

Informative Inventory Report (IIR) 2025 of Albania

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

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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_x), non-methane volatile organic compounds (NMVOC), sulphur dioxide (SO_x), ammonia (NH₃), 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.

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 Albania
1979	Convention on Long-range Transboundary Air Pollution (in Geneva)	51	16.03.1983	23. 10. 2006. (d) ¹
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) ²	47	28.01.1988	23. 10. 2006. (d) ³
1998	Aarhus Protocol on Heavy Metals ⁴	36	29.12.2003	01.07.2011 (a) ⁵
1998	Aarhus Protocol on Persistent Organic Pollutants (POPs) ⁶	36	23.10.2003	01.07.2011 (a) ⁷

1.2 Institutional, legal and procedural arrangements

1.2.1 National entity or national focal point

¹ <https://unece.org/DAM/env/lrtap/status/Status%20of%20the%20Convention.pdf>

² <https://unece.org/DAM/env/lrtap/full%20text/1984.EMEP.e.pdf>

³ https://unece.org/DAM/env/lrtap/status/84e_st.htm

⁴ <https://unece.org/DAM/env/lrtap/full%20text/1998.Heavy.Metals.e.pdf>

⁵ https://unece.org/DAM/env/lrtap/status/98hm_st.htm

⁶ <https://unece.org/DAM/env/lrtap/full%20text/1998.POPs.e.pdf>

⁷ https://unece.org/DAM/env/lrtap/status/98pop_st.htm

1.3 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 2023⁸
- GHG are the
 - 2006 IPCC Guidelines for National Greenhouse Gas Inventories⁹
 - 2019 Refinements to the 2006 IPCC Guidelines¹⁰

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 2023¹¹
- Volume 2 – 5 of the 2006 IPCC guidelines.

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

⁸ <https://www.eea.europa.eu/publications/emep-eea-guidebook-2023>

⁹ <https://www.ipcc-nggip.iges.or.jp/public/2006gl/>

¹⁰ <https://www.ipcc-nggip.iges.or.jp/public/2019rf/index.html>

¹¹ <https://www.eea.europa.eu/publications/emep-eea-guidebook-2023/part-b-sectoral-guidance-chapters>

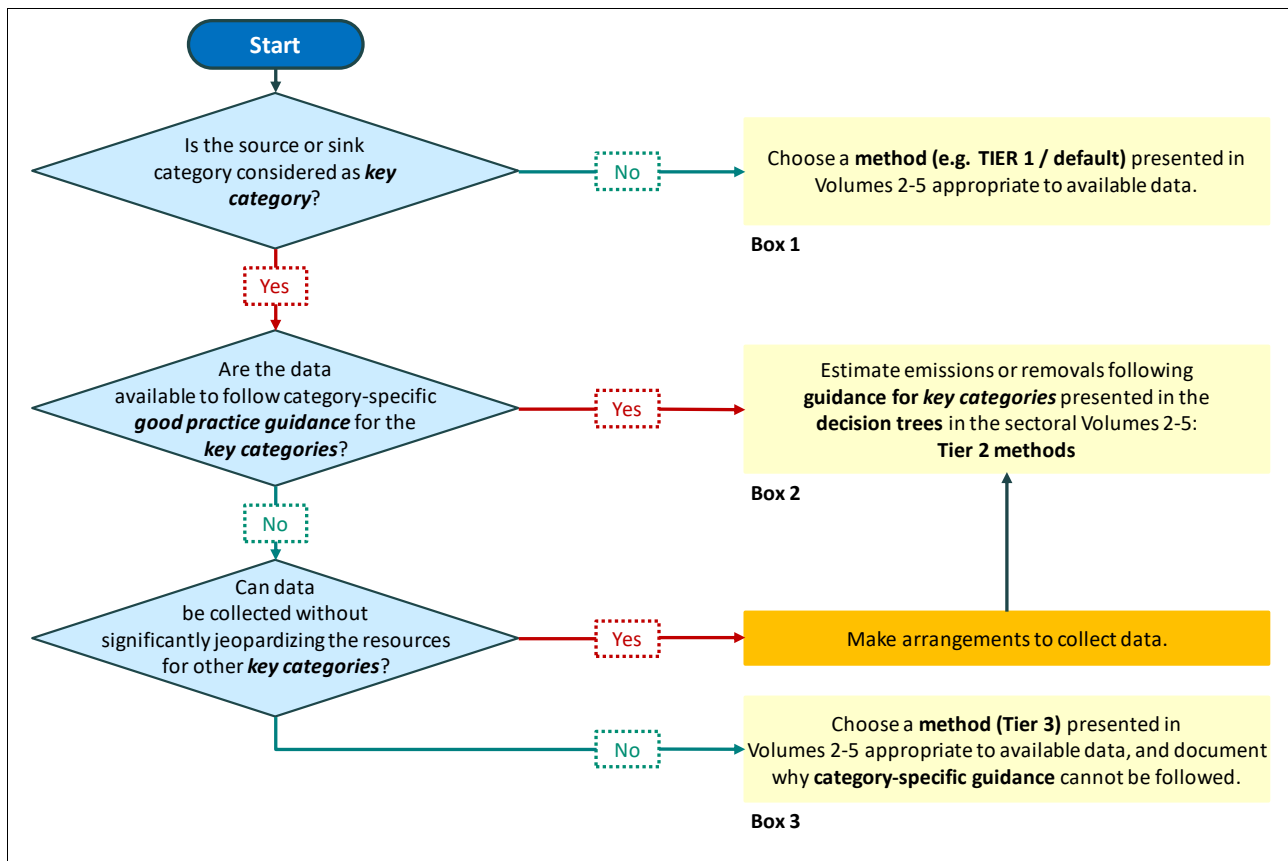


Figure 1.1 Decision Tree to choose a Good Practice method

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 1.2 Summary report for methods and emission factors used and source of activity data

Source	Main Pollutants (NOx, SOx, NMVOC, NH3, CO)			Particulate Matter (TSP, PM10; PM2.5, 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
1. Energy												
A. Fuel combustion												
1. Energy industries	T1	CS	INSTAT	T1	CS	INSTAT	T1	D	INSTAT	T1	D	INSTAT
2. Manufacturing industries and construction	T1	D	INSTAT	T1	D	INSTAT	T1	D	INSTAT	T1	D	INSTAT
3. Transport	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4. Other sectors	T1	D	INSTAT	T1	D	INSTAT	T1	D	INSTAT	T1	D	INSTAT
5. Other (please specify)	NE	NE	NE	NE	NE	NE	NE	NE	NE			
B. Fugitive emissions from fuels												
1. Solid fuels	T1	D	INSTAT	T1	D	INSTAT	NA	NA	NA	NA	NA	NA
2. Oil and natural gas	T1	D	INSTAT	NA	NA	NA	NA	NA	NA	NA	NA	NA
2. Industrial processes process and Product Use (IPPU)												
A. Mineral products	NO	NO	NO	T1	D	INSTAT	NA	NA	NA	NO	NO	NO
B. Chemical industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Metal production	T1	D	INSTAT	T1	D	INSTAT	NA	NA	NA	NO	NO	NO
D. Other production	T1/T2	D	PS/INSTAT	NA	NA	NA	NA	NA	NA	NA	NA	NA
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
H Food and beverages industry	T1	D	PS/INSTAT	NO	NO	NO	NO	NO	NO	NO	NO	NO
I. Wood processing	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
J. Production of POPs	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
K. Consumption of POPs and heavy metals	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Source	Main Pollutants (NO _x , SO _x , NMVOC, NH ₃ , CO)			Particulate Matter (TSP, PM ₁₀ ; PM _{2.5} , 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
L. Other production, consumption, storage, transportation or handling of bulk products	NA	NA	NA	NE	NE	NE	NA	NA	NA	NA	NA	NA
3. Agriculture												
A. Enteric fermentation	T1	D	INSTAT	T1	D	INSTAT	T1	D	INSTAT	T1	D	INSTAT
B. Manure management	T1	D	INSTAT	T1	D	INSTAT	T1	D	INSTAT	T1	D	INSTAT
C. Rice cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural soils	T1	D	INSTAT	T1	D	INSTAT	T1	D	INSTAT	T1	D	INSTAT
E. Prescribed burning of savannahs	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field burning of agricultural residues	T1	D	INSTAT	T1	D	INSTAT	T1	D	INSTAT	T1	D	INSTAT
G. Other (Urea application)	T1	D	INSTAT	T1	D	INSTAT	T1	D	INSTAT	T1	D	INSTAT
5. Waste												
A. Solid waste disposal on land	T1	D	INSTAT	T1	D	INSTAT	T1	D	INSTAT	T1	D	INSTAT
B. Waste-water handling	T1	D	INSTAT	T1	D	INSTAT	T1	D	INSTAT	T1	D	INSTAT
C. Waste incineration	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
D. Other - Composting	NE	NE	NE	NA	NA	-	NA	NA	-	NA	NA	-
6. Other												
Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Memo items												
International bunkers												
Aviation	T1	D	INSTAT	T1	D	INSTAT	T1	D	INSTAT	T1	D	INSTAT
Marine	NE	NE	INSTAT	NE	NE	INSTAT	NE	NE	INSTAT	NE	NE	INSTAT
Natural												

Source	Main Pollutants (NOx. SOx. NMVOC. NH3. CO)			Particulate Matter (TSP. PM10; PM2.5. 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
Volcanoes	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Forest fires	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Other natural emissions	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

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			
NA	Not applicable	D	IPCC default	CS	Country Specific	D	IPCC default			Q	Specific Questionnaire	PS	Plant specific
NO	Not occurring	T1	IPCC Tier 1	CR	CORINAIR	CS	Country specific			INSTA T	Statistical Office of Albania	EJ	Expert Judgement
NE	Not estimated	T1a. T1b. T1c	IPCC Tier 1a. Tier 1b and Tier 1c. respectively	RA	Reference Approach	PS	Plant specific			EUROS TAT	Statistical office of the European Union		
IE	Included elsewhere	T2	IPCC Tier 2	OTH	Other	OTH	Other			UNSD	United Nations Statistics Division (UNSD)		
C	Confidential	T3	IPCC Tier 3	M	Model	M	Model			FAO	FAO Statistics Division (FAOSTAT)		

1.4 Brief description of key categories

The identification of key categories (KCA) is prepared in accordance with EMEP/EEA air pollutant emission inventory guidebook 2023¹². 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)

1.4.1 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.	✓

1.4.2 Level Assessment

The Tier 1 approach of the EMEP/EEA air pollutant emission inventory guidebook 2023 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.

¹² EMEP/EEA GB (2019). *Key category analysis and methodological choice 2019. Part A.*

1.4.3 Trend Assessment

The Tier 1 approach of the EMEP/EEA air pollutant emission inventory guidebook 2023 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 Information on the QA/QC plan including verification and treatment of confidentiality issues

The the EMEP/EEA air pollutant emission inventory guidebook 2023 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.

1.5.1 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

1.5.1.1 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 Air pollutant emission inventory - estimation of GHG emissions and removals including reporting elements - is subject to continuous improvement.

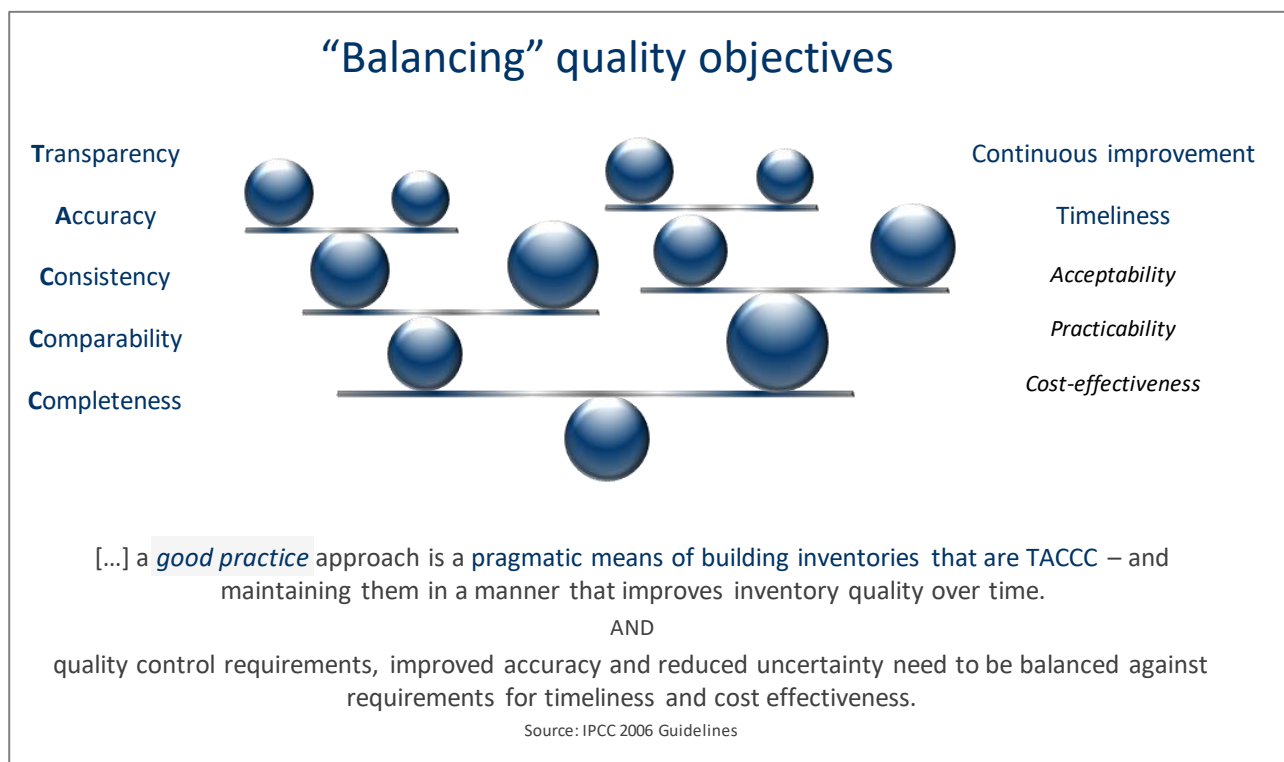


Figure 1.2 **Balancing quality objectives**

1.5.1.2 Inventory improvement plan

The planning of the Air pollutant emission 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 Air pollutant emission inventory.

The QA/QC plan and the improvement of the Air pollutant emission inventory follows a Plan-Do-Check-Act-Cycle (PDCA-cycle)¹³. 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.

¹³ <https://asq.org/quality-resources/pdca-cycle>

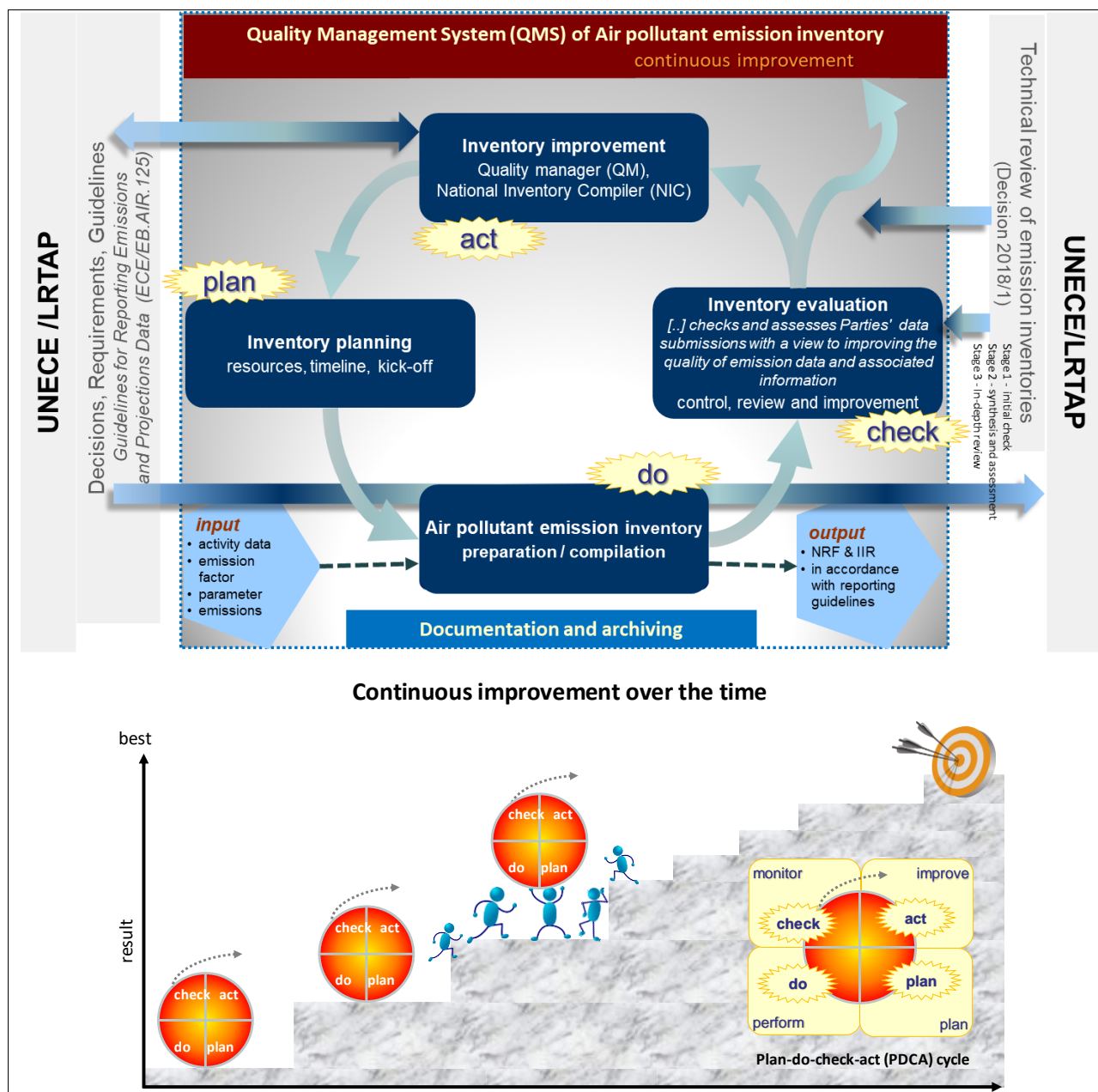


Figure 1.3 Continuous improvement

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 list 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 1.3 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 manager)!											
No	IPCC category	Source	Citation	Issue	Urgency	Resources	Timeline	responsible person (s)	Finished	Check NIC	Improvement made
			<p>Original quote of the (review) reports!</p> <p>summary (in non-technical /informal language) of PROBLEM and MEASURE</p>								Text for NIR!
		<p>Review / Technical analysis: 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</p> <p>Archive: email, mail, (oral) complaints documented expl. with protocol "Pxxx"</p> <p>Inventory team / Personal: "Name, date"</p> <p>Audit protocol: "Audit_No"</p> <p>!!! Each finding, which is <u>not</u> identified by responsible inventory person, have to be available in written form!!!</p>		<p>1 - urgent / high e.g. finding were several times topic or recommendation; SHALL requirements</p> <p>2 - important / medium new topic, might be urgent topic in the future, Key Category (KCA) related, SHOULD requirement</p> <p>3 - low for non-urgent topics, Non-Key Category related; ENCOURAGEMENT --> does not need a schedule</p>				<p>name of responsible experts/persons (and name of institutions)</p>			
		<p>Estimates of time frame for NEPA and UNFCCC focal point!</p> <p>NEPA: more financial resources are needed for research</p> <p>UNFCCC Focal point: more resources are needed</p> <p>GHG inventory 20XX: can be solved within the 'normal' framework of inventory preparation (usual planning run)</p>							<p>- GHG inventory 20XX if related to numbers</p> <p>- NIR 20XX if related to transparency</p> <p>!! 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!!!</p>		<p>- GHG inventory 20XX if related to numbers</p> <p>- NIR 20XX if related to transparency</p> <p>!!!Remarks or links (e.g. NIR 2019, page 213) as a comment!!!</p>
1											
2											

1.5.1.3 Inventory development cycle and guidance

The annual preparation of the Air pollutant emission 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).

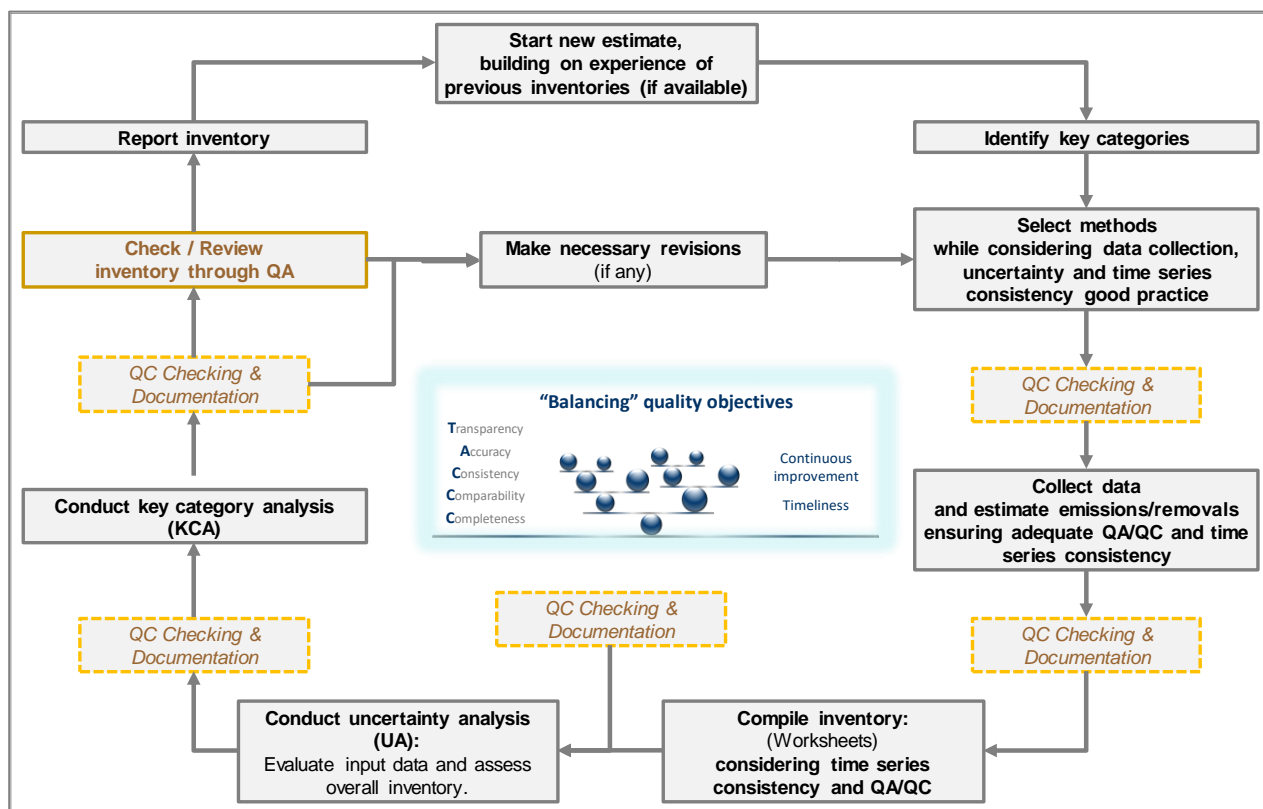


Figure 1.4 Inventory development cycle

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.¹⁴ 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 1.5.2 (**Error! Reference source not found.- Error! Reference source not found.**).

¹⁴ 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 1.4 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"> Analyzing the QA/QC plan & Inventory improvement plan Prioritizing the recommended improvements (including a timeline and responsibilities) planning relevant resources. 	Protocol (template) Inventory improvement plan.xlsx QA-QC improvement plan.xlsx											
3.		Kick-off meeting – Air pollutant emission 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	NIR 2022 chapter 1.5.docx ME_GHG-KCA_2022.xlsx IIR 2022 chapter 1.5.docx ME_NFR-KCA_2022.xlsx											
6.		Select methods while considering data collection. uncertainty and time series consistency good practice	2006 IPCC GL. Volume 2 – 5 NIR – sectoral chapters EMEP/EEA Guidebook 2019; Part 2 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"> QC Checking (completeness. transparency. accuracy) time series consistency 	Data collection using data collection files (template) (source-specific) from data provider											
10.		<ul style="list-style-type: none"> documentation (if discrepancies. delay. etc.) 	Archiving response (letter. Email. etc.) in folder 04_Archive											

	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
11.		Preparation/Updating of calculation sheets <ul style="list-style-type: none"> • adding new year • modification if higher TIER methodology will be applied • updating IIR tables templates • updating graphs 	source-specific calculation sheets. e.g. 1A1a_InventoryTool_ME.xlsx											
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"> • Documentation in column Update of each "source-specific" calculation file. sheet AD • QC checks according to part 1.2.3 and 6 of QC TIER 1 & 2 Checklist 											
14.		Preparation/Updating of Inventory file <ul style="list-style-type: none"> • adding new year • adding new calculation file. if needed • updating IIR tables templates • updating graphs 	CTR-CommonReportingTables_ME.xlsx NFR-ME.xlsx											
15.		Compile inventory considering time series consistency and QA/QC: update links of all calculation sheets	CTR-CommonReportingTables_ME.xlsx NFR-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_GHG-Uncertainties_Table 6.1.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												

	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
22.		Make necessary revisions (if any)												
23.		Conduct key category analysis (KCA) <ul style="list-style-type: none"> Update formula for new inventory year Update link with CTR-CommonReportingTables.xlsx 	ME-KCA-2022.xlsx CTR-CommonReportingTables_ME.xlsx ME_NFR-KCA_2022.xlsx ME-timeseries-1990-2019.xlsx											
24.		QC Checking & Documentation. updating Inventory improvement plan	QC checks according to part 1 of <i>QC TIER 1 & 2 Checklist</i>											
25.		Sharing results with inventory team and QC check of KCA file by sector experts and NIR/ IIR coordinator	ME_GHG-KCA_2022.xlsx ME_NFR-KCA_2022.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"> Add new year in IPCC software Update of timeseries entry files for IPCC software Update database {sector} 												
29.		QC Checking & Documentation. updating Inventory improvement plan	QC checks according to part 2 and 3 of <i>QC TIER 1 & 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 & 2 Checklist</i>											
32.		Update NIR sectoral chapter 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 & 2 Checklist</i>											
34.		Update IIR chapter 1 Introduction Update NIR 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 & 2 Checklist</i>											
36.		Update NIR chapter 1.6 KCA												

	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 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 & 2 Checklist</i>											
38.		Update NIR chapter 1.7 Uncertainties 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 & 5 Checklist</i>											
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 NIR chapter 1.6 QA/QC 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 & 2 Checklist</i>											
43.		Update NIR chapter 2 Trend 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 & 2 Checklist</i>											
45.		Treatment of confidentiality issues	Checklist - Confidential data											
46.		Update NIR chapter # References 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 & 2 Checklist</i>											
48.		Check / Review inventory and NIR through QA Check / Review inventory and IIR through QA	QA checks using the <i>QC TIER 1 & 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												

	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
51.		Finalize National Air pollutant emission inventory and Informative Inventory Report (IIR) for approval Finalize National GHG inventory and National Inventory Report (NIR) for approval												
52.		Reporting of National GHG Inventory and National Inventory Report (NIR) Reporting of National Air pollutant emissions Inventory and Informative 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\2022\Submission 07_NIR\2022_NIR\02_Submission_UNFCCC 08_IIR\2022_IIR\02_Submission_LRTAP											

1.5.2 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) • A technical analysis of BUR by a team of experts (TTE) • A facilitative sharing of views in the form of workshop under the SBI evaluate if TIER 2 QC is effectively performed (check if methodologies are applicable)	

Figure 5 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

1.5.3 Documentation and archiving

1.5.3.1 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 **Error! Reference source not found.** 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 1.5 ReadMe of emission calculation sheets

A

B

C

D

E

F

G

1

This calculation tool is prepared by **umweltbundesamt**^U

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Integrated inventory for Greenhouse gas (GHG) and Air pollutant emission

project-name: Integrated inventory for GHG and Air pollutants Emissions

project-number:

prepared by: Traute Köther

Last changes: 11.03.2020

QM-link:

file name: 1A2a_InventoryTool_MNE.xlsx

status: in progress

timeseries: 1990-2018

IPCC-Sources: 1 A 2 a - Manufacturing Industries and Construction - Iron and Steel

file linked to: MNE_EnergyBalance_1990-2018-v1.xlsx
MNE_NCV-data.xlsx

description/content:

Feedback and questions can be sent to trainingcenter@umweltbundesamt.at

older versions always with date, e.g. 1A2a_InventoryTool_MNE_20200214.xlsx
drop down

Sheet name

Content

Content description

Susanne2018

IPCC

Other remarks

Password

ChangeLog

Information regarding updating / modification / changes

Information

unprotected worksheet

worksheet_1A

Activity data for transfer to IPCC software

Activity data

protected worksheet

1.A.2.a

1A2a_CRT

GHG emissions (automatised) for CRT reporting

(intermediate) result

protected worksheet

1.A.2.a

CRT – Common Reporting Tables

1A2a_NFR

Air Pollutants emissions (automatised) for NFR

(intermediate) result

protected worksheet

1.A.2.a

Nomenclature Format for Reporting (NFR) tables

1A2a_AD

Calculation of emissions by fuel and GHG / Pollutants

Input data

unprotected worksheet but occasional protected cells

1.A.2.a

Uncertainty

Information related to Uncertainties for transfer to: Uncertainty_MNE.xlsx
NIR sectoral Chapter

Uncertainty data

unprotected worksheet

1.A.2.a

Uncertainty_MNE.xlsx
NIR sectoral Chapter

PlannedImprovements

Information related to Planned improvements for transfer to NIR sectoral Chapter
for transfer to Chapter Recalculation & Planned improvements

Planned improvements

unprotected worksheet

1.A.2.a

Recalculation

Information related to Recalculation for transfer to NIR sectoral Chapter
for transfer to Chapter Recalculation & Planned improvements

Recalculation

unprotected worksheet

1.A.2.a

EF IPCC

Emission factors of 2006 IPCC GL for sector 1A

Emission factors

protected worksheet

ExcelSupport

Excel support regarding used formulas

Information

unprotected worksheet

EF EMEP-EEA 1A1

Emission factors of EMEP/EEA GB for sector 1.A.1

Emission factors

protected worksheet

Matrix_EBxCRF

Correspondance of activities of Energy Balance (IEA/EUROSTAT Questionnaire) and CRF sub categories

Information

unprotected worksheet

DropDown&Definition

List for DropDown and Definitions of sectors and fuels

Information

protected worksheet

1.5.3.2 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

1.5.3.3 Archiving

Archiving takes place on a central server within the folder 'Emission inventory' and relevant subfolders. The structure of the 'Emission 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.

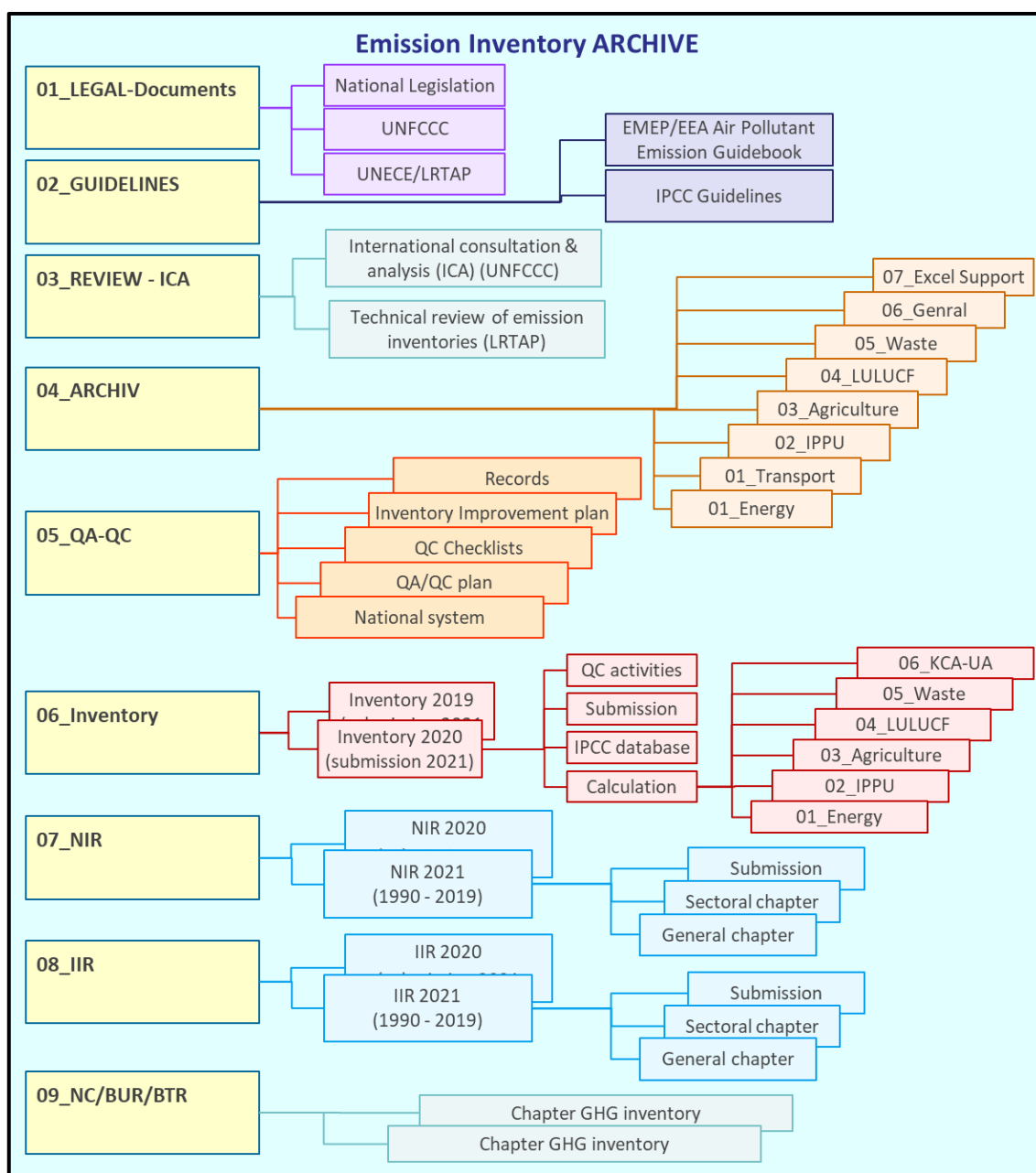


Figure 1.6 Emission Inventory Archive

1.6 General uncertainty evaluation

According to the EMEP/EEA air pollutant emission inventory guidebook 2023. 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 2023. 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 1.6 **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%

Source: Table 3-2 Rating definitions. Chapter 5 of the EMEP/EEA emission inventory guidebook 2023.

1.7 General assessment of the completeness

The sources not considered in the inventory but included in the EMEP/EEA Air pollutants emission Guidebook 2023 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*¹⁵. para 12. page 7.

Sources and sinks	Allmost all sources included in the EMEP/EEA Air pollutants emission Guidebook 2019 are addressed. No additional sources specific to Albania 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.
Pollutants	All Air pollutants are covered by the Air pollutant emission inventory of Albania.
Geographic coverage	The geographic coverage is complete. There is no part of the Albania’s territory not covered by the inventory.

¹⁵ ECE/EB.AIR/125: Guidelines for Reporting Emissions and Projections Data under the Convention on Long-range Transboundary Air Pollution

2 Trend

Description of the trend will be presented in next inventory cycle.

3 Energy (NFR sector 1)

3.1 Fuel Combustion Activities (NFR category 1.A)

3.1.1 International bunkers

3.1.1.1 International Civil Aviation (IPCC/NFR category 1.A.3.a)

3.1.1.1.1 Source category description

Table 3.1 Overview on reported emissions from sub categories 1.A.3.a.i and 1.A.3.a.ii

	1.A.3.a.ii Domestic aviation			1.A.3.a.i International aviation			1.A.3.a.ii Domestic aviation			1.A.3.a.i International aviation			
	Landing and Take-Off (LTO)						Climb-Cruise-Descent (CCD)						
Reporting ¹⁶	included in the national totals						not included in national totals						
Air pollutants	liquid	biomass	Other	liquid	biomass	Other	liquid	biomass	Other	liquid	biomass	Other	Key Category
NOx	✓	NO	NO	✓	NO	NO	✓	NO	NO	✓	NO	NO	-
CO	✓	NO	NO	✓	NO	NO	✓	NO	NO	✓	NO	NO	-
NMVOC	✓	NO	NO	✓	NO	NO	✓	NO	NO	✓	NO	NO	-
SOx	✓	NO	NO	✓	NO	NO	✓	NO	NO	✓	NO	NO	-
NH3	NA	NO	NO	NA	NO	NO	NA	NO	NO	NA	NO	NO	-
TSP	✓	NO	NO	✓	NO	NO	✓	NO	NO	✓	NO	NO	-
PM10	✓	NO	NO	✓	NO	NO	✓	NO	NO	✓	NO	NO	-
PM2.5	✓	NO	NO	✓	NO	NO	✓	NO	NO	✓	NO	NO	-
BC	NA	NO	NO	NA	NO	NO	NA	NO	NO	NA	NO	NO	-
Pb	NA	NO	NO	NA	NO	NO	NA	NO	NO	NA	NO	NO	-
Cd	NA	NO	NO	NA	NO	NO	NA	NO	NO	NA	NO	NO	-
Hg	NA	NO	NO	NA	NO	NO	NA	NO	NO	NA	NO	NO	-
As	NA	NO	NO	NA	NO	NO	NA	NO	NO	NA	NO	NO	-
Cr	NA	NO	NO	NA	NO	NO	NA	NO	NO	NA	NO	NO	-
Cu	NA	NO	NO	NA	NO	NO	NA	NO	NO	NA	NO	NO	-
Ni	NA	NO	NO	NA	NO	NO	NA	NO	NO	NA	NO	NO	-
Se	NA	NO	NO	NA	NO	NO	NA	NO	NO	NA	NO	NO	-
Zn	NA	NO	NO	NA	NO	NO	NA	NO	NO	NA	NO	NO	-
PCB	NA	NO	NO	NA	NO	NO	NA	NO	NO	NA	NO	NO	-
PCDD/F	NA	NO	NO	NA	NO	NO	NA	NO	NO	NA	NO	NO	-
PAH	NA	NO	NO	NA	NO	NO	NA	NO	NO	NA	NO	NO	-
HCB	NA	NO	NO	NA	NO	NO	NA	NO	NO	NA	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													

¹⁶ 24. Emissions from domestic and international aviation during the landing and take-off cycle shall be included in the national totals. Cruise emissions from domestic and international aviation shall not be included in national totals. These cruise emissions should be reported separately as memorandum items in the annex I reporting template.

Table 3.2 Emissions of NO_x, NMVOC, SO_x, CO and PM from LTO of international flights.

	NO _x	NMVOC	SO _x	CO	PM ₁₀	PM _{2.5}
	LTO	LTO	LTO	LTO	LTO	LTO
Reporting	1 A 3 a i (i)	1 A 3 a i (i)	1 A 3 a i (i)	1 A 3 a i (i)	1 A 3 a i (i)	1 A 3 a i (i)
Unit	kt	kt	kt	kt	kt	kt
1990	NO	NO	NO	NO	NO	NO
1991	NO	NO	NO	NO	NO	NO
1992	NO	NO	NO	NO	NO	NO
1993	NO	NO	NO	NO	NO	NO
1994	NO	NO	NO	NO	NO	NO
1995	NO	NO	NO	NO	NO	NO
1996	NO	NO	NO	NO	NO	NO
1997	NO	NO	NO	NO	NO	NO
1998	NO	NO	NO	NO	NO	NO
1999	110.23	6.64	10.62	156.71	0.93	0.93
2000	119.17	7.18	11.49	169.42	1.01	1.01
2001	128.10	7.72	12.35	182.12	1.08	1.08
2002	128.10	7.72	12.35	182.12	1.08	1.08
2003	140.02	8.43	13.50	199.06	1.18	1.18
2004	143.00	8.61	13.78	203.30	1.21	1.21
2005	169.81	10.23	16.37	241.42	1.43	1.43
2006	134.06	8.08	12.92	190.59	1.13	1.13
2007	151.69	9.14	14.62	215.66	1.28	1.28
2008	151.69	9.14	14.62	215.66	1.28	1.28
2009	167.78	10.11	16.17	238.53	1.41	1.41
2010	172.43	10.39	16.62	245.15	1.45	1.45
2011	190.34	11.47	18.35	270.60	1.61	1.61
2012	169.39	10.20	16.33	240.81	1.43	1.43
2013	164.33	9.90	15.84	233.63	1.39	1.39
2014	152.60	9.19	14.71	216.94	1.29	1.29
2015	177.21	10.68	17.08	251.94	1.49	1.49
2016	185.52	11.18	17.88	263.75	1.56	1.56
2017	203.88	12.28	19.65	289.86	1.72	1.72
2018	211.73	12.76	20.41	301.02	1.79	1.79
2019	238.17	14.35	22.96	338.60	2.01	2.01
2020	126.82	7.64	12.22	180.30	1.07	1.07
2021	218.57	13.17	21.07	310.74	1.84	1.84
2022	324.21	19.53	31.25	460.93	2.73	2.73
Trend						
1990-2022	NA	NA	NA	NA	NA	NA
2005-2022	90.9%	90.9%	90.9%	90.9%	90.9%	90.9%
2021-2022	48.3%	48.3%	48.3%	48.3%	48.3%	48.3%

Table 3.3 Emissions of NO_x, NMVOC, SO_x, CO and PM from LTO of international flights.

	NO _x	NMVOC	SO _x	CO	PM ₁₀	PM _{2.5}
	Cruise	Cruise	Cruise	Cruise	Cruise	Cruise
Reporting	1 A 3 a i (ii)	1 A 3 a i (ii)	1 A 3 a i (ii)	1 A 3 a i (ii)	1 A 3 a i (ii)	1 A 3 a i (ii)
Unit	kt	kt	kt	kt	kt	kt
1990	NO	NO	NO	NO	NO	NO
1991	NO	NO	NO	NO	NO	NO
1992	NO	NO	NO	NO	NO	NO
1993	NO	NO	NO	NO	NO	NO
1994	NO	NO	NO	NO	NO	NO
1995	NO	NO	NO	NO	NO	NO
1996	NO	NO	NO	NO	NO	NO
1997	NO	NO	NO	NO	NO	NO
1998	NO	NO	NO	NO	NO	NO
1999	333.36	13.02	26.04	28.65	5.21	5.21
2000	360.39	14.08	28.16	30.97	5.63	5.63
2001	387.42	15.13	30.27	33.29	6.05	6.05
2002	387.42	15.13	30.27	33.29	6.05	6.05
2003	423.45	16.54	33.08	36.39	6.62	6.62
2004	432.46	16.89	33.79	37.16	6.76	6.76
2005	513.55	20.06	40.12	44.13	8.02	8.02
2006	405.43	15.84	31.67	34.84	6.33	6.33
2007	50.21	1.96	3.92	4.31	0.78	0.78
2008	139.81	5.46	10.92	12.01	2.18	2.18
2009	29.74	1.16	2.32	2.56	0.46	0.46
2010	NO	NO	NO	NO	NO	NO
2011	13.84	0.54	1.08	1.19	0.22	0.22
2012	40.49	1.58	3.16	3.48	0.63	0.63
2013	59.72	2.33	4.67	5.13	0.93	0.93
2014	NO	NO	NO	NO	NO	NO
2015	NO	NO	NO	NO	NO	NO
2016	NO	NO	NO	NO	NO	NO
2017	NO	NO	NO	NO	NO	NO
2018	NO	NO	NO	NO	NO	NO
2019	NO	NO	NO	NO	NO	NO
2020	40.88	1.60	3.19	3.51	0.64	0.64
2021	NO	NO	NO	NO	NO	NO
2022	NO	NO	NO	NO	NO	NO
Trend						
1990-2022	NA	NA	NA	NA	NA	NA
2005-2022	-140.3%	-140.3%	-140.3%	-140.3%	-140.3%	-140.3%
2021-2022	185.0%	185.0%	185.0%	185.0%	185.0%	185.0%

3.1.1.1.2 Methodological issues

3.1.1.1.2.1 Choice of methods

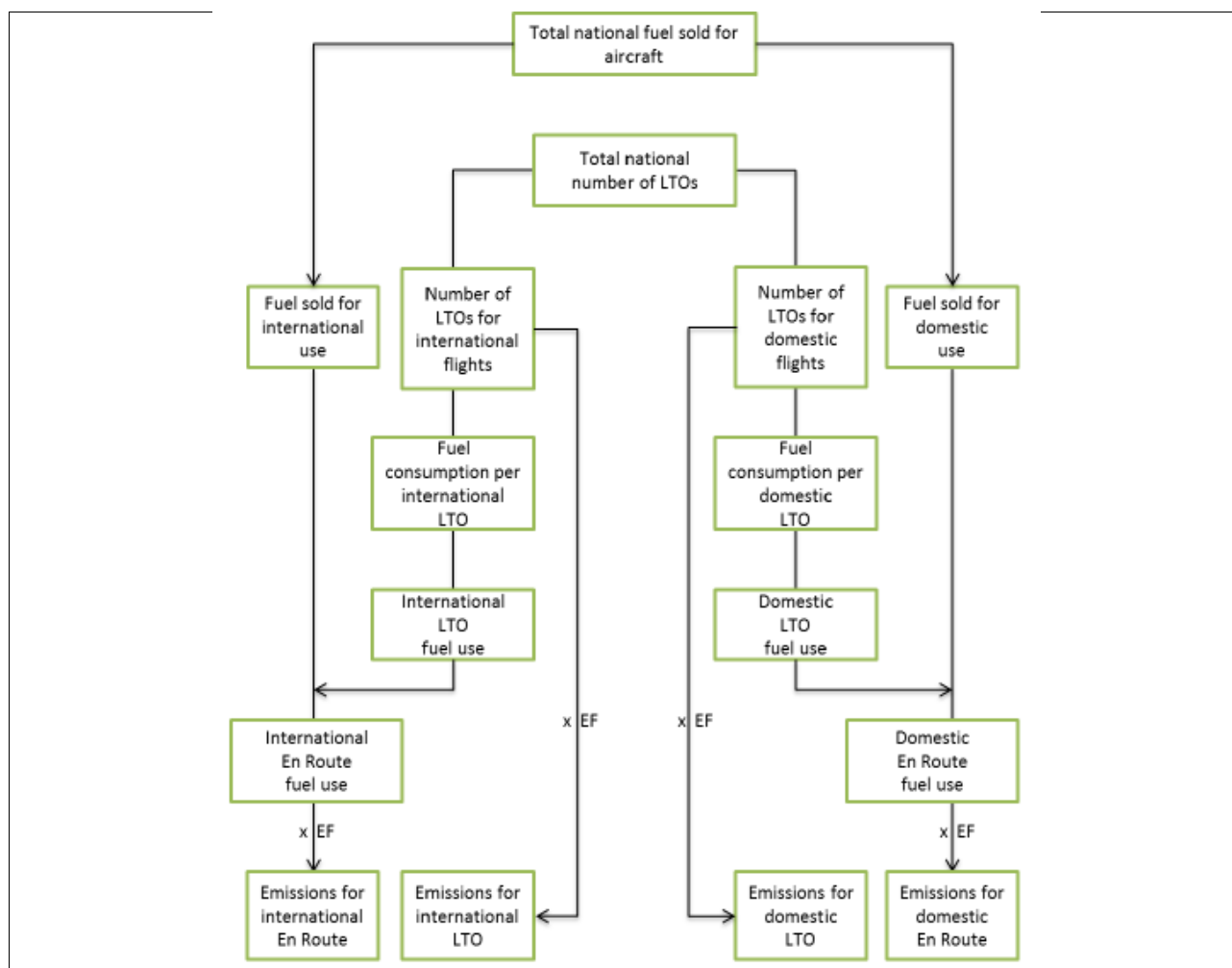


Figure 3.1 Estimation of aircraft emissions using the Tier 1 and Tier 2 methodologies (EMEP/EEA 2023)

For estimating the air pollutants emissions the Tier 1 approach¹⁷ of the EMEP/EEA air pollutant emission inventory guidebook 2023 has been applied:

Equation: Air pollutant emissions from stationary combustion

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

Where:

- Emissions_{pollutant} = emissions of a given pollutant for each of the LTO (Landing and Take-Off) and CCD (Climb-Cruise-Descent) phases of domestic and international flights (kg pollutant)
- Fuel consumption_{fuel} = amount of fuel combusted for each of the flight phases and flight types
- Emission factor_{pollutant, fuel} = default emission factor of a given pollutant by pollutant for the corresponding flight phase and flight type
- Pollutant = main pollutants : NO_x, CO, NMVOC, SO₂, particulate matter: TSP, PM₁₀, PM_{2.5}, BC

¹⁷ Source: EMEP/EEA air pollutant emission inventory guidebook 2023, 1.A.3.a Aviation 2023

Fuel = liquid fuels

3.1.1.1.2.2 Choice of activity data

The following fuels are used:

Fuel type	Fuel types
Liquid fuels	<ul style="list-style-type: none"> Kerosene

As the fuel consumption (national and international fuel consumption (Energy balance)) and the number of LTOs for domestic and international flights, the assumptions on LTO fuel consumption below can be used to divide these data into LTO and CCD data using equation 1.

<i>(Equation 1 Total fuel consumption)</i>	
Total fuel = LTO fuel + CCD fuel	
where	
<i>LTO fuel = number of LTOs x fuel consumption per LTO</i>	
<i>CCD fuel = total fuel consumption – LTO fuel consumption</i>	

Where:

LTO fuel = fuel consumed during LTOs (Landing and Take-Off)

CCD fuel = fuel consumed during CCD (Climb-Cruise-Descent)

A default consumption factor for LTO of 825 kg/LTO was applied, which is representative for an average fleet and short distances (where mainly B373-400 were used).¹⁸

Table 3.4 Calculation of fuel consumption per LTO and Cruise

	Number of LTO cycles	Source	Energy Balance International aviation		Fuel consumption Reference ¹⁹			
			Kerosene	NCV (CS) [GJ/t]	LTO [kg/LTO]	NCV (CS) [GJ/t]	Cruise	NCV (CS) [GJ/t]
				43.00				
					Fuel consumption			
			t	GJ	t	GJ	t	GJ
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

¹⁸ Table 3–3 Emission factors and fuel use for the Tier 1 methodology using jet kerosene as fuel. EMEP/EEA emission inventory guidebook 2013. Chapter 1.A.3.a, 1.A.5.b Aviation.

¹⁹ EMEP/EEA air pollutant emission inventory guidebook 2023, 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.

²⁰ Amount of fuel used for cruise is the difference of Fuel sold (energy balance) and fuel for LTO's (calculated); if the amount is 0 or negative, then it is assumed that the amount of fuel for cruise is allocated by the Party of destination; therefore the notation key NO is used.

	Number of LTO cycles	Source	Energy Balance International aviation		Fuel consumption Reference ¹⁹			
			Kerosene	NCV (CS) [GJ/t]	LTO [kg/LTO]	NCV (CS) [GJ/t]	Cruise	NCV (CS) [GJ/t]
				43.00				
					Fuel consumption			
			t	GJ	t	GJ	t	GJ
1995	NO		NO	NO	NO	NO	NO	
1996	NO		NO	NO	NO	NO		
1997	NO		NO	NO	NO	NO		
1998	NO		NO	NO	NO	NO		
1999	13281	Calculated based on ratio to fuel consumption to LTO in 2006	37,000	1,591,000	10,956	471,127	26,044	1,119,873
2000	14357		40,000	1,720,000	11,845	509,326	28,155	1,210,674
2001	15434		43,000	1,849,000	12,733	547,526	30,267	1,301,474
2002	15434.13		43,000	1,849,000	12,733	547,526	30,267	1,301,474
2003	16869.87		47,000	2,021,000	13,918	598,459	33,082	1,422,541
2004	17228.8		48,000	2,064,000	14,214	611,192	33,786	1,452,808
2005	20459.2		57,000	2,451,000	16,879	725,790	40,121	1,725,210
2006	16152		45,000	1,935,000	13,325	572,992	31,675	1,362,008
2007	18276	INSTAT Airport statistic	19,000	817,000	15,078	648,341	3,922	168,659
2008	18276		26,000	1,118,000	15,078	648,341	10,922	469,659
2009	20214		19,000	817,000	16,677	717,092	2,323	99,908
2010	20775		17,000	731,000	17,139	736,993	NO	NO
2011	22932		20,000	860,000	18,919	813,513	1,081	46,487
2012	20408		20,000	860,000	16,837	723,974	3,163	136,026
2013	19799		21,000	903,000	16,334	702,370	4,666	200,630
2014	18385		8,000	344,000	15,168	652,208	NO	NO
2015	21351		2,000	86,000	17,615	757,427	NO	NO
2016	22352		6,000	258,000	18,440	792,937	NO	NO
2017	24564		7,280	313,040	20,265	871,408	NO	NO
2018	25510		6,690	287,670	21,046	904,967	NO	NO
2019	28695		21,000	903,000	23,673	1,017,955	NO	NO
2020	15280		15,800	679,400	12,606	542,058	3,194	137,342
2021	26334		16,050	690,150	21,726	934,199	NO	NO
2022	39062		16,050	690,150	32,226	1,385,724	NO	NO
Trend								
1990-2022	NA		NA	NA	NA	NA	NA	NA
2005-2022	90.9%		-71.8%	-71.8%	90.9%	90.9%	NA	NA
2021-2022	48.3%		0.0%	0.0%	48.3%	48.3%	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 category 1.A.3.a *Aviation*.

Table 3.5 Net calorific values (NCVs) applied for conversion to energy units in category 1.A.3.a *Aviation*

Fuel	Fuel type	Net calorific value (NCV)					
		NCV	unit	type	NCV	unit	type
Kerosene	liquid	43.0	TJ/Gg	CS	44.1	TJ/Gg	D
					for comparison		
Source		Eurostat (2023): Complete energy balances (Code: nrg_bal_c)			2006 IPCC guidelines, Vol. 2, Chapter 1, Table 1.2		
Note:							
D	Default	CS	Country specific		PS	Plant specific	

3.1.1.1.2.3 Choice of emission factor

Default emission factors for air pollutant were taken from the EMEP/EEA air pollutant emission inventory guidebook 2023 and are presented in the following table.

Table 3.6 Estimation factors of air pollutants per LTO and Cruise

Pollutants		EF	Unit	reporting
NO _x	LTO	0.0083	t/LTO	1 A 3 a i (i)
	Cruise	0.0128	t/t Fuel	1 A 3 a i (ii)
NMVOC	LTO	0.0005	t/LTO	1 A 3 a i (i)
	Cruise	0.0005	t/t Fuel	1 A 3 a i (ii)
SO _x	LTO	0.0008	t/LTO	1 A 3 a i (i)
	Cruise	0.001	t/t Fuel	1 A 3 a i (ii)
PM _{2.5}	LTO	0.00007	t/LTO	1 A 3 a i (i)
	Cruise	0.0002	t/t Fuel	1 A 3 a i (ii)
PM ₁₀	LTO	0.00007	t/LTO	1 A 3 a i (i)
	Cruise	0.0002	t/t Fuel	1 A 3 a i (ii)
CO	LTO	0.0118	t/LTO	1 A 3 a i (i)
	Cruise	0.0011	t/t Fuel	1 A 3 a i (ii)
Source		EMEP/EEA air pollutant emission inventory guidebook 2013, Chapter Aviation 1.A.3.a, Page 18		

3.1.1.1.3 Uncertainties and time-series consistency

The uncertainties for activity data and emission factors used for IPCC/NFR category 1A3ai(i) and 1A3a(ii) Civil aviation are presented in the following table.

Table 3.7 Uncertainty for category 1.A.3.a Aviation

Uncertainty	Kerosene		Biomass	Reference
Activity data (AD)	2%		-	2006 IPCC GL. Vol. 2. CIVIL AVIATION - Chap. 3.6.1.7 UNCERTAINTY ASSESSMENT
Emission factor (EF)	Rating	Typical error range	Average	Reference
NO _x	D	100% to 300%	200%	Table 2 2 Rating definitions Table 2 3 Main NFR source categories with applicable quality data ratings EMEP EEA GB 2023. Part A. Chapter 5 Uncertainties.
CO	D	100% to 300%	200%	
NM VOC	D	100% to 300%	200%	
SO _x	B	20% to 60%	40%	
NH ₃	E	order of magnitude	750%	
TSP, PM ₁₀ , PM _{2.5}	D	100% to 300%	200%	
Hg, Pb, Cd, As, Cr, Cu, Ni, Se, Zn	E	order of magnitude	750%	

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.

3.1.1.1.4 Source-specific recalculations

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

Table 3.8 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 2023	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

3.1.1.1.5 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 3.9 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 2023, TIER 2	method	Comparability	high
1.A.3.a	use of default EF of EMEP/EEA air pollutant emission inventory guidebook 2023, TIER 2	EF	Comparability	medium
1.A.3.a	Investigation on Flight movements Investigation on fleet	AD	Comparability	high

3.1.1.2 International navigation (IPCC/NFR category 1.A.3.d.i)

3.1.1.2.1 Source category description

This section describes emissions resulting from fuel combustion activities of *International navigation* (movement of goods or people by ships).

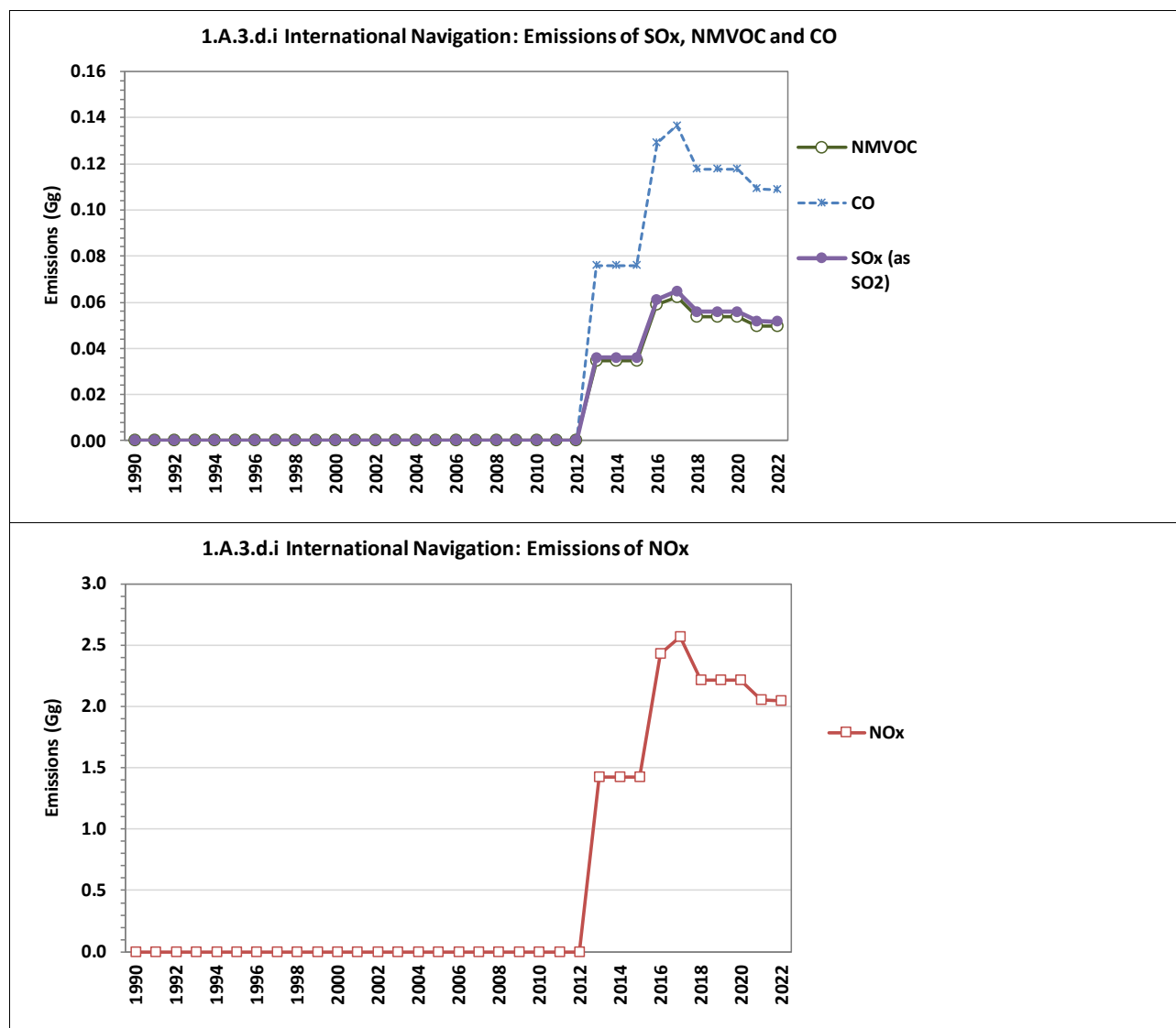
Table 3.10 Overview on reported emissions from sub categories 1.A.3.d.i *International navigation*.

Air pollutants	1.A.3.d.i International navigation						Key Category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
NO _x	✓	NO	NO	NO	NO	NO	NA
CO	✓	NO	NO	NO	NO	NO	NA
NM VOC	✓	NO	NO	NO	NO	NO	NA
SO _x	✓	NO	NO	NO	NO	NO	NA
NH ₃	NA	NO	NO	NO	NO	NO	NA
TSP	✓	NO	NO	NO	NO	NO	NA
PM ₁₀	✓	NO	NO	NO	NO	NO	NA
PM _{2.5}	✓	NO	NO	NO	NO	NO	NA
BC	✓	NO	NO	NO	NO	NO	NA
Pb	✓	NO	NO	NO	NO	NO	NA
Cd	✓	NO	NO	NO	NO	NO	NA
Hg	NA	NO	NO	NO	NO	NO	NA
As	NA	NO	NO	NO	NO	NO	NA
Cr	✓	NO	NO	NO	NO	NO	NA
Cu	✓	NO	NO	NO	NO	NO	NA
Ni	✓	NO	NO	NO	NO	NO	NA
Se	✓	NO	NO	NO	NO	NO	NA
Zn	✓	NO	NO	NO	NO	NO	NA
PCB	NA	NO	NO	NO	NO	NO	NA
PCDD/F	✓	NO	NO	NO	NO	NO	NA
PAH	✓	NO	NO	NO	NO	NO	NA
Benzo(a)pyrene	✓	NO	NO	NO	NO	NO	NA
Benzo(b)fluoranthene	✓	NO	NO	NO	NO	NO	NA

Air pollutants	1.A.3.d.i International navigation						Key Category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
Benzo(k)fluoranthene	✓	NO	NO	NO	NO	NO	NA
Indeno(1,2,3-cd)pyrene	✓	NO	NO	NO	NO	NO	NA
HCB	NA	NO	NO	NO	NO	NO	NA
A '✓' indicates: emissions from this 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 category 1.A.3.d.i *International navigation* is provided in the following figures and tables:

- annual emissions of air pollutants;
- Trend of the periods 1990 – 2022 and 2021 – 2022.



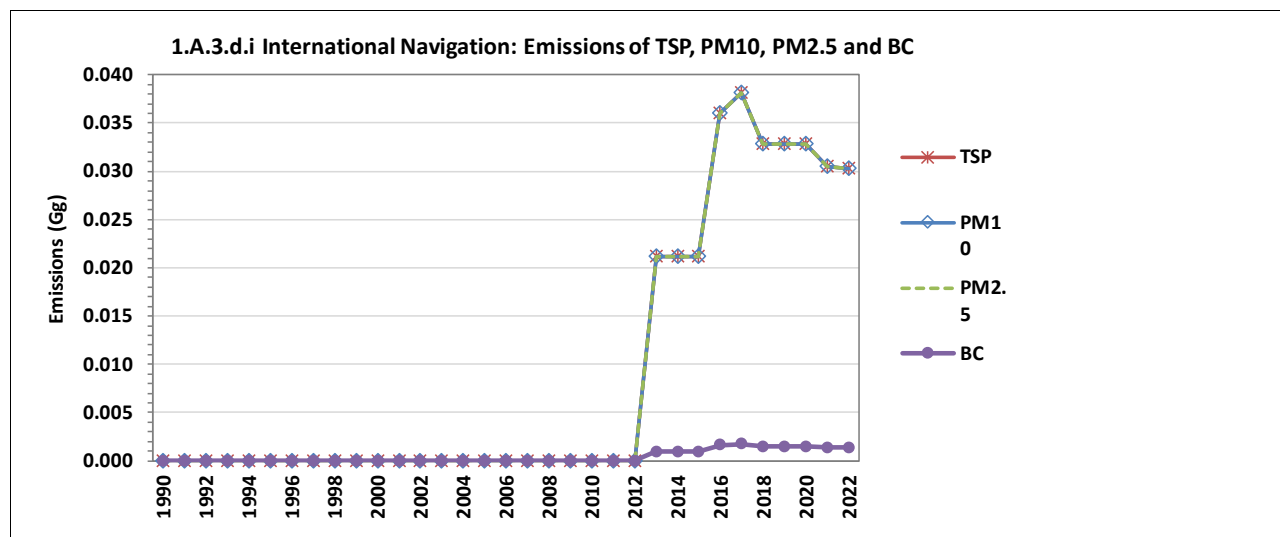


Figure 3.2 Emissions from category 1.A.3.d.i *International navigation*

3.1.1.3 International navigation (IPCC/NFR category 1.A.3.d.i)

3.1.1.3.1 Source category description

This section describes emissions resulting from fuel combustion activities of *International navigation* (movement of goods or people by ships).

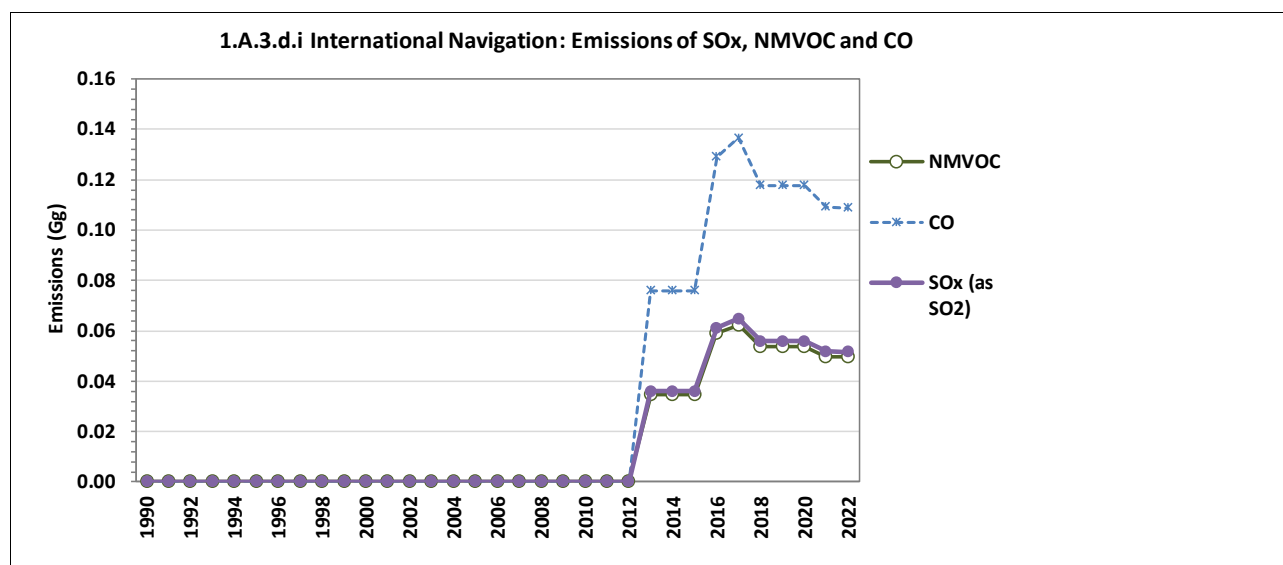
Table 3.11 Overview on reported emissions from sub categories 1.A.3.d.i *International navigation*.

Air pollutants	1.A.3.d.i International navigation						Key Category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
NO _x	✓	NO	NO	NO	NO	NO	NA
CO	✓	NO	NO	NO	NO	NO	NA
NM VOC	✓	NO	NO	NO	NO	NO	NA
SO _x	✓	NO	NO	NO	NO	NO	NA
NH ₃	NA	NO	NO	NO	NO	NO	NA
TSP	✓	NO	NO	NO	NO	NO	NA
PM ₁₀	✓	NO	NO	NO	NO	NO	NA
PM _{2.5}	✓	NO	NO	NO	NO	NO	NA
BC	✓	NO	NO	NO	NO	NO	NA
Pb	✓	NO	NO	NO	NO	NO	NA
Cd	✓	NO	NO	NO	NO	NO	NA
Hg	NA	NO	NO	NO	NO	NO	NA
As	NA	NO	NO	NO	NO	NO	NA
Cr	✓	NO	NO	NO	NO	NO	NA
Cu	✓	NO	NO	NO	NO	NO	NA
Ni	✓	NO	NO	NO	NO	NO	NA
Se	✓	NO	NO	NO	NO	NO	NA
Zn	✓	NO	NO	NO	NO	NO	NA
PCB	NA	NO	NO	NO	NO	NO	NA

Air pollutants	1.A.3.d.i International navigation						Key Category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
PCDD/F	✓	NO	NO	NO	NO	NO	NA
PAH	✓	NO	NO	NO	NO	NO	NA
Benzo(a)pyrene	✓	NO	NO	NO	NO	NO	NA
Benzo(b)fluoranthene	✓	NO	NO	NO	NO	NO	NA
Benzo(k)fluoranthene	✓	NO	NO	NO	NO	NO	NA
Indeno(1,2,3-cd)pyrene	✓	NO	NO	NO	NO	NO	NA
HCB	NA	NO	NO	NO	NO	NO	NA
<p>A '✓' indicates: emissions from this 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, TA XX - Trend Assessment in year XX</p>							

An overview of the emission from fuel combustion in category 1.A.3.d.i *International navigation* is provided in the following figures and tables:

- annual emissions of air pollutants;
- Trend of the periods 1990 – 2022 and 2021 – 2022.



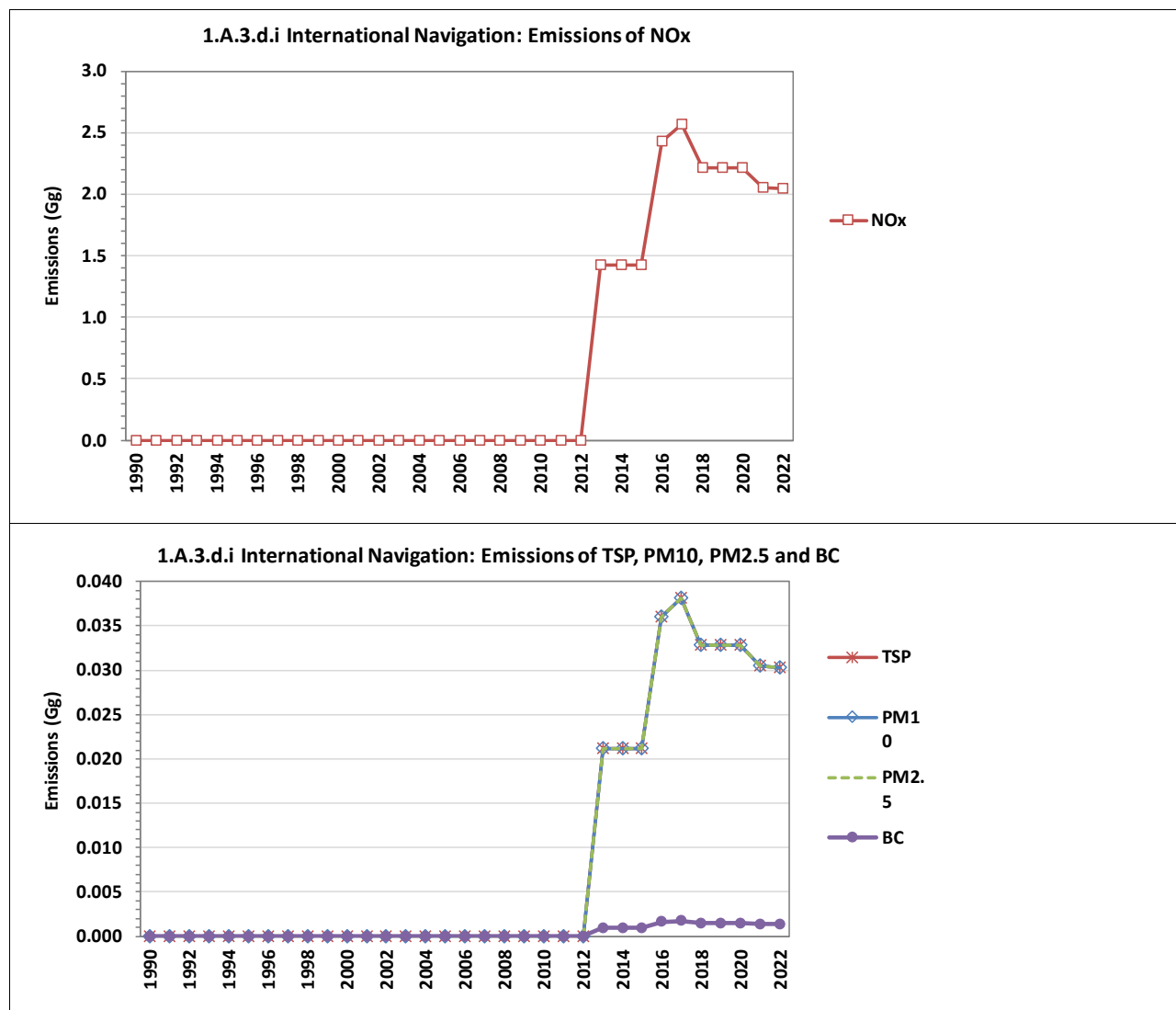


Figure 3.3 Emissions from category 1.A.3.d.i *International navigation*

Table 3.12 Emissions of main pollutants (NO_x, SO₂, NMVOC, CO and NH₃) from category 1.A.3.d.i *International navigation*

Emissions	NO _x	NMVOC	SO _x	CO	NH ₃
	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	IE	IE	IE	IE	NA
1997	IE	IE	IE	IE	NA
1998	IE	IE	IE	IE	NA
1999	IE	IE	IE	IE	NA
2000	IE	IE	IE	IE	NA
2001	IE	IE	IE	IE	NA
2002	IE	IE	IE	IE	NA
2003	IE	IE	IE	IE	NA
2004	IE	IE	IE	IE	NA
2005	IE	IE	IE	IE	NA
2006	IE	IE	IE	IE	NA
2007	IE	IE	IE	IE	NA
2008	IE	IE	IE	IE	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	1.428	0.035	0.036	0.076	NA
2014	1.428	0.035	0.036	0.076	NA
2015	1.428	0.035	0.036	0.076	NA
2016	2.427	0.059	0.061	0.129	NA
2017	2.570	0.062	0.065	0.137	NA
2018	2.213	0.054	0.056	0.118	NA
2019	2.213	0.054	0.056	0.118	NA
2020	2.213	0.054	0.056	0.118	NA
2021	2.054	0.050	0.052	0.109	NA
2022	2.046	0.050	0.052	0.109	NA
Trend					
1990 – 2022	NA	NA	NA	NA	NA
2005 – 2022	NA	NA	NA	NA	NA
2021 – 2022	-0.4%	-0.4%	-0.4%	-0.4%	NA

Table 3.13 Emissions of particulate matter (PM) from category 1.A.3.d.i *International navigation*

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	IE	IE	IE	IE
2006	IE	IE	IE	IE
2007	IE	IE	IE	IE
2008	IE	IE	IE	IE
2009	IE	IE	IE	IE
2010	IE	IE	IE	IE
2011	IE	IE	IE	IE
2012	IE	IE	IE	IE
2013	0.0212	0.0212	0.0212	0.0010
2014	0.0212	0.0212	0.0212	0.0010
2015	0.0212	0.0212	0.0212	0.0010
2016	0.0360	0.0360	0.0360	0.0016
2017	0.0381	0.0381	0.0381	0.0017
2018	0.0328	0.0328	0.0328	0.0015
2019	0.0328	0.0328	0.0328	0.0015
2020	0.0328	0.0328	0.0328	0.0015
2021	0.0304	0.0304	0.0304	0.0014
2022	0.0303	0.0303	0.0303	0.0014
Trend				
1990 – 2022	NA	NA	NA	NA
2005 – 2022	NA	NA	NA	NA
2021 – 2022	-0.4%	-0.4%	-0.4%	-0.4%

Table 3.14 Emissions of Heavy Metals (HM) from category 1.A.3.d.i *International navigation*

Emissions	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg
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	IE	IE	IE	IE	IE	IE	IE	IE	IE
2006	IE	IE	IE	IE	IE	IE	IE	IE	IE
2007	IE	IE	IE	IE	IE	IE	IE	IE	IE
2008	IE	IE	IE	IE	IE	IE	IE	IE	IE
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	<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	<0.001
2015	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2016	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2017	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2018	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2019	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2020	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2021	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2022	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Trend									
1990 – 2022	NA	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	NA	NA	NA	NA	NA	NA	NA	NA	NA
2021 – 2022	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%

Table 3.15 Emissions of Persistent Organic Pollutants (POPs) from category 1.A.3.d.i International navigation

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	IE	IE	IE	IE	IE
1991	IE	IE	IE	IE	IE	IE	IE	IE
1992	IE	IE	IE	IE	IE	IE	IE	IE
1993	IE	IE	IE	IE	IE	IE	IE	IE
1994	IE	IE	IE	IE	IE	IE	IE	IE
1995	IE	IE	IE	IE	IE	IE	IE	IE
1996	IE	IE	IE	IE	IE	IE	IE	IE
1997	IE	IE	IE	IE	IE	IE	IE	IE
1998	IE	IE	IE	IE	IE	IE	IE	IE
1999	IE	IE	IE	IE	IE	IE	IE	IE
2000	IE	IE	IE	IE	IE	IE	IE	IE
2001	IE	IE	IE	IE	IE	IE	IE	IE
2002	IE	IE	IE	IE	IE	IE	IE	IE
2003	IE	IE	IE	IE	IE	IE	IE	IE
2004	IE	IE	IE	IE	IE	IE	IE	IE
2005	IE	IE	IE	IE	IE	IE	IE	IE
2006	IE	IE	IE	IE	IE	IE	IE	IE
2007	IE	IE	IE	IE	IE	IE	IE	IE
2008	IE	IE	IE	IE	IE	IE	IE	IE
2009	IE	IE	IE	IE	IE	IE	IE	IE
2010	IE	IE	IE	IE	IE	IE	IE	IE
2011	IE	IE	IE	IE	IE	IE	IE	IE
2012	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
2014	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2015	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2016	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2017	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2018	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2019	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2020	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2021	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2022	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Trend								
1990 – 2022	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	NA	NA	NA	NA	NA	NA	NA	NA
2021 – 2022	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%

3.1.1.3.2 Methodological issues

3.1.1.3.2.1 Choice of methods

For estimating the air pollutants emissions the Tier 1 approach²¹ of the EMEP/EEA air pollutant emission inventory guidebook 2023 has been applied:

Equation: emissions from stationary combustion

$$\text{Emissions}_{\text{pollutant}} = \text{Fuel Consumption}_{\text{fuel}} \times \text{Emission Factor}_{\text{pollutant, fuel}}$$

Where:

Emissions _{pollutant}	= emissions of a given pollutant by type of fuel (kg pollutant)
Fuel consumption _{fuel}	= amount of fuel combusted (TJ)
Emission factor _{pollutant, fuel}	= default emission factor of a given pollutant by type of fuel (g _{pollutant} /GJ).
Pollutant	= main pollutants: NO _x , CO, NMVOC, SO ₂ particulate matter: TSP, PM ₁₀ , PM _{2.5} , 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

3.1.1.3.2.2 Choice of activity data

The following fuels are used for category 1.A.3.d.i *International navigation*:

Tier 1 fuel type	Associated fuel types
Liquid fuels	<ul style="list-style-type: none"> Gas/Diesel Oil

Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2022 were taken from EUROSTAT, prepared by Albanian Institute of Statistics (INSTAT).

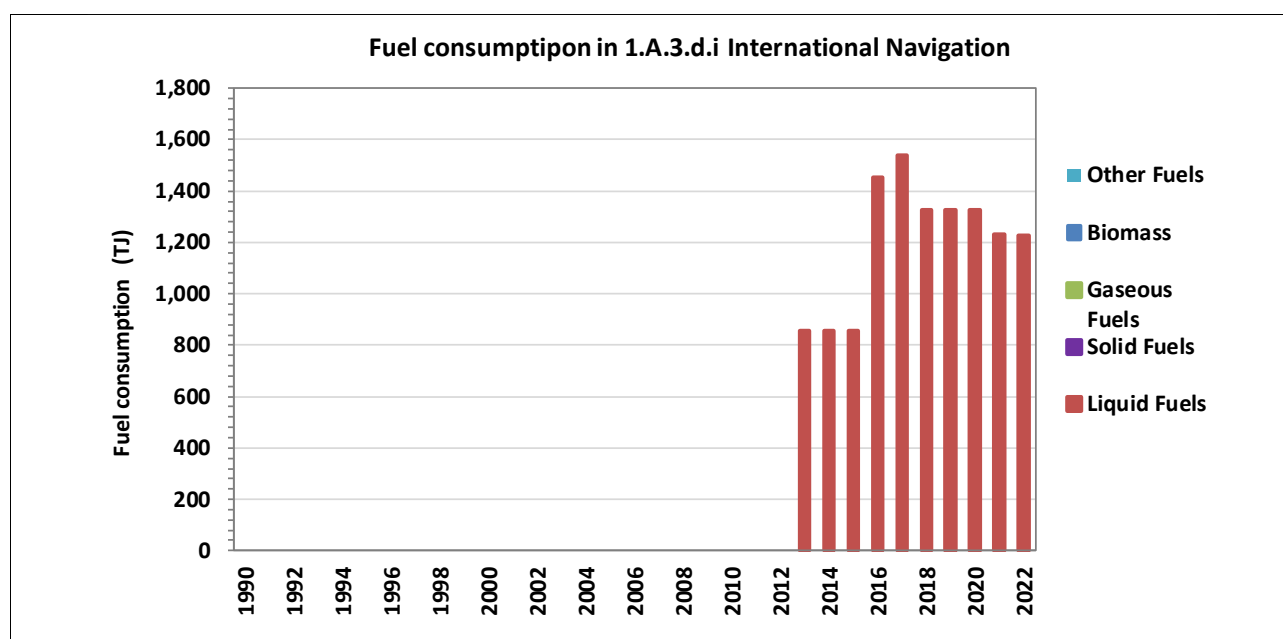


Figure 3.4 Activity data for category 1.A.3.d.i *International navigation*

²¹ Source: EMEP/EEA air pollutant emission inventory guidebook 2023. Chapter 1.A.3.c Railways. sub-chapter 3.2 Tier 1 total fuel used methodology.

Table 3.16 Activity data for category 1.A.3.d.i *International navigation*

Activity data 1.A.1.d	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	IE	IE	NO	NO	NO	NO	NO
2006	IE	IE	NO	NO	NO	NO	NO
2007	IE	IE	NO	NO	NO	NO	NO
2008	IE	IE	NO	NO	NO	NO	NO
2009	IE	IE	NO	NO	NO	NO	NO
2010	IE	IE	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	856.00	856.00	NO	NO	NO	NO	NO
2015	856.00	856.00	NO	NO	NO	NO	NO
2016	856.00	856.00	NO	NO	NO	NO	NO
2017	1,455.20	1,455.20	NO	NO	NO	NO	NO
2018	1,540.80	1,540.80	NO	NO	NO	NO	NO
2019	1,326.80	1,326.80	NO	NO	NO	NO	NO
2020	1,326.80	1,326.80	NO	NO	NO	NO	NO
2021	1,326.80	1,326.80	NO	NO	NO	NO	NO
2022	1,231.78	1,231.78	NO	NO	NO	NO	NO
Trend							
1990 – 2022	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	NA	NA	NA	NA	NA	NA	NA
2021 – 2022	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%	-0.4%

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 bases on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in category 1.A.3.d.i *International navigation*.

Table 3.17 Net calorific values (NCVs) applied for conversion to energy units in category 1.A.3.d.i *International navigation*

Fuel	Fuel type	Net calorific value (NCV)					
		NCV	unit	type	NCV	unit	type
Gas/Diesel Oil (Non-bio gas/diesel oil)	liquid	43.292	TJ/Gg	CS	47.3	TJ/Gg	D
					for comparision		
Source		Eurostat (2023): Complete energy balances (Code: nrg_bal_c)			2006 IPCC guidelines, Vol. 2, Chapter 1, Table 1.2		
Note:							
D	Default	CS	Country specific		PS	Plant specific	

3.1.1.3.2.3 Choice of emission factors

Default emission factors for air pollutant were taken from the EMEP/EEA air pollutant emission inventory guidebook 2023 and are presented in the following table.

Table 3.18 Emission factors (EF) for Main pollutants, Particulate Matter (PM), Heavy metals (HM) and Persistent Organic Pollutants (POPs) for category 1.A.3.d.i *International navigation*.

Fuel Type	UNIT	Gas/Diesel Oil (Non-bio gas/diesel oil)	
		Default EF	type
NOx	kg/tonne fuel	72.2	D
CO	kg/tonne fuel	3.84	D
NM VOC	kg/tonne fuel	1.75	D
SOx	kg/tonne fuel	1.82	D
NH3	kg/tonne fuel	NE	D
TSP	kg/tonne fuel	1.07	D
PM10	kg/tonne fuel	1.07	D
PM2.5	kg/tonne fuel	1.07	D
BC	% of PM2.5	0.0483	D
Pb	g/tonne fuel	0.13	D
Cd	g/tonne fuel	0.01	D
Hg	g/tonne fuel	0.03	D
As	g/tonne fuel	0.04	D
Cr	g/tonne fuel	0.05	D
Cu	g/tonne fuel	0.88	D
Ni	g/tonne fuel	1	D
Se	g/tonne fuel	0.1	D
Zn	g/tonne fuel	1.2	D

Fuel Type		UNIT	Gas/Diesel Oil (Non-bio gas/diesel oil)							
Pollutant			Default EF				type			
PCB		mg/tonne fuel	0.038				D			
PCDD/F		ug I-TEQ/tonne	0.13				D			
Benzo(a)pyrene		g/tonne fuel	0.01				D			
Benzo(b)fluoranthene		g/tonne fuel	0.01				D			
Benzo(k)fluoranthene		g/tonne fuel	0.002				D			
Indeno(1,2,3-cd)pyrene		g/tonne fuel	0.001				D			
HCB		g/tonne fuel	0.08				D			
Source		Table 3-1 Tier 1 emission factors for ships using marine diesel oil/marine gas oil. Section 3.2.2. page 17.								
		EMEP/EEA air pollutant emission inventory guidebook 2023. Part B. Chapter 1.A.3.d.i, 1.A.3.d.ii, 1.A.4.c.iii International maritime and inland navigation, national navigation, national fishing, recreational boats International maritime navigation, international inland navigation, national navigation (shipping), national fishing.								
Note:										
T1	TIER1	D	Default	CS	Country specific	PS	Plant specific	IEF	Implied emission factor	

3.1.1.3.3 Uncertainties and time-series consistency

The uncertainties for activity data and emission factors used for IPCC/NFR category 1.A.3.d *Water-borne navigation* s are presented in the following table.

Table 3.19 Uncertainty for category 1.A.3.d.i International navigation.

Uncertainty	Solid fuels	Gaseous fuels	Liquid fuels	Biomass	Reference
Activity data (AD)	-	-	5%	-	Table 2.15. 2006 IPCC GL. Vol. 2. Chap. 2 (2.4.2)
Emission factor (EF)	Rating	Typical error range	Average	Reference	
NO _x	D	100% to 300%	200%	Table 2 2 Rating definitions Table 2 3 Main NFR source categories with applicable quality data ratings EMEP EEA GB 2023. Part A. Chapter 5 Uncertainties.	
CO	D	100% to 300%	200%		
NM VOC	D	100% to 300%	200%		
SO _x	B	20% to 60%	40%		
NH ₃	E	order of magnitude	750%		
TSP, PM ₁₀ , PM _{2.5} , BC	D	100% to 300%	200%		
Hg	B	20% to 60%	40%		
Pb, Cd, As, Cr, Cu, Ni, Se, Zn	D	100% to 300%	200%		
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.

3.1.1.3.4 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.

3.1.1.3.5 Source-specific recalculations

The following table presents the main revisions and recalculations done since last submission and relevant to category 1.A.3.d.i *International navigation*.

Table 3.20 Recalculations done in category 1.A.3.d.i *International navigation*.

source category	Revisions of data	Type of revision	Type of improvement
1.A.3.d.i	Revision of NCV by using country specific NCV	AD	Accuracy
1.A.3.d.i	Revision of activity data	AD	Accuracy

3.1.1.3.6 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 3.21 Planned improvements for category 1.A.3.d.i *International navigation*.

source category	Planned improvement	Type of improvement		Priority
1.A.3.d.i	Collection of information on sulphur content Sulphur content in used fuel for preparing country specific emission factor (CS EF) $\Rightarrow \text{CS EF}_{\text{SO}_2} [\text{g/GJ}] = (\text{S} [\%] \cdot 20000) / (\text{NCV} [\text{GJ/t}])$	AD, EF	Completeness Accuracy Transparency	Medium
1.A.3.d.i	Improvement of time series consistency and split of fuels: check of years 1990- 2022	AD	Accuracy Transparency	High

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

Energy industries are defined as consisting of economic units whose principal activity is primary energy production, transformation of energy or distribution²². 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 Completeness

Table 3.22 Overview on reported emissions from NFR sub-categories 1.A.1.a.i. 1.A.1.a.ii and 1.A.1.a.iii

Air pollutants	1.A.1.a						1.A.1.b						1.A.1.c					
	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 _x , CO, NMVOC, SO _x	NO	✓*	NO	NO	NO	NO	NO	✓*	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
NH ₃	NO	NA	NO	NO	NO	NO	NO	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
TSP, PM ₁₀ , PM _{2.5} , BC	NO	✓*	NO	NO	NO	NO	NO	✓*	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Pb, Cd, Hg, Cu	NO	✓*	NO	NO	NO	NO	NO	✓*	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
As, Cr, Ni, Se, Zn	NO	✓*	NO	NO	NO	NO	NO	✓*	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
PCB	NO	NA	NO	NO	NO	NO	NO	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
PCDD/F	NO	✓*	NO	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	NO	NO
HCB	NO	NA	NO	NO	NO	NO	NO	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
A '✓' indicates: emissions from this category have been estimated. Notation keys: IE - included elsewhere. NO – not occurred. NE - not estimated. NA - not applicable. C – confidential																		
Use of notation key and comments																		
✓*	1.A.1.a.i liquid			only 1990 - 2011														
	1.A.1.a.ii liquid			only 1990 - 2011														

²² For more information see <https://unstats.un.org/unsd/energy/ires/IRES-web.pdf>

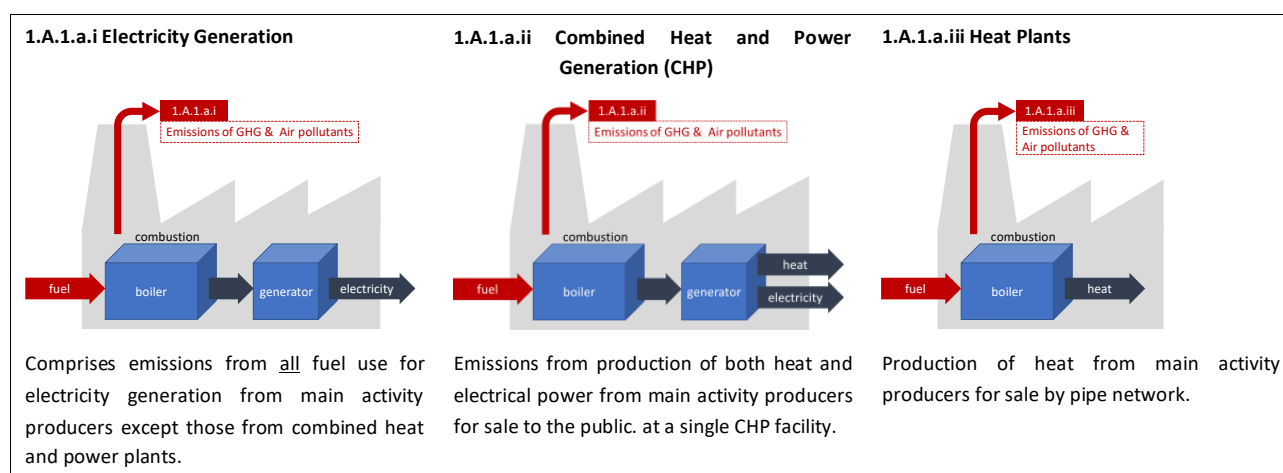
3.1.2.2 Main Activity Electricity and Heat Production (NFR category 1.A.1.a)

3.1.2.2.1 Source category description

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

The following sub-categories are defined in the 2006 IPCC Guidelines and EMEP/EEA air pollutant emission inventory guidebook 2023:



3.1.2.2.1.1 Completeness

Table 3.23 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					
	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 _x , CO, NMVOC, SO _x	NO	✓*	NO	NO	NO	NO	NO	✓*	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
NH ₃	NO	NA	NO	NO	NO	NO	NO	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
TSP, PM ₁₀ , PM _{2.5} , BC	NO	✓*	NO	NO	NO	NO	NO	✓*	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Pb, Cd, Hg, Cu	NO	✓*	NO	NO	NO	NO	NO	✓*	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
As, Cr, Ni, Se, Zn	NO	✓*	NO	NO	NO	NO	NO	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Air pollutants	1.A.1.a.i						1.A.1.a.ii						1.A.1.a.iii					
	liquid	solid	gaseous	Other fossil fuel	Peat	biomass	liquid	solid	gaseous	Other fossil fuel	Peat	biomass	liquid	solid	Gaseous	Other fossil fuel	Peat	biomass
PCDD/F	NO	✓*	NO	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	NO	NO
Benzo(a)pyrene	NO	✓*	NO	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	NO	NO
Benzo(k)fluoranthene	NO	✓*	NO	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	NO	NO
PCB, HCB	NO	NA	NO	NO	NO	NO	NO	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
A '✓' indicates: emissions from this category have been estimated. Notation keys: IE - included elsewhere. NO – not occurred. NE - not estimated. NA - not applicable. C – confidential																		
Use of notation key and comments																		
✓*	1.A.1.a.i liquid			only 1990 - 2011														
	1.A.1.a.ii liquid			only 1990 - 2011														

3.1.2.2.1.2 Emission trends

An overview of the GHG emission from fuel combustion in category 1.A.1.a.i *Electricity Generation* is provided in the following figures and tables:

- annual emissions of air pollutants;
- trend of the periods 1990 – 2011.

In the period 1990 – 2011, the electricity in Albania is produced with liquid fuels. Since 2015, only renewable energy, here mainly hydropower, is used.

Fluctuation of emissions in the period 1990 – 2011 are due to

- reduced energy needs by the general stopped and shut-down industrial production in the beginning of the 1990er years.
- ### please provide further reasons

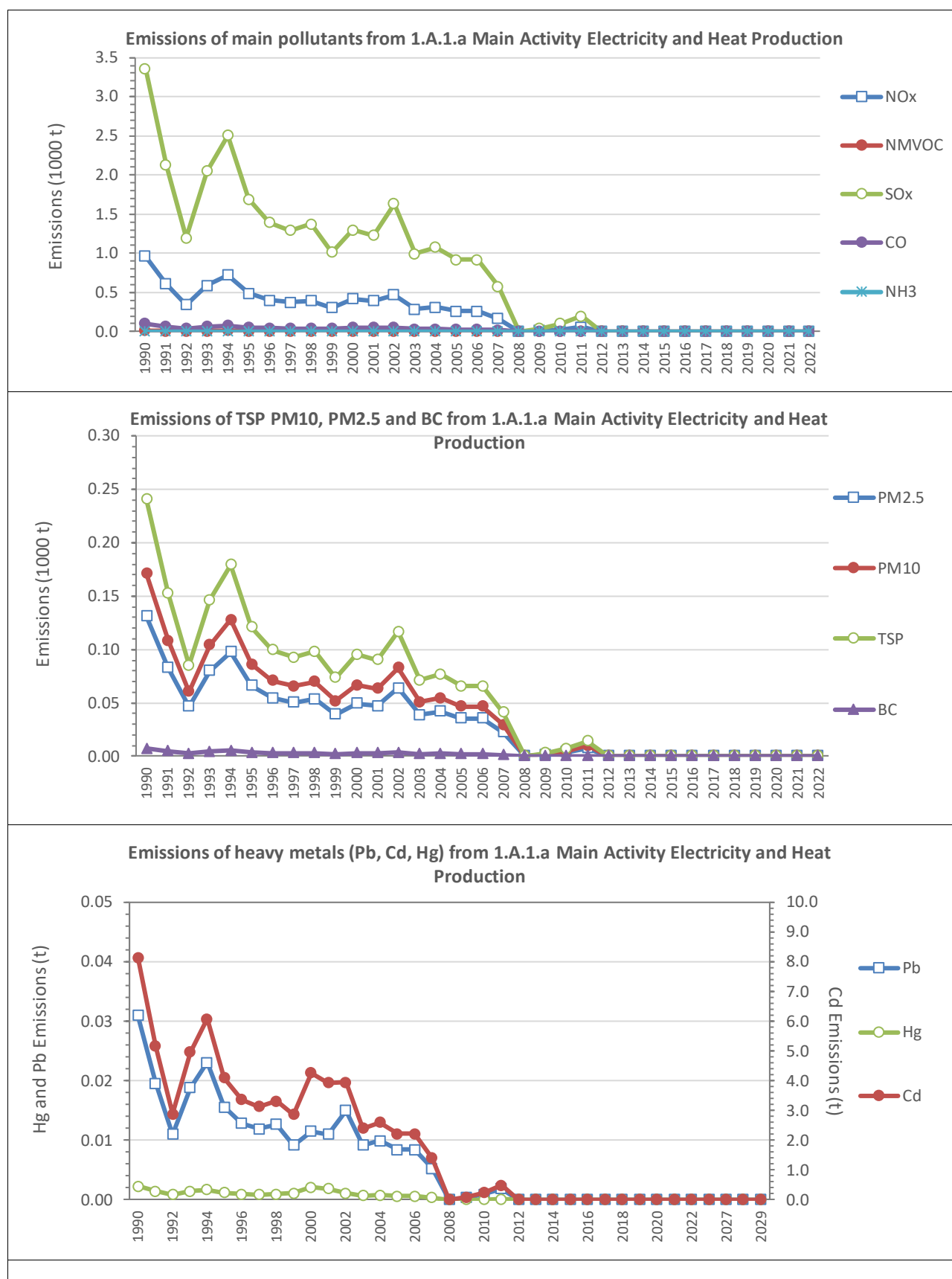


Figure 3.5 Emissions from category 1.A.1.a Main Activity Electricity and Heat Production

Table 3.24 Emissions of main pollutants (NO_x, SO₂, NMVOC and CO) from Category 1.A.1.a Main Activity Electricity and Heat Production

Emissions	NO _x	NMVOC	SO ₂	CO	NH ₃
	Gg	Gg	Gg	Gg	Gg
1990	0.965	0.016	3.362	0.103	NA
1991	0.611	0.010	2.129	0.065	NA
1992	0.342	0.006	1.194	0.036	NA
1993	0.588	0.010	2.049	0.063	NA
1994	0.719	0.012	2.507	0.076	NA
1995	0.485	0.008	1.691	0.052	NA
1996	0.400	0.006	1.393	0.042	NA
1997	0.371	0.006	1.293	0.039	NA
1998	0.394	0.006	1.373	0.042	NA
1999	0.308	0.005	1.011	0.036	NA
2000	0.418	0.007	1.295	0.053	NA
2001	0.393	0.006	1.230	0.049	NA
2002	0.468	0.008	1.631	0.050	NA
2003	0.285	0.005	0.995	0.030	NA
2004	0.308	0.005	1.074	0.033	NA
2005	0.263	0.004	0.915	0.028	NA
2006	0.263	0.004	0.915	0.028	NA
2007	0.166	0.003	0.577	0.018	NA
2008	NO	NO	NO	NO	NA
2009	0.011	0.000	0.040	0.001	NA
2010	0.029	0.000	0.099	0.003	NA
2011	0.057	0.001	0.199	0.006	NA
2012	NO	NO	NO	NO	NA
2013	NO	NO	NO	NO	NA
2014	NO	NO	NO	NO	NA
2015	NO	NO	NO	NO	NA
2016	NO	NO	NO	NO	NA
2017	NO	NO	NO	NO	NA
2018	NO	NO	NO	NO	NA
2019	NO	NO	NO	NO	NA
2020	NO	NO	NO	NO	NA
2021	NO	NO	NO	NO	NA
2022	NO	NO	NO	NO	NA
<i>Trend</i>					
1990 – 2022	-100%	-100%	-100%	-100%	NA
2005 – 2022	-100%	-100%	-100%	-100%	NA
2021 – 2022	NA	NA	NA	NA	NA

Table 3.25 Emissions of particulate matter (PMs) from category 1.A.1.a.i Main Activity Electricity and Heat Production

Emissions	PM2.5	PM10	TSP	BC
	Gg	Gg	Gg	Gg
1990	0.131	0.171	0.240	0.007
1991	0.083	0.108	0.152	0.005
1992	0.047	0.061	0.085	0.003
1993	0.080	0.104	0.147	0.004
1994	0.098	0.128	0.179	0.005
1995	0.066	0.086	0.121	0.004
1996	0.054	0.071	0.100	0.003
1997	0.050	0.066	0.092	0.003
1998	0.054	0.070	0.098	0.003
1999	0.039	0.052	0.073	0.002
2000	0.050	0.067	0.095	0.003
2001	0.047	0.063	0.090	0.003
2002	0.064	0.083	0.117	0.004
2003	0.039	0.051	0.071	0.002
2004	0.042	0.055	0.077	0.002
2005	0.036	0.047	0.065	0.002
2006	0.036	0.047	0.065	0.002
2007	0.022	0.029	0.041	0.001
2008	NO	NO	NO	NO
2009	0.002	0.002	0.003	0.000
2010	0.004	0.005	0.007	0.000
2011	0.008	0.010	0.014	0.000
2012	NO	NO	NO	NO
2013	NO	NO	NO	NO
2014	NO	NO	NO	NO
2015	NO	NO	NO	NO
2016	NO	NO	NO	NO
2017	NO	NO	NO	NO
2018	NO	NO	NO	NO
2019	NO	NO	NO	NO
2020	NO	NO	NO	NO
2021	NO	NO	NO	NO
2022	NO	NO	NO	NO
<i>Trend</i>				
1990 – 2022	-100%	-100%	-100%	-63.8%
2005 – 2022	-100%	-100%	-100%	130.9%
2021 – 2022	NA	NA	NA	-9.7%

Table 3.26 Emissions of Heavy Metals (HM) from category 1.A.1.a.i 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	0.031	8.151	0.002	0.027	0.017	0.036	1.732	0.014	0.596
1991	0.020	5.161	0.001	0.017	0.011	0.023	1.097	0.009	0.378
1992	0.011	2.894	0.001	0.010	0.006	0.013	0.615	0.005	0.212
1993	0.019	4.968	0.001	0.016	0.011	0.022	1.056	0.009	0.363
1994	0.023	6.077	0.002	0.020	0.013	0.027	1.291	0.010	0.445
1995	0.016	4.100	0.001	0.014	0.009	0.018	0.871	0.007	0.300
1996	0.013	3.376	0.001	0.011	0.007	0.015	0.717	0.006	0.247
1997	0.012	3.135	0.001	0.010	0.007	0.014	0.666	0.005	0.229
1998	0.013	3.328	0.001	0.011	0.007	0.015	0.707	0.006	0.243
1999	0.009	2.877	0.001	0.009	0.006	0.012	0.513	0.006	0.177
2000	0.012	4.261	0.002	0.012	0.008	0.016	0.647	0.011	0.224
2001	0.011	3.942	0.002	0.011	0.007	0.015	0.616	0.010	0.213
2002	0.015	3.955	0.001	0.013	0.008	0.018	0.840	0.007	0.289
2003	0.009	2.412	0.001	0.008	0.005	0.011	0.512	0.004	0.176
2004	0.010	2.605	0.001	0.009	0.006	0.012	0.553	0.004	0.191
2005	0.008	2.219	0.001	0.007	0.005	0.010	0.471	0.004	0.162
2006	0.008	2.219	0.001	0.007	0.005	0.010	0.471	0.004	0.162
2007	0.005	1.399	0.000	0.005	0.003	0.006	0.297	0.002	0.102
2008	NO	NO	NO	NO	NO	NO	NO	NO	NO
2009	0.000	0.096	0.000	0.000	0.000	0.000	0.020	0.000	0.007
2010	0.001	0.241	0.000	0.001	0.001	0.001	0.051	0.000	0.018
2011	0.002	0.482	0.000	0.002	0.001	0.002	0.102	0.001	0.035
2012	NO	NO	NO	NO	NO	NO	NO	NO	NO
2013	NO	NO	NO	NO	NO	NO	NO	NO	NO
2014	NO	NO	NO	NO	NO	NO	NO	NO	NO
2015	NO	NO	NO	NO	NO	NO	NO	NO	NO
2016	NO	NO	NO	NO	NO	NO	NO	NO	NO
2017	NO	NO	NO	NO	NO	NO	NO	NO	NO
2018	NO	NO	NO	NO	NO	NO	NO	NO	NO
2019	NO	NO	NO	NO	NO	NO	NO	NO	NO
2020	NO	NO	NO	NO	NO	NO	NO	NO	NO
2021	NO	NO	NO	NO	NO	NO	NO	NO	NO
2022	NO	NO	NO	NO	NO	NO	NO	NO	NO
<i>Trend</i>									
1990 – 2022	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%
2005 – 2022	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%
2021 – 2022	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 3.27 Emissions of Persistent Organic Pollutants (POPs) from category 1.A.1.a.i Main Activity Electricity and Heat Production

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	g	g	g	g	g	g	g
1990	0.017	NA	30.567	30.567	47.005	108.138	NA	NA
1991	0.011	NA	19.353	19.353	29.761	68.466	NA	NA
1992	0.006	NA	10.852	10.852	16.688	38.392	0.001	NA
1993	0.010	NA	18.629	18.629	28.648	65.907	0.002	NA
1994	0.013	NA	22.789	22.789	35.045	80.624	0.003	NA
1995	0.009	NA	15.374	15.374	23.642	54.389	0.002	NA
1996	0.007	NA	12.661	12.661	19.469	44.791	0.001	NA
1997	0.007	NA	11.756	11.756	18.079	41.592	0.001	NA
1998	0.007	NA	12.480	12.480	19.191	44.151	0.001	NA
1999	0.005	NA	9.043	9.043	16.276	34.363	0.001	NA
2000	0.007	NA	11.395	11.395	23.742	46.532	NA	NA
2001	0.006	NA	10.852	10.852	22.019	43.724	NA	NA
2002	0.008	NA	14.831	14.831	22.807	52.470	NA	NA
2003	0.005	NA	9.043	9.043	13.907	31.994	NA	NA
2004	0.005	NA	9.767	9.767	15.019	34.553	NA	NA
2005	0.005	NA	8.320	8.320	12.794	29.434	NA	NA
2006	0.005	NA	8.320	8.320	12.794	29.434	NA	NA
2007	0.003	NA	5.245	5.245	8.066	18.556	NA	NA
2008	NO	NA	NO	NO	NO	NO	NA	NA
2009	0.000	NA	0.362	0.362	0.556	1.280	NA	NA
2010	0.001	NA	0.904	0.904	1.391	3.199	NA	NA
2011	0.001	NA	1.809	1.809	2.781	6.399	NA	NA
2012	NO	NA	NO	NO	NO	NO	NA	NA
2013	NO	NA	NO	NO	NO	NO	NA	NA
2014	NO	NA	NO	NO	NO	NO	NA	NA
2015	NO	NA	NO	NO	NO	NO	NA	NA
2016	NO	NA	NO	NO	NO	NO	NA	NA
2017	NO	NA	NO	NO	NO	NO	NA	NA
2018	NO	NA	NO	NO	NO	NO	NA	NA
2019	NO	NA	NO	NO	NO	NO	NA	NA
2020	NO	NA	NO	NO	NO	NO	NA	NA
2021	NO	NA	NO	NO	NO	NO	NA	NA
2022	NO	NA	NO	NO	NO	NO	NA	NA
<i>Trend</i>								
1990 – 2022	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%
2005 – 2022	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%
2021 – 2022	NA	NA	NA	NA	NA	NA	NA	NA

3.1.2.2.2 Methodological issues

3.1.2.2.2.1 Choice of methods

For estimating the air pollutants emissions the Tier 1 approach²³ of the EMEP/EEA air pollutant emission inventory guidebook 2023 has been applied:

Equation: emissions from stationary combustion

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

Where:

Emissions _{pollutant}	= emissions of a given pollutant by type of fuel (kg pollutant)
Fuel consumption _{fuel}	= amount of fuel combusted (TJ)
Emission factor _{pollutant. fuel}	= default emission factor of a given pollutant by type of fuel (g _{pollutant} /GJ).
Pollutant	= main pollutants: NO _x , SO _x , NMVOC, CO, NH ₃ 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

3.1.2.2.2.2 Choice of activity data

The following fuels are used for electricity production:

- Liquid fuels:**
- Residual fuel oil
 - Gas/Diesel Oil (Non-bio gas/diesel oil)

Fuel consumption used for estimating the air pollutant emissions for the years 1990 - 2022 were taken from EUROSTAT but were prepared by Albanian Institute of Statistics (INSTAT).

The total fuel consumption decreased by 100% in the period 1990 – 2011. Since 2012, electricity is generated with renewable energy, here mainly hydropower.

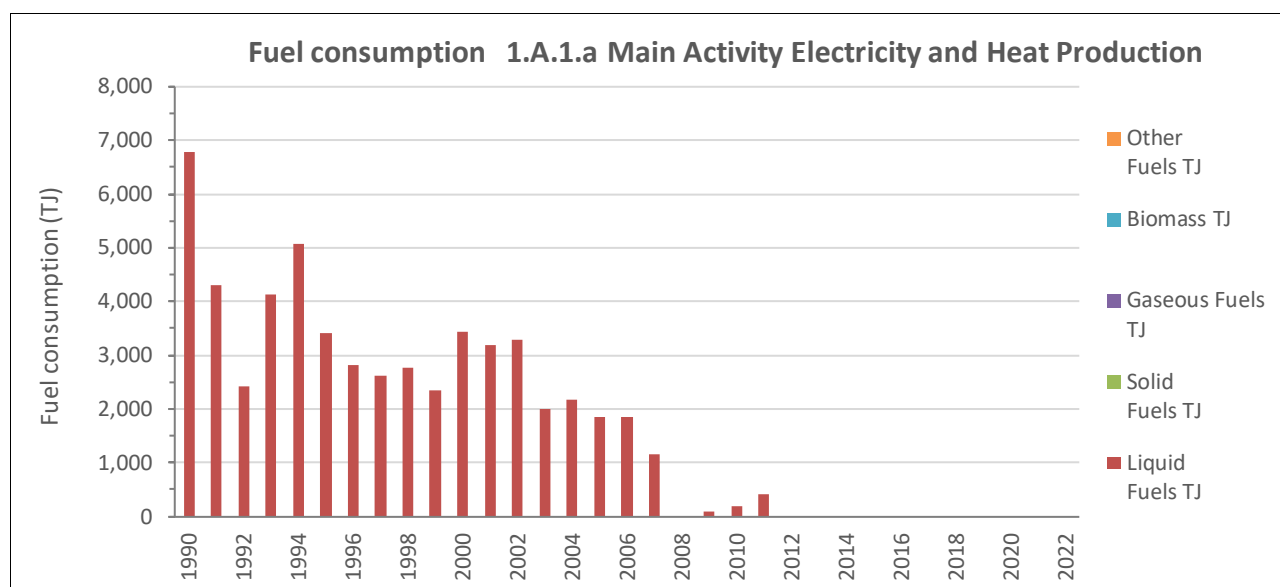


Figure 3.6 Activity data for category 1.A.1.a Main Activity Electricity and Heat Production

²³ Source: EMEP/EEA air pollutant emission inventory guidebook 2023. 1.A.1 Energy industries. sub-chapter 3.4.2 Tier 1 default approach.

Table 3.28 Activity data for category 1.A.1.a Main Activity Electricity and Heat Production

Activity data 1.A.1.a.i	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
1990	6,792.62	6,792.62	NO	NO	NO	NO	NO
1991	4,300.65	4,300.65	NO	NO	NO	NO	NO
1992	2,411.58	2,411.58	NO	NO	NO	NO	NO
1993	4,139.88	4,139.88	NO	NO	NO	NO	NO
1994	5,064.32	5,064.32	NO	NO	NO	NO	NO
1995	3,416.41	3,416.41	NO	NO	NO	NO	NO
1996	2,813.51	2,813.51	NO	NO	NO	NO	NO
1997	2,612.55	2,612.55	NO	NO	NO	NO	NO
1998	2,773.32	2,773.32	NO	NO	NO	NO	NO
1999	2,352.05	2,352.05	NO	NO	NO	NO	NO
2000	3,430.96	3,430.96	NO	NO	NO	NO	NO
2001	3,181.98	3,181.98	NO	NO	NO	NO	NO
2002	3,295.83	3,295.83	NO	NO	NO	NO	NO
2003	2,009.65	2,009.65	NO	NO	NO	NO	NO
2004	2,170.42	2,170.42	NO	NO	NO	NO	NO
2005	1,848.88	1,848.88	NO	NO	NO	NO	NO
2006	1,848.88	1,848.88	NO	NO	NO	NO	NO
2007	1,165.60	1,165.60	NO	NO	NO	NO	NO
2008	NO	NO	NO	NO	NO	NO	NO
2009	80.39	80.39	NO	NO	NO	NO	NO
2010	200.97	200.97	NO	NO	NO	NO	NO
2011	401.93	401.93	NO	NO	NO	NO	NO
2012	NO	NO	NO	NO	NO	NO	NO
2013	NO	NO	NO	NO	NO	NO	NO
2014	NO	NO	NO	NO	NO	NO	NO
2015	NO	NO	NO	NO	NO	NO	NO
2016	NO	NO	NO	NO	NO	NO	NO
2017	NO	NO	NO	NO	NO	NO	NO
2018	NO	NO	NO	NO	NO	NO	NO
2019	NO	NO	NO	NO	NO	NO	NO
2020	NO	NO	NO	NO	NO	NO	NO
2021	NO	NO	NO	NO	NO	NO	NO
2022	NO	NO	NO	NO	NO	NO	NO
<i>Trend</i>							
1990 – 2022	-100%	-100%	NA	NA	NA	NA	NA
2005 – 2022	-100%	-100%	NA	NA	NA	NA	NA
2021 – 2022	NA	NA	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 category 1.A.1.a *Main Activity Electricity and Heat Production*.

Table 3.29 Net calorific values (NCVs) applied for conversion to energy units in category 1.A.1.a Main Activity Electricity and Heat Production

Fuel		Fuel type	Net calorific value (NCV) (TJ/Gg)			
			NCV		type	
Residual fuel oil		liquid	40.193	CS	40.4	D
Gas/Diesel Oil (Non-bio gas/diesel oil)		liquid	43.292	CS	43.0	D
					<i>for comparison</i>	
Source			Eurostat (2023): Complete energy balances (Code: nrg_bal_c)		2006 IPCC guidelines, Vol. 2, Chapter 1, Table 1.2	
Note:						
D	Default	CS	Country specific	PS	Plant specific	

3.1.2.2.2.3 Choice of emission factors

Default emission factors for air pollutant were taken from the EMEP/EEA air pollutant emission inventory guidebook 2023²⁴ and are presented in the following table.

Table 3.30 Emission factors (EF) for Main pollutants, Particulate Matter (PM), Heavy metals (HM) and Persistent Organic Pollutants (POPs) for category 1.A.1.a Main Activity Electricity and Heat Production

Fuel Type	UNIT	Heavy fuel oil		Light oil	
Associated fuel types		Residual fuel oil, refinery feedstock, petroleum coke, orimulsion, bitumen		Gas oil, kerosene, naphtha, shale oil	
Pollutant		EF	Type	EF	type
NOx	g/GJ	142.00	D	65	D
CO	g/GJ	15.10	D	16.2	D
NMVOC	g/GJ	2.30	D	0.8	D
SOx	g/GJ	495.00	D	46.5	D
NH3	g/GJ	NA		NA	
TSP	g/GJ	35.40	D	6.5	D
PM10	g/GJ	25.20	D	3.2	D
PM2.5	g/GJ	19.30	D	0.8	D
BC	% of PM2.5	5.60	D	33.5	D
Pb	mg/GJ	4.56	D	4.07	D
Cd	mg/GJ	1.20	D	1.36	D
Hg	mg/GJ	0.34	D	1.36	D
As	mg/GJ	3.98	D	1.81	D
Cr	mg/GJ	2.55	D	1.36	D
Cu	mg/GJ	5.31	D	2.72	D
Ni	mg/GJ	255.00	D	1.36	D

²⁴ Source: EMEP/EEA air pollutant emission inventory guidebook 2023. 1.A.1 Energy industries.

Fuel Type	UNIT	Heavy fuel oil		Light oil	
Associated fuel types		Residual fuel oil, refinery feedstock, petroleum coke, orimulsion, bitumen		Gas oil, kerosene, naphtha, shale oil	
Pollutant		EF	Type	EF	type
Se	mg/GJ	2.06	D	6.79	D
Zn	mg/GJ	87.80	D	1.81	D
PCB	ng WHO-TEG/GJ	2.50	D	NA	
PCDD/F	ng I-TEQ/GJ	4.50	D	0.5	D
Benzo(a)pyrene	µg/GJ	4.50	D	NA	D
Benzo(b)fluoranthene	µg/GJ	6.92	D	NA	D
Benzo(k)fluoranthene	µg/GJ	142.00	D	NA	D
Indeno(1,2,3-cd)pyrene	µg/GJ	15.10	D	6.92	D
HCB	µg/GJ	2.30	D	NA	D
Source		Table 3-6 Tier 1 emission factors for source category 1.A.1.a using heavy fuel oil. section 3.4.2.2. page 18/19.		Table 3-7 Tier 1 emission factors for source category 1.A.1.a using gas oil. section 3.4.2.2. page 18/19.	
		EMEP/EEA air pollutant emission inventory guidebook 2023. Part B. Chapter 1.A.1 Energy industries.			
Note:					
D Default	CS Country specific	PS Plant specific		IEF Implied emission factor	

3.1.2.2.3 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 3.31 Uncertainty for NFR category 1.A.1.a Main Activity Electricity and Heat Production.

Uncertainty	Heavy Fuel Oil		Gas oil	Reference
Activity data (AD)	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 _x	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 2023. Part A. Chapter 5 Uncertainties.v
CO	B	20% to 60%	40%	
NM VOC	C	50% to 200%	125%	
SO _x	A	10% to 30%	20%	
NH ₃	E	order of magnitude	750%	
TSP, PM ₁₀ , PM _{2.5} , 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.

3.1.2.2.4 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 three 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.

3.1.2.2.5 Source-specific recalculations

The following table presents the main revisions and recalculations done since the last submission in 2022 and relevant to category 1.A.1.a *Main Activity Electricity and Heat Production*.

Table 3.32 Recalculations done in 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	Revision of NCV by using country specific NCV	AD	accuracy

3.1.2.2.6 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 3.33 Planned improvements for category 1.A.1.a Main Activity Electricity and Heat Production

source category	Planned improvement	Type of improvement	Priority
1.A.1.a	No improvements are planned.		

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

3.1.2.3.1 Source category description

This section describes emissions of air pollutants resulting from all combustion activities supporting the refining of petroleum products including on-site combustion for the generation of electricity and/or heat for own use. Fugitive emissions (evaporative emissions) occurring at the refinery are not included and should be reported separately under 1.B.2.a.

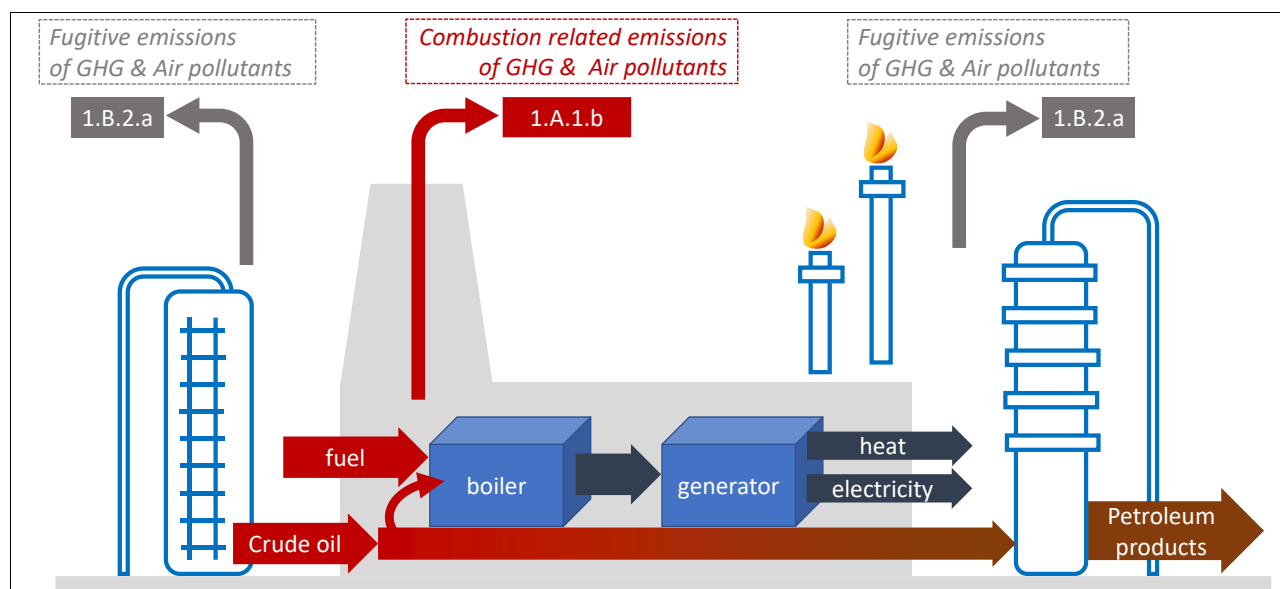


Figure 3.7 Emissions Reporting of emission from refinery: fuel combustion and fugitive emissions.

3.1.2.3.1.1 Completeness

Table 3.34 Overview on reported emissions from NFR sub-categories 1.A.1.b Petroleum refining

Air pollutants	1.A.1.b					
	liquid	solid	gaseous	Other fossil fuel	Peat	biomass
NO _x , CO, , SO _x	✓*	NO	✓*	NO	NO	NO
NM VOC	IE in 1.B.2.a.iv		IE in 1.B.2.a.iv	NO	NO	NO
NH ₃	NA	NA	NA	NA	NA	NA
TSP, PM ₁₀ , PM _{2.5} , BC	✓	NO	✓	NO	NO	NO
Pb, Cd, Hg, Cu	✓	NO	✓	NO	NO	NO
As, Cr, Ni, Se, Zn	✓	NO	✓	NO	NO	NO
PCDD/F	✓	NO	✓	NO	NO	NO
Total PAH, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene	✓	NO	✓	NO	NO	NO
PCB, HCB	NA	NO	NA	NO	NO	NO

A '✓' indicates: emissions from this category have been estimated.
 Notation keys: IE - included elsewhere. NO – not occurred. NE - not estimated. NA - not applicable. C – confidential

3.1.2.3.1.2 Emission trends

An overview of the air pollutants emissions from fuel combustion in IPCC/NFR category 1.A.1.b *Petroleum Refining* is provided in the following figures and tables:

- annual emissions of air pollutants;
- trend of the periods 1990 – 2022.

In Albania, there is currently only one refiner. Two refineries stopped in the the 1990, the Ballsh refinery stopped in 2019.

Fluctuation of emissions in the period 1990 – 2022 are due to

- the change in fuels used (refinery gas, natural gas, petroleum coke)
- reduced energy needs by the general stopped and shut-down industrial production in the beginning of the 1990er years.
- ### please provide further reasons

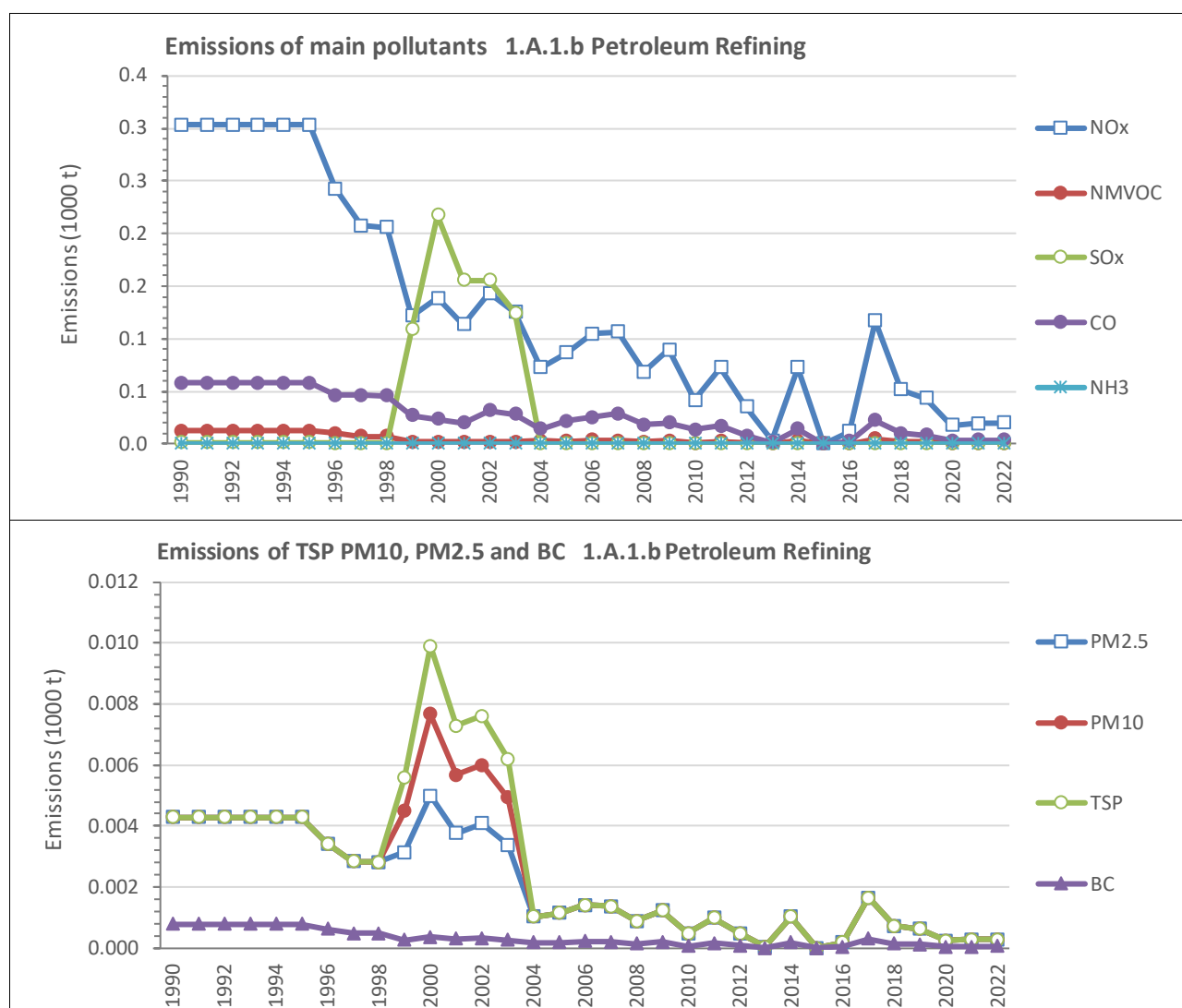


Figure 3.8 Emissions of main pollutants and particulate matter (PM) from NFR category 1.A.1.b Petroleum Refining

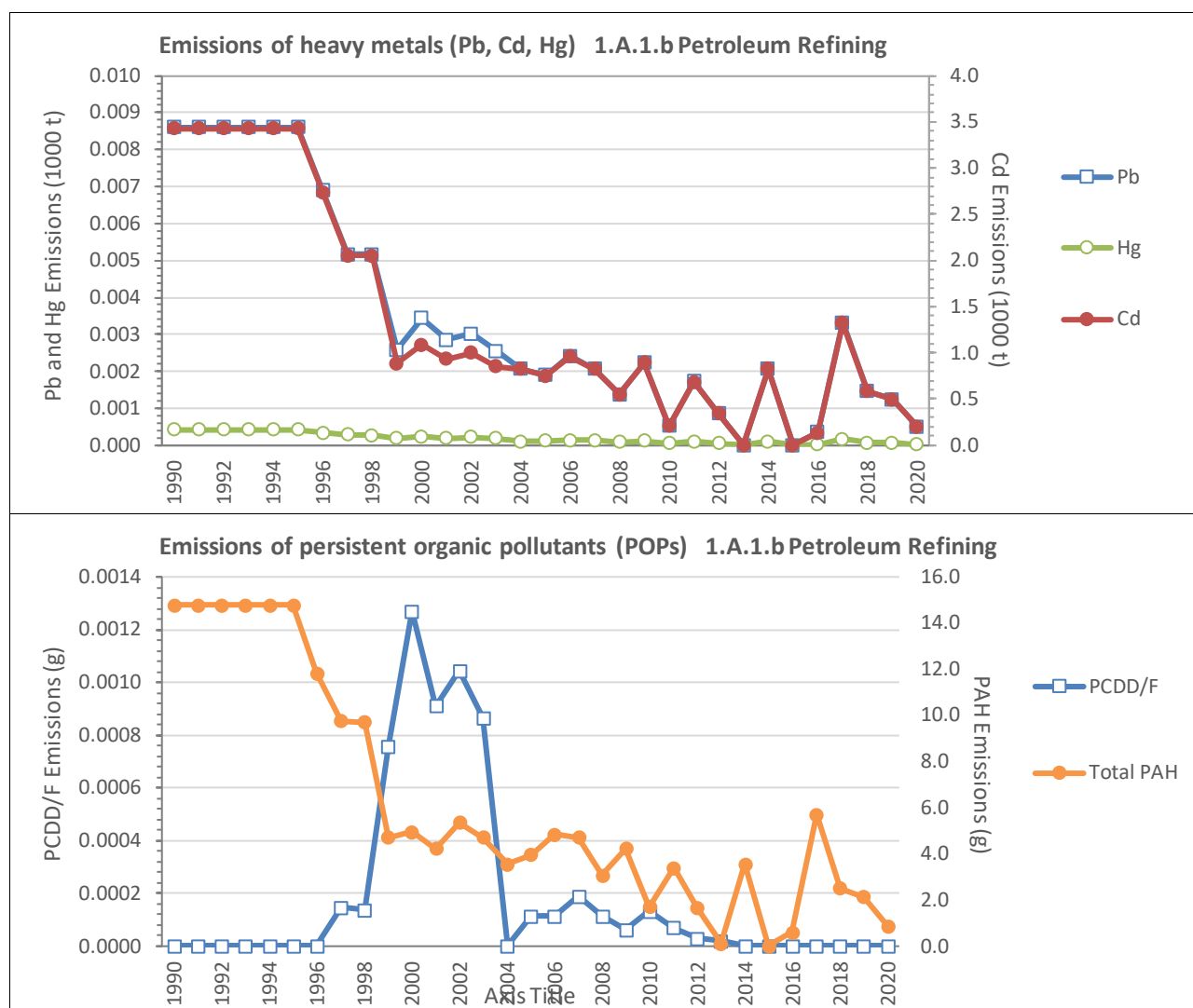


Figure 3.9 Emissions of heavy metals and persistent organic pollutants (POPs) from NFR category 1.A.1.b Petroleum Refining

Table 3.35 Emissions of main pollutants (NO_x, SO₂, NMVOC and CO) from NFR Category 1.A.1.b Petroleum Refining

Emissions	NO _x	NMVOC	SO ₂	CO	NH ₃
	Gg	Gg	Gg	Gg	Gg
1990	0.303	0.012	0.001	0.058	NA
1991	0.303	0.012	0.001	0.058	NA
1992	0.303	0.012	0.001	0.058	NA
1993	0.303	0.012	0.001	0.058	NA
1994	0.303	0.012	0.001	0.058	NA
1995	0.303	0.012	0.001	0.058	NA
1996	0.242	0.010	0.001	0.047	NA
1997	0.208	0.007	0.001	0.046	NA
1998	0.206	0.007	0.001	0.046	NA
1999	0.122	0.002	0.109	0.027	NA
2000	0.139	0.002	0.217	0.024	NA
2001	0.114	0.002	0.155	0.020	NA
2002	0.144	0.002	0.156	0.031	NA
2003	0.125	0.002	0.124	0.028	NA
2004	0.073	0.003	<0.001	0.014	NA
2005	0.087	0.003	<0.001	0.022	NA
2006	0.105	0.003	<0.001	0.025	NA
2007	0.106	0.003	<0.001	0.029	NA
2008	0.069	0.002	<0.001	0.018	NA
2009	0.090	0.003	<0.001	0.020	NA
2010	0.042	0.001	<0.001	0.014	NA
2011	0.073	0.002	<0.001	0.017	NA
2012	0.035	0.001	<0.001	0.008	NA
2013	0.003	NO	<0.001	0.001	NA
2014	0.073	0.003	<0.001	0.014	NA
2015	NO	NO	NO	NO	NA
2016	0.012	<0.001	<0.001	0.002	NA
2017	0.117	0.005	0.001	0.022	NA
2018	0.052	0.002	<0.001	0.010	NA
2019	0.044	0.002	<0.001	0.008	NA
2020	0.018	0.001	<0.001	0.003	NA
2021	0.019	0.001	<0.001	0.004	NA
2022	0.020	0.001	<0.001	0.004	NA
<i>Trend</i>					
1990 – 2022	-93.5%	-93.5%	-93.5%	-93.5%	NA
2005 – 2022	-77.1%	-70.3%	-75.5%	-82.4%	NA
2021 – 2022	2.9%	2.9%	2.9%	2.9%	NA

Table 3.36 Emissions of particulate matter (PMs) from NFR category 1.A.1.b Petroleum Refining

Emissions	PM2.5	PM10	TSP	BC
	Gg	Gg	Gg	Gg
1990	0.004	0.004	0.004	0.001
1991	0.004	0.004	0.004	0.001
1992	0.004	0.004	0.004	0.001
1993	0.004	0.004	0.004	0.001
1994	0.004	0.004	0.004	0.001
1995	0.004	0.004	0.004	0.001
1996	0.003	0.003	0.003	0.001
1997	0.003	0.003	0.003	<0.001
1998	0.003	0.003	0.003	<0.001
1999	0.003	0.004	0.006	<0.001
2000	0.005	0.008	0.010	<0.001
2001	0.004	0.006	0.007	<0.001
2002	0.004	0.006	0.008	<0.001
2003	0.003	0.005	0.006	<0.001
2004	0.001	0.001	0.001	<0.001
2005	0.001	0.001	0.001	<0.001
2006	0.001	0.001	0.001	<0.001
2007	0.001	0.001	0.001	<0.001
2008	0.001	0.001	0.001	<0.001
2009	0.001	0.001	0.001	<0.001
2010	<0.001	<0.001	<0.001	<0.001
2011	0.001	0.001	0.001	<0.001
2012	<0.001	<0.001	<0.001	<0.001
2013	<0.001	<0.001	<0.001	<0.001
2014	0.001	0.001	0.001	<0.001
2015	NO	NO	NO	NO
2016	<0.001	<0.001	<0.001	<0.001
2017	0.002	0.002	0.002	<0.001
2018	0.001	0.001	0.001	<0.001
2019	0.001	0.001	0.001	<0.001
2020	<0.001	<0.001	<0.001	<0.001
2021	<0.001	<0.001	<0.001	<0.001
2022	<0.001	<0.001	<0.001	<0.001
<i>Trend</i>				
1990 – 2022	-93.5%	-93.5%	-93.5%	-93.5%
2005 – 2022	-75.5%	-75.5%	-75.5%	-71.2%
2021 – 2022	2.9%	2.9%	2.9%	2.9%

Table 3.37 Emissions of Heavy Metals (HM) from NFR category 1.A.1.b Petroleum Refining

Emissions	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg
1990	0.009	3.425	<0.001	0.002	0.013	0.011	0.017	0.002	0.123
1991	0.009	3.425	<0.001	0.002	0.013	0.011	0.017	0.002	0.123
1992	0.009	3.425	<0.001	0.002	0.013	0.011	0.017	0.002	0.123
1993	0.009	3.425	<0.001	0.002	0.013	0.011	0.017	0.002	0.123
1994	0.009	3.425	<0.001	0.002	0.013	0.011	0.017	0.002	0.123
1995	0.009	3.425	<0.001	0.002	0.013	0.011	0.017	0.002	0.123
1996	0.007	2.740	<0.001	0.001	0.011	0.009	0.014	0.002	0.098
1997	0.005	2.055	<0.001	0.001	0.008	0.006	0.010	0.001	0.074
1998	0.005	2.055	<0.001	0.001	0.008	0.006	0.010	0.001	0.074
1999	0.003	0.885	<0.001	0.001	0.006	0.005	0.176	0.001	0.033
2000	0.003	1.085	<0.001	0.002	0.009	0.007	0.349	0.001	0.042
2001	0.003	0.932	<0.001	0.002	0.007	0.006	0.250	0.001	0.035
2002	0.003	1.000	<0.001	0.002	0.007	0.006	0.250	0.001	0.038
2003	0.003	0.855	<0.001	0.001	0.006	0.005	0.201	0.001	0.032
2004	0.002	0.822	<0.001	<0.001	0.003	0.003	0.004	<0.001	0.029
2005	0.002	0.754	<0.001	<0.001	0.003	0.002	0.004	<0.001	0.027
2006	0.002	0.959	<0.001	<0.001	0.004	0.003	0.005	0.001	0.034
2007	0.002	0.822	<0.001	<0.001	0.003	0.003	0.004	<0.001	0.029
2008	0.001	0.548	<0.001	<0.001	0.002	0.002	0.003	<0.001	0.020
2009	0.002	0.891	<0.001	<0.001	0.003	0.003	0.005	0.001	0.032
2010	0.001	0.206	<0.001	<0.001	0.001	0.001	0.001	<0.001	0.007
2011	0.002	0.685	<0.001	<0.001	0.003	0.002	0.003	<0.001	0.025
2012	0.001	0.343	<0.001	<0.001	0.001	0.001	0.002	<0.001	0.012
2013	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2014	0.002	0.822	<0.001	<0.001	0.003	0.003	0.004	<0.001	0.029
2015	NO	NO	NO	NO	NO	NO	NO	NO	NO
2016	<0.001	0.137	<0.001	<0.001	0.001	<0.001	0.001	<0.001	0.005
2017	0.003	1.322	<0.001	0.001	0.005	0.004	0.007	0.001	0.047
2018	0.001	0.582	<0.001	<0.001	0.002	0.002	0.003	<0.001	0.021
2019	0.001	0.493	<0.001	<0.001	0.002	0.002	0.002	<0.001	0.018
2020	<0.001	0.199	<0.001	<0.001	0.001	0.001	0.001	<0.001	0.007
2021	0.001	<0.001	<0.001	<0.001	0.001	0.001	0.001	<0.001	0.008
2022	0.001	<0.001	<0.001	<0.001	0.001	0.001	0.001	<0.001	0.008
<i>Trend</i>									
1990 – 2022	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%
2005 – 2022	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%
2021 – 2022	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 3.38 Emissions of Persistent Organic Pollutants (POPs) from NFR category 1.A.1.b Petroleum Refining

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	g	g	g	g	g	g	g
1990	NO	3.218	5.484	3.035	3.035	14.773	NA	NA
1991	NO	3.218	5.484	3.035	3.035	14.773	NA	NA
1992	NO	3.218	5.484	3.035	3.035	14.773	NA	NA
1993	NO	3.218	5.484	3.035	3.035	14.773	NA	NA
1994	NO	3.218	5.484	3.035	3.035	14.773	NA	NA
1995	NO	3.218	5.484	3.035	3.035	14.773	NA	NA
1996	NO	2.575	4.387	2.428	2.428	11.819	NA	NA
1997	0.000	2.094	3.535	2.066	2.066	9.762	NA	NA
1998	0.000	2.083	3.519	2.050	2.050	9.701	NA	NA
1999	0.001	0.801	2.148	0.879	0.879	4.707	NA	NA
2000	0.001	0.684	2.788	0.739	0.739	4.949	NA	NA
2001	0.001	0.639	2.248	0.672	0.672	4.232	NA	NA
2002	0.001	0.853	2.582	0.958	0.958	5.351	NA	NA
2003	0.001	0.768	2.204	0.865	0.865	4.702	NA	NA
2004	NO	0.772	1.316	0.729	0.729	3.546	NA	NA
2005	0.000	0.835	1.396	0.858	0.858	3.946	NA	NA
2006	0.000	1.028	1.725	1.040	1.040	4.832	NA	NA
2007	0.000	0.984	1.633	1.045	1.045	4.707	NA	NA
2008	0.000	0.641	1.067	0.675	0.675	3.060	NA	NA
2009	0.000	0.906	1.530	0.894	0.894	4.224	NA	NA
2010	0.000	0.341	0.551	0.404	0.404	1.699	NA	NA
2011	0.000	0.720	1.212	0.722	0.722	3.376	NA	NA
2012	0.000	0.353	0.595	0.350	0.350	1.649	NA	NA
2013	0.000	0.021	0.031	0.031	0.031	0.114	NA	NA
2014	NO	0.772	1.316	0.729	0.729	3.546	NA	NA
2015	NO	NO	NO	NO	NO	NO	NA	NA
2016	NO	0.129	0.219	0.121	0.121	0.591	NA	NA
2017	NO	1.242	2.117	1.172	1.172	5.703	NA	NA
2018	NO	0.547	0.932	0.516	0.516	2.511	NA	NA
2019	NO	0.463	0.790	0.437	0.437	2.127	NA	NA
2020	NO	0.187	0.318	0.176	0.176	0.857	NA	NA
2021	NO	0.205	0.349	0.193	0.193	0.940	NA	NA
2022	NO	0.211	0.359	0.199	0.199	0.967	NA	NA
<i>Trend</i>								
1990 – 2022	NA	-93.5%	-93.5%	-93.5%	-93.5%	-93.5%	NA	NA
2005 – 2022	NA	-74.8%	-74.3%	-76.8%	-76.8%	-75.5%	NA	NA
2021 – 2022	NA	2.9%	2.9%	2.9%	2.9%	2.9%	NA	NA

3.1.2.3.2 Methodological issues

3.1.2.3.2.1 Choice of methods

For estimating the air pollutants emissions the Tier 2 approach²⁵ of the EMEP/EEA air pollutant emission inventory guidebook 2023 has been applied:

Equation: emissions from stationary combustion

$$Emissions_{pollutant} = Fuel\ Consumption_{fuel} \times TIER\ 2\ Emission\ Factor_{pollutant.\ fuel}$$

Where:

Emissions _{pollutant}	= emissions of a given pollutant by type of fuel (kg pollutant)
Fuel consumption _{fuel}	= amount of fuel combusted (TJ)
Tier 2 Emission factor _{pollutant. fuel}	= default TIER 2 emission factor of a given pollutant by type of fuel (g _{pollutant} /GJ).
Pollutant	= main pollutants: NO _x , SO _x , NMVOC, CO, NH ₃ 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

3.1.2.3.2.2 Choice of activity data

The following fuels are used during petroleum refining process:

- Liquid fuels:**
- Natural gas
 - Petroleum Coke
 - Refinery gas

As presented in 'Albania's Technology Needs Assessment'²⁶, report sent to UNFCCC, in 1994 the oil refining industry in Albania has four refineries, located respectively in Cerrik, Kucove, Fier and Ballsh. Three refineries (Cerrik, Kucove and Fier) were built in the 1960's and they are simple ones with distillation processes (topping and small vacuum distillation) as well as washing process of the light products and have been used for refining of part of crude oil produced in Albania, fulfilling the needs of Albanian market until 1978. The Cerrik and Kucova refineries were progressively suspended from operation after 1990. The Ballsh refinery with an annual capacity of 1.25 million t crude oil stopped in 2019. Currenly there is only the Fier refinery (capacity of 500 thousand t crude oil) working.

Fuel consumption used for estimating the air pollutant emissions for the years 1990 - 2022 were taken from EUROSTAT but were prepared by Albanian Institute of Statistics (INSTAT).

²⁵ Source: EMEP/EEA air pollutant emission inventory guidebook 2023. 1.A.1 Energy industries. sub-chapter 3.4.2 Tier 1 default approach.

²⁶ UNDP-GEF Climate Change Program (2004): Albania's Technology Needs Assessment
https://unfccc.int/files/meetings/seminar/application/pdf/sem_albania_sup2.pdf

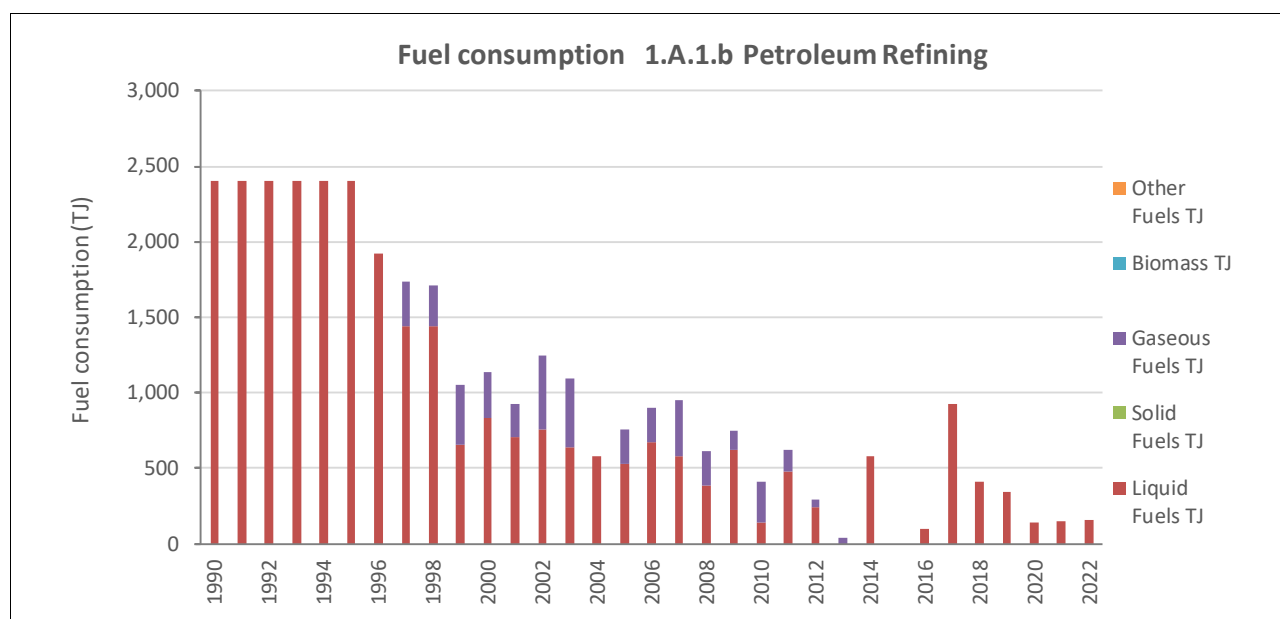


Figure 3.10 Activity data for NFR category 1.A.1.b Petroleum Refining

Table 3.39 Activity data for NFR category 1.A.1.b Petroleum Refining

Activity data 1.A.1.b	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
1990	2,405.30	2,405.30	NO	NO	NO	NO	NO
1991	2,405.30	2,405.30	NO	NO	NO	NO	NO
1992	2,405.30	2,405.30	NO	NO	NO	NO	NO
1993	2,405.30	2,405.30	NO	NO	NO	NO	NO
1994	2,405.30	2,405.30	NO	NO	NO	NO	NO
1995	2,405.30	2,405.30	NO	NO	NO	NO	NO
1996	1,924.24	1,924.24	NO	NO	NO	NO	NO
1997	1,734.78	1,443.18	NO	291.60	NO	NO	NO
1998	1,714.98	1,443.18	NO	271.80	NO	NO	NO
1999	1,052.86	656.86	NO	396.00	NO	NO	NO
2000	1,134.17	832.67	NO	301.50	NO	NO	NO
2001	927.02	704.72	NO	222.30	NO	NO	NO
2002	1,242.42	752.82	NO	489.60	NO	NO	NO
2003	1,092.54	640.74	NO	451.80	NO	NO	NO
2004	577.27	577.27	NO	NO	NO	NO	NO
2005	755.07	529.17	NO	225.90	NO	NO	NO
2006	899.38	673.48	NO	225.90	NO	NO	NO
2007	954.37	577.27	NO	377.10	NO	NO	NO
2008	610.75	384.85	NO	225.90	NO	NO	NO
2009	749.58	625.38	NO	124.20	NO	NO	NO
2010	408.02	144.32	NO	263.70	NO	NO	NO
2011	617.86	481.06	NO	136.80	NO	NO	NO
2012	296.33	240.53	NO	55.80	NO	NO	NO
2013	36.90	NO	NO	36.90	NO	NO	NO

Activity data 1.A.1.b	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
2014	577.27	577.27	NO	NO	NO	NO	NO
2015	NO	NO	NO	NO	NO	NO	NO
2016	96.21	96.21	NO	NO	NO	NO	NO
2017	928.45	928.45	NO	NO	NO	NO	NO
2018	408.90	408.90	NO	NO	NO	NO	NO
2019	346.36	346.36	NO	NO	NO	NO	NO
2020	139.51	139.51	NO	NO	NO	NO	NO
2021	152.98	152.98	NO	NO	NO	NO	NO
2022	157.41	157.41	NO	NO	NO	NO	NO
<i>Trend</i>							
1990 – 2022	-93.5%	-93.5%	NA	NA	NA	NA	NA
2005 – 2022	-79.2%	-70.3%	NA	NA	NA	NA	NA
2021 – 2022	2.9%	2.9%	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 NFR category 1.A.1.b *Petroleum Refining*.

Table 3.40 Net calorific values (NCVs) applied for conversion to energy units in NFR category 1.A.1.b Petroleum Refining in 2022

Fuel	Fuel type	Net calorific value (NCV)					
		NCV	unit	type	NCV	unit	type
Petroleum Coke	liquid	31.99	TJ/Gg	CS	32.5	TJ/Gg	D
Natural gas	Gaseous	32.396	GJ/1000 m3	CS	39.02	GJ/1000 m3	D*
Refinery gas	liquid	48.11	TJ/Gg	CS	49.5	TJ/Gg	D
					for comparision		
Source		Eurostat (2023): Complete energy balances (Code: nrg_bal_c)			2006 IPCC guidelines, Vol. 2, Chapter 1, Table 1.2 * UNstat – IRES (2028) Table 4.1		
Note:							
D	Default	CS	Country specific		PS	Plant specific	

3.1.2.3.2.3 Choice of emission factors

Default emission factors for air pollutant were taken from the EMEP/EEA air pollutant emission inventory guidebook 2023²⁷ and are presented in the following table.

²⁷ Source: EMEP/EEA air pollutant emission inventory guidebook 2023. 1.A.1 Energy industries.

Table 3.41 TIER 2 Emission factors (EF) for Main pollutants, Particulate Matter (PM), Heavy metals (HM) and Persistent Organic Pollutants (POPs) for NFR category 1.A.1.b Petroleum Refining

Fuel Type			UNIT		Natural gas		Other liquid fuels		Residual fuel oil			
Associated fuel types					Refinery gas		Petroleum coke					
Pollutant			EF (TIER 2)		type	EF (TIER 2)		type	EF (TIER 2)		Type	
Nox			g/GJ		63	T2-D	63		T2-D	142		T2-D
CO			g/GJ		39.3	T2-D	12.1		T2-D	6		T2-D
NMVOC			g/GJ		in 1.B.2.a.iv		in 1.B.2.a.iv			in 1.B.2.a.iv		
SOx			g/GJ		0.244	T2-D	0.281		T2-D	485		T2-D
NH3			g/GJ		NA		NA			NA		
TSP			g/GJ		0.14	T2-D	0.89		T2-D	20		T2-D
PM10			g/GJ		0.14	T2-D	0.89		T2-D	15		T2-D
PM2.5			g/GJ		0.14	T2-D	0.89		T2-D	9		T2-D
BC			% of PM2.5		18.4	T2-D	18.4		T2-D	5.6		T2-D
Pb			mg/GJ		0.0015	T2-D	1.79		T2-D	4.6		T2-D
Cd			mg/GJ		0.00025	T2-D	0.712		T2-D	1.2		T2-D
Hg			mg/GJ		0.05	T2-D	0.086		T2-D	0.3		T2-D
As			mg/GJ		0.12	T2-D	0.343		T2-D	3.98		T2-D
Cr			mg/GJ		0.00076	T2-D	2.74		T2-D	14.8		T2-D
Cu			mg/GJ		0.000076	T2-D	2.22		T2-D	11.9		T2-D
Ni			mg/GJ		0.00051	T2-D	3.6		T2-D	773		T2-D
Se			mg/GJ		0.0112	T2-D	0.42		T2-D	2.1		T2-D
Zn			mg/GJ		0.0015	T2-D	25.5		T2-D	49.3		T2-D
PCB			ng WHO-TEG/GJ		NA		NA			NA		
PCDD/F			ng I-TEQ/GJ		NA		NA			2.50		T2-D
Benzo(a)pyrene			µg/GJ		NA	T2-D	0.669		T2-D	NA		
Benzo(b)fluoranthene			µg/GJ		NA	T2-D	1.14		T2-D	3.7		T2-D
Benzo(k)fluoranthene			µg/GJ		NA	T2-D	0.631		T2-D	NA		
Indeno(1,2,3-cd)pyrene			µg/GJ		NA	T2-D	0.631		T2-D	NA		
HCB			µg/GJ		NA		NA			NA		
Source					Table 4-8 Tier 2 emission factors for source category 1.A.1.b, process furnaces using natural gas. Section 4.4.3.2. page 47.			Table 4-4 Tier 2 emission factors for source category 1.A.1.b, refinery gas. Section 4.4.3.2. page 44.			Table 4-6 Tier 2 emission factors for source category 1.A.1.b, process furnaces using residual oi. Section 4.4.3.2.. page 45.	
					EMEP/EEA air pollutant emission inventory guidebook 2023. Part B. Chapter 1.A.1 Energy industries.							
Note:												
T2	TIER 2	D	Default	CS	Country specific	PS	Plant specific	IEF	Implied emission factor			

3.1.2.3.3 Uncertainties and time-series consistency

The uncertainties for activity data and emission factors used for NFR category 1.A.1.b *Petroleum Refining* are presented in the following table.

Table 3.42 Uncertainty for NFR category 1.A.1.b Petroleum Refining.

Uncertainty	Natural gas	Refinery gas	Petroleum coke	Reference
Activity data (AD)	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 _x	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 2023. Part A. Chapter 5 Uncertainties.v
CO	B	20% to 60%	40%	
NM VOC	C	50% to 200%	125%	
SO _x	A	10% to 30%	20%	
NH ₃	E	order of magnitude	750%	
TSP, PM ₁₀ , PM _{2.5} , 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.

3.1.2.3.4 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 three 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.

3.1.2.3.5 Source-specific recalculations

The following table presents the main revisions and recalculations done since the last submission in 2022 and relevant to NFR category 1.A.1.b *Petroleum Refining*.

Table 3.43 Recalculations done in NFR category 1.A.1.b Petroleum Refining.

Source category	Revisions of data	Type of revision	Type of improvement
1.A.1.b	Revision of NCV by using country specific NCV	AD	Accuracy
1.A.1.b	Application of Tier 2 methodology according to EMEP EEA GB 2023	EF	Accuracy Comparability
1.A.1.b	Application of Tier 2 (default) emission factors from EMEP EEA GB 2023	EF	Accuracy

3.1.2.3.6 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 3.44 Planned improvements for NFR category 1.A.1.b Petroleum Refining.

source category	Planned improvement	Type of improvement		Priority
1.A.1.a	As this source is a key category, further investigation of technology including abatement technology applied.	AD	Accuracy Transparency	high

3.1.2.4 Manufacture of Solid Fuels and Other Energy Industries (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 Oil and gas extraction

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

3.1.2.4.1 Source category description

In the following table an overview on reported emissions from sub categories 1.A.1.c.i, 1.A.1.c.ii and, 1.A.1.c.iii is provided.

Table 3.45 Overview on reported emissions from sub categories 1.A.1.c.i, 1.A.1.c.ii and, 1.A.1.c.iii

Air pollutants	1.A.1.c.i						1.A.1.c.iii						1.A.1.c.iii					
	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 _x , CO, NMVOC,	NA	NA	NA	NA	NA	NE	✓	NO	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO
SO _x , NH ₃	NA	NA	NA	NA	NA	NA	NA	NO	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO
TSP, PM ₁₀ , PM _{2.5} , BC	NA	NA	NA	NA	NA	NE	✓	NO	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO
Pb, Cd, Hg, Cu	NA	NA	NA	NA	NA	NA	✓	NO	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO
As, Cr, Ni, Se, Zn	NA	NA	NA	NA	NA	NA	NA	NO	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO
PCDD/F	NA	NA	NA	NA	NA	NA	✓	NO	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO
PAH	NA	NA	NA	NA	NA	NA	✓	NO	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	✓	NO	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	✓	NO	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	✓	NO	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	NA	✓	NO	✓	NO	NO	NO	NO	NO	NO	NO	NO	NO
PCB, HCB	NA	NA	NA	NA	NA	NA	NA	NO	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO
A '✓' indicates: emissions from this category have been estimated. Notation keys: IE - included elsewhere. NO – not occurred. NE - not estimated. NA - not applicable. C – confidential																		

3.1.2.4.2 Manufacture of Solid Fuels - Charcoal production (NFR category 1.A.1.c.i)

3.1.2.4.2.1 Source category description

This section describes emissions of air pollutants resulting from charcoal production.

3.1.2.4.2.1.1 Completeness

In the following table an overview on reported emissions from sub categories 1.A.1.c.i Manufacture of Solid Fuels - Charcoal production is provided.

Table 3.46 Overview on reported emissions from NFR category 1.A.1.c.i Manufacture of Solid Fuels - Charcoal production

Air pollutants	1.A.1.c.ii					
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	biomass
NO _x , CO, NMVOC,	NA	NA	NA	NA	NO	NE
SO _x , NH ₃	NA	NA	NA	NA	NO	NO
TSP, PM ₁₀ , PM _{2.5} ,	NA	NA	NA	NA	NO	NE
BC	NA	NA	NA	NA	NO	NO
Pb, Cd, Hg, Cu	NA	NA	NA	NA	NO	NO
As, Cr, Ni, Se, Zn	NA	NA	NA	NA	NO	NO
PCDD/F, PAH, PCB, HCB	NA	NA	NA	NA	NO	NO
<p>A '✓' indicates: emissions from this category have been estimated. Notation keys: IE - included elsewhere, NO – not occurrent, NE - not estimated, NA - not applicable, C – confidential</p>						

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

3.1.2.4.2.2 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 3.47 Planned improvements for NFR category 1.A.1.c.ii Oil and gas extraction

source category	Planned improvement	Type of improvement		Priority
1.A.1.c.i	Cross-check of national (INSTAT) and international data sources (FAO, EUROSTAT and UN) on charcoal production	AD	Consistency Transparency	medium
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		Accuracy Transparency	medium
1.A.1.c.i	Country specific Net Caloric Value (NCV) for fuels of national production: charcoal	AD	Accuracy Transparency	low
1.A.1.c.i	Estimation of carbon monoxide (CO). sulphur dioxide (SO ₂). nitrogen dioxide (NO ₂) and particulate matter (PM _{2.5})		Completeness	medium

3.1.2.4.3 Oil and gas extraction (NFR category 1.A.1.c.ii)

3.1.2.4.3.1 Source category description

This section describes emissions of air pollutants resulting from all combustion activities supporting the oil and gas extraction including on-site combustion for the generation of electricity and/or heat for own use. Fugitive emissions (evaporative emissions) occurring at the oil and gas extraction are not included and should be reported separately under 1.B.2.a.

3.1.2.4.3.1.1 Completeness

Table 3.48 Overview on reported emissions from NFR category 1.A.1.c.ii Oil and gas extraction

Air pollutants	1.A.1.c.ii					
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	biomass
NO _x , CO, NMVOC, SO _x	✓	NO	✓	NO	NO	NO
NH ₃	NA	NO	NA	NO	NO	NO
TSP, PM ₁₀ , PM _{2.5} , BC	✓	NO	✓	NO	NO	NO
Pb, Cd, Hg, Cu	✓	NO	✓	NO	NO	NO
As, Cr, Ni, Se, Zn	✓	NO	✓	NO	NO	NO
PCDD/F	✓	NO	✓	NO	NO	NO
PAH (total), Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene	✓	NO	✓	NO	NO	NO
PCB, HCB	NA	NO	NA	NO	NO	NO
A '✓' indicates: emissions from this category have been estimated. Notation keys: IE - included elsewhere, NO – not occurring, NE - not estimated, NA - not applicable, C – confidential						
Use of notation key and comments						
1.A.1.c.ii gaseous	IE	1990 – 1995 included in 1.A.2.m				
	✓	From 1996 onwards				
1.A.1.c.ii liquid	NO	1990 – 2012 not occurring				
	✓	From 2013 onwards				

3.1.2.4.3.1.2 Emission trends

An overview of the GHG emission from fuel combustion in NFR category 1.A.1.c.ii *Oil and gas extraction* is provided in the following figures and tables:

- annual emissions of air pollutants;
- trend of the periods 1990 – 2022.

In the period 1990 – 2022, Natural gas is produced. However, emission of air pollutants are estimated for the period 1996-2022. Emissions for the period 1990 – 1995 are included in 1.A.2.m.

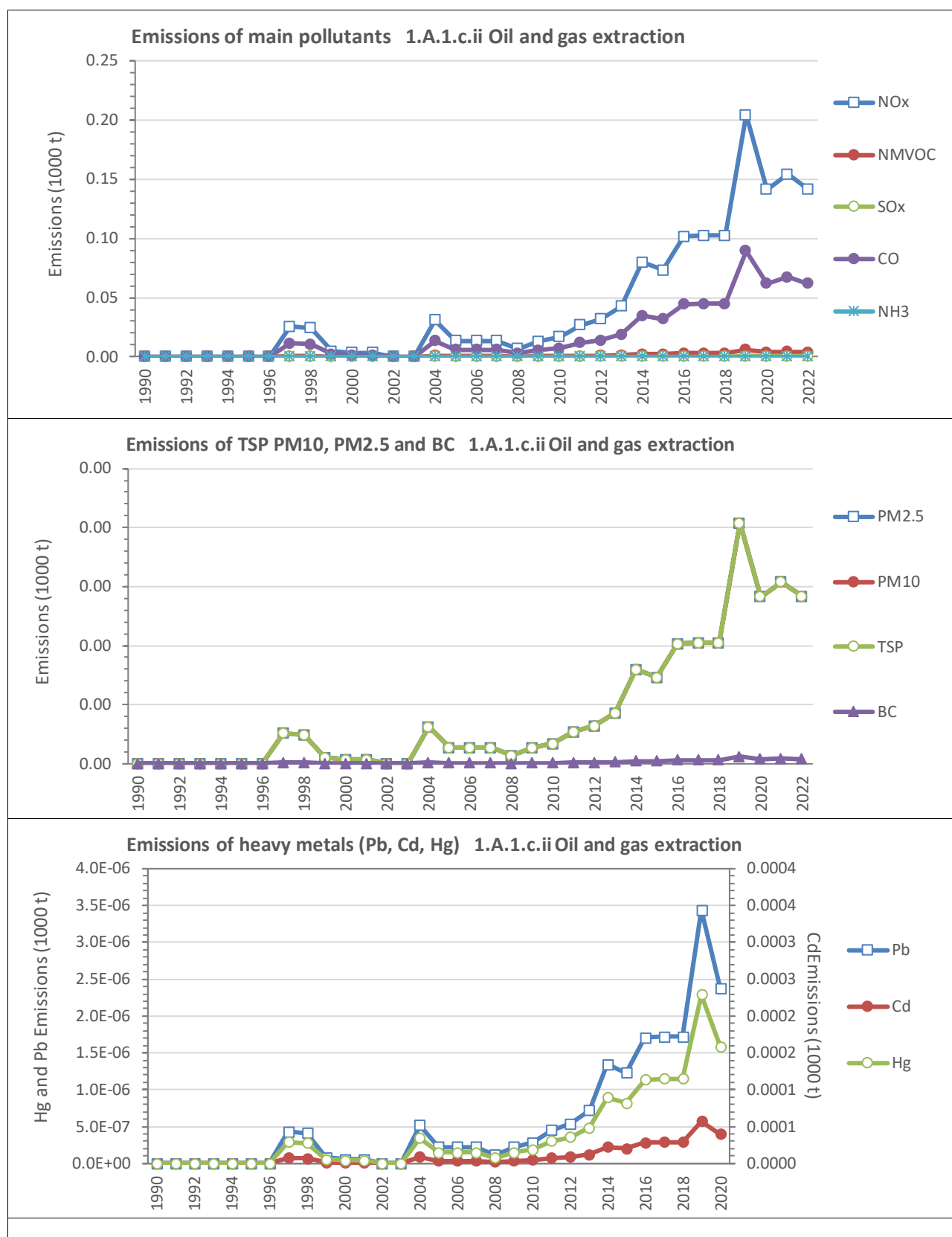


Figure 3.11 Emissions of air pollutants from NFR category 1.A.1.c.ii *Oil and gas extraction*

Table 3.49 Emissions of main pollutants (NO_x, SO₂, NMVOC and CO) from NFR category 1.A.1.c.ii Oil and gas extraction

Emissions	NO _x	NMVOC	SO ₂	CO	NH ₃
	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	IE	IE	IE	IE	NA
1997	0.026	0.001	0.000	0.011	NA
1998	0.024	0.001	0.000	0.011	NA
1999	0.005	0.000	0.000	0.002	NA
2000	0.003	0.000	0.000	0.001	NA
2001	0.003	0.000	0.000	0.001	NA
2002	IE	IE	IE	IE	NA
2003	IE	IE	IE	IE	NA
2004	0.031	0.001	0.000	0.014	NA
2005	0.013	0.000	0.000	0.006	NA
2006	0.013	0.000	0.000	0.006	NA
2007	0.013	0.000	0.000	0.006	NA
2008	0.007	0.000	0.000	0.003	NA
2009	0.013	0.000	0.000	0.006	NA
2010	0.017	0.000	0.000	0.007	NA
2011	0.027	0.001	0.000	0.012	NA
2012	0.032	0.001	0.000	0.014	NA
2013	0.043	0.001	0.000	0.019	NA
2014	0.080	0.002	0.000	0.035	NA
2015	0.073	0.002	0.000	0.032	NA
2016	0.101	0.003	0.000	0.044	NA
2017	0.102	0.003	0.000	0.045	NA
2018	0.102	0.003	0.000	0.045	NA
2019	0.204	0.006	0.001	0.089	NA
2020	0.141	0.004	0.000	0.062	NA
2021	0.154	0.004	0.000	0.067	NA
2022	0.142	0.004	0.000	0.062	NA
<i>Trend</i>					
1990 – 2022	NA	NA	NA	NA	NA
2005 – 2022	958.6%	958.6%	958.6%	958.6%	NA
2021 – 2022	-8.0%	-8.0%	-8.0%	-8.0%	NA

Table 3.50 Emissions of particulate matter (PMs) from NFR category 1.A.1.c.ii Oil and gas extraction

Emissions	PM2.5	PM10	TSP	BC
	t	t	t	t
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	0.256	0.256	0.256	0.007
1998	0.244	0.244	0.244	0.007
1999	0.049	0.049	0.049	0.001
2000	0.034	0.034	0.034	0.001
2001	0.034	0.034	0.034	0.001
2002	IE	IE	IE	IE
2003	IE	IE	IE	IE
2004	0.308	0.308	0.308	0.009
2005	0.134	0.134	0.134	0.004
2006	0.134	0.134	0.134	0.004
2007	0.134	0.134	0.134	0.004
2008	0.067	0.067	0.067	0.002
2009	0.132	0.132	0.132	0.004
2010	0.167	0.167	0.167	0.005
2011	0.268	0.268	0.268	0.008
2012	0.319	0.319	0.319	0.009
2013	0.428	0.428	0.428	0.012
2014	0.797	0.797	0.797	0.022
2015	0.730	0.730	0.730	0.021
2016	1.013	1.013	1.013	0.028
2017	1.022	1.022	1.022	0.029
2018	1.022	1.022	1.022	0.029
2019	2.040	2.040	2.040	0.057
2020	1.412	1.412	1.412	0.040
2021	1.539	1.539	1.539	0.043
2022	1.416	1.416	1.416	0.040
<i>Trend</i>				
1990 – 2022	NA	NA	NA	NA
2005 – 2022	958.6%	958.6%	958.6%	958.6%
2021 – 2022	-8.0%	-8.0%	-8.0%	-8.0%

Table 3.51 Emissions of Heavy Metals (HM) from NFR category 1.A.1.c.ii Oil and gas extraction

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	0.0004	0.0001	0.0288	0.0346	0.0002	0.0000	0.0001	0.0032	0.0004
1998	0.0004	0.0001	0.0274	0.0328	0.0002	0.0000	0.0001	0.0031	0.0004
1999	0.0001	0.0000	0.0055	0.0066	0.0000	0.0000	0.0000	0.0006	0.0001
2000	0.0001	0.0000	0.0038	0.0045	0.0000	0.0000	0.0000	0.0004	0.0001
2001	0.0001	0.0000	0.0038	0.0045	0.0000	0.0000	0.0000	0.0004	0.0001
2002	IE	IE	IE	IE	IE	IE	IE	IE	IE
2003	IE	IE	IE	IE	IE	IE	IE	IE	IE
2004	0.0005	0.0001	0.0347	0.0416	0.0003	0.0000	0.0002	0.0039	0.0005
2005	0.0002	0.0000	0.0150	0.0180	0.0001	0.0000	0.0001	0.0017	0.0002
2006	0.0002	0.0000	0.0150	0.0180	0.0001	0.0000	0.0001	0.0017	0.0002
2007	0.0002	0.0000	0.0150	0.0180	0.0001	0.0000	0.0001	0.0017	0.0002
2008	0.0001	0.0000	0.0076	0.0091	0.0001	0.0000	0.0000	0.0008	0.0001
2009	0.0002	0.0000	0.0149	0.0178	0.0001	0.0000	0.0001	0.0017	0.0002
2010	0.0003	0.0000	0.0188	0.0226	0.0001	0.0000	0.0001	0.0021	0.0003
2011	0.0005	0.0001	0.0301	0.0361	0.0002	0.0000	0.0002	0.0034	0.0005
2012	0.0005	0.0001	0.0358	0.0430	0.0003	0.0000	0.0002	0.0040	0.0005
2013	0.0007	0.0001	0.0481	0.0577	0.0004	0.0000	0.0002	0.0054	0.0007
2014	0.0013	0.0002	0.0895	0.1074	0.0007	0.0001	0.0005	0.0100	0.0013
2015	0.0012	0.0002	0.0821	0.0985	0.0006	0.0001	0.0004	0.0092	0.0012
2016	0.0017	0.0003	0.1138	0.1366	0.0009	0.0001	0.0006	0.0127	0.0017
2017	0.0017	0.0003	0.1148	0.1377	0.0009	0.0001	0.0006	0.0129	0.0017
2018	0.0017	0.0003	0.1148	0.1377	0.0009	0.0001	0.0006	0.0129	0.0017
2019	0.0034	0.0006	0.2292	0.2750	0.0017	0.0002	0.0012	0.0257	0.0034
2020	0.0024	0.0004	0.1587	0.1904	0.0012	0.0001	0.0008	0.0178	0.0024
2021	0.0026	0.0004	0.1729	0.2075	0.0013	0.0001	0.0009	0.0194	0.0026
2022	0.0024	0.0004	0.1591	0.1909	0.0012	0.0001	0.0008	0.0178	0.0024
<i>Trend</i>									
1990 – 2022	NA	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	958.6%	958.6%	958.6%	958.6%	958.6%	958.6%	958.6%	958.6%	958.6%
2021 – 2022	-8.0%	-8.0%	-8.0%	-8.0%	-8.0%	-8.0%	-8.0%	-8.0%	-8.0%

Table 3.52 Emissions of Persistent Organic Pollutants (POPs) from NFR category 1.A.1.c.ii Oil and gas extraction

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	g	g	g	g	g	g	g
1990	IE	IE	IE	IE	IE	IE	NA	NA
1991	IE	IE	IE	IE	IE	IE	NA	NA
1992	IE	IE	IE	IE	IE	IE	NA	NA
1993	IE	IE	IE	IE	IE	IE	NA	NA
1994	IE	IE	IE	IE	IE	IE	NA	NA
1995	IE	IE	IE	IE	IE	IE	NA	NA
1996	IE	IE	IE	IE	IE	IE	NA	NA
1997	0.000	0.161	0.242	0.242	0.242	0.887	NA	NA
1998	0.000	0.153	0.230	0.230	0.230	0.843	NA	NA
1999	0.000	0.031	0.046	0.046	0.046	0.169	NA	NA
2000	0.000	0.021	0.032	0.032	0.032	0.116	NA	NA
2001	0.000	0.021	0.032	0.032	0.032	0.116	NA	NA
2002	IE	IE	IE	IE	IE	IE	NA	NA
2003	IE	IE	IE	IE	IE	IE	NA	NA
2004	0.000	0.194	0.291	0.291	0.291	1.067	NA	NA
2005	0.000	0.084	0.126	0.126	0.126	0.463	NA	NA
2006	0.000	0.084	0.126	0.126	0.126	0.463	NA	NA
2007	0.000	0.084	0.126	0.126	0.126	0.463	NA	NA
2008	0.000	0.042	0.064	0.064	0.064	0.233	NA	NA
2009	0.000	0.083	0.125	0.125	0.125	0.457	NA	NA
2010	0.000	0.105	0.158	0.158	0.158	0.579	NA	NA
2011	0.000	0.168	0.253	0.253	0.253	0.926	NA	NA
2012	0.000	0.201	0.301	0.301	0.301	1.103	NA	NA
2013	0.000	0.269	0.404	0.404	0.404	1.482	NA	NA
2014	0.000	0.501	0.752	0.752	0.752	2.757	NA	NA
2015	0.000	0.459	0.689	0.689	0.689	2.527	NA	NA
2016	0.001	0.637	0.956	0.956	0.956	3.506	NA	NA
2017	0.001	0.643	0.964	0.964	0.964	3.535	NA	NA
2018	0.001	0.643	0.964	0.964	0.964	3.535	NA	NA
2019	0.001	1.283	1.925	1.925	1.925	7.058	NA	NA
2020	0.001	0.888	1.333	1.333	1.333	4.886	NA	NA
2021	0.001	0.968	1.452	1.452	1.452	5.325	NA	NA
2022	0.001	0.891	1.337	1.337	1.337	4.901	NA	NA
<i>Trend</i>								
1990 – 2022	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	958.6%	958.6%	958.6%	958.6%	958.6%	958.6%	NA	NA
2021 – 2022	-8.0%	-8.0%	-8.0%	-8.0%	-8.0%	-8.0%	NA	NA

3.1.2.4.3.2 Methodological issues

3.1.2.4.3.2.1 Choice of methods

For estimating the air pollutants emissions the Tier 1 approach²⁸ of the EMEP/EEA air pollutant emission inventory guidebook 2023 has been applied:

Equation: emissions from stationary combustion

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

Where:

Emissions _{pollutant}	= emissions of a given pollutant by type of fuel (kg pollutant)
Fuel consumption _{fuel}	= amount of fuel combusted (TJ)
Emission factor _{pollutant. fuel}	= default emission factor of a given pollutant by type of fuel (g _{pollutant} /GJ).
Pollutant	= main pollutants: NO _x , SO _x , NMVOC, CO, NH ₃ 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

3.1.2.4.3.2.2 Choice of activity data

The following fuels are used for fuel combustion in NFR category 1.A.1.c.ii *Oil and gas extraction*:

Use of notation key and comments			
Gaseous fuel	IE	Natural gas	1990 – 1995 included in 1.A.2.m
	✓		From 1996 onwards
liquid fuel	NO	Liquefied petroleum gas (LPG)	1990 – 2012 not occurring
	✓		From 2013 onwards

Fuel consumption used for estimating the air pollutant emissions for the years 1990 - 2022 were taken from EUROSTAT but were prepared by Albanian Institute of Statistics (INSTAT).

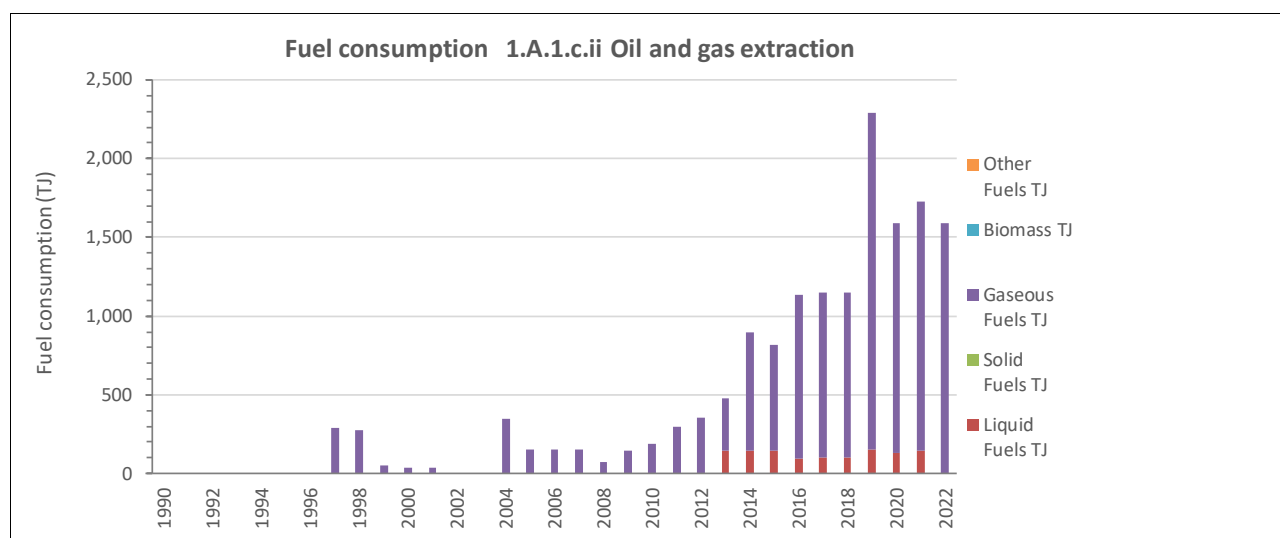


Figure 3.12 Activity data for NFR category 1.A.1.c.ii *Oil and gas extraction*

²⁸ Source: EMEP/EEA air pollutant emission inventory guidebook 2023. 1.A.1 Energy industries. sub-chapter 3.4.2 Tier 1 default approach.

Table 3.53 Activity data for NFR category 1.A.1.c.ii *Oil and gas extraction*

Activity data 1.A.1.c.ii	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
1990	IE	NO	NO	IE	NO	NO	NO
1991	IE	NO	NO	IE	NO	NO	NO
1992	IE	NO	NO	IE	NO	NO	NO
1993	IE	NO	NO	IE	NO	NO	NO
1994	IE	NO	NO	IE	NO	NO	NO
1995	IE	NO	NO	IE	NO	NO	NO
1996	IE	NO	NO	IE	NO	NO	NO
1997	288.00	NO	NO	288.00	NO	NO	NO
1998	273.60	NO	NO	273.60	NO	NO	NO
1999	54.90	NO	NO	54.90	NO	NO	NO
2000	37.80	NO	NO	37.80	NO	NO	NO
2001	37.80	NO	NO	37.80	NO	NO	NO
2002	NO	NO	NO	NO	NO	NO	NO
2003	NO	NO	NO	NO	NO	NO	NO
2004	346.50	NO	NO	346.50	NO	NO	NO
2005	150.30	NO	NO	150.30	NO	NO	NO
2006	150.30	NO	NO	150.30	NO	NO	NO
2007	150.30	NO	NO	150.30	NO	NO	NO
2008	75.60	NO	NO	75.60	NO	NO	NO
2009	148.50	NO	NO	148.50	NO	NO	NO
2010	188.10	NO	NO	188.10	NO	NO	NO
2011	300.60	NO	NO	300.60	NO	NO	NO
2012	358.20	NO	NO	358.20	NO	NO	NO
2013	481.23	141.93	NO	339.30	NO	NO	NO
2014	895.23	141.93	NO	753.30	NO	NO	NO
2015	820.53	141.93	NO	678.60	NO	NO	NO
2016	1,138.39	94.62	NO	1,043.77	NO	NO	NO
2017	1,147.85	104.08	NO	1,043.77	NO	NO	NO
2018	1,147.85	104.08	NO	1,043.77	NO	NO	NO
2019	2,291.69	151.40	NO	2,140.29	NO	NO	NO
2020	1,586.51	132.47	NO	1,454.04	NO	NO	NO
2021	1,728.86	146.66	NO	1,582.20	NO	NO	NO
2022	1,591.12	NO	NO	1,591.12	NO	NO	NO
<i>Trend</i>							
1990 – 2022	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	958.6%	NA	NA	958.6%	NA	NA	NA
2021 – 2022	-8.0%	NA	NA	0.6%	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 category 1.A.1.a *Main Activity Electricity and Heat Production*.

Table 3.54 Net calorific values (NCVs) applied for conversion to energy units in NFR category 1.A.1.c.ii Oil and gas extraction

Fuel	Fuel type	Net calorific value (NCV)					
		NCV	unit	type	NCV	unit	type
Natural gas	Gaseous	32.396	GJ/1000 m3	CS	39.02	GJ/1000 m3	D*
Liquefied petroleum gas (LPG)	liquid	47.311	TJ/Gg	CS	47.3	TJ/Gg	D
					for comparision		
Source		Eurostat (2023): Complete energy balances (Code: nrg_bal_c)			2006 IPCC guidelines, Vol. 2, Chapter 1, Table 1.2 * UNstat – IRES (2028) Table 4.1		
Note:							
D	Default	CS	Country specific		PS	Plant specific	

3.1.2.4.3.2.3 Choice of emission factors

Default emission factors for air pollutant were taken from the EMEP/EEA air pollutant emission inventory guidebook 2023²⁹ and are presented in the following table.

Table 3.55 Emission factors (EF) for Main pollutants, Particulate Matter (PM), Heavy metals (HM) and Persistent Organic Pollutants (POPs) for NFR category 1.A.1.c.ii Oil and gas extraction

Fuel types	Unit	Natural gas		Liquefied petroleum gas (LPG)	
Pollutant		EF	Type	EF	type
NOx	g/GJ	89	D	89	D
CO	g/GJ	39	D	39	D
NMVOC	g/GJ	2.6	D	2.6	D
SOx	g/GJ	0.281	D	0.281	D
NH3	g/GJ	NE		NE	
TSP	g/GJ	0.89	D	0.89	D
PM10	g/GJ	0.89	D	0.89	D
PM2.5	g/GJ	0.89	D	0.89	D
BC	% of PM2.5	2.5	D	2.5	D
Pb	mg/GJ	0.0015	D	0.0015	D
Cd	mg/GJ	0.00025	D	0.00025	D
Hg	mg/GJ	0.1	D	0.1	D
As	mg/GJ	0.12	D	0.12	D
Cr	mg/GJ	0.00076	D	0.00076	D
Cu	mg/GJ	0.000076	D	0.000076	D
Ni	mg/GJ	0.00051	D	0.00051	D
Se	mg/GJ	0.0112	D	0.0112	D

²⁹ Source: EMEP/EEA air pollutant emission inventory guidebook 2023. 1.A.1 Energy industries.

Fuel types	Unit	Natural gas		Liquefied petroleum gas (LPG)	
Pollutant		EF	Type	EF	type
Zn	mg/GJ	0.0015	D	0.0015	D
PCB	ng WHO-TEG/GJ	NE	D	NE	
PCDD/F	ng I-TEQ/GJ	0.5	D	0.5	D
Benzo(a)pyrene	µg/GJ	0.56	D	0.56	D
Benzo(b)fluoranthene	µg/GJ	0.84	D	0.84	D
Benzo(k)fluoranthene	µg/GJ	0.84	D	0.84	D
Indeno(1,2,3-cd)pyrene	µg/GJ	0.84	D	0.84	D
HCB	µg/GJ	NE	D	NE	D
Source		Table 3-4 Tier 1 emission factors for source category 1.A.1.a using natural gas			
		EMEP/EEA air pollutant emission inventory guidebook 2023. Part B. Chapter 1.A.1 Energy industries.			
Note:					
D Default	CS Country specific	PS Plant specific	IEF Implied emission factor		

3.1.2.4.3.3 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 3.56 Uncertainty for NFR category 1.A.1.c.ii Oil and gas extraction.

Uncertainty	Heavy Fuel Oil		Gas oil	Reference
Activity data (AD)	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 _x	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 2023. Part A. Chapter 5 Uncertainties.v
CO	B	20% to 60%	40%	
NM VOC	C	50% to 200%	125%	
SO _x	A	10% to 30%	20%	
NH ₃	E	order of magnitude	750%	
TSP, PM ₁₀ , PM _{2.5} , 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.

3.1.2.4.3.4 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 three 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.

3.1.2.4.3.5 Source-specific recalculations

The following table presents the main revisions and recalculations done since the last submission in 2022 and relevant to category 1.A.1.a Main Activity Electricity and Heat Production.

Table 3.57 Recalculations done in NFR category 1.A.1.c.ii Oil and gas extraction

source category	Revisions of data	Type of revision	Type of improvement
1.A.1.c.ii	Revision of NCV by using country specific NCV	AD	Accurary
1.A.1.c.ii	Revision of activity data	AD	Accurary

3.1.2.4.3.6 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 3.58 Planned improvements for NFR category 1.A.1.c.ii Oil and gas extraction

source category	Planned improvement	Type of improvement		Priority
1.A.1.c.ii	Preparation of complete timeseries 1990 - 2022			

3.1.2.4.4 Other Energy Industries (NFR category 1.A.1.c.iii)

NFR category 1.A.1.c.iii Other Energy Industries does not exist in Albania.

3.1.3 Manufacturing Industries and Construction (category 1.A.2)

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

NFR	IPCC code	Description	Occurrent			Not occurrent (NO)
			Estimated	Included elsewhere (IE)	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.iii	1.A.2.g	Manufacturing of transport equipment		✓		
1.A.2.g.iii	1.A.2.h	Manufacturing of machinery		✓		
1.A.2.g.iii	1.A.2.i	Mining (excluding fuels) and Quarrying	✓			
1.A.2.g.iii	1.A.2.j	Wood and wood products		✓		
1.A.2.g.iii	1.A.2.k	Construction	✓			
1.A.2.g.iii	1.A.2.l	Textile and Leather	✓			
1.A.2.g.iii	1.A.2.m	Other	✓			

A '✓' indicates: emissions from this 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 (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* -.

3.1.3.1.1.1 Completeness

In the following table an overview on reported emissions from sub categories 1.A.2.a Iron and Steel is provided.

Table 3.59 Overview on reported emissions from sub categories 1.A.2.a Iron and Steel

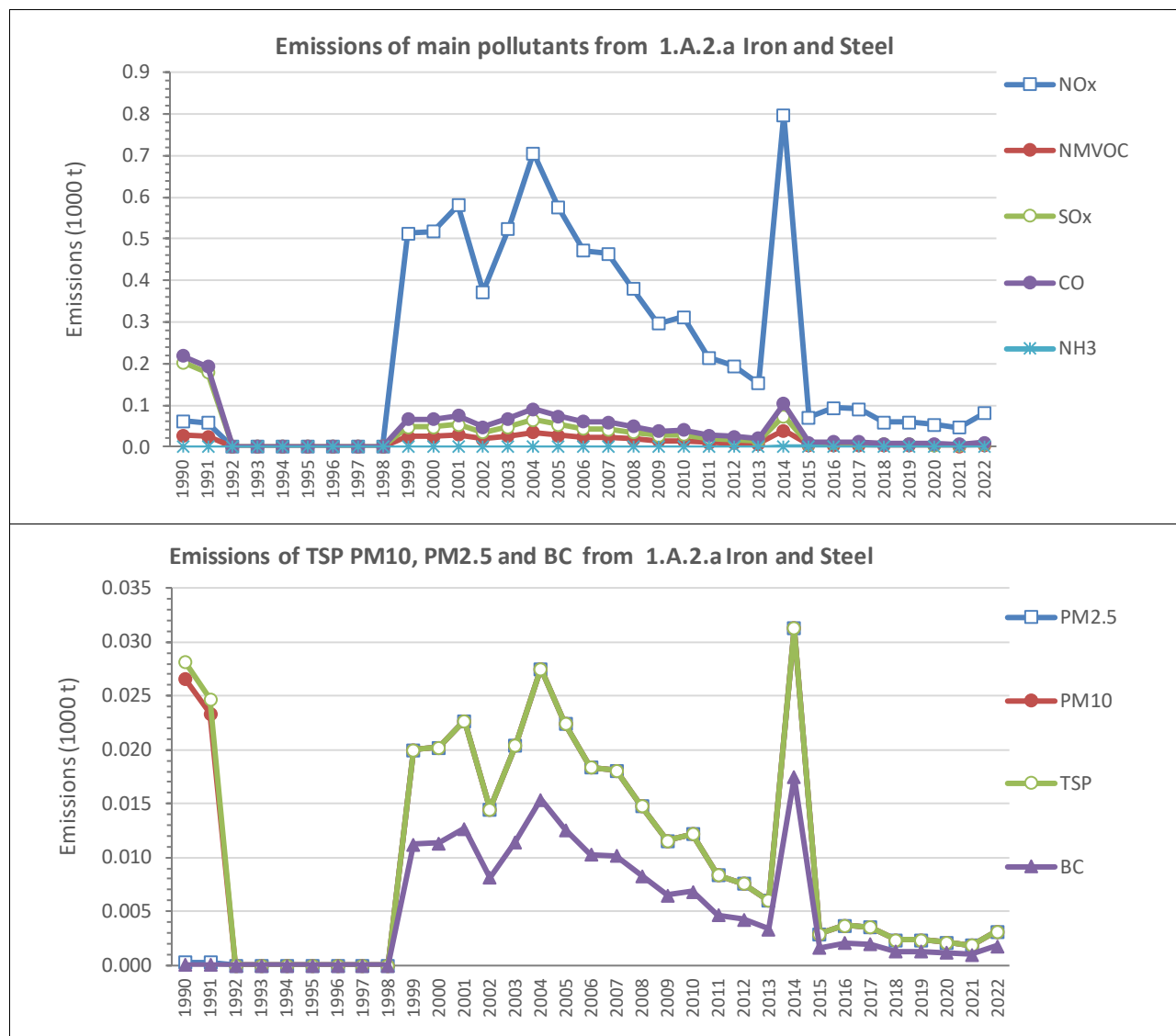
Air pollutants	1.A.2.a						Key Category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
NO _x	✓	✓	NO	NO	NO	NO	
CO	✓	✓	NO	NO	NO	NO	
NM VOC	✓	✓	NO	NO	NO	NO	
SO _x	✓	✓	NO	NO	NO	NO	
NH ₃	NA	NA	NO	NO	NO	NO	
TSP	✓	✓	NO	NO	NO	NO	
PM ₁₀	✓	✓	NO	NO	NO	NO	
PM _{2.5}	✓	✓	NO	NO	NO	NO	
BC	✓	✓	NO	NO	NO	NO	
Pb	✓	✓	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	
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	NA	✓	NO	NO	NO	NO	
HCB	NA	✓	NO	NO	NO	NO	
<p>A '✓' indicates: emissions from this 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>							

3.1.3.1.1.2 Emission trends

An overview of the emission from fuel combustion in IPCC/NFR 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 – 2022, 2005 – 2022, 2021 – 2022.

Until 1992, in Albania iron and steel was produced in a blast oxygen furnace (BOF). In 1999, the production of iron and steel was done in a electric arc furnace plant.



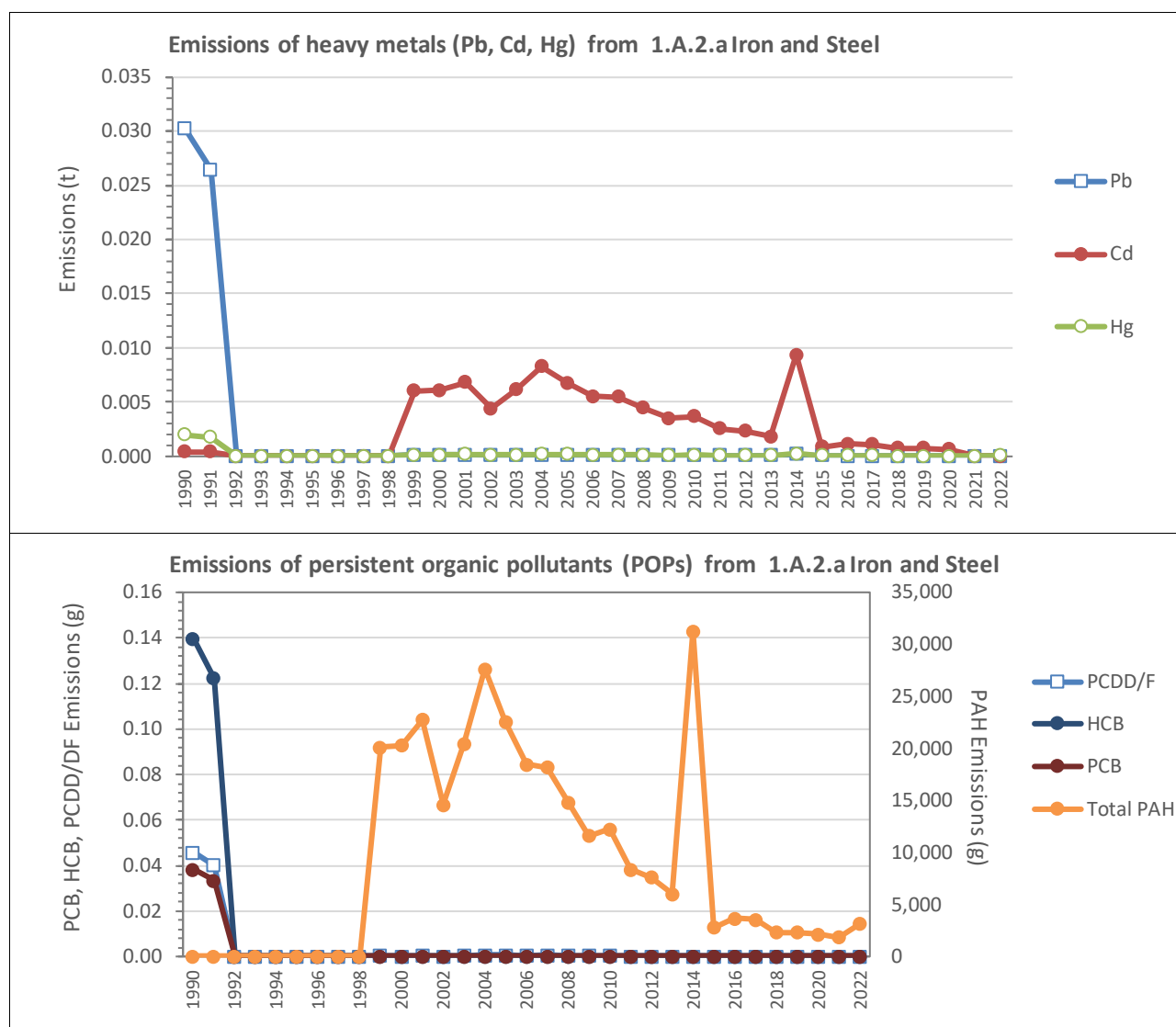


Figure 3.13 Emissions from category 1.A.2.a Iron and Steel

Table 3.60 Emissions of main pollutants (NO_x, SO₂, NMVOC, CO and NH₃) from category 1.A.2.a Iron and Steel

Emissions	NO _x	NMVOC	SO _x	CO	NH ₃
	Gg	Gg	Gg	Gg	Gg
1990	0.062	0.027	0.203	0.219	NA
1991	0.058	0.025	0.178	0.193	NA
1992	NO	NO	NO	NO	NA
1993	NO	NO	NO	NO	NA
1994	NO	NO	NO	NO	NA
1995	NO	NO	NO	NO	NA
1996	NO	NO	NO	NO	NA
1997	NO	NO	NO	NO	NA
1998	NO	NO	NO	NO	NA
1999	0.513	0.025	0.047	0.066	NA
2000	0.518	0.025	0.047	0.067	NA
2001	0.582	0.028	0.053	0.075	NA
2002	0.372	0.018	0.034	0.048	NA
2003	0.523	0.026	0.048	0.067	NA
2004	0.706	0.034	0.065	0.091	NA
2005	0.575	0.028	0.053	0.074	NA
2006	0.472	0.023	0.043	0.061	NA
2007	0.464	0.023	0.043	0.060	NA
2008	0.379	0.018	0.035	0.049	NA
2009	0.297	0.014	0.027	0.038	NA
2010	0.312	0.015	0.029	0.040	NA
2011	0.214	0.010	0.020	0.028	NA
2012	0.195	0.009	0.018	0.025	NA
2013	0.153	0.007	0.014	0.020	NA
2014	0.799	0.039	0.073	0.103	NA
2015	0.071	0.003	0.007	0.009	NA
2016	0.094	0.005	0.009	0.012	NA
2017	0.090	0.004	0.008	0.012	NA
2018	0.060	0.003	0.005	0.008	NA
2019	0.060	0.003	0.005	0.008	NA
2020	0.054	0.003	0.005	0.007	NA
2021	0.047	0.002	0.004	0.006	NA
2022	0.081	0.004	0.007	0.010	NA
<i>Trend</i>					
1990 – 2022	29.1%	-85.6%	-96.4%	-95.3%	NA
2005 – 2022	-86.0%	-86.0%	-86.0%	-86.0%	NA
2021 – 2022	72.3%	72.3%	72.3%	72.3%	NA

Table 3.61 Emissions of particulate matter (PM) from category 1.A.2.a Iron and Steel

Emissions	PM2.5	PM10	TSP	BC
	Gg	Gg	Gg	Gg
1990	0.0012	0.0266	0.0282	<0.0010
1991	0.0012	0.0233	0.0247	<0.0010
1992	NO	NO	NO	NO
1993	NO	NO	NO	NO
1994	NO	NO	NO	NO
1995	NO	NO	NO	NO
1996	NO	NO	NO	NO
1997	NO	NO	NO	NO
1998	NO	NO	NO	NO
1999	0.0200	0.0200	0.0200	0.0112
2000	0.0202	0.0202	0.0202	0.0113
2001	0.0227	0.0227	0.0227	0.0127
2002	0.0145	0.0145	0.0145	0.0081
2003	0.0204	0.0204	0.0204	0.0114
2004	0.0275	0.0275	0.0275	0.0154
2005	0.0224	0.0224	0.0224	0.0125
2006	0.0184	0.0184	0.0184	0.0103
2007	0.0181	0.0181	0.0181	0.0101
2008	0.0148	0.0148	0.0148	0.0083
2009	0.0116	0.0116	0.0116	0.0065
2010	0.0122	0.0122	0.0122	0.0068
2011	0.0083	0.0083	0.0083	0.0047
2012	0.0076	0.0076	0.0076	0.0043
2013	0.0060	0.0060	0.0060	0.0033
2014	0.0311	0.0311	0.0311	0.0174
2015	0.0028	0.0028	0.0028	0.0016
2016	0.0037	0.0037	0.0037	0.0021
2017	0.0035	0.0035	0.0035	0.0020
2018	0.0023	0.0023	0.0023	0.0013
2019	0.0023	0.0023	0.0023	0.0013
2020	0.0021	0.0021	0.0021	0.0012
2021	0.0018	0.0018	0.0018	0.0010
2022	0.0031	0.0031	0.0031	0.0018
<i>Trend</i>				
1990 – 2022	1174.2%	-88.2%	-88.9%	13814.1%
2005 – 2022	-86.0%	-86.0%	-86.0%	-86.0%
2021 – 2022	72.3%	72.3%	72.3%	72.3%

Table 3.62 Emissions of Heavy Metals (HM) from 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	0.030	<0.001	0.002	0.001	0.003	0.004	<0.001	<0.001	0.045
1991	0.026	<0.001	0.002	0.001	0.003	0.003	<0.001	<0.001	0.040
1992	NO	NO	NO	NO	NO	NO	NO	NO	NO
1993	NO	NO	NO	NO	NO	NO	NO	NO	NO
1994	NO	NO	NO	NO	NO	NO	NO	NO	NO
1995	NO	NO	NO	NO	NO	NO	NO	NO	NO
1996	NO	NO	NO	NO	NO	NO	NO	NO	NO
1997	NO	NO	NO	NO	NO	NO	NO	NO	NO
1998	NO	NO	NO	NO	NO	NO	NO	NO	NO
1999	<0.001	0.006	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.029
2000	<0.001	0.006	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.029
2001	<0.001	0.007	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.033
2002	<0.001	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.021
2003	<0.001	0.006	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.030
2004	<0.001	0.008	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.040
2005	<0.001	0.007	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.032
2006	<0.001	0.006	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.027
2007	<0.001	0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.026
2008	<0.001	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.021
2009	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.017
2010	<0.001	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.018
2011	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.012
2012	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.011
2013	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.009
2014	<0.001	0.009	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.045
2015	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004
2016	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.005
2017	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.005
2018	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003
2019	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003
2020	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003
2021	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003
2022	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.005
<i>Trend</i>									
1990 – 2022	-100.0%	-99.8%	-99.0%	-99.5%	-99.0%	-99.1%	-69.4%	-95.9%	-90.0%
2005 – 2022	-91.3%	-100.0%	-86.0%	-86.0%	-86.0%	-86.0%	-86.0%	-86.0%	-86.0%
2021 – 2022	142.3%	72.3%	72.3%	72.3%	72.3%	72.3%	72.3%	72.3%	72.3%

Table 3.63 Emissions of Persistent Organic Pollutants (POPs) from 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	0.05	10.3	13.3	5.3	4.2	33.1	0.14	0.04
1991	0.04	9.0	11.6	4.7	3.7	28.9	0.12	0.03
1992	NO	NO	NO	NO	NO	NO	NO	NO
1993	NO	NO	NO	NO	NO	NO	NO	NO
1994	NO	NO	NO	NO	NO	NO	NO	NO
1995	NO	NO	NO	NO	NO	NO	NO	NO
1996	NO	NO	NO	NO	NO	NO	NO	NO
1997	NO	NO	NO	NO	NO	NO	NO	NO
1998	NO	NO	NO	NO	NO	NO	NO	NO
1999	0.00	1,901.2	15,009.6	1,701.1	1,501.0	20,112.9	NO	NO
2000	0.00	1,920.2	15,159.2	1,718.0	1,515.9	20,313.4	NO	NO
2001	0.00	2,154.2	17,007.0	1,927.5	1,700.7	22,789.4	NO	NO
2002	0.00	1,378.1	10,880.1	1,233.1	1,088.0	14,579.3	NO	NO
2003	0.00	1,938.2	15,301.9	1,734.2	1,530.2	20,504.5	NO	NO
2004	0.00	2,614.9	20,643.9	2,339.6	2,064.4	27,662.9	NO	NO
2005	0.00	2,128.7	16,805.5	1,904.6	1,680.5	22,519.4	NO	NO
2006	0.00	1,746.9	13,791.0	1,563.0	1,379.1	18,480.0	NO	NO
2007	0.00	1,719.2	13,572.3	1,538.2	1,357.2	18,186.9	NO	NO
2008	0.00	1,404.9	11,091.6	1,257.0	1,109.2	14,862.8	NO	NO
2009	0.00	1,099.5	8,680.0	983.7	868.0	11,631.2	NO	NO
2010	0.00	1,157.2	9,135.6	1,035.4	913.6	12,241.7	NO	NO
2011	0.00	791.7	6,250.0	708.3	625.0	8,375.0	NO	NO
2012	0.00	721.0	5,692.4	645.1	569.2	7,627.9	NO	NO
2013	0.00	567.5	4,480.4	507.8	448.0	6,003.8	NO	NO
2014	0.00	2,958.3	23,355.0	2,646.9	2,335.5	31,295.7	NO	NO
2015	0.00	263.6	2,081.4	235.9	208.1	2,789.1	NO	NO
2016	0.00	348.8	2,753.4	312.1	275.3	3,689.6	NO	NO
2017	0.00	334.8	2,643.2	299.6	264.3	3,541.8	NO	NO
2018	0.00	220.4	1,740.1	197.2	174.0	2,331.7	NO	NO
2019	0.00	220.4	1,740.1	197.2	174.0	2,331.7	NO	NO
2020	0.00	200.1	1,580.0	179.1	158.0	2,117.2	NO	NO
2021	0.00	173.2	1,367.4	155.0	136.7	1,832.3	NO	NO
2022	0.00	298.4	2,355.5	267.0	235.5	3,156.3	NO	NO
<i>Trend</i>								
1990 – 2022	-99.7%	2806.6%	17626.4%	4892.8%	5543.7%	9443.5%	NA	NA
2005 – 2022	-84.8%	-86.0%	-86.0%	-86.0%	-86.0%	-86.0%	NA	NA
2021 – 2022	36.1%	72.3%	72.3%	72.3%	72.3%	72.3%	NA	NA

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 approach³⁰ of the EMEP/EEA air pollutant emission inventory guidebook 2023 has been applied:

Equation: emissions from stationary combustion

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

Where:

Emissions _{pollutant}	= emissions of a given pollutant by type of fuel (kg pollutant)
Fuel consumption _{fuel}	= amount of fuel combusted (TJ)
Emission factor _{pollutant. fuel}	= default emission factor of a given pollutant by type of fuel (g _{pollutant} /GJ).
Pollutant	= main pollutants: NO _x , CO, NMVOC, SO ₂ particulate matter: TSP, PM ₁₀ , PM _{2.5} , 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:

Fuel type	Fuel types
Liquid fuels	<ul style="list-style-type: none"> Residual fuel oil Gas/Diesel Oil (Non-bio gas/diesel oil) Other Oil - Other Petroleum Products Petroleum coke
Solid fuels	<ul style="list-style-type: none"> Blast furnace gas Other Bituminous Coal

Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2022 were taken from EUROSTAT prepared by Albanian Institute of Statistics (INSTAT).

³⁰ Source: EMEP/EEA air pollutant emission inventory guidebook 2023. 1.A.2 Manufacturing industries and construction (combustion). sub-chapter 3.2 Tier 1 default approach.

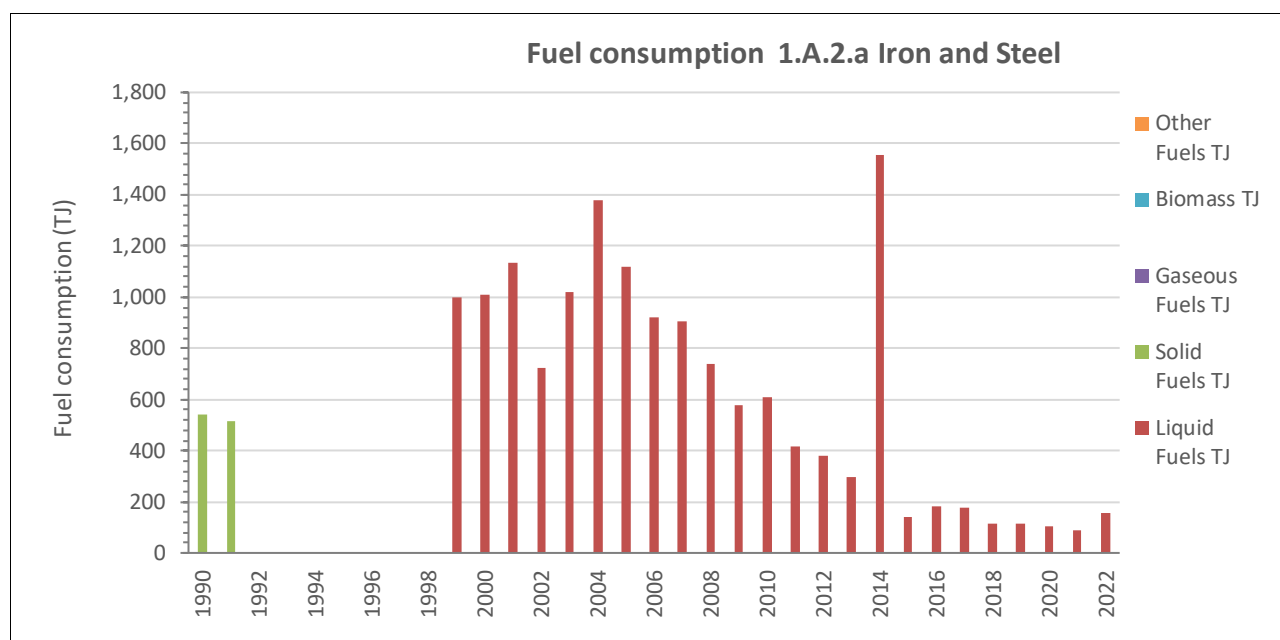


Figure 3.14 Activity data for category 1.A.2.a Iron and Steel

Table 3.64 Activity data for category 1.A.2.a Iron and Steel

Activity data 1.A.2.a	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
1990	541.60	NO	541.60	NO	NO	NO	NO
1991	513.40	NO	513.40	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	NO	NO	NO	NO	NO	NO	NO
1997	NO	NO	NO	NO	NO	NO	NO
1998	NO	NO	NO	NO	NO	NO	NO
1999	1,000.64	1,000.64	NO	NO	NO	NO	NO
2000	1,010.62	1,010.62	NO	NO	NO	NO	NO
2001	1,133.80	1,133.80	NO	NO	NO	NO	NO
2002	725.34	725.34	NO	NO	NO	NO	NO
2003	1,020.12	1,020.12	NO	NO	NO	NO	NO
2004	1,376.26	1,376.26	NO	NO	NO	NO	NO
2005	1,120.37	1,120.37	NO	NO	NO	NO	NO
2006	919.40	919.40	NO	NO	NO	NO	NO
2007	904.82	904.82	NO	NO	NO	NO	NO
2008	739.44	739.44	NO	NO	NO	NO	NO
2009	578.67	578.67	NO	NO	NO	NO	NO
2010	609.04	609.04	NO	NO	NO	NO	NO
2011	416.67	416.67	NO	NO	NO	NO	NO
2012	379.50	379.50	NO	NO	NO	NO	NO

Activity data 1.A.2.a	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
2013	298.70	298.70	NO	NO	NO	NO	NO
2014	1,557.00	1,557.00	NO	NO	NO	NO	NO
2015	138.76	138.76	NO	NO	NO	NO	NO
2016	183.56	183.56	NO	NO	NO	NO	NO
2017	176.21	176.21	NO	NO	NO	NO	NO
2018	116.01	116.01	NO	NO	NO	NO	NO
2019	116.01	116.01	NO	NO	NO	NO	NO
2020	105.33	105.33	NO	NO	NO	NO	NO
2021	91.16	91.16	NO	NO	NO	NO	NO
2022	157.03	157.03	NO	NO	NO	NO	NO
<i>Trend</i>							
1990 – 2022	-71.0%	NA	NA	NA	NA	NA	NA
2005 – 2022	-86.0%	-86.0%	NA	NA	NA	NA	NA
2021 – 2022	72.3%	72.3%	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 IPCC/NFR category 1.A.2.a Iron and Steel.

Table 3.65 Net calorific values (NCVs) applied for conversion to energy units in category 1.A.2.a Iron and Steel

Fuel	Fuel type	Net calorific value (NCV)					
		NCV	unit	type	NCV	unit	type
Residual fuel oil	liquid	40.193	TJ/Gg	CS	40.4	TJ/Gg	D
Gas/Diesel Oil (Non-bio gas/diesel oil)	liquid	43.292	TJ/Gg	CS	47.3	TJ/Gg	D
Petroleum coke	liquid	46.89	TJ/Gg	CS	32.5	TJ/Gg	D
Other Oil - Other Petroleum Products	liquid	40.2	TJ/Gg	CS	40.2	TJ/Gg	D
Blast furnance gas	solid	16.85	TJ/Gg	CS	2.5	TJ/Gg	D
Coke oven Coke	solid	28.20	TJ/Gg	CS	28.2	TJ/Gg	D
					<i>for comparision</i>		
Source		Eurostat (2023): Complete energy balances (Code: nrg_bal_c)			2006 IPCC guidelines, Vol. 2, Chapter 1, Table 1.2		
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 2023³¹ and are presented in the following table.

Table 3.66 Emission factors (EF) for Main pollutants, Particulate Matter (PM), Heavy metals (HM) and Persistent Organic Pollutants (POPs) for category 1.A.2.a Iron and Steel

Fuel Type	UNIT	Solid Fuels		Liquid fuels	
Associated fuel types		Blast furnance gas Coke oven Coke		Residual fuel oil, Gas/Diesel Oil (Non-bio gas/diesel oil), Petroleum coke, Other Oil - Other Petroleum Products	
Pollutant		EF	type	EF	type
NOx	g/GJ	173	D	513	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	NE	D	NA	D
NH3	g/GJ	124	D	20	D
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	NA	D
PCDD/F	ng I-TEQ/GJ	203	D	1.4	D
Benzo(a)pyrene	µg/GJ	45.5	D	1900	D
Benzo(b)fluoranthene	µg/GJ	58.9	D	15000	D
Benzo(k)fluoranthene	µg/GJ	23.7	D	1700	D
Indeno(1,2,3-cd)pyrene	µg/GJ	18.5	D	1500	D
HCB	µg/GJ	0.62	D	NA	D
Source		Table 3-2 Tier 1 emission factors for 1.A.2 combustion in industry using solid fuels		Table 3-4 Tier 1 emission factors for 1.A.2 combustion in industry using liquid fuels	
		EMEP/EEA air pollutant emission inventory guidebook 2023. Part B. Chapter Chapter 1.A.2 Combustion in manufacturing industries and construction.			
Note:					
D Default	CS Country specific	PS Plant specific		IEF Implied emission factor	

³¹ Source: EMEP/EEA air pollutant emission inventory guidebook 2023. 1.A.2 Manufacturing industries and construction (combustion). sub-chapter 3.2.2 Default emission factors.

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 3.67 Uncertainty for category 1.A.2.a Iron and Steel .

Uncertainty	Solid fuels	Gaseous fuels	Liquid fuels	Biomass	Reference
Activity data (AD)	10%	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 _x	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 2023. Part A. Chapter 5 Uncertainties.	
CO	C	50% to 200%	125%		
NM VOC	D	100% to 300%	200%		
SO _x	A	10% to 30%	20%		
NH ₃	E	order of magnitude	750%		
TSP, PM ₁₀ , PM _{2.5} , 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)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 2022 and relevant to category 1.A.2.a Iron and Steel.

Table 3.68 Recalculations done in category 1.A.2.a Iron and Steel

source category	Revisions of data	Type of revision	Type of improvement
1.A.2.a	Revision of NCV by using country specific NCV	AD	Accurary
1.A.2.a	Revision of activity data	AD	Accurary

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 3.69 Planned improvements for 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"> Determination of the <ul style="list-style-type: none"> temperature in waste gases [°C]; static pressure and the dynamic pressure [kPa]; flow rate [m/s]; volume flow rate [m³/h and Nm³/h]; concentration of CO, SO₂, NO_x in the exhaust gases [mg/Nm³]; and Gravimetric extraction of solid particles (TSP) from gases and determination by applying a gravimetric method (mg/Nm³). 	EF	Accuracy Transparency	High
1.A.2.a	Improvement of time series consistency and split of fuels: check of years 1990-1999	AD	Accuracy Transparency	High

3.1.3.2 Non-Ferrous Metals (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** -.

3.1.3.2.1.1 Completeness

In the following table an overview on reported emissions from sub categories 1.A.2.b *Non-Ferrous Metals* is provided.

Table 3.70 Overview on reported emissions from sub categories 1.A.2.b Non-Ferrous Metals

Air pollutants	1.A.2.b					
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass
NOx	✓	NO	NO	NO	NO	NO
CO	✓	NO	NO	NO	NO	NO
NMVOC	✓	NO	NO	NO	NO	NO
SOx	✓	NO	NO	NO	NO	NO
NH3	NA	NO	NO	NO	NO	NO
TSP	✓	NO	NO	NO	NO	NO
PM10	✓	NO	NO	NO	NO	NO
PM2.5	✓	NO	NO	NO	NO	NO
BC	✓	NO	NO	NO	NO	NO
Pb	✓	NO	NO	NO	NO	NO
Cd	✓	NO	NO	NO	NO	NO
Hg	✓	NO	NO	NO	NO	NO
As	✓	NO	NO	NO	NO	NO
Cr	✓	NO	NO	NO	NO	NO
Cu	✓	NO	NO	NO	NO	NO
Ni	✓	NO	NO	NO	NO	NO
Se	✓	NO	NO	NO	NO	NO
Zn	✓	NO	NO	NO	NO	NO
PCB	NA	NO	NO	NO	NO	NO
PCDD/F	✓	NO	NO	NO	NO	NO
PAH	✓	NO	NO	NO	NO	NO
Benzo(a)pyrene	✓	NO	NO	NO	NO	NO
Benzo(b)fluoranthene	✓	NO	NO	NO	NO	NO
Benzo(k)fluoranthene	✓	NO	NO	NO	NO	NO
Indeno(1,2,3-cd)pyrene	✓	NO	NO	NO	NO	NO
HCB	NA	NO	NO	NO	NO	NO

3.1.3.2.1.2 Emission trends

This section describes emissions resulting from fuel combustion activities in *Manufacturing Industries and Construction -Non-Ferrous Metals* -An overview of the emission from fuel combustion in IPCC/NFR 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 – 2022, 2005 – 2022, 2021 – 2022.

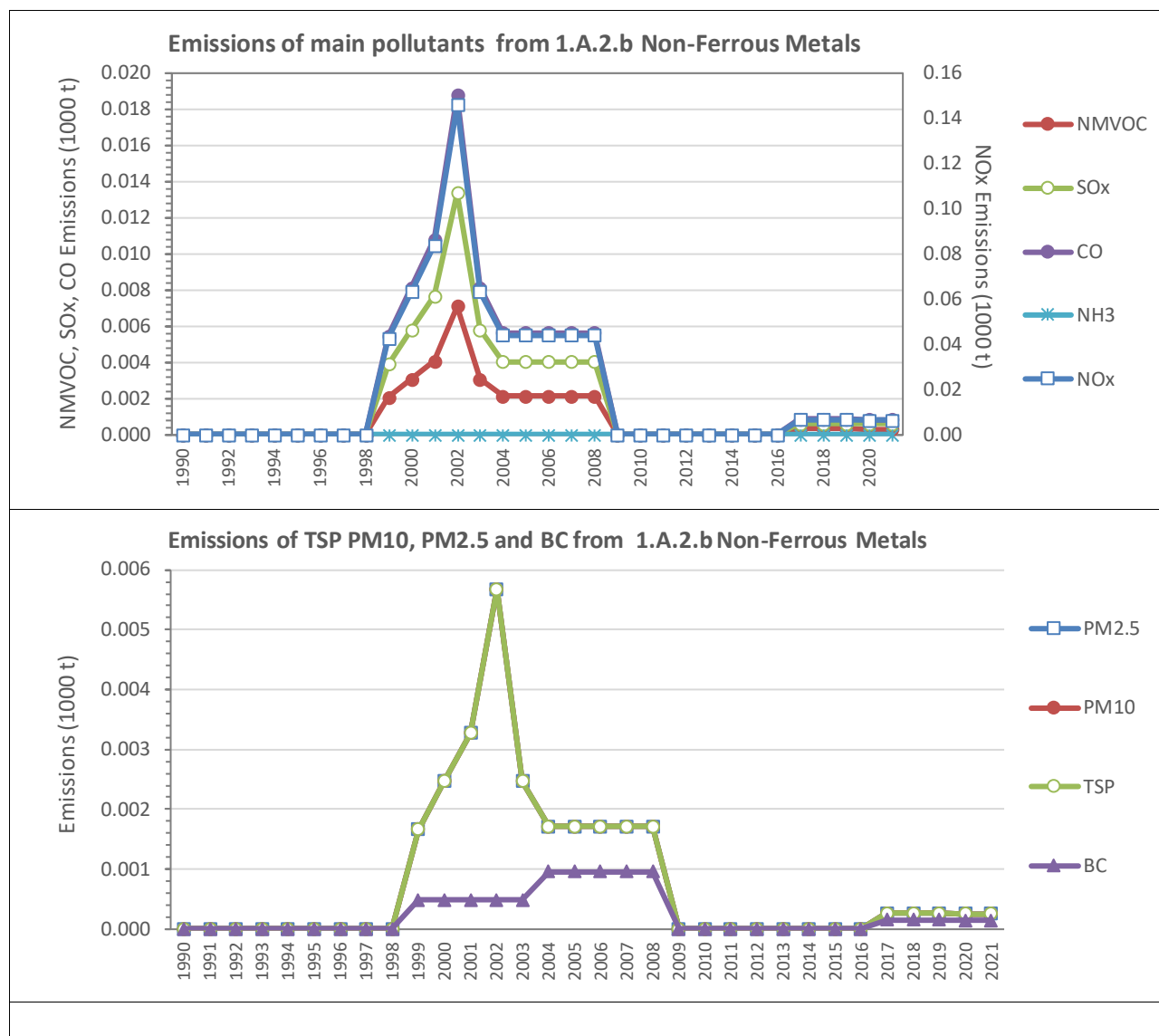


Figure 3.15 Emissions from category 1.A.2.b Non-Ferrous Metals

Table 3.71 Emissions of main pollutants (NO_x, SO₂, NMVOC, CO and NH₃) from category 1.A.2.b Non-Ferrous Metals

Emissions	NO _x	NMVOC	SO _x	CO	NH ₃
	Gg	Gg	Gg	Gg	Gg
1990	NO	NO	NO	NO	NA
1991	NO	NO	NO	NO	NA
1992	NO	NO	NO	NO	NA
1993	NO	NO	NO	NO	NA
1994	NO	NO	NO	NO	NA
1995	NO	NO	NO	NO	NA
1996	NO	NO	NO	NO	NA
1997	NO	NO	NO	NO	NA
1998	NO	NO	NO	NO	NA
1999	0.043	0.002	0.004	0.005	NA
2000	0.063	0.003	0.006	0.008	NA
2001	0.084	0.004	0.008	0.011	NA
2002	0.146	0.007	0.013	0.019	NA
2003	0.063	0.003	0.006	0.008	NA
2004	0.044	0.002	0.004	0.006	NA
2005	0.044	0.002	0.004	0.006	NA
2006	0.044	0.002	0.004	0.006	NA
2007	0.044	0.002	0.004	0.006	NA
2008	0.044	0.002	0.004	0.006	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	IE	IE	IE	IE	NA
2015	IE	IE	IE	IE	NA
2016	IE	IE	IE	IE	NA
2017	0.007	<0.001	0.001	0.001	NA
2018	0.007	<0.001	0.001	0.001	NA
2019	0.007	<0.001	0.001	0.001	NA
2020	0.006	<0.001	0.001	0.001	NA
2021	0.006	<0.001	0.001	0.001	NA
2022	0.009	<0.001	0.001	0.001	NA
<i>Trend</i>					
1990 – 2022	NA	NA	NA	NA	NA
2005 – 2022	-80.0%	-80.0%	-80.0%	-80.0%	NA
2021 – 2022	36.1%	36.1%	36.1%	36.1%	NA

Table 3.72 Emissions of particulate matter (PM) from category 1.A.2.b Non-Ferrous Metals

Emissions	PM2.5	PM10	TSP	BC
	Gg	Gg	Gg	Gg
1990	NO	NO	NO	NO
1991	NO	NO	NO	NO
1992	NO	NO	NO	NO
1993	NO	NO	NO	NO
1994	NO	NO	NO	NO
1995	NO	NO	NO	NO
1996	NO	NO	NO	NO
1997	NO	NO	NO	NO
1998	NO	NO	NO	NO
1999	0.0017	0.0017	0.0017	0.0005
2000	0.0025	0.0025	0.0025	0.0005
2001	0.0033	0.0033	0.0033	0.0005
2002	0.0057	0.0057	0.0057	0.0005
2003	0.0025	0.0025	0.0025	0.0005
2004	0.0017	0.0017	0.0017	0.0010
2005	0.0017	0.0017	0.0017	0.0010
2006	0.0017	0.0017	0.0017	0.0010
2007	0.0017	0.0017	0.0017	0.0010
2008	0.0017	0.0017	0.0017	0.0010
2009	IE	IE	IE	IE
2010	IE	IE	IE	IE
2011	IE	IE	IE	IE
2012	IE	IE	IE	IE
2013	IE	IE	IE	IE
2014	IE	IE	IE	IE
2015	IE	IE	IE	IE
2016	IE	IE	IE	IE
2017	0.0003	0.0003	0.0003	0.0001
2018	0.0003	0.0003	0.0003	0.0001
2019	0.0003	0.0003	0.0003	0.0001
2020	0.0003	0.0003	0.0003	0.0001
2021	0.0003	0.0003	0.0003	0.0001
2022	0.0003	0.0003	0.0003	0.0002
<i>Trend</i>				
1990 – 2022	NA	NA	NA	NA
2005 – 2022	-80.0%	-80.0%	-80.0%	-80.0%
2021 – 2022	36.1%	36.1%	36.1%	36.1%

Table 3.73 Emissions of Heavy Metals (HM) from 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	NO	NO	NO	NO	NO	NO	NO	NO	NO
1991	NO	NO	NO	NO	NO	NO	NO	NO	NO
1992	NO	NO	NO	NO	NO	NO	NO	NO	NO
1993	NO	NO	NO	NO	NO	NO	NO	NO	NO
1994	NO	NO	NO	NO	NO	NO	NO	NO	NO
1995	NO	NO	NO	NO	NO	NO	NO	NO	NO
1996	NO	NO	NO	NO	NO	NO	NO	NO	NO
1997	NO	NO	NO	NO	NO	NO	NO	NO	NO
1998	NO	NO	NO	NO	NO	NO	NO	NO	NO
1999	0.003	0.498	0.010	0.002	0.017	0.018	0.001	0.009	2.407
2000	0.006	0.739	0.015	0.004	0.025	0.027	0.001	0.014	3.572
2001	0.010	0.980	0.020	0.005	0.033	0.036	0.001	0.018	4.738
2002	0.019	1.704	0.034	0.009	0.057	0.062	0.002	0.031	8.235
2003	0.006	0.739	0.015	0.004	0.025	0.027	0.001	0.014	3.572
2004	0.000	0.514	0.010	0.003	0.017	0.019	0.001	0.009	2.482
2005	0.000	0.514	0.010	0.003	0.017	0.019	0.001	0.009	2.482
2006	0.000	0.514	0.010	0.003	0.017	0.019	0.001	0.009	2.482
2007	0.000	0.514	0.010	0.003	0.017	0.019	0.001	0.009	2.482
2008	0.000	0.514	0.010	0.003	0.017	0.019	0.001	0.009	2.482
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	IE	IE	IE	IE	IE	IE	IE	IE	IE
2015	IE	IE	IE	IE	IE	IE	IE	IE	IE
2016	IE	IE	IE	IE	IE	IE	IE	IE	IE
2017	<0.001	0.080	0.002	<0.001	0.003	0.003	<0.001	0.001	0.385
2018	<0.001	0.080	0.002	<0.001	0.003	0.003	<0.001	0.001	0.385
2019	<0.001	0.080	0.002	<0.001	0.003	0.003	<0.001	0.001	0.385
2020	<0.001	0.075	0.002	<0.001	0.003	0.003	<0.001	0.001	0.365
2021	<0.001	0.000	0.002	<0.001	0.003	0.003	<0.001	0.001	0.365
2022	<0.001	0.000	0.002	0.001	0.003	0.004	<0.001	0.002	0.497
<i>Trend</i>									
1990 – 2022	NA	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	-80.0%	-100.0%	-80.0%	-80.0%	-80.0%	-80.0%	-80.0%	-80.0%	-80.0%
2021 – 2022	36.1%	36.1%	36.1%	36.1%	36.1%	36.1%	36.1%	36.1%	36.1%

Table 3.74 Emissions of Persistent Organic Pollutants (POPs) from 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	NO	NO	NO	NO	NO	NO	NO	NO
1991	NO	NO	NO	NO	NO	NO	NO	NO
1992	NO	NO	NO	NO	NO	NO	NO	NO
1993	NO	NO	NO	NO	NO	NO	NO	NO
1994	NO	NO	NO	NO	NO	NO	NO	NO
1995	NO	NO	NO	NO	NO	NO	NO	NO
1996	NO	NO	NO	NO	NO	NO	NO	NO
1997	NO	NO	NO	NO	NO	NO	NO	NO
1998	NO	NO	NO	NO	NO	NO	NO	NO
1999	0.116	0.158	1.245	0.141	0.124	1.668	NO	NO
2000	0.172	0.234	1.848	0.209	0.185	2.476	NO	NO
2001	0.229	0.310	2.451	0.278	0.245	3.284	NO	NO
2002	0.398	0.540	4.259	0.483	0.426	5.708	NO	NO
2003	0.172	0.234	1.848	0.209	0.185	2.476	NO	NO
2004	0.120	0.163	1.284	0.146	0.128	1.721	NO	NO
2005	0.120	0.163	1.284	0.146	0.128	1.721	NO	NO
2006	0.120	0.163	1.284	0.146	0.128	1.721	NO	NO
2007	0.120	0.163	1.284	0.146	0.128	1.721	NO	NO
2008	0.120	0.163	1.284	0.146	0.128	1.721	NO	NO
2009	IE	IE	IE	IE	IE	IE	NO	NO
2010	IE	IE	IE	IE	IE	IE	NO	NO
2011	IE	IE	IE	IE	IE	IE	NO	NO
2012	IE	IE	IE	IE	IE	IE	NO	NO
2013	IE	IE	IE	IE	IE	IE	NO	NO
2014	IE	IE	IE	IE	IE	IE	NO	NO
2015	IE	IE	IE	IE	IE	IE	NO	NO
2016	IE	IE	IE	IE	IE	IE	NO	NO
2017	0.019	0.025	0.199	0.023	0.020	0.267	NO	NO
2018	0.019	0.025	0.199	0.023	0.020	0.267	NO	NO
2019	0.019	0.025	0.199	0.023	0.020	0.267	NO	NO
2020	0.018	0.024	0.189	0.021	0.019	0.253	NO	NO
2021	0.018	0.024	0.189	0.021	0.019	0.253	NO	NO
2022	0.024	0.033	0.257	0.029	0.026	0.344	NO	NO
<i>Trend</i>								
1990 – 2022	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	-80.0%	-80.0%	-80.0%	-80.0%	-80.0%	-80.0%	NA	NA
2021 – 2022	36.1%	36.1%	36.1%	36.1%	36.1%	36.1%	NA	NA

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 approach³² of the EMEP/EEA air pollutant emission inventory guidebook 2023 has been applied:

Equation: emissions from stationary combustion

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

Where:

Emissions _{pollutant}	= emissions of a given pollutant by type of fuel (kg pollutant)
Fuel consumption _{fuel}	= amount of fuel combusted (TJ)
Emission factor _{pollutant. fuel}	= default emission factor of a given pollutant by type of fuel (g _{pollutant} /GJ).
Pollutant	= main pollutants: NO _x , CO, NMVOC, SO ₂ particulate matter: TSP, PM ₁₀ , PM _{2.5} , 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):

Fuel type	fuel types
Liquid fuels	<ul style="list-style-type: none"> Residual fuel oil /Diesel Oil Gas/Diesel Oil (Non-bio gas/diesel oil)

Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2022 were taken from EUROSTAT and prepared by Albanian Institute of Statistics (INSTAT).

³² Source: EMEP/EEA air pollutant emission inventory guidebook 2023. 1.A.2 Manufacturing industries and construction (combustion). sub-chapter 3.2 Tier 1 default approach.

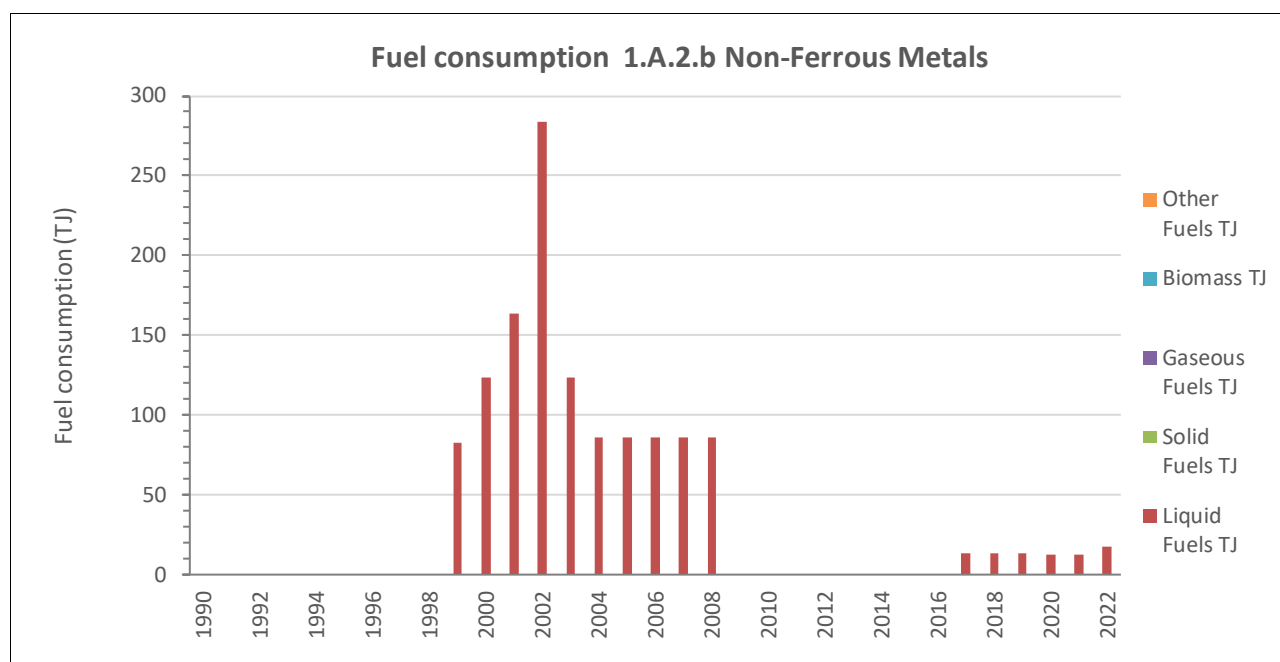


Figure 3.16 Activity data for category 1.A.2.b Non-Ferrous Metals

Table 3.75 Activity data for 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	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	NO	NO	NO	NO	NO	NO	NO
1997	NO	NO	NO	NO	NO	NO	NO
1998	NO	NO	NO	NO	NO	NO	NO
1999	82.99	82.99	NO	NO	NO	NO	NO
2000	123.19	123.19	NO	NO	NO	NO	NO
2001	163.38	163.38	NO	NO	NO	NO	NO
2002	283.96	283.96	NO	NO	NO	NO	NO
2003	123.19	123.19	NO	NO	NO	NO	NO
2004	85.60	85.60	NO	NO	NO	NO	NO
2005	85.60	85.60	NO	NO	NO	NO	NO
2006	85.60	85.60	NO	NO	NO	NO	NO
2007	85.60	85.60	NO	NO	NO	NO	NO
2008	85.60	85.60	NO	NO	NO	NO	NO
2009	IE	IE	NO	NO	NO	NO	NO
2010	IE	IE	NO	NO	NO	NO	NO
2011	IE	IE	NO	NO	NO	NO	NO
2012	IE	IE	NO	NO	NO	NO	NO

Activity data 1.A.1.b	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
2013	IE	IE	NO	NO	NO	NO	NO
2014	IE	IE	NO	NO	NO	NO	NO
2015	IE	IE	NO	NO	NO	NO	NO
2016	IE	IE	NO	NO	NO	NO	NO
2017	13.27	13.27	NO	NO	NO	NO	NO
2018	13.27	13.27	NO	NO	NO	NO	NO
2019	13.27	13.27	NO	NO	NO	NO	NO
2020	12.58	12.58	NO	NO	NO	NO	NO
2021	12.58	12.58	NO	NO	NO	NO	NO
2022	17.13	17.13	NO	NO	NO	NO	NO
<i>Trend</i>							
1990 – 2022	-99.9%	-99.9%	NA	NA	NA	NA	NA
2005 – 2022	-99.9%	-99.9%	NA	NA	NA	NA	NA
2021 – 2022	-98.0%	-98.0%	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 IPCC/NFR category 1.A.2.b Non-Ferrous Metals.

Table 3.76 Net calorific values (NCVs) applied for conversion to energy units in category 1.A.2.b Non-Ferrous Metals

Fuel	Fuel type	Net calorific value (NCV)					
		NCV	unit	type	NCV	unit	type
Residual fuel oil	liquid	40.193	TJ/Gg	CS	40.4	TJ/Gg	D
Gas/Diesel Oil (Non-bio gas/diesel oil)	liquid	43.292	TJ/Gg	CS	47.3	TJ/Gg	D
					<i>for comparison</i>		
Source		Eurostat (2023): Complete energy balances (Code: nrg_bal_c)			2006 IPCC guidelines, Vol. 2, Chapter 1, Table 1.2		
Note:							
D	Default	CS	Country specific		PS	Plant specific	

3.1.3.2.2.3 Choice of emission factors

Default emission factors for air pollutant were taken from the EMEP/EEA air pollutant emission inventory guidebook 2023 and are presented in the following table.

Table 3.77 Emission factors (EF) for Main pollutants, Particulate Matter (PM), Heavy metals (HM) and Persistent Organic Pollutants (POPs) for category 1.A.2.b Non-Ferrous Metals

Fuel Type	UNIT	Liquid fuels	
Associated fuel types		Residual fuel oil, Gas/Diesel Oil (Non-bio gas/diesel oil)	
Pollutant		EF	type
NOx	g/GJ	513	D
CO	g/GJ	66	D
NMVOC	g/GJ	25	D
SOx	g/GJ	47	D
TSP	g/GJ	NA	D
NH3	g/GJ	20	D
PM10	g/GJ	20	D
PM2.5	g/GJ	20	D
BC	% of PM2.5	56	D
Pb	mg/GJ	0.08	D
Cd	mg/GJ	0.006	D
Hg	mg/GJ	0.12	D
As	mg/GJ	0.03	D
Cr	mg/GJ	0.2	D
Cu	mg/GJ	0.22	D
Ni	mg/GJ	0.008	D
Se	mg/GJ	0.11	D
Zn	mg/GJ	29	D
PCB	ng WHO-TEG/GJ	NA	D
PCDD/F	ng I-TEQ/GJ	1.4	D
Benzo(a)pyrene	µg/GJ	1900	D
Benzo(b)fluoranthene	µg/GJ	15000	D
Benzo(k)fluoranthene	µg/GJ	1700	D
Indeno(1,2,3-cd)pyrene	µg/GJ	1500	D
HCB	µg/GJ	NA	D
Source		Table 3-4 Tier 1 emission factors for 1.A.2 combustion in industry using liquid fuels	
		EMEP/EEA air pollutant emission inventory guidebook 2023. Part B. Chapter Chapter 1.A.2 Combustion in manufacturing industries and construction.	
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 3.78 Uncertainty for category 1.A.2.b Non-Ferrous Metals .

Uncertainty	Solid fuels	Gaseous fuels	Liquid fuels	Biomass	Reference
Activity data (AD)	-	-	5%	-	Table 2.15. 2006 IPCC GL. Vol. 2. Chap. 2 (2.4.2)
Emission factor (EF)	Rating	Typical error range	Average	Reference	
NO _x	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 2023. Part A. Chapter 5 Uncertainties.	
CO	C	50% to 200%	125%		
NMVOC	D	100% to 300%	200%		
SO _x	A	10% to 30%	20%		
NH ₃	E	order of magnitude	750%		
TSP, PM ₁₀ , PM _{2.5} , 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)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.

3.1.3.2.4 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 2022 and relevant to category 1.A.2.b *Non-Ferrous Metals*.

Table 3.79 Recalculations done in category 1.A.2.b Non-Ferrous Metals

source category	Revisions of data	Type of revision	Type of improvement
1.A.2.b	Revision of NCV by using country specific NCV	AD	Accuracy
1.A.2.b	Revision of activity 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 3.80 Planned improvements for 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"> Determination of the <ul style="list-style-type: none"> temperature in waste gases [°C]; static pressure and the dynamic pressure [kPa]; flow rate [m/s]; volume flow rate [m³/h and Nm³/h]; concentration of CO, SO₂, NO_x in the exhaust gases [mg/Nm³]; and Gravimetric extraction of solid particles (TSP) from gases and determination by applying a gravimetric method (mg/Nm³). 	EF	Accuracy Transparency	Medium
1.A.2.b	Improvement of time series consistency and split of fuels: check of years 1990-2015	AD	Accuracy Transparency	High

3.1.3.3 Chemical industry (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-*.

3.1.3.3.1.1 Completeness

In the following table an overview on reported emissions from sub categories 1.A.2.b *Non-Ferrous Metals* is provided.

Table 3.81 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	IE	NO	NO	NO	-
CO	✓	NO	IE	NO	NO	NO	-
NMVOC	✓	NO	IE	NO	NO	NO	-
SOx	✓	NO	IE	NO	NO	NO	-
NH3	NA	NO	NA	NO	NO	NO	-
TSP	✓	NO	IE	NO	NO	NO	-
PM10	✓	NO	IE	NO	NO	NO	-
PM2.5	✓	NO	IE	NO	NO	NO	-
BC	✓	NO	IE	NO	NO	NO	-
Pb	✓	NO	IE	NO	NO	NO	-
Cd	✓	NO	IE	NO	NO	NO	-
Hg	✓	NO	IE	NO	NO	NO	-
As	✓	NO	IE	NO	NO	NO	-
Cr	✓	NO	IE	NO	NO	NO	-
Cu	✓	NO	IE	NO	NO	NO	-
Ni	✓	NO	IE	NO	NO	NO	-
Se	✓	NO	IE	NO	NO	NO	-
Zn	✓	NO	IE	NO	NO	NO	-
PCB	✓	NO	IE	NO	NO	NO	-
PCDD/F	NA	NO	NA	NO	NO	NO	-
PAH	✓	NO	IE	NO	NO	NO	-
Benzo(a)pyrene	✓	NO	IE	NO	NO	NO	-
Benzo(b)fluoranthene	✓	NO	IE	NO	NO	NO	-
Benzo(k)fluoranthene	✓	NO	IE	NO	NO	NO	-
Indeno(1,2,3-cd)pyrene	✓	NO	IE	NO	NO	NO	-
HCB	NA	NO	NA	NO	NO	NO	-

A '✓' indicates: emissions from this category have been estimated.

Notation keys: IE - included elsewhere. NO – not occurred. NE - not estimated. NA - not applicable. C – confidential

* data provided only in the period 2005-2008. all other years IE; ** data provided only in the period 2014-2018. all other years IE;

LA XX - Level Assessment in year XX

TA XX - Trend Assessment in year XX

IE liquid fuels 1990 – 1995, 1997 – 2000 included in 1.A.2.m

IE gaseous fuels 1990 – 1995, 1997 - 2022 included in 1.A.2.m

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

- annual emissions of air pollutants;
- Trend of the periods 1990 – 2022, 2005 – 2022, 2021 – 2022.

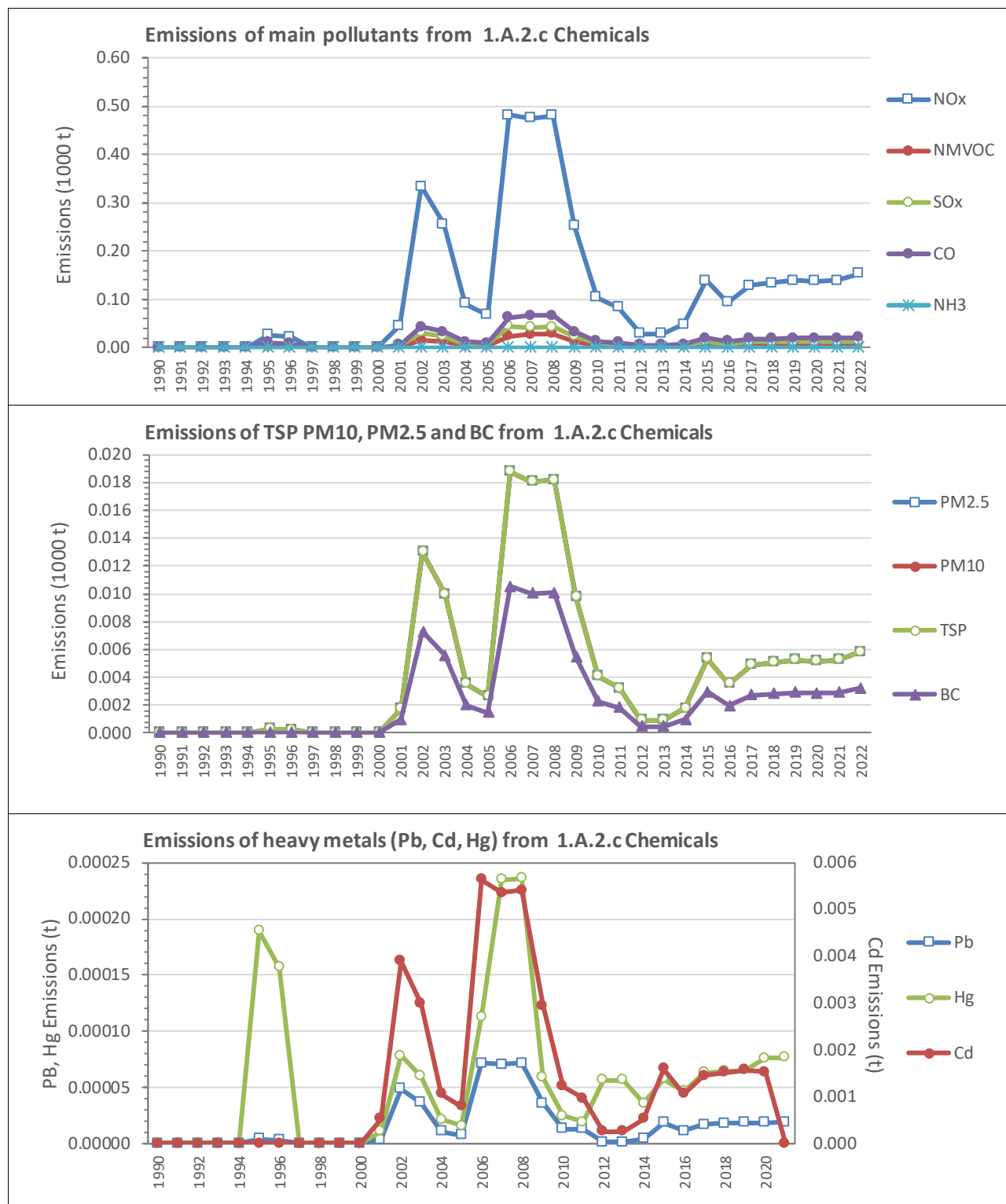


Figure 3.17 Emissions from category 1.A.2.c Chemicals

Table 3.82 Emissions of main pollutants (NO_x, SO₂, NMVOC and CO) from category 1.A.2.c Chemicals

Emissions	NO _x	NMVOC	SO _x	CO	NH ₃
	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	0.026	0.008	0.000	0.010	NA
1996	0.022	0.007	0.000	0.008	NA
1997	IE	IE	IE	IE	NA
1998	IE	IE	IE	IE	NA
1999	IE	IE	IE	IE	NA
2000	IE	IE	IE	IE	NA
2001	0.045	0.002	0.004	0.006	NA
2002	0.334	0.016	0.031	0.043	NA
2003	0.256	0.012	0.023	0.033	NA
2004	0.091	0.004	0.008	0.012	NA
2005	0.068	0.003	0.006	0.009	NA
2006	0.482	0.023	0.044	0.062	NA
2007	0.476	0.028	0.042	0.066	NA
2008	0.480	0.028	0.043	0.066	NA
2009	0.252	0.012	0.023	0.032	NA
2010	0.104	0.005	0.010	0.013	NA
2011	0.082	0.004	0.008	0.011	NA
2012	0.029	0.003	0.002	0.006	NA
2013	0.029	0.003	0.002	0.006	NA
2014	0.048	0.003	0.004	0.007	NA
2015	0.140	0.008	0.012	0.019	NA
2016	0.094	0.005	0.008	0.013	NA
2017	0.129	0.008	0.011	0.018	NA
2018	0.134	0.008	0.012	0.018	NA
2019	0.138	0.008	0.012	0.019	NA
2020	0.137	0.008	0.012	0.019	NA
2021	0.139	0.008	0.012	0.020	NA
2022	0.154	0.009	0.014	0.021	NA
<i>Trend</i>					
1990 – 2022	NA	NA	NA	NA	NA
2005 – 2022	126.4%	173.8%	118.5%	144.5%	NA
2021 – 2022	10.3%	7.5%	10.9%	9.1%	NA

Table 3.83 Emissions of particulate matter (PM) from 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	0.0003	0.0003	0.0003	0.0000
1996	0.0002	0.0002	0.0002	0.0000
1997	IE	IE	IE	IE
1998	IE	IE	IE	IE
1999	IE	IE	IE	IE
2000	IE	IE	IE	IE
2001	0.0018	0.0018	0.0018	0.0010
2002	0.0130	0.0130	0.0130	0.0073
2003	0.0100	0.0100	0.0100	0.0056
2004	0.0035	0.0035	0.0035	0.0020
2005	0.0026	0.0026	0.0026	0.0015
2006	0.0188	0.0188	0.0188	0.0105
2007	0.0180	0.0180	0.0180	0.0100
2008	0.0182	0.0182	0.0182	0.0101
2009	0.0098	0.0098	0.0098	0.0055
2010	0.0041	0.0041	0.0041	0.0023
2011	0.0032	0.0032	0.0032	0.0018
2012	0.0009	0.0009	0.0009	0.0005
2013	0.0009	0.0009	0.0009	0.0005
2014	0.0018	0.0018	0.0018	0.0010
2015	0.0053	0.0053	0.0053	0.0030
2016	0.0036	0.0036	0.0036	0.0020
2017	0.0049	0.0049	0.0049	0.0027
2018	0.0051	0.0051	0.0051	0.0028
2019	0.0053	0.0053	0.0053	0.0029
2020	0.0052	0.0052	0.0052	0.0029
2021	0.0053	0.0053	0.0053	0.0029
2022	0.0058	0.0058	0.0058	0.0032
<i>Trend</i>				
1990 – 2022	NA	NA	NA	NA
2005 – 2022	120.0%	120.0%	120.0%	117.8%
2021 – 2022	10.8%	10.8%	10.8%	10.9%

Table 3.84 Emissions of Heavy Metals (HM) from 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	0.004	0.000	0.189	0.035	0.005	0.001	0.005	0.020	0.256
1996	0.003	0.000	0.157	0.029	0.004	0.001	0.004	0.017	0.212
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	0.004	0.526	0.011	0.003	0.018	0.019	0.001	0.010	2.540
2002	0.049	3.902	0.078	0.020	0.130	0.143	0.005	0.072	18.859
2003	0.036	2.992	0.060	0.015	0.100	0.110	0.004	0.055	14.463
2004	0.011	1.063	0.021	0.005	0.035	0.039	0.001	0.019	5.139
2005	0.007	0.794	0.016	0.004	0.026	0.029	0.001	0.015	3.840
2006	0.072	5.633	0.113	0.028	0.188	0.207	0.008	0.103	27.225
2007	0.071	5.359	0.235	0.050	0.182	0.197	0.010	0.112	26.075
2008	0.071	5.407	0.236	0.051	0.183	0.199	0.010	0.113	26.306
2009	0.036	2.945	0.059	0.015	0.098	0.108	0.004	0.054	14.233
2010	0.013	1.221	0.024	0.006	0.041	0.045	0.002	0.022	5.904
2011	0.013	0.965	0.019	0.005	0.032	0.035	0.001	0.018	4.662
2012	0.001	0.257	0.056	0.011	0.010	0.010	0.002	0.010	1.310
2013	0.001	0.257	0.056	0.011	0.010	0.010	0.002	0.010	1.310
2014	0.004	0.526	0.036	0.007	0.018	0.019	0.001	0.012	2.575
2015	0.018	1.591	0.057	0.013	0.054	0.058	0.003	0.032	7.725
2016	0.011	1.056	0.047	0.010	0.036	0.039	0.002	0.022	5.139
2017	0.017	1.454	0.063	0.014	0.049	0.053	0.003	0.030	7.073
2018	0.018	1.510	0.064	0.014	0.051	0.056	0.003	0.031	7.346
2019	0.019	1.564	0.066	0.014	0.053	0.057	0.003	0.032	7.603
2020	0.019	1.532	0.076	0.016	0.052	0.056	0.003	0.033	7.466
2021	0.019	0.002	0.077	0.016	0.053	0.057	0.003	0.033	7.592
2022	0.020	0.002	0.078	0.017	0.059	0.064	0.003	0.036	8.415
Trend									
1990 – 2022	NA	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	180.1%	-99.8%	392.5%	321.3%	121.6%	118.3%	216.9%	149.8%	119.2%
2021 – 2022	6.4%	10.3%	2.1%	3.2%	10.6%	10.9%	5.8%	8.8%	10.8%

Table 3.85 Emissions of Persistent Organic Pollutants (POPs) from 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	IE	IE	IE	NA	NA
1991	IE	IE	IE	IE	IE	IE	NA	NA
1992	IE	IE	IE	IE	IE	IE	NA	NA
1993	IE	IE	IE	IE	IE	IE	NA	NA
1994	IE	IE	IE	IE	IE	IE	NA	NA
1995	IE	IE	IE	IE	IE	IE	NA	NA
1996	IE	IE	IE	IE	IE	IE	NA	NA
1997	IE	IE	IE	IE	IE	IE	NA	NA
1998	IE	IE	IE	IE	IE	IE	NA	NA
1999	IE	IE	IE	IE	IE	IE	NA	NA
2000	IE	IE	IE	IE	IE	IE	NA	NA
2001	0.0001	166.4	1314.0	148.9	131.4	1760.7	NA	NA
2002	0.0005	1235.6	9754.5	1105.5	975.5	13071.1	NA	NA
2003	0.0003	947.6	7481.1	847.9	748.1	10024.7	NA	NA
2004	0.0001	336.7	2658.0	301.2	265.8	3561.7	NA	NA
2005	0.0001	251.6	1986.0	225.1	198.6	2661.2	NA	NA
2006	0.0001	1783.7	14081.7	1595.9	1408.2	18869.5	NA	NA
2007	0.0001	1697.0	13397.7	1518.4	1339.8	17953.0	NA	NA
2008	0.0003	1712.2	13517.0	1531.9	1351.7	18112.8	NA	NA
2009	0.0001	932.5	7361.9	834.3	736.2	9864.9	NA	NA
2010	0.0002	386.8	3053.6	346.1	305.4	4091.8	NA	NA
2011	0.0001	305.5	2411.6	273.3	241.2	3231.5	NA	NA
2012	0.0001	81.3	642.0	72.8	64.2	860.3	NA	NA
2013	0.0001	81.3	642.0	72.8	64.2	860.3	NA	NA
2014	0.0001	166.4	1314.0	148.9	131.4	1760.7	NA	NA
2015	0.0001	503.9	3978.0	450.8	397.8	5330.5	NA	NA
2016	0.0001	334.4	2640.0	299.2	264.0	3537.6	NA	NA
2017	0.0001	460.4	3634.4	411.9	363.4	4870.0	NA	NA
2018	0.0001	478.2	3775.5	427.9	377.5	5059.1	NA	NA
2019	0.0001	495.1	3908.7	443.0	390.9	5237.6	NA	NA
2020	<0.0001	485.1	3830.1	434.1	383.0	5132.3	NA	NA
2021	<0.0001	493.4	3895.3	441.5	389.5	5219.6	NA	NA
2022	0.0001	547.4	4321.9	489.8	432.2	5791.4	NA	NA
Trend								
1990 – 2022	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	12.7%	118%	118%	118%	118%	118%	NA	NA
2021 – 2022	36.1%	11.0%	11.0%	11.0%	11.0%	11.0%	NA	NA

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 approach³³ of the EMEP/EEA air pollutant emission inventory guidebook 2023 has been applied:

Equation: emissions from stationary combustion

$$\text{Emissions}_{\text{pollutant}} = \text{Fuel Consumption}_{\text{fuel}} \times \text{Emission Factor}_{\text{pollutant. fuel}}$$

Where:

Emissions _{pollutant}	= emissions of a given pollutant by type of fuel (kg pollutant)
Fuel consumption _{fuel}	= amount of fuel combusted (TJ)
Emission factor _{pollutant. fuel}	= default emission factor of a given pollutant by type of fuel (g _{pollutant} /GJ).
Pollutant	= main pollutants: NO _x , CO, NMVOC, SO ₂ particulate matter: TSP, PM ₁₀ , PM _{2.5} , 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	Included elsewhere (IE)
Liquid fuels	<ul style="list-style-type: none"> Residual fuel oil Gas/Diesel Oil Motor Gasoline (Non-biogasoline) Liquefied Petroleum Gases (LPG) Other Oil - Other Petroleum Products Petroleum coke 	1990 – 1995, 1997 – 2000 included in 1.A.2.m
Gaseous fuels	<ul style="list-style-type: none"> Natural gas 	1990 – 1995, 1997 - 2022 included in 1.A.2.m

Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2022 were taken from EUROSTAT, prepared by Albanian Institute of Statistics (INSTAT).

³³ Source: EMEP/EEA air pollutant emission inventory guidebook 2023. 1.A.2 Manufacturing industries and construction (combustion). sub-chapter 3.2 Tier 1 default approach.

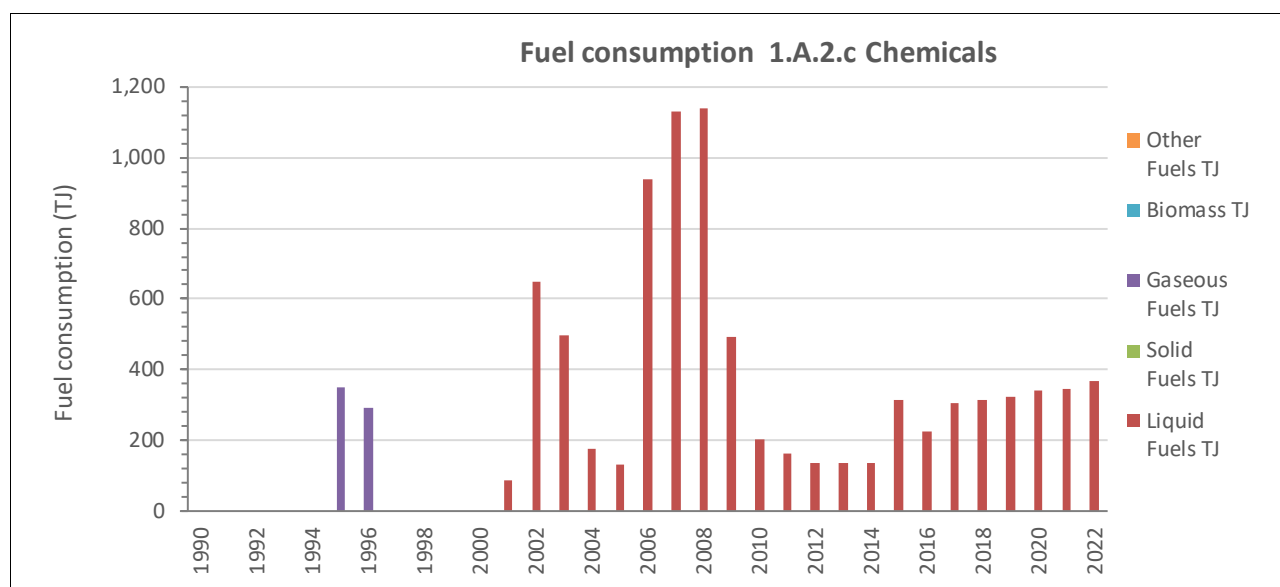


Figure 3.18 Activity data for category 1.A.2.c Chemicals

Table 3.86 Activity data for 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	NO	IE	NO	NO	IE
1991	IE	IE	NO	IE	NO	NO	IE
1992	IE	IE	NO	IE	NO	NO	IE
1993	IE	IE	NO	IE	NO	NO	IE
1994	IE	IE	NO	IE	NO	NO	IE
1995	350.10	IE	NO	350.10	NO	NO	350.10
1996	290.70	IE	NO	290.70	NO	NO	290.70
1997	IE	IE	NO	IE	NO	NO	IE
1998	IE	IE	NO	IE	NO	NO	IE
1999	IE	IE	NO	IE	NO	NO	IE
2000	IE	IE	NO	IE	NO	NO	IE
2001	87.60	87.60	NO	IE	NO	NO	87.60
2002	650.30	650.30	NO	IE	NO	NO	650.30
2003	498.74	498.74	NO	IE	NO	NO	498.74
2004	177.20	177.20	NO	IE	NO	NO	177.20
2005	132.40	132.40	NO	IE	NO	NO	132.40
2006	938.78	938.78	NO	IE	NO	NO	938.78
2007	1,129.74	1,129.74	NO	IE	NO	NO	1,129.74
2008	1,137.69	1,137.69	NO	IE	NO	NO	1,137.69
2009	490.79	490.79	NO	IE	NO	NO	490.79
2010	203.57	203.57	NO	IE	NO	NO	203.57
2011	160.77	160.77	NO	IE	NO	NO	160.77
2012	137.42	137.42	NO	IE	NO	NO	137.42
2013	137.42	137.42	NO	IE	NO	NO	137.42

Activity data 1.A.1.c	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
2014	134.91	134.91	NO	IE	NO	NO	134.91
2015	312.51	312.51	NO	IE	NO	NO	312.51
2016	223.31	223.31	NO	IE	NO	NO	223.31
2017	305.69	305.69	NO	IE	NO	NO	305.69
2018	315.10	315.10	NO	IE	NO	NO	315.10
2019	323.98	323.98	NO	IE	NO	NO	323.98
2020	339.55	339.55	NO	IE	NO	NO	339.55
2021	343.90	343.90	NO	IE	NO	NO	343.90
2022	369.01	369.01	NO	IE	NO	NO	369.01
Trend							
1990 – 2022	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	178.7%	178.7%	NA	NA	NA	NA	178.7%
2021 – 2022	7.3%	7.3%	NA	NA	NA	NA	7.3%

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 IPCC/NFR category 1.A.2.c Chemicals.

Table 3.87 Net calorific values (NCVs) applied for conversion to energy units in category 1.A.2.c Chemicals

Fuel	Fuel type	Net calorific value (NCV)					
		NCV	unit	type	NCV	unit	type
Residual fuel oil	liquid	40.193	TJ/Gg	CS	40.4	TJ/Gg	D
Gasoline	liquid	44.799	TJ/Gg	CS		TJ/Gg	D
Gas/Diesel Oil (Non-bio gas/diesel oil)	liquid	43.292	TJ/Gg	CS	47.3	TJ/Gg	D
Petroleum coke	liquid	46.89	TJ/Gg	CS	32.5	TJ/Gg	D
Other Oil - Other Petroleum Products	liquid	40.2	TJ/Gg	CS	40.2	TJ/Gg	D
Liquefied petroleum gas (LPG)	liquid	47.311	TJ/Gg	CS	47.3	TJ/Gg	D
Natural gas	Gaseous	32.396	GJ/1000 m3	CS	39.02	GJ/1000 m3	D*
					for comparision		
Source		Eurostat (2023): Complete energy balances (Code: nrg_bal_c)			2006 IPCC guidelines, Vol. 2, Chapter 1, Table 1.2 * UNstat – IRES (2028) Table 4.1		
Note:							
D	Default	CS	Country specific		PS	Plant specific	

3.1.3.3.2.3 Choice of emission factors

Default emission factors for air pollutant were taken from the EMEP/EEA air pollutant emission inventory guidebook 2023 and are presented in the following table.

Table 3.88 Emission factors (EF) for Main pollutants, Particulate Matter (PM), Heavy metals (HM) and Persistent Organic Pollutants (POPs) for category 1.A.2.c Chemicals

Fuel Type			UNIT		Natural gas			Liquid fuels		
Associated fuel types								Residual fuel oil, Gas/Diesel Oil (Non-bio gas/diesel oil), Petroleum coke, Other Oil - Other Petroleum Products, Liquefied petroleum gas (LPG)		
Pollutant					EF (TIER 1)		type	EF (TIER 2)		type
Nox			g/GJ		74	D	513		D	
CO			g/GJ		29	D	66		D	
NMVOC			g/GJ		23	D	25		D	
SOx			g/GJ		0.67	D	47		D	
NH3			g/GJ		NA					
TSP			g/GJ		0.78	D	20		D	
PM10			g/GJ		0.78	D	20		D	
PM2.5			g/GJ		0.78	D	20		D	
BC			% of PM2.5		4	D	56		D	
Pb			mg/GJ		0.011	D	0.08		D	
Cd			mg/GJ		0.0009	D	0.006		D	
Hg			mg/GJ		0.54	D	0.12		D	
As			mg/GJ		0.1	D	0.03		D	
Cr			mg/GJ		0.013	D	0.2		D	
Cu			mg/GJ		0.0026	D	0.22		D	
Ni			mg/GJ		0.013	D	0.008		D	
Se			mg/GJ		0.058	D	0.11		D	
Zn			mg/GJ		0.73	D	29		D	
PCB			ng WHO-TEG/GJ		NA		NA			
PCDD/F			ng I-TEQ/GJ		NA		1.4		D	
Benzo(a)pyrene			µg/GJ		NA		1900		D	
Benzo(b)fluoranthene			µg/GJ		NA		15000		D	
Benzo(k)fluoranthene			µg/GJ		NA		1700		D	
Indeno(1,2,3-cd)pyrene			µg/GJ		NA		1500		D	
HCB			µg/GJ		NA		NA			
Source					Table 3-3 Tier 1 emission factors for 1.A.2 combustion in industry using natural gas. Section 3.2.2. page 16.			Table 3-4 Tier 1 emission factors for 1.A.2 combustion in industry using liquid fuels. Section 3.2.2. page 17.		
					EMEP/EEA air pollutant emission inventory guidebook 2023. Part B. Chapter 1.A.1 Energy industries.					
Note:										
T2	TIER 2	D	Default	CS	Country specific	PS	Plant specific	IEF	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 3.89 Uncertainty for category 1.A.2.c Chemicals.

Uncertainty	Solid fuels	Gaseous fuels	Liquid fuels	Biomass	Reference
Activity data (AD)	-	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 _x	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 2023. Part A. Chapter 5 Uncertainties.	
CO	C	50% to 200%	125%		
NM VOC	D	100% to 300%	200%		
SO _x	A	10% to 30%	20%		
NH ₃	E	order of magnitude	750%		
TSP, PM ₁₀ , PM _{2.5} , 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)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.

3.1.3.3.4 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 submission in 2020 and relevant to category 1.A.2.c Chemicals .

Table 3.90 Recalculations done in category 1.A.2.c Chemicals

source category	Revisions of data	Type of revision	Type of improvement
1.A.2.c	Revision of NCV by using country specific NCV	AD	Accurary
1.A.2.c	Revision of activity data	AD	Accurary

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 3.91 Planned improvements for 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	High
1.A.2.c	Information about fitted/non-fitted equipment for flue gas cleaning. improvement in combustion	EF	Accuracy Transparency	High
1.A.2.c	Data obtained from measurements made on the emission of air pollutants <ul style="list-style-type: none"> Determination of the <ul style="list-style-type: none"> temperature in waste gases [°C]; static pressure and the dynamic pressure [kPa]; flow rate [m/s]; volume flow rate [m³/h and Nm³/h]; concentration of CO, SO₂, NO_x in the exhaust gases [mg/Nm³]; and Gravimetric extraction of solid particles (TSP) from gases and determination by applying a gravimetric method (mg/Nm³). 	EF	Accuracy Transparency	High
1.A.2.c	Improvement of time series consistency and split of fuels: check of years 1990-1999	AD	Accuracy Transparency	High

3.1.3.4 Pulp, Paper and Print (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** -.

Table 3.92 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	
NO _x	✓	NO	NO	NO	NO	NO	-
CO	✓	NO	NO	NO	NO	NO	-
NM VOC	✓	NO	NO	NO	NO	NO	-
SO _x	✓	NO	NO	NO	NO	NO	-
NH ₃	NA	NO	NO	NO	NO	NO	-
TSP	✓	NO	NO	NO	NO	NO	-
PM ₁₀	✓	NO	NO	NO	NO	NO	-
PM _{2.5}	✓	NO	NO	NO	NO	NO	-
BC	✓	NO	NO	NO	NO	NO	-
Pb	✓	NO	NO	NO	NO	NO	-
Cd	✓	NO	NO	NO	NO	NO	-
Hg	✓	NO	NO	NO	NO	NO	-
As	✓	NO	NO	NO	NO	NO	-
Cr	✓	NO	NO	NO	NO	NO	-
Cu	✓	NO	NO	NO	NO	NO	-
Ni	✓	NO	NO	NO	NO	NO	-
Se	✓	NO	NO	NO	NO	NO	-
Zn	✓	NO	NO	NO	NO	NO	-
PCB	✓	NO	NO	NO	NO	NO	-
PCDD/F	✓	NO	NO	NO	NO	NO	-
PAH	NA	NO	NO	NO	NO	NO	-
Benzo(a)pyrene	✓	NO	NO	NO	NO	NO	-
Benzo(b)fluoranthene	✓	NO	NO	NO	NO	NO	-
Benzo(k)fluoranthene	✓	NO	NO	NO	NO	NO	-
Indeno(1,2,3-cd)pyrene	✓	NO	NO	NO	NO	NO	-
HCB	NA	NO	NO	NO	NO	NO	-

A '✓' indicates: emissions from this 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 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 – 2022, 2005 – 2022, 2021 – 2022.

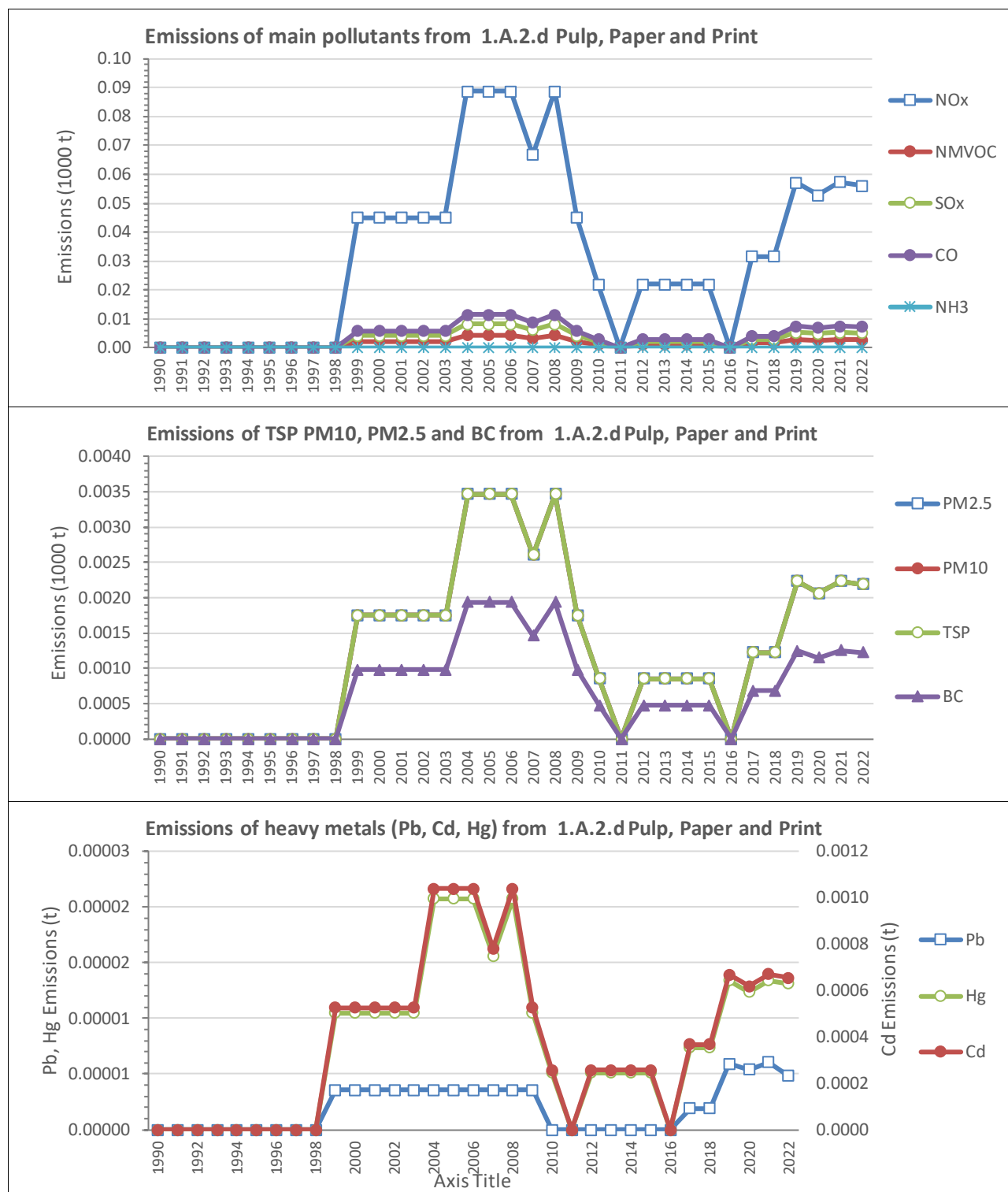


Figure 3.19 Emissions from category 1.A.2.d Pulp, Paper and Print

Table 3.93 Emissions of main pollutants (NO_x, SO₂, NMVOC, CO and NH₃) from category 1.A.2.d Pulp, Paper and Print

Emissions	NO _x	NMVOC	SO _x	CO	NH ₃
	t	Gg	Gg	Gg	Gg
1990	NO	NO	NO	NO	NA
1991	NO	NO	NO	NO	NA
1992	NO	NO	NO	NO	NA
1993	NO	NO	NO	NO	NA
1994	NO	NO	NO	NO	NA
1995	NO	NO	NO	NO	NA
1996	NO	NO	NO	NO	NA
1997	NO	NO	NO	NO	NA
1998	NO	NO	NO	NO	NA
1999	44.938	2.190	4.117	5.782	NA
2000	44.938	2.190	4.117	5.782	NA
2001	44.938	2.190	4.117	5.782	NA
2002	44.938	2.190	4.117	5.782	NA
2003	44.938	2.190	4.117	5.782	NA
2004	88.851	4.330	8.140	11.431	NA
2005	88.851	4.330	8.140	11.431	NA
2006	88.851	4.330	8.140	11.431	NA
2007	66.895	3.260	6.129	8.606	NA
2008	88.851	4.330	8.140	11.431	NA
2009	44.938	2.190	4.117	5.782	NA
2010	21.956	1.070	2.012	2.825	NA
2011	IE	IE	IE	IE	NA
2012	21.956	1.070	2.012	2.825	NA
2013	21.956	1.070	2.012	2.825	NA
2014	21.956	1.070	2.012	2.825	NA
2015	21.956	1.070	2.012	2.825	NA
2016	IE	IE	IE	IE	NA
2017	31.502	1.535	2.886	4.053	NA
2018	31.502	1.535	2.886	4.053	NA
2019	57.242	2.790	5.244	7.364	NA
2020	52.852	2.576	4.842	6.800	NA
2021	57.334	2.794	5.253	7.376	NA
2022	56.103	2.734	5.140	7.218	NA
Trend					
1990 – 2022	NA	NA	NA	NA	NA
2005 – 2022	-36.9%	-36.9%	-36.9%	-36.9%	NA
2021 – 2022	-2.1%	-2.1%	-2.1%	-2.1%	NA

Table 3.94 Emissions of particulate matter (PM) from category 1.A.2.d Pulp, Paper and Print

Emissions	PM2.5	PM10	TSP	BC
	Gg	Gg	Gg	Gg
1990	NO	NO	NO	NO
1991	NO	NO	NO	NO
1992	NO	NO	NO	NO
1993	NO	NO	NO	NO
1994	NO	NO	NO	NO
1995	NO	NO	NO	NO
1996	NO	NO	NO	NO
1997	NO	NO	NO	NO
1998	NO	NO	NO	NO
1999	1.752	1.752	1.752	0.981
2000	1.752	1.752	1.752	0.981
2001	1.752	1.752	1.752	0.981
2002	1.752	1.752	1.752	0.981
2003	1.752	1.752	1.752	0.981
2004	3.464	3.464	3.464	1.940
2005	3.464	3.464	3.464	1.940
2006	3.464	3.464	3.464	1.940
2007	2.608	2.608	2.608	1.460
2008	3.464	3.464	3.464	1.940
2009	1.752	1.752	1.752	0.981
2010	0.856	0.856	0.856	0.479
2011	IE	IE	IE	IE
2012	0.856	0.856	0.856	0.479
2013	0.856	0.856	0.856	0.479
2014	0.856	0.856	0.856	0.479
2015	0.856	0.856	0.856	0.479
2016	IE	IE	IE	IE
2017	1.228	1.228	1.228	0.688
2018	1.228	1.228	1.228	0.688
2019	2.232	2.232	2.232	1.250
2020	2.061	2.061	2.061	1.154
2021	2.235	2.235	2.235	1.252
2022	2.187	2.187	2.187	1.225
Trend				
1990 – 2022	NA	NA	NA	NA
2005 – 2022	-36.9%	-36.9%	-36.9%	-36.9%
2021 – 2022	-2.1%	-2.1%	-2.1%	-2.1%

Table 3.95 Emissions of Heavy Metals (HM) from 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	NO	NO	NO	NO	NO	NO	NO	NO	NO
1991	NO	NO	NO	NO	NO	NO	NO	NO	NO
1992	NO	NO	NO	NO	NO	NO	NO	NO	NO
1993	NO	NO	NO	NO	NO	NO	NO	NO	NO
1994	NO	NO	NO	NO	NO	NO	NO	NO	NO
1995	NO	NO	NO	NO	NO	NO	NO	NO	NO
1996	NO	NO	NO	NO	NO	NO	NO	NO	NO
1997	NO	NO	NO	NO	NO	NO	NO	NO	NO
1998	NO	NO	NO	NO	NO	NO	NO	NO	NO
1999	0.004	0.526	0.011	0.003	0.018	0.019	0.001	0.010	2.540
2000	0.004	0.526	0.011	0.003	0.018	0.019	0.001	0.010	2.540
2001	0.004	0.526	0.011	0.003	0.018	0.019	0.001	0.010	2.540
2002	0.004	0.526	0.011	0.003	0.018	0.019	0.001	0.010	2.540
2003	0.004	0.526	0.011	0.003	0.018	0.019	0.001	0.010	2.540
2004	0.004	1.039	0.021	0.005	0.035	0.038	0.001	0.019	5.023
2005	0.004	1.039	0.021	0.005	0.035	0.038	0.001	0.019	5.023
2006	0.004	1.039	0.021	0.005	0.035	0.038	0.001	0.019	5.023
2007	0.004	0.782	0.016	0.004	0.026	0.029	0.001	0.014	3.782
2008	0.004	1.039	0.021	0.005	0.035	0.038	0.001	0.019	5.023
2009	0.004	0.526	0.011	0.003	0.018	0.019	0.001	0.010	2.540
2010	0.000	0.257	0.005	0.001	0.009	0.009	0.000	0.005	1.241
2011	IE	IE	IE	IE	IE	IE	IE	IE	IE
2012	0.000	0.257	0.005	0.001	0.009	0.009	0.000	0.005	1.241
2013	0.000	0.257	0.005	0.001	0.009	0.009	0.000	0.005	1.241
2014	0.000	0.257	0.005	0.001	0.009	0.009	0.000	0.005	1.241
2015	0.000	0.257	0.005	0.001	0.009	0.009	0.000	0.005	1.241
2016	IE	IE	IE	IE	IE	IE	IE	IE	IE
2017	0.002	0.368	0.007	0.002	0.012	0.014	0.000	0.007	1.781
2018	0.002	0.368	0.007	0.002	0.012	0.014	0.000	0.007	1.781
2019	0.006	0.669	0.013	0.003	0.022	0.025	0.001	0.012	3.236
2020	0.005	0.618	0.012	0.003	0.021	0.023	0.001	0.011	2.988
2021	0.006	0.671	0.013	0.003	0.022	0.025	0.001	0.012	3.241
2022	0.005	0.656	0.013	0.003	0.022	0.024	0.001	0.012	3.172
Trend									
1990 – 2022	NA	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	35.5%	-36.9%	-36.9%	-36.9%	-36.9%	-36.9%	-36.9%	-36.9%	-36.9%
2021 – 2022	-20.1%	-2.1%	-2.1%	-2.1%	-2.1%	-2.1%	-2.1%	-2.1%	-2.1%

Table 3.96 Emissions of Persistent Organic Pollutants (POPs) from category 1.A.2.d Pulp, Paper and Print

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	NO	NO	NO	NO	NO	NO	NA	NA
1991	NO	NO	NO	NO	NO	NO	NA	NA
1992	NO	NO	NO	NO	NO	NO	NA	NA
1993	NO	NO	NO	NO	NO	NO	NA	NA
1994	NO	NO	NO	NO	NO	NO	NA	NA
1995	NO	NO	NO	NO	NO	NO	NA	NA
1996	NO	NO	NO	NO	NO	NO	NA	NA
1997	NO	NO	NO	NO	NO	NO	NA	NA
1998	NO	NO	NO	NO	NO	NO	NA	NA
1999	0.000	0.000	0.001	0.000	0.000	0.002	0.000	NA
2000	0.000	0.000	0.001	0.000	0.000	0.002	NA	NA
2001	0.000	0.000	0.001	0.000	0.000	0.002	NA	NA
2002	0.000	0.000	0.001	0.000	0.000	0.002	NA	NA
2003	0.000	0.000	0.001	0.000	0.000	0.002	NA	NA
2004	0.000	0.000	0.003	0.000	0.000	0.003	NA	NA
2005	0.000	0.000	0.003	0.000	0.000	0.003	NA	NA
2006	0.000	0.000	0.003	0.000	0.000	0.003	NA	NA
2007	0.000	0.000	0.002	0.000	0.000	0.003	NA	NA
2008	0.000	0.000	0.003	0.000	0.000	0.003	NA	NA
2009	0.000	0.000	0.001	0.000	0.000	0.002	NA	NA
2010	0.000	0.000	0.001	0.000	0.000	0.001	NA	NA
2011	IE	IE	IE	IE	IE	IE	NA	NA
2012	0.000	0.000	0.001	0.000	0.000	0.001	NA	NA
2013	0.000	0.000	0.001	0.000	0.000	0.001	NA	NA
2014	0.000	0.000	0.001	0.000	0.000	0.001	NA	NA
2015	0.000	0.000	0.001	0.000	0.000	0.001	NA	NA
2016	IE	IE	IE	IE	IE	IE	NA	NA
2017	0.000	0.000	0.001	0.000	0.000	0.001	NA	NA
2018	0.000	0.000	0.001	0.000	0.000	0.001	NA	NA
2019	0.000	0.000	0.002	0.000	0.000	0.002	NA	NA
2020	0.000	0.000	0.002	0.000	0.000	0.002	NA	NA
2021	0.000	0.000	0.002	0.000	0.000	0.002	NA	NA
2022	0.00	0.00	0.00	0.00	0.00	0.00	NA	NA
Trend								
1990 – 2022	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	-62.1%	-36.9%	-36.9%	-36.9%	-36.9%	-36.9%	NA	NA
2021 – 2022	36.1%	-2.1%	-2.1%	-2.1%	-2.1%	-2.1%	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 approach³⁴ of the EMEP/EEA air pollutant emission inventory guidebook 2023 has been applied:

Equation: emissions from stationary combustion

$$\text{Emissions}_{\text{pollutant}} = \text{Fuel Consumption}_{\text{fuel}} \times \text{Emission Factor}_{\text{pollutant. fuel}}$$

Where:

Emissions _{pollutant}	= emissions of a given pollutant by type of fuel (kg pollutant)
Fuel consumption _{fuel}	= amount of fuel combusted (TJ)
Emission factor _{pollutant. fuel}	= default emission factor of a given pollutant by type of fuel (g _{pollutant} /GJ).
Pollutant	= main pollutants: NO _x , CO, NMVOC, SO ₂ particulate matter: TSP, PM ₁₀ , PM _{2.5} , 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
Liquid fuels	<ul style="list-style-type: none"> Gas/Diesel Oil

Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2022 were taken from EUROSTAT, prepared by Albanian Institute of Statistics (INSTAT).

³⁴ Source: EMEP/EEA air pollutant emission inventory guidebook 2023. 1.A.2 Manufacturing industries and construction (combustion). sub-chapter 3.2 Tier 1 default approach.

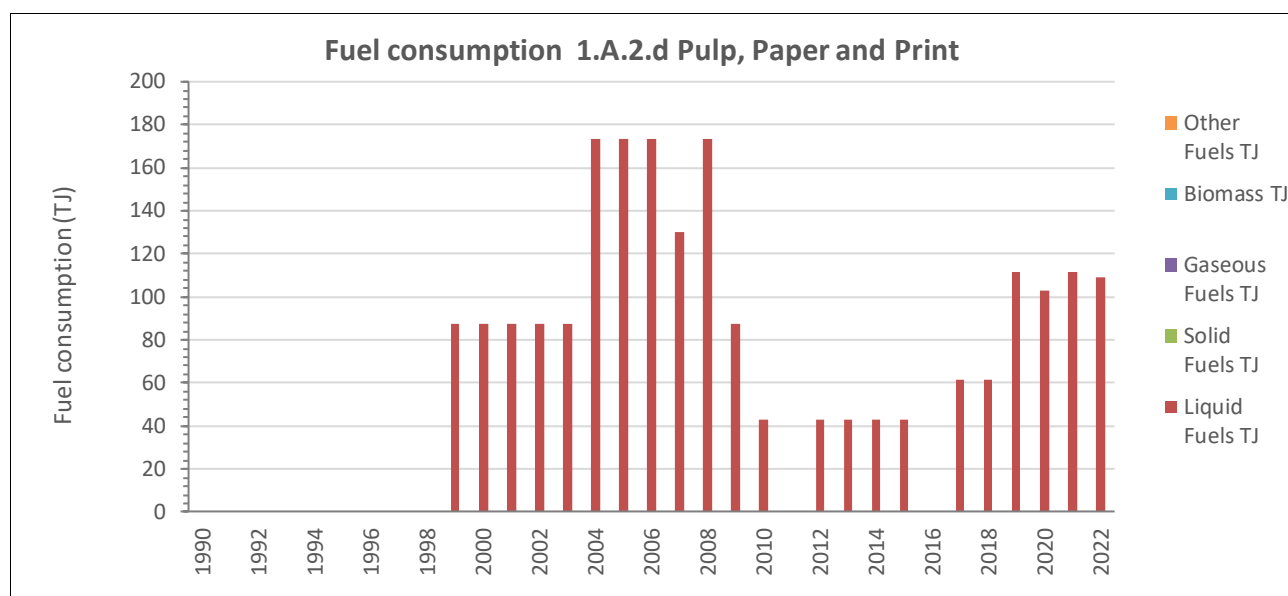


Figure 3.20 Activity data for category 1.A.2.d Pulp, Paper and Print

Table 3.97 Activity data for 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	NO	NO	NO	NO	NO	NO	NO
1997	NO	NO	NO	NO	NO	NO	NO
1998	NO	NO	NO	NO	NO	NO	NO
1999	87.60	87.60	NO	NO	NO	NO	NO
2000	87.60	87.60	NO	NO	NO	NO	NO
2001	87.60	87.60	NO	NO	NO	NO	NO
2002	87.60	87.60	NO	NO	NO	NO	NO
2003	87.60	87.60	NO	NO	NO	NO	NO
2004	173.20	173.20	NO	NO	NO	NO	NO
2005	173.20	173.20	NO	NO	NO	NO	NO
2006	173.20	173.20	NO	NO	NO	NO	NO
2007	130.40	130.40	NO	NO	NO	NO	NO
2008	173.20	173.20	NO	NO	NO	NO	NO
2009	87.60	87.60	NO	NO	NO	NO	NO
2010	42.80	42.80	NO	NO	NO	NO	NO
2011	IE	IE	NO	NO	NO	NO	NO
2012	42.80	42.80	NO	NO	NO	NO	NO
2013	42.80	42.80	NO	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						
2014	42.80	42.80	NO	NO	NO	NO	NO
2015	42.80	42.80	NO	NO	NO	NO	NO
2016	IE	IE	NO	NO	NO	NO	NO
2017	61.41	61.41	NO	NO	NO	NO	NO
2018	61.41	61.41	NO	NO	NO	NO	NO
2019	111.58	111.58	NO	NO	NO	NO	NO
2020	103.03	103.03	NO	NO	NO	NO	NO
2021	111.76	111.76	NO	NO	NO	NO	NO
2022	109.36	109.36	NO	NO	NO	NO	NO
Trend							
1990 – 2022	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	-36.9%	-36.9%	NA	NA	NA	NA	NA
2021 – 2022	-2.1%	-2.1%	NA	0.0%	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 category 1.A.2.d Pulp, Paper and Print.

Table 3.98 Net calorific values (NCVs) applied for conversion to energy units in category 1.A.2.d Pulp, Paper and Print

Fuel	Fuel type	Net calorific value (NCV)					
		NCV	unit	type	NCV	unit	type
Gas/Diesel Oil (Non-bio gas/diesel oil)	liquid	43.292	TJ/Gg	CS	47.3	TJ/Gg	D
					for comparision		
Source		Eurostat (2023): Complete energy balances (Code: nrg_bal_c)			2006 IPCC guidelines, Vol. 2, Chapter 1, Table 1.2		
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 2023 and are presented in the following table.

Table 3.99 Emission factors (EF) for Main pollutants, Particulate Matter (PM), Heavy metals (HM) and Persistent Organic Pollutants (POPs) for category 1.A.2.d Pulp, Paper and Print

Fuel Type			UNIT		Natural gas			Liquid fuels			
Associated fuel types								Residual fuel oil, Gas/Diesel Oil (Non-bio gas/diesel oil), Petroleum coke, Other Oil - Other Petroleum Products, Liquefied petroleum gas (LPG)			
Pollutant					EF (TIER 1)		type	EF (TIER 2)		type	
Nox			g/GJ		74	D	513		D		
CO			g/GJ		29	D	66		D		
NMVOC			g/GJ		23	D	25		D		
SOx			g/GJ		0.67	D	47		D		
NH3			g/GJ		NA						
TSP			g/GJ		0.78	D	20		D		
PM10			g/GJ		0.78	D	20		D		
PM2.5			g/GJ		0.78	D	20		D		
BC			% of PM2.5		4	D	56		D		
Pb			mg/GJ		0.011	D	0.08		D		
Cd			mg/GJ		0.0009	D	0.006		D		
Hg			mg/GJ		0.54	D	0.12		D		
As			mg/GJ		0.1	D	0.03		D		
Cr			mg/GJ		0.013	D	0.2		D		
Cu			mg/GJ		0.0026	D	0.22		D		
Ni			mg/GJ		0.013	D	0.008		D		
Se			mg/GJ		0.058	D	0.11		D		
Zn			mg/GJ		0.73	D	29		D		
PCB			ng WHO-TEG/GJ		NA		NA				
PCDD/F			ng I-TEQ/GJ		NA		1.4		D		
Benzo(a)pyrene			µg/GJ		NA		1900		D		
Benzo(b)fluoranthene			µg/GJ		NA		15000		D		
Benzo(k)fluoranthene			µg/GJ		NA		1700		D		
Indeno(1,2,3-cd)pyrene			µg/GJ		NA		1500		D		
HCB			µg/GJ		NA		NA				
Source					Table 3-3 Tier 1 emission factors for 1.A.2 combustion in industry using natural gas. Section 3.2.2. page 16.			Table 3-4 Tier 1 emission factors for 1.A.2 combustion in industry using liquid fuels. Section 3.2.2. page 17.			
					EMEP/EEA air pollutant emission inventory guidebook 2023. Part B. Chapter 1.A.1 Energy industries.						
Note:											
T2	TIER 2		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 3.100 Uncertainty for category 1.A.2.d Pulp, Paper and Print.

Uncertainty	Solid fuels	Gaseous fuels	Liquid fuels	Biomass	Reference
Activity data (AD)	-	-	5%	-	Table 2.15. 2006 IPCC GL. Vol. 2. Chap. 2 (2.4.2)
Emission factor (EF)	Rating	Typical error range	Average	Reference	
NO _x	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 2023. Part A. Chapter 5 Uncertainties.	
CO	C	50% to 200%	125%		
NM VOC	D	100% to 300%	200%		
SO _x	A	10% to 30%	20%		
NH ₃	E	order of magnitude	750%		
TSP, PM ₁₀ , PM _{2.5} , 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)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.

3.1.3.4.4 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 submission in 2020 and relevant to category 1.A.2.d Pulp, Paper and Print.

Table 3.101 Recalculations done in category 1.A.2.d Pulp, Paper and Print

source category	Revisions of data	Type of revision	Type of improvement
1.A.2.d	Revision of NCV by using country specific NCV	AD	Accurary
1.A.2.d	Revision of activity data	AD	Accurary

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 3.102 Planned improvements for category 1.A.2.d Pulp, Paper and Print

source category	Planned improvement	Type of improvement		Priority
1.A.2.d	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.d	Information about fitted/non-fitted equipment for flue gas cleaning. improvement in combustion	EF	Accuracy Transparency	High
1.A.2.d	Data obtained from measurements made on the emission of air pollutants <ul style="list-style-type: none"> Determination of the <ul style="list-style-type: none"> temperature in waste gases [°C]; static pressure and the dynamic pressure [kPa]; flow rate [m/s]; volume flow rate [m³/h and Nm³/h]; concentration of CO, SO₂, NOx in the exhaust gases [mg/Nm³]; and Gravimetric extraction of solid particles (TSP) from gases and determination by applying a gravimetric method (mg/Nm³). 	EF	Accuracy Transparency	High
1.A.2.d	Improvement of time series consistency and split of fuels: check of years 1990-1998 and 2011 and 2016	AD	Accuracy Transparency	High

3.1.3.5 Food Processing, Beverages and Tobacco (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 category 1.A.2.e Food Processing, Beverages and Tobacco includes the

(1) Manufacture of food products	
• Processing and preserving of	<ul style="list-style-type: none"> ○ meat ○ fish. crustaceans and molluscs ○ fruit and vegetables
• Manufacture of	<ul style="list-style-type: none"> ○ 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	<ul style="list-style-type: none"> ○ wines ○ malt liquors and malt ○ soft drinks; production of mineral waters and other bottled waters
(3) Manufacture of tobacco products	

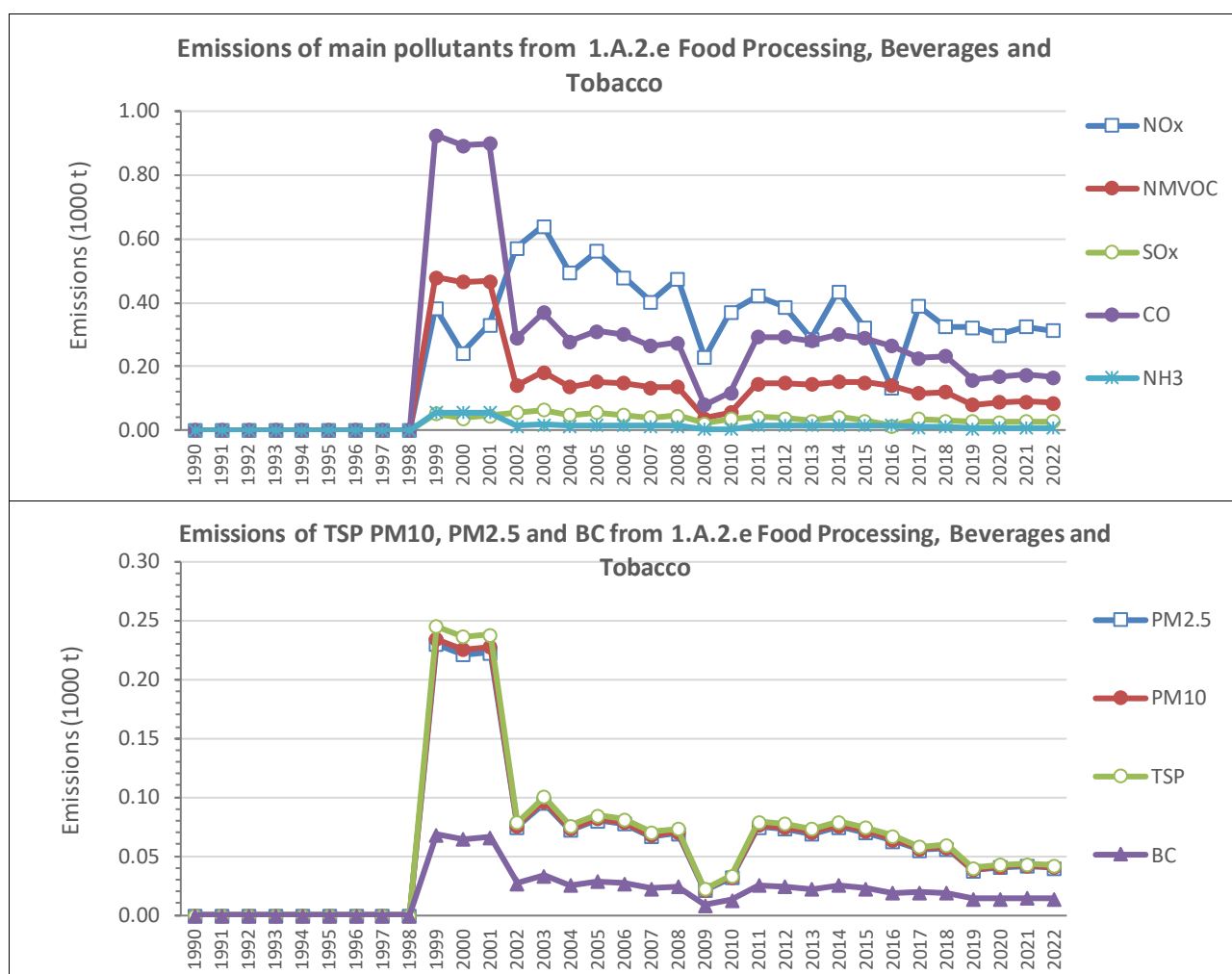
Table 3.103 Overview on reported emissions from sub categories 1.A.2.e Food Processing, Beverages and Tobacco

Air pollutants	1.A.2.e						Key category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
NO _x	✓	NO	✓	NO	NO	✓	
CO	✓	NO	✓	NO	NO	✓	
NM VOC	✓	NO	✓	NO	NO	✓	
SO _x	✓	NO	✓	NO	NO	✓	
NH ₃	NA	NO	✓	NO	NO	✓	
TSP	✓	NO	✓	NO	NO	✓	
PM ₁₀	✓	NO	✓	NO	NO	✓	
PM _{2.5}	✓	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	✓	
PCDD/F	✓	NO	✓	NO	NO	✓	

Air pollutants	1.A.2.e						Key category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
PAH	NA	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	NA	NO	✓	NO	NO	✓	
<p>A '✓' indicates: emissions from this 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 fuel combustion in 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 – 2022, 2005 – 2022, 2021 – 2022.



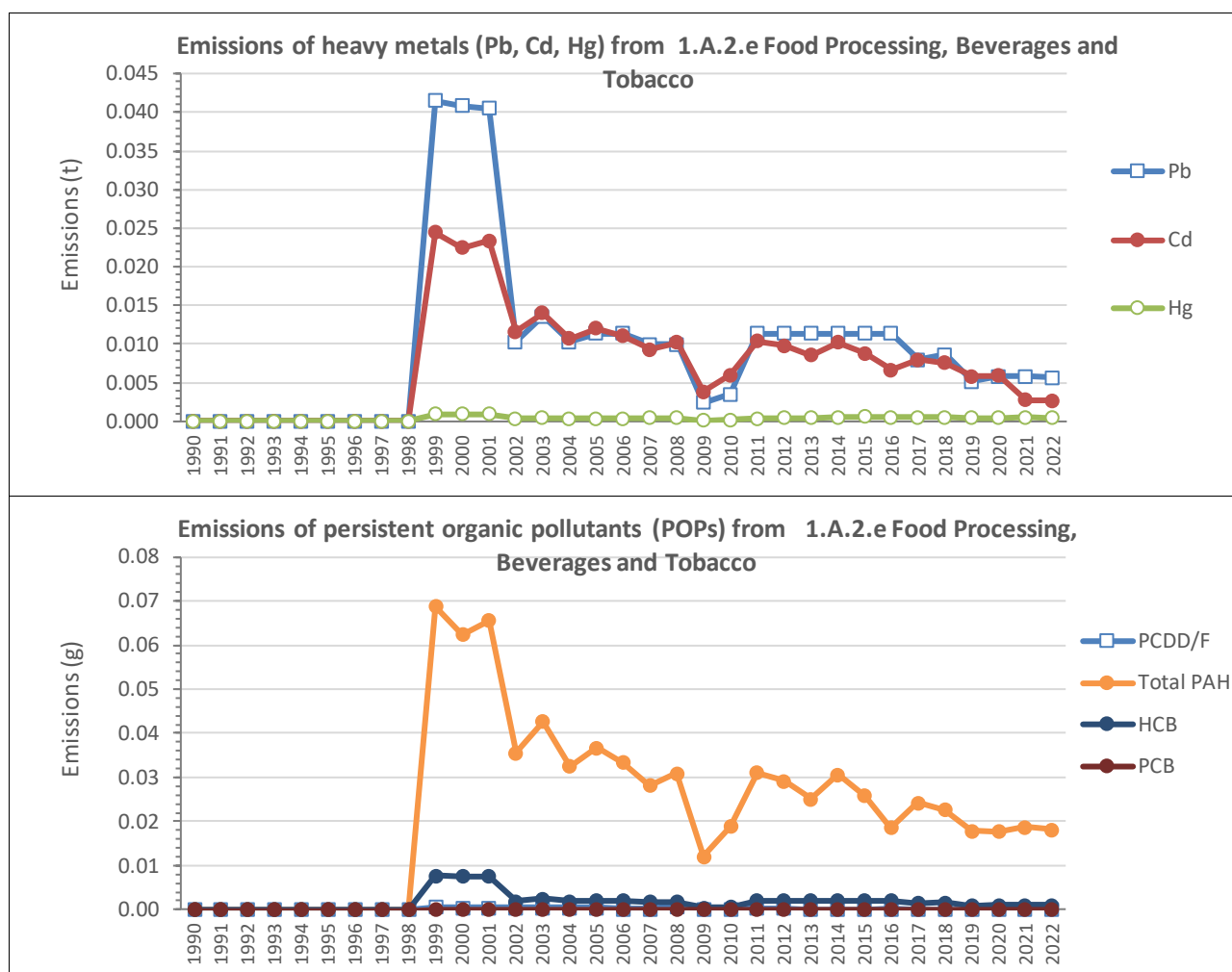


Figure 3.21 Emissions from category 1.A.2.e Food Processing, Beverages and Tobacco

Table 3.104 Emissions of main pollutants (NO_x, SO₂, NMVOC, CO and NH₃) from category 1.A.2.e Food Processing, Beverages and Tobacco

Emissions	NO _x	NMVOC	SO _x	CO	NH ₃
	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	0.383	0.479	0.052	0.925	0.057
2000	0.243	0.465	0.039	0.893	0.056
2001	0.332	0.466	0.047	0.898	0.056
2002	0.572	0.141	0.057	0.288	0.014
2003	0.641	0.182	0.064	0.369	0.019
2004	0.493	0.137	0.049	0.278	0.014
2005	0.562	0.153	0.056	0.311	0.016
2006	0.480	0.149	0.049	0.301	0.016
2007	0.403	0.134	0.040	0.265	0.014
2008	0.475	0.137	0.046	0.275	0.014
2009	0.229	0.038	0.022	0.080	0.003
2010	0.371	0.056	0.035	0.120	0.005
2011	0.421	0.146	0.043	0.293	0.016
2012	0.386	0.148	0.039	0.292	0.016
2013	0.287	0.144	0.029	0.280	0.015
2014	0.435	0.154	0.042	0.301	0.016
2015	0.321	0.151	0.031	0.290	0.016
2016	0.133	0.141	0.014	0.265	0.016
2017	0.390	0.116	0.036	0.226	0.011
2018	0.326	0.120	0.031	0.232	0.012
2019	0.323	0.081	0.029	0.158	0.007
2020	0.298	0.088	0.027	0.169	0.008
2021	0.326	0.090	0.029	0.174	0.008
2022	0.313	0.086	0.028	0.166	0.008
Trend					
1990 – 2022	NA	NA	NA	NA	NA
2005 – 2022	-44%	-44%	-50%	-47%	-51%
2021 – 2022	-3.8%	-5.0%	-2.4%	-4.3%	-3.5%

Table 3.105 Emissions of particulate matter (PM) from category 1.A.2.e Food Processing, Beverages and Tobacco

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	0.230	0.235	0.245	0.069
2000	0.221	0.226	0.236	0.065
2001	0.223	0.228	0.238	0.066
2002	0.075	0.076	0.079	0.027
2003	0.095	0.097	0.100	0.034
2004	0.072	0.073	0.076	0.026
2005	0.081	0.082	0.085	0.029
2006	0.077	0.079	0.082	0.027
2007	0.067	0.068	0.070	0.023
2008	0.070	0.071	0.073	0.024
2009	0.021	0.022	0.022	0.008
2010	0.032	0.032	0.033	0.013
2011	0.075	0.076	0.079	0.026
2012	0.073	0.075	0.077	0.025
2013	0.069	0.070	0.073	0.022
2014	0.075	0.076	0.079	0.025
2015	0.070	0.071	0.074	0.023
2016	0.063	0.064	0.067	0.019
2017	0.055	0.056	0.058	0.019
2018	0.056	0.057	0.059	0.019
2019	0.038	0.039	0.040	0.014
2020	0.041	0.041	0.043	0.014
2021	0.041	0.042	0.044	0.015
2022	0.040	0.041	0.042	0.014
Trend				
1990 – 2022	NA	NA	NA	NA
2005 – 2022	-50%	-50%	-50%	-50%
2021 – 2022	-3.3%	-3.3%	-3.3%	-3.0%

Table 3.106 Emissions of Heavy Metals (HM) from 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	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	0.042	0.024	0.001	<0.001	0.035	0.009	0.003	0.001	0.808
2000	0.041	0.022	0.001	<0.001	0.035	0.009	0.003	0.001	0.788
2001	0.041	0.023	0.001	<0.001	0.035	0.009	0.003	0.001	0.787
2002	0.010	0.012	<0.001	<0.001	0.009	0.003	0.001	<0.001	0.225
2003	0.014	0.014	<0.001	<0.001	0.012	0.003	0.001	<0.001	0.293
2004	0.010	0.011	<0.001	<0.001	0.009	0.002	0.001	<0.001	0.221
2005	0.011	0.012	<0.001	<0.001	0.010	0.003	0.001	<0.001	0.246
2006	0.011	0.011	<0.001	<0.001	0.010	0.003	0.001	<0.001	0.242
2007	0.010	0.009	<0.001	<0.001	0.009	0.002	0.001	<0.001	0.211
2008	0.010	0.010	<0.001	<0.001	0.009	0.002	0.001	<0.001	0.215
2009	0.002	0.004	<0.001	<0.001	0.002	0.001	<0.001	<0.001	0.058
2010	0.003	0.006	<0.001	<0.001	0.003	0.001	<0.001	<0.001	0.085
2011	0.011	0.010	<0.001	<0.001	0.010	0.003	0.001	<0.001	0.238
2012	0.011	0.010	<0.001	<0.001	0.010	0.003	0.001	<0.001	0.236
2013	0.011	0.009	<0.001	<0.001	0.010	0.003	0.001	<0.001	0.229
2014	0.011	0.010	0.001	<0.001	0.010	0.003	0.001	<0.001	0.238
2015	0.011	0.009	0.001	<0.001	0.010	0.003	0.001	<0.001	0.231
2016	0.011	0.007	0.001	<0.001	0.010	0.003	0.001	<0.001	0.220
2017	0.008	0.008	<0.001	<0.001	0.007	0.002	0.001	<0.001	0.171
2018	0.009	0.008	<0.001	<0.001	0.007	0.002	0.001	<0.001	0.180
2019	0.005	0.006	<0.001	<0.001	0.004	0.001	<0.001	<0.001	0.113
2020	0.006	0.006	<0.001	<0.001	0.005	0.001	<0.001	<0.001	0.125
2021	0.006	0.003	<0.001	<0.001	0.005	0.001	<0.001	<0.001	0.126
2022	0.006	0.003	<0.001	<0.001	0.005	0.001	<0.001	<0.001	0.122
Trend									
1990 – 2022	NA	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	-50.8%	-77.7%	14.7%	-11.3%	-50.8%	-50.7%	-50.2%	-42.8%	-50.6%
2021 – 2022	-3.5%	-3.5%	-10.9%	-9.3%	-3.5%	-3.4%	-3.7%	-5.0%	-3.4%

Table 3.107 Emissions of Persistent Organic Pollutants (POPs) from category 1.A.2.e Food Processing, Beverages and Tobacco

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	IE	IE	IE	IE	IE
1991	IE	IE	IE	IE	IE	IE	IE	IE
1992	IE	IE	IE	IE	IE	IE	IE	IE
1993	IE	IE	IE	IE	IE	IE	IE	IE
1994	IE	IE	IE	IE	IE	IE	IE	IE
1995	IE	IE	IE	IE	IE	IE	IE	IE
1996	IE	IE	IE	IE	IE	IE	IE	IE
1997	IE	IE	IE	IE	IE	IE	IE	IE
1998	IE	IE	IE	IE	IE	IE	IE	IE
1999	0.001	0.017	0.036	0.009	0.007	0.069	0.008	<0.001
2000	<0.001	0.016	0.031	0.008	0.007	0.062	0.008	<0.001
2001	0.001	0.016	0.034	0.009	0.007	0.066	0.008	<0.001
2002	<0.001	0.006	0.023	0.004	0.003	0.036	0.002	<0.001
2003	<0.001	0.007	0.027	0.005	0.004	0.043	0.003	<0.001
2004	<0.001	0.006	0.020	0.004	0.003	0.033	0.002	<0.001
2005	<0.001	0.006	0.023	0.004	0.003	0.037	0.002	<0.001
2006	<0.001	0.006	0.021	0.004	0.003	0.033	0.002	<0.001
2007	<0.001	0.005	0.017	0.003	0.003	0.028	0.002	<0.001
2008	0.001	0.005	0.019	0.003	0.003	0.031	0.002	<0.001
2009	<0.001	0.002	0.008	0.001	0.001	0.012	<0.001	<0.001
2010	<0.001	0.003	0.013	0.002	0.002	0.019	0.001	<0.001
2011	<0.001	0.006	0.019	0.003	0.003	0.031	0.002	<0.001
2012	<0.001	0.006	0.018	0.003	0.003	0.029	0.002	<0.001
2013	<0.001	0.005	0.015	0.003	0.002	0.025	0.002	<0.001
2014	<0.001	0.006	0.019	0.003	0.003	0.031	0.002	<0.001
2015	<0.001	0.005	0.015	0.003	0.003	0.026	0.002	<0.001
2016	<0.001	0.005	0.010	0.002	0.002	0.019	0.002	<0.001
2017	<0.001	0.004	0.015	0.003	0.002	0.024	0.001	<0.001
2018	<0.001	0.004	0.014	0.003	0.002	0.023	0.002	<0.001
2019	<0.001	0.003	0.011	0.002	0.002	0.018	0.001	<0.001
2020	<0.001	0.003	0.011	0.002	0.002	0.018	0.001	<0.001
2021	<0.001	0.003	0.012	0.002	0.002	0.019	0.001	<0.001
2022	<0.001	0.003	0.011	0.002	0.002	0.018	0.001	<0.001
Trend								
1990 – 2022	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	-84.8%	-50.6%	-50.3%	-50.5%	-50.5%	-50.4%	-50.8%	-50.8%
2021 – 2022	21.0%	-3.1%	-2.5%	-2.9%	-2.8%	-2.7%	-3.5%	-3.5%

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 approach³⁵ of the EMEP/EEA air pollutant emission inventory guidebook 2023 has been applied:

Equation: emissions from stationary combustion

$$\text{Emissions}_{\text{pollutant}} = \text{Fuel Consumption}_{\text{fuel}} \times \text{Emission Factor}_{\text{pollutant. fuel}}$$

Where:

Emissions _{pollutant}	= emissions of a given pollutant by type of fuel (kg pollutant)
Fuel consumption _{fuel}	= amount of fuel combusted (TJ)
Emission factor _{pollutant. fuel}	= default emission factor of a given pollutant by type of fuel (g _{pollutant} /GJ).
Pollutant	= main pollutants: NO _x , CO, NMVOC, SO ₂ particulate matter: TSP, PM ₁₀ , PM _{2.5} , 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
Liquid fuels	<ul style="list-style-type: none"> Residual fuel oil Gas/Diesel Oil Other petroleum products Liquefied Petroleum Gases (LPG) Petroleum Coke 	Summary of fuel aggregations at Tier 1 according to EMEP/EEA air pollutant emission inventory guidebook 2023. Part B. Chapter 1.A.2.
Gaseous fuels	<ul style="list-style-type: none"> Natural gas 	
Biomass	<ul style="list-style-type: none"> Wood / Fuelwood 	

Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2022 were taken from prepared by Albanian Institute of Statistics (INSTAT).

³⁵ Source: EMEP/EEA air pollutant emission inventory guidebook 2023. 1.A.2 Manufacturing industries and construction (combustion). sub-chapter 3.2 Tier 1 default approach.

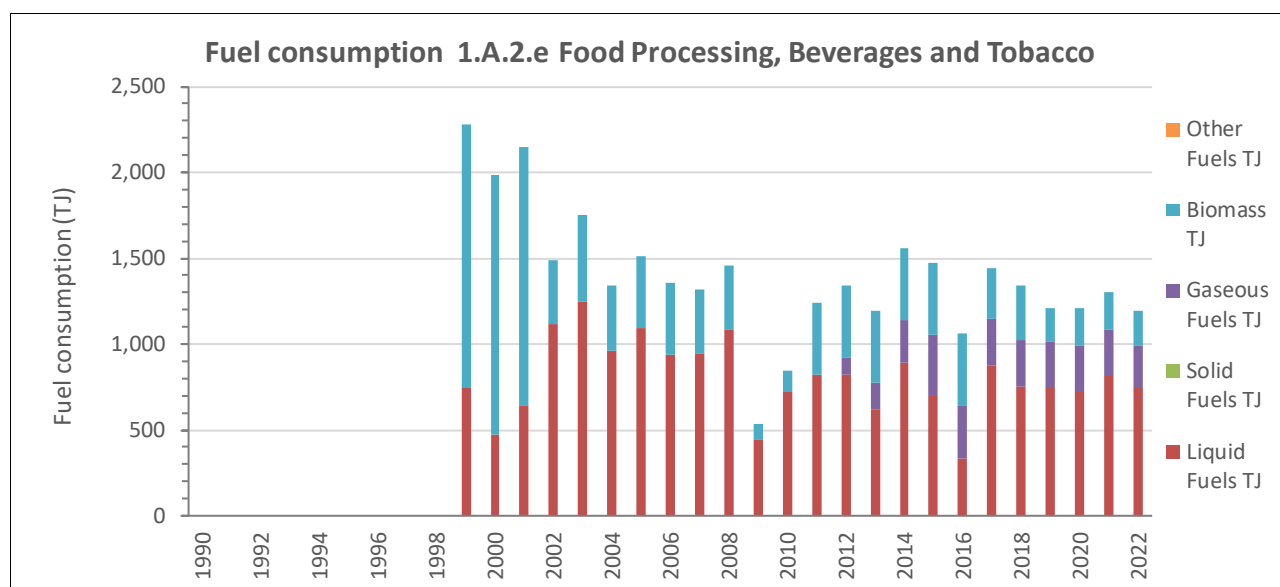


Figure 3.22 Activity data for category 1.A.2.e Food Processing, Beverages and Tobacco

Table 3.108 Activity data for 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	IE	IE	IE	IE	NO	NO	IE
1991	IE	IE	IE	IE	NO	NO	IE
1992	IE	IE	IE	IE	NO	NO	IE
1993	IE	IE	IE	IE	NO	NO	IE
1994	IE	IE	IE	IE	NO	NO	IE
1995	IE	IE	IE	IE	NO	NO	IE
1996	IE	IE	IE	IE	NO	NO	IE
1997	IE	IE	IE	IE	NO	NO	IE
1998	IE	IE	IE	IE	NO	NO	IE
1999	2,282.05	746.05	IE	IE	NO	NO	1,536.00
2000	1,985.74	473.74	IE	IE	NO	NO	1,512.00
2001	2,148.09	647.09	NO	NO	NO	NO	1,501.00
2002	1,491.26	1,114.26	NO	NO	NO	NO	377.00
2003	1,750.66	1,248.66	NO	NO	NO	NO	502.00
2004	1,338.16	961.16	NO	NO	NO	NO	377.00
2005	1,514.55	1,095.55	NO	NO	NO	NO	419.00
2006	1,353.78	934.78	NO	NO	NO	NO	419.00
2007	1,314.83	946.83	NO	NO	NO	NO	368.00
2008	1,455.79	1,087.79	NO	NO	NO	NO	368.00
2009	533.99	445.99	NO	NO	NO	NO	88.00
2010	848.73	722.73	NO	NO	NO	NO	126.00
2011	1,238.77	819.77	NO	NO	NO	NO	419.00
2012	1,339.93	819.23	NO	101.70	NO	NO	419.00

Activity data 1.A.1.e	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
2013	1,193.63	617.23	NO	158.40	NO	NO	418.00
2014	1,559.87	892.47	NO	248.40	NO	NO	419.00
2015	1,470.30	696.70	NO	354.60	NO	NO	419.00
2016	1,064.29	336.31	NO	308.99	NO	NO	419.00
2017	1,441.47	877.09	NO	271.31	NO	NO	293.08
2018	1,342.27	752.77	NO	271.31	NO	NO	318.20
2019	1,207.32	747.62	NO	271.31	NO	NO	188.40
2020	1,205.91	721.15	NO	271.26	NO	NO	213.50
2021	1,299.20	814.41	NO	271.26	NO	NO	213.53
2022	1,194.84	747.50	NO	241.35	NO	NO	205.99
Trend							
1990 – 2022	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	-21.1%	-31.8%	NA	NA	NA	NA	-50.8%
2021 – 2022	-8.0%	-8.2%	NA	-11.0%	NA	NA	-3.5%

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 category 1.A.2.e Food Processing, Beverages and Tobacco.

Table 3.109 Net calorific values (NCVs) applied for conversion to energy units in category 1.A.2.e Food Processing, Beverages and Tobacco

Fuel	Fuel type	Net calorific value (NCV)					
		NCV	unit	type	NCV	unit	type
Residual fuel oil	liquid	40.193	TJ/Gg	CS	40.4	TJ/Gg	D
Gas/Diesel Oil (Non-bio gas/diesel oil)	liquid	43.292	TJ/Gg	CS	47.3	TJ/Gg	D
Petroleum coke	liquid	46.89	TJ/Gg	CS	32.5	TJ/Gg	D
Other Oil - Other Petroleum Products	liquid	40.2	TJ/Gg	CS	40.2	TJ/Gg	D
Liquefied petroleum gas (LPG)	liquid	47.311	TJ/Gg	CS	47.3	TJ/Gg	D
Natural gas	Gaseous	35.00	GJ/1000 m3	CS	39.02	GJ/1000 m3	D
Wood/ Fuelwood	biomass		GJ/1000 m3	CS	48.0	TJ/Gg	D
					for comparision		
Source		Eurostat (2023): Complete energy balances (Code: nrg_bal_c)			2006 IPCC guidelines, Vol. 2, Chapter 1, Table 1.2		
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 2023 and are presented in the following table.

Table 3.110 Emission factors (EF) for Main pollutants, Particulate Matter (PM), Heavy metals (HM) and Persistent Organic Pollutants (POPs) for category 1.A.2.e Food Processing, Beverages and Tobacco

Fuel Type	UNIT	Gaseous fuels		Liquid fuels		Biomass	
Associated fuel types		Natrual gas		Gas/Diesel Oil Residual fuel oil, (LPG) Petroleum Coke		Charcoal Wood / Fuelwood Wood pellets	
Pollutant		EF (TIER 1)	type	EF	type	EF	type
NOx	g/GJ	74	D	513.0	D	91	D
CO	g/GJ	29	D	66	D	570	D
NMVOC	g/GJ	23	D	25	D	300	D
SOx	g/GJ	0.67	D	47	D	11	D
TSP	g/GJ	NA		20	D	1.2	D
NH3	g/GJ	0.78	D	NE		150	D
PM10	g/GJ	0.78	D	20	D	143	D
PM2.5	g/GJ	0.78	D	20	D	140	D
BC	% of PM2.5	4	D	56	D	28	D
Pb	mg/GJ	0.011	D	0.08	D	27	D
Cd	mg/GJ	0.0009	D	0.006	D	13	D
Hg	mg/GJ	0.54	D	0.12	D	0.56	D
As	mg/GJ	0.1	D	0.03	D	0.19	D
Cr	mg/GJ	0.013	D	0.2	D	23	D
Cu	mg/GJ	0.0026	D	0.22	D	6	D
Ni	mg/GJ	0.013	D	0.008	D	2	D
Se	mg/GJ	0.058	D	0.11	D	0.5	D
Zn	mg/GJ	0.73	D	29	D	512	D
PCB	ng WHO-TEG/GJ	NA		NE	D	0.06	D
PCDD/F	ng I-TEQ/GJ	NA		1.4	D	100	D
Benzo(a)pyrene	µg/GJ	NA		0.0019	D	0.01	D
Benzo(b)fluoranthene	µg/GJ	NA		0.015	D	0.016	D
Benzo(k)fluoranthene	µg/GJ	NA		0.0017	D	0.005	D
Indeno(1,2,3-cd)pyrene	µg/GJ	NA		0.0015	D	0.004	D
HCB	µg/GJ	NA		NE	D	5	D
Source		Table 3-3, Section 3.2.2. page 16.		Table 3-, Section 3.2.2. page 17.		Table 3.5. section 3.4. page 17.	
		EMEP/EEA air pollutant emission inventory guidebook 2023. 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 3.111 Uncertainty for category 1.A.2.e Food Processing, Beverages and Tobacco .

Uncertainty	Solid fuels	Gaseous fuels	Liquid fuels	Biomass	Reference
Activity data (AD)	-	5%	5%	8%	Table 2.15. 2006 IPCC GL. Vol. 2. Chap. 2 (2.4.2)
Emission factor (EF)	Rating	Typical error range	Average	Reference	
NO _x	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 2023. Part A. Chapter 5 Uncertainties.	
CO	C	50% to 200%	125%		
NM VOC	D	100% to 300%	200%		
SO _x	A	10% to 30%	20%		
NH ₃	E	order of magnitude	750%		
TSP, PM ₁₀ , PM _{2.5} , 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)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 and relevant to category 1.A.2.e Food Processing, Beverages and Tobacco .

Table 3.112 Recalculations done in 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	Revision of NCV by using country specific NCV	AD	Accuracy
1.A.2.e	Revision of activity 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 3.113 Planned improvements for 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) $\Rightarrow CS EF_{SO_2} [g/GJ] = (S [\%] \cdot 20000) / (NCV [GJ/t])$	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"> Determination of the <ul style="list-style-type: none"> temperature in waste gases [°C]; static pressure and the dynamic pressure [kPa]; flow rate [m/s]; volume flow rate [m³/h and Nm³/h]; concentration of CO. SO₂. NO_x in the exhaust gases [mg/Nm³]; and Gravimetric extraction of solid particles (TSP) from gases and determination by applying a gravimetric method (mg/Nm³). 	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

	Available in Albania
• Manufacture of glass and glass products	
• Manufacture of non-structural non-refractory ceramic ware	
• Manufacture of refractory ceramic products	
• Manufacture of structural non-refractory clay and ceramic products	
• Manufacture of cement, lime and plaster	✓
• Manufacture of articles of concrete, cement and plaster	
• Cutting, shaping and finishing of stone	
• Manufacture of other non-metallic mineral products n.e.c	

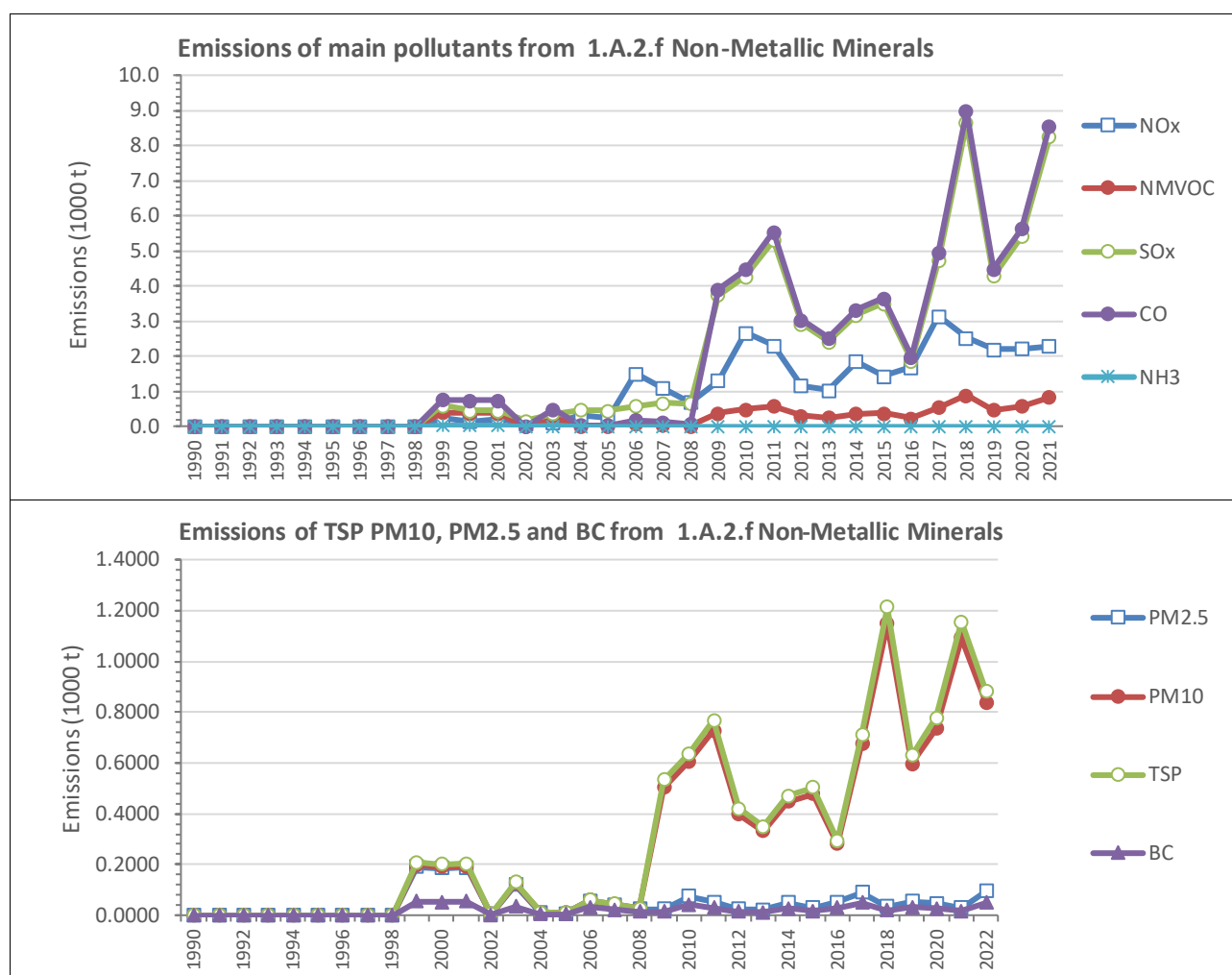
Table 3.114 Overview on reported emissions from sub categories 1.A.2.f Non-Metallic Minerals

Air pollutants	1.A.2.e						Key category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
NOx	✓	NO	✓	NO	NO	✓	
CO	✓	NO	✓	NO	NO	✓	
NMVOC	✓	NO	✓	NO	NO	✓	
SOx	✓	NO	✓	NO	NO	✓	
NH3	NA	NO	✓	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	✓	
PCDD/F	✓	NO	✓	NO	NO	✓	
PAH	NA	NO	✓	NO	NO	✓	
Benzo(a)pyrene	✓	NO	✓	NO	NO	✓	
Benzo(b)fluoranthene	✓	NO	✓	NO	NO	✓	

Air pollutants	1.A.2.e						Key category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
Benzo(k)fluoranthene	✓	NO	✓	NO	NO	✓	
Indeno(1,2,3-cd)pyrene	✓	NO	✓	NO	NO	✓	
HCB	NA	NO	✓	NO	NO	✓	
<p>A '✓' indicates: emissions from this category have been estimated.</p> <p>Notation keys: IE - included elsewhere. NO – not occurred. 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 fuel combustion in 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 – 2022, 2005 – 2022, 2021 – 2022.



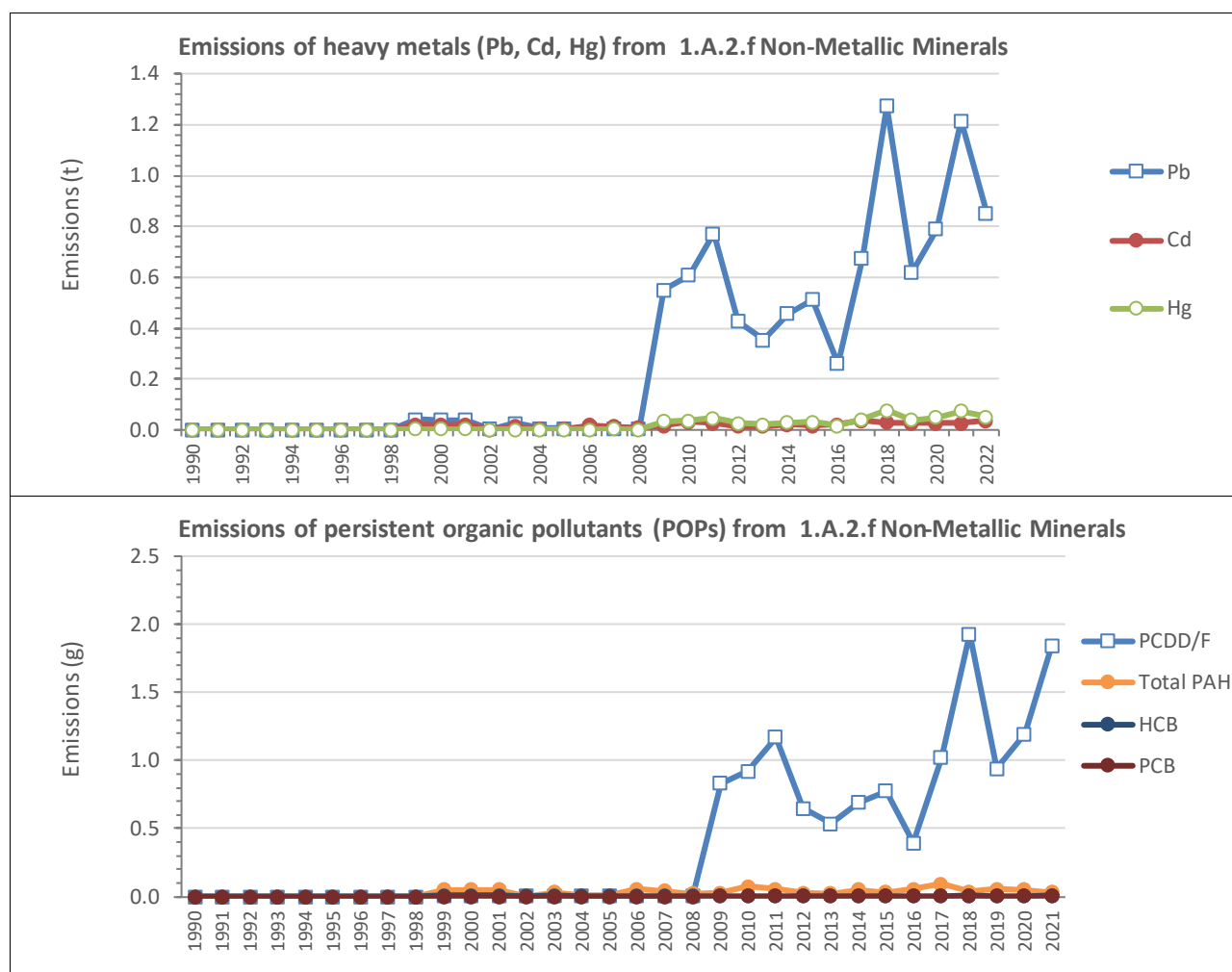


Figure 3.23 Emissions from category 1.A.2.f Non-Metallic Minerals

Table 3.115 Emissions of main pollutants (NO_x, SO₂, NMVOC, CO and NH₃) from category 1.A.2.f Non-Metallic Minerals

Emissions	NO _x	NMVOC	SO _x	CO	NH ₃
	Gg	Gg	Gg	Gg	Gg
1990	NO	NO	NO	NO	NO
1991	NO	NO	NO	NO	NO
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	0.003	0.001	0.000	0.001	IE
1998	0.001	0.000	0.000	0.000	IE
1999	IE	IE	IE	IE	IE
2000	IE	IE	IE	IE	IE
2001	0.241	0.405	0.607	0.775	0.049
2002	0.148	0.394	0.452	0.753	0.048
2003	0.213	0.394	0.458	0.755	0.048
2004	0.090	0.003	0.171	0.009	IE
2005	0.117	0.255	0.362	0.487	0.031
2006	0.309	0.019	0.483	0.041	IE
2007	0.258	0.017	0.462	0.034	IE
2008	1.513	0.072	0.579	0.189	IE
2009	1.086	0.049	0.670	0.132	IE
2010	0.686	0.030	0.666	0.080	IE
2011	1.307	0.394	3.753	3.902	IE
2012	2.679	0.496	4.264	4.475	IE
2013	2.311	0.576	5.313	5.540	IE
2014	1.174	0.313	2.923	3.045	IE
2015	1.031	0.262	2.428	2.532	IE
2016	1.852	0.364	3.177	3.330	IE
2017	1.431	0.376	3.505	3.652	IE
2018	1.693	0.239	1.872	1.983	IE
2019	3.143	0.557	4.726	4.966	IE
2020	2.536	0.888	8.642	8.970	IE
2021	2.204	0.480	4.298	4.493	IE
2022	2.227	0.582	5.409	5.636	IE
Trend					
1990 – 2022	NA	NA	NA	NA	NA
2005 – 2022	1101.0%	3983.6%	1177.2%	18028.2%	NA
2021 – 2022	34.7%	-17.2%	-28.5%	-27.1%	NA

Table 3.116 Emissions of particulate matter (PM) from 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	0.000	0.000	0.000	0.000
1996	0.000	0.000	0.000	0.000
1997	IE	IE	IE	IE
1998	IE	IE	IE	IE
1999	0.191	0.197	0.207	0.055
2000	0.185	0.191	0.201	0.053
2001	0.187	0.192	0.202	0.054
2002	0.003	0.003	0.004	0.001
2003	0.120	0.124	0.131	0.034
2004	0.009	0.011	0.012	0.005
2005	0.008	0.009	0.010	0.004
2006	0.057	0.058	0.059	0.032
2007	0.040	0.042	0.043	0.022
2008	0.024	0.026	0.028	0.013
2009	0.023	0.504	0.533	0.013
2010	0.074	0.606	0.637	0.041
2011	0.051	0.726	0.767	0.029
2012	0.024	0.397	0.419	0.014
2013	0.022	0.331	0.350	0.013
2014	0.049	0.447	0.471	0.028
2015	0.030	0.476	0.503	0.017
2016	0.053	0.280	0.294	0.030
2017	0.089	0.676	0.711	0.050
2018	0.035	1.148	1.214	0.019
2019	0.055	0.597	0.629	0.031
2020	0.047	0.736	0.777	0.026
2021	0.028	1.091	1.155	0.016
2022	0.095	0.838	0.883	0.048
Trend				
1990 – 2022	NA	NA	NA	NA
2005 – 2022	1156.1%	9429.8%	8909.9%	1223.4%
2021 – 2022	235.0%	-23.2%	-23.5%	205.2%

Table 3.117 Emissions of Heavy Metals (HM) from 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	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1996	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1997	IE	IE	IE	IE	IE	IE	IE	IE	IE
1998	IE	IE	IE	IE	IE	IE	IE	IE	IE
1999	0.041	0.019	0.002	0.005	0.033	0.008	0.006	0.016	0.685
2000	0.039	0.018	0.002	0.004	0.032	0.008	0.005	0.012	0.670
2001	0.039	0.019	0.002	0.004	0.032	0.008	0.005	0.012	0.669
2002	0.001	0.001	<0.001	0.001	0.001	<0.001	0.001	0.004	0.005
2003	0.026	0.012	0.001	0.003	0.021	0.005	0.004	0.010	0.434
2004	0.004	0.003	0.001	0.004	0.003	<0.001	0.003	0.012	0.015
2005	0.004	0.002	0.001	0.004	0.002	<0.001	0.003	0.012	0.012
2006	0.004	0.017	0.001	0.004	0.003	0.001	0.003	0.012	0.084
2007	0.005	0.012	0.001	0.005	0.004	0.001	0.003	0.016	0.060
2008	0.006	0.008	0.001	0.005	0.004	0.001	0.004	0.017	0.037
2009	0.551	0.014	0.033	0.016	0.056	0.072	<0.001	0.008	0.856
2010	0.609	0.030	0.036	0.018	0.062	0.080	<0.001	0.009	1.016
2011	0.773	0.026	0.046	0.023	0.078	0.102	<0.001	0.011	1.228
2012	0.427	0.013	0.025	0.013	0.043	0.056	<0.001	0.006	0.672
2013	0.354	0.011	0.021	0.011	0.036	0.046	<0.001	0.005	0.560
2014	0.456	0.021	0.027	0.014	0.046	0.060	<0.001	0.006	0.752
2015	0.511	0.016	0.030	0.015	0.052	0.067	<0.001	0.007	0.807
2016	0.260	0.019	0.016	0.008	0.027	0.035	<0.001	0.004	0.465
2017	0.673	0.036	0.040	0.020	0.069	0.089	<0.001	0.010	1.132
2018	1.275	0.028	0.075	0.038	0.129	0.167	<0.001	0.017	1.953
2019	0.621	0.025	0.037	0.019	0.063	0.082	<0.001	0.009	1.006
2020	0.789	0.025	0.047	0.024	0.080	0.104	<0.001	0.011	1.246
2021	1.218	0.025	0.072	0.036	0.123	0.159	<0.001	0.017	1.858
2022	0.854	0.036	0.051	0.026	0.089	0.113	<0.001	0.012	1.444
Trend									
1990 – 2022	NA	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	21170.1%	1416.1%	4901.3%	563.6%	3488.4%	33323.6%	-89.5%	-0.8%	12046.1%
2021 – 2022	-29.8%	46.4%	-29.5%	-29.8%	-27.4%	-29.3%	2307.0%	-27.8%	-22.3%

Table 3.118 Emissions of Persistent Organic Pollutants (POPs) from 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	IE	IE	IE	IE	IE
1991	IE	IE	IE	IE	IE	IE	IE	IE
1992	IE	IE	IE	IE	IE	IE	IE	IE
1993	IE	IE	IE	IE	IE	IE	IE	IE
1994	IE	IE	IE	IE	IE	IE	IE	IE
1995	IE	IE	IE	IE	IE	IE	IE	IE
1996	IE	IE	IE	IE	IE	IE	IE	IE
1997	IE	IE	IE	IE	IE	IE	IE	IE
1998	IE	IE	IE	IE	IE	IE	IE	IE
1999	0.004	0.014	0.025	0.007	0.006	0.052	0.009	<0.001
2000	0.003	0.013	0.023	0.007	0.005	0.049	0.008	<0.001
2001	0.003	0.013	0.025	0.007	0.006	0.051	0.008	<0.001
2002	0.001	<0.001	0.002	<0.001	<0.001	0.003	0.001	<0.001
2003	0.002	0.009	0.015	0.004	0.004	0.032	0.006	<0.001
2004	0.003	0.001	0.006	0.001	0.001	0.008	0.002	<0.001
2005	0.003	0.001	0.005	0.001	<0.001	0.006	0.002	<0.001
2006	0.003	0.005	0.042	0.005	0.004	0.057	0.002	<0.001
2007	0.003	0.004	0.029	0.003	0.003	0.039	0.002	<0.001
2008	0.004	0.002	0.017	0.002	0.002	0.023	0.002	<0.001
2009	0.834	0.002	0.018	0.002	0.002	0.024	0.003	0.001
2010	0.923	0.007	0.056	0.006	0.006	0.075	0.003	0.001
2011	1.171	0.005	0.039	0.004	0.004	0.052	0.004	0.001
2012	0.646	0.002	0.018	0.002	0.002	0.025	0.002	0.001
2013	0.536	0.002	0.017	0.002	0.002	0.023	0.002	<0.001
2014	0.691	0.005	0.037	0.004	0.004	0.050	0.002	0.001
2015	0.775	0.003	0.023	0.003	0.002	0.031	0.002	0.001
2016	0.394	0.005	0.040	0.005	0.004	0.053	0.001	<0.001
2017	1.019	0.009	0.067	0.008	0.007	0.090	0.003	0.001
2018	1.931	0.004	0.027	0.003	0.003	0.036	0.006	0.002
2019	0.941	0.005	0.041	0.005	0.004	0.056	0.003	0.001
2020	1.195	0.005	0.036	0.004	0.004	0.048	0.004	0.001
2021	1.845	0.003	0.022	0.003	0.002	0.030	0.006	0.002
2022	1.289	0.009	0.061	0.007	0.006	0.083	0.005	0.001
Trend								
1990 – 2022	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	48397.9%	1362.2%	1162.6%	1236.7%	1240.6%	1193.6%	154.9%	123782.0%
2021 – 2022	-30.1%	186.8%	179.1%	181.4%	181.3%	180.3%	-19.4%	-29.7%

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 approach³⁶ of the EMEP/EEA air pollutant emission inventory guidebook 2023 has been applied:

Equation: emissions from stationary combustion

$$\text{Emissions}_{\text{pollutant}} = \text{Fuel Consumption}_{\text{fuel}} \times \text{Emission Factor}_{\text{pollutant. fuel}}$$

Where:

- Emissions_{pollutant} = emissions of a given pollutant by type of fuel (kg pollutant)
- Fuel consumption_{fuel} = amount of fuel combusted (TJ)
- Emission factor_{pollutant. fuel} = default emission factor of a given pollutant by type of fuel (g_{pollutant}/GJ).
- Pollutant = main pollutants: NO_x, CO, NMVOC, SO₂
 particulate matter: TSP, PM₁₀, PM_{2.5}, 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
Liquid fuels	<ul style="list-style-type: none"> Gas/Diesel Oil Liquefied Petroleum Gases (LPG) Other Other Petroleum Products Petroleum Coke 	Summary of fuel aggregations at Tier 1 according to EMEP/EEA air pollutant emission inventory guidebook 2023. Part B. Chapter 1.A.2.
Solid fuels	<ul style="list-style-type: none"> Anthracite Lignite Other Bituminous Coal 	
Gaseous fuels	<ul style="list-style-type: none"> Natural gas 	
Biomass	<ul style="list-style-type: none"> Wood / Fuelwood 	

Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2022 were taken from prepared by Albanian Institute of Statistics (INSTAT).

³⁶ Source: EMEP/EEA air pollutant emission inventory guidebook 2023. 1.A.2 Manufacturing industries and construction (combustion). sub-chapter 3.2 Tier 1 default approach.

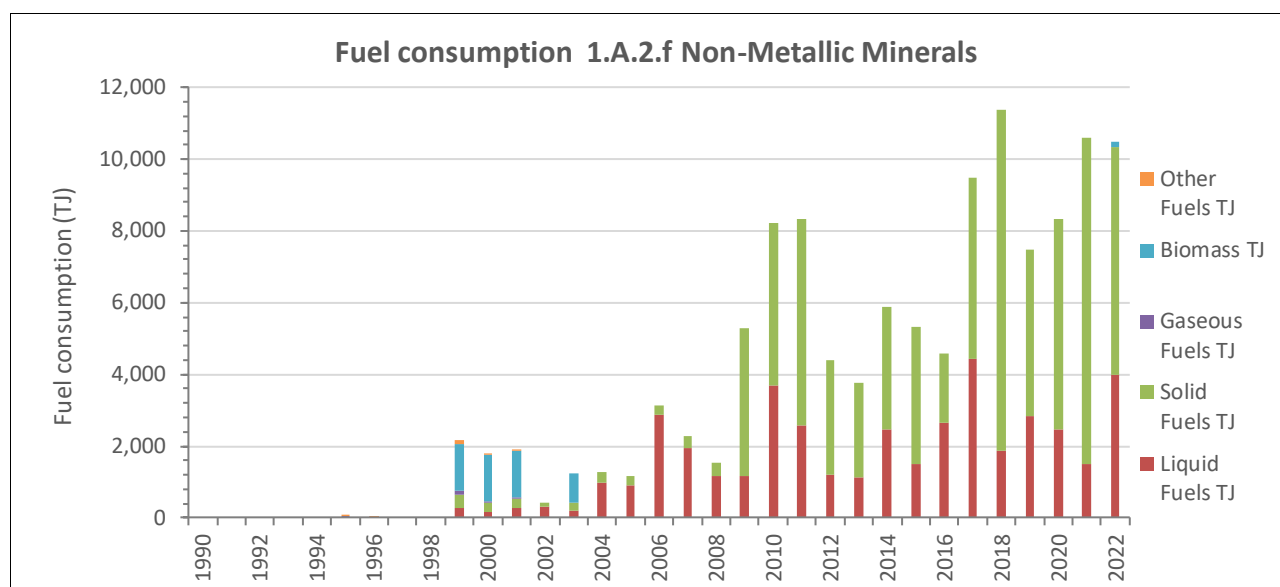


Figure 3.24 Activity data for category 1.A.2.f Non-Metallic Minerals

Table 3.119 Activity data for 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
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	35.10	IE	IE	35.10	NO	NO	IE
1996	12.60	IE	IE	12.60	NO	NO	IE
1997	IE	IE	IE	NO	NO	NO	IE
1998	IE	IE	IE	NO	NO	NO	IE
1999	2,063.59	287.88	344.51	115.20	NO	NO	1,316.00
2000	1,749.65	159.94	255.92	37.80	NO	NO	1,296.00
2001	1,864.00	287.88	255.92	34.20	NO	NO	1,286.00
2002	427.34	328.91	98.43	NO	NO	NO	IE
2003	1,252.04	208.33	206.70	NO	NO	NO	837.00
2004	1,270.89	995.28	275.60	NO	NO	NO	IE
2005	1,165.08	899.32	265.76	NO	NO	NO	IE
2006	3,127.93	2,862.17	265.76	NO	NO	NO	IE
2007	2,295.71	1,951.21	344.51	NO	NO	NO	IE
2008	1,526.54	1,162.35	364.19	NO	NO	NO	IE
2009	5,271.66	1,162.35	4,109.31	NO	NO	NO	IE
2010	8,234.06	3,689.32	4,544.74	NO	NO	NO	IE
2011	8,328.33	2,558.96	5,769.37	NO	NO	NO	IE
2012	4,399.54	1,215.51	3,184.04	NO	NO	NO	IE
2013	3,759.30	1,119.55	2,639.76	NO	NO	NO	IE
2014	5,864.75	2,463.00	3,401.75	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
2015	5,318.94	1,503.39	3,815.55	NO	NO	NO	IE
2016	4,586.97	2,644.56	1,942.41	NO	NO	NO	IE
2017	9,465.86	4,446.58	5,019.29	NO	NO	NO	IE
2018	11,393.48	1,881.88	9,511.60	NO	NO	NO	IE
2019	7,467.35	2,834.76	4,632.59	NO	NO	NO	IE
2020	8,334.69	2,447.83	5,886.86	NO	NO	NO	IE
2021	10,603.88	1,518.22	9,085.66	NO	NO	NO	IE
2022	10,469.02	4,000.06	6,348.38	NO	NO	NO	120.58
Trend							
1990 – 2022	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	798.6%	344.8%	2288.8%	NA	NA	NA	NA
2021 – 2022	-1.3%	163.5%	-30.1%	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 category 1.A.2.f Non-Metallic Minerals.

Table 3.120 Net calorific values (NCVs) applied for conversion to energy units in category 1.A.2.f Non-Metallic Minerals

Fuel	Fuel type	Net calorific value (NCV)					
		NCV	unit	type	NCV	unit	type
Residual fuel oil	liquid	40.193	TJ/Gg	CS	40.4	TJ/Gg	D
Gas/Diesel Oil (Non-bio)	liquid	43.292	TJ/Gg	CS	47.3	TJ/Gg	D
Petroleum coke	liquid	46.89	TJ/Gg	CS	32.5	TJ/Gg	D
Other Oil - Other Petroleum Products	liquid	40.2	TJ/Gg	CS	40.2	TJ/Gg	D
Liquefied petroleum gas (LPG)	liquid	47.311	TJ/Gg	CS	47.3	TJ/Gg	D
Anthracite	solid	27.214	TJ/Gg	CS	26.7	TJ/Gg	D
Lignite	solid	9.843	TJ/Gg	CS	11.9	TJ/Gg	D
Other Bituminous Coal	solid	27.214	TJ/Gg	CS	25.8	TJ/Gg	D
Natural gas	Gaseous	35.00	GJ/1000 m3	CS	39.02	GJ/1000 m3	D
Wood/ Fuelwood	biomass		GJ/1000 m3	CS	48.0	TJ/Gg	D
					for comparision		
Source		Eurostat (2023): Complete energy balances (Code: nrg_bal_c)			2006 IPCC guidelines, Vol. 2, Chapter 1, Table 1.2		
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 2023 and are presented in the following table.

Table 3.121 Emission factors (EF) for Main pollutants, Particulate Matter (PM), Heavy metals (HM) and Persistent Organic Pollutants (POPs) for 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 2023. Part B. Chapter 1.A.2 Manufacturing industries and construction (combustion).					
Note:							
D	Default	CS Country specific		PS	Plant specific	IEF	Implied emission factor

Fuel Type	UNIT	Solid fuels		Gaseous fuels		Liquid fuels		Biomass	
Associated fuel types		Anthracite, Lignite, Other Bituminous Coal		Natrual gas		Gas/Diesel Oil Residual fuel oil, (LPG), Petroleum Coke		Charcoal Wood / Fuelwood Wood pellets	
Pollutant		EF	type	EF	type	EF	type	EF	type
NOx	g/GJ	173	D	74	D	513.0	D	91	D
CO	g/GJ	931	D	29	D	66	D	570	D
NMVOC	g/GJ	88.8	D	23	D	25	D	300	D
SOx	g/GJ	900	D	0.67	D	47	D	11	D
TSP	g/GJ	124	D	NA		20	D	1.2	D
NH3	g/GJ	NA		0.78	D	NA		150	D
PM10	g/GJ	117	D	0.78	D	20	D	143	D
PM2.5	g/GJ	108	D	0.78	D	20	D	140	D
BC	% of PM2.5	6.4	D	4	D	56	D	28	D
Pb	mg/GJ	134	D	0.011	D	0.08	D	27	D
Cd	mg/GJ	1.8	D	0.0009	D	0.006	D	13	D
Hg	mg/GJ	7.9	D	0.54	D	0.12	D	0.56	D
As	mg/GJ	4	D	0.1	D	0.03	D	0.19	D
Cr	mg/GJ	13.5	D	0.013	D	0.2	D	23	D
Cu	mg/GJ	17.5	D	0.0026	D	0.22	D	6	D
Ni	mg/GJ	13	D	0.013	D	0.008	D	2	D
Se	mg/GJ	1.8	D	0.058	D	0.11	D	0.5	D
Zn	mg/GJ	200	D	0.73	D	29	D	512	D
PCB	ng WHO-TEG/GJ	170	D	NA		NA	D	0.06	D
PCDD/F	ng I-TEQ/GJ	203	D	NA		1.4	D	100	D
Benzo(a)pyrene	µg/GJ	45.5	D	NA		0.0019	D	0.01	D
Benzo(b)fluoranthene	µg/GJ	58.9	D	NA		0.015	D	0.016	D
Benzo(k)fluoranthene	µg/GJ	23.7	D	NA		0.0017	D	0.005	D
Indeno(1,2,3-cd)pyrene	µg/GJ	18.5	D	NA		0.0015	D	0.004	D
HCB	µg/GJ	0.62	D	NA		NE	D	5	D
Source		Table 3-3, Section 3.2.2. page 16.		Table 3-, Section 3.2.2. page 17.		Table 3.5. section 3.4. page 17.			
		EMEP/EEA air pollutant emission inventory guidebook 2023. 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 3.122 Uncertainty for category 1.A.2.f Non-Metallic Minerals .

Uncertainty	Solid fuels	Gaseous fuels	Liquid fuels	Biomass	Reference
Activity data (AD)	5%	5%	5%	8%	Table 2.15. 2006 IPCC GL. Vol. 2. Chap. 2 (2.4.2)
Emission factor (EF)	Rating	Typical error range	Average	Reference	
NO _x	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 2023. Part A. Chapter 5 Uncertainties.	
CO	C	50% to 200%	125%		
NM VOC	D	100% to 300%	200%		
SO _x	A	10% to 30%	20%		
NH ₃	E	order of magnitude	750%		
TSP, PM ₁₀ , PM _{2.5} , 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)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.

3.1.3.6.4 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 and relevant to category 1.A.2.f Non-Metallic Minerals .

Table 3.123 Recalculations done in category 1.A.2.f Non-Metallic Minerals

source category	Revisions of data	Type of revision	Type of improvement
1.A.2.f	Revision of NCV by using country specific NCV	AD	Accuracy
1.A.2.f	Revision of activity 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 3.124 Planned improvements for 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"> Determination of the <ul style="list-style-type: none"> temperature in waste gases [°C]; static pressure and the dynamic pressure [kPa]; flow rate [m/s]; volume flow rate [m³/h and Nm³/h]; concentration of CO, SO₂, NOx in the exhaust gases [mg/Nm³]; and Gravimetric extraction of solid particles (TSP) from gases and determination by applying a gravimetric method (mg/Nm³). 	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		
▪	IPCC/NFR category 1.A.2.g	Manufacturing of transport equipment
▪	IPCC/NFR category 1.A.2.h	Manufacturing of transport equipment
▪	IPCC/NFR category 1.A.2.i	Mining (excluding fuels) and Quarrying
▪	IPCC/NFR category 1.A.2.j	Wood and wood products
▪	IPCC/NFR category 1.A.2.k	Construction
▪	IPCC/NFR category 1.A.2.l	Textile and Leather
▪	IPCC/NFR category 1.A.2.m	Other
• 1A2gvii Mobile combustion in manufacturing industries and construction		
▪	All mobile combustion in category 1.A.2 Manufacturing Industries and Construction	

Emissions of air pollutants of category 1A2gvii *Mobile combustion in manufacturing industries and construction* are included in category 1A2g viii *Stationary combustion in manufacturing industries and construction: Other*.

3.1.3.8 Mobile combustion in manufacturing industries and construction (IPCC/NFR category 1.A.2.g.vii)

3.1.3.8.1 Source category description

This section describes emissions resulting from all mobile fuel combustion activities in *Combustion in manufacturing industries and construction*.

Emissions of air pollutants of category 1A2gvii *Mobile combustion in manufacturing industries and construction* are included in category 1A2g viii *Stationary combustion in manufacturing industries and construction: Other* as currently no detailed data on this activities are available.

3.1.3.8.2 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 3.125 Planned improvements for category 1.A.2.g.vii Mobile combustion in manufacturing industries and construction

Source category	Planned improvement	Type of improvement		Priority
1.A.2.g	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

3.1.3.9 Manufacturing of transport equipment (NFR category 1.A.2.g)

3.1.3.9.1 Source category description

The IPCC category 1.A.2.g *Manufacturing of transport equipment* includes Emissions resulting from fuel combustion activities grouped in

- ISIC Division 29 Manufacture of motor vehicles, trailers and semi-trailers.
- ISIC Division 30 Manufacture of other transport equipment.

The Energy balance currently does not provide information on the consumption of fuels in activities under *Manufacture of motor vehicles, trailers and semi-trailers* and *Manufacture of other transport equipment*. However, as maybe there are activities in Albania, fuel combustion in this sector can be assumed. Therefore the notation key IE (included elsewhere) was used.

3.1.3.9.2 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 3.126 Planned improvements for category 1.A.2.g Manufacturing of transport equipment

Source category	Planned improvement	Type of improvement		Priority
1.A.2.g	Investigation if this activity does occur in Albania. 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

3.1.3.10 Manufacturing of machinery (NFR category 1.A.2.h)

3.1.3.10.1 Source category description

The IPCC category 1.A.2.h *Manufacturing of machinery* includes Emissions resulting from fuel combustion activities grouped in

- ISIC Division 25 Manufacture of fabricated metal products, except machinery and equipment
 - Manufacture of structural metal products, tanks, reservoirs and steam generators
 - Manufacture of weapons and ammunition
 - Manufacture of other fabricated metal products; metalworking service activities
- ISIC Division 26 Manufacture of computer, electronic and optical products
 - Manufacture of electronic components and boards
 - Manufacture of computers and peripheral equipment
 - Manufacture of communication equipment
 - Manufacture of consumer electronics
 - Manufacture of measuring, testing, navigating and control equipment; watches and clocks
 - Manufacture of irradiation, electromedical and electrotherapeutic equipment
 - Manufacture of optical instruments and photographic equipment

- Manufacture of magnetic and optical media
- ISIC Division 27 Manufacture of electrical equipment
 - Manufacture of electric motors, generators, transformers and electricity distribution and control apparatus
 - Manufacture of batteries and accumulators
 - Manufacture of wiring and wiring devices
 - Manufacture of electric lighting equipment
 - Manufacture of domestic appliances
 - Manufacture of other electrical equipment
- ISIC Division 28 Manufacture of machinery and equipment n.e.c.
 - Manufacture of general-purpose machinery
 - Manufacture of special-purpose machinery

The Energy balance currently does not provide information on the consumption of fuels in activities under *Manufacture of different kind of machineries and devices*. However, as maybe there are activities in Albania, fuel combustion in this sector can be assumed. Therefore the notation key IE (included elsewhere) was used.

3.1.3.10.2 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 category 1.A.2.h Manufacturing of machinery

Source category	Planned improvement	Type of improvement		Priority
1.A.2.h	Investigation if this activity does occur in Albania. 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

3.1.3.11 Mining (excluding fuels) and Quarrying (NFR category 1.A.2.i)

3.1.3.11.1 Source category description

This section describes emissions resulting from fuel combustion activities in Manufacturing Industries and Construction - **Mining (excluding fuels) and quarrying** -. The subcategory 1.A.2.i *Mining (excluding fuels) and quarrying* includes Emissions resulting from fuel combustion activities in

- ISIC Division 07 Mining of metal ores (iron ores and non-ferrous metal ores).
- ISIC Division 08 Other mining and quarrying
 - Quarrying of stone, sand and clay
 - Mining and quarrying n.e.c.:
 - Mining of chemical and fertilizer minerals (Extraction of peat, salt)
 - Other mining and quarrying n.e.c.
- ISIC Division 09 Mining support service activities
 - Support activities for petroleum and natural gas extraction
 - Support activities for other mining and quarrying

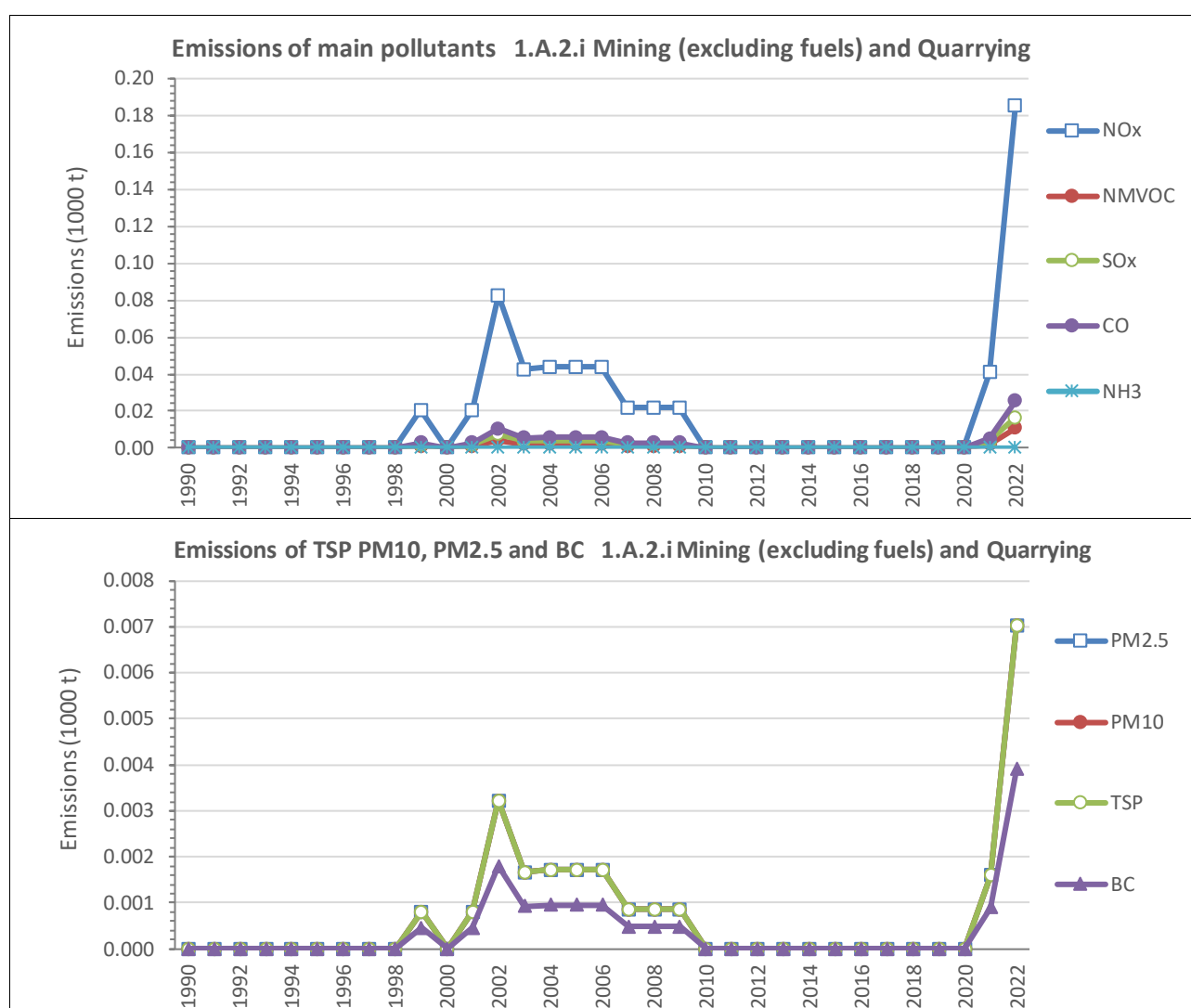
Table 3.128 Overview on reported emissions from sub categories 1.A.2.i Mining (excluding fuels) and quarrying

Air pollutants	1.A.2i						Key category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
NOx	✓	NO	NO	NO	NO	NO	-
CO	✓	NO	NO	NO	NO	NO	-
NMVOC	✓	NO	NO	NO	NO	NO	-
SOx	✓	NO	NO	NO	NO	NO	-
NH3	NA	NO	NO	NO	NO	NO	-
TSP	✓	NO	NO	NO	NO	NO	-
PM10	✓	NO	NO	NO	NO	NO	-
PM2.5	✓	NO	NO	NO	NO	NO	-
BC	✓	NO	NO	NO	NO	NO	-
Pb	✓	NO	NO	NO	NO	NO	-
Cd	✓	NO	NO	NO	NO	NO	-
Hg	✓	NO	NO	NO	NO	NO	-
As	✓	NO	NO	NO	NO	NO	-
Cr	✓	NO	NO	NO	NO	NO	-
Cu	✓	NO	NO	NO	NO	NO	-
Ni	✓	NO	NO	NO	NO	NO	-
Se	✓	NO	NO	NO	NO	NO	-
Zn	✓	NO	NO	NO	NO	NO	-
PCB	NA	NO	NO	NO	NO	NO	-
PCDD/F	✓	NO	NO	NO	NO	NO	-
PAH	✓	NO	NO	NO	NO	NO	-
Benzo(a)pyrene	✓	NO	NO	NO	NO	NO	-
Benzo(b)fluoranthene	✓	NO	NO	NO	NO	NO	-
Benzo(k)fluoranthene	✓	NO	NO	NO	NO	NO	-
Indeno(1,2,3-cd)pyrene	✓	NO	NO	NO	NO	NO	-

Air pollutants	1.A.2i						Key category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
HCB	NA	NO	NO	NO	NO	NO	-
<p>A '✓' indicates: emissions from this category have been estimated.</p> <p>Notation keys: IE - included elsewhere. NO – not occurred. 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 fuel combustion in category 1.A.2.i *Mining (excluding fuels) and quarrying* is provided in the following figures and tables:

- annual emissions of air pollutants;
- Trend of the periods 1990 – 2022, 2005 – 2022, 2021 – 2022.



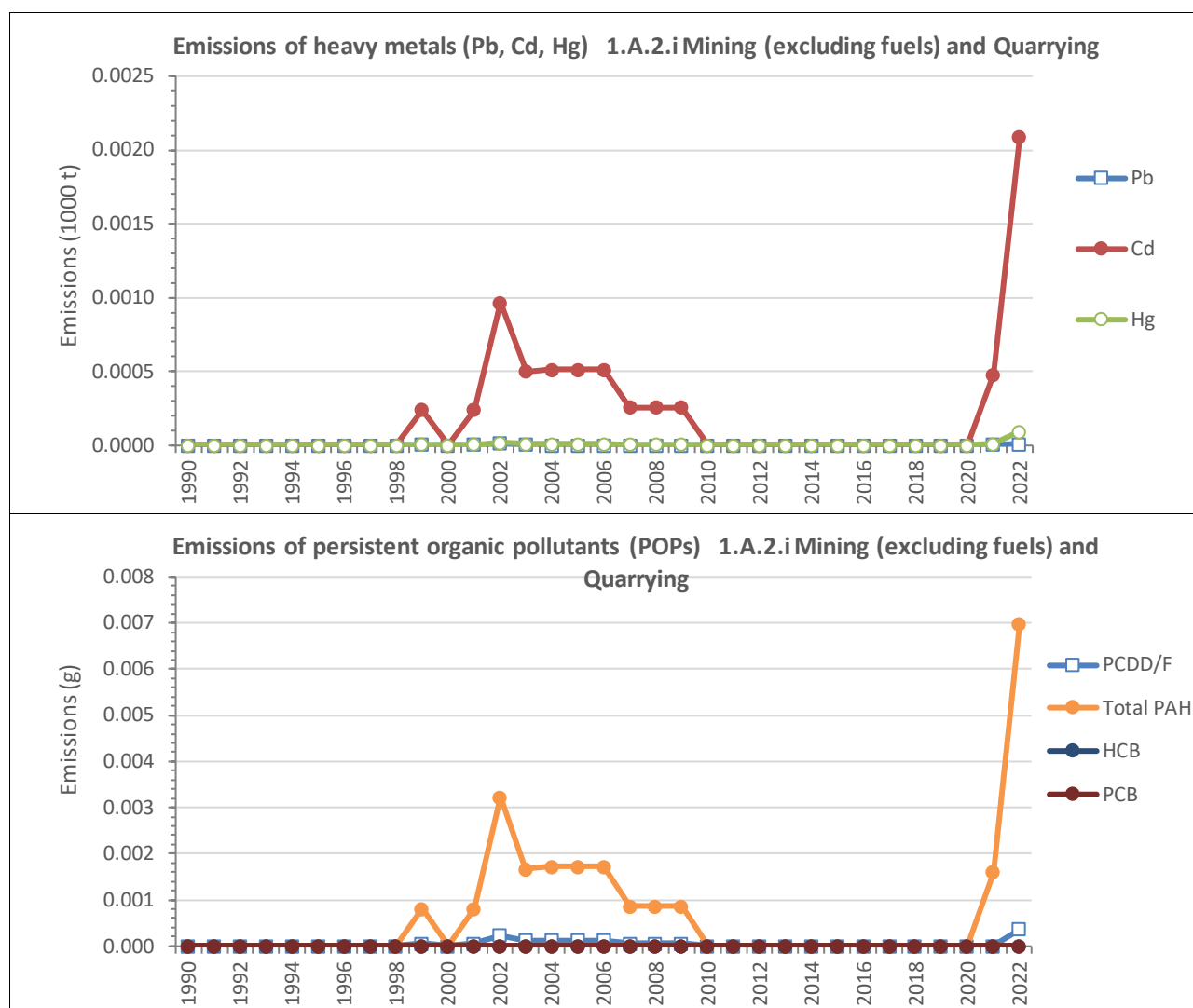


Figure 3.25 Emissions from category 1.A.2.i Mining (excluding fuels) and quarrying

Table 3.129 Emissions of main pollutants (NO_x, SO₂, NMVOC, CO and NH₃) from category 1.A.2.i Mining (excluding fuels) and quarrying

Emissions	NO _x	NMVOC	SO _x	CO	NH ₃
	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	IE	IE	IE	IE	NA
1997	IE	IE	IE	IE	NA
1998	IE	IE	IE	IE	NA
1999	0.021	0.001	0.002	0.003	NA
2000	IE	IE	IE	IE	NA
2001	0.021	0.001	0.002	0.003	NA
2002	0.082	0.004	0.008	0.011	NA
2003	0.043	0.002	0.004	0.005	NA
2004	0.044	0.002	0.004	0.006	NA
2005	0.044	0.002	0.004	0.006	NA
2006	0.044	0.002	0.004	0.006	NA
2007	0.022	0.001	0.002	0.003	NA
2008	0.022	0.001	0.002	0.003	NA
2009	0.022	0.001	0.002	0.003	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	IE	IE	IE	IE	NA
2015	IE	IE	IE	IE	NA
2016	IE	IE	IE	IE	NA
2017	IE	IE	IE	IE	NA
2018	IE	IE	IE	IE	NA
2019	IE	IE	IE	IE	NA
2020	IE	IE	IE	IE	NA
2021	0.041	0.002	0.004	0.005	NA
2022	0.185	0.011	0.016	0.026	NA
Trend					
1990 – 2022	NA	NA	NA	NA	NA
2005 – 2022	321.7%	404.9%	307.8%	353.3%	NA
2021 – 2022	351.7%	440.7%	336.7%	385.6%	NA

Table 3.130 Emissions of particulate matter (PM) from category 1.A.2.i Mining (excluding fuels) and quarrying

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	0.001	0.001	0.001	<0.001
2000	IE	IE	IE	IE
2001	0.001	0.001	0.001	<0.001
2002	0.003	0.003	0.003	0.002
2003	0.002	0.002	0.002	0.001
2004	0.002	0.002	0.002	0.001
2005	0.002	0.002	0.002	0.001
2006	0.002	0.002	0.002	0.001
2007	0.001	0.001	0.001	<0.001
2008	0.001	0.001	0.001	<0.001
2009	0.001	0.001	0.001	<0.001
2010	IE	IE	IE	IE
2011	IE	IE	IE	IE
2012	IE	IE	IE	IE
2013	IE	IE	IE	IE
2014	IE	IE	IE	IE
2015	IE	IE	IE	IE
2016	IE	IE	IE	IE
2017	IE	IE	IE	IE
2018	IE	IE	IE	IE
2019	IE	IE	IE	IE
2020	IE	IE	IE	IE
2021	0.002	0.002	0.002	0.001
2022	0.007	0.007	0.007	0.004
Trend				
1990 – 2022	NA	NA	NA	NA
2005 – 2022	310.4%	310.4%	310.4%	306.6%
2021 – 2022	339.6%	339.6%	339.6%	335.5%

Table 3.131 Emissions of Heavy Metals (HM) from category 1.A.2.i Mining (excluding fuels) and quarrying

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	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
2000	IE	IE	IE	IE	IE	IE	IE	IE	IE
2001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
2002	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.005
2003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002
2004	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002
2005	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002
2006	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002
2007	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
2008	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
2009	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
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	IE	IE	IE	IE	IE	IE	IE	IE	IE
2015	IE	IE	IE	IE	IE	IE	IE	IE	IE
2016	IE	IE	IE	IE	IE	IE	IE	IE	IE
2017	IE	IE	IE	IE	IE	IE	IE	IE	IE
2018	IE	IE	IE	IE	IE	IE	IE	IE	IE
2019	IE	IE	IE	IE	IE	IE	IE	IE	IE
2020	IE	IE	IE	IE	IE	IE	IE	IE	IE
2021	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002
2022	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.010
Trend									
1990 – 2022	NA	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	>10000%	306.3%	788.6%	663.6%	313.2%	307.5%	480.4%	362.8%	308.9%
2021 – 2022	26.1%	335.1%	851.8%	717.8%	342.6%	336.5%	521.7%	395.6%	338.0%

Table 3.132 Emissions of Persistent Organic Pollutants (POPs) from category 1.A.2.i Mining (excluding fuels) and quarrying

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	IE	IE	IE	NA	NA
1991	IE	IE	IE	IE	IE	IE	NA	NA
1992	IE	IE	IE	IE	IE	IE	NA	NA
1993	IE	IE	IE	IE	IE	IE	NA	NA
1994	IE	IE	IE	IE	IE	IE	NA	NA
1995	IE	IE	IE	IE	IE	IE	NA	NA
1996	IE	IE	IE	IE	IE	IE	NA	NA
1997	IE	IE	IE	IE	IE	IE	NA	NA
1998	IE	IE	IE	IE	IE	IE	NA	NA
1999	<0.001	<0.001	0.001	<0.001	<0.001	0.001	<0.001	NA
2000	IE	IE	IE	IE	IE	IE	NA	NA
2001	<0.001	<0.001	0.001	<0.001	<0.001	0.001	NA	NA
2002	<0.001	<0.001	0.002	<0.001	<0.001	0.003	NA	NA
2003	<0.001	<0.001	0.001	<0.001	<0.001	0.002	NA	NA
2004	<0.001	<0.001	0.001	<0.001	<0.001	0.002	NA	NA
2005	<0.001	<0.001	0.001	<0.001	<0.001	0.002	NA	NA
2006	<0.001	<0.001	0.001	<0.001	<0.001	0.002	NA	NA
2007	<0.001	<0.001	0.001	<0.001	<0.001	0.001	NA	NA
2008	<0.001	<0.001	0.001	<0.001	<0.001	0.001	NA	NA
2009	<0.001	<0.001	0.001	<0.001	<0.001	0.001	NA	NA
2010	IE	IE	IE	IE	IE	IE	NA	NA
2011	IE	IE	IE	IE	IE	IE	NA	NA
2012	IE	IE	IE	IE	IE	IE	NA	NA
2013	IE	IE	IE	IE	IE	IE	NA	NA
2014	IE	IE	IE	IE	IE	IE	NA	NA
2015	IE	IE	IE	IE	IE	IE	NA	NA
2016	IE	IE	IE	IE	IE	IE	NA	NA
2017	IE	IE	IE	IE	IE	IE	NA	NA
2018	IE	IE	IE	IE	IE	IE	NA	NA
2019	IE	IE	IE	IE	IE	IE	NA	NA
2020	IE	IE	IE	IE	IE	IE	NA	NA
2021	IE	<0.001	0.001	<0.001	<0.001	0.002	NA	NA
2022	<0.001	0.001	0.005	0.001	0.001	0.007	NA	NA
Trend								
1990 – 2022	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	203.2%	306.2%	306.2%	306.2%	306.2%	306.2%	NA	NA
2021 – 2022	NA	335.1%	335.1%	335.1%	335.1%	335.1%	NA	NA

3.1.3.11.2 Methodological issues

3.1.3.11.2.1 Choice of methods

For estimating the air pollutants emissions the Tier 1 approach³⁷ of the EMEP/EEA air pollutant emission inventory guidebook 2023 has been applied:

Equation: emissions from stationary combustion

$$\text{Emissions}_{\text{pollutant}} = \text{Fuel Consumption}_{\text{fuel}} \times \text{Emission Factor}_{\text{pollutant. fuel}}$$

Where:

Emissions _{pollutant}	= emissions of a given pollutant by type of fuel (kg pollutant)
Fuel consumption _{fuel}	= amount of fuel combusted (TJ)
Emission factor _{pollutant. fuel}	= default emission factor of a given pollutant by type of fuel (g _{pollutant} /GJ).
Pollutant	= main pollutants: NO _x , CO, NMVOC, SO ₂ particulate matter: TSP, PM ₁₀ , PM _{2.5} , 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

3.1.3.11.2.2 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"> Gas/Diesel Oil Motor gasoline Residual Fuel oil 	Summary of fuel aggregations at Tier 1 according to EMEP/EEA air pollutant emission inventory guidebook 2023. Part B. Chapter 1.A.2.

Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2022 were taken from prepared by Albanian Institute of Statistics (INSTAT).

³⁷ Source: EMEP/EEA air pollutant emission inventory guidebook 2023. 1.A.2 Manufacturing industries and construction (combustion). sub-chapter 3.2 Tier 1 default approach.

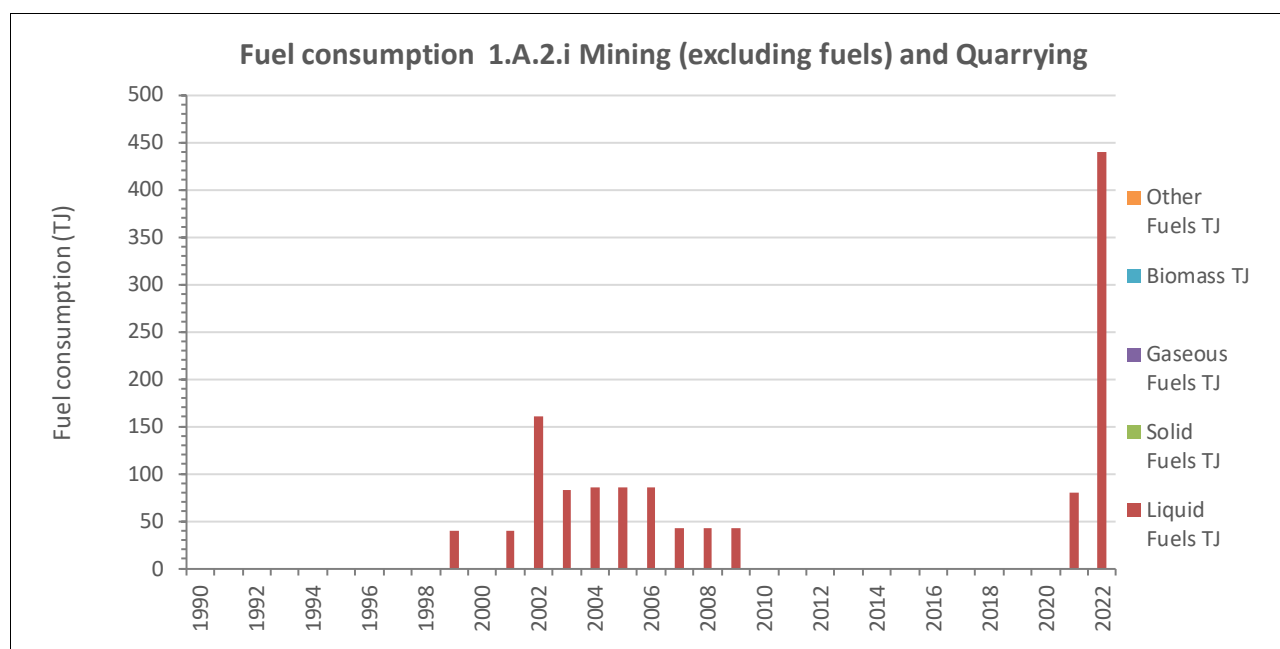


Figure 3.26 Activity data for category 1.A.2.i Mining (excluding fuels) and quarrying

Table 3.133 Activity data for 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
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	40.19	40.19	NO	NO	NO	NO	NO
2000	IE	IE	NO	NO	NO	NO	NO
2001	40.19	40.19	NO	NO	NO	NO	NO
2002	160.77	160.77	NO	NO	NO	NO	NO
2003	82.99	82.99	NO	NO	NO	NO	NO
2004	85.60	85.60	NO	NO	NO	NO	NO
2005	85.60	85.60	NO	NO	NO	NO	NO
2006	85.60	85.60	NO	NO	NO	NO	NO
2007	42.80	42.80	NO	NO	NO	NO	NO
2008	42.80	42.80	NO	NO	NO	NO	NO
2009	42.80	42.80	NO	NO	NO	NO	NO
2010	IE	IE	NO	NO	NO	NO	NO
2011	IE	IE	NO	NO	NO	NO	NO
2012	IE	IE	NO	NO	NO	NO	NO

Activity data 1.A.2.i	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
2013	IE	IE	NO	NO	NO	NO	NO
2014	IE	IE	NO	NO	NO	NO	NO
2015	IE	IE	NO	NO	NO	NO	NO
2016	IE	IE	NO	NO	NO	NO	NO
2017	IE	IE	NO	NO	NO	NO	NO
2018	IE	IE	NO	NO	NO	NO	NO
2019	IE	IE	NO	NO	NO	NO	NO
2020	IE	IE	NO	NO	NO	NO	NO
2021	79.92	79.92	NO	NO	NO	NO	NO
2022	439.50	439.50	NO	NO	NO	NO	NO
Trend							
1990 – 2022	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	413.4%	413.4%	NA	NA	NA	NA	NA
2021 – 2022	449.9%	449.9%	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 category 1.A.2.i *Mining (excluding fuels) and quarrying*.

Table 3.134 Net calorific values (NCVs) applied for conversion to energy units in category 1.A.2.i Mining (excluding fuels) and quarrying

Fuel	Fuel type	Net calorific value (NCV)					
		NCV	unit	type	NCV	unit	type
Residual fuel oil	liquid	40.193	TJ/Gg	CS	40.4	TJ/Gg	D
Gas/Diesel Oil (Non-bio)	liquid	43.292	TJ/Gg	CS	47.3	TJ/Gg	D
Gasoline	liquid	44.799	TJ/Gg	CS	44.3	TJ/Gg	D
					for comparision		
Source		Eurostat (2023): Complete energy balances (Code: nrg_bal_c)			2006 IPCC guidelines, Vol. 2, Chapter 1, Table 1.2		
Note:							
D	Default	CS	Country specific		PS	Plant specific	

3.1.3.11.2.3 Choice of emission factors

Default emission factors for air pollutant were taken from the EMEP/EEA air pollutant emission inventory guidebook 2023 and are presented in the following table.

Table 3.135 Emission factors (EF) for Main pollutants, Particulate Matter (PM), Heavy metals (HM) and Persistent Organic Pollutants (POPs) for category 1.A.2.i Mining (excluding fuels) and quarrying

Fuel Type	UNIT	Liquid fuels	
Associated fuel types		Gas/Diesel Oil Residual fuel oil, (LPG), Petroleum Coke	
Pollutant		EF	type
NOx	g/GJ	513.0	D
CO	g/GJ	66	D
NMVOC	g/GJ	25	D
SOx	g/GJ	47	D
TSP	g/GJ	20	D
NH3	g/GJ	NA	
PM10	g/GJ	20	D
PM2.5	g/GJ	20	D
BC	% of PM2.5	56	D
Pb	mg/GJ	0.08	D
Cd	mg/GJ	0.006	D
Hg	mg/GJ	0.12	D
As	mg/GJ	0.03	D
Cr	mg/GJ	0.2	D
Cu	mg/GJ	0.22	D
Ni	mg/GJ	0.008	D
Se	mg/GJ	0.11	D
Zn	mg/GJ	29	D
PCB	ng WHO-TEG/GJ	NA	D
PCDD/F	ng I-TEQ/GJ	1.4	D
Benzo(a)pyrene	µg/GJ	0.0019	D
Benzo(b)fluoranthene	µg/GJ	0.015	D
Benzo(k)fluoranthene	µg/GJ	0.0017	D
Indeno(1,2,3-cd)pyrene	µg/GJ	0.0015	D
HCB	µg/GJ	NA	D
Source		Table 3-4, Section 3.2.2. page 17.	
		EMEP/EEA air pollutant emission inventory guidebook 2023. Part B. Chapter 1.A.2 Manufacturing industries and construction (combustion).	
Note:			
D	Default	CS	Country specific
		PS	Plant specific
		IEF	Implied emission factor

3.1.3.11.3 Uncertainties and time-series consistency

The uncertainties for activity data and emission factors used for IPCC/NFR category 1.A.2.i *Mining (excluding fuels) and quarrying* are presented in the following table.

Table 3.136 Uncertainty for category 1.A.2.i *Mining (excluding fuels) and quarrying*.

Uncertainty	Solid fuels	Gaseous fuels	Liquid fuels	Biomass	Reference
Activity data (AD)	5%	5%	5%	8%	Table 2.15. 2006 IPCC GL. Vol. 2. Chap. 2 (2.4.2)
Emission factor (EF)	Rating	Typical error range	Average	Reference	
NO _x	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 2023. Part A. Chapter 5 Uncertainties.	
CO	C	50% to 200%	125%		
NM VOC	D	100% to 300%	200%		
SO _x	A	10% to 30%	20%		
NH ₃	E	order of magnitude	750%		
TSP, PM ₁₀ , PM _{2.5} , 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)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.

3.1.3.11.4 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.

3.1.3.11.5 Source-specific recalculations

The following table presents the main revisions and recalculations done since the last submission and relevant to category 1.A.2.i *Mining (excluding fuels) and quarrying*.

Table 3.137 Recalculations done in category 1.A.2.i *Mining (excluding fuels) and quarrying*

source category	Revisions of data	Type of revision	Type of improvement
1.A.2.i	Revision of NCV by using country specific NCV	AD	Accuracy
1.A.2.i	Revision of activity data	AD	Accuracy

3.1.3.11.6 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 3.138 Planned improvements for category 1.A.2.i *Mining (excluding fuels) and quarrying*

source category	Planned improvement	Type of improvement		Priority
1.A.2.i	Investigation of fuels consumed by stationary equipments or off-road machinery	AD	Accuracy Transparency	High
1.A.2.i	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

3.1.3.12 Wood and wood products (NFR category 1.A.2.j)

3.1.3.12.1 Source category description

The IPCC category 1.A.2.j *Wood and wood products* includes Emissions resulting from fuel combustion activities grouped in

- ISIC Division 16 Manufacture of wood and of products of wood and cork (except furniture), and 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
 - Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials Quarrying

The Energy balance currently does not provide information on the consumption of fuels in activities under *Manufacture of wood and of products of wood and cork (except furniture), and manufacture of articles of straw and plaiting materials*. However, as there are such activities in Albania, fuel combustion in this sector can be assumed. Therefore the notation key IE (included elsewhere) was used.

3.1.3.12.2 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 3.139 Planned improvements for category 1.A.2.j Wood and wood products

Source category	Planned improvement	Type of improvement		Priority
1.A.2.j	Investigation if this activity does occur in Albania. 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

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

3.1.3.13.1 Source category description

This section describes emissions resulting from fuel combustion activities in Manufacturing Industries and Construction – **Construction** -. The subcategory 1.A.2.k *Construction* includes Emissions resulting from fuel combustion activities in

- ISIC Division 41 Construction of buildings
- Division 42 Civil engineering
 - Construction of roads and railways
 - Construction of utility projects
 - Construction of other civil engineering projects
- Division 43 Specialized construction activities
 - Demolition and site preparation
 - Electrical, plumbing and heat and air-conditioning installation, and other construction installation activities
 - Building completion and finishing
 - Other specialized construction activities Manufacture

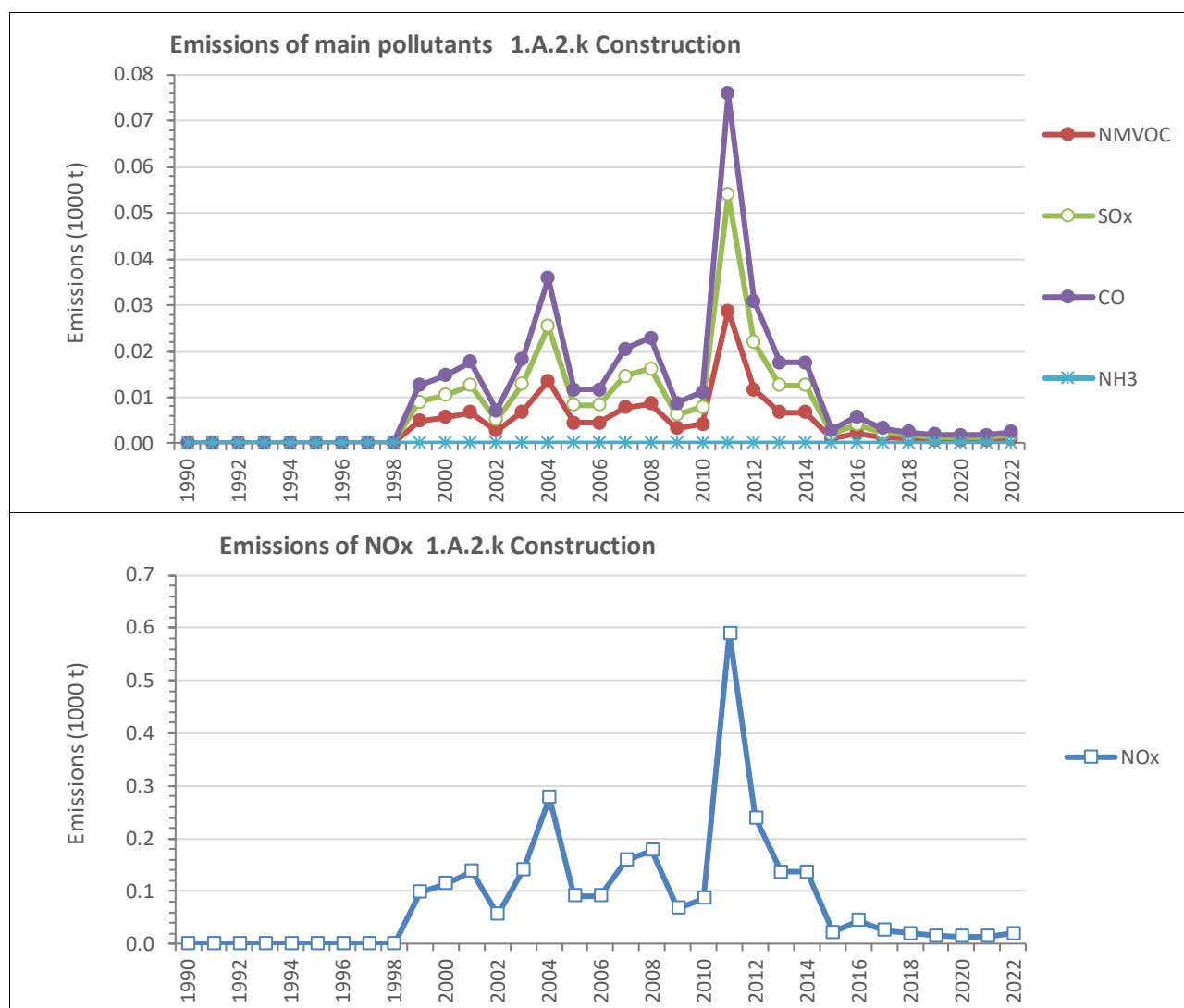
Table 3.140 Overview on reported emissions from sub categories 1.A.2.k Construction

Air pollutants	1.A.2.k						Key category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
NOx	✓	NO	NO	NO	NO	NO	-
CO	✓	NO	NO	NO	NO	NO	-
NMVOC	✓	NO	NO	NO	NO	NO	-
SOx	✓	NO	NO	NO	NO	NO	-
NH3	NA	NO	NO	NO	NO	NO	-
TSP	✓	NO	NO	NO	NO	NO	-
PM10	✓	NO	NO	NO	NO	NO	-
PM2.5	✓	NO	NO	NO	NO	NO	-
BC	✓	NO	NO	NO	NO	NO	-
Pb	✓	NO	NO	NO	NO	NO	-
Cd	✓	NO	NO	NO	NO	NO	-
Hg	✓	NO	NO	NO	NO	NO	-
As	✓	NO	NO	NO	NO	NO	-
Cr	✓	NO	NO	NO	NO	NO	-
Cu	✓	NO	NO	NO	NO	NO	-
Ni	✓	NO	NO	NO	NO	NO	-
Se	✓	NO	NO	NO	NO	NO	-
Zn	✓	NO	NO	NO	NO	NO	-
PCB	NA	NO	NO	NO	NO	NO	-
PCDD/F	✓	NO	NO	NO	NO	NO	-
PAH	✓	NO	NO	NO	NO	NO	-
HCB	NA	NO	NO	NO	NO	NO	-

Air pollutants	1.A.2.k						Key category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
A ‘✓’ indicates: emissions from this 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 category 1.A.2.k *Construction* is provided in the following figures and tables:

- annual emissions of air pollutants;
- Trend of the periods 1990 – 2022, 2005 – 2022, 2021 – 2022.



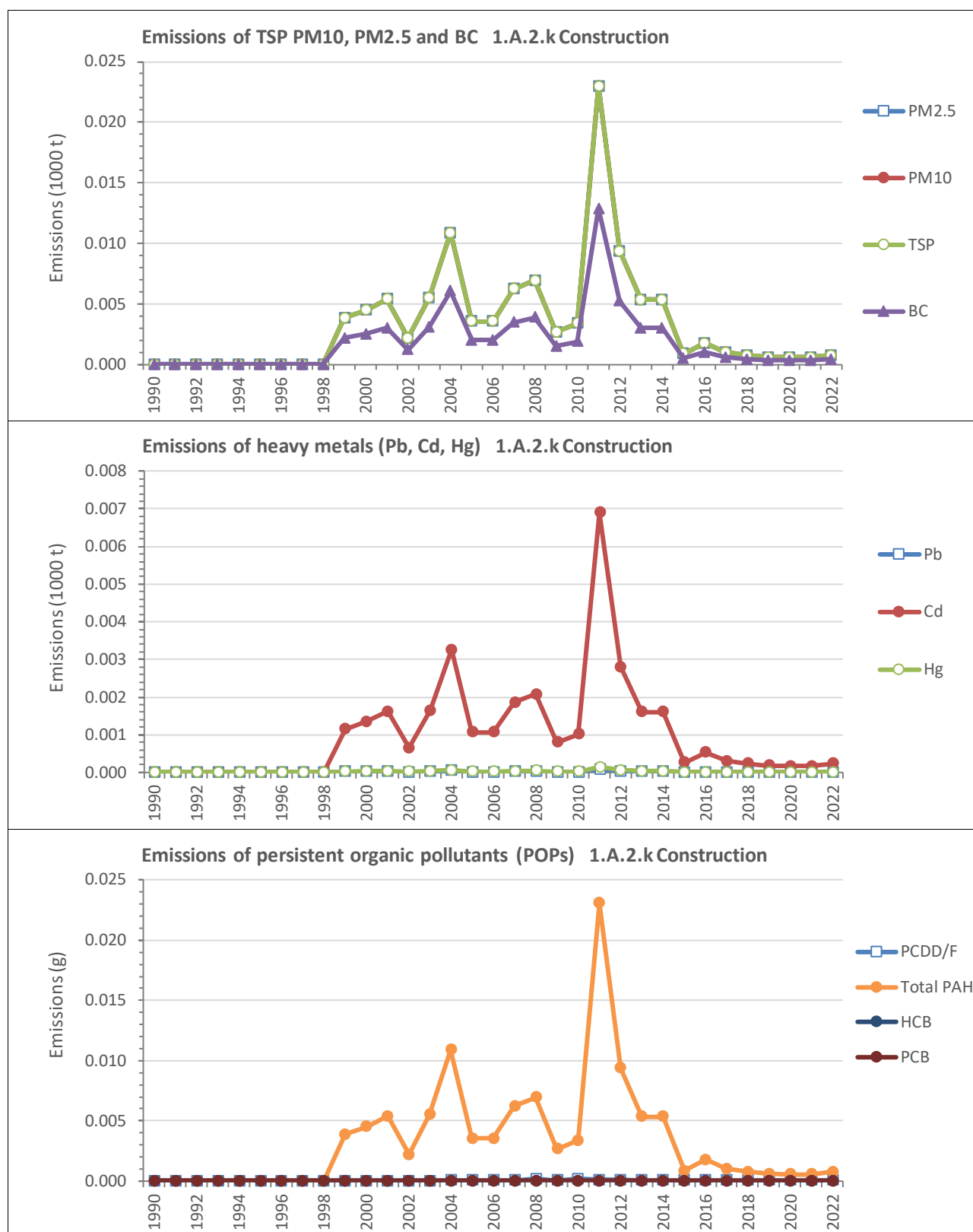


Figure 3.27 Emissions from category 1.A.2.k Construction

Table 3.141 Emissions of main pollutants (NO_x, SO₂, NMVOC, CO and NH₃) from category 1.A.2.k Construction

Emissions	NO _x	NMVOC	SO _x	CO	NH ₃
	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	IE	IE	IE	IE	NA
1997	IE	IE	IE	IE	NA
1998	IE	IE	IE	IE	NA
1999	0.098	0.005	0.009	0.013	NA
2000	0.115	0.006	0.011	0.015	NA
2001	0.138	0.007	0.013	0.018	NA
2002	0.056	0.003	0.005	0.007	NA
2003	0.141	0.007	0.013	0.018	NA
2004	0.278	0.014	0.025	0.036	NA
2005	0.091	0.004	0.008	0.012	NA
2006	0.091	0.004	0.008	0.012	NA
2007	0.159	0.008	0.015	0.020	NA
2008	0.177	0.009	0.016	0.023	NA
2009	0.068	0.003	0.006	0.009	NA
2010	0.086	0.004	0.008	0.011	NA
2011	0.589	0.029	0.054	0.076	NA
2012	0.240	0.012	0.022	0.031	NA
2013	0.137	0.007	0.013	0.018	NA
2014	0.137	0.007	0.013	0.018	NA
2015	0.022	0.001	0.002	0.003	NA
2016	0.045	0.002	0.004	0.006	NA
2017	0.026	0.001	0.002	0.003	NA
2018	0.020	0.001	0.002	0.003	NA
2019	0.015	0.001	0.001	0.002	NA
2020	0.014	0.001	0.001	0.002	NA
2021	0.014	0.001	0.001	0.002	NA
2022	0.020	0.001	0.002	0.003	NA
Trend					
1990 – 2022	NA	NA	NA	NA	NA
2005 – 2022	-78.5%	-78.5%	-78.5%	-78.5%	NA
2021 – 2022	-26.5%	-26.5%	-26.5%	-26.5%	NA

Table 3.142 Emissions of particulate matter (PM) from category 1.A.2.k *Construction*

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	0.004	0.004	0.004	0.002
2000	0.004	0.004	0.004	0.003
2001	0.005	0.005	0.005	0.003
2002	0.002	0.002	0.002	0.001
2003	0.006	0.006	0.006	0.003
2004	0.011	0.011	0.011	0.006
2005	0.004	0.004	0.004	0.002
2006	0.004	0.004	0.004	0.002
2007	0.006	0.006	0.006	0.003
2008	0.007	0.007	0.007	0.004
2009	0.003	0.003	0.003	0.001
2010	0.003	0.003	0.003	0.002
2011	0.023	0.023	0.023	0.013
2012	0.009	0.009	0.009	0.005
2013	0.005	0.005	0.005	0.003
2014	0.005	0.005	0.005	0.003
2015	0.001	0.001	0.001	<0.001
2016	0.002	0.002	0.002	0.001
2017	0.001	0.001	0.001	0.001
2018	0.001	0.001	0.001	<0.001
2019	0.001	0.001	0.001	<0.001
2020	0.001	0.001	0.001	<0.001
2021	0.001	0.001	0.001	<0.001
2022	0.001	0.001	0.001	<0.001
Trend				
1990 – 2022	NA	NA	NA	NA
2005 – 2022	-78.5%	-78.5%	-78.5%	-78.5%
2021 – 2022	-26.5%	-26.5%	-26.5%	-26.5%

Table 3.143 Emissions of Heavy Metals (HM) from category 1.A.2.k Construction

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	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.006
2000	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.006
2001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.008
2002	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003
2003	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.008
2004	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.016
2005	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.005
2006	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.005
2007	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.009
2008	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.010
2009	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004
2010	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.005
2011	<0.001	0.007	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.033
2012	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.014
2013	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.008
2014	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.008
2015	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
2016	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003
2017	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
2018	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
2019	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
2020	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
2021	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
2022	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
Trend									
1990 – 2022	NA	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	-100.0%	-78.5%	-78.5%	-78.5%	-78.5%	-78.5%	-78.5%	-78.5%	-78.5%
2021 – 2022	-26.5%	-26.5%	-26.5%	-26.5%	-26.5%	-26.5%	-26.5%	-26.5%	-26.5%

Table 3.144 Emissions of Persistent Organic Pollutants (POPs) from category 1.A.2.k Construction

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	IE	IE	IE	NA	NA
1991	IE	IE	IE	IE	IE	IE	NA	NA
1992	IE	IE	IE	IE	IE	IE	NA	NA
1993	IE	IE	IE	IE	IE	IE	NA	NA
1994	IE	IE	IE	IE	IE	IE	NA	NA
1995	IE	IE	IE	IE	IE	IE	NA	NA
1996	IE	IE	IE	IE	IE	IE	NA	NA
1997	IE	IE	IE	IE	IE	IE	NA	NA
1998	IE	IE	IE	IE	IE	IE	NA	NA
1999	IE	0.000	0.003	0.000	0.000	0.004	NA	NA
2000	IE	0.000	0.003	0.000	0.000	0.005	NA	NA
2001	IE	0.001	0.004	0.000	0.000	0.005	NA	NA
2002	IE	0.000	0.002	0.000	0.000	0.002	NA	NA
2003	IE	0.001	0.004	0.000	0.000	0.006	NA	NA
2004	0.000	0.001	0.008	0.001	0.001	0.011	NA	NA
2005	0.000	0.000	0.003	0.000	0.000	0.004	NA	NA
2006	0.000	0.000	0.003	0.000	0.000	0.004	NA	NA
2007	0.000	0.001	0.005	0.001	0.000	0.006	NA	NA
2008	0.000	0.001	0.005	0.001	0.001	0.007	NA	NA
2009	0.000	0.000	0.002	0.000	0.000	0.003	NA	NA
2010	0.000	0.000	0.003	0.000	0.000	0.003	NA	NA
2011	0.000	0.002	0.017	0.002	0.002	0.023	NA	NA
2012	0.000	0.001	0.007	0.001	0.001	0.009	NA	NA
2013	0.000	0.001	0.004	0.000	0.000	0.005	NA	NA
2014	0.000	0.001	0.004	0.000	0.000	0.005	NA	NA
2015	0.000	0.000	0.001	0.000	0.000	0.001	NA	NA
2016	0.000	0.000	0.001	0.000	0.000	0.002	NA	NA
2017	0.000	0.000	0.001	0.000	0.000	0.001	NA	NA
2018	0.000	0.000	0.001	0.000	0.000	0.001	NA	NA
2019	0.000	0.000	0.000	0.000	0.000	0.001	NA	NA
2020	0.000	0.000	0.000	0.000	0.000	0.001	NA	NA
2021	0.000	0.000	0.000	0.000	0.000	0.001	NA	NA
2022	0.000	0.000	0.001	0.000	0.000	0.001	NA	NA
Trend								
1990 – 2022	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	-10.8%	-78.5%	-78.5%	-78.5%	-78.5%	-78.5%	NA	NA
2021 – 2022	-26.5%	-26.5%	-26.5%	-26.5%	-26.5%	-26.5%	NA	NA

3.1.3.13.2 Methodological issues

3.1.3.13.2.1 Choice of methods

For estimating the air pollutants emissions the Tier 1 approach³⁸ of the EMEP/EEA air pollutant emission inventory guidebook 2023 has been applied:

Equation: emissions from stationary combustion

$$\text{Emissions}_{\text{pollutant}} = \text{Fuel Consumption}_{\text{fuel}} \times \text{Emission Factor}_{\text{pollutant. fuel}}$$

Where:

Emissions _{pollutant}	= emissions of a given pollutant by type of fuel (kg pollutant)
Fuel consumption _{fuel}	= amount of fuel combusted (TJ)
Emission factor _{pollutant. fuel}	= default emission factor of a given pollutant by type of fuel (g _{pollutant} /GJ).
Pollutant	= main pollutants: NO _x , CO, NMVOC, SO ₂ particulate matter: TSP, PM ₁₀ , PM _{2.5} , 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

3.1.3.13.2.2 Choice of activity data

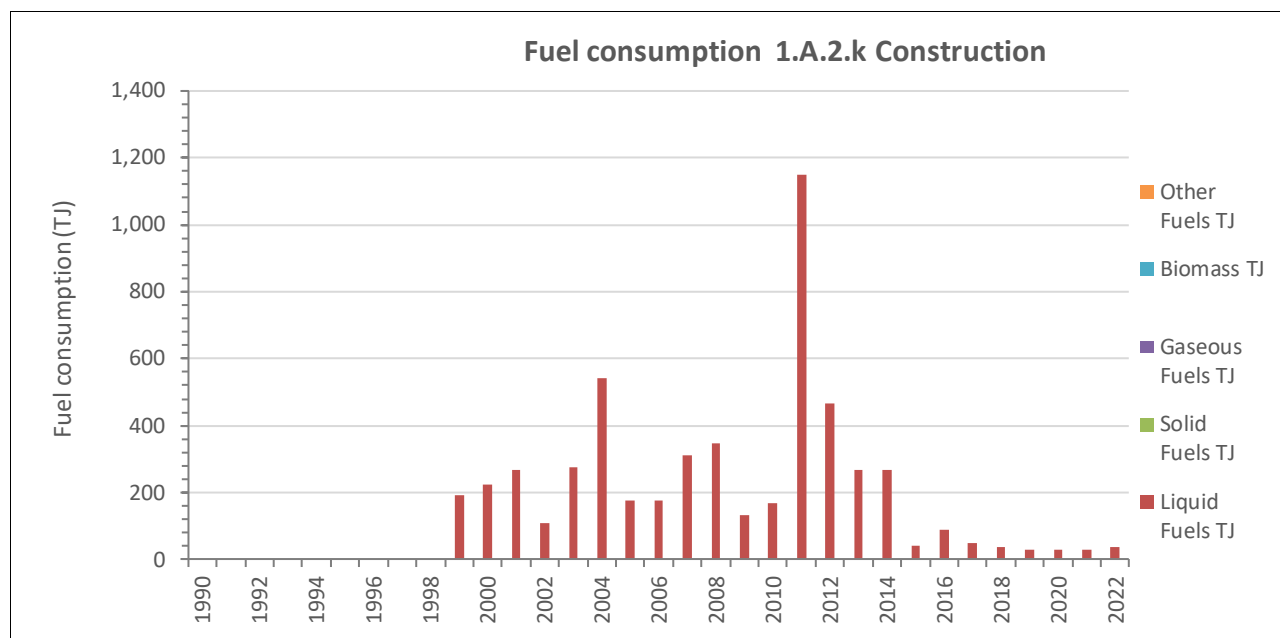


Figure 3.28 Activity data for category 1.A.2.k Construction

³⁸ Source: EMEP/EEA air pollutant emission inventory guidebook 2023. 1.A.2 Manufacturing industries and construction (combustion). sub-chapter 3.2 Tier 1 default approach.

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"> Gas/Diesel Oil Motor gasoline Residual fuel oil Other Other Petroleum Products Petroleum Coke 	Summary of fuel aggregations at Tier 1 according to EMEP/EEA air pollutant emission inventory guidebook 2023. Part B. Chapter 1.A.2.

Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2022 were taken from prepared by Albanian Institute of Statistics (INSTAT).

Table 3.145 Activity data for category 1.A.2.k Construction

Activity data 1.A.2.l	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	191.92	191.92	NO	NO	NO	NO	NO
2000	223.91	223.91	NO	NO	NO	NO	NO
2001	268.71	268.71	NO	NO	NO	NO	NO
2002	108.77	108.77	NO	NO	NO	NO	NO
2003	275.16	275.16	NO	NO	NO	NO	NO
2004	541.87	541.87	NO	NO	NO	NO	NO
2005	177.20	177.20	NO	NO	NO	NO	NO
2006	177.20	177.20	NO	NO	NO	NO	NO
2007	310.40	310.40	NO	NO	NO	NO	NO
2008	345.98	345.98	NO	NO	NO	NO	NO
2009	132.40	132.40	NO	NO	NO	NO	NO
2010	167.99	167.99	NO	NO	NO	NO	NO
2011	1,148.77	1,148.77	NO	NO	NO	NO	NO
2012	467.04	467.04	NO	NO	NO	NO	NO
2013	266.71	266.71	NO	NO	NO	NO	NO
2014	266.71	266.71	NO	NO	NO	NO	NO

Activity data 1.A.2.l	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
2015	42.80	42.80	NO	NO	NO	NO	NO
2016	87.60	87.60	NO	NO	NO	NO	NO
2017	50.01	50.01	NO	NO	NO	NO	NO
2018	38.05	38.05	NO	NO	NO	NO	NO
2019	29.53	29.53	NO	NO	NO	NO	NO
2020	28.03	28.03	NO	NO	NO	NO	NO
2021	28.03	28.03	NO	NO	NO	NO	NO
2022	38.17	38.17	NO	NO	NO	NO	NO
Trend							
1990 – 2022	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	-78.5%	-78.5%	NA	NA	NA	NA	NA
2021 – 2022	-26.5%	-26.5%	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 category 1.A.2.l *Textile and Leather*.

Table 3.146 Net calorific values (NCVs) applied for conversion to energy units in category 1.A.2.k Construction.

Fuel	Fuel type	Net calorific value (NCV)					
		NCV	unit	type	NCV	unit	type
Motor gasoline	liquid	44.799	TJ/Gg	CS	44.3	TJ/Gg	D
Gas/Diesel Oil (Non-bio)	liquid	43.292	TJ/Gg	CS	47.3	TJ/Gg	D
Petroleum coke	liquid	46.89	TJ/Gg	CS	32.5	TJ/Gg	D
Other Oil - Other Petroleum Products	liquid	40.2	TJ/Gg	CS	40.2	TJ/Gg	D
					for comparison		
Source		Eurostat (2023): Complete energy balances (Code: nrg_bal_c)			2006 IPCC guidelines, Vol. 2, Chapter 1, Table 1.2		
Note:							
D	Default	CS	Country specific		PS	Plant specific	

3.1.3.13.2.3 Choice of emission factors

Default emission factors for air pollutant were taken from the EMEP/EEA air pollutant emission inventory guidebook 2023 and are presented in the following table.

Table 3.147 Emission factors (EF) for Main pollutants, Particulate Matter (PM), Heavy metals (HM) and Persistent Organic Pollutants (POPs) for category 1.A.2.k Construction.

Fuel Type	UNIT	Liquid fuels	
Associated fuel types		Gas/Diesel Oil Residual fuel oil, (LPG), Petroleum Coke	
Pollutant		EF	type
NOx	g/GJ	513.0	D
CO	g/GJ	66	D
NMVOC	g/GJ	25	D
SOx	g/GJ	47	D
TSP	g/GJ	20	D
NH3	g/GJ	NA	
PM10	g/GJ	20	D
PM2.5	g/GJ	20	D
BC	% of PM2.5	56	D
Pb	mg/GJ	0.08	D
Cd	mg/GJ	0.006	D
Hg	mg/GJ	0.12	D
As	mg/GJ	0.03	D
Cr	mg/GJ	0.2	D
Cu	mg/GJ	0.22	D
Ni	mg/GJ	0.008	D
Se	mg/GJ	0.11	D
Zn	mg/GJ	29	D
PCB	ng WHO-TEG/GJ	NA	D
PCDD/F	ng I-TEQ/GJ	1.4	D
Benzo(a)pyrene	µg/GJ	0.0019	D
Benzo(b)fluoranthene	µg/GJ	0.015	D
Benzo(k)fluoranthene	µg/GJ	0.0017	D
Indeno(1,2,3-cd)pyrene	µg/GJ	0.0015	D
HCB	µg/GJ	NA	D
Source		Table 3-4, Section 3.2.2. page 17.	
		EMEP/EEA air pollutant emission inventory guidebook 2023. Part B. Chapter 1.A.2 Manufacturing industries and construction (combustion).	
Note:			
D Default	CS Country specific	PS Plant specific	IEF Implied emission factor

3.1.3.13.3 Uncertainties and time-series consistency

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

Table 3.148 Uncertainty for category 1.A.2.k *Construction*.

Uncertainty	Solid fuels	Gaseous fuels	Liquid fuels	Biomass	Reference
Activity data (AD)	5%	5%	5%	8%	Table 2.15. 2006 IPCC GL. Vol. 2. Chap. 2 (2.4.2)
Emission factor (EF)	Rating	Typical error range	Average	Reference	
NO _x	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 2023. Part A. Chapter 5 Uncertainties.	
CO	C	50% to 200%	125%		
NM VOC	D	100% to 300%	200%		
SO _x	A	10% to 30%	20%		
NH ₃	E	order of magnitude	750%		
TSP, PM ₁₀ , PM _{2.5} , 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)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.

3.1.3.13.4 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.

3.1.3.13.5 Source-specific recalculations

The following table presents the main revisions and recalculations done since the last submission and relevant to category 1.A.2.k *Construction*.

Table 3.149 Recalculations done in category 1.A.2.k *Construction*

source category	Revisions of data	Type of revision	Type of improvement
1.A.2.l	Revision of NCV by using country specific NCV	AD	Accuracy
1.A.2.l	Revision of activity data	AD	Accuracy

3.1.3.13.6 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 3.150 Planned improvements for category 1.A.2.k *Construction*

source category	Planned improvement	Type of improvement		Priority
1.A.2k	Investigation of fuels consumed by stationary equipments or off-road machinery	AD	Accuracy Transparency	High
1.A.2.k	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

3.1.3.14 Textile and Leather (IPCC/NFR category 1.A.2.I)

3.1.3.14.1 Source category description

This section describes emissions resulting from fuel combustion activities in Manufacturing Industries and Construction - **Textile and Leather**-. The subcategory 1.A.2.I *Textile and Leather* includes Emissions resulting from fuel combustion activities in

- ISIC Division 13 Manufacture of textiles
 - Spinning, weaving and finishing of textiles
 - Manufacture of other textiles
 - Manufacture of knitted and crocheted fabrics, made-up textile articles (except apparel)
 - Manufacture of carpets and rugs, cordage, rope, twine and netting
 - Manufacture of other textiles n.e.c.
- Division 14 Manufacture of wearing apparel
 - Manufacture of wearing apparel, except fur apparel
 - Manufacture of articles of fur
 - Manufacture of knitted and crocheted apparel
- Division 15 Manufacture of leather and related products
 - Tanning and dressing of leather; manufacture of luggage, handbags, saddlery and harness; dressing and dyeing of fur
 - Manufacture of footwear

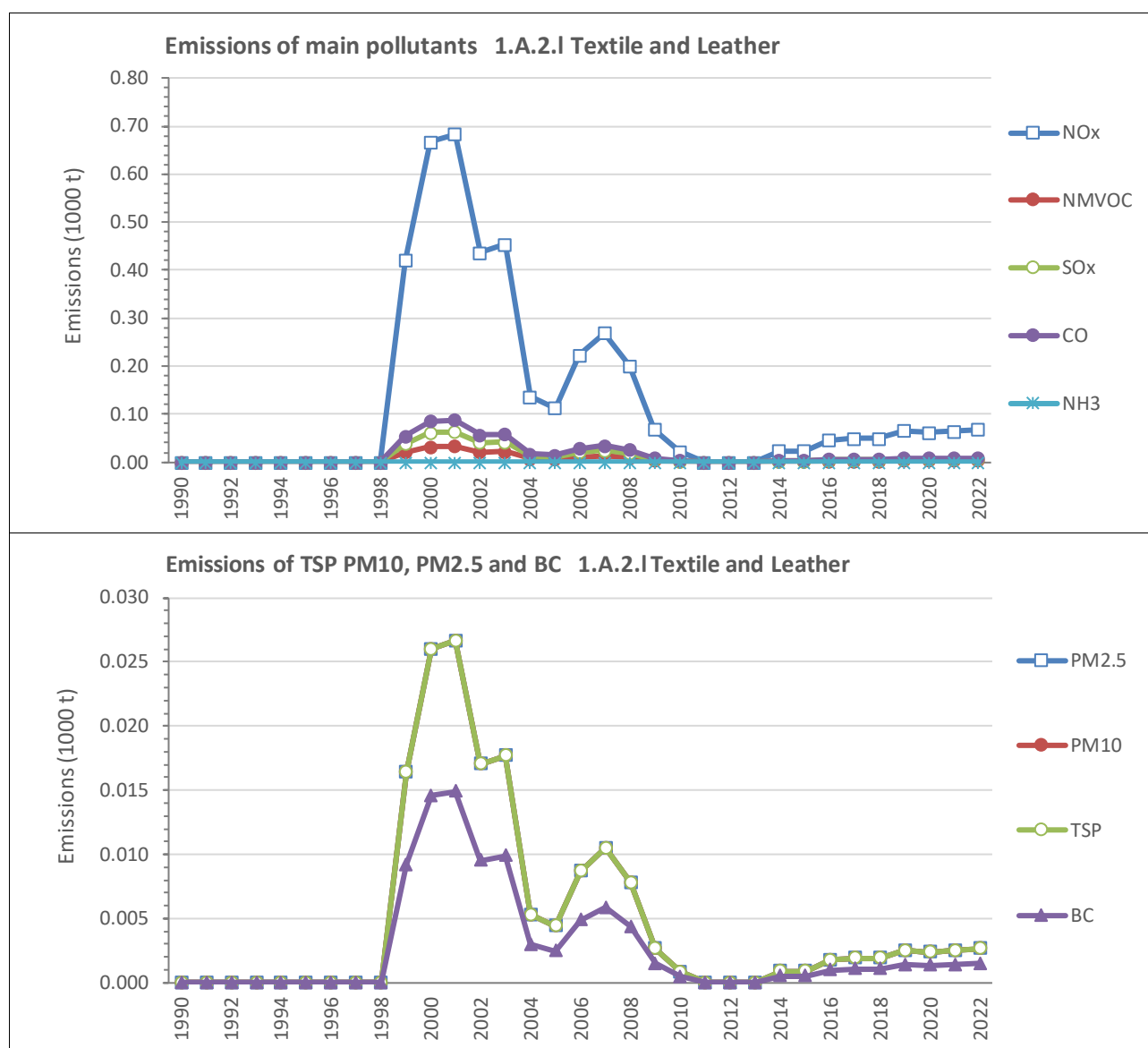
Table 3.151 Overview on reported emissions from sub categories 1.A.2.I *Textile and Leather*

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

Air pollutants	1.A.2.I						Key category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
PCDD/F	✓	NO	NO	NO	NO	NO	-
PAH	✓	NO	NO	NO	NO	NO	-
HCB	NA	NO	NO	NO	NO	NO	-
<p>A '✓' indicates: emissions from this category have been estimated.</p> <p>Notation keys: IE - included elsewhere. NO – not occurred. 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 fuel combustion in category 1.A.2.I *Textile and Leather* is provided in the following figures and tables:

- annual emissions of air pollutants;
- Trend of the periods 1990 – 2022, 2005 – 2022, 2021 – 2022.



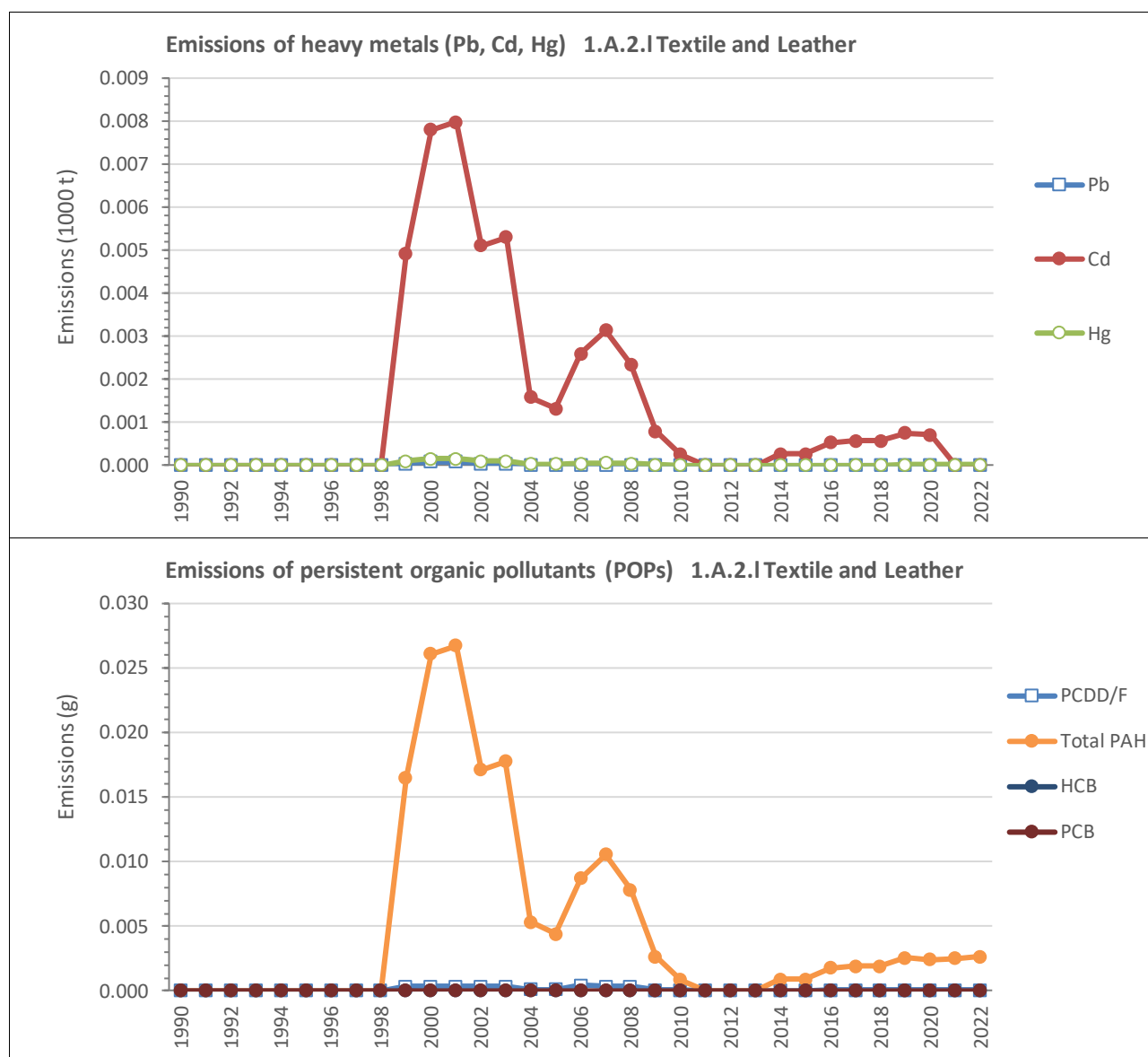


Figure 3.29 Emissions from category 1.A.2.I Textile and Leather

Table 3.152 Emissions of main pollutants (NO_x, SO₂, NMVOC, CO and NH₃) from category 1.A.2.I Textile and Leather

Emissions	NO _x	NMVOC	SO _x	CO	NH ₃
	Gg	Gg	Gg	Gg	Gg
1990	IE	IE	IE	IE	NO
1991	IE	IE	IE	IE	NO
1992	IE	IE	IE	IE	NO
1993	IE	IE	IE	IE	NO
1994	IE	IE	IE	IE	NO
1995	IE	IE	IE	IE	NO
1996	IE	IE	IE	IE	NO
1997	IE	IE	IE	IE	NO
1998	IE	IE	IE	IE	NO
1999	0.421	0.020	0.039	0.054	NO
2000	0.667	0.032	0.061	0.086	NO
2001	0.683	0.033	0.063	0.088	NO
2002	0.437	0.021	0.040	0.056	NO
2003	0.453	0.022	0.042	0.058	NO
2004	0.136	0.007	0.012	0.017	NO
2005	0.113	0.005	0.010	0.015	NO
2006	0.223	0.011	0.020	0.029	NO
2007	0.269	0.013	0.025	0.035	NO
2008	0.200	0.010	0.018	0.026	NO
2009	0.068	0.003	0.006	0.009	NO
2010	0.022	0.001	0.002	0.003	NO
2011	IE	IE	IE	IE	NO
2012	IE	IE	IE	IE	NO
2013	IE	IE	IE	IE	NO
2014	0.023	0.001	0.002	0.003	NO
2015	0.023	0.001	0.002	0.003	NO
2016	0.045	0.002	0.004	0.006	NO
2017	0.049	0.002	0.004	0.006	NO
2018	0.049	0.002	0.004	0.006	NO
2019	0.065	0.003	0.006	0.008	NO
2020	0.061	0.003	0.006	0.008	NO
2021	0.064	0.003	0.006	0.008	NO
2022	0.068	0.003	0.006	0.009	NO
Trend					
1990 – 2022	NA	NA	NA	NA	NA
2005 – 2022	-39.9%	-39.9%	-39.9%	-39.9%	NA
2021 – 2022	5.2%	5.2%	5.2%	5.2%	NA

Table 3.153 Emissions of particulate matter (PM) from category 1.A.2.I Textile and Leather

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	0.016	0.016	0.016	0.009
2000	0.026	0.026	0.026	0.015
2001	0.027	0.027	0.027	0.015
2002	0.017	0.017	0.017	0.010
2003	0.018	0.018	0.018	0.010
2004	0.005	0.005	0.005	0.003
2005	0.004	0.004	0.004	0.002
2006	0.009	0.009	0.009	0.005
2007	0.010	0.010	0.010	0.006
2008	0.008	0.008	0.008	0.004
2009	0.003	0.003	0.003	0.001
2010	0.001	0.001	0.001	0.000
2011	IE	IE	IE	IE
2012	IE	IE	IE	IE
2013	IE	IE	IE	IE
2014	0.001	0.001	0.001	0.001
2015	0.001	0.001	0.001	0.001
2016	0.002	0.002	0.002	0.001
2017	0.002	0.002	0.002	0.001
2018	0.002	0.002	0.002	0.001
2019	0.003	0.003	0.003	0.001
2020	0.002	0.002	0.002	0.001
2021	0.003	0.003	0.003	0.001
2022	0.003	0.003	0.003	0.001
Trend				
1990 – 2022	NA	NA	NA	NA
2005 – 2022	-39.9%	-39.9%	-39.9%	-39.9%
2021 – 2022	5.2%	5.2%	5.2%	5.2%

Table 3.154 Emissions of Heavy Metals (HM) from category 1.A.2.I Textile and Leather

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	<0.001	0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.024
2000	<0.001	0.008	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.038
2001	<0.001	0.008	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.039
2002	<0.001	0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.025
2003	<0.001	0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.026
2004	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.008
2005	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.006
2006	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.013
2007	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.015
2008	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.011
2009	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004
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	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	0.001
2015	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
2016	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003
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	0.003
2019	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004
2020	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003
2021	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004
2022	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004
Trend									
1990 – 2022	NA	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	>10000%	306.3%	788.6%	663.6%	313.2%	307.5%	480.4%	362.8%	308.9%
2021 – 2022	26.1%	335.1%	851.8%	717.8%	342.6%	336.5%	521.7%	395.6%	338.0%

Table 3.155 Emissions of Persistent Organic Pollutants (POPs) from category 1.A.2.I *Textile and Leather*

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	IE	IE	IE	NA	NA
1991	IE	IE	IE	IE	IE	IE	NA	NA
1992	IE	IE	IE	IE	IE	IE	NA	NA
1993	IE	IE	IE	IE	IE	IE	NA	NA
1994	IE	IE	IE	IE	IE	IE	NA	NA
1995	IE	IE	IE	IE	IE	IE	NA	NA
1996	IE	IE	IE	IE	IE	IE	NA	NA
1997	IE	IE	IE	IE	IE	IE	NA	NA
1998	IE	IE	IE	IE	IE	IE	NA	NA
1999	<0.001	0.002	0.012	0.001	0.001	0.016	NA	NA
2000	<0.001	0.002	0.019	0.002	0.002	0.026	NA	NA
2001	<0.001	0.003	0.020	0.002	0.002	0.027	NA	NA
2002	<0.001	0.002	0.013	0.001	0.001	0.017	NA	NA
2003	<0.001	0.002	0.013	0.002	0.001	0.018	NA	NA
2004	<0.001	0.001	0.004	<0.001	<0.001	0.005	NA	NA
2005	<0.001	<0.001	0.003	<0.001	<0.001	0.004	NA	NA
2006	<0.001	0.001	0.007	0.001	0.001	0.009	NA	NA
2007	<0.001	0.001	0.008	0.001	0.001	0.011	NA	NA
2008	<0.001	0.001	0.006	0.001	0.001	0.008	NA	NA
2009	<0.001	<0.001	0.002	<0.001	<0.001	0.003	NA	NA
2010	<0.001	<0.001	0.001	<0.001	<0.001	0.001	NA	NA
2011	IE	IE	IE	IE	IE	IE	NA	NA
2012	IE	IE	IE	IE	IE	IE	NA	NA
2013	IE	IE	IE	IE	IE	IE	NA	NA
2014	IE	<0.001	0.001	<0.001	<0.001	0.001	NA	NA
2015	IE	<0.001	0.001	<0.001	<0.001	0.001	NA	NA
2016	<0.001	<0.001	0.001	<0.001	<0.001	0.002	NA	NA
2017	<0.001	<0.001	0.001	<0.001	<0.001	0.002	NA	NA
2018	<0.001	<0.001	0.001	<0.001	<0.001	0.002	NA	NA
2019	<0.001	<0.001	0.002	<0.001	<0.001	0.003	NA	NA
2020	<0.001	<0.001	0.002	<0.001	<0.001	0.002	NA	NA
2021	<0.001	<0.001	0.002	<0.001	<0.001	0.003	NA	NA
2022	<0.001	<0.001	0.002	<0.001	<0.001	0.003	NA	NA
Trend								
1990 – 2022	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	-36.8%	-39.9%	-39.9%	-39.9%	-39.9%	-39.9%	NA	NA
2021 – 2022	36.1%	5.2%	5.2%	5.2%	5.2%	5.2%	NA	NA

3.1.3.14.2 Methodological issues

3.1.3.14.2.1 Choice of methods

For estimating the air pollutants emissions the Tier 1 approach³⁹ of the EMEP/EEA air pollutant emission inventory guidebook 2023 has been applied:

Equation: emissions from stationary combustion

$$\text{Emissions}_{\text{pollutant}} = \text{Fuel Consumption}_{\text{fuel}} \times \text{Emission Factor}_{\text{pollutant. fuel}}$$

Where:

Emissions _{pollutant}	= emissions of a given pollutant by type of fuel (kg pollutant)
Fuel consumption _{fuel}	= amount of fuel combusted (TJ)
Emission factor _{pollutant. fuel}	= default emission factor of a given pollutant by type of fuel (g _{pollutant} /GJ).
Pollutant	= main pollutants: NO _x , CO, NMVOC, SO ₂ particulate matter: TSP, PM ₁₀ , PM _{2.5} , 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

3.1.3.14.2.2 Choice of activity data

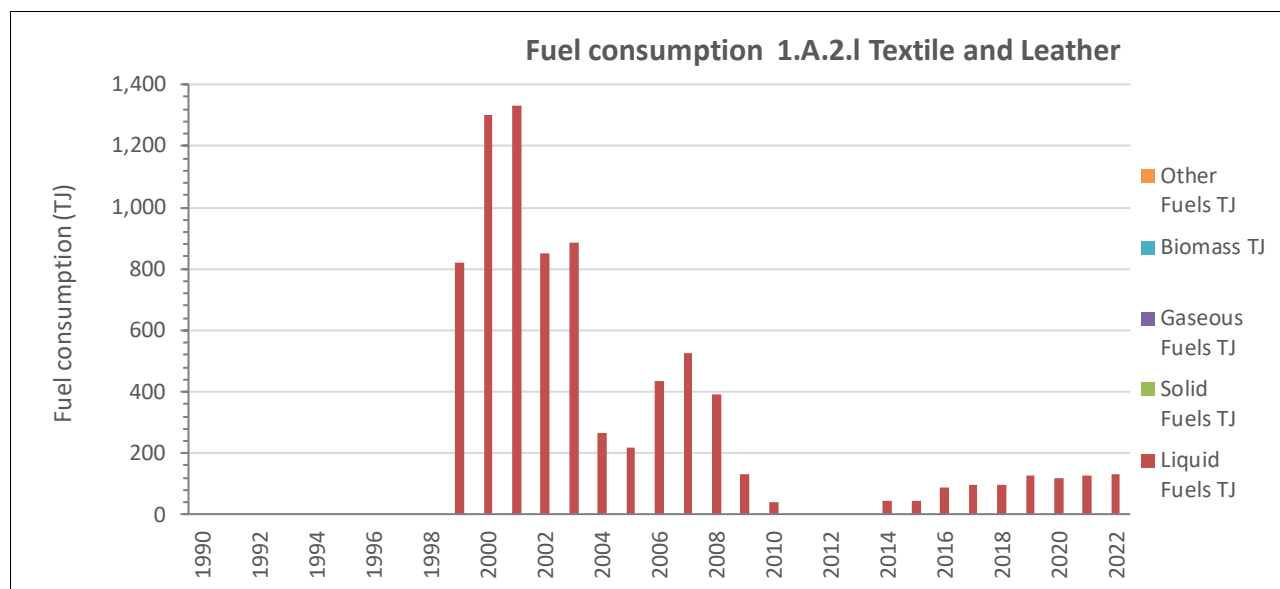


Figure 3.30 Activity data for category 1.A.2.I Textile and Leather

³⁹ Source: EMEP/EEA air pollutant emission inventory guidebook 2023. 1.A.2 Manufacturing industries and construction (combustion). sub-chapter 3.2 Tier 1 default approach.

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"> Gas/Diesel Oil Motor gasoline Other Other Petroleum Products Petroleum Coke 	Summary of fuel aggregations at Tier 1 according to EMEP/EEA air pollutant emission inventory guidebook 2023. Part B. Chapter 1.A.2.

Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2022 were taken from prepared by Albanian Institute of Statistics (INSTAT).

Table 3.156 Activity data for 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	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	819.84	819.84	NO	NO	NO	NO	NO
2000	1,299.65	1,299.65	NO	NO	NO	NO	NO
2001	1,331.63	1,331.63	NO	NO	NO	NO	NO
2002	851.83	851.83	NO	NO	NO	NO	NO
2003	883.81	883.81	NO	NO	NO	NO	NO
2004	264.80	264.80	NO	NO	NO	NO	NO
2005	220.00	220.00	NO	NO	NO	NO	NO
2006	434.00	434.00	NO	NO	NO	NO	NO
2007	524.40	524.40	NO	NO	NO	NO	NO
2008	390.80	390.80	NO	NO	NO	NO	NO
2009	132.40	132.40	NO	NO	NO	NO	NO
2010	42.80	42.80	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	44.80	44.80	NO	NO	NO	NO	NO

Activity data 1.A.2.I	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
2015	44.80	44.80	NO	NO	NO	NO	NO
2016	87.60	87.60	NO	NO	NO	NO	NO
2017	95.21	95.21	NO	NO	NO	NO	NO
2018	95.21	95.21	NO	NO	NO	NO	NO
2019	126.29	126.29	NO	NO	NO	NO	NO
2020	119.36	119.36	NO	NO	NO	NO	NO
2021	125.68	125.68	NO	NO	NO	NO	NO
2022	132.20	132.20	NO	NO	NO	NO	NO
Trend							
1990 – 2022	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	-39.9%	-39.9%	NA	NA	NA	NA	NA
2021 – 2022	5.2%	5.2%	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 category 1.A.2.I *Textile and Leather*.

Table 3.157 Net calorific values (NCVs) applied for conversion to energy units in category 1.A.2.I *Textile and Leather*.

Fuel	Fuel type	Net calorific value (NCV)					
		NCV	unit	type	NCV	unit	type
Motor gasoline	liquid	44.799	TJ/Gg	CS	44.3	TJ/Gg	D
Gas/Diesel Oil (Non-bio)	liquid	43.292	TJ/Gg	CS	47.3	TJ/Gg	D
Petroleum coke	liquid	46.89	TJ/Gg	CS	32.5	TJ/Gg	D
Other Oil - Other Petroleum Products	liquid	40.2	TJ/Gg	CS	40.2	TJ/Gg	D
					for comparison		
Source		Eurostat (2023): Complete energy balances (Code: nrg_bal_c)			2006 IPCC guidelines, Vol. 2, Chapter 1, Table 1.2		
Note:							
D	Default	CS	Country specific		PS	Plant specific	

3.1.3.14.2.3 Choice of emission factors

Default emission factors for air pollutant were taken from the EMEP/EEA air pollutant emission inventory guidebook 2023 and are presented in the following table.

Table 3.158 Emission factors (EF) for Main pollutants, Particulate Matter (PM), Heavy metals (HM) and Persistent Organic Pollutants (POPs) for category 1.A.2.I Textile and Leather.

Fuel Type	UNIT	Liquid fuels	
Associated fuel types		Gas/Diesel Oil Residual fuel oil, (LPG), Petroleum Coke	
Pollutant		EF	type
NOx	g/GJ	513.0	D
CO	g/GJ	66	D
NMVOC	g/GJ	25	D
SOx	g/GJ	47	D
TSP	g/GJ	20	D
NH3	g/GJ	NA	
PM10	g/GJ	20	D
PM2.5	g/GJ	20	D
BC	% of PM2.5	56	D
Pb	mg/GJ	0.08	D
Cd	mg/GJ	0.006	D
Hg	mg/GJ	0.12	D
As	mg/GJ	0.03	D
Cr	mg/GJ	0.2	D
Cu	mg/GJ	0.22	D
Ni	mg/GJ	0.008	D
Se	mg/GJ	0.11	D
Zn	mg/GJ	29	D
PCB	ng WHO-TEG/GJ	NA	D
PCDD/F	ng I-TEQ/GJ	1.4	D
Benzo(a)pyrene	µg/GJ	0.0019	D
Benzo(b)fluoranthene	µg/GJ	0.015	D
Benzo(k)fluoranthene	µg/GJ	0.0017	D
Indeno(1,2,3-cd)pyrene	µg/GJ	0.0015	D
HCB	µg/GJ	NA	D
Source		Table 3-4, Section 3.2.2. page 17.	
		EMEP/EEA air pollutant emission inventory guidebook 2023. Part B. Chapter 1.A.2 Manufacturing industries and construction (combustion).	
Note:			
D Default	CS Country specific	PS Plant specific	IEF Implied emission factor

3.1.3.14.3 Uncertainties and time-series consistency

The uncertainties for activity data and emission factors used for IPCC/NFR category 1.A.2.I *Textile and Leather* are presented in the following table.

Table 3.159 Uncertainty for category 1.A.2.I *Textile and Leather*.

Uncertainty	Solid fuels	Gaseous fuels	Liquid fuels	Biomass	Reference
Activity data (AD)	5%	5%	5%	8%	Table 2.15. 2006 IPCC GL. Vol. 2. Chap. 2 (2.4.2)
Emission factor (EF)	Rating	Typical error range	Average	Reference	
NO _x	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 2023. Part A. Chapter 5 Uncertainties.	
CO	C	50% to 200%	125%		
NM VOC	D	100% to 300%	200%		
SO _x	A	10% to 30%	20%		
NH ₃	E	order of magnitude	750%		
TSP, PM ₁₀ , PM _{2.5} , 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)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.

3.1.3.14.4 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.

3.1.3.14.5 Source-specific recalculations

The following table presents the main revisions and recalculations done since the last submission and relevant to category 1.A.2.I *Textile and Leather*.

Table 3.160 Recalculations done in category 1.A.2.I *Textile and Leather*

source category	Revisions of data	Type of revision	Type of improvement
1.A.2.I	Revision of NCV by using country specific NCV	AD	Accuracy
1.A.2.I	Revision of activity data	AD	Accuracy

3.1.3.14.6 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 3.161 Planned improvements for category 1.A.2.I *Textile and Leather*

source category	Planned improvement	Type of improvement		Priority
1.A.2.I	Investigation of fuels consumed by stationary equipments or off-road machinery	AD	Accuracy Transparency	High
1.A.2.I	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

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

3.1.3.15.1 Source category description

This section describes emissions resulting from fuel combustion activities in Manufacturing Industries and Construction -**Other**-. The subcategory 1.A.2.m *Other* includes activities not mentioned above under 1.A.2.a to 1.A.2.l.

Table 3.162 Overview on reported emissions from sub categories 1.A.2.f Non-Metallic Minerals

Air pollutants	1.A.2.e						Key category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
NO _x	✓	✓	✓	NO	NO	✓	
CO	✓	✓	✓	NO	NO	✓	
NM VOC	✓	✓	✓	NO	NO	✓	
SO _x	✓	✓	✓	NO	NO	✓	
NH ₃	NA	NA	✓	NO	NO	✓	
TSP	✓	✓	✓	NO	NO	✓	
PM ₁₀	✓	✓	✓	NO	NO	✓	
PM _{2.5}	✓	✓	✓	NO	NO	✓	
BC	✓	✓	✓	NO	NO	✓	
Pb	✓	✓	✓	NO	NO	✓	
Cd	✓	✓	✓	NO	NO	✓	
Hg	✓	✓		NO	NO	✓	
As	✓	✓	✓	NO	NO	✓	
Cr	✓	✓	✓	NO	NO	✓	
Cu	✓	✓	✓	NO	NO	✓	
Ni	✓	✓	✓	NO	NO	✓	
Se	✓	✓	✓	NO	NO	✓	
Zn	✓	✓	✓	NO	NO	✓	
PCB	✓	✓	✓	NO	NO	✓	
PCDD/F	✓	✓	✓	NO	NO	✓	
PAH	NA	✓	✓	NO	NO	✓	
Benzo(a)pyrene	✓	✓	✓	NO	NO	✓	
Benzo(b)fluoranthene	✓	✓	✓	NO	NO	✓	
Benzo(k)fluoranthene	✓	✓	✓	NO	NO	✓	
Indeno(1,2,3-cd)pyrene	✓	✓	✓	NO	NO	✓	
HCB	NA	✓	✓	NO	NO	✓	
A '✓' indicates: emissions from this 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 category 1.A.2.m *Other* is provided in the following figures and tables:

- annual emissions of air pollutants;
- Trend of the periods 1990 – 2022, 2005 – 2022, 2021 – 2022.

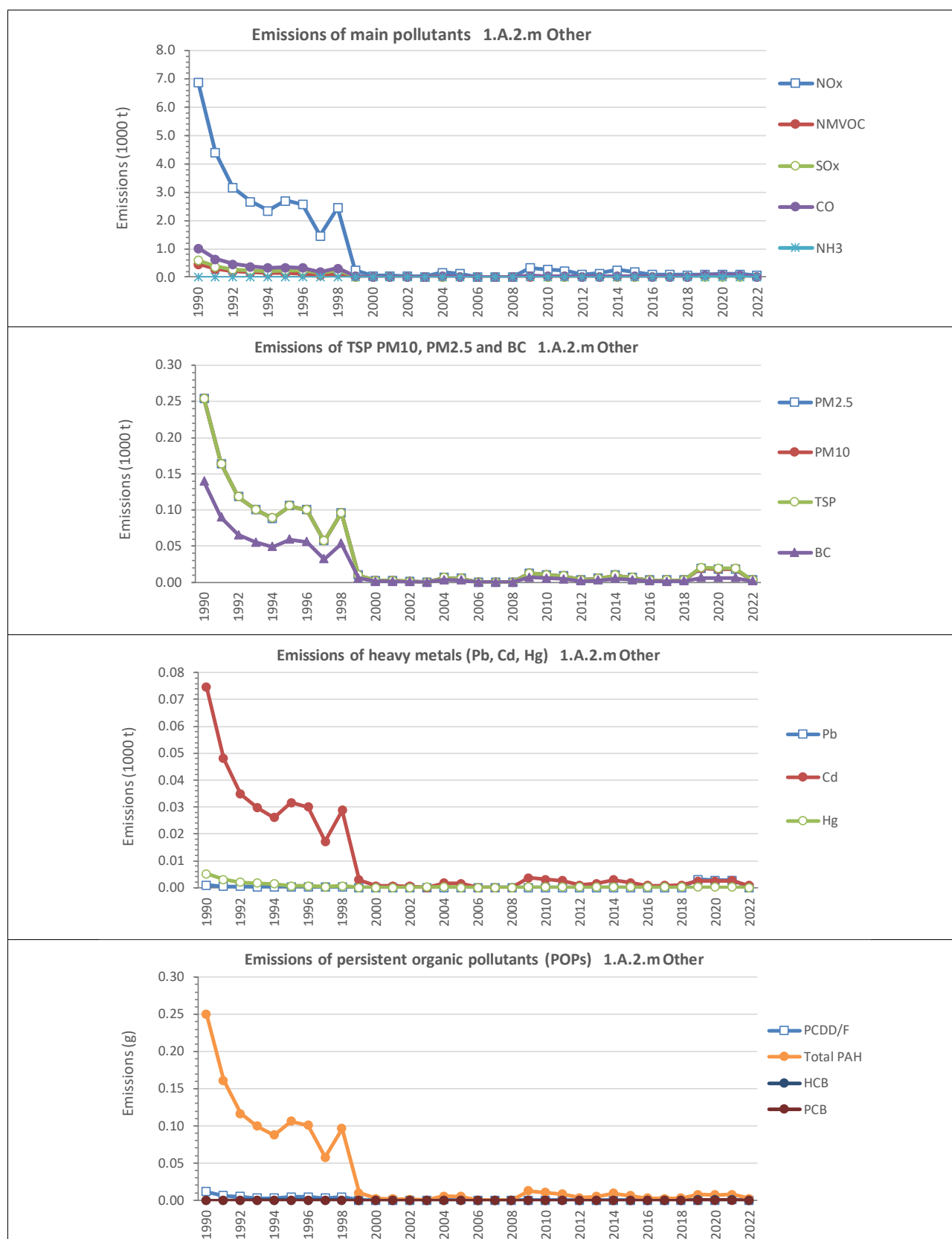


Figure 3.31 Emissions from category 1.A.2.m *Other*

Table 3.163 Emissions of main pollutants (NO_x, SO₂, NMVOC, CO and NH₃) from category 1.A.2.m Other

Emissions	NO _x	NMVOC	SO _x	CO	NH ₃
	Gg	Gg	Gg	Gg	Gg
1990	6.886	0.468	0.589	1.019	NO
1991	4.397	0.289	0.380	0.640	NO
1992	3.163	0.202	0.275	0.455	NO
1993	2.677	0.166	0.234	0.381	NO
1994	2.346	0.144	0.206	0.331	NO
1995	2.706	0.132	0.248	0.348	NO
1996	2.567	0.125	0.235	0.330	NO
1997	1.467	0.072	0.135	0.189	NO
1998	2.458	0.120	0.225	0.316	NO
1999	0.246	0.012	0.023	0.032	NO
2000	0.055	0.003	0.005	0.007	NO
2001	0.049	0.002	0.005	0.006	NO
2002	0.033	0.002	0.003	0.004	NO
2003	0.014	0.004	0.000	0.006	NO
2004	0.172	0.016	0.014	0.030	NO
2005	0.124	0.006	0.011	0.016	NO
2006	0.000	0.000	0.000	0.000	NO
2007	0.000	0.000	0.000	0.000	NO
2008	0.000	0.000	0.000	0.000	NO
2009	0.334	0.022	0.029	0.048	NO
2010	0.276	0.018	0.024	0.040	NO
2011	0.231	0.016	0.020	0.034	NO
2012	0.092	0.007	0.008	0.014	NO
2013	0.144	0.012	0.012	0.024	NO
2014	0.254	0.016	0.022	0.036	NO
2015	0.178	0.015	0.015	0.029	NO
2016	0.089	0.010	0.006	0.017	NO
2017	0.087	0.012	0.006	0.019	NO
2018	0.085	0.008	0.007	0.014	NO
2019	0.099	0.039	0.010	0.077	0.004
2020	0.105	0.037	0.010	0.073	0.004
2021	0.111	0.037	0.011	0.073	0.004
2022	0.070	0.005	0.006	0.011	NO
Trend					
1990 – 2022	-99.0%	-98.8%	-99.0%	-98.9%	NA
2005 – 2022	-43.4%	-9.9%	-48.7%	-30.5%	NA
2021 – 2022	-36.8%	-85.5%	-45.5%	-84.9%	NA

Table 3.164 Emissions of particulate matter (PM) from category 1.A.2.m *Other*

Emissions	PM2.5	PM10	TSP	BC
	Gg	Gg	Gg	Gg
1990	0.254	0.254	0.254	0.140
1991	0.163	0.163	0.163	0.090
1992	0.118	0.118	0.118	0.065
1993	0.100	0.100	0.100	0.056
1994	0.088	0.088	0.088	0.049
1995	0.106	0.106	0.106	0.059
1996	0.100	0.100	0.100	0.056
1997	0.057	0.057	0.057	0.032
1998	0.096	0.096	0.096	0.054
1999	0.010	0.010	0.010	0.005
2000	0.002	0.002	0.002	0.001
2001	0.002	0.002	0.002	0.001
2002	0.001	0.001	0.001	0.001
2003	0.000	0.000	0.000	0.000
2004	0.006	0.006	0.006	0.003
2005	0.005	0.005	0.005	0.003
2006	NO	0.000	0.000	NO
2007	NO	0.000	0.000	NO
2008	NO	0.000	0.000	NO
2009	0.012	0.012	0.012	0.007
2010	0.010	0.010	0.010	0.006
2011	0.009	0.009	0.009	0.005
2012	0.003	0.003	0.003	0.002
2013	0.005	0.005	0.005	0.003
2014	0.010	0.010	0.010	0.005
2015	0.006	0.006	0.006	0.003
2016	0.003	0.003	0.003	0.001
2017	0.003	0.003	0.003	0.001
2018	0.003	0.003	0.003	0.002
2019	0.019	0.019	0.020	0.006
2020	0.018	0.018	0.019	0.006
2021	0.018	0.018	0.019	0.006
2022	0.003	0.003	0.003	0.001
Trend				
1990 – 2022	-99.0%	-99.0%	-99.0%	-99.0%
2005 – 2022	-48.0%	-47.9%	-47.9%	-49.5%
2021 – 2022	-86.2%	-86.4%	-86.9%	-78.0%

Table 3.165 Emissions of Heavy Metals (HM) from category 1.A.2.m *Other*

Emissions	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
	kg	kg	kg	kg	kg	kg	kg	kg	kg
1990	0.001	0.075	0.005	0.001	0.003	0.003	<0.001	0.002	0.366
1991	0.001	0.048	0.003	0.001	0.002	0.002	<0.001	0.001	0.235
1992	<0.001	0.035	0.002	<0.001	0.001	0.001	<0.001	0.001	0.170
1993	<0.001	0.030	0.002	<0.001	0.001	0.001	<0.001	0.001	0.145
1994	<0.001	0.026	0.001	<0.001	0.001	0.001	<0.001	0.001	0.127
1995	<0.001	0.032	0.001	<0.001	0.001	0.001	<0.001	0.001	0.153
1996	<0.001	0.030	0.001	<0.001	0.001	0.001	<0.001	0.001	0.145
1997	<0.001	0.017	<0.001	<0.001	0.001	0.001	<0.001	<0.001	0.083
1998	<0.001	0.029	0.001	<0.001	0.001	0.001	<0.001	0.001	0.139
1999	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.014
2000	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003
2001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003
2002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002
2003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2004	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.008
2005	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.007
2006	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	NO	<0.001	<0.001
2007	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	NO	<0.001	<0.001
2008	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	NO	<0.001	<0.001
2009	<0.001	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.018
2010	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.015
2011	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.012
2012	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.005
2013	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.007
2014	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.014
2015	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.009
2016	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004
2017	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004
2018	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004
2019	0.003	0.002	<0.001	<0.001	0.003	0.001	<0.001	<0.001	0.061
2020	0.003	0.002	<0.001	<0.001	0.002	0.001	<0.001	<0.001	0.057
2021	0.003	0.003	<0.001	<0.001	0.002	0.001	<0.001	<0.001	0.057
2022	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004
Trend									
1990 – 2022	-97.3%	-99.0%	-98.6%	-98.6%	-99.0%	-99.0%	-98.8%	-98.9%	-99.0%
2005 – 2022	-27.0%	-49.6%	141.1%	89.8%	-45.7%	-47.7%	20.5%	-26.7%	-48.4%
2021 – 2022	-99.2%	-71.1%	-46.1%	-58.9%	-98.9%	-95.6%	-98.9%	-75.0%	-93.7%

Table 3.166 Emissions of Persistent Organic Pollutants (POPs) from category 1.A.2.m *Other*

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	0.012	0.024	0.187	0.021	0.019	0.250	<0.001	<0.001
1991	0.006	0.015	0.120	0.014	0.012	0.161	<0.001	<0.001
1992	0.005	0.011	0.087	0.010	0.009	0.117	<0.001	<0.001
1993	0.003	0.009	0.074	0.008	0.007	0.099	<0.001	<0.001
1994	0.003	0.008	0.065	0.007	0.007	0.088	<0.001	<0.001
1995	0.004	0.010	0.079	0.009	0.008	0.106	<0.001	<0.001
1996	0.004	0.010	0.075	0.009	0.008	0.101	<0.001	<0.001
1997	0.002	0.005	0.043	0.005	0.004	0.057	<0.001	<0.001
1998	0.004	0.009	0.072	0.008	0.007	0.096	<0.001	<0.001
1999	<0.001	0.001	0.007	0.001	0.001	0.010	<0.001	<0.001
2000	<0.001	<0.001	0.002	<0.001	<0.001	0.002	<0.001	<0.001
2001	<0.001	<0.001	0.001	<0.001	<0.001	0.002	<0.001	<0.001
2002	<0.001	<0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001
2003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2004	<0.001	0.001	0.004	<0.001	<0.001	0.006	<0.001	<0.001
2005	<0.001	<0.001	0.004	<0.001	<0.001	0.005	<0.001	<0.001
2006	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2007	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2008	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2009	<0.001	0.001	0.009	0.001	0.001	0.012	<0.001	<0.001
2010	<0.001	0.001	0.008	0.001	0.001	0.010	<0.001	<0.001
2011	<0.001	0.001	0.006	0.001	0.001	0.008	<0.001	<0.001
2012	<0.001	<0.001	0.002	<0.001	<0.001	0.003	<0.001	<0.001
2013	<0.001	<0.001	0.004	<0.001	<0.001	0.005	<0.001	<0.001
2014	<0.001	0.001	0.007	0.001	0.001	0.009	<0.001	<0.001
2015	<0.001	0.001	0.005	0.001	<0.001	0.006	<0.001	<0.001
2016	<0.001	<0.001	0.002	<0.001	<0.001	0.003	<0.001	<0.001
2017	<0.001	<0.001	0.002	<0.001	<0.001	0.002	<0.001	<0.001
2018	<0.001	<0.001	0.002	<0.001	<0.001	0.003	<0.001	<0.001
2019	<0.001	0.001	0.004	0.001	0.001	0.007	0.001	<0.001
2020	<0.001	0.001	0.004	0.001	0.001	0.007	0.001	<0.001
2021	<0.001	0.001	0.005	0.001	0.001	0.008	0.001	<0.001
2022	<0.001	<0.001	0.002	<0.001	<0.001	0.002	<0.001	<0.001
Trend								
1990 – 2022	-98.4%	-99.0%	-99.0%	-99.0%	-99.0%	-99.0%	0.0%	0.0%
2005 – 2022	-47.1%	-49.7%	-49.7%	-49.7%	-49.7%	-49.7%	0.0%	0.0%
2021 – 2022	-39.6%	-83.4%	-60.7%	-75.6%	-74.2%	-67.8%	-100.0%	-99.8%

3.1.3.15.2 Methodological issues

3.1.3.15.2.1 Choice of methods

For estimating the air pollutants emissions the Tier 1 approach⁴⁰ of the EMEP/EEA air pollutant emission inventory guidebook 2023 has been applied:

Equation: emissions from stationary combustion

$$\text{Emissions}_{\text{pollutant}} = \text{Fuel Consumption}_{\text{fuel}} \times \text{Emission Factor}_{\text{pollutant. fuel}}$$

Where:

Emissions _{pollutant}	= emissions of a given pollutant by type of fuel (kg pollutant)
Fuel consumption _{fuel}	= amount of fuel combusted (TJ)
Emission factor _{pollutant. fuel}	= default emission factor of a given pollutant by type of fuel (g _{pollutant} /GJ).
Pollutant	= main pollutants: NO _x , CO, NMVOC, SO ₂ particulate matter: TSP, PM ₁₀ , PM _{2.5} , 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

3.1.3.15.2.2 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"> Gas/Diesel Oil Motor gasoline Residual Fuel oil Liquefied Petroleum Gases (LPG) Other Petroleum Products Petroleum Coke 	Summary of fuel aggregations at Tier 1 according to EMEP/EEA air pollutant emission inventory guidebook 2023. Part B. Chapter 1.A.2.
Solid fuels	<ul style="list-style-type: none"> Other Bituminous Coal 	
Gaseous fuels	<ul style="list-style-type: none"> Natural gas 	
Biomass	<ul style="list-style-type: none"> Wood / Fuelwood 	

Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2022 were taken from prepared by Albanian Institute of Statistics (INSTAT).

⁴⁰ Source: EMEP/EEA air pollutant emission inventory guidebook 2023. 1.A.2 Manufacturing industries and construction (combustion). sub-chapter 3.2 Tier 1 default approach.

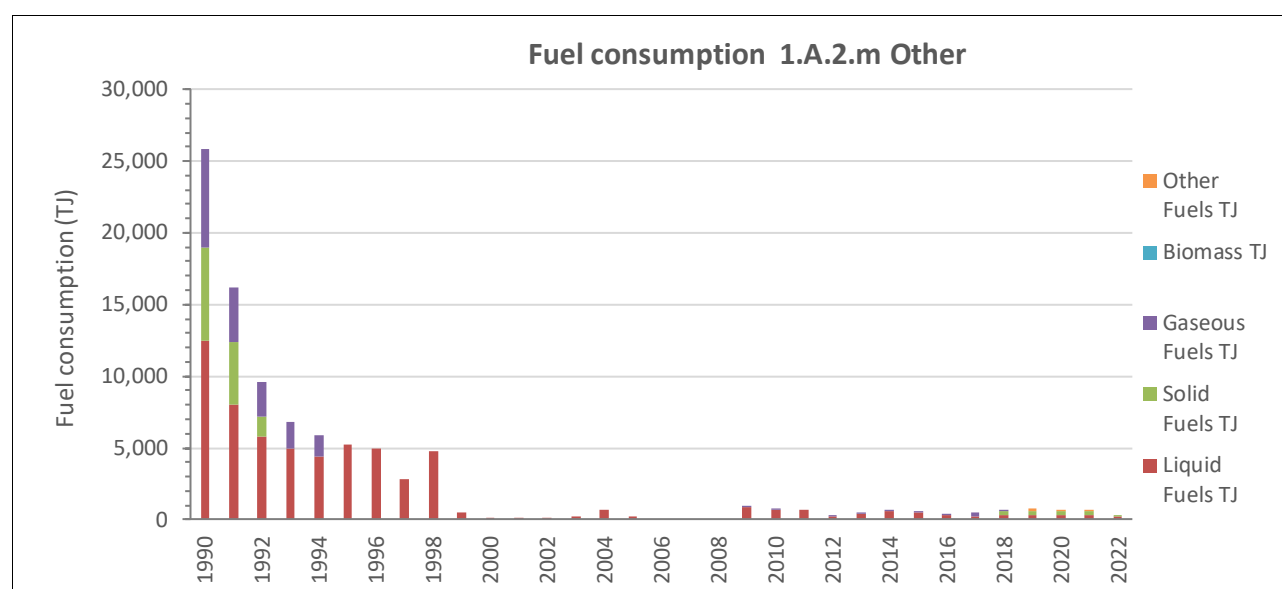


Figure 3.32 Activity data for category 1.A.2.m *Other*

Table 3.167 Activity data for category 1.A.2.m *Other*

Activity data 1.A.1.m	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
1990	25,815.98	12,435.62	6,531.36	6,849.00	NO	NO	IE
1991	16,203.01	8,018.37	4,354.24	3,830.40	NO	NO	IE
1992	9,637.41	5,810.71	1,360.70	2,466.00	NO	NO	IE
1993	6,807.11	4,949.51	NO	1,857.60	NO	NO	IE
1994	5,861.78	4,355.18	NO	1,506.60	NO	NO	IE
1995	5,275.24	5,275.24	NO	NO	NO	NO	IE
1996	5,003.70	5,003.70	NO	NO	NO	NO	IE
1997	2,860.18	2,860.18	NO	NO	NO	NO	IE
1998	4,791.29	4,791.29	NO	NO	NO	NO	IE
1999	479.81	479.81	NO	NO	NO	NO	1,316.00
2000	106.77	106.77	NO	NO	NO	NO	1,296.00
2001	95.96	95.96	NO	NO	NO	NO	1,286.00
2002	63.97	63.97	NO	NO	NO	NO	IE
2003	189.24	189.24	NO	NO	NO	NO	837.00
2004	659.84	659.84	NO	NO	NO	NO	IE
2005	241.16	241.16	NO	NO	NO	NO	IE
2006	NO	NO	NO	NO	NO	NO	IE
2007	NO	NO	NO	NO	NO	NO	IE
2008	NO	NO	NO	NO	NO	NO	IE
2009	883.04	848.84	NO	34.20	NO	NO	IE
2010	724.46	694.76	NO	29.70	NO	NO	IE
2011	653.29	653.29	NO	NO	NO	NO	IE
2012	292.36	254.56	NO	37.80	NO	NO	IE
2013	507.98	432.38	NO	75.60	NO	NO	IE
2014	649.68	611.88	NO	37.80	NO	NO	IE

Activity data 1.A.1.m	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
2015	605.74	493.24	NO	112.50	NO	NO	IE
2016	429.60	318.44	NO	111.16	NO	NO	IE
2017	493.32	241.27	NO	252.04	NO	NO	IE
2018	680.15	280.36	362.11	37.68	NO	NO	IE
2019	743.84	272.87	362.11	NO	NO	NO	IE
2020	671.94	286.92	284.52	NO	NO	NO	IE
2021	682.41	297.23	284.70	NO	NO	NO	IE
2022	342.42	225.47	116.95	NO	NO	NO	120.58
Trend							
1990 – 2022	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	798.6%	344.8%	2288.8%	NA	NA	NA	NA
2021 – 2022	-1.3%	163.5%	-30.1%	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 category 1.A.2.m *Other*.

Table 3.168 Net calorific values (NCVs) applied for conversion to energy units in category 1.A.2.m *Other*

Fuel	Fuel type	Net calorific value (NCV)					
		NCV	unit	type	NCV	unit	type
Residual fuel oil	liquid	40.193	TJ/Gg	CS	40.4	TJ/Gg	D
Gas/Diesel Oil (Non-bio)	liquid	43.292	TJ/Gg	CS	47.3	TJ/Gg	D
Petroleum coke	liquid	46.89	TJ/Gg	CS	32.5	TJ/Gg	D
Other Oil - Other Petroleum Products	liquid	40.2	TJ/Gg	CS	40.2	TJ/Gg	D
Liquefied petroleum gas (LPG)	liquid	47.311	TJ/Gg	CS	47.3	TJ/Gg	D
Other Bituminous Coal	solid	27.214	TJ/Gg	CS	25.8	TJ/Gg	D
Natural gas	Gaseous	35.00	GJ/1000 m3	CS	39.02	GJ/1000 m3	D
Wood/ Fuelwood	biomass		GJ/1000 m3	CS	48.0	TJ/Gg	D
					for comparison		
Source		Eurostat (2023): Complete energy balances (Code: nrg_bal_c)			2006 IPCC guidelines, Vol. 2, Chapter 1, Table 1.2		
Note:							
D	Default	CS	Country specific		PS	Plant specific	

3.1.3.15.2.3 Choice of emission factors

Default emission factors for air pollutant were taken from the EMEP/EEA air pollutant emission inventory guidebook 2023 and are presented in the following table.

Table 3.169 Emission factors (EF) for Main pollutants, Particulate Matter (PM), Heavy metals (HM) and Persistent Organic Pollutants (POPs) for category 1.A.2.m Other

Fuel Type	UNIT	Solid fuels		Gaseous fuels		Liquid fuels		Biomass	
Associated fuel types		Anthracite, Lignite, Other Bituminous Coal		Natrual gas		Gas/Diesel Oil Residual fuel oil, (LPG), Petroleum Coke		Charcoal Wood / Fuelwood Wood pellets	
Pollutant		EF	type	EF	type	EF	type	EF	type
NOx	g/GJ	173	D	74	D	513.0	D	91	D
CO	g/GJ	931	D	29	D	66	D	570	D
NM VOC	g/GJ	88.8	D	23	D	25	D	300	D
SOx	g/GJ	900	D	0.67	D	47	D	11	D
TSP	g/GJ	124	D	NA		20	D	1.2	D
NH3	g/GJ	NA		0.78	D	NA		150	D
PM10	g/GJ	117	D	0.78	D	20	D	143	D
PM2.5	g/GJ	108	D	0.78	D	20	D	140	D
BC	% of PM2.5	6.4	D	4	D	56	D	28	D
Pb	mg/GJ	134	D	0.011	D	0.08	D	27	D
Cd	mg/GJ	1.8	D	0.0009	D	0.006	D	13	D
Hg	mg/GJ	7.9	D	0.54	D	0.12	D	0.56	D
As	mg/GJ	4	D	0.1	D	0.03	D	0.19	D
Cr	mg/GJ	13.5	D	0.013	D	0.2	D	23	D
Cu	mg/GJ	17.5	D	0.0026	D	0.22	D	6	D
Ni	mg/GJ	13	D	0.013	D	0.008	D	2	D
Se	mg/GJ	1.8	D	0.058	D	0.11	D	0.5	D
Zn	mg/GJ	200	D	0.73	D	29	D	512	D
PCB	ng WHO-TEG/GJ	170	D	NA		NA	D	0.06	D
PCDD/F	ng I-TEQ/GJ	203	D	NA		1.4	D	100	D
Benzo(a)pyrene	µg/GJ	45.5	D	NA		0.0019	D	0.01	D
Benzo(b)fluoranthene	µg/GJ	58.9	D	NA		0.015	D	0.016	D
Benzo(k)fluoranthene	µg/GJ	23.7	D	NA		0.0017	D	0.005	D
Indeno(1,2,3-cd)pyrene	µg/GJ	18.5	D	NA		0.0015	D	0.004	D
HCB	µg/GJ	0.62	D	NA		NE	D	5	D
Source		Table 3-3, Section 3.2.2. page 16.		Table 3-, Section 3.2.2. page 17.		Table 3.5. section 3.4. page 17.			
		EMEP/EEA air pollutant emission inventory guidebook 2023. Part B. Chapter 1.A.2 Manufacturing industries and construction (combustion).							
Note:									
D	Default	CS Country specific		PS Plant specific		IEF Implied emission factor			

3.1.3.15.3 Uncertainties and time-series consistency

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

Table 3.170 Uncertainty for category 1.A.2.m *Other*.

Uncertainty	Solid fuels	Gaseous fuels	Liquid fuels	Biomass	Reference
Activity data (AD)	5%	5%	5%	8%	Table 2.15. 2006 IPCC GL. Vol. 2. Chap. 2 (2.4.2)
Emission factor (EF)	Rating	Typical error range	Average	Reference	
NO _x	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 2023. Part A. Chapter 5 Uncertainties.	
CO	C	50% to 200%	125%		
NM VOC	D	100% to 300%	200%		
SO _x	A	10% to 30%	20%		
NH ₃	E	order of magnitude	750%		
TSP, PM ₁₀ , PM _{2.5} , 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)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.

3.1.3.15.4 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.

3.1.3.15.5 Source-specific recalculations

The following table presents the main revisions and recalculations done since the last submission and relevant to category 1.A.2.m *Other*.

Table 3.171 Recalculations done in category 1.A.2.m *Other*

source category	Revisions of data	Type of revision	Type of improvement
1.A.2.m	Revision of NCV by using country specific NCV	AD	Accuracy
1.A.2.m	Revision of activity data	AD	Accuracy

3.1.3.15.6 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 3.172 Planned improvements for category 1.A.2.m *Other*

source category	Planned improvement	Type of improvement		Priority
1.A.2.m	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.m	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF	Accuracy Transparency	Medium
1.A.2.m	Data obtained from measurements made on the emission of air pollutants	EF	Accuracy Transparency	Medium
1.A.2.m	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

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.

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

Domestic Civil Aviation (IPCC/NFR category 1.A.3.a.i) does not occur in Albania.

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

Road transport (IPCC/NFR category 1.A.3.b) is not estimated due to lack of data and resources.

3.1.4.3 Railways (IPCC/NFR category 1.A.3.c)

3.1.4.3.1 Source category description

This section describes emissions resulting from fuel combustion activities in rail transport and concerns the movement of goods or people by rail. Diesel locomotives either use only diesel engines for propulsion or in combination with an on-board alternator or generator to produce electricity which powers their traction motors (diesel-electric).

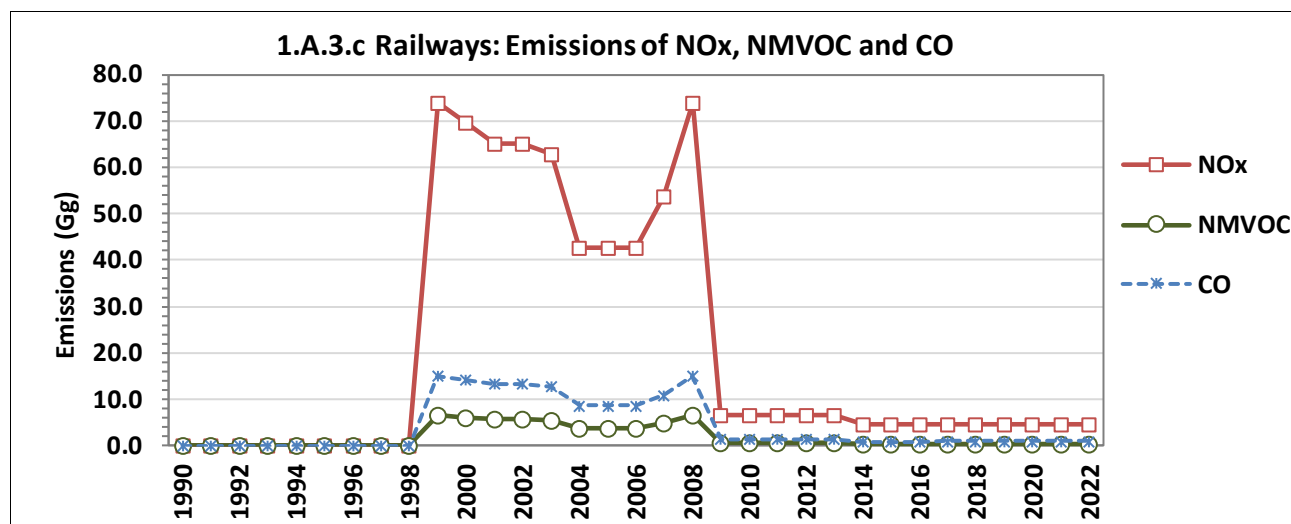
Table 3.173 Overview on reported emissions from sub categories 1.A.3.c Railways

Air pollutants	1.A.3.c Railways						Key Category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
NO _x	✓	NO	NO	NO	NO	NO	-
CO	✓	NO	NO	NO	NO	NO	-
NM VOC	✓	NO	NO	NO	NO	NO	-
SO _x	NA	NO	NO	NO	NO	NO	-
NH ₃	NA	NO	NO	NO	NO	NO	-
TSP	✓	NO	NO	NO	NO	NO	-
PM ₁₀	✓	NO	NO	NO	NO	NO	-
PM _{2.5}	✓	NO	NO	NO	NO	NO	-
BC	NA	NO	NO	NO	NO	NO	-
Pb	NA	NO	NO	NO	NO	NO	-
Cd	✓	NO	NO	NO	NO	NO	-
Hg	NA	NO	NO	NO	NO	NO	-
As	NA	NO	NO	NO	NO	NO	-
Cr	✓	NO	NO	NO	NO	NO	-
Cu	✓	NO	NO	NO	NO	NO	-

Air pollutants	1.A.3.c Railways						Key Category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
Ni	✓	NO	NO	NO	NO	NO	-
Se	✓	NO	NO	NO	NO	NO	-
Zn	✓	NO	NO	NO	NO	NO	-
PCB	NA	NO	NO	NO	NO	NO	-
PCDD/F	NA	NO	NO	NO	NO	NO	-
PAH	✓	NO	NO	NO	NO	NO	-
Benzo(a)pyrene	✓	NO	NO	NO	NO	NO	-
Benzo(b)fluoranthene	✓	NO	NO	NO	NO	NO	-
Benzo(k)fluoranthene	✓	NO	NO	NO	NO	NO	-
Indeno(1,2,3-cd)pyrene	NA	NO	NO	NO	NO	NO	-
HCB	NA	NO	NO	NO	NO	NO	-
A '✓' indicates: emissions from this 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 category 1.A.3.c Railways is provided in the following figures and tables:

- annual emissions of air pollutants;
- Trend of the periods 1990 – 2022, 2005 – 2022, 2021 – 2022.



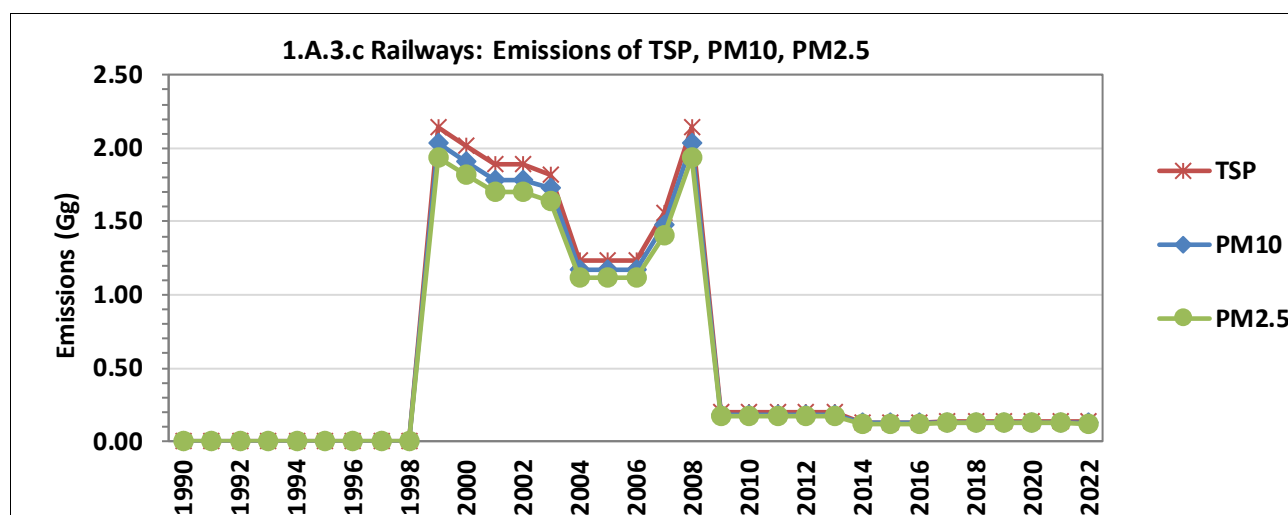


Figure 3.33 Emissions from category 1.A.3.c Railways

Table 3.174 Emissions of main pollutants (NO_x, SO₂, NMVOC, CO and NH₃) from category 1.A.3.c Railways

Emissions	NO _x	NMVOC	SO _x	CO	NH ₃
	t	Gg	Gg	Gg	Gg
1990	IE	IE	NE	IE	IE
1991	IE	IE	NE	IE	IE
1992	IE	IE	NE	IE	IE
1993	IE	IE	NE	IE	IE
1994	IE	IE	NE	IE	IE
1995	IE	IE	NE	IE	IE
1996	IE	IE	NE	IE	IE
1997	IE	IE	NE	IE	IE
1998	IE	IE	NE	IE	IE
1999	1709.55	151.71	NE	349.09	0.228
2000	1605.94	142.51	NE	327.93	0.215
2001	1502.33	133.32	NE	306.77	0.201
2002	1502.33	133.32	NE	306.77	0.201
2003	1450.53	128.72	NE	296.20	0.194
2004	984.29	87.35	NE	200.99	0.131
2005	984.29	87.35	NE	200.99	0.131
2006	984.29	87.35	NE	200.99	0.131
2007	1243.31	110.33	NE	253.88	0.166
2008	1709.55	151.71	NE	349.09	0.228
2009	155.41	13.79	NE	31.74	0.021
2010	155.41	13.79	NE	31.74	0.021
2011	155.41	13.79	NE	31.74	0.021
2012	155.41	13.79	NE	31.74	0.021
2013	155.41	13.79	NE	31.74	0.021
2014	103.61	9.19	NE	21.16	0.014
2015	103.61	9.19	NE	21.16	0.014
2016	103.61	9.19	NE	21.16	0.014
2017	108.79	9.65	NE	22.21	0.015
2018	108.79	9.65	NE	22.21	0.015
2019	108.79	9.65	NE	22.21	0.015
2020	108.79	9.65	NE	22.21	0.015
2021	108.79	9.65	NE	22.21	0.015
2022	106.42	9.44	NE	21.73	0.014
Trend					
1990 – 2022	NA	NA	NA	NA	NA
2005 – 2022	-89.2%	-89.2%	NA	-89.2%	-89.2%
2021 – 2022	-2.2%	-2.2%	NA	-2.2%	-2.2%

Table 3.175 Emissions of particulate matter (PM) from category 1.A.3.c Railways

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	IE	IE	IE	NA
1997	IE	IE	IE	NA
1998	IE	IE	IE	NA
1999	44.70	46.98	49.59	NA
2000	41.99	44.13	46.58	NA
2001	39.28	41.29	43.58	NA
2002	39.28	41.29	43.58	NA
2003	37.92	39.86	42.08	NA
2004	25.73	27.05	28.55	NA
2005	25.73	27.05	28.55	NA
2006	25.73	27.05	28.55	NA
2007	32.51	34.17	36.07	NA
2008	44.70	46.98	49.59	NA
2009	4.06	4.27	4.51	NA
2010	4.06	4.27	4.51	NA
2011	4.06	4.27	4.51	NA
2012	4.06	4.27	4.51	NA
2013	4.06	4.27	4.51	NA
2014	2.71	2.85	3.01	NA
2015	2.71	2.85	3.01	NA
2016	2.71	2.85	3.01	NA
2017	2.84	2.99	3.16	NA
2018	2.84	2.99	3.16	NA
2019	2.84	2.99	3.16	NA
2020	2.84	2.99	3.16	NA
2021	2.84	2.99	3.16	NA
2022	2.78	2.92	3.09	NA
Trend				
1990 – 2022	NA	NA	NA	NA
2005 – 2022	-89.2%	-89.2%	-89.2%	NA
2021 – 2022	-2.2%	-2.2%	-2.2%	NA

Table 3.176 Emissions of Heavy Metals (HM) from category 1.A.3.c Railways

Emissions	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
	kg	kg	kg	kg	kg	kg	kg	kg	kg
1990	NA	IE	NA	NA	IE	IE	IE	IE	IE
1991	NA	IE	NA	NA	IE	IE	IE	IE	IE
1992	NA	IE	NA	NA	IE	IE	IE	IE	IE
1993	NA	IE	NA	NA	IE	IE	IE	IE	IE
1994	NA	IE	NA	NA	IE	IE	IE	IE	IE
1995	NA	IE	NA	NA	IE	IE	IE	IE	IE
1996	NA	IE	NA	NA	IE	IE	IE	IE	IE
1997	NA	IE	NA	NA	IE	IE	IE	IE	IE
1998	NA	IE	NA	NA	IE	IE	IE	IE	IE
1999	NA	0.0003	NA	NA	0.0016	0.0555	0.0023	0.0003	0.0326
2000	NA	0.0003	NA	NA	0.0015	0.0521	0.0021	0.0003	0.0306
2001	NA	0.0003	NA	NA	0.0014	0.0487	0.0020	0.0003	0.0287
2002	NA	0.0003	NA	NA	0.0014	0.0487	0.0020	0.0003	0.0287
2003	NA	0.0003	NA	NA	0.0014	0.0471	0.0019	0.0003	0.0277
2004	NA	0.0002	NA	NA	0.0009	0.0319	0.0013	0.0002	0.0188
2005	NA	0.0002	NA	NA	0.0009	0.0319	0.0013	0.0002	0.0188
2006	NA	0.0002	NA	NA	0.0009	0.0319	0.0013	0.0002	0.0188
2007	NA	0.0002	NA	NA	0.0012	0.0403	0.0017	0.0002	0.0237
2008	NA	0.0003	NA	NA	0.0016	0.0555	0.0023	0.0003	0.0326
2009	NA	<0.0001	NA	NA	0.0001	0.0050	0.0002	<0.0001	0.0030
2010	NA	<0.0001	NA	NA	0.0001	0.0050	0.0002	<0.0001	0.0030
2011	NA	<0.0001	NA	NO	0.0001	0.0050	0.0002	<0.0001	0.0030
2012	NA	<0.0001	NA	NO	0.0001	0.0050	0.0002	<0.0001	0.0030
2013	NA	<0.0001	NA	NO	0.0001	0.0050	0.0002	<0.0001	0.0030
2014	NA	<0.0001	NA	NO	0.0001	0.0034	0.0001	<0.0001	0.0020
2015	NA	<0.0001	NA	NO	0.0001	0.0034	0.0001	<0.0001	0.0020
2016	NA	<0.0001	NA	NO	0.0001	0.0034	0.0001	<0.0001	0.0020
2017	NA	<0.0001	NA	NO	0.0001	0.0035	0.0001	<0.0001	0.0021
2018	NA	<0.0001	NA	NO	0.0001	0.0035	0.0001	<0.0001	0.0021
2019	NA	<0.0001	NA	NO	0.0001	0.0035	0.0001	<0.0001	0.0021
2020	NA	<0.0001	NA	NO	0.0001	0.0035	0.0001	<0.0001	0.0021
2021	NA	<0.0001	NA	NO	0.0001	0.0035	0.0001	<0.0001	0.0021
2022	NA	<0.0001	NA	NO	0.0001	0.0035	0.0001	<0.0001	0.0020
Trend									
1990 – 2022	NA	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	NA	-89.2%	NA	NA	-89.2%	-89.2%	-89.2%	-89.2%	-89.2%
2021 – 2022	NA	-2.2%	NA	NA	-2.2%	-2.2%	-2.2%	-2.2%	-2.2%

Table 3.177 Emissions of Persistent Organic Pollutants (POPs) from category 1.A.3.c Railways

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	NA	IE	IE	NA	IE	IE	NA	NA
1991	NA	IE	IE	NA	IE	IE	NA	NA
1992	NA	IE	IE	NA	IE	IE	NA	NA
1993	NA	IE	IE	NA	IE	IE	NA	NA
1994	NA	IE	IE	NA	IE	IE	NA	NA
1995	NA	IE	IE	NA	IE	IE	NA	NA
1996	NA	IE	IE	NA	IE	IE	NA	NA
1997	NA	IE	IE	NA	IE	IE	NA	NA
1998	NA	IE	IE	NA	IE	IE	NA	NA
1999	NA	<0.0001	<0.0001	NA	0.0003	0.0029	NA	NA
2000	NA	<0.0001	<0.0001	NA	0.0003	0.0028	NA	NA
2001	NA	<0.0001	<0.0001	NA	0.0003	0.0026	NA	NA
2002	NA	<0.0001	<0.0001	NA	0.0003	0.0026	NA	NA
2003	NA	<0.0001	<0.0001	NA	0.0003	0.0025	NA	NA
2004	NA	<0.0001	<0.0001	NA	0.0002	0.0017	NA	NA
2005	NA	<0.0001	<0.0001	NA	0.0002	0.0017	NA	NA
2006	NA	<0.0001	<0.0001	NA	0.0002	0.0017	NA	NA
2007	NA	<0.0001	<0.0001	NA	0.0002	0.0021	NA	NA
2008	NA	<0.0001	<0.0001	NA	0.0003	0.0029	NA	NA
2009	NA	<0.0001	<0.0001	NA	<0.0001	0.0003	NA	NA
2010	NA	<0.0001	<0.0001	NA	<0.0001	0.0003	NA	NA
2011	NA	<0.0001	<0.0001	NA	<0.0001	0.0003	NA	NA
2012	NA	<0.0001	<0.0001	NA	<0.0001	0.0003	NA	NA
2013	NA	<0.0001	<0.0001	NA	<0.0001	0.0003	NA	NA
2014	NA	<0.0001	<0.0001	NA	<0.0001	0.0002	NA	NA
2015	NA	<0.0001	<0.0001	NA	<0.0001	0.0002	NA	NA
2016	NA	<0.0001	<0.0001	NA	<0.0001	0.0002	NA	NA
2017	NA	<0.0001	<0.0001	NA	<0.0001	0.0002	NA	NA
2018	NA	<0.0001	<0.0001	NA	<0.0001	0.0002	NA	NA
2019	NA	<0.0001	<0.0001	NA	<0.0001	0.0002	NO	NO
2020	NA	<0.0001	<0.0001	NA	<0.0001	0.0002	NO	NO
2021	NA	<0.0001	<0.0001	NA	<0.0001	0.0002	NO	NO
2022	NA	<0.0001	<0.0001	NA	<0.0001	0.0002	NO	NO
Trend								
1990 – 2022	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	NA	-89.2%	-89.2%	NA	-89.2%	-89.2%	NA	NA
2021 – 2022	NA	-2.2%	-2.2%	NA	-2.2%	-2.2%	NA	NA

3.1.4.3.2 Methodological issues

3.1.4.3.2.1 Choice of methods

For estimating the air pollutants emissions the Tier 1 approach⁴¹ of the EMEP/EEA air pollutant emission inventory guidebook 2023 has been applied:

Equation: emissions from stationary combustion

$$\text{Emissions}_{\text{pollutant}} = \text{Fuel Consumption}_{\text{fuel}} \times \text{Emission Factor}_{\text{pollutant, fuel}}$$

Where:

Emissions _{pollutant}	= emissions of a given pollutant by type of fuel (kg pollutant)
Fuel consumption _{fuel}	= amount of fuel combusted (TJ)
Emission factor _{pollutant, fuel}	= default emission factor of a given pollutant by type of fuel (g _{pollutant} /GJ).
Pollutant	= main pollutants: NO _x , CO, NMVOC, SO ₂ particulate matter: TSP, PM ₁₀ , PM _{2.5} , 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

3.1.4.3.2.2 Choice of activity data

The following fuels are used for category 1.A.3.c Railways:

Tier 1 fuel type	Associated fuel types
Liquid fuels	<ul style="list-style-type: none"> Gas/Diesel Oil

Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2022 were taken from EUROSTAT, prepared by Albanian Institute of Statistics (INSTAT).

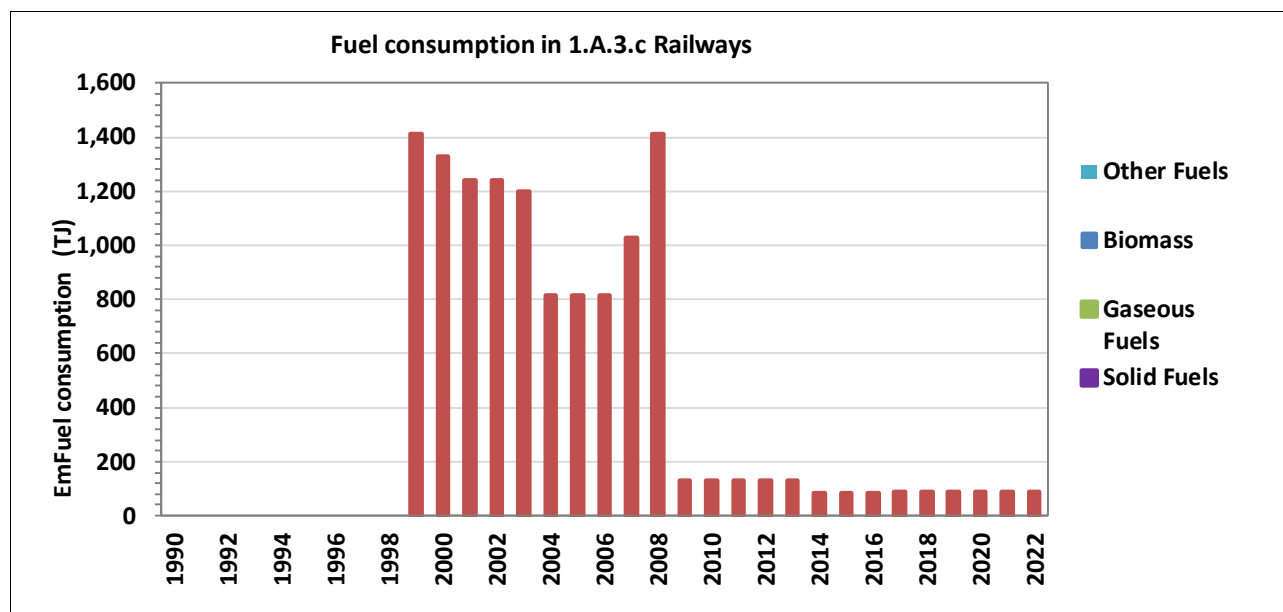


Figure 3.34 Activity data for category 1.A.3.c Railways

⁴¹ Source: EMEP/EEA air pollutant emission inventory guidebook 2023. Chapter 1.A.3.c Railways. sub-chapter 3.2 Tier 1 total fuel used methodology.

Table 3.178 Activity data for category 1.A.3.c Railways

Activity data 1.A.1.d	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	1,412.40	1,412.40	NO	NO	NO	NO	NO
2000	1,326.80	1,326.80	NO	NO	NO	NO	NO
2001	1,241.20	1,241.20	NO	NO	NO	NO	NO
2002	1,241.20	1,241.20	NO	NO	NO	NO	NO
2003	1,198.40	1,198.40	NO	NO	NO	NO	NO
2004	813.20	813.20	NO	NO	NO	NO	NO
2005	813.20	813.20	NO	NO	NO	NO	NO
2006	813.20	813.20	NO	NO	NO	NO	NO
2007	1,027.20	1,027.20	NO	NO	NO	NO	NO
2008	1,412.40	1,412.40	NO	NO	NO	NO	NO
2009	128.40	128.40	NO	NO	NO	NO	NO
2010	128.40	128.40	NO	NO	NO	NO	NO
2011	128.40	128.40	NO	NO	NO	NO	NO
2012	128.40	128.40	NO	NO	NO	NO	NO
2013	128.40	128.40	NO	NO	NO	NO	NO
2014	85.60	85.60	NO	NO	NO	NO	NO
2015	85.60	85.60	NO	NO	NO	NO	NO
2016	85.60	85.60	NO	NO	NO	NO	NO
2017	89.88	89.88	NO	NO	NO	NO	NO
2018	89.88	89.88	NO	NO	NO	NO	NO
2019	89.88	89.88	NO	NO	NO	NO	NO
2020	89.88	89.88	NO	NO	NO	NO	NO
2021	89.88	89.88	NO	NO	NO	NO	NO
2022	87.92	87.92	NO	NO	NO	NO	NO
Trend							
1990 – 2022	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	-89.2%	-89.2%	NA	NA	NA	NA	NA
2021 – 2022	-2.2%	-2.2%	NA	0.0%	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 bases on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in category 1.A.3.c Railways.

Table 3.179 Net calorific values (NCVs) applied for conversion to energy units in category 1.A.3.c Railways

Fuel	Fuel type	Net calorific value (NCV)					
		NCV	unit	type	NCV	unit	type
Gas/Diesel Oil (Non-bio gas/diesel oil)	liquid	43.292	TJ/Gg	CS	47.3	TJ/Gg	D
					for comparision		
Source		Eurostat (2023): Complete energy balances (Code: nrg_bal_c)			2006 IPCC guidelines, Vol. 2, Chapter 1, Table 1.2		
Note:							
D	Default	CS	Country specific		PS	Plant specific	

3.1.4.3.2.3 Choice of emission factors

Default emission factors for air pollutant were taken from the EMEP/EEA air pollutant emission inventory guidebook 2023 and are presented in the following table.

Table 3.180 Emission factors (EF) for Main pollutants, Particulate Matter (PM), Heavy metals (HM) and Persistent Organic Pollutants (POPs) for category 1.A.3.c Railways

Fuel Type	UNIT	Gas/Diesel Oil (Non-bio gas/diesel oil)	
		Default EF	type
NOx	kg/tonne fuel	52.40	D
CO	kg/tonne fuel	10.70	D
NMVOC	kg/tonne fuel	4.65	D
SOx	kg/tonne fuel	NA	
NH3	kg/tonne fuel	0.007	D
TSP	kg/tonne fuel	1.52	D
PM10	kg/tonne fuel	1.44	D
PM2.5	kg/tonne fuel	1.37	D
BC	% of PM2.5	0.65 of PM	D
Pb	g/tonne fuel	NA	D
Cd	g/tonne fuel	0.01	D
Hg	g/tonne fuel	NA	
As	g/tonne fuel	NA	
Cr	g/tonne fuel	0.05	D
Cu	g/tonne fuel	1.7	D
Ni	g/tonne fuel	0.07	D
Se	g/tonne fuel	0.01	D
Zn	g/tonne fuel	1	D
PCB	g/tonne fuel	NA	

Fuel Type			UNIT		Gas/Diesel Oil (Non-bio gas/diesel oil)					
Pollutant					Default EF			type		
PCDD/F			g/tonne fuel		NA					
Benzo(a)pyrene			g/tonne fuel		0.03			D		
Benzo(b)fluoranthene			g/tonne fuel		0.05			D		
Benzo(k)fluoranthene			g/tonne fuel		0.08			D		
Indeno(1,2,3-cd)pyrene			g/tonne fuel		NA					
HCB			g/tonne fuel		NA					
Source			Table 3-1 Tier 1 emission factors for railways. Section 3.2.2. page 8.							
			EMEP/EEA air pollutant emission inventory guidebook 2023. Part B. Chapter 1.A.1 Energy industries.							
Note:										
T1	TIER1	D	Default	CS	Country specific	PS	Plant specific	IEF	Implied emission factor	

3.1.4.3.3 Uncertainties and time-series consistency

The uncertainties for activity data and emission factors used for IPCC/NFR category 1.A.3.c Railways are presented in the following table.

Table 3.181 Uncertainty for category 1.A.3.c Railways.

Uncertainty	Solid fuels	Gaseous fuels	Liquid fuels	Biomass	Reference
Activity data (AD)	-	-	5%	-	Table 2.15. 2006 IPCC GL. Vol. 2. Chap. 2 (2.4.2)
Emission factor (EF)	Rating	Typical error range	Average	Reference	
NO _x	D	100% to 300%	200%	Table 2 2 Rating definitions Table 2 3 Main NFR source categories with applicable quality data ratings EMEP EEA GB 2023. Part A. Chapter 5 Uncertainties.	
CO	D	100% to 300%	200%		
NMVOC	D	100% to 300%	200%		
SO _x	B	20% to 60%	40%		
NH ₃	E	order of magnitude	750%		
TSP, PM ₁₀ , PM _{2.5} , BC	D	100% to 300%	200%		
Hg	B	20% to 60%	40%		
Pb, Cd, As, Cr, Cu, Ni, Se, Zn	D	100% to 300%	200%		
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.

3.1.4.3.4 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.

3.1.4.3.5 Source-specific recalculations

The following table presents the main revisions and recalculations done since last submission and relevant to category 1.A.3.c Railways.

Table 3.182 Recalculations done in category 1.A.3.c Railways

source category	Revisions of data	Type of revision	Type of improvement
1.A.3.c	Revision of NCV by using country specific NCV	AD	Accurary
1.A.3.c	Revision of activity data	AD	Accurary

3.1.4.3.6 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 3.183 Planned improvements for category 1.A.3.c Railways

source category	Planned improvement	Type of improvement		Priority
1.A.3.c	Collection of information on sulphur content Sulphur content in used fuel for preparing country specific emission factor (CS EF) $\Rightarrow \text{CS EF}_{\text{SO}_2} [\text{g/GJ}] = (\text{S} [\%] \cdot 20000) / (\text{NCV} [\text{GJ/t}])$	AD, EF	Completeness Accuracy Transparency	Medium
1.A.3.c	Improvement of time series consistency and split of fuels: check of years 1990- 2022	AD	Accuracy Transparency	High

3.1.4.4 Water-borne navigation (IPCC/NFR category 1.A.3.d)

3.1.4.4.1 Source category description

This section describes emissions resulting from fuel combustion activities of 1.A.3.d.i *Domestic water-borne navigation* (transport of goods or people) in Albania.

Table 3.184 Overview on reported emissions from sub categories 1.A.3.d.i *Domestic water-borne navigation*

Air pollutants	1.A.3.d Water-borne navigation						Key Category
	Liquid	Solid	Gaseous	Other fossil fuel	Peat	Biomass	
NO _x	✓	NO	NO	NO	NO	NO	-
CO	✓	NO	NO	NO	NO	NO	-
NM VOC	✓	NO	NO	NO	NO	NO	-
SO _x	✓	NO	NO	NO	NO	NO	-
NH ₃	NA	NO	NO	NO	NO	NO	-
TSP	✓	NO	NO	NO	NO	NO	-
PM ₁₀	✓	NO	NO	NO	NO	NO	-
PM _{2.5}	✓	NO	NO	NO	NO	NO	-
BC	✓	NO	NO	NO	NO	NO	-
Pb	✓	NO	NO	NO	NO	NO	-
Cd	✓	NO	NO	NO	NO	NO	-
Hg	✓	NO	NO	NO	NO	NO	-
As	✓	NO	NO	NO	NO	NO	-
Cr	✓	NO	NO	NO	NO	NO	-
Cu	✓	NO	NO	NO	NO	NO	-
Ni	✓	NO	NO	NO	NO	NO	-
Se	✓	NO	NO	NO	NO	NO	-
Zn	✓	NO	NO	NO	NO	NO	-
PCB	✓	NO	NO	NO	NO	NO	-
PCDD/F	✓	NO	NO	NO	NO	NO	-
PAH	✓	NO	NO	NO	NO	NO	-
Benzo(a)pyrene	✓	NO	NO	NO	NO	NO	-
Benzo(b)fluoranthene	✓	NO	NO	NO	NO	NO	-
Benzo(k)fluoranthene	NA	NO	NO	NO	NO	NO	-
Indeno(1,2,3-cd)pyrene	✓	NO	NO	NO	NO	NO	-
HCB	✓	NO	NO	NO	NO	NO	-
A '✓' indicates: emissions from this 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 category 1.A.3.d.i *Domestic water-borne navigation* is provided in the following figures and tables:

- annual emissions of air pollutants;
- Trend of the periods 1990 – 2022, 2005 – 2022, 2021 – 2022.

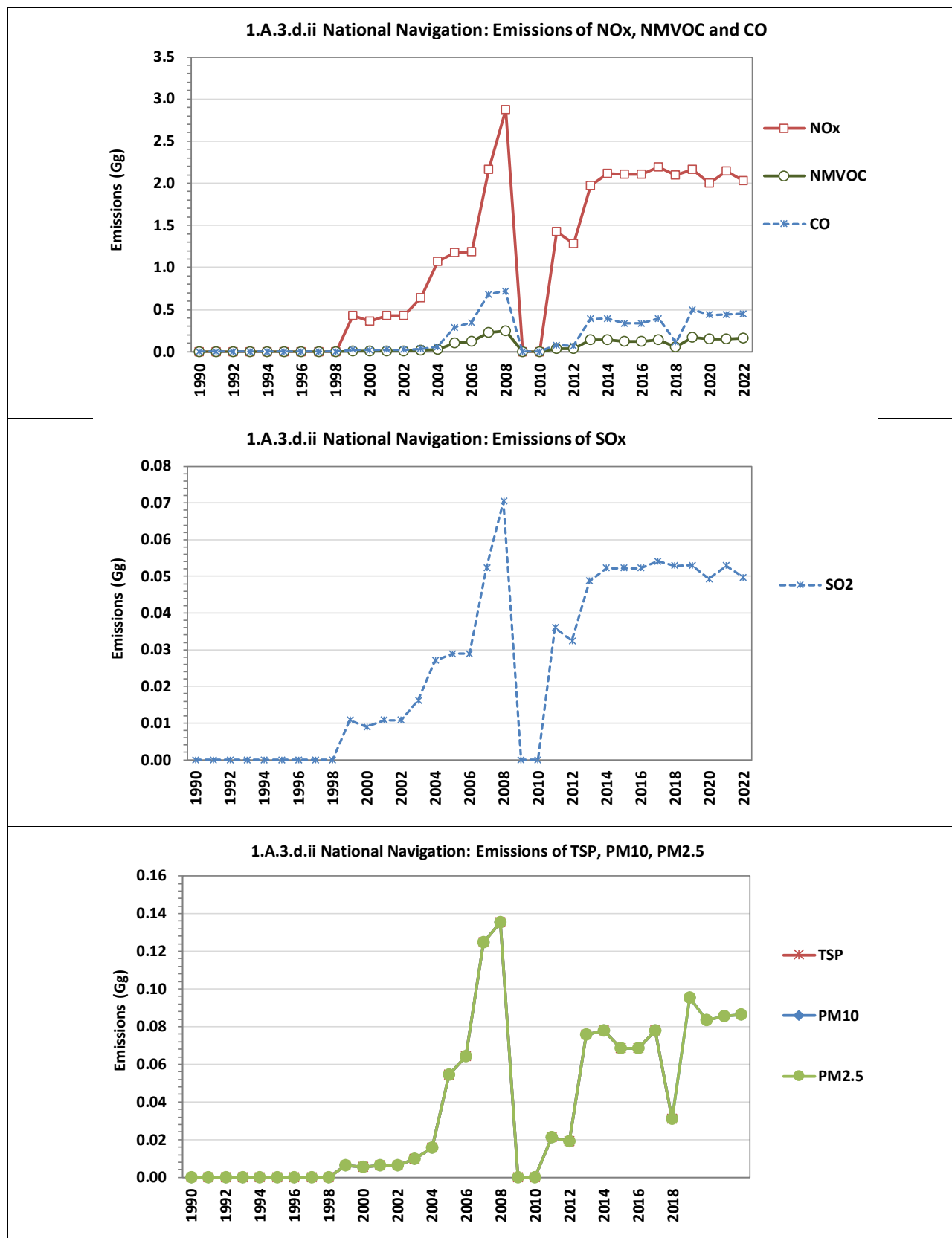


Figure 3.35 Emissions from category 1.A.3.d.i *Domestic water-borne navigation*

Table 3.185 Emissions of main pollutants (NO_x, SO₂, NMVOC, CO and NH₃) from category 1.A.3.d.i Domestic water-borne navigation

Emissions	NO _x	NMVOC	SO _x	CO	NH ₃
	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	IE	IE	IE	IE	NA
1997	IE	IE	IE	IE	NA
1998	IE	IE	IE	IE	NA
1999	0.428	0.010	0.011	0.023	NA
2000	0.357	0.009	0.009	0.019	NA
2001	0.428	0.010	0.011	0.023	NA
2002	0.428	0.010	0.011	0.023	NA
2003	0.642	0.016	0.016	0.034	NA
2004	1.071	0.026	0.027	0.057	NA
2005	1.179	0.100	0.029	0.288	NA
2006	1.189	0.118	0.029	0.345	NA
2007	2.163	0.230	0.052	0.679	NA
2008	2.877	0.247	0.070	0.717	NA
2009	IE	IE	IE	IE	NA
2010	IE	IE	IE	IE	NA
2011	1.428	0.035	0.036	0.076	NA
2012	1.285	0.031	0.032	0.068	NA
2013	1.974	0.137	0.049	0.387	NA
2014	2.117	0.140	0.052	0.394	NA
2015	2.107	0.122	0.052	0.338	NA
2016	2.107	0.122	0.052	0.338	NA
2017	2.189	0.140	0.054	0.392	NA
2018	2.099	0.051	0.053	0.112	NA
2019	2.162	0.173	0.053	0.498	NA
2020	2.003	0.152	0.049	0.434	NA
2021	2.145	0.155	0.053	0.441	NA
2022	2.026	0.157	0.050	0.451	NA
Trend					
1990 – 2022	NA	NA	NA	NA	NA
2005 – 2022	71.8%	57.8%	72.4%	56.4%	NA
2021 – 2022	-5.6%	1.4%	-5.8%	2.2%	NA

Table 3.186 Emissions of particulate matter (PM) from category 1.A.3.d.i Domestic water-borne navigation

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	0.006	0.006	0.006	0.000
2000	0.005	0.005	0.005	0.000
2001	0.006	0.006	0.006	0.000
2002	0.006	0.006	0.006	0.000
2003	0.010	0.010	0.010	0.000
2004	0.016	0.016	0.016	0.001
2005	0.055	0.055	0.055	0.001
2006	0.064	0.064	0.064	0.001
2007	0.125	0.125	0.125	0.001
2008	0.135	0.135	0.135	0.002
2009	IE	IE	IE	IE
2010	IE	IE	IE	IE
2011	0.021	0.021	0.021	0.001
2012	0.019	0.019	0.019	0.001
2013	0.076	0.076	0.076	0.001
2014	0.078	0.078	0.078	0.001
2015	0.068	0.068	0.068	0.001
2016	0.068	0.068	0.068	0.001
2017	0.078	0.078	0.078	0.001
2018	0.031	0.031	0.031	0.001
2019	0.095	0.095	0.095	0.001
2020	0.083	0.083	0.083	0.001
2021	0.086	0.086	0.086	0.001
2022	0.086	0.086	0.086	0.001
Trend				
1990 – 2022	NA	NA	NA	NA
2005 – 2022	58.4%	58.4%	58.4%	72.4%
2021 – 2022	1.0%	1.0%	1.0%	-5.9%

Table 3.187 Emissions of Heavy Metals (HM) from category 1.A.3.d.i Domestic water-borne navigation

Emissions	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg
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	<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	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
2012	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
2013	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
2014	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
2015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
2016	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
2017	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
2018	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
2019	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
2020	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
2021	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
2022	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Trend									
1990 – 2022	NA	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	72.4%	72.4%	72.4%	72.4%	72.4%	72.4%	72.4%	72.4%	72.4%
2021 – 2022	-5.9%	-5.9%	-5.9%	-5.9%	-5.9%	-5.9%	-5.9%	-5.9%	-5.9%

Table 3.188 Emissions of Persistent Organic Pollutants (POPs) from category 1.A.3.d.i Domestic water-borne navigation

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	<0.0001	<0.0001	<0.0001	NA	<0.0001	<0.0001	<0.0001	<0.0001
2000	<0.0001	<0.0001	<0.0001	NA	<0.0001	<0.0001	<0.0001	<0.0001
2001	<0.0001	<0.0001	<0.0001	NA	<0.0001	<0.0001	<0.0001	<0.0001
2002	<0.0001	<0.0001	<0.0001	NA	<0.0001	<0.0001	<0.0001	<0.0001
2003	<0.0001	<0.0001	<0.0001	NA	<0.0001	<0.0001	<0.0001	<0.0001
2004	<0.0001	<0.0001	<0.0001	NA	<0.0001	<0.0001	<0.0001	<0.0001
2005	<0.0001	<0.0001	<0.0001	NA	<0.0001	<0.0001	<0.0001	<0.0001
2006	<0.0001	<0.0001	<0.0001	NA	<0.0001	<0.0001	<0.0001	<0.0001
2007	<0.0001	<0.0001	<0.0001	NA	<0.0001	<0.0001	<0.0001	<0.0001
2008	<0.0001	<0.0001	<0.0001	NA	<0.0001	<0.0001	<0.0001	<0.0001
2009	IE	IE	IE	NA	IE	IE	IE	IE
2010	IE	IE	IE	NA	IE	IE	IE	IE
2011	<0.0001	<0.0001	<0.0001	NA	<0.0001	<0.0001	<0.0001	<0.0001
2012	<0.0001	<0.0001	<0.0001	NA	<0.0001	<0.0001	<0.0001	<0.0001
2013	<0.0001	<0.0001	<0.0001	NA	<0.0001	<0.0001	<0.0001	<0.0001
2014	<0.0001	<0.0001	<0.0001	NA	<0.0001	<0.0001	<0.0001	<0.0001
2015	<0.0001	<0.0001	<0.0001	NA	<0.0001	<0.0001	<0.0001	<0.0001
2016	<0.0001	<0.0001	<0.0001	NA	<0.0001	<0.0001	<0.0001	<0.0001
2017	<0.0001	<0.0001	<0.0001	NA	<0.0001	<0.0001	<0.0001	<0.0001
2018	<0.0001	<0.0001	<0.0001	NA	<0.0001	<0.0001	<0.0001	<0.0001
2019	<0.0001	<0.0001	<0.0001	NA	<0.0001	<0.0001	<0.0001	<0.0001
2020	<0.0001	<0.0001	<0.0001	NA	<0.0001	<0.0001	<0.0001	<0.0001
2021	<0.0001	<0.0001	<0.0001	NA	<0.0001	<0.0001	<0.0001	<0.0001
2022	<0.0001	<0.0001	<0.0001	NA	<0.0001	<0.0001	<0.0001	<0.0001
Trend								
1990 – 2022	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	72.4%	72.4%	72.4%	NA	72.4%	72.4%	72.4%	72.4%
2021 – 2022	-5.9%	-5.9%	-5.9%	NA	-5.9%	-5.9%	-5.9%	-5.9%

3.1.4.4.2 Methodological issues

3.1.4.4.2.1 Choice of methods

For estimating the air pollutants emissions the Tier 1 approach⁴² of the EMEP/EEA air pollutant emission inventory guidebook 2023 has been applied:

Equation: emissions from stationary combustion

$$\text{Emissions}_{\text{pollutant}} = \text{Fuel Consumption}_{\text{fuel}} \times \text{Emission Factor}_{\text{pollutant. fuel}}$$

Where:

Emissions _{pollutant}	= emissions of a given pollutant by type of fuel (kg pollutant)
Fuel consumption _{fuel}	= amount of fuel combusted (TJ)
Emission factor _{pollutant. fuel}	= default emission factor of a given pollutant by type of fuel (g _{pollutant} /GJ).
Pollutant	= main pollutants: NO _x , CO, NMVOC, SO ₂ particulate matter: TSP, PM ₁₀ , PM _{2.5} , 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

3.1.4.4.2.2 Choice of activity data

The following fuels are used for category 1.A.3.d.i *Domestic water-borne navigation*:

Tier 1 fuel type	Associated fuel types
Liquid fuels	• Gas/Diesel Oil
	• Gasoline

Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2022 were taken from EUROSTAT, prepared by Albanian Institute of Statistics (INSTAT).

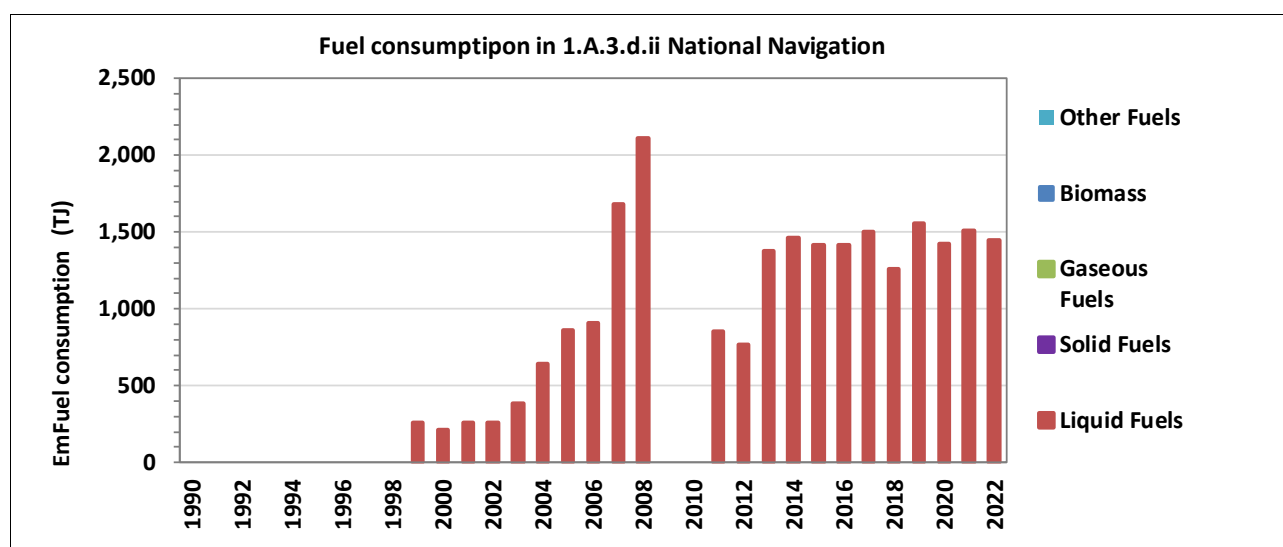


Figure 3.36 Activity data for category 1.A.3.d.i *Domestic water-borne navigation*

⁴² Source: EMEP/EEA air pollutant emission inventory guidebook 2023. Chapter 1.A.3.c Railways. sub-chapter 3.2 Tier 1 total fuel used methodology.

Table 3.189 Activity data for category 1.A.3.d.i Domestic water-borne navigation

Activity data 1.A.1.d.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	256.80	256.80	NO	NO	NO	NO	NO
2000	214.00	214.00	NO	NO	NO	NO	NO
2001	256.80	256.80	NO	NO	NO	NO	NO
2002	256.80	256.80	NO	NO	NO	NO	NO
2003	385.20	385.20	NO	NO	NO	NO	NO
2004	642.00	642.00	NO	NO	NO	NO	NO
2005	862.40	862.40	NO	NO	NO	NO	NO
2006	906.80	906.80	NO	NO	NO	NO	NO
2007	1,685.20	1,685.20	NO	NO	NO	NO	NO
2008	2,113.20	2,113.20	NO	NO	NO	NO	NO
2009	IE	IE	NO	NO	NO	NO	NO
2010	IE	IE	NO	NO	NO	NO	NO
2011	856.00	856.00	NO	NO	NO	NO	NO
2012	770.40	770.40	NO	NO	NO	NO	NO
2013	1,377.60	1,377.60	NO	NO	NO	NO	NO
2014	1,463.20	1,463.20	NO	NO	NO	NO	NO
2015	1,418.80	1,418.80	NO	NO	NO	NO	NO
2016	1,418.80	1,418.80	NO	NO	NO	NO	NO
2017	1,501.96	1,501.96	NO	NO	NO	NO	NO
2018	1,258.32	1,258.32	NO	NO	NO	NO	NO
2019	1,560.24	1,560.24	NO	NO	NO	NO	NO
2020	1,425.96	1,425.96	NO	NO	NO	NO	NO
2021	1,511.56	1,511.56	NO	NO	NO	NO	NO
2022	1,450.91	1,450.91	NO	NO	NO	NO	NO
Trend							
1990 – 2022	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	68.2%	68.2%	NA	NA	NA	NA	NA
2021 – 2022	-4.0%	-4.0%	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 bases on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in category 1.A.3.d.i *Domestic water-borne navigation*.

Table 3.190 Net calorific values (NCVs) applied for conversion to energy units in category 1.A.3.d.i *Domestic water-borne navigation*.

Fuel	Fuel type	Net calorific value (NCV)					
		NCV	unit	type	NCV	unit	type
Gas/Diesel Oil (Non-bio gas/diesel oil)	liquid	43.292	TJ/Gg	CS	47.3	TJ/Gg	D
Gasoline	liquid	44.80	TJ/Gg	CS	43.0	TJ/Gg	D
					<i>for comparision</i>		
Source		Eurostat (2023): Complete energy balances (Code: nrg_bal_c)			2006 IPCC guidelines, Vol. 2, Chapter 1, Table 1.2		
Note:							
D	Default	CS	Country specific		PS	Plant specific	

3.1.4.4.2.3 Choice of emission factors

Default emission factors for air pollutant were taken from the EMEP/EEA air pollutant emission inventory guidebook 2023 and are presented in the following table.

Table 3.191 Emission factors (EF) for Main pollutants, Particulate Matter (PM), Heavy metals (HM) and Persistent Organic Pollutants (POPs) for category 1.A.3.d.i *Domestic water-borne navigation*.

Fuel Type	UNIT	Gas/Diesel Oil (Non-bio gas/diesel oil)		Motor Gasoline	
Pollutant		Default EF	type	Default EF	type
NOx	kg/tonne fuel	72.2	D		
CO	kg/tonne fuel	3.84	D		
NMVOC	kg/tonne fuel	1.75	D		
SOx	kg/tonne fuel	1.82	D		
NH3	kg/tonne fuel	NA	D		
TSP	kg/tonne fuel	1.07	D		
PM10	kg/tonne fuel	1.07	D		
PM2.5	kg/tonne fuel	1.07	D		
BC	% of PM2.5	0.0483	D		
Pb	g/tonne fuel	0.13	D		
Cd	g/tonne fuel	0.01	D		
Hg	g/tonne fuel	0.03	D		
As	g/tonne fuel	0.04	D		
Cr	g/tonne fuel	0.05	D		
Cu	g/tonne fuel	0.88	D		
Ni	g/tonne fuel	1	D		
Se	g/tonne fuel	0.1	D		
Zn	g/tonne fuel	1.2	D		
PCB	mg/tonne fuel	0.038	D		

Fuel Type		UNIT	Gas/Diesel Oil (Non-bio gas/diesel oil)		Motor Gasoline				
Pollutant			Default EF	type	Default EF	type			
PCDD/F		ug I-TEQ/tonne	0.13	D					
Benzo(a)pyrene		g/tonne fuel	0.01	D					
Benzo(b)fluoranthene		g/tonne fuel	0.01	D					
Benzo(k)fluoranthene		g/tonne fuel	0.002	D					
Indeno(1,2,3-cd)pyrene		g/tonne fuel	0.001	D					
HCB		g/tonne fuel	0.08	D					
Source		Table 3-1 Tier 1 emission factors for ships using marine diesel oil/marine gas oil. Section 3.2.2. page 17.							
		EMEP/EEA air pollutant emission inventory guidebook 2023. Part B. Chapter 1.A.3.d.i, 1.A.3.d.ii, 1.A.4.c.iii International maritime and inland navigation, national navigation, national fishing, recreational boats International maritime navigation, international inland navigation, national navigation (shipping), national fishing.							
Note:									
T1	TIER1	D	Default	CS	Country specific	PS	Plant specific	IEF	Implied emission factor

3.1.4.4.3 Uncertainties and time-series consistency

The uncertainties for activity data and emission factors used for IPCC/NFR category 1.A.3.d.i *Domestic water-borne navigation* s are presented in the following table.

Table 3.192 Uncertainty for category 1.A.3.d.i Domestic water-borne navigation.

Uncertainty	Solid fuels	Gaseous fuels	Liquid fuels	Biomass	Reference
Activity data (AD)	-	-	5%	-	Table 2.15. 2006 IPCC GL. Vol. 2. Chap. 2 (2.4.2)
Emission factor (EF)	Rating	Typical error range	Average	Reference Table 2 2 Rating definitions Table 2 3 Main NFR source categories with applicable quality data ratings EMEP EEA GB 2023. Part A. Chapter 5 Uncertainties.	
NO _x	D	100% to 300%	200%		
CO	D	100% to 300%	200%		
NM VOC	D	100% to 300%	200%		
SO _x	B	20% to 60%	40%		
NH ₃	E	order of magnitude	750%		
TSP, PM ₁₀ , PM _{2.5} , BC	D	100% to 300%	200%		
Hg	B	20% to 60%	40%		
Pb, Cd, As, Cr, Cu, Ni, Se, Zn	D	100% to 300%	200%		
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.

3.1.4.4.4 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.

3.1.4.4.5 Source-specific recalculations

The following table presents the main revisions and recalculations done since last submission and relevant to category 1.A.3.d.i *Domestic water-borne navigation*.

Table 3.193 Recalculations done in category 1.A.3.d.i *Domestic water-borne navigation*.

source category	Revisions of data	Type of revision	Type of improvement
1.A.3.d	Revision of NCV by using country specific NCV	AD	Accurary
1.A.3.d	Revision of activity data	AD	Accurary

3.1.4.4.6 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 3.194 Planned improvements for category 1.A.3.d.i *Domestic water-borne navigation*.

source category	Planned improvement	Type of improvement		Priority
1.A.3.d	Collection of information on sulphur content Sulphur content in used fuel for preparing country specific emission factor (CS EF) $\Rightarrow \text{CS EF}_{\text{SO}_2} [\text{g/GJ}] = (\text{S} [\%] \cdot 20000) / (\text{NCV} [\text{GJ/t}])$	AD, EF	Completeness Accuracy Transparency	Medium
1.A.3.d	Improvement of time series consistency and split of fuels: check of years 1990- 2022	AD	Accuracy Transparency	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.

		Air pollutants emissions			
		estimated	IE included elsewhere	NO not accruing	NE not estimated
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.b.i	stationary	✓			
1.A.4.b.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 3.195 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						Key Category	1.A.4.a.ii						Key Category
	liquid	solid	gaseous	Other fossil fuel	Peat	biomass		liquid	solid	gaseous	Other fossil fuel	Peat	biomass	
NO _x	✓	✓	✓	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 _x	✓	✓	✓	NO	NO	✓		IE	NO	IE	NO	NO	NO	
NH ₃	NA	NA	NA	NO	NO	✓		IE	NO	IE	NO	NO	NO	
TSP	✓	✓	✓	NO	NO	✓		IE	NO	IE	NO	NO	NO	
PM ₁₀	✓	✓	✓	NO	NO	✓		IE	NO	IE	NO	NO	NO	
PM _{2.5}	✓	✓	✓	NO	NO	✓		IE	NO	IE	NO	NO	NO	

Air pollutants	1.A.4.a.i						Key Category	1.A. 4.a.ii						Key Category
	liquid	solid	gaseous	Other fossil fuel	Peat	biomass		liquid	solid	gaseous	Other fossil fuel	Peat	biomass	
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	✓	✓	NA	NO	NO	✓		IE	NO	IE	NO	NO	NO	
Benzo(a)pyrene	✓	✓	NA	NO	NO	✓		IE	NO	IE	NO	NO	NO	
Benzo(b)fluoranthene	✓	✓	NA	NO	NO	✓		IE	NO	IE	NO	NO	NO	
Benzo(k)fluoranthene	✓	✓	NA	NO	NO	✓		IE	NO	IE	NO	NO	NO	
Indeno(1,2,3-cd)pyrene	✓	✓	NA	NO	NO	✓		IE	NO	IE	NO	NO	NO	
HCB	NA	✓	NA	NO	NO	✓		IE	NO	IE	NO	NO	NO	
A ‘✓’ indicates: emissions from this category have been estimated.														
Notation keys: IE - included elsewhere. NO – not occurred. NE - not estimated. NA - not applicable. C – confidential														
Use of notation keys														
1.A.4.a.ii	IE		The emissions are included in 1.A.4.a.i stationary.											

An overview of the emission from fuel combustion in Category 1.A.4.a Commercial/Institutional is provided in the following figures and tables:

- annual emissions of air pollutants;
- Trend of the periods 1990 – 2022, 2005 – 2022, 2021 – 2022.

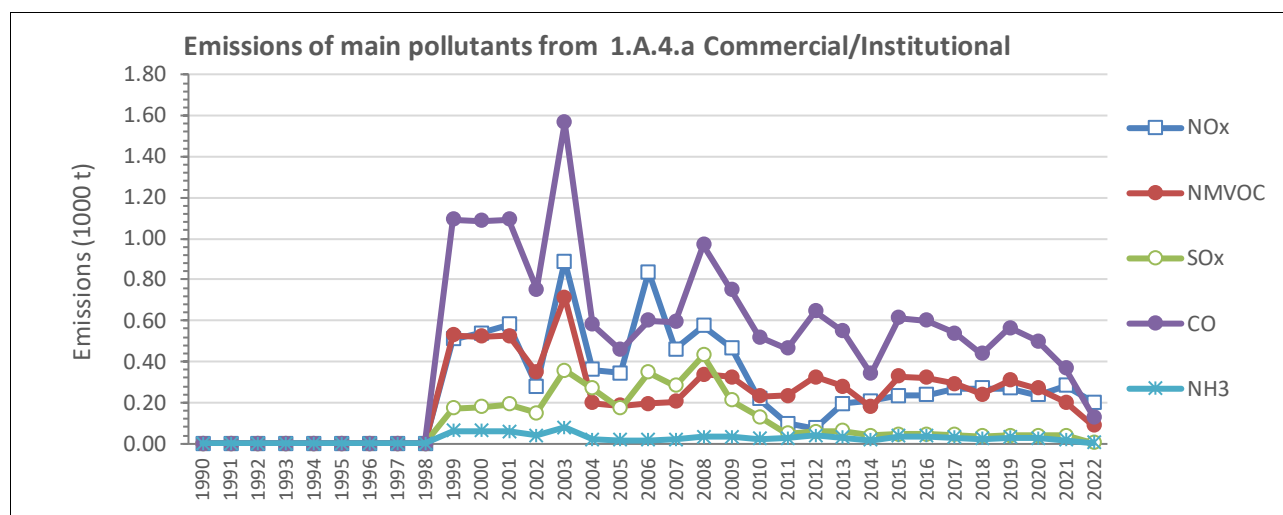


Figure 3.37 Emissions category 1.A.4.a Commercial/Institutional of main pollutants (NOx, SO2, NMVOC and CO)

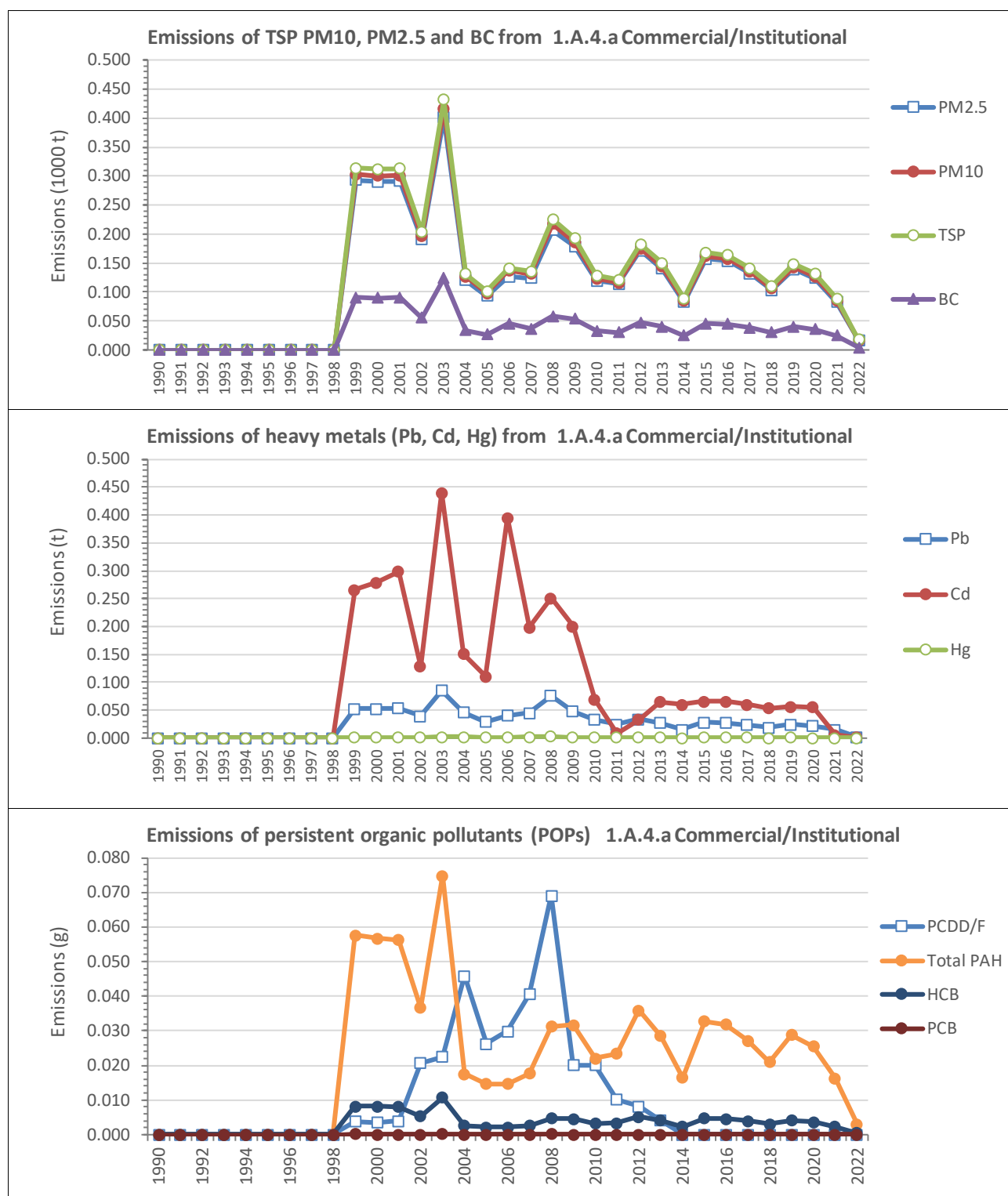


Figure 3.38 Emissions of dust, heavy metals and POPs from category 1.A.4.a Commercial/Institutional

Table 3.196 Emissions of main pollutants (NO_x, SO₂, NMVOC and CO) from category 1.A.4.a Commercial/Institutional

Emissions	NO _x	NMVOC	SO _x	CO	NH ₃
	Gg	Gg	Gg	Gg	Gg
1990	IE	IE	IE	IE	IE
1991	IE	IE	IE	IE	IE
1992	IE	IE	IE	IE	IE

Emissions	NOx	NMVOC	SOx	CO	NH3
	Gg	Gg	Gg	Gg	Gg
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	0.509	0.529	0.171	1.093	0.061
2000	0.537	0.524	0.180	1.088	0.060
2001	0.581	0.524	0.192	1.094	0.059
2002	0.278	0.346	0.150	0.753	0.039
2003	0.890	0.714	0.356	1.568	0.079
2004	0.360	0.198	0.269	0.580	0.019
2005	0.343	0.184	0.170	0.456	0.016
2006	0.836	0.195	0.348	0.599	0.016
2007	0.461	0.204	0.283	0.594	0.019
2008	0.574	0.338	0.432	0.971	0.033
2009	0.467	0.326	0.211	0.750	0.033
2010	0.217	0.229	0.128	0.517	0.023
2011	0.097	0.233	0.050	0.463	0.025
2012	0.076	0.323	0.057	0.645	0.038
2013	0.194	0.279	0.060	0.549	0.030
2014	0.208	0.178	0.040	0.339	0.017
2015	0.232	0.326	0.045	0.614	0.035
2016	0.236	0.319	0.045	0.602	0.034
2017	0.269	0.291	0.042	0.539	0.029
2018	0.270	0.241	0.037	0.439	0.022
2019	0.269	0.307	0.039	0.566	0.030
2020	0.238	0.269	0.038	0.500	0.027
2021	0.282	0.201	0.040	0.366	0.017
2022	0.200	0.089	0.003	0.129	0.003
Trend					
1990 – 2022	NA	NA	NA	NA	NA
2005 – 2022	-41.7%	-51.8%	-98.4%	-71.8%	-78.8%
2021 – 2022	-29.1%	-55.8%	-93.0%	-64.8%	-80.9%

Table 3.197 Emissions of particulate matter (PM) from category 1.A.4.a Commercial/Institutional

Emissions	PM2.5	PM10	TSP	BC
	Gg	Gg	Gg	Gg
1990	IE	IE	IE	IE
1991	IE	IE	IE	IE

Emissions	PM2.5	PM10	TSP	BC
	Gg	Gg	Gg	Gg
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	0.293	0.302	0.314	0.090
2000	0.290	0.300	0.312	0.090
2001	0.291	0.301	0.312	0.091
2002	0.190	0.196	0.204	0.055
2003	0.401	0.416	0.432	0.124
2004	0.120	0.126	0.131	0.034
2005	0.094	0.098	0.102	0.027
2006	0.127	0.137	0.141	0.046
2007	0.124	0.131	0.136	0.037
2008	0.207	0.217	0.226	0.058
2009	0.179	0.186	0.193	0.054
2010	0.119	0.123	0.128	0.033
2011	0.113	0.116	0.121	0.030
2012	0.171	0.175	0.182	0.048
2013	0.140	0.144	0.150	0.040
2014	0.083	0.085	0.088	0.025
2015	0.157	0.161	0.168	0.046
2016	0.153	0.157	0.164	0.044
2017	0.132	0.135	0.141	0.038
2018	0.103	0.106	0.110	0.030
2019	0.139	0.142	0.148	0.040
2020	0.124	0.127	0.132	0.036
2021	0.083	0.085	0.088	0.024
2022	0.016	0.017	0.017	0.004
Trend				
1990 – 2022	NA	NA	NA	NA
2005 – 2022	-82.6%	-83.1%	-83.1%	-84.7%
2021 – 2022	-80.2%	-80.5%	-80.5%	-83.3%

Table 3.198 Emissions of Heavy Metals (HM) from category 1.A.4.a Commercial/Institutional

Emissions	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg
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	0.053	0.266	0.001	0.001	0.054	0.015	0.207	0.001	0.872
2000	0.053	0.279	0.001	0.001	0.054	0.015	0.218	0.001	0.861
2001	0.053	0.299	0.001	0.001	0.056	0.015	0.235	0.001	0.857
2002	0.040	0.128	0.001	0.001	0.033	0.010	0.098	0.001	0.566
2003	0.086	0.439	0.002	0.002	0.078	0.023	0.348	0.002	1.161
2004	0.046	0.150	0.002	0.001	0.024	0.010	0.123	0.001	0.316
2005	0.030	0.110	0.001	0.001	0.018	0.007	0.090	0.001	0.252
2006	0.041	0.395	0.001	0.002	0.037	0.012	0.327	0.001	0.285
2007	0.045	0.199	0.002	0.002	0.027	0.010	0.163	0.001	0.318
2008	0.076	0.250	0.003	0.002	0.041	0.016	0.205	0.001	0.551
2009	0.048	0.200	0.001	0.001	0.035	0.011	0.160	0.001	0.506
2010	0.033	0.069	0.001	0.001	0.020	0.007	0.053	0.001	0.349
2011	0.025	0.009	0.001	<0.001	0.016	0.005	0.002	<0.001	0.354
2012	0.034	0.033	0.001	<0.001	0.025	0.007	0.019	0.001	0.536
2013	0.028	0.064	0.001	0.001	0.023	0.006	0.047	0.001	0.429
2014	0.016	0.060	<0.001	<0.001	0.014	0.004	0.046	<0.001	0.248
2015	0.028	0.066	0.001	0.001	0.025	0.007	0.047	0.001	0.486
2016	0.027	0.066	0.001	0.001	0.025	0.007	0.047	0.001	0.474
2017	0.024	0.060	0.001	0.001	0.021	0.006	0.044	0.001	0.405
2018	0.019	0.053	0.001	0.001	0.017	0.005	0.039	<0.001	0.314
2019	0.025	0.056	0.001	0.001	0.022	0.006	0.040	0.001	0.428
2020	0.022	0.055	0.001	<0.001	0.020	0.005	0.040	0.001	0.380
2021	0.015	0.006	0.001	<0.001	0.014	0.004	0.045	<0.001	0.246
2022	0.002	0.001	<0.001	<0.001	0.002	0.001	<0.001	<0.001	0.047
Trend									
1990 – 2022	NA	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	-91.8%	-99.0%	-76.9%	-72.6%	-88.6%	-91.9%	-99.8%	-65.2%	-81.2%
2021 – 2022	-84.2%	-81.0%	-39.9%	-42.6%	-85.4%	-86.0%	-99.5%	-50.3%	-80.7%

Table 3.199 Emissions of Persistent Organic Pollutants (POPs) from category 1.A.4.a 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	IE	IE	IE	IE	IE	IE	IE	IE
1991	IE	IE	IE	IE	IE	IE	IE	IE
1992	IE	IE	IE	IE	IE	IE	IE	IE
1993	IE	IE	IE	IE	IE	IE	IE	IE
1994	IE	IE	IE	IE	IE	IE	IE	IE
1995	IE	IE	IE	IE	IE	IE	IE	IE
1996	IE	IE	IE	IE	IE	IE	IE	IE
1997	IE	IE	IE	IE	IE	IE	IE	IE
1998	IE	IE	IE	IE	IE	IE	IE	IE
1999	0.004	0.016	0.026	0.008	0.007	0.058	0.008	<0.001
2000	0.004	0.016	0.026	0.008	0.006	0.057	0.008	<0.001
2001	0.004	0.016	0.026	0.008	0.006	0.056	0.008	<0.001
2002	0.021	0.010	0.017	0.005	0.004	0.037	0.005	<0.001
2003	0.023	0.021	0.034	0.011	0.009	0.075	0.011	<0.001
2004	0.046	0.005	0.008	0.003	0.002	0.018	0.003	<0.001
2005	0.026	0.004	0.007	0.002	0.002	0.015	0.002	<0.001
2006	0.030	0.004	0.007	0.002	0.002	0.015	0.002	<0.001
2007	0.041	0.005	0.008	0.003	0.002	0.018	0.003	<0.001
2008	0.069	0.009	0.014	0.004	0.004	0.031	0.005	<0.001
2009	0.020	0.009	0.014	0.005	0.004	0.032	0.005	<0.001
2010	0.020	0.006	0.010	0.003	0.003	0.022	0.003	<0.001
2011	0.010	0.007	0.011	0.003	0.003	0.023	0.003	<0.001
2012	0.008	0.010	0.016	0.005	0.004	0.036	0.005	<0.001
2013	0.004	0.008	0.013	0.004	0.003	0.029	0.004	<0.001
2014	<0.001	0.005	0.008	0.002	0.002	0.016	0.002	<0.001
2015	<0.001	0.009	0.015	0.005	0.004	0.033	0.005	<0.001
2016	<0.001	0.009	0.015	0.005	0.004	0.032	0.005	<0.001
2017	<0.001	0.008	0.012	0.004	0.003	0.027	0.004	<0.001
2018	<0.001	0.006	0.010	0.003	0.002	0.021	0.003	<0.001
2019	<0.001	0.008	0.013	0.004	0.003	0.029	0.004	<0.001
2020	<0.001	0.007	0.012	0.004	0.003	0.026	0.004	<0.001
2021	<0.001	0.005	0.007	0.002	0.002	0.016	0.002	<0.001
2022	<0.001	0.001	0.001	<0.001	<0.001	0.003	<0.001	<0.001
Trend								
1990 – 2022	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	-99.9%	-78.8%	-78.8%	-78.8%	-78.8%	-78.8%	-79.5%	-88.2%
2021 – 2022	-80.9%	-80.9%	-80.9%	-80.9%	-80.9%	-80.9%	-80.9%	-80.9%

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 approach⁴³ of the EMEP/EEA air pollutant emission inventory guidebook 2023 has been applied:

Equation: emissions from stationary combustion

$$\text{Emissions}_{\text{pollutant}} = \text{Fuel Consumption}_{\text{fuel}} \times \text{Emission Factor}_{\text{pollutant. fuel}}$$

Where:

Emissions _{pollutant}	= emissions of a given pollutant by type of fuel (kg pollutant)
Fuel consumption _{fuel}	= amount of fuel combusted (TJ)
Emission factor _{pollutant. fuel}	= default emission factor of a given pollutant by type of fuel (g _{pollutant} /GJ).
Pollutant	= main pollutants: NO _x , CO, NMVOC, SO ₂ particulate matter: TSP, PM ₁₀ , PM _{2.5} , 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"> Gas/Diesel Oil Motor Gasoline (Non-biogasoline) Other Kerosene Other Oil - Other Petroleum Products Liquefied Petroleum Gases (LPG) 	Summary of fuel aggregations at Tier 1 according to EMEP/EEA air pollutant emission inventory guidebook 2023. Part B. Chapter 1.A.4.
Solid fuels	<ul style="list-style-type: none"> Lignite 	
Biomass	<ul style="list-style-type: none"> Charcoal Wood/ Fuelwood Wood Waste Wood pellets WoodBriquette 	

Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2022 were taken from prepared by Albanian Institute of Statistics (INSTAT).

⁴³ Source: EMEP/EEA air pollutant emission inventory guidebook 2023. 1.A.2 Manufacturing industries and construction (combustion). sub-chapter 3.2 Tier 1 default approach.

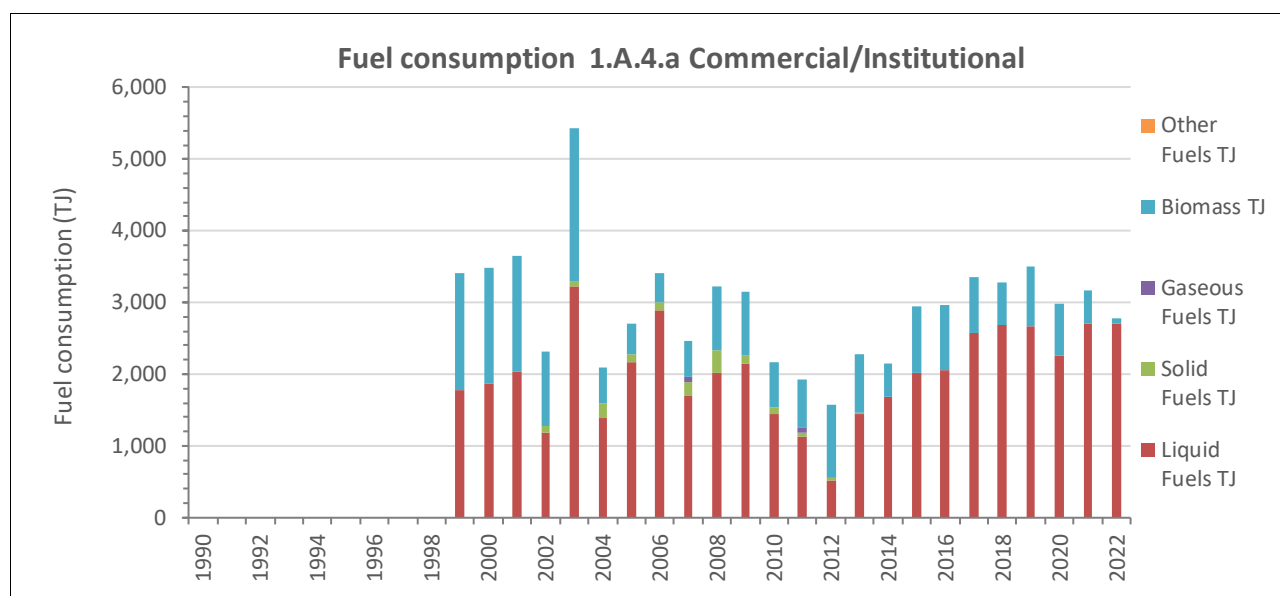


Figure 3.39 Activity data for category 1.A.4.a Commercial/Institutional

Table 3.200 Activity data for category 1.A.4.a Commercial/Institutional

Activity data 1.A.1.a	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Biomass	Peat	Other fuels
	TJ						
1990	IE	IE	IE	NO	IE	NO	0.00
1991	IE	IE	IE	NO	IE	NO	0.00
1992	IE	IE	IE	NO	IE	NO	0.00
1993	IE	IE	IE	NO	IE	NO	0.00
1994	IE	IE	IE	NO	IE	NO	0.00
1995	IE	IE	IE	NO	IE	NO	0.00
1996	IE	IE	IE	NO	IE	NO	0.00
1997	IE	IE	IE	NO	IE	NO	0.00
1998	IE	IE	IE	NO	IE	NO	0.00
1999	3,416.51	1,771.51	IE	NO	1,645.00	NO	0.00
2000	3,483.11	1,863.11	IE	NO	1,620.00	NO	0.00
2001	3,648.82	2,040.82	IE	NO	1,608.00	NO	0.00
2002	2,314.12	1,188.38	78.74	NO	1,047.00	NO	0.00
2003	5,440.25	3,216.67	88.59	NO	2,135.00	NO	0.00
2004	2,091.30	1,382.59	206.70	NO	502.00	NO	0.00
2005	2,702.55	2,165.43	118.12	NO	419.00	NO	0.00
2006	3,418.55	2,881.43	118.12	NO	419.00	NO	0.00
2007	2,469.60	1,704.98	187.02	75.60	502.00	NO	0.00
2008	3,231.39	2,014.58	324.82	NO	892.00	NO	0.00
2009	3,155.71	2,153.28	98.43	NO	904.00	NO	0.00
2010	2,170.46	1,444.03	98.43	NO	628.00	NO	0.00
2011	1,919.48	1,135.46	49.22	64.80	670.00	NO	0.00
2012	1,577.06	511.69	39.37	NO	1,026.00	NO	0.00
2013	2,283.23	1,446.55	19.69	NO	817.00	NO	0.00

Activity data 1.A.1.a	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Biomass	Peat	Other fuels
TJ							
2014	2,152.10	1,683.10	NO	NO	469.00	NO	0.00
2015	2,949.28	2,014.28	NO	NO	935.00	NO	0.00
2016	2,971.79	2,061.59	NO	NO	910.20	NO	0.00
2017	3,353.26	2,577.12	NO	NO	776.15	NO	0.00
2018	3,287.40	2,687.69	NO	NO	599.72	NO	0.00
2019	3,496.41	2,674.20	NO	NO	822.21	NO	0.00
2020	2,983.67	2,255.27	NO	NO	728.40	NO	0.00
2021	3175.86	2710.72	NO	NO	465.14	NO	0.00
2022	2,787.27	2,698.47	NO	NO	88.80	NO	0.00
Trend							
1990–2020	NA	NA	NA	NA	NA	NA	NA
2005–2020	3.1%	24.6%	NA	NA	-78.8%	NA	NA
2019–2020	-12.2%	-0.5%	NA	NA	-80.9%	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 category 1.A.4.a Commercial/Institutional.

Table 3.201 Net calorific values (NCVs) applied for conversion to energy units in category 1.A.4.a.i Commercial/Institutional

Fuel	Fuel type	Net calorific value (NCV) (TJ/Gg) or * (TJ/m³)			
		NCV	type	NCV	type
Lignite	solid	9.843	CS	11.9	D
Residual fuel oil	liquid	40.193	CS	40.4	D
Gas/Diesel Oil	liquid	43.292	CS	43.0	D
Motor gasoline	liquid	44.799	CS	44.3	D
Liquefied Petroleum Gases (LPG)	liquid	46.89	CS	47.3	D
Other Kerosene	liquid	43.00	CS	43.8	D
Other oil products n.e.c.	liquid	44.799	CS	40.2	D
Charcoal	biomass	46.00	CS	25.9	D
Wood/ Fuelwood*	biomass	9.1764	CS	15.6	D
		Source			
		Albanian Institute of Statistics (INSTAT)		2006 IPCC Guidelines, Vol 2, Chapter 1, Table 1.2	
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 2023 and are presented in the following table.

Table 3.202 Emission factors (EF) for Main pollutants, Particulate Matter (PM), Heavy metals (HM) and Persistent Organic Pollutants (POPs) for 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) Other kerosene		Natural gas		Charcoal Wood/ Fuelwood	
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
NM VOC	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	NA	D	0.78	D	1.2	D
NH3	g/GJ	NA		21		NA		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	NA	D	0.06	D
PCDD/F	ng I-TEQ/GJ	203	D	6	D	NA	D	100	D
Benzo(a)pyrene	µg/GJ	0.0455	D	1.9	D	NA	D	0.01	D
Benzo(b)fluoranthene	µg/GJ	0.0589	D	15	D	NA	D	0.016	D
Benzo(k)fluoranthene	µg/GJ	0.0237	D	1.7	D	NA	D	0.005	D
Indeno(1,2,3-cd)pyrene	µg/GJ	0.0185	D	1.5	D	NA	D	0.004	D
HCB	µg/GJ	0.62	D	0.22	D	NA	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 2023. ⁴⁴ Part B. Chapter 1.A4 Small combustion							
Note:									
D	Default	CS Country specific		PS	Plant specific		IEF	Implied emission factor	

⁴⁴ Source: EMEP/EEA air pollutant emission inventory guidebook 2023. Chapter 1.A4 Small combustion. sub-chapter 3.2.2 Default emission factors.

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 Commercial/Institutional are presented in the following table.

Table 3.203 Uncertainty for category 1.A.4.a.i Commercial/Institutional

Uncertainty		Lignite	Gaseous fuels	Heavy Fuel Oil	Gas oil	Biomass	Reference
Activity data (AD)		3%	5%	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 2023. Part A. Chapter 5 Uncertainties.	
CO	C	50% to 200%		125%			
NMVOOC	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 last submission and relevant to category 1.A.4.a Commercial/Institutional.

Table 3.204 Recalculations done in category 1.A.4.a Commercial/Institutional

source category	Revisions of data	Type of revision	Type of improvement
1.A.4.a	Revision of energy balance	AD	Consistency
1.A.4.a	use of CS NCV	AD	Comparability

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 3.205 Planned improvements for category 1.A.4.a.i Commercial/Institutional

Source category	Planned improvement	Type of improvement		Priority
1.A.4.a	<ul style="list-style-type: none"> 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. Split of fuels to different sub categories (1A4ai and 1A4aii) 	AD	Accuracy Transparency	High
1.A.4.a	Characterisation of <ul style="list-style-type: none"> residential heating / non-residential heating: <ul style="list-style-type: none"> (open/partly open) fire places. water heaters. advanced/ conventional stoves. space heating. boilers <ul style="list-style-type: none"> Conventional boilers >50kW Standard boilers >50KWth <1MWth Boilers <1MWth – manual feed technology Boilers <1MWth – automatic feed technology Standard boilers >50KWth <1MWth Standard boilers >1MWth <50MWth cookers; CHP 	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 3.206 Overview on reported emissions from sub categories 1.A.4.b.i. 1.A. 4.b.ii

Air pollutants	1.A.4.b.i						Key Category	1.A. 4.b.ii						Key Category
	liquid	solid	gaseous	Other fossil fuel	Peat	biomass		liquid	solid	gaseous	Other fossil fuel	Peat	biomass	
NO _x	✓	✓	✓	NO	NO	✓	-	IE	NO	NO	NO	NO	NO	-
CO	✓	✓	✓	NO	NO	✓	-	IE	NO	NO	NO	NO	NO	-
NM VOC	✓	✓	✓	NO	NO	✓	-	IE	NO	NO	NO	NO	NO	-
SO _x	✓	✓	✓	NO	NO	✓	-	IE	NO	NO	NO	NO	NO	-
NH ₃	NA	NA	NA	NO	NO	✓	-	IE	NO	NO	NO	NO	NO	-
TSP	✓	✓	✓	NO	NO	✓	-	IE	NO	NO	NO	NO	NO	-
PM ₁₀	✓	✓	✓	NO	NO	✓	-	IE	NO	NO	NO	NO	NO	-
PM _{2.5}	✓	✓	✓	NO	NO	✓	-	IE	NO	NO	NO	NO	NO	-
BC	✓	✓	✓	NO	NO	✓	-	IE	NO	NO	NO	NO	NO	-
Pb	✓	✓	✓	NO	NO	✓	-	IE	NO	NO	NO	NO	NO	-
Cd	✓	✓	✓	NO	NO	✓	-	IE	NO	NO	NO	NO	NO	-
Hg	✓	✓	✓	NO	NO	✓	-	IE	NO	NO	NO	NO	NO	-
As	✓	✓	✓	NO	NO	✓	-	IE	NO	NO	NO	NO	NO	-
Cr	✓	✓	✓	NO	NO	✓	-	IE	NO	NO	NO	NO	NO	-
Cu	✓	✓	✓	NO	NO	✓	-	IE	NO	NO	NO	NO	NO	-
Ni	✓	✓	✓	NO	NO	✓	-	IE	NO	NO	NO	NO	NO	-
Se	✓	✓	✓	NO	NO	✓	-	IE	NO	NO	NO	NO	NO	-
Zn	✓	✓	✓	NO	NO	✓	-	IE	NO	NO	NO	NO	NO	-
PCB	NA	✓	NA	NO	NO	✓	-	IE	NO	NO	NO	NO	NO	-
PCDD/F	✓	✓	✓	NO	NO	✓	-	IE	NO	NO	NO	NO	NO	-
Benzo(a)pyrene	✓	✓	✓	NO	NO	✓	-	IE	NO	NO	NO	NO	NO	-
Benzo(b)fluor-anthene	✓	✓	✓	NO	NO	✓	-	IE	NO	NO	NO	NO	NO	-
Benzo(k)fluor-anthene	✓	✓	✓	NO	NO	✓	-	IE	NO	NO	NO	NO	NO	-

Air pollutants	1.A.4.b.i						Key Category	1.A. 4.b.ii						Key Category
	liquid	solid	gaseous	Other fossil fuel	Peat	biomass		liquid	solid	gaseous	Other fossil fuel	Peat	biomass	
Indeno(1,2,3-cd)pyrene	✓	✓	✓	NO	NO	✓	-	IE	NO	NO	NO	NO	NO	-
HCB	NA	✓	✓	NO	NO	✓	-	IE	NO	NO	NO	NO	NO	-
<p>A '✓' indicates: emissions from this category have been estimated.</p> <p>Notation keys: IE - included elsewhere. NO – not occurring. NE - not estimated. NA - not applicable. C – confidential</p> <p>Use of notation keys</p> <p>1.A. 4.b.ii IE The emissions are included in</p> <ul style="list-style-type: none"> • 1.A.4.b.i stationary • 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 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 – 2022, 2005 – 2022, 2021 – 2022.

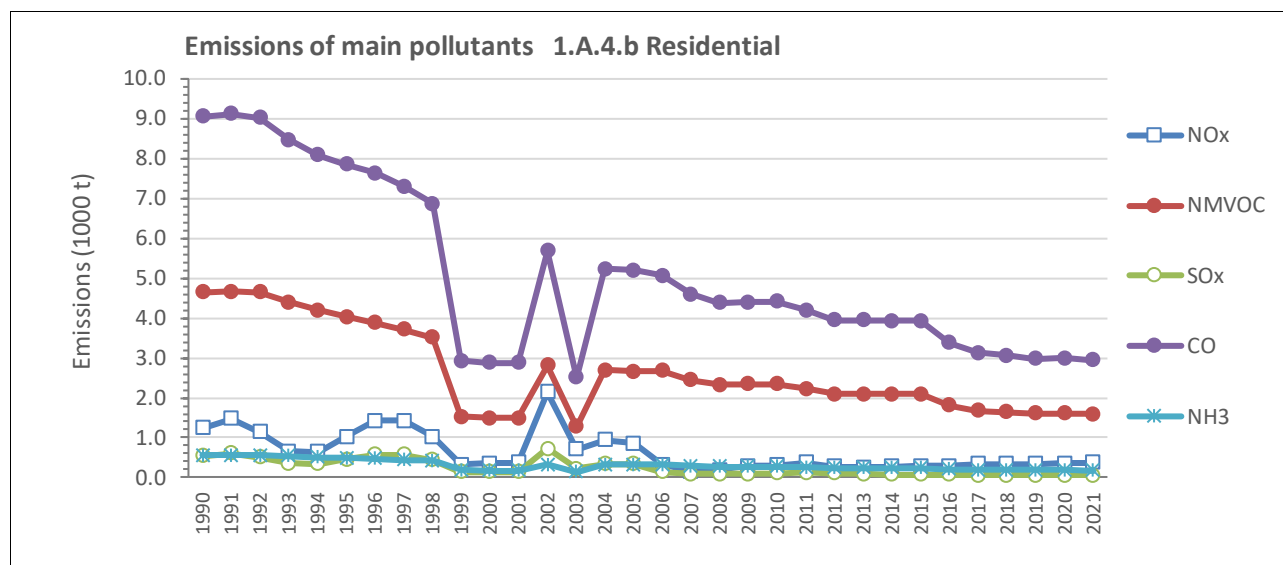


Figure 3.40 Emissions category 1.A.4.b Residential of main pollutants (NOx, SO2, NMVOC and CO)

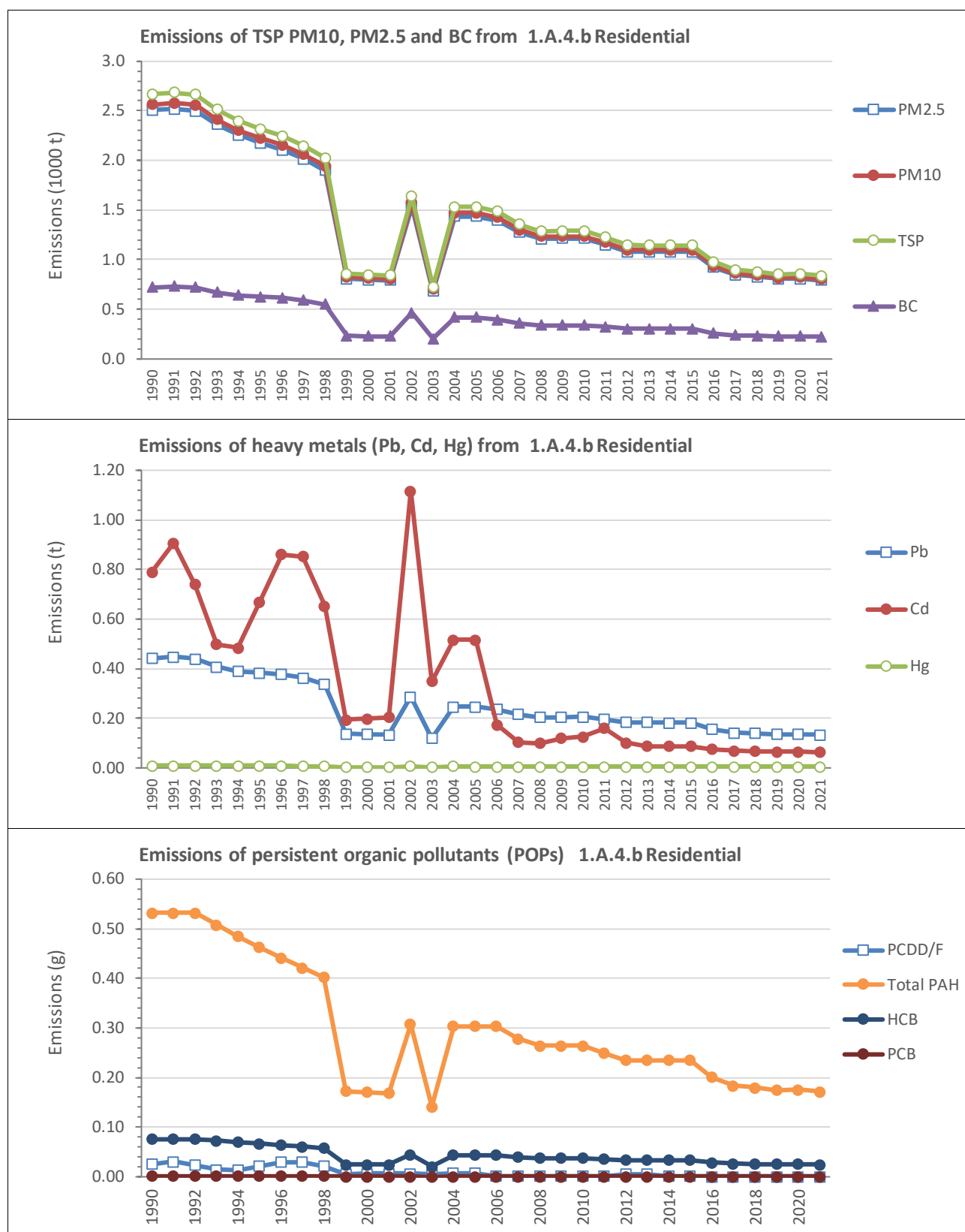


Figure 3.41 Emissions of dust, heavy metals and POPs from category 1.A.4.b.i Residential

Table 3.207 Emissions of main pollutants (NO_x, SO₂, NMVOC, CO and NH₃) from category 1.A.4.b.i Residential

Emissions	NO _x	NMVOC	SO _x	CO	NH ₃
1.A.4.b.i	Gg	Gg	Gg	Gg	Gg
1990	1.430	3.880	0.575	7.626	0.467
1991	1.421	3.705	0.569	7.295	0.446
1992	1.026	3.515	0.442	6.863	0.425
1993	0.329	1.519	0.136	2.919	0.183
1994	0.349	1.499	0.139	2.883	0.180
1995	0.369	1.491	0.142	2.868	0.178
1996	2.145	2.803	0.725	5.672	0.325
1997	0.711	1.278	0.231	2.516	0.149
1998	0.936	2.690	0.349	5.235	0.321
1999	0.852	2.664	0.348	5.202	0.321
2000	0.322	2.670	0.135	5.056	0.321
2001	0.165	2.438	0.089	4.599	0.294
2002	0.196	2.322	0.085	4.372	0.279
2003	0.283	2.339	0.098	4.403	0.279
2004	0.303	2.342	0.102	4.410	0.279
2005	0.381	2.220	0.122	4.195	0.263
2006	0.276	2.089	0.101	3.941	0.248
2007	0.259	2.091	0.093	3.937	0.248
2008	0.277	2.096	0.076	3.927	0.248
2009	0.284	2.098	0.076	3.930	0.248
2010	0.298	1.808	0.066	3.377	0.212
2011	0.333	1.679	0.061	3.123	0.194
2012	0.340	1.647	0.060	3.061	0.190
2013	0.340	1.604	0.058	2.980	0.185
2014	0.351	1.609	0.058	2.987	0.185
2015	0.379	1.587	0.057	2.940	0.181
2016	0.354	1.592	0.058	2.954	0.183
2017	1.430	3.880	0.575	7.626	0.467
2018	1.421	3.705	0.569	7.295	0.446
2019	1.026	3.515	0.442	6.863	0.425
2020	0.329	1.519	0.136	2.919	0.183
2021	0.349	1.499	0.139	2.883	0.180
2022	0.369	1.491	0.142	2.868	0.178
Trend					
1990 – 2022	-71.4%	-65.7%	-89.3%	-67.3%	-67.5%
2005 – 2022	-58.5%	-40.2%	-83.5%	-43.2%	-43.0%
2021 – 2022	-6.5%	0.3%	0.4%	0.5%	0.9%

Table 3.208 Emissions of particulate matter (PM) from category 1.A.4.b.i Residential

Emissions	PM2.5	PM10	TSP	BC
1.A.4.b.i	Gg	Gg	Gg	Gg
1990	2.503	2.561	2.667	0.721
1991	2.517	2.577	2.683	0.729
1992	2.497	2.554	2.660	0.717
1993	2.359	2.408	2.510	0.671
1994	2.252	2.300	2.397	0.641
1995	2.174	2.224	2.317	0.626
1996	2.102	2.154	2.242	0.612
1997	2.010	2.060	2.144	0.586
1998	1.899	1.944	2.024	0.549
1999	0.806	0.823	0.858	0.230
2000	0.795	0.812	0.846	0.227
2001	0.790	0.807	0.841	0.226
2002	1.528	1.574	1.636	0.461
2003	0.680	0.698	0.726	0.200
2004	1.436	1.470	1.531	0.415
2005	1.435	1.469	1.530	0.415
2006	1.396	1.423	1.484	0.392
2007	1.275	1.298	1.354	0.356
2008	1.208	1.230	1.283	0.338
2009	1.211	1.234	1.286	0.339
2010	1.212	1.235	1.288	0.340
2011	1.149	1.172	1.222	0.323
2012	1.078	1.099	1.146	0.301
2013	1.077	1.097	1.144	0.300
2014	1.075	1.095	1.142	0.300
2015	1.075	1.095	1.142	0.300
2016	0.918	0.935	0.976	0.256
2017	0.844	0.859	0.896	0.235
2018	0.826	0.841	0.877	0.230
2019	0.803	0.818	0.853	0.224
2020	0.804	0.819	0.854	0.224
2021	0.788	0.802	0.837	0.220
2022	0.794	0.809	0.843	0.221
Trend				
1990 – 2022	-68.3%	-68.4%	-68.4%	-69.3%
2005 – 2022	-44.7%	-44.9%	-44.9%	-46.7%
2021 – 2022	0.8%	0.8%	0.8%	0.8%

Table 3.209 Emissions of Heavy Metals (HM) from category 1.A.4.b.i Residential

Emissions	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
1.A.4.b.i	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg
1990	0.442	0.791	0.009	0.005	0.389	0.103	0.525	0.008	7.853
1991	0.448	0.907	0.009	0.005	0.397	0.105	0.622	0.008	7.867
1992	0.439	0.739	0.009	0.005	0.386	0.102	0.482	0.008	7.847
1993	0.408	0.498	0.008	0.004	0.354	0.093	0.287	0.007	7.465
1994	0.390	0.483	0.008	0.004	0.339	0.089	0.280	0.007	7.126
1995	0.383	0.668	0.008	0.004	0.337	0.089	0.440	0.007	6.827
1996	0.378	0.861	0.008	0.005	0.337	0.090	0.606	0.007	6.543
1997	0.362	0.853	0.007	0.005	0.323	0.086	0.605	0.006	6.249
1998	0.337	0.653	0.007	0.004	0.298	0.079	0.442	0.006	5.945
1999	0.137	0.193	0.003	0.001	0.122	0.032	0.117	0.003	2.543
2000	0.134	0.198	0.003	0.001	0.121	0.032	0.122	0.003	2.506
2001	0.133	0.204	0.003	0.001	0.120	0.032	0.128	0.003	2.487
2002	0.286	1.116	0.006	0.005	0.269	0.073	0.852	0.005	4.623
2003	0.120	0.349	0.003	0.002	0.112	0.030	0.255	0.002	2.094
2004	0.247	0.515	0.005	0.003	0.226	0.060	0.353	0.005	4.487
2005	0.247	0.515	0.005	0.003	0.226	0.060	0.353	0.005	4.486
2006	0.237	0.173	0.005	0.002	0.203	0.053	0.067	0.005	4.447
2007	0.215	0.103	0.005	0.002	0.183	0.048	0.016	0.004	4.075
2008	0.204	0.098	0.004	0.002	0.173	0.045	0.015	0.004	3.860
2009	0.205	0.118	0.005	0.002	0.175	0.046	0.032	0.004	3.863
2010	0.205	0.125	0.005	0.002	0.175	0.046	0.038	0.004	3.864
2011	0.196	0.159	0.004	0.002	0.168	0.044	0.070	0.004	3.655
2012	0.184	0.100	0.004	0.002	0.155	0.041	0.025	0.004	3.438
2013	0.184	0.087	0.004	0.002	0.154	0.041	0.014	0.004	3.436
2014	0.181	0.087	0.004	0.002	0.154	0.040	0.013	0.004	3.433
2015	0.181	0.087	0.004	0.002	0.154	0.040	0.013	0.004	3.433
2016	0.154	0.074	0.004	0.001	0.132	0.034	0.011	0.003	2.932
2017	0.142	0.068	0.003	0.001	0.121	0.032	0.011	0.003	2.692
2018	0.139	0.067	0.003	0.001	0.118	0.031	0.010	0.003	2.634
2019	0.135	0.065	0.003	0.001	0.115	0.030	0.010	0.003	2.560
2020	0.135	0.065	0.003	0.001	0.115	0.030	0.010	0.003	2.563
2021	0.132	0.064	0.003	0.001	0.113	0.029	0.010	0.003	2.512
2022	0.133	0.064	0.003	0.001	0.114	0.030	0.010	0.003	2.533
Trend									
1990 – 2022	-69.8%	-91.9%	-63.7%	-71.1%	-70.8%	-71.2%	-98.1%	-65.7%	-67.8%
2005 – 2022	-46.0%	-87.5%	-37.2%	-53.3%	-49.7%	-50.6%	-97.2%	-40.6%	-43.5%
2021 – 2022	0.8%	0.9%	-0.3%	-1.8%	0.8%	0.8%	0.8%	0.1%	0.8%

Table 3.210 Emissions of Persistent Organic Pollutants (POPs) from category 1.A.4.b.i Residential

1.A.4.b.i	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	0.025	0.152	0.243	0.076	0.061	0.532	0.076	0.001
1991	0.030	0.152	0.243	0.076	0.061	0.532	0.076	0.001
1992	0.023	0.152	0.243	0.076	0.061	0.532	0.076	0.001
1993	0.014	0.145	0.232	0.073	0.058	0.508	0.073	0.001
1994	0.014	0.138	0.222	0.069	0.055	0.485	0.069	0.001
1995	0.021	0.132	0.212	0.066	0.053	0.463	0.066	0.001
1996	0.029	0.126	0.202	0.063	0.050	0.442	0.063	0.001
1997	0.029	0.120	0.193	0.060	0.048	0.422	0.060	0.001
1998	0.021	0.115	0.184	0.057	0.046	0.402	0.057	0.001
1999	0.006	0.049	0.079	0.025	0.020	0.173	0.025	<0.001
2000	0.006	0.049	0.078	0.024	0.019	0.170	0.024	<0.001
2001	0.006	0.048	0.077	0.024	0.019	0.169	0.024	<0.001
2002	0.007	0.088	0.141	0.044	0.035	0.308	0.044	0.001
2003	0.005	0.040	0.064	0.020	0.016	0.141	0.020	<0.001
2004	0.007	0.087	0.139	0.043	0.035	0.303	0.043	0.001
2005	0.007	0.087	0.139	0.043	0.035	0.303	0.043	0.001
2006	0.001	0.087	0.139	0.043	0.035	0.303	0.043	0.001
2007	0.001	0.080	0.127	0.040	0.032	0.278	0.040	<0.001
2008	0.001	0.075	0.121	0.038	0.030	0.264	0.038	<0.001
2009	0.001	0.075	0.121	0.038	0.030	0.264	0.038	<0.001
2010	0.001	0.075	0.121	0.038	0.030	0.264	0.038	<0.001
2011	0.001	0.071	0.114	0.036	0.028	0.249	0.036	<0.001
2012	0.005	0.067	0.107	0.033	0.027	0.234	0.034	<0.001
2013	0.005	0.067	0.107	0.033	0.027	0.234	0.034	<0.001
2014	0.001	0.067	0.107	0.033	0.027	0.234	0.033	<0.001
2015	0.001	0.067	0.107	0.033	0.027	0.234	0.033	<0.001
2016	0.001	0.057	0.092	0.029	0.023	0.200	0.029	<0.001
2017	0.001	0.053	0.084	0.026	0.021	0.184	0.026	<0.001
2018	0.001	0.051	0.082	0.026	0.021	0.180	0.026	<0.001
2019	<0.001	0.050	0.080	0.025	0.020	0.175	0.025	<0.001
2020	<0.001	0.050	0.080	0.025	0.020	0.175	0.025	<0.001
2021	<0.001	0.049	0.078	0.024	0.020	0.171	0.024	<0.001
2022	<0.001	0.049	0.079	0.025	0.020	0.173	0.025	<0.001
Trend								
1990 – 2022	-98.0%	-67.5%	-67.5%	-67.5%	-67.5%	-67.5%	-67.5%	-67.5%
2005 – 2022	-93.2%	-43.0%	-43.0%	-43.0%	-43.0%	-43.0%	-43.0%	-43.0%
2021 – 2022	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%

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 approach⁴⁵ of the EMEP/EEA air pollutant emission inventory guidebook 2023 has been applied:

Equation: emissions from stationary combustion

$$\text{Emissions}_{\text{pollutant}} = \text{Fuel Consumption}_{\text{fuel}} \times \text{Emission Factor}_{\text{pollutant. fuel}}$$

Where:

Emissions _{pollutant}	= emissions of a given pollutant by type of fuel (kg pollutant)
Fuel consumption _{fuel}	= amount of fuel combusted (TJ)
Emission factor _{pollutant. fuel}	= default emission factor of a given pollutant by type of fuel (g _{pollutant} /GJ).
Pollutant	= main pollutants: NO _x , CO, NMVOC, SO ₂ particulate matter: TSP, PM ₁₀ , PM _{2.5} , 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"> Residual fuel oil Gas/Diesel Oil (Non-bio gas/diesel oil) Liquefied Petroleum Gases (LPG) Other Kerosene Other Petroleum Products 	Summary of fuel aggregations at Tier 1 according to EMEP/EEA air pollutant emission inventory guidebook 2023. Part B. Chapter 1.A.4.
Solid fuels	<ul style="list-style-type: none"> Lignite 	
Biomass	<ul style="list-style-type: none"> Charcoal Wood/ Fuelwood 	

Fuel consumption used for estimating the Air pollutant emissions for the years 1990 - 2022 were taken from prepared by Albanian Institute of Statistics (INSTAT).

⁴⁵ Source: EMEP/EEA air pollutant emission inventory guidebook 2023. 1.A.4 Small Combustion. sub-chapter 3.2 Tier 1 default approach.

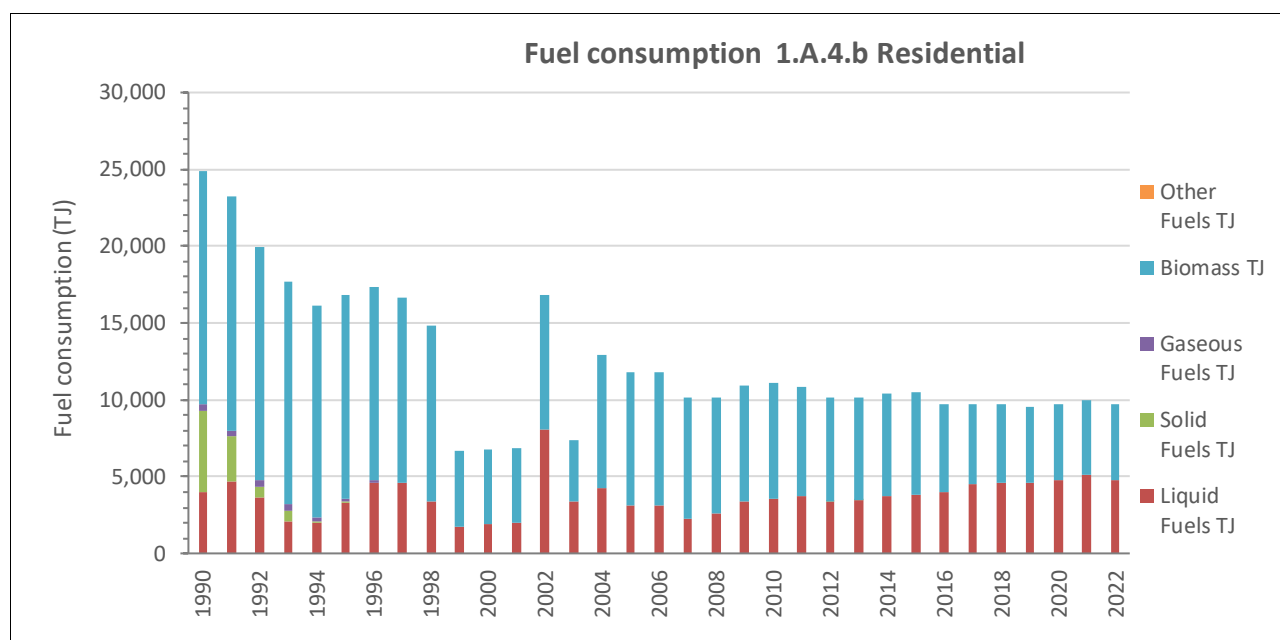


Figure 3.42 Activity data for category 1.A.4.b.i Residential

Table 3.211 Activity data for 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	24,895.70	3,956.00	5,360.00	380.70	NO	NO	15,199.00
1991	23,208.60	4,730.00	2,880.00	399.60	NO	NO	15,199.00
1992	19,950.60	3,612.00	740.00	399.60	NO	NO	15,199.00
1993	17,691.00	2,064.00	760.00	360.00	NO	NO	14,507.00
1994	16,161.80	2,021.00	40.00	253.80	NO	NO	13,847.00
1995	16,787.50	3,311.00	120.00	139.50	NO	NO	13,217.00
1996	17,375.10	4,644.00	IE	116.10	NO	NO	12,615.00
1997	16,685.00	4,644.00	IE	NO	NO	NO	12,041.00
1998	14,847.00	3,354.00	IE	NO	NO	NO	11,493.00
1999	6,692.91	1,756.91	IE	NO	NO	NO	4,936.00
2000	6,755.13	1,894.13	IE	NO	NO	NO	4,861.00
2001	6,854.35	2,031.35	IE	NO	NO	NO	4,823.00
2002	16,841.49	8,049.49	IE	NO	NO	NO	8,792.00
2003	7,417.30	3,398.30	IE	NO	NO	NO	4,019.00
2004	12,911.03	4,244.03	IE	NO	NO	NO	8,667.00
2005	11,775.56	3,108.56	IE	NO	NO	NO	8,667.00
2006	11,762.92	3,095.92	IE	NO	NO	NO	8,667.00
2007	10,178.62	2,223.62	IE	NO	NO	NO	7,955.00
2008	10,185.42	2,649.42	IE	NO	NO	NO	7,536.00
2009	10,934.86	3,398.86	IE	NO	NO	NO	7,536.00
2010	11,074.28	3,538.28	IE	NO	NO	NO	7,536.00
2011	10,873.77	3,755.77	IE	NO	NO	NO	7,118.00
2012	10,109.41	3,400.57	9.84	NO	NO	NO	6,699.00

Activity data 1.A.4.b	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
2013	10,162.55	3,453.70	9.84	NO	NO	NO	6,699.00
2014	10,436.57	3,737.57	IE	NO	NO	NO	6,699.00
2015	10,531.19	3,832.19	IE	NO	NO	NO	6,699.00
2016	9,741.44	4,021.44	IE	NO	NO	NO	5,720.00
2017	9,744.99	4,494.55	IE	NO	NO	NO	5,250.44
2018	9,726.47	4,589.17	IE	NO	NO	NO	5,137.30
2019	9,583.30	4,589.17	IE	NO	NO	NO	4,994.13
2020	9,736.58	4,736.78	IE	NO	NO	NO	4,999.80
2021	10,013.32	5,115.27	IE	NO	NO	NO	4,898.05
2022	9,722.70	4,782.98	IE	NO	NO	NO	4,939.72
Trend							
1990 – 2022	-60.9%	20.9%	NA	NA	NA	NA	-67.5%
2005 – 2022	-17.4%	53.9%	NA	NA	NA	NA	-43.0%
2021 – 2022	-2.9%	-6.5%	NA	NA	NA	NA	0.9%

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 category 1.A.4.b.i Residential.

Table 3.212 Net calorific values (NCVs) applied for conversion to energy units in category 1.A.4.b.i Residential

Fuel	Fuel type	Net calorific value (NCV) (TJ/Gg) or * (TJ/m³)			
		NCV	type	NCV	type
Lignite	solid	9.843	CS	11.9	D
Residual fuel oil	liquid	40.193	CS	40.4	D
Gas/Diesel Oil	liquid	43.292	CS	43.0	D
Motor gasoline	liquid	44.799	CS	44.3	D
Liquefied Petroleum Gases (LPG)	liquid	46.89	CS	47.3	D
Other Kerosene	liquid	43.00	CS	43.8	D
Other oil products n.e.c.	liquid	44.799	CS	40.2	D
Petroleum Coke	liquid	31.987	CS	40.2	D
Wood/ Fuelwood*	biomass	9.1764	CS	15.6	D
		Source			
		Albanian Institute of Statistics (INSTAT) / Eurostat		2006 IPCC Guidelines, Vol 2, Chapter 1, Table 1.2	
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 2023⁴⁶ and are presented in the following table.

Table 3.213 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	NA		NA		NA		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	NA	D	0.06	D
PCDD/F	ng I-TEQ/GJ	203	D	1.4	D	NA	D	100	D
Benzo(a)pyrene	µg/GJ	0.0455	D	1.9	D	NA	D	0.01	D
Benzo(b)fluoranthene	µg/GJ	0.0589	D	15	D	NA	D	0.016	D
Benzo(k)fluoranthene	µg/GJ	0.0237	D	1.7	D	NA	D	0.005	D
Indeno(1,2,3-cd)pyrene	µg/GJ	0.0185	D	1.5	D	NA	D	0.004	D
HCB	µg/GJ	0.62	D	0.22	D	NA	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 2023. Part B. Chapter 1.A4 Small combustion							
Note:									
D Default	CS Country specific	PS Plant specific	IEF Implied emission factor						

⁴⁶ Source: EMEP/EEA air pollutant emission inventory guidebook 2023. Chapter 1.A4 Small combustion. sub-chapter 3.2.2 Default emission factors.

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.b.i Residential are presented in the following table.

Table 3.214 Uncertainty for category 1.A.4.b.i Residential

Uncertainty	Sub-bituminous coal	Lignite	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 2023. 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)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.

3.1.5.2.4 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 and relevant to category 1.A.4.b.i Residential.

Table 3.215 Recalculations done in category 1.A.4.b.i Residential

source category	Revisions of data	Type of revision	Type of improvement
1.A.4.b	Revision of energy balance	AD	Consistency
1.A.4.b	use of CS NCV	AD	Comparability

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 3.216 Planned improvements for 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 time series.	AD	Accuracy Transparency	High
1.A.4.c	Characterisation of <ul style="list-style-type: none"> • residential heating : <ul style="list-style-type: none"> ○ (open/partly open) fire places. ○ water heaters. ○ advanced/ conventional stoves. ○ space heating. ○ boilers <ul style="list-style-type: none"> ▪ Conventional boilers >50kW ▪ Standard boilers >50KWth <1MWth ▪ Boilers <1MWth – manual feed technology ▪ Boilers <1MWth – automatic feed technology ▪ Standard boilers >50KWth <1MWth ▪ Standard boilers >1MWth <50MWth ▪ Gas turbines ○ cookers; 	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

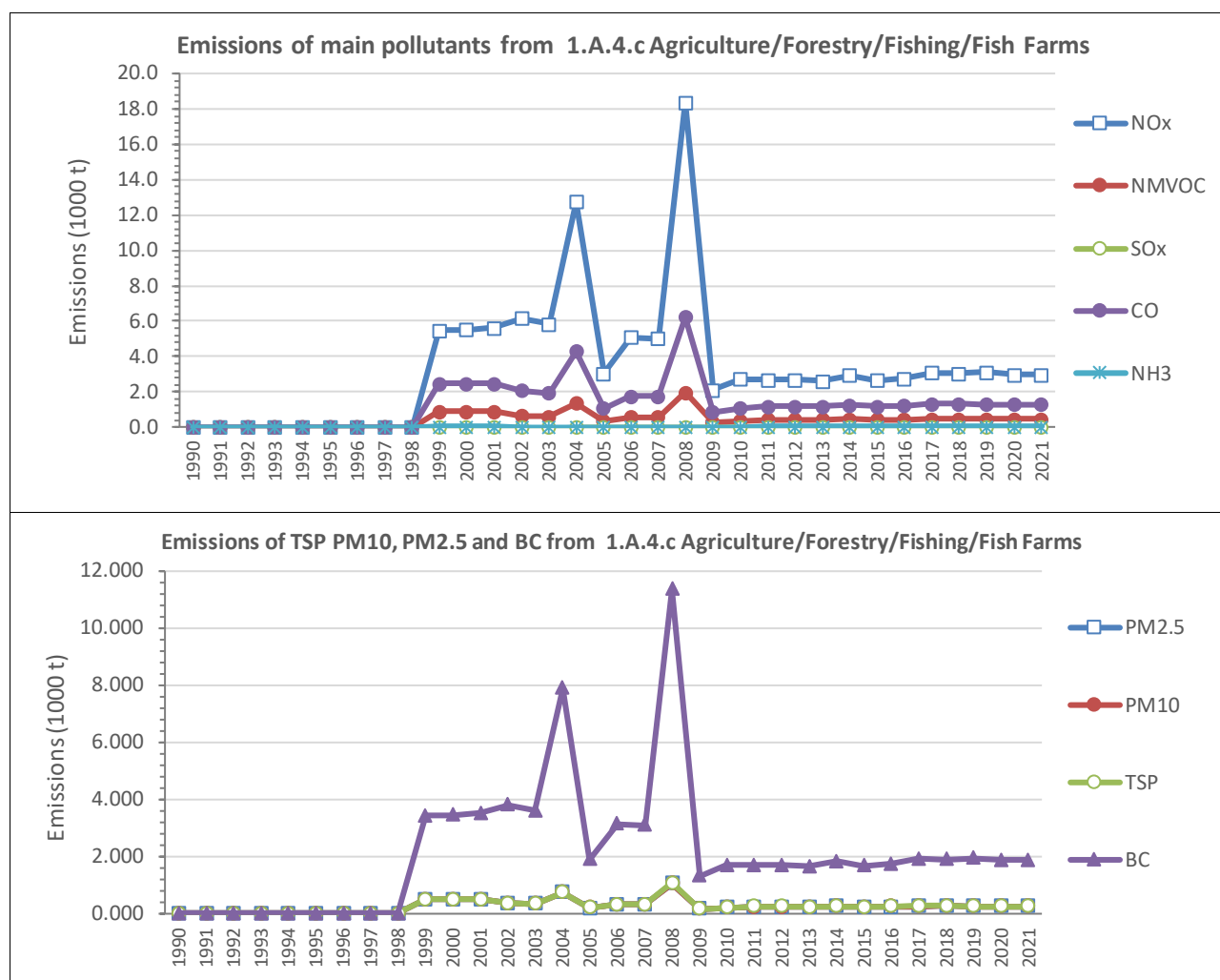
in subcategory 1.A.4.b.i Residential - stationary.

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 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 – 2022, 2005 – 2022, 2021 – 2022.



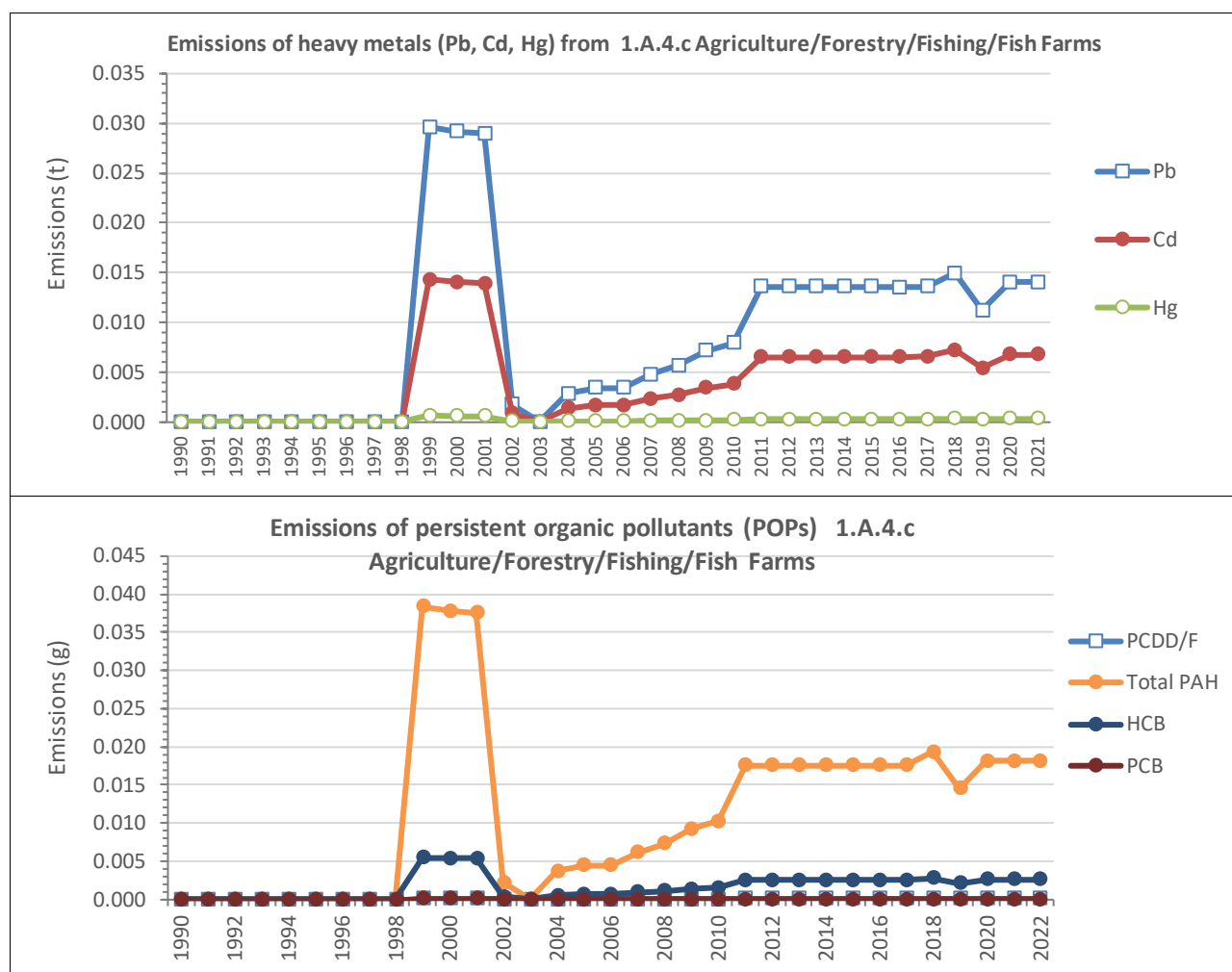


Figure 3.43 Emissions from category 1.A.4.c Agriculture/ Forestry/Fishing/Fish Farms

Table 3.217 Emissions of main pollutants (NO_x, SO₂, NMVOC, CO and NH₃) from category 1.A.4.c Agriculture/ Forestry/Fishing/Fish Farms

Emissions	NO _x	NMVOC	SO _x	CO	NH ₃
1.A.4.c	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	5.483	0.893	0.012	2.450	0.042
2000	5.517	0.891	0.012	2.452	0.041
2001	5.619	0.899	0.012	2.481	0.041
2002	6.171	0.653	0.001	2.090	0.004
2003	5.821	0.598	IE	1.937	0.001
2004	12.762	1.343	0.001	4.308	0.007
2005	3.042	0.350	0.001	1.084	0.005
2006	5.086	0.561	0.001	1.765	0.006
2007	5.006	0.567	0.002	1.767	0.008
2008	18.383	1.952	0.002	6.238	0.012
2009	2.112	0.296	0.003	0.853	0.010
2010	2.700	0.365	0.003	1.066	0.011
2011	2.694	0.427	0.006	1.183	0.019
2012	2.697	0.428	0.006	1.184	0.019
2013	2.625	0.420	0.006	1.160	0.019
2014	2.932	0.452	0.006	1.262	0.019
2015	2.658	0.424	0.006	1.171	0.019
2016	2.761	0.434	0.006	1.204	0.019
2017	3.079	0.467	0.006	1.311	0.019
2018	3.025	0.477	0.006	1.322	0.021
2019	3.113	0.444	0.005	1.272	0.016
2020	2.981	0.462	0.006	1.288	0.020
2021	2.976	0.462	0.006	1.287	0.020
2022	2.556	0.419	0.006	1.147	0.020
Trend					
1990 – 2022	NA	NA	NA	NA	NA
2005 – 2022	-16.0%	19.4%	312.3%	5.8%	268.9%
2021 – 2022	16.4%	10.3%	0.0%	12.2%	0.5%

Table 3.218 Emissions of particulate matter (PM) from category 1.A.4.c Agriculture/Forestry/Fishing/Fish Farms

Emissions	PM2.5	PM10	TSP	BC
1.A.4.c	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	0.480	0.483	0.491	3.431
2000	0.479	0.482	0.490	3.451
2001	0.483	0.487	0.494	3.514
2002	0.353	0.353	0.353	3.809
2003	0.323	0.323	0.323	3.590
2004	0.725	0.726	0.726	7.877
2005	0.189	0.189	0.190	1.882
2006	0.303	0.303	0.304	3.142
2007	0.306	0.307	0.308	3.096
2008	1.054	1.055	1.056	11.348
2009	0.159	0.160	0.162	1.315
2010	0.197	0.198	0.200	1.679
2011	0.230	0.231	0.235	1.684
2012	0.230	0.232	0.235	1.686
2013	0.226	0.228	0.231	1.641
2014	0.243	0.245	0.248	1.831
2015	0.228	0.229	0.233	1.662
2016	0.233	0.235	0.238	1.725
2017	0.251	0.253	0.256	1.921
2018	0.256	0.258	0.262	1.890
2019	0.239	0.240	0.243	1.938
2020	0.249	0.250	0.254	1.862
2021	0.248	0.250	0.253	1.859
2022	0.225	0.227	0.230	1.600
Trend				
1990 – 2022	NA	NA	NA	NA
2005 – 2022	19.0%	19.6%	21.0%	-15.0%
2021 – 2022	10.4%	10.3%	10.1%	16.2%

Table 3.219 Emissions of Heavy Metals (HM) from category 1.A.4.c Agriculture/Forestry/Fishing/Fish Farms

Emissions	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
1.A.4.c	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg
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	0.030	0.014	0.001	<0.001	0.025	0.007	0.002	0.001	0.562
2000	0.029	0.014	0.001	<0.001	0.025	0.006	0.002	0.001	0.553
2001	0.029	0.014	0.001	<0.001	0.025	0.006	0.002	0.001	0.549
2002	0.002	0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.032
2003	<0.001	<0.001	<0.001	IE	IE	IE	IE	IE	IE
2004	0.003	0.001	<0.001	<0.001	0.002	0.001	<0.001	<0.001	0.054
2005	0.003	0.002	<0.001	<0.001	0.003	0.001	<0.001	<0.001	0.065
2006	0.003	0.002	<0.001	<0.001	0.003	0.001	<0.001	<0.001	0.065
2007	0.005	0.002	<0.001	<0.001	0.004	0.001	<0.001	<0.001	0.090
2008	0.006	0.003	<0.001	<0.001	0.005	0.001	<0.001	<0.001	0.107
2009	0.007	0.003	<0.001	<0.001	0.006	0.002	0.001	<0.001	0.135
2010	0.008	0.004	<0.001	<0.001	0.007	0.002	0.001	<0.001	0.150
2011	0.014	0.007	<0.001	<0.001	0.012	0.003	0.001	<0.001	0.257
2012	0.014	0.007	<0.001	<0.001	0.012	0.003	0.001	<0.001	0.257
2013	0.014	0.007	<0.001	<0.001	0.012	0.003	0.001	<0.001	0.257
2014	0.014	0.007	<0.001	<0.001	0.012	0.003	0.001	<0.001	0.257
2015	0.014	0.007	<0.001	<0.001	0.012	0.003	0.001	<0.001	0.257
2016	0.014	0.007	<0.001	<0.001	0.012	0.003	0.001	<0.001	0.257
2017	0.014	0.007	<0.001	<0.001	0.012	0.003	0.001	<0.001	0.257
2018	0.015	0.007	<0.001	<0.001	0.013	0.003	0.001	<0.001	0.283
2019	0.011	0.005	<0.001	<0.001	0.010	0.002	0.001	<0.001	0.212
2020	0.014	0.007	<0.001	<0.001	0.012	0.003	0.001	<0.001	0.266
2021	0.014	0.007	<0.001	<0.001	0.012	0.003	0.001	<0.001	0.266
2022	0.014	0.007	<0.001	<0.001	0.012	0.003	0.001	<0.001	0.266
Trend									
1990 – 2022	NA	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	312.0%	312.0%	312.5%	314.1%	312.0%	312.0%	312.1%	312.5%	312.0%
2021 – 2022	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 3.220 Emissions of Persistent Organic Pollutants (POPs) from category 1.A.4.c Agriculture/ Forestry/Fishing/Fish Farms

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.c	g I-TEQ	Mg	Mg	Mg	Mg	Mg	kg	Kg
1990	IE	IE	IE	IE	IE	IE	IE	IE
1991	IE	IE	IE	IE	IE	IE	IE	IE
1992	IE	IE	IE	IE	IE	IE	IE	IE
1993	IE	IE	IE	IE	IE	IE	IE	IE
1994	IE	IE	IE	IE	IE	IE	IE	IE
1995	IE	IE	IE	IE	IE	IE	IE	IE
1996	IE	IE	IE	IE	IE	IE	IE	IE
1997	IE	IE	IE	IE	IE	IE	IE	IE
1998	IE	IE	IE	IE	IE	IE	IE	IE
1999	0.000	0.011	0.018	0.005	0.004	0.038	0.005	0.000
2000	0.000	0.011	0.017	0.005	0.004	0.038	0.005	0.000
2001	0.000	0.011	0.017	0.005	0.004	0.038	0.005	0.000
2002	0.000	0.001	0.001	0.000	0.000	0.002	0.000	0.000
2003	IE	IE	IE	IE	IE	IE	IE	IE
2004	0.000	0.001	0.002	0.001	0.000	0.004	0.001	0.000
2005	0.000	0.001	0.002	0.001	0.001	0.004	0.001	0.000
2006	0.000	0.001	0.002	0.001	0.001	0.004	0.001	0.000
2007	0.000	0.002	0.003	0.001	0.001	0.006	0.001	0.000
2008	0.000	0.002	0.003	0.001	0.001	0.007	0.001	0.000
2009	0.000	0.003	0.004	0.001	0.001	0.009	0.001	0.000
2010	0.000	0.003	0.005	0.001	0.001	0.010	0.001	0.000
2011	0.000	0.005	0.008	0.003	0.002	0.018	0.003	0.000
2012	0.000	0.005	0.008	0.003	0.002	0.018	0.003	0.000
2013	0.000	0.005	0.008	0.003	0.002	0.018	0.003	0.000
2014	0.000	0.005	0.008	0.003	0.002	0.018	0.003	0.000
2015	0.000	0.005	0.008	0.003	0.002	0.018	0.003	0.000
2016	0.000	0.005	0.008	0.003	0.002	0.018	0.003	0.000
2017	0.000	0.005	0.008	0.003	0.002	0.018	0.003	0.000
2018	0.000	0.006	0.009	0.003	0.002	0.019	0.003	0.000
2019	0.000	0.004	0.007	0.002	0.002	0.015	0.002	0.000
2020	0.000	0.005	0.008	0.003	0.002	0.018	0.003	0.000
2021	0.000	0.005	0.008	0.003	0.002	0.018	0.003	0.000
2022	0.000	0.005	0.008	0.003	0.002	0.018	0.003	0.000
Trend								
1990 – 2022	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	312.0%	312%	312%	312%	312%	312%	312%	312.0%
2021 – 2022	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

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 approach⁴⁷ of the EMEP/EEA air pollutant emission inventory guidebook 2023 has been applied:

Equation: emissions from stationary combustion

$$\text{Emissions}_{\text{pollutant}} = \text{Fuel Consumption}_{\text{fuel}} \times \text{Emission Factor}_{\text{pollutant, fuel}}$$

Where:

Emissions _{pollutant}	= emissions of a given pollutant by type of fuel (kg pollutant)
Fuel consumption _{fuel}	= amount of fuel combusted (TJ)
Emission factor _{pollutant, fuel}	= default emission factor of a given pollutant by type of fuel (g _{pollutant} /GJ).
Pollutant	= main pollutants: NO _x , CO, NMVOC, SO ₂ particulate matter: TSP, PM ₁₀ , PM _{2.5} , 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"> Residual fuel oil Gas/Diesel Oil (Non-bio gas/diesel oil) Motor Gasoline Liquefied Petroleum Gases (LPG) Other Kerosene Other Petroleum Products 	Summary of fuel aggregations at Tier 1 according to EMEP/EEA air pollutant emission inventory guidebook 2023. Part B. Chapter 1.A.4.
Biomass	<ul style="list-style-type: none"> Wood/ Fuelwood 	

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 - 2022 were taken from prepared by Albanian Institute of Statistics (INSTAT).

⁴⁷ Source: EMEP/EEA air pollutant emission inventory guidebook 2023. 1.A.4 Small Combustion. sub-chapter 3.2 Tier 1 default approach.

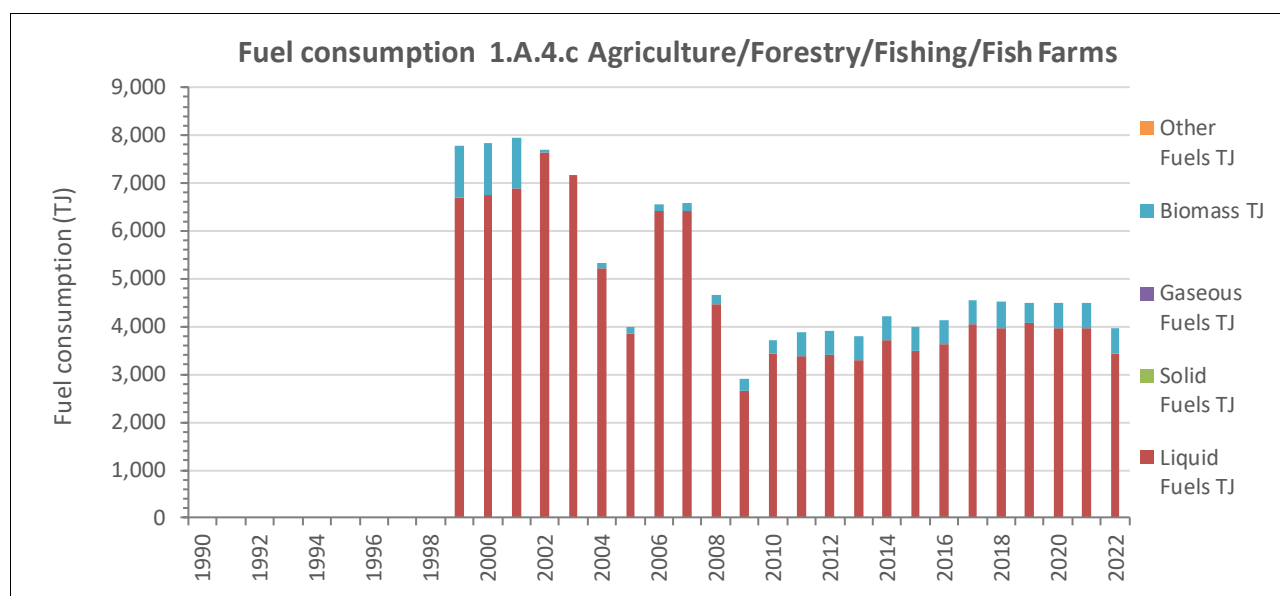


Figure 3.44 Activity data for category 1.A.4.c Agriculture/Forestry/Fishing/Fish Farms

Table 3.221 Activity data for category 1.A.4.c Agriculture/Forestry/Fishing/Fish Farms

Activity data 1.A.4.c	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	7,788.62	6,691.62	NO	NO	NO	NO	1,097.00
2000	7,829.23	6,749.23	NO	NO	NO	NO	1,080.00
2001	7,949.63	6,877.63	NO	NO	NO	NO	1,072.00
2002	7,695.85	7,632.85	NO	NO	NO	NO	63.00
2003	7,158.87	7,158.87	NO	NO	NO	NO	IE
2004	5,317.34	5,212.34	NO	NO	NO	NO	105.00
2005	3,985.18	3,859.18	NO	NO	NO	NO	126.00
2006	6,553.18	6,427.18	NO	NO	NO	NO	126.00
2007	6,590.72	6,414.72	NO	NO	NO	NO	176.00
2008	4,664.69	4,455.69	NO	NO	NO	NO	209.00
2009	2,917.60	2,653.60	NO	NO	NO	NO	264.00
2010	3,720.18	3,427.18	NO	NO	NO	NO	293.00
2011	3,895.19	3,393.19	NO	NO	NO	NO	502.00
2012	3,913.19	3,411.19	NO	NO	NO	NO	502.00
2013	3,810.00	3,308.00	NO	NO	NO	NO	502.00

Activity data 1.A.4.c	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
TJ							
2014	4,205.20	3,703.20	NO	NO	NO	NO	502.00
2015	3,990.73	3,488.73	NO	NO	NO	NO	502.00
2016	4,120.13	3,619.13	NO	NO	NO	NO	501.00
2017	4,549.82	4,047.40	NO	NO	NO	NO	502.42
2018	4,521.33	3,968.67	NO	NO	NO	NO	552.66
2019	4,497.69	4,082.94	NO	NO	NO	NO	414.75
2020	4,486.44	3,967.24	NO	NO	NO	NO	519.20
2021	4488.71	3969.53	NO	NO	NO	NO	519.18
2022	3,964.48	3,445.32	NO	NO	NO	NO	519.16
Trend							
1990 – 2022	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	-0.5%	-10.7%	NA	NA	NA	NA	312.0%
2021 – 2022	13.2%	15.2%	NA	NA	NA	NA	0.0%

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 category 1.A.4.c Agriculture/Forestry/Fishing/Fish Farms.

Table 3.222 Net calorific values (NCVs) applied for conversion to energy units in category 1.A.4.c.ii Agriculture/Forestry/Fishing/Fish Farms

Fuel	Fuel type	Net calorific value (NCV) (TJ/Gg) or * (TJ/m³)			
		NCV	type	NCV	type
Lignite	solid	9.843	CS	11.9	D
Residual fuel oil	liquid	40.193	CS	40.4	D
Gas/Diesel Oil	liquid	43.292	CS	43.0	D
Motor gasoline	liquid	44.799	CS	44.3	D
Liquefied Petroleum Gases (LPG)	liquid	46.89	CS	47.3	D
Other Kerosene	liquid	43.00	CS	43.8	D
Other oil products n.e.c.	liquid	44.799	CS	40.2	D
Petroleum Coke	liquid	31.987	CS	40.2	D
Wood/ Fuelwood*	biomass	9.1764	CS	15.6	D
		Source		2006 IPCC Guidelines, Vol 2, Chapter 1, Table 1.2	
		Albanian Institute of Statistics (INSTAT) / Eurostat			
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 2023⁴⁸ and are presented in the following table.

Table 3.223 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		Biomass	
Associated fuel types		Motor gasoline		Residual fuel oil Gas/Diesel Oil		LPG		Fuelwood	
Pollutant		EF	type	EF	type	EF	type		
NO _x	g/tonne g/GJ	7117	D	34457	D	28571	D	91	D
CO	g/tonne g/GJ	770368	D	11469	D	4823	D	570	D
NM VOC	g/tonne g/GJ	18893	D	3542	D	6720	D	300	D
SO _x	g/tonne g/GJ	NA	D	NA	D	NA	D	11	D
NH ₃	g/tonne g/GJ	4	D	8	D	10	D	1.2	D
TSP	g/tonne g/GJ	157		1913		225	D	150	D
PM ₁₀	g/tonne g/GJ	157	D	1913	D	225	D	143	D
PM _{2.5}	g/tonne g/GJ	157	D	1913	D	225	D	140	D
BC	g/tonne % of PM _{2.5}	8	D	1111	D	11	D	28	D
Pb	mg/tonne mg/GJ	NE	D	NA	D	NA	D	27	D
Cd	mg/tonne mg/GJ	0.01	D	0.01	D	NA	D	13	D
Hg	mg/tonne mg/GJ	NA	D	NA	D	NA	D	0.56	D
As	mg/tonne mg/GJ	NA	D	NA	D	NA	D	0.19	D
Cr	mg/tonne mg/GJ	0.05	D	0.05	D	NA	D	23	D
Cu	mg/tonne mg/GJ	1.7	D	1.7	D	NA	D	6	D
Ni	mg/tonne mg/GJ	0.07	D	0.07	D	NA	D	2	D
Se	mg/tonne mg/GJ	0.01	D	0.01	D	NA	D	0.5	D

⁴⁸ Source: EMEP/EEA air pollutant emission inventory guidebook 2023. Chapter 1.A4 Small combustion. sub-chapter 3.2.2 Default emission factors.

Fuel Type	UNIT	Liquid fuels		Liquid fuels		Liquid fuels		Biomass		
Associated fuel types		Motor gasoline		Residual fuel oil Gas/Diesel Oil		LPG		Fuelwood		
Zn	mg/tonne mg/GJ	1	D	1	D	NA	D	512	D	
PCB	mg/tonne ng WHO-TEG/GJ	NA	D	NA	D	NA	D	0.06	D	
PCDD/F	mg/tonne ng I-TEQ/GJ	NA	D	NA	D	NA	D	100	D	
Benzo(a)pyrene	µg/tonne µg/GJ	40	D	30	D	NA	D	0.01	D	
Benzo(b)fluoranthene	µg/tonne µg/GJ	40	D	50	D	NA	D	0.016	D	
Benzo(k)fluoranthene	µg/tonne µg/GJ	NA	D	NE	D	NA	D	0.005	D	
Indeno(1,2,3-cd)pyrene	µg/tonne µg/GJ	NA	D	NE	D	NA	D	0.004	D	
HCB	µg/GJ	NA	D	NE	D	NA	D	5	D	
Source		1.A.2.g vii; 1.A.4.a.ii, 1.A.4.b ii; 1.A.4.c ii; 1.A.4.c iii; 1.A.5.b Non-road mobile sources and machinery						1.A.4.a.i, 1.A.4.b.i, 1.A.4.c.i, 1.A.5.a Small combustion		
		EMEP/EEA air pollutant emission inventory guidebook 2023. Part B.								
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 3.224 Uncertainty for category 1.A.4.c.ii Agriculture/Forestry/Fishing/Fish Farms - Off-road

Uncertainty	Sub-bituminous coal	Lignite	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 2023. 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)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.

3.1.5.3.4 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 and relevant to category 1.A.4.c.ii Agriculture/Forestry/Fishing/Fish Farms.

Table 3.225 Recalculations done in category 1.A.4.c.ii Agriculture/Forestry/Fishing/Fish Farms

source category	Revisions of data	Type of revision	Type of improvement
1.A.4.c	Revision of energy balance	AD	Consistency
1.A.4.c	use of CS NCV	AD	Comparability

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 3.226 Planned improvements for category 1.A.4.c.ii Agriculture/Forestry/Fishing/Fish Farms - Off-road

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	Split of fuels to different sub categories (1A4ci and 1A4cii and 1A4ciii)	AD	Completeness/c omparability	medium
1.A.4.c	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)

3.2.1 Source category description

The fugitive emissions of NMVOC, TSP, PM10 and PM2.5 are estimated from

- 1.B.1. Solid fuels
- Oil and natural gas and other emissions from energy production

IPPC/NFR code and description	Air pollutants emissions						
1.B. Fugitive emissions from fuels	estimated				IE included elsewhere	NE not estimated	NO not occurring
	NMVOC	TSP	PM10	PM2.5			
1.B.1. Solid fuels							
1.B.1.a. Coal mining and handling							
1.B.1.a.i. Underground mines							
1.B.1.a.i.1. Mining activities	✓	✓	✓	✓			
1.B.1.a.i.2. Post-mining activities		✓	✓	✓			
1.B.1.a.ii. Surface mines							
1.B.1.a.ii.1. Mining activities	✓	✓	✓	✓			
1.B.1.a.ii.2. Post-mining activities		✓	✓	✓			
1.B.1.b. Fuel transformation							
1.B.1.b.i. Charcoal and biochar production						✓	
1.B.1.b.ii. Coke production							✓
1.B.1.b.iii. Coal to liquids							✓
1.B.1.b.iv. Gas to liquids							✓
1.B.1.b.v. Other							✓
1.B.1.c. Other							✓
1.B.2. Oil and natural gas and other emissions from energy production							
1.B.2.a. Oil							
1.B.2.a.i. Exploration	✓						
1.B.2.a.ii. Production and upgrading	✓						
1.B.2.a.iii. Transport	✓						
1.B.2.a.iv. Refining/storage	✓						
1.B.2.a.v. Distribution of oil products	✓						
1.B.2.a.vi. Other	✓						
1.B.2.a.vi.1. Abandoned wells							
1.B.2.a.vi.2. Other							
1.B.2.b. Natural gas							
1.B.2.b.i. Exploration	✓						
1.B.2.b.ii. Production and gathering	✓						
1.B.2.b.iii. Processing	✓						

IPPC/NFR code and description	Air pollutants emissions						
	estimated				IE included elsewhere	NE not estimated	NO not occurring
1.B. Fugitive emissions from fuels	NMVOC	TSP	PM10	PM2.5			
1.B.2.b.iv. Transmission and storage	✓						
1.B.2.b.v. Distribution	✓						
1.B.2.b.vi. Other	✓						
1.B.2.b.vi.1. Gas post-meter							
1.B.2.b.vi.2. Abandoned wells							
1.B.2.b.vi.3. Other							
1.B.2.c. Venting and flaring							
1.B.2.c.i. Venting							
1.B.2.c.i.1. Oil							
1.B.2.c.i.2. Gas							
1.B.2.c.i.3. Combined							
1.B.2.c.ii. Flaring							
1.B.2.c.ii.1. Oil							
1.B.2.c.ii.2. Gas							
1.B.2.c.ii.3. Combined							
1.B.2.d. Other							

Description of the trend, methodology including activity data and emission factors, as well as information on recalculation and planned improvements will be presented in next inventory cycle.

4 Industrial Processes and Product Use (IPPU) (NFR sector 2)

4.1 Source category description

The main industrial processes in Albania 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. A brought range of sources is **not occurring** in Albania, apart from the main emission sources in industrial processes, the facilities are only processing imported material. Due to lack of data and resources several sources have not been estimated yet, however these sources are planned to be added, to 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		
2A1	Cement production	✓		
2A2	Lime production			NE
2A3	Glass production		NO	
2A5a	Quarrying and mining of minerals other than coal			NE
2A5b	Construction and demolition			NE
2A5c	Storage, handling and transport of mineral products		NO	
2A6	Other mineral products		NO	
2B1	Ammonia production			NE
2B2	Nitric acid production		NO	
2B3	Adipic acid production		NO	
2B5	Carbide production		NO	
2B6	Titanium dioxide production		NO	
2B7	Soda ash production			NE
2B10a	Chemical industry: Other		NO	
2B10b	Storage, handling and transport of chemical products		NO	
2C1	Iron and steel production	✓		
2C2	Ferroalloys production		NO	
2C3	Aluminium production		NO	
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
2D3a	Domestic solvent use including fungicides	✓		
2D3b	Road paving with asphalt	✓		

Code	NFR description	Status		
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			
2G4	Use of Fireworks			NE
2G4	Use of Tobacco			NE
2G4	Use of Charcoal for barbecues			NE
2H	Other: Pulp & Paper, Food	NE		
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

4.2 Mineral Products (IPCC/NFR category 2.A)

4.2.1 Cement production (IPCC/NFR category 2.A.1)

This chapter includes the emissions estimations from cement production.

Emissions	TSP	PM ₁₀	PM _{2.5}	BC	PCBs	All other pollutants
Lime production	✓	✓	✓	✓	NA	NE

A '✓' indicates: emissions from this category have been estimated.
 Notation keys: IE - included elsewhere. NO – not occurrent. NE - not estimated. NA - not applicable. C – confidential

As described in the EMEP/EEA air pollutant emission inventory guidebook 2023⁴⁹ atmospheric emissions in the cement manufacturing industry include particulate emissions from the stacks of the kiln system production.

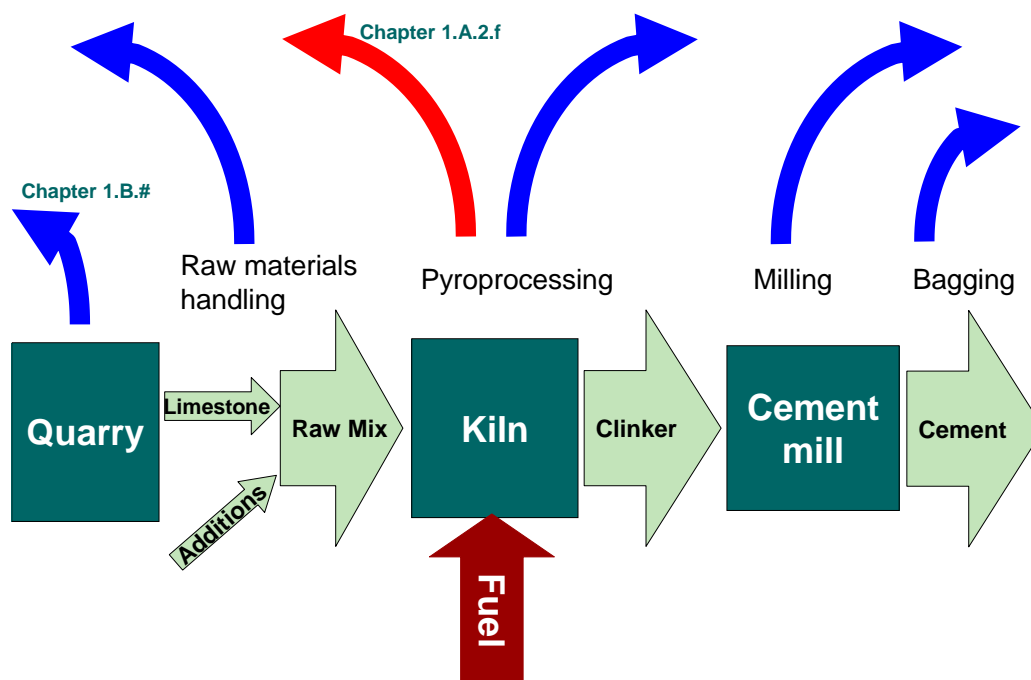


Figure 4-1 Process scheme for source category 2.A.1 Cement production⁵⁰

During cement manufacture, raw materials, such as limestone, are finely ground and then transformed in a kiln at high temperatures (calcination) to produce clinker. Gypsum is then blended with clinker to produce cement. The combustion process in the cement kiln is an integral part of the production process, where the fuel ash becomes part of the cement clinker. It is therefore not possible in most cases to distinguish the process and combustion emissions from one another.

The main emissions from cement production are emissions from kiln systems. However, only emissions of particulate matter, which mainly originate from pre- and after-treatment are considered in this sector. Emissions from the kiln are a combination of combustion and process emissions but the emissions of other

⁴⁹ Source: EMEP/EEA air pollutant emission inventory guidebook 2023. 2.A.2 Lime production. sub-chapter 1 Overview.

⁵⁰ Source: EMEP/EEA air pollutant emission inventory guidebook 2023. 2.A.2 Cement production, page 5

pollutants are assessed to originate mainly from fuel combustion, and are therefore allocated to the Energy sector.

An overview of the emission from from category 2.A.1. Cement-production is provided in the following figures and tables:

- Annual emissions of air pollutants;
- Trend of the periods 1990 – 2022, 2005 – 2022, 2021 – 2022;
- Share of sector 2.A.1 Cement-production of each pollutants in the related National total emissions.

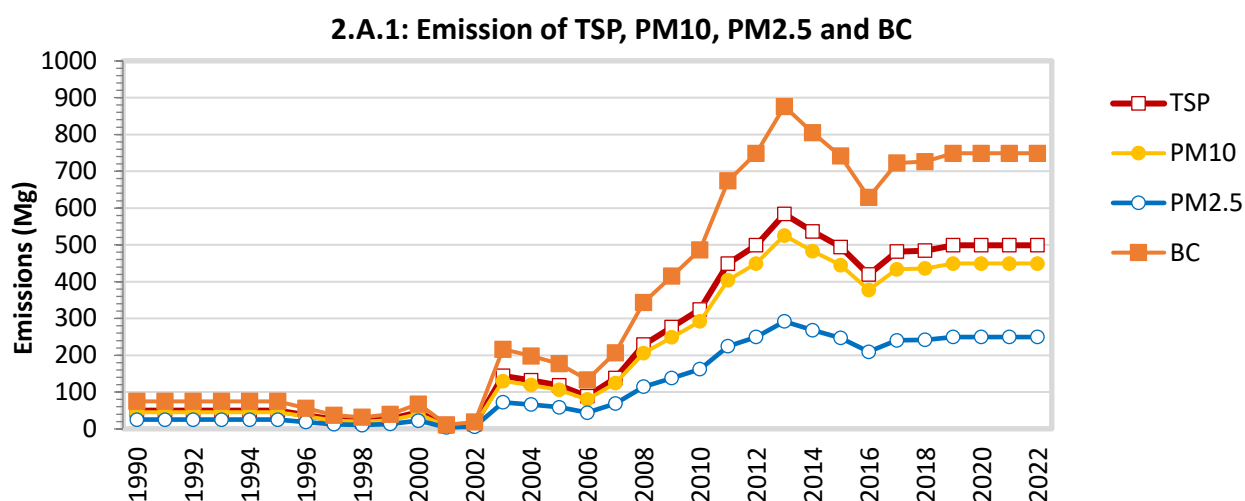


Figure 4-2 Emissions of main pollutants (TSP, PM10, PM2.5 and BC) from category 2.A.1 Cement production

Table 4.2 Activity data and emissions from clinker production

Year	Cement Produced	Clinker produced	TSP	PM10	PM2.5	BC
	Mg (=t)	Mg (=t)	Mg (=t)	Mg (=t)	Mg (=t)	Mg (=t)
1990	200000	192000	49.92	44.93	24.96	74.88
1991	200000	192000	49.92	44.93	24.96	74.88
1992	200000	192000	49.92	44.93	24.96	74.88
1993	200000	192000	49.92	44.93	24.96	74.88
1994	200000	192000	49.92	44.93	24.96	74.88
1995	200000	192000	49.92	44.93	24.96	74.88
1996	150000	144000	37.44	33.70	18.72	56.16
1997	100000	96000	24.96	22.46	12.48	37.44
1998	84000	80640	20.97	18.87	10.48	31.45
1999	107000	102720	26.71	24.04	13.35	40.06
2000	180000	172800	44.93	40.44	22.46	67.39
2001	30000	28800	7.49	6.74	3.74	11.23
2002	50000	48000	12.48	11.23	6.24	18.72
2003	578000	554880	144.27	129.84	72.13	216.40
2004	529600	508416	132.19	118.97	66.09	198.28

Year	Cement Produced	Clinker produced	TSP	PM10	PM2.5	BC
	Mg (=t)	Mg (=t)	Mg (=t)	Mg (=t)	Mg (=t)	Mg (=t)
2005	472900	453984	118.04	106.23	59.02	177.05
2006	355700	341472	88.78	79.90	44.39	133.17
2007	552700	530592	137.95	124.16	68.98	206.93
2008	918000	881280	229.13	206.22	114.57	343.70
2009	1108300	1063968	276.63	248.97	138.32	414.95
2010	1300000	1248000	324.48	292.03	162.24	486.72
2011	1800000	1728000	449.28	404.35	224.64	673.92
2012	2000000	1920000	499.20	449.28	249.60	748.80
2013	2340000	2246400	584.06	525.66	292.03	876.10
2014	2150000	2064000	536.64	482.98	268.32	804.96
2015	1980000	1900800	494.21	444.79	247.10	741.31
2016	1680000	1612800	419.33	377.40	209.66	628.99
2017	1930000	1852800	481.73	433.56	240.86	722.59
2018	1940000	1862400	484.22	435.80	242.11	726.34
2019	2000000	1920000	499.20	449.28	249.60	748.80
2020	2000000	1920000	499.20	449.28	249.60	748.80
2021	2000000	1920000	499.20	449.28	249.60	748.80
2022	2000000	1920000	499.20	449.28	249.60	748.80
Trend						
1990 – 2022	900%	900%	900%	900%	900%	900%
2005 – 2022	323%	323%	323%	323%	323%	323%
2021 – 2022	0%	0%	0%	0%	0%	0%

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 2023 (EEA. 2023).

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

$E_{\text{pollutant}}$ = the emission of the specified pollutant

$AR_{\text{production}}$ = the activity rate for the cement production

$EF_{\text{pollutant}}$ = the emission factor for the relevant pollutant

Since emission factor are expressed per mass of clinker produced, activity statistics must be recalculated from cement to clinker production statistics. Most cement produced is Portland cement which has an average clinker content of 95-97% (IPCC,2006). For the time series 1990-2022, a clinker content of 96% was applied.

4.2.1.1.2 Choice of activity data

Activities were provided by the UNdata⁵¹ and The Mineral Industry of Albania (2010-2019) publications and presented in Table 4.7 above. Due to Lack of resources for the period 1990-1994 is applied the same activity data as for 1995.

4.2.1.1.3 Choice of emission factors

Default emission factors from the EMEP EEA Guidebook 2023. Table 3-1. are applied and are presented in the following table.

Table 4.3 Tier 1 emission factors for source category 2.A.1 Cement production

Pollutant	Value	Unit	Type of Emission factor
TSP	260	g/Mg clinker	default
PM ₁₀	234	g/Mg clinker	default
PM _{2.5}	130	g/Mg clinker	default
BC	3	% of PM _{2.5}	default

4.2.1.2 Uncertainties and time-series consistency

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

Table 4.4 Uncertainty for category 2.A.1 Cement production

Uncertainty	UN statistical databases	Default values, other sectors and data sources	Reference
Activity data (AD)	5-10 %	30-100 %	Table 2-1 Indicative error ranges in activity data for uncertainty analysis EMEP EEA GB 2023.
Emission factor (EF)	Rating	Typical error range	Average
TSP, PM ₁₀ , PM _{2.5} , BC	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 2023.			

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.

4.1.1.1 Source-specific QA/QC and verification

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

- Checked of calculations by spreadsheets
 - documented sources.
 - use of units.
 - strictly defined interfaces between spreadsheets/calculation modules.

⁵¹ <https://data.un.org/Data.aspx?q=cement&d=ICS&f=cmID%3a37440-0>

- 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.

4.1.1.2 Source-specific Recalculations

The following table presents the main revisions and recalculations done since the last submission to category 2.A.2.

Table 4.5 Recalculations done in category 2.A.1

source category	Revisions of data	Type of revision	Type of improvement
2.A.1	No revision has been performed		

4.1.1.3 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 4.6 Planned improvements for category 2.A.1

Source category	Planned improvement	Type of improvement		Priority
2.A.1	Analysis of national cement data by different types of clinker for application Tier 2	AD	Completeness	Medium
2.A.1	To complete national data sets for the period 1990-2022	AD	Completeness	High

4.1.2 Lime production (IPCC/NFR category 2.A.2)

This chapter includes the emissions estimations from lime production.

Emissions	TSP	PM ₁₀	PM _{2.5}	All other pollutants
Lime production	✓	✓	✓	NA

A '✓' indicates: emissions from this category have been estimated.
 Notation keys: IE - included elsewhere. NO – not occurred. NE - not estimated. NA - not applicable. C – confidential

As described in the EMEP/EEA air pollutant emission inventory guidebook 2023⁵² 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.

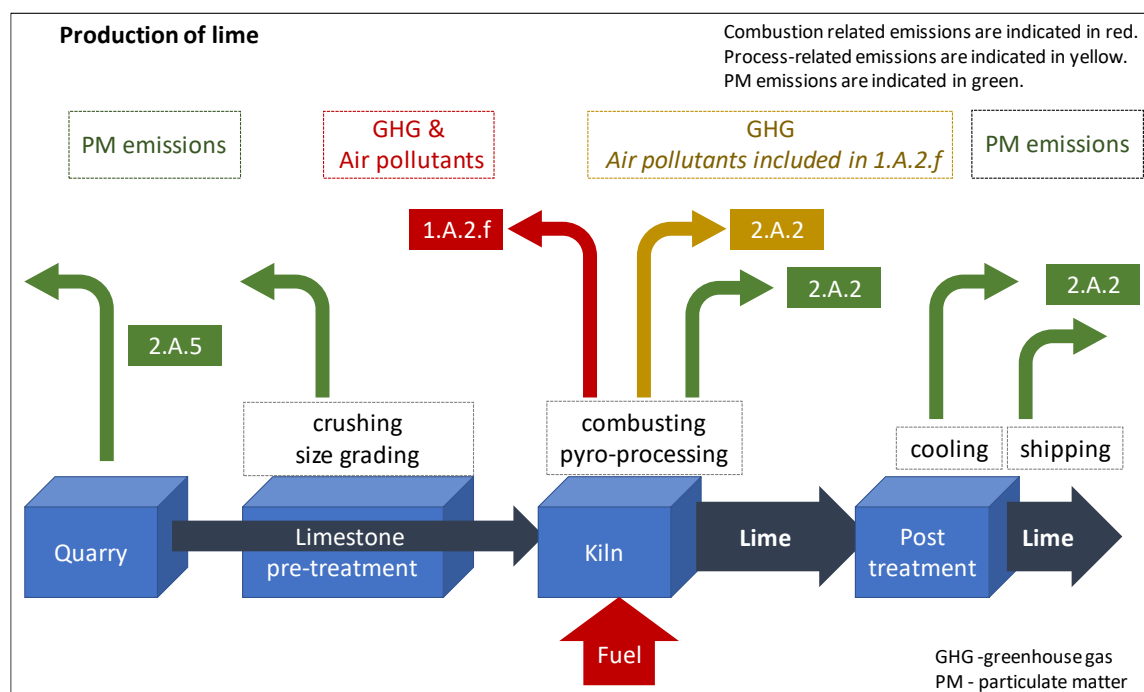
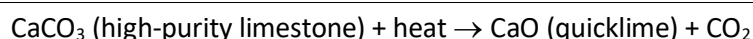


Figure 4-3 Process scheme for source category 2.A.2 Lime production

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 CO₂. Depending on the product requirements (e.g., metallurgy, pulp and paper, construction materials, effluent treatment, water softening, pH control, and soil stabilisation), primarily high calcium limestone (calcite) is utilized in accordance with the following reaction:



⁵² Source: EMEP/EEA air pollutant emission inventory guidebook 2023. 2.A.2 Lime production, sub-chapter 1 Overview.

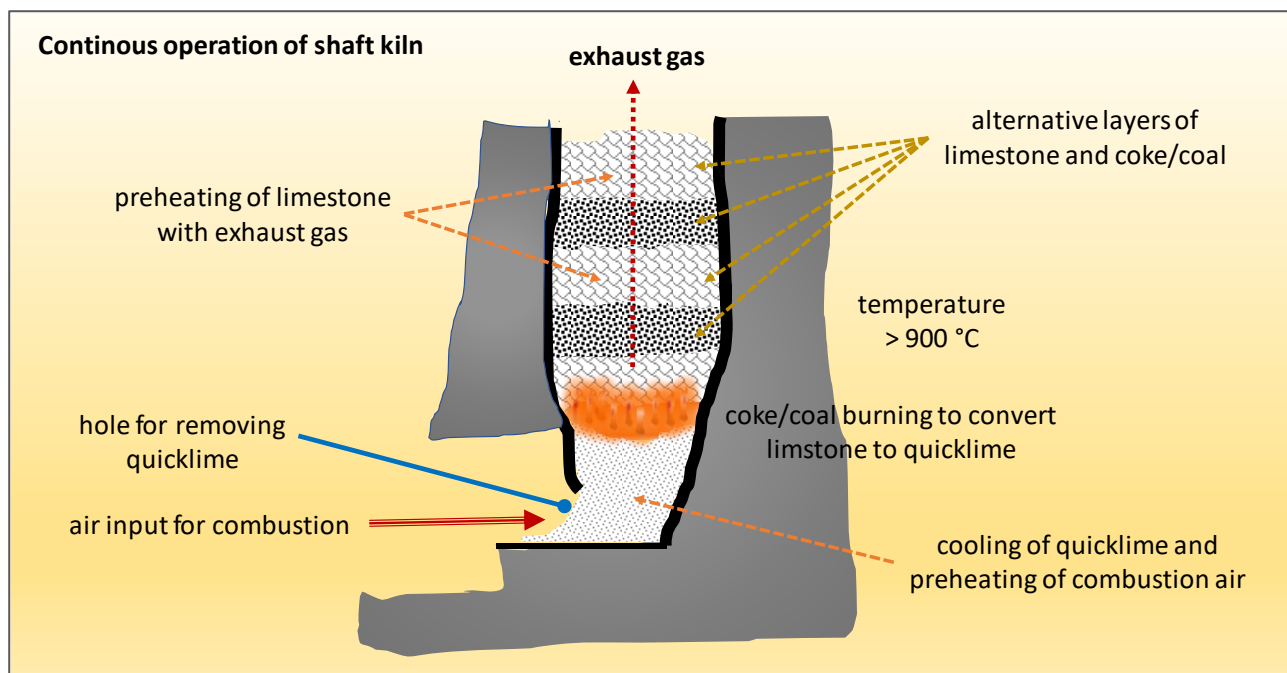


Figure 4-4 Illustration of a shaft kiln for lime production

Table 4.7 Activity data⁵³

Year	Lime produced
	Mg (=t)
2010	46039
2011	43620
2012	23096
2013	23007
2014	23000
2015	23000
2016	23000
2017	24000
2018	24000
2019	24000

This category has not been estimated this year due to lack of activity data. Therefore, emissions from lime production will be estimated for the next submission with improved activity data sets.

⁵³ Source of data: The Mineral Industry of Albania

4.1.3 Quarrying and mining of minerals other than coal (IPCC/NFR category 2.A.5a)

Emissions from from category 2.A.5a were not estimated due to lack of activity data.

4.1.3.1 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 4.8 Planned improvements for category 2.A.5a Quarrying and mining of minerals other than coal

Source category	Planned improvement	Type of improvement		Priority
2.A.5a	Collection of national activity data	AD	Completeness	High

4.1.4 Construction and demolition (IPCC/NFR category 2.A.5b)

Emissions from from category 2.A.5b were not estimated due to lack of activity data.

4.1.4.1 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 4.9 Planned improvements for category 2.A.5b Construction and demolition

Source category	Planned improvement	Type of improvement		Priority
2.A.5b	Collection of national activity data	AD	Completeness	High

4.1.5 Ammonia production (IPCC/NFR category 2.B.1)

Emissions from from category 2.B.1 were not estimated due to lack of activity data.

4.1.5.1 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 4.10 Planned improvements for category 2.B.1 Ammonia production

Source category	Planned improvement	Type of improvement		Priority
2.B.1	Collection of national activity data	AD	Completeness	High

4.1.6 Soda ash production (IPCC/NFR category 2.B.7)

Emissions from from category 2.B.7 were not estimated due to lack of activity data.

4.1.6.1 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 4.11 **Planned improvements for category 2.B.7 Soda ash production**

Source category	Planned improvement	Type of improvement		Priority
2.B.7	Collection of national activity data	AD	Completeness	High

4.2 Metal Production (category 2.C)

4.2.1 Iron and steel production (category 2.C.1)

Emissions occur only from electro-steel production in Albania. The following table provides an overview on reported emissions from this source.

Table 4.12 Overview on reported emissions from sub categories 2.C.1 Iron and steel production

Air pollutants	2.C.1
NOx	✓
CO	✓
NM VOC	✓
SOx	✓
NH3	NA
TSP	✓
PM10	✓
PM2.5	✓
BC	✓
Pb	✓
Cd	✓
Hg	✓
As	✓
Cr	✓
Cu	✓
Ni	✓
Se	✓
Zn	✓
PCB	✓
PCDD/F	✓
PAH	✓
Benzo(a)pyrene	NA
Benzo(b)fluoranthene	NA
Benzo(k)fluoranthene	NA
Indeno(1,2,3-cd)pyrene	NA
HCB	NA

An overview of the emission from from 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 – 2022, 2005 – 2022, 2021 – 2022;
- Share of sector 2.C.1 electrosteel of each pollutants in the related National total emissions.

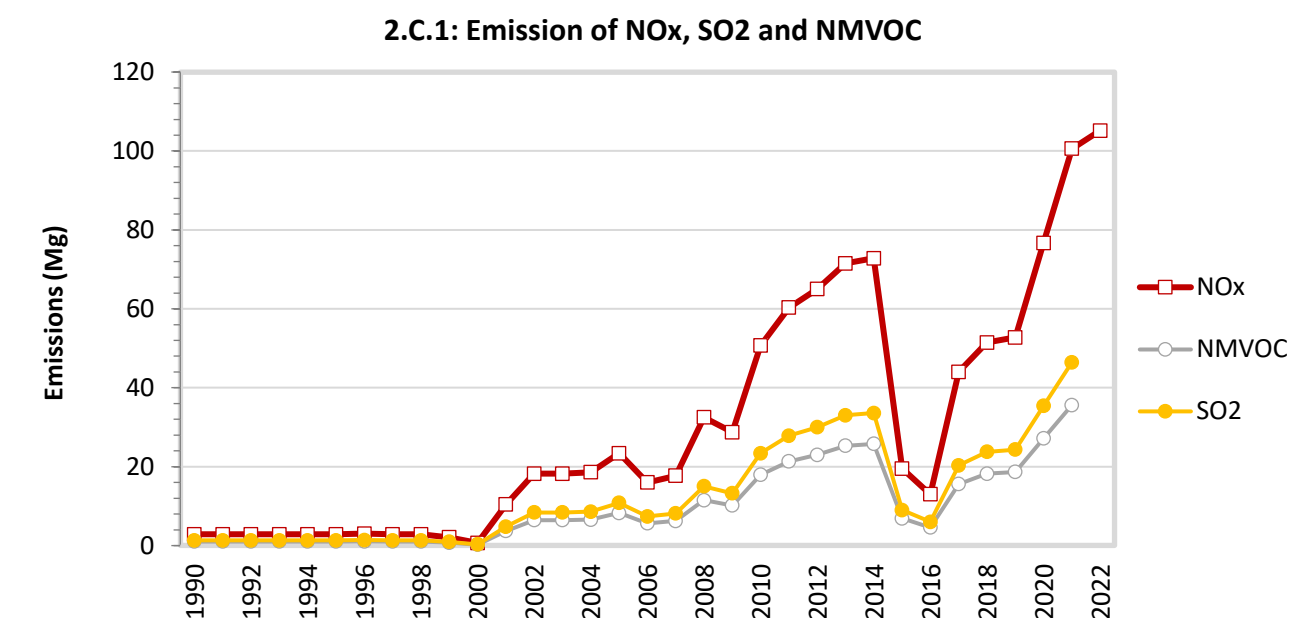
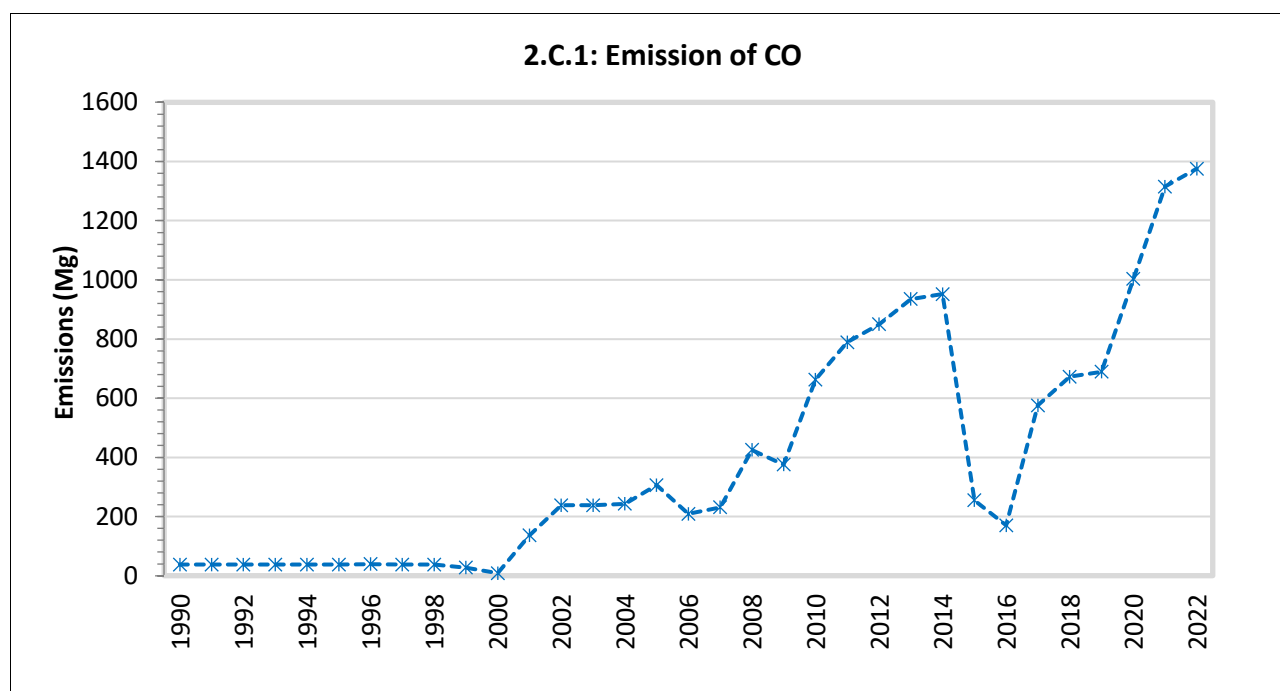


Figure 4-5 Emissions of main pollutants (NO_x, SO₂, NMVOC and CO) from category 2.C.1 Electrosteel

Table 4.13 Emissions of main pollutants (NO_x, SO₂, NMVOC and CO) from category 2.C.1 Electrosteel

Emissions	NO _x	CO	NMVOC	SO _x	NH ₃
	t	t	t	t	t
1990	2.86	37.40	1.01	1.32	NA
1991	2.86	37.40	1.01	1.32	NA
1992	2.86	37.40	1.01	1.32	NA
1993	2.86	37.40	1.01	1.32	NA
1994	2.86	37.40	1.01	1.32	NA
1995	2.86	37.40	1.01	1.32	NA
1996	2.99	39.10	1.06	1.38	NA

Emissions	NO _x	CO	NM _{VOC}	SO _x	NH ₃
	t	t	t	t	t
1997	2.86	37.40	1.01	1.32	NA
1998	2.86	37.40	1.01	1.32	NA
1999	2.08	27.20	0.74	0.96	NA
2000	0.65	8.50	0.23	0.30	NA
2001	10.40	136.00	3.68	4.80	NA
2002	18.20	238.00	6.44	8.40	NA
2003	18.20	238.00	6.44	8.40	NA
2004	18.59	243.10	6.58	8.58	NA
2005	23.40	306.00	8.28	10.80	NA
2006	15.99	209.10	5.66	7.38	NA
2007	17.68	231.20	6.26	8.16	NA
2008	32.50	425.00	11.50	15.00	NA
2009	28.73	375.70	10.17	13.26	NA
2010	50.70	663.00	17.94	23.40	NA
2011	60.32	788.80	21.34	27.84	NA
2012	65.00	850.00	23.00	30.00	NA
2013	71.50	935.00	25.30	33.00	NA
2014	72.80	952.00	25.76	33.60	NA
2015	19.50	255.00	6.90	9.00	NA
2016	13.00	170.00	4.60	6.00	NA
2017	44.00	575.42	15.57	20.31	NA
2018	51.44	672.62	18.20	23.74	NA
2019	52.73	689.51	18.66	24.34	NA
2020	76.70	1003.00	27.14	35.40	NA
2021	100.58	1315.24	35.59	46.42	NA
2022	105.17	1375.27	37.21	48.54	NO
Trend					
1990 – 2022	3577.2%	3577.2%	3577.2%	3577.2%	3577.2%
2005 – 2022	349.4%	349.4%	349.4%	349.4%	349.4%
2021 – 2022	4.6%	4.6%	4.6%	4.6%	4.6%

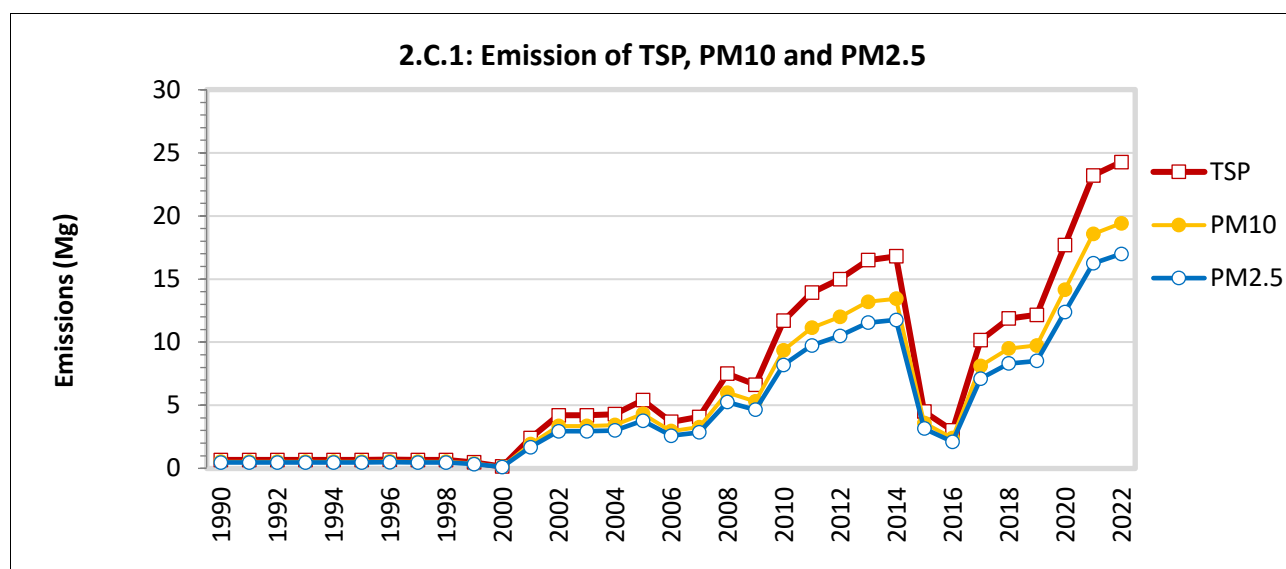


Figure 4-6 Emissions of main pollutants (TSP, PM10 and PM2.5) from category 2.C.1 Electrosteel

Table 4.14 Emissions of particulate matter (PM) from category 2.C.1 Electrosteel

Emissions	PM2.5	PM10	TSP	BC
	Mg	Mg	Mg	Mg
1990	0.46	0.53	0.66	0.17
1991	0.46	0.53	0.66	0.17
1992	0.46	0.53	0.66	0.17
1993	0.46	0.53	0.66	0.17
1994	0.46	0.53	0.66	0.17
1995	0.46	0.53	0.66	0.17
1996	0.48	0.55	0.69	0.17
1997	0.46	0.53	0.66	0.17
1998	0.46	0.53	0.66	0.17
1999	0.34	0.38	0.48	0.12
2000	0.11	0.12	0.15	0.04
2001	1.68	1.92	2.40	0.60
2002	2.94	3.36	4.20	1.06
2003	2.94	3.36	4.20	1.06
2004	3.00	3.43	4.29	1.08
2005	3.78	4.32	5.40	1.36
2006	2.58	2.95	3.69	0.93
2007	2.86	3.26	4.08	1.03
2008	5.25	6.00	7.50	1.89
2009	4.64	5.30	6.63	1.67
2010	8.19	9.36	11.70	2.95
2011	9.74	11.14	13.92	3.51
2012	10.50	12.00	15.00	3.78
2013	11.55	13.20	16.50	4.16
2014	11.76	13.44	16.80	4.23

Emissions	PM2.5	PM10	TSP	BC
	Mg	Mg	Mg	Mg
2015	3.15	3.60	4.50	1.13
2016	2.10	2.40	3.00	0.76
2017	7.11	8.12	10.15	2.56
2018	8.31	9.50	11.87	2.99
2019	8.52	9.73	12.17	3.07
2020	12.39	14.16	17.70	4.46
2021	16.25	18.57	23.21	5.85
2022	16.99	19.42	24.27	6.12
Trend				
1990 – 2022	3577.2%	3577.2%	3577.2%	3577.2%
2005 – 2022	349.4%	349.4%	349.4%	349.4%
2021 – 2022	4.6%	4.6%	4.6%	4.6%

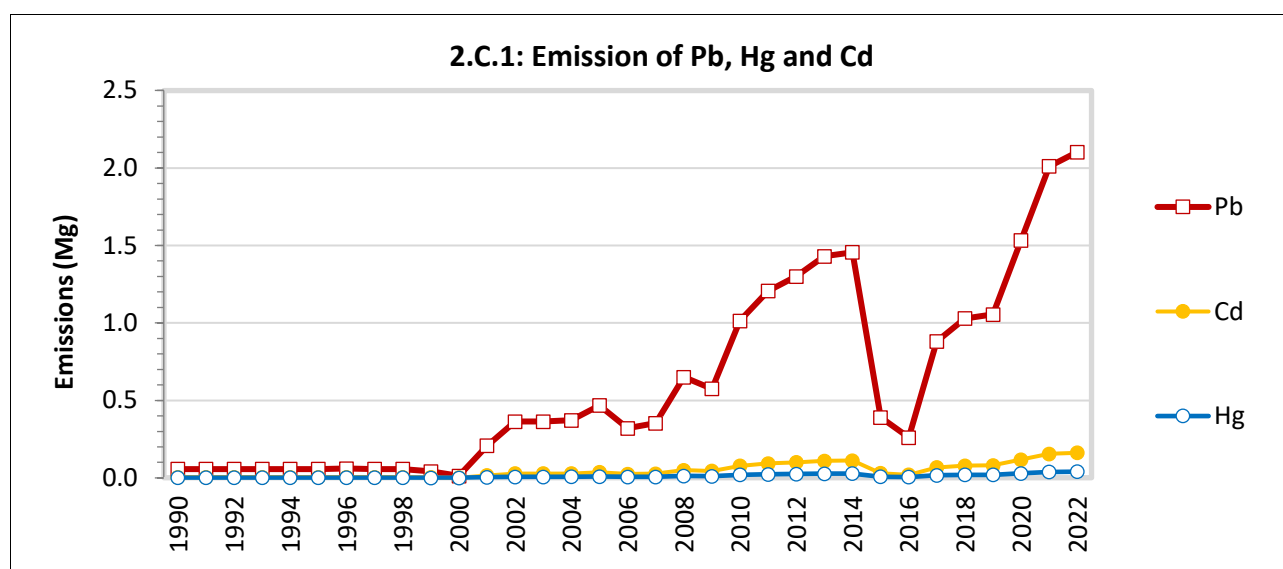


Figure 4-7 Emissions of Pb, Cd and Hg from category 2.C.1 Electrosteel

Table 4.15 Emissions of Heavy Metals (HM) from category 2.C.1 Electrosteel

Emissions	Pb	Cd	Hg	As	Cr	Cu	Ni	Zn
	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg
1990	0.06	<0.001	<0.001	<0.001	<0.001	<0.001	0.02	0.08
1991	0.06	<0.001	<0.001	<0.001	<0.001	<0.001	0.02	0.08
1992	0.06	<0.001	<0.001	<0.001	<0.001	<0.001	0.02	0.08
1993	0.06	<0.001	<0.001	<0.001	<0.001	<0.001	0.02	0.08
1994	0.06	<0.001	<0.001	<0.001	<0.001	<0.001	0.02	0.08
1995	0.06	<0.001	<0.001	<0.001	<0.001	<0.001	0.02	0.08
1996	0.06	<0.001	<0.001	<0.001	<0.001	<0.001	0.02	0.08
1997	0.06	<0.001	<0.001	<0.001	<0.001	<0.001	0.02	0.08
1998	0.06	<0.001	<0.001	<0.001	<0.001	<0.001	0.02	0.08
1999	0.04	<0.001	<0.001	<0.001	<0.001	<0.001	0.01	0.06
2000	0.01	<0.001	<0.001	<0.001	<0.001	<0.001	0.00	0.02
2001	0.21	0.02	<0.001	<0.001	0.01	<0.001	0.06	0.29
2002	0.36	0.03	0.01	<0.001	0.01	<0.001	0.10	0.50
2003	0.36	0.03	0.01	<0.001	0.01	<0.001	0.10	0.50
2004	0.37	0.03	0.01	<0.001	0.01	<0.001	0.10	0.51
2005	0.47	0.04	0.01	<0.001	0.02	<0.001	0.13	0.65
2006	0.32	0.02	0.01	<0.001	0.01	<0.001	0.09	0.44
2007	0.35	0.03	0.01	<0.001	0.01	<0.001	0.10	0.49
2008	0.65	0.05	0.01	<0.001	0.03	0.01	0.18	0.90
2009	0.57	0.04	0.01	<0.001	0.02	0.00	0.15	0.80
2010	1.01	0.08	0.02	0.01	0.04	0.01	0.27	1.40
2011	1.21	0.09	0.02	0.01	0.05	0.01	0.32	1.67
2012	1.30	0.10	0.03	0.01	0.05	0.01	0.35	1.80
2013	1.43	0.11	0.03	0.01	0.06	0.01	0.39	1.98
2014	1.46	0.11	0.03	0.01	0.06	0.01	0.39	2.02
2015	0.39	0.03	0.01	<0.001	0.02	0.00	0.11	0.54
2016	0.26	0.02	0.01	<0.001	0.01	0.00	0.07	0.36
2017	0.88	0.07	0.02	0.01	0.03	0.01	0.24	1.22
2018	1.03	0.08	0.02	0.01	0.04	0.01	0.28	1.42
2019	1.05	0.08	0.02	0.01	0.04	0.01	0.28	1.46
2020	1.53	0.12	0.03	0.01	0.06	0.01	0.41	2.12
2021	2.01	0.15	0.04	0.01	0.08	0.02	0.54	2.79
2022	2.10	0.16	0.04	0.01	0.08	0.02	0.57	2.91
Trend								
1990 – 2022	3577.2%	3577.2%	3577.2%	3577.2%	3577.2%	3577.2%	3577.2%	3577.2%
2005 – 2022	349.4%	349.4%	349.4%	349.4%	349.4%	349.4%	349.4%	349.4%
2021 – 2022	4.6%	4.6%	4.6%	4.6%	4.6%	4.6%	4.6%	4.6%

Table 4.16 Emissions of Persistent Organic Pollutants (POPs) from sub- category 2.C.1 Electrosteel

Emissions	PCDD/F	Total PAH	HCB	PCB
	g I-TEQ	Mg	kg	Kg
1990	0.07	0.01	NA	<0.001
1991	0.07	0.01	NA	<0.001
1992	0.07	0.01	NA	<0.001
1993	0.07	0.01	NA	<0.001
1994	0.07	0.01	NA	<0.001
1995	0.07	0.01	NA	<0.001
1996	0.07	0.01	NA	<0.001
1997	0.07	0.01	NA	<0.001
1998	0.07	0.01	NA	<0.001
1999	0.05	0.01	NA	<0.001
2000	0.02	0.00	NA	<0.001
2001	0.24	0.04	NA	<0.001
2002	0.42	0.07	NA	<0.001
2003	0.42	0.07	NA	<0.001
2004	0.43	0.07	NA	<0.001
2005	0.54	0.09	NA	<0.001
2006	0.37	0.06	NA	<0.001
2007	0.41	0.07	NA	<0.001
2008	0.75	0.12	NA	0.001
2009	0.66	0.11	NA	<0.001
2010	1.17	0.19	NA	<0.001
2011	1.39	0.22	NA	<0.001
2012	1.50	0.24	NA	<0.001
2013	1.65	0.26	NA	<0.001
2014	1.68	0.27	NA	<0.001
2015	0.45	0.07	NA	<0.001
2016	0.30	0.05	NA	<0.001
2017	1.02	0.16	NA	<0.001
2018	1.19	0.19	NA	<0.001
2019	1.22	0.19	NA	<0.001
2020	1.77	0.28	NA	<0.001
2021	2.32	0.37	NA	<0.001
2022	2.43	0.39	NA	<0.001
Trend				
1990 – 2022	3577.2%	3577.2%	3577.2%	3577.2%
2005 – 2022	349.4%	349.4%	349.4%	349.4%
2021 – 2022	4.6%	4.6%	4.6%	4.6%

4.2.1.1 Methodological issues

4.2.1.1.1 Choice of methods

The emissions were calculated by Tier 2 methodology from the EMEP EEA GB 2023 (EEA. 2023). 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

4.2.1.1.2 Choice of activity data

The activity data are taken from UN data statistics and Minerals Yearbook (The Minerals of Albania publication).

Due to lack of data for the period 1990-1994 is applied the same value of steel production as for 1995.

Table 4.17 Activity data and emissions from electro-steel production

year	tonnes of steel produced		year	tonnes of steel produced
	t			t
1990	22000		2006	123000
1991	22000		2007	136000
1992	22000		2008	250000
1993	22000		2009	221000
1994	22000		2010	390000
1995	22000		2011	464000
1996	23000		2012	500000
1997	22000		2013	550000
1998	22000		2014	560000
1999	16000		2015	150000
2000	5000		2016	100000
2001	80000		2017	338480
2002	140000		2018	395656
2003	140000		2019	405597
2004	143000		2020	590000
2005	180000		2021	773668
			2022	808983
Trend				
1990 – 2022				3577.2%
2005 – 2022				349.4%
2021 – 2022				4.6%

4.2.1.1.3 Choice of emission factors

Default emission factors from the EMEP EEA Guidebook 2023 Chapter 2.C.1- Table 3.15. are applied and are presented in the following table.

Table 4.18 Default Tier 2 emission factors for source category 2.C.1 Iron and steel production

Pollutant	Value	Unit	Type of emission factor
NO _x	130	g/Mg steel	Default Tier 2
CO	1.7	kg/Mg steel	Default Tier 2
NMVOC	46	g/Mg steel	Default Tier 2
SO ₂	60	g/Mg steel	Default Tier 2
TSP	30	g/Mg steel	Default Tier 2
PM ₁₀	24	g/Mg steel	Default Tier 2
PM _{2.5}	21	g/Mg steel	Default Tier 2
BC	0.36	% of PM _{2.5}	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

4.2.1.2 Uncertainties and time-series consistency

The uncertainties for activity data and emission factors used for IPCC/NFR category 2.C.1 Iron and steel production are presented in the following table.

4.2.1.3 Source-specific QA/QC and verification

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

- Checked of calculations by spreadsheets
 - 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.

Table 4.19 Uncertainty for category 2.C.1 Iron and steel production

Uncertainty	Iron and steel production in Electric arc furnace			Reference
Activity data (AD)	1%			2006 IPCC GL. Vol. 3. Chap. 4 (4.2.3)
Emission factor (EF)	Rating	Typical error range	Average	Reference
NO _x	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 2023. Part A. Chapter 5 Uncertainties.
CO	C	50% to 200%	125%	
NM VOC	C	50% to 200%	125%	
SO _x	B	20% to 60%	40%	
NH ₃	E	order of magnitude	750%	
TSP, PM ₁₀ , PM _{2.5} , BC	C	50% to 200%	125%	
Hg, Pb, Cd, As, Cr, Cu, Ni, Se, Zn	E	order of magnitude	750%	
PCDD/F, PAH (Benzo(a)pyrene, Benzo(b)-fluoranthene, Benzo(k)fluor-anthene, Indeno(1,2,3-cd)pyrene), HCB, PCBs	E	order of magnitude	750%	

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.

4.2.1.4 Source-specific Recalculations

The following table presents the main revisions and recalculations done since the last submission to category 2.C.1.

Table 4.20 Recalculations done in category 2.C.1

source category	Revisions of data	Type of revision	Type of improvement
2.C.1	No recalculations have been performed.		

4.2.1.5 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 4.21 Planned improvements for category 2.C.1

Source category	Planned improvement	Type of improvement		Priority
2.C.1	Check timeseries of steel production - the data source is not consistent for the time series: data for the beginning of the time series are combination of data assumption and UN statistics and then The Minerals yearbook data; check national data	AD	time series consistency - cross-category consistency	High

Storage, handling and transport of metal products

4.2.2 Storage, handling and transport of metal products (category 2.C.7d)

Emissions from category 2.C.7d were not estimated due to lack of activity data.

4.2.2.1 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 4.22 Planned improvements for category 2.B.7 Soda ash production

Source category	Planned improvement	Type of improvement		Priority
		AD	Completeness	
2.C.7d	Collection of national activity data			Low

4.3 Other Solvent and Product Use (category 2.D)

4.3.1 Domestic solvent use including fungicides (category 2.D.3.a)

The following table provides an overview of activity data and NMVOC emissions from category 2.D.3.a Domestic solvent use including fungicides.

Emissions	NMVOC	All other pollutants
Domestic solvent use including fungicides	✓	NA
A '✓' indicates: emissions from this category have been estimated. Notation keys: IE - included elsewhere. NO – not occurring. NE - not estimated. NA - not applicable. C – confidential		

Table 4.23 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 2023. Part B. Chapter 2.D.3.a Domestic solvent use including fungicides. Table 2.1.

Table 4.24 Activity data and emissions from domestic solvent use

year	Inhabitants	NMVOC
	Capita	t
1990	3286500	3943.80
1991	3259814	3911.78
1992	3190103	3828.12
1993	3167478	3800.97
1994	3220310	3864.37
1995	3248836	3898.60
1996	3283000	3939.60
1997	3324317	3989.18
1998	3354341	4025.21
1999	3373445	4048.13
2000	3058497	3670.20
2001	3063318	3675.98
2002	3057018	3668.42

year	Inhabitants	NM VOC
	Capita	t
2003	3044993	3653.99
2004	3034231	3641.08
2005	3019634	3623.56
2006	3003329	3603.99
2007	2981755	3578.11
2008	2958266	3549.92
2009	2936355	3523.63
2010	2918674	3502.41
2011	2907368	3488.84
2012	2903008	3483.61
2013	2897770	3477.32
2014	2892394	3470.87
2015	2885796	3462.96
2016	2875592	3450.71
2017	2876591	3451.91
2018	2870324	3444.39
2019	2862427	3434.91
2020	2845955	3415.146
2021	2829741	3395.689
2022	2793592	3352.31
Trend		
1990-2022	-15.00%	-15.00%
2005-2022	-7.49%	-7.49%
2021-2022	-1.28%	-1.28%

4.3.1.1 Methodological issues

4.3.1.1.1 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

4.3.1.1.2 Choice of activity data

Population data are taken from the national statistical office INSTAT.

4.3.1.1.3 Choice of emission factors

The emission factor of 1.2 kg per capita for other countries from the EMEP EEA GB 2023 was applied (EEA, 2023).

Table 4.25 Tier 1 emission factors for source category 2.D.3.a

Pollutant	Value	Unit	Type of emission factor
NMVOC	1.2	kg/capita	default

4.3.1.2 Uncertainties and time-series consistency

The uncertainties for activity data and emission factors used for IPCC/NFR category 2.D.3.a Domestic solvent use including fungicides are presented in the following table.

Table 4.26 Uncertainty for category 2.D.3.a Domestic solvent use including fungicides

Uncertainty	2.D.3.a Domestic solvent use including fungicides			Reference
Activity data (AD)	2%			Table 2-1 Indicative error ranges in activity data for uncertainty analysis EMEP EEA GB 2023. Part A. Chapter 5 Uncertainties.
Emission factor (EF)	Rating	Typical error range	Average	Reference
NMVOC	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 2023. Part A. Chapter 5 Uncertainties.

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.

4.3.1.3 Source-specific QA/QC and verification

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

- Checked of calculations by spreadsheets
 - 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.

4.3.1.4 Source-specific Recalculations

The following table presents the main revisions and recalculations done since the last submission to category 2D.3.a.

Table 4.27 Recalculations done in category 2.D.3.a

source category	Revisions of data	Type of revision	Type of improvement
2.D.3.a	No recalculations have been performed		

4.3.1.5 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 4.28 Planned improvements for category 2.D.3.a

Source category	Planned improvement	Type of improvement		Priority
2.D.3.a	Check timeseries of population - the data source is not consistent for the time series: some data of the time series is taken from UN statistics; check national data	AD	time series consistency - cross-category consistency	medium

4.3.2 Road paving with asphalt (category 2.D.3.b)

The following table provides an overview of activity data and NMVOC, TSP, PM10, PM2.5 and BC emission from sub category 2.D.3.b Road paving with asphalt.

Emissions	NMVOC	TSP	PM 10	PM 2.5	BC
Domestic solvent use including fungicides	✓	✓	✓	✓	✓
Key Category			-		
A '✓' indicates: emissions from this 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 4.29 Activity data and emissions from road paving

year	Asphalt consumed	NMVOC	TSP	PM10	PM2.5	BC
	t	t	t	t	t	t
1990	54,000	0.86	810.00	108.00	5.40	0.31
1991	21,000	0.34	315.00	42.00	2.10	0.12
1992	11,000	0.18	165.00	22.00	1.10	0.06
1993	19,000	0.30	285.00	38.00	1.90	0.11
1994	34,000	0.54	510.00	68.00	3.40	0.19
1995	33,000	0.53	495.00	66.00	3.30	0.19
1996	20,000	0.32	300.00	40.00	2.00	0.11
1997	17,000	0.27	255.00	34.00	1.70	0.10
1998	16,000	0.26	240.00	32.00	1.60	0.09
1999	17,000	0.27	255.00	34.00	1.70	0.10
2000	16,000	0.26	240.00	32.00	1.60	0.09
2001	16,000	0.26	240.00	32.00	1.60	0.09
2002	17,000	0.27	255.00	34.00	1.70	0.10
2003	45,000	0.72	675.00	90.00	4.50	0.26
2004	16,000	0.26	240.00	32.00	1.60	0.09
2005	89,000	1.42	1335.00	178.00	8.90	0.51
2006	86,000	1.38	1290.00	172.00	8.60	0.49
2007	71,000	1.14	1065.00	142.00	7.10	0.40
2008	47,550	0.76	713.25	95.10	4.76	0.27
2009	73,230	1.17	1098.45	146.46	7.32	0.42
2010	64,210	1.03	963.15	128.42	6.42	0.37
2011	25,890	0.41	388.35	51.78	2.59	0.15
2012	25,190	0.40	377.85	50.38	2.52	0.14
2013	28,690	0.46	430.35	57.38	2.87	0.16
2014	61,990	0.99	929.85	123.98	6.20	0.35
2015	83,000	1.33	1245.00	166.00	8.30	0.47
2016	84,000	1.34	1260.00	168.00	8.40	0.48
2017	77,100	1.23	1156.50	154.20	7.71	0.44

year	Asphalt consumed	NMVOC	TSP	PM10	PM2.5	BC
	t	t	t	t	t	t
2018	25,820	0.41	387.30	51.64	2.58	0.15
2019	104,580	1.67	1568.70	209.16	10.46	0.60
2020	75,040	1.20	1125.60	150.08	7.50	0.43
2021	106,055	1.70	1590.83	212.11	10.61	0.60
2022	69,356	1	1040.35	138.71	6.94	0.40
Trend						
1990 – 2022	28.4%	28.4%	28.4%	28.4%	28.4%	28.4%
2005 – 2022	-22.1%	-22.1%	-22.1%	-22.1%	-22.1%	-22.1%
2021 – 2022	-34.6%	-34.6%	-34.6%	-34.6%	-34.6%	-34.6%

4.3.2.1 Methodological issues

4.3.2.1.1 Choice of methods

The emissions of domestic solvent use were estimated by Tier 1 methodology from the EMEP EEA GB 2019.

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

$E_{\text{pollutant}}$ = the emission of the specified pollutant

$AR_{\text{consumption}}$ = the activity rate for the for the asphalt consumption

$EF_{\text{pollutant}}$ = the emission factor for this pollutant

4.3.2.1.2 Choice of activity data

Asphalt consumption data are taken from the UN data statistics (Energy balance) and are presented in Table 4.24.

4.3.2.1.3 Choice of emission factors

The emission factors (see Table 4.30) from US EPA (2004) were applied.

Table 4.30 Tier 1 emission factors for source category 2.D.3.b

Pollutant	Value	Unit	Reference
NMVOC	16	g/Mg asphalt	US EPA (2004)
TSP	14000	g/Mg asphalt	US EPA (2004)
PM10	3000	g/Mg asphalt	US EPA (2004)
PM2.5	400	g/Mg asphalt	US EPA (2004)
BC	0.057	% of PM 2.5	US EPA (2011. file no.: 91159)

4.3.2.2 Uncertainties and time-series consistency

The uncertainties for activity data and emission factors used for IPCC/NFR category 2.D.3.a Domestic solvent use including fungicides are presented in the following table.

Table 4.31 Uncertainty for category 2.D.3.a Domestic solvent use including fungicides

Uncertainty	2.D.3.b Road paving with asphalt			Reference
Activity data (AD)	2%			Table 2-1 Indicative error ranges in activity data for uncertainty analysis EMEP EEA GB 2023. Part A. Chapter 5 Uncertainties.
Emission factor (EF)	Rating	Typical error range	Average	Reference
NM VOC	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 2023. Part A. Chapter 5 Uncertainties.
TSP, PM10, PM2.5, BC	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.

4.3.2.3 Source-specific QA/QC and verification

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

- Checked of calculations by spreadsheets
 - 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.

4.3.2.4 Source-specific Recalculations

The following table presents the main revisions and recalculations done since the last submission to category 2D.3.b.

Table 4.32 Recalculations done in category 2.D.3.b

source category	Revisions of data	Type of revision	Type of improvement
2.D.3.b	No recalculation performed (new)	new	

4.3.2.5 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 4.33 **Planned improvements for category 2.D.3.b**

Source category	Planned improvement	Type of improvement		Priority
2.D.3.b	Check of AD with national statistics for the years 1990-2022.	AD	Completeness	High

4.3.3 Asphalt roofing (category 2.D.3.c)

Emissions from category 2.D.3.c were not estimated due to lack of activity data.

4.3.3.1 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 4.34 Planned improvements for category 2.D.3.c Quarrying and mining of minerals other than coal

Source category	Planned improvement	Type of improvement		Priority
2.D.3.c	Collection of national activity data	AD	Completeness	High

4.3.4 Coating applications (category 2.D.3.d)

Emissions from category 2.D.3.d were not estimated due to lack of activity data.

4.3.4.1 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 4.35 Planned improvements for category 2.D.3.d Quarrying and mining of minerals other than coal

Source category	Planned improvement	Type of improvement		Priority
2.D.3.d	Collection of national activity data	AD	Completeness	High

4.3.5 Degreasing (category 2.D.3.e)

Emissions from category 2.D.3.e were not estimated due to lack of activity data.

4.3.5.1 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 4.36 Planned improvements for category 2.D.3.e Quarrying and mining of minerals other than coal

Source category	Planned improvement	Type of improvement		Priority
2.D.3.e	Collection of national activity data	AD	Completeness	High

4.3.6 Dry cleaning (category 2.D.3.f)

Emissions from from category 2.D.3.f were not estimated due to lack of activity data.

4.3.6.1 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 4.37 Planned improvements for category 2.D.3.f Quarrying and mining of minerals other than coal

Source category	Planned improvement	Type of improvement		Priority
2.D.3.f	Collection of national activity data	AD	Completeness	High

4.3.7 Printing (category 2.D.3.h)

Emissions from from category 2.D.3.h were not estimated due to lack of activity data.

4.3.7.1 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 4.38 Planned improvements for category 2.D.3.h Quarrying and mining of minerals other than coal

Source category	Planned improvement	Type of improvement		Priority
2.D.3.h	Collection of national activity data	AD	Completeness	High

4.4 Other Product Use (category 2.G)

NFR 2.G includes emissions from fireworks, from tobacco and from charcoal used for barbecues.

4.4.1 Other Product use: Tobacco combustion (category 2.G.1)

Emissions from category 2.G.1 Tobacco combustion were not estimated due to lack of activity data.

4.4.1.1 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 4.39 Planned improvements for category 2.G.1 Tobacco combustion

Source category	Planned improvement	Type of improvement		Priority
2.G.1	Collection of activity data: number of cigarettes and/or Cigarettes containing tobacco in kg <ul style="list-style-type: none"> • Production • Import • Export 	AD	Completeness	High

4.4.2 Fireworks (category 2.G.2)

Emissions from category 2.G.2 Fireworks were not estimated due to lack of activity data.

4.4.2.1 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 4.40 Planned improvements for category 2.G.2 Fireworks

Source category	Planned improvement	Type of improvement		Priority
2.G.2	Collection of activity data: CN 36 code Explosives, pyrotechnics, matches, pyrophorics, etc (CN code 360410 and CN code 360490) in kg <ul style="list-style-type: none"> • Production • Import • Export 	AD	Completeness	High

4.4.3 Use of Charcoal for barbecues (category 2.G.3)

Emissions from category 2.G.3 - Use of Charcoal for barbecues were not estimated due to lack of activity data.

4.4.3.1 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 4.41 **Planned improvements for category 2.G.3 Use of Charcoal for barbecues**

Source category	Planned improvement	Type of improvement		Priority
2.G.3	Collection of activity data: Charcoal in kg <ul style="list-style-type: none">• Production• Import• Export	AD	Completeness	High

4.5 Other Industry Production (category 2.H)

4.5.1 Food and beverages industry (category 2.H.2)

The emissions from food and beverages industry include NMVOC emissions from bread, wine and spirits production. Activity data and emissions from sub category 2.H.2 Food and beverages industry are provided in the following table.

Table 4.42 Activity data and emissions from food and beverages production

Year	Bread	beer	Wine	spirits	NMVOC
	t	liter	liter	liter	t
1990	100,502	8,900,000	1,050,000	3,410,000	228
1991	99,686	8,900,000	1,050,000	3,410,000	226
1992	97,555	8,900,000	1,050,000	3,410,000	222
1993	96,863	8,900,000	1,050,000	3,410,000	220
1994	98,478	8,900,000	1,050,000	3,410,000	224
1995	99,351	8,900,000	1,050,000	3,410,000	225
1996	100,395	9,000,000	1,050,000	3,410,000	228
1997	101,659	15,100,000	1,050,000	3,410,000	242
1998	102,577	9,300,000	1,050,000	3,410,000	233
1999	103,161	8,700,000	1,270,000	3,410,000	233
2000	93,530	8,600,000	740,000	3,410,000	213
2001	93,677	11,700,000	1,400,000	3,410,000	220
2002	93,485	1,500,000	700,000	3,410,000	198
2003	93,117	14,400,000	900,000	3,410,000	224
2004	87,200	29,830,000	1,390,000	3,410,000	244
2005	95,000	28,620,000	1,710,000	2,690,000	256
2006	84,600	34,780,000	1,500,000	2,100,000	246
2007	101,100	36,588,000	1,530,000	3,370,000	285
2008	114,000	33,020,000	2,368,000	1,810,000	302
2009	94,300	24,920,000	2,520,000	1,650,000	247
2010	98,600	32,720,000	2,130,000	1,230,000	269
2011	83,900	31,103,917	2,070,000	1,206,000	237
2012	84,100	77,202,630	2,170,000	1,320,000	330
2013	77,100	48,840,112	2,250,000	1,130,000	259
2014	78,092	77,609,600	2,250,000	1,226,400	318
2015	84,469	89,161,800	2,450,000	1,251,000	355
2016	86,143	86,202,600	2,242,000	1,774,000	353
2017	87,967	86,202,600	2,242,000	1,774,000	356
2018	87,776	86,202,600	2,242,000	1,774,000	356
2019	87,534	86,202,600	2,242,000	1,774,000	356
2020	87,030	86,202,600	2,242,000	1,774,000	354
2021	86,535	86,202,600	2,242,000	1,774,000	354
2022	85,429	86,202,600	2,242,000	1,774,000	351

4.5.1.1 Methodological issues

4.5.1.1.1 Choice of methods

The emissions were calculated by Tier 1 methodology from the EMEP EEA GB 2023 (EEA. 2023) $E_{\text{pollutant}} = AR_{\text{production}} \times EF_{\text{pollutant}}$

$E_{\text{pollutant}}$ = 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

4.5.1.1.2 Choice of activity data

Activity data for period 1990-2003 and 2017-2022 are assessed due to 2004-2016 UN data set and population data statistics. For spiritis, liquors and other spiritis production for the period 2004-2016 UN data was used. For the period 1990-2003 data are missing and the same amount like 2004 value was used. Additionally there were no activity data for 2017-2022 available and therefore is gapfilled with the 2016 value. For the wine production UN data was used for 1997-2016. For the missing data 1990-1997 value for the 1998 was used and for the period 2017-2022 the value for 2016 was applied. As the beverages are like usual measured in volume units it is assessed that the density of all 3 activities is 1 kg/l.

4.5.1.1.3 Choice of emission factors

The default Tier 1 Emission factor from the EMEP/EEA Guidebook 2023. Table 3-1 is applied and is presented in the following table:

Table 4.43 Tier 1 emission factors for source category 2H.2 Food and beverages industry

Pollutant	Value	Unit
NM VOC	2	kg/Mg product produced

4.5.1.2 Uncertainties and time-series consistency

The uncertainties for activity data and emission factors used for IPCC/NFR category 2.H.2 Food and beverages industry are presented in the following table.

Table 4.44 Uncertainty for category 2.H.2 Food and beverages industry

Uncertainty	2.H.2 Food and beverages industry			Reference
Activity data (AD)	2%			Table 2-1 Indicative error ranges in activity data for uncertainty analysis
Emission factor (EF)	Rating	Typical error range	Average	Reference
NM VOC	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 2023. Part A. Chapter 5 Uncertainties.

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.

4.5.1.3 Source-specific QA/QC and verification

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

- Checked of calculations by spreadsheets
 - 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.

4.5.1.4 Source-specific recalculations

The following table presents the main revisions and recalculations done since the last submission to category 2.H.2.

Table 4.45 Recalculations done in category 2.H.2

source category	Revisions of data	Type of revision	Type of improvement
2.H.2	No revision has been performed		

4.5.1.5 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 4.46 **Planned improvements for category 2.H.2**

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.H.2	look for national data sets for bread production value for 1990-2022; look for national data sets for wine production value for 1990-2022; look for national data sets for bread production value for 1990-2022; spiritis, liquers and other spiritis	AD	Completeness	High

5 Agriculture (NFR 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 NFR sector 3 Agriculture for the period 1990 to 2020. This sector comprises emission from the following sub-categories.

NFR Code	Description	NO _x	NM _{VOC}	SO _x	NH ₃	PM _{2.5}	PM ₁₀	TSP	HCB
3.B	Manure management								
3.B.1.a	Dairy cattle	✓	✓	NA	✓	✓	✓	✓	NA
3.B.1.b	Non-dairy cattle	✓	✓	NA	✓	✓	✓	✓	NA
3.B.2	Sheep	✓	✓	NA	✓	✓	✓	✓	NA
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
3.B.4.g.ii	Broilers	✓	✓	NA	✓	✓	✓	✓	NA
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
3.D	Emissions from managed soils								
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
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
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

5.1 Manure management (IPCC/NFR category 3.B)

This section describes the estimation of ammonia (NH₃), 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.

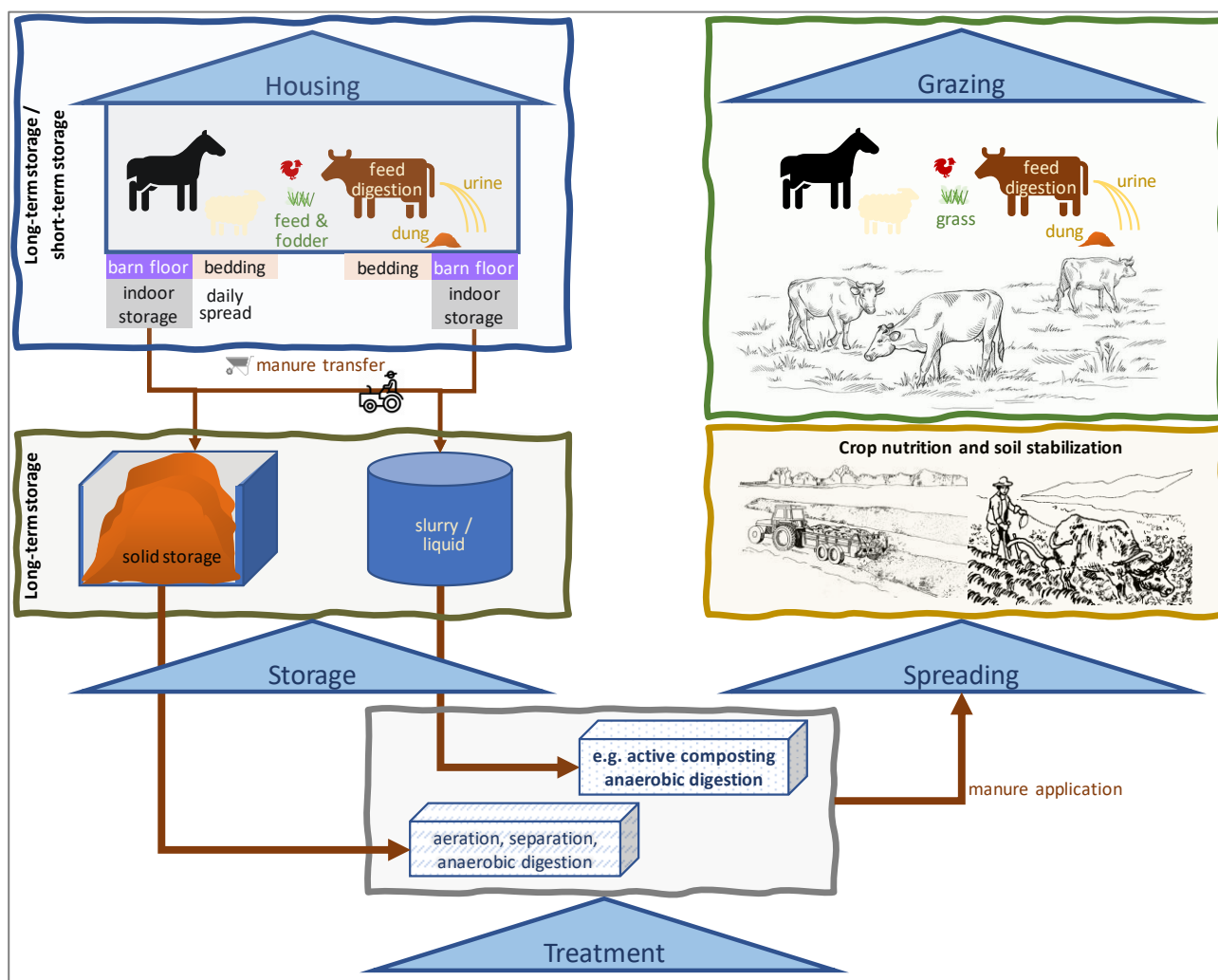


Figure 5.1 Schematic overview of manure management practices

As described in the EMEP/EEA Guidebook 2019 emissions of NH₃, 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 (NH₃, PM, NMVOCs);
- manure storage (NH₃, NO, NMVOCs);
- field-applied manure (NH₃, NO, NMVOCs);
- excreta deposited during grazing (NH₃, 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 Albania 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
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 ₂ and CH ₄ . 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. 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.	

System according to		Definition	Storage time of manure
IPCC	EMEP/EEA GB 2019		
	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.

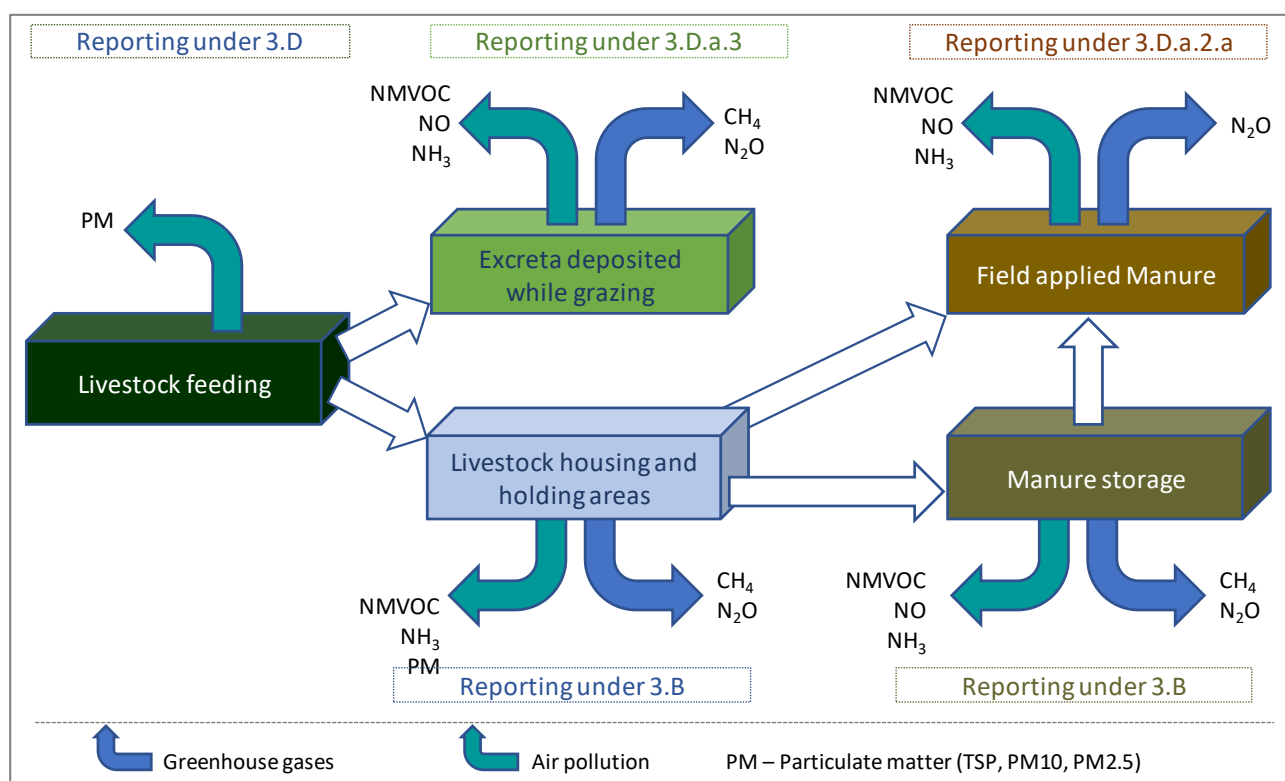


Figure 5.2 Scheme for emissions resulting from livestock feeding, livestock excreta and manure management

5.1.1 Methodological issues

5.1.1.1 Choice of methods

For estimating the emissions of NH₃, NMVOC, NO and PM from all livestock the EMEP/EEA Guidebook Tier 1 approach⁵⁴ 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 ($Emission\ factor_{pollutant_animal}$):

Equation: Air pollutant emissions from manure management from a livestock category

$$Emissions_{pollutant_animal} = Livestock_{category} \times \left(\frac{Emission\ Factor_{pollutant_animal}}{10^6} \right)$$

⁵⁴ 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.

Where:

Emissions _{pollutant_animal}	= NH ₃ . NMVOC. NO and PM emissions (Gg)
Livestock _{category}	= number of head of livestock species / category T
Emission factor _{pollutant_animal}	= default emission factor for a defined livestock population (kg CH ₄ head ⁻¹).
animal	= species/category of livestock
pollutant	= NH ₃ . NMVOC. NO and PM (TSP. PM10. PM2.5)

5.1.1.2 Choice of activity data

The original data provider for the national and international agricultural data is Albanian Institute of Statistics (INSTAT). The agricultural data used and presented in this inventory are taken from the following national and international sources:

Statistical yearbook	<p>The official statistics (several years) of INSTAT provides information on</p> <ul style="list-style-type: none"> • 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	<p>The FAO agricultural data base (FAOSTAT) provides worldwide harmonized data (FAO AGRICULTURE STATISTICAL SYSTEM 2001).⁵⁵ The FAO data base provides data for the entire time series 1990 – 2022. even some data are based on estimates done by FAO.</p>

The results of these QA/QC checks are presented in the following chapters under “Source-specific QA/QC and verification”.

5.1.1.3 Choice of emission factors

Default emission factors for ammonia (NH₃)

The default emission factors for ammonia (NH₃) were taken from EMEP/EEA air pollutant emission inventory guidebook 2023 and are presented in the following table.

⁵⁵ Available (03. Januar 2020) on <http://www.fao.org/faostat/en/#data>

Table 5.2 NH₃ Emission factors for Tier 1 for IPCC/NFR category 3.B Manure Management

Revised NFR	Livestock	Manure type	Total EF _{NH3}	Default EF _{NH3} for emissions from housing, storage and yards	Default EF _{NH3} for emissions following manure application	Default EF _{NH3} for emissions from grazed pastures
				kg a ⁻¹ AAP ⁻¹ NH ₃		
				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 2023. Part B. Chapter 3.B Manure management. p. 16. Table 3.2 Default Tier 1 EF (EF _{NH3}) for calculation of NH ₃ emissions from manure management. Figures are annually averaged emissions in kg AAP ⁻¹ a ⁻¹ NH ₃ . as defined in subsection 3.3.1						

Default emission factors for nitrogen oxides (NO_x)

The default emission factors for nitrogen oxides (NO_x) were taken from EMEP/EEA air pollutant emission inventory guidebook 2023 and are presented in the following table.

Table 5.3 NO_x Emission factors for Tier 1 for IPCC/NFR category 3.B Manure Management

NFR	Livestock	Manure type	Default EF _{NO}
			(kg a ⁻¹ AAP ⁻¹ NO ₂)
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 2023. Part B. Chapter 3.B Manure management. p. 16. Table 3.3 Default Tier 1 EFs for NO (as NO ₂) from stored manure. According to Annex I of the NFR Reporting Guidelines. NO emissions have to be reported as NO ₂ . hence the EFs below are provided as NO ₂			

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 2023 and are presented in the following table.

Table 5.4 NMVOC Emission factors for Tier 1 for IPCC/NFR category 3.B Manure Management

Code	Livestock	Default EF _{NMVOC} with silage feeding	EF _{NMVOC} without silage feeding
		kg AAP ⁻¹ a ⁻¹	
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 2023. 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 2023 and are presented in the following table.

Table 5.5 PM Emission factors for Tier 1 for IPCC/NFR category 3.B Manure Management

Code	Livestock	EF for TSP	EF for PM ₁₀	EF for PM _{2.5}
		(kg AAP ⁻¹ a ⁻¹)	(kg AAP ⁻¹ a ⁻¹)	(kg AAP ⁻¹ a ⁻¹)
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 2023. 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 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 5.6 Uncertainty for 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 2023. Part A. Chapter 5 Uncertainties.	
NM VOC	C	50% to 200%				125%				
NH3	B	20% to 60%				40%				
TSP, PM10, PM2.5, BC	C	50% to 200%				125%				

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 and relevant to Category 3.B Manure management.

Table 5.7 Recalculations done in category 3.B Manure management

source category	Revisions of data	Type of revision	Type of improvement
3.B	Tier 2 methodology	method	Comparability
3.B	Improvement and revision of AD	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 5.8 Planned improvements for 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"> • characteristics of Livestock Husbandry for the whole time series: <ul style="list-style-type: none"> ○ breed. ○ age distribution. ○ weight ○ milk wool yield. ○ wool yield. ○ working hours • characteristics of manure management practice: <ul style="list-style-type: none"> ○ stall / housed and Housing period ○ pasture/range/paddock (flat/hilly) 	AD	Accuracy Consistency Comparability Transparency	high

source	Planned improvement	Type of improvement		Priority
	<ul style="list-style-type: none"> ○ grazing large areas (flat/hilly) ○ daily spread ○ solid storage ○ dry lot ○ liquid/slurry with/without natural crust cover ○ uncovered anaerobic lagoon ○ pit storage below animal confinements ○ anaerobic digester ○ burned for fuel ○ cattle and swine deep bedding ○ composting ○ aerobic treatment 			
3.B	<ul style="list-style-type: none"> • nitrogen excretion • annual straw use in litter-based manure management systems and the N content of straw 	AD	Accuracy Consistency Comparability Transparency	high
3.B	Estimation of methane (NH ₃) 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"> • broiler chickens. layer hens. poultry (free range) • turkeys. • ducks. • geese 	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 N_2O 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 NH_3 and NO_x from managed soils and from fossil fuel combustion and biomass burning, and the subsequent redeposition of these gases and their products NH_4^+ and NO_3^- to soils and waters; and
(ii) after leaching and runoff of N, mainly as NO_3^- , from managed soils.

The principal pathways are illustrated in the following figure. Direct emissions of N_2O from managed soils are estimated separately from indirect emissions, though using a common set of activity data.

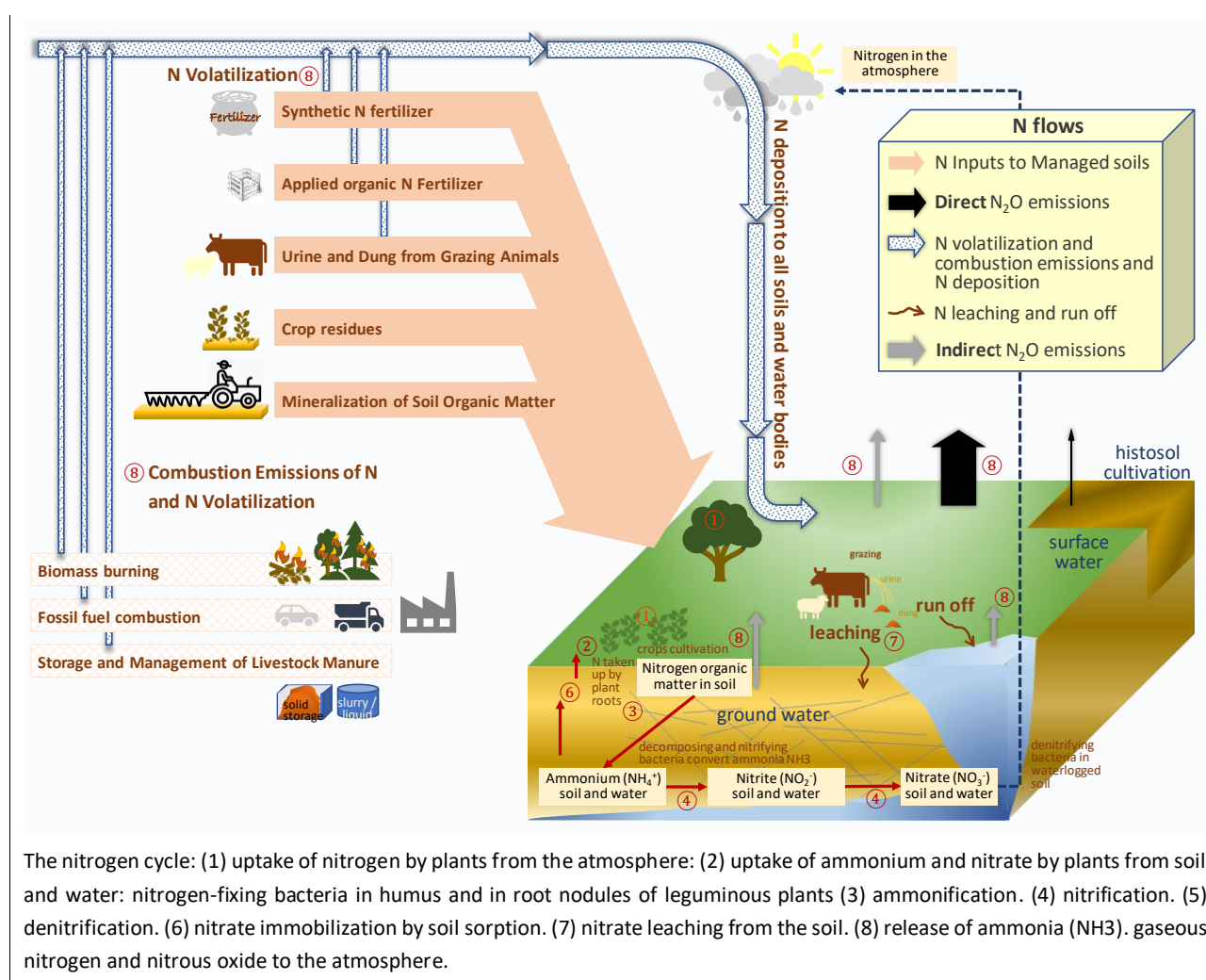


Figure 5.3 Schematic diagram illustrating the sources and pathways of N that result in direct and indirect N_2O emissions from soils and waters

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.

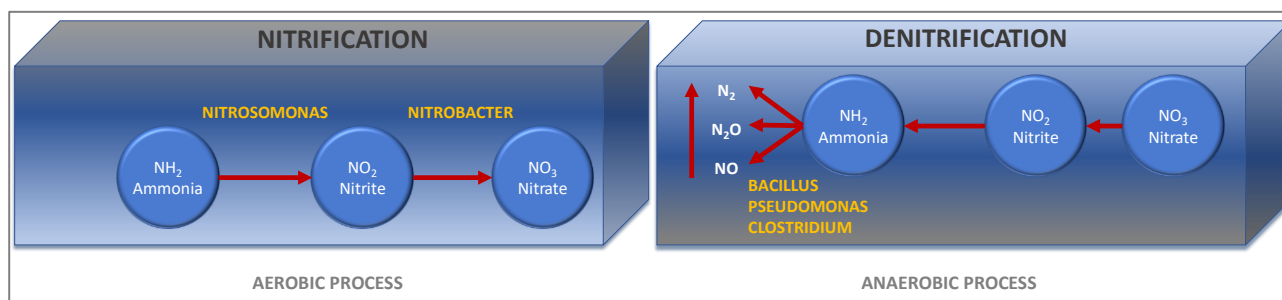


Figure 5.4 Nitrification and Denitrification

Table 5.9 Statust of estimation emissions from category 3.D Agricultural soils

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.	NH3 - 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.	NH3 - yes. calculated in 3B NO	✓
3Da2b	Sewage sludge applied to soils	Sewage sludge applied to soils.	NH3	NE
3Da2c	Other organic fertilizers applied to soils (including digestate and compost)	Organic fertilizers. other than livestock manures and sewage sludge. applied to soils (including digestate and compost).	NH3 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.	NH3 - 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 storage, handling and transport of agricultural products	This source includes not only emissions arising from the handling and storage of agricultural products on farms, such as grain, but also emissions during the handling and storage of products produced elsewhere to be used on the farm such as fertilizers and livestock feeds.	Soil cultivation and crop harvesting are currently reported to account for 80% of PM emissions in 3D.** The values for PM do not include emissions from fertilizer, pesticides or from grassland, e.g. hay making.	NE

NFR	Name	Definition and clarification of source	Do we have EFs we can use?	Estimated in current inventory
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 ₃ 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 2023. Part B. Chapter 3.B Manure management. p. 12. Table 3-1 Tier 1 emission factors for source category 3.D				

5.2.1 Methodological issues

5.2.1.1 Choice of methods

For estimating the emissions of NH₃ and NO_x from N fertilizer the EMEP/EEA Guidebook Tier 1 approach⁵⁶ has been applied.

Equation: Air pollutant emissions from manure management from a livestock category

$$\text{Emissions}_{\text{pollutant}} = \text{ARN}_{\text{applied}} \times \text{Emission factor}_{\text{pollutant}}$$

Where:

Emissions _{pollutant}	= NH ₃ , NO emissions (Gg)
AR _{N, applied}	= amount of N applied in fertiliser or organic waste (kg a ⁻¹)
Emission factor _{pollutant}	= NH ₃ , N ₂ O

5.2.1.2 Choice of emission factor

The default emission factors for ammonia (NH₃) were taken from EMEP/EEA air pollutant emission inventory guidebook 2023:

NH ₃ from N fertiliser	0.05 kg NH ₃ kg ⁻¹ fertiliser applied to soil
NO from N fertiliser	0.04 kg NO kg ⁻¹ fertiliser applied to soil

5.2.1.3 Choice of activity data

The activity data, inorganic N fertilizer used in t N-fertilizer, were taken from FAO database. The activity data are presented in the table below.

⁵⁶ 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.

5.2.2 Uncertainties and time-series consistency

The uncertainties for activity data and emission factors used for IPCC/NFR category 3.D Agricultural soils are presented in the following table.

Table 5.10 Uncertainty for category 3.D Agricultural soils

Uncertainty	Inorganic N fertilisers	Animal manure	Urine and dung deposited by grazing animals	Reference
Activity data (AD)	3%	3%	5%	Table 2.15. 2006 IPCC GL. Vol. 2. Chap. 2 (2.4.2)
Emission factor (EF)	Rating	Typical error range	Average	Reference
NH ₃	D	100% to 300%	200%	Table 2 2 Rating definitions Table 2 3 Main NFR source categories with applicable quality data ratings EMEP EEA GB 2023. Part A. Chapter 5 Uncertainties.
NO _x	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.

5.2.3 Source-specific QA/QC and verification

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

- Checked of calculations by spreadsheets
 - consistent use of 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, FAO
- time series consistency - plausibility checks of dips and jumps.

5.2.4 Source-specific recalculations

The following table presents the main revisions and recalculations done since the last submission and relevant to Category 3.D Manure management.

Table 5.11 Recalculations done in category 3.D Agricultural soils

source category	Revisions of data	Type of revision	Type of improvement
3.D	No revisions were performed		

5.2.5 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 5.12 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"> ○ Livestock manure applied to soils ○ Sewage sludge applied to soils ○ Other organic fertilizers applied to soils (including compost) 	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 Farm-level agricultural operations including storage, handling and transport of agricultural products	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 5.13 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"> Investigation on crops and fraction of crop residues burnt in field Investigation on of Dry matter fraction 	AD	Comparability Transparency Accuracy	high

6 Waste (NFR 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 2022. In the Waste sector emissions of all air pollutants 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	5C1b i	5C1b ii	5C1b iii	5C1b iv	5C1b v	5C1b vi	5C2	5D1	5D2	5D3	5E
NO _x	NA	NA	NA	NO	NO	NO	✓	NA	NO	NA	✓	NA	NA	NA	NA
NM VOC	✓	NA	NA	NO	NO	NO	✓	NA	NO	NA	✓	✓	NE	NA	NA
SO _x	NA	NA	NA	NO	NO	NO	✓	NA	NO	NA	✓	NA	NA	NA	NA
NH ₃	NA	NO	NO	NO	NA	NA	NA	NA	NA	NA	NA	NE	NA	NA	NO
CO	NA	NO	NA	NO	NO	NO	✓	NO	NO	NA	✓	NA	NA	NA	NA
PM _{2.5}	✓	NA	NA	NO	NO	NO	✓	NO	NO	NA	✓	NA	NA	NA	NO
PM ₁₀	✓	NA	NA	NO	NO	NO	✓	NO	NO	NA	✓	NA	NA	NA	NO
TSP	✓	NA	NA	NO	NO	NO	✓	NO	NO	NA	✓	NA	NA	NA	NO
BC	NA	NA	NA	NO	NO	NO	✓	NA	NA	NA	✓	NA	NA	NA	NA
Pb	NA	NA	NA	NO	NO	NO	✓	NO	NO	NA	✓	NA	NA	NA	NO
Cd	NA	NA	NA	NO	NO	NO	✓	NO	NO	NA	✓	NA	NA	NA	NO
Hg	NA	NA	NA	NO	NO	NO	✓	NO	NO	NA	NA	NA	NA	NA	NO

NFR Code	5A	5B1	5B2	5C1a	5C1b i	5C1b ii	5C1b iii	5C1b iv	5C1b v	5C1b vi	5C2	5D1	5D2	5D3	5E
As	NA	NA	NA	NO	NO	NO	✓	NO	NO	NA	✓	NA	NA	NA	NO
Cr	NA	NA	NA	NO	NO	NO	✓	NO	NO	NA	✓	NA	NA	NA	NO
Cu	NA	NA	NA	NO	NO	NO	✓	NO	NO	NA	✓	NA	NA	NA	NO
Ni	NA	NA	NA	NO	NO	NO	NA	NO	NO	NA	NA	NA	NA	NA	NA
Se	NA	NA	NA	NO	NA	NA	NA	NA	NA	NA	✓	NA	NA	NA	NA
Zn	NA	NA	NA	NO	NA	NA	NA	NA	NA	NA	✓	NA	NA	NA	NA
PCDD/ PCDF	NA	NA	NA	NO	NO	NO	✓	NO	NO	NA	✓	NA	NA	NA	NO
PAH	NA	NA	NA	NO	NA	NA	✓	NO	NO	NA	✓	NA	NA	NA	NA
HCB	NA	NA	NA	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

A '✓' indicates: emissions from this category have been estimated.

Notation keys: IE - included elsewhere. NO – not occurred. NE - not estimated. NA - not applicable. C – confidential

6.1 Emission trends

The following table provides an overview on emissions from solid waste disposal on land for the period 1990-2022. Emissions increased mainly due to increasing landfilling activities which is a result of increasing population and growing waste generation rates. Also, the reduction of illegal disposal (sites) or open burning results in increasing landfilling.

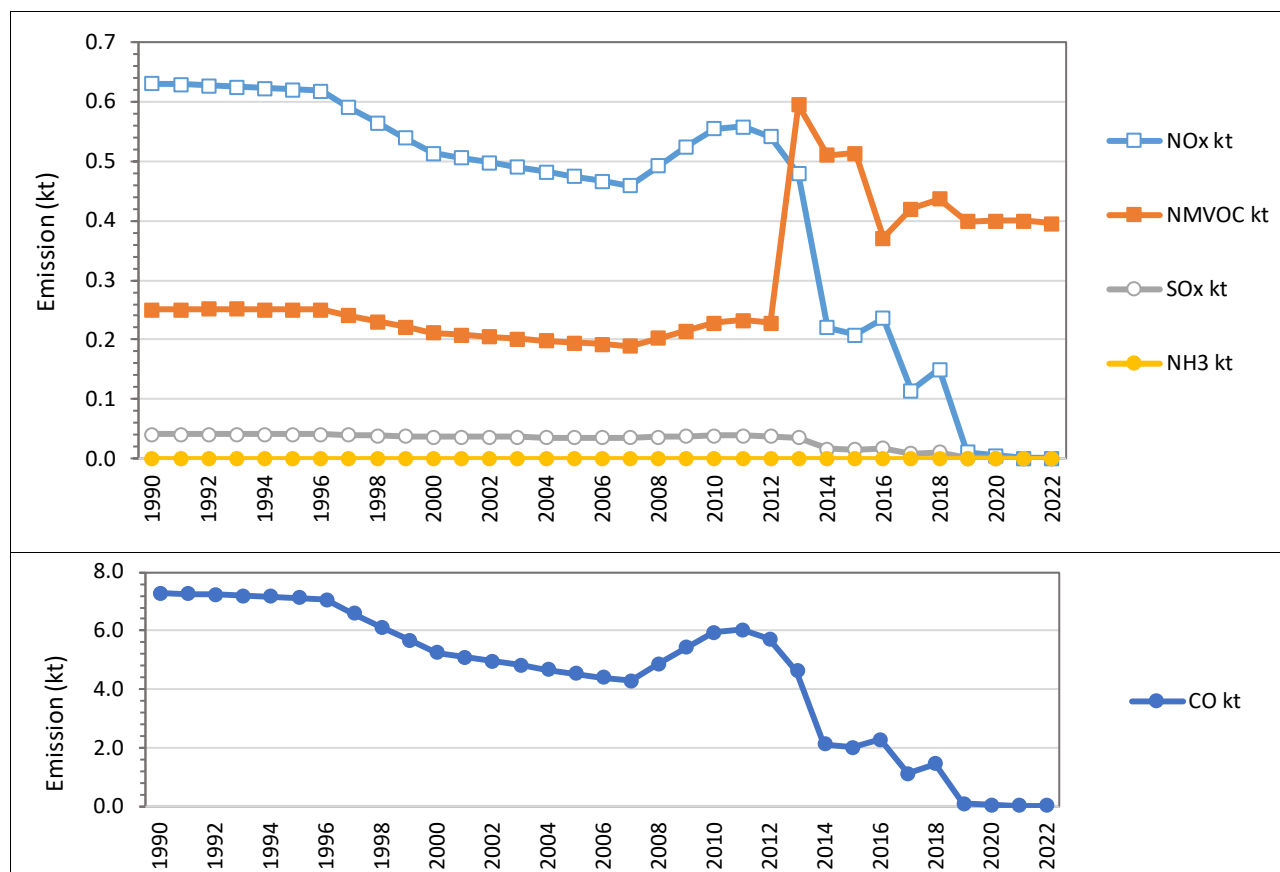


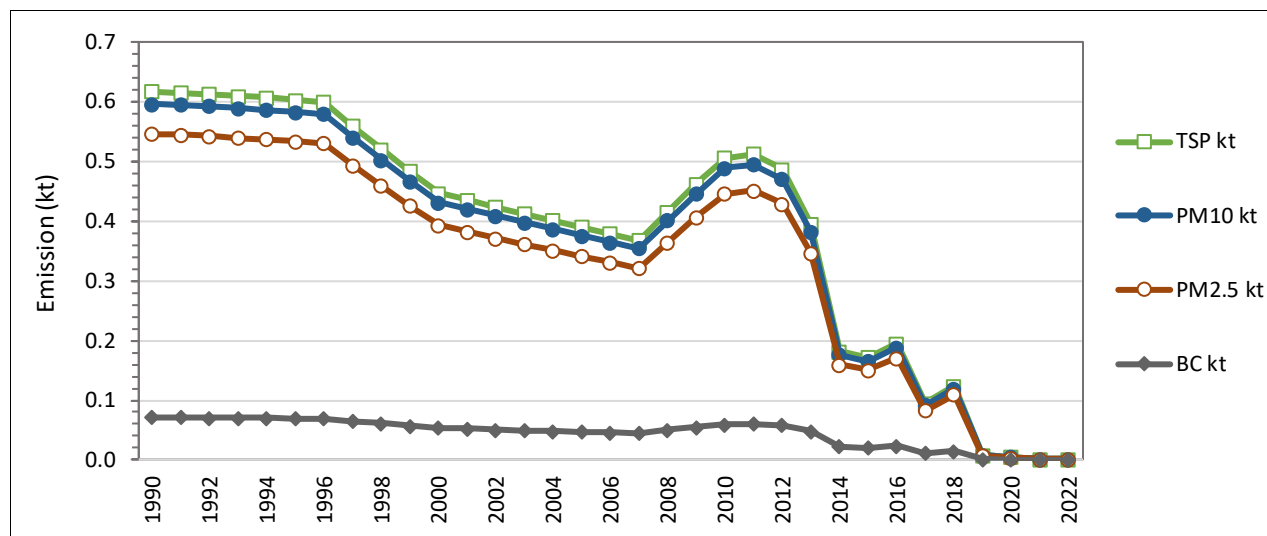
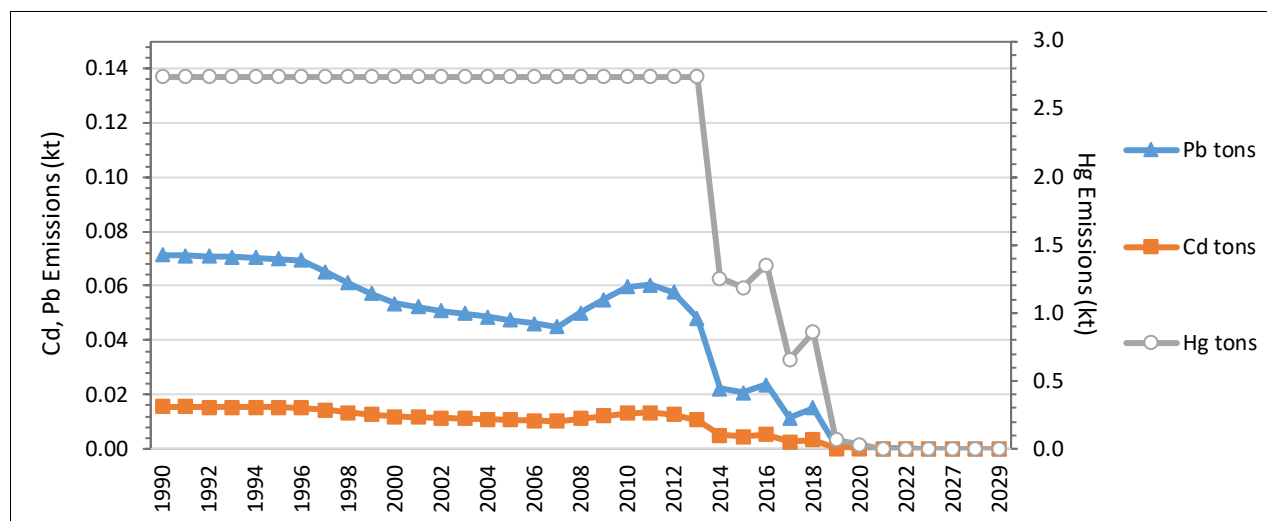
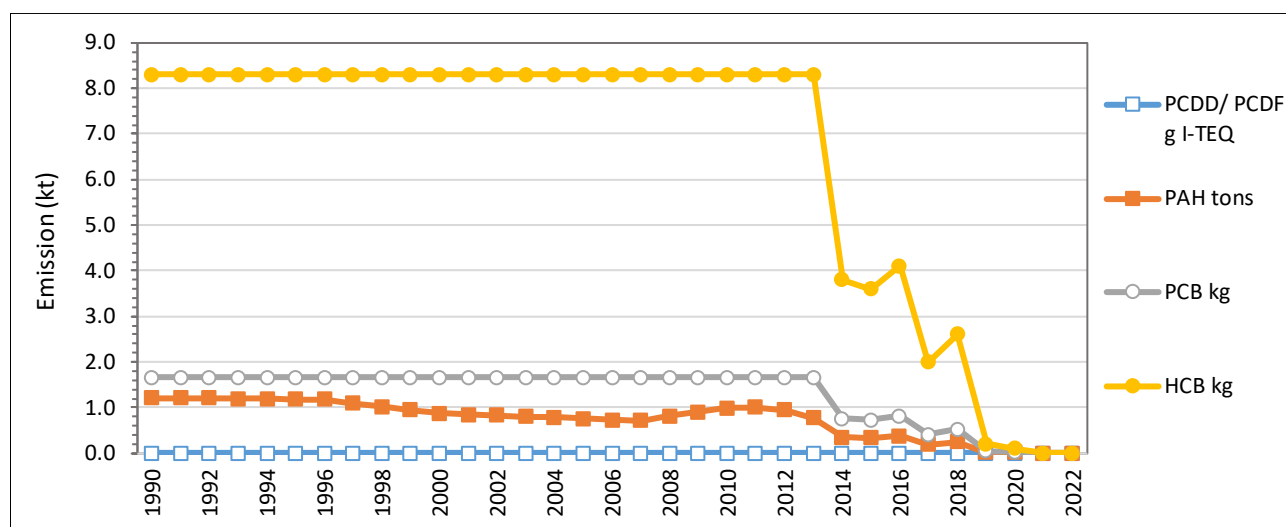
Figure 6.1 Emissions of main pollutants (NO_x, NMVOC, SO_x) from from Sector 5 Waste**Figure 6.2 Emissions of particulates (TSP, PM10, PM2.5, BC) from from Sector 5 Waste****Figure 6.3 Emissions of heavy metals (HM) from from Sector 5 Waste**

Figure 6.4 Emissions of Persistent organic pollutants (POPs)(PCDD/ PCDF, PAH, PCB, HCB) from from Sector 5 Waste from from Sector 5 Waste

Table 6.2 Emissions of main pollutants (NO_x, NMVOC, SO_x, CO) and particulates (TSP, PM₁₀, PM_{2.5}, BC) from Sector 5 Waste

Year	NO _x	NMVOC	SO _x	NH ₃	CO	TSP	PM ₁₀	PM _{2.5}	BC
	kt	kt	kt	kt	kt	kt	kt	kt	kt
1990	0.251	0.016	0.041	NO	7.28	0.600	0.597	0.547	0.055
1991	0.251	0.017	0.041	NO	7.26	0.560	0.595	0.545	0.055
1992	0.251	0.017	0.041	NO	7.23	0.521	0.593	0.543	0.055
1993	0.250	0.017	0.041	NO	7.20	0.484	0.590	0.540	0.054
1994	0.240	0.018	0.041	NO	7.16	0.448	0.587	0.537	0.054
1995	0.231	0.018	0.041	NO	7.12	0.436	0.584	0.534	0.054
1996	0.221	0.019	0.040	NO	7.07	0.424	0.580	0.531	0.053
1997	0.212	0.018	0.040	NO	6.59	0.413	0.541	0.495	0.050
1998	0.208	0.017	0.039	NO	6.12	0.401	0.503	0.460	0.046
1999	0.205	0.016	0.038	NO	5.67	0.390	0.467	0.426	0.043
2000	0.202	0.016	0.037	NO	5.24	0.379	0.432	0.393	0.040
2001	0.198	0.015	0.037	NO	5.09	0.368	0.420	0.383	0.039
2002	0.195	0.015	0.036	NO	4.95	0.416	0.409	0.372	0.038
2003	0.192	0.015	0.036	NO	4.82	0.463	0.398	0.362	0.036
2004	0.189	0.015	0.036	NO	4.68	0.507	0.387	0.351	0.035
2005	0.202	0.015	0.036	NO	4.54	0.513	0.376	0.341	0.034
2006	0.215	0.015	0.035	NO	4.41	0.488	0.365	0.331	0.033
2007	0.229	0.015	0.035	NO	4.28	0.396	0.354	0.321	0.032
2008	0.233	0.017	0.036	NO	4.86	0.182	0.402	0.365	0.037
2009	0.228	0.020	0.037	NO	5.42	0.172	0.447	0.407	0.041
2010	0.595	0.022	0.038	NO	5.95	0.195	0.489	0.447	0.045
2011	0.510	0.022	0.038	NO	6.02	0.095	0.495	0.452	0.046
2012	0.513	0.024	0.038	NO	5.72	0.124	0.471	0.429	0.043
2013	0.371	0.022	0.036	NO	4.62	0.008	0.382	0.347	0.035
2014	0.420	0.036	0.016	NO	2.13	0.004	0.176	0.160	0.016
2015	0.437	0.045	0.015	NO	2.00	0.001	0.166	0.150	0.015
2016	0.399	0.047	0.018	NO	2.28	0.002	0.188	0.171	0.017
2017	0.399	0.045	0.009	NO	1.11	0.600	0.092	0.083	0.008
2018	0.400	0.047	0.011	NO	1.45	0.560	0.120	0.109	0.011
2019	0.396	0.039	0.001	NO	0.10	0.521	0.008	0.007	0.001
2020	0.095	0.039	<0.001	NO	0.05	0.484	0.004	0.004	<0.001
2021	0.082	0.032	<0.001	NO	0.02	0.448	0.001	0.001	<0.001
2022	0.070	0.029	<0.001	NO	0.02	0.436	0.002	0.002	<0.001
Trend									
1990 – 2022	-99.8%	58.0%	-99.9%	80.6%	-99.7%	-99.7%	-99.7%	-99.7%	-99.7%
2005 – 2022	-99.7%	103.0%	-99.9%	93.1%	-99.5%	-99.5%	-99.5%	-99.5%	-99.5%
2021 – 2022	21.9%	-0.9%	21.9%	-9.1%	21.9%	21.2%	21.5%	21.8%	21.9%

Table 6.3 Emissions of heavy metals (HM) from Sector 5 Waste

Year	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
	tons	tons	tons	tons	tons	tons	tons	tons	tons
1990	0.071	0.016	2.739	0.070	0.026	0.026	0.003	NO	NO
1991	0.071	0.015	2.739	0.070	0.026	0.026	0.003	NO	NO
1992	0.071	0.015	2.739	0.070	0.026	0.026	0.003	NO	NO
1993	0.071	0.015	2.739	0.069	0.026	0.026	0.003	NO	NO
1994	0.070	0.015	2.739	0.069	0.026	0.026	0.003	NO	NO
1995	0.070	0.015	2.739	0.069	0.026	0.025	0.003	NO	NO
1996	0.069	0.015	2.739	0.068	0.026	0.025	0.003	NO	NO
1997	0.065	0.014	2.739	0.065	0.026	0.024	0.003	NO	NO
1998	0.061	0.013	2.739	0.062	0.026	0.022	0.003	NO	NO
1999	0.057	0.013	2.739	0.058	0.026	0.020	0.003	NO	NO
2000	0.053	0.012	2.739	0.055	0.026	0.019	0.003	NO	NO
2001	0.052	0.012	2.739	0.054	0.026	0.018	0.003	NO	NO
2002	0.051	0.011	2.739	0.053	0.026	0.018	0.003	NO	NO
2003	0.050	0.011	2.739	0.052	0.026	0.017	0.003	NO	NO
2004	0.049	0.011	2.739	0.051	0.026	0.017	0.003	NO	NO
2005	0.047	0.011	2.739	0.050	0.026	0.016	0.003	NO	NO
2006	0.046	0.010	2.739	0.049	0.026	0.016	0.003	NO	NO
2007	0.045	0.010	2.739	0.048	0.026	0.015	0.003	NO	NO
2008	0.050	0.011	2.739	0.052	0.026	0.017	0.003	NO	NO
2009	0.055	0.012	2.739	0.056	0.026	0.019	0.003	NO	NO
2010	0.060	0.013	2.739	0.060	0.026	0.021	0.003	NO	NO
2011	0.060	0.013	2.739	0.061	0.026	0.022	0.003	NO	NO
2012	0.058	0.013	2.739	0.059	0.026	0.020	0.003	NO	NO
2013	0.048	0.011	2.739	0.051	0.026	0.017	0.003	NO	NO
2014	0.022	0.005	1.254	0.023	0.012	0.008	0.002	NO	NO
2015	0.021	0.005	1.188	0.022	0.011	0.007	0.001	NO	NO
2016	0.024	0.005	1.353	0.025	0.013	0.008	0.002	NO	NO
2017	0.012	0.003	0.660	0.012	0.006	0.004	0.001	NO	NO
2018	0.015	0.003	0.858	0.016	0.008	0.005	0.001	NO	NO
2019	0.001	<0.001	0.066	0.001	0.001	<0.001	<0.001	NO	NO
2020	0.001	<0.001	0.033	0.001	<0.001	<0.001	<0.001	NO	NO
2021	<0.001	<0.001	NO	<0.001	<0.001	<0.001	NO	NO	NO
2022	<0.001	<0.001	NO	<0.001	<0.001	<0.001	NO	NO	NO
Trend									
1990 – 2022	-99.7%	-99.8%	NA	-99.8%	-100.0%	-99.7%	NA	NA	NA
2005 – 2022	-99.6%	-99.6%	NA	-99.7%	-100.0%	-99.5%	NA	NA	NA
2021 – 2022	21.9%	21.9%	NA	21.9%	21.9%	21.9%	NA	NA	NA

Table 6.4 Emissions of Persistent organic pollutants (POPs)(PCDD/ PCDF (dioxins/ furans), PAH, PCB, HCB) from Sector 5 Waste

Year	PCDD/ PCDF (dioxins/ furans)	PAH	PCB	HCB
	g I-TEQ	tons	kg	kg
1990	0.002	1.212	1.660	8.300
1991	0.002	1.208	1.660	8.300
1992	0.002	1.203	1.660	8.300
1993	0.002	1.198	1.660	8.300
1994	0.002	1.191	1.660	8.300
1995	0.002	1.184	1.660	8.300
1996	0.002	1.176	1.660	8.300
1997	0.001	1.096	1.660	8.300
1998	0.001	1.019	1.660	8.300
1999	0.001	0.944	1.660	8.300
2000	0.001	0.871	1.660	8.300
2001	0.001	0.848	1.660	8.300
2002	0.001	0.824	1.660	8.300
2003	0.001	0.801	1.660	8.300
2004	0.001	0.778	1.660	8.300
2005	0.001	0.756	1.660	8.300
2006	0.001	0.734	1.660	8.300
2007	0.001	0.712	1.660	8.300
2008	0.001	0.809	1.660	8.300
2009	0.001	0.902	1.660	8.300
2010	0.001	0.990	1.660	8.300
2011	0.001	1.002	1.660	8.300
2012	0.001	0.952	1.660	8.300
2013	0.001	0.769	1.660	8.300
2014	0.000	0.354	0.760	3.800
2015	0.000	0.333	0.720	3.600
2016	0.001	0.379	0.820	4.100
2017	<0.001	0.184	0.400	2.000
2018	<0.001	0.241	0.520	2.600
2019	<0.001	0.016	0.040	0.200
2020	<0.001	0.008	0.020	0.100
2021	<0.001	0.003	NO	NO
2022	<0.001	0.004	NO	NO
Trend				
1990 – 2022	-99.8%	-99.7%	NA	NA
2005 – 2022	-99.6%	-99.5%	NA	NA
2021 – 2022	21.9%	21.9%	NA	NA

6.2 Waste generation in Albania

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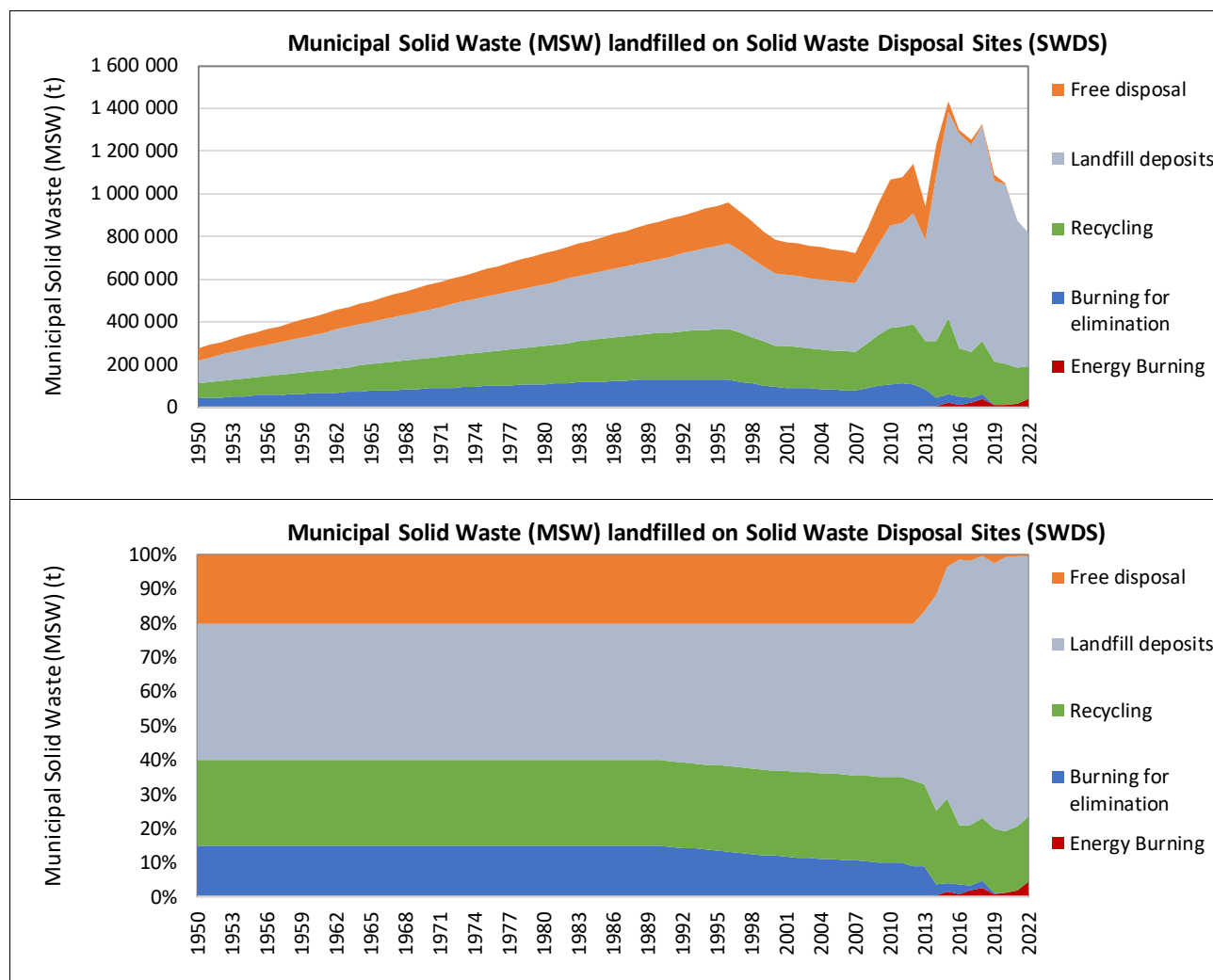


Figure 6-5 Management practices of Municipal solid wastes (MSW) for the period 1990 - 2022

Table 6-5 Management practices of Municipal solid wastes (MSW) for the period 1990 – 2022

	Waste management practices										
	TOTAL	Energy Burning		Burning for elimination		Recycling		Landfill deposits		Free disposal	
	kt	kt	%	kt	%	kt	%	kt	%	kt	%
1950	275.6	NO	0.0	41.3	15.0	68.9	25.0	110.2	40.0	55.1	20.0
1960	424.1	NO	0.0	63.6	15.0	106.0	25.0	169.6	40.0	84.8	20.0
1970	572.6	NO	0.0	85.9	15.0	143.1	25.0	229.0	40.0	114.5	20.0
1980	721.0	NO	0.0	108.2	15.0	180.3	25.0	288.4	40.0	144.2	20.0
1990	869.5	NO	0.0	130.4	15.0	217.4	25.0	347.8	40.0	173.9	20.0
1991	884.4	NO	0.0	130.0	14.7	221.1	25.0	356.4	40.3	176.9	20.0
1992	899.2	NO	0.0	129.5	14.4	224.8	25.0	365.1	40.6	179.8	20.0
1993	914.1	NO	0.0	128.9	14.1	228.5	25.0	373.9	40.9	182.8	20.0
1994	928.9	NO	0.0	128.2	13.8	232.2	25.0	382.7	41.2	185.8	20.0

	Waste management practices										
	TOTAL	Energy Burning		Burning for elimination		Recycling		Landfill deposits		Free disposal	
	kt	kt	%	kt	%	kt	%	kt	%	kt	%
1995	943.8	NO	0.0	127.4	13.5	235.9	25.0	391.7	41.5	188.8	20.0
1996	958.6	NO	0.0	126.5	13.2	239.7	25.0	400.7	41.8	191.7	20.0
1997	914.3	NO	0.0	117.9	12.9	228.6	25.0	384.9	42.1	182.9	20.0
1998	870.0	NO	0.0	109.6	12.6	217.5	25.0	368.9	42.4	174.0	20.0
1999	825.7	NO	0.0	101.6	12.3	206.4	25.0	352.6	42.7	165.1	20.0
2000	781.4	NO	0.0	93.8	12.0	195.4	25.0	336.0	43.0	156.3	20.0
2001	773.1	NO	0.0	91.2	11.8	193.3	25.0	334.0	43.2	154.6	20.0
2002	764.7	NO	0.0	88.7	11.6	191.2	25.0	331.9	43.4	152.9	20.0
2003	756.3	NO	0.0	86.2	11.4	189.1	25.0	329.7	43.6	151.3	20.0
2004	747.9	NO	0.0	83.8	11.2	187.0	25.0	327.6	43.8	149.6	20.0
2005	739.5	NO	0.0	81.3	11.0	184.9	25.0	325.4	44.0	147.9	20.0
2006	731.1	NO	0.0	79.0	10.8	182.8	25.0	323.2	44.2	146.2	20.0
2007	722.7	NO	0.0	76.6	10.6	180.7	25.0	320.9	44.4	144.5	20.0
2008	836.9	NO	0.0	87.0	10.4	209.2	25.0	373.3	44.6	167.4	20.0
2009	951.1	NO	0.0	97.0	10.2	237.8	25.0	426.1	44.8	190.2	20.0
2010	1 065.3	NO	0.0	106.5	10.0	266.3	25.0	479.4	45.0	213.1	20.0
2011	1 078.6	0.5	0.1	107.9	10.0	269.7	25.0	484.8	45.0	215.7	20.0
2012	1 138.0	0.6	0.1	102.4	9.0	284.5	25.0	522.9	46.0	227.6	20.0
2013	940.2	0.9	0.1	82.7	8.8	225.6	24.0	475.7	50.6	155.1	16.6
2014	1 228.9	6.1	0.5	38.1	3.1	265.4	21.6	779.1	63.4	140.1	11.4
2015	1 413.2	21.7	1.5	35.9	2.5	357.5	25.3	970.2	68.6	49.7	2.0
2016	1 300.4	9.0	0.7	40.8	3.2	224.2	17.2	1 010.3	77.7	16.1	1.2
2017	1 253.9	22.9	1.8	19.8	1.6	218.2	17.4	971.6	77.5	21.5	1.7
2018	1 325.1	36.6	2.8	26.0	2.0	245.0	18.5	1 012.5	76.4	5.0	0.4
2019	1 086.7	9.7	0.9	1.7	0.2	203.4	18.7	847.2	77.9	24.5	2.3
2020	1 047.9	11.2	1.1	0.9	0.1	189.9	18.1	840.7	80.2	5.3	0.5
2021	875.1	17.2	2.0	0.3	0.0	164.4	18.8	691.4	79.0	1.8	0.2
2022	820.3	36.0	4.4	0.4	0.1	154.9	18.9	628.2	76.6	0.8	0.1
Trend											
1950 - 2022	197.7%	NA		-99.1%		124.9%		469.9%		-98.6%	
1990 - 2022	-5.7%	NA		-99.7%		-28.7%		80.6%		-99.6%	
2005 - 2022	10.9%	NA		-99.5%		-16.2%		93.1%		-99.5%	
2021 - 2022	-6.3%	109.4%		21.9%		-5.8%		-9.1%		-57.2%	

6.3 Solid waste disposal on land (IPCC/NFR category 5.A)

6.3.1 Category description

As described in the EMEP/EEA/EMEP/EEA air pollutant emission inventory guidebook 2023, emissions from solid waste disposal on land occurs, especially NMVOC emissions from organic waste degradation in landfills. Furthermore, particulate (as TSP, PM₁₀, PM_{2.5}) emissions from mineral waste handling during disposal in landfills and reuse as backfilling and construction material are also considered. Other air pollutants may be emitted from solid waste disposal, such as NH₃ from waste degradation in landfills or NO_x, CO, SO_x, PM, and POPs from landfill gas flaring, but emissions are expected to be negligible and no EFs are proposed in the current version of the chapter.

This chapter describes the methodology applied and activity and emission factors used.

Emissions	NMVOC		TSP		PM ₁₀		PM _{2.5}		All other pollutants
	Estimated	Key category	Estimated	Key category	Estimated	Key category	Estimated	Key category	
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									
A ‘✓’ indicates: emissions from this category have been estimated. Notation keys: IE -included elsewhere. NO – not occurred. NE -not estimated. NA -not applicable. C – confidential									

Emission trends

The following table provides an overview on emissions from solid waste disposal on land for the period 1990-2022. Emissions increased mainly due to increasing landfilling activities which is a result of increasing population and growing waste generation rates. Also, the reduction of illegal disposal (sites) or open burning results in increasing landfilling.

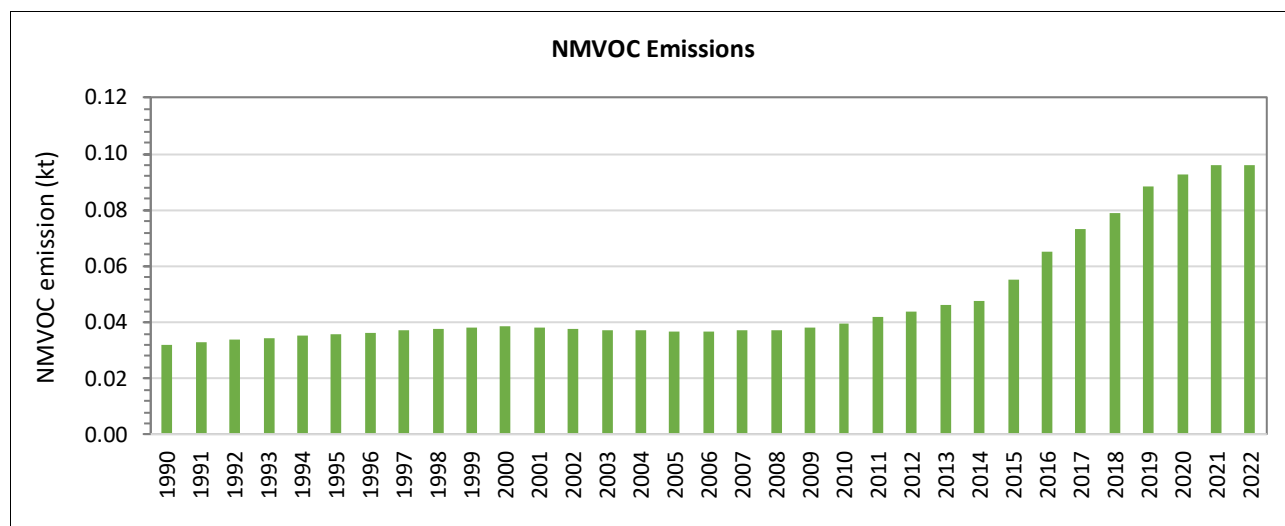


Figure 6.6 Emissions of NMVOC from category 5.A Solid waste disposal on land

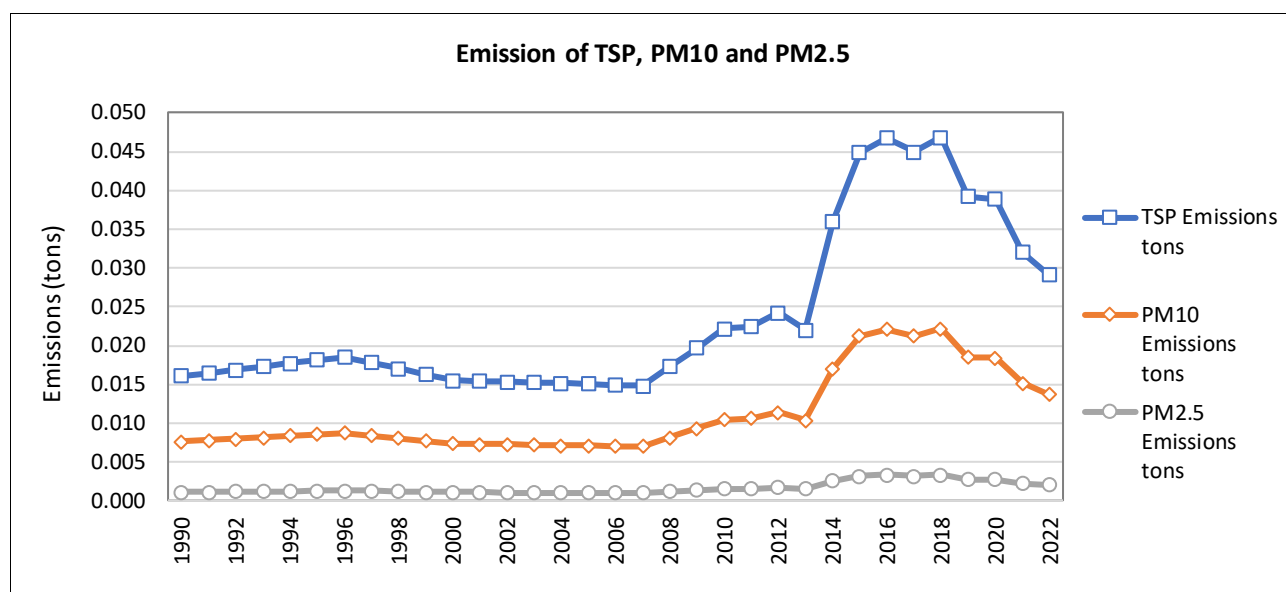


Figure 6.7 Emissions of TSP, PM10 and PM2.5 from category 5.A Solid waste disposal on land

Table 6.6 Emissions from category 5.A Solid waste disposal on land

Year	NMVOC Emissions	TSP Emissions	PM10 Emissions	PM2.5 Emissions
	Gg	t	t	t
1990	0.032	0.016	0.008	0.001
1991	0.033	0.017	0.008	0.001
1992	0.034	0.017	0.008	0.001
1993	0.035	0.017	0.008	0.001
1994	0.035	0.018	0.008	0.001
1995	0.036	0.018	0.009	0.001
1996	0.036	0.019	0.009	0.001
1997	0.037	0.018	0.008	0.001
1998	0.038	0.017	0.008	0.001
1999	0.038	0.016	0.008	0.001
2000	0.038	0.016	0.007	0.001
2001	0.038	0.015	0.007	0.001
2002	0.038	0.015	0.007	0.001
2003	0.037	0.015	0.007	0.001
2004	0.037	0.015	0.007	0.001
2005	0.037	0.015	0.007	0.001
2006	0.037	0.015	0.007	0.001
2007	0.037	0.015	0.007	0.001
2008	0.037	0.017	0.008	0.001
2009	0.038	0.020	0.009	0.001
2010	0.040	0.022	0.010	0.002
2011	0.042	0.022	0.011	0.002
2012	0.044	0.024	0.011	0.002
2013	0.046	0.022	0.010	0.002

Year	NMVOC Emissions	TSP Emissions	PM10 Emissions	PM2.5 Emissions
	Gg	t	t	t
2014	0.048	0.036	0.017	0.003
2015	0.055	0.045	0.021	0.003
2016	0.065	0.047	0.022	0.003
2017	0.073	0.045	0.021	0.003
2018	0.079	0.047	0.022	0.003
2019	0.089	0.039	0.019	0.003
2020	0.093	0.039	0.018	0.003
2021	0.096	0.032	0.015	0.002
2022	0.096	0.029	0.014	0.002
Trend				
1990 – 2022	199.4%	80.6%	80.6%	80.6%
2005 – 2022	160.7%	93.1%	93.1%	93.1%
2021 – 2022	0.1%	-9.1%	-9.1%	-9.1%

6.3.2 Methodological issues

6.3.2.1 Choice of methods

The emissions were calculated by Tier 1 methodology from the EMEP/EEA air pollutant emission inventory guidebook 2023 ⁵⁷:

$$\text{Emission}_{\text{pollutant}} = \text{Activity Data}_{\text{production}} \times \text{Emission Factor}_{\text{pollutant}}$$

6.3.2.2 Choice of Activity Data

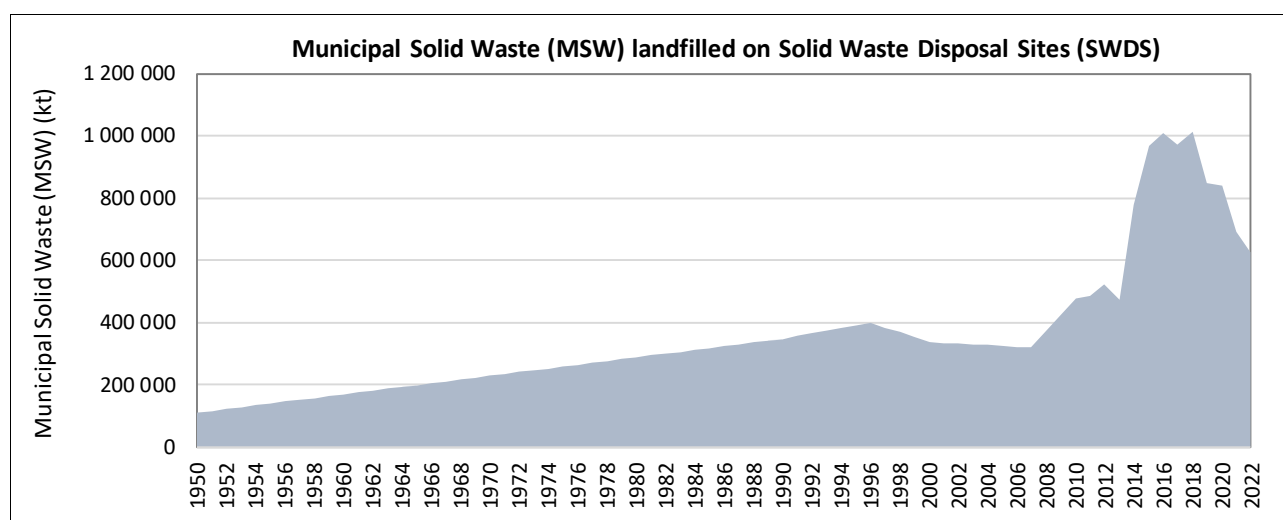


Figure 6-8 Municipal solid waste (MSW) landfilled on solid waste disposal sites (SWDS)

No national data on amounts of municipal waste generation and disposal were available for the years 1950 to 2022. For the period 2013 – 2022, information of population, Municipal Solid Waste (MSW), Waste per

⁵⁷ <https://www.eea.europa.eu/publications/emep-eea-guidebook-2023/part-b-sectoral-guidance-chapters/5-waste/5-a-solid-waste-disposal/view>

capita rate, and share of MSW landfilled on Solid Waste Disposal Sites (SWDS) were taken from Urban solid waste statistics of INSTAT58. Based on the national population and country specific waste generation rates for total population, the total amount of waste which is disposed on land could be estimated. For more information see Chapter 6.2 Waste generation in Albania above.

Table 6-7 Municipal solid waste (MSW) landfilled on solid waste disposal sites (SWDS)

	Population	Source	Waste per capita	Source	Total Municipal Solid Waste (MSW)	Source	% to Solid Waste Disposal Sites (SWDS)	Source	Total amount of waste to SWDS	Source
	Millions		kg/cap/y		kt		%		kt	
1990	869 540	Eurostat	282.61	extrapolation	869 540	Calculated based on Population and Waste per capita	40.0	D	347 816	Calculated based on Total MSW and % to Solid Waste Disposal Sites (SWDS)
1991	884 389		284.17		884 389		40.3	extrapolation	356 409	
1992	899 239		285.74		899 239		40.6		365 091	
1993	914 088		287.30		914 088		40.9		373 862	
1994	928 937		288.87		928 937		41.2		382 722	
1995	943 787		290.43		943 787		41.5		391 671	
1996	958 636		292.00		958 636		41.8		400 710	
1997	914 338		282.88		914 338		42.1		384 937	
1998	870 041		273.75		870 041		42.4		368 897	
1999	825 743		264.63		825 743		42.7		352 592	
2000	781 446		255.50		781 446		43.0		336 022	
2001	773 058	INSTAT	253.63	extrapolation	773 058	Calculated based on Population and Waste per capita	43.2	extrapolation	333 961	Calculated based on Total MSW and % to Solid Waste Disposal Sites (SWDS)
2002	764 670		251.75		764 670		43.4		331 867	
2003	756 282		249.88		756 282		43.6		329 739	
2004	747 895		248.01		747 895		43.8		327 578	
2005	739 507		246.13		739 507		44.0		325 383	
2006	731 119		244.26		731 119		44.2		323 155	
2007	722 731		242.38		722 731		44.4		320 893	
2008	836 926		283.26		836 926		44.6		373 269	
2009	951 121		324.13		951 121		44.8		426 102	
2010	1 065 316		365.00		1 065 316		45.0		479 392	
2011	1 078 634		371.00		1 078 634		45.0		484 846	
2012	1 137 979		392.00		1 137 979		46.0		522 901	
2013	940 160		325.00	INSTAT	940 160	INSTAT	50.6	INSTAT	475 721	INSTAT
2014	1 228 884		425.00		1 228 884		63.4		779 112	
2015	1 413 233		491.00		1 413 233		68.6		970 157	
2016	1 300 373		452.00		1 300 373		77.7		1 010 335	
2017	1 253 913		436.00		1 253 913		77.5		971 572	
2018	1 325 071		462.00		1 325 071		76.4		1 012 517	
2019	1 086 692		381.00		1 086 692		77.9		847 208	
2020	1 047 852		369.00		1 047 852		80.2		840 658	
2021	875 105		311.00		875 105		79.0		691 352	

⁵⁸ Available (18.01.2024) on <https://www.instat.gov.al/en/themes/environment-and-energy/environment/#tab3>

	Population	Source	Waste per capita	Source	Total Municipal Solid Waste (MSW)	Source	% to Solid Waste Disposal Sites (SWDS)	Source	Total amount of waste to SWDS	Source
	Millions		kg/cap/y		kt		%		kt	
2022	820 322		295.00		820 322		76.6		628 239	
Trend										
1950-2022	121.8%		34.1%		197.7%		91.5%		469.9%	
1990-2022	-15.5%		4.4%		-5.7%		91.5%		80.6%	
2005-2022	-8.0%		19.9%		10.9%		74.1%		93.1%	
2021-2022	-1.2%		-5.1%		-6.3%		-3.0%		-9.1%	
Remarks: EJ – Expert judgement, D – IPCC default										

6.3.2.3 Choice of emission factors

Default emission factors from the EMEP/EEA air pollutant emission inventory guidebook 2023 were applied and are presented in the following table.

Table 6.8 Tier 1 emission factors for category 5.A Solid waste disposal on land.

Pollutant	Value	Unit	Type pf EF	Source	
NM VOC	1.56	kg/Mg waste	Default	Table 3-2	EMEP/EEA air pollutant emission inventory guidebook 2023, Part B, Chapter 5.A Solid waste disposal on land, section 3.2.2 Default emission factors
TSP	0.463	kg/Mg waste	Default	Table 3-1	
PM10	0.219	kg/Mg waste	Default		
PM2.5	0.033	kg/Mg waste	Default		

6.3.3 Uncertainties and time-series consistency

The uncertainties for activity data and emission factors used for IPCC/NFR category 5.A Solid waste disposal on land are presented in the following table.

Table 6.9 Uncertainty for category 5.A Solid waste disposal on land

Uncertainty	Amount of Solid waste disposed on land			Reference
Activity data (AD)	139%			Based on Table 3.5 Vol. 5, Chapter 2, 2006 IPCC Guidelines
Emission factor (EF)	Rating	Typical error range	Average	Reference
NM VOC	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 2023. Part A. Chapter 5 Uncertainties.
TSP, PM10, PM2.5, BC	C	50% to 200%	125%	

The time-series are considered to be consistent as the same methodology is applied to the whole period.

6.3.4 Source-specific QA/QC and verification

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

- Checked of calculations by spreadsheets
 - consistent use of 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.

6.3.5 Source-specific recalculations

The following table presents the main revisions and recalculations done since the last submission to category 5.A Biological treatment of waste - Solid waste disposal on land.

Table 6.10 Recalculations done in category 5.A

Source category	Revisions of data	Type of revision	Type of improvement
5.A.	Waste statistics based on INSTAT	AD	Accuracy

6.3.6 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 6.11 Planned improvements for category 5 - Waste.

Source category	Planned improvement	Type of improvement		Priority
5.A, 5.B., 5.C	Investigation on waste flow: collection, disposal, recycling, incineration with energy and without energy recovery, open burning, composting, etc. <ul style="list-style-type: none"> • Urban population • Rural population 	EF	Accuracy	medium
5.A, 5.B., 5.C	Investigation on waste generation (rate) <ul style="list-style-type: none"> • by urban and rural population • by composition 	AD	Accuracy	5.A

6.4 Biological treatment of solid waste (category 5.B)

The following section describes emissions of air pollutants resulting from biological treatment of solid waste, which originates from three different processes:

- Composting,
- anaerobic digestion of organic waste, and
- mechanical-biological (MB) treatment.

Composting and anaerobic digestion of organic waste, such as food waste, garden and park waste and sludge, is common in many countries. Advantages of the biological treatment include:

- reduced volume in the waste material,
- stabilization of the waste,
- destruction of pathogens in the waste material, and
- production of biogas for energy use.

The end products of the biological treatment can, depending on its quality, be recycled as fertilizer and soil amendment, or be disposed in Solid waste disposal sites (SWDS).

Composting is a preferred method of solid waste disposal in rural area, mainly due to the high percentage of organic material in the waste composition. As no specific information on composting activities in Albania were available, this category has not been estimated.

6.4.1 Source category description

5.B. Biological treatment of solid waste	NH ₃		CO		All other pollutants
	Estimated	Key category	Estimated	Key category	
5.B.1 Composting	NE		NE		NA
5.B.2 Anaerobic Digestion Biogas	NE		NA		

A '✓' indicates: emissions from this category have been estimated.
 Notation keys: IE - included elsewhere. NO – not occurred. NE - not estimated. NA - not applicable. C – confidential

6.4.2 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 6.12 Planned improvements for category 5.B Biological treatment of waste

Source category	Planned improvement	Type of improvement		Priority
5.B.1	Survey on composting activities <ul style="list-style-type: none"> • in urban / rural areas • type of composting facility 	AD	Completeness	medium
5.B.2	Biogas production	AD	Completeness	medium
5.B	Estimation of NH ₃ emissions	EMI	Completeness	medium

6.5 Incineration and open burning of waste (5.C.)

Table 6.13 Overview on reported emissions from sector 5 Waste

NFR Code	5C1a	5C1b i	5C1b ii	5C1b iii	5C1b iv	5C1bv	5C1bvi	5C2
NO _x	NO	NE	NE	✓	NA	NO	NA	✓
NM _{VOC}	NO	NE	NE	✓	NA	NO	NA	✓
SO _x	NO	NE	NE	✓	NA	NO	NA	✓
NH ₃	NO	NA	NA	NA	NA	NA	NA	NA
CO	NO	NE	NE	✓	NO	NO	NA	✓
PM _{2.5}	NO	NE	NE	✓	NO	NO	NA	✓
PM ₁₀	NO	NE	NE	✓	NO	NO	NA	✓
TSP	NO	NE	NE	✓	NO	NO	NA	✓
BC	NO	NE	NE	✓	NA	NA	NA	✓
Pb	NO	NE	NE	✓	NO	NO	NA	✓
Cd	NO	NE	NE	✓	NO	NO	NA	✓
Hg	NO	NE	NE	✓	NO	NO	NA	NA
As	NO	NE	NE	✓	NO	NO	NA	✓
Cr	NO	NE	NE	✓	NO	NO	NA	✓
Cu	NO	NE	NE	✓	NO	NO	NA	✓
Ni	NO	NE	NE	NA	NO	NO	NA	NA
Se	NO	NA	NA	NA	NA	NA	NA	✓
Zn	NO	NA	NA	NA	NA	NA	NA	✓
PCDD/ PCDF	NO	NE	NE	✓	NO	NO	NA	✓
PAH	NO	NA	NA	✓	NO	NO	NA	✓
HCB	NO	NE	NE	✓	NO	NO	NA	NA
PCBs	NO	NA	NA	NA	NO	NO	NA	NA

A '✓' indicates: emissions from this category have been estimated.

Notation keys: IE - included elsewhere. NO – not occurred. NE - not estimated. NA - not applicable. C – confidential

6.5.1 Municipal waste incineration (category 5.C.1.a)

The category 5.C.1.a Municipal waste incineration without energy recovery does not occur in Albania. Municipal waste incineration with energy recovery takes places since 2018 and is reported under IPCC/NFR sector 1 Energy. Furthermore, municipal waste is landfilled or open burned.

6.5.2 Industrial waste incineration (category 5.C.1.b.i)

The category 5.C.1.b.i Industrial waste incineration did maybe occur in the past in Albania but currently no emissions were estimated due to lack of resources and data.

6.5.3 Hazardous waste incineration (category 5.C.1.b.ii)

The IPCC/NFR category category 5.C.1.b.ii Hazardous waste incineration did maybe occur in the past in Albania but currently no emissions were estimated due to lack of resources and data.

6.5.4 Clinical waste incineration (category 5.C.1.b.iii)

6.5.4.1 Emission trends

The following table provides an overview on emissions of air pollutants from *clinical waste incineration* for the period 1990-2022. Emissions from *clinical waste incineration* decreased mainly due to decreasing #####.

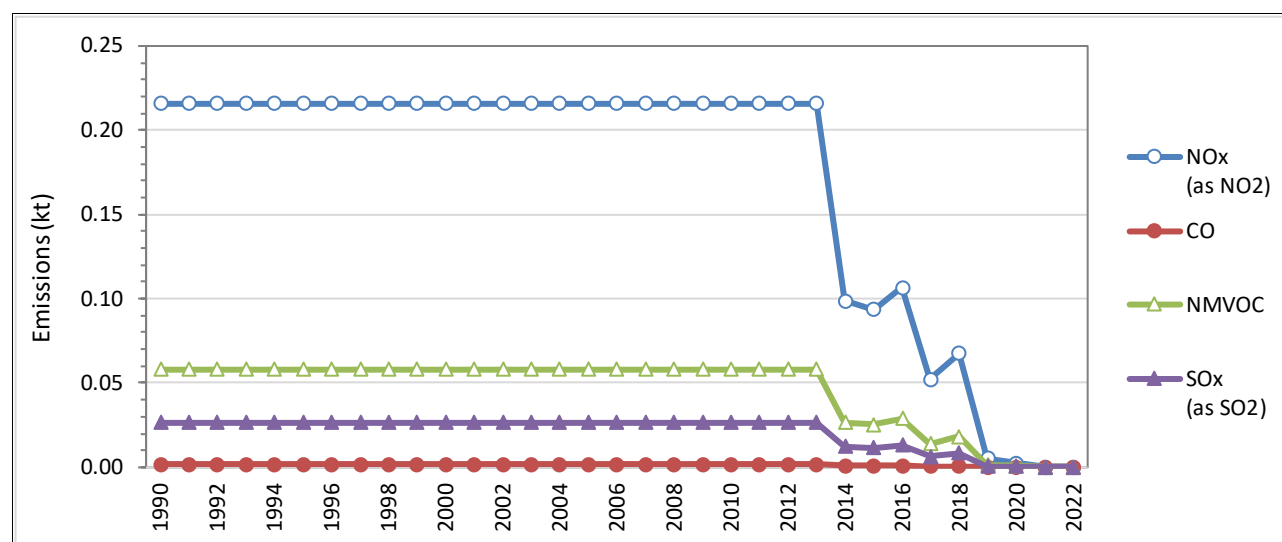


Figure 6.9 Emissions of main pollutants (NOx, CO, SOx, NMVOC) from category IPCC/NFR category 5.C.1.b.iii Clinical waste incineration

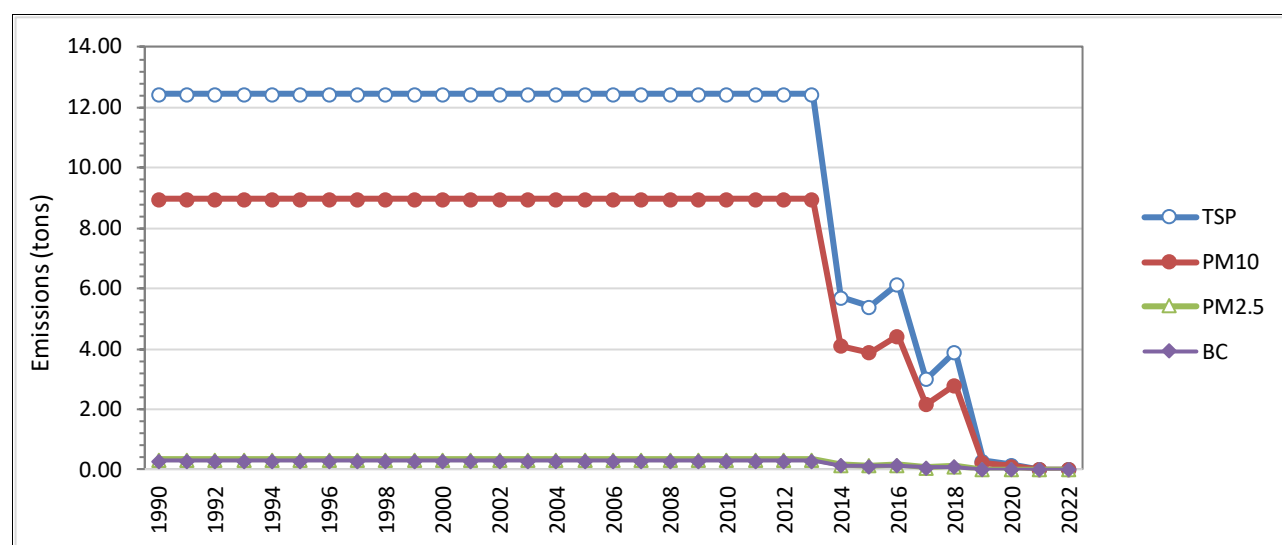


Figure 6.10 Emissions of TSP, PM10, PM2.5 and BC from category IPCC/NFR category 5.C.1.b.iii Clinical waste incineration

Table 6.14 Emissions of main pollutants (NOx, CO, SOx, NMVOC) and particulate (TSP, PM10, PM2.5 and BC) from category IPCC/NFR category 5.C.1.b.iii Clinical waste incineration

Year	NOx	NMVOC	SOx	CO	NH3	TSP	PM10	PM2.5	BC
	kt	kt	kt	kt	kt	tons	tons	tons	tons
1990	0.216	0.058	0.027	0.002	NA	12.45	8.96	0.34	0.29

Year	NOx	NMVOC	SOx	CO	NH3	TSP	PM10	PM2.5	BC
	kt	kt	kt	kt	kt	tons	tons	tons	tons
1991	0.216	0.058	0.027	0.002	NA	12.45	8.96	0.34	0.29
1992	0.216	0.058	0.027	0.002	NA	12.45	8.96	0.34	0.29
1993	0.216	0.058	0.027	0.002	NA	12.45	8.96	0.34	0.29
1994	0.216	0.058	0.027	0.002	NA	12.45	8.96	0.34	0.29
1995	0.216	0.058	0.027	0.002	NA	12.45	8.96	0.34	0.29
1996	0.216	0.058	0.027	0.002	NA	12.45	8.96	0.34	0.29
1997	0.216	0.058	0.027	0.002	NA	12.45	8.96	0.34	0.29
1998	0.216	0.058	0.027	0.002	NA	12.45	8.96	0.34	0.29
1999	0.216	0.058	0.027	0.002	NA	12.45	8.96	0.34	0.29
2000	0.216	0.058	0.027	0.002	NA	12.45	8.96	0.34	0.29
2001	0.216	0.058	0.027	0.002	NA	12.45	8.96	0.34	0.29
2002	0.216	0.058	0.027	0.002	NA	12.45	8.96	0.34	0.29
2003	0.216	0.058	0.027	0.002	NA	12.45	8.96	0.34	0.29
2004	0.216	0.058	0.027	0.002	NA	12.45	8.96	0.34	0.29
2005	0.216	0.058	0.027	0.002	NA	12.45	8.96	0.34	0.29
2006	0.216	0.058	0.027	0.002	NA	12.45	8.96	0.34	0.29
2007	0.216	0.058	0.027	0.002	NA	12.45	8.96	0.34	0.29
2008	0.216	0.058	0.027	0.002	NA	12.45	8.96	0.34	0.29
2009	0.216	0.058	0.027	0.002	NA	12.45	8.96	0.34	0.29
2010	0.216	0.058	0.027	0.002	NA	12.45	8.96	0.34	0.29
2011	0.216	0.058	0.027	0.002	NA	12.45	8.96	0.34	0.29
2012	0.216	0.058	0.027	0.002	NA	12.45	8.96	0.34	0.29
2013	0.216	0.058	0.027	0.002	NA	12.45	8.96	0.34	0.29
2014	0.099	0.027	0.012	0.001	NA	5.70	4.10	0.15	0.13
2015	0.094	0.025	0.012	0.001	NA	5.40	3.89	0.15	0.12
2016	0.107	0.029	0.013	0.001	NA	6.15	4.43	0.17	0.14
2017	0.052	0.014	0.006	0.000	NA	3.00	2.16	0.08	0.07
2018	0.068	0.018	0.008	0.001	NA	3.90	2.81	0.11	0.09
2019	0.005	0.001	0.001	0.000	NA	0.30	0.22	0.01	0.01
2020	0.003	0.001	0.000	0.000	NA	0.15	0.11	0.00	0.00
2021	NO	NO	NO	NO	NA	NO	NO	NO	NO
2022	NO	NO	NO	NO	NA	NO	NO	NO	NO
Trend									
1990 – 2022	NA	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	NA	NA	NA	NA	NA	NA	NA	NA	NA
2021 – 2022	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 6.15 Emissions of heavy metals from category IPCC/NFR category category 5.C.1.b.iii Clinical waste incineration

Year	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
	tons	tons	tons	tons	tons	tons	tons	tons	tons
1990	0.007	0.002	2.739	0.017	0.025	NA	0.003	NA	NA
1991	0.007	0.002	2.739	0.017	0.025	NA	0.003	NA	NA
1992	0.007	0.002	2.739	0.017	0.025	NA	0.003	NA	NA
1993	0.007	0.002	2.739	0.017	0.025	NA	0.003	NA	NA
1994	0.007	0.002	2.739	0.017	0.025	NA	0.003	NA	NA
1995	0.007	0.002	2.739	0.017	0.025	NA	0.003	NA	NA
1996	0.007	0.002	2.739	0.017	0.025	NA	0.003	NA	NA
1997	0.007	0.002	2.739	0.017	0.025	NA	0.003	NA	NA
1998	0.007	0.002	2.739	0.017	0.025	NA	0.003	NA	NA
1999	0.007	0.002	2.739	0.017	0.025	NA	0.003	NA	NA
2000	0.007	0.002	2.739	0.017	0.025	NA	0.003	NA	NA
2001	0.007	0.002	2.739	0.017	0.025	NA	0.003	NA	NA
2002	0.007	0.002	2.739	0.017	0.025	NA	0.003	NA	NA
2003	0.007	0.002	2.739	0.017	0.025	NA	0.003	NA	NA
2004	0.007	0.002	2.739	0.017	0.025	NA	0.003	NA	NA
2005	0.007	0.002	2.739	0.017	0.025	NA	0.003	NA	NA
2006	0.007	0.002	2.739	0.017	0.025	NA	0.003	NA	NA
2007	0.007	0.002	2.739	0.017	0.025	NA	0.003	NA	NA
2008	0.007	0.002	2.739	0.017	0.025	NA	0.003	NA	NA
2009	0.007	0.002	2.739	0.017	0.025	NA	0.003	NA	NA
2010	0.007	0.002	2.739	0.017	0.025	NA	0.003	NA	NA
2011	0.007	0.002	2.739	0.017	0.025	NA	0.003	NA	NA
2012	0.007	0.002	2.739	0.017	0.025	NA	0.003	NA	NA
2013	0.007	0.002	2.739	0.017	0.025	NA	0.003	NA	NA
2014	0.003	0.001	1.254	0.008	0.011	NA	0.002	NA	NA
2015	0.003	0.001	1.188	0.007	0.011	NA	0.001	NA	NA
2016	0.004	0.001	1.353	0.008	0.012	NA	0.002	NA	NA
2017	0.002	0.001	0.660	0.004	0.006	NA	0.001	NA	NA
2018	0.002	0.001	0.858	0.005	0.008	NA	0.001	NA	NA
2019	<0.001	<0.001	0.066	0.000	0.001	NA	<0.001	NA	NA
2020	<0.001	<0.001	0.033	<0.001	<0.001	NA	<0.001	NA	NA
2021	NO	NO	NO	NO	NO	NA	NO	NA	NA
2022	NO	NO	NO	NO	NO	NA	NO	NA	NA
Trend									
1990 – 2022	NA	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2022	NA	NA	NA	NA	NA	NA	NA	NA	NA
2021 – 2022	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 6.16 Emissions of Persistent organic pollutants (POPs)(PCDD/ PCDF, PAH, PCB, HCB) from category IPCC/NFR category category 5.C.1.b.iii Clinical waste incineration

Year	PCDD/ PCDF (dioxins/ furans)	PAH	PCB	HCB
	mg I-TEQ	tons	kg	kg
1990	0.249	0.249	1.660	8.300
1991	0.249	0.249	1.660	8.300
1992	0.249	0.249	1.660	8.300
1993	0.249	0.249	1.660	8.300
1994	0.249	0.249	1.660	8.300
1995	0.249	0.249	1.660	8.300
1996	0.249	0.249	1.660	8.300
1997	0.249	0.249	1.660	8.300
1998	0.249	0.249	1.660	8.300
1999	0.249	0.249	1.660	8.300
2000	0.249	0.249	1.660	8.300
2001	0.249	0.249	1.660	8.300
2002	0.249	0.249	1.660	8.300
2003	0.249	0.249	1.660	8.300
2004	0.249	0.249	1.660	8.300
2005	0.249	0.249	1.660	8.300
2006	0.249	0.249	1.660	8.300
2007	0.249	0.249	1.660	8.300
2008	0.249	0.249	1.660	8.300
2009	0.249	0.249	1.660	8.300
2010	0.249	0.249	1.660	8.300
2011	0.249	0.249	1.660	8.300
2012	0.249	0.249	1.660	8.300
2013	0.249	0.249	1.660	8.300
2014	0.114	0.114	0.760	3.800
2015	0.108	0.108	0.720	3.600
2016	0.123	0.123	0.820	4.100
2017	0.060	0.060	0.400	2.000
2018	0.078	0.078	0.520	2.600
2019	0.006	0.006	0.040	0.200
2020	0.003	0.003	0.020	0.100
2021	NO	NO	NO	NO
2022	NO	NO	NO	NO
Trend				
1990 – 2022	NA	NA	NA	NA
2005 – 2022	NA	NA	NA	NA
2021 – 2022	NA	NA	NA	NA

6.5.4.2 Methodological issues

6.5.4.2.1 Choice of methods

The emissions were calculated by Tier 1 methodology from the EMEP/EEA air pollutant emission inventory guidebook 2023⁵⁹.

$$\text{Emission}_{\text{pollutant}} = \text{Activity Data}_{\text{production}} \times \text{Emission Factor}_{\text{pollutant}}$$

6.5.4.2.2 Choice of Activity Data

National data on amounts of clinical waste incinerated were available for the years 2013 to 2021 and were taken from Eurostat. For the period 1990 – 2012, data of 2013 was used, for 2023, data of 2021 was used.

Table 6-17 IPCC/NFR category category 5.C.1.b.iii Clinical waste incineration

	Clinical waste	Source
	kt	
1990	83.00	As of 2013
↓	↓	
2012	83.00	
2013	83.00	Eurostat
2014	38.00	
2015	36.00	
2016	41.00	
2017	20.00	
2018	26.00	
2019	2.00	
2020	1.00	
2021	NO	
2022	NO	As of 2021
Trend		
1990-2022	NA	
2005-2022	NA	
2021-2022	NA	

⁵⁹ EMEP/EEA air pollutant emission inventory guidebook 2023, Part B sectoral guidance, Chapters 5.C.1.b.iii Clinical waste incineration 2023. Available (18.01.2024) on <https://www.eea.europa.eu/publications/emep-eea-guidebook-2023/part-b-sectoral-guidance-chapters/5-waste/5-c-1-b-iii/view>

6.5.4.2.3 Choice of emission factors

Default emission factors from the EMEP/EEA air pollutant emission inventory guidebook 2023 were applied and are presented in the following table.

Table 6.18 Tier 1 emission factors for category IPCC/NFR category category 5.C.1.b.iii Clinical waste incineration.

Pollutant	Value	Unit	Type pf EF	Source
NOx	2.6	kg/Mg waste	Default	EMEP/EEA air pollutant emission inventory guidebook 2023, Part B, Chapter 5.A Solid waste disposal on land, section 3.2.2Default emission factors, Table 3-1 Tier 1 emission factors for source category 5.C.1.b.iii Clinical waste incineration, rotary kiln incinerator equipped with spry dryer or fabric filter
CO	0.02	kg/Mg waste	Default	
NMVOC	0.7	kg/Mg waste	Default	
SO2	0.32	kg/Mg waste	Default	
TSP	0.15	kg/Mg waste	Default	
BC1	2.3	% of TSP	Default	
PM10	72	% of TSP	Default	
PM2.5	2,7	% of TSP	Default	
Pb	0.09	g/Mg waste	Default	
Cd	0.03	g/Mg waste	Default	
Hg	33	g/Mg waste	Default	
As	0.2	g/Mg waste	Default	
Cr	0,05	g/Mg waste	Default	
Cu	0,3	g/Mg waste	Default	
Ni	0,04	g/Mg waste	Default	
PCB	0.02	g/Mg waste	Default	
PCDD/F1	3	mg I-TEQ/Mg waste	Default	
Total 4 PAHs	0.04	mg/Mg waste	Default	
HCB	0.1	g/Mg waste	Default	

6.5.4.3 Uncertainties and time-series consistency

The uncertainties for activity data and emission factors used for IPCC/NFR category category 5.C.1.b.iii Clinical waste incineration are presented in the following table.

Table 6.19 Uncertainty for category IPCC/NFR category category 5.C.1.b.iii Clinical waste incineration

Uncertainty	Amount of Solid waste disposed on land			Reference
Activity data (AD)	100%			Expert Judegment
Emission factor (EF)	Rating	Typical error range	Average	Reference
NOx, SOx, NMVOC, CO	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 2023. Part A. Chapter 5 Uncertainties.
TSP, PM10, PM2.5, BC	C	50% to 200%	125%	
HM/POP	E	order of magnitude	300%	

The time-series are considered to be consistent as the same methodology is applied to the whole period.

6.5.4.4 Source-specific QA/QC and verification

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

- Checked of calculations by spreadsheets
 - consistent use of 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.
- time series consistency - plausibility checks of dips and jumps.

6.5.4.5 Source-specific recalculations

The following table presents the main revisions and recalculations done since the last submission to category IPCC/NFR category category 5.C.1.b.iii Clinical waste incineration.

Table 6.20 Recalculations done in category IPCC/NFR category category 5.C.1.b.iii Clinical waste incineration

Source category	Revisions of data	Type of revision	Type of improvement
5.C.1.b.iii	Updated data	AD	Accuracy

6.5.4.6 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 6.21 Planned improvements for category IPCC/NFR category category 5.C.1.b.iii Clinical waste incineration.

Source category	Planned improvement	Type of improvement		Priority
5.C.1.b.iii	Investigation on amount of clinical waste generated and incinerated	AD	Accuracy	medium

6.5.5 Sludge incineration (category 5.C.1.b.iv)

The IPCC/NFR category category 5.C.1.b.iv Sludge incineration does currently not occur in Albania.

6.5.6 Cremation (5.C.1.b.v)

The category 5.C.1.b.v Cremation does not occur in Albania.

6.5.7 Other waste incineration (5.C.1.b.v.i)

The category 5.C.1.b.v.i Other waste incineration does not occur in Albania.

6.5.8 Open burning of waste (5.C.2)

6.5.8.1 Emission trends

The following table provides an overview on emissions of air pollutants from *clinical waste incineration* for the period 1990-2022. Emissions from *Open burning of waste* decreased mainly due managements practices such as landfilling and burning for energy recovery. Open burning of waste is not allowed since ### due to law/legal act ###.

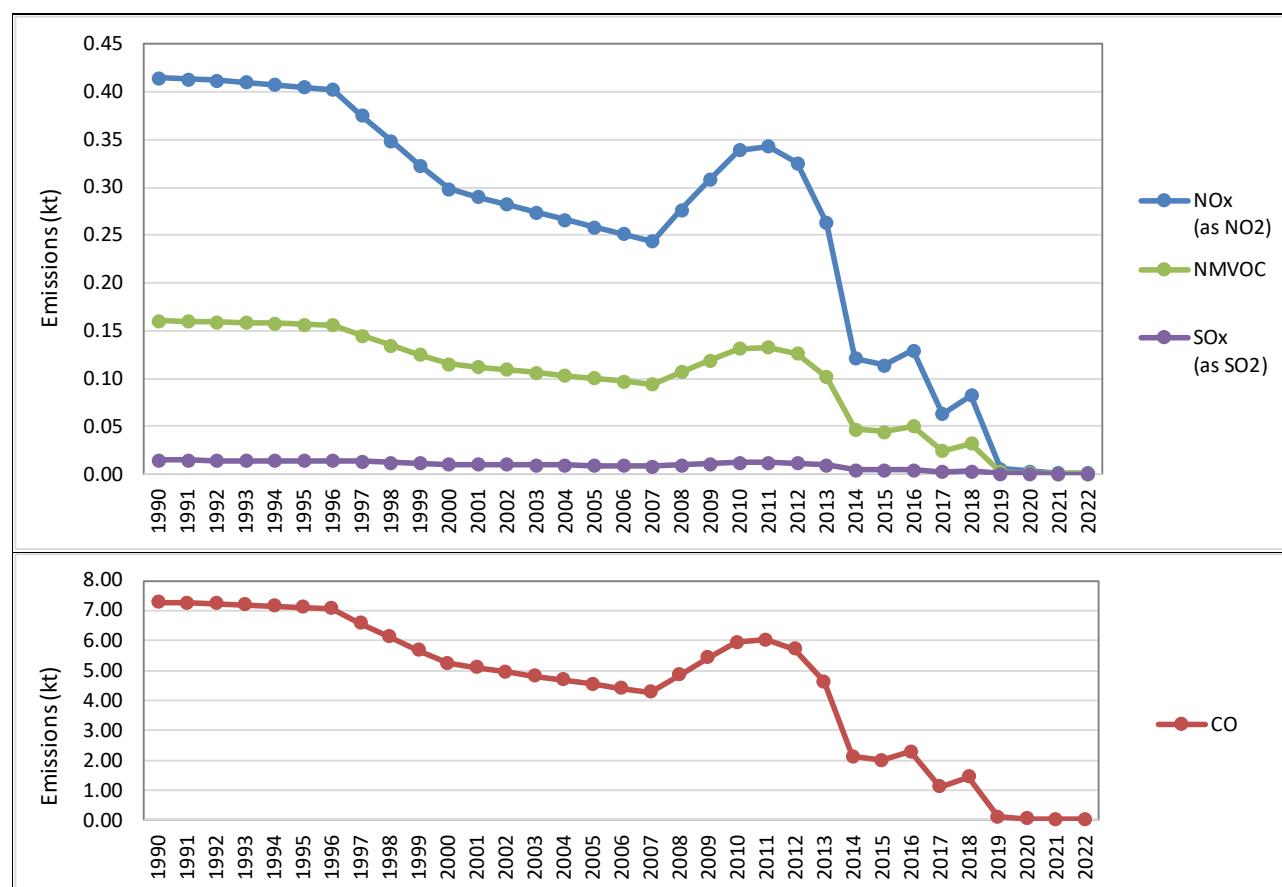


Figure 6.11 Emissions of main pollutants (NOx, CO, SOx, NMVOC) from category IPCC/NFR category category 5.C.2 Open burning of waste.

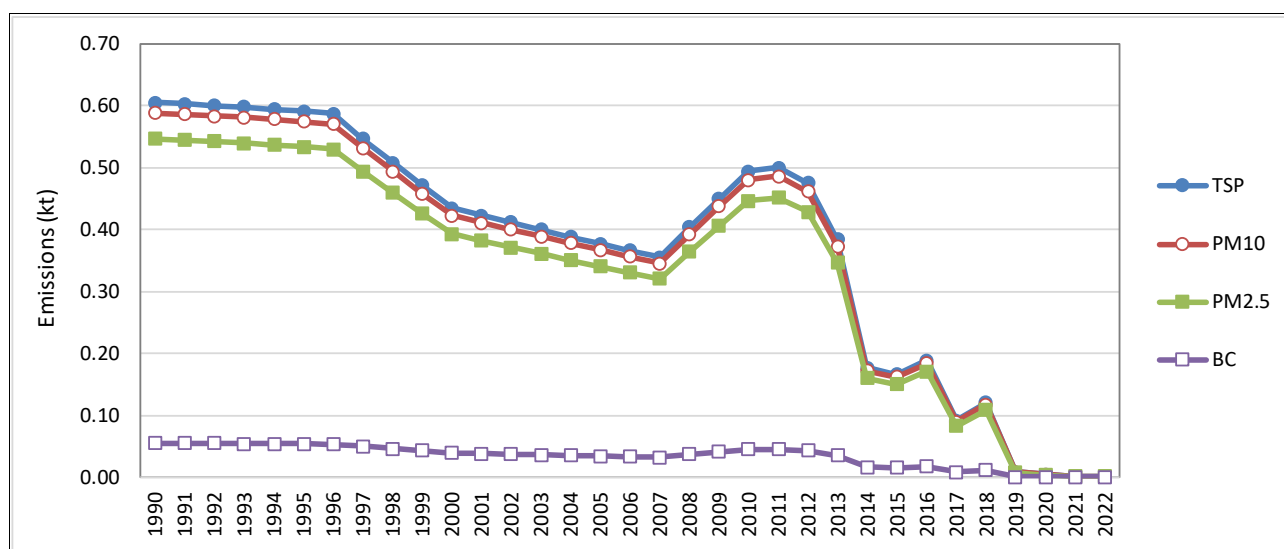


Figure 6.12 Emissions of TSP, PM10, PM2.5 and BC from category IPCC/NFR category category 5.C.2 Open burning of waste.

Table 6.22 Emissions of main pollutants (NO_x, CO, SO_x, NMVOC) and particulate (TSP, PM₁₀, PM_{2.5} and BC) from category IPCC/NFR category category 5.C.2 Open burning of waste.

Year	NO _x	NMVOC	SO _x	CO	NH ₃	TSP	PM ₁₀	PM _{2.5}	BC
	kt	kt	kt	kt	kt	tons	tons	tons	tons
1990	0.415	0.160	0.014	7.282	NA	0.605	0.588	0.547	0.055
1991	0.413	0.160	0.014	7.258	NA	0.603	0.586	0.545	0.055
1992	0.412	0.159	0.014	7.229	NA	0.601	0.584	0.543	0.054
1993	0.410	0.159	0.014	7.196	NA	0.598	0.581	0.540	0.054
1994	0.408	0.158	0.014	7.157	NA	0.595	0.578	0.537	0.054
1995	0.405	0.157	0.014	7.113	NA	0.591	0.575	0.534	0.054
1996	0.402	0.156	0.014	7.065	NA	0.587	0.571	0.530	0.053
1997	0.375	0.145	0.013	6.585	NA	0.547	0.532	0.494	0.050
1998	0.349	0.135	0.012	6.120	NA	0.509	0.494	0.459	0.046
1999	0.323	0.125	0.011	5.670	NA	0.471	0.458	0.426	0.043
2000	0.298	0.115	0.010	5.235	NA	0.435	0.423	0.393	0.039
2001	0.290	0.112	0.010	5.093	NA	0.423	0.411	0.382	0.038
2002	0.282	0.109	0.010	4.952	NA	0.412	0.400	0.372	0.037
2003	0.274	0.106	0.009	4.813	NA	0.400	0.389	0.361	0.036
2004	0.266	0.103	0.009	4.677	NA	0.389	0.378	0.351	0.035
2005	0.259	0.100	0.009	4.542	NA	0.377	0.367	0.341	0.034
2006	0.251	0.097	0.009	4.408	NA	0.366	0.356	0.331	0.033
2007	0.244	0.094	0.008	4.277	NA	0.355	0.346	0.321	0.032
2008	0.277	0.107	0.010	4.859	NA	0.404	0.393	0.365	0.037
2009	0.309	0.119	0.011	5.416	NA	0.450	0.438	0.406	0.041
2010	0.339	0.131	0.012	5.948	NA	0.494	0.480	0.446	0.045
2011	0.343	0.133	0.012	6.022	NA	0.500	0.486	0.452	0.045
2012	0.326	0.126	0.011	5.718	NA	0.475	0.462	0.429	0.043
2013	0.263	0.102	0.009	4.619	NA	0.384	0.373	0.347	0.035
2014	0.121	0.047	0.004	2.127	NA	0.177	0.172	0.160	0.016
2015	0.114	0.044	0.004	2.003	NA	0.166	0.162	0.150	0.015
2016	0.130	0.050	0.004	2.277	NA	0.189	0.184	0.171	0.017
2017	0.063	0.024	0.002	1.106	NA	0.092	0.089	0.083	0.008
2018	0.083	0.032	0.003	1.450	NA	0.121	0.117	0.109	0.011
2019	0.006	0.002	<0.001	0.097	NA	0.008	0.008	0.007	0.001
2020	0.003	0.001	<0.001	0.050	NA	0.004	0.004	0.004	<0.001
2021	0.001	<0.001	<0.001	0.017	NA	0.001	0.001	0.001	<0.001
2022	0.001	<0.001	<0.001	0.021	NA	0.002	0.002	0.002	<0.001
Trend									
1990 – 2022	-99.7%	-99.7%	-99.7%	-99.7%	NA	-99.7%	-99.7%	-99.7%	-99.7%
2005 – 2022	-99.5%	-99.5%	-99.5%	-99.5%	NA	-99.5%	-99.5%	-99.5%	-99.5%
2021 – 2022	21.9%	21.9%	21.9%	21.9%	NA	21.9%	21.9%	21.9%	21.9%

Table 6.23 Emissions of heavy metals from category IPCC/NFR category category 5.C.2 Open burning of waste.

Year	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
	tons	tons	tons	tons	tons	tons	tons	tons	tons
1990	0.064	0.013	NA	0.053	0.001	0.026	NA	NA	NA
1991	0.064	0.013	NA	0.053	0.001	0.026	NA	NA	NA
1992	0.063	0.013	NA	0.053	0.001	0.026	NA	NA	NA
1993	0.063	0.013	NA	0.053	0.001	0.026	NA	NA	NA
1994	0.063	0.013	NA	0.053	0.001	0.026	NA	NA	NA
1995	0.062	0.013	NA	0.052	0.001	0.025	NA	NA	NA
1996	0.062	0.013	NA	0.052	0.001	0.025	NA	NA	NA
1997	0.058	0.012	NA	0.048	0.001	0.024	NA	NA	NA
1998	0.054	0.011	NA	0.045	0.001	0.022	NA	NA	NA
1999	0.050	0.010	NA	0.042	0.001	0.020	NA	NA	NA
2000	0.046	0.009	NA	0.038	0.001	0.019	NA	NA	NA
2001	0.045	0.009	NA	0.037	0.001	0.018	NA	NA	NA
2002	0.043	0.009	NA	0.036	0.001	0.018	NA	NA	NA
2003	0.042	0.009	NA	0.035	0.001	0.017	NA	NA	NA
2004	0.041	0.008	NA	0.034	0.001	0.017	NA	NA	NA
2005	0.040	0.008	NA	0.033	0.001	0.016	NA	NA	NA
2006	0.039	0.008	NA	0.032	0.001	0.016	NA	NA	NA
2007	0.038	0.008	NA	0.031	0.001	0.015	NA	NA	NA
2008	0.043	0.009	NA	0.036	0.001	0.017	NA	NA	NA
2009	0.048	0.010	NA	0.040	0.001	0.019	NA	NA	NA
2010	0.052	0.011	NA	0.044	0.001	0.021	NA	NA	NA
2011	0.053	0.011	NA	0.044	0.001	0.022	NA	NA	NA
2012	0.050	0.010	NA	0.042	0.001	0.020	NA	NA	NA
2013	0.041	0.008	NA	0.034	0.001	0.017	NA	NA	NA
2014	0.019	0.004	NA	0.016	<0.001	0.008	NA	NA	NA
2015	0.018	0.004	NA	0.015	<0.001	0.007	NA	NA	NA
2016	0.020	0.004	NA	0.017	<0.001	0.008	NA	NA	NA
2017	0.010	0.002	NA	0.008	<0.001	0.004	NA	NA	NA
2018	0.013	0.003	NA	0.011	<0.001	0.005	NA	NA	NA
2019	0.001	<0.001	NA	0.001	<0.001	<0.001	NA	NA	NA
2020	<0.001	<0.001	NA	<0.001	<0.001	<0.001	NA	NA	NA
2021	<0.001	<0.001	NA	<0.001	<0.001	<0.001	NA	NA	NA
2022	<0.001	<0.001	NA	<0.001	<0.001	<0.001	NA	NA	NA
Trend									
1990 – 2022	-99.7%	-99.7%	NA	-99.7%	-99.7%	-99.7%	NA	NA	NA
2005 – 2022	-99.5%	-99.5%	NA	-99.5%	-99.5%	-99.5%	NA	NA	NA
2021 – 2022	21.9%	21.9%	NA	21.9%	21.9%	21.9%	NA	NA	NA

Table 6.24 Emissions of Persistent organic pollutants (POPs)(PCDD/ PCDF, PAH, PCB, HCB) from category IPCC/NFR category category 5.C.2 Open burning of waste.

Year	PCDD/ PCDF (dioxins/ furans)	PAH	PCB	HCB
	mg I-TEQ	tons	kg	kg
1990	1.30	1.212	NA	NA
1991	1.30	1.208	NA	NA
1992	1.29	1.203	NA	NA
1993	1.29	1.197	NA	NA
1994	1.28	1.191	NA	NA
1995	1.27	1.184	NA	NA
1996	1.27	1.176	NA	NA
1997	1.18	1.096	NA	NA
1998	1.10	1.018	NA	NA
1999	1.02	0.944	NA	NA
2000	0.94	0.871	NA	NA
2001	0.91	0.847	NA	NA
2002	0.89	0.824	NA	NA
2003	0.86	0.801	NA	NA
2004	0.84	0.778	NA	NA
2005	0.81	0.756	NA	NA
2006	0.79	0.734	NA	NA
2007	0.77	0.712	NA	NA
2008	0.87	0.809	NA	NA
2009	0.97	0.901	NA	NA
2010	1.07	0.990	NA	NA
2011	1.08	1.002	NA	NA
2012	1.02	0.951	NA	NA
2013	0.83	0.769	NA	NA
2014	0.38	0.354	NA	NA
2015	0.36	0.333	NA	NA
2016	0.41	0.379	NA	NA
2017	0.20	0.184	NA	NA
2018	0.26	0.241	NA	NA
2019	0.02	0.016	NA	NA
2020	0.01	0.008	NA	NA
2021	0.00	0.003	NA	NA
2022	0.00	0.004	NA	NA
Trend				
1990 – 2022	-99.7%	-99.7%	NA	NA
2005 – 2022	-99.5%	-99.5%	NA	NA
2021 – 2022	21.9%	21.9%	NA	NA

6.5.8.2 Methodological issues

6.5.8.2.1 Choice of methods

The emissions were calculated by Tier 1 methodology from the EMEP/EEA air pollutant emission inventory guidebook 2023⁶⁰.

$$\text{Emission}_{\text{pollutant}} = \text{Activity Data}_{\text{amount of waste open burned}} \times \text{Emission Factor}_{\text{pollutant}}$$

6.5.8.2.2 Choice of Activity Data

No national data on amounts of municipal waste generation and disposal were available for the years 1990 to 2012. For the period 2013 – 2022, information of population, Municipal Solid Waste (MSW), Waste per capita rate, and share of MSW landfilled on Solid Waste Disposal Sites (SWDS) were taken from Urban solid waste statistics of INSTAT⁶¹. Based on the national population and country specific waste generation rates for total population, the total amount of waste which is disposed on land could be estimated. For more information see Chapter 6.2 Waste generation in Albania above.

Table 6-25 Municipal solid waste (MSW) landfilled on solid waste disposal sites (SWDS)

	Population	Source	Waste per capita	Source	Total Municipal Solid Waste (MSW)	Source	% of waste which is open burned	Source	Total amount of waste open burned	Source
	Millions		kg/cap/y		kt		%		kt	
1990	869 540	Eurostat	282.61	extrapolation	869 540	Calculated based on Population and Waste per capita	15.0	extrapolation	130.4	Calculated based on Total MSW and % to Solid Waste Disposal Sites (SWDS)
1991	884 389		284.17		884 389		15.0		130.0	
1992	899 239		285.74		899 239		15.0		129.5	
1993	914 088		287.30		914 088		15.0		128.9	
1994	928 937		288.87		928 937		15.0		128.2	
1995	943 787		290.43		943 787		14.7		127.4	
1996	958 636		292.00		958 636		14.4		126.5	
1997	914 338		282.88		914 338		14.1		117.9	
1998	870 041		273.75		870 041		13.8		109.6	
1999	825 743		264.63		825 743		13.5		101.6	
2000	781 446	INSTAT	255.50		781 446		13.2		93.8	
2001	773 058		253.63		773 058		12.9		91.2	
2002	764 670		251.75		764 670		12.6		88.7	
2003	756 282		249.88		756 282		12.3		86.2	
2004	747 895		248.01		747 895		12.0		83.8	
2005	739 507		246.13		739 507		11.8		81.3	
2006	731 119		244.26		731 119		11.6		79.0	
2007	722 731		242.38		722 731		11.4		76.6	
2008	836 926		283.26		836 926		11.2		87.0	

⁶⁰ EMEP/EEA air pollutant emission inventory guidebook 2023, Part B sectoral guidance, Chapters 5. Section 3.2 Tier 1 default approach. Available (18.01.2024) on <https://www.eea.europa.eu/publications/emep-eea-guidebook-2023/part-b-sectoral-guidance-chapters/5-waste/5-c-2-open-burning/view>

⁶¹ Available (18.01.2024) on <https://www.instat.gov.al/en/themes/environment-and-energy/environment/#tab3>

	Population	Source	Waste per capita	Source	Total Municipal Solid Waste (MSW)	Source	% of waste which is open burned	Source	Total amount of waste open burned	Source
	Millions		kg/cap/y		kt		%		kt	
2009	951 121		324.13		951 121		11.0		97.0	
2010	1 065 316		365.00		1 065 316		10.8		106.5	
2011	1 078 634		371.00		1 078 634		10.6		107.9	
2012	1 137 979		392.00		1 137 979		10.4		102.4	
2013	940 160		325.00		940 160		10.2		82.7	
2014	1 228 884		425.00		1 228 884		10.0		38.1	
2015	1 413 233		491.00		1 413 233		10.0		35.9	
2016	1 300 373		452.00		1 300 373		9.0		40.8	
2017	1 253 913		436.00		1 253 913		8.8		19.8	
2018	1 325 071		462.00		1 325 071		3.1		26.0	
2019	1 086 692		381.00		1 086 692		2.5		1.7	
2020	1 047 852		369.00		1 047 852		3.2		0.9	
2021	875 105		311.00		875 105		1.6		0.3	
2022	820 322		295.00		820 322		2.0		0.4	
Trend										
1990-2022	-15.5%		4.4%		-5.7%				-99.7%	
2005-2022	-8.0%		19.9%		10.9%				-99.5%	
2021-2022	-1.2%		-5.1%		-6.3%				21.9%	
Remarks: EJ – Expert judgement, D – IPCC default										

6.5.8.2.3 Choice of emission factors

Default emission factors from the EMEP/EEA air pollutant emission inventory guidebook 2023 were applied and are presented in the following table.

Table 6.26 Tier 1 emission factors for category IPCC/NFR category category 5.C.2 Open burning of waste.

Pollutant	Value	Unit	Type pf EF	Source
CO	55.83	kg/Mg waste	Default	EMEP/EEA air pollutant emission inventory guidebook 2023, Part B, Chapter 5.A Solid waste disposal on land, section 3.2.2 Default emission factors, Table 3-1 Tier 1 emission factors for source category 5.C.2 Small-scale waste burning
NOx	3.18	kg/Mg waste	Default	
SO2	0.11	kg/Mg waste	Default	
NMVOC	1.23	kg/Mg waste	Default	
TSP	4.64	kg/Mg waste	Default	
PM10	4.51	kg/Mg waste	Default	
PM2.5	4.19	kg/Mg waste	Default	
BC1	42.0	% of PM2.5	Default	
Cr	0.01	g/Mg waste	Default	
Cu	0.20	g/Mg waste	Default	
Zn	17.53	g/Mg waste	Default	
As	0.41	g/Mg waste	Default	

Pollutant	Value	Unit	Type pf EF	Source
Se	0.07	g/Mg waste	Default	
Pb	0.49	g/Mg waste	Default	
Cd	0.10	g/Mg waste	Default	
Benzo[b]fluoranthene	4.63	g/Mg waste	Default	
Benzo[k]fluoranthene	5.68	g/Mg waste	Default	
Benzo[a]pyrene	2.33	g/Mg waste	Default	
PCDD/F	10	µg I-TEQ/Mg waste	Default	

6.5.8.3 Uncertainties and time-series consistency

The uncertainties for activity data and emission factors used for IPCC/NFR category category 5.C.2 Open burning of waste are presented in the following table.

Table 6.27 Uncertainty for category IPCC/NFR category category 5.C.2 Open burning of waste

Uncertainty	Amount of Solid waste disposed on land			Reference
Activity data (AD)	100%			Expert Judegment
Emission factor (EF)	Rating	Typical error range	Average	Reference
NO _x , SO _x , NMVOC, CO	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 2023. Part A. Chapter 5 Uncertainties.
TSP, PM ₁₀ , PM _{2.5} , BC	C	50% to 200%	125%	
HM/POP	E	order of magnitude	300%	

The time-series are considered to be consistent as the same methodology is applied to the whole period.

6.5.8.4 Source-specific QA/QC and verification

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

- Checked of calculations by spreadsheets
 - consistent use of 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 consistenolpcy through all steps of calculation.
- time series consistency - plausibility checks of dips and jumps.

6.5.8.5 Source-specific recalculations

The following table presents the main revisions and recalculations done since the last submission to category IPCC/NFR category category 5.C.2 Open burning of waste.

Table 6.28 Recalculations done in category IPCC/NFR category category 5.C.2 Open burning of waste.

Source category	Revisions of data	Type of revision	Type of improvement
5.C.1.b.iii	Updated activity data	AD	Accuracy

6.5.8.6 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 6.29 Planned improvements for category IPCC/NFR category category 5.C.2 Open burning of waste.

Source category	Planned improvement	Type of improvement		Priority
5.A, 5.B., 5.C	Investigation on waste flow: collection, disposal, recycling, incineration with energy and without energy recovery, open burning, composting, etc. <ul style="list-style-type: none"> Urban population Rural population 	EF	Accuracy	high
5.A, 5.B., 5.C	Investigation on waste generation (rate) <ul style="list-style-type: none"> by urban and rural population by composition 	AD	Accuracy	High

6.6 Wastewater treatment and discharge (5.D)

The following section describes Air pollutant emissions resulting from Wastewater Treatment and Discharge. The term “sanitation chain” which refers to the sequence according to which wastewater is “handled” along the way from production at the level of the households until its disposal is shown in the following figures.

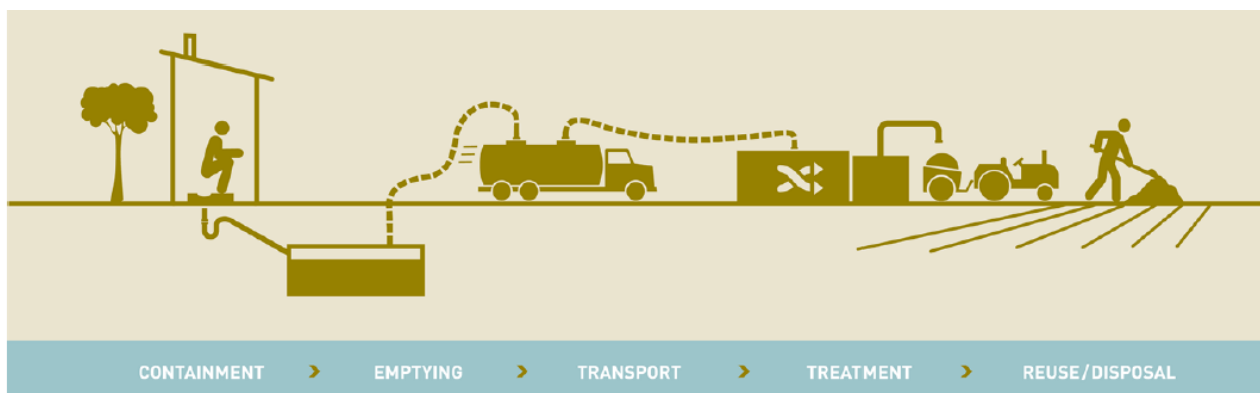


Figure 6-13 The Sanitation Chain

Wastewater is defined as

- domestic effluent consisting of blackwater (excreta, urine and fecal sludge) and grey-water (kitchen and bathing wastewater), or
- water from commercial establishments and institutions, including hospitals, or
- industrial effluent, storm water and other urban run-off.

Sanitation services have, mainly understandably, been given less priority than water supply since people tend to grant more urgency to the provision of water. Access to improved sanitation can have different interpretations from one country to another. Septic tanks, latrines, river and lake discharge and sewer are on many developing countries the main domestic treatment and discharge facilities. In 2016, among the five treatment and discharge systems, latrine facilities were the commonest.

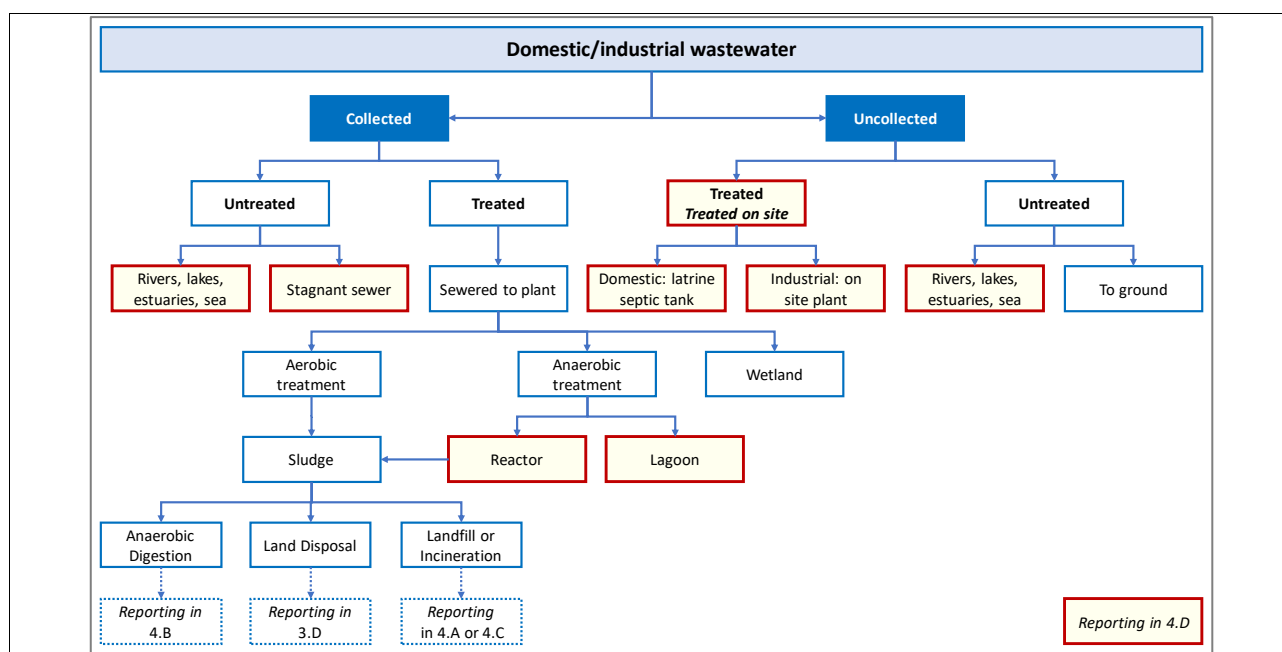


Figure 6-14 Wastewater treatment systems and discharge pathways⁶²

⁶² Source: 2006 IPCC Guidelines, Volume 5: Waste, Chapter 6: Wastewater Treatment and Discharge - Figure 6.1

In most developing countries, data on urban and rural areas are generally scarce and, if available, reliable only for the last year. However, according to available data, wastewater collection in rural areas is very low compared to urban areas.

6.6.1 Domestic wastewater handling (5.D.1)

Emissions from wastewater treatment plants are mainly NH₃ and NMVOC and greenhouse gases. As presented in the EMEP/EEA air pollutant emission inventory guidebook 2023⁶³, NMVOC emissions from WWTPs occur mainly through the volatilization of substances in influents (driven by the concentration differences between the air and the contacting aqueous phase), increased by agitation and forced-air flow, and evaporation (driven by the temperature difference between the air and the aqueous phase). The composition and magnitude of NMVOC emissions depend on the characteristics of the wastewater influents (flow rates, hydrocarbons concentrations) of environmental conditions (mainly the wind speed and the temperature). NMVOC emissions to air from wastewater treatment plants may in some cases be significant in urban areas or in facilities handling wastewater with high hydrocarbon loads and may even contribute significantly at a national level.

6.6.1.1 Emission trends

The following table and graph provide an overview on emissions of air pollutants from *Domestic wastewater handling* for the period 1990-2022. Emissions from *Domestic wastewater handling (5.D.1)* decreased mainly due to ##### ..

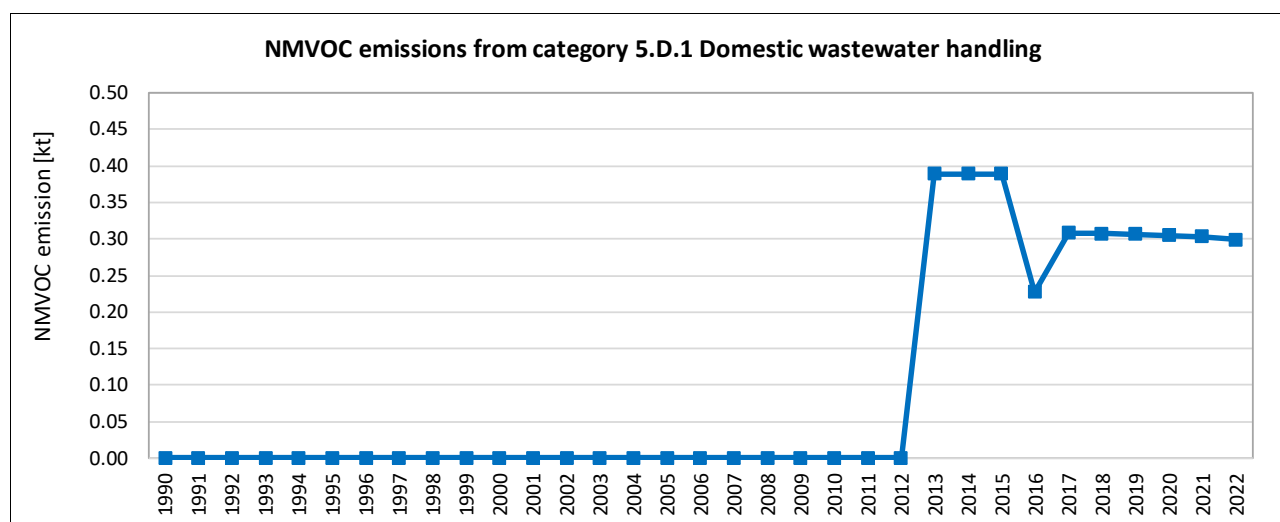


Figure 6.15 Emissions of main pollutants (NO_x, CO, SO_x, NMVOC) from category IPCC/NFR category category 5.D.1 Domestic wastewater handling.

Table 6.30 NMVOC emissions from category 5.D.1 Domestic wastewater handling and related information on population and amount of domestic wastewater handled

Year	Population	Total Amount of Domestic wastewater handled	Wastewater handling rate for domestic waste water	NMVOC Emissions
	capita	1000 m ³	kg per capita	kt
1990	3 286 500	NE	NE	NE
1991	3 259 814	NE	NE	NE

⁶³ <https://www.eea.europa.eu/publications/emep-eea-guidebook-2023/part-b-sectoral-guidance-chapters/5-waste/5-d-wastewater-handling/view>

Year	Population	Total Amount of Domestic wastewater handled	Wastewater handling rate for domestic waste water	NMVOC Emissions
	capita	1000 m ³	kg per capita	kt
1992	3 190 103	NE	NE	NE
1993	3 167 478	NE	NE	NE
1994	3 220 310	NE	NE	NE
1995	3 248 836	NE	NE	NE
1996	3 283 000	NE	NE	NE
1997	3 324 317	NE	NE	NE
1998	3 354 341	NE	NE	NE
1999	3 373 445	NE	NE	NE
2000	3 058 497	NE	NE	NE
2001	3 063 318	NE	NE	NE
2002	3 057 018	NE	NE	NE
2003	3 044 993	NE	NE	NE
2004	3 034 231	NE	NE	NE
2005	3 019 634	NE	NE	NE
2006	3 003 329	NE	NE	NE
2007	2 981 755	NE	NE	NE
2008	2 958 266	NE	NE	NE
2009	2 936 355	NE	NE	NE
2010	2 918 674	NE	NE	NE
2011	2 907 368	NE	NE	NE
2012	2 903 008	NE	NE	NE
2013	2 897 770	25 939	0.009	0.389
2014	2 892 394	25 939	0.009	0.389
2015	2 885 796	25 939	0.009	0.389
2016	2 875 592	15 149	0.005	0.227
2017	2 876 591	20 544	0.007	0.308
2018	2 870 324	20 499	0.007	0.307
2019	2 862 427	20 443	0.007	0.307
2020	2 845 955	20 325	0.007	0.305
2021	2 829 741	20 209	0.007	0.303
2022	2 793 592	19 951	0.007	0.299
Trend				
1990-2022	-15.0%	NA	NA	NA
2005-2022	-7.5%	NA	NA	NA
2021-2022	-1.3%	-1.3%	0.0%	0.0%

6.6.1.2 Methodological issues

6.6.1.2.1 Choice of methods

The emissions were calculated by Tier 1 methodology from the EMEP/EEA air pollutant emission inventory guidebook 2023 ⁶⁴:

$$\text{Emission}_{\text{pollutant}} = \text{Activity Data}_{\text{production}} \times \text{Emission Factor}_{\text{pollutant}}$$

6.6.1.2.2 Choice of Activity Data

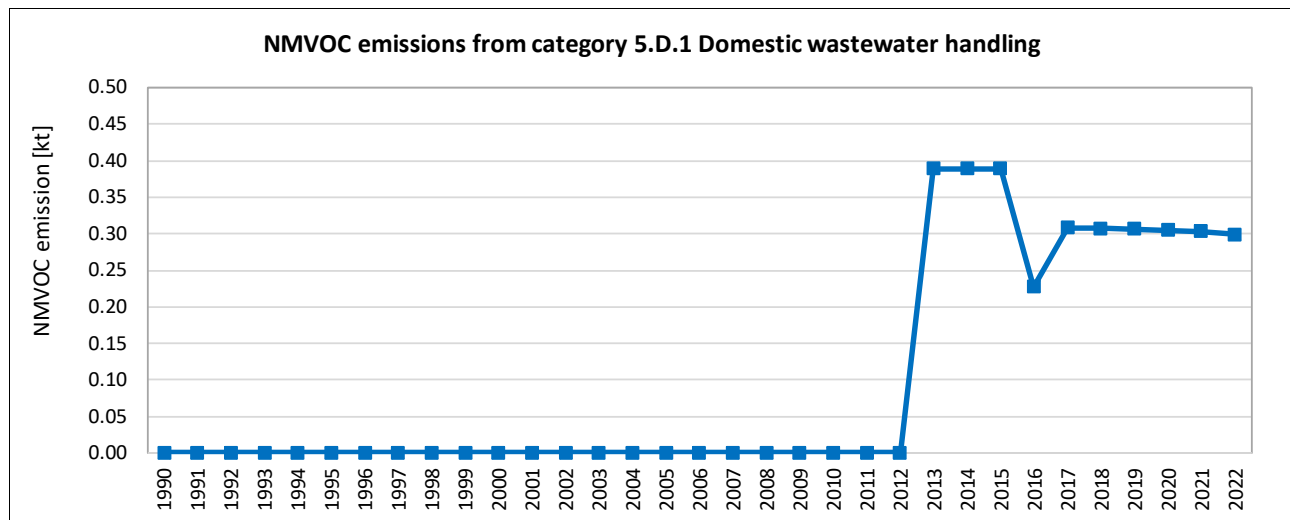


Figure 6.16 Emissions of main pollutants (NO_x, CO, SO_x, NMVOC) from category IPCC/NFR category category 5.D.1 Domestic wastewater handling.

The first wastewater treatment plant (WWTP) in Albania started operating in 2006 and in 2022 the country has 12 WWTPs, serving to around 13 % of the population.⁶⁵ The amount of amount of domestic wastewater handled in treatment plants were available for the period 2013-2021 and was taken from EUROSTAT. The The amount of amount of domestic wastewater handled, the related population and the wastewater handling rate for domestic waste water in Albania is provided in the figure and table above.

⁶⁴ EMEP/EEA air pollutant emission inventory guidebook 2023, Part B sectoral guidance, Chapter 5.D Wastewater handling Available (18.01.2024) on <https://www.eea.europa.eu/publications/emep-eea-guidebook-2023/part-b-sectoral-guidance-chapters/5-waste/5-d-wastewater-handling/view>

⁶⁵ Capacity Building Workshop on Wastewater management in the context of a Circular Economy. Available (18.01.2024) on <https://www.gwp.org/en/GWP-Mediterranean/WE-ACT/Programmes-per-theme/Water-Food-Energy-Nexus/seenexus/albania/capacity-building-on-circular-economy-and-wastewater-treatment/>

6.6.1.2.3 Choice of emission factors

Default emission factors from the EMEP/EEA air pollutant emission inventory guidebook 2023 and are presented in the following table.

Table 6.31 Tier 1 emission factors for source category 5.D.1 Domestic wastewater handling

Pollutant	Value	Unit	Type of EF	Source
NM VOC	15	mg/m ³	Default	Table 3-1 (page 7), EMEP/EEA air pollutant emission inventory guidebook 2023, Part B, Chapter 5.D Wastewater handling; section 3.2.2 Default Emission Factors

6.6.1.3 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.
- time series consistency - plausibility checks of dips and jumps.

6.6.1.4 Source-specific recalculations

The following table presents the main revisions and recalculations done since the last submission to category 5.A Biological treatment of waste - Solid waste disposal on land.

Table 6.32 Recalculations done in category 5.D.1 Domestic wastewater handling

source category	Revisions of data	Type of revision	Type of improvement
5.A	Updated waste water statistics	AD	Accuracy

6.6.1.5 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 6.33 Planned improvements for category 5.D.1 Domestic wastewater handling

Source category	Planned improvement	Type of improvement		Priority
5.D.1	Survey on domestic waste water treatment and managements for the period 1990-2022	AD	Completeness	high

6.6.2 Industrial wastewater handling (5.D.2)

The category 5.D.2 Industrial wastewater handling does occur in Albania but currently no emissions were estimated due to lack of resources and data.

6.6.2.1 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 6.34 Planned improvements for 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"> Waste water treatment and management practices in industry Co-charging of industrial waste water to domestic waste water 	AD	Completeness	high
5.D.2	Estimation of NMVOC emissions from 5.D.2	EMI	Completeness	high

6.6.3 Other wastewater handling (5.D.3)

The category 5.D.3 Other wastewater *handling* does not occur in Albania.

6.7 Other waste (5.E)

The category 5.E *Other waste* does not occur in Albania.

7 Other Sources (NFR 6) and Natural Sources (NFR 11)

7.1 Other Sources (NFR 6)

The sector Other Sources (NFR 6) does not exist in Albania.

7.2 Forest Fires (11.B)

In Albania's forests prescribed burning is not applied. Therefore, all forest fires are categorized as wildfires (include emissions from forest fires occurring naturally or caused by humans).

Emission were not estimated due to lack of data and resources.

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<http://data.un.org/Explorer.aspx>

9 Units and abbreviations

9.1 Units and abbreviations. and standard equivalents

Unit	Abbreviation	Equivalents	Equivalents
1 tonne of oil equivalent (toe)	1 toe	1 x 10 ¹⁰ calories	1 x 10 ¹⁰ 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 ⁴ square meters	10 ⁴ m ²
1 calorie _{IT}	1 cal _{IT}	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 ⁵ kiloWatt hour	2.78 x 10 ⁵ kWh
1 kilowatt hour	1 kWh	3.6 x 10 ⁶ Joules	3.6 x 10 ⁶ J

Source: 2006 IPCC Guidelines. Volume 1: General Guidance and Reporting. Annex 8A.1: Prefixes, units and abbreviations, standard equivalents

9.2 Derived units

Tons			Grams			Equivalents*				
Multiple	Name	Symbol	Multiple	Name	Symbol	Tonnes (t)	Kilograms (kg)	Grams (g)	US/short tons (ST) [†]	Imperial/long tons (LT) [†]
10 ⁰	tonne	t	10 ⁶	megagram	Mg	1 t	1 000 kg	1 million g	1.1023 ST	0.98421 LT
10 ³	kilotonne	kt	10 ⁹	gigagram	Gg	1 000 t	1 million kg	1 billion g	1 102.3 ST	984.21 LT
10 ⁶	megatonne	Mt	10 ¹²	teragram	Tg	1 million t	1 billion kg	1 trillion g	1.1023 million ST	984.210 LT
10 ⁹	gigatonne	Gt	10 ¹⁵	petagram	Pg	1 billion t	1 trillion kg	1 quadrillion g	1.1023 billion ST	984.21 million LT
10 ¹²	teratonne	Tt	10 ¹⁸	exagram	Eg	1 trillion t	1 quadrillion kg	1 quintillion g	1.1023 trillion ST	984.21 billion LT
10 ¹⁵	petatonne	Pt	10 ²¹	zettagram	Zg	1 quadrillion t	1 quintillion kg	1 sextillion g	1.1023 quadrillion ST	984.21 trillion LT
10 ¹⁸	exatonne	Et	10 ²⁴	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>

9.3 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	μ

Source: 2006 IPCC Guidelines. Volume 1: General Guidance and Reporting. Annex 8A.1: Prefixes, units and abbreviations. standard equivalents

9.4 Chemical formulae

Chemical formula	Gas
C	Carbon
CH ₄	Methane
CO	Carbon monoxide
CO ₂	Carbon dioxide
H ₂	Hydrogen
H ₂ S	Hydrogen sulphide
N ₂ O	Nitrous oxide
NO _x	Nitrogen oxides
SO _x	Sulphur oxides
SO ₂	Sulphur dioxide
NM VOC	Non-methane volatile organic compound
F-gases	
NH ₃	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

10ANNEX - NFR Tables

See <https://www.ceip.at/status-of-reporting-and-review-results/2023-submission>

or <https://cdr.eionet.europa.eu/al/un/clrtap>

Table 10.1 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
1A2gvii	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

NFR Code	Long name
1B2c	Venting and flaring (oil, gas, combined oil and gas)
1B2d	Other fugitive emissions from energy production
2	Industrial Processes and Product Use (IPPU)
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

NFR Code	Long name
3B4giii	Manure management - Turkeys
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