TA: Pb, Hg, As, Zn dioxin/furane
2C2	Ferroalloys production		NO		
2C3	Aluminium production	✓			LA: CO; TA: SO <sub>2</sub> , CO
2C4	Magnesium production		NO		
2C5	Lead production		NO		
2C6	Zinc production		NO		
2C7a	Copper production		NO		
2C7b	Nickel production		NO		
2C7c	Other metal production		NO		
2C7d	Storage, handling and transport of metal products			NE	

Code	NFR description	Status			Key category
2D3a	Domestic solvent use including fungicides	✓			LA & TA: NMVOC
2D3b	Road paving with asphalt			NE	
2D3c	Asphalt roofing			NE	
2D3d	Coating applications			NE	
2D3e	Degreasing			NE	
2D3f	Dry cleaning			NE	
2D3g	Chemical products		NO		
2D3h	Printing			NE	
2D3i	Other solvent use		NO		
2G	Other product use		NO		
2H1	Pulp and paper industry		NO		
2H2	Food and beverages industry	✓			
2H3	Other industrial processes		NO		
2I	Wood processing		NO		
2J	Production of POPs		NO		
2K	Consumption of POPs and heavy metals		NO		
2L	Other production, consumption, storage, transportation or handling of bulk products			NE	
<p>A '✓' indicates: emissions from this sub-category have been estimated.</p> <p>Notation keys: IE - included elsewhere, NO – not occurrent, NE - not estimated, NA - not applicable, C – confidential</p> <p>LA XX - Level Assessment in year XX</p> <p>TA XX - Trend Assessment in year XX</p>					



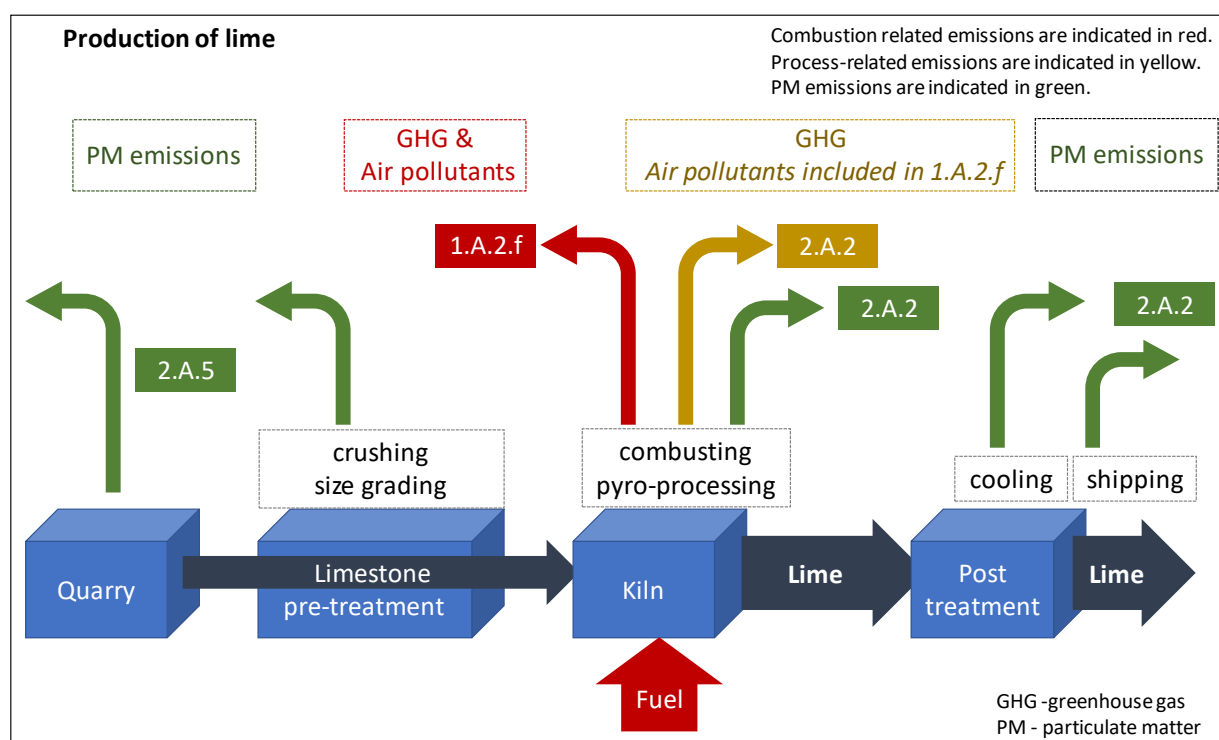
## 4.2 Mineral Products (IPCC/NFR category 2.A)

### 4.2.1 Lime production (IPCC/NFR subcategory 2.A.2)

This chapter includes the emissions estimations from lime production.

Emissions	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	All other pollutants
Lime production	✓	✓	✓	NA
Key Category	-	-	-	-
A '✓' indicates: emissions from this sub-category have been estimated.				
Notation keys: IE -included elsewhere, NO – not occurrent, NE -not estimated, NA - not applicable, C – confidential				
LA – Level Assessment (in year); TA – Trend Assessment				

As described in the EMEP/EEA air pollutant emission inventory guidebook 2019<sup>49</sup> atmospheric emissions in the lime manufacturing industry include particulate emissions from the mining, handling, crushing, screening and calcining of the limestone and emissions of air pollutants generated during fuel combustion in kilns. These emissions are not very significant on a global or even regional scale. However, lime works can be an important emission source of air pollutants on a local scale.



**Figure 4.1** Process scheme for source category 2.A.2 Lime production

Calcium oxide (CaO), also called as quicklime, is formed by heating limestone to decompose the carbonates. This is usually done in shaft or rotary kilns at high temperatures and the process releases CO<sub>2</sub>. Depending on the product requirements (e.g., metallurgy, pulp and paper, construction materials, effluent treatment,

<sup>49</sup> Source: EMEP/EEA air pollutant emission inventory guidebook 2019, 2.A.2 Lime production, sub-chapter 1 Overview.

water softening, pH control, and soil stabilisation), primarily high calcium limestone (calcite) is utilized in accordance with the following reaction:

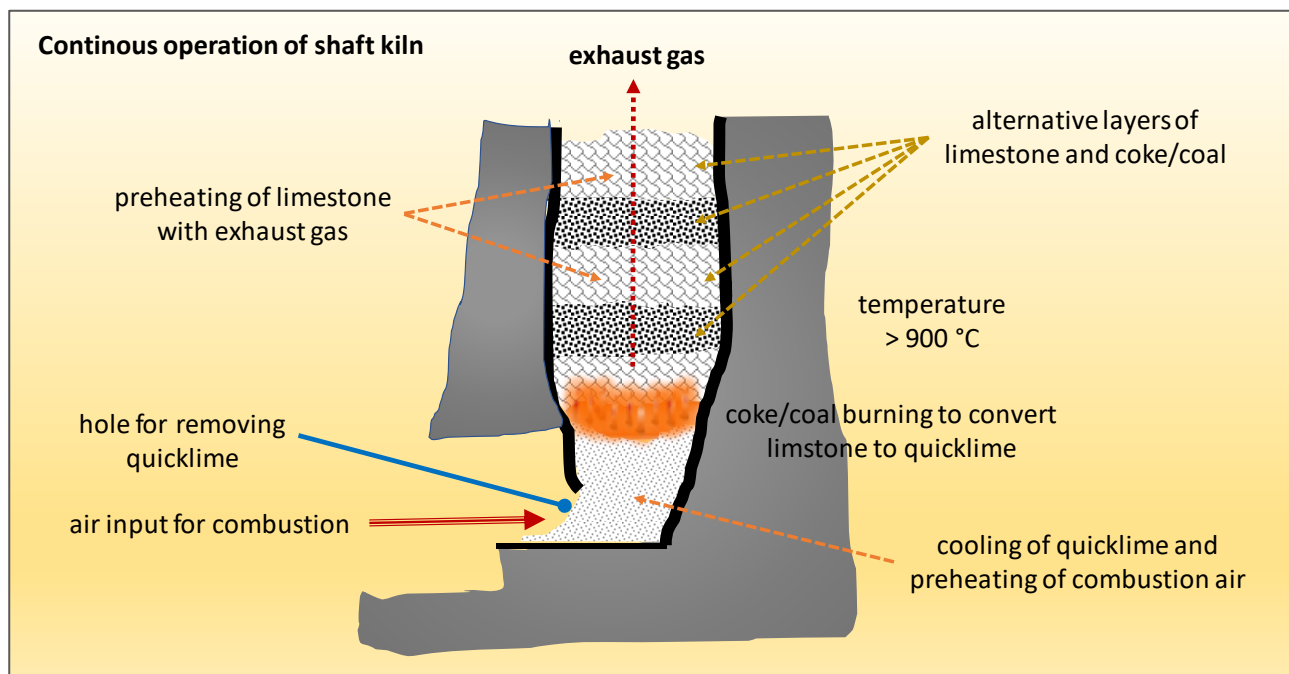
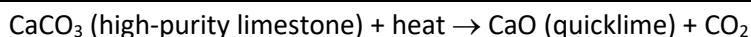


Figure 4.2 Illustration of a shaft kiln for lime production

Emissions from Lime production only occur until 2011.

Table 4.2 Activity data and emissions from lime-production

Year	Lime produced	TSP	PM10	PM2.5
	Mg (=t)	Mg (=t)	Mg (=t)	Mg (=t)
1990	33,000	297	116	23
1991	31,000	279	109	22
1992	22,000	198	77	15
1993	13,000	117	46	9
1994	4,000	36	14	3
1995	7,000	63	25	5
1996	8,000	72	28	6
1997	8,000	72	28	6
1998	8,000	72	28	6
1999	8,000	72	28	6
2000	7,113	64	25	5
2001	12,989	117	45	9
2002	11,123	100	39	8
2003	8,136	73	28	6

Year	Lime produced	TSP	PM10	PM2.5
	Mg (=t)	Mg (=t)	Mg (=t)	Mg (=t)
2004	10,591	95	37	7
2005	6,008	54	21	4
2006	8,118	73	28	6
2007	7,089	64	25	5
2008	9,839	89	34	7
2009	4,497	40	16	3
2010	839	8	3	1
2011	3,448	31	12	2
2012	33,000	NO	NO	NO
2013	31,000	NO	NO	NO
2014	22,000	NO	NO	NO
2015	13,000	NO	NO	NO
2016	4,000	NO	NO	NO
2017	7,000	NO	NO	NO
2018	8,000	NO	NO	NO
2019				
<b>Trend</b>				
1990 – 2019	-100%	-100%	-100%	-100%
2005 – 2019	-100%	-100%	-100%	-100%
2018 – 2019	NA	NA	NA	NA

#### 4.2.1.1 Methodological issues

##### 4.2.1.1.1 Choice of methods

The emissions were calculated by Tier 1 methodology from the EMEP EEA GB 2019 (EEA, 2019).

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

$E_{\text{pollutant}}$  = the emission of the specified pollutant

$AR_{\text{production}}$  = the activity rate for the lime production

$EF_{\text{pollutant}}$  = the emission factor for this pollutant

##### 4.2.1.1.2 Choice of activity data

Activities were provided by the national statistical office Monstat (Monstat, 2019) and presented in Table 4.2 above.

##### 4.2.1.1.3 Choice of emission factors

Default emission factors from the EMEP EEA Guidebook 2019, Table 3-1, are applied and are presented in the following table.

**Table 4.3 Tier 1 emission factors for source category 2.A.2 Lime production**

Pollutant	Value	Unit	Type of Emission factor
TSP	9000	g/Mg lime	default
PM <sub>10</sub>	3500	g/Mg lime	default
PM <sub>2.5</sub>	700	g/Mg lime	default
BC	0.46%	% of PM <sub>2.5</sub>	default

#### 4.2.1.2 Recalculations

The following table presents the main revisions and recalculations done since the last submission to sub-category 2.A.5.a.

**Table 4.4 Recalculations done in sub-category 2.A.2**

source category	Revisions of data	Type of revision	Type of improvement
2.A.2	application of EMEP/EEA air pollutant emission inventory guidebook 2019	method	Comparability
2.A.2	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019	EF	Comparability
2.A.2	Revision of activity data	AD	Accuracy

#### 4.2.1.3 Source-specific planned improvements

Considering the potential contribution of identified improvements in the total emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

**Table 4.5 Planned improvements for sub-category 2.A.2**

Source category	Planned improvement	Type of improvement		Priority
2.A.2	<ul style="list-style-type: none"> <li>No planned improvements</li> </ul>			

#### 4.2.2 Quarrying and mining of minerals other than coal (subcategory 2.A.5.a)

Emissions	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	All other pollutants
Lime production	✓	✓	✓	NA
Key Category	-	-	-	-
A '✓' indicates: emissions from this sub-category have been estimated.				
Notation keys: IE -included elsewhere, NO – not occurring, NE -not estimated, NA -not applicable, C – confidential				
LA – Level Assessment (in year); TA – Trend Assessment				

In this category emissions from the mining and quarrying of bauxite is included. From 2010 on detailed data on crushed stones, marble, sands, etc. are available. In order to ensure time series consistency this data will be included, when the examination of the years before 2010 is finished. Fluctuations of the activity data has been investigated by personal communication with the responsible company. 1994 no bauxite was mined because of the critical situation in Montenegro. In 2010 and 2016 no bauxite was mined due to structural reforms in the company. The significant high value for 2017 is caused by the effort to finish the mining sites, which are currently in operation.

The following table provides an overview of activity data and emissions of PMs in this subcategory.

**Table 4.6 Activity data and emissions from mining and quarrying**

Year	Bauxite	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>
	Mg (=t)	Mg (=t)	Mg (=t)	Mg (=t)
1990	759.82	77.50	37.99	3.80
1991	877.86	89.54	43.89	4.39
1992	781.54	79.72	39.08	3.91
1993	109.90	11.21	5.50	0.55
1994	NO	NO	NO	NO
1995	57.73	5.89	2.89	0.29
1996	328.32	33.49	16.42	1.64
1997	470.05	47.95	23.50	2.35
1998	238.49	24.33	11.92	1.19
1999	503.44	51.35	25.17	2.52
2000	630.00	64.26	31.50	3.15
2001	610.00	62.22	30.50	3.05
2002	611.50	62.37	30.58	3.06
2003	540.05	55.09	27.00	2.70
2004	610.00	62.22	30.50	3.05
2005	672.34	68.58	33.62	3.36
2006	659.37	67.26	32.97	3.30
2007	667.05	68.04	33.35	3.34
2008	671.81	68.52	33.59	3.36
2009	45.78	4.67	2.29	0.23

Year	Bauxite	TSP	PM10	PM2.5
	Mg (=t)	Mg (=t)	Mg (=t)	Mg (=t)
2010	61.21	6.24	3.06	0.31
2011	158.61	16.18	7.93	0.79
2012	NO	NO	NO	NO
2013	61.15	6.24	3.06	0.31
2014	155.15	15.83	7.76	0.78
2015	50.37	5.14	2.52	0.25
2016	NO	NO	NO	NO
2017	927.85	94.64	46.39	4.64
2018	468.16	47.75	23.41	2.34
2019				
<b>Trend</b>				
1990 – 2019	-38.4%	-38.4%	-38.4%	-38.4%
2005 – 2019	-30.4%	-30.4%	-30.4%	-30.4%
2018 – 2019	-49.5%	-49.5%	-49.5%	-49.5%

#### 4.2.2.1 Methodological issues

##### 4.2.2.1.1 Choice of methods

The emissions were calculated by Tier 1 methodology from the EMEP EEA GB 2019 (EEA, 2019).

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

$E_{\text{pollutant}}$ =the emission of the specified pollutant

$AR_{\text{production}}$ =the activity rate for the quarrying/mining

$EF_{\text{pollutant}}$ =the emission factor for this pollutant

##### 4.2.2.1.2 Choice of activity data

Activity data are provided by the national statistical office Monstat (Monstat, 2019).

##### 4.2.2.1.3 Choice of emission factors

Default emission factors from the EMEP/EEA Guidebook 2019 are applied and presented in the following table.

**Table 4.7 Tier 1 emission factors for source category 2.A.5.a Quarrying and mining of minerals other than coal**

Pollutant	Value	Unit	Type pf emission factor
TSP	102	g/Mg mineral	default
PM <sub>10</sub>	50	g/Mg mineral	default
PM <sub>2.5</sub>	5	g/Mg mineral	default

#### 4.2.2.2 Recalculations

The following table presents the main revisions and recalculations done since the last submission to sub-category 2.A.5.a.

**Table 4.8 Recalculations done in sub-category 2.A.5.a**

source category	Revisions of data	Type of revision	Type of improvement
2.A.5.a	application of EMEP/EEA air pollutant emission inventory guidebook 2019	method	Comparability
2.A.5.a	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019	EF	Comparability
2.A.5.a	Revision of activity data	AD	Accuracy

#### 4.2.2.3 Source-specific planned improvements

Considering the potential contribution of identified improvements in the total emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

**Table 4.9 Planned improvements for sub-category 2.A.5.a**

Source category	Planned improvement	Type of improvement		Priority
2.A.5.a	<ul style="list-style-type: none"> <li>No planned improvements</li> </ul>			

### 4.3 Metal Production (category 2.C)

#### 4.3.1 Iron and steel production (subcategory 2.C.1)

Emissions occur only from electro-steel production in Montenegro. The following table provides an overview on reported emissions from this source.

**Table 4.10 Overview on reported emissions from sub categories 2.C.1 Iron and steel production**

Air pollutants	2.C.1	Key Category
NO <sub>x</sub>	✓	-
CO	✓	LA 2018; Trend 2018
NM VOC	✓	-
SO <sub>x</sub>	✓	Trend 2018
NH <sub>3</sub>	NA	-
TSP	✓	-
PM <sub>10</sub>	✓	-
PM <sub>2.5</sub>	✓	-
BC	✓	-
Pb	✓	LA 2018; Trend 2018
Cd	✓	Trend 2018
Hg	✓	Trend 2018
As	✓	Trend 2018
Cr	✓	-
Cu	✓	-
Ni	✓	-
Se	✓	-
Zn	✓	Trend 2018
PCB	✓	-
PCDD/F	✓	LA 2018; Trend 2018
PAH	✓	-
Benzo(a)pyrene	NA	-
Benzo(b)fluoranthene	NA	-
Benzo(k)fluoranthene	NA	-
Indeno(1,2,3-cd)pyrene	NA	-
HCB	NA	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE - included elsewhere, NO – not occurrent, NE - not estimated, NA - not applicable, C – confidential		
LA XX - Level Assessment in year XX TA XX - Trend Assessment in year XX		

An overview of the emission from from sub-category 2.C.1. *Electro-steel production* is provided in the following figures and tables:

- annual emissions of air pollutants;
- Trend of the periods 1990 – 2019, 2005 – 2019, 2017 – 2019;
- Share of sector 2.C.1 Electrosteel of each pollutants in the related National total emissions.



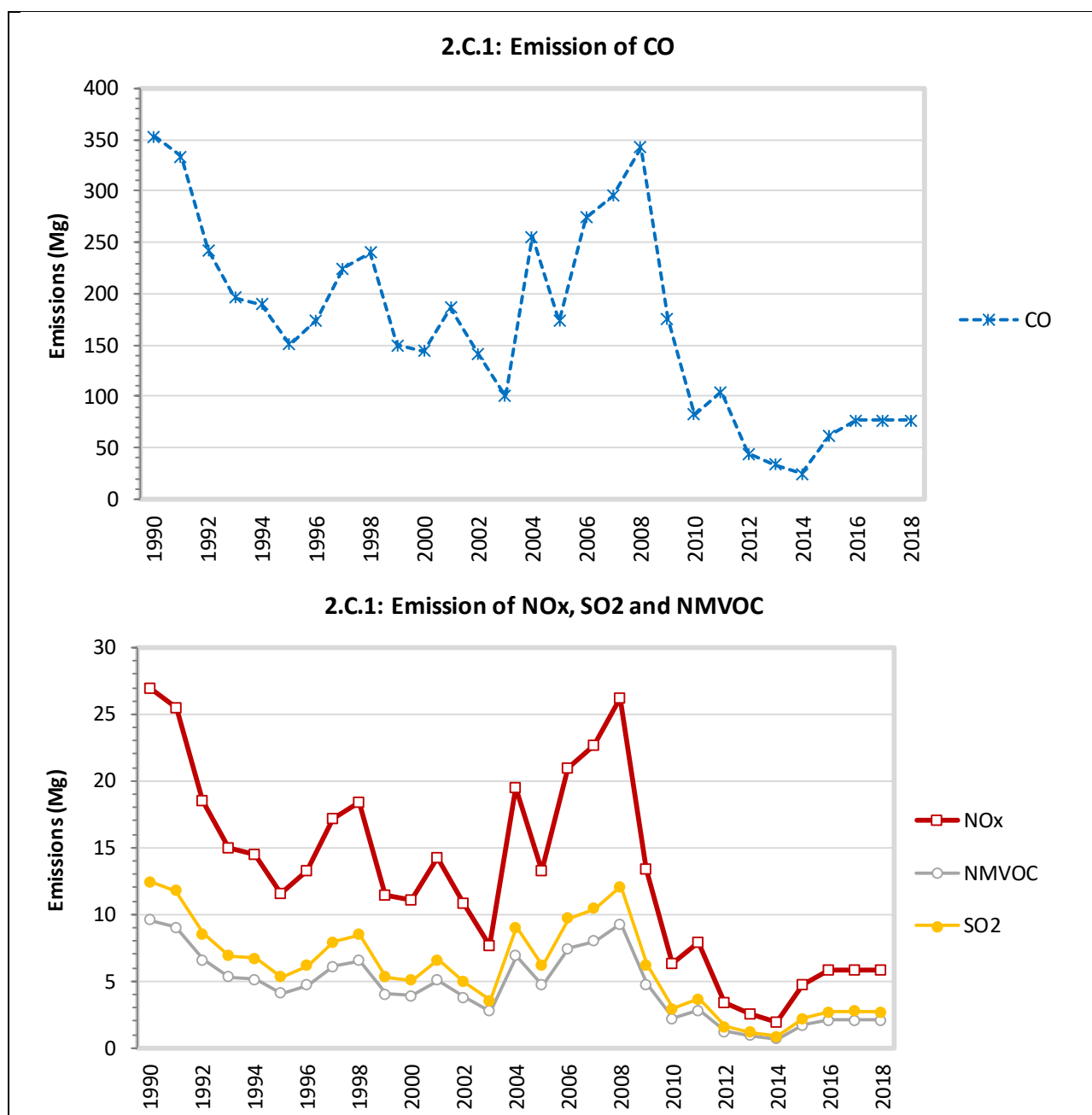
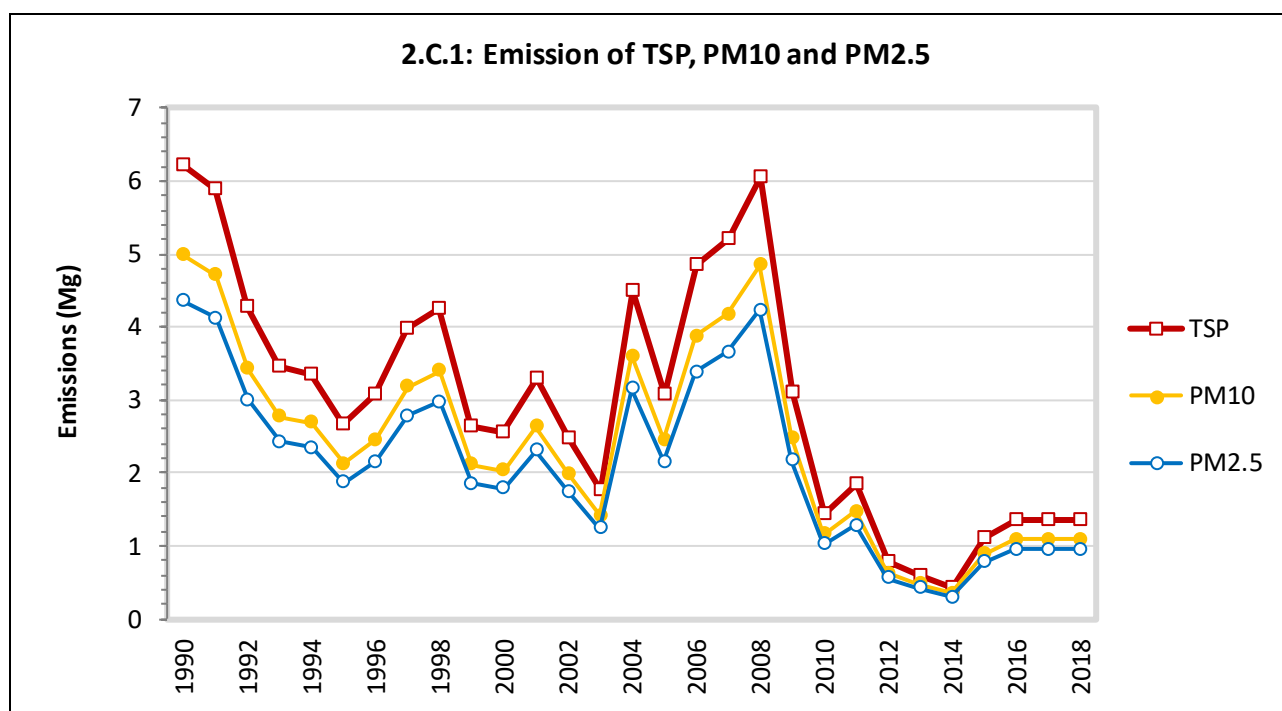


Figure 4.3 Emissions of main pollutants (NO<sub>x</sub>, SO<sub>2</sub>, NMVOC and CO) from sub-category 2.C.1 Electrosteel

Table 4.11 Emissions of main pollutants (NO<sub>x</sub>, SO<sub>2</sub>, NMVOC and CO) from sub-category 2.C.1 Electrosteel

Emissions	NO <sub>x</sub>	NMVOC	SO <sub>x</sub>	CO	NH <sub>3</sub>
	t	t	t	t	t
1990	26.99	352.99	9.55	12.46	NA
1991	25.53	333.82	9.03	11.78	NA
1992	18.56	242.72	6.57	8.57	NA
1993	14.99	196.01	5.30	6.92	NA
1994	14.54	190.10	5.14	6.71	NA
1995	11.52	150.60	4.08	5.32	NA
1996	13.32	174.23	4.71	6.15	NA

Emissions	NO <sub>x</sub>	NM <sub>VOC</sub>	SO <sub>x</sub>	CO	NH <sub>3</sub>
	t	t	t	t	t
1997	17.21	225.02	6.09	7.94	NA
1998	18.39	240.46	6.51	8.49	NA
1999	11.44	149.60	4.05	5.28	NA
2000	11.02	144.14	3.90	5.09	NA
2001	14.27	186.59	5.05	6.59	NA
2002	10.77	140.81	3.81	4.97	NA
2003	7.67	100.36	2.72	3.54	NA
2004	19.52	255.28	6.91	9.01	NA
2005	13.29	173.82	4.70	6.13	NA
2006	20.97	274.27	7.42	9.68	NA
2007	22.61	295.65	8.00	10.43	NA
2008	26.22	342.87	9.28	12.10	NA
2009	13.45	175.91	4.76	6.21	NA
2010	6.28	82.06	2.22	2.90	NA
2011	7.95	103.98	2.81	3.67	NA
2012	3.40	44.47	1.20	1.57	NA
2013	2.56	33.53	0.91	1.18	NA
2014	1.86	24.36	0.66	0.86	NA
2015	4.76	62.22	1.68	2.20	NA
2016	5.87	76.78	2.08	2.71	NA
2017	5.88	76.88	2.08	2.71	NA
2018	5.88	76.83	2.08	2.71	NA
2019					
<i>Trend</i>					
1990 – 2019	-78.2%	-78.2%	-78.2%	-78.2%	NA
2005 – 2019	-55.8%	-55.8%	-55.8%	-55.8%	NA
2018 – 2019	-0.1%	-0.1%	-0.1%	-0.1%	NA
<i>Share in National Total</i>					
1990	0.1%	<0.1%	0.1%	<0.1%	NA
2005	1.0%	0.1%	0.2%	0.1%	NA
2019	1.4%	1.0%	0.1%	0.5%	0.1%



**Figure 4.4** Emissions of TSP PM10 and PM2.5 from sub-category 2.C.1 Electrosteel

**Table 4.12** Emissions of particulate matter (PM) from sub-category 2.C.1 Electrosteel

Emissions	PM2.5	PM10	TSP	BC
	Mg	Mg	Mg	Mg
1990	6.229	4.983	4.360	1.570
1991	5.891	4.713	4.124	1.485
1992	4.283	3.427	2.998	1.079
1993	3.459	2.767	2.421	0.872
1994	3.355	2.684	2.348	0.845
1995	2.658	2.126	1.860	0.670
1996	3.075	2.460	2.152	0.775
1997	3.971	3.177	2.780	1.001
1998	4.243	3.395	2.970	1.069
1999	2.640	2.112	1.848	0.665
2000	2.544	2.035	1.781	0.641
2001	3.293	2.634	2.305	0.830
2002	2.485	1.988	1.739	0.626
2003	1.771	1.417	1.240	0.446
2004	4.505	3.604	3.153	1.135
2005	3.067	2.454	2.147	0.773
2006	4.840	3.872	3.388	1.220
2007	5.217	4.174	3.652	1.315
2008	6.051	4.841	4.235	1.525
2009	3.104	2.483	2.173	0.782
2010	1.448	1.159	1.014	0.365

Emissions	PM2.5	PM10	TSP	BC
	Mg	Mg	Mg	Mg
2011	1.835	1.468	1.284	0.462
2012	0.785	0.628	0.549	0.198
2013	0.592	0.473	0.414	0.149
2014	0.430	0.344	0.301	0.108
2015	1.098	0.878	0.769	0.277
2016	1.355	1.084	0.949	0.341
2017	1.357	1.085	0.950	0.342
2018	1.356	1.085	0.949	0.342
2019				
<i>Trend</i>				
1990 – 2019	-78.2%	-78.2%	-78.2%	-78.2%
2005 – 2019	-55.8%	-55.8%	-55.8%	-55.8%
2018 – 2019	-0.1%	-0.1%	-0.1%	-0.1%

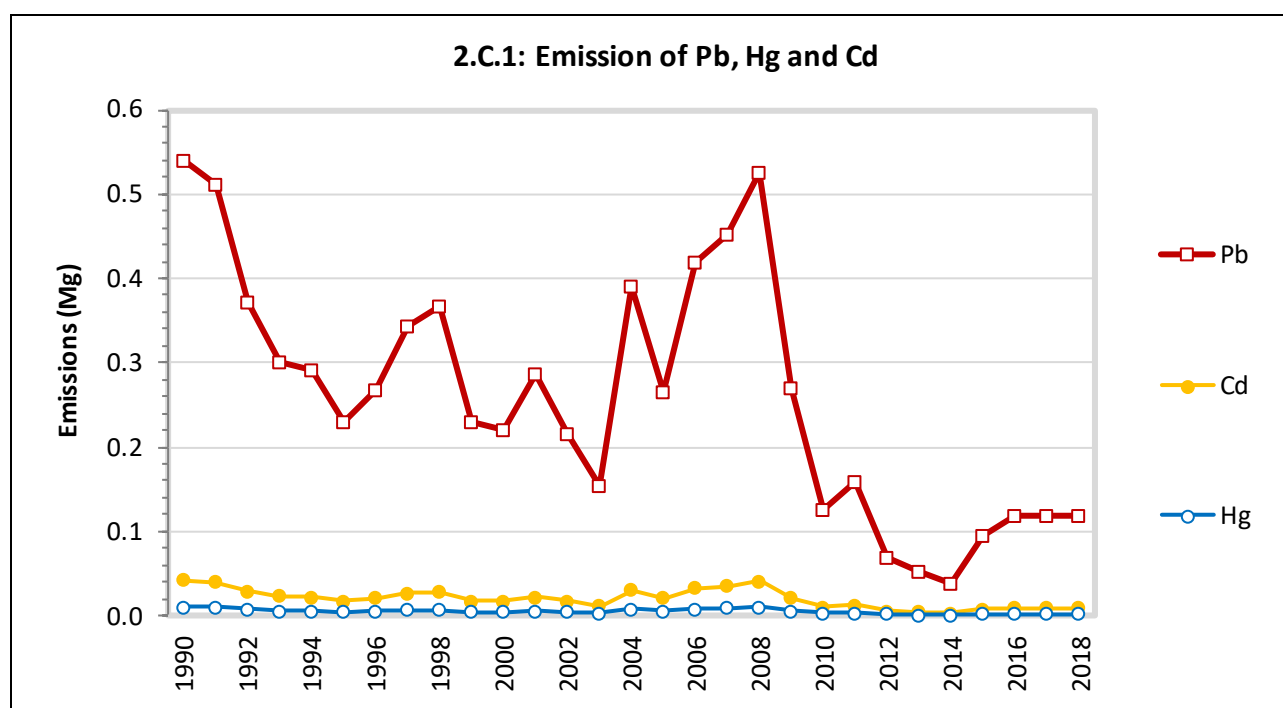


Figure 4.5 Emissions of Pb, Cd and Hg from sub-category 2.C.1 Electrosteel

**Table 4.13 Emissions of Heavy Metals (HM) from sub-category 2.C.1 Electrosteel**

Emissions	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
	kg	kg	kg	kg	kg	kg	kg	kg	kg
1990	0.540	0.042	0.010	0.003	0.021	0.004	0.145	0.748	0.540
1991	0.511	0.039	0.010	0.003	0.020	0.004	0.137	0.707	0.511
1992	0.371	0.029	0.007	0.002	0.014	0.003	0.100	0.514	0.371
1993	0.300	0.023	0.006	0.002	0.012	0.002	0.081	0.415	0.300
1994	0.291	0.022	0.006	0.002	0.011	0.002	0.078	0.403	0.291
1995	0.230	0.018	0.004	0.001	0.009	0.002	0.062	0.319	0.230
1996	0.266	0.020	0.005	0.002	0.010	0.002	0.072	0.369	0.266
1997	0.344	0.026	0.007	0.002	0.013	0.003	0.093	0.477	0.344
1998	0.368	0.028	0.007	0.002	0.014	0.003	0.099	0.509	0.368
1999	0.229	0.018	0.004	0.001	0.009	0.002	0.062	0.317	0.229
2000	0.220	0.017	0.004	0.001	0.008	0.002	0.059	0.305	0.220
2001	0.285	0.022	0.005	0.002	0.011	0.002	0.077	0.395	0.285
2002	0.215	0.017	0.004	0.001	0.008	0.002	0.058	0.298	0.215
2003	0.153	0.012	0.003	0.001	0.006	0.001	0.041	0.213	0.153
2004	0.390	0.030	0.008	0.002	0.015	0.003	0.105	0.541	0.390
2005	0.266	0.020	0.005	0.002	0.010	0.002	0.072	0.368	0.266
2006	0.419	0.032	0.008	0.002	0.016	0.003	0.113	0.581	0.419
2007	0.452	0.035	0.009	0.003	0.017	0.003	0.122	0.626	0.452
2008	0.524	0.040	0.010	0.003	0.020	0.004	0.141	0.726	0.524
2009	0.269	0.021	0.005	0.002	0.010	0.002	0.072	0.373	0.269
2010	0.126	0.010	0.002	0.001	0.005	0.001	0.034	0.174	0.126
2011	0.159	0.012	0.003	0.001	0.006	0.001	0.043	0.220	0.159
2012	0.068	0.005	0.001	0.000	0.003	0.001	0.018	0.094	0.068
2013	0.051	0.004	0.001	0.000	0.002	0.000	0.014	0.071	0.051
2014	0.037	0.003	0.001	0.000	0.001	0.000	0.010	0.052	0.037
2015	0.095	0.007	0.002	0.001	0.004	0.001	0.026	0.132	0.095
2016	0.117	0.009	0.002	0.001	0.005	0.001	0.032	0.163	0.117
2017	0.118	0.009	0.002	0.001	0.005	0.001	0.032	0.163	0.118
2018	0.118	0.009	0.002	0.001	0.005	0.001	0.032	0.163	0.118
2019									
<i>Trend</i>									
1990 – 2019	-78.2%	-78.2%	-78.2%	-78.2%	-78.2%	-78.2%	-78.2%	-78.2%	-78.2%
2005 – 2019	-55.8%	-55.8%	-55.8%	-55.8%	-55.8%	-55.8%	-55.8%	-55.8%	-55.8%
2018 – 2019	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%

Table 4.14 Emissions of Persistent Organic Pollutants (POPs) from sub- category 2.C.1 Electrosteel

Emissions	PCDD/F	Benzo(a)-pyrene	Benzo(b)-fluor-anthene	Benzo(k)-fluor-anthene	Indeno (1,2,3-cd) pyrene	Total PAH	HCB	PCB
	g I-TEQ	Mg	Mg	Mg	Mg	Mg	kg	Kg
1990	0.623	-	-	-	-	0.100	NA	0.001
1991	0.589	-	-	-	-	0.094	NA	<0.001
1992	0.428	-	-	-	-	0.069	NA	<0.001
1993	0.346	-	-	-	-	0.055	NA	<0.001
1994	0.335	-	-	-	-	0.054	NA	<0.001
1995	0.266	-	-	-	-	0.043	NA	<0.001
1996	0.307	-	-	-	-	0.049	NA	<0.001
1997	0.397	-	-	-	-	0.064	NA	<0.001
1998	0.424	-	-	-	-	0.068	NA	<0.001
1999	0.264	-	-	-	-	0.042	NA	<0.001
2000	0.254	-	-	-	-	0.041	NA	<0.001
2001	0.329	-	-	-	-	0.053	NA	<0.001
2002	0.248	-	-	-	-	0.040	NA	<0.001
2003	0.177	-	-	-	-	0.028	NA	<0.001
2004	0.450	-	-	-	-	0.072	NA	<0.001
2005	0.307	-	-	-	-	0.049	NA	<0.001
2006	0.484	-	-	-	-	0.077	NA	<0.001
2007	0.522	-	-	-	-	0.083	NA	<0.001
2008	0.605	-	-	-	-	0.097	NA	0.001
2009	0.310	-	-	-	-	0.050	NA	<0.001
2010	0.145	-	-	-	-	0.023	NA	<0.001
2011	0.183	-	-	-	-	0.029	NA	<0.001
2012	0.078	-	-	-	-	0.013	NA	<0.001
2013	0.059	-	-	-	-	0.009	NA	<0.001
2014	0.043	-	-	-	-	0.007	NA	<0.001
2015	0.110	-	-	-	-	0.018	NA	<0.001
2016	0.136	-	-	-	-	0.022	NA	<0.001
2017	0.136	-	-	-	-	0.022	NA	<0.001
2018	0.136	-	-	-	-	0.022	NA	<0.001
2019								
<i>Trend</i>								
1990 – 2019	-78.2%	-78.2%	-78.2%	-78.2%	-78.2%	-78.2%	-78.2%	-78.2%
2005 – 2019	-55.8%	-55.8%	-55.8%	-55.8%	-55.8%	-55.8%	-55.8%	-55.8%
2018 – 2019	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%

### 4.3.1.1 Methodological issues

#### 4.3.1.1.1 Choice of methods

The emissions were calculated by Tier 2 methodology from the EMEP EEA GB 2019 (EEA, 2019), Chapter 2.C.1- Table 3.15

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

$E_{\text{pollutant}}$  = the emission of the specified pollutant

$AR_{\text{production}}$  = the activity rate for the iron and steel production

$EF_{\text{pollutant}}$  = the emission factor for this pollutant

#### 4.3.1.1.2 Choice of activity data

The activity data are provided by the steel producing facilities.

**Table 4.15 Activity data and emissions from electro-steel production**

year	tonnes of steel produced		year	tonnes of steel produced
	t			t
1990	207,642.00		2005	102,247.00
1991	196,365.00		2006	161,333.00
1992	142,775.00		2007	173,913.00
1993	115,301.00		2008	201,690.00
1994	111,821.00		2009	103,479.00
1995	88,591.00		2010	48,272.00
1996	102,487.00		2011	61,164.00
1997	132,362.00		2012	26,161.00
1998	141,445.00		2013	19,723.00
1999	88,002.00		2014	14,330.00
2000	84,789.00		2015	36,602.00
2001	109,757.00		2016	45,167.57
2002	82,832.00		2017	45,223.00
2003	59,036.00		2018	45,193.06
2004	150,165.00		2019	
<b>Trend</b>				
1990 – 2019				
2005 – 2019				
2018 – 2019				

### 4.3.1.1.3 Choice of emission factors

Default emission factors from the EMEP EEA Guidebook 2019, Chapter 2.C.1- Table 3.15, are applied and are presented in the following table.

**Table 4.16** Default Tier 2 emission factors for source category 2.C.1 Iron and steel production

Pollutant	Value	Unit	Type of emission factor
NO <sub>x</sub>	130	g/Mg steel	Default Tier 2
CO	1.7	kg/Mg steel	Default Tier 2
NM VOC	46	g/Mg steel	Default Tier 2
SO <sub>2</sub>	60	g/Mg steel	Default Tier 2
TSP	30	g/Mg steel	Default Tier 2
PM <sub>10</sub>	24	g/Mg steel	Default Tier 2
PM <sub>2.5</sub>	21	g/Mg steel	Default Tier 2
BC	0.36	% of PM <sub>2.5</sub>	Default Tier 2
Pb	2.6	g/Mg steel	Default Tier 2
Cd	0.2	g/Mg steel	Default Tier 2
Hg	0.05	g/Mg steel	Default Tier 2
As	0.015	g/Mg steel	Default Tier 2
Cr	0.1	g/Mg steel	Default Tier 2
Cu	0.02	g/Mg steel	Default Tier 2
Ni	0.7	g/Mg steel	Default Tier 2
Zn	3.6	g/Mg steel	Default Tier 2
PCB	2.5	mg/Mg steel	Default Tier 2
PCDD/F	3	µg I-TEQ/Mg steel	Default Tier 2
Total 4 PAHs	0.48	g/Mg steel	Default Tier 2

### 4.3.1.2 Recalculations

The following table presents the main revisions and recalculations done since the last submission to sub-category 2.C.1.

**Table 4.17** Recalculations done in sub-category 2.C.1

source category	Revisions of data	Type of revision	Type of improvement
2.C.1	application of EMEP/EEA air pollutant emission inventory guidebook 2019	method	Comparability
2.C.1	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019	EF	Comparability
2.C.1	Revision of activity data	AD	Accuracy



#### 4.3.1.3 Source-specific planned improvements

Considering the potential contribution of identified improvements in the total emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

**Table 4.18** Planned improvements for sub-category 2.C.1

Source category	Planned improvement	Type of improvement		Priority
2.C.1	<ul style="list-style-type: none"> <li>Collection of facility-level data</li> <li>Incorporating of plant-specific emission factors based on measurements / Facility-level data</li> </ul>	EF	Accuracy	high
2.C.3	<ul style="list-style-type: none"> <li>Application of TIER 3 methodology</li> </ul>	method	Accuracy comparability	high

#### 4.3.2 Aluminum production (subcategory 2.C.3)

Aluminum production is one of the major industry sectors in Montenegro. The following table provides an overview on reported emissions from this source.

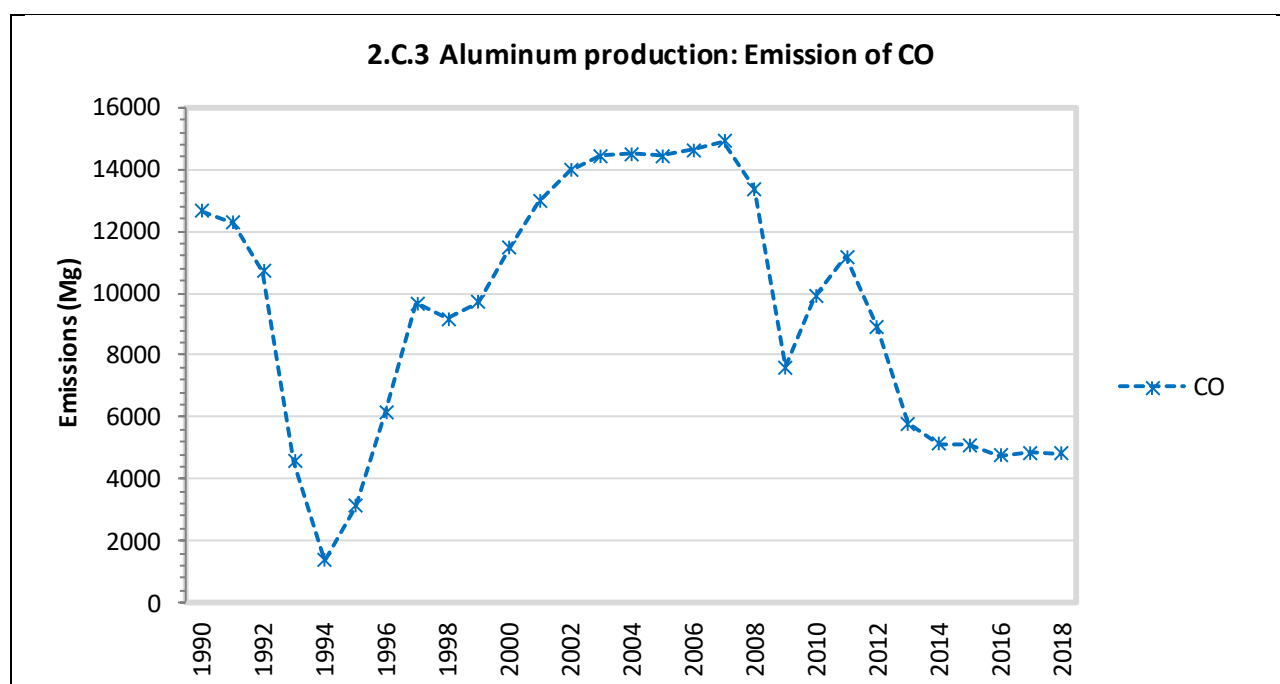
**Table 4.19** Overview on reported emissions from sub categories 2.C.3 Aluminum production

Air pollutants	2.C.1	Key Category
NOx	✓	-
CO	✓	LA 2018; Trend 2018
NM VOC	✓	-
SOx	✓	Trend 2018
NH3	NA	-
TSP	✓	-
PM10	✓	-
PM2.5	✓	-
BC	✓	-
Pb	✓	LA 2018; Trend 2018
Cd	✓	Trend 2018
Hg	✓	Trend 2018
As	✓	Trend 2018
Cr	✓	-
Cu	✓	-
Ni	✓	-
Se	✓	-
Zn	✓	Trend 2018
PCB	✓	-
PCDD/F	✓	LA 2018; Trend 2018

Air pollutants	2.C.1	Key Category
PAH	✓	-
Benzo(a)pyrene	NA	-
Benzo(b)fluoranthene	NA	-
Benzo(k)fluoranthene	NA	-
Indeno(1,2,3-cd)pyrene	NA	-
HCB	NA	-
<p>A '✓' indicates: emissions from this sub-category have been estimated.</p> <p>Notation keys: IE - included elsewhere, NO – not occurrent, NE -not estimated, NA -not applicable, C – confidential</p> <p>LA XX - Level Assessment in year XX</p> <p>TA XX - Trend Assessment in year XX</p>		

An overview of the emission from from sub-category 2.C.3 *Aluminum production* is provided in the following figures and tables:

- annual emissions of air pollutants;
- Trend of the periods 1990 – 2019, 2005 – 2019, 2017 – 2019;
- Share of sector 2.C.1 Electrosteel of each pollutants in the related National total emissions.



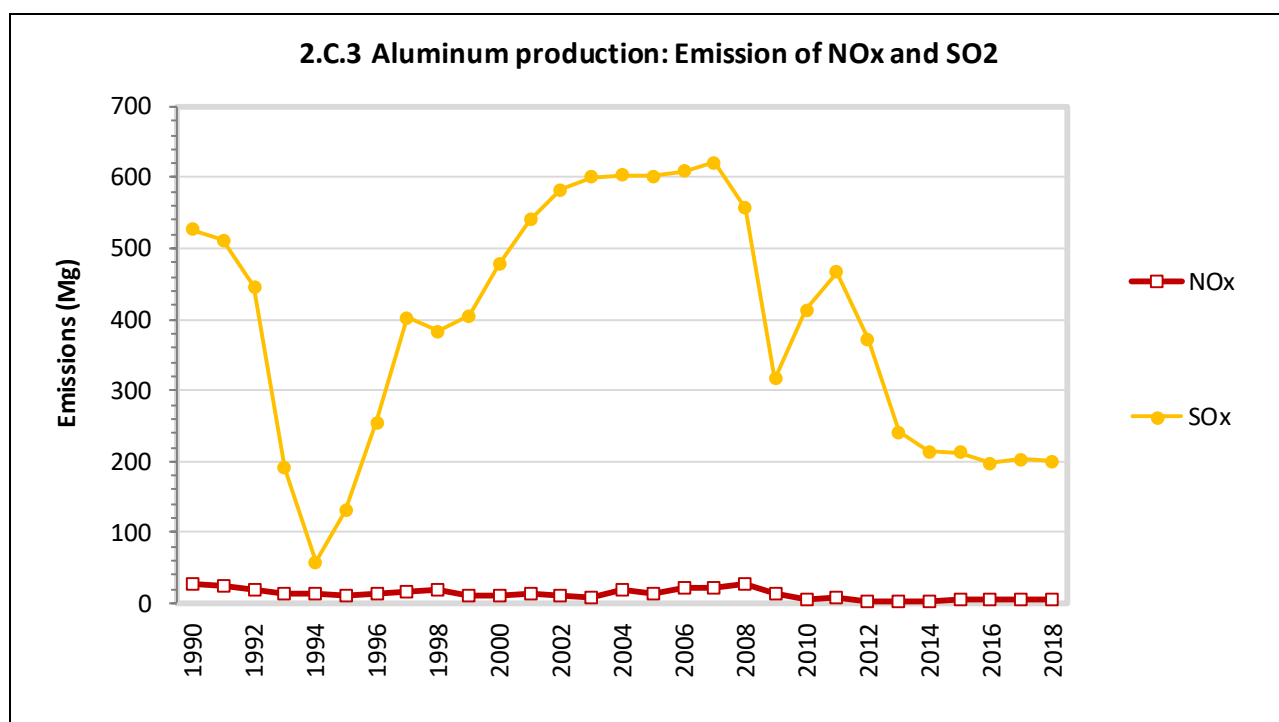


Figure 4.6 Emissions of main pollutants (NOx, SO2 and CO) from sub-category 2.C.3 Aluminum production

Table 4.20 Emissions of main pollutants (NOx, SO2 and CO) from sub-category 2.C.3 Aluminum production

Emissions	NOx	NM VOC	SOx	CO	NH3
	t	t	t	t	t
1990	105.42	NA	527.08	12,650.03	NA
1991	102.33	NA	511.64	12,279.41	NA
1992	89.16	NA	445.82	10,699.70	NA
1993	38.10	NA	190.52	4,572.49	NA
1994	11.50	NA	57.48	1,379.54	NA
1995	26.07	NA	130.36	3,128.55	NA
1996	51.08	NA	255.39	6,129.39	NA
1997	80.60	NA	403.00	9,672.04	NA
1998	76.56	NA	382.78	9,186.80	NA
1999	80.92	NA	404.58	9,709.93	NA
2000	95.53	NA	477.63	11,463.08	NA
2001	108.12	NA	540.61	12,974.75	NA
2002	116.48	NA	582.41	13,977.89	NA
2003	120.21	NA	601.06	14,425.52	NA
2004	120.80	NA	603.98	14,495.63	NA
2005	120.38	NA	601.90	14,445.53	NA
2006	121.80	NA	608.99	14,615.76	NA
2007	124.23	NA	621.15	14,907.58	NA
2008	111.34	NA	556.72	13,361.32	NA
2009	63.38	NA	316.90	7,605.48	NA
2010	82.56	NA	412.80	9,907.20	NA

Emissions	NO <sub>x</sub>	NM <sub>VOC</sub>	SO <sub>x</sub>	CO	NH <sub>3</sub>
	t	t	t	t	t
2011	93.24	NA	466.21	11,189.04	NA
2012	74.38	NA	371.92	8,926.15	NA
2013	48.32	NA	241.62	5,798.84	NA
2014	42.77	NA	213.84	5,132.04	NA
2015	42.50	NA	212.50	5,099.88	NA
2016	39.56	NA	197.78	4,746.72	NA
2017	40.46	NA	202.30	4,855.26	NA
2018	40.16	NA	200.82	4,819.56	NA
2019					
<i>Trend</i>					
1990 – 2019	-61.9%	NA	-61.9%	-61.9%	NA
2005 – 2019	-66.6%	NA	-66.6%	-66.6%	NA
2018 – 2019	-0.7%	NA	-0.7%	-0.7%	NA

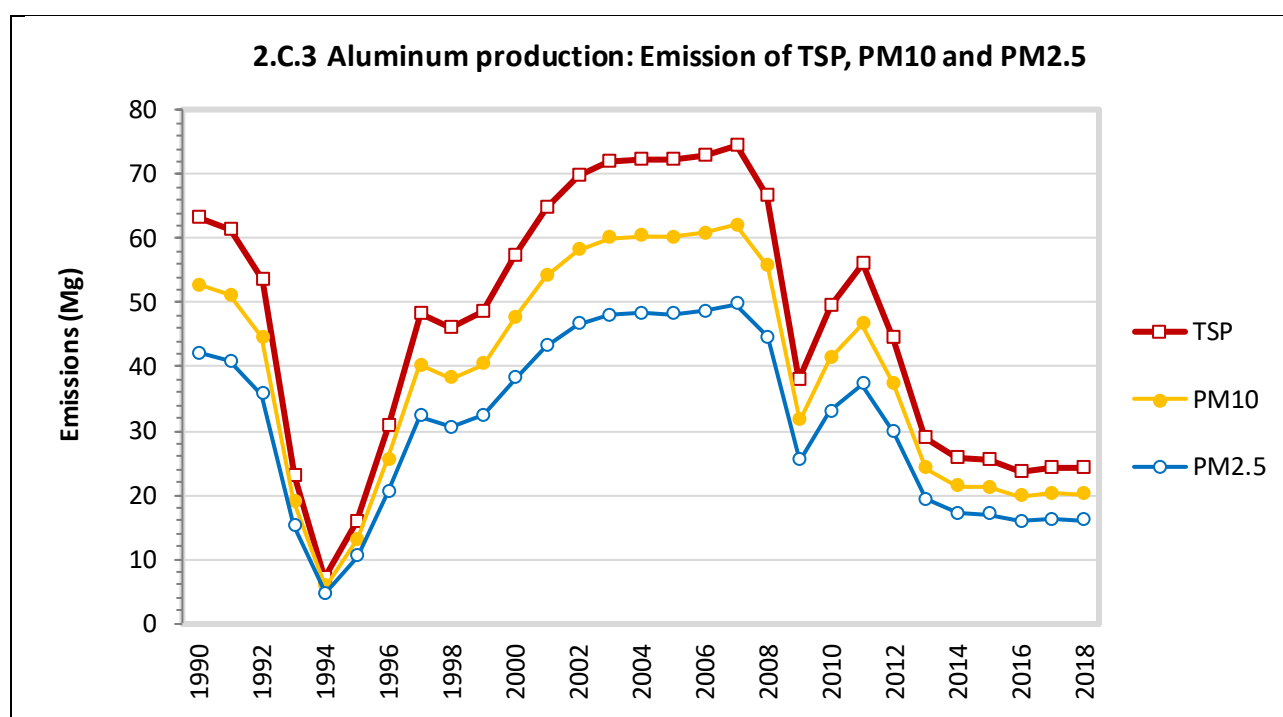


Figure 4.7 Emissions of TSP PM10 and PM2.5 from sub-category 2.C.3 Aluminum production

Table 4.21 Emissions of particulate matter (PM) from sub-category 2.C.3 Aluminum production

Emissions	PM <sub>2.5</sub>	PM <sub>10</sub>	TSP	BC
	Mg	Mg	Mg	Mg
1990	63.25	52.71	42.17	0.97
1991	61.40	51.16	40.93	0.94
1992	53.50	44.58	35.67	0.82
1993	22.86	19.05	15.24	0.35
1994	6.90	5.75	4.60	0.11

Emissions	PM2.5	PM10	TSP	BC
	Mg	Mg	Mg	Mg
1995	15.64	13.04	10.43	0.24
1996	30.65	25.54	20.43	0.47
1997	48.36	40.30	32.24	0.74
1998	45.93	38.28	30.62	0.70
1999	48.55	40.46	32.37	0.74
2000	57.32	47.76	38.21	0.88
2001	64.87	54.06	43.25	0.99
2002	69.89	58.24	46.59	1.07
2003	72.13	60.11	48.09	1.11
2004	72.48	60.40	48.32	1.11
2005	72.23	60.19	48.15	1.11
2006	73.08	60.90	48.72	1.12
2007	74.54	62.11	49.69	1.14
2008	66.81	55.67	44.54	1.02
2009	38.03	31.69	25.35	0.58
2010	49.54	41.28	33.02	0.76
2011	55.95	46.62	37.30	0.86
2012	44.63	37.19	29.75	0.68
2013	28.99	24.16	19.33	0.44
2014	25.66	21.38	17.11	0.39
2015	25.50	21.25	17.00	0.39
2016	23.73	19.78	15.82	0.36
2017	24.28	20.23	16.18	0.37
2018	24.10	20.08	16.07	0.37
2019				
<i>Trend</i>				
1990 – 2019	-61.9%	-61.9%	-61.9%	-61.9%
2005 – 2019	-66.6%	-66.6%	-66.6%	-66.6%
2018 – 2019	-0.7%	-0.7%	-0.7%	-0.7%

Table 4.22 Emissions of Persistent Organic Pollutants (POPs) from sub- category 2.C.3 Aluminum production

Emissions	PCDD/F	Benzo(a)-pyrene	Benzo(b)-fluor-anthene	Benzo(k)-fluor-anthene	Indeno (1,2,3-cd) pyrene	Total PAH	HCB	PCB
	g I-TEQ	kg	kg	kg	kg	kg	kg	Kg
1990	NA	0.17	2.11	2.11	1.05	5.441	NA	NA
1991	NA	0.16	2.05	2.05	1.02	5.281	NA	NA
1992	NA	0.14	1.78	1.78	0.89	4.602	NA	NA
1993	NA	0.06	0.76	0.76	0.38	1.967	NA	NA
1994	NA	0.02	0.23	0.23	0.11	0.593	NA	NA

Emissions	PCDD/F	Benzo(a)-pyrene	Benzo(b)-fluor-anthene	Benzo(k)-fluor-anthene	Indeno (1,2,3-cd) pyrene	Total PAH	HCB	PCB
	g I-TEQ	kg	kg	kg	kg	kg	kg	Kg
1995	NA	0.04	0.52	0.52	0.26	1.346	NA	NA
1996	NA	0.08	1.02	1.02	0.51	2.636	NA	NA
1997	NA	0.13	1.61	1.61	0.81	4.160	NA	NA
1998	NA	0.12	1.53	1.53	0.77	3.951	NA	NA
1999	NA	0.13	1.62	1.62	0.81	4.176	NA	NA
2000	NA	0.15	1.91	1.91	0.96	4.930	NA	NA
2001	NA	0.17	2.16	2.16	1.08	5.580	NA	NA
2002	NA	0.19	2.33	2.33	1.16	6.012	NA	NA
2003	NA	0.19	2.40	2.40	1.20	6.204	NA	NA
2004	NA	0.19	2.42	2.42	1.21	6.234	NA	NA
2005	NA	0.19	2.41	2.41	1.20	6.213	NA	NA
2006	NA	0.20	2.44	2.44	1.22	6.286	NA	NA
2007	NA	0.20	2.48	2.48	1.24	6.411	NA	NA
2008	NA	0.18	2.23	2.23	1.11	5.746	NA	NA
2009	NA	0.10	1.27	1.27	0.63	3.271	NA	NA
2010	NA	0.13	1.65	1.65	0.83	4.261	NA	NA
2011	NA	0.15	1.86	1.86	0.93	4.812	NA	NA
2012	NA	0.12	1.49	1.49	0.74	3.839	NA	NA
2013	NA	0.08	0.97	0.97	0.48	2.494	NA	NA
2014	NA	0.07	0.86	0.86	0.43	2.207	NA	NA
2015	NA	0.07	0.85	0.85	0.42	2.193	NA	NA
2016	NA	0.06	0.79	0.79	0.40	2.041	NA	NA
2017	NA	0.07	0.81	0.81	0.40	2.088	NA	NA
2018	NA	0.06	0.80	0.80	0.40	2.073	NA	NA
2019								
<i>Trend</i>								
1990 – 2019	NA	-61.9%	-61.9%	-61.9%	-61.9%	-61.9%	NA	NA
2005 – 2019	NA	-66.6%	-66.6%	-66.6%	-66.6%	-66.6%	NA	NA
2018 – 2019	NA	-0.7%	-0.7%	-0.7%	-0.7%	-0.7%	NA	NA

### 4.3.2.1 Methodological issues

#### 4.3.2.1.1 Choice of methods

The emissions were calculated by Tier 2 methodology from the EMEP EEA GB 2019 (EEA, 2019).

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

$E_{\text{pollutant}}$  = the emission of the specified pollutant

$AR_{\text{production}}$  = the activity rate for the aluminium production

$EF_{\text{pollutant}}$  = the emission factor for this pollutant

#### 4.3.2.1.2 Choice of activity data

The activity data are provided by the aluminum producing facilities.

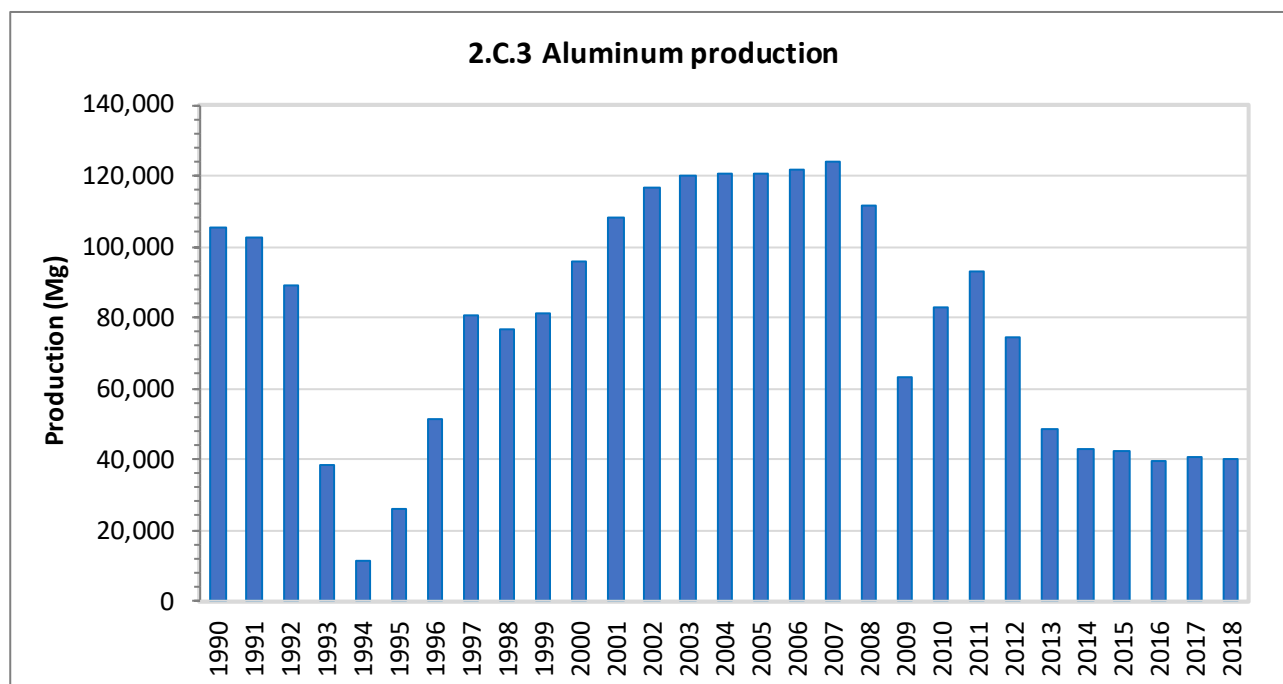


Figure 4.8 Activity data for category 2.A.3 Aluminium production 1990 – 2018

Table 4.23 Activity data and emissions from aluminum production

year	tonnes of aluminium produced	year	tonnes of aluminium produced
	t		t
1990	105,416.90	2005	120,379.40
1991	102,328.40	2006	121,798.00
1992	89,164.20	2007	124,229.80
1993	38,104.11	2008	111,344.30
1994	11,496.16	2009	63,379.00
1995	26,071.26	2010	82,560.00
1996	51,078.22	2011	93,242.00
1997	80,600.35	2012	74,384.62
1998	76,556.70	2013	48,323.69
1999	80,916.10	2014	42,767.00
2000	95,525.70	2015	42,499.00
2001	108,122.90	2016	39,556.00
2002	116,482.40	2017	40,460.54
2003	120,212.70	2018	40,163.00
2004	120,796.90	2019	
<b>Trend</b>			
1990 – 2019		-61.9%	
2005 – 2019		-66.6%	

year	tonnes of aluminium produced		year	tonnes of aluminium produced
	t			t
2018 – 2019	-0.7%			

#### 4.3.2.1.3 Choice of emission factors

Default emission factors from the EMEP/EEA Guidebook 2019, Table 3-2, are applied and are presented in the following table.

**Table 4.24 Tier 2 emission factors for source category 2.C.3 Aluminium production**

Pollutant	Value	Unit	Type of emission factor
NO <sub>x</sub>	1	kg/Mg aluminium	Default TIER 2
CO	120	kg/Mg aluminium	Default TIER 2
SO <sub>x</sub>	5	kg/Mg aluminium	Default TIER 2
TSP	0.6	kg/Mg aluminium	Default TIER 2
PM <sub>10</sub>	0.5	kg/Mg aluminium	Default TIER 2
PM <sub>2.5</sub>	0.4	kg/Mg aluminium	Default TIER 2
BC	2.30%	% of PM <sub>2.5</sub>	Default TIER 2
Benzo(a)pyrene	0.07	g/Mg aluminium	Default TIER 2
Benzo(b)fluoranthene	0.02	g/Mg aluminium	Default TIER 2
Benzo(k)fluoranthene	0.02	g/Mg aluminium	Default TIER 2
Indeno(1,2,3-cd)pyrene	0.01	g/Mg aluminium	Default TIER 2

#### 4.3.2.2 Recalculations

The following table presents the main revisions and recalculations done since the last submission to sub-category 2.C.3 Aluminum production.

**Table 4.25 Recalculations done in sub-category 2.C.3 Aluminum production**

source category	Revisions of data	Type of revision	Type of improvement
2.C.3	application of EMEP/EEA air pollutant emission inventory guidebook 2019	method	Comparability
2.C.3	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019	EF	Comparability
2.C.3	Revision of activity data	AD	Accuracy

#### 4.3.2.3 Source-specific planned improvements

Considering the potential contribution of identified improvements in the total emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.



Table 4.26 Planned improvements for sub-category 2.C.3 Aluminum production

Source category	Planned improvement	Type of improvement		Priority
2.C.3	<ul style="list-style-type: none"> <li>Detailed process modelling: <ul style="list-style-type: none"> <li>production of alumina and pre-treatment</li> <li>electrolysis</li> <li>post-treatment (refining and casting)</li> </ul> </li> <li>Collection of facility-level data</li> <li>Incorporating of plant-specific emission factors based on measurements / Facility-level data</li> </ul>	EF	Accuracy	high
2.C.3	Application of TIER 3 methodology	method	Accuracy comparability	high

## 4.4 2.D. Other Solvent and Product Use

### 4.4.1 2.D.3.a Domestic solvent use including fungicides

The following table provides an overview of activity data and NMVOC emissions from sub category 2.D.3.a Domestic solvent use including fungicides.

Emissions	NMVOC	All other pollutants
Domestic solvent use including fungicides	✓	NA
Key Category	LA2018; TA 2018	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere, NO – not occurrent, NE -not estimated, NA - not applicable, C – confidential LA – Level Assessment (in year); TA – Trend Assessment		

**Table 4.27 Main categories with regard to the domestic use of solvents**

Category	Description
Cosmetics and toiletries	Products for the maintenance or improvement of personal appearance, health or hygiene
Household products	Products used to maintain or improve the appearance of household durables
Construction/DIY	Products used to improve the appearance or the structure of buildings such as adhesives and paint remover. This sector would also normally include coatings; however, these products fall outside the scope of this section and are therefore omitted
Car care products	Products used for improving the appearance of vehicles to maintain vehicles, or winter products such as antifreeze
Pesticides	Pesticides, such as garden fungicides, herbicides and insecticides, and household insecticide sprays may be considered as consumer products. Most agrochemicals, however, are produced for agricultural use and fall outside the scope of this section

Source: EMEP EEA GB 2019, Part B, Chapter 2.D.3.a Domestic solvent use including fungicides, Table 2.1.

**Table 4.28 Activity data and emissions from domestic solvent use**

year	Inhabitants	NMVOC
	Capita	t
1990	579,892	695.87
1991	582,999	699.60
1992	585,438	702.53
1993	587,877	705.45
1994	590,316	708.38
1995	592,755	711.31
1996	595,194	714.23
1997	597,633	717.16
1998	600,072	720.09

year	Inhabitants	NM VOC
	Capita	t
1999	602,511	723.01
2000	604,950	725.94
2001	607,389	728.87
2002	609,828	731.79
2003	612,267	734.72
2004	613,353	736.02
2005	614,261	737.11
2006	615,025	738.03
2007	615,875	739.05
2008	616,969	740.36
2009	618,294	741.95
2010	619,428	743.31
2011	620,079	744.09
2012	620,601	744.72
2013	621,207	745.45
2014	621,810	746.17
2015	622,159	746.59
2016	622,303	746.76
2017	622,373	746.85
2018	622,182	746.62
2019		
<i>Trend</i>		
1990 – 2019	7.29%	7.29%
2005 – 2019	1.29%	1.29%
2018 – 2019	-0.03%	-0.03%

#### 4.4.1.1 Methodological issues

##### 4.4.1.1.1 Choice of methods

The emissions of domestic solvent use were estimated by Tier 1 methodology from the EMEP EEA GB 2019.

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

$E_{\text{pollutant}}$  = the emission of the specified pollutant

$AR_{\text{production}}$  = the activity rate for the for the coating application (in this case the population)

$EF_{\text{pollutant}}$  = the emission factor for this pollutant

#### 4.4.1.1.2 Choice of activity data

Population data are taken from the national statistical office Monstat (Monstat, 2019) and are presented in Table 4.28.

#### 4.4.1.1.3 Choice of emission factors

The emission factor (see Table 4.29) of 1.2 kg per capita for other countries from the EMEP EEA GB 2019 was applied (EEA, 2019).

**Table 4.29** Tier 1 emission factors for source category 2.D.3.a

Pollutant	Value	Unit	Type of emission factor
NMVOC	1.2	kg/capita	default

#### 4.4.1.2 Recalculations

The following table presents the main revisions and recalculations done since the last submission to sub-category 2D.3.a.

**Table 4.30** Recalculations done in sub-category 2.D.3.a

source category	Revisions of data	Type of revision	Type of improvement
2.D.3.a	application of EMEP/EEA air pollutant emission inventory guidebook 2019	method	Comparability
2.D.3.a	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019	EF	Comparability
2.D.3.a	Revision of activity data	AD	Accuracy

#### 4.4.1.3 Source-specific planned improvements

Considering the potential contribution of identified improvements in the total emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

**Table 4.31** Planned improvements for sub-category 2.D.3.a

Source category	Planned improvement	Type of improvement		Priority
2.D.3.a	Collection of production, import and export data and finally country-specific consumption data <ul style="list-style-type: none"> <li>• Agrochemical uses</li> <li>• Blowing agents</li> <li>• De-icing</li> <li>• Binder and release agents</li> <li>• Professional consumer cleaning</li> <li>• Industrial, professional and consumer coatings</li> <li>• Road and construction</li> <li>• Other consumer uses (households, aerosols, cosmetics)</li> </ul>	AD	Accuray	high
	<ul style="list-style-type: none"> <li>• Cosmetics and toiletries <ul style="list-style-type: none"> <li>○ general</li> <li>○ hair sprays</li> <li>○ toilet waters</li> <li>○ after shaves</li> <li>○ perfumes</li> <li>○ face care</li> <li>○ personal deodorants and antiperspirants</li> <li>○ body care</li> </ul> </li> <li>• Household products <ul style="list-style-type: none"> <li>○ all / general</li> <li>○ soaps: liquid or paste</li> <li>○ polishes and creams for floors</li> <li>○ shoe polishes and creams</li> </ul> </li> <li>• Car care products <ul style="list-style-type: none"> <li>○ all / general</li> <li>○ antifreeze agents in windscreen wiper systems</li> </ul> </li> <li>• Do it yourself (DIY)/buildings <ul style="list-style-type: none"> <li>○ all / general</li> <li>○ adhesives</li> <li>○ paint/varnish removers and solvents</li> <li>○ sealants, filling agents</li> </ul> </li> <li>• Pesticides</li> </ul>			
2.D.3.a	Collection of solvent content for specific products in domestic solvent use	EF	Accuray	high
2.D.3.a	Application of TIER 2 methodology	method	Accuracy comparability	high

## 4.5 2.H. Other Industry Production

### 2.H.2 Food and beverages industry

The emissions of the food and beverages sector were estimated with the production data of bread, wine and spirits. Activity data and emissions from sub category 2.H.2 are provided in Table 4.32

**Table 4.32 Activity data and emissions from food and beverages production**

Year	Bread	beer	Wine	spirits	NMVOC
	T	l	L	l	t
1990	21823	66200000	3323000	569500	184
1991	21823	60700000	2416600	1074700	172
1992	21838	41800000	2522200	1484800	135
1993	21853	21700000	1726100	1026100	93
1994	21869	36500000	2678800	1445000	125
1995	21884	42100000	3537400	1580400	138
1996	21899	37900000	3195200	1348700	129
1997	21914	39800000	2875900	1026700	131
1998	21929	45300000	3598900	981700	144
1999	21944	59400000	4920200	977100	174
2000	21499	63476600	5772550	939700	183
2001	21053	67553200	6624900	902300	192
2002	20247	30121300	10026900	1389800	124
2003	18640	55328200	8651700	1293100	168
2004	20746	49118900	9387200	1304100	161
2005	22787	51533200	10070400	729400	170
2006	24166	51694200	12170100	789700	178
2007	25229	53438600	11015800	574300	181
2008	25246	55652100	11138100	570500	185
2009	22733	45689600	10591600	437900	159
2010	21596	42379900	10558600	526600	150
2011	17858	40439600	10443600	447800	138
2012	16335	43388000	10296600	379000	141
2013	15407	40072000	9301100	417700	130
2014	15229	36451100	10998100	374900	126
2015	16210	35780400	11324100	353600	127
2016	17185	36262500	10129800	366900	128
2017	17344	38035500	11045200	347800	134
2018	16300	39380400	8812400	180900	129
2019					

### 4.5.1 Methodological issues

#### 4.5.1.1 Choice of methods

The emissions were calculated by Tier 1 methodology from the EMEP EEA GB 2019 (EEA, 2019)  $E_{\text{pollutant}} = AR_{\text{production}} \times EF_{\text{pollutant}}$

$E_{\text{pollutant}}$  = the emission of the specified pollutant

$AR_{\text{production}}$  = the activity rate for the national total food and beverages production

$EF_{\text{pollutant}}$  = the emission factor for this pollutant

#### 4.5.1.2 Choice of activity data

All of these data are from the statistical yearbooks provided by the national statistical office Monstat (Monstat, 2019). For bread production in 1990 the data are missing and the same amount like 1991 value was used. Additionally there were no activity data 2000 available and therefore 2000 is gapfilled with the average of 1999 and 2001. As the beverages are like usual measured in volume units, it is assumed that the density of all 3 activities is 1 kg/l.

#### 4.5.1.3 Choice of emission factors

The default Tier 1 Emission factor from the EMEP/EEA Guidebook 2019, Table 3-1, is applied and is presented in the following table:

**Table 4.33 Tier 1 emission factors for source category 2H.2 Food and beverages industry**

Pollutant	Value	Unit
NM VOC	2	kg/Mg product produced

### 4.5.2 Recalculations

The following table presents the main revisions and recalculations done since the last submission to sub-category 2.H.2.

**Table 4.34 Recalculations done in sub-category 2.H.2**

source category	Revisions of data	Type of revision	Type of improvement
2.H.2	application of EMEP/EEA air pollutant emission inventory guidebook 2019	method	Comparability
2.H.2	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019	EF	Comparability
2.H.2	Revision of activity data	AD	Accuracy

## 4.6 Sector-specific planned improvements

**Table 4.35 Planned improvements for sub-category 1.A.4.a commercial/institutional.**

GHG source & sink category	Planned improvement	Type of improvement		Priority
2A5b, 2D3b, 2D3c, 2D3d, 2D3e, 2D3f, 2D3h, 2G	The last comprehensive inventory was done by an consulting company. As either the methodology and the data are fully transparent, these categories could not be estimated for the whole time series in this submission. For the future it is planned to estimate these categories based on the recommended methodologies and explore new data sources.	AD	Completeness	high
2A2	Further investigation of the drop in Limeproduction in 2010.	AD	Completeness/c omparability	medium
2A5a	From 2010 on data on crushed stones, marvel, pebbles etc. are available. This data will be included, when activity data on the years before 2010 can be estimated by the use of economic parameters.	AD	Completeness	high
2.H.	Searching in international sources for production data of bread, beer, wine and spirits in the year 2000.	AD	Completeness	high



## 5 Agriculture (IPCC sector 3)

This chapter includes information on and description of methodologies used for estimating air pollutant emissions as well as references to activity data and emission factors reported under IPCC Sector 3 Agriculture for the period 1990 to 2018. This sector comprises emission from the following sub-categories.

NFR Code	Description	NO <sub>x</sub>	NM VOC	SO <sub>x</sub>	NH <sub>3</sub>	PM <sub>2.5</sub>	PM <sub>10</sub>	TSP	HCB	Key category
<b>3.B Manure management</b>										
3.B.1.a	Dairy cattle	✓	✓	NA	✓	✓	✓	✓	NA	NH <sub>3</sub> : LA 2017, TA NM VOC: LA 2017, TA
3.B.1.b	Non-dairy cattle	✓	✓	NA	✓	✓	✓	✓	NA	-
3.B.2	Sheep	✓	✓	NA	✓	✓	✓	✓	NA	NH <sub>3</sub> : TA
3.B.3	Swine	✓	✓	NA	✓	✓	✓	✓	NA	-
3.B.4.a	Buffalo	NO	NO	NA	NO	NO	NO	NO	NA	-
3.B.4.d	Goats	✓	✓	NA	✓	✓	✓	✓	NA	-
3.B.4.e	Horses	✓	✓	NA	✓	✓	✓	✓	NA	-
3.B.4.f	Mules and asses	IE	IE	NA	NO	IE	IE	IE	NA	-
3.B.4.g.i	Laying hens	✓	✓	NA	✓	✓	✓	✓	NA	NH <sub>3</sub> : LA 2017 TSP: TA
3.B.4.g.ii	Broilers	✓	✓	NA	✓	✓	✓	✓	NA	NH <sub>3</sub> : LA 2017, TA
3.B.4.g.iii	Turkeys	IE	IE	NA	IE	IE	IE	IE	NA	-
3.B.4.g.iv	Other poultry	IE	IE	NA	IE	IE	IE	IE	NA	-
3.B.4.h	Other animals	NO	NO	NA	NO	NO	NO	NO	NA	-
<b>3.D Emissions from managed soils</b>										
3.D.a.1	Inorganic N-fertilizers	✓	NA	NA	✓	NE	NE	NE	NA	-
3.D.a.2.a	Animal manure applied to soils	✓	NA	NA	✓	NE	NE	NE	NA	NH <sub>3</sub> : LA 2017, TA
3.D.a.2.b	Sewage sludge applied to soils	NE	NA	NA	NE	NO	NO	NO	NA	-
3.D.a.2.c	Other organic fertilisers applied to soils	NE	NA	NA	NE	NA	NA	NA	NA	-
3.D.a.3	Urine and dung deposited by grazing animals	NE	NE	NA	✓	NA	NA	NA	NA	NH <sub>3</sub> : TA
3.D.a.4	Crop residues applied to soils	NA	NA	NA	NE	NA	NA	NA	NA	-
3.D.b	Indirect emissions from managed soils	NA	NA	NA	NA	NA	NA	NA	NA	-
3.D.c	Farm-level agricultural operations	NA	NA	NA	NA	NO	NO	NO	NA	-
3.D.d	Off-farm storage, handling and transport of bulk agricultural products	NA	NA	NA	NA	NO	NO	NO	NA	-
3.D.e	Cultivated crops	NA	NE	NA	NA	NA	NA	NA	NA	-
3.D.f	Use of pesticides	NA	NA	NA	NA	NA	NA	NA	NE	-

3F	Field burning of agricultural residues	NE	NE	NE	NE	NE	NE	NE	NA	-
3I	Agriculture other	NO	NO	NO	NO	NO	NO	NO	NA	-
<p>A '✓' indicates: emissions from this sub-category have been estimated.</p> <p>Notation keys: IE - included elsewhere, NO – not occurring, NE -not estimated, NA -not applicable, C – confidential</p> <p>LA – Level Assessment (in year); TA – Trend Assessment</p>										

### Country-specific issues

The following graphs and table provides an overview on the agriculture position in Montenegro.

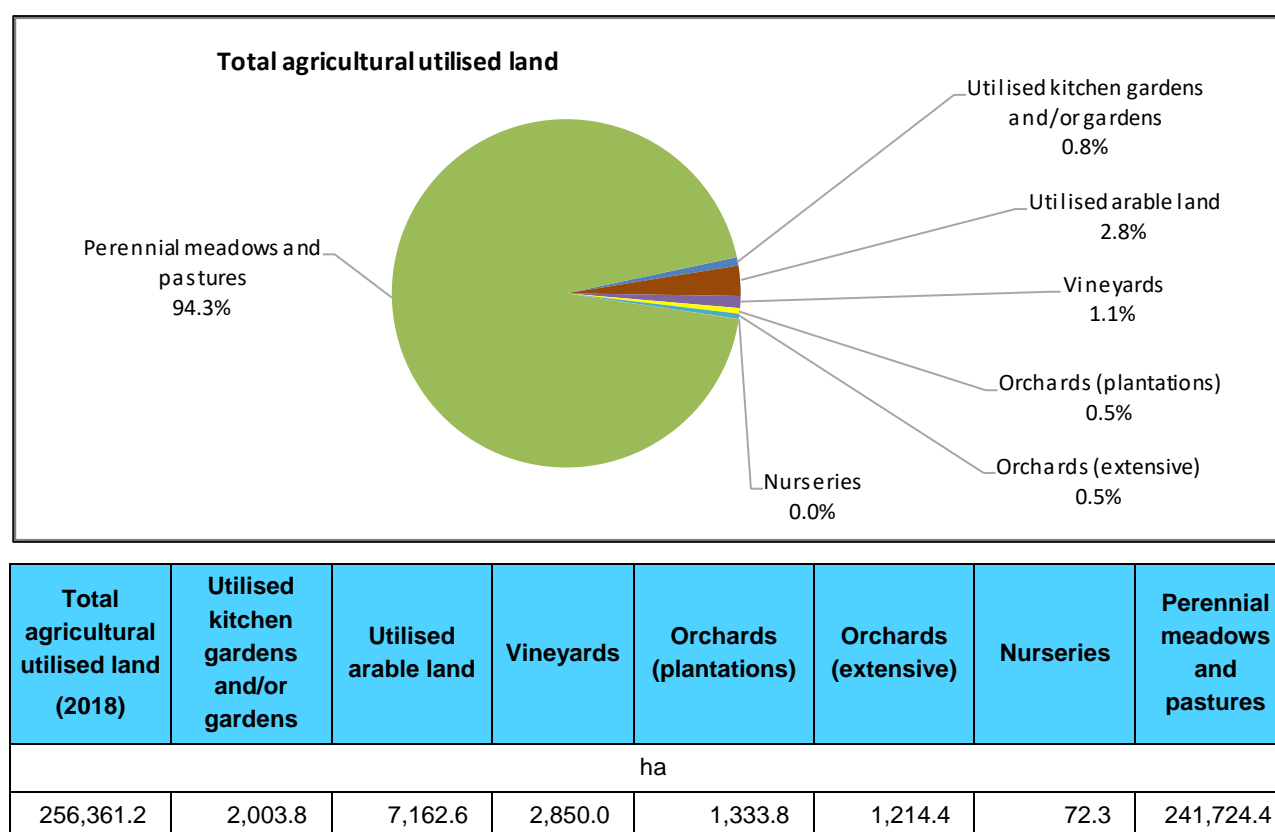


Figure 5.1 Total agricultural utilized land

The Montenegrin landscape is only partly used for intensive agriculture due to its natural conditions and the specific development of agriculture in the past. Intensive farming is practiced only in vicinity of the capital Podgorica and close to urban area of Niksic.<sup>50</sup> Agriculture as a primary sector together forestry and fishery represents with 6.7% of the GDP (2018) in Montenegro. In 2018, the total agricultural utilised land covers 256,807.7 ha (18.5% of the country). Overall, agriculture is highly diversified from olive and citrus growing in the coastal strip, vegetables and vine growing in the central part to the extensive livestock breeding particularly in the northern part.

The agricultural land is dominated by Perennial meadows and pastures (241,724.4 ha) which combined areas represents 94.3% of the Total agricultural utilised land in the country.

<sup>50</sup> Available (03. Januar 2020) on <http://see.efnecp.org/countries/montenegro/hnv-farming/>

Arable land and household gardens cover 9,213.9 ha (less than 4% of total agricultural utilised land). Arable land decreased since 2005) mostly due to urbanization and construction of infrastructure facilities. On the other hand, the area of orchards (2,570.6 ha) and vineyards (2,837.9 ha) was slowly increasing since 2005.

Main characteristics of Montenegrin agriculture is the large number of small agricultural holdings, with different crops and types of cattle.

### 5.1 Manure management (IPCC/NFR category 3.B)

This section describes the estimation of ammonia (NH<sub>3</sub>), nitric oxide (NO) and non-methane volatile organic compounds (NMVOCs) as well as particulate matter (PM) emissions resulting during the storage and treatment of manure, and from manure deposited on pasture. The term 'manure' is used here collectively to include both dung and urine (i.e., the solids and the liquids) produced by livestock. The following figure shows a schematic overview of manure management practices.

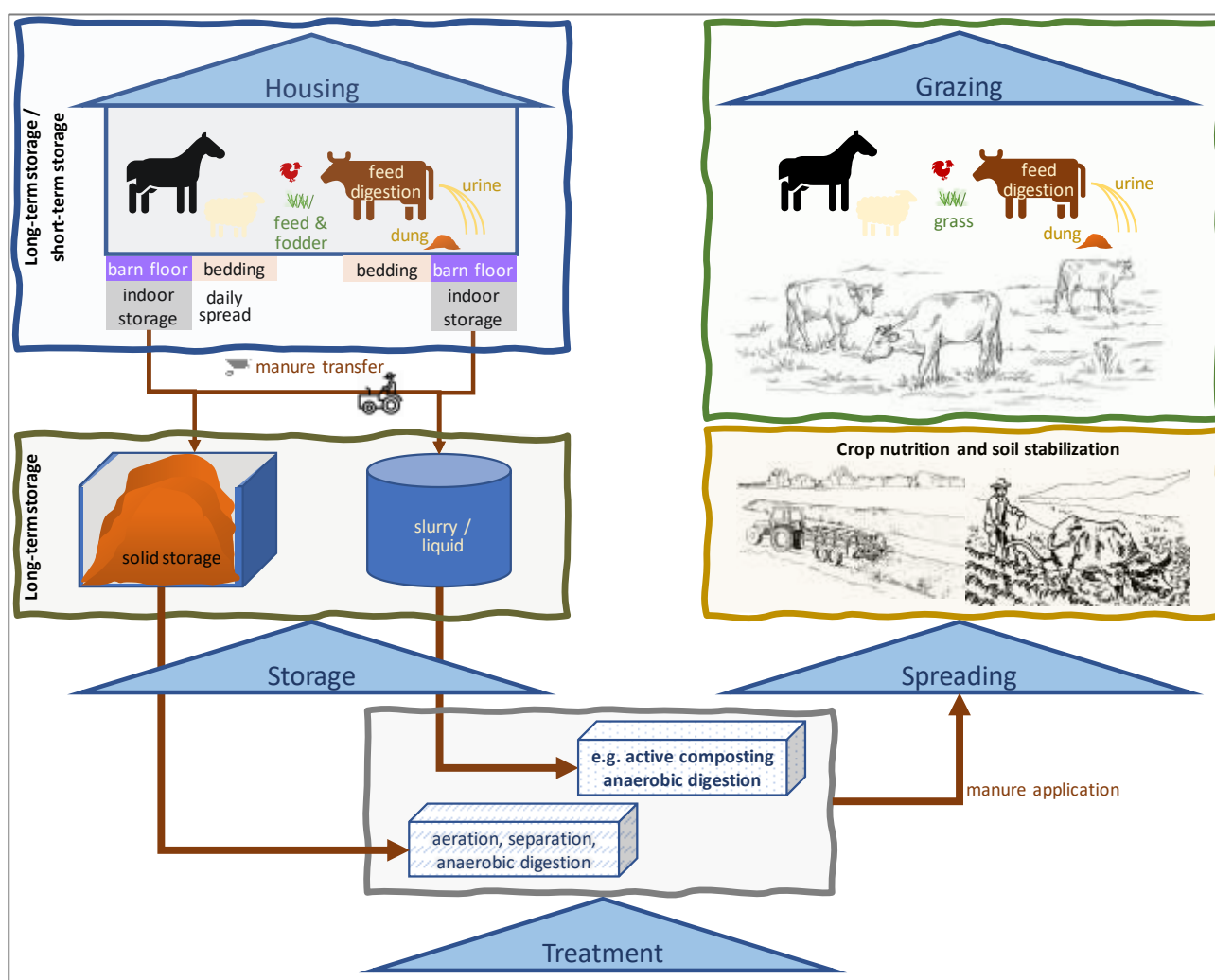


Figure 5.2 Schematic overview of manure management practices

As described in the EMEP/EEA Guidebook 2019<sup>51</sup> emissions of NH<sub>3</sub>, NO and NMVOCs arise from the excreta of agricultural livestock that are deposited in and around buildings housing livestock and collected as liquid slurry, solid manure or litter-based farmyard manure (FYM)

There are five main sources of emissions related to livestock husbandry and manure management:

- livestock feeding (PM);
- manure generated in livestock housing and on open yard areas (NH<sub>3</sub>, PM, NMVOCs);
- manure storage (NH<sub>3</sub>, NO, NMVOCs);
- field-applied manure (NH<sub>3</sub>, NO, NMVOCs);
- excreta deposited during grazing (NH<sub>3</sub>, NO, NMVOCs).

In the following table are the different manure management systems and their definitions presented. The table below provides information regarding the manure management system (MMS) in Montenegro as used in the inventory .

**Table 5.1 Definitions of manure management systems**

System according to		Definition	Storage time of manure
IPCC	EMEP/EEA GB 2019		
Pasture/ Range/ Paddock (PRP)	Pasture/ Range/ Paddock (PRP)	The manure from pasture and range grazing animals is allowed to lie as deposited, and is not managed.	
Daily spread	Daily spread	Manure is routinely removed from a confinement facility and is applied to cropland or pasture within 24 hours of excretion.	
Solid storage	Heaps	The storage of manure, typically for a period of several months, in unconfined piles or stacks. Manure is able to be stacked due to the presence of a sufficient amount of bedding material or loss of moisture by evaporation.	long period of time (months)
Dry lot		A paved or unpaved open confinement area without any significant vegetative cover where accumulating manure may be removed periodically.	
Liquid/Slurry	Lagoons Tanks	Manure is stored as excreted or with some minimal addition of water in either tanks or earthen ponds outside the animal housing, usually for periods less than one year.	≥ 6 months
Uncovered anaerobic lagoon		A type of liquid storage system designed and operated to combine waste stabilization and storage. Lagoon supernatant is usually used to remove manure from the associated confinement facilities to the lagoon. Anaerobic lagoons are designed with varying lengths of storage (up to a year or greater), depending on the climate region, the volatile solids loading rate, and other operational factors. The water from the lagoon may be recycled as flush water or used to irrigate and fertilize fields.	30 days to >200 days
Pit storage below animal confinements	In-house slurry pit	Collection and storage of manure usually with little or no added water typically below a slatted floor in an enclosed animal confinement facility, usually for periods less than one year.	two categories: <1 month > 1 month

<sup>51</sup> EMEP/EEA Air Pollutants emissions inventory guidebook 2019, Part B, 3.B Manure management, page 3.

System according to		Definition	Storage time of manure
IPCC	EMEP/EEA GB 2019		
Anaerobic digester	Biogas treatment	Animal excreta with or without straw are collected and anaerobically digested in a large containment vessel or covered lagoon. Digesters are designed and operated for waste stabilization by the microbial reduction of complex organic compounds to CO <sub>2</sub> and CH <sub>4</sub> , which is captured and flared or used as a fuel.	
Burned for fuel		The dung and urine are excreted on fields. The sun dried dung cakes are burned for fuel.	
Cattle and Swine deep bedding	In-house deep litter	As manure accumulates, bedding is continually added to absorb moisture over a production cycle and possibly for as long as 6 to 12 months. This manure management system also is known as a bedded pack manure management system and may be combined with a dry lot or pasture.	6 to 12 months
Composting	in- vessel	Composting, passive windrow	Composting, typically in an enclosed channel, with forced aeration and continuous mixing.
	Static pile	Forced-aeration composting	Composting in piles with forced aeration but no mixing.
	Intensive windrow		Composting in windrows with regular (at least daily) turning for mixing and aeration.
	Passive windrow		Composting in windrows with infrequent turning for mixing and aeration.
Poultry manure with litter		Similar to cattle and swine deep bedding except usually not combined with a dry lot or pasture. Typically used for all poultry breeder flocks and for the production of meat type chickens (broilers) and other fowl.	
Poultry manure without litter		May be similar to open pits in enclosed animal confinement facilities or may be designed and operated to dry the manure as it accumulates. The latter is known as a high-rise manure management system and is a form of passive windrow composting when designed and operated properly.	-
Aerobic treatment		The biological oxidation of manure collected as a liquid with either forced or natural aeration. Natural aeration is limited to aerobic and facultative ponds and wetland systems and is due primarily to photosynthesis. Hence, these systems typically become anoxic during periods without sunlight.	-
No definition given	Crust	Natural or artificial layer on the surface of slurry which reduces the diffusion of gasses to the atmosphere	
No definition given	Cover	Rigid or flexible structure that covers the manure and is impermeable to water and gasses	
No definition given	Slurry separation	The separation of the solid and liquid components of slurry.	
No definition given	Acidification	The addition of strong acid to reduce manure pH.	

Source: 2006 IPCC Guidelines, Volume 4: AFOLU, Chapter 10 Emissions from Livestock and Manure Management - sub-chapter 10.4.4 Uncertainty assessment. Table 10.18 Definitions of manure management systems. Page 10.48.

EMEP/EEA Air Pollutants emissions inventory guidebook 2019, Part B, 3.B Manure management - sub-chapter 3.4.5 Activity data, Table 3.13 Comparison of manure storage type definitions used here and those used by the IPCC, page 33.

Table 5.2 Manure management system (MMS) in Montenegro

		Manure System								
		Pasture Range & Paddock	Daily Spread	Solid Storage	Dry Lot	Liquid/ Slurry System	Burned for fuel	An-aerobic Lagoon	Other	Total
3.B.2.a.i	Dairy Cattle	12%	19%	10%	0%	1%	0%	0%	0%	100%
3.B.2.a.ii	Other Cattle	12%	20%	10%	4%	1%	0%	0%	0%	100%
3.B.2.b	Buffalo	-	-	-	-	-	-	-	-	-
3.B.2.c	Sheep	79%	15%	15%	0%	0%	0%	0%	0%	100%
3.B.2.d	Goats	72%	15%	15%	0%	0%	0%	0%	0%	100%
3.B.2.e	Camels	-	-	-	-	-	-	-	-	-
3.B.2.f	Horses	50%	15%	15%	0%	0%	0%	0%	0%	100%
3.B.2.g	Mules and Asses	50%	15%	15%	0%	0%	0%	0%	0%	100%
3.B.2.h	Swine	-	-	100%	-	-	0%	0%	0%	-
3.B.2.i	Poultry	15%	38%	10%	0%	1%	0%	0%	0%	100%

Source: FAO (2018): Nitrogen inputs to agricultural soils from livestock manure New statistics. In : Integrated Crop Management. Vol. 24 – 2018. Rome. Page 55. Available (18.01.2020) at <http://www.fao.org/3/I8153EN/I8153en.pdf>

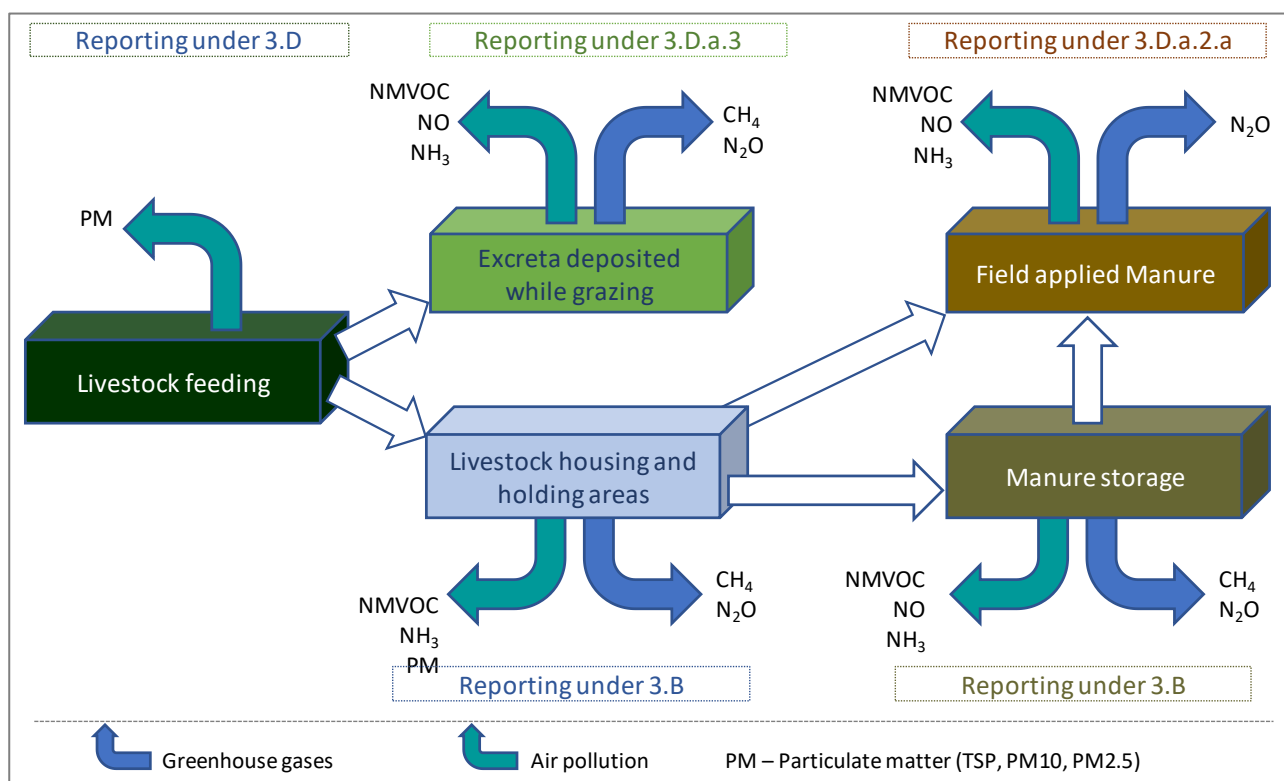


Figure 5.3 Scheme for emissions resulting from livestock feeding, livestock excreta and manure management

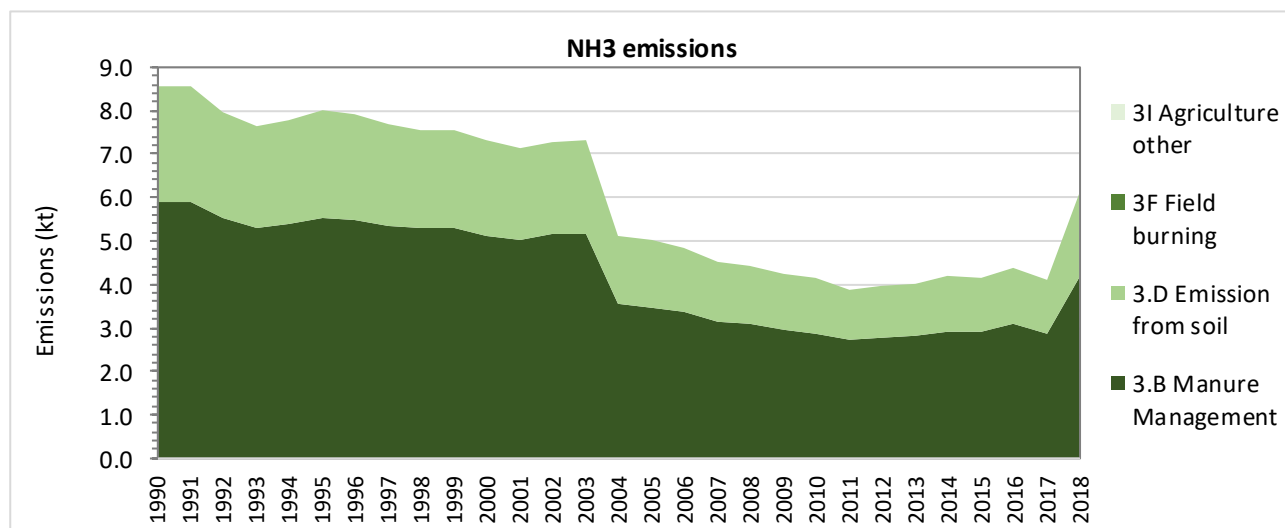


Figure 5.4 NH3 Emissions from IPCC/NFR sub-category 3.B Manure Management

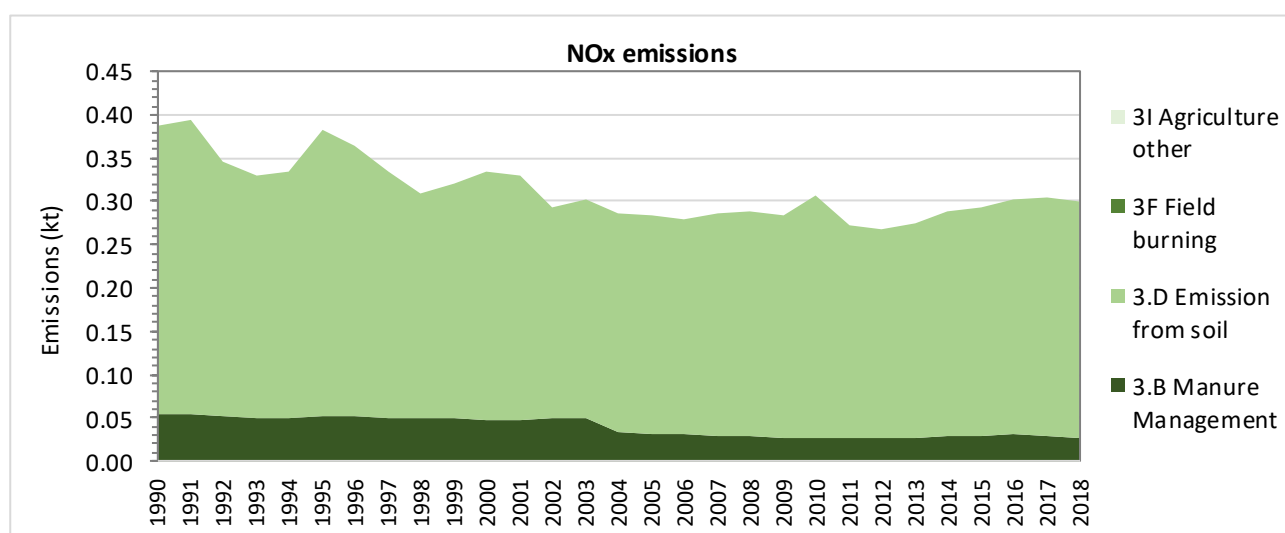


Figure 5.5 NOx Emissions from IPCC/NFR sub-category 3.B Manure Management

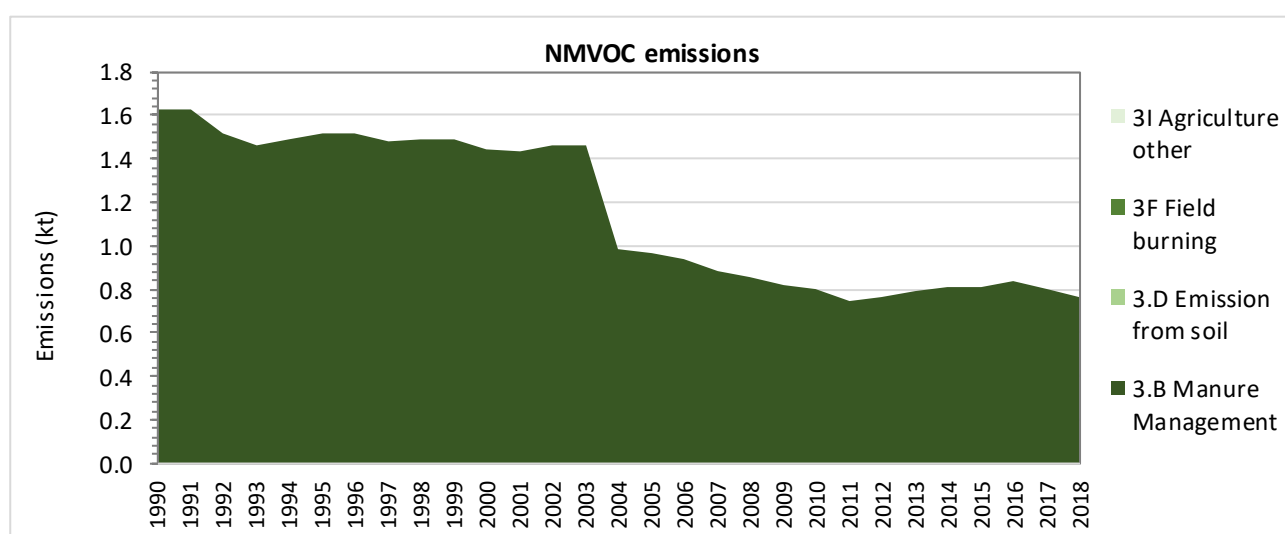


Figure 5.6 NMVOC Emissions from IPCC/NFR sub-category 3.B Manure Management

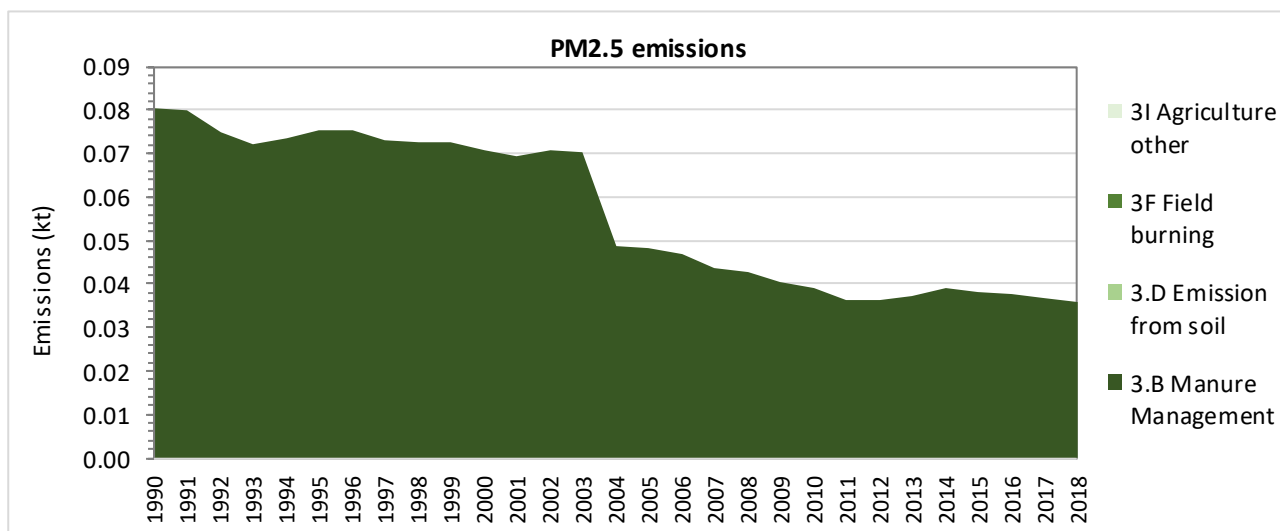


Figure 5.7 PM2.5 Emissions from IPCC/NFR sub-category 3.B Manure Management

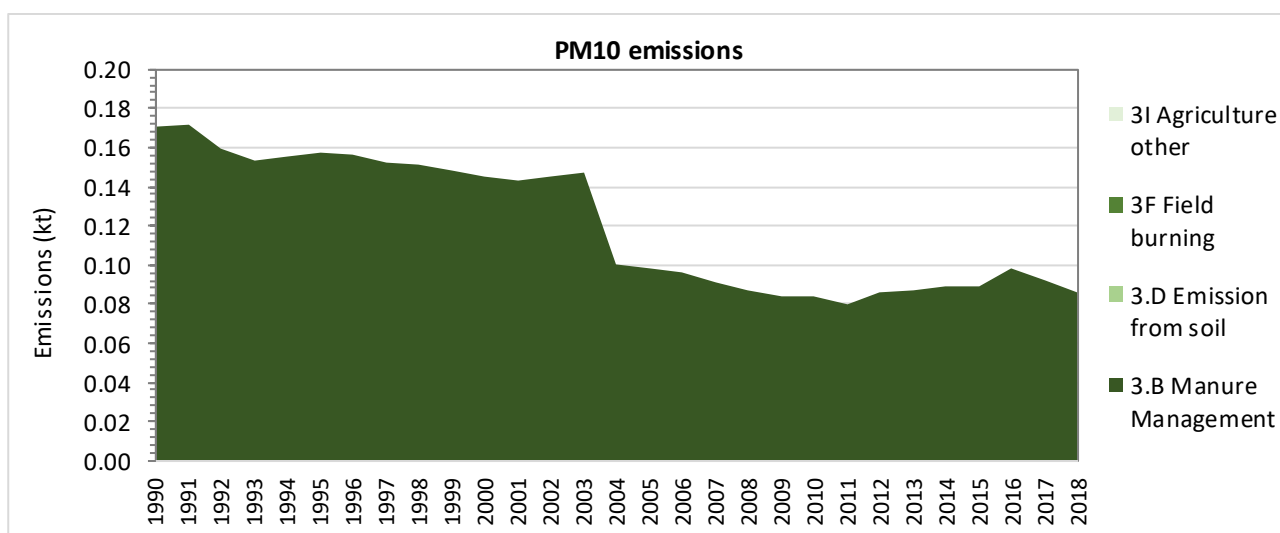


Figure 5.8 PM10 Emissions from IPCC/NFR sub-category 3.B Manure Management

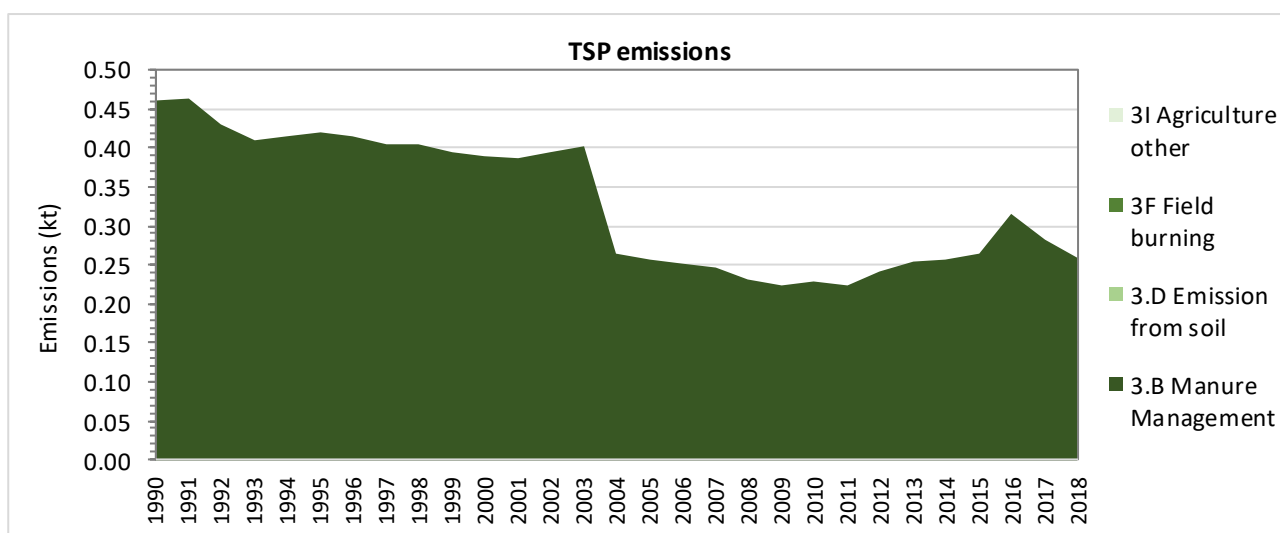


Figure 5.9 TSP Emissions from IPCC/NFR sub-category 3.B Manure Management



Table 5.3 NH3 Emissions from IPCC/NFR category 3.B Manure Management by sub-categories

NH3 Emissions	Total Manure Management	Dairy cattle	Non-dairy cattle	Sheep	Swine	Buffalo	Goats	Horses	Mules and asses	Laying hens	Broilers	Turkeys	Other poultry	Other animals
Code	3.B	3.B.1.a	3.B.1.b	3.B.2	3.B.3	3.B.4.a	3.B.4.d	3.B.4.e	3.B.4.f	3.B.4.g.i	3.B.4.g.ii	3.B.4.g.iii	3.B.4.g.iv	3.B.4.h
Unit	kt NH3													
1990	5.900	3.722	0.537	0.681	0.157	NO	0.076	0.295	NO	0.332	0.099	IE	IE	NO
1991	5.892	3.716	0.533	0.683	0.151	NO	0.074	0.286	NO	0.345	0.103	IE	IE	NO
1992	5.514	3.511	0.498	0.628	0.150	NO	0.073	0.250	NO	0.311	0.093	IE	IE	NO
1993	5.308	3.423	0.457	0.603	0.142	NO	0.071	0.239	NO	0.287	0.086	IE	IE	NO
1994	5.403	3.509	0.461	0.603	0.141	NO	0.069	0.240	NO	0.292	0.087	IE	IE	NO
1995	5.511	3.563	0.506	0.627	0.139	NO	0.068	0.242	NO	0.283	0.085	IE	IE	NO
1996	5.487	3.559	0.507	0.614	0.144	NO	0.066	0.234	NO	0.279	0.084	IE	IE	NO
1997	5.355	3.531	0.484	0.549	0.152	NO	0.064	0.222	NO	0.271	0.081	IE	IE	NO
1998	5.313	3.557	0.491	0.466	0.145	NO	0.062	0.210	NO	0.294	0.088	IE	IE	NO
1999	5.300	3.666	0.474	0.428	0.137	NO	0.061	0.185	NO	0.269	0.081	IE	IE	NO
2000	5.119	3.462	0.534	0.410	0.123	NO	0.059	0.158	NO	0.286	0.086	IE	IE	NO
2001	5.032	3.444	0.530	0.341	0.136	NO	0.049	0.148	NO	0.296	0.089	IE	IE	NO
2002	5.137	3.533	0.544	0.337	0.142	NO	0.046	0.142	NO	0.303	0.091	IE	IE	NO
2003	5.173	3.632	0.441	0.353	0.152	NO	0.042	0.134	NO	0.322	0.096	IE	IE	NO
2004	3.554	2.445	0.288	0.359	0.080	NO	0.039	0.114	NO	0.175	0.053	IE	IE	NO
2005	3.481	2.370	0.322	0.357	0.074	NO	0.036	0.105	NO	0.167	0.050	IE	IE	NO
2006	3.380	2.275	0.325	0.349	0.095	NO	0.033	0.093	NO	0.162	0.049	IE	IE	NO
2007	3.156	2.092	0.333	0.311	0.072	NO	0.030	0.081	NO	0.183	0.055	IE	IE	NO
2008	3.074	2.101	0.304	0.293	0.071	NO	0.027	0.076	NO	0.156	0.047	IE	IE	NO
2009	2.953	2.015	0.279	0.280	0.087	NO	0.023	0.073	NO	0.151	0.045	IE	IE	NO

NH3 Emissions	Total Manure Management	Dairy cattle	Non-dairy cattle	Sheep	Swine	Buffalo	Goats	Horses	Mules and asses	Laying hens	Broilers	Turkeys	Other poultry	Other animals
Code	3.B	3.B.1.a	3.B.1.b	3.B.2	3.B.3	3.B.4.a	3.B.4.d	3.B.4.e	3.B.4.f	3.B.4.g.i	3.B.4.g.ii	3.B.4.g.iii	3.B.4.g.iv	3.B.4.h
Unit	kt NH3													
2010	2.874	1.924	0.264	0.277	0.080	NO	0.020	0.071	NO	0.183	0.055	IE	IE	NO
2011	2.707	1.703	0.254	0.292	0.144	NO	0.033	0.060	NO	0.170	0.051	IE	IE	NO
2012	2.787	1.715	0.227	0.290	0.119	NO	0.033	0.058	NO	0.208	0.136	IE	IE	NO
2013	2.824	1.768	0.250	0.267	0.133	NO	0.042	0.072	NO	0.251	0.040	IE	IE	NO
2014	2.926	1.827	0.273	0.286	0.140	NO	0.046	0.074	NO	0.236	0.044	IE	IE	NO
2015	2.911	1.809	0.269	0.272	0.161	NO	0.042	0.073	NO	0.255	0.030	IE	IE	NO
2016	3.111	1.717	0.269	0.269	0.361	NO	0.044	0.058	NO	0.310	0.083	IE	IE	NO
2017	2.872	1.733	0.240	0.265	0.162	NO	0.041	0.060	NO	0.313	0.057	IE	IE	NO
2018	4.157	1.712	0.215	0.262	0.153	NO	0.041	0.059	NO	0.267	1.448	IE	IE	NO
2019														
<b>Trend</b>														
1990 – 2019	-29.5%	-54.0%	-59.9%	-61.6%	-2.7%	NA	-46.6%	-79.9%	NA	-19.4%	1357.3%	NA	NA	NA
2005 – 2019	19.4%	-27.8%	-33.1%	-26.6%	107.3%	NA	13.3%	-43.7%	NA	59.9%	2791.8%	NA	NA	NA
2018 – 2019	44.8%	-1.2%	-10.1%	-1.1%	-5.6%	NA	-1.9%	-1.6%	NA	-14.7%	2430.0%	NA	NA	NA
<b>Share in National Total</b>														
1990	61.4%	38.7%	5.6%	7.1%	1.6%	NA	0.8%	3.1%	NA	3.5%	1.0%	NA	NA	NA
2005	65.4%	26.9%	3.4%	4.1%	2.4%	NA	0.6%	0.9%	NA	4.2%	22.8%	NA	NA	NA
2019														

Table 5.4 NOx Emissions from IPCC/NFR category 3.B Manure Management by sub-categories

NOx Emissions	Total Manure Management	Dairy cattle	Non-dairy cattle	Sheep	Swine	Buffalo	Goats	Horses	Mules and asses	Laying hens	Broilers	Turkeys	Other poultry	Other animals
Code	3.B	3.B.1.a	3.B.1.b	3.B.2	3.B.3	3.B.4.a	3.B.4.d	3.B.4.e	3.B.4.f	3.B.4.g.i	3.B.4.g.ii	3.B.4.g.iii	3.B.4.g.iv	3.B.4.h
Unit	kt NOx													
1990	0.0554	0.0307	0.0084	0.0039	0.0040	NO	0.0004	0.0040	IE	0.0035	0.0004	IE	IE	NO
1991	0.0552	0.0307	0.0083	0.0039	0.0038	NO	0.0004	0.0039	IE	0.0037	0.0004	IE	IE	NO
1992	0.0517	0.0290	0.0078	0.0036	0.0038	NO	0.0004	0.0034	IE	0.0033	0.0004	IE	IE	NO
1993	0.0495	0.0282	0.0071	0.0034	0.0036	NO	0.0004	0.0032	IE	0.0031	0.0004	IE	IE	NO
1994	0.0503	0.0290	0.0072	0.0034	0.0036	NO	0.0004	0.0033	IE	0.0031	0.0004	IE	IE	NO
1995	0.0515	0.0294	0.0079	0.0036	0.0035	NO	0.0004	0.0033	IE	0.0030	0.0004	IE	IE	NO
1996	0.0514	0.0294	0.0079	0.0035	0.0037	NO	0.0004	0.0032	IE	0.0030	0.0004	IE	IE	NO
1997	0.0503	0.0291	0.0076	0.0031	0.0039	NO	0.0004	0.0030	IE	0.0029	0.0003	IE	IE	NO
1998	0.0501	0.0294	0.0077	0.0027	0.0037	NO	0.0004	0.0029	IE	0.0031	0.0004	IE	IE	NO
1999	0.0497	0.0303	0.0074	0.0024	0.0035	NO	0.0003	0.0025	IE	0.0029	0.0003	IE	IE	NO
2000	0.0483	0.0286	0.0084	0.0023	0.0031	NO	0.0003	0.0022	IE	0.0030	0.0004	IE	IE	NO
2001	0.0479	0.0284	0.0083	0.0019	0.0034	NO	0.0003	0.0020	IE	0.0031	0.0004	IE	IE	NO
2002	0.0490	0.0292	0.0085	0.0019	0.0036	NO	0.0003	0.0019	IE	0.0032	0.0004	IE	IE	NO
2003	0.0487	0.0300	0.0069	0.0020	0.0039	NO	0.0002	0.0018	IE	0.0034	0.0004	IE	IE	NO
2004	0.0326	0.0202	0.0045	0.0021	0.0020	NO	0.0002	0.0015	IE	0.0019	0.0002	IE	IE	NO
2005	0.0321	0.0196	0.0050	0.0020	0.0019	NO	0.0002	0.0014	IE	0.0018	0.0002	IE	IE	NO
2006	0.0317	0.0188	0.0051	0.0020	0.0024	NO	0.0002	0.0013	IE	0.0017	0.0002	IE	IE	NO
2007	0.0295	0.0173	0.0052	0.0018	0.0018	NO	0.0002	0.0011	IE	0.0019	0.0002	IE	IE	NO
2008	0.0286	0.0173	0.0048	0.0017	0.0018	NO	0.0002	0.0010	IE	0.0017	0.0002	IE	IE	NO
2009	0.0277	0.0166	0.0044	0.0016	0.0022	NO	0.0001	0.0010	IE	0.0016	0.0002	IE	IE	NO

NOx Emissions	Total Manure Management	Dairy cattle	Non-dairy cattle	Sheep	Swine	Buffalo	Goats	Horses	Mules and asses	Laying hens	Broilers	Turkeys	Other poultry	Other animals
Code	3.B	3.B.1.a	3.B.1.b	3.B.2	3.B.3	3.B.4.a	3.B.4.d	3.B.4.e	3.B.4.f	3.B.4.g.i	3.B.4.g.ii	3.B.4.g.iii	3.B.4.g.iv	3.B.4.h
Unit	kt NOx													
2010	0.0269	0.0159	0.0041	0.0016	0.0020	NO	0.0001	0.0010	IE	0.0019	0.0002	IE	IE	NO
2011	0.0264	0.0140	0.0040	0.0017	0.0036	NO	0.0002	0.0008	IE	0.0018	0.0002	IE	IE	NO
2012	0.0261	0.0142	0.0036	0.0017	0.0030	NO	0.0002	0.0008	IE	0.0022	0.0006	IE	IE	NO
2013	0.0276	0.0146	0.0039	0.0015	0.0035	NO	0.0002	0.0010	IE	0.0027	0.0002	IE	IE	NO
2014	0.0282	0.0151	0.0043	0.0016	0.0033	NO	0.0003	0.0010	IE	0.0025	0.0002	IE	IE	NO
2015	0.0285	0.0149	0.0042	0.0016	0.0038	NO	0.0002	0.0010	IE	0.0027	0.0001	IE	IE	NO
2016	0.0311	0.0142	0.0042	0.0015	0.0065	NO	0.0003	0.0008	IE	0.0033	0.0004	IE	IE	NO
2017	0.0280	0.0143	0.0037	0.0015	0.0038	NO	0.0002	0.0008	IE	0.0033	0.0002	IE	IE	NO
2018	0.0265	0.0141	0.0034	0.0015	0.0034	NO	0.0002	0.0008	IE	0.0028	0.0002	IE	IE	NO
2019														
<b>Trend</b>														
1990 – 2019	-52.2%	-54.0%	-59.9%	-61.6%	-14.7%	NA	-46.6%	-79.9%	NA	-19.4%	-53.7%	NA	NA	NA
2005 – 2019	-17.6%	-27.8%	-33.1%	-26.6%	81.6%	NA	13.3%	-43.7%	NA	59.9%	-8.2%	NA	NA	NA
2018 – 2019	-5.4%	-1.2%	-10.1%	-1.1%	-10.2%	NA	-1.9%	-1.6%	NA	-14.7%	-19.7%	NA	NA	NA
<b>Share in National Total</b>														
1990	0.5%	0.30%	0.08%	0.04%	0.04%	NA	0.00%	0.04%	NA	0.03%	0.00%	NA	NA	NA
2005	0.2%	0.11%	0.03%	0.01%	0.03%	NA	0.00%	0.01%	NA	0.02%	0.00%	NA	NA	NA
2019														

Table 5.5 NMVOC Emissions from IPCC/NFR category 3.B Manure Management by sub-categories

NMVOC Emissions	Total Manure Management	Dairy cattle	Non-dairy cattle	Sheep	Swine	Buffalo	Goats	Horses	Mules and asses	Laying hens	Broilers	Turkeys	Other poultry	Other animals
Code	3.B	3.B.1.a	3.B.1.b	3.B.2	3.B.3	3.B.4.a	3.B.4.d	3.B.4.e	3.B.4.f	3.B.4.g.i	3.B.4.g.ii	3.B.4.g.iii	3.B.4.g.iv	3.B.4.h
Unit	kt NMVOC													
1990	0.0554	1.047	0.210	0.082	0.033	NO	0.030	0.085	IE	0.116	0.023	IE	IE	NO
1991	0.0552	1.046	0.209	0.082	0.032	NO	0.029	0.083	IE	0.121	0.024	IE	IE	NO
1992	0.0517	0.988	0.195	0.076	0.032	NO	0.028	0.072	IE	0.109	0.021	IE	IE	NO
1993	0.0495	0.963	0.179	0.073	0.030	NO	0.028	0.069	IE	0.101	0.020	IE	IE	NO
1994	0.0503	0.987	0.181	0.073	0.030	NO	0.027	0.069	IE	0.102	0.020	IE	IE	NO
1995	0.0515	1.002	0.198	0.076	0.029	NO	0.026	0.070	IE	0.099	0.019	IE	IE	NO
1996	0.0514	1.002	0.199	0.074	0.030	NO	0.026	0.068	IE	0.098	0.019	IE	IE	NO
1997	0.0503	0.994	0.189	0.066	0.032	NO	0.025	0.064	IE	0.095	0.019	IE	IE	NO
1998	0.0501	1.001	0.192	0.056	0.031	NO	0.024	0.061	IE	0.103	0.020	IE	IE	NO
1999	0.0497	1.031	0.186	0.052	0.029	NO	0.024	0.053	IE	0.095	0.019	IE	IE	NO
2000	0.0483	0.974	0.209	0.050	0.026	NO	0.023	0.046	IE	0.100	0.020	IE	IE	NO
2001	0.0479	0.969	0.208	0.041	0.029	NO	0.019	0.043	IE	0.104	0.020	IE	IE	NO
2002	0.0490	0.994	0.213	0.041	0.030	NO	0.018	0.041	IE	0.106	0.021	IE	IE	NO
2003	0.0487	1.022	0.173	0.043	0.032	NO	0.016	0.039	IE	0.113	0.022	IE	IE	NO
2004	0.0326	0.688	0.113	0.043	0.017	NO	0.015	0.033	IE	0.062	0.012	IE	IE	NO
2005	0.0321	0.667	0.126	0.043	0.016	NO	0.014	0.030	IE	0.059	0.012	IE	IE	NO
2006	0.0317	0.640	0.127	0.042	0.020	NO	0.013	0.027	IE	0.057	0.011	IE	IE	NO
2007	0.0295	0.589	0.131	0.038	0.015	NO	0.011	0.023	IE	0.064	0.013	IE	IE	NO
2008	0.0286	0.591	0.119	0.035	0.015	NO	0.010	0.022	IE	0.055	0.011	IE	IE	NO
2009	0.0277	0.567	0.109	0.034	0.018	NO	0.009	0.021	IE	0.053	0.010	IE	IE	NO

NMVOC Emissions	Total Manure Management	Dairy cattle	Non-dairy cattle	Sheep	Swine	Buffalo	Goats	Horses	Mules and asses	Laying hens	Broilers	Turkeys	Other poultry	Other animals
Code	3.B	3.B.1.a	3.B.1.b	3.B.2	3.B.3	3.B.4.a	3.B.4.d	3.B.4.e	3.B.4.f	3.B.4.g.i	3.B.4.g.ii	3.B.4.g.iii	3.B.4.g.iv	3.B.4.h
Unit	kt NMVOC													
2010	0.0269	0.541	0.103	0.033	0.017	NO	0.008	0.021	IE	0.064	0.013	IE	IE	NO
2011	0.0264	0.479	0.100	0.035	0.030	NO	0.013	0.017	IE	0.060	0.012	IE	IE	NO
2012	0.0261	0.483	0.089	0.035	0.025	NO	0.013	0.017	IE	0.073	0.031	IE	IE	NO
2013	0.0276	0.498	0.098	0.032	0.029	NO	0.016	0.021	IE	0.088	0.009	IE	IE	NO
2014	0.0282	0.514	0.107	0.035	0.027	NO	0.018	0.021	IE	0.083	0.010	IE	IE	NO
2015	0.0285	0.509	0.105	0.033	0.031	NO	0.016	0.021	IE	0.089	0.007	IE	IE	NO
2016	0.0311	0.483	0.105	0.032	0.054	NO	0.017	0.017	IE	0.109	0.019	IE	IE	NO
2017	0.0280	0.488	0.094	0.032	0.032	NO	0.016	0.017	IE	0.110	0.013	IE	IE	NO
2018	0.0265	0.482	0.084	0.032	0.028	NO	0.016	0.017	IE	0.094	0.011	IE	IE	NO
2019														
<b>Trend</b>														
1990 – 2019	-52.2%	-54.0%	-59.9%	-61.6%	-14.7%	NA	-46.6%	-79.9%	NA	-19.4%	-53.7%	NA	NA	NA
2005 – 2019	-17.6%	-27.8%	-33.1%	-26.6%	81.6%	NA	13.3%	-43.7%	NA	59.9%	-8.2%	NA	NA	NA
2018 – 2019	-5.4%	-1.2%	-10.1%	-1.1%	-10.2%	NA	-1.9%	-1.6%	NA	-14.7%	-19.7%	NA	NA	NA
<b>Share in National Total</b>														
1990	11.5%	7.4%	1.5%	0.6%	0.2%	NA	0.2%	0.6%	NA	0.8%	0.2%	NA	NA	NA
2005	9.0%	5.7%	1.0%	0.4%	0.3%	NA	0.2%	0.2%	NA	1.1%	0.1%	NA	NA	NA
2019														

Table 5.6 PM2.5 Emissions from IPCC/NFR category 3.B Manure Management by sub-categories

PM2.5 Emissions	Total Manure Management	Dairy cattle	Non-dairy cattle	Sheep	Swine	Buffalo	Goats	Horses	Mules and asses	Laying hens	Broilers	Turkeys	Other poultry	Other animals
Code	3.B	3.B.1.a	3.B.1.b	3.B.2	3.B.3	3.B.4.a	3.B.4.d	3.B.4.e	3.B.4.f	3.B.4.g.i	3.B.4.g.ii	3.B.4.g.iii	3.B.4.g.iv	3.B.4.h
Unit	kt PM2.5													
1990	0.080	0.0534	0.0105	0.0097	0.0002	NO	0.0011	0.0028	IE	0.0021	0.0004	IE	IE	NO
1991	0.080	0.0533	0.0104	0.0098	0.0002	NO	0.0011	0.0027	IE	0.0022	0.0004	IE	IE	NO
1992	0.075	0.0503	0.0098	0.0090	0.0002	NO	0.0010	0.0024	IE	0.0020	0.0004	IE	IE	NO
1993	0.072	0.0491	0.0089	0.0086	0.0002	NO	0.0010	0.0023	IE	0.0018	0.0004	IE	IE	NO
1994	0.074	0.0503	0.0090	0.0086	0.0002	NO	0.0010	0.0023	IE	0.0019	0.0004	IE	IE	NO
1995	0.076	0.0511	0.0099	0.0090	0.0002	NO	0.0010	0.0023	IE	0.0018	0.0004	IE	IE	NO
1996	0.075	0.0510	0.0099	0.0088	0.0002	NO	0.0009	0.0022	IE	0.0018	0.0004	IE	IE	NO
1997	0.073	0.0506	0.0095	0.0078	0.0002	NO	0.0009	0.0021	IE	0.0017	0.0003	IE	IE	NO
1998	0.073	0.0510	0.0096	0.0067	0.0002	NO	0.0009	0.0020	IE	0.0019	0.0004	IE	IE	NO
1999	0.073	0.0526	0.0093	0.0061	0.0002	NO	0.0009	0.0017	IE	0.0017	0.0003	IE	IE	NO
2000	0.071	0.0496	0.0104	0.0059	0.0002	NO	0.0008	0.0015	IE	0.0018	0.0004	IE	IE	NO
2001	0.069	0.0494	0.0104	0.0049	0.0002	NO	0.0007	0.0014	IE	0.0019	0.0004	IE	IE	NO
2002	0.071	0.0506	0.0106	0.0048	0.0002	NO	0.0007	0.0013	IE	0.0019	0.0004	IE	IE	NO
2003	0.070	0.0521	0.0086	0.0050	0.0002	NO	0.0006	0.0013	IE	0.0021	0.0004	IE	IE	NO
2004	0.049	0.0351	0.0056	0.0051	0.0001	NO	0.0006	0.0011	IE	0.0011	0.0002	IE	IE	NO
2005	0.048	0.0340	0.0063	0.0051	0.0001	NO	0.0005	0.0010	IE	0.0011	0.0002	IE	IE	NO
2006	0.047	0.0326	0.0064	0.0050	0.0001	NO	0.0005	0.0009	IE	0.0010	0.0002	IE	IE	NO
2007	0.044	0.0300	0.0065	0.0044	0.0001	NO	0.0004	0.0008	IE	0.0012	0.0002	IE	IE	NO
2008	0.043	0.0301	0.0059	0.0042	0.0001	NO	0.0004	0.0007	IE	0.0010	0.0002	IE	IE	NO
2009	0.041	0.0289	0.0055	0.0040	0.0001	NO	0.0003	0.0007	IE	0.0010	0.0002	IE	IE	NO

PM2.5 Emissions	Total Manure Management	Dairy cattle	Non-dairy cattle	Sheep	Swine	Buffalo	Goats	Horses	Mules and asses	Laying hens	Broilers	Turkeys	Other poultry	Other animals
Code	3.B	3.B.1.a	3.B.1.b	3.B.2	3.B.3	3.B.4.a	3.B.4.d	3.B.4.e	3.B.4.f	3.B.4.g.i	3.B.4.g.ii	3.B.4.g.iii	3.B.4.g.iv	3.B.4.h
Unit	kt PM2.5													
2010	0.039	0.0276	0.0052	0.0040	0.0001	NO	0.0003	0.0007	IE	0.0012	0.0002	IE	IE	NO
2011	0.036	0.0244	0.0050	0.0042	0.0002	NO	0.0005	0.0006	IE	0.0011	0.0002	IE	IE	NO
2012	0.036	0.0246	0.0044	0.0041	0.0002	NO	0.0005	0.0005	IE	0.0013	0.0006	IE	IE	NO
2013	0.037	0.0254	0.0049	0.0038	0.0002	NO	0.0006	0.0007	IE	0.0016	0.0002	IE	IE	NO
2014	0.039	0.0262	0.0053	0.0041	0.0002	NO	0.0007	0.0007	IE	0.0015	0.0002	IE	IE	NO
2015	0.038	0.0259	0.0053	0.0039	0.0002	NO	0.0006	0.0007	IE	0.0016	0.0001	IE	IE	NO
2016	0.038	0.0246	0.0053	0.0038	0.0004	NO	0.0006	0.0006	IE	0.0020	0.0004	IE	IE	NO
2017	0.037	0.0248	0.0047	0.0038	0.0002	NO	0.0006	0.0006	IE	0.0020	0.0002	IE	IE	NO
2018	0.036	0.0245	0.0042	0.0037	0.0002	NO	0.0006	0.0006	IE	0.0017	0.0002	IE	IE	NO
2019														
Trend														
1990 – 2019	-55.5%	-54.0%	-59.9%	-61.6%	-9.4%	NA	-46.6%	-79.9%	NA	-19.4%	-53.7%	NA	NA	NA
2005 – 2019	-26.0%	-27.8%	-33.1%	-26.6%	93.1%	NA	13.3%	-43.7%	NA	59.9%	-8.2%	NA	NA	NA
2018 – 2019	-3.3%	-1.2%	-10.1%	-1.1%	-8.1%	NA	-1.9%	-1.6%	NA	-14.7%	-19.7%	NA	NA	NA
Share in National Total														
1990	0.73%	0.48%	0.10%	0.09%	0.00%	NA	0.01%	0.03%	NA	0.02%	0.00%	NA	NA	NA
2005	0.37%	0.50%	0.09%	0.08%	0.00%	NA	0.01%	0.01%	NA	0.03%	0.00%	NA	NA	NA
2019														



Table 5.7 PM10 Emissions from IPCC/NFR category 3.B Manure Management by sub-categories

PM10 Emissions	Total Manure Management	Dairy cattle	Non-dairy cattle	Sheep	Swine	Buffalo	Goats	Horses	Mules and asses	Laying hens	Broilers	Turkeys	Other poultry	Other animals
Code	3.B	3.B.1.a	3.B.1.b	3.B.2	3.B.3	3.B.4.a	3.B.4.d	3.B.4.e	3.B.4.f	3.B.4.g.i	3.B.4.g.ii	3.B.4.g.iii	3.B.4.g.iv	3.B.4.h
Unit	kt PM10													
1990	0.171	0.082	0.016	0.029	0.004	NO	0.003	0.004	IE	0.028	0.004	IE	IE	NO
1991	0.172	0.082	0.016	0.029	0.004	NO	0.003	0.004	IE	0.029	0.004	IE	IE	NO
1992	0.160	0.077	0.015	0.027	0.004	NO	0.003	0.004	IE	0.026	0.004	IE	IE	NO
1993	0.153	0.075	0.013	0.026	0.004	NO	0.003	0.004	IE	0.024	0.004	IE	IE	NO
1994	0.155	0.077	0.014	0.026	0.004	NO	0.003	0.004	IE	0.025	0.004	IE	IE	NO
1995	0.158	0.078	0.015	0.027	0.003	NO	0.003	0.004	IE	0.024	0.004	IE	IE	NO
1996	0.157	0.078	0.015	0.026	0.004	NO	0.003	0.003	IE	0.024	0.004	IE	IE	NO
1997	0.152	0.078	0.014	0.024	0.004	NO	0.003	0.003	IE	0.023	0.003	IE	IE	NO
1998	0.151	0.078	0.014	0.020	0.004	NO	0.003	0.003	IE	0.025	0.004	IE	IE	NO
1999	0.148	0.081	0.014	0.018	0.003	NO	0.003	0.003	IE	0.023	0.003	IE	IE	NO
2000	0.145	0.076	0.016	0.018	0.003	NO	0.003	0.002	IE	0.024	0.004	IE	IE	NO
2001	0.143	0.076	0.016	0.015	0.003	NO	0.002	0.002	IE	0.025	0.004	IE	IE	NO
2002	0.145	0.078	0.016	0.014	0.004	NO	0.002	0.002	IE	0.026	0.004	IE	IE	NO
2003	0.147	0.080	0.013	0.015	0.004	NO	0.002	0.002	IE	0.027	0.004	IE	IE	NO
2004	0.100	0.054	0.008	0.015	0.002	NO	0.002	0.002	IE	0.015	0.002	IE	IE	NO
2005	0.098	0.052	0.009	0.015	0.002	NO	0.002	0.002	IE	0.014	0.002	IE	IE	NO
2006	0.096	0.050	0.010	0.015	0.002	NO	0.001	0.001	IE	0.014	0.002	IE	IE	NO
2007	0.091	0.046	0.010	0.013	0.002	NO	0.001	0.001	IE	0.016	0.002	IE	IE	NO
2008	0.087	0.046	0.009	0.013	0.002	NO	0.001	0.001	IE	0.013	0.002	IE	IE	NO
2009	0.084	0.044	0.008	0.012	0.002	NO	0.001	0.001	IE	0.013	0.002	IE	IE	NO

PM10 Emissions	Total Manure Management	Dairy cattle	Non-dairy cattle	Sheep	Swine	Buffalo	Goats	Horses	Mules and asses	Laying hens	Broilers	Turkeys	Other poultry	Other animals
Code	3.B	3.B.1.a	3.B.1.b	3.B.2	3.B.3	3.B.4.a	3.B.4.d	3.B.4.e	3.B.4.f	3.B.4.g.i	3.B.4.g.ii	3.B.4.g.iii	3.B.4.g.iv	3.B.4.h
Unit	kt PM10													
2010	0.084	0.042	0.008	0.012	0.002	NO	0.001	0.001	IE	0.016	0.002	IE	IE	NO
2011	0.080	0.038	0.007	0.013	0.004	NO	0.001	0.001	IE	0.014	0.002	IE	IE	NO
2012	0.086	0.038	0.007	0.012	0.003	NO	0.001	0.001	IE	0.018	0.006	IE	IE	NO
2013	0.087	0.039	0.007	0.011	0.003	NO	0.002	0.001	IE	0.021	0.002	IE	IE	NO
2014	0.089	0.040	0.008	0.012	0.003	NO	0.002	0.001	IE	0.020	0.002	IE	IE	NO
2015	0.089	0.040	0.008	0.012	0.004	NO	0.002	0.001	IE	0.022	0.001	IE	IE	NO
2016	0.098	0.038	0.008	0.012	0.008	NO	0.002	0.001	IE	0.026	0.004	IE	IE	NO
2017	0.092	0.038	0.007	0.011	0.004	NO	0.002	0.001	IE	0.027	0.002	IE	IE	NO
2018	0.086	0.038	0.006	0.011	0.004	NO	0.002	0.001	IE	0.023	0.002	IE	IE	NO
2019														
<b>Trend</b>														
1990 – 2019	-55.5%	-54.0%	-59.9%	-61.6%	-5.4%	NA	-46.6%	-79.9%	NA	-19.4%	-53.7%	NA	NA	NA
2005 – 2019	-26.0%	-27.8%	-33.1%	-26.6%	101.4%	NA	13.3%	-43.7%	NA	59.9%	-8.2%	NA	NA	NA
2018 – 2019	-3.3%	-1.2%	-10.1%	-1.1%	-6.6%	NA	-1.9%	-1.6%	NA	-14.7%	-19.7%	NA	NA	NA
<b>Share in National Total</b>														
1990	1.5%	0.70%	0.13%	0.25%	0.03%	NA	0.03%	0.04%	NA	0.24%	0.04%	NA	NA	NA
2005	1.7%	0.75%	0.12%	0.22%	0.07%	NA	0.03%	0.02%	NA	0.45%	0.04%	NA	NA	NA
2019														

Table 5.8 TSP Emissions from IPCC/NFR category 3.B Manure Management by sub-categories

TSP Emissions	Total Manure Management	Dairy cattle	Non-dairy cattle	Sheep	Swine	Buffalo	Goats	Horses	Mules and asses	Laying hens	Broilers	Turkeys	Other poultry	Other animals
Code	3.B	3.B.1.a	3.B.1.b	3.B.2	3.B.3	3.B.4.a	3.B.4.d	3.B.4.e	3.B.4.f	3.B.4.g.i	3.B.4.g.ii	3.B.4.g.iii	3.B.4.g.iv	3.B.4.h
Unit	kt TSP													
1990	0.460	0.165	0.029	0.060	0.016	NO	0.007	0.008	IE	0.116	0.007	IE	IE	NO
1991	0.464	0.169	0.030	0.060	0.016	NO	0.007	0.008	IE	0.118	0.007	IE	IE	NO
1992	0.430	0.172	0.032	0.063	0.016	NO	0.007	0.008	IE	0.114	0.007	IE	IE	NO
1993	0.409	0.172	0.033	0.061	0.016	NO	0.007	0.008	IE	0.113	0.007	IE	IE	NO
1994	0.415	0.170	0.031	0.055	0.017	NO	0.006	0.007	IE	0.110	0.007	IE	IE	NO
1995	0.419	0.172	0.031	0.047	0.017	NO	0.006	0.007	IE	0.119	0.007	IE	IE	NO
1996	0.416	0.177	0.030	0.043	0.016	NO	0.006	0.006	IE	0.109	0.007	IE	IE	NO
1997	0.404	0.167	0.034	0.041	0.014	NO	0.006	0.005	IE	0.116	0.007	IE	IE	NO
1998	0.406	0.166	0.034	0.034	0.016	NO	0.005	0.005	IE	0.120	0.008	IE	IE	NO
1999	0.394	0.170	0.035	0.034	0.016	NO	0.005	0.005	IE	0.122	0.008	IE	IE	NO
2000	0.390	0.175	0.028	0.035	0.017	NO	0.004	0.004	IE	0.130	0.008	IE	IE	NO
2001	0.387	0.118	0.018	0.036	0.009	NO	0.004	0.004	IE	0.071	0.004	IE	IE	NO
2002	0.395	0.114	0.021	0.036	0.008	NO	0.004	0.003	IE	0.068	0.004	IE	IE	NO
2003	0.403	0.110	0.021	0.035	0.011	NO	0.003	0.003	IE	0.066	0.004	IE	IE	NO
2004	0.265	0.101	0.021	0.031	0.008	NO	0.003	0.003	IE	0.074	0.005	IE	IE	NO
2005	0.258	0.101	0.019	0.029	0.008	NO	0.003	0.002	IE	0.063	0.004	IE	IE	NO
2006	0.252	0.097	0.018	0.028	0.010	NO	0.002	0.002	IE	0.061	0.004	IE	IE	NO
2007	0.246	0.093	0.017	0.028	0.009	NO	0.002	0.002	IE	0.074	0.005	IE	IE	NO
2008	0.231	0.082	0.016	0.029	0.017	NO	0.003	0.002	IE	0.069	0.004	IE	IE	NO
2009	0.222	0.083	0.015	0.029	0.014	NO	0.003	0.002	IE	0.084	0.012	IE	IE	NO

<b>TSP Emissions</b>	<b>Total Manure Management</b>	<b>Dairy cattle</b>	<b>Non-dairy cattle</b>	<b>Sheep</b>	<b>Swine</b>	<b>Buffalo</b>	<b>Goats</b>	<b>Horses</b>	<b>Mules and asses</b>	<b>Laying hens</b>	<b>Broilers</b>	<b>Turkeys</b>	<b>Other poultry</b>	<b>Other animals</b>
<b>Code</b>	<b>3.B</b>	<b>3.B.1.a</b>	<b>3.B.1.b</b>	<b>3.B.2</b>	<b>3.B.3</b>	<b>3.B.4.a</b>	<b>3.B.4.d</b>	<b>3.B.4.e</b>	<b>3.B.4.f</b>	<b>3.B.4.g.i</b>	<b>3.B.4.g.ii</b>	<b>3.B.4.g.iii</b>	<b>3.B.4.g.iv</b>	<b>3.B.4.h</b>
<b>Unit</b>	<b>kt TSP</b>													
<b>2010</b>	0.230	0.085	0.016	0.027	0.015	NO	0.004	0.002	IE	0.102	0.003	IE	IE	NO
<b>2011</b>	0.223	0.088	0.017	0.029	0.017	NO	0.005	0.002	IE	0.095	0.004	IE	IE	NO
<b>2012</b>	0.241	0.087	0.017	0.027	0.020	NO	0.004	0.002	IE	0.103	0.003	IE	IE	NO
<b>2013</b>	0.254	0.083	0.017	0.027	0.050	NO	0.004	0.002	IE	0.125	0.007	IE	IE	NO
<b>2014</b>	0.257	0.084	0.015	0.026	0.020	NO	0.004	0.002	IE	0.127	0.005	IE	IE	NO
<b>2015</b>	0.263	0.083	0.014	0.026	0.019	NO	0.004	0.002	IE	0.108	0.004	IE	IE	NO
<b>2016</b>	0.315	0.165	0.029	0.060	0.016	NO	0.007	0.008	IE	0.116	0.007	IE	IE	NO
<b>2017</b>	0.283	0.169	0.030	0.060	0.016	NO	0.007	0.008	IE	0.118	0.007	IE	IE	NO
<b>2018</b>	0.260	0.172	0.032	0.063	0.016	NO	0.007	0.008	IE	0.114	0.007	IE	IE	NO
<b>2019</b>														
<b>Trend</b>														
<b>1990 – 2019</b>	-43.6%	-54.0%	-59.9%	-61.6%	5.8%	NA	-46.6%	-79.9%	NA	-19.4%	-53.7%	NA	NA	NA
<b>2005 – 2019</b>	0.6%	-27.8%	-33.1%	-26.6%	125.4%	NA	13.3%	-43.7%	NA	59.9%	-8.2%	NA	NA	NA
<b>2018 – 2019</b>	-8.2%	-1.2%	-10.1%	-1.1%	-2.7%	NA	-1.9%	-1.6%	NA	-14.7%	-19.7%	NA	NA	NA
<b>Share in National Total</b>														
<b>1990</b>	3.6%	1.40%	0.27%	0.53%	0.14%	NA	0.06%	0.07%	NA	1.05%	0.07%	NA	NA	NA
<b>2005</b>	4.6%	1.46%	0.24%	0.46%	0.34%	NA	0.07%	0.03%	NA	1.91%	0.07%	NA	NA	NA
<b>2019</b>														

### 5.1.1 Methodological issues

#### 5.1.1.1 Choice of methods

For estimating the emissions of NH<sub>3</sub>, NMVOC, NO and PM from all livestock the EMEP/EEA Guidebook Tier 1 approach<sup>52</sup> has been applied.

The following steps have been done:

*Step 1:* definition of appropriate livestock categories and obtain the annual average number of animals in each category. The aim of this categorisation is to group types of livestock that are managed similarly. Collect population data from the Livestock Population Characterization;

*Step 2:* decision for each cattle or pig livestock category whether manure is typically handled as slurry or solid.

*Step 3:* selection of default EF for each livestock category

*Step 4:* Calculation the pollutant emissions ( $Emissions_{pollutant\_animal}$ ) for each livestock category, using the corresponding annual average population for each category ( $Livestock_{category}$ ) and the relevant EF (Emission factor<sub>pollutant\_animal</sub>):

*Equation: Air pollutant emissions from manure management from a livestock category*

$$Emissions_{pollutant\_animal} = Livestock_{category} \times \left( \frac{Emission\ Factor_{pollutant\_animal}}{10^6} \right)$$

Where:

$Emissions_{pollutant\_animal}$	= NH <sub>3</sub> , NMVOC, NO and PM emissions (Gg)
$Livestock_{category}$	= number of head of livestock species / category T
Emission factor <sub>pollutant_animal</sub>	= default emission factor for a defined livestock population (kg CH <sub>4</sub> head <sup>-1</sup> ).
animal	= species/category of livestock
pollutant	= NH <sub>3</sub> , NMVOC, NO and PM (TSP, PM <sub>10</sub> , PM <sub>2.5</sub> )

#### 5.1.1.2 Choice of activity data

The original data provider for the national and international agricultural data is the Ministry of Agriculture and Rural Development and Statistical Office of Montenegro (MONSTAT)<sup>53</sup>. The agricultural data used and presented in this inventory are taken from the following national and international sources:

<sup>52</sup> EMEP/EEA Air Pollutants emissions inventory guidebook 2019, Part B, Chapter 3.B Manure management - sub-chapter 3.3 Tier 1 default approach, page 14.

<sup>53</sup> Available (03. Januar 2020) on <https://www.monstat.org/eng/index.php>

Census of Agriculture<sup>54</sup> In 2010 the Agricultural Census was conducted at the whole territory of the country, using the “door-to-door” approach, and was the first independent Agricultural Census in Montenegro. It was conducted by Statistical Office of Montenegro MONSTAT in cooperation with the Food and Agriculture Organization of the United Nations (FAO) EU consultants.

Statistical yearbook<sup>55</sup> The official statistics (several years) of MONSTAT provides information on

- usable land area and cultivated land area
- crop production, crop yield of agricultural products
- fruit and vegetable cultivated land area
- fruit area and production by province
- area and production of wheat, barley, maize etc
- annual livestock numbers
- livestock production by type

FAO agricultural data base<sup>56</sup> The FAO agricultural data base (FAOSTAT) provides worldwide harmonized data (FAO AGRICULTURE STATISTICAL SYSTEM 2001).<sup>57</sup> The FAO data base provides data for the entire time series 1990 – 2017, even some data are based on estimates done by FAO.

The results of these QA/QC checks are presented in the following chapters under “Source-specific QA/QC and verification”.

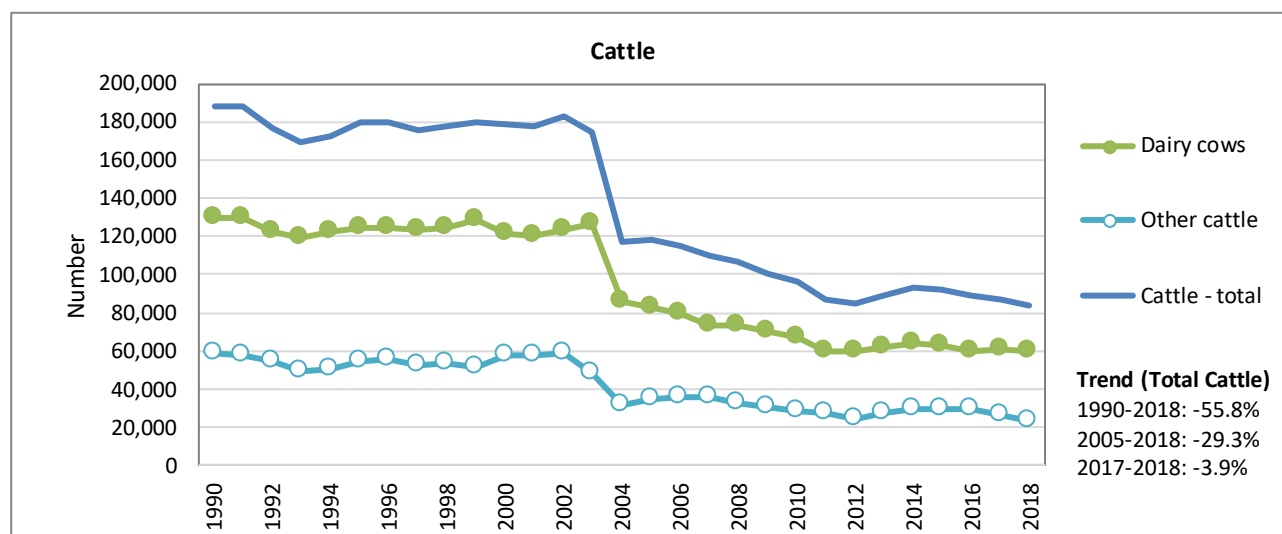


Figure 5.10 Cattle - dairy and non-dairy (calves, bulls, bovines) population and its trend 1990–2018

<sup>54</sup> Available (03. Januar 2020) on <https://www.monstat.org/eng/page.php?id=58&pageid=58>

<sup>55</sup> Available (03. Januar 2020) on <http://www.monstat.org/eng/novosti.php?id=2961>

<sup>56</sup> Available (03. Januar 2020) on <http://www.fao.org/statistics/en/>

<sup>57</sup> Available (03. Januar 2020) on <http://www.fao.org/faostat/en/#data>

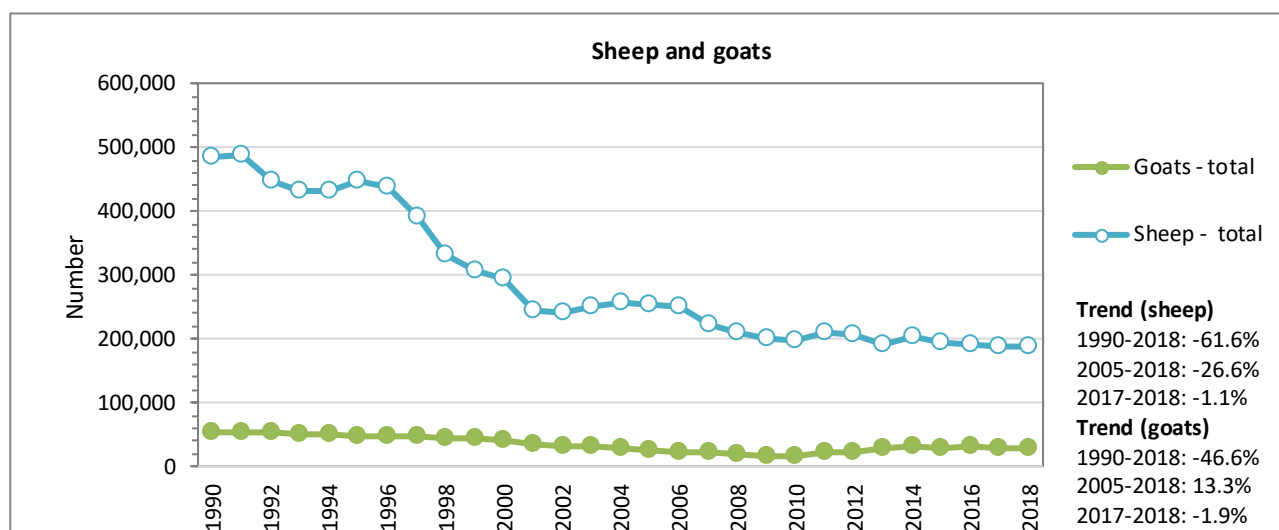


Figure 5.11 Sheep and goat population and its trend 1990–2018

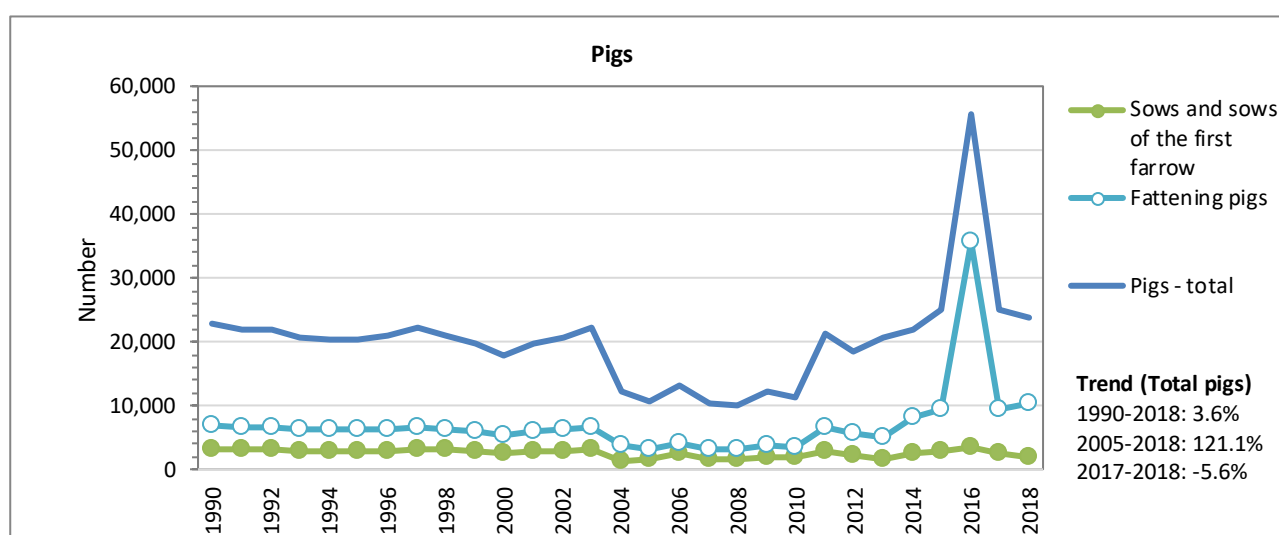


Figure 5.12 Pigs (fattening pigs and sows) population and its trend 1990–2018

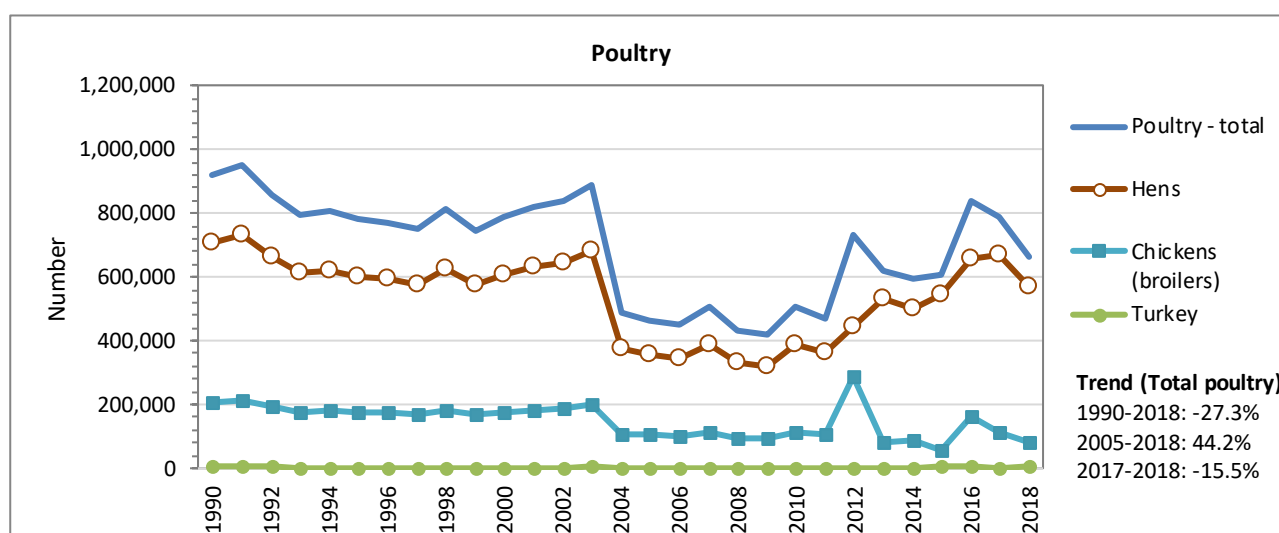


Figure 5.13 Poultry (hens, chicken, turkey) population and its trend 1990–2018

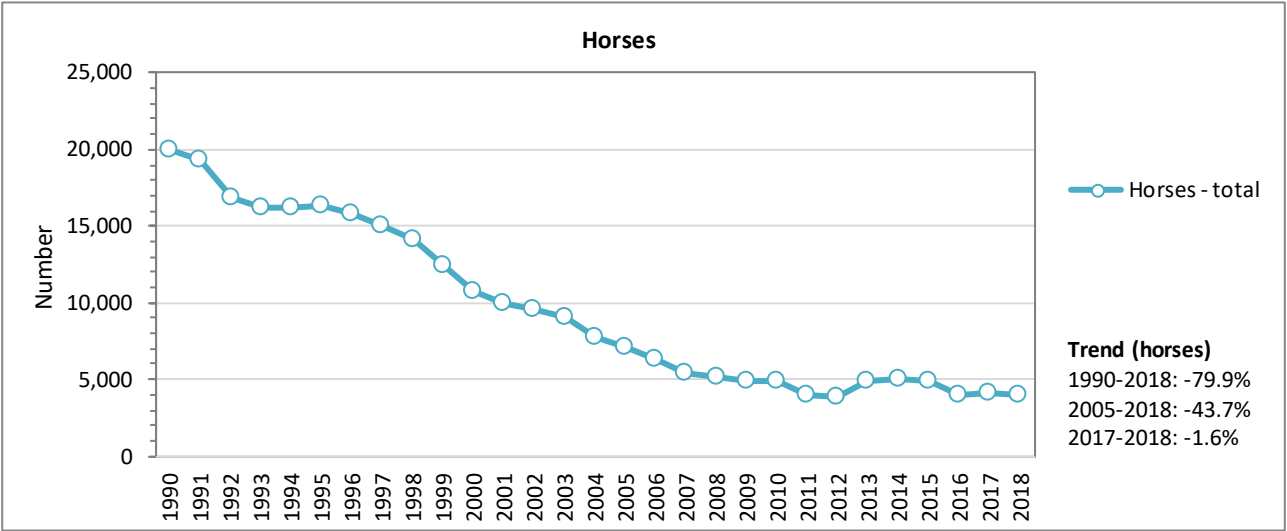


Figure 5.14 Horse population and its trend 1990–2018



Table 5.9 Cattle: livestock population and its trend 1990–2018

	Cattle (total)		Dairy cows		Other cattle															
						Young cattle under 1 years old				Cattle between 1 and 2 years old				Cattle of 2 years and over (without dairy cows)						
						Calves for slaughter	Other, female	Other, male		Male	Heifers	Heifers, for slaughter		Heifers		Heifers, for slaughter		Other cows		Male (Oxen and Bullocks)
1990	188,509	calculated	130,144	Statistical Yearbook	58,365	20,125	15,168	4,302	Calculated based on share of 2014	1,374	6,503	383	Calculated based on share of 2014	2,540	Calculated based on share of 2004	7,456	Calculated based on share of 2014	2,140	Calculated based on share of 2014	6,108
1991	187,906		129,926		57,980	20,061	15,120	4,288		1,370	6,482	381		2,531		7,234		2,136		6,088
1992	176,946		122,763		54,183	18,891	14,238	4,038		1,290	6,104	359		2,384		6,397		2,018		5,733
1993	169,324		119,702		49,622	18,077	13,625	3,864		1,234	5,841	344		2,281		3,894		1,968		5,486
1994	172,839		122,704		50,135	18,452	13,907	3,945		1,260	5,962	351		2,328		3,458		2,017		5,600
1995	179,524		124,567		54,957	19,166	14,445	4,097		1,309	6,193	364		2,419		6,475		2,048		5,816
1996	179,581		124,457		55,124	19,172	14,450	4,098		1,309	6,195	364		2,419		6,626		2,046		5,818
1997	176,043		123,473		52,570	18,795	14,165	4,018		1,283	6,073	357		2,372		5,028		2,030		5,704
1998	177,693		124,373		53,320	18,971	14,298	4,055		1,295	6,130	361		2,394		5,332		2,045		5,757
1999	179,706		128,179		51,527	19,186	14,460	4,101		1,310	6,199	365		2,421		2,996		2,107		5,822
2000	179,071		121,060		58,011	19,118	14,409	4,087		1,305	6,177	363		2,412		9,651		1,990		5,802
2001	178,064		120,427		57,637	19,010	14,328	4,064		1,298	6,142	361		2,399		9,549		1,980		5,769
2002	182,680		123,534		59,146	19,503	14,699	4,169		1,332	6,302	371		2,461		9,811		2,031		5,919
2003	174,954		126,987		47,967	18,678	14,078	3,993		1,275	6,035	355		2,357		719		2,088		5,668

	Cattle (total)		Dairy cows		Other cattle																	
						Young cattle under 1 years old				Cattle between 1 and 2 years old				Cattle of 2 years and over (without dairy cows)								
						Calves for slaughter	Other, female	Other, male		Male	Heifers	Heifers, for slaughter		Heifers		Heifers, for slaughter		Other cows		Male (Oxen and Bullocks)		
2004	116,794	MONSTAT - Statistical Yearbook	85,496	MONSTAT - Statistical Yearbook	31,298	calculated	12,458	9,390	2,663		189	897	53		1,545	MONSTAT - Statistical Yearbook	-534		1,406		4,103	MONSTAT - Statistical Yearbook
2005	117,842		82,851		34,991		14,168	10,678	3,029		287	1,359	80		1,476		3,182		1,362		3,914	
2006	114,922		79,553		35,369		14,774	11,135	3,158		216	1,024	60		1,685		4,604		1,308		3,316	
2007	109,378		73,142		36,236		15,112	11,390	3,230		188	890	52		1,294		6,341		1,203		4,080	
2008	106,494		73,477		33,017		11,882	8,955	2,540		765	3,620	213		1,182		4,100		1,208		3,860	
2009	100,835		70,467		30,368		10,802	8,141	2,309		795	3,761	221		1,092		3,423		1,159		3,247	
2010	95,963		67,259		28,704		10,115	7,624	2,162		827	3,914	230		1,254		3,358		1,106		2,578	
2011	87,173		59,532		27,641	9,553	7,200	2,042	MONSTAT - Statistical Yearbook	487	2,305	136	MONSTAT - Statistical Yearbook	2,667	MONSTAT - Statistical Yearbook	2,179	MONSTAT - Statistical Yearbook	979	MONSTAT - Statistical Yearbook	3,252	MONSTAT - Statistical Yearbook	
2012	84,701		59,979		24,722	8,266	6,230	1,767		449	2,125	125		2,948		142		986		2,650		
2013	89,058		61,830		27,228	7,551	7,268	2,109		467	2,929	130		3,213		548		833		3,012		
2014	93,550		63,889		29,660	8,473	7,935	3,243		529	3,399	171		2,756		459		793		2,697		
2015	92,452		63,262		29,190	7,171	8,850	2,877		607	4,312	69		2,350		281		450		2,673		
2016	89,269		60,040		29,229	7,244	5,861	2,598		2,114	4,585	350		3,313		237		457		2,927		
2017	86,649		60,609		26,040	5,369	8,837	2,301		1,640	2,764	215		2,500		230		567		2,184		
2018	83,264		59,859		23,405	5,425	7,316	2,064	1,414	2,490	105	2,230	86	390	2,275							
2019																						
Trend																						
1990-2019	207%		344%		109%		-73.0%	-51.8%	-52.0%		2.9%	-61.7%	-72.6%		-12.2%		-98.8%		-81.8%		-62.8%	
2005-2019	41%		38%		47%		-61.7%	-31.5%	-31.9%		392.5%	83.2%	31.4%		51.1%		-97.3%		-71.4%		-41.9%	

	Cattle (total)		Dairy cows		Other cattle																
						Young cattle under 1 years old				Cattle between 1 and 2 years old				Cattle of 2 years and over (without dairy cows)							
						Calves for slaughter	Other, female	Other, male		Male	Heifers	Heifers, for slaughter		Heifers		Heifers, for slaughter		Other cows		Male (Oxen and Bullocks)	
2018 2019	0%		0%		0%		1.0%	-17.2%	-10.3%		-13.8%	-9.9%	-51.2%		-10.8%		-62.6%		-31.2%		4.2%

Table 5.10 Sheep and goats: livestock population and its trend 1990–2018

	Sheep										Goats							
	Sheep (total)		Lambs & young sheep under 1 years old		Breeding ewe		of which dairy		Rams and sterile sheep		Other Sheep		Goats - total		young goats under 1 years old	Goats- already kidded	Goats - first time mated	Other goats
1990	486,634	Statistical Yearbook	80,400	Calculated based on share of 2004	375,801	Calculated based on share of 2004	317,636	Calculated based on share of 2012	30,433	Calculated based on share of 2004	-	Calculated based on share of 2012	54,431	Statistical Yearbook	6,943	38,434	4,627	4,428
1991	487,500		80,543		376,470		318,202		30,487		-		53,201		6,786	37,565	4,522	4,328
1992	448,543		74,107		346,386		292,774		28,051		-		51,971		6,629	36,697	4,418	4,228
1993	430,498		71,125		332,451		280,995		26,922		-		50,741		6,472	35,828	4,313	4,128
1994	430,847		71,183		332,720		281,223		26,944		-		49,511		6,315	34,960	4,209	4,027
1995	447,909		74,002		345,896		292,360		28,011		-		48,281		6,158	34,091	4,104	3,927
1996	438,881		72,510		338,924		286,467		27,446		-		47,051		6,001	33,223	3,999	3,827
1997	392,058		64,774		302,765		255,905		24,518		-		45,821		5,844	32,354	3,895	3,727
1998	332,795		54,983		257,000		217,222		20,812		-		44,591		5,687	31,486	3,790	3,627
1999	305,707		50,508		236,081		199,541		19,118		-		43,361		5,531	30,617	3,686	3,527
2000	293,197		48,441		226,420		191,376		18,336		-		42,131		5,374	29,749	3,581	3,427
2001	243,524		40,234		188,061		158,953		15,229		-		35,001		4,464	24,714	2,975	2,847
2002	240,531		39,740		185,749		157,000		15,042		-		32,656		4,165	23,059	2,776	2,656
2003	252,007		41,636		194,612		164,490		15,760		-		30,311		3,866	21,403	2,577	2,466

	Sheep												Goats								
	Sheep (total)		Lambs & young sheep under 1 years old		Breeding ewe		of which dairy		Rams and sterile sheep		Other Sheep		Goats - total		young goats under 1 years old	Goats- already kidded	Goats - first time mated	Other goats			
2004	256,602	MONSTAT - Statistical Yearbook	50,117	MONSTAT - Statistical Yearbook	191,493	MONSTAT - Statistical Yearbook	167,490	MONSTAT - Statistical Yearbook	14,992	MONSTAT - Statistical Yearbook	-	MONSTAT - Statistical Yearbook	27,966	MONSTAT - Statistical Yearbook	3,567	19,747	2,377	2,275	MONSTAT - Statistical Yearbook		
2005	254,898		41,349		197,970		166,377		15,579		-		25,621		3,268	18,091	2,178	2,084			
2006	249,281		34,431		197,882		162,711		16,968		-		23,276		2,969	16,435	1,979	1,893			
2007	222,244		35,935		169,926		145,063		16,383		-		21,077		2,688	14,883	1,792	1,715			
2008	209,354		32,438		160,912		136,650		16,004		-		18,932		2,415	13,368	1,609	1,540			
2009	199,764		26,451		159,905		130,390		13,408		-		16,175		2,063	11,421	1,375	1,316			
2010	198,165		28,076		158,503		129,347		11,586		-		14,427		1,840	10,187	1,226	1,174			
2011	208,771		23,786		172,924		136,269		12,061		-		23,660		3,018	16,706	2,011	1,925			
2012	207,047		24,391		169,295		135,144		13,361		-		23,273		3,068	17,331	987	1,887			
2013	190,843		24,067		153,450		126,452		13,326		-		29,675		3,261	20,087	4,192	2,135			
2014	204,403		27,025		165,351		116,876		12,028		-		32,997		4,650	22,990	2,354	3,003			
2015	194,636		28,518		155,543		101,242		10,575		-		29,678		4,454	21,516	1,688	2,020			
2016	191,992		29,087		151,697		95,243		11,208		-		31,458		5,920	21,429	2,003	2,106			
2017	189,008		23,566		157,284		97,276		8,158		-		29,595		5,644	18,987	2,401	2,563			
2018	187,021		25,105		153,426		96,741		8,490		90,280		29,040		5,307	19,839	1,611	2,283			
2019																					
Trend																					
1990																					
2019	-61.6%		-68.8%		-59.2%		-69.5%		-72.1%		NA		-46.6%		-23.6%		-48.4%		-65.2%		-48.4%
2005																					
2019	-26.6%	-39.3%	-22.5%	-41.9%	-45.5%	NA	13.3%	62.4%	9.7%	-26.0%	9.5%										
2018																					
2019	-1.1%	6.5%	-2.5%	-0.5%	4.1%	NA	-1.9%	-6.0%	4.5%	-32.9%	-10.9%										

Table 5.11 Pigs: livestock population and its trend 1990–2018

	Pigs (total)		Piglets up to 19 kg	Pigs from 20-49 kg		Fattening pigs				Sows and sows of the first farrow						Boars			
							- 50-79 kg	- 80-109 kg	- Over 110 kg			Gilts - mated	Gilts - other	Sows - mated	Sows - other				
1990	22,831	Statistical Yearbook	4,462	9,711	Calculated based on share of 2010	6,068	2,686	1,687	1,695	Calculated based on share of 2010	2,389	Calculated (sum)	234	104	1,640	410	Calculated based on share of 2010	237	Calculated based on share of 2004
1991	21,941		4,288	9,332		5,831	2,581	1,621	1,629		2,295		225	100	1,576	394		227	
1992	21,779		4,256	9,263		5,788	2,562	1,609	1,617		2,279		223	99	1,565	391		226	
1993	20,624		4,031	8,772		5,481	2,426	1,524	1,532		2,158		211	94	1,482	371		214	
1994	20,510		4,008	8,723		5,451	2,413	1,515	1,523		2,146		210	94	1,473	369		212	
1995	20,219		3,952	8,600		5,374	2,378	1,494	1,501		2,115		207	92	1,453	363		209	
1996	20,855		4,076	8,870		5,543	2,453	1,541	1,549		2,182		214	95	1,498	375		216	
1997	22,107		4,321	9,403		5,875	2,600	1,633	1,642		2,313		227	101	1,588	397		229	
1998	21,078		4,119	8,965		5,602	2,479	1,557	1,565		2,205		216	96	1,514	379		218	
1999	19,852		3,880	8,444		5,276	2,335	1,467	1,474		2,077		203	91	1,426	357		206	
2000	17,896		3,498	7,612		4,756	2,105	1,322	1,329		1,872		183	82	1,286	322		185	
2001	19,663		3,843	8,363		5,226	2,313	1,453	1,460		2,057		202	90	1,413	353		204	
2002	20,548		4,016	8,740		5,461	2,417	1,518	1,526		2,150		211	94	1,476	369		213	
2003	22,094		4,318	9,397		5,872	2,599	1,632	1,641		2,311		226	101	1,587	397		229	

	Pigs (total)		Piglets up to 19 kg	Pigs from 20-49 kg		Fattening pigs					Sows and sows of the first farrow						Boars	
							- 50-79 kg	- 80-109 kg	- Over 110 kg				Gilts - mated	Gilts - other	Sows - mated	Sows - other		
2004	12,101	MONSTAT - Statistical Yearbook	2,365	5,147	MONSTAT - Statistical Yearbook	3,216	1,423	894	899	MONSTAT - Statistical Yearbook	1,266	Calculated (sum)	124	55	869	217	MONSTAT - Statistical Yearbook	107
2005	10,697		2,091	4,123		2,843	1,258	790	794		1,555		152	68	1,068	267		85
2006	13,294		2,598	4,578		3,533	1,564	982	987		2,395		235	104	1,645	411		190
2007	10,374		2,027	3,929		2,757	1,220	766	770		1,593		156	69	1,094	274		67
2008	10,017		1,958	3,664		2,662	1,178	740	744		1,676		164	73	1,151	288		57
2009	12,377		2,419	4,658		3,289	1,456	914	919		1,977		194	86	1,358	340		34
2010	11,205		2,190	4,026		2,978	1,318	828	832		1,952		191	85	1,340	335		59
2011	21,398		4,182	8,494		5,687	2,517	1,581	1,589		2,945		289	128	2,022	506		90
2012	18,451		4,017	6,437		5,599	793	926	3,880		2,317		227	101	1,591	398		81
2013	20,572		4,598	9,355		4,872	819	886	3,167		1,601		128	145	1,254	74		146
2014	22,053		4,869	5,675		8,267	1,240	1,381	5,647		2,663		469	316	1,241	637		248
2015	24,951		6,276	6,303		9,550	1,256	1,099	7,195		2,700		536	63	1,799	302		123
2016	55,841		11,356	5,068		35,642	1,924	9,841	23,877		3,448		796	110	1,966	576		327
2017	25,043		7,480	5,470		9,560	1,066	2,268	6,226		2,450		349	153	1,522	426		83
2018	23,651		5,892	5,323		10,336	1,086	2,217	7,033		2,013		398	32	1,486	97		87
2019																		
Trend																		
1990-2019	3.6%		32.0%	-45.2%		70.3%	-59.6%	31.4%	314.8%		-15.7%		70.1%	-69.3%	-9.4%	-76.4%		-56.9%
2005-2019	121.1%		181.8%	29.1%		263.6%	-13.7%	180.5%	785.4%		29.5%		161.2%	-52.8%	39.2%	-63.7%		2.4%
2018-2019	-5.6%		-21.2%	-2.7%		8.1%	1.9%	-2.2%	13.0%		-17.8%		14.0%	-79.1%	-2.4%	-77.2%		4.8%

Table 5.12 Sheep: livestock population and its trend 1990–2018

	Poultry								Horses						
	Poultry - total		Chickens (broilers)	Hens	Turkey	Geese & Ducks	Other poultry		Horses - total		Colts and yearlings	Mares and In-foal yearling mares	Studhorses and geldings	Mules & Asses	
1990	917,084	Calculated based on share of 2004	205,210	705,695	3,121	IE	3,058	Calculated based on share of 2004	19,914	Calculated based on share of 2004	753	3,285	15,876	IE	Calculated based on share of 2004
1991	953,273		213,307	733,542	3,245	IE	3,178		19,318		730	3,186	15,401	IE	
1992	859,543		192,334	661,417	2,926	IE	2,866		16,864		638	2,782	13,445	IE	
1993	794,435		177,765	611,317	2,704	IE	2,649		16,160		611	2,665	12,884	IE	
1994	806,196		180,397	620,367	2,744	IE	2,688		16,209		613	2,674	12,923	IE	
1995	781,265		174,818	601,182	2,659	IE	2,605		16,327		617	2,693	13,017	IE	
1996	770,826		172,483	593,150	2,624	IE	2,570		15,812		598	2,608	12,606	IE	
1997	750,074		167,839	577,181	2,553	IE	2,501		14,997		567	2,474	11,956	IE	
1998	813,358		182,000	625,878	2,768	IE	2,712		14,182		536	2,339	11,307	IE	
1999	745,017		166,707	573,290	2,536	IE	2,484		12,474		472	2,057	9,945	IE	
2000	790,577		176,902	608,348	2,691	IE	2,636		10,703		405	1,765	8,533	IE	
2001	817,445		182,914	629,023	2,782	IE	2,726		9,967		377	1,644	7,946	IE	
2002	837,542		187,411	644,488	2,851	IE	2,793		9,568		362	1,578	7,628	IE	
2003	890,045		199,159	684,889	3,029	IE	2,968		9,028		341	1,489	7,198	IE	

	Poultry								Horses							
	Poultry - total		Chickens (broilers)	Hens	Turkey	Geese & Ducks	Other poultry		Horses - total		Colts and yearlings	Mares and In-foal yearling mares	Studhorses and geldings	Mules & Asses		
2004	485,042	MONSTAT - Statistical Yearbook	108,535	373,239	1,651	IE	1,617	MONSTAT - Statistical Yearbook	7,688	MONSTAT - Statistical Yearbook	355	1,236	6,097	IE	MONSTAT - Statistical Yearbook	
2005	462,149		103,412	355,623	1,573	IE	1,541		7,119		282	1,051	5,786	IE		
2006	448,502		100,358	345,122	1,527	IE	1,495		6,260		173	1,167	4,920	IE		
2007	505,355		113,080	388,870	1,720	IE	1,685		5,463		212	1,417	3,834	IE		
2008	432,264		96,725	332,627	1,471	IE	1,441		5,124		192	1,224	3,708	IE		
2009	416,737		93,250	320,679	1,418	IE	1,390		4,951		114	929	3,908	IE		
2010	506,520		113,341	389,767	1,724	IE	1,689		4,828		96	669	4,063	IE		
2011	470,047		183,211	284,116	1,197	IE	1,567		4,035		245	799	2,991	IE		
2012	732,091		285,349	442,506	1,864	IE	2,372		3,905		164	636	3,105	IE		
2013	620,354		81,805	534,410	1,993	IE	2,146		4,858		429	1,133	3,296	IE		
2014	595,675		89,142	501,913	2,652	IE	1,968		4,968		234	1,219	3,517	IE		
2015	606,225		54,874	541,928	4,900	IE	4,523		4,927		414	1,225	3,287	IE		
2016	835,705		159,615	659,613	5,466	IE	11,011		3,947		146	896	2,905	IE		
2017	788,309		111,573	666,550	2,611	IE	7,575		4,071		267	691	3,113	IE		
2018	666,339		82,198	568,511	3,364	IE	12,266		4,005		263	680	3,063	IE		
2019																
Trend																
1990 - 2019	-27.3%		-59.9%	-19.4%	7.8%	NA	301.1%		-79.9%		-65.1%	-79.3%	-80.7%	NA		
2005 - 2019	44.2%		-20.5%	59.9%	113.9%	NA	696.0%		-43.7%		-6.9%	-35.3%	-47.1%	NA		
2018 - 2019	-15.5%		-26.3%	-14.7%	28.8%	NA	61.9%		-1.6%		-1.6%	-1.6%	-1.6%	NA		





### 5.1.1.3 Choice of emission factors

#### Default emission factors for ammonia (NH<sub>3</sub>)

The default emission factors for ammonia (NH<sub>3</sub>) were taken from EMEP/EEA air pollutant emission inventory Guidebook 2019 and are presented in the following table.

**Table 5.13 NH<sub>3</sub> Emission factors for Tier 1 for IPCC/NFR sub-category 3.B Manure Management**

Revised NFR	Livestock	Manure type	Total EF <sub>NH3</sub>	Default EF <sub>NH3</sub> for emissions from housing, storage and yards	Default EF <sub>NH3</sub> for emissions following manure application	Default EF <sub>NH3</sub> for emissions from grazed pastures
			kg a <sup>-1</sup> AAP <sup>-1</sup> NH <sub>3</sub>			
				Reported under		
				Manure management 3.B	Manure applied to soils 3.D.a.2	'Excreta deposited by grazing livestock' 3.D.a.3
3B1a	Dairy cattle	Slurry	41.8	22.0	15.4	4.4
3B1a	Dairy cattle	Solid	26.4	16.1	6.0	4.4
3B1b	Other cattle (all other cattle)	Slurry	15.0	7.9	5.1	2.0
3B1b	Other cattle	Solid	10.0	5.7	2.2	2.0
3B2	Sheep	Solid	1.4	0.4	0.2	0.8
3B3	'Swine' - finishing pigs	Slurry	6.5	3.7	2.8	0.0
3B3	'Swine' - finishing pigs	Solid	5.6	4.2	1.4	0.0
3B3	'Swine' - sows	Slurry	17.7	12.5	5.2	0.0
3B3	'Swine' - sows	Solid	15.1	12.1	3.1	0.0
3B4d	Goats	Solid	1.4	0.4	0.2	0.8
3B4e	Horses	Solid	15.8	7.0	2.7	6.1
3B4gi	Laying hens (laying hens and parents)	Solid	0.31	0.16	0.15	0.0
3B4gi	Laying hens (laying hens and parents)	Slurry	0.48	0.32	0.15	0.0
3B4gii	Broilers (broilers and parents)	Litter	0.17	0.13	0.04	0.0
Source: EMEP/EEA air pollutant emission inventory Guidebook 2019, Part B, Chapter 3.B Manure management, p. 16, Table 3.2 Default Tier 1 EF (EF <sub>NH3</sub> ) for calculation of NH <sub>3</sub> emissions from manure management. Figures are annually averaged emissions in kg AAP <sup>-1</sup> a <sup>-1</sup> NH <sub>3</sub> , as defined in subsection 3.3.1						

#### Default emission factors for nitrogen oxides (NO<sub>x</sub>)

The default emission factors for nitrogen oxides (NO<sub>x</sub>) were taken from EMEP/EEA air pollutant emission inventory Guidebook 2019 and are presented in the following table.

**Table 5.14 NO<sub>x</sub> Emission factors for Tier 1 for IPCC/NFR sub-category 3.B Manure Management**

NFR	Livestock	Manure type	Default EF <sub>NO</sub>
			(kg a <sup>-1</sup> AAP <sup>-1</sup> NO <sub>2</sub> )
3B1a	Dairy cattle	Slurry	0.010
3B1a	Dairy cattle	Solid	0.752
3B1b	Non-dairy cattle (all other cattle)	Slurry	0.003
3B1b	Non-dairy cattle	Solid	0.217
3B2	Sheep	Solid	0.012
3B3	'Swine' – finishing pigs	Slurry	0.002
3B3	'Swine' – finishing pigs	Solid	0.017
3B3	'Swine' – sows	Slurry	0.005
3B3	'Swine' – sows	Solid	0.471
3B4d	Goats	Solid	0.012
3B4e	Horses	Solid	0.250
3B4f	Mules and asses	Solid	0.250
3B4gi	Laying hens (laying hens and parents)	Solid	0.014
3B4gi	Laying hens (laying hens and parents)	Slurry	0.0001
3B4gii	Broilers (broilers and parents)	Litter	0.027
Source: EMEP/EEA air pollutant emission inventory Guidebook 2019, Part B, Chapter 3.B Manure management, p. 16, Table 3.3 Default Tier 1 EFs for NO (as NO <sub>2</sub> ) from stored manure. According to Annex I of the NFR Reporting Guidelines, NO emissions have to be reported as NO <sub>2</sub> , hence the EFs below are provided as NO <sub>2</sub>			

**Default emission factors for methane (NMVOC)**

The default emission factors for non-methane volatile organic compounds (NMVOC) were taken from EMEP/EEA air pollutant emission inventory Guidebook 2019 and are presented in the following table.

**Table 5.15 NMVOC Emission factors for Tier 1 for IPCC/NFR sub-category 3.B Manure Management**

Code	Livestock	Default EF <sub>NMVOC</sub> with silage feeding	EF <sub>NMVOC</sub> without silage feeding
		kg AAP <sup>-1</sup> a <sup>-1</sup>	
3B1a	Dairy cattle	17.937	8.047
3B1b	Non-dairy cattle	8.902	3.602
3B2	Sheep	0.279	0.169
3B3	'Swine' (finishing pigs)	–	0.551
3B3	'Swine' (sows)	–	1.704
3B4d	Goats	0.624	0.542
3B4e	Horses	7.781	4.275
3B4gi	Laying hens (laying hens and parents)	–	0.165
3B4gii	Broilers (broilers and parents)	–	0.108
Source: EMEP/EEA air pollutant emission inventory Guidebook 2019, Part B, Chapter 3.B Manure management, p. 16, Table 3.4 Default Tier 1 EFs for NMVOCs			

### Default emission factors for Particulate matter (PM)

The default emission factors for particulate matter (PM) were taken from EMEP/EEA air pollutant emission inventory Guidebook 2019 and are presented in the following table.

**Table 5.16 PM Emission factors for Tier 1 for IPCC/NFR sub-category 3.B Manure Management**

Code	Livestock	EF for TSP	EF for PM <sub>10</sub>	EF for PM <sub>2.5</sub>
		(kg AAP <sup>-1</sup> a <sup>-1</sup> )	(kg AAP <sup>-1</sup> a <sup>-1</sup> )	(kg AAP <sup>-1</sup> a <sup>-1</sup> )
3B1a	Dairy cattle	1.38	0.63	0.41
3B1b	Non-dairy cattle (all other cattle except calves)	0.59	0.27	0.18
3B1b	Non-dairy cattle (calves)	0.34	0.16	0.10
3B2	Sheep	0.14	0.06	0.02
3B3	'Swine' (finishing pigs)	1.05	0.14	0.006
3B3	'Swine' (sows)	0.62	0.17	0.01
3B4d	Goats	0.14	0.06	0.02
3B4e	Horses	0.48	0.22	0.14
3B4gi	Laying hens (laying hens and parents)	0.19	0.04	0.003
3B4gii	Broilers (broilers and parents)	0.04	0.02	0.002
Source: EMEP/EEA air pollutant emission inventory Guidebook 2019, Part B, Chapter 3.B Manure management, p. 19, Table 3.5 Default Tier 1 estimates of EF for particle emissions from livestock husbandry (housing)				

### 5.1.2 Uncertainties and time-series consistency for Sub-category 3.B Manure management

The uncertainties for activity data and emission factors used for IPCC/NFR category 3.B *Manure management* are presented in the following table.

**Table 5.17 Uncertainty for sub-category 3.B Manure management.**

Uncertainty	3B1a	3B1b	3B2	3B3	3B4a	3B4d	3B4e	3B4gi	3B4gii	Reference
Activity data (AD)	10%	10%	10%	10%	10%	10%	10%	10%	10%	2006 IPCC GL, Vol. 4, Chap. 10 ( 10.2.3)
Emission factor (EF)	Rating	Typical error range				Average			Reference	
NOx	C	50% to 200%				125%			Table 2 2 Rating definitions  Table 2 3 Main NFR source categories with applicable quality data ratings  EMEP EEA GB 2019, Part A, Chapter 5 Uncertainties.v	
CO	-	-				-				
NMVOC	C	50% to 200%				125%				
SOx	-	-				-				
NH3	B	20% to 60%				40%				
TSP, PM10, PM2.5, BC	C	50% to 200%				125%				
Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn	-	-				-				
PCBs, PCDD/F, HCB, Benzo(a)-pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene,	-	-				-				

The time-series are considered to be consistent as the same methodology is applied to the whole period. Activity data are considered to be consistent as national and international data were always compared.

### 5.1.3 Source-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
  - consistent use of livestock data (statistical yearbook and FAOstat- Live Animals, and Eurostat),
  - documented sources,
  - use of units,
  - strictly defined interfaces between spreadsheets/calculation modules,
  - unique structure of sheets which do the same,
  - record keeping, use of write protection,
  - unique use of formulas, special cases are documented/highlighted,
  - quick-control checks for data consistency through all steps of calculation.
- cross-checked from different sources: national statistic (Agricultural Census, Statistical Yearbooks) and international statistics (FAO)
- time series consistency - plausibility checks of dips and jumps.

### 5.1.4 Source-specific recalculations

The following table presents the main revisions and recalculations done since the last submission (SNC) to the UNFCCC and relevant to Sub-category 3.B *Manure management*.

**Table 5.18** Recalculations done in sub-category 3.B *Manure management*

source category	Revisions of data	Type of revision	Type of improvement
3.B	application of EMEP/EEA air pollutant emission inventory guidebook 2019	method	Comparability
3.B	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019	EF	Comparability
3.B	use of default manure management system	AD	Accuracy
3.B	revised livestock data	AD	Accuracy

### 5.1.5 Source-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

**Table 5.19 Planned improvements for Sub-category 3.B Manure management**

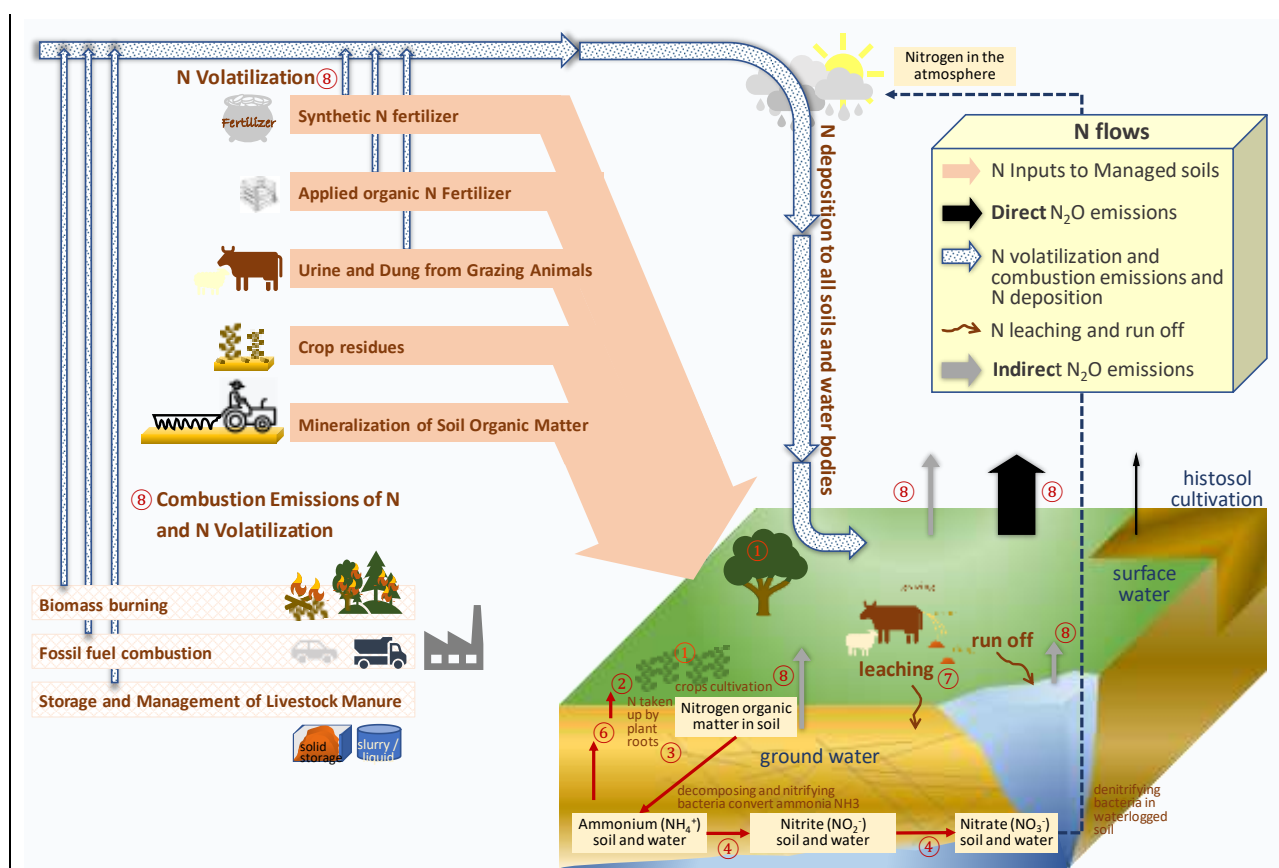
source	Planned improvement	Type of improvement		Priority
3.B	Correction of technical mistakes in calculation	AD EF	Accuracy	high
3.B. 3.D.	Husbandry and Management Practice with consideration <ul style="list-style-type: none"> <li>characteristics of Livestock Husbandry for the whole time series: <ul style="list-style-type: none"> <li>breed,</li> <li>age distribution,</li> <li>weight</li> <li>milk wool yield,</li> <li>wool yield,</li> <li>working hours</li> </ul> </li> <li>characteristics of manure management practice: <ul style="list-style-type: none"> <li>stall / housed and Housing period</li> <li>pasture/range/paddock (flat/hilly)</li> <li>grazing large areas (flat/hilly)</li> <li>daily spread</li> <li>solid storage</li> <li>dry lot</li> <li>liquid/slurry with/without natural crust cover</li> <li>uncovered anaerobic lagoon</li> <li>pit storage below animal confinements</li> <li>anaerobic digester</li> <li>burned for fuel</li> <li>cattle and swine deep bedding</li> <li>composting</li> <li>aerobic treatment</li> </ul> </li> </ul>	AD	Accuracy Consistency Comparability Transparency	high
3.B	<ul style="list-style-type: none"> <li>nitrogen excretion</li> <li>annual straw use in litter-based manure management systems and the N content of straw</li> </ul>	AD	Accuracy Consistency Comparability Transparency	high
3.B	Estimation of methane (NH <sub>3</sub> ) and other air pollutant emissions applying TIER 2 approach as some sub-categories are key categories	meth od	Transparency Comparability	high
3.A.1.j 3.B. 3.D	Survey and/or research on Livestock which is not included in current statistics: e.g. buffalo, fur bearing animals	AD	Completeness	High
3.B 3.D	Survey and/or research on Livestock split of poultry: <ul style="list-style-type: none"> <li>broiler chickens, layer hens, poultry (free range)</li> <li>turkeys,</li> <li>ducks,</li> <li>geese</li> </ul>	AD	Accuracy Consistency Comparability Transparency	High
3.B	Survey and/or research on VS excretion rates		Accuracy	medium

## 5.2 Agricultural soils (IPCC/NFR category 3.D)

This section describes the estimation of emissions from managed soils due to nitrogen input, including indirect  $\text{N}_2\text{O}$  emissions from additions of N to land due to deposition and leaching. As defined in 2006 IPCC GL, Vol. 4, Chap. 1.1 managed land is land where human interventions and practices have been applied to perform production, ecological or social functions. The emissions that result from anthropogenic N inputs or N mineralization occur through both:

- direct pathway: directly from the soils to which the N is added/released
- indirect pathways: (i) following volatilization of  $\text{NH}_3$  and  $\text{NO}_x$  from managed soils and from fossil fuel combustion and biomass burning, and the subsequent redeposition of these gases and their products  $\text{NH}_4^+$  and  $\text{NO}_3^-$  to soils and waters; and  
(ii) after leaching and runoff of N, mainly as  $\text{NO}_3^-$ , from managed soils.

The principal pathways are illustrated in the following figure. Direct emissions of  $\text{N}_2\text{O}$  from managed soils are estimated separately from indirect emissions, though using a common set of activity data.



The nitrogen cycle: (1) uptake of nitrogen by plants from the atmosphere; (2) uptake of ammonium and nitrate by plants from soil and water; nitrogen-fixing bacteria in humus and in root nodules of leguminous plants (3) ammonification, (4) nitrification, (5) denitrification, (6) nitrate immobilization by soil sorption, (7) nitrate leaching from the soil, (8) release of ammonia ( $\text{NH}_3$ ), gaseous nitrogen and nitrous oxide to the atmosphere.

**Figure 5.15** Schematic diagram illustrating the sources and pathways of N that result in direct and indirect  $\text{N}_2\text{O}$  emissions from soils and waters

Source: After (1) 2006 IPCC Guidelines, Volume 4, Chapter 11, Figure 11.1, page 11.8. and

(2) Bednarek, A.; Szklarek, S. & Zalewski, M. (2014): Nitrogen pollution removal from areas of intensive farming—comparison of various denitrification biotechnologies. In: *Ecohydrology & Hydrobiology* 14 (2014) 132–141.

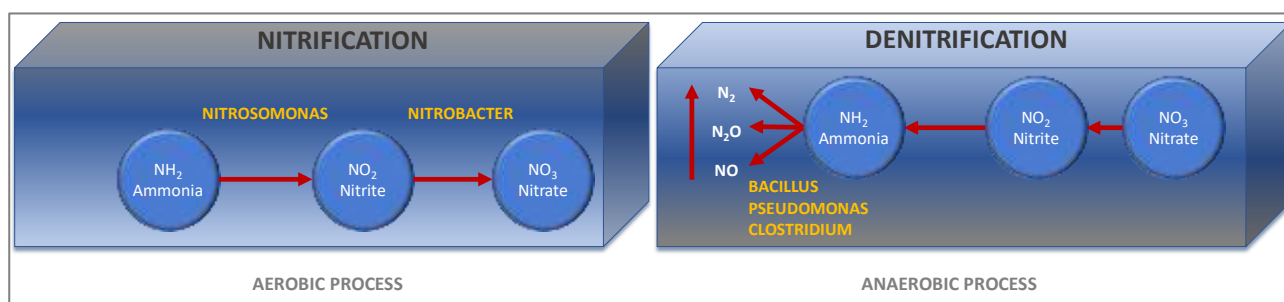


Figure 5.16 Nitrification and Denitrification

### 5.2.1 Source-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 5.20 Source-specific planned improvements for NFR 3.D.

NFR	Name	Definition and clarification of source	Do we have EFs we can use?	Estimated in current inventory
3Da1	Inorganic N-fertilizers (includes urea)	Emissions that arise during and after the application of N fertilizers to land. No emissions arising from the handling of N fertilizers after delivery to the farm but before application to land; these are to be included with emissions during the handling and storage of other dry bulk materials in 3Dc.	NH <sub>3</sub> - yes and a revised Tier 2.	✓
			NO	NE
			PM - No	NA
3Da2a	Livestock manure applied to soils	Livestock manure applied to soils. The guidance for calculating these emissions is given in Chapter 3B.	NH <sub>3</sub> - yes, calculated in 3B NO	✓
3Da2b	Sewage sludge applied to soils	Sewage sludge applied to soils.	NH <sub>3</sub>	NE
3Da2c	Other organic fertilizers applied to soils (including compost)	Organic fertilizers, other than livestock manures and sewage sludge, applied to soils (including digestate and compost).	NH <sub>3</sub> NO	NE
3Da3	Urine and dung deposited by grazing livestock	Urine and dung deposited by grazing livestock to fields during grazing. The guidance for calculating these emissions is given in Chapter 3B.	NH <sub>3</sub> - yes, calculated in 3B	✓
3Da4	Crop residues applied to soils	All non-senesced crop residues which are either returned or applied to soils. In the great majority of cases these will be residues from the crop grown in that field which remain on the soil surface. However, in some cases crop residues may be imported to the field in order to control erosion, act as a mulch or a source of nutrients.	No	NA
3Db	Indirect emissions from managed soils	Emissions resulting from the deposition of N emitted from managed soils.	No	NA
3Dc	Farm-level agricultural operations including	This source includes not only emissions arising from the handling and storage of agricultural products on farms, such as grain, but also	Soil cultivation and crop harvesting are currently reported to account for 80%	NE



NFR	Name	Definition and clarification of source	Do we have EFs we can use?	Estimated in current inventory
	storage, handling and transport of agricultural products	emissions during the handling and storage of products produced elsewhere to be used on the farm such as fertilizers and livestock feeds.	of PM emissions in 3D.** The values for PM do not include emissions from fertilizer, pesticides or from grassland, e.g. hay making.	
3Dd	Off-farm storage, handling and transport of bulk agricultural products	Off-farm storage, handling and transport of bulk agricultural products	Any emissions from this source are to be reported here because they would not be reported elsewhere. However, no methodology has yet been developed for these.	NA
3De	Cultivated crops	Ammonia emissions arising from standing or "cultivated" crops. This source is distinct from emissions of NH <sub>3</sub> that arise from the application of fertilizer to crops (which are reported under 3Da1 and 3Da2a-c).	No	NA
Source: EMEP/EEA air pollutant emission inventory Guidebook 2019, Part B, Chapter 3.B Manure management, p. 12, Table 3-1 Tier 1 emission factors for source category 3.D				

Table 5.21 Source-specific planned improvements for NFR 3.D.

source	Planned improvement	Type of improvement		Priority
3.D.a.1	Estimation of air pollutant emissions applying TIER 2 approach of EMEP/EEA GB 2019	AD EF	Accuracy	high
3.D.a.1	Investigation on crops and fraction Inorganic N- fertilizers (includes urea)	AD	Comparability Transparency Accuracy	High
3.D.a.2.a/b/c	Estimation of air pollutant emissions applying TIER 2 approach of EMEP/EEA GB 2019	AD EF	Accuracy	high
3.D.a.2.a/b/c	Investigation on practices regarding <ul style="list-style-type: none"> <li>○ Livestock manure applied to soils</li> <li>○ Sewage sludge applied to soils</li> <li>○ Other organic fertilizers applied to soils (including compost)</li> </ul>	AD	Comparability Transparency Accuracy	High
3.D.a.3	• Estimation of air pollutant emissions applying TIER 2 approach of EMEP/EEA GB 2019 for key categories	AD EF	Accuracy	high
3.D.c	Estimation of air pollutant emissions applying TIER 1 approach of EMEP/EEA GB 2019	AD EF	Accuracy	high
3.D.c	Investigation on practices regarding <i>Farm-level agricultural operations including storage, handling and transport of agricultural products</i>	AD	Comparability Transparency Accuracy	High

### 5.3 Field Burning of Agricultural Residues (IPCC/NFR category 3.F)

This category comprises burning straw from cereals and residual wood of vinicultures on open fields.

This category is currently not estimated due to lack of data and resources.

#### 5.3.1 Source-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

**Table 5.22** Source-specific planned improvements for NFR 3.F.

source	Planned improvement	Type of improvement		Priority
3.F	Estimation of air pollutant emissions applying TIER 1 approach of EMEP/EEA GB 2019	AD EF	Accuracy	high
3.F	<ul style="list-style-type: none"> <li>Investigation on crops and fraction of crop residues burnt in field</li> <li>Investigation on of Dry matter fraction</li> </ul>	AD	Comparability Transparency Accuracy	high

## 6 Waste (sector 5)

This chapter includes information on and description of methodologies used for estimating air pollutant emissions, as well as references to activity data and emission factors reported under Sector 5 – *Waste* for the period 1990 to 2018. In the Waste sector emissions of all air pollutant originate from the following categories:

- 5.A Solid waste disposal,
- 5.B Biological treatment of solid waste,
  - 5B1 Composting
  - 5B2 Anaerobic digestion at biogas facilities
- 5.C Incineration and open burning of waste
  - 5C1a Municipal waste incineration
  - 5C1bi Industrial waste incineration
  - 5C1bii Hazardous waste incineration
  - 5C1biii Clinical waste incineration
  - 5C1biv Sewage sludge incineration
  - 5C1bv Cremation
  - 5C1bvi Other waste incineration
  - 5C2 Open burning of waste
- 5.D Wastewater treatment and discharge
  - 5D1 Domestic wastewater handling
  - 5D2 Industrial wastewater handling
  - 5D3 Other wastewater handling
- 5E Other waste

**Table 6.1 Overview on reported emissions from sector 5 Waste**

NFR Code	5A	5B1	5B2	5C1a	5C1bi	5C1bii	5C1biv	5C1bv	5C1bvi	5C2	5D1	5D2	5D3	5E
NO <sub>x</sub>	NA	NA	NA	NO	NO	NO	NO	NA	NO	NA	NE	NA	NA	NA
NM VOC	✓	NA	NA	NO	NO	NO	NO	NA	NO	NA	NE	NA	NE	NA
SO <sub>x</sub>	NA	NA	NA	NO	NO	NO	NO	NA	NO	NA	NE	NA	NA	NA
NH <sub>3</sub>	NA	NO	NO	NO	NA	NA	NA	NA	NA	NA	NE	NA	NA	NO
CO	NA	NO	NA	NO	NO	NO	NO	NO	NO	NA	NE	NA	NA	NA
PM <sub>2.5</sub>	✓	NA	NA	NO	NO	NO	NO	NO	NO	NA	NE	NA	NA	NO
PM <sub>10</sub>	✓	NA	NA	NO	NO	NO	NO	NO	NO	NA	NE	NA	NA	NO
TSP	✓	NA	NA	NO	NO	NO	NO	NO	NO	NA	NE	NA	NA	NO
BC	NA	NA	NA	NO	NO	NO	NA	NA	NA	NA	NE	NA	NA	NA
Pb	NA	NA	NA	NO	NO	NO	NO	NO	NO	NA	NE	NA	NA	NO
Cd	NA	NA	NA	NO	NO	NO	NO	NO	NO	NA	NE	NA	NA	NO
Hg	NA	NA	NA	NO	NO	NO	NO	NO	NO	NA	NA	NA	NA	NO

NFR Code	5A	5B1	5B2	5C1a	5C1b i	5C1bi i	5C1bi ii	5C1b iv	5C1b v	5C1b vi	5C2	5D1	5D2	5D3	5E
As	NA	NA	NA	NO	NO	NO	NO	NO	NO	NA	NE	NA	NA	NA	NO
Cr	NA	NA	NA	NO	NO	NO	NO	NO	NO	NA	NE	NA	NA	NA	NO
Cu	NA	NA	NA	NO	NO	NO	NO	NO	NO	NA	NE	NA	NA	NA	NO
Ni	NA	NA	NA	NO	NO	NO	NO	NO	NO	NA	NA	NA	NA	NA	NA
Se	NA	NA	NA	NO	NA	NA	NA	NA	NA	NA	NE	NA	NA	NA	NA
Zn	NA	NA	NA	NO	NA	NA	NA	NA	NA	NA	NE	NA	NA	NA	NA
PCDD/ PCDF	NA	NA	NA	NO	NO	NO	NO	NO	NO	NA	NE	NA	NA	NA	NO
PAH	NA	NA	NA	NO	NA	NA	NA	NO	NO	NA	NE	NA	NA	NA	NA
HCB	NA	NA	NA	NO	NO	NO	NO	NO	NO	NA	NA	NA	NA	NA	NA
PCBs	NA	NA	NA	NO	NA	NA	NO	NO	NO	NA	NA	NA	NA	NA	NA
<p>A '✓' indicates: emissions from this sub-category have been estimated.</p> <p>Notation keys: IE - included elsewhere, NO – not occurrent, NE -not estimated, NA -not applicable, C – confidential</p>															

## 6.1 Solid waste disposal on land (5.A)

The following section describes air pollutant emissions resulting from solid waste disposal on land. A differentiation in type of waste disposal sites, as for the estimation of GHG, is for the estimation of air pollutant emission not necessary.

### 6.1.1 Source category description

Emissions	NMVOC	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	All other pollutants
Estimated					
5.A.1 Managed Waste Disposal Sites	✓	✓	✓	✓	NA (see also Table 6.1)
5.A.2 Unmanaged Waste Disposal Sites					
5.A.3 Uncategorized Waste Disposal Sites					
Key Category	LA 2018; TA	-	-	-	-
<p>A '✓' indicates: emissions from this sub-category have been estimated.</p> <p>Notation keys: IE - included elsewhere, NO – not occurrent, NE -not estimated, NA -not applicable, C – confidential</p> <p>LA – Level Assessment (in year); TA – Trend Assessment</p>					

This chapter includes information on the methodologies used for estimating emissions, as well as references to activity data and emission factors reported for the period 1990 to 2018. The following table provides an overview on activity data and emissions from solid waste disposal on land.

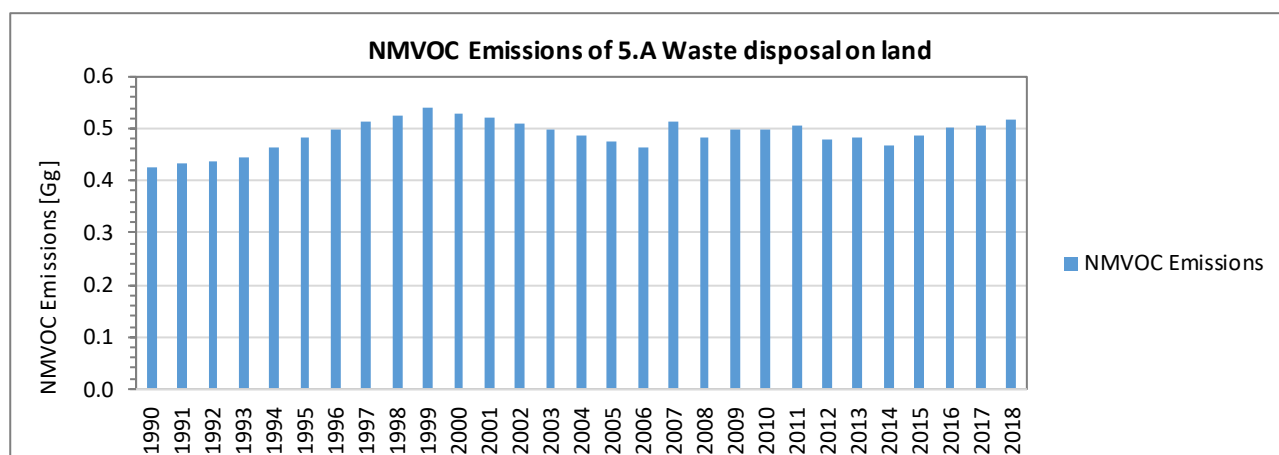


Figure 6.1 Emissions of NMVOC from sub-category 5.A Solid waste disposal on land

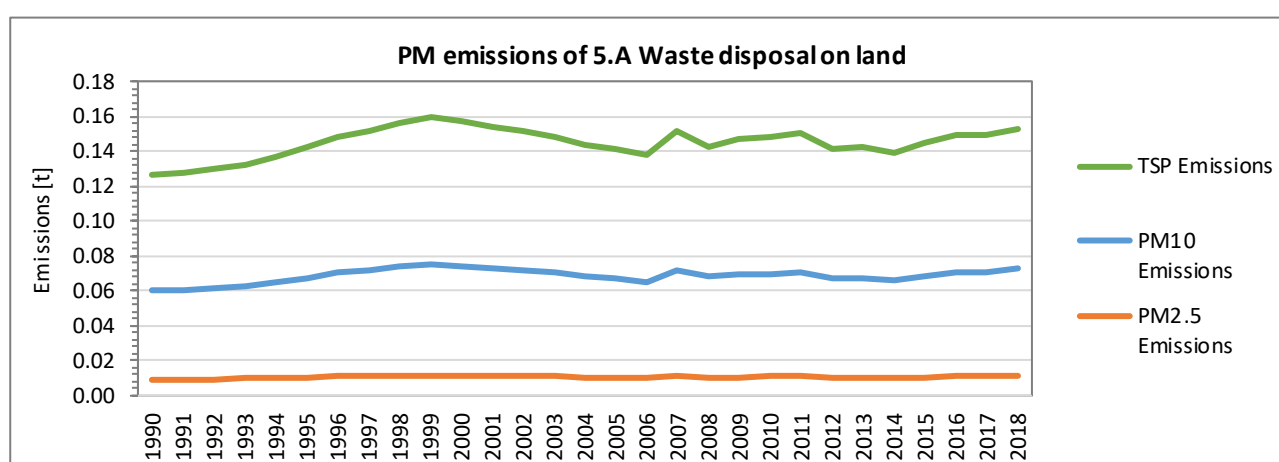


Figure 6.2 Emissions of TSP, PM10, PM2.5 from sub-category 5.A Solid waste disposal on land

Table 6.2 Emissions from solid waste disposal on land

Year	NMVOC Emissions	TSP Emissions	PM10 Emissions	PM2.5 Emissions
	Gg	t	t	t
1990	0.43	0.13	0.06	0.01
1991	0.43	0.13	0.06	0.01
1992	0.44	0.13	0.06	0.01
1993	0.44	0.13	0.06	0.01
1994	0.46	0.14	0.06	0.01
1995	0.48	0.14	0.07	0.01
1996	0.50	0.15	0.07	0.01
1997	0.51	0.15	0.07	0.01
1998	0.53	0.16	0.07	0.01
1999	0.54	0.16	0.08	0.01
2000	0.53	0.16	0.07	0.01
2001	0.52	0.15	0.07	0.01

Year	NMVOC Emissions	TSP Emissions	PM10 Emissions	PM2.5 Emissions
	Gg	t	t	t
2002	0.51	0.15	0.07	0.01
2003	0.50	0.15	0.07	0.01
2004	0.49	0.14	0.07	0.01
2005	0.48	0.14	0.07	0.01
2006	0.46	0.14	0.07	0.01
2007	0.51	0.15	0.07	0.01
2008	0.48	0.14	0.07	0.01
2009	0.50	0.15	0.07	0.01
2010	0.50	0.15	0.07	0.01
2011	0.51	0.15	0.07	0.01
2012	0.48	0.14	0.07	0.01
2013	0.48	0.14	0.07	0.01
2014	0.47	0.14	0.07	0.01
2015	0.49	0.14	0.07	0.01
2016	0.50	0.15	0.07	0.01
2017	0.51	0.15	0.07	0.01
2018	0.52	0.15	0.07	0.01
2019				
Trend				
1990 – 2019	21.2%	21.2%	21.2%	21.2%
2005 – 2019	8.6%	8.6%	8.6%	8.6%
2018 – 2019	2.1%	2.1%	2.1%	2.1%

## 6.1.2 Methodological issues

### 6.1.2.1 Choice of methods

The emissions were calculated by Tier 1 methodology from the EMEP EEA GB 2019 (EEA, 2019):

$$\text{Emission}_{\text{pollutant}} = \text{Activity Data}_{\text{production}} \times \text{Emission Factor}_{\text{pollutant}}$$

### 6.1.2.2 Choice of Activity Data

For the activity data the values out of the IPCC FOD model, according to the IPCC methodology of 2006, were taken. For the modelling, data on the total population as well as the production of solid waste per capita (kg / capita / year) were used. Value for population, municipal solid waste per capita and the composition of biodegradable waste disposed of in landfills for all types of waste were taken from Development of Montenegro's Third National Communication, which were delivered by the national statistical office MONSTAT (Monstat, 2019a). Historical data on the total population and municipal solid waste per capita and

composition of biodegradable waste deposited in landfills for a period 1950 to 1989 were estimated by interpolation and extrapolation.

**Table 6.3 Activity data from solid waste disposal on land**

Year	Population	Waste per capita	Waste landfilled (Wet Weight)
		kg/cap/yr	Gg
1990	579,892	471	272.90
1991	582,999	475	276.98
1992	585,438	480	281.01
1993	587,877	485	285.06
1994	590,316	503	296.63
1995	592,755	520	308.47
1996	595,194	538	320.45
1997	597,633	550	328.64
1998	600,072	562	337.00
1999	602,511	574	345.54
2000	604,950	562	339.86
2001	607,389	550	333.82
2002	609,828	537	327.48
2003	612,267	523	320.09
2004	613,353	508	311.58
2005	614,261	496	304.73
2006	615,025	484	297.61
2007	615,875	533	328.02
2008	616,969	502	309.47
2009	618,294	515	318.24
2010	619,428	516	319.75
2011	620,079	524	325.05
2012	620,601	494	306.83
2013	621,207	497	308.55
2014	621,810	484	300.77
2015	622,159	503	312.70
2016	622,303	518	322.29
2017	622,373	521	324.13
2018	622,182	532	330.81
2019			
<b>Trend</b>			
1990 – 2019	7.3%	13.0%	21.2%

Year	Population	Waste per capita	Waste landfilled (Wet Weight)
		kg/cap/yr	Gg
2005 – 2019	1.3%	7.2%	8.6%
2018 – 2019	0.0%	2.1%	2.1%

### 6.1.2.3 Choice of emission factors

Default emission factors from the EMEP EEA Guidebook 2019, Table 3-1, are applied and are presented in the following table.

**Table 6.4 Tier 1 emission factors for source category 5.A.**

Pollutant	Value	Unit	Type pf EF
NM VOC	1.56	kg/Mg waste	Default
TSP	0.463	kg/Mg waste	Default
PM10	0.219	kg/Mg waste	Default
PM2.5	0.033	kg/Mg waste	Default

### 6.1.3 Source-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
  - consistent use of waste data (questionnaires),
  - documented sources,
  - use of units,
  - strictly defined interfaces between spreadsheets/calculation modules,
  - unique structure of sheets which do the same,
  - record keeping, use of write protection,
  - unique use of formulas, special cases are documented/highlighted,
  - quick-control checks for data consistency through all steps of calculation.
- cross-checked from two sources: national statistics, EUROSTAT and international statistics
- time series consistency - plausibility checks of dips and jumps.

### 6.1.4 Recalculations

The following table presents the main revisions and recalculations done since the last submission to sub-category 5.A *Biological treatment of waste - Solid waste disposal on land*.

**Table 6.5 Recalculations done in sub-category 5.A**

source category	Revisions of data	Type of revision	Type of improvement
5.A	application of EMEP/EEA air pollutant emission inventory guidebook 2019	method	Comparability



source category	Revisions of data	Type of revision	Type of improvement
5.A	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019	EF	Comparability
5.A	Update of activity data	AD	Accuracy

### 6.1.5 Sector-specific planned improvements

Considering the potential contribution of identified improvements in the total emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

**Table 6.6 Planned improvements for sub-category 5 - Waste.**

source category	Planned improvement	Type of improvement		Priority
5.A	<p>This sub-category is a key category for NMVOC. Therefore a higher TIER methodology should be used, but no TIER 2 or TIER 3 default emission factor is provided in the EMEP/EEA GB 2019 or EFDB.</p> <p>However, a literature research will be undertaken.</p> <p>It is also expected that this category is not key category anymore if the sector 2 product use is completely estimated.</p>	EF	Accuracy	medium

## 6.2 Biological treatment of solid waste (5.B)

### 6.2.1 Biological treatment of waste - Composting (5.B.1)

The sub-category 5.B.1 *Biological treatment of waste - Composting* does exist in Montenegro but currently no emissions were estimated due to lack of resources and data.

#### 6.2.1.1 Source-specific planned improvements

Considering the potential contribution of identified improvements in the total emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

**Table 6.7 Planned improvements for sub-category 5.B.1 Biological treatment of waste - Composting**

Source category	Planned improvement	Type of improvement		Priority
5.C.1.b.i	<p>Survey on composting activities</p> <ul style="list-style-type: none"> <li>in urban / rural areas</li> <li>type of composting facility</li> </ul>	AD	Completeness	low
5.C.1.b.i	Estimation of NH <sub>3</sub> emissions	EMI	Completeness	low

## 6.2.2 Biological treatment of waste - Anaerobic digestion at biogas facilities (5.B.2)

The sub-category 5.B.2 *Biological treatment of waste - Anaerobic digestion at biogas facilities* does not occur in Montenegro.

## 6.3 Incineration and open burning of waste (5.C.)

### 6.3.1 Municipal waste incineration (5.C.1.a)

The sub-category 5.C.1.a *Municipal waste incineration* does not occur in Montenegro. Municipal waste is landfilled.

### 6.3.2 Industrial waste incineration (5.C.1.b.i)

The sub-category 5.C.1.b.i *Industrial waste incineration* did maybe occur in the past in Montenegro but currently no emissions were estimated due to lack of resources and data.

This category consist out of four sources

- (1) Incineration of industrial wastes (except flaring)
- (2) Flaring in chemical industries
- (3) Incineration of sludges from waste water treatment (see here chapter 6.3.5)
- (4) Incineration of waste oil

#### 6.3.2.1 Source-specific planned improvements

Considering the potential contribution of identified improvements in the total emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

**Table 6.8 Planned improvements for sub-category 5.C.1.b.i Industrial waste incineration**

Source category	Planned improvement	Type of improvement		Priority
5.C.1.b.i	Survey on Incineration of <ul style="list-style-type: none"> <li>• Incineration of industrial wastes (except flaring)</li> <li>• Flaring in chemical industries</li> <li>• Incineration of waste oil</li> </ul>	AD	Completeness	medium
5.C.1.b.i	Estimation of all air pollutants emissions	EMI	Completeness	medium

### 6.3.3 Hazardous waste incineration (5.C.1.b.ii)

The sub-category 5.C.1.b.ii *Hazardous waste incineration* does not occur in Montenegro. Hazardous waste is exported to countries with appropriate facilities.

### 6.3.4 Clinical waste incineration (5.C.1.b.iii)

The sub-category 5.C.1.b.iii *Clinical waste incineration* does occur in Montenegro but no emissions occur as the clinical waste is thermal treated in an autoclave. The related fuel consumption is considered in NFR sector 1 *Energy*.

### 6.3.5 Sludge incineration (5.C.1.b.iv)

The sub-category 5.C.1.b.iv *Sludge incineration* does currently not occur in Montenegro.

### 6.3.6 Cremation (5.C.1.b.v)

The sub-category 5.C.1.b.v *Cremation* does not occur in Montenegro.

### 6.3.7 Other waste incineration (5.C.1.b.v.i)

The sub-category 5.C.1.b.v.i *Open waste incineration* does not occur in Montenegro.

### 6.3.8 Open burning of waste (5.C.2)

The sub-category 5.C.2 *Open burning of waste* does occur in Montenegro but currently no emissions were estimated due to lack of resources and data.

#### 6.3.8.1 Source-specific planned improvements

Considering the potential contribution of identified improvements in the total emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

**Table 6.9 Planned improvements for sub-category 5.C.2 *Open burning of waste***

Source category	Planned improvement	Type of improvement		Priority
5.C.2	Survey on open burning of waste with consideration of <ul style="list-style-type: none"> <li>changes of practices over the time</li> <li>different practices in urban and rural areas</li> <li>typ of waste which is burned</li> </ul>	AD	Completeness	high
5.C.2	An estimate with approaches from other countries with similar circumstances will be examined	AD	Completeness	high
5.C.2	Estimation of all air pollutants emissions	EMI	Completeness	high

## 6.4 Wastewater treatment and discharge (5.D)

### 6.4.1 Domestic wastewater handling (5.D.1)

The sub-category 5.D.1 *Domestic wastewater handling* does occur in Montenegro but currently no emissions were estimated due to lack of resources and data.

#### 6.4.1.1 Source-specific planned improvements

Considering the potential contribution of identified improvements in the total emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

**Table 6.10** Planned improvements for sub-category 5.D.1 *Domestic wastewater handling*

Source category	Planned improvement	Type of improvement		Priority
5.D.2	Survey on domestic waste water treatment  Information on waste water is already collected for the GHG inventory. As this data collection focussed on Nitrogen and Carbon content and not the volume of waste water, which is needed for the Tier1 methodology, further investigation is needed.	AD	Completeness	high
5.D.2	Estimation of NMVOC emissions from 5.D.2	EMI	Completeness	high

### 6.4.2 Industrial wastewater handling (5.D.2)

The sub-category 5.D.2 *Industrial wastewater handling* does occur in Montenegro but currently no emissions were estimated due to lack of resources and data.

#### 6.4.2.1 Source-specific planned improvements

Considering the potential contribution of identified improvements in the total emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

**Table 6.11** Planned improvements for sub-category 5.D.2 *Industrial wastewater handling*

Source category	Planned improvement	Type of improvement		Priority
5.D.2	Survey on <ul style="list-style-type: none"> <li>Waste water treatment in industry</li> <li>Waste water treatment in residential/commercial sectors</li> </ul>	AD	Completeness	high
5.D.2	Estimation of NMVOC emissions from 5.D.2	EMI	Completeness	high

### 6.4.3 Other wastewater handling (5.D.3)

The sub-category 5.D.3 *Other wastewater handling* does not occur in Montenegro.

## **6.5 Other waste (5.E)**

The category 5.E *Other waste* does not occur in Montenegro.

## 7 Other

Montenegro does not report any emissions under sector 6 Other.

## 8 Recalculations and Improvements

Recalculations of previously submitted inventory data are performed with the only purpose to improve the GHG inventory. This chapter quantifies the changes in emissions for all greenhouse gases compared to the previous submission.

### 8.1 Explanations and justifications for recalculations

Compiling an emission inventory includes **data collecting**, **data transfer** and **data processing**. Data has to be collected from different sources, for instance national statistics, plant operators, studies, personal information or other publications. The provided data must be transferred from different data formats and units into a unique electronic format to be processed further. The calculation of emissions by applying methodologies on the collected data and the final computing of time series into a predefined reporting format are further steps in the preparation of the final submission.

Finally, the submission must be delivered in due time. Even though a QA/QC system gives assistance so that potential error sources are minimized it is sometimes necessary to make some revisions (called recalculations) under the following circumstances:

- An emission source was not considered in the previous inventory.
- A source/data supplier has delivered new data. The causes might be: Previous data were preliminary data only (by estimation, extrapolation), improvements in methodology.
- Occurrence of errors in data transfer or processing: wrong data, unit-conversion, software errors, etc.
- Methodological changes: a new methodology must be applied to fulfil the reporting obligations caused by one of the following reasons:
  - to decrease uncertainties.
  - an emission source becomes a key source.
  - consistent input data needed for applying the methodology is no longer accessible.
  - input data for more detailed methodology is now available.
  - the methodology is no longer appropriate.

Detailed information on recalculations and their justifications can be found in the following subchapters as well as the corresponding Sector-specific Chapters of the sectors Energy, IPPU, Agriculture, LULUCF and Waste, in which all methodological changes and activity data updates that led to recalculations of emissions with respect to the previous submission are listed.

**Table 6.11 Recalculations**

Source	Revisions of data	Type of revision	Type of improvement
1.A.1.a	application of EMEP/EEA air pollutant emission inventory guidebook 2019	method	Comparability
1.A.1.a	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019	EF	Comparability
1.A.1.a	use of PS NCV	AD	Accuracy
1.A.1.a	Fuel consumption data (activity data) was revised due to revised fuel consumption data – plant specific data	AD	Accuracy

Source	Revisions of data	Type of revision	Type of improvement
1.A.2	application of EMEP/EEA air pollutant emission inventory guidebook 2019	method	Comparability
1.A.2	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019	EF	Comparability
1.A.2	use of CS NCV	AD	Accuracy
1.A.2	Fuel consumption data (activity data) was revised due to revised fuel consumption data	AD	Accuracy
1.A.3.a	Application of EMEP/EEA air pollutant emission inventory guidebook 2013	method	Comparability
1.A.3.a	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2013	EF	Comparability
1.A.3.a	use of CS NCVd	AD	Accuracy
1.A.3.a	Fuel consumption data (activity data) was revised	AD	Accuracy
1.A.3.a	• Application of EMEP/EEA air pollutant emission inventory guidebook 2013	method	Comparability
1.A.3.a	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2013	EF	Comparability
1.A.3.a	use of CS NCV	AD	Accuracy
1.A.3.a	Fuel consumption data (activity data) was revised	AD	Accuracy
1.A.4	application of EMEP/EEA air pollutant emission inventory guidebook 2019	method	Comparability
1.A.4	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019	EF	Comparability
1.A.4	use of CS NCV	AD	Accuracy
1.A.4	Fuel consumption data (activity data) was revised due to revised fuel consumption data – plant specific data	AD	Accuracy
2.A.2	application of EMEP/EEA air pollutant emission inventory guidebook 2019	method	Comparability
2.A.2	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019	EF	Comparability
2.A.2	Revision of activity data	AD	Accuracy
2.C	application of EMEP/EEA air pollutant emission inventory guidebook 2019	method	Comparability
2.C	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019	EF	Comparability
2.C	Revision of activity data	AD	Accuracy
2.D.3	application of EMEP/EEA air pollutant emission inventory guidebook 2019	method	Comparability
2.D.3	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019	EF	Comparability
2.D.3	Revision of activity data	AD	Accuracy
2.H.2	application of EMEP/EEA air pollutant emission inventory guidebook 2019	method	Comparability
2.H.2	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019	EF	Comparability



Source	Revisions of data	Type of revision	Type of improvement
2.H.2	Revision of activity data	AD	Accuracy
3.B	application of EMEP/EEA air pollutant emission inventory guidebook 2019	method	Comparability
3.B	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019	EF	Comparability
3.B	use of default manure management system	AD	Accuracy
3.B	revised livestock data	AD	Accuracy
5.A	application of EMEP/EEA air pollutant emission inventory guidebook 2019	method	Comparability
5.A	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019	EF	Comparability
5.A	Update of activity data	AD	Accuracy

## 8.2 Planned improvements

Table 8.1 Inventory Improvement plan

IPCC code	Planned improvement	Type of improvement		Priority
all	Improve QA/QC activities	all	Accuracy Transparency	high
all	Revision of technical mistakes	all	Accuracy Transparency	high
all	Quantitative uncertainty analysis	all	Accuracy Transparency Completeness Comparability	high
1.A.1.a.iii	Survey on use of fuels in Heat Plants: The amount of fuel consumption is not known yet.	AD	Completeness	High
1.A.1.a	Sulphur content in used fuel for preparing country specific emission factor (CS EF) $\Rightarrow \text{CS EF}_{\text{SO}_2} [\text{g/GJ}] = (\text{S} [\%] \cdot 20000) / (\text{NCV} [\text{GJ/t}])$	EF	Accuracy Transparency	Medium
1.A.1.a	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF	Accuracy Transparency	Medium
1.A.1.a	Data obtained from measurements made on the emission of air pollutants <ul style="list-style-type: none"> <li>Determination of the <ul style="list-style-type: none"> <li>temperature in waste gases [<math>^{\circ}\text{C}</math>];</li> <li>static pressure and the dynamic pressure [kPa];</li> <li>flow rate [m/s];</li> <li>volume flow rate [m<sup>3</sup>/h and Nm<sup>3</sup>/h];</li> <li>concentration of CO, SO<sub>2</sub>, NO<sub>x</sub> in the exhaust gases [mg/Nm<sup>3</sup>]; and</li> </ul> </li> </ul> Gravimetric extraction of solid particles (TSP) from gases and determination by applying a gravimetric method (mg/Nm <sup>3</sup> ).	EF	Accuracy Transparency	Medium
1.A.1.a	Improvement of tie series consistency	EF	Accuracy Transparency	High
1.A.1.c.i	Cross-check of national and international data sources on charcoal production	AD	Consistency Transparency	high

IPCC code	Planned improvement	Type of improvement		Priority
1.A.1.c.i	Analysis of charcoal production (4) Raw materials for carbonization. <ul style="list-style-type: none"> <li>Fuelwood &amp; wood fuel: type of wood and wood waste</li> <li>Agricultural residues</li> <li>bark waste</li> </ul> (5) charcoal making technologies efficiencies of various types of kiln			high
1.A.1.c.i	Country specific Net Caloric Value (NCV) for fuels of national production: charcoal ⇒ conversion from mass unit to energy unit (unit EF is kg /TJ)	AD EF	Accuracy Transparency	medium
1.A.1.c.i	Estimation of carbon monoxide (CO), sulphur dioxide (SO <sub>2</sub> ), nitrogen dioxide (NO <sub>2</sub> ) and particulate matter (PM <sub>2.5</sub> )		Completeness	high
1.A.1.c.i	Carbon content (%) of charcoal for preparing country specific emission factor (CS EF) ⇒ $CS\ EF_{CO_2} [t/TJ] = (C [\%] \cdot 44 \cdot Ox) / (NCV [TJ/t] \cdot 12 \cdot 100)$	EF	Accuracy Transparency	medium
1.A.2	Sulphur content in used fuel for preparing country specific emission factor (CS EF) ⇒ $CS\ EF_{SO_2} [g/GJ] = (S [\%] \cdot 20000) / (NCV [GJ/t])$	EF	Accuracy Transparency	Medium
1.A.2	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF	Accuracy Transparency	Medium
1.A.2	Data obtained from measurements made on the emission of air polluters <ul style="list-style-type: none"> <li>Determination of the <ul style="list-style-type: none"> <li>temperature in waste gases [°C];</li> <li>static pressure and the dynamic pressure [kPa];</li> <li>flow rate [m/s];</li> <li>volume flow rate [m<sup>3</sup>/h and Nm<sup>3</sup>/h];</li> <li>concentration of CO, SO<sub>2</sub>, NO<sub>x</sub> in the exhaust gases [mg/Nm<sup>3</sup>]; and</li> </ul> </li> <li>Gravimetric extraction of solid particles (TSP) from gases and determination by applying a gravimetric method (mg/Nm<sup>3</sup>).</li> </ul>	EF	Accuracy Transparency	Medium
1.A.2	Improvement of time series consistency and split of fuels: the energy statistics is still under development; a split of the fuel combustion for this subcategory has to be reviewed for the entire timeseries. Emissions are allocated in IPCC/NFR subcategory 1.A.2.m Other.	AD	Accuracy Transparency	High
1.A.3.a	Application of EMEP/EEA air pollutant emission inventory guidebook 2019, TIER 2	method	Comparability	high
1.A.3.a	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019, TIER 2	EF	Comparability	medium
1.A.3.a	Investigation on Flight movements Investigation on fleet	AD	Comparability	high

IPCC code	Planned improvement	Type of improvement		Priority
1.A.3.b	Application of EMEP/EEA air pollutant emission inventory guidebook 2019, TIER 2/3 <b>Use of COPERT model</b>	method	Comparability	high
1.A.3.a	Investigation on vehicle movements (mileage, age technology of vehicles) Investigation on vehicle fleet	AD	Comparability	high
1.A.4	Improvement of time series consistency and split of fuels: the energy statistics is still under development; a split of the fuel combustion for this subcategory has to be reviewed for the entire timeseries.	AD	Accuracy Transparency	High
1.A.4	Characterisation of <ul style="list-style-type: none"> <li>residential heating : <ul style="list-style-type: none"> <li>(open/partly open) fire places,</li> <li>water heaters,</li> <li>advanced/ conventional stoves,</li> <li>space heating,</li> <li>boilers</li> <li>cookers;</li> </ul> </li> <li>non-residential heating: <ul style="list-style-type: none"> <li>space heating,</li> <li>boilers</li> <li>CHP</li> </ul> </li> </ul>	AD	Accuracy Transparency	High
1.A.4	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF	Accuracy Transparency	Medium
1.A.4	Split of fuels to different sub categories (1A4ai and 1A4aii)	AD	Completeness/comparability	medium
1.B.	application of EMEP/EEA air pollutant emission inventory guidebook 2019	method	Comparability	
1.B.	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2019	EF	Comparability	
1.B.	Fuel consumption data (activity data) was revised due to revised fuel consumption data – plant specific data	AD	Accuracy	
2.C.1	<ul style="list-style-type: none"> <li>Collection of facility-level data</li> <li>Incorporating of plant-specific emission factors based on measurements / Facility-level data</li> </ul>	EF	Accuracy	high
2.C.3	Application of TIER 3 methodology	method	Accuracy comparability	high

IPCC code	Planned improvement	Type of improvement		Priority
2.C.3	<ul style="list-style-type: none"> <li>Detailed process modelling:               <ul style="list-style-type: none"> <li>production of alumina and pre-treatment</li> <li>electrolysis</li> <li>post-treatment (refining and casting)</li> </ul> </li> <li>Collection of facility-level data</li> </ul> <p>Incorporating of plant-specific emission factors based on measurements / Facility-level data</p>	EF	Accuray	high
2.C.3	Application of TIER 3 methodovlogy	method	Accuracy comparablility	high
2.D.3.a	<p>Collection of production, import and export data and finally country-specific consumption data</p> <ul style="list-style-type: none"> <li>Agrochemical uses</li> <li>Blowing agents</li> <li>De-icing</li> <li>Binder and release agents</li> <li>Professional consumer cleaning</li> <li>Industrial, professional and consumer coatings</li> <li>Road and construction</li> <li>Other consumer uses (households, aerosols, cosmetics)</li> <li>Cosmetics and toiletries</li> <li>Household products</li> <li>Car care products</li> <li>Do it yourself (DIY)/buildings</li> <li>Pesticides</li> </ul>	AD	Accuray	high
2.D.3.a	Collection of solvent content for specific products in domestic solvent use	EF	Accuray	high
2.D.3.a	Application of TIER 2 methodovlogy	method	Accuracy comparablility	high
2A5b, 2D3b, 2D3c, 2D3d, 2D3e, 2D3f, 2D3h, 2G	The last comprehensive inventory was done by an consulting company. As either the methodology and the data are fully transparent, these categories could not be estimated for the whole time series in this submission. For the future it is planned to estimate these categories based on the recommended methodologies and explore new data sources.	AD	Completeness	high
2A2	Further investigation of the drop in Limeproduction in 2010.	AD	Completeness/comparability	medium
2A5a	From 2010 on data on crushed stones, marvel, pebbles etc. are available. This data will be included, when activity data on the years before 2010 can be estimated by the use of economic parameters.	AD	Completeness	high
2.H.	Searching in international sources for production data of bread, beer, wine and spirits in the year 2000.	AD	Completeness	high

IPCC code	Planned improvement	Type of improvement		Priority
3.B	Correction of technical mistakes in calculation	AD EF	Accuracy	high
3.B. 3.D.	Husbandry and Management Practice with consideration <ul style="list-style-type: none"> <li>characteristics of Livestock Husbandry for the whole time series: <ul style="list-style-type: none"> <li>breed,</li> <li>age distribution,</li> <li>weight</li> <li>milk wool yield,</li> <li>wool yield,</li> <li>working hours</li> </ul> </li> <li>characteristics of manure management practice: <ul style="list-style-type: none"> <li>stall / housed and Housing period</li> <li>pasture/range/paddock (flat/hilly)</li> <li>grazing large areas (flat/hilly)</li> <li>daily spread</li> <li>solid storage</li> <li>dry lot</li> <li>liquid/slurry with/without natural crust cover</li> <li>uncovered anaerobic lagoon</li> <li>pit storage below animal confinements</li> <li>anaerobic digester</li> <li>burned for fuel</li> <li>cattle and swine deep bedding</li> <li>composting</li> <li>aerobic treatment</li> </ul> </li> </ul>	AD	Accuracy Consistency Comparability Transparency	high
3.B	<ul style="list-style-type: none"> <li>nitrogen excretion</li> <li>annual straw use in litter-based manure management systems and the N content of straw</li> </ul>	AD	Accuracy Consistency Comparability Transparency	high
3.B	Estimation of methane (NH <sub>3</sub> ) and other air pollutant emissions applying TIER 2 approach as some sub-categories are key categories	method	Transparency Comparability	high

IPCC code	Planned improvement	Type of improvement		Priority
3.A.1.j 3.B. 3.D	Survey and/or research on Livestock which is not included in current statistics: e.g. buffalo, fur bearing animals	AD	Completeness	High
3.B 3.D	Survey and/or research on Livestock split of poultry: <ul style="list-style-type: none"> <li>• broiler chickens, layer hens, poultry (free range)</li> <li>• turkeys,</li> <li>• ducks,</li> <li>geese</li> </ul>	AD	Accuracy Consistency Comparability Transparency	High
3.B	Survey and/or research on VS excretion rates		Accuracy	medium
3.D.a.1	Estimation of air pollutant emissions applying TIER 2 approach of EMEP/EEA GB 2019	AD EF	Accuracy	high
3.D.a.1	Investigation on crops and fraction Inorganic N- fertilizers (includes urea)	AD	Comparability Transparency Accuracy	High
3.D.a.2.a/b/c	Estimation of air pollutant emissions applying TIER 2 approach of EMEP/EEA GB 2019	AD EF	Accuracy	high
3.D.a.2.a/b/c	Investigation on practices regarding <ul style="list-style-type: none"> <li>○ Livestock manure applied to soils</li> <li>○ Sewage sludge applied to soils</li> <li>Other organic fertilizers applied to soils (including compost)</li> </ul>	AD	Comparability Transparency Accuracy	High
3.D.a.3	Estimation of air pollutant emissions applying TIER 2 approach of EMEP/EEA GB 2019 for key categories	AD EF	Accuracy	high
3.D.c	Estimation of air pollutant emissions applying TIER 1 approach of EMEP/EEA GB 2019	AD EF	Accuracy	high
3.D.c	Investigation on practices regarding <i>Farm-level agricultural operations including storage, handling and transport of agricultural products</i>	AD	Comparability Transparency Accuracy	High
3.F	Estimation of air pollutant emissions applying TIER 1 approach of EMEP/EEA GB 2019	AD EF	Accuracy	high

IPCC code	Planned improvement	Type of improvement		Priority
3.F	<ul style="list-style-type: none"> <li>Investigation on crops and fraction of crop residues burnt in field</li> <li>Investigation on of Dry matter fraction</li> </ul>	AD	Comparability Transparency Accuracy	high
5.A	<p>This sub-category is a key category for NMVOC. Therefore a higher TIER methodology should be used, but no TIER 2 or TIER 3 default emission factor is provided in the EMEP/EEA GB 2019 or EFDB.</p> <p>However, a literature research will be undertaken.</p> <p>It is also expected that this category is not key category anymore if the sector 2 product use is completely estimated.</p>	EF	Accuracy	medium
5.C.1.b.i	<p>Survey on composting activities</p> <ul style="list-style-type: none"> <li>in urban / rural areas</li> </ul> <p>type of composting facility</p>	AD	Completeness	low
5.C.1.b.i	Estimation of NH <sub>3</sub> emissions	EMI	Completeness	low
5.C.1.b.i	<p>Survey on Incineration of</p> <ul style="list-style-type: none"> <li>Incineration of industrial wastes (except flaring)</li> <li>Flaring in chemical industries</li> </ul> <p>Incineration of waste oil</p>	AD	Completeness	medium
5.C.1.b.i	Estimation of all air pollutants emissions	EMI	Completeness	medium
5.C.2	<p>Survey on open burning of waste with consideration of</p> <ul style="list-style-type: none"> <li>changes of practices over the time</li> <li>different practices in urban and rural areas</li> </ul> <p>typ of waste which is burned</p>	AD	Completeness	high
5.C.2	An estimate with approaches from other countries with similar circumstances will be examined	AD	Completeness	high
5.C.2	Estimation of all air pollutants emissions	EMI	Completeness	high
5.D.1	<p>Survey on domestic waste water treatment</p> <p>Information on waste water is already collected for the GHG inventory. As this data collection focussed on Nitrogen and Carbon content and not the volume of waste water, which is needed for the Tier1 methodology, further investigation is needed.</p>	AD	Completeness	high
5.D.1	Estimation of NMVOC emissions from 5.D1	EMI	Completeness	high



IPCC code	Planned improvement	Type of improvement		Priority
5.D.2	Survey on <ul style="list-style-type: none"><li>Waste water treatment in industry</li><li>Waste water treatment in residential/commercial sectors</li></ul>	AD	Completeness	high
5.D.2	Estimation of NMVOC emissions from 5.D.2	EMI	Completeness	high

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## 10 Units and abbreviations

### 10.1 Units and abbreviations, and standard equivalents

Unit	Abbreviation	Equivalents	Equivalents
1 tonne of oil equivalent (toe)	1 toe	1 x 10 <sup>10</sup> calories	1 x 10 <sup>10</sup> cal
1 ktoe		41.868 terajoules	41.868 TJ
1 short ton	1 sh t	0.9072 tonne	0.9072 t
1 tonne	1 t	1.1023 short tons	1.1023 sh t
1 kilogram	1 kg	2.2046 pounds	2.2046 lb
1 hectare	1 ha	10 <sup>4</sup> square meters	10 <sup>4</sup> m <sup>2</sup>
1 calorie <sub>IT</sub>	1 cal <sub>IT</sub>	4.1868 Joules	4.1868 J
1 atmosphere	1 atm	101.325 kilopascal	101.325 kPa
1 gram	1 g	0.002205 pounds	0.00205 lb
1 pound	1 lb	453.6 gram	453.6 g
1 terajoule	1 TJ	2.78 x 10 <sup>5</sup> kiloWatt hour	2.78 x 10 <sup>5</sup> kWh
1 kilowatt hour	1 kWh	3.6 x 10 <sup>6</sup> Joules	3.6 x 10 <sup>6</sup> J

Source: 2006 IPCC Guidelines, Volume 1: General Guidance and Reporting, Annex 8A.1: Prefixes, units and abbreviations, standard equivalents

### 10.2 Derived units

Tons			Grams			Equivalents*				
Multiple	Name	Symbol	Multiple	Name	Symbol	Tonnes (t)	Kilograms (kg)	Grams (g)	US/short tons (ST) <sup>†</sup>	Imperial/long tons (LT) <sup>†</sup>
10 <sup>0</sup>	tonne	t	10 <sup>6</sup>	megagram	Mg	1 t	1 000 kg	1 million g	1.1023 ST	0.98421 LT
10 <sup>3</sup>	kilotonne	kt	10 <sup>9</sup>	gigagram	Gg	1 000 t	1 million kg	1 billion g	1 102.3 ST	984.21 LT
10 <sup>6</sup>	megatonne	Mt	10 <sup>12</sup>	teragram	Tg	1 million t	1 billion kg	1 trillion g	1.1023 million ST	984,210 LT
10 <sup>9</sup>	gigatonne	Gt	10 <sup>15</sup>	petagram	Pg	1 billion t	1 trillion kg	1 quadrillion g	1.1023 billion ST	984.21 million LT
10 <sup>12</sup>	teratonne	Tt	10 <sup>18</sup>	exagram	Eg	1 trillion t	1 quadrillion kg	1 quintillion g	1.1023 trillion ST	984.21 billion LT
10 <sup>15</sup>	petatonne	Pt	10 <sup>21</sup>	zettagram	Zg	1 quadrillion t	1 quintillion kg	1 sextillion g	1.1023 quadrillion ST	984.21 trillion LT
10 <sup>18</sup>	exatonne	Et	10 <sup>24</sup>	yottagram	Yg	1 quintillion t	1 sextillion kg	1 septillion g	1.1023 quintillion ST	984.21 quadrillion LT

(\*The equivalent units columns use the short scale large-number naming system currently used in most English-language countries, e.g. 1 billion = 1 000 million = 1 000 000 000)

Source: <https://en.wikipedia.org/wiki/Tonne>

### 10.3 Prefixes and multiplication factors

Multiplication Factor	Abbreviation	Prefix	Symbol
1 000 000 000 000 000	$10^{15}$	peta	P
1 000 000 000 000	$10^{12}$	tera	T
1 000 000 000	$10^9$	giga	G
1 000 000	$10^6$	mega	M
1 000	$10^3$	kilo	k
100	$10^2$	hecto	h
10	$10^1$	deca	da
0.1	$10^{-1}$	deci	d
0.01	$10^{-2}$	centi	c
0.001	$10^{-3}$	milli	m
0.000 001	$10^{-6}$	micro	$\mu$

Source: 2006 IPCC Guidelines, Volume 1: General Guidance and Reporting, Annex 8A.1: Prefixes, units and abbreviations, standard equivalents

### 10.4 Chemical formulae

Chemical formula	Gas
C	Carbon
CH <sub>4</sub>	Methane
CO	Carbon monoxide
CO <sub>2</sub>	Carbon dioxide
H <sub>2</sub>	Hydrogen
H <sub>2</sub> S	Hydrogen sulphide
N <sub>2</sub> O	Nitrous oxide
NO <sub>x</sub>	Nitrogen oxides
SO <sub>x</sub>	Sulphur oxides
SO <sub>2</sub>	Sulphur dioxide
NMVOC	Non-methane volatile organic compound
F-gases	
NH <sub>3</sub>	Ammonia
Hg	Mercury
PAH	Polycyclic Aromatic Hydrocarbons
Pb	Lead
POP	Persistent Organic Pollutants
Cd	Cadmium

Source: 2006 IPCC Guidelines, Volume 1: General Guidance and Reporting, Annex 8A.1: Prefixes, units and abbreviations, standard equivalents

## 11 ANNEX - NFR Tables

**Table 11.1 NFR Code and description**

NFR Code	Long name
1	Energy
1A	Fuel Combustion
1A1a	Public electricity and heat production
1A1b	Petroleum refining
1A1c	Manufacture of solid fuels and other energy industries
1A2a	Iron and steel
1A2b	Non-ferrous metals
1A2c	Chemicals
1A2d	Pulp, Paper and Print
1A2e	Food processing, beverages and tobacco
1A2f	Non-metallic minerals
1A2gvi	Mobile combustion in manufacturing industries and construction
1A2gviii	Other
1A3ai(i)	International aviation LTO (civil)
1A3aii(i)	Domestic aviation LTO (civil)
1A3bi	RT: Passenger cars
1A3bii	RT: Light duty vehicles
1A3biii	RT: Heavy duty vehicles and buses
1A3biv	RT: Mopeds & motorcycles
1A3bv	RT: Gasoline evaporation
1A3bvi	RT: Automobile tyre and brake wear
1A3bvii	RT: Automobile road abrasion
1A3c	Railways
1A3di(ii)	International inland waterways
1A3dii	National navigation (shipping)
1A3ei	Pipeline transport
1A3eii	Other
1A4ai	Commercial/Institutional: Stationary
1A4aii	Commercial/Institutional: Mobile
1A4bi	Residential: Stationary
1A4bii	Residential: Household and gardening (mobile)
1A4ci	Agriculture/Forestry/Fishing: Stationary
1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery
1A4ciii	Agriculture/Forestry/Fishing: National fishing
1A5a	Other stationary (including military)
1A5b	Other, Mobile (including military, land based and recreational boats)
1B	Fugitive emission from solid fuels
1B1a	Fugitive emission from solid fuels: Coal mining and handling
1B1b	Fugitive emission from solid fuels: Solid fuel transformation
1B1c	Other fugitive emissions from solid fuels
1B2ai	Fugitive emissions oil: Exploration, production, transport
1B2aiv	Fugitive emissions oil: Refining and storage
1B2av	Distribution of oil products
1B2b	Fugitive emissions from natural gas
1B2c	Venting and flaring (oil, gas, combined oil and gas)
1B2d	Other fugitive emissions from energy production
2	Industrial Processes and Product Use (IPPU)

NFR Code	Long name
2A1	Cement production
2A2	Lime production
2A3	Glass production
2A5a	Quarrying and mining of minerals other than coal
2A5b	Construction and demolition
2A5c	Storage, handling and transport of mineral products
2A6	Other mineral products
2B1	Ammonia production
2B2	Nitric acid production
2B3	Adipic acid production
2B5	Carbide production
2B6	Titanium dioxide production
2B7	Soda ash production
2B10a	Chemical industry: Other
2B10b	Storage, handling and transport of chemical products
2C1	Iron and steel production
2C2	Ferroalloys production
2C3	Aluminium production
2C4	Magnesium production
2C5	Lead production
2C6	Zinc production
2C7a	Copper production
2C7b	Nickel production
2C7c	Other metal production
2C7d	Storage, handling and transport of metal products
2D3a	Domestic solvent use including fungicides
2D3b	Road paving with asphalt
2D3c	Asphalt roofing
2D3d	Coating applications
2D3e	Degreasing
2D3f	Dry cleaning
2D3g	Chemical products
2D3h	Printing
2D3i	Other solvent use
2G	Other product use
2H1	Pulp and paper industry
2H2	Food and beverages industry
2H3	Other industrial processes
2I	Wood processing
2J	Production of POPs
2K	Consumption of POPs and heavy metals
2L	Other production, consumption, storage, transportation or handling of bulk products
3	Agriculture
3B1a	Manure management - Dairy cattle
3B1b	Manure management - Non-dairy cattle
3B2	Manure management - Sheep
3B3	Manure management - Swine
3B4a	Manure management - Buffalo
3B4d	Manure management - Goats
3B4e	Manure management - Horses
3B4f	Manure management - Mules and asses
3B4gi	Manure management - Laying hens
3B4gii	Manure management - Broilers
3B4giii	Manure management - Turkeys

NFR Code	Long name
3B4giv	Manure management - Other poultry
3B4h	Manure management - Other animals
3Da1	Inorganic N-fertilizers (includes also urea application)
3Da2a	Animal manure applied to soils
3Da2b	Sewage sludge applied to soils
3Da2c	Other organic fertilisers applied to soils (including compost)
3Da3	Urine and dung deposited by grazing animals
3Da4	Crop residues applied to soils
3Db	Indirect emissions from managed soils
3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products
3Dd	Off-farm storage, handling and transport of bulk agricultural products
3De	Cultivated crops
3Df	Use of pesticides
3F	Field burning of agricultural residues
3I	Agriculture other
5	Waste
5A	Biological treatment of waste - Solid waste disposal on land
5B1	Biological treatment of waste - Composting
5B2	Biological treatment of waste - Anaerobic digestion at biogas facilities
5C1a	Municipal waste incineration
5C1bi	Industrial waste incineration
5C1bii	Hazardous waste incineration
5C1biii	Clinical waste incineration
5C1biv	Sewage sludge incineration
5C1bv	Cremation
5C1bvi	Other waste incineration
5C2	Open burning of waste
5D1	Domestic wastewater handling
5D2	Industrial wastewater handling
5D3	Other wastewater handling
5E	Other waste
6	Other
6A	Other (included in national total for entire territory)
1A3ai(ii)	International aviation cruise (civil)
1A3aii(ii)	Domestic aviation cruise (civil)
1A3di(i)	International maritime navigation

Table 11.2 NFR table - NO<sub>x</sub> Emissions

NO <sub>x</sub>	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1A1a	4.08	3.39	2.66	2.29	1.89	0.32	2.69	2.52	3.22	3.36	3.30	2.56	3.89	3.70	3.62	2.74	3.12	2.25	3.52	1.84	3.93	4.24	4.16	3.70	3.71	4.03	3.36	3.48	4.01	
1A1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A1c	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A2a	0.57	0.85	0.53	0.44	0.42	0.40	0.47	0.31	0.28	0.21	0.16	0.21	0.15	0.10	0.26	0.21	0.21	0.24	0.29	0.01	0.17	0.01	0.01	0.07	0.01	0.02	0.02	0.02	0.01	
1A2b	1.60	2.25	1.23	0.81	0.87	0.83	0.83	0.39	0.38	0.40	0.87	0.89	1.26	1.50	1.28	2.71	2.83	2.92	2.72	1.17	0.64	0.57	0.38	0.35	0.06	0.07	0.06	0.06	0.04	
1A2c	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A2d	IE	IE	IE	IE	IE	IE	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	IE	IE	IE	IE	0.01	0.01	0.01	0.01	0.01	
1A2e	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.01	0.02	0.00	0.00	0.01	0.00	0.00	0.11	0.06	0.10	0.12	0.03	0.03	IE	0.00	0.00	0.21	0.18	0.18	0.18	0.18	
1A2f	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.02	0.02	0.03	0.03	0.02	0.02	IE	IE	0.02	0.03	0.04	0.03	0.05	0.07	
1A2gvii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A2gviii	0.11	0.11	0.11	0.09	0.05	0.07	0.09	0.01	0.02	0.02	0.00	0.01	0.02	0.01	0.00	0.15	0.10	0.26	0.26	0.05	0.05	0.04	0.04	0.16	0.67	0.62	0.63	0.80	0.76	
1A3ai(i)	0.03	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.03	0.04	0.02	0.03	0.05	0.05	0.06	0.07	0.09	0.08	0.09	0.09	0.11	0.11	0.09	0.09	0.10	0.12	0.12	
1A3aii(i)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A3bi	0.53	0.55	0.36	0.27	0.30	0.32	0.40	0.45	0.62	0.67	0.58	0.50	0.39	0.47	0.50	0.46	0.53	0.55	0.53	0.66	0.60	0.57	0.54	0.52	0.53	0.56	0.60	0.61	0.65	
1A3bii	0.02	0.02	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.02	0.02	0.03	0.04	0.06	0.05	0.06	0.06	0.05	0.04	0.05	0.03	0.02	0.02	
1A3biii	1.42	1.82	1.06	0.85	0.96	1.05	1.31	1.27	1.88	2.58	2.93	2.49	2.02	1.85	2.44	2.23	2.38	3.33	4.14	4.69	3.98	4.85	4.70	4.46	3.51	4.00	5.00	5.61	6.13	
1A3biv	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A3bv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3bvi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3bvii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3c	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.05	0.05	0.06	0.10	0.11	0.10	0.11	0.12	0.16	NO	NO	NO	NO	NO	NO	NO	NO	
1A3di(ii)	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.19	0.09	0.08	0.08	0.20	0.18	0.35	IE	0.66	0.82	IE	IE	IE	IE	IE	IE	IE	IE	
1A3dii	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.06	0.07	0.07	0.07	0.12	0.13	0.13	0.13	0.13	0.15	0.10	0.13	0.15	0.11	0.11	0.10	IE	IE	
1A3ei	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A3eii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A4ai	0.33	0.30	0.15	0.17	0.14	0.19	0.13	0.25	0.27	0.26	0.31	0.27	0.34	0.33	0.31	0.32	0.30	0.56	0.57	0.47	0.50	0.45	0.34	0.30	0.11	0.13	0.14	0.15	0.16	
1A4aii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4bi	0.75	0.65	0.68	0.74	0.52	0.30	0.29	0.26	0.24	0.25	0.25	0.22	0.31	0.33	0.33	0.31	0.32	0.32	0.32	0.34	0.35	0.36	0.36	0.34	0.32	0.33	0.33	0.32	0.29	
1A4bii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4ci	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4cii	0.31	0.28	0.24	0.21	0.24	0.28	0.24	0.28	0.28	0.24	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.38	0.38	0.24	0.24	0.28	0.08	0.11	0.18	0.19	0.10	0.10	0.11	
1A4ciii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A5a	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	



NOx	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1A5b	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1B1a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B1c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2ai	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2aiv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2av	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2d	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A5a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A5b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A5c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B1	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B2	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B5	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B7	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B10a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B10b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C1	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.02	0.02	0.03	0.01	0.03	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.01	
2C2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C3	0.11	0.10	0.09	0.04	0.01	0.03	0.05	0.08	0.08	0.08	0.10	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.11	0.06	0.11	0.09	0.07	0.05	0.04	0.04	0.04	0.04	0.04	
2C4	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C5	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7a	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7b	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7c	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

NOx	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
2C7d	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3a	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3b	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3c	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3d	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3e	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3f	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3g	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3h	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3i	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2G	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2H1	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2I	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2J	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2K	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2L	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3B1a	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	
3B1b	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3B2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3B3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	
3B4a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3B4d	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3B4e	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3B4f	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
3B4gi	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3B4gii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3B4giii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
3B4giv	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
3B4h	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3Da1	0.07	0.07	0.04	0.02	0.03	0.07	0.05	0.02	0.00	0.01	0.03	0.03	0.00	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.05	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	
3Da2a	0.26	0.27	0.25	0.26	0.25	0.26	0.26	0.26	0.26	0.26	0.25	0.25	0.24	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.22	0.22	0.22	0.23	0.23	0.24	0.25	0.24	
3Da2b	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	

NOx	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
3Da2c	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3Da3	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3Da4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Db	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Dc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Dd	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3De	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Df	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3F	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3I	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5B1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5B2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bi	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1biii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1biv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1bv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bvi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C2	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
5D1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5E	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
6A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
<b>NATIONAL TOTAL</b>	10.37	10.87	7.59	6.36	5.86	4.30	7.01	6.35	7.73	8.57	9.26	8.24	9.30	9.23	9.70	10.43	11.05	12.06	13.68	10.93	12.21	11.98	11.24	10.68	9.92	10.77	11.04	11.87	12.91	
1A3ai(ii)	0.12	0.14	0.02	0.01	0.01	0.01	0.01	0.01	0.05	0.12	0.12	0.15	0.16	0.13	0.03	0.12	0.13	0.04	0.07	0.05	0.13	0.07	0.01	0.02	0.11	0.12	0.11	0.10	0.14	
1A3aii(ii)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3di(i)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	

Table 11.3 NFR table - NMVOC Emissions

NMVOC	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	
1A1a	0.03	0.02	0.02	0.02	0.01	0.00	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.01	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02		
1A1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		
1A1c	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE		
1A2a	0.03	0.04	0.03	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00		
1A2b	0.08	0.11	0.06	0.04	0.04	0.04	0.04	0.02	0.02	0.02	0.04	0.04	0.06	0.07	0.06	0.13	0.14	0.14	0.13	0.06	0.03	0.03	0.02	0.02	0.00	0.00	0.00	0.00	0.00		
1A2c	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	IE	IE	0.01	0.00	IE	0.01	0.03	0.03	0.02	0.02		
1A2d	IE	IE	IE	IE	IE	IE	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00		
1A2e	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00	IE	0.00	0.00	0.10	0.08	0.09	0.08	0.09		
1A2f	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A2gvii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE		
1A2gviii	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.03	0.02	0.03	0.03	0.01	0.01	0.08	0.09	0.09	0.05	0.05	0.05	0.05	0.05		
1A3ai(i)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01		
1A3aii(ii)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		
1A3bi	0.57	0.59	0.39	0.29	0.32	0.34	0.42	0.48	0.66	0.72	0.60	0.52	0.40	0.50	0.50	0.45	0.49	0.48	0.43	0.55	0.49	0.36	0.30	0.26	0.32	0.33	0.34	0.33	0.34		
1A3bii	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.01	0.01	0.00		
1A3biii	0.38	0.53	0.36	0.25	0.27	0.28	0.33	0.33	0.45	0.66	0.62	0.50	0.39	0.42	0.45	0.42	0.45	0.55	0.59	0.71	0.65	0.61	0.63	0.41	0.50	0.56	0.66	0.71	0.74		
1A3biv	0.01	0.01	0.01	0.00	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.04	0.05	0.05	0.04	0.03	0.03	0.03	0.03	0.03	0.04	0.05		
1A3bv	NE	NE	NE	NE	NE	NE	NE	NE	0.20	0.16	0.17	0.13	0.14	0.15	0.13	0.16	0.20	0.25	0.25	0.23	0.20	0.19	0.19	0.18	0.16	0.17	0.18	0.18	0.19		
1A3bvi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
1A3bvii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
1A3c	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	NO	NO	NO	NO	NO	NO	NO	NO		
1A3di(ii)	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.01	0.00	0.00	0.00	0.01	0.01	0.01	IE	0.02	0.03	IE	IE	IE	IE	IE	IE	IE	IE		
1A3dii	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.02	0.03	0.38	0.39	0.03	0.02	0.02	0.02	IE	IE		
1A3ei	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		
1A3eii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		
1A4ai	0.03	0.03	0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.05	0.13	0.13	0.12	0.06	0.10	0.09	0.10	0.07	0.08	0.08	0.09	0.10		
1A4aii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE		
1A4bi	8.57	7.33	7.93	8.74	6.03	3.43	3.25	2.94	2.67	2.77	2.90	2.43	3.53	3.65	3.72	3.57	3.62	3.64	3.64	3.83	4.00	4.10	4.16	3.94	3.78	3.86	3.79	3.73	3.39		

NMVOG	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1A4bii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4ci	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4cii	0.03	0.03	0.02	0.02	0.02	0.03	0.02	0.03	0.03	0.02	0.04	0.02	0.02	0.02	0.02	0.02	0.02	0.04	0.04	0.02	0.02	0.05	0.03	0.03	0.03	0.03	0.02	0.02	0.02	
1A4ciii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A5a	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A5b	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1B1a	1.40	1.39	1.35	1.15	1.00	0.67	1.12	1.03	1.27	1.21	1.25	0.95	1.44	1.29	1.22	1.04	1.21	0.96	1.39	0.77	1.40	1.55	1.58	1.35	1.32	1.42	1.12	1.18	1.28	
1B1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B1c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2ai	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2aiv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2av	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1B2b	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1B2c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2d	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A5a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A5b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A5c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B1	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B5	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B7	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B10a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

NMVOG	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
2B10b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C1	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2C2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C4	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C5	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7a	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7b	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7c	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7d	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3a	0.70	0.70	0.70	0.71	0.71	0.71	0.71	0.72	0.72	0.72	0.73	0.73	0.73	0.73	0.74	0.74	0.74	0.74	0.74	0.74	0.70	0.74	0.74	0.75	0.75	0.75	0.75	0.75	0.75	
2D3b	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2D3c	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2D3d	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2D3e	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2D3f	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3g	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3h	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2D3i	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2G	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2H1	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H2	0.18	0.17	0.14	0.09	0.12	0.14	0.13	0.13	0.14	0.17	0.18	0.19	0.12	0.17	0.16	0.17	0.18	0.18	0.19	0.16	0.18	0.14	0.14	0.13	0.13	0.13	0.13	0.13	0.13	
2H3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2I	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2J	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2K	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2L	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3B1a	1.05	1.05	0.99	0.96	0.99	1.00	1.00	0.99	1.00	1.03	0.97	0.97	0.99	1.02	0.69	0.67	0.64	0.59	0.59	0.57	0.54	0.48	0.48	0.50	0.51	0.51	0.48	0.49	0.48	

NMVOG	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
3B1b	0.21	0.21	0.20	0.18	0.18	0.20	0.20	0.19	0.19	0.19	0.21	0.21	0.21	0.17	0.11	0.13	0.13	0.13	0.12	0.11	0.10	0.10	0.09	0.10	0.11	0.11	0.11	0.09	0.08	
3B2	0.08	0.08	0.08	0.07	0.07	0.08	0.07	0.07	0.06	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	
3B3	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.02	0.01	0.02	0.01	0.01	0.02	0.02	0.03	0.02	0.03	0.03	0.03	0.05	0.03	0.03	
3B4a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3B4d	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	
3B4e	0.09	0.08	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	
3B4f	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
3B4gi	0.12	0.12	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.10	0.10	0.11	0.11	0.06	0.06	0.06	0.06	0.05	0.05	0.06	0.05	0.07	0.09	0.08	0.09	0.11	0.11	0.09	
3B4gii	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.01	0.01	0.01	0.02	0.01	0.01	
3B4giii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
3B4giv	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
3B4h	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3Da1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da2a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da2b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da2c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da3	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3Da4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Db	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Dc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Dd	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3De	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3Df	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3F	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3I	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5A	0.43	0.43	0.44	0.44	0.46	0.48	0.50	0.51	0.53	0.54	0.53	0.52	0.51	0.50	0.49	0.48	0.46	0.51	0.48	0.50	0.50	0.51	0.48	0.48	0.47	0.49	0.50	0.51	0.52	
5B1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5B2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

NMVOIC	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
5C1bi	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1biii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1biv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1bv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bvi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C2	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
5D1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D2	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
5D3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5E	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
6A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
NATIONAL TOTAL	14.11	13.05	13.01	13.28	10.57	7.73	8.17	7.80	8.28	8.59	8.62	7.58	8.94	9.10	8.61	8.33	8.62	8.67	9.07	8.67	9.23	9.68	9.68	8.64	8.59	8.90	8.66	8.67	8.46	
1A3ai(ii)	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01		
1A3aii(ii)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3di(i)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	



Table 11.4 NFR table - SO<sub>2</sub> Emissions

SO <sub>2</sub>	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1A1a	25.81	21.52	17.14	14.87	12.08	1.46	17.53	15.89	20.74	21.60	21.15	16.00	25.14	23.75	23.09	18.59	21.20	15.27	23.89	12.51	26.64	28.75	28.21	25.16	25.20	27.39	22.20	22.95	26.45	
1A1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A1c	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A2a	0.05	0.08	0.05	0.04	0.04	0.04	0.04	0.03	0.03	0.02	0.01	0.02	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	
1A2b	0.15	0.21	0.11	0.07	0.08	0.08	0.08	0.04	0.03	0.04	0.08	0.08	0.12	0.14	0.12	0.25	0.26	0.27	0.25	0.11	0.06	0.05	0.04	0.03	0.01	0.01	0.01	0.01	0.00	
1A2c	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.03	0.02	0.03	0.02	IE	IE	0.00	0.00	IE	0.00	0.00	0.00	0.00	0.00	
1A2d	IE	IE	IE	IE	IE	IE	0.14	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	
1A2e	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.00	0.03	0.00	0.02	0.03	0.02	0.02	0.04	0.02	0.07	0.04	0.00	0.00	IE	0.00	0.00	0.02	0.03	0.03	0.03	0.03	
1A2f	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.02	0.02	0.03	0.03	0.00	0.00	IE	IE	0.00	0.00	0.00	0.00	0.00	0.01	
1A2gvii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A2gviii	0.04	0.04	0.04	0.05	0.03	0.05	0.05	0.03	0.00	0.09	0.00	0.08	0.09	0.03	0.03	0.24	0.11	0.16	0.17	0.05	0.00	0.00	0.00	0.01	0.06	0.06	0.06	0.07	0.07	
1A3ai(i)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
1A3aii(i)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A3bi	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3bii	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3biii	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3biv	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3bv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3bvi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3bvii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3c	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	NO	NO	NO	NO	NO	NO	NO	NO	
1A3di(ii)	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.05	0.02	0.02	0.02	0.05	0.05	0.09	IE	0.17	0.21	IE	IE	IE	IE	IE	IE	IE	IE	
1A3dii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	IE	IE	IE	IE	IE	IE	
1A3ei	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A3eii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A4ai	0.10	0.09	0.05	0.05	0.04	0.06	0.04	0.08	0.08	0.08	0.10	0.08	0.10	0.10	0.09	0.10	0.09	0.17	0.17	0.14	0.15	0.13	0.10	0.09	0.03	0.04	0.04	0.04	0.04	
1A4aii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4bi	0.16	0.14	0.15	0.16	0.11	0.07	0.06	0.06	0.05	0.05	0.06	0.05	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.06	

SO2	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1A4bii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4ci	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4cii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A4ciii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A5a	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A5b	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1B1a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B1c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2ai	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2aiv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2av	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2d	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A5a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A5b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A5c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B5	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B7	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B10a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

SO2	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	
2B10b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C1	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2C2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C3	0.53	0.51	0.45	0.19	0.06	0.13	0.26	0.40	0.38	0.40	0.48	0.54	0.58	0.60	0.60	0.60	0.61	0.62	0.56	0.32	0.53	0.47	0.37	0.24	0.21	0.21	0.20	0.20	0.20	
2C4	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C5	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7d	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3a	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3b	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3c	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3d	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3e	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3f	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3g	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3h	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3i	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2G	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2H1	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2I	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2J	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2K	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2L	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3B1a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	

SO2	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
3B1b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4d	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4e	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4f	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4gi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4gii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4giii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4giv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4h	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da2a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da2b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da2c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Db	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Dc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Dd	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3De	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Df	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3F	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3I	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5B1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5B2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

SO2	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
5C1bi	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1biii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1biv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1bv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bvi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C2	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
5D1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5E	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
6A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
<b>NATIONAL TOTAL</b>	26.87	22.61	18.01	15.46	12.47	1.90	18.21	16.73	21.33	22.32	21.88	16.92	26.17	24.74	24.08	20.01	22.48	16.82	25.24	13.38	27.71	29.50	28.81	25.64	25.62	27.82	22.62	23.39	26.88	
1A3ai(ii)	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01	
1A3aii(ii)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3di(i)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	

Table 11.5 NFR table - NH3 Emissions

NO <sub>x</sub>	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1A1a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A1c	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A2a	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	IE	IE	IE	
1A2b	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	IE	IE	
1A2c	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	
1A2d	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A2e	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.01	0.01	0.01	0.01	0.01	
1A2f	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	IE	
1A2gvii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A2gviii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	
1A3ai(i)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3aii(i)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A3bi	0.06	0.07	0.04	0.03	0.04	0.04	0.05	0.05	0.07	0.08	0.07	0.06	0.04	0.05	0.05	0.05	0.05	0.05	0.04	0.06	0.05	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	
1A3bii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A3biii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A3biv	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A3bv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3bvi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3bvii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3c	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NO	NO	NO	NO	NO	NO	NO	NO	
1A3di(ii)	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A3dii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	IE	
1A3ei	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A3eii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A4ai	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
1A4aii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4bi	1.00	0.45	0.49	0.54	0.37	0.21	0.20	0.18	0.16	0.17	0.18	0.15	0.22	0.22	0.23	0.22	0.22	0.22	0.22	0.24	0.25	0.25	0.26	0.24	0.23	0.24	0.23	0.23	0.21	

NOx	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1A4bii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4ci	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4cii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A4ciii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A5a	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A5b	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1B1a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B1c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2ai	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2aiv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2av	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2d	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A5a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A5b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A5c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B1	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B5	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B7	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B10a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

NOx	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
2B10b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C4	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C5	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7a	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7b	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7c	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7d	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3a	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3b	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3c	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3d	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3e	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3f	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3g	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3h	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3i	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2G	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2H1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2I	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2J	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2K	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2L	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3B1a	3.72	3.72	3.51	3.42	3.51	3.56	3.56	3.53	3.56	3.67	3.46	3.44	3.53	3.63	2.45	2.37	2.28	2.09	2.10	2.02	1.92	1.70	1.72	1.77	1.83	1.81	1.72	1.73	1.71	



NOx	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
3B1b	0.54	0.53	0.50	0.46	0.46	0.51	0.51	0.48	0.49	0.47	0.53	0.53	0.54	0.44	0.29	0.32	0.33	0.33	0.30	0.28	0.26	0.25	0.23	0.25	0.27	0.27	0.27	0.24	0.22	
3B2	0.68	0.68	0.63	0.60	0.60	0.63	0.61	0.55	0.47	0.43	0.41	0.34	0.34	0.35	0.36	0.36	0.35	0.31	0.29	0.28	0.28	0.29	0.29	0.27	0.29	0.27	0.27	0.26	0.26	
3B3	0.15	0.14	0.14	0.13	0.13	0.13	0.13	0.14	0.14	0.13	0.12	0.13	0.13	0.14	0.08	0.07	0.09	0.07	0.06	0.08	0.07	0.14	0.12	0.13	0.14	0.16	0.36	0.16	0.15	
3B4a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3B4d	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.04	0.05	0.04	0.04	0.04	0.04	
3B4e	0.29	0.29	0.25	0.24	0.24	0.24	0.23	0.22	0.21	0.18	0.16	0.15	0.14	0.13	0.11	0.11	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.07	0.07	0.07	0.06	0.06	0.06	
3B4f	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3B4gi	0.33	0.34	0.31	0.29	0.29	0.28	0.28	0.27	0.29	0.27	0.29	0.30	0.30	0.32	0.18	0.17	0.16	0.18	0.16	0.15	0.18	0.13	0.21	0.25	0.24	0.25	0.31	0.31	0.27	
3B4gii	0.10	0.10	0.09	0.09	0.09	0.08	0.08	0.08	0.09	0.08	0.09	0.09	0.09	0.10	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.09	0.14	0.04	0.04	0.03	0.08	0.06	1.45	
3B4giii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
3B4giv	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
3B4h	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3Da1	0.09	0.09	0.05	0.03	0.04	0.09	0.06	0.03	0.00	0.01	0.04	0.04	0.00	0.02	0.02	0.03	0.03	0.03	0.04	0.03	0.06	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	
3Da2a	1.58	1.58	1.48	1.43	1.46	1.48	1.48	1.45	1.46	1.47	1.42	1.40	1.44	1.45	0.98	0.96	0.92	0.87	0.85	0.81	0.79	0.73	0.76	0.77	0.80	0.79	0.83	0.79	0.91	
3Da2b	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
3Da2c	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
3Da3	0.98	0.97	0.90	0.87	0.88	0.90	0.89	0.84	0.79	0.77	0.73	0.68	0.68	0.69	0.55	0.54	0.52	0.47	0.45	0.43	0.42	0.41	0.40	0.41	0.43	0.42	0.40	0.40	0.99	
3Da4	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
3Db	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3Dc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3Dd	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3De	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3Df	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3F	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
3I	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5B1	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5B2	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5C1a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

NOx	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
5C1bi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1bii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1biii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1biv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1bv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1bvi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D1	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
5D2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5E	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
6A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
NATIONAL TOTAL	9.60	9.05	8.47	8.20	8.18	8.23	8.16	7.91	7.79	7.79	7.55	7.36	7.52	7.61	5.39	5.27	5.12	4.81	4.69	4.54	4.45	4.18	4.29	4.33	4.48	4.45	4.67	4.38	6.36	
1A3ai(ii)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3aii(ii)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3di(i)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	

Table 11.6 NFR table - CO Emissions

CO	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	
1A1a	0.19	0.15	0.11	0.10	0.08	0.03	0.11	0.12	0.14	0.15	0.14	0.12	0.17	0.16	0.16	0.10	0.11	0.08	0.13	0.07	0.14	0.15	0.15	0.13	0.13	0.14	0.12	0.12	0.14		
1A1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A1c	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A2a	0.07	0.11	0.07	0.06	0.05	0.05	0.06	0.04	0.04	0.03	0.02	0.03	0.02	0.01	0.03	0.03	0.03	0.03	0.04	0.01	0.02	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.00		
1A2b	0.21	0.29	0.16	0.10	0.11	0.11	0.11	0.05	0.05	0.05	0.11	0.11	0.16	0.19	0.17	0.35	0.36	0.38	0.35	0.15	0.08	0.07	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.01	
1A2c	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.03	0.02	0.03	0.02	IE	IE	0.01	0.01	IE	0.02	0.06	0.06	0.04	0.04		
1A2d	IE	IE	IE	IE	IE	IE	0.14	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	
1A2e	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.00	0.03	0.00	0.02	0.03	0.02	0.02	0.04	0.02	0.07	0.05	0.00	0.00	IE	0.00	0.00	0.19	0.18	0.18	0.17	0.18		
1A2f	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.02	0.02	0.03	0.03	0.00	0.00	IE	IE	0.00	0.01	0.01	0.01	0.01	0.01	0.01	
1A2gvii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A2gviii	0.05	0.05	0.05	0.06	0.04	0.06	0.06	0.03	0.00	0.10	0.00	0.08	0.10	0.03	0.03	0.25	0.13	0.18	0.19	0.06	0.01	0.16	0.16	0.17	0.11	0.11	0.11	0.13	0.12		
1A3ai(i)	0.05	0.05	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.05	0.05	0.06	0.03	0.04	0.07	0.07	0.08	0.11	0.12	0.11	0.13	0.13	0.16	0.16	0.12	0.13	0.14	0.17	0.17		
1A3aii(ii)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A3bi	4.82	5.00	3.30	2.46	2.73	2.89	3.51	4.02	5.52	6.05	5.08	4.39	3.40	4.17	4.20	3.71	4.04	3.91	3.55	4.52	4.03	2.91	2.44	2.14	2.55	2.62	2.68	2.65	2.67		
1A3bii	0.11	0.15	0.09	0.07	0.08	0.09	0.11	0.11	0.13	0.19	0.15	0.13	0.11	0.13	0.13	0.11	0.10	0.10	0.13	0.21	0.19	0.15	0.15	0.12	0.13	0.14	0.07	0.04	0.04		
1A3biii	2.48	3.44	2.34	1.61	1.76	1.78	2.14	2.14	2.89	4.25	3.89	3.09	2.39	2.67	2.76	2.49	2.58	3.12	3.27	3.99	3.65	3.21	3.31	2.10	2.64	2.94	3.42	3.68	3.81		
1A3biv	0.03	0.02	0.02	0.02	0.03	0.06	0.06	0.07	0.03	0.03	0.04	0.03	0.03	0.09	0.07	0.06	0.06	0.10	0.14	0.20	0.19	0.14	0.12	0.12	0.11	0.12	0.13	0.13	0.18		
1A3bv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3bvi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3bvii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3c	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.03	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A3di(ii)	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.02	0.01	0.01	0.01	0.02	0.02	0.03	IE	0.06	0.08	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A3dii	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.04	0.06	0.07	0.07	0.07	0.07	0.08	1.19	1.21	0.08	0.06	0.06	0.05	IE	IE		
1A3ei	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A3eii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A4ai	0.11	0.10	0.06	0.06	0.06	0.07	0.04	0.09	0.09	0.09	0.10	0.09	0.11	0.12	0.11	0.12	0.15	0.34	0.34	0.31	0.20	0.27	0.23	0.24	0.14	0.18	0.18	0.19	0.21		
1A4aii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4bi	57.13	48.85	52.85	58.25	40.22	22.84	21.69	19.62	17.79	18.46	19.32	16.18	23.57	24.33	24.81	23.83	24.11	24.31	24.31	25.54	26.66	27.37	27.71	26.24	25.17	25.74	25.30	24.90	22.62		

CO	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1A4bii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4ci	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4cii	0.10	0.09	0.08	0.07	0.08	0.09	0.08	0.09	0.09	0.08	0.85	0.08	0.08	0.08	0.08	0.08	0.08	0.13	0.13	0.08	0.08	0.86	0.79	0.80	0.60	0.68	0.34	0.26	0.34	
1A4ciii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A5a	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A5b	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1B1a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B1c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2ai	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2aiv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2av	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2d	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A5a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A5b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A5c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B1	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B5	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B7	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B10a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

CO	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
2B10b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C1	0.35	0.33	0.24	0.20	0.19	0.15	0.17	0.23	0.24	0.15	0.14	0.19	0.14	0.10	0.26	0.17	0.27	0.30	0.34	0.18	0.35	0.10	0.04	0.03	0.02	0.06	0.08	0.08	0.08	
2C2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C3	12.65	12.28	10.70	4.57	1.38	3.13	6.13	9.67	9.19	9.71	11.46	12.97	13.98	14.43	14.50	14.45	14.62	14.91	13.36	7.61	12.65	11.19	8.93	5.80	5.13	5.10	4.75	4.86	4.82	
2C4	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C5	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7a	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7b	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7c	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7d	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3a	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3b	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3d	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3e	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3f	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3g	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3h	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3i	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2G	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2H1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2I	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2J	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2K	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2L	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3B1a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	

CO	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
3B1b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4d	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4e	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4f	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4gi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4gii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4giii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4giv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4h	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da2a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da2b	NA	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3Da2c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Db	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Dc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Dd	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3De	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Df	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3F	NA	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3I	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5B1	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5B2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

CO	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
5C1bi	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1biii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1biv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bvi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C2	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
5D1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5E	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
6A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
<b>NATIONAL TOTAL</b>	78.39	70.97	70.13	67.67	46.86	31.41	34.47	36.51	36.25	39.43	41.40	37.63	44.38	46.62	47.44	46.01	46.88	48.23	46.59	43.16	48.58	47.91	45.46	38.21	37.16	38.28	37.62	37.45	35.45	
1A3ai(ii)	0.12	0.14	0.02	0.01	0.01	0.01	0.01	0.01	0.05	0.12	0.12	0.15	0.16	0.13	0.03	0.12	0.13	0.04	0.07	0.05	0.13	0.07	0.01	0.02	0.11	0.12	0.11	0.10	0.14	
1A3aii(ii)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3di(i)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	

Table 11.7 NFR table - TSP Emissions

TSP	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	
1A1a	0.30	0.25	0.18	0.15	0.13	0.06	0.17	0.19	0.22	0.24	0.23	0.21	0.26	0.26	0.26	0.13	0.15	0.11	0.17	0.09	0.19	0.20	0.20	0.18	0.18	0.19	0.16	0.16	0.19		
1A1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A1c	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A2a	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A2b	0.06	0.09	0.05	0.03	0.03	0.03	0.03	0.02	0.01	0.02	0.03	0.03	0.05	0.06	0.05	0.11	0.11	0.11	0.11	0.05	0.03	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	
1A2c	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	IE	IE	0.00	0.00	IE	0.01	0.02	0.02	0.01	0.01		
1A2d	IE	IE	IE	IE	IE	IE	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	
1A2e	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00	IE	0.00	0.00	0.05	0.04	0.04	0.04	0.04		
1A2f	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A2gvii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A2gviii	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.04	0.02	0.03	0.03	0.01	0.00	0.04	0.04	0.04	0.03	0.03	0.03	0.04	0.03		
1A3ai(i)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
1A3aii(ii)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A3bi	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.02	0.02	0.03	0.03	0.03		
1A3bii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
1A3biii	0.03	0.04	0.02	0.02	0.02	0.02	0.03	0.03	0.05	0.06	0.07	0.06	0.05	0.04	0.06	0.06	0.06	0.08	0.11	0.12	0.10	0.13	0.12	0.12	0.09	0.10	0.13	0.15	0.16		
1A3biv	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
1A3bv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3bvi	NE	NE	NE	NE	NE	NE	NE	NE	0.05	0.05	0.06	0.04	0.04	0.04	0.04	0.04	0.05	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.08	0.08		
1A3bvii	NE	NE	NE	NE	NE	NE	NE	NE	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03		
1A3c	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NO	NO	NO	NO	NO	NO	NO	NO		
1A3di(ii)	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.01	0.01	0.01	0.01	0.02	0.01	0.03	IE	0.05	0.06	IE	IE	IE	IE	IE	IE	IE	IE		
1A3dii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.02	0.01	0.01	0.01	IE	IE		
1A3ei	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A3eii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A4ai	0.02	0.02	0.01	0.01	0.01	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.02	0.03	0.04	0.09	0.09	0.08	0.05	0.07	0.06	0.06	0.04	0.05	0.05	0.05	0.06		
1A4aii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4bi	11.42	9.77	10.57	11.65	8.04	4.57	4.34	3.92	3.56	3.69	3.86	3.23	4.71	4.86	4.96	4.76	4.82	4.86	4.86	5.11	5.33	5.47	5.54	5.25	5.03	5.15	5.06	4.98	4.52		



TSP	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1A4bii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4ci	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4cii	0.02	0.02	0.01	0.01	0.01	0.02	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.00	0.01	0.01	0.01	0.01	0.01	0.01	
1A4ciii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A5a	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A5b	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1B1a	0.16	0.15	0.15	0.13	0.11	0.07	0.13	0.11	0.14	0.13	0.14	0.11	0.16	0.14	0.14	0.12	0.13	0.11	0.15	0.09	0.16	0.17	0.18	0.15	0.15	0.16	0.12	0.13	0.14	
1B1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B1c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2ai	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2aiv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2av	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2d	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A1	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A2	0.12	0.11	0.08	0.05	0.01	0.02	0.03	0.03	0.03	0.03	0.02	0.05	0.04	0.03	0.04	0.02	0.03	0.02	0.03	0.02	0.12	0.01	NO	NO	NO	NO	NO	NO	NO	
2A3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A5a	0.08	0.09	0.08	0.01	NO	0.01	0.03	0.05	0.02	0.05	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.00	0.08	0.02	NO	0.01	0.02	0.01	NO	0.09	0.05	
2A5b	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2A5c	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2A6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B5	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B7	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B10a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

TSP	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
2B10b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C1	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2C2	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C3	0.06	0.06	0.05	0.02	0.01	0.02	0.03	0.05	0.05	0.05	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.04	0.06	0.06	0.04	0.03	0.03	0.03	0.02	0.02	0.02	
2C4	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C5	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7d	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3a	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3d	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3e	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3f	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3g	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3h	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3i	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2G	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2H1	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2I	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2J	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2K	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2L	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3B1a	0.18	0.18	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.18	0.17	0.17	0.17	0.18	0.12	0.11	0.11	0.10	0.10	0.10	0.09	0.08	0.08	0.09	0.09	0.09	0.08	0.08	0.08	

TSP	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
3B1b	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.01	
3B2	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.05	0.05	0.04	0.04	0.03	0.03	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	
3B3	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.02	0.02	0.05	0.02	0.02
3B4a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3B4d	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3B4e	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3B4f	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
3B4gi	0.13	0.14	0.13	0.12	0.12	0.11	0.11	0.11	0.12	0.11	0.12	0.12	0.12	0.13	0.07	0.07	0.07	0.07	0.06	0.06	0.07	0.05	0.08	0.10	0.10	0.10	0.13	0.13	0.11	
3B4gii	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	
3B4giii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
3B4giv	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
3B4h	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3Da1	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3Da2a	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3Da2b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3Da2c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Db	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Dc	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3Dd	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3De	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Df	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3F	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3I	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5B1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5B2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

TSP	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
5C1bi	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1biii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1biv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bvi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C2	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
5D1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5E	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
6A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
NATIONAL TOTAL	12.79	11.12	11.68	12.53	8.84	5.30	5.29	4.90	4.62	4.80	5.02	4.35	5.95	6.06	6.04	5.80	5.90	6.02	6.11	6.02	6.56	6.57	6.61	6.26	6.02	6.19	6.11	6.12	5.66	
1A3ai(ii)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A3aii(ii)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3di(i)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	

Table 11.8 NFR table - PM10 Emissions

PM10	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1A1a	0.21	0.17	0.12	0.10	0.09	0.04	0.12	0.13	0.15	0.16	0.16	0.14	0.18	0.18	0.18	0.09	0.10	0.07	0.11	0.06	0.13	0.14	0.14	0.12	0.12	0.13	0.11	0.11	0.13	
1A1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A1c	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A2a	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A2b	0.06	0.09	0.05	0.03	0.03	0.03	0.03	0.02	0.01	0.02	0.03	0.03	0.05	0.06	0.05	0.11	0.11	0.11	0.11	0.05	0.03	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.00	
1A2c	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	IE	IE	0.00	0.00	IE	0.01	0.02	0.02	0.01	0.01	
1A2d	IE	IE	IE	IE	IE	IE	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	
1A2e	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00	IE	0.00	0.00	0.05	0.04	0.04	0.04	0.04	
1A2f	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	
1A2gvii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A2gviii	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.03	0.02	0.03	0.03	0.01	0.00	0.04	0.04	0.04	0.03	0.03	0.03	0.04	0.03	
1A3ai(i)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
1A3aii(ii)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A3bi	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.02	0.02	0.03	0.03	0.03	
1A3bii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A3biii	0.03	0.04	0.02	0.02	0.02	0.02	0.03	0.03	0.05	0.06	0.07	0.06	0.05	0.04	0.06	0.06	0.06	0.08	0.11	0.12	0.10	0.13	0.12	0.12	0.09	0.10	0.13	0.15	0.16	
1A3biv	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A3bv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3bvi	NE	NE	NE	NE	NE	NE	NE	NE	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06
1A3bvii	NE	NE	NE	NE	NE	NE	NE	NE	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	
1A3c	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NO	NO	NO	NO	NO	NO	NO	NO	
1A3di(ii)	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.01	0.01	0.01	0.01	0.02	0.01	0.03	IE	0.05	0.06	IE	IE	IE	IE	IE	IE	IE	IE	
1A3dii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.02	0.01	0.01	0.01	IE	IE	
1A3ei	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A3eii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A4ai	0.02	0.02	0.01	0.01	0.01	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.02	0.03	0.04	0.09	0.09	0.08	0.05	0.07	0.06	0.06	0.04	0.05	0.05	0.05	0.06	
1A4aii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4bi	10.85	9.28	10.04	11.07	7.64	4.34	4.12	3.73	3.38	3.51	3.67	3.07	4.48	4.62	4.71	4.53	4.58	4.62	4.62	4.85	5.06	5.20	5.26	4.98	4.78	4.89	4.81	4.73	4.30	

PM10	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1A4bii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4ci	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4cii	0.02	0.02	0.01	0.01	0.01	0.02	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.00	0.01	0.01	0.01	0.01	0.01	0.01	
1A4ciii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A5a	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A5b	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1B1a	0.07	0.07	0.07	0.06	0.05	0.04	0.06	0.05	0.07	0.06	0.07	0.05	0.08	0.07	0.06	0.05	0.06	0.05	0.07	0.04	0.07	0.08	0.08	0.07	0.07	0.07	0.06	0.06	0.07	
1B1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B1c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2ai	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2aiv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2av	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2d	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A1	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A2	0.12	0.11	0.08	0.05	0.01	0.02	0.03	0.03	0.03	0.03	0.02	0.05	0.04	0.03	0.04	0.02	0.03	0.02	0.03	0.02	0.12	0.01	NO	NO	NO	NO	NO	NO	NO	
2A3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A5a	0.04	0.04	0.04	0.01	NO	0.00	0.02	0.02	0.01	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.00	0.04	0.01	NO	0.00	0.01	0.00	NO	0.05	0.02	
2A5b	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2A5c	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2A6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B5	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B7	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B10a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

PM10	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
2B10b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2C2	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C3	0.05	0.05	0.04	0.02	0.01	0.01	0.03	0.04	0.04	0.04	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.03	0.05	0.05	0.04	0.02	0.02	0.02	0.02	0.02	0.02	
2C4	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C5	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7b	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7c	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7d	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3a	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3d	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3e	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3f	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3g	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3h	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3i	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2G	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2H1	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H2	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2H3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2I	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2J	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2K	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2L	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3B1a	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.05	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	

PM10	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
3B1b	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
3B2	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
3B3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	
3B4a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3B4d	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3B4e	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3B4f	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
3B4gi	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.03	0.03	0.03	0.01	0.01	0.01	0.02	0.01	0.01	0.02	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.02	
3B4gii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	
3B4giii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
3B4giv	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
3B4h	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3Da1	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3Da2a	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3Da2b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3Da2c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Db	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Dc	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3Dd	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3De	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Df	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3F	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3I	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5B1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5B2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	



PM10	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
5C1bi	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1biii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1biv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bvi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C2	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
5D1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5E	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
6A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
NATIONAL TOTAL	11.70	10.13	10.70	11.57	8.08	4.74	4.67	4.30	4.00	4.18	4.37	3.76	5.24	5.35	5.42	5.24	5.32	5.45	5.51	5.52	5.93	5.96	5.98	5.66	5.42	5.58	5.49	5.47	5.06	
1A3ai(ii)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A3aii(ii)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3di(i)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	

Table 11.9 NFR table - PM2.5 Emissions

PM2.5	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019			
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt			
1A1a	0.12	0.10	0.07	0.05	0.05	0.03	0.06	0.08	0.08	0.09	0.09	0.08	0.10	0.10	0.10	0.04	0.04	0.03	0.05	0.02	0.05	0.06	0.06	0.05	0.05	0.05	0.04	0.05	0.05				
1A1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO			
1A1c	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE			
1A2a	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
1A2b	0.06	0.09	0.05	0.03	0.03	0.03	0.03	0.02	0.01	0.02	0.03	0.03	0.05	0.06	0.05	0.11	0.11	0.11	0.11	0.05	0.03	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00			
1A2c	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	IE	IE	0.00	0.00	IE	0.01	0.02	0.01	0.01	0.01	0.01			
1A2d	IE	IE	IE	IE	IE	IE	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
1A2e	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00	IE	0.00	0.00	0.05	0.04	0.04	0.04	0.04	0.04			
1A2f	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
1A2gvii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE		
1A2gviii	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.03	0.02	0.02	0.03	0.01	0.00	0.04	0.04	0.04	0.03	0.03	0.03	0.04	0.03	0.03			
1A3ai(i)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
1A3aii(ii)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		
1A3bi	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.03	0.03		
1A3bii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
1A3biii	0.03	0.04	0.02	0.02	0.02	0.02	0.03	0.03	0.05	0.06	0.07	0.06	0.05	0.04	0.06	0.06	0.06	0.08	0.11	0.12	0.10	0.13	0.12	0.12	0.09	0.10	0.13	0.15	0.16	0.16	0.16		
1A3biv	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
1A3bv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
1A3bvi	NE	NE	NE	NE	NE	NE	NE	NE	0.18	0.14	0.15	0.11	0.12	0.13	0.12	0.15	0.18	0.23	0.24	0.22	0.20	0.20	0.20	0.21	0.21	0.21	0.22	0.22	0.22	0.24	0.24		
1A3bvii	NE	NE	NE	NE	NE	NE	NE	NE	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	
1A3c	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		
1A3di(ii)	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.01	0.01	0.01	0.01	0.01	0.01	0.02	IE	0.05	0.06	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE		
1A3dii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.02	0.01	0.01	0.01	IE	IE	IE	IE		
1A3ei	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A3eii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A4ai	0.02	0.02	0.01	0.01	0.01	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.08	0.08	0.07	0.04	0.06	0.06	0.06	0.04	0.05	0.05	0.05	0.05	0.05	0.05		
1A4aii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4bi	10.57	9.04	9.78	10.78	7.44	4.22	4.01	3.63	3.29	3.41	3.57	2.99	4.36	4.50	4.59	4.41	4.46	4.50	4.50	4.72	4.93	5.06	5.13	4.85	4.66	4.76	4.68	4.61	4.18	4.18	4.18	4.18	

PM2.5	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1A4bii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4ci	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4cii	0.02	0.02	0.01	0.01	0.01	0.02	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.00	0.01	0.01	0.01	0.01	0.01	0.01	
1A4ciii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A5a	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A5b	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1B1a	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
1B1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B1c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2ai	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2aiv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2av	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2d	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A1	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A2	0.02	0.02	0.02	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.01	0.00	0.02	0.00	NO	NO	NO	NO	NO	NO	NO	
2A3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A5a	0.00	0.00	0.00	0.00	NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NO	0.00	0.00	0.00	NO	0.00	0.00	
2A5b	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2A5c	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2A6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B5	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B7	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B10a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

PM2.5	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
2B10b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2C2	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C3	0.04	0.04	0.04	0.02	0.00	0.01	0.02	0.03	0.03	0.03	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.03	0.04	0.04	0.03	0.02	0.02	0.02	0.02	0.02	0.02	
2C4	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C5	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7b	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7c	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7d	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3a	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3d	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3e	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3f	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3g	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3h	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3i	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2G	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2H1	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2I	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2J	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2K	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2L	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3B1a	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.02	

PM2.5	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
3B1b	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	
3B2	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3B3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3B4a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3B4d	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3B4e	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3B4f	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
3B4gi	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3B4gii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3B4giii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
3B4giv	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
3B4h	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3Da1	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3Da2a	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3Da2b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3Da2c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Db	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Dc	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3Dd	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3De	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Df	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3F	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3I	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5B1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5B2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

PM2.5	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
5C1bi	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1biii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1biv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bvi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C2	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
5D1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5E	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
6A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
<b>NATIONAL TOTAL</b>	11.03	9.51	10.12	11.05	7.70	4.48	4.33	3.96	3.80	3.92	4.12	3.51	4.90	5.05	5.13	5.01	5.10	5.30	5.32	5.41	5.61	5.75	5.78	5.49	5.26	5.40	5.34	5.29	4.90	
1A3ai(ii)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A3aii(ii)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3di(i)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	

Table 11.10 NFR table - BC Emissions

BC	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1A1a	0.04	0.03	0.03	0.02	0.02	0.00	0.03	0.02	0.03	0.03	0.03	0.02	0.04	0.04	0.04	0.03	0.04	0.03	0.04	0.02	0.05	0.05	0.05	0.04	0.04	0.05	0.04	0.04	0.05	
1A1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A1c	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A2a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A2b	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	IE	IE	
1A2c	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.04	0.09	0.09	0.06	0.06	
1A2d	NA	NA	NA	NA	NA	NA	NA	NA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A2e	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.26	0.22	0.22	0.21	0.22	
1A2f	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.01	0.01	0.01	IE	IE	
1A2gvii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A2gviii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	IE	0.00	0.00	0.23	0.25	0.23	0.02	0.03	0.03	0.03	0.02	
1A3ai(i)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3aii(i)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A3bi	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3bii	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3biii	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3biv	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3bv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3bvi	NE	NE	NE	NE	NE	NE	NE	NE	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	
1A3bvii	NE	NE	NE	NE	NE	NE	NE	NE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A3c	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NO	NO	NO	NO	NO	NO	NO	NO	
1A3di(ii)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3dii	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3ei	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A3eii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A4ai	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	IE	0.00	0.00	0.00	0.00	0.00	
1A4aii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4bi	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

BC	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1A4bii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4ci	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4cii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	
1A4ciii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A5a	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A5b	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1B1a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B1c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2ai	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2aiv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2av	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2d	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A1	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NO	NO	NO	NO	NO	NO	NO	
2A3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A5a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A5b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A5c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B5	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B7	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B10a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	



BC	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	
2B10b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2C2	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2C4	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C5	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7b	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7c	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7d	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3a	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3d	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3e	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3f	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3g	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3h	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3i	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2G	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2H1	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2I	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2J	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2K	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2L	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3B1a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	

BC	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
3B1b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4d	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4e	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4f	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4gi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4gii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4giii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4giv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4h	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da2a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da2b	NA	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3Da2c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Db	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Dc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Dd	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3De	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Df	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3F	NA	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3I	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5B1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5B2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

BC	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
5C1bi	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1biii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1biv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1bv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1bvi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C2	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
5D1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5E	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
6A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
<b>NATIONAL TOTAL</b>	0.04	0.04	0.03	0.03	0.02	0.00	0.03	0.03	0.06	0.05	0.06	0.04	0.06	0.05	0.05	0.05	0.06	0.05	0.07	0.05	0.07	0.31	0.33	0.31	0.40	0.42	0.41	0.37	0.39	
1A3ai(ii)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3aii(ii)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3di(i)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	

Table 11.11 NFR table - Pb Emissions

Pb	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	kt
1A1a	0.23	0.19	0.15	0.13	0.11	0.01	0.16	0.14	0.19	0.19	0.19	0.14	0.23	0.21	0.21	0.17	0.19	0.14	0.21	0.11	0.24	0.26	0.25	0.22	0.23	0.24	0.20	0.20	0.24	
1A1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A1c	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A2a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A2b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A2c	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	IE	IE	0.00	0.00	IE	0.00	0.00	0.00	0.00	0.00	
1A2d	IE	IE	IE	IE	IE	IE	0.02	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	
1A2e	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	IE	0.00	0.00	0.01	0.01	0.01	0.01	0.01	
1A2f	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	
1A2gvii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A2gviii	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.03	0.02	0.02	0.02	0.01	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	
1A3ai(i)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3aii(i)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A3bi	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A3bii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A3biii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
1A3biv	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A3bv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3bvi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3bvii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3c	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NO	NO	NO	NO	NO	NO	NO	NO	
1A3di(ii)	NE	NE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	0.00	0.00	IE	IE	IE	IE	IE	IE	IE	IE	
1A3dii	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3ei	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A3eii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A4ai	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
1A4aii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4bi	0.39	0.33	0.36	0.39	0.27	0.15	0.15	0.13	0.12	0.12	0.13	0.11	0.16	0.16	0.17	0.16	0.16	0.16	0.16	0.17	0.18	0.18	0.19	0.18	0.17	0.17	0.17	0.17	0.15	

Pb	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	kt
1A4bii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4ci	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4cii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A4ciii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A5a	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A5b	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1B1a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B1c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2ai	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2aiv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2av	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2d	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A5a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A5b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A5c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B5	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B7	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B10a	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

Pb	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	kt
2B10b	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C1	0.54	0.51	0.37	0.30	0.29	0.23	0.27	0.34	0.37	0.23	0.22	0.29	0.22	0.15	0.39	0.27	0.42	0.45	0.52	0.27	0.54	0.16	0.07	0.05	0.04	0.10	0.12	0.12	0.12	
2C2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C4	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C5	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7b	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7c	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7d	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3a	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3b	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3c	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3d	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3e	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3f	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3g	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3h	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3i	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2G	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2H1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2I	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2J	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2K	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2L	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3B1a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	

Pb	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	kt	
3B1b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4d	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4e	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4f	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4gi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4gii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4giii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4giv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4h	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da2a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da2b	NA	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3Da2c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Db	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Dc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Dd	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3De	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Df	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3F	NA	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3I	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5B1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5B2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

Pb	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
NFR Code	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	kt	
5C1bi	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1biii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1biv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bvi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C2	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
5D1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5E	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
6A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
NATIONAL TOTAL	1.18	1.05	0.90	0.84	0.68	0.42	0.61	0.66	0.69	0.58	0.56	0.57	0.63	0.55	0.79	0.65	0.81	0.82	0.97	0.59	0.98	0.63	0.54	0.48	0.46	0.54	0.52	0.52	0.54		
1A3ai(ii)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3aii(ii)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3di(i)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	



Table 11.12 NFR table - Cd Emissions

Cd	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	kt
1A1a	0.03	0.03	0.02	0.02	0.01	0.00	0.02	0.02	0.02	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.02	0.03	0.01	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.03	
1A1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A1c	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A2a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A2b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A2c	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	IE	IE	0.00	0.00	IE	0.00	0.00	0.00	0.00	0.00	
1A2d	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	
1A2e	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A2f	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	
1A2gvii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A2gviii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A3ai(i)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3aii(i)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A3bi	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3bii	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3biii	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3biv	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3bv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3bvi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3bvii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3c	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NO	NO	NO	NO	NO	NO	NO	NO	
1A3di(ii)	NE	NE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	0.00	0.00	IE	IE	IE	IE	IE	IE	IE	IE	
1A3dii	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3ei	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A3eii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A4ai	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A4aii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4bi	0.19	0.16	0.17	0.19	0.13	0.07	0.07	0.06	0.06	0.06	0.06	0.05	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.07	

Cd	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
NFR Code	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	kt	
1A4bii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4ci	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4cii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A4ciii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A5a	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A5b	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1B1a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B1c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2ai	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2aiv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2av	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2d	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A5a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A5b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A5c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B5	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B7	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B10a	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

Cd	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	kt
2B10b	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C1	0.04	0.04	0.03	0.02	0.02	0.02	0.02	0.03	0.03	0.02	0.02	0.02	0.02	0.01	0.03	0.02	0.03	0.03	0.04	0.02	0.04	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01	
2C2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C4	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C5	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7b	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7c	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7d	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3a	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3b	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3c	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3d	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3e	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3f	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3g	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3h	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3i	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2G	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2H1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2I	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2J	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2K	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2L	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3B1a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	

Cd	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	kt
3B1b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4d	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4e	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4f	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4gi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4gii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4giii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4giv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4h	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da2a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da2b	NA	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3Da2c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Db	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Dc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Dd	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3De	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Df	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3F	NA	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3I	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5B1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5B2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

Cd	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
NFR Code	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	kt	
5C1bi	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1biii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1biv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bvi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C2	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
5D1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5E	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
6A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
NATIONAL TOTAL	0.26	0.22	0.22	0.23	0.17	0.10	0.11	0.11	0.11	0.10	0.10	0.09	0.12	0.12	0.14	0.12	0.14	0.14	0.15	0.12	0.16	0.14	0.13	0.12	0.12	0.13	0.12	0.12	0.12		
1A3ai(ii)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3aii(ii)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3di(i)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	

Table 11.13 NFR table - Hg Emissions

Hg	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	kt
1A1a	0.04	0.04	0.03	0.03	0.02	0.00	0.03	0.03	0.03	0.04	0.04	0.03	0.04	0.04	0.04	0.03	0.04	0.03	0.04	0.02	0.05	0.05	0.05	0.04	0.04	0.05	0.04	0.04	0.05	
1A1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A1c	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A2a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A2b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A2c	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	IE	IE	0.00	0.00	IE	0.00	0.00	0.00	0.00	0.00	
1A2d	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	
1A2e	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A2f	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	
1A2gvii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A2gviii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A3ai(i)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3aii(i)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A3bi	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3bii	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3biii	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3biv	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3bv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3bvi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3bvii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3c	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NO	NO	NO	NO	NO	NO	NO	NO	
1A3di(ii)	NE	NE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	0.00	0.00	IE	IE	IE	IE	IE	IE	IE	IE	
1A3dii	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3ei	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A3eii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A4ai	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A4aii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4bi	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Hg	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
NFR Code	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	kt	
1A4bii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4ci	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4cii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A4ciii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A5a	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A5b	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1B1a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B1c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2ai	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2aiv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2av	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2d	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A5a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A5b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A5c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B5	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B7	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B10a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

Hg	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	kt
2B10b	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C1	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2C2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C4	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C5	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7b	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7c	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7d	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3a	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3b	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3c	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3d	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3e	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3f	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3g	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3h	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3i	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2G	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2H1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2I	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2J	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2K	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2L	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3B1a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	



Hg	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	kt
3B1b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4d	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4e	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4f	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4gi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4gii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4giii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4giv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4h	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da2a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da2b	NA	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3Da2c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Db	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Dc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Dd	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3De	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Df	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3F	NA	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3I	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5B1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5B2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

Hg	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	kt
5C1bi	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1biii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1biv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bvi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5E	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
6A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
NATIONAL TOTAL	0.06	0.05	0.04	0.04	0.03	0.01	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.04	0.05	0.04	0.06	0.03	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
1A3ai(ii)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3aii(ii)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3di(i)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	

Table 11.14 NFR table - NO<sub>x</sub> Emissions

NO <sub>x</sub>	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1A1a	4.08	3.39	2.66	2.29	1.89	0.32	2.69	2.52	3.22	3.36	3.30	2.56	3.89	3.70	3.62	2.74	3.12	2.25	3.52	1.84	3.93	4.24	4.16	3.70	3.71	4.03	3.36	3.48	4.01	
1A1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A1c	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A2a	0.57	0.85	0.53	0.44	0.42	0.40	0.47	0.31	0.28	0.21	0.16	0.21	0.15	0.10	0.26	0.21	0.21	0.24	0.29	0.01	0.17	0.01	0.01	0.07	0.01	0.02	0.02	0.02	0.01	
1A2b	1.60	2.25	1.23	0.81	0.87	0.83	0.83	0.39	0.38	0.40	0.87	0.89	1.26	1.50	1.28	2.71	2.83	2.92	2.72	1.17	0.64	0.57	0.38	0.35	0.06	0.07	0.06	0.06	0.04	
1A2c	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A2d	IE	IE	IE	IE	IE	IE	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	IE	IE	IE	IE	0.01	0.01	0.01	0.01	0.01	
1A2e	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.01	0.02	0.00	0.00	0.01	0.00	0.00	0.11	0.06	0.10	0.12	0.03	0.03	IE	0.00	0.00	0.21	0.18	0.18	0.18	0.18	
1A2f	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.02	0.02	0.03	0.03	0.02	0.02	IE	IE	0.02	0.03	0.04	0.03	0.05	0.07	
1A2gvii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A2gviii	0.11	0.11	0.11	0.09	0.05	0.07	0.09	0.01	0.02	0.02	0.00	0.01	0.02	0.01	0.00	0.15	0.10	0.26	0.26	0.05	0.05	0.04	0.04	0.16	0.67	0.62	0.63	0.80	0.76	
1A3ai(i)	0.03	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.03	0.04	0.02	0.03	0.05	0.05	0.06	0.07	0.09	0.08	0.09	0.09	0.11	0.11	0.09	0.09	0.10	0.12	0.12	
1A3aii(i)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A3bi	0.53	0.55	0.36	0.27	0.30	0.32	0.40	0.45	0.62	0.67	0.58	0.50	0.39	0.47	0.50	0.46	0.53	0.55	0.53	0.66	0.60	0.57	0.54	0.52	0.53	0.56	0.60	0.61	0.65	
1A3bii	0.02	0.02	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.02	0.02	0.03	0.04	0.06	0.05	0.06	0.06	0.05	0.04	0.05	0.03	0.02	0.02	
1A3biii	1.42	1.82	1.06	0.85	0.96	1.05	1.31	1.27	1.88	2.58	2.93	2.49	2.02	1.85	2.44	2.23	2.38	3.33	4.14	4.69	3.98	4.85	4.70	4.46	3.51	4.00	5.00	5.61	6.13	
1A3biv	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A3bv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3bvi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3bvii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3c	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.05	0.05	0.06	0.10	0.11	0.10	0.11	0.12	0.16	NO	NO	NO	NO	NO	NO	NO	NO	
1A3di(ii)	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.19	0.09	0.08	0.08	0.20	0.18	0.35	IE	0.66	0.82	IE	IE	IE	IE	IE	IE	IE	IE	
1A3dii	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.06	0.07	0.07	0.07	0.12	0.13	0.13	0.13	0.13	0.15	0.10	0.13	0.15	0.11	0.11	0.10	IE	IE	
1A3ei	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A3eii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A4ai	0.33	0.30	0.15	0.17	0.14	0.19	0.13	0.25	0.27	0.26	0.31	0.27	0.34	0.33	0.31	0.32	0.30	0.56	0.57	0.47	0.50	0.45	0.34	0.30	0.11	0.13	0.14	0.15	0.16	
1A4aii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4bi	0.75	0.65	0.68	0.74	0.52	0.30	0.29	0.26	0.24	0.25	0.25	0.22	0.31	0.33	0.33	0.31	0.32	0.32	0.32	0.34	0.35	0.36	0.36	0.34	0.32	0.33	0.33	0.32	0.29	

NOx	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1A4bii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4ci	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4cii	0.31	0.28	0.24	0.21	0.24	0.28	0.24	0.28	0.28	0.24	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.38	0.38	0.24	0.24	0.28	0.08	0.11	0.18	0.19	0.10	0.10	0.11	
1A4ciii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A5a	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A5b	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1B1a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B1c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2ai	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2aiv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2av	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2d	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A5a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A5b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A5c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B1	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B2	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B5	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B7	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B10a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

NOx	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
2B10b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C1	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.02	0.02	0.03	0.01	0.03	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.01	
2C2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C3	0.11	0.10	0.09	0.04	0.01	0.03	0.05	0.08	0.08	0.08	0.10	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.11	0.06	0.11	0.09	0.07	0.05	0.04	0.04	0.04	0.04	0.04	
2C4	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C5	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7a	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7b	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7c	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7d	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3a	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3b	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3c	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3d	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3e	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3f	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3g	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3h	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3i	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2G	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2H1	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2I	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2J	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2K	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2L	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3B1a	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01

NOx	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019		
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt		
3B1b	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
3B2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
3B3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00			
3B4a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		
3B4d	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
3B4e	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
3B4f	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE		
3B4gi	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
3B4gii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
3B4giii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
3B4giv	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
3B4h	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3Da1	0.07	0.07	0.04	0.02	0.03	0.07	0.05	0.02	0.00	0.01	0.03	0.03	0.00	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.05	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03		
3Da2a	0.26	0.27	0.25	0.26	0.25	0.26	0.26	0.26	0.26	0.26	0.25	0.25	0.24	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.22	0.22	0.22	0.23	0.23	0.24	0.25	0.24		
3Da2b	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3Da2c	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3Da3	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3Da4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Db	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Dc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Dd	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3De	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Df	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3F	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3I	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5B1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5B2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

NOx	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
5C1bi	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1biii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1biv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1bv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bvi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C2	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
5D1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5E	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
6A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
<b>NATIONAL TOTAL</b>	10.37	10.87	7.59	6.36	5.86	4.30	7.01	6.35	7.73	8.57	9.26	8.24	9.30	9.23	9.70	10.43	11.05	12.06	13.68	10.93	12.21	11.98	11.24	10.68	9.92	10.77	11.04	11.87	12.91	
1A3ai(ii)	0.12	0.14	0.02	0.01	0.01	0.01	0.01	0.01	0.05	0.12	0.12	0.15	0.16	0.13	0.03	0.12	0.13	0.04	0.07	0.05	0.13	0.07	0.01	0.02	0.11	0.12	0.11	0.10	0.14	
1A3aii(ii)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3di(i)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	

Table 11.15 NFR table - Dioxin and furan Emissions

NOx	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019									
NFR Code	g I-TEQ																																						
1A1a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00										
1A1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO									
1A1c	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE									
1A2a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00									
1A2b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00								
1A2c	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	IE	IE	0.00	0.00	IE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00							
1A2d	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00						
1A2e	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00						
1A2f	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
1A2gvii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE					
1A2gviii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00				
1A3ai(i)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE				
1A3aii(ii)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO			
1A3bi	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE			
1A3bii	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE			
1A3biii	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE			
1A3biv	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE			
1A3bv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
1A3bvi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
1A3bvii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
1A3c	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		
1A3di(ii)	NE	NE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	0.00	0.00	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE		
1A3dii	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE		
1A3ei	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		
1A3eii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		
1A4ai	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
1A4aii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4bi	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	



NOx	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	g I-TEQ																													
1A4bii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4ci	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4cii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A4ciii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A5a	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A5b	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1B1a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B1c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2ai	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2aiv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2av	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2d	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A5a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A5b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A5c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B5	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B7	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B10a	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

NOx	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	g I-TEQ																													
2B10b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C1	0.62	0.59	0.43	0.35	0.34	0.27	0.31	0.40	0.42	0.26	0.25	0.33	0.25	0.18	0.45	0.31	0.48	0.52	0.61	0.31	0.62	0.18	0.08	0.06	0.04	0.11	0.14	0.14	0.14	
2C2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C3	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2C4	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C5	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7b	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7c	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7d	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3a	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3b	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3c	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3d	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3e	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3f	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3g	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3h	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3i	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2G	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2H1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2I	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2J	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2K	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2L	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3B1a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	

NOx	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	g I-TEQ																													
3B1b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4d	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4e	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4f	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4gi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4gii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4giii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4giv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4h	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da2a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da2b	NA	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3Da2c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Db	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Dc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Dd	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3De	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Df	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3F	NA	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3I	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5B1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5B2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

NOx	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	g I-TEQ																													
5C1bi	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1biii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1biv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bvi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C2	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
5D1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5E	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
6A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
<b>NATIONAL TOTAL</b>	0.63	0.60	0.44	0.36	0.34	0.27	0.31	0.40	0.43	0.27	0.26	0.33	0.25	0.18	0.46	0.31	0.49	0.53	0.61	0.32	0.63	0.19	0.08	0.06	0.05	0.12	0.14	0.14	0.14	
1A3ai(ii)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3aii(ii)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3di(i)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	

Table 11.16 NFR table - PAH Emissions

PAH	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019		
NFR Code	t																															
1A1a	0.09	0.08	0.05	0.04	0.04	0.03	0.05	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.08	0.03	0.03	0.02	0.03	0.02	0.04	0.04	0.04	0.03	0.03	0.04	0.03	0.03	0.03			
1A1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		
1A1c	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE		
1A2a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
1A2b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
1A2c	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	IE	IE	0.00	0.00	IE	0.00	0.00	0.00	0.00	0.00	0.00		
1A2d	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00		
1A2e	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
1A2f	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00		
1A2gvii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE		
1A2gviii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
1A3ai(i)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE		
1A3aii(i)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		
1A3bi	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
1A3bii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
1A3biii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
1A3biv	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A3bv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3bvi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3bvii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3c	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NO	NO	NO	NO	NO	NO	NO	NO	NO		
1A3di(ii)	NE	NE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	0.00	0.00	IE	IE	IE	IE	IE	IE	IE	IE	IE		
1A3dii	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3ei	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A3eii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A4ai	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
1A4aii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4bi	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	

PAH	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
NFR Code	t																														
1A4bii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE		
1A4ci	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4cii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.04	0.03	0.03	0.02	0.01	0.02	
1A4ciii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A5a	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A5b	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1B1a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B1c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2ai	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2aiv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2av	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2d	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A5a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A5b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A5c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B5	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B7	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B10a	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

PAH	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	t																													
2B10b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2C2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C3	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2C4	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C5	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7a	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7b	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7c	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7d	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3a	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3b	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3c	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3d	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3e	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3f	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3g	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3h	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3i	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2G	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2H1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2I	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2J	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2K	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2L	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3B1a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	

PAH	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	t																													
3B1b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4d	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4e	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4f	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4gi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4gii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4giii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4giv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4h	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da2a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da2b	NA	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3Da2c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Db	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Dc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Dd	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3De	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Df	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3F	NA	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3I	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5B1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5B2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	



PAH	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	t																													
5C1bi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1bii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1biii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1biv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bvi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C2	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
5D1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5E	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
6A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
NATIONAL TOTAL	0.12	0.10	0.07	0.06	0.06	0.04	0.07	0.08	0.09	0.09	0.13	0.09	0.10	0.10	0.10	0.06	0.06	0.07	0.08	0.06	0.08	0.12	0.11	0.11	0.08	0.08	0.06	0.06	0.07	
1A3ai(ii)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3aii(ii)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3di(i)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	

Table 11.17 NFR table - HCB Emissions

HCB	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
NFR Code	kg																														
1A1a	0.10	0.08	0.06	0.06	0.05	0.00	0.07	0.06	0.08	0.08	0.08	0.06	0.09	0.09	0.09	0.07	0.08	0.06	0.10	0.05	0.11	0.11	0.11	0.10	0.10	0.11	0.09	0.09	0.11		
1A1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		
1A1c	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE		
1A2a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
1A2b	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	IE	IE	
1A2c	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	
1A2d	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A2e	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A2f	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	IE	
1A2gvii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A2gviii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A3ai(i)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3aii(ii)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A3bi	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3bii	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3biii	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3biv	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3bv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3bvi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3bvii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3di(ii)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3dii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3ei	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A3eii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A4ai	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A4aii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4bi	0.07	0.06	0.07	0.07	0.05	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	

HCB	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
NFR Code	kg																														
1A4bii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE		
1A4ci	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4cii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A4ciii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A5a	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A5b	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1B1a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B1b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B1c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2ai	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2aiv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2av	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2d	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A5a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A5b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A5c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B5	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B7	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B10a	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

HCB	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kg																													
2B10b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C3	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2C4	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C5	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7a	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7b	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7c	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7d	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3a	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3b	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3c	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3d	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3e	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3f	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3g	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3h	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3i	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2G	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2I	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2J	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2K	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2L	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3B1a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	

HCB	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kg																													
3B1b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4d	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4e	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4f	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4gi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4gii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4giii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4giv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4h	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da2a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da2b	NA	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3Da2c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Db	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Dc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Dd	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3De	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Df	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3F	NA	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3I	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5B1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5B2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

HCB	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kg																													
5C1bi	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1biii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1biv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bvi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5E	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
6A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
NATIONAL TOTAL	0.17	0.14	0.13	0.13	0.10	0.03	0.09	0.08	0.10	0.10	0.10	0.08	0.12	0.12	0.12	0.10	0.12	0.09	0.13	0.08	0.14	0.15	0.15	0.14	0.13	0.14	0.13	0.13	0.14	
1A3ai(ii)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3aii(ii)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3di(i)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	

Table 11.18 NFR table - PCBs Emissions

PCBs	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kg																													
1A1a	0.03	0.03	0.02	0.02	0.01	0.00	0.02	0.02	0.02	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.03	0.02	0.03	0.02	0.03	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.04	
1A1b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A1c	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A2a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A2b	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.00	IE	IE	
1A2c	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.01	0.00	0.01	0.00	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	
1A2d	IE	IE	IE	IE	IE	IE	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A2e	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.01	0.01	IE	IE	IE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A2f	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0.00	0.00	0.01	0.01	IE	IE	IE	IE	IE	0.00	0.00	0.00	0.00	IE	
1A2gvii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A2gviii	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.02	0.00	0.01	0.02	0.01	0.01	0.04	0.02	0.03	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A3ai(i)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3aii(i)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A3bi	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3bii	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3biii	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3biv	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3bv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3bvi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3bvii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3di(ii)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3dii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3ei	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A3eii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1A4ai	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1A4aii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4bi	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

PCBs	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
NFR Code	kg																														
1A4bii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE		
1A4ci	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A4cii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A4ciii	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
1A5a	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A5b	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1B1a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B1b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B1c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2ai	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2aiv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2av	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1B2c	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1B2d	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2A5a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A5b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A5c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
2A6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B5	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B6	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B7	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2B10a	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	



PCBs	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kg																													
2B10b	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2C2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C4	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C5	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7b	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7c	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2C7d	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3a	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3b	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3c	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3d	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3e	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3f	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3g	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3h	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2D3i	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2G	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H1	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H2	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2H3	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2I	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2J	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
2K	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2L	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3B1a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	

PCBs	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kg																													
3B1b	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4d	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4e	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4f	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4gi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4gii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4giii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4giv	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3B4h	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da2a	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da2b	NA	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
3Da2c	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Da4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Db	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Dc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Dd	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3De	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3Df	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3F	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
3I	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5B1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5B2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

PCBs	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NFR Code	kg																													
5C1bi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1bii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C1biii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1biv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bv	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5C1bvi	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5C2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5D3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
5E	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
6A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
NATIONAL TOTAL	0.04	0.03	0.03	0.03	0.02	0.01	0.06	0.06	0.03	0.05	0.03	0.04	0.05	0.04	0.04	0.08	0.06	0.07	0.07	0.02	0.03	0.04	0.04	0.03	0.03	0.04	0.03	0.03	0.04	
1A3ai(ii)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
1A3aii(ii)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1A3di(i)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	

