Icelandic Environment and Energy Agency

2025

Informative Inventory Report

Emissions of Air Pollutants in Iceland from 1990 to 2023

Submitted under the Convention on Long-Range Transboundary Air Pollution

Informative Inventory Report 2025

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Preface

The Convention on Long-Range Transboundary Air Pollution (CLRTAP) was adopted in 1979 and entered into force in 1983. The Convention has been extended by eight Protocols, of which Iceland has ratified the Protocol on Persistent Organic Pollutants. Furthermore, in 2009 the National Emissions Ceilings Directive (NECD) 2001/81/EC was incorporated to the EEA agreement, with national emission targets set for Iceland for SO_2, NO_x, NMVOCs, and NH_3, for the year 2010.

According to Article 8 of the Convention, Parties shall exchange information on emissions of pollutants. To comply with this requirement and with Directive 2001/81/EC, Iceland prepares an Informative Inventory Report (IIR) each year. The IIR, together with the associated Nomenclature for Reporting Tables (NFR tables) is Iceland's contribution to this round of reporting under the Convention. This report emphasises emissions of persistent organic pollutants (POPs), as Iceland has only ratified the Protocol on Persistent Organic Pollutants (POPs) under the CLRTAP. Emissions of the indirect greenhouse gases (NO_x, CO, and NMVOCs), NH_3, and SO_2 are provided in the NFR tables as they are calculated to comply with the reporting requirements of Directive 2001/81/EC and the United Nations Framework Convention on Climate Change (UNFCCC). Emission estimates for particulate matter (PM), black carbon (BC), and heavy metals (HM) are provided for all sources for which emission factors are available in the most current EMEP/EEA guidebook. A description of the trends and the calculation method for the pollutants are given in this report. Further estimates are provided for SO_2, $PM_{2.5}$, and PM_{10} for the volcanic eruptions at Eyjafjallajökull (2010), Grímsvötn (2011), Holuhraun (2014-2015), Fagradalsfjall (2021), Meradalir (2022), Litli-Hrútur (2023 and Sundhnúksgígar (2023).

The IIR is written by staff at the Icelandic Environment and Energy Agency (*Umhverfis- og Orkustofnun*) (IEEA).

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List of Abbreviations

AAP	Annual Average Populations
AFOLU	Agriculture Forestry and Other Land Use
BAT	Best Available Technology
BREF	Best Available Techniques Reference
CDFRS	Capital District Fire and Rescue Service
CLRTAP	Convention on Long-Range Transboundary Air Pollution
DOAS	Differential Optical Absorption Spectroscopy
EEA	European Environment Agency
EF	Emission Factor
EMEP	European Monitoring and Evaluation Programme
E-PRTR	European Pollutant Release and Transfer Register
ERT	Expert Review Team
ETS	Emissions Trading System
EU	European Union
FAI	Farmers Association of Iceland (*Bændasamtök Íslands*)
GHG	Greenhouse Gas
IEEA	Icelandic Environment and Energy Agency
IEF	Implied Emission Factor
IFVA	Icelandic Food and Veterinary Authority (*Matvælastofnun*)
IGLUD	Icelandic Geographic Land-use Database
IIASA	International Institute for Applied Systems Analysis
IIR	Informative Inventory Report
IMO	Icelandic Meteorological Office (*Veðurstofa Íslands*)
IPPU	Industrial Processes and Product Use
IRCA	Icelandic Road and Coastal Administration (*Vegagerðin*)
ITA	Icelandic Transport Authority (*Samgöngustofa*)
KC	Key Category
KCA	Key Category Analysis
LTO	Landing and Take-Off
MEEC	Ministry of the Environment, Energy, and Climate (Umhverfis-, orku- og loftslagsráðuneytið)
MI	Ministry of Industries (Atvinnuvegaráðuneytið)
MMS	Manure Management System
MRV	Measurement, Reporting, and Verification
NCV	Net Calorific Value
NEA	National Energy Authority (*Orkustofnun*)
NECD	National Emission Ceilings Directive
NLSI	National Land Survey of Iceland (*Landmælingar Íslands*)
NFR	Nomenclature for Reporting
NK	Nitrogen (N), Potassium (K) ratio
NPK	Nitrogen (N), Phosphorus (P), and Potassium (K) ratio
OECD	Organisation for Economic Co-operation and Development
QA/QC	Quality Assurance/Quality Control
SI	Statistics Iceland (*Hagstofa Íslands*)
SWDS	Solid Waste Disposal Sites
TAN	Total Ammoniacal Nitrogen
TFEIP	Task Force on Emission Inventories and Projections
UNFCCC	United Nations Framework Convention on Climate Change

Pollutants:

Main Pollutants	
BC	Black Carbon
CO	Carbon Monoxide
NH_3	Ammonia
NMVOC	Non-Methane Volatile Organic Compounds
NO_x	Nitrogen Oxides
$PM_{2.5}$	Particulate Matter ≤ 2.5 µm
PM_{10}	Particulate Matter ≤ 10 µm
SO_x	Sulphur Oxides
TSP	Total Suspended Particulate
POPs (Persistent Organic Pollutants)	
HCB	Hexachlorobenzene
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
PCDD	Polychlorinated Dibenzo(P)Dioxins
PCDF	Polychlorinated Dibenzofurans
Heavy Metals	
As	Arsenic
Cd	Cadmium
Cr	Chromium
Cu	Copper
Hg	Mercury
Ni	Nickel
Pb	Lead
Se	Selenium
Zn	Zinc

Notation keys:

IE	Included Elsewhere
NA	Not Applicable
NE	Not Estimated
NO	Not Occurring

Executive Summary

ES.1 Background

The Convention on Long-Range Transboundary Air Pollution (CLRTAP) entered into force in 1983. The Convention has been extended by eight Protocols. Iceland has ratified one of them, the Protocol on Persistent Organic Pollutants (POPs), which entered into force in 2003. According to Article 8 of the Convention, Parties shall exchange information on emissions of pollutants. In 2009, the national emission ceilings directive (NECD) 2001/81/EC was incorporated to the EEA agreement, with national emission targets set for Iceland for SO_2, NO_x, NMVOCs, and NH_3 for the year 2010. At the time of writing, work is underway by the Icelandic government to evaluate and work on the incorporation of the new National Emissions Ceilings Directive (Directive (EU) 2016/2284) into the EEA agreement.

To comply with the requirements of CLRTAP and the NECD, Iceland prepares an Informative Inventory Report (IIR) annually. The IIR, together with the associated Nomenclature for Reporting tables (NFR tables), is Iceland's contribution to this round of reporting under the LRTAP Convention and covers emissions in the period 1990-2023.

This report and the associated NFR tables, as well as reports and data from previous years, are available on the Centre on Emission Inventories and Projections (CEIP)[1].

ES.2 Responsible Institution

The Icelandic Environment and Energy Agency (*Umhverfis- og Orkustofnun*) (IEEA), an agency under the Ministry of the Environment, Energy, and Climate (*Umhverfis-, orku- og loftslagsráðuneytið*) (MEEC), is responsible for the annual preparation and submission of the Icelandic IIR and NFR tables to the CLRTAP. The IEEA participates in meetings under the United Nations Economic Commission for Europe (UNECE) Task Force on Emission Inventories and Projections (TFEIP) and related expert panels, where parties to the Convention prepare and discuss the guidelines and methodologies on inventories.

[1] https://www.ceip.at/status-of-reporting-and-review-results

ES.3 Overview of POPs Emissions

All sources of POPs emissions fall under the Energy, Industry, and Waste sectors; activities belonging to the Agriculture sector do not generate POPs emissions.

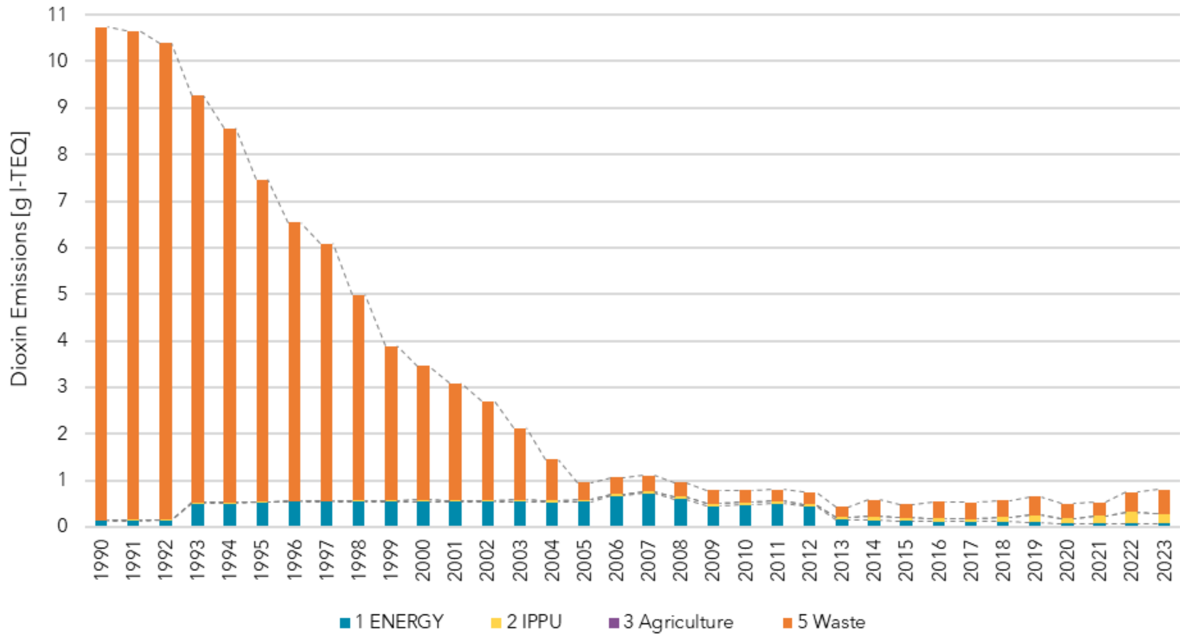


Figure ES.1 Trends in dioxin emissions by source, since 1990.

Dioxin (PCDD/PCDF) emissions decreased substantially over the reported time period (Figure ES.1), due to a significant decrease in the occurrence of open burning of waste. Open burning of waste was a common waste management practice in Iceland before 2004. Iceland's largest waste incineration plant was opened in 2004. It is not equipped with energy recovery systems. The last waste incineration plant with energy recovery was closed in 2013.

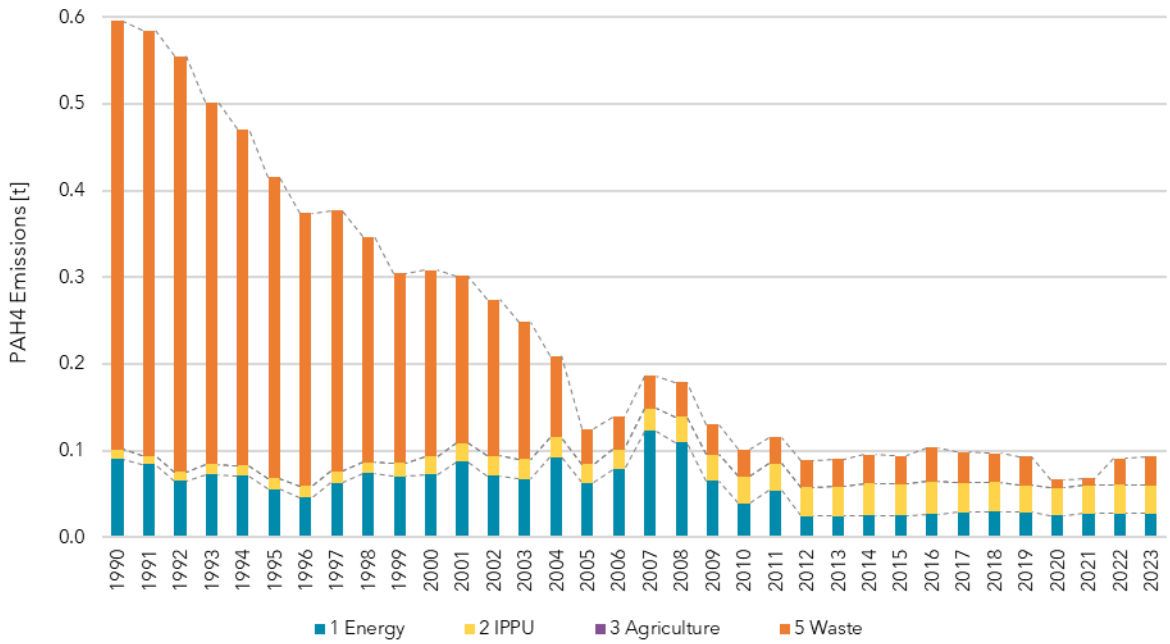


Figure ES.2 Trends in PAH4 emissions by source, since 1990.

PAH4 (Benzo(a)pyrene-BaP, Benzo(b)fluoranthene-BbF, Benzo(k)fluoranthene-BkF, Indeno(1,2,3-cd)pyrene-IPy) emissions also decreased substantially over the reported time period (Figure ES.2), for the same reason as described above for dioxin emissions. The largest contributors of PAH4 emissions in Iceland in recent years are the Metal Industry (Industry sector), Road Transport (Energy sector) and Open Buring of Waste, i.e. bonfires (Waste sector). There are almost no emissions from open burning of waste in 2020 and 2021 as most bonfires were cancelled due to COVID-19.

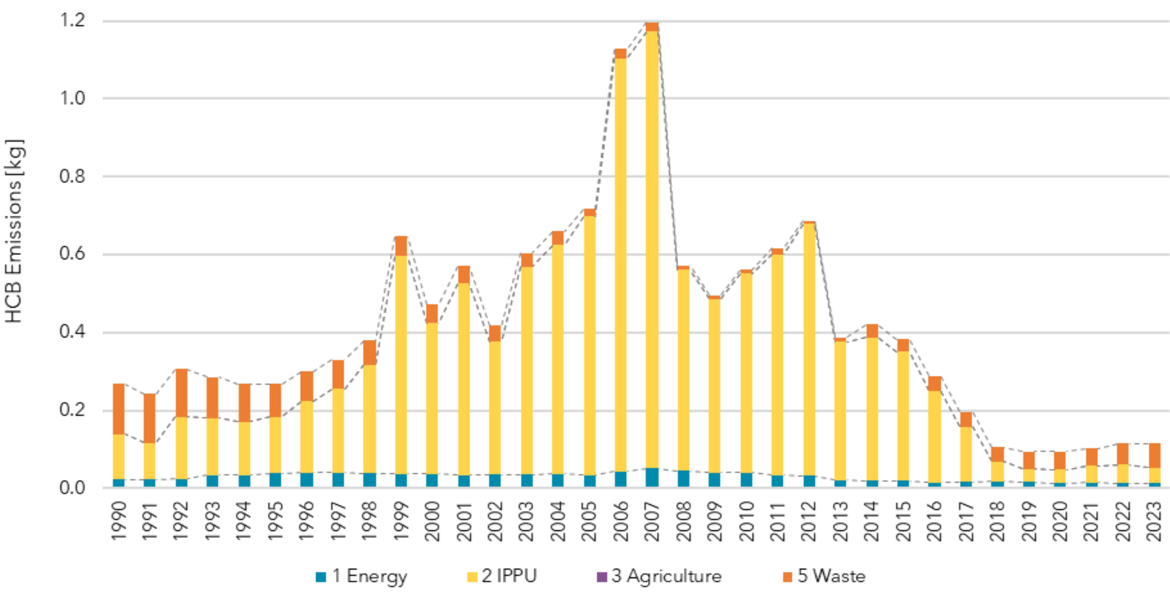


Figure ES.3 Trends in HCB emissions by sector, since 1990.

The estimated hexachlorobenzene (HCB) emissions have fluctuated markedly over the reported time series (Figure ES.3). For most of the time period observed, Fireworks

(Industry sector) were the largest contributor of HCB emissions in Iceland. Those emissions have been decreasing since 2012 after samples of all imported fireworks were tested for HCB and those that contained more than 50 mg/kg were banned. Other main sources of HCB emissions are Clinical Waste Incineration (Waste sector) followed by emissions originating from the Metal Industry (Industry sector) and from Fishing (Energy sector). HCB emissions from the Industry sector increased in 2004 following the opening of a secondary aluminium plant. Open burning of waste was a common waste management practice in Iceland before 2004. However, an increase in the amount of waste incinerated in incineration plants without energy recovery occurred in 2004 while a reduction of the amount of waste burned in the open occurred in that same year. The increase in emissions from the Waste sector in 2014 is linked to an increased quantity of clinical waste incinerated.

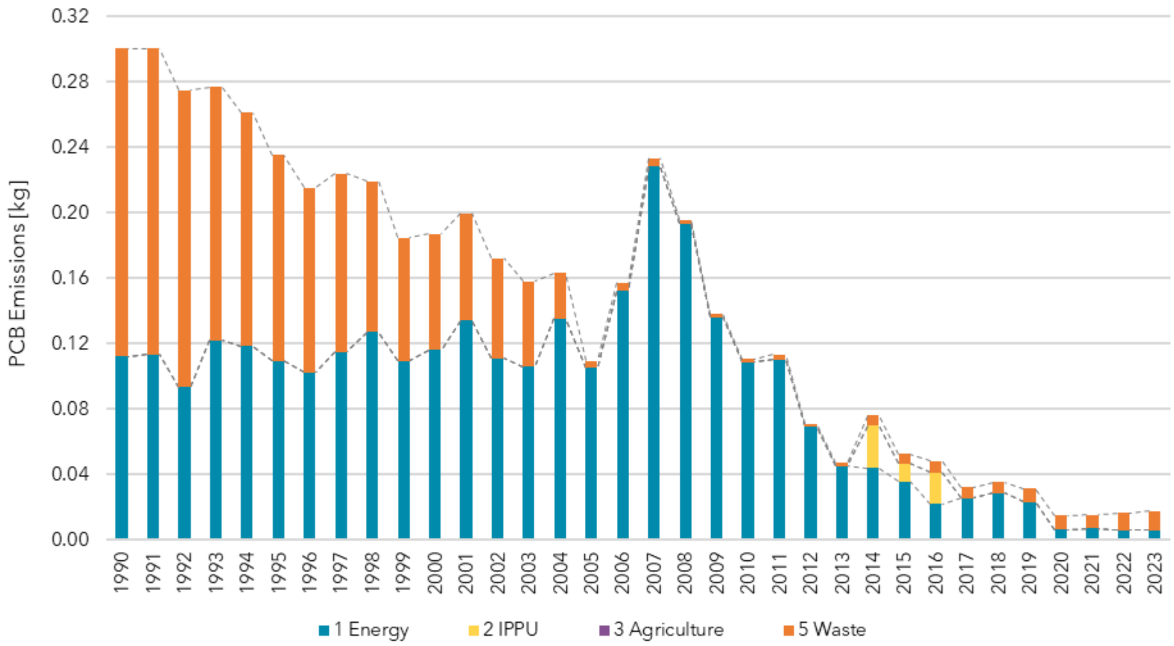


Figure ES.4 Trends in PCB emissions by sector, since 1990.

Polychlorinated biphenyl (PCB) emissions have decreased across the time series (Figure ES.4). Over most of the timeline the largest contributor of PCB emissions in Iceland is fuel consumption by the fishing fleet, primarily diesel oil. The only source of PCB estimated from industrial processes is secondary steel production (2C1), which occurred only for three years (2014-2016). Open burning of waste was a common waste management practice in Iceland before 2004 and the largest source of PCB emissions in 1990 and the years after that. However, an increase in the amount of waste incinerated in incineration plants without energy recovery occurred in 2004 while a reduction of the amount of waste burned in the open was occurring simultaneously.

1 Introduction

1.1 Background Information

The 1979 Convention on Long-Range Transboundary Air Pollution (CLRTAP) was signed by Iceland on 13 November 1979 and ratified in May 1983. The CLRTAP entered into force in August 1983. One of the requirements under CLRTAP is that Parties are to report their national emissions by sources.

CLRTAP has been extended by eight Protocols. Iceland has ratified one of the eight protocols, the Protocol on Persistent Organic Pollutants (Protocol on POPs). It was ratified by Iceland in May 2003 and entered into force in October 2003. By ratifying the protocol Iceland is required to emit less PCDD/F, PAH and HCB annually than in the year 1990. The air pollutant PCB was added with an amendment to the protocol and Iceland ratified that amendment in June 2022. Additionally, Iceland signed the Protocol on Heavy Metals in 1998 but has not ratified it.

In 2009, Directive 2001/81/EC[2] on national emission ceilings was incorporated into the Agreement on the European Economic Area (EEA), with national emission targets set for Iceland for SO_2, NO_x, NMVOCs, and NH_3 as shown in Table 1.1. The targets set were to be reached by 2010 and not to be exceeded thereafter. Iceland did comply with this commitment.

Table 1.1 Emission targets set for Iceland for SO_2, NO_x, NMVOC, and NH_3 according to Directive 2001/81/EC.

Air Pollutant	Emission target [kt]
SO_2	90
NO_x	27
NMVOC	31
NH_3	8

In December 2016, Directive (EU) 2016/2284[3] (National Emission Ceilings Directive, NECD) entered into force in the EU, repealing the previous NEC Directive 2001/81/EC. The new NECD includes the same pollutants as the Directive it replaces, with the additions of obligatory reporting on CO, Cd, Hg, Pb, POPs (PCDD/F (Dioxins/furans), PAH, HCB, PCBs), $PM_{2.5}$, PM_{10}, and BC if available, as well as voluntary reporting on TSP, As, Cr, Cu, Ni, Se, and Zn. At the time of writing, work is underway at the IEEA and the Icelandic government to evaluate and work towards the incorporation of the new National Emissions Ceiling Directive (Directive (EU) 2016/2284) into the EEA agreement; Iceland-specific targets are yet to be determined. In 2020, the International Institute for Applied Systems Analysis (IIASA) carried out an analysis of reduction potentials for Iceland for NO_x, SO_2, NMVOCs, NH_3, and $PM_{2.5}$, which was done in a way comparable to the analysis done by IIASA for the European Union (EU) Member States (see also TSAP Report no 16[4]).

[2] Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants.

[3] Directive (EU) 2016/2284 of the European Parliament and of the Council of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC

[4] http://www.iiasa.ac.at/web/home/research/researchPrograms/air/policy/TSAP_16b.pdf

The present report and associated NFR (Nomenclature for Reporting) tables are Iceland's contribution to the 2025 reporting under the CLRTAP.

Anthropogenic emissions of the precursors (NO_x, CO, NMVOCs, NH_3, and SO_2) are provided in the NFR tables as they are calculated to comply with the reporting requirements of the UNFCCC and of the NECD. Emission estimates for particulate matter (PM), black carbon (BC), and heavy metals (HM) are provided for all emission sources where an EF is provided in the 2023 EEA/EMEP Guidebook. A short description of the trends and the calculation methods for those pollutants are given in this report.

Estimates for SO_2, $PM_{2.5}$, and PM_{10} for the volcanic eruptions at Eyjafjallajökull (2010), Grímsvötn (2011), Holuhraun (2014-2015), Fagradalsfjall (2021, 2022), Litli-Hrútur (2023) and Sundhnúksgígar (2023) are also provided (Chapter 7).

1.2 Protocol on Persistent Organic Pollutants

The Protocol on Persistent Organic Pollutants (POPs) was adopted on 24 June 1998 and entered into force on 23 October 2003. It was amended in 2009, and those amendments were ratified by Iceland on 1 June 2022. It focuses on a list of substances that have been singled out according to agreed risk criteria. The substances comprise pesticides, industrial chemicals, and by-products/contaminants. The ultimate objective is to eliminate any discharges, emissions, and losses of POPs. The Protocol bans the production and use of some products outright, while others are scheduled for elimination at a later stage. Finally, the Protocol severely restricts the use of those products which use is not banned completely. The Protocol includes provisions for dealing with the wastes of products that will be banned. It also obliges Parties to reduce their emissions of dioxins, furans, PAHs, and HCB below their levels in 1990 (or an alternative year between 1985 and 1995), and PCB emissions below the 2005 level (or an alternative year between 1995 and 2010). The PCB reduction requirement was added in the 2009 amendment to the protocol. Of the POPs chemicals only aldrin has been used in Iceland, though not since 1975. DDT and heptachlor have not been used in Iceland since 1975 and were banned in 1996. Lindane (HCH) was used in Iceland until the early nineties. Sales statistics exist for 1990 to 1992, and the use of lindane was banned in 1999. PCBs were banned in Iceland in 1988. Iceland is in compliance with the emission reductions required by this protocol.

1.3 Institutional Arrangements for Inventory Preparation

Article 36 of the Icelandic Act on Public Health and Pollution Control no 7/1988 (*Lög um hollustuhætti og mengunarvarnir*) establishes the responsibility of the Icelandic Environment and Energy Agency (*Umhverfis- og Orkustofnun*) (IEEA), an agency under the Ministry of the Environment, Energy, and Climate (*Umhverfis-, orku- og loftslagsráðuneytið*) (MEEC), for the annual preparation and submission of the national inventory to the CLRTAP. This act also authorises the IEEA to collect all necessary data and information from relevant authorities, institutions, and companies. Figure 1.1 illustrates the flow of information and allocation of responsibilities. The methodologies and data sources used for different sectors are described in more details in the respective sectoral chapters.

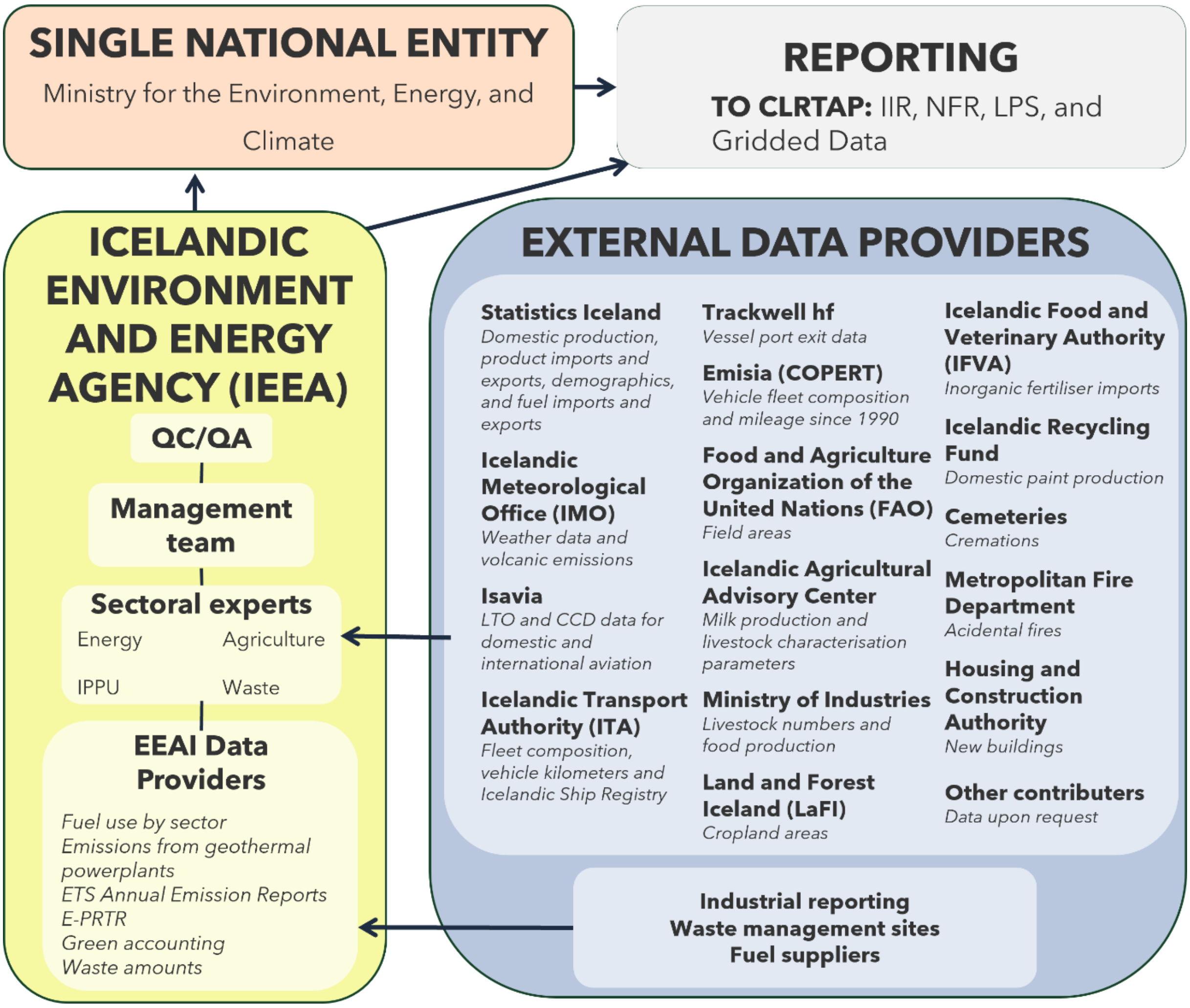


Figure 1.1 Information flow and distribution of responsibilities in the Icelandic emissions inventory system for reporting to the CLRTAP.

1.4 Inventory Preparation

The IEEA collects the bulk of data necessary to calculate yearly emissions, i.e., activity data and emission factors. Activity data is collected from various institutions and companies. In most cases, the same activity data information is used both for the air pollutants inventory (as per this report) and for the National Greenhouse Gas Inventory submitted to the EU according to Regulation 2018/1999 and to the UNFCCC according to Decision 18/CMA.1. Data is gathered according to Icelandic Regulation No. 520/2017 on data collection for the greenhouse gas inventory, as well as provided by various units within the IEEA. The main data streams are the following:

1. The IEEA (previously, the NEA) collects fuel sales data by sector; however, the sectoral split does not entirely match that of the NFR disaggregation, thus the IEEA processes the data to ensure correct attribution to the NFR codes.
2. Additionally, the IEEA collects various additional data through the annual emission reports reported under the European Emissions Trading System (EU ETS (Directive 2003/87/EC) as implemented into Icelandic legislation with Act No. 70/2012 on Climate Change), European

Pollutant Release and Transfer Register (E-PRTR (Regulation (EC) no 166/2006, as implemented into Icelandic legislation with Regulation No. 990/2008), and Green Accounting reports from industry submitted under Icelandic Regulation No. 851/2002

3. The Ministry of industries (MI) (Atvinnuvegaráðuneytið), a new ministry comprising amongst other things what was previously the Ministry for Food, Agriculture, and Fisheries (Matvælaráðuneytið), has been responsible for assessing the size of the animal population each year since 2019. On request by the IEEA, the Farmers Association of Iceland (*Bændasamtök Íslands*) (FAI) assisted the development of a method to account for young animals that are mostly excluded from national statistics on animal population.

4. Statistics Iceland (*Hagstofa Íslands*) (SI) provides information on population, GDP, imports and exports of various products, domestic production, and domestic usage.

5. Data for using the transport model COPERT originates from the NEA, the Icelandic Transport Authority (*Samgöngustofa)* (ITA), the Icelandic Meteorological Office (*Veðurstofa Íslands*) (IMO), and EMISIA SA[5] and used for emission estimates from Road Transport (NFR 1A3b) (see more details in the Energy sector).

6. Aviation emissions are calculated using LTO and CCD data provided by ISAVIA, the national airport and air navigation service of Iceland.

7. Emission factors are mainly taken from the EMEP/EEA Emission Inventory Guidebook (European Environment Agency, 2023) unless otherwise referenced.

8. The IEEA also collects activity data on waste amounts split by treatment pathways and plant-specific emission factors based on measurements from the industry.

A new annual inventory cycle begins with an initial planning of activities for the inventory cycle by the Emissions Inventories Unit and major data providers as needed, considering the outcome of internal and external reviews. The initial planning is followed by a period assigned for compilation of the national inventory and improvement of the National System. After compilation of activity data, emission estimates are calculated, and quality checks performed to validate results.

A series of internal review activities are carried out annually to detect and rectify any anomalies in the estimates, e.g., time series variations, with priority given to key source categories and those categories where data and methodological changes have recently occurred.

1.5 Key Category Analysis (KCA)

A key category is one that is prioritised within the national inventory system because it has a significant influence on a country's total inventory of a given pollutant in terms of the absolute level of emissions, the trend in emissions, or both. Total emissions from the key categories amount to 80% of the total emissions included in the inventory. The KCA has been undertaken based on Approach 1 outlined in the 2023 Guidebook. A KCA has been performed for each pollutant, calculating both the level assessment for the base year (1990) and the most recent inventory year (2023) as well as the trend assessment (1990-2023). Memo items are excluded from the KCA. Table 1.2, Table 1.3, and Table 1.4 present the results of the KCA for main pollutants, POPs, and heavy metals, respectively,

[5] https://www.emisia.com/utilities/copert-data/

for the year 2023. The KCAs for the above-mentioned pollutant categories in 1990 as well as the 1990-2023 trend assessment are presented in KCA Results for 1990 and Trends 1990-2023.

Table 1.2 Key Category Analysis for reported main pollutants in 2023.

Component	Key Categories (Sorted from high to low, from left to right, and from top to bottom)					Total (%)
NO_x	*National fishing*	*Ferroalloy production*	*Aluminium production*	*Road transport: Passenger cars*	*Road transport: Heavy duty vehicles and buses*	82.4%
	NFR 1A4ciii	*NFR 2C2*	*NFR 2C3*	*NFR 1A3bi*	*NFR 1A3biii*	
	53.2%	10.5%	5.8%	4.8%	4.6%	
	Mobile Combustion in manufacturing industries and construction					
	NFR 1A2gvii					
	3.6%					
NMVOC	*Domestic solvent use including fungicides*	*Manure management: horses*	*International aviation LTO (civil)*	*Manure management - Dairy cattle*	*Food and beverages industry*	81.2%
	NFR 2D3a	*NFR 3B4e*	*NFR 1A3ai(i)*	*NFR 3B1a*	*NFR 2H2*	
	14.5%	11.5%	9.9%	9.4%	8.9%	
	Coating applications	*National Fishing*	*Distribution of oil products*	*Manure management - Non-dairy cattle*	*Manure management - Sheep*	
	NFR 2D3d	*NFR 1A4ciii*	*NFR 1B2av*	*NFR 3B1b*	*NFR 3B2*	
	7.5%	6.4%	5.9%	3.9%	3.4%	
SO_x	*Other fugitive emissions from energy production (Geothermal energy)*	*Aluminium production*				95.2%
	NFR 1B2d	*NFR 2C3*				
	72.5%	22.7%				
NH_3	*Animal Manure Applied to Soils*	*Urine and Dung Deposited by Grazing Animals*	*Manure Management - Dairy Cattle*	*Manure Management - Sheep*	*Manure Management - Non-dairy Cattle*	87.9%
	NFR 3Da2a	*NFR 3Da3*	*NFR 3B1a*	*NFR 3B2*	*NFR 3B1b*	
	29.2%	15.2%	15.1%	10.1%	10.0%	
	Inorganic N-fertilizers (includes also urea application)					
	NFR 3Da1					
	8.2%					
$PM_{2.5}$	*Aluminium production*	*Road transport: Automobile Road abrasion*	*National Fishing*	*Construction and Demolition*	*Road Transport: Automobile Tyre and Brake Wear*	81.4%
	NFR 2C3	*NFR 1A3bvii*	*NFR 1A4ciii*	*NFR 2A5b*	*NFR 1A3bvi*	
	34.1%	21.3%	12.4%	5.4%	4.4%	
	Ferroalloys production					
	NFR 2C2					
	3.7%					

Component	Key Categories (Sorted from high to low, from left to right, and from top to bottom)					Total (%)
PM_{10}	*Construction and demolition*	*Aluminium production*	*Road transport: Automobile Road abrasion*	*National Fishing*	*Road transport: Automobile tyre and brake wear*	82.6%
	NFR 2A5b	*NFR 2C3*	*NFR 1A3bvii*	*NFR 1A4ciii*	*NFR 1A3bvi*	
	25.8%	23.9%	18.6%	6.9%	4.0%	
	Quarrying and mining of minerals other than coal					
	NFR 2A5a					
	3.4%					
TSP	*Construction and demolition*	*Road transport: Automobile Road abrasion*	*Aluminium production*	*Quarrying and mining of minerals other than coal*		82.9%
	NFR 2A5b	*NFR 1A3bvii*	*NFR 2C3*	*NFR 2A5a*		
	44.8%	19.4%	14.9%	3.8%		
BC	*Mobile Combustion in manufacturing industries and construction*	*Road transport: Automobile tyre and brake wear*	*Road transport: Automobile Road abrasion*	*Agriculture/Forestry/Fishing: Off-road vehicles and other machinery*	*National fishing*	84.6%
	NFR 1A2gvii	*NFR 1A3bvi*	*NFR 1A3bvii*	*NFR 1A4cii*	*NFR 1A4ciii*	
	22.1%	12.9%	10.3%	9.2%	8.1%	
	Aluminium production	*Road Transport: Passenger Cars*	*Stationary combustion in manufacturing industries and construction:*			
	NFR 2C3	*NFR 1A3bi*	*NFR 1A2e*			
	7.9%	7.2%	7.1%			
CO	*Aluminium production*					96.7%
	NFR 2C3					
	96.7%					

Table 1.3 Key Category Analysis for reported POPs in 2023.

Component	Key Categories (Sorted from high to low and from left to right)					Total (%)
Dioxin	*Clinical waste incineration*	*Ferroalloys production*	*Accidental fires*	*Open burning of waste*		83.1%
	NFR 5C1biii	*NFR 2C2*	*NFR 5E*	*NFR 5C2*		
	27.8%	21.5%	21.0%	12.7%		
PAH4	*Open burning of waste*	*Aluminium production*	*Ferroalloys production*	*Road Transport: Passenger Cars*	*Accidental fires*	82.8%
	NFR 5C2	*NFR 2C3*	*NFR 2C2*	*NFR 1A3bi*	*NFR 5E*	
	25.4%	18.3%	16.7%	12.0%	10.3%	
HCB	*Clinical waste incineration*	*Other product use (Tobacco, Fireworks)*	*Aluminium production*			83.6%
	NFR 5C1biii	*NFR 2G*	*NFR 2C3*			
	48.4%	18.2%	16.9%			
PCB	*Clinical waste incineration*	*National fishing*				96.1%
	NFR 5C1biii	*NFR 1A4ciii*				
	63.3%	32.8%				

Table 1.4 Key Category Analysis for reported heavy metals in 2023

Component	Key Categories (Sorted from high to low and from left to right)					Total (%)
Pb	*Road transport: Automobile tyre and brake wear*	*Aluminium production*	*Domestic aviation LTO (civil)*	*Accidental fires*		87.5%
	NFR 1A3bvi	*NFR 2C3*	*NFR 1A3aii(i)*	*NFR 5E*		
	42.0%	21.2%	16.5%	7.9%		
Cd	*Aluminium production*					95.8%
	NFR 2C3					
	95.8%					
Hg	*National fishing*	*Cremation*	*Road transport: Passenger cars*	*Clinical waste incineration*		85.2%
	NFR 1A4ciii	*NFR 5C1bv*	*NFR 1A3bi*	*NFR 5C1biii*		
	45.0%	17.2%	14.1%	8.9%		
As	*Aluminium production*					90.9%
	NFR 2C3					
	90.9%					
Cr	*Road transport: Automobile tyre and brake wear*	*Aluminium production*				90.3%
	NFR 1A3bvi	*NFR 2C3*				
	53.8%	36.5%				
Cu	*Road transport: Automobile tyre and brake wear*					83.6%
	NFR 1A3bvi					
	83.6%					
Ni	*Aluminium production*					89.8%
	NFR 2C3					
	89.8%					
Se	*National fishing*	*Road transport: Automobile tyre and brake wear*				88.8%
	NFR 1A4ciii	*NFR 1A3bvi*				
	76.7%	12.1%				
Zn	*Aluminium production*	*Road transport: Automobile tyre and brake wear*				88.7%
	NFR 2C3	*NFR 1A3bvi*				
	72.5%	16.2%				

1.6 Quality Assurance & Quality Control (QA/QC)

The objective of QA/QC activities in national inventories is to improve transparency, consistency, comparability, completeness, accuracy, confidence, and timeliness.

1.6.1 Background Information on Iceland's QA/QC Activities

The web application Notion developed by Notion Labs inc. is used as a QA/QC systems management by the Emissions Inventories Unit at the IEEA. It provides a centralised basis for the unit to design, manage, and record its QA/QC activities and improvement plan.

The QA/QC procedures for the national inventory for air pollutants are closely linked to the ones established for the national inventory for greenhouse gases, since the two inventories are produced by the same unit, and in most categories the activity data is the same for both inventories.

Each sector has a live improvement plan. Every item on the plan includes a record of which review report suggested the improvement, if relevant, and is assigned to a sectoral expert. The sectoral expert is then responsible for assessing the feasibility and timeframe for each improvement. The ongoing QA/QC activities ensure that over time, Iceland's inventory submissions continue to improve in quality.

QC procedures are outlined in a general guidance document (one document for both AP and GHG inventories), where general and sector-specific QC activities are listed. The QC guidance document is in line with the QC activities listed in Table 6.1 in the 2006 IPCC guidelines and with the activities detailed in Chapter 5 of Part A.6 of the 2023 EMEP/EEA guidebook. QC activities are clearly outlined in detail and documented in the guidance document in a centralised location (Notion) along with the live improvement plan.

Each subsector has a live progress list for every step of the inventory cycle:

- Implementation of planned improvements
- Compilation of the input data and calculations of emissions
- QC activities
- Report writing

All steps are time-bound and assigned to one or more unit members who are responsible for completing the task and signing it as complete.

1.6.2 Roles and Responsibilities Overview

The overall responsibility over the inventory lies with the head of the Emissions Inventories Unit at the Icelandic Environment and Energy Agency (IEEA), who has overall responsibility for the completion of QA/QC activities, submission, improvements planning, and review coordination. The Emissions Inventories Unit produces both the greenhouse gas (GHG) inventory as well as the air pollutant inventory. Sectoral experts thus calculate emissions from their respective sector both for GHG and air pollutants.

The head of the Emissions Inventories Unit is assisted by the IIR coordinator who oversees daily tasks relating to the generation of the IIR. Within the Emissions Inventories Unit at the IEEA there are two sectoral subgroups within the unit, one Energy/IPPU group and one Agriculture/Waste group. Data collection, processing, QC, and improvements are conducted within each group, in collaboration with the IIR coordinator and the head of unit. The various roles within the Emissions Inventories Unit are described below:

- Head of Emissions Inventories Unit– Overall responsibility for the accurate and timely production and submission of the inventories according to the rules and deadlines specified in relevant domestic and international legislation. The head of unit is responsible for the communication with the Icelandic ministries, as well as communication with the UNECE, the EU and CLRTAP expert review teams. The head of unit is also responsible for the submission process.

- IIR coordinator – Responsible for leading the work on producing the air pollutants inventory.
- NIR coordinator – Responsible for leading the work on producing the greenhouse gas inventory.
- Sectoral Experts – Main knowledge holders on individual inventory sectors. They are responsible for completion of day-to-day data processing and QC activities. Each sector comprises three to four sectoral experts; prior to each submission cycle, it is decided how roles are divided between the sectoral experts, making sure that QC activities are done by someone other than the individual who did the calculations. In addition, each IIR chapter is proof-read by one of the experts not involved in the writing of the chapter. Sectoral experts are responsible for communication with relevant data providers.
- Lawyer – Responsible for all the legal aspects of the inventory work, such as examining new legal texts, implementing EU regulation into domestic legislation, as well as understanding Iceland's various air pollutants and greenhouse gases commitments.

1.6.3 Quality Assurance (QA)

Iceland's air pollutant inventory has been undergoing regular CLRTAP reviews in recent years. It was subjected to a Stage 3 in-depth review in 2020, as well as Stage 3 ad-hoc reviews in 2022 and 2023. A review of projections for this year and a review of the transport sector is scheduled for 2026.

In many categories, activity data used for the air pollutant inventory are the same as those used for the greenhouse gas inventories. Regular reviews of the GHG inventory thus also contributes to increased quality of the air pollutant inventory, and QA of the GHG inventory often leads to QA of the air pollutant inventory.

Further QA is provided by Iceland's collaboration with consultants at Aether Ltd., who assist with and review sector-specific methodological choices and calculations. As part of this collaboration, the calculations for the Agriculture and Waste sectors, as well as the aviation subsector (under Energy) were revised and improved in recent years.

Iceland participates in a Nordic inventory experts' working group, funded by the Nordic Council of Ministers and focussing on comparisons of emission factors across Nordic countries, where inventory compilers from Norway, Sweden, Finland, Denmark, and Iceland meet regularly to discuss specific topics/sectors/air pollutants.

Furthermore, Iceland participates in the annual TFEIP meetings.

1.6.4 Quality Control (QC)

The unit uses standardised notation protocols in the calculation files to document changes, possible issues, and necessary improvements. This is done via an excel tool ("Q Comments"), which allows the documentation of changes and flagging of issues by use of comments starting with hashtags including the initials of the inventory compiler/QC reviewer, the date, and one or more flags pertaining to the type of issue (such as, for instance, potentially identified issue, transparency issue, or reason for change). A summary of all comments can be generated for each calculation file, enabling for instance someone performing QC checks to track and verify changes made to the file, as well as check the status of flagged issues. The issues can then either be marked as resolved, addressed immediately, or added to the improvement plan, depending on the type of issue. This tool is an important source of information when QC activities are performed.

Aether also assists Iceland in the development of QA/QC activities and has provided Iceland with several tools running checks on the latest inventory. Those checks include:

- **Recalculation check:** Comparing the values reported in the current and previous versions of the inventory.
- **Negative and zero values checks:** To highlight the occurrence of negative values and zero values in the inventory.
- **Notation keys check:** To summarise the occurrence of each notation key to ensure consistency and accuracy in the inventory.
- **PAHs sum check:** To ensure that the sum of the four reported PAHs equals the reported "total" PAH emissions.
- **Particulate Matter check:** To ensure that reported TSP emissions are greater than or equal to PM_{10}, and similarly that reported PM_{10} emissions are greater than or equal to $PM_{2.5}$.
- **Trends check:** To highlight large changes in emissions between any two adjacent years, that need reviewing.

In all cases, the findings of the checks are reviewed, not only to identify where corrections may be required, but also to consider whether there are any steps of the inventory compilation process that need improvement. This ensures that all results from the QC process feed back into the continuous improvement programme. Further details are available under Annex 1.

As per Article 15 of Regulation (EU) 2020/1208, EU member states, Iceland and Norway are to perform checks on the consistency of the data used to estimate emissions in preparation of the GHG inventories with the data used to prepare inventories of air pollutants pursuant to Directive (EU) 2016/2284, for the year X-2 and for the air pollutants CO, SO_2, NO_x, and NMVOCs. Directive (EU) 2016/2284 has not yet been incorporated into the EEA Agreement, and thus Iceland is not reporting according to that directive. However, as these checks are useful in terms of QA/QC, Iceland performed similar checks with the data reported under the CLRTAP.

Other QC activities include investigating the following:

- Are appropriate activity data, methods, calculations, units, emission factors, and notation keys used?
- Are all data sources well referenced/documented?
- Are the emission estimate files consistent with summary files and NFR outputs?
- Are recalculations properly documented?
- Documentation of performed checks within the emission estimation files and on separate document to track progress and enhance transparency.

The IIR coordinator makes sure to allocate time for all inventory compilers during the inventory preparation cycle for performing the above-mentioned quality checks and assists the compilers regarding the tasks to be carried out and/or implemented.

The general QC procedures in the guidance document are updated regularly, as the sectors continue to be improved. Current sector specific QC check are given in Table 1.6. An example of a general checklist all sectors must complete is given in Table 1.5, details of how to perform the checks and in what order are given in the guidance document. As staff changes and general time restrictions could affect QC procedures, the checklist is divided into three sections: minimum requirements, which have to be carried out each year and do not necessarily require a deep knowledge of the sector and then further controls and checks which require a certain experience within the sector and take also longer time to be performed.

Table 1.5 QC checks performed during the inventory cycle.

Check	Description
1. Activity data	
Activity data source	Is the appropriate data source being used for activity data and is it up to date?
Correct units	Check that the correct units are being used
Consistency	Is the data consistent with previous years?
Documentation	Has the data source been documented and archived correctly?
Colour Coding	Has colour coding been used in a consistent and accurate manner? Are there any significant data gaps or weaknesses?
Notation keys	Review the use of notation keys and the associated assumption to ensure they are correct.
Recalculation	Check values against previous submission. Give reasons where the two values do not match.
Time series consistency	Use recalculations to check for outliers in the data and if the data is time-series consistent.
2. Emission Factors	
Correct units	Check that the correct units and conversion factors are being used. Check unit carry through in calculations.
Emission factor applicability	Where default emission factors are used, are they correct? Is source information provided?
Documentation	Are all emissions factors and conversion factors documented and referenced correctly?
Colour Coding	Has colour coding been used in a consistent and accurate manner? Are there any significant data gaps or weaknesses?
Recalculation	Check values against previous submission. Give reasons where the two values do not match.
Time series consistency	Are the emission factors time series consistent? Use recalculations to check for outliers and make sure any changes between years are explained and documented correctly.
3. Emission Calculations	
Method validity	Are the calculation methods used valid and appropriate?
Correct units	Check that the correct units are being used
Documentation	Is there sufficient documentation?
Notation keys	Review the use of notation keys and the associated assumption to ensure they are correct.
Colour coding	Has colour coding been used in a consistent and accurate manner? Are there any significant data gaps or weaknesses?
Recalculation	Check values against previous submission. Give reasons where the two values do not match.
Time series consistency	Are the emission factors time series consistent? Use recalculations to check for outliers and make sure any changes between years are explained and documented correctly.
Uncertainty	Check all uncertainty calculations. Make sure appropriate equations are being used and check if all uncertainty estimations are sufficiently documented.
4. NFR reporting tables	
Completeness	Make sure all emissions are reported in the NFR reporting tables
Notation keys	Review the use of notation keys and the associated assumption to ensure they are correct.
Accuracy	Cross check emissions in NFR reporting tables with calculation files.

Table 1.6 Sector-specific QC procedures.

Sector	QC Checks
Energy	• Cross-checks with fuel sales data (previously from the National Energy Authority (Orkustofnun) (NEA)) with total input data in calculations files to ensure that all fuels are accounted for. • Regular meetings are held in order to address discrepancies between energy statistics and data used in the inventory. Activity data for the whole time series is checked and the attribution between subsectors is discussed.
IPPU	• Visits with the inspection unit of the IEEA to factories/companies to increase transparency, knowledge, and accuracy through active dialogue with the field. • Review of the IPPU chapter in this IIR by external stakeholders (not every year).
Agriculture	• For the category Mature Dairy Cattle, the correlation between milk yield and feed digestibility is checked. • Data is checked to assure consistency between N deposited on pasture, range and paddock and urine and dung deposited by grazing animals.
Waste	• The Waste sector emissions are presented to the interdisciplinary waste expert group at the IEEA each year for comments. • Data on methane recovery and flaring from waste operators is compared to data on fuel sales statistics.

1.6.5 Planned Improvements for QA/QC Activities

It is planned to interlink QA/QC activities with the KCA and the uncertainty analysis in order to prepare a prioritised improvement plan at the sectoral level as well as for the inventory work in general.

1.7 Uncertainty Evaluation

Work on the uncertainty analysis has started and will be included in next year's submission.

1.8 General Assessment of Completeness

The aim is to make, in the highest possible level of disaggregation, estimates of all known emissions to air in the IIR. The inventory is generally complete, however there are some pollutants and/or categories that have not been estimated at all or only for part of the time series. The activities/pollutants not included in the present submission were not estimated due to lack of emission factors in tables provided in the EMEP/EEA Guidebook, lack of data, and/or due to time constraints in the preparation of the emission inventory which prevented additional work.

1.8.1 Categories Not Estimated (NE)

In the 2020 Stage 3 review, the ERT pointed out to Iceland that NE has a different meaning in the Guidebook and in the NFR tables, and that NA is the correct notation key if there is no default emission factor provided. Therefore, notation keys have been reviewed. Pollutants and NFR categories for which there is an emission factor provided, but are lacking relevant activity data, are noted as Not Estimated and listed in Table 1.7 below.

Table 1.7 List of pollutants not estimated by sector.

NFR Code	NFR Category	Pollutants Not Estimated (NE)	Reason
3Da4	Crop Residues Applied to Soils	NH_3	Relevant activity data not available
5B2a	Composting: Anaerobic Digestion	NH_3	Relevant activity data not available
5D1	Domestic Wastewater Handling	NMVOC	Relevant activity data not available
5D2	Industrial Wastewater Handling	NMVOC	Relevant activity data not available

1.8.2 Categories Reported as Included Elsewhere (IE)

The table below indicates the categories where the notation key IE has been used in the reporting for some or all pollutants.

Table 1.8 Categories included elsewhere.

NFR Code	NFR Category	Pollutants Included Elsewhere (IE)	Reported Under	
			NFR Code	NFR Category
1A4bii	Residential: Household and gardening (mobile)	All	1A2gvii	Mobile combustion in manufacturing industries and construction
2B1	Ammonia production[1]	All	2B10a	Chemical industry: Other[1]
5C1bi	Industrial Waste Incineration	NO_x, SO_2, PM, BC, CO	5C1a	Municipal Waste Incineration
5C1bii	Hazardous Waste Incineration	NO_x, SO_2, PM, BC, CO	5C1a	Municipal Waste Incineration
5C1biii	Clinical Waste Incineration	NO_x, SO_2, PM, BC, CO	5C1a	Municipal Waste Incineration
5C1biv	Sewage Sludge Incineration	NO_x, SO_2, PM, BC, CO	5C1a	Municipal Waste Incineration

[1] Reported for the years 1990-2004.

A recalculation file is used to identify and document all recalculations. This QC file compares Year x-3 (the latest year which exists in both inventories) and the base year (1990) for the current and previous submissions for all pollutants. The file has been compiled to enable any changes in the data to be easily identified and justifications for changes provided where required. As far as possible, the recalculation check includes all reported sectors.

The main sector-specific recalculations and improvements done for this submission are mentioned below for each sector, and all recalculations are described in more details in each subsector in the relevant chapter.

1.8.3 Energy

The main improvements and recalculations in the Energy sector are listed below.

- Update in emission factors from the 2019 to the 2023 EMEP/EEA Guidebook.
    - New emission factors for biomethane led to recalculations of pollutants from biofuels in the years 2002-2009. Categories affected: 1A1ai.
    - The emission factor for dioxin and all the four PAH4 for LPG is NA in the 2023 EMEP/EEA Guidebook for stationary combustion. In last submission, the emission factors were taken from the 2019 EMEP/EEA Guidebook. This led to recalculations of dioxin, BaP, Bbf, BkF, IpY and PAH4 for the years when LPG was used. Categories affected: 1A2, 1A4ai, 1A4bi, 1A4ci, 1A5a.

- A more precise NVC for diesel was obtained for the years 2021 and 2022 resulting in recalculation for these two years for some air pollutants. Categories affected: 1A1ai, 1A1aiii, 1A2, 1A4ai, 1A4bi, 1A5a, 1A2gvii, 1A3eii, 1A4cii.
- The activity data for biomass was updated. Biomass was used 2002-2009 instead of 2003-2007. Categories affected: 1A1ai.
- S content of LPG was corrected. Caused recalculations for the years when LGP was used in stationary combustion. Categories affected: 1A2a, 1A2b, 1A2gviii, 1A4ai, 1A4bi, 1A4ci, 1A5a.
- Unit correction in the emission factor for PCB. Led to recalculation for the whole timeline. Categories affected: 1A4ai.
- Charcoal activity was data added for the years 1990-2018 and updated for the year 2022. This caused recalculation for these years for all air pollutants. Categories affected: 1A4bi.
- Updated methodological improvements in aviation (see in more detail in the chapter about Civil Aviation in the Energy chapter). This led to recalculations for NOx, CO, NMVOC, SO_x, PM, BC, and dioxin for the whole timeline. Categories affected: 1A3a.
- Update in COPERT led to recalculation in road transport (see in detail in the chapter about Road Transport in the Energy chapter). This led to recalculation of most air pollutants. Categories affected: 1A3b.
- Tier upgrade in navigation from tier 1 to tier 2 (see in detail in the chapter about International and Domestic Navigation in the Energy chapter). This led to recalculation of all applicable air pollutants. Categories affected: 1A3dii, 1A3di(i), and 1A4ciii.
- Activity data for distribution of oil products is now the total fuel sold (instead of the total imported fuel) which is considered to be more representative of oil distributed. This caused recalculations for the whole timeline for NMVOC. Categories affected: 1B2av.
- Correction of a calculation error led to recalculation of SO2 emissions from geothermal energy for the years 2021-2022. Categories affected: 1B2d.

1.8.4 Industrial Processes and Product Use (IPPU)

The main recalculations and improvements for IPPU are:

- In 2A5b Construction and Demolition a change of assignment of buildings categories data provided by the Housing and Construction Authority to types of construction defined in chapter 2.A.5.b, section 3.2, of 2023 EMEP/EEA Guidebook, as well as updated data from IRCA regarding paved road length for the year 2021 necessitated a recalculation for the period from 1990 to 2005, excluding 1993, 1997, 2001, and for the period from 2013 to 2021.
- In 2C2 Ferroalloys Production, one active facility submitted updated measurement values for dioxin, arsenic (As), and chromium (Cr) for the year 2022 in their Green Accounting report to the IEEA, necessitating an update of the reported totals for 2022 of these pollutants.
- In 2C3 Primary Aluminium Production, corrections to the calculations of $PM_{2.5}$ and BC emissions of two plants were applied in accordance with the ratios between TSP, PM_{10}, and $PM_{2.5}$, as derived from table 3.2 of the 2023 EMEP/EEA Guidebook. $PM_{2.5}$ and BC emissions of a third plant were recalculated based on the ratio between PM_{10} and $PM_{2.5}$ derived from measurements done in 2022. Recalculations of $PM_{2.5}$ and BC emission totals affect the entire timeline from 1990 to 2022.

- In 2D3a Domestic Solvent Use Including Fungicides, recalculations within the 2D3a subsector were done since the emissions are now based on population only as in tier 1 but not tier 2b, since no data on product use is available.
- In 2D3d Coating, recalculations were due to updated import data from Statistic Iceland from the year 1995.
- In 2D3e Degreasing, recalculations were due to updated import data from Statistic Iceland from the year 2010.
- In 2D3f Dry Cleaning, recalculations were due to updated data from Statistics Iceland regarding population statistics from the year 2011.
- In 2D3h Printing, recalculations were due to updated import data from Statistic Iceland from the year 1997.
- In 2D3i Organic Solvent Borne Preservative, recalculations were due to updated import data from Statistic Iceland from the year 1997.
- In 2G4 Tobacco and Fireworks, recalculations were made due to updates in import/export data from SI. These recalculations occurred in all air pollutants in this category for the years 2005, 2007-2010, 2020-2022 for Tobacco and for the years 2007, 2009-2010, 2012, 2016, 2018, and 2020 for Fireworks.
- In 2H2 Food and Beverages Industry, the method of estimating NMVOC emissions from beer and malt was changed. In the 2024 submission, it was based on the survey about the diet of Icelanders and the import/export, as in the case of spirits (see above). Now, production data from the main producers was gathered which is considered a better estimate. This led to recalculations for the NMVOC emissions for the whole timeline. Another reason for recalculations were updates in import/export data from SI and updated data from Statistics Iceland regarding population statistics from the year 2011.

1.8.5 Agriculture

The main recalculations and improvements in the Agriculture sector are as follows:

- The 2019 Refinements methodology is now applied for Tier 1 animal categories for emissions from manure management, which results in recalculations of NO_x and NH_3 emissions from manure management, urine and dung from grazing animals and animal manure applied to soils.
- The animal weight of some of the Tier 1 animals was updated, which also affected both NO_x and NH_3 emissions.
- An error was found in the fractions of slurry with and without crust in the Nitrogen flow model, causing recalculations of NO_x and NH_3 emissions for all Cattle subcategories.
- For adult cattle categories the protein content in milk was used instead of the milk fat content in the nitrogen retention calculations, which affected the Nex rate for these categories, and hence, the NMVOC, NO_x and NH_3 emissions.
- Broilers chickens, which are bred for meat production, were previously categorised as Chicken but are now under the category Broiler, resulting in recalculations of NMVOC, NO_x, NH_3 and PM emissions.
- A correction was made to the number of pullets for the whole timeline. The number for pullets in the livestock census data is the AAP number but had been believed to be the

number of animals produced annually. Hence, recalculations of NMVOC, NO_x and NH_3 and PM emissions.

- Activity data on fertiliser types was revisited with a fertiliser expert in the spring of 2024 affecting NH_3 emissions from Inorganic N-fertilisers.
- Other organic fertilizers applied to soils, where updated due to updated activity data on hay and fish sludge and led to recalculation of NO_x and NH_3 emissions.
- Updated cropland area, affecting NMVOC, $PM_{2.5}$, PM_{10} and TSP emissions from 3De Cultivated crops.

1.8.6 Waste

The main recalculations and improvements in the Waste sector are the following:

- Recalculations were made for 5A Solid waste disposal on land for the years 1990-2022 due to updated methodology in the 2023 EMEP/EEA Guidebook for NMVOC. An error in PM emission calculations for 5A1b was fixed as well for the whole timeline.
- No recalculations were made for 5B Biological treatment of solid waste for this submission.
- Recalculations were made for 5C1a Municipal waste incineration, 5C1bi Industrial waste incineration and 5C1bii Hazardous waste incineration due to updated data on the distribution of waste to these categories. This resulted in changes in emissions from NMVOC, NH_3, all metals and POPs. A calculation error was also fixed for PAH in these categories as well as in 5C1biii Clinical waste incineration.
- Recalculations were made for 5C2 Open burning of waste due to updated EF in the 2023 EMEP/EEA GB for NH_3.
- No recalculations were made for 5D Wastewater handling for this submission.
- Recalculations were made for 5E Other waste for the years 1990-2022 due to a calculation error that was fixed for vehicle fires. This resulted in changes in emissions from NMVOC, NO_x, SO_x, CO, $PM_{2.5}$, PM_{10}, TSP, Dioxin, PAH4, Pb, Cd, As, Cr, Cu Ni, and Zn.

1.9 Planned Improvements

Various improvements are planned to increase the overall quality of the inventory and the report. Those include:

- Adding a comprehensive uncertainty analysis.
- Finalising a complete QA/QC plan, covering both AP and GHG inventories, and adding the plan as an annex to the IIR and to the NID.
- Improving the workflow pertaining to keeping track and acting upon comments received by reviewers.

Furthermore, several sector-specific improvements are planned. The main improvements are mentioned below for each sector, and all planned improvements are described in more details in each subsector in the relevant chapter.

1.9.1 Energy

For future submissions the main improvements are:

- to determine constant proportion between the three Mobile Machinery categories for 1990-2018.
- in collaboration with the ITA, to develop procedures to obtain enhanced data on vehicle stock and mileage data for COPERT.

1.9.2 Industrial Processes and Product Use (IPPU)

The main improvements planned for the IPPU sector consists of:

- harmonising the reporting under CLRTAP with the reports under the E-PRTR Regulation (E-PRTR, according to Icelandic Regulation No. 990/2008, which implements Regulation (EC) no 166/2006 concerning the establishment of a European Pollutant Release and Transfer Register).
- for the future submissions, the production data from the IRCA for the most recent years will be updated to more accurate data.

1.9.3 Agriculture

The main improvements planned for the Agriculture sector consists of:

- continuing to update the method for calculating NMVOC emissions from manure management from Tier 1 to Tier 2 for Sheep. This requires a detailed investigation into which data are easily available in Iceland and which data need to be collected specifically for this task.
- improving the registration of different inorganic N fertiliser types in our inventory for future submissions.

1.9.4 Waste

The main improvements planned for the Waste sector consists of:

- To obtain, for future submissions, the activity data necessary to estimate emissions from wastewater handling and review the methodology to estimate emissions from accidental fires.
- to obtain data on the amount of nitrogen in the waste inserted into the anaerobic digestion plant GAJA, to be able to estimate NH_3 emissions in 5B2.

2 Trends in Emissions

2.1 Emissions Profile in Iceland

The emissions profile for Iceland differs from that of other European countries for a number of reasons:

- Emissions from the generation of **Electricity and Space Heating** are low due to the widespread use of renewable energy sources. Almost all electricity in Iceland is produced with hydropower (around 70%) and geothermal power (around 30%), with wind power and fossil fuel-derived power accounting for less than 0.1%.
- **Geothermal Energy** is used for space heating in over 90% of all homes. It should be noted, however, that significant amounts of sulphur are emitted from geothermal power plants as hydrogen sulphide (H_2S).
- Around 90% of the fuel used in the Energy sector is used by **Mobile Sources** (Transport, Mobile Machinery, and Fishing Vessels).
- Emissions from **Industrial Processes**, especially from non-ferrous metal production, contribute a higher share of total emissions in Iceland than in most other countries. Around 75% of the electricity produced in Iceland is now used in the metal production industry. The production capacity has increased considerably since 1990.

The emissions profile of Iceland is further influenced by the fact that Iceland was severely affected by a financial collapse in 2008, when its three largest banks collapsed. In the years preceding the crisis, the economy experienced a significant upswing, resulting in an increase in fuel consumption. The crisis resulted in a serious contraction of the economy, and as a result oil consumption decreased. The result of this can be seen in several pollutants associated with fuel consumption, with a clear peak in 2007, or the years preceding the crisis. In recent years, the economy has recovered, and the tourism sector has increased significantly, leading to rising fuel consumption. In 2020, the country again experienced an economic downturn as a result of the COVID-19 Pandemic.

2.2 Emission Trends for SO_x, NO_x, NH_3, NMVOC, PM, BC, and CO

The total amount of SO_x, NO_x, NH_3, NMVOC, PM_{10}, $PM_{2.5}$, TSP, BC, and CO emissions in Iceland in 1990 and the latest year is presented in Table 2.1. The emissions of SO_2 have increased significantly since 1990 levels. This includes H_2S from geothermal plants; all sulphur species emitted are to be reported as SO_2 equivalents. CO emissions have approximately doubled since 1990. The most significant decrease in emissions are BC emissions, which have roughly halved since 1990 levels.

Table 2.1 Emissions of SO_x, NO_x, NH_3, NMVOC, PM, BC, and CO in 1990 and 2023.

	SO_x [kt SO_2]	NO_x [kt NO_2]	NH_3 [kt]	NMVOC [kt]	PM2.5 [kt]	PM10 [kt]	TSP [kt]	BC [kt]	CO [kt]
1990	23.0	24.7	5.17	8.85	1.34	2.98	6.37	0.223	56.9
2023	46.4	13.8	4.54	4.65	1.10	2.32	4.45	0.089	107
Change 1990-2023	102%	-44%	-12%	-47%	-18%	-22%	-30%	-60%	89%

For the current inventory year, the emissions of all pollutants included in the NECD 2001/81/EC were below the emission maxima set by the 2001 NECD, as shown in Table 2.2.

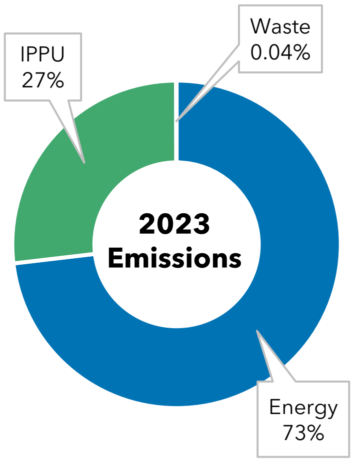
Table 2.2 Emissions of SO_x, NO_x, NH_3, and NMVOC compared to their respective NECD 2001/81/EC target.

Pollutant	Target	Notes
SO_x	90 kt	Has not been exceeded during the reporting period.
NO_x	27 kt	Emissions have been below the target since 2008.
NH_3	8 kt	Emissions have been stable between 4 and 5 kt since 1990.
NMVOC	31 kt	Emissions have been decreasing steadily since 1992 when the maximum NMVOC emissions occurred (9.5 kt in that year).

As of March 2025, no emission targets have been set yet for Iceland for 2030 and the incorporation of the new NECD (Directive 2016/2284) into the EEA is still pending.

2.2.1 Trends in SO_x Emissions

Total emissions in this inventory year: **46.4 kt**

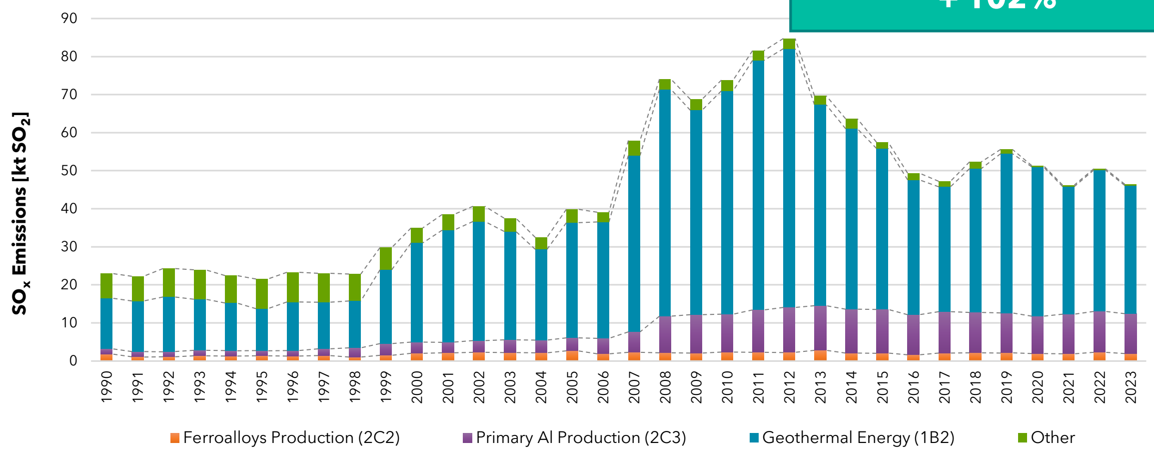


SO_x (SO_2)

The main sources for SO_x include:

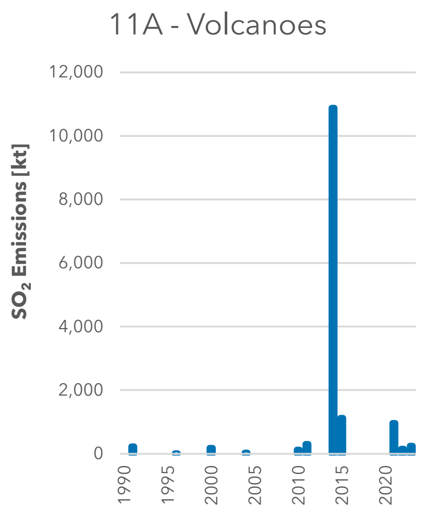
- **Geothermal Energy (1B2d):** Geothermal energy is the largest source of sulphur emissions in Iceland. Emissions have increased substantially since 1990 due to increasing geothermal energy production. A sulphur capture and storage project started in 2014 which proportionally lowers the SO_x emissions per production unit.
- **Metal Production (2C):** Emissions from industrial processes are dominated by aluminium and ferroalloy production. SO_2 emissions were relatively stable until 1998, after which there has been a great expansion of the metal industry. Sulphur comes mostly from impurities in the carbon reductants used in the metal production process.

Change over the timeseries:
+ 102%



Volcanic eruptions contribute significantly to sulphur emissions (11A, memo). Emissions from this source are reported as a memo item and do not contribute to the national total. The last three eruptions are:

- **2023:** Sundhnúksgígar. An eruption characterised by high lava flow rates along a 4 km fissure during its first hours, but the eruption was considered over by day 4.
- **2023:** Litli-Hrútur. A 700–800-meter fissure opened rapidly. After 24 hours, activity has significantly decreased and eventually concentrated into one single crater.
- **2022:** Meradalir. A fissure eruption that started in August and lasted 18 days. It is part of the same volcanic system as the Fagradalsfjall eruption.



The trend overview for SO_x emissions is provided above. The main source of SO_x emissions is geothermal power plants. The overall trend in the emissions can mostly be explained by changes within the emissions from the geothermal power plants. Other sources are metal production and fishing ships. SO_x emissions in Iceland are mainly from the subsectors described below. The emissions from these sources can be seen in Table 2.3.

- **Geothermal Energy (1B2d):** Geothermal energy exploitation is the largest source of sulphur emissions in Iceland. Sulphur is emitted from geothermal power plants in the form of H_2S. Emissions have increased substantially since 1990 due to electricity production at geothermal power plants increasing more than 20-fold since 1990. Since 2014 a sulphur capture and storage project (*Sulfix*) has been operated at one of the geothermal power plants (*Hellisheiði Power Plant*). *SulFix* consists of separating H_2S from the steam and also reinjecting the gas into the subsurface and mineralising on contact with the basalt host rock. About 5-8 kt are captured and stored annually.
- **Aluminium Production (2C3):** Aluminium is currently produced at three primary aluminium plants in Iceland. Sulphur emissions are due to the S content of alumina and electrodes in the production process. The emissions rose slightly in 1998 due to the opening of a new facility, and more significantly in the period 2006-2008 due to an expansion of one facility and the onset of operations at a new facility. The emissions from primary Al production have been relatively stable since 2008.
- **Ferroalloys Production (2C2):** Currently, two factories produce ferroalloys in Iceland. One company has been producing FeSi75 since 1979 and another one started production of ≥98.5% pure silicon metal in 2018. A third company was operating between 2016-2017 producing silicon metal but stopped production in 2017. Sulphur emissions are due to the S content of the reducing agents in the production process.

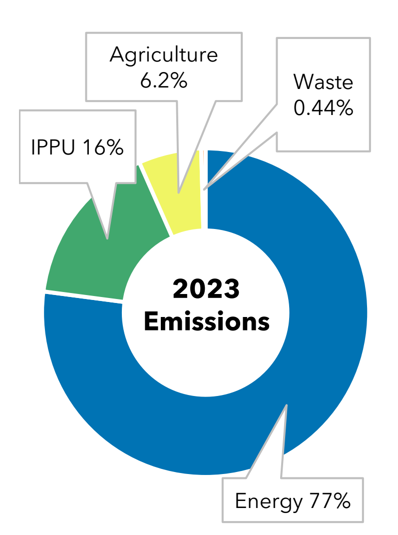
Table 2.3 SO_x emissions by main sources since 1990 [kt SO_2].

SO_x Emissions [kt SO_2]	1990	1995	2000	2005	2010	2015	2020	2022	2023	Change '90-'23	Change '05-'23	Change '22-'23
Geothermal Energy (1B2)	13.3	11.0	26.0	30.3	58.7	42.4	39.3	37.1	33.7	+152%	+11%	-9.4%
Primary Al Production (2C3)	1.34	1.36	2.94	3.41	9.93	11.5	9.8	10.75	10.5	+689%	+208%	-2.1%
Ferroalloys Production (2C2)	1.85	1.38	2.04	2.64	2.37	2.06	1.95	2.26	1.92	+4%	-27%	-15%
Other	6.44	7.78	3.94	3.49	2.85	1.64	0.338	0.368	0.31	-95%	-91%	-16%
Total [kt]	**23.0**	**21.5**	**34.9**	**39.8**	**73.8**	**57.5**	**51.4**	**50.5**	**46.4**	**+102%**	**+16%**	**-8.1%**

2.2.2 Trends in NO_x Emissions

NO_x (NO_2)

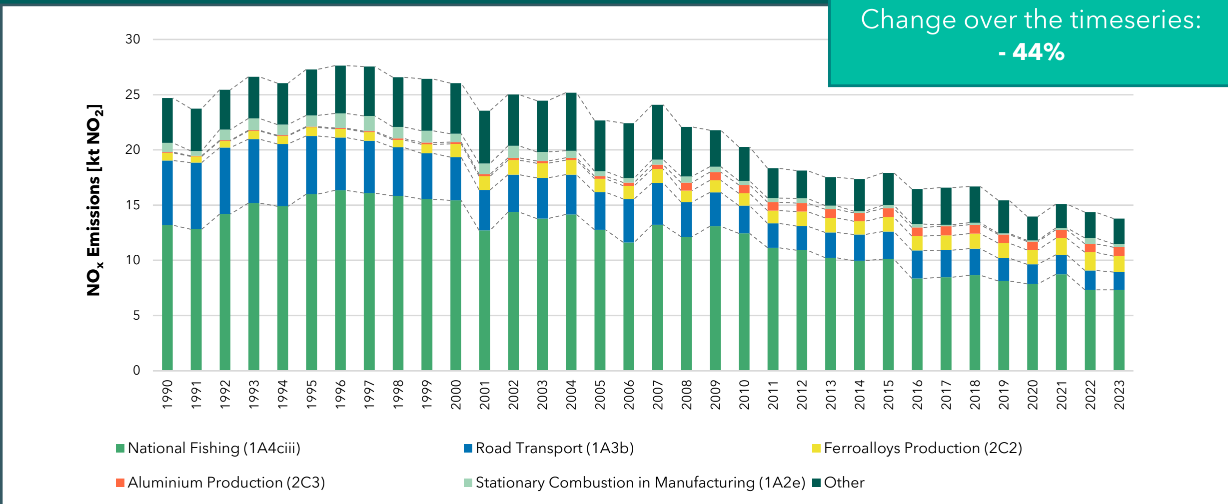
Total emissions in this inventory year: **13.8 kt**



NO_x emissions are dominated by the Energy sector, specifically:

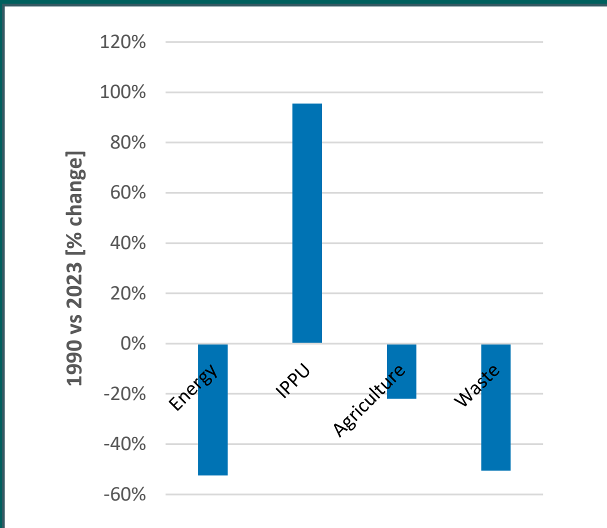
- **Fishing (1A4ciii)**: Emissions from fisheries rose between 1990 and 1996 because a substantial portion of the fishing fleet was operating in unusually distant fishing grounds. Since 1996, the emissions have generally been decreasing, with large annual variations due to changes in fish stock size and location. Emissions remain below 1990 levels.
- **Road Transport (1A3b)**: Emissions decreased rapidly after the use of catalytic converters in all new vehicles became obligatory in 1995, even though fuel consumption has significantly increased.

Change over the timeseries: **- 44%**



Other sources of NO_2 emissions include:

- **Metal Production (2C):** Since 1990, the production capacity of the metal factories has seen a significant increase, and the NO_x emissions have increased accordingly.
- **Agriculture (3):** The majority of emissions occur due to the application of organic and inorganic fertilisers on agricultural soils.
- **Waste (5):** There are very low emissions from waste incineration, which have steadily declined since 1990.



The trend overview for NO_x emissions is provided above. The main source of NO_x emissions is the fishing fleet. As fuel is burned, nitrogen monoxide (NO) is formed when nitrogen and oxygen react. In the atmosphere, NO oxidises into nitrogen dioxide (NO_2). The overall trend in the emissions can mostly be explained by less fuel usage within the fishing fleet. Other significant sources are metal production and Road Transport. NO_x emissions in Iceland are mainly from the subsectors described below. The emissions from these sources can be seen in Table 2.4.

- **National Fishing (1A4ciii):** The decrease in emissions over the timeline are mainly due to less fuel use within the fishing fleet. However, emissions from fisheries rose from 1990 to 1996 because a substantial portion of the fishing fleet was operating in unusually distant fishing grounds. Since 1996, the emissions have generally been decreasing, not least due to an ongoing fleet renewal towards higher NO_x tier levels after 2000. However, with large annual variations due to annual differences in fish stock size and location. Emissions remain below 1990 levels.
- **Road Transport (1A3b):** Emissions from Road Transport have decreased significantly, (especially from passenger cars) due to the use of catalytic converters from 1995 onwards, despite fuel consumption having significantly increased over the timeline.
- **Ferroalloys Production (2C2):** Emissions of NO_x from Ferroalloys Production follow the production amount. Two factories produce ferroalloys in Iceland. One company has been producing FeSi75 since 1979 and another one started production of ≥98.5% pure silicon metal in 2018. A third company was operating between 2016-2017 producing silicon metal but stopped production in 2017.
- **Aluminium Production (2C3):** Emissions of NO_x emissions from Aluminium Production follow the production amount. Aluminium is currently produced at three primary aluminium plants in Iceland. The increase over the timeline mirrors the expansion of the industry.
- **Food Processing (1A2e):** This sector is primarily comprised of fishmeal production and other food processing. Fishmeal production is a large industry in Iceland and has historically had higher emissions, but in recent years many fishmeal factories have been using electricity instead of fossil fuels, leading to a general downward trend in emissions for this sector.

Table 2.4 NO_x emissions by main sources since 1990 [kt NO_2].

NO_x Emissions [kt NO_2]	1990	1995	2000	2005	2010	2015	2020	2022	2023	Change '90-'23	Change '05-'23	Change '22-'23
National Fishing (1A4ciii)	13.2	16.0	15.4	12.8	12.5	10.1	7.9	7.3	7.3	-44%	-43%	0.0%
Road Transport (1A3b)	5.86	5.27	3.92	3.41	2.50	2.50	1.77	1.75	1.61	-73%	-53%	-8.08%
Ferroalloys Production (2C2)	0.69	0.79	1.20	1.22	1.12	1.30	1.30	1.64	1.45	+109%	+18%	-12.1%
Aluminium Production (2C3)	0.061	0.069	0.17	0.22	0.76	0.80	0.77	0.78	0.80	+1219%	+269%	3.08%
Stationary Combustion in Manufacturing (1A2e)	0.85	1.01	0.75	0.44	0.37	0.30	0.11	0.54	0.29	-66%	-34%	-46%
Other	4.07	4.17	4.57	4.60	3.08	2.91	2.16	2.32	2.31	-43%	-50%	-0.5%
Total [kt]	**24.7**	**27.3**	**26.0**	**22.7**	**20.3**	**17.9**	**14.0**	**14.4**	**13.8**	**-44%**	**-39%**	**-4.0%**

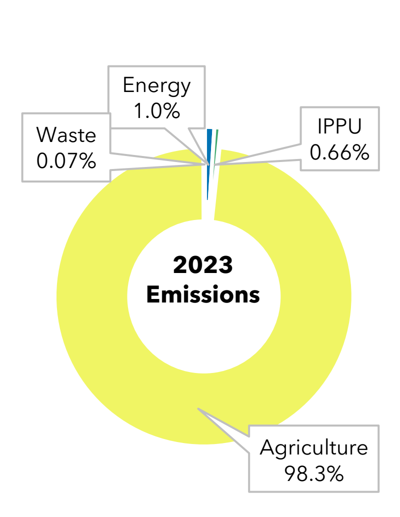
2.2.3 Trends in NH_3 Emissions

NH_3

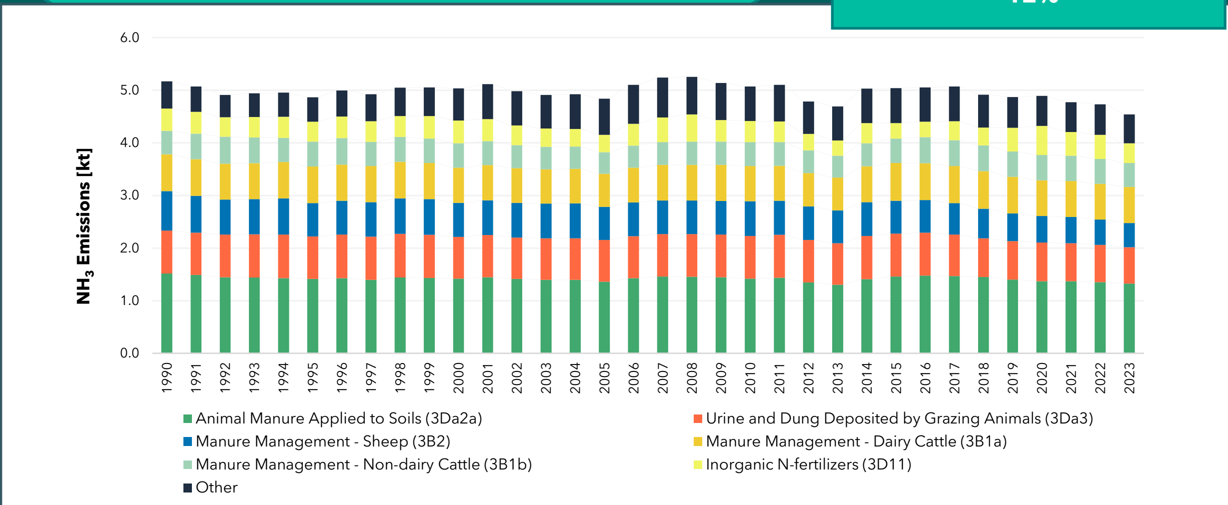
Total emissions in this inventory year: **4.5 kt**

Ammonia (NH_3) emissions mostly originate from the Agriculture sector. Emissions have been fluctuating between 4 and 5 kt NH_3 since 1990. The main driver behind the general trend and its oscillations is the trend in livestock population and fertiliser use. There is also a small amount of NH_3 from other sources, including:

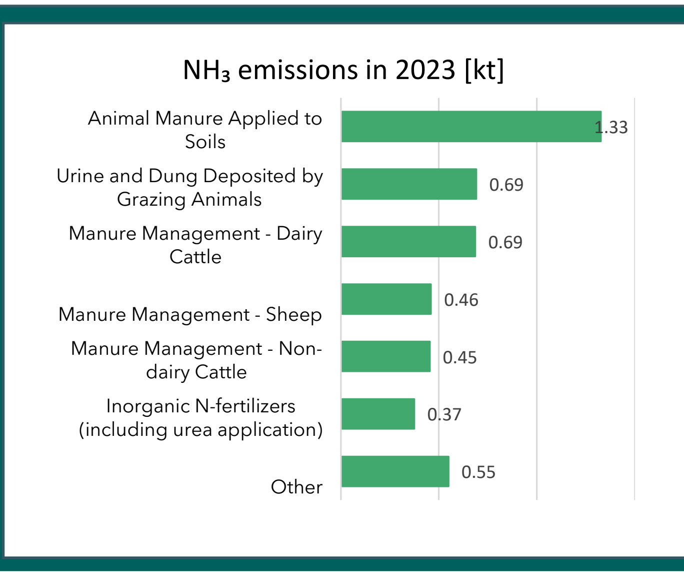
- **Road Transport (1A3b)**: Catalytic converters cause a small amount of NH_3 emissions. Emissions peaked in 2004 but has decreased since then due to a reduction of Euro 1 and 2 vehicles on the roads.
- **Mineral Products (2A)**: Mineral wool production.
- **Other Metal Production (2C7c)**: Capacitor production since 2009.
- **Biological Treatment of Waste (5B)**: NH_3 emissions are released during composting.



Change over the timeseries: **-12%**



- Animal Manure Applied to Soils (3Da2), Manure Management (3B), and Urine and Dung Deposited by Grazing Animals (3Da3) are the main sources of NH_3 in Iceland.
- Sheep and cattle are the livestock categories which have the biggest contribution to ammonia emissions, causing over 80% of NH_3 emissions from manure management.
- NH_3 emissions from Inorganic Fertiliser Application (3Da1) only have a minor contribution to the overall emissions.



The trend overview for ammonia (NH_3) emissions is provided above. The main source of NH_3 is the Agriculture sector. Most of the emissions come from 3Da2 Animal Manure Applied to Soils, 3B Manure Management and 3Da3 Urine and Dung Deposited by Grazing Animals. Emissions have been fluctuating between 4 and 5.5 kt NH_3 since 1990. The trend in NH_3 emissions is relatively steady which is driven by relatively little overall variability in livestock numbers.

NH_3 emissions in Iceland are mainly from the subsectors described below. The emissions from these sources can be seen in Table 2.5.

- **Manure Management (3B):** The main driver behind the general trend and its oscillations is the trend in livestock population of sheep and cattle, as manure management practices have not changed significantly. The population of sheep and dairy cattle has been declining in recent years and the trend in the population of non-dairy cattle is increasing.
- **Animal Manure Applied to Soils (3Da2a):** The main driver behind the general trend and its oscillations is the trend in livestock population as for 3B.
- **Urine and Dung Deposited by Grazing Animals (3Da3):** The main driver behind the general trend and its oscillations is the trend in livestock population as for 3B.

Table 2.5 NH_3 emissions by main sources since 1990 [kt].

NH_3 Emissions [kt]	1990	1995	2000	2005	2010	2015	2020	2022	2023	Change '90-'23	Change '05-'23	Change '22-'23
Animal Manure Applied to Soils (3Da2a)	1.52	1.41	1.42	1.36	1.42	1.46	1.37	1.35	1.33	-12%	-2.43%	-1.89%
Urine and Dung Deposited by Grazing Animals (3Da3)	0.82	0.81	0.79	0.79	0.81	0.82	0.74	0.71	0.69	-15%	-13%	-2.6%
Manure Management - Sheep (3B2)	0.75	0.63	0.65	0.63	0.66	0.62	0.50	0.48	0.46	-39%	-27%	-3.9%
Manure Management - Dairy Cattle (3B1a)	0.70	0.70	0.67	0.63	0.67	0.72	0.68	0.68	0.69	-2.3%	+9.0%	+0.55%
Manure Management - Non-dairy Cattle (3B1b)	0.45	0.47	0.47	0.41	0.46	0.46	0.48	0.47	0.45	+1.7%	+11%	-3.6%
Inorganic N-fertilizers (3D11)	0.42	0.38	0.43	0.33	0.40	0.29	0.55	0.46	0.37	-11%	+13%	-19%
Other	0.94	0.46	0.61	0.69	0.66	0.67	0.57	0.58	0.55	-42%	-20%	-5.3%
Total [kt]	**5.17**	**4.87**	**5.04**	**4.84**	**5.07**	**5.04**	**4.89**	**4.73**	**4.54**	**-12%**	**-6.2%**	**-4.06%**

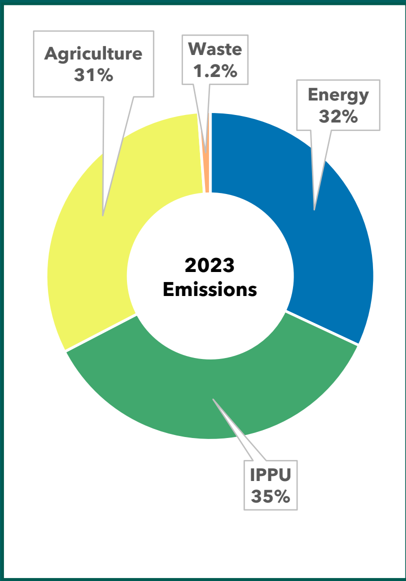
2.2.4 Trends in NMVOC Emissions

NMVOC

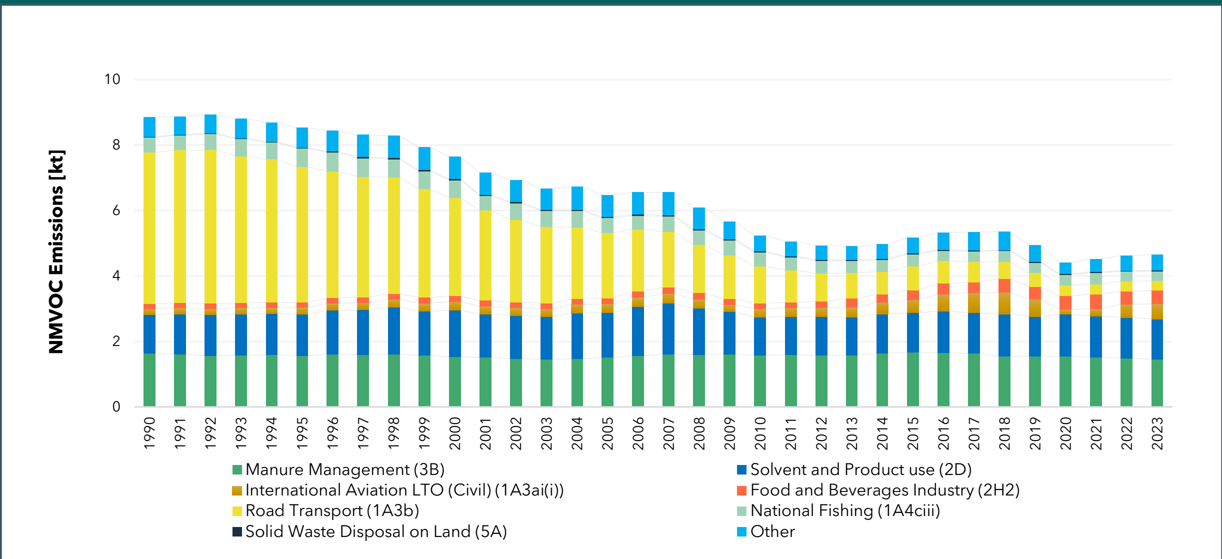
Many sources contribute to NMVOC emissions in Iceland. The main sources are:

- **Solvent and Product Use (2D3):** The main source of NMVOCs linked to solvent use is domestic solvent use, which in turn is linked to population size. The population in Iceland has been increasing steadily since 1990.
- **Manure Management (3B):** Horse and cattle manure management systems are responsible for most of the NMVOC emissions from Agriculture. The variations over the years are mostly linked to livestock population fluctuations.
- **International Aviation LTO (1A3ai(i))**: The long-term increase over the timeline results from an increase in international air travel, with a temporary decrease in 2020 and 2021.
- **Food and Beverage Industry (2H2):** NMVOC emissions are released during the production of beer and other alcoholic beverages. Emissions have increased in recent years.
- **Road Transport (1A3b):** A general decrease in emissions over the timeline exists due to improved emissions-limiting technologies in newer vehicles.
- **National Fishing (1A4ciii):** Emissions in the latest inventory year were around a third lower than the 1990 level. Annual variations are inherent to the nature of fisheries.
- **Solid Waste Disposal on Land (5A):** Emissions have halved over the time series.

Total emissions in latest inventory year: **5.7 kt**



Change over the timeseries: **- 47%**



The trend overview for NMVOC emissions is provided above. NMVOC emissions come from a variety of sources across sectors. The decrease in emissions since 1990 is mainly due to the increased use of newer vehicles with higher emissions standards and emission-reducing technologies. NMVOC emissions in Iceland are mainly from the subsectors described below. The emissions from these sources can be seen in Table 2.6.

- **Solvent and Product Use (2D):** The emissions from solvent and product use have not changed much over the timeline. Some increase is apparent, which can partly be explained by an increasing population and consequent increased usage of solvents.
- **Manure Management (3B):** Horse and cattle manure management systems are responsible for most of the NMVOC emissions from Agriculture. The variations over the years are mostly linked to livestock population fluctuations.
- **Food and Beverages Industry (2H2):** The increase in NMVOC emissions from the food and beverage industry is caused by growing spirit production. In recent years, spirit production has increased, leading to an increase in exports of spirits.
- **Road Transport: Passenger Cars (1A3bi):** The decrease in emissions since 1990 is mainly due to the modernisation of the car fleet with the introduction of more cars with higher emission standards and improved emission-reducing technologies.
- **International Aviation LTO (1A3ai(i)):** A long-term increase over the timeline can be observed which is due growth in the international air travel sector. Emissions peaked in 2018 and are increasing again in 2022 and 2023 after a temporary decrease in 2020 and 2021.
- **National Fishing (1A4ciii):** The decrease in emissions over the timeline is mainly due to less fuel use within the fishing fleet. Emissions from commercial fishing rose from 1990 to 1996 when a substantial portion of the fishing fleet was operating in distant fishing grounds. Emissions in the latest year were around a third lower than the 1990 level. Annual variations are inherent to the nature of fisheries.
- **Solid Waste Disposal on Land (5A):** The declining trend in NMVOC emissions in this category is due to a lower amount of waste being deposited on land.

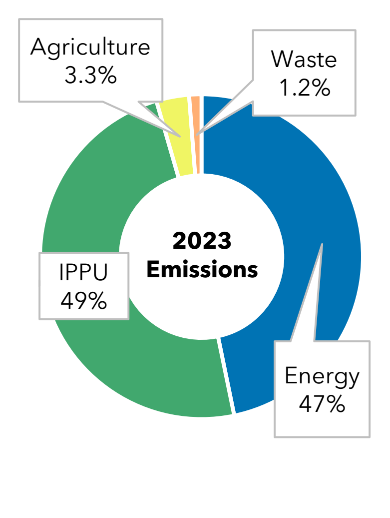
Table 2.6 NMVOC emissions by main sources since 1990 [kt].

NMVOC Emissions [kt]	1990	1995	2000	2005	2010	2015	2020	2022	2023	Change '90-'23	Change '05-'23	Change '22-'23
Manure Management (3B)	1.63	1.56	1.53	1.51	1.58	1.66	1.54	1.49	1.45	-10.8%	-3.75%	-2.7%
Solvent and Product use (2D)	1.18	1.27	1.43	1.37	1.16	1.22	1.29	1.24	1.23	+3.8%	-10.2%	-0.7%
International Aviation LTO (Civil) (1A3ai(i))	0.18	0.21	0.26	0.26	0.25	0.40	0.16	0.40	0.46	+152.2%	+74.9%	14.3%
Food and Beverages Industry (2H2)	0.15	0.16	0.17	0.18	0.18	0.28	0.40	0.40	0.41	+171%	+130%	3.1%
National Fishing (1A4ciii)	0.46	0.56	0.55	0.45	0.44	0.37	0.31	0.30	0.30	-35%	-34%	1%
Solid Waste Disposal on Land (5A)	0.02	0.03	0.03	0.04	0.04	0.03	0.03	0.03	0.03	+17%	-29%	-6%
Road Transport (1A3b)	4.62	4.14	3.00	2.00	1.13	0.73	0.33	0.30	0.29	-94%	-86%	-5.3%
Other	0.60	0.61	0.68	0.67	0.47	0.47	0.34	0.47	0.48	-19%	-27.3%	4%
Total [kt]	**8.85**	**8.53**	**7.64**	**6.47**	**5.23**	**5.17**	**4.40**	**4.63**	**4.65**	**-47%**	**-28%**	**0.5%**

2.2.5 Trends in $PM_{2.5}$ Emissions

$PM_{2.5}$

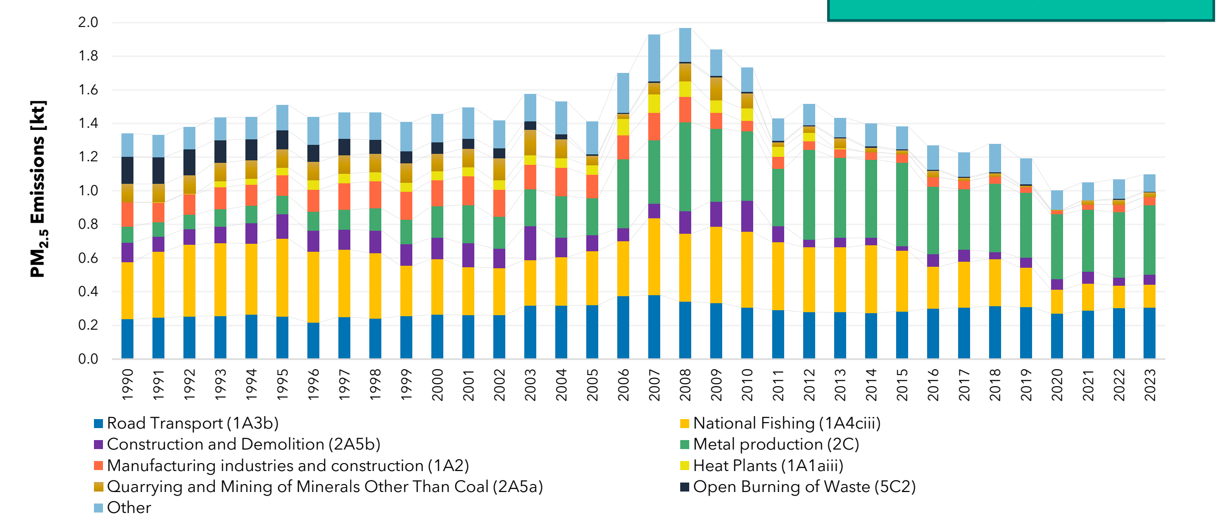
Total emissions in latest inventory year: **1.1 kt**



Emissions of $PM_{2.5}$ are dominated by the Energy and IPPU sectors; the main sources are:

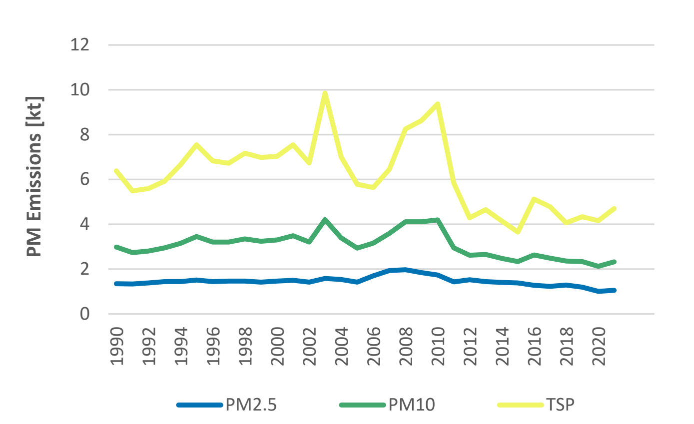
- **Metal Production (2C):** Production capacity in the metal production sector has increased substantially.
- **Road Transport (1A3b):** A general decrease in emissions can be seen. Fluctuations in PM emissions result from the combination of changes in the pollution control standards and an increase in vehicle fleet size.
- **National Fishing (1A4ciii):** Emissions remain below 1990 levels, however there are annual variations due to the inherent nature of fisheries.
- **Construction and Demolition (2A5b):** The emissions from this category are from road and building construction.
- **Open Burning of Waste (5C2):** Open burning of waste resulted in PM emissions in the 1990s.

Change over the timeseries: **-18 %**



Particulate Matter:

Emissions from PM_{10} and Total Suspended Particulate (TSP) follow the same trend as $PM_{2.5}$ and are dominated by the same main sources.



The trend overview for $PM_{2.5}$ emissions is provided above. $PM_{2.5}$ emissions are predominantly derived from 2C Metal Production, 1A3b Road Transport, and 1A4ciii Fishing. The overall decrease in emissions since 1990 can largely be explained by less fuel usage within the fishing fleet.

$PM_{2.5}$ emissions in Iceland are mainly from the subsectors described below. The emissions from these sources can be seen in Table 2.7.

- **Metal Production (2C):** PM emissions from aluminium and ferroalloys production follow the production amount. The increase over the timeline mirrors the expansion of particularly the aluminium industry.
- **Road Transport (1A3b):** Fluctuations in PM emissions result from the combination of changes in the pollution control standards, increased fuel usage, and vehicle kilometres driven.
- **National Fishing (1A4ciii):** The decrease in emissions over the timeline is mainly due to less fuel use within the fishing fleet. Emissions from commercial fishing rose from 1990 to 1996 when a substantial portion of the fishing fleet was operating in distant fishing grounds. Emissions in the latest year were around a third lower than the 1990 level. Annual variations are inherent to the nature of fisheries.
- **Construction and Demolition (2A5b) and Quarrying and Mining of Minerals Other Than Coal (2A5a):** The emissions follow the number of houses built and roads constructed. The main reason for the decrease in PM emissions over the timeline is the reduction in road construction.
- **Manufacturing Industries and Construction (1A2):** Significant $PM_{2.5}$ emissions resulted from the combustion of other bituminous coal for cement production until 2012 when production was stopped. Additionally, food processing causes $PM_{2.5}$ emissions as a result of fuel burning.
- **Open Burning of Waste (5C2):** Open pit burning was a common practice in Iceland the early nineties but has since been stopped. Since 2010, New Year's Eve bonfires, which are heavily regulated, monitored, and restricted, have been the only source of emissions in this category.
- **Heat Plants (1A1aiii):** Waste incineration with energy recovery was occurring between 1993-2013, which caused significant emissions.

Table 2.7 $PM_{2.5}$ emissions by main sources since 1990 [t].

$PM_{2.5}$ Emissions [t]	1990	1995	2000	2005	2010	2015	2020	2022	2023	Change '90-'23	Change '05-'23	Change '22-'23
Metal production (2C)	95	108	188	219	411	496	385	388	415	+337%	+89%	7%
Road Transport (1A3b)	237	254	263	319	305	282	271	303	305	+29%	-4.5%	0.8%
National Fishing (1A4ciii)	340	461	329	324	452	360	143	135	136	-60%	-58%	1%
Construction and Demolition (2A5b)	117	145	128	93	185	29	62	47	60	-49%	-36%	28%
Quarrying and Mining of Minerals Other Than Coal (2A5a)	109	109	103	57	89	22	6.8	28	28	-74%	-51%	0%

$PM_{2.5}$ Emissions [t]	1990	1995	2000	2005	2010	2015	2020	2022	2023	Change '90-'23	'05-'23	'22-'23
Manufacturing industries and construction (1A2)	142	125	153	141	64	51	21	46	46	-68%	-68%	-1%
Open Burning of Waste (5C2)	159	111	67	9.8	7.6	7.1	0.85	7.12	7.1	-96%	-27%	0%
Heat Plants (1A1aiii)	2.3	45.2	55.8	54.9	74.6	0.11	0.00	0.02	0.05	-98%	-100%	103%
Other	139	152	168	195	145	135	114	115	100	-28%	-49%	-12.5%
Total [t]	**1,340**	**1,511**	**1,457**	**1,413**	**1,732**	**1,383**	**1,003**	**1,068**	**1,097**	**-18%**	**-22%**	**2.7%**

Emissions of PM_{10} can be seen in Table 2.8 and Figure 2.1. Emissions of TSP (total suspended particles) can be seen in Table 2.9 and Figure 2.2. The trend descriptions above are also applicable to PM_{10} and TSP trends.

Table 2.8 PM_{10} emissions by main sources since 1990 [kt].

PM_{10} Emissions [kt]	1990	1995	2000	2005	2010	2015	2020	2022	2023	Change '90-'23	'05-'23	'22-'23
Construction and Demolition (2A5b)	1.17	1.45	1.28	0.93	1.85	0.29	0.62	0.47	0.60	-49%	-36%	28%
Road Transport (1A3b)	0.34	0.36	0.39	0.48	0.48	0.48	0.48	0.54	0.55	+61%	+13%	1.2%
Metal production (2C)	0.17	0.20	0.32	0.37	0.59	0.72	0.52	0.57	0.61	+252%	+66%	7%
Quarrying and Mining of Minerals Other Than Coal (2A5a)	0.31	0.31	0.29	0.16	0.25	0.062	0.019	0.079	0.079	-74%	-51%	0%
National Fishing (1A4ciii)	0.40	0.54	0.39	0.38	0.53	0.42	0.17	0.16	0.16	-60%	-58%	1%
Fireworks (2G)	0.011	0.014	0.038	0.064	0.049	0.060	0.049	0.069	0.044	+290%	-30.3%	-35%
Open Burning of Waste (5C2)	0.17	0.12	0.073	0.011	0.0082	0.0077	9.2E-4	7.7E-3	7.7E-3	-96%	-27%	0%
Other	0.39	0.44	0.51	0.53	0.43	0.29	0.25	0.28	0.27	-31%	-48%	-1.8%
Total [kt]	**2.97**	**3.44**	**3.29**	**2.93**	**4.19**	**2.33**	**2.11**	**2.17**	**2.32**	**-22%**	**-21%**	**6.8%**

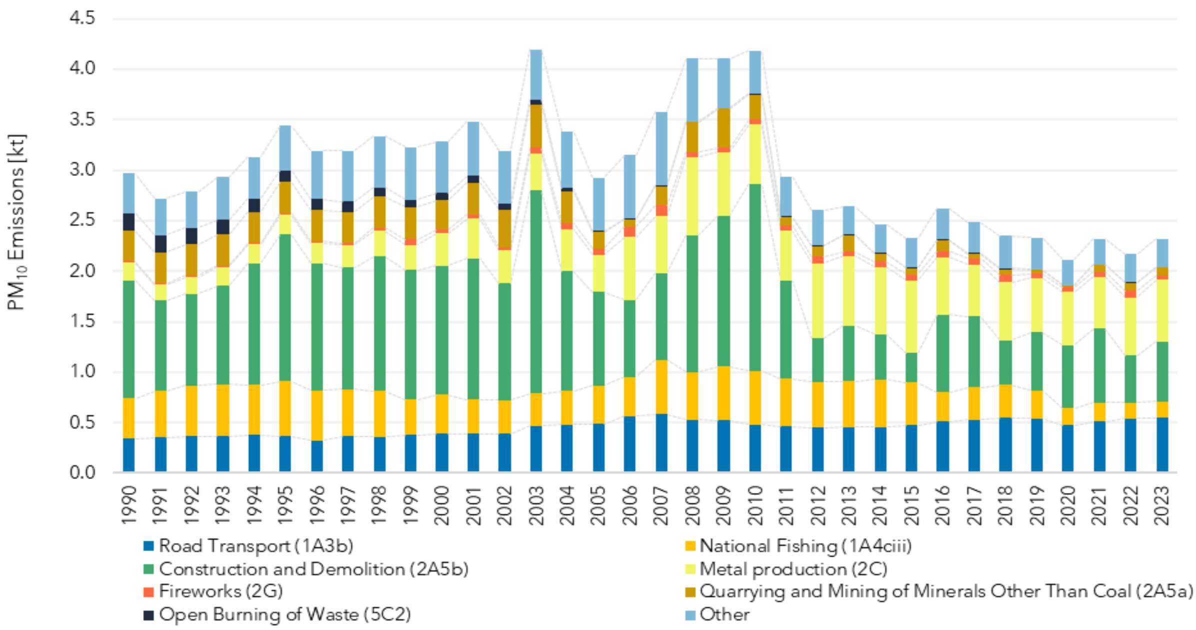


Figure 2.1 PM_{10} emissions by sector, since 1990.

Table 2.9 TSP emissions by main sources since 1990 [kt].

TSP Emissions [kt]	1990	1995	2000	2005	2010	2015	2020	2022	2023	Change '90-'23	Change '05-'23	Change '22-'23
Construction and Demolition (2A5b)	3.91	4.86	4.28	3.10	6.19	0.96	2.08	1.56	1.99	-49%	-36%	28%
Road Transport (1A3b)	0.53	0.57	0.62	0.79	0.81	0.84	0.87	0.99	1.01	+89%	+27%	1.7%
Quarrying and Mining of Minerals Other Than Coal (2A5a)	0.65	0.65	0.62	0.34	0.53	0.13	0.041	0.17	0.17	-74%	-51%	0%
Metal production (2C)	0.21	0.23	0.37	0.44	0.70	0.86	0.62	0.68	0.73	+254%	+66%	7%
National Fishing (1A4ciii)	0.40	0.54	0.39	0.38	0.53	0.42	0.17	0.16	0.16	-60%	-58%	1%
Other	0.66	0.67	0.73	0.71	0.60	0.43	0.38	0.43	0.40	-40%	-44%	-8%
Total [kt]	**6.36**	**7.53**	**7.01**	**5.77**	**9.36**	**3.65**	**4.15**	**3.99**	**4.45**	**-30%**	**-23%**	**12%**

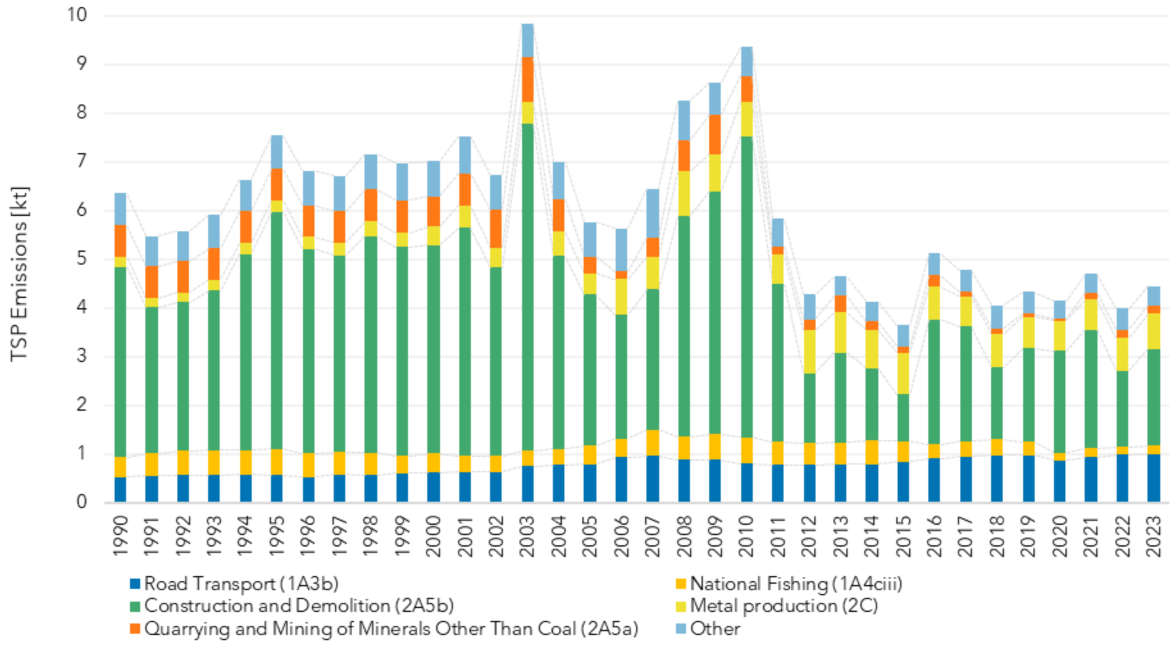


Figure 2.2 TSP emissions by sector, since 1990.

2.2.6 Trends in BC (Black Carbon) Emissions

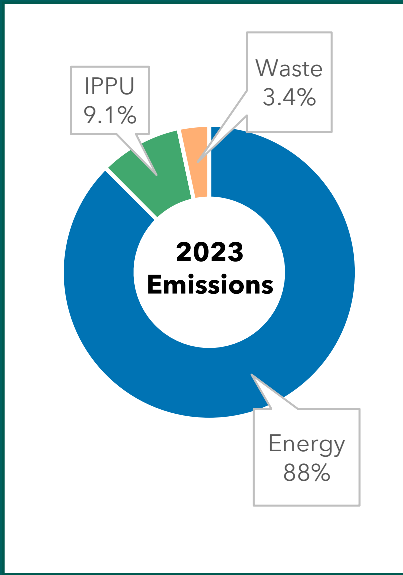
BC

Total emissions in latest inventory year: **89 t**

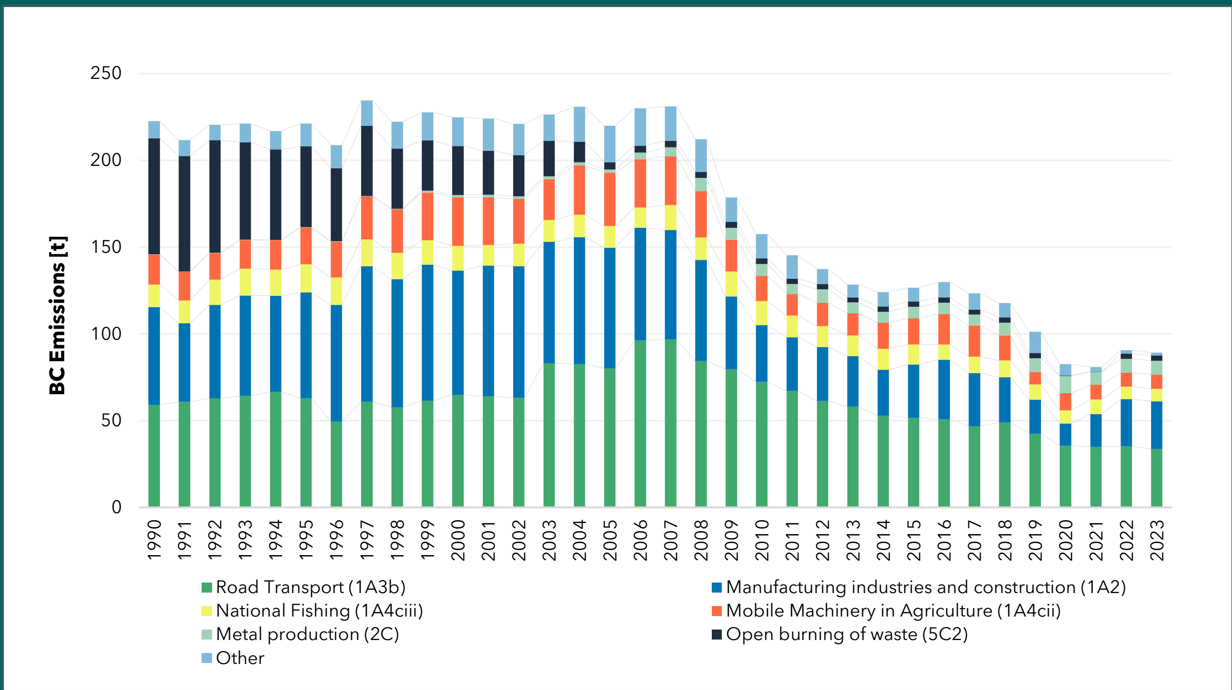
Black carbon contributes relatively few emissions compared to the NECD pollutants. Emissions of black carbon are heavily dominated by the Energy sector. As with SO_x, there are no emissions of black carbon associated with the Agriculture sector. The following sources comprise the majority of black carbon emissions:

- **Road Transport (1A3b)**
- **Manufacturing Industries and Construction (1A2)**
- **Fishing (1A4ciii)**
- **Mobile Machinery in Agriculture (1A4cii)**

After the Energy sector, the next biggest source of black carbon emissions is from Aluminium Production (2C3). Emissions have increased with the expansion of the production capacity of the metal factories.



Change over the timeseries:
- 60%



The trend overview for black carbon (BC) emissions is provided above. Emissions of black carbon are heavily dominated by the Energy sector. As with SO_x, there are no emissions of black carbon associated with the Agriculture sector. The majority of black carbon emissions are from mobile sources. The overall decrease in emissions since 1990 can mostly be explained by less fuel usage and changes in pollution standards.

BC emissions in Iceland are mainly from the subsectors described below. The emissions from these sources can be seen in Table 2.10.

- **Road Transport (1A3b):** A general decrease in emissions can be seen. Fluctuations in BC emissions result from the combination of changes in the pollution control standards and an increase in vehicle fleet size.
- **Mobile Machinery in Agriculture (1A4cii):** Emissions are based on fuel usage within this subsector with a general decrease in emissions over the timeline.
- **Manufacturing Industries and Construction (1A2):** The emissions are mainly from Food Processing (1A2e) and Mobile Combustion in Manufacturing Industries and Construction (1A2gvii). The Food Processing is primarily comprised of fishmeal production and other food processing. Fishmeal production has historically had relatively high emissions, but in recent years many fishmeal factories have been using electricity instead of fossil fuels, leading to a general downward trend in emissions for this sector. During the economic upswing prior to 2008, there was an increase in fuel use for off-road vehicles and other machinery, which caused an increase in emissions followed by a downward trend since then.
- **National Fishing (1A4ciii):** The decrease in emissions over the timeline is mainly due to less fuel use within the fishing fleet.
- **Metal Production (2C):** PM emissions from aluminium and ferroalloys production follow the production amount. The increase over the timeline mirrors the expansion of the industry.
- **Open Burning of Waste (5C2):** Open pit burning was a common practice in Iceland the early nineties but has since been stopped. Since 2010, New Year's Eve bonfires, which are heavily regulated, monitored, and restricted, have been the only source of emissions in this category.

Table 2.10 BC emissions by main sources since 1990 [t].

BC Emissions [t]	1990	1995	2000	2005	2010	2015	2020	2022	2023	Change '90-'23	Change '05-'23	Change '22-'23
Road Transport (1A3b)	59	63	65	80	72	52	36	35	34	-43%	-58%	-4.30%
Mobile Machinery in Agriculture (1A4cii)	17	21	28	31	15	15	9.9	8.2	8.2	-53%	-73%	0.0%
Manufacturing industries and construction (1A2)	56	61	72	70	33	31	13	27	27	-51%	-60%	1%
National Fishing (1A4ciii)	13	16	14	12	14	12	7.5	7.1	7.2	-44%	-42%	1%
Metal production (2C)	0.15	0.17	1.13	1.8	6.8	6.7	9.9	7.9	8.0	+5282%	+342%	2%
Open burning of waste (5C2)	67	47	28	4.1	3.2	3.0	0.36	2.99	3.0	-96%	-27%	0%
Other	9.8	13	16	21	14	8.0	6.5	2.1	1.7	-83%	-92%	-21%
Total [t]	**223**	**221**	**225**	**220**	**158**	**127**	**83**	**91**	**89**	**-60%**	**-59%**	**-2%**

2.2.7 Trends in Carbon Monoxide (CO) Emissions

CO emissions in Iceland are mainly from the subsectors described below. The emissions from these sources can be seen in Table 2.11. Figure 2.3 shows the sectoral emission trends since 1990.

- **Aluminium Production (2C3):** The main source of CO is Primary Aluminium Production. The varying increase in emissions from the IPPU sector corresponds to the expansion of production capacity. This sector accounts for over 96% of Iceland's CO emissions.
- **Road Transport (1A3b):** In the earlier part of the time series, more than half of the total CO emissions originated from Road Transport. Emissions from Road Transport have been steadily decreasing since 1990 due to advances in pollution control equipment in vehicles, and now they amount to a small percentage of the total emissions.
- **National Fishing (1A4ciii):** CO emissions from national fishing exhibit a downward trend over the timeline. After peaking in 1996, emissions have been decreasing, with industry specific fluctuations, in absolute as well as relative terms.
- **Manufacturing Industries and Construction (1A2):** Although this sector accounts for <1% of Iceland's CO emissions, it (comprised of its subsectors) is the fourth largest source of CO.
- **Open Burning of Waste (5C2):** Open pit burning was a common practice in Iceland the early nineties but has since been stopped. Since 2010, New Year's Eve bonfires, which are heavily regulated, monitored, and restricted, have been the only source of emissions in this category.

Table 2.11 CO emissions by main sources since 1990 [kt].

CO Emissions [kt]	1990	1995	2000	2005	2010	2015	2020	2022	2023	Change '90-'23	Change '05-'23	Change '22-'23
Aluminium Production (2C3)	11	12	27	33	98	103	100	101	104	+886%	+218%	3.10%
Road Transport (1A3b)	41	33	22	14	8.3	5.3	1.9	1.8	1.7	-96%	-88%	-4.7%
National Fishing (1A4ciii)	1.1	1.3	1.2	1.0	1.0	0.9	0.7	0.7	0.7	-36%	-34%	1.0%
Manufacturing Industries and Construction (1A2)	0.8	0.6	0.8	0.7	0.3	0.2	0.1	0.2	0.2	-74%	-72%	9%
Open Burning of Waste (5C2)	2.1	1.5	0.9	0.1	0.1	2.1	1.5	0.09	0.09	-96%	-27%	0%
Other	1.1	1.1	1.4	1.4	1.0	1.0	0.9	1.0	0.9	-17%	-38%	-7.9%
Total [kt]	**57**	**49**	**53**	**50**	**109**	**110**	**103**	**104**	**107**	**+89%**	**+113%**	**2.86%**

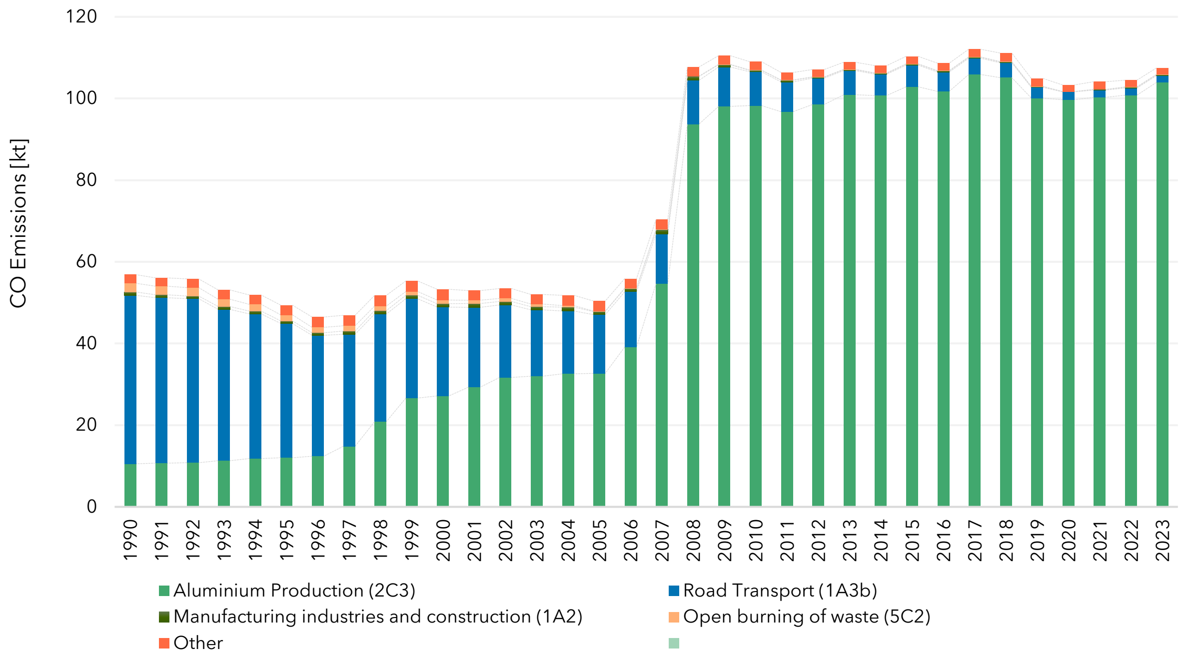


Figure 2.3 CO emissions by sector, since 1990.

2.3 Emission Trends for Persistent Organic Pollutants (POPs)

The total amount of dioxins, PAH4, HCB, and PCB emitted in Iceland has significantly decreased since 1990, as is presented in Table 2.12.

Table 2.12 Emissions of POPs in Iceland 1990 and 2023.

Year	Dioxin [g I-TEQ]	PAH4 [t]	HCB [kg]	PCB [kg]
1990	10.73	0.596	0.267	0.300
2023	0.80	0.093	0.115	0.018
Change 1990-2023	-93%	-84%	-57%	-94%

2.3.1 Trends in Dioxin Emissions

Dioxin emissions in Iceland have decreased by more than 90% since 1990. The main reason for this large reduction of emissions is a significant decrease in open burning of waste between 1990 and 2004. In recent years, the main contributors to dioxin emissions have been Clinical Waste Incineration (5C1biii), Accidental Fires (reported as 5E Other Waste), and Bonfires (reported as 5C2 Open Burning of Waste).

Dioxin emissions in Iceland are mainly from the subsectors described below. The emissions from these sources can be seen in Table 2.13 and Figure 2.4 and Figure 2.5.

- **Clinical Waste Incineration (5C1biii) and Open Burning of Waste (5C2):** Practices of waste disposal treatment have undergone a radical change in Iceland since 1990. This is one of the main reasons for the substantial decline in dioxin emissions since 1990. Various factors that have influenced the dioxin emission profile from the Waste sector are described below:

- Open pit burning, which used to be the most common means of waste disposal outside the Capital Region, has gradually decreased since 1990. Open pit burning is practically non-existent today, as the last site was closed by the end of 2010;
- In recent years, smaller waste incinerators, most of which were considered as open burning of waste due to the lack of emission abatement, have been closed. Currently, there is only one large incineration plant operating in Iceland. The incineration plant is called *Kalka* and it does not recover energy.
- Emissions from bonfires around New Year's Eve and Twelfth Night celebrations are included in the waste incineration sector. Emissions from bonfires have decreased since 1990, due to the fact that bonfires are fewer and better controlled. Guidelines for bonfires, published in 2000, include restrictions on size, burnout time, and the material allowed.
- The total amount of waste being incinerated has decreased.

- **Accidental Fires (5E):** A peak in emissions from accidental fires occurred in 2004, when a major fire broke out at a recycling company (*Hringrás*). In the fire, 300 tonnes of tyres, among other separated waste materials, burned. A fire broke out in the same company in 2011 which was estimated to be 10% the size of the 2004 fire. In 2014, a major fire broke out in an industrial laundry service when, among other materials, around 60-80 tons of asphalt roll roofing burned.
- **Public Electricity and Heat Generation (1A1a):** Waste burning with energy recovery occurred in Iceland between 1993 and 2013, since then the emissions have been relatively low. Other sources within the Energy sector, contributing to dioxin emissions since 2013, are Road Transport and Fishing, but the emissions from these sources are generally decreasing in the last two decades.
- **Metal production (2C):** Metal production is a significant contributor to dioxin emissions in Iceland, with most of the sector's emissions generated by Ferroalloys Production (2C2). Emissions of this subsector increased with the opening of a plant in 2018, with fluctuations linked to production amount.

Table 2.13 Dioxin emissions by main sources since 1990 [g I-TEQ].

Dioxin Emissions [g I-TEQ]	1990	1995	2000	2005	2010	2015	2020	2022	2023	Change '90-'23	Change '05-'23	Change '22-'23
Open Burning of Waste (5C2)	10	6.8	2.8	0.15	0.12	0.10	0.012	0.102	0.10	-99%	-33%	0%
Clinical Waste Incineration (5C1biii)	NO	NO	NO	0.078	0.033	0.11	0.16	0.20	0.22		+185%	+12%
Metal production (2C)	0.014	0.016	0.027	0.030	0.047	0.064	0.11	0.24	0.21	+1444%	+600%	-12%
Road Transport (1A3b)	0.064	0.069	0.088	0.11	0.11	0.072	0.043	0.039	0.035	-45%	-66%	-8.6%
National Fishing (1A4ciii)	0.043	0.057	0.044	0.041	0.053	0.043	0.021	0.020	0.020	-54%	-52%	+1%
Public Electricity and Heat Generation (1A1a)	3.3E-04	0.38	0.39	0.38	0.29	3.9E-05	1.8E-05	7.1E-05	7.4E-05	-78%	-100%	+5%
Accidental Fires (5E)	0.085	0.085	0.085	0.14	0.11	0.070	0.10	0.11	0.17	+97%	+22%	+47.2%
Other	0.026	0.025	0.028	0.028	0.020	0.024	0.036	0.036	0.041	+61%	+48.8%	+17%
Total [g I-TEQ]	**11**	**7.5**	**3.5**	**0.95**	**0.79**	**0.49**	**0.50**	**0.75**	**0.80**	**-93%**	**-16%**	**+7%**

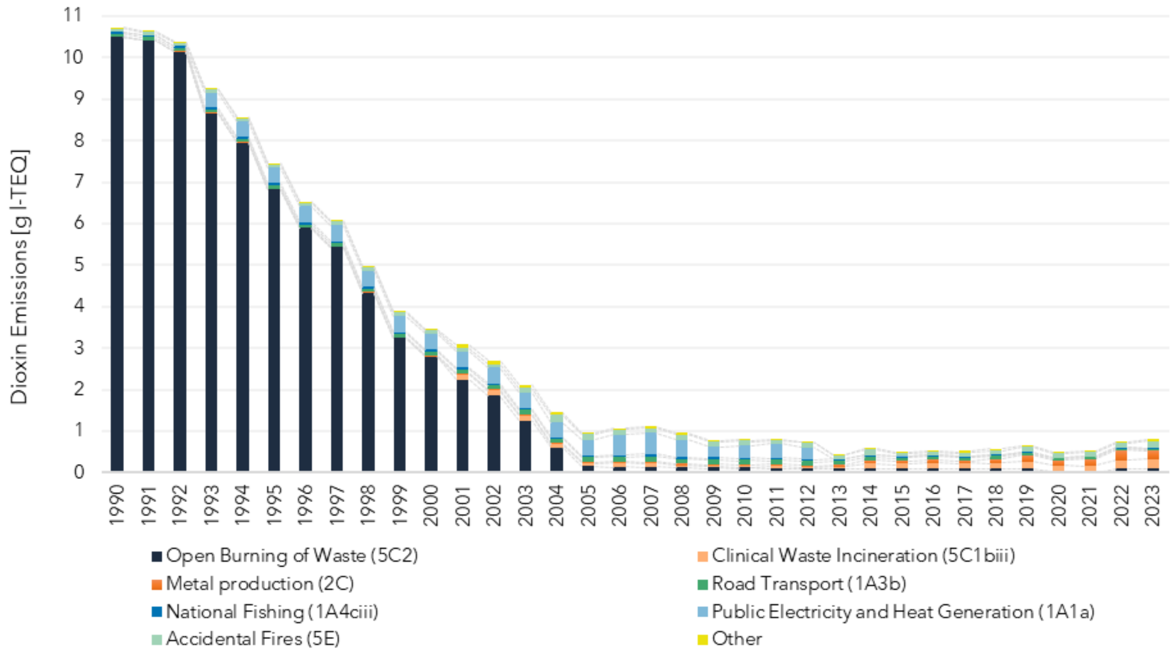


Figure 2.4 Dioxin emissions by main sources since 1990 [g I-TEQ].

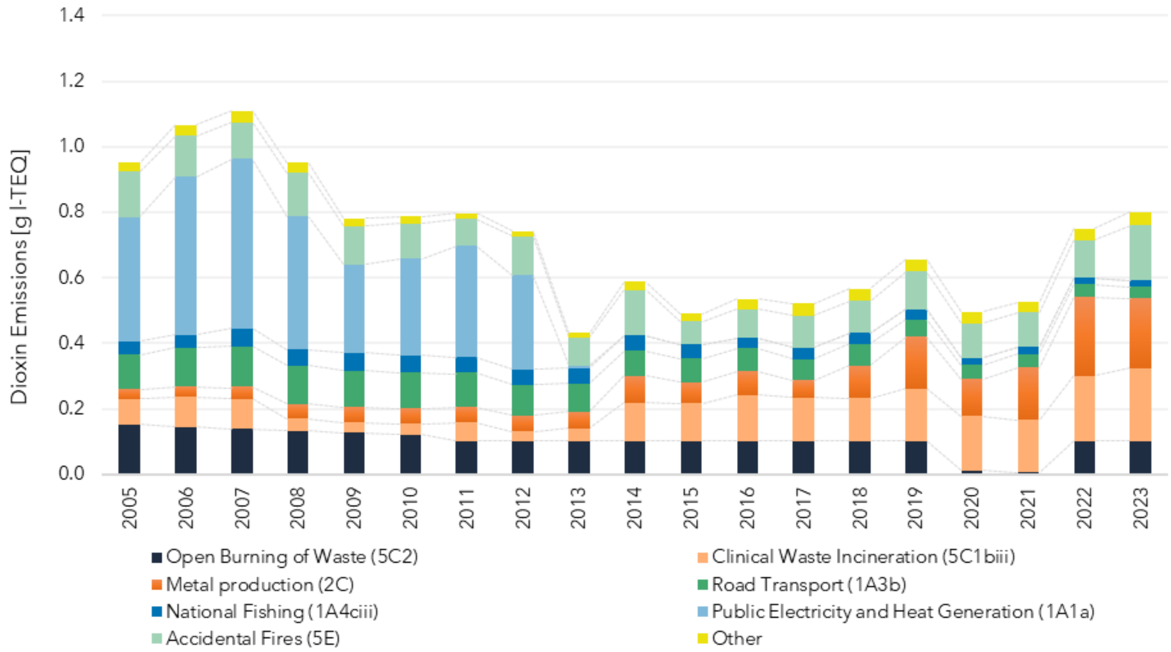


Figure 2.5 Dioxin emissions by main sources since 2005 [g I-TEQ].

Dioxins form a family of toxic chlorinated organic compounds that share certain chemical structures and biological characteristics. Dioxins are members of two closely related families: the polychlorinated dibenzo(p)dioxins (PCDDs; 75 congeners) and polychlorinated dibenzofurans (PCDFs; 135 congeners). Dioxins bioaccumulate in humans and wildlife due to their fat solubility and 17 of these compounds are especially toxic. Dioxins are formed during combustion processes such as commercial or municipal waste incineration and from burning fuels like wood, coal, or oil. Dioxins can also be formed in natural processes such as forest fires. Dioxins also enter the environment through the production and use of organochlorine compounds, chlorine bleaching of pulp and paper, certain types of chemical manufacturing and processing, and other industrial processes that create small quantities of dioxins. Cigarette smoke also contains small amounts of dioxins.

Emissions of dioxins are presented in [g I-TEQ] (International Toxic Equivalents). 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) is the most toxic of the dioxin congeners. Other congeners (or mixtures thereof) are given a toxicity rating from 0 to 1, where TCDD is 1. The total dioxin toxic equivalence (TEQ) value expresses the toxicity as if the mixture were pure TCDD.

2.3.2 Trends in Polycyclic Aromatic Hydrocarbons (PAHs) Emissions

Since 1990, total emissions of PAH4 in Iceland have decreased substantially. The main reason for the significant reduction of PAH4 emissions is the significant decrease in open burning of waste between 1990 and 2004. In recent years, the main contributors to PAH4 emissions have been Bonfires (reported as 5C2 Open Burning of Waste), Aluminium Production (2C3), Ferroalloys Production (2C2) and Road Transport (1A3b).

PAH4 emissions in Iceland are mainly from the subsectors described below. The emissions from these sources can be seen in Table 2.14 and Figure 2.6.

- **Open Burning of Waste (5C2):** PAH4 emissions from Open Burning of Waste have decreased significantly since 1990, partly because outdated incineration plants and open pit burning have been discontinued. A more detailed description of the decrease in emissions from this sector is in Section 2.3.1 above.
- **Metal Production (2C):** The contribution of the sector to the total PAH4 emissions has been steadily increasing since 1990. The main increase in emissions happened in 1998-2000 as well as in 2006-2008. Between 1998 and 2000, the increase in emissions was due to increased production capacity both in the aluminium and the ferrosilicon industries. In 2006-2008, the cause was increased production capacity in the aluminium industry.
- **Road Transport (1A3b):** Road Transport is an important source of PAH4 emissions in Iceland. PAH4 emissions from this sector are estimated to have more than doubled since 1990 due to more vehicle kilometres travelled and consequent increase in fuel usage.
- **Accidental Fires (5E):** The emissions have been relatively stable since 1990 but fluctuate according to the number of accidental building and vehicle fires each year.
- **Stationary Combustion: Non-metallic Minerals (1A2f):** Significant PAH4 emissions resulted from the combustion of other bituminous coal for cement production until 2012 when production was stopped.

Table 2.14 PAH4 emissions by main sources since 1990 [t].

PAH4 Emissions [t]	1990	1995	2000	2005	2010	2015	2020	2022	2023	'90-'23	Change '05-'23	'22-'23
Open Burning of Waste (5C2)	0.486	0.339	0.208	0.033	0.025	0.024	0.003	0.024	0.024	-95%	-27%	0%
Stationary Combustion: Non-metallic Minerals (1A2f)	0.070	0.033	0.050	0.038	0.014	9E-08	1E-07	1E-07	1E-07	-100%	-100%	8.21%
Aluminium Production (2C3)	0.002	0.002	0.005	0.006	0.016	0.017	0.016	0.017	0.017	775%	197%	3.10%
Ferroalloys Production (2C2)	0.009	0.010	0.016	0.016	0.015	0.017	0.015	0.016	0.016	73%	-2.3%	-3.7%
Road Transport (1A3b)	0.008	0.008	0.008	0.011	0.013	0.014	0.018	0.020	0.019	151%	76%	-3.1%
Accidental Fires (5E)	0.008	0.008	0.007	0.008	0.006	0.009	0.007	0.007	0.010	23%	22%	35.55%
Other	0.012	0.015	0.015	0.014	0.013	0.013	0.007	0.008	0.008	-34.0%	-43%	3.0%
Total [t]	**0.60**	**0.42**	**0.31**	**0.12**	**0.102**	**0.094**	**0.067**	**0.091**	**0.093**	**-84%**	**-25%**	**2%**

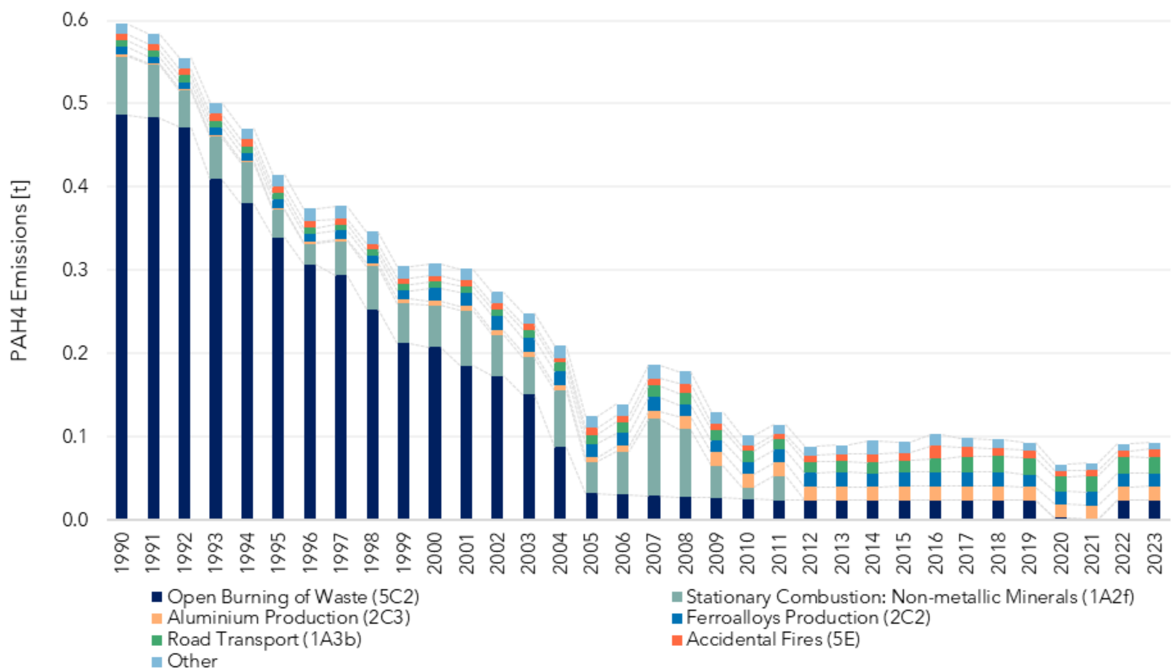


Figure 2.6 PAH emissions by sector, since 1990.

The polycyclic aromatic hydrocarbons (PAH) are molecules built up of benzene rings which resemble fragments of single layers of graphite. PAHs are a group of approximately 100 compounds. Most PAHs in the environment arise from incomplete burning of carbon-containing materials like oil, coal, wood, or waste. Fires can produce fine PAH particles; they bind to ash particles and sometimes move long distances through the air. Thus, PAHs have been ubiquitously distributed in the natural environment for thousands of years. The four compounds benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene are used as PAH indicators for the purposes of emission inventories, as specified in the POPs - Protocol.

2.3.3 Trends in Hexachlorobenzene (HCB) Emissions

There have been significant changes in HCB emissions since 1990. For most of the years since 1990, fireworks (2G) were the largest source of HCB emissions in Iceland. More stringent restrictions on HCB in fireworks are the reason for a significant reduction in HCB emissions since 2012. Other main sources of HCB emissions are Clinical Waste Incineration (5C1biii), Aluminium Production (2C3) and National Fishing (1A4ciii). The emissions from these sources are described below and can be seen in Table 2.15 and Figure 2.7.

- **Fireworks (2G):** Fireworks now use a country-specific emission factor based on measurements of the average Pb and HCB taking from samples of different fireworks sold in Iceland in 2018. The new emissions factors indicate that fireworks are now a key category for HCB emissions. It is worth noting that fireworks are only legal to use in Iceland around New Year's, but their usage during this time is widespread and extremely high. After peaking in 2007, HCB emissions from fireworks show a decreasing trend.
- **Clinical Waste Incineration (5C1biii):** Clinical waste incineration was responsible for most HCB emissions in Iceland in recent years.
- **Aluminium Production (2C3):** The HCB emissions rise from secondary aluminium production. HCB emissions from primary aluminium production are not estimated since there is no emission factor available in the 2019 EMEP/EEA Guidebook.
- **National Fishing (1A4ciii):** Emissions from commercial fishing rose from 1990 to 1996 when a substantial portion of the fishing fleet was operating in distant fishing grounds. Since then, emissions have been following a generally decreasing trend, but with fluctuations due to varying conditions in the fishing industry (renewing of fishing fleet, status of fish stocks, etc), as well as different ratios of the use of marine gas oil versus heavy fuel oil, which was not used since 2020.
- **Open Burning of Waste (5C2):** HCB emissions from Open Burning of Waste have decreased significantly since 1990, mostly because outdated incineration plants and open pit burning have been discontinued, and less waste is burned overall. A more detailed description of the decrease in emissions from this sector is in Section 2.3.1 above.

Table 2.15 HCB emissions by main sources since 1990 [kg].

HCB Emissions [kg]	1990	1995	2000	2005	2010	2015	2020	2022	2023	'90-'23	Change '05-'23	'22-'23
Fireworks (2G)	0.116	0.144	0.385	0.650	0.500	0.321	0.023	0.032	0.021	-82%	-97%	-35%
Clinical Waste Incineration (5C1biii)	NO	NO	NO	0.020	0.008	0.029	0.041	0.050	0.056		+185%	+12%
National Fishing (1A4ciii)	0.021	0.027	0.024	0.021	0.022	0.019	0.013	0.012	0.012	-43%	-41%	+1%
Aluminium Production (2C3)	NA	NA	NA	0.011	0.010	0.011	0.011	0.016	0.019		+73%	+24%
Open Burning of Waste (5C2)	0.13	0.085	0.048	4E-04	3E-04	2E-04	2E-05	2E-04	2E-04	-100%	-60%	0%
Other	0.002	0.012	0.015	0.016	0.019	3E-03	6E-03	5E-03	7E-03	+169%	-58%	+26%
Total [kg]	**0.27**	**0.27**	**0.47**	**0.72**	**0.56**	**0.38**	**0.09**	**0.12**	**0.12**	**-57%**	**-84%**	**-0%**

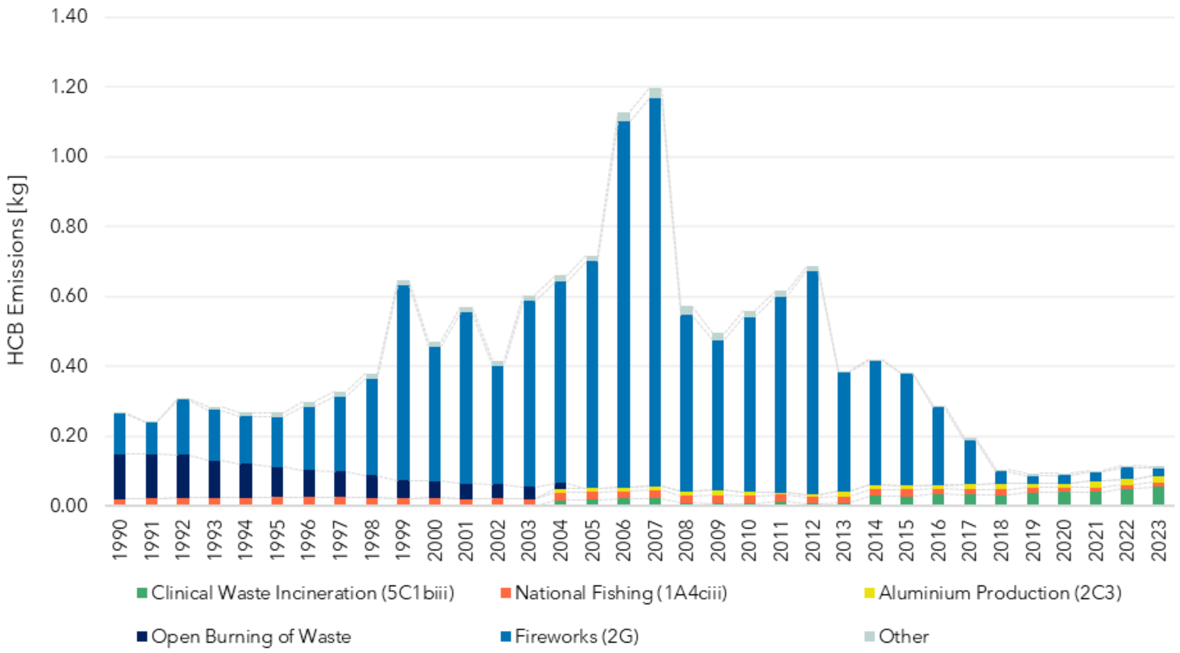


Figure 2.7 HCB emissions by sector, since 1990.

Hexachlorobenzene (HCB) or perchlorobenzene is a chlorocarbon with the molecular formula C6Cl6. HCB is a fungicide that was first introduced in 1945 for seed treatment, especially for the control of bunt of wheat. HCB is currently emitted as a by-product in the manufacture of several chlorinated solvents. Overall, processes resulting in dioxin formation also result in HCB emissions. HCB is considered to be a probable human carcinogen. HCB is a very persistent environmental chemical due to its chemical stability and resistance to biodegradation.

2.3.4 Trends in Polychlorinated Biphenyl (PCB) Emissions

In the early years of the time series, one of the main sources of PCB in Iceland was open burning of waste, following a decreasing trend between 1990 and 2004 as seen for the other POPs. The other main sources contributing to PCB emission trends were National Fishing (1A4ciii), Stationary Combustion: Non-metallic Minerals (1A2f), and Heat Plants (1A1aiii). Currently, the main source is Clinical Waste Incineration (5C1biii). The only source of PCB estimated from industrial processes is Secondary Steel Production (2C1). The only secondary steel plant in Iceland started its activities in 2014 and closed in 2016. PCB emissions in Iceland are mainly from the subsectors described below. The emissions from these sources can be seen in Table 2.16 and Figure 2.8.

The analysis of the trends in PCB emissions in Iceland must be interpreted with care as only a few sources have been estimated, which reflects the lack of emission factors in the 2023 EMEP/EEA Guidebook.

- **Clinical Waste Incineration (5C1biii):** Waste incineration was responsible for the majority of PCB emissions in recent years, as emissions from other sectors have decreased.
- **National Fishing (1A4ciii):** Emissions from commercial fishing have fluctuated due to varying conditions in the fishing industry (renewing of fishing fleet, status of fish stocks, etc.), as well as different ratios of the use of marine gas oil versus residual fuel oil. Those two

fuel types have very different emission factors for PCB. Residual fuel oil use on ships has been banned since 1 January 2020, hence the lower PCB emissions since then.

- **Open Burning of Waste (5C2):** PCB emissions from Open Burning of Waste have decreased significantly since 1990, partly because outdated incineration plants and open pit burning have been discontinued. A more detailed description of the decrease in emissions from this sector is in Section 2.3.1 above.
- **Stationary Combustion: Non-metallic Minerals (1A2f):** Significant PCB emissions resulted from the combustion of other bituminous coal for cement production until 2012 when production was stopped.
- **Heat Plants (1A1aiii):** Waste incineration with energy recovery, which caused significant emissions, was occurring between 1993-2013.

Table 2.16 PCB emissions by main sources since 1990 [kg].

PCB Emissions [kg]	1990	1995	2000	2005	2010	2015	2020	2022	2023	Change '90-'23	'05-'23	'22-'23
Clinical Waste Incineration (5C1biii)	NO	NO	NO	0.004	0.002	0.006	0.008	0.010	0.011		+185%	+12%
National Fishing (1A4ciii)	0.028	0.041	0.022	0.026	0.046	0.035	0.006	0.006	0.006	-79%	-78%	+1%
Open Burning of Waste (5C2)	0.19	0.13	0.071	3E-04	2E-04	2E-06	2E-07	2E-06	2E-06	-100%	-99%	0%
Stationary Combustion: Non-metallic Minerals (1A2f)	0.082	0.038	0.058	0.043	0.016	NA	NA	NA	NA	-100%	-100%	
Heat Plants (1A1aiii)	NA	0.025	0.032	0.032	0.043	NA	NA	NA	NA		-100%	
Secondary Steel Production (2C1)	NO	NO	NO	NO	NO	0.011	NO	NO	NO			
Other	0.003	0.005	0.004	0.004	0.004	0.012	7E-4	8E-4	7E-4	-73%	-83%	-9%
Total [kg]	**0.30**	**0.24**	**0.19**	**0.11**	**0.11**	**0.05**	**0.01**	**0.02**	**0.02**	**-94%**	**-84%**	**+7.2%**

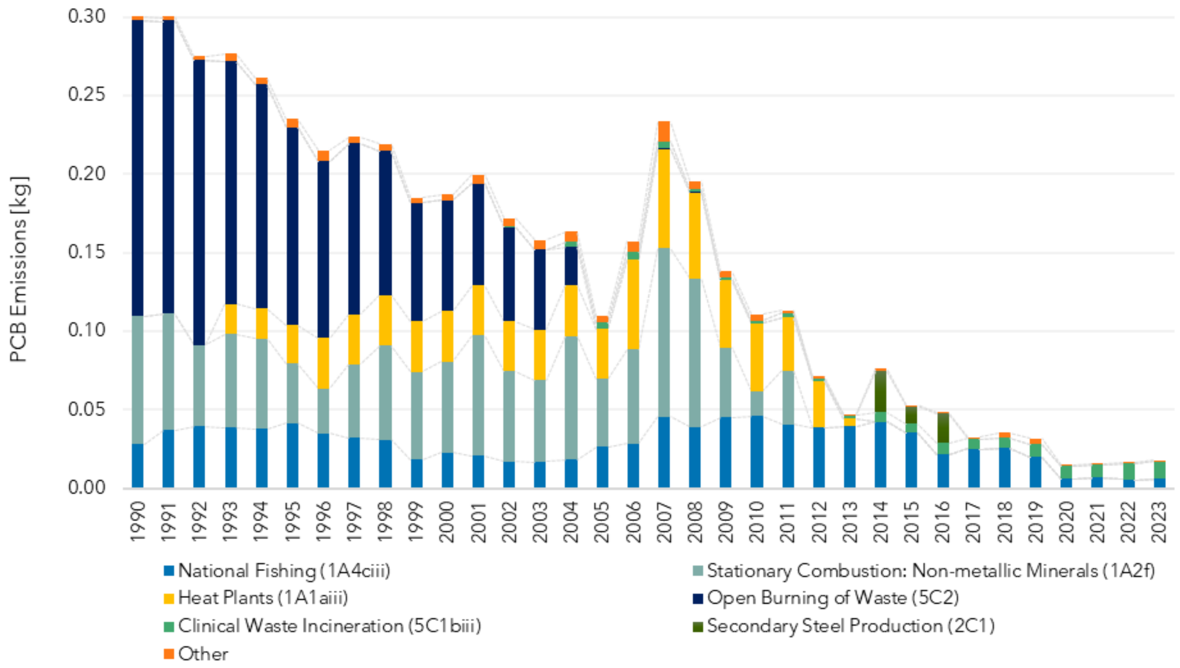


Figure 2.8 PCB emissions by sector, since 1990.

2.4 Emission Trends for Heavy Metals

Emission estimates for 1990 and 2023 for priority heavy metals (Pb, Cd, and Hg) as well as additional heavy metals (As, Cr, Cu, Ni, Se, and Zn) are shown in Table 2.17. The sectors contributing to the emissions of heavy metals are Energy, Industrial Processes, and Waste. According to the 2023 EMEP/EEA Guidebook, heavy metal emissions in the Agriculture sector only arise from the burning of crop residues. Since this activity does not occur in Iceland, there are no heavy metal emissions from the Agriculture sector. Current emissions are dominated by either emissions from Road Transport or Aluminium Production for all heavy metals other than Hg and Se, where National Fishing is the largest source of emissions.

Table 2.17 Estimated emissions of heavy metals, 1990 and 2023.

	Pb [t]	Cd [t]	Hg [t]	As [t]	Cr [t]	Cu [t]	Ni [t]	Se [t]	Zn [t]
1990	0.79	0.022	0.140	0.070	0.12	1.72	1.72	0.035	2.31
2023	0.81	0.134	0.010	0.146	0.23	3.32	1.91	0.020	5.91
Change 1990-2023	2%	498%	-93%	108%	91%	93%	11%	-44%	155%

2.4.1 Trends in Priority Heavy Metals (Pb, Cd, Hg)

Pb, Cd and Hg emissions in Iceland are mainly from the subsectors described below. The Pb emissions from the main sources can be seen in Table 2.18, Table 2.16 and Figure 2.9. The Cd emissions from the main sources can be seen in Table 2.19, Table 2.16 and Figure 2.10. The Hg emissions from the main sources can be seen in Table 2.20 and Figure 2.11.

- **Road Transport (1A3b):** Emissions from Road Transport are a part of the current Pb and Hg emissions. The Pb emissions are mainly from tyre and brake wear and have increased over the timeline due to an increase in the car fleet. The Hg emissions have increased over the timeline due to higher fuel use.

- **Aluminium Production (2C3):** Emissions from Aluminium Production are the main source of Cd emissions over the whole timeline, as well as a part of the current Pb emissions. The emissions increased significantly in 2006-2008 due to increased production and have been relatively stable since.
- **Domestic Aviation LTO (civil) (1A3aii(i)):** Emissions from Domestic Aviation are a part of Pb emissions. They have decreased significantly since 1990 due to reduced use of aviation gasoline.
- **Fireworks (2G):** A contributor to the Pb emissions is the use of fireworks (under IPPU), mostly around New Year's Eve. A peak in the years 2006-2007 reflects the peak in economic growth, before the economic collapse of 2008.
- **Accidental Fires (5E):** Accidental Fires cause a part of the Pb emissions.
- **Heat Plants (1A1aiii):** In 1993, Waste Incineration with Recovery of Energy (included in the Energy sector under 1A1a Public Electricity and Heat Production) started in Iceland, leading to an increase in Pb, Cd, and Hg. The amount of waste burned with recovery of energy peaked in 2007, and after that decreased until 2013, at which point this activity stopped.
- **National Fishing (1A4ciii):** Emissions from Commercial Fishing contribute significantly to Hg emissions, less to Cd and Pb emissions. Since 1995, the emissions have been following a generally decreasing trend, but with fluctuations due to varying conditions in the fishing industry (renewing of fishing fleet, status of fish stocks, etc.), as well as different ratios of use of marine gas oil versus heavy fuel oil.
- **Open Burning of Waste (5C2):** The main source of Hg emissions in the 1990s was open burning of waste. It was also a contributor of Cd emissions. Open pit burning was mostly occurring between 1990 and 2004.
- **Clinical Waste Incineration (5C1biii):** The largest emission source of Hg in recent years is Clinical Waste Incineration. Clinical waste was burnt openly, until 2011 when the waste incinerator *Kalka* started handling all of Iceland's clinical waste.
- **Cremation (5C1bv):** Cremations are an increasing source of Hg emissions in Iceland as it becomes a more popular option among Icelanders.

Table 2.18 Pb emissions by main sources since 1990 [t].

Pb Emissions [t]	1990	1995	2000	2005	2010	2015	2020	2022	2023	Change '90-'23	'05-'23	'22-'23
Fireworks (2G)	0.089	0.11	0.30	0.50	0.22	0.029	0.024	0.033	0.022	-76%	-96%	-35%
Road transport: Automobile tyre and brake wear (1A3bvi)	0.16	0.18	0.20	0.26	0.28	0.29	0.31	0.34	0.34	+109%	+32%	-0.4%
Accidental Fires (5E)	0.056	0.058	0.051	0.053	0.041	0.065	0.049	0.048	0.064	+14%	+22%	+33.4%
Stationary Combustion: Non-metallic Minerals (1A2f)	0.064	0.030	0.046	0.034	0.013	4E-7	4E-7	4E-7	5E-7	-100%	-100%	+8.21%
Heat Plants (1A1aiii)	6E-4	0.48	0.63	0.62	0.84	3E-5	NO	1E-4	3E-4	-54%	-100%	+103%
Domestic Aviation LTO (Civil) (1A3aii(i))	0.26	0.22	0.31	0.30	0.20	0.11	0.20	0.19	0.13	-48%	-55%	-28.5%
Aluminium Production (2C3)	0.02	0.02	0.04	0.05	0.16	0.17	0.16	0.17	0.17	+886%	+218%	+3.10%
Other	0.42	0.45	0.61	0.60	0.52	0.40	0.44	0.42	0.38	-8%	-36%	-9.4%
Total [t]	**0.79**	**1.3**	**1.8**	**2.1**	**1.9**	**0.78**	**0.82**	**0.85**	**0.81**	**+2%**	**-61%**	**-4.4%**

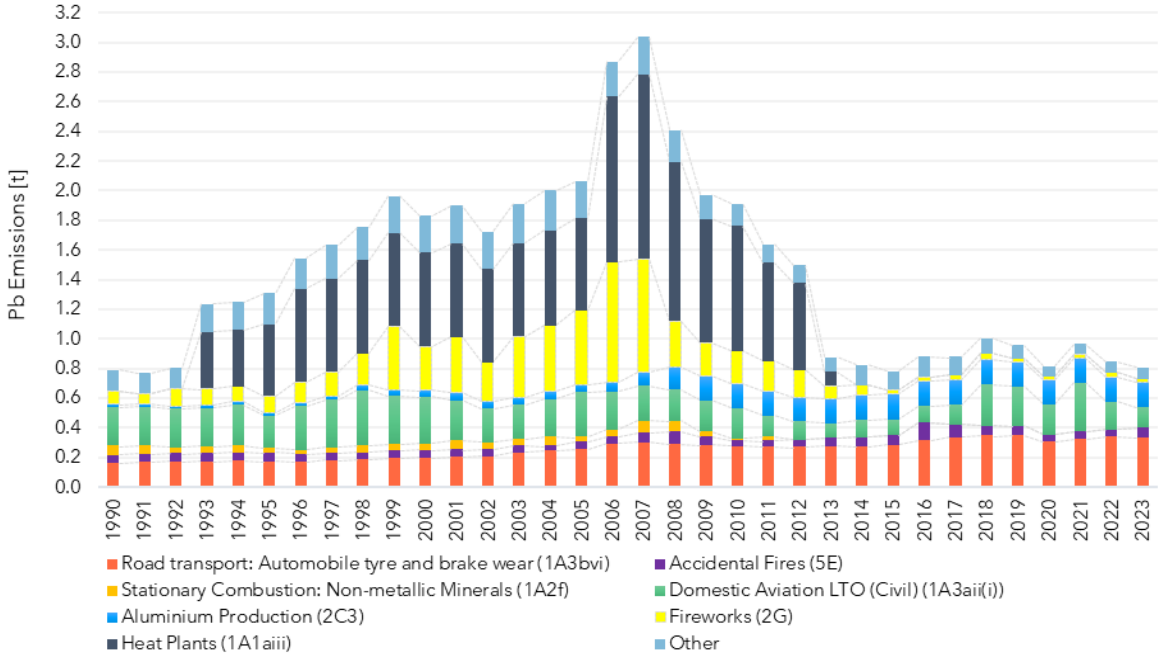


Figure 2.9 Pb emissions by sector, since 1990.

Table 2.19 Cd emissions by main sources since 1990 [kg].

Cd Emissions [kg]	1990	1995	2000	2005	2010	2015	2020	2022	2023	Change		
										'90-'23	'05-'23	'22-'23
Aluminium Production (2C3)	13	15	34	40	121	127	123	125	128	+886%	+218%	+3.10%
National Fishing (1A4ciii)	2.7	3.5	3.0	2.7	3.0	2.5	1.6	1.5	1.5	-45%	-43%	+1%
Open burning of waste (5C2)	3.8	2.6	1.6	0.23	0.18	0.17	0.02	0.17	0.17	-96%	-27%	0%
Heat Plants (1A1aiii)	0.14	16	21	20	28	0.01	NO	0.04	0.08	-42%	-100%	+103%
Other	2.7	4.0	5.1	5.7	4.2	4.1	4.3	4.7	3.9	+45%	-31%	-16%
Total [kg]	**22**	**41**	**64**	**69**	**156**	**134**	**129**	**131**	**134**	**+498%**	**+94%**	**+2.4%**

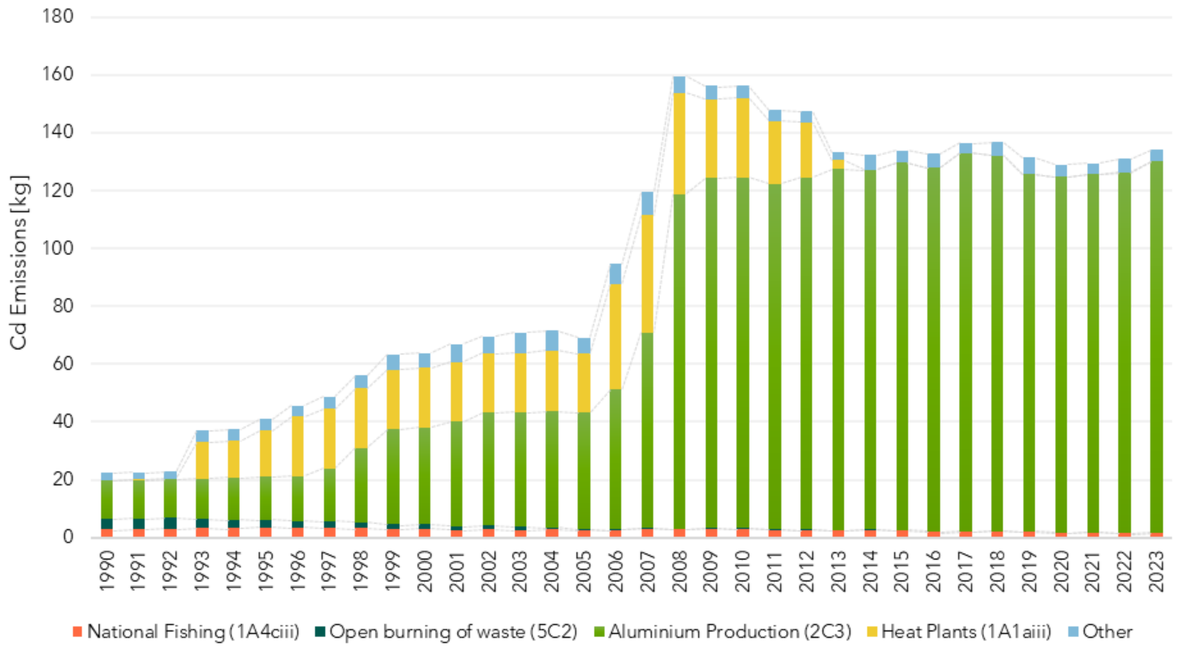


Figure 2.10 Cd emissions by sector, since 1990.

Table 2.20 Hg emissions by main sources since 1990 [kg].

Hg Emissions [kg]	1990	1995	2000	2005	2010	2015	2020	2022	2023	Change '90-'23	Change '05-'23	Change '22-'23
National Fishing (1A4ciii)	6.8	8.1	8.2	6.7	6.1	5.3	4.8	4.5	4.6	-33%	-31%	+1%
Road Transport (1A3b)	1.3	1.4	1.5	1.8	1.9	1.9	1.9	2.0	2.0	+57%	+13%	-0.3%
Cremation (5C1bv)	0.19	0.25	0.32	0.52	0.67	0.94	1.5	1.6	1.7	+831%	+234%	+6%
Clinical waste incineration (5C1biii)	NO	NO	NO	0.32	0.13	0.46	0.67	0.81	0.90		+185%	+12%
Heat Plants (1A1aiii)	0.041	13	17	17	23	0.002	NO	4.1E-2	8.4E-2	+104%	-99%	+103%
Open burning of waste (5C2)	126	84	47	0.20	0.17	0.017	0.002	1.7E-2	1.7E-2	-100%	-91%	0%
Other	14	14	16	14	12	10	7.3	7.5	7.4	-45%	-48%	-1.5%
Total [kg]	**140**	**112**	**81**	**32**	**35**	**12**	**9.5**	**10**	**10**	**-93%**	**-68%**	**+1.3%**

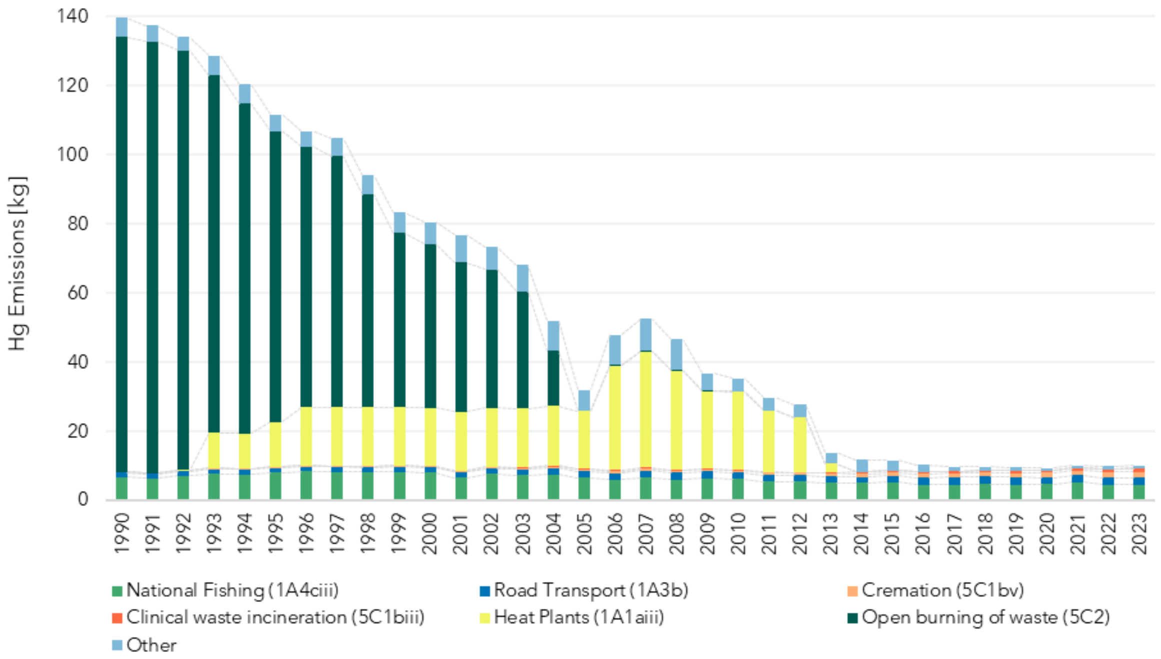


Figure 2.11 Hg emissions by sector, since 1990.

2.4.2 Trends in Additional Heavy Metals (As, Cr, Cu, Ni, Se, and Zn)

The sectors contributing to the emissions of As, Cr, Cu, Ni, Se, and Zn are Energy, Industrial Processes, and Waste. Current emissions are dominated by Road Transport, National Fishing, or Aluminium Production subsectors, for all heavy metals.

As, Cr, Cu, Ni, Se, and Zn emissions in Iceland are mainly from the subsectors described below. The emissions can be seen in the tables and figures below.

- **National Fishing (1A4ciii):** Commercial Fishing is the largest contributor of Se emissions and the second largest of As and Ni emissions. Since 1995, the emissions have been following a generally decreasing trend, but with fluctuations due to varying conditions in the fishing industry (renewing of fishing fleet, status of fish stocks, etc), as well as different ratios of use of marine gas oil versus heavy fuel oil.
- **Road Transport (1A3b):** Road Transport is the largest contributor of Cr and Cu emissions and the second largest of Se and Zn emissions, with most of the emissions coming from tyre and brake wear. The emissions have increased over the timeline due to more driving in Iceland.
- **Aluminium Production (2C3):** Aluminium Production is the largest source of As, Ni and Zn emissions and the second largest source of Cr emissions. Aluminium is currently produced at three primary aluminium plants in Iceland. The emissions rose slightly in 1998 due to the opening of a new facility, and more significantly in the period 2006-2008 due to an expansion of one facility and the onset of operations at a new facility. The emissions from primary Al production have been relatively stable since 2008.
- **Heat Plants (1A1aiii):** In 1993, Waste Incineration with Recovery of Energy started in Iceland, leading to an increase in As emissions. The amount of waste burned with recovery of energy peaked in 2007, and after that decreased until 2013, after which year this activity stopped.

- **Open Burning of Waste (5C2):** It was a large contributor of As, Se and Zn emissions in 1990. These emissions decreased steadily until 2004, when open burning of waste, other than bonfires around New Year's Eve, was stopped in Iceland.
- **Fireworks (2G):** A contributor to the Cr, Cu, Ni, and Zn trend is the use of fireworks (under IPPU). The steady increase since 1990 reflects the growing popularity of fireworks in Iceland (mostly around New Year's Eve). A peak in 2007 reflects the peak in economic growth that year, before the economic collapse of 2008.
- **National Navigation (Shipping) (1A3dii):** A contributor to the Cr, Ni and Se trend is National Navigation. A decrease in emissions in recent years is in parts related to the factual ban of heavy fuel oil in Iceland's territorial waters.
- **Stationary Combustion: Non-metallic Minerals (1A2f):** Some Cr and Se emissions resulted from the combustion of other bituminous coal for cement production until 2012 when production was stopped.
- **Public Electricity and Heat Generation (1A1a):** Emissions from Public Electricity and Heat Generation cause a part of the current Se emissions. This is because of fuel burned.
- **Accidental Fires (5E):** Emissions from Accidental Fires cause some Zn emissions.

Table 2.21 As emissions by main sources since 1990 [kg].

As Emissions [kg]	1990	1995	2000	2005	2010	2015	2020	2022	2023	Change '90-'23	Change '05-'23	Change '22-'23
National Fishing (1A4ciii)	32	48	25	30	54	41	6.4	6.0	6.1	-81%	-80%	+1%
Road Transport (1A3b)	1.9	2.1	2.3	3.0	3.2	3.3	3.6	4.0	3.9	+108%	+32%	-0.3%
Aluminium Production (2C3)	13	15	35	42	125	131	127	129	133	+886%	+218%	+3.1%
Heat Plants (1A1aiii)	0	10	13	13	17	0.02	NO	0.06	0.11	-77%	-99%	+103%
Open burning of waste (5C2)	16	11	6.6	1.0	0.7	0.7	0.1	0.7	0.7	-96%	-27%	-100%
Other	6.5	7.2	5.9	6.0	5.7	5.6	3.6	3.2	2.4	-62.9%	-59.7%	-23%
Total [kg]	**70**	**94**	**88**	**95**	**206**	**182**	**141**	**143**	**146**	**+108%**	**+54%**	**+2.3%**

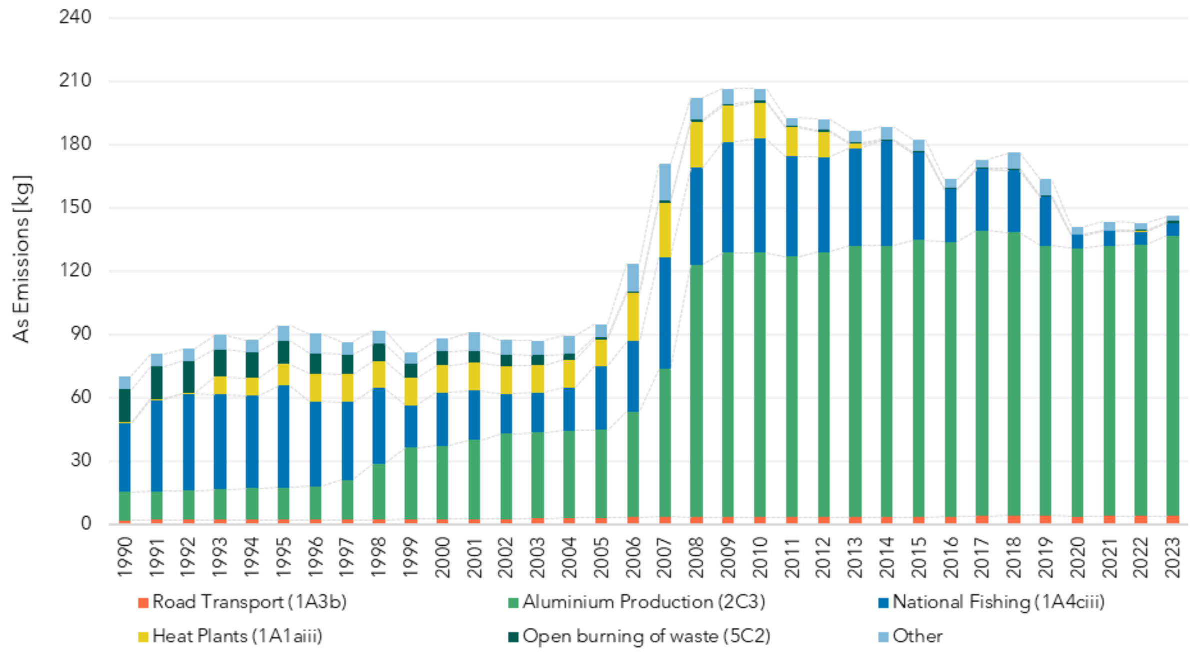


Figure 2.12 As emissions by sector, since 1990.

Table 2.22 Cr emissions by main sources since 1990 [kg].

Cr Emissions [kg]	1990	1995	2000	2005	2010	2015	2020	2022	2023	Change '90-'23	'05-'23	'22-'23
Road transport: Automobile tyre and brake wear (1A3bvi)	61	66	75	96	103	107	114	127	126	+108%	+32%	-0.5%
National Fishing (1A4ciii)	36	53	29	33	58	45	7.9	7.5	7.6	-79%	-77%	+1%
Fireworks (2G)	1.8	2.2	5.9	10.0	7.7	9.4	7.7	10.7	7	+290%	-30.3%	-35%
Stationary Combustion: Non-metallic Minerals (1A2f)	6.5	3.1	4.7	3.5	1.3	9E-04	1E-03	1E-03	1E-03	-100%	-100%	+8.21%
Aluminium Production (2C3)	8.7	9.9	22	27	81	85	82	83	86	+886%	+218%	+3.10%
Other	9.8	11.8	9.7	10.3	9.7	11.3	9.1	9.0	8.3	-15%	-18.8%	-7.6%
Total [kg]	**123**	**145**	**146**	**180**	**261**	**257**	**221**	**237**	**235**	**+91%**	**+31%**	**-1.0%**

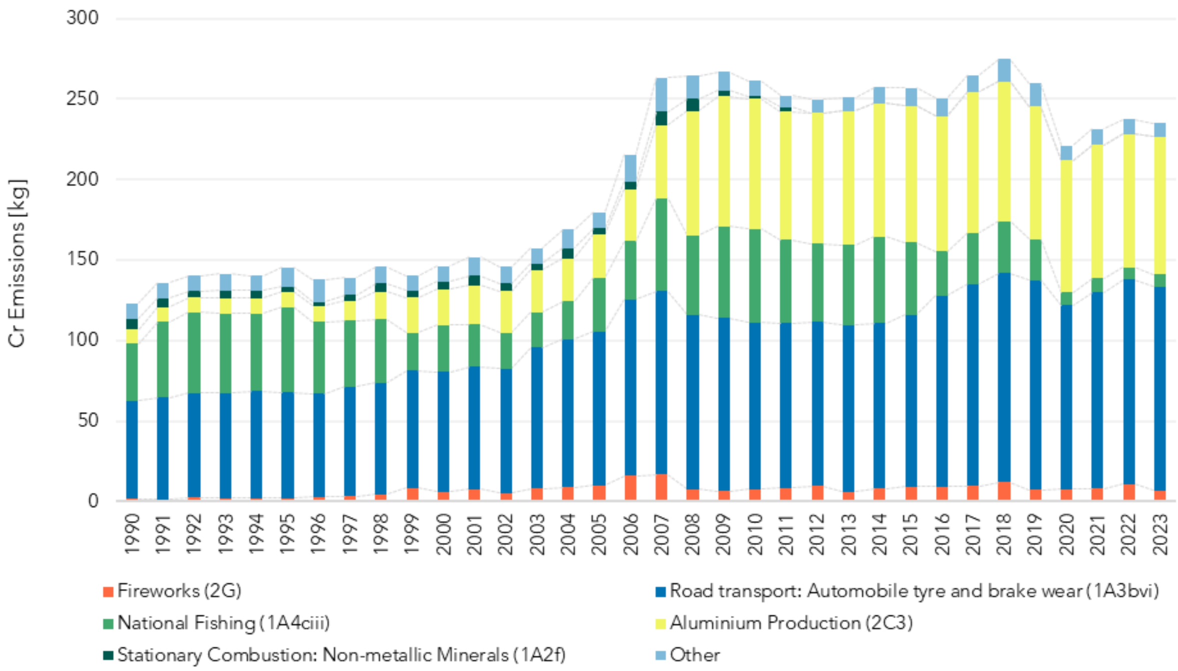


Figure 2.13 Cr emissions by sector, since 1990.

Table 2.23 Cu emissions by main sources since 1990 [t].

Cu Emissions [t]	1990	1995	2000	2005	2010	2015	2020	2022	2023	Change		
										'90-'23	'05-'23	'22-'23
Road transport: Automobile tyre and brake wear (1A3bvi)	1.33	1.44	1.64	2.10	2.27	2.34	2.51	2.79	2.77	+108%	+32%	-0.5%
Fireworks (2G)	0.05	0.06	0.17	0.28	0.22	0.27	0.22	0.30	0.20	+290%	-30%	-35%
National Fishing (1A4ciii)	0.22	0.28	0.25	0.22	0.23	0.19	0.14	0.13	0.13	-40%	-38%	+1%
Aluminium Production (2C3)	0.01	0.02	0.04	0.04	0.13	0.14	0.14	0.14	0.14	+886%	+218%	+3.1%
Other	0.10	0.12	0.13	0.14	0.09	0.09	0.07	0.07	0.07	-30%	-48%	+5%
Total [t]	**1.72**	**1.91**	**2.23**	**2.78**	**2.93**	**3.03**	**3.07**	**3.43**	**3.32**	**+93%**	**+19%**	**-3%**

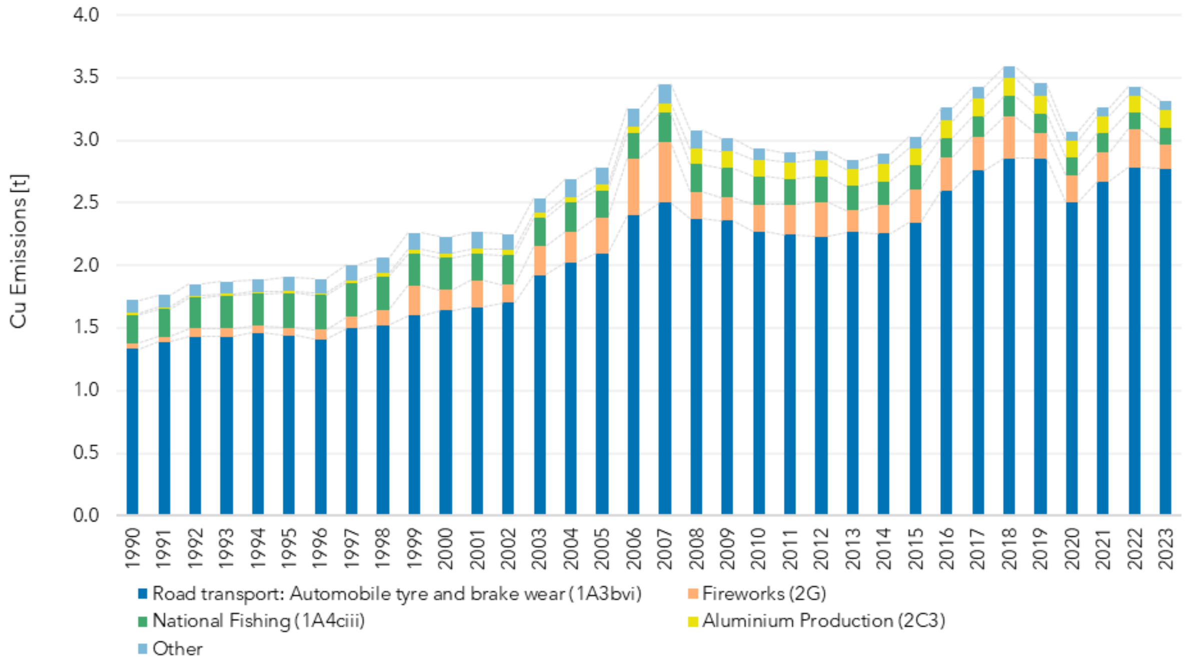


Figure 2.14 Cu emissions by sector, since 1990.

Table 2.24 Ni emissions by main sources since 1990 [t].

Ni Emissions [t]	1990	1995	2000	2005	2010	2015	2020	2022	2023	Change '90-'23	'05-'23	'22-'23
National Fishing (1A4ciii)	1.34	2.06	0.97	1.24	2.39	1.82	0.16	0.15	0.15	-89%	-88%	+1%
Aluminium Production (2C3)	0.17	0.20	0.45	0.54	1.62	1.70	1.64	1.66	1.71	+886%	+218%	+3%
National Navigation (Shipping) (1A3dii)	0.13	0.16	0.02	0.03	0.09	0.02	0.01	0.01	0.01	-96%	-85%	-31%
Other	0.07	0.07	0.04	0.05	0.04	0.04	0.04	0.05	0.04	-43%	-26%	-16%
Total [t]	**1.72**	**2.48**	**1.48**	**1.87**	**4.14**	**3.58**	**1.85**	**1.86**	**1.91**	**+11%**	**+2%**	**+2%**

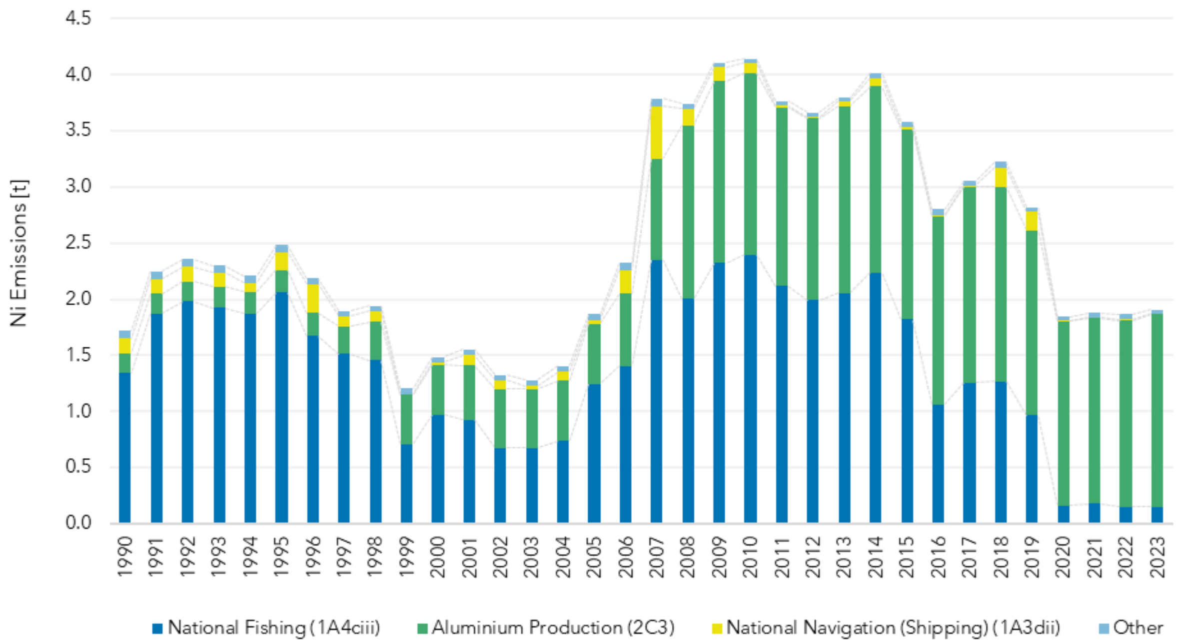


Figure 2.15 Ni emissions by sector, since 1990.

Table 2.25 Se emissions by main sources since 1990 [kg].

Se Emissions [kg]	1990	1995	2000	2005	2010	2015	2020	2022	2023	Change '90-'23	'05-'23	'22-'23
National Fishing (1A4ciii)	28	35	30	27	31	25	16	15	15	-45%	-43%	+1%
Road transport: Automobile tyre and brake wear (1A3bvi)	1.1	1.2	1.3	1.7	1.8	1.9	2.1	2.4	2.4	+123%	+41%	+1%
National Navigation (Shipping) (1A3dii)	1.47	1.70	0.46	0.80	1.39	0.88	0.78	0.77	0.53	-64%	-34%	-31%
Stationary Combustion: Non-metallic Minerals (1A2f)	0.87	0.42	0.64	0.50	0.17	5E-04	6E-04	6E-04	7E-04	-100%	-100%	+8%
Open burning of waste (5C2)	2.66	1.85	1.13	0.16	0.13	1E-04	1E-05	1E-04	1E-04	-100%	-100%	0%
Other	1.37	1.46	1.37	1.24	1.08	1.14	0.74	1.67	1.69	+23%	+37%	+1%
Total [kg]	**35**	**42**	**35**	**31**	**35**	**29**	**20**	**20**	**20**	**-44%**	**-37%**	**-0%**

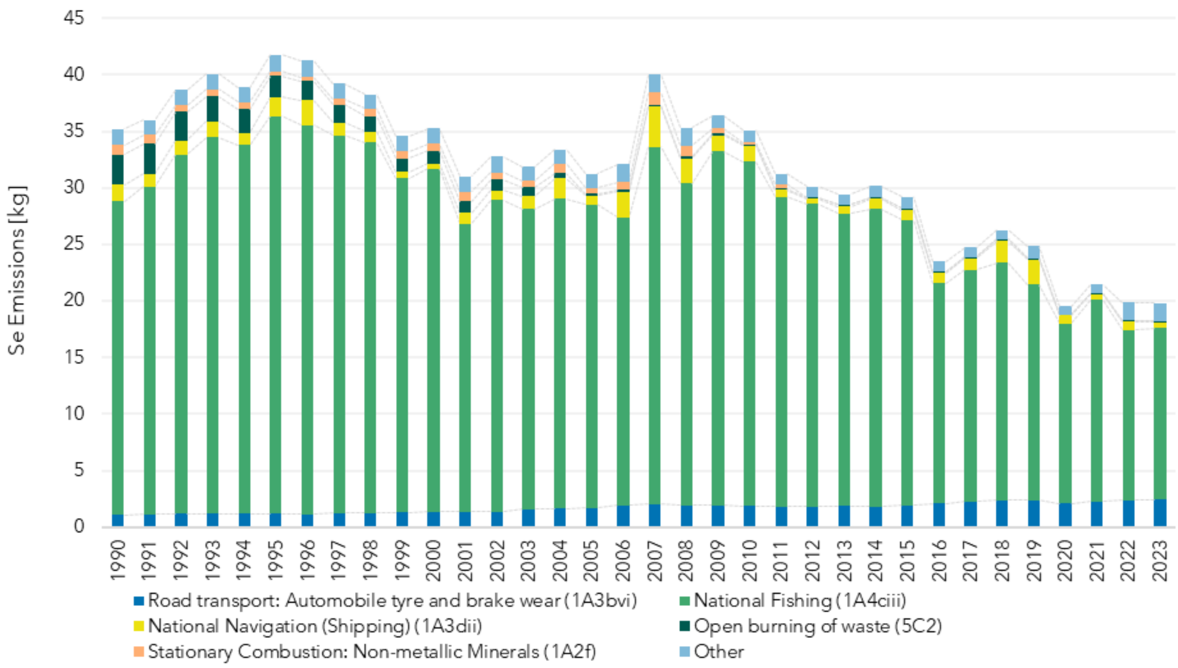


Figure 2.16 Se emissions by sector, since 1990.

Table 2.26 Zn emissions by main sources since 1990 [t].

Zn Emissions [t]	1990	1995	2000	2005	2010	2015	2020	2022	2023	Change '90-'23	Change '05-'23	Change '22-'23
Road transport: Automobile tyre and brake wear (1A3bvi)	0.43	0.47	0.53	0.68	0.74	0.76	0.84	0.95	0.96	+122%	+41%	+1%
National Fishing (1A4ciii)	0.29	0.35	0.33	0.28	0.27	0.23	0.19	0.18	0.18	-36%	-35%	+1%
Accidental Fires (5E)	0.22	0.22	0.20	0.21	0.16	0.25	0.19	0.19	0.25	+14%	+22%	+33%
Fireworks (2G)	0.03	0.04	0.10	0.17	0.13	0.16	0.13	0.18	0.12	+290%	-30.3%	-35%
Open burning of waste (5C2)	0.67	0.46	0.28	0.04	0.03	0.03	0.00	0.03	0.03	-96%	-27%	0%
Aluminium Production (2C3)	0.43	0.50	1.12	1.35	4.05	4.24	4.11	4.15	4.28	+886%	+218%	+3%
Other	0.25	0.21	0.23	0.22	0.13	0.11	0.097	0.117	0.09	-63%	-59%	-22%
Total [t]	**2.31**	**2.25**	**2.80**	**2.94**	**5.50**	**5.79**	**5.56**	**5.80**	**5.91**	**+155%**	**+101%**	**+2%**

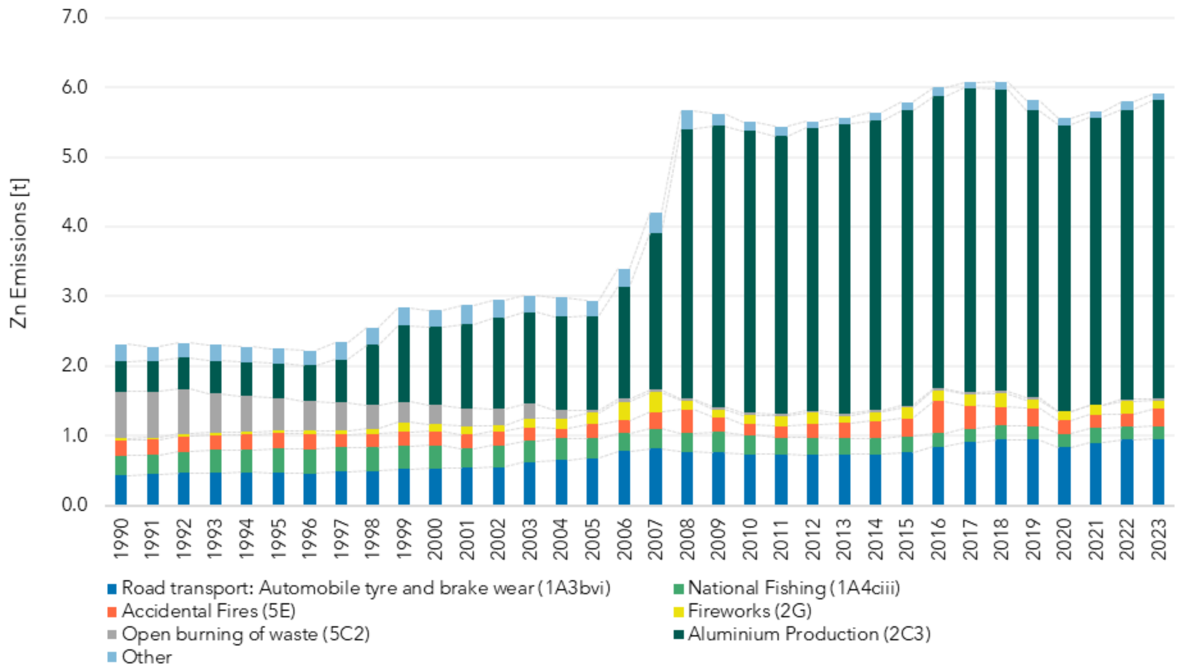


Figure 2.17 Zn emissions by sector, since 1990.

3 Energy (NFR Sector 1)

3.1 Overview

Iceland ranks first among Organisation for Economic Co-operation and Development (OECD) countries in the per capita consumption of primary energy. However, the proportion of domestic renewable energy in the total energy budget is approximately 85%, which is a much higher share than that of most other countries. The cold climate and sparse population call for high energy use for space heating and transport. Also, key export industries such as fisheries and metal production are energy intensive. The metal production industry uses around three-quarters of the total electricity produced in Iceland. Iceland relies heavily on its geothermal energy sources for space heating (over 90% of all homes) and electricity production (approx. 30% of the electricity) and on hydropower for electricity production (70% of the electricity). Thus, atmospheric pollutant emissions in the Energy sector originate predominantly from mobile sources: Road Transport, Fishing, and Off-road Machinery including Construction, as well as waste incineration with energy recovery (occurring from 1993-2013). One exception to this is the emission of H_2S from geothermal powerplants, which is by far the largest key category in Iceland's inventory for sulphur (calculated as SO_2e).

The IEEA has been working with a consulting company (Aether Ltd.) since 2015 to improve the Icelandic inventory, and in 2018 a complete review and restructuring of the Energy sector took place in collaboration with experts from Aether, including updating/redesigning calculation spreadsheets as well as checking all emission factors across the sector. Further work is planned in collaboration with the Icelandic Transport Authority (*Samgöngustofa*) (ITA), and Statistics Iceland (*Hagstofa Íslands*) (SI) in order to harmonise all datasets used.

The Energy chapter is divided into the following subchapters:

- Stationary Combustion (NFR 1A1, 1A2, 1A4, and 1A5)
- Transport and Other Mobile Sources (NFR 1A2, 1A3, and 1A4)
- Fugitive Emissions (NFR 1B2) (including emissions from geothermal utilisation)

Table 3.1 illustrates the key categories of air pollutants within the Energy sector, as determined by their significance in terms of absolute level, trend, or uncertainty in emissions within the national inventory system (EEA, 2023). Categories whose cumulative percentage contribution is greater than 80% should be identified as key.

Table 3.1 Key categories for air pollutants within Energy.

SO_x, NO_x, NH_3, NMVOCs, PM, BC, and CO	1990	2023	Trend
1A2e Stationary Combustion in Manufacturing Industries and Construction: Food Processing and Beverages	NO_x, BC	BC	NO_x, SO_x
1A2f Stationary Combustion in Manufacturing Industries and Construction: Non-metallic Minerals	$PM_{2.5}$		$PM_{2.5}$
1A2gvii Mobile Combustion in Manufacturing Industries and Construction	$PM_{2.5}$, BC	NO_x, BC	BC
1A3ai(i) International Aviation LTO (Civil)	NMVOC	NMVOC	NO_x, NMVOC
1A3bi Road Transport: Passenger Cars	NO_x, NMVOC, $PM_{2.5}$, BC, CO	NO_x, BC	NO_x, NMVOC, CO
1A3bii Road transport: Light duty vehicles			NOx
1A3biii Road Transport: Heavy-duty Vehicles and Buses	NO_x, $PM_{2.5}$, BC	NO_x	BC
1A3bv Road Transport: Gasoline Evaporation	NMVOC		
1A3bvi Road Transport: Automobile Tire and Brake Wear		$PM_{2.5}$, PM_{10}, BC	BC
1A3bvii Road Transport: Automobile Road Abrasion	$PM_{2.5}$, PM_{10}, TSP	$PM_{2.5}$, PM_{10}, TSP, BC	$PM_{2.5}$, PM_{10}, TSP, BC
1A4cii Agriculture/Forestry/Fishing: Off-road Vehicles and other machinery	BC	BC	
1A4ciii National Fishing	NO_x, NMVOC, SO_x, $PM_{2.5}$, PM_{10}, TSP, BC	NO_x, NMVOC, $PM_{2.5}$, PM_{10}, BC	SO_x, $PM_{2.5}$, PM_{10}, TSP
1B2av Distribution of Oil Products	NMVOC	NMVOC	NMVOC
1B2d Other Fugitive Emissions from Energy Production (Geothermal Energy)	SOx	SO_x	SO_x
Persistent Organic Pollutants (POPs)	**1990**	**2023**	**Trend**
1A2f Stationary Combustion in Manufacturing Industries and Construction: Non-metallic Minerals	PCB		PAH4
1A3bi Road Transport: Passenger Cars		PAH4	PAH4
1A4ciii National Fishing		PCB	
Heavy Metals (HMs)	**1990**	**2023**	**Trend**
1A1a Public electricity and heat production			Se
1A2f Stationary Combustion in Manufacturing Industries and Construction: Non-metallic Minerals	Pb		Pb, Cr, Se
1A2gvii Mobile Combustion in Manufacturing Industries and Construction	Pb		
1A3aii(i) Domestic aviation LTO (civil)	Pb	Pb	Pb
1A3bi Road Transport: Passenger Cars		Hg	Hg
1A3bvi Road Transport: Automobile Tire and Brake Wear	Pb, Cr, Cu, Zn	Pb, Cr, Cu, Se, Zn	Pb, Cu, Se
1A4ciii National Fishing	Cd, As, Cr, Cu, Ni, Se, Zn	Hg, Se	Cd, Hg, As, Cr, Cu, Ni, Se, Zn

3.2 General Methodology

Emissions from fuel combustion activities are estimated at the sector level based on methodologies suggested by the 2006 IPCC Guidelines and the 2023 EEA/EMEP Guidebook. Activity data is fuel sales data (provided by the oil companies on fuel sales by sector), data on port entry/exits provided by Trackwell and Samsýn and data on flights provided by ISAVIA, the national airport and air navigation service of Iceland. Emissions from geothermal power plants are obtained directly from the operators.

Emissions from Road Transportation are estimated using COPERT 5.8.1, which follows the methodology presented in the 2023 EEA/EMEP Guidebook. A more detailed description is provided in Chapter 0.

In recent years, a comprehensive review was performed on how the fuels sales data is attributed to IPCC/NFR sectors. The aim of the review of the fuel sales data was to make the adjustments from the sales statistics to the IPCC/NFR categories more transparent. This is what was done for each category to achieve the following:

- 1A1 Energy Industries – sales statistics are used directly, and no adjustments are needed;
- 1A2 Manufacturing Industries – adjustments are needed to transform sales statistics into IPCC/NFR categories (detailed description below);
- 1A4a and 1A4b Commercial/Residential Combustion – sales statistics are used directly, and no adjustments are needed;
- 1A5 Other – all fuels that are categorised as Other in sales statistics without any explanation of use are attributed to this category.

Due to insufficiently detailed splits in the sales statistics between fuel used for different manufacturing industries that belong to NFR category 1A2, some adjustments are needed. To try to have this input data as accurate as possible:

- It is assumed that Green Accounting reports (Regulation 851/2002) and EU ETS Annual Emission Reports from 2013 are correct for each company and that data is used for 1A2a, 1A2b, 1A2c, and 1A2f – this is the known usage.
- Because these fuels are purchased from domestic oil companies, they will be subtracted from the sales statistics.
- The difference between known usage and sales statistics is attributed to the category 1A2gviii Other Industry.

These adjustments are described in Figure 3.1. For some fuel types and years, the subtraction of known use from sales statistics results in a negative number indicating that usage was more than what was sold. It is considered more likely that some data is missing from sales statistics and therefore these values will be input as zero. This will cause more fuel used than what is in the sales statistics, and a possible overestimate of emissions. This is however a very low amount compared to the total energy emissions.

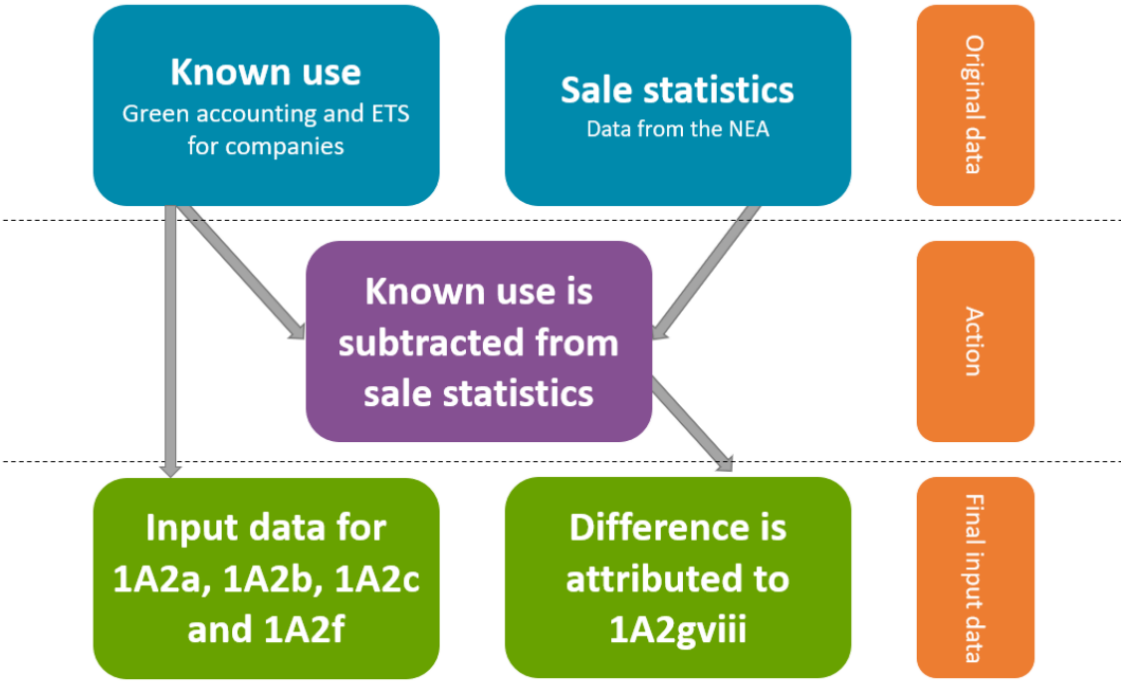


Figure 3.1 Description of adjustments in input data for IPCC/NFR category 1A2.

In the sales statistics there are unspecified categories for all fuels, labelled as "Other." These fuels are accounted for in NFR Category 1A5. Efforts have been made to minimize the amount of fuel that is categorized as "other" by contacting the companies when substantial amount of fuel appears and making sure that it does not belong in another category. By doing this fuel have been correctly categorized elsewhere.

3.3 Stationary Combustion (NFR 1A1, 1A2, 1A4, and 1A5)

3.3.1 Electricity and Heat (NFR 1A1a)

Energy Industries include emissions from Electricity and Heat production. Iceland has extensively utilised renewable energy sources for electricity and heat production, thus emissions from this sector are low. For dioxin, PAH4, SO_x, and NMVOC, waste incineration with energy recovery is the main source of emissions within this category. However, waste incineration with energy recovery has not been occurring in Iceland since 2013. Activity data on fuel use for the energy industries are based on fuel sales data adjusted by the IEEA (see Chapter 3.2). Activity data on waste is collected by IEEA directly from the plants.

The main sources of electricity in Iceland are hydropower and geothermal energy. In recent years, wind power development has taken place. As can be seen in Table 3.2, only a small fraction of electricity is produced with fuel combustion; electricity was produced with fuel combustion at two locations that are located far from the distribution system (two sparsely populated islands, Grímsey and Flatey); furthermore, some public electricity facilities have emergency backup fuel combustion power plants which are used if problems occur in the distribution system. Those plants are seldom used apart from testing and during maintenance.

Table 3.2 Electricity production in Iceland [GWh]

	1990	1995	2000	2005	2010	2015	2020	2022	2023
Hydropower	4159	4677	6350	7015	12592	13781	13157	14196	14226
Geothermal	283	290	1323	1658	4465	5003	5961	5916	6006
Fuel Combustion	4.6	8.4	4.4	7.8	1.7	3.9	3.1	4.7	4.2
Wind Power	–	–	–	–	–	11	6.7	5.7	6.2
Total [GWh]	**4446**	**4976**	**7678**	**8681**	**17059**	**18799**	**19127**	**20122**	**20243**

Geothermal energy is the main source of heat production in Iceland. Some district heating facilities that lack access to geothermal energy sources use electric boilers to produce heat from electricity. These depend on curtailable energy. These heat plants have backup fuel combustion in case of electricity shortages or problems in the distribution system. Three district heating facilities burned waste to produce heat and were connected to the local distribution system. However, since 2013 no more waste burning with energy recovery is occurring in Iceland. Emissions from these waste incineration plants are reported under Energy Industries.

3.3.1.1 Activity Data

Activity data for electricity and heat production with fuel combustion and waste incineration are given in Table 3.3. The use of residual fuel oil for electricity production in 2007 was much higher than in surrounding years. In 2007, a new aluminium plant was established in Iceland. Because the *Kárahnjúkar Hydropower Project* (hydropower plant that was purpose-built for this aluminium plant) was delayed, the aluminium plant was supplied with electricity for a while from the distribution system. This led to electricity shortages for the district heating system and industry depending on curtailable energy leading to increased fuel combustion.

The different fuel composition from year to year (waste, fuel) affects the implied emission factor (IEF). For example, the IEF for dioxin in this sector is higher in years when fuel combustion is low, and the sector is dominated by waste incineration. The following years were unusual: 1995 (issues in the electricity distribution system caused by snow avalanches in northwest Iceland (the Westfjords) and icing in the northern part of the country); 1997/1998 (unfavourable weather conditions for hydropower plants during the winter); and 2007 (explained above).

Table 3.3 Fuel combustion and waste incineration [kt] for Electricity and Heat Production.

	1990	1995	2000	2005	2010	2015	2020	2022	2023
1A1ai – Gas/Diesel Oil	1.3	1.1	1.1	0.021	1.0	1.2	0.82	2.6	2.0
1A1ai – Residual Fuel Oil	NO	NO	NO	NO	NO	NO	NO	NO	NO
1A1ai – Biomethane	NO	NO	NO	0.3	NO	NO	NO	NO	NO
1A1ai – Biodiesel	NO	NO	NO	NO	NO	NO	NO	NO	NO
1A1aiii – Gas/Diesel Oil	NO	NO	NO	NO	NO	NO	NO	0.71	1.44
1A1aiii – Residual Fuel Oil	3.0	3.1	0.12	0.2	NO	0.14	NO	NO	NO
1A1aiii – Biodiesel	NO	NO	NO	NO	NO	NO	NO	NO	NO
1A1aiii – Solid Waste	NO	4.7	6.1	6.0	8.1	NO	NO	NO	NO

Emission factors are Tier 1 factors taken from the 2023 EMEP/EEA Guidebook (Chapter 1.A.1. Energy Industries, 3-6 (fuel oil), 3-7 (gas oil and biodiesel) and 3-9 (biogas)). Emission factors for the burning of waste with energy recovery are taken from Table 3-2 of

Chapter 5C1a of the 2023 EMEP/EEA Guidebook. Due to the lack of emission factors given in the 2023 Guidebook, the following pollutants are not estimated:

- Gas oil: NH_3, PCBs, HCB, BaP, BbF, BkF;
- Residual fuel oil: NH_3, PCBs, HCB, BaP;
- Gaseous fuels (biomethane): PCBs, HCB, BaP, BbF, BkF, TSP, PM_{10}, $PM_{2.5}$.

3.3.1.2 Recalculations and Improvements

Recalculations for the 2025 Submission

1A1ai Electricity Generation: A recalculation was done in 1A1ai due to new emission factors for biomethane in the 2023 EMEP/EEA Guidebook. Previously emission factors for gaseous fuels from the 2019 EMEP/EEA Guidebook were used. This led to recalculations of pollutants from biofuels in the years 2002-2009. Second, a more precise NCV for diesel was obtained for the years 2021 and 2022 resulting in recalculations for these two years. Third, NH_3 emissions for biomethane are now calculated (2002-2009). Fourth, the activity data for biomass changed (was 2003-2007 and is now 2002-2009).

Table 3.4 Recalculations in 1A1ai Electricity Generation for 2002-2009 and 2021-2022.

1A1ai Electritity Generation	2002	2003	2005	2009	2021	2022
2024 submission NOx [kt]	3.11E-03	2.72E-03	1.38E-03	2.12E-03	2.462E-03	7.27E-03
2025 submission NOx [kt]	8.36E-03	8.47E-03	9.23E-03	3.17E-03	2.463E-03	7.23E-03
Change relative to the 2024 submission NOx [kt]	5.25E-03	5.74E-03	7.85E-03	1.04E-03	1.25E-06	-3.54E-05
Change relative to the 2024 submission NOx [%]	169%	211%	570%	49%	0.05%	-0.49%
2024 submission CO [kt]	7.75E-04	8.60E-04	5.93E-04	5.29E-04	6.135E-04	1.81E-03
2025 submission CO [kt]	4.91E-03	5.72E-03	7.24E-03	1.35E-03	6.138E-04	1.80E-03
Change relative to the 2024 submission CO [kt]	4.13E-03	4.86E-03	6.65E-03	8.21E-04	3.12E-07	-8.83E-06
Change relative to the 2024 submission CO [%]	534%	565%	1122%	155%	0.05%	-0.49%
2024 submission NMVOC [kt]	3.83E-05	4.97E-05	3.92E-05	2.61E-05	3.030E-05	8.95E-05
2025 submission NMVOC [kt]	3.03E-04	3.60E-04	4.64E-04	7.88E-05	3.031E-05	8.90E-05
Change relative to the 2024 submission NMVOC [kt]	2.65E-04	3.10E-04	4.25E-04	5.26E-05	1.54E-08	-4.36E-07
Change relative to the 2024 submission NMVOC [%]	693%	624%	1082%	201%	0.05%	-0.49%
2024 submission dioxin [mg]	2.39E-05	1.90E-05	7.86E-06	1.63E-05	1.894E-05	5.59E-05
2025 submission dioxin [mg]	4.94E-05	4.61E-05	4.49E-05	2.14E-05	1.895E-05	5.56E-05
Change relative to the 2024 submission dioxin [mg]	2.54E-05	2.71E-05	3.71E-05	5.05E-06	9.62E-09	-2.72E-07
Change relative to the 2024 submission dioxin [%]	106%	143%	471%	31%	0.05%	-0.49%
2024 submission SO2 [kt]	3.47E-03	1.26E-03	4.62E-05	1.52E-03	1.761E-03	5.20E-03
2025 submission SO2 [kt]	3.75E-03	1.63E-03	5.42E-04	1.58E-03	1.762E-03	5.18E-03
Change relative to the 2024 submission SO2 [kt]	2.86E-04	3.63E-04	4.96E-04	5.68E-05	8.95E-07	-2.53E-05
Change relative to the 2024 submission SO2 [%]	8.3%	29%	1075%	4%	0.05%	-0.49%
2024 submission TSP [kt]	3.11E-04	1.86E-04	1.91E-05	2.12E-04	2.462E-04	7.27E-04
2025 submission TSP [kt]	3.11E-04	1.76E-04	5.87E-06	2.12E-04	2.463E-04	7.23E-04
Change relative to the 2024 submission TSP [kt]	0.00E+00	-9.60E-06	-1.32E-05	0.00E+00	1.25E-07	-3.54E-06

1A1ai Electritity Generation	2002	2003	2005	2009	2021	2022
Change relative to the 2024 submission TSP [%]	0%	-5.2%	-69%	0%	0.05%	-0.49%
2024 submission PM10 [kt]	1.53E-04	9.64E-05	1.61E-05	1.05E-04	1.212E-04	3.58E-04
2025 submission PM10 [kt]	1.53E-04	8.68E-05	2.89E-06	1.05E-04	1.213E-04	3.56E-04
Change relative to the 2024 submission PM10 [kt]	0.00E+00	-9.60E-06	-1.32E-05	0.00E+00	6.16E-08	-1.74E-06
Change relative to the 2024 submission PM10 [%]	0%	-10%	-82%	0%	0.05%	-0.49%
2024 submission PM2.5 [kt]	3.83E-05	3.13E-05	1.39E-05	2.61E-05	3.030E-05	8.95E-05
2025 submission PM2.5 [kt]	3.83E-05	2.17E-05	7.22E-07	2.61E-05	3.031E-05	8.90E-05
Change relative to the 2024 submission PM2.5 [kt]	0.00E+00	-9.60E-06	-1.32E-05	0.00E+00	1.54E-08	-4.36E-07
Change relative to the 2024 submission PM2.5 [%]	0%	-31%	-95%	0%	0.05%	-0.49%
2024 submission BC [kt]	1.28E-05	7.51E-06	5.72E-07	8.76E-06	1.0150E-05	3.00E-05
2025 submission BC [kt]	1.28E-05	7.27E-06	2.42E-07	8.76E-06	1.0155E-05	2.98E-05
Change relative to the 2024 submission BC [kt]	0.00E+00	-2.40E-07	-3.30E-07	0.00E+00	5.16E-09	-1.46E-07
Change relative to the 2024 submission BC [%]	0%	-3.2%	-58%	0%	0.051%	-0.49%
2024 submission Pb [t]	1.946E-04	1.10E-04	3.70E-06	1.3301E-04	1.541E-04	4.55E-04
2025 submission Pb [t]	1.947E-04	1.11E-04	3.91E-06	1.3303E-04	1.542E-04	4.53E-04
Change relative to the 2024 submission Pb [kt]	1.33E-07	1.53E-07	2.09E-07	2.63E-08	7.83E-08	-2.22E-06
Change relative to the 2024 submission Pb [%]	0.07%	0.14%	5.7%	0.02%	0.05%	-0.49%
2024 submission Cd [t]	6.503E-05	3.69E-05	1.23E-06	4.44448E-05	5.151E-05	1.52E-04
2025 submission Cd [t]	6.508E-05	3.70E-05	1.32E-06	4.44553E-05	5.153E-05	1.51E-04
Change relative to the 2024 submission Cd [kt]	5.30E-08	6.50E-08	8.89E-08	1.05E-08	2.62E-08	-7.41E-07
Change relative to the 2024 submission Cd [%]	0.08%	0.18%	7.2%	0.02%	0.05%	-0.49%
2024 submission Hg [t]	6.50E-05	3.80E-05	2.71E-06	4.44E-05	5.151E-05	1.52E-04
2025 submission Hg [t]	6.82E-05	4.10E-05	6.79E-06	4.51E-05	5.153E-05	1.51E-04
Change relative to the 2024 submission Hg [t]	3.18E-06	2.98E-06	4.08E-06	6.31E-07	2.62E-08	-7.41E-07
Change relative to the 2024 submission Hg [%]	4.9%	7.9%	150%	1.4%	0.05%	-0.49%
2024 submission As [t]	8.66E-05	5.04E-05	3.41E-06	5.92E-05	6.85E-05	2.02E-04
2025 submission As [t]	8.77E-05	5.05E-05	3.58E-06	5.94E-05	6.86E-05	2.01E-04
Change relative to the 2024 submission As [t]	1.11E-06	1.28E-07	1.67E-07	2.21E-07	3.48E-08	-9.86E-07
Change relative to the 2024 submission As [%]	1.3%	0.25%	4.9%	0.37%	0.05%	-0.49%
2024 submission Cr [t]	6.50E-05	3.69E-05	1.24E-06	4.44E-05	5.151E-05	1.52E-04
2025 submission Cr [t]	6.98E-05	4.30E-05	9.56E-06	4.54E-05	5.153E-05	1.51E-04
Change relative to the 2024 submission Cr [t]	4.77E-06	6.09E-06	8.33E-06	9.47E-07	2.62E-08	-7.41E-07
Change relative to the 2024 submission Cr [%]	7.3%	16%	672%	2.1%	0.05%	-0.49%
2024 submission Cu [t]	1.301E-04	7.38E-05	2.46E-06	8.89E-05	1.030E-04	3.04E-04
2025 submission Cu [t]	1.38E-04	8.43E-05	1.68E-05	9.05E-05	1.031E-04	3.03E-04
Change relative to the 2024 submission Cu [t]	8.22E-06	1.05E-05	1.44E-05	1.63E-06	5.23E-08	-1.48E-06
Change relative to the 2024 submission Cu [%]	6.3%	14%	584%	1.8%	0.051%	-0.49%
2024 submission Ni [t]	6.53E-05	3.69E-05	1.24E-06	4.44E-05	5.151E-05	1.52E-04
2025 submission Ni [t]	7.14E-05	4.47E-05	1.19E-05	4.57E-05	5.153E-05	1.51E-04

1A1ai Electritity Generation	2002	2003	2005	2009	2021	2022
Change relative to the 2024 submission Ni [t]	6.10E-06	7.78E-06	1.06E-05	1.21E-06	2.62E-08	-7.41E-07
Change relative to the 2024 submission Ni [%]	9.3%	21%	861%	2.7%	0.051%	-0.49%
2024 submission Se [t]	3.25E-04	1.84E-04	6.30E-06	2.22E-04	2.571E-04	7.59E-04
2025 submission Se [t]	3.30E-04	1.91E-04	1.59E-05	2.23E-04	2.573E-04	7.56E-04
Change relative to the 2024 submission Se [t]	5.57E-06	6.99E-06	9.56E-06	1.11E-06	1.31E-07	-3.70E-06
Change relative to the 2024 submission Se [%]	1.7%	3.8%	152%	0.50%	0.05%	-0.49%
2024 submission Zn [t]	8.66E-05	4.91E-05	1.66E-06	5.92E-05	6.85E-05	2.02E-04
2025 submission Zn [t]	1.93E-04	1.85E-04	1.87E-04	8.02E-05	6.86E-05	2.01E-04
Change relative to the 2024 submission Zn [t]	1.06E-04	1.35E-04	1.85E-04	2.10E-05	3.48E-08	-9.86E-07
Change relative to the 2024 submission Zn [%]	122%	276%	11181%	36%	0%	0%
2024 submission NH3 [t]	NA	NA	NA	NA	NA	NA
2025 submission NH3 [t]	6.10E-06	7.79E-06	1.07E-05	1.21E-06	NA	NA
Change relative to the 2024 submission NH3 [t]	6.10E-06	7.79E-06	1.07E-05	1.21E-06	NA	NA
Change relative to the 2024 submission NH3 [%]	-	-	-	-	-	-
2024 submission BaP [t]	NA	6.04E-06	8.30E-06	NA	NA	NA
2025 submission BaP [t]	NA	NA	NA	NA	NA	NA
Change relative to the 2024 submission BaP [t]	-	-6.04E-06	-8.30E-06	-	-	-
Change relative to the 2024 submission BaP [%]	-	-	-	-	-	-
2024 submission BbF [t]	4.18E-09	9.06E-06	1.24E-05	NA	NA	NA
2025 submission BbF [t]	4.18E-09	NA	NA	NA	NA	NA
Change relative to the 2024 submission BbF [t]	0.00E+00	-9.06E-06	-1.24E-05	-	-	-
Change relative to the 2024 submission BbF [%]	0%	-	-	-	-	-
2024 submission BkF [t]	4.18E-09	9.06E-06	1.24E-05	NA	NA	NA
2025 submission BkF [t]	4.18E-09	NA	NA	NA	NA	NA
Change relative to the 2024 submission BkF [t]	0.00E+00	-9.06E-06	-1.24E-05	-	-	-
Change relative to the 2024 submission BkF [%]	0%	-	-	-	-	-
2024 submission IPy [t]	3.37E-07	9.25E-06	1.25E-05	2.26E-07	2.62E-07	7.74E-07
2025 submission IPy [t]	3.37E-07	1.88E-07	6.25E-09	2.26E-07	2.62E-07	7.70E-07
Change relative to the 2024 submission IPy [t]	0.00E+00	-9.06E-06	-1.24E-05	0.00E+00	1.33E-10	-3.77E-09
Change relative to the 2024 submission IPy [%]	0%	-98%	-99.95%	0%	0.051%	-0.49%
2024 submission PAH4 [t]	3.46E-07	3.34E-05	4.56E-05	2.26E-07	2.621E-07	7.74E-07
2025 submission PAH4 [t]	3.46E-07	1.88E-07	6.25E-09	2.26E-07	2.622E-07	7.70E-07
Change relative to the 2024 submission PAH4 [t]	0.00E+00	-3.32E-05	-4.56E-05	0.00E+00	1.33E-10	-3.77E-09
Change relative to the 2024 submission PAH4 [%]	0%	-99%	-99.99%	0%	0.051%	-0.49%

1A1aiii Heat Plants: A more precise NCV for diesel was obtained for the years 2021 and 2022 resulting in recalculations for these two years.

Table 3.5 Recalculations in 1A1aiii Heat Plants for 2021-2022.

1A1ai Electriticy Generation	2021	2022
2024 submission NOx [kt]	3.541E-04	1.99E-03
2025 submission NOx [kt]	3.542E-04	1.98E-03
Change relative to the 2024 submission NOx [kt]	1.80E-07	-9.68E-06
Change relative to the 2024 submission NOx [%]	0.051%	-0.487%
2024 submission CO [kt]	8.82E-05	4.95E-04
2025 submission CO [kt]	8.83E-05	4.93E-04
Change relative to the 2024 submission CO [kt]	4.48E-08	-2.41E-06
Change relative to the 2024 submission CO [%]	0.051%	-0.49%
2024 submission NMVOC [kt]	4.358E-06	2.44E-05
2025 submission NMVOC [kt]	4.360E-06	2.43E-05
Change relative to the 2024 submission NMVOC [kt]	2.21E-09	-1.19E-07
Change relative to the 2024 submission NMVOC [%]	0.051%	-0.49%
2024 submission dioxin [mg]	2.724E-06	1.53E-05
2025 submission dioxin [mg]	2.725E-06	1.52E-05
Change relative to the 2024 submission dioxin [mg]	1.38E-09	-7.44E-08
Change relative to the 2024 submission dioxin [%]	0.051%	-0.49%
2024 submission SO2 [kt]	2.533E-04	1.42E-03
2025 submission SO2 [kt]	2.534E-04	1.41E-03
Change relative to the 2024 submission SO2 [kt]	1.29E-07	-6.92E-06
Change relative to the 2024 submission SO2 [%]	0.051%	-0.49%
2024 submission TSP [kt]	3.541E-05	1.99E-04
2025 submission TSP [kt]	3.542E-05	1.98E-04
Change relative to the 2024 submission TSP [kt]	1.80E-08	-9.68E-07
Change relative to the 2024 submission TSP [%]	0.051%	-0.49%
2024 submission PM10 [kt]	1.743E-05	9.78E-05
2025 submission PM10 [kt]	1.744E-05	9.73E-05
Change relative to the 2024 submission PM10 [kt]	8.86E-09	-4.76E-07
Change relative to the 2024 submission PM10 [%]	0.051%	-0.49%
2024 submission PM2.5 [kt]	4.358E-06	2.44E-05
2025 submission PM2.5 [kt]	4.360E-06	2.43E-05
Change relative to the 2024 submission PM2.5 [kt]	2.21E-09	-1.19E-07
Change relative to the 2024 submission PM2.5 [%]	0.051%	-0.49%
2024 submission BC [kt]	1.460E-06	8.19E-06
2025 submission BC [kt]	1.461E-06	8.15E-06
Change relative to the 2024 submission BC [kt]	7.42E-10	-3.99E-08
Change relative to the 2024 submission BC [%]	0.051%	-0.49%
2024 submission Pb [t]	2.217E-05	1.24E-04
2025 submission Pb [t]	2.218E-05	1.24E-04
Change relative to the 2024 submission Pb [kt]	1.13E-08	-6.06E-07
Change relative to the 2024 submission Pb [%]	0.051%	-0.49%
2024 submission Cd [t]	7.408E-06	4.16E-05
2025 submission Cd [t]	7.412E-06	4.14E-05
Change relative to the 2024 submission Cd [kt]	3.76E-09	-2.02E-07
Change relative to the 2024 submission Cd [%]	0.051%	-0.49%
2024 submission Hg [t]	7.408E-06	4.16E-05
2025 submission Hg [t]	7.412E-06	4.14E-05

1A1ai Electriticy Generation	2021	2022
Change relative to the 2024 submission Hg [t]	3.76E-09	-2.02E-07
Change relative to the 2024 submission Hg [%]	0.051%	-0.49%
2024 submission As [t]	9.859E-06	5.53E-05
2025 submission As [t]	9.864E-06	5.50E-05
Change relative to the 2024 submission As [t]	5.01E-09	-2.69E-07
Change relative to the 2024 submission As [%]	0.051%	-0.49%
2024 submission Cr [t]	7.408E-06	4.16E-05
2025 submission Cr [t]	7.412E-06	4.14E-05
Change relative to the 2024 submission Cr [t]	3.76E-09	-2.02E-07
Change relative to the 2024 submission Cr [%]	0.051%	-0.49%
2024 submission Cu [t]	1.4816E-05	8.31E-05
2025 submission Cu [t]	1.4823E-05	8.27E-05
Change relative to the 2024 submission Cu [t]	7.53E-09	-4.05E-07
Change relative to the 2024 submission Cu [%]	0.051%	-0.49%
2024 submission Ni [t]	7.408E-06	4.16E-05
2025 submission Ni [t]	7.412E-06	4.14E-05
Change relative to the 2024 submission Ni [t]	3.76E-09	-2.02E-07
Change relative to the 2024 submission Ni [%]	0.051%	-0.49%
2024 submission Se [t]	3.699E-05	2.07E-04
2025 submission Se [t]	3.700E-05	2.06E-04
Change relative to the 2024 submission Se [t]	1.88E-08	-1.01E-06
Change relative to the 2024 submission Se [%]	0.051%	-0.49%
2024 submission Zn [t]	9.859E-06	5.53E-05
2025 submission Zn [t]	9.864E-06	5.50E-05
Change relative to the 2024 submission Zn [t]	5.01E-09	-2.69E-07
Change relative to the 2024 submission Zn [%]	0.051%	-0.49%
2024 submission IPy [t]	3.769E-05	2.11E-04
2025 submission IPy [t]	3.771E-05	2.10E-04
Change relative to the 2024 submission IPy [t]	1.92E-08	-1.03E-06
Change relative to the 2024 submission IPy [%]	0.051%	-0.49%
2024 submission PAH4 [t]	3.769E-05	2.11E-04
2025 submission PAH4 [t]	3.771E-05	2.10E-04
Change relative to the 2024 submission PAH4 [t]	1.92E-08	-1.03E-06
Change relative to the 2024 submission PAH4 [%]	0.051%	-0.49%

Recalculations for the 2024 Submission

1A1ai Electricity Generation

In the 2024 submission, the activity data for gas/diesel oil was not properly accounted for 2020 and 2021 and a country specific NCV for diesel was missing for 2016. These have been fixed and led to recalculations of all air pollutants for those three years (see Table 3.6), minor for 2016 but large for the other two. As for sulphur content in residual fuel, an error in the default value was fixed for 1990-2011 while country specific values were applied for 2012 onwards. These changes in sulphur content in residual fuel led to large recalculations of SO2 through the time series (see Table 3.7). Lastly, a calculation error was fixed for BC which also led to large recalculations for BC through the time series (see Table 3.8).

Table 3.6 Recalculations of all air pollutants except SO_2 and BC in 1A1ai Electricity Generation and between submissions.

1A1aiElectricity Generation	2016	2020	2021
2023 submission NO_x [kt]	2.029 E-03	1.6 E-03	2.09 E-03
2024 submission NO_x [kt]	2.039 E-03	2.3 E-03	2.46 E-03
Change relative to the 2023 submission NO_x [%]	0.47%	47%	18%
2023 submission CO [kt]	5.057 E-04	3.9 E-04	5.2 E-04
2024 submission CO [kt]	5.081 E-04	5.7 E-04	6.1 E-04
Change relative to the 2023 submission CO [%]	0.47%	47%	18%
2023 submission NMVOC [kt]	2.497 E-05	1.9 E-05	2.6 E-05
2024 submission NMVOC [kt]	2.509 E-05	2.8 E-05	3.0 E-05
Change relative to the 2023 submission NMVOC [%]	0.47%	47%	18%
2023 submission dioxin [mg]	1.5609 E-05	1.20 E-05	1.60 E-05
2024 submission dioxin [mg]	1.5682 E-05	1.76 E-05	1.89 E-05
Change relative to the 2023 submission dioxin [%]	0.47%	47%	18%
2023 submission TSP [kt]	2.029 E-04	1.6 E-04	2.09 E-04
2024 submission TSP [kt]	2.039 E-04	2.3 E-04	2.46 E-04
Change relative to the 2023 submission TSP [%]	0.47%	47%	18%
2023 submission PM_{10} [kt]	9.99 E-05	7.7 E-05	1.03 E-04
2024 submission PM_{10} [kt]	1.00 E-04	1.1 E-04	1.21 E-04
Change relative to the 2023 submission PM10 [%]	0.47%	47%	18%
2023 submission $PM_{2.5}$ [kt]	2.497 E-05	1.9 E-05	2.6 E-05
2024 submission $PM_{2.5}$ [kt]	2.509 E-05	2.8 E-05	3.0 E-05
Change relative to the 2023 submission $PM_{2.5}$ [%]	0.47%	47%	18%
2023 submission Pb [t]	1.2706 E-04	9.8 E-05	1.31 E-04
2024 submission Pb [t]	1.2765 E-04	1.4 E-04	1.54 E-04
Change relative to the 2023 submission Pb [%]	0.47%	47%	18%
2023 submission Cd [t]	4.246 E-05	3.3 E-05	4.4 E-05
2024 submission Cd [t]	4.265 E-05	4.8 E-05	5.2 E-05
Change relative to the 2023 submission Cd [%]	0.47%	47%	18%
2023 submission Hg [t]	4.246 E-05	3.3 E-05	4.4 E-05
2024 submission Hg [t]	4.265 E-05	4.8 E-05	5.2 E-05
Change relative to the 2023 submission Hg [%]	0.47%	47%	18%
2023 submission As [t]	5.650 E-05	4.3 E-05	5.8 E-05
2024 submission As [t]	5.677 E-05	6.4 E-05	6.9 E-05
Change relative to the 2023 submission As [%]	0.47%	47%	18%
2023 submission Cr [t]	4.246 E-05	3.3 E-05	4.4 E-05
2024 submission Cr [t]	4.265 E-05	4.8 E-05	5.2 E-05
Change relative to the 2023 submission Cr [%]	0.47%	47%	18%
2023 submission Cu [t]	8.49 E-05	6.5 E-05	8.7 E-05
2024 submission Cu [t]	8.53 E-05	9.6 E-05	1.0 E-04
Change relative to the 2023 submission Cu [%]	0.47%	47%	18%
2023 submission Ni [t]	4.246 E-05	3.3 E-05	4.4 E-05

1A1aiElectricity Generation	2016	2020	2021
2024 submission Ni [t]	4.265 E-05	4.8 E-05	5.2 E-05
Change relative to the 2023 submission Ni [%]	0.47%	47%	18%
2023 submission Se [t]	2.120 E-04	1.6 E-04	2.18 E-04
2024 submission Se [t]	2.130 E-04	2.4 E-04	2.57 E-04
Change relative to the 2023 submission Se [%]	0.47%	47%	18%
2023 submission Zn [t]	5.650 E-05	4.3 E-05	5.8 E-05
2024 submission Zn [t]	5.677 E-05	6.4 E-05	6.9 E-05
Change relative to the 2023 submission Zn [%]	0.47%	47%	18%
2023 submission IPy [t]	2.160.E-07	1.7.E-07	2.22.E-07
2024 submission IPy [t]	2.170.E-07	2.4.E-07	2.62.E-07
Change relative to the 2023 submission IPy [%]	0.47%	47%	18%
2023 submission PAH4 [t]	2.160 E-07	1.7 E-07	2.22 E-07
2024 submission PAH4 [t]	2.170 E-07	2.4 E-07	2.62 E-07
Change relative to the 2023 submission PAH4 [%]	0.47%	47%	18%

Table 3.7 Recalculations of SO_2 in 1A1ai Electricity Generation between submissions.*

1A1ai Electricity Generation	1996	1997	1998	1999	2002	2007	2013	2020	2021
2023 submission SO_2 [kt]	0.00315	0.0033	0.031	0.0099	0.00305	0.164	0.0067	0.00111	0.00149
2024 submission SO_2 [kt]	0.00348	0.0044	0.045	0.0140	0.00347	0.137	0.0055	0.00163	0.00176
Change relative to the 2023 submission SO_2 [%]	10%	31%	48%	42%	14%	-16%	-17%	47%	18%

* Recalculations for 2006, 2012, 2016, 2017 and 2018 are not shown as they are relatively small (between -6.0% to +1.8%) compared to other years.

Table 3.8 Recalculations of BC in 1A1ai Electricity Generation between submissions.

1A1ai Electricity Generation	2003	2004	2005	2006	2007	2016	2020	2021
2023 submission BC [kt]	1.7 E-05	8.3 E-06	1.3 E-05	1.88 E-05	1.47 E-05	8.37 E-06	6.4 E-06	8.6 E-06
2024 submission BC [kt]	7.5 E-06	1.5 E-06	5.7 E-07	1.56 E-05	1.30 E-05	8.41 E-06	9.4 E-06	1.0 E-05
Change relative to the 2023 submission BC [%]	-55%	-82%	-96%	-17%	-12%	0.47%	47%	18%

1A1aiii Heat Plants

Similar to 1Aai Electricity Generation, the activity data for gas/diesel oil for 2021 was not properly accounted in the last submission. This has been fixed and led to recalculations of all air pollutants for 2021 (see Table 3.9). Changes in sulphur content in residual fuel that were describe in 1A1ai Electricity Generation also apply for 1A1aii Heat Plants, i.e. an error in the default value was fixed for 1990-2011 while country specific values were applied for 2012 onwards. Additionally, emission factor for SO2 emissions from gas/diesel was corrected, contributing to large recalculations of SO2 through the time series (see Table 3.10)

Table 3.9 Recalculations of all air pollutants except SO_2 in 1A1aiii Heat Plant between submissions.

1A1aiii Heat Plants	2021
2023 submission NO_X [kt]	0.00017
2024 submission NO_X [kt]	0.00035
Change relative to the 2023 submission NO_X [%]	108%
2023 submission NMVOC [kt]	0.0000021
2024 submission NMVOC [kt]	0.0000044
Change relative to the 2023 submission NMVOC [%]	108%
2023 submission $PM_{2.5}$ [kt]	0.0000021
2024 submission $PM_{2.5}$ [kt]	0.0000044
Change relative to the 2023 submission $PM_{2.5}$ [%]	108%
2023 submission PM_{10} [kt]	0.0000084
2024 submission PM_{10} [kt]	0.0000174
Change relative to the 2023 submission PM_{10} [%]	108%
2023 submission TSP [kt]	0.000017
2024 submission TSP [kt]	0.000035
Change relative to the 2023 submission TSP [%]	108%
2023 submission BC [kt]	0.00000070
2024 submission BC [kt]	0.00000146
Change relative to the 2023 submission BC [%]	108%
2023 submission CO [kt]	0.000042
2024 submission CO [kt]	0.000088
Change relative to the 2023 submission CO [%]	108%
2023 submission Pb [t]	0.000011
2024 submission Pb [t]	0.000022
Change relative to the 2023 submission Pb [%]	108%
2023 submission Cd [t]	0.0000036
2024 submission Cd [t]	0.0000074
Change relative to the 2023 submission Cd [%]	108%
2023 submission Hg [t]	0.0000036
2024 submission Hg [t]	0.0000074
Change relative to the 2023 submission Hg [%]	108%
2023 submission As [t]	0.0000047
2024 submission As [t]	0.0000099
Change relative to the 2023 submission As [%]	108%
2023 submission Cr [t]	0.0000036
2024 submission Cr [t]	0.0000074
Change relative to the 2023 submission Cr [%]	108%
2023 submission Cu [t]	0.0000071
2024 submission Cu [t]	0.0000148
Change relative to the 2023 submission Cu [%]	108%
2023 submission Ni [t]	0.0000036

1A1aiii Heat Plants	2021
2024 submission Ni [t]	0.0000074
Change relative to the 2023 submission Ni [%]	108%
2023 submission Se [t]	0.000018
2024 submission Se [t]	0.000037
Change relative to the 2023 submission Se [%]	108%
2023 submission Zn [t]	0.0000047
2024 submission Zn [t]	0.0000099
Change relative to the 2023 submission Zn [%]	108%
2023 submission dioxin [g]	0.0000013
2024 submission dioxin [g]	0.0000027
Change relative to the 2023 submission dioxin [%]	108%
2023 submission IPy [t]	0.000018
2024 submission IPy [t]	0.000038
Change relative to the 2023 submission IPy [%]	108%
2023 submission PAH4 [t]	0.000018
2024 submission PAH4 [t]	0.000038
Change relative to the 2023 submission PAH4 [%]	108%

Table 3.10 Recalculations of SO_2 in 1A1aiii Heat Plant between submissions.*

1A1aiii Heat Plants	1990	1995	2000	2005	2015	2021
2023 submission SO_2 [kt]	0.108	0.119	0.0147	0.0171	0.00493	0.00284
2024 submission SO_2 [kt]	0.161	0.174	0.0169	0.0206	0.00269	0.00025
Change relative to the 2023 submission SO2 [%]	50%	47%	15%	20%	-46%	-91%

* The table shows 5-years interval and the latest inventory year, excluding 2010 and 2020 as there were no recalculations for those two years (no use fuels involved).

Planned Improvements

No improvements are currently planned for this subsector.

3.3.2 Manufacturing Industries, Stationary Combustion (NFR 1A2, Excluding Mobile Sources)

3.3.2.1 Activity Data

The activity data is the total amount of fuel sold to the manufacturing industries for stationary combustion. The sales statistics do not fully specify by which type of industry the fuel is being purchased. This division is made by the IEEA on the basis of the reported fuel use by all major industrial plants falling under Act 96/2023 and the EU ETS Directive 2003/87/EC (metal production, fish meal production, and mineral wool) and from green accounts submitted by the industry in accordance with regulation No 851/2002. All major industries falling under Act 96/2023 report their fuel use to the IEEA along with other relevant information for industrial processes. The difference between the given total for the sector and the sum of the fuel use as reported by industrial facilities is categorised as 1A2gviii non-specified industry (see Figure 3.1). The total fuel consumption per fuel type can be seen in Table 3.11.

Emissions from the cement industry (the single operating cement plant was closed in 2011) and the mineral wool production are reported under 1A2f. For dioxin, emissions from the cement industry are reported under industrial processes (2A1).

Table 3.11 Fuel use [kt], Stationary Combustion in the Manufacturing Industry.

Fuel Type	1990	1995	2000	2005	2010	2015	2020	2022	2023
1A2a - Iron and Steel									
Gas/Diesel Oil	0.11	0.22	0.56	0.46	0.46	0.29	0.21	0.21	0.22
LPG	NO	NO	NO	NO	NO	0.10	0.20	0.22	0.19
1A2b - Non-ferrous Metals									
Gas/Diesel Oil	NO	NO	0.55	5.37	1.35	0.046	1.72	1.33	0.13
Residual Fuel Oil	3.93	5.16	7.51	NO	3.31	1.40	NO	NO	NO
LPG	0.41	0.31	0.67	0.66	0.61	0.39	0.23	0.70	1.26
1A2c - Chemicals									
Residual Fuel Oil	2.38	2.31	2.27	NO	NO	NO	NO	NO	NO
1A2e - Food processing, Beverages, and Tobacco (Fishmeal Production)									
Gas/Diesel Oil	NO	NO	NO	NO	2.16	NO	NO	14.60	5.33
Residual Fuel Oil	41.03	48.54	36.37	21.44	9.61	8.41	1.22	2.70	1.91
Waste Oil	NO	NO	NO	NO	1.36	1.59	0.37	4.63	4.18
Biodiesel	NO	NO	NO	NO	NO	NO	NO	NO	NO
1A2e - Food processing, Beverages, and Tobacco (Other)									
Gas/Diesel Oil	NO	NO	NO	NO	2.71	3.75	3.37	3.03	2.22
Residual Fuel Oil	NO	NO	NO	NO	1.71	0.33	NO	NO	NO
1A2f - Non-metallic Minerals (Cement)									
Gas/Diesel Oil	NO	NO	0.0060	0.019	0.0050	NO	NO	NO	NO
Residual Fuel Oil	0.06	NO	NO	NO	NO	NO	NO	NO	NO
Petroleum Coke	NO	NO	NO	8.13	NO	NO	NO	NO	NO
Waste Oil	NO	4.99	6.04	1.82	NO	NO	NO	NO	NO
Other Bituminous Coal	18.60	8.65	13.26	9.91	3.65	NO	NO	NO	NO
1A2f - Non-metallic Minerals (Mineral Wool)									
Gas/Diesel Oil	NO	0.15	0.17	0.16	0.07	0.11	0.13	0.13	0.14
Residual Fuel Oil	0.59	NO	NO	NO	NO	*NO*	NO	NO	NO
Petroleum Coke	NO	NO	NO	NO	NO	NO	NO	NO	NO
1A2gviii - Other Industry									
Gas/Diesel Oil	4.96	0.76	7.64	9.19	NO	2.92	2.13	2.27	2.40
Residual Fuel Oil	7.91	0.16	1.0E-05	3.56	0.30	0.052	NO	NO	NO
LPG	NO	NO	0.19	0.27	0.44	0.32	0.57	0.55	0.25
Other Bituminous Coal	NO	NO	NO	NO	NO	NO	NO	NO	NO

3.3.2.2 Emission Factors

Emission factors (EFs) for all pollutants are Tier 1 EFs from Chapter 1.A.2 of the 2023 EMEP/EEA Guidebook.

Table 3.12 Emission factors for pollutants from Stationary Combustion in the Manufacturing Industry.

Fuel Type	Reference	Exception
Gas/Diesel Oil	Tier 1 EF for liquid fuels from **Table 3-4** from Chapter 1.A.2 of the 2023 EMEP/EEA Guidebook	SO_2 emissions are based on Tier 1 sulphur content from Table 3-14 in chapter 1A3b Road Transport of the EMEP/EEA 2023 Guidebook for 1990-2005. The emissions are then based country specific sulphur content from 2006. SO_2 from 1A2f (cement) included in IPPU 2A1
Residual Fuel Oil		SO_2 emissions are based on Tier 1 sulphur content from Table 3-1 in chapter 1A3d Navigation of the EMEP/EEA 2016 Guidebook for 1990-2011. The emissions are then based on country specific sulphur content from 2012. SO_2 from 1A2f (cement) included in IPPU 2A1
Waste Oil		SO_2 emissions are based on a country specific sulphur content of 0.5%. SO_2 from 1A2f (cement) included in IPPU 2A1
LPG	Tier 1 EF for gaseous fuels from **Table 3-3** from Chapter 1.A.2 of the 2023 EMEP/EEA Guidebook	SO_2 emissions are based on 0.00052% sulphur content which was calculated by using the equation from chapter 4.3.2 with value from Table A 22, 1A4 Small Combustion, of the 2023 EMEP/EEA Guidebook.
Other Bituminous Coal	Tier 1 EF for solid fuels from **Table 3-2** from Chapter 1.A.2 of the 2023 EMEP/EEA Guidebook	SO_2 emissions are based on a country specific sulphur content of 1.5%. SO_2 and dioxins emissions are included in 2A1 in IPPU Chapter
Petroleum Coke		

Due to the lack of emission factors given in the 2023 EMEP/EEA Guidebook, the following pollutants are not estimated:

- All liquid fuels and LPG: NH_3, PCB, HCB;
- Other bituminous coal: NH_3.

3.3.2.3 Recalculations and Improvements

Recalculations for the 2025 Submission

For the 2025 submission, recalculations were due to following changes (the results can be seen in the tables below):

- A more precise NCV for diesel was obtained for the years 2021 and 2022 resulting in recalculations for these two years for all air pollutants.
- The S content of LPG was corrected. Causes recalculations for SO_2 for the years when LPG was used in 1A2a Iron and steel, 1A2b Non-ferrous metal and 1A2gviii Other.

- The emission factor for dioxin and all the four PAH4 for LPG is NA in the 2023 EMEP/EEA Guidebook. In last submission, the emission factors were taken from the 2019 EMEP/EEA Guidebook. This led to recalculations of dioxin, BaP, Bbf, BkF, IpY and PAH4 for the years when LPG was used.

Table 3.13 Recalculations in 1A2, Manufacturing Industries (excluding mobile sources) between submissions.

1A2 Manufacturing Industries	1990	1995	2000	2005	2010	2015	2020	2021	2022
2024 submission SO_2 [kt]	1.912	1.724	1.515	0.773	0.291	0.130	0.010	0.026	0.060
2025 submission SO_2 [kt]	1.912	1.724	1.515	0.773	0.291	0.130	0.010	0.026	0.060
Change relative to the 2024 submission SO_2 [kt]	-3.83E-6	-2.92E-6	-8.03E-6	-8.66E-6	-9.80E-6	-7.56E-6	-9.35E-6	-1.0E-5	-1.2E-5
Change relative to the 2024 submission SO_2 [%]	-0.0002%	-0.0002%	-0.001%	-0.001%	-0.003%	-0.006%	-0.094%	-0.038%	-0.020%
2024 submission NO_x [kt]	1.355	1.332	1.340	1.074	0.506	0.404	0.202	0.2821	0.634
2025 submission NO_x [kt]	1.355	1.332	1.340	1.074	0.506	0.404	0.202	0.2823	0.631
Change relative to the 2024 submission NO_x [kt]	0	0	0	0	0	0	0	1.1E-4	-2.3E-3
Change relative to the 2024 submission NO_x [%]	0%	0%	0%	0%	0%	0%	0%	0.040%	-0.367%
2024 submission CO [kt]	0.611	0.374	0.484	0.371	0.152	0.053	0.027	0.03721	0.0829
2025 submission CO [kt]	0.611	0.374	0.484	0.371	0.152	0.053	0.027	0.03722	0.0826
Change relative to the 2024 submission CO [kt]	0	0	0	0	0	0	0	1.43E-05	-2.99E-4
Change relative to the 2024 submission CO [%]	0%	0%	0%	0%	0%	0%	0%	0.039%	-0.361%
2024 submission NMVOC [kt]	0.105	0.083	0.094	0.074	0.033	0.020	0.011	0.015	0.0322
2025 submission NMVOC [kt]	0.105	0.083	0.094	0.074	0.033	0.020	0.011	0.015	0.0321
Change relative to the 2024 submission NMVOC [kt]	0	0	0	0	0	0	0	5.43E-6	-1.1E-4
Change relative to the 2024 submission NMVOC [%]	0%	0%	0%	0%	0%	0%	0%	0.037%	-0.351%
2024 submission dioxin [g]	3.48E-3	3.53E-03	3.51E-3	2.45E-03	1.35E-3	1.11E-3	5.62E-4	7.81E-4	1.75E-3
2025 submission dioxin [g]	3.47E-3	3.53E-03	3.49E-3	2.43E-03	1.33E-3	1.09E-3	5.43E-4	7.61E-4	1.71E-3
Change relative to the 2024 submission dioxin [g]	-1.01E-5	-7.67E-6	-2.11E-5	-2.28E-5	-2.57E-5	-1.74E-5	-1.96E-5	-2.1E-5	-3.7E-5
Change relative to the 2024 submission dioxin [%]	-0.289%	-0.217%	-0.601%	-0.927%	-1.903%	-1.570%	-3.478%	-2.629%	-2.121%
2024 submission TSP [kt]	0.109	0.078	0.092	0.072	0.031	0.016	0.008	0.011	0.025
2025 submission TSP [kt]	0.109	0.078	0.092	0.072	0.031	0.016	0.008	0.011	0.024
Change relative to the 2024 submission TSP [kt]	0	0	0	0	0	0	0	4.35E-6	-9.1E-5

1A2 Manufacturing Industries	1990	1995	2000	2005	2010	2015	2020	2021	2022
Change relative to the 2024 submission TSP [%]	0%	0%	0%	0%	0%	0%	0%	0.040%	-0.369%
2024 submission PM_{10} [kt]	0.106	0.076	0.090	0.070	0.030	0.016	0.008	0.011	0.025
2025 submission PM_{10} [kt]	0.106	0.076	0.090	0.070	0.030	0.016	0.008	0.011	0.024
Change relative to the 2024 submission PM_{10} [kt]	0	0	0	0	0	0	0	4.35E-06	-9.06E-5
Change relative to the 2024 submission PM_{10} [%]	0%	0%	0%	0%	0%	0%	0%	0.040%	-0.369%
2024 submission $PM_{2.5}$ [kt]	0.101	0.074	0.087	0.068	0.029	0.016	0.008	0.011	0.025
2025 submission $PM_{2.5}$ [kt]	0.101	0.074	0.087	0.068	0.029	0.016	0.008	0.011	0.024
Change relative to the 2024 submission $PM_{2.5}$ [kt]	0	0	0	0	0	0	0	4.35E-6	-9.1E-5
Change relative to the 2024 submission $PM_{2.5}$ [%]	0%	0%	0%	0%	0%	0%	0%	0.040%	-0.369%
2024 submission BC [kt]	0.031	0.030	0.030	0.024	0.011	0.009	0.004	6.09E-3	1.37E-2
2025 submission BC [kt]	0.031	0.030	0.030	0.024	0.011	0.009	0.004	6.09E-3	1.37E-2
Change relative to the 2024 submission BC [kt]	0	0	0	0	0	0	0	2.43E-6	-5.1E-5
Change relative to the 2024 submission BC [%]	0%	0%	0%	0%	0%	0%	0%	0.040%	-0.370%
2024 submission Pb [t]	0.064	0.030	0.046	0.034	0.013	0.000	0.000	4.40E-5	9.88E-5
2025 submission Pb [t]	0.064	0.030	0.046	0.034	0.013	0.000	0.000	4.40E-5	9.84E-5
Change relative to the 2024 submission Pb [t]	0	0	0	0	0	0	0	1.74E-8	-3.6E-7
Change relative to the 2024 submission Pb [%]	0%	0%	0%	0%	0%	0%	0%	0.040%	-0.367%
2024 submission Cd [t]	0.001	0.000	0.001	0.000	0.000	0.000	0.000	3.30E-6	7.41E-6
2025 submission Cd [t]	0.001	0.000	0.001	0.000	0.000	0.000	0.000	3.30E-6	7.39E-6
Change relative to the 2024 submission Cd [t]	0	0	0	0	0	0	0	1.30E-9	-2.7E-8
Change relative to the 2024 submission Cd [%]	0%	0%	0%	0%	0%	0%	0%	0.039%	-0.367%
2024 submission Hg [t]	0.004	0.002	0.003	0.002	0.001	0.000	0.000	9.04E-5	1.85E-4
2025 submission Hg [t]	0.004	0.002	0.003	0.002	0.001	0.000	0.000	9.04E-5	1.84E-4
Change relative to the 2024 submission Hg [t]	0	0	0	0	0	0	0	2.61E-8	-5.4E-7
Change relative to the 2024 submission Hg [%]	0%	0%	0%	0%	0%	0%	0%	0.029%	-0.294%
2024 submission As [t]	0.002	0.001	0.001	0.001	0.000	0.000	0.000	2.10E-5	4.37E-5
2025 submission As [t]	0.002	0.001	0.001	0.001	0.000	0.000	0.000	2.10E-5	4.36E-5
Change relative to the 2024 submission As [t]	0	0	0	0	0	0	0	6.52E-9	-1.4E-7
Change relative to the 2024 submission As [%]	0%	0%	0%	0%	0%	0%	0%	0.031%	-0.311%
2024 submission Cr [t]	0.007	0.004	0.005	0.004	0.001	0.000	0.000	1.09E-4	2.46E-4
2025 submission Cr [t]	0.007	0.004	0.005	0.004	0.001	0.000	0.000	1.09E-4	2.45E-4

1A2 Manufacturing Industries	1990	1995	2000	2005	2010	2015	2020	2021	2022
Change relative to the 2024 submission Cr [t]	0	0	0	0	0	0	0	4.35E-8	-9.1E-7
Change relative to the 2024 submission Cr [%]	0%	0%	0%	0%	0%	0%	0%	0.040%	-0.368%
2024 submission Cu [t]	0.009	0.004	0.007	0.005	0.002	0.000	0.000	1.20E-4	2.70E-4
2025 submission Cu [t]	0.009	0.004	0.007	0.005	0.002	0.000	0.000	1.20E-4	2.69E-4
Change relative to the 2024 submission Cu [t]	0	0	0	0	0	0	0	4.78E-8	-9.96E-7
Change relative to the 2024 submission Cu [%]	0%	0%	0%	0%	0%	0%	0%	0.040%	-0.369%
2024 submission Ni [t]	0.006	0.003	0.004	0.003	0.001	0.000	0.000	4.95E-6	1.07E-05
2025 submission Ni [t]	0.006	0.003	0.004	0.003	0.001	0.000	0.000	4.95E-6	1.07E-05
Change relative to the 2024 submission Ni [t]	0	0	0	0	0	0	0	1.74E-9	-3.62E-8
Change relative to the 2024 submission Ni [%]	0%	0%	0%	0%	0%	0%	0%	0.035%	-0.338%
2024 submission Se [t]	0.001	0.001	0.001	0.001	0.000	0.000	0.000	6.25E-5	1.39E-04
2025 submission Se [t]	0.001	0.001	0.001	0.001	0.000	0.000	0.000	6.25E-5	1.38E-04
Change relative to the 2024 submission Se [t]	0	0	0	0	0	0	0	2.39E-8	-4.98E-7
Change relative to the 2024 submission Se [%]	0%	0%	0%	0%	0%	0%	0%	0.038%	-0.359%
2024 submission Zn [t]	0.168	0.118	0.141	0.109	0.046	0.023	0.011	0.016	0.036
2025 submission Zn [t]	0.168	0.118	0.141	0.109	0.046	0.023	0.011	0.016	0.035
Change relative to the 2024 submission Zn [t]	0	0	0	0	0	0	0	6.30E-6	-1.31E-4
Change relative to the 2024 submission Zn [%]	0%	0%	0%	0%	0%	0%	0%	0.040%	-0.369%
2024 submission PCB [t]	0.082	0.038	0.058	0.043	0.016	0.000	0.000	0.000	0.000
2025 submission PCB [t]	0.082	0.038	0.058	0.043	0.016	0.000	0.000	0.000	0.000
Change relative to the 2024 submission PCB [t]	0	0	0	0	0	0	0	0	0
Change relative to the 2024 submission PCB [%]	0%	0%	0%	0%	0%	-	-	-	-
2024 submission BaP [t]	2.18E-2	1.02E-02	1.56E-2	1.16E-02	4.28E-3	1.51E-6	7.71E-7	1.07E-6	2.38E-6
2025 submission BaP [t]	2.18E-2	1.02E-02	1.56E-2	1.16E-02	4.28E-3	1.48E-6	7.37E-7	1.03E-6	2.32E-6
Change relative to the 2024 submission BaP [t]	-1.39E-8	-1.06E-8	-2.92E-8	-3.15E-8	-3.56E-8	-2.75E-8	-3.40E-8	-3.3E-8	-5.9E-8
Change relative to the 2024 submission BaP [%]	-0.0001%	-0.0001%	-0.0002%	-0.0003%	-0.001%	-1.8%	-4.4%	-3.112%	-2.467%
2024 submission BbF [t]	2.83E-2	1.32E-02	2.02E-2	1.51E-02	5.55E-3	1.18E-5	5.95E-6	8.28E-6	1.86E-5
2025 submission BbF [t]	2.83E-2	1.32E-02	2.02E-2	1.51E-02	5.55E-3	1.17E-5	5.82E-6	8.15E-6	1.83E-5
Change relative to the 2024 submission BbF [t]	-5.61E-8	-4.28E-8	-1.18E-7	-1.27E-7	-1.43E-7	-1.11E-7	-1.37E-7	-1.3E-7	-2.7E-7
Change relative to the 2024 submission BbF [%]	0.000%	0.000%	-0.001%	-0.001%	-0.003%	-0.936%	-2.300%	-1.593%	-1.451%

1A2 Manufacturing Industries	1990	1995	2000	2005	2010	2015	2020	2021	2022
2024 submission BkF [t]	1.14E-2	5.29E-03	8.11E-3	6.06E-3	2.23E-3	1.37E-6	7.11E-7	9.75E-7	2.16E-6
2025 submission BkF [t]	1.14E-2	5.29E-03	8.11E-3	6.06E-3	2.23E-3	1.33E-6	6.59E-7	9.24E-7	2.07E-6
Change relative to the 2024 submission BkF [t]	-2.13E-8	-1.62E-8	-4.46E-8	-4.81E-8	-5.44E-8	-4.20E-8	-5.19E-8	-5.1E-8	-8.4E-8
Change relative to the 2024 submission BkF [%]	-0.0002%	-0.0003%	-0.001%	-0.001%	-0.002%	-3.07%	-7.30%	-5.23%	-3.90%
2024 submission IPy [t]	8.88E-3	4.13E-03	6.33E-3	4.73E-03	1.74E-3	1.21E-6	6.33E-7	8.65E-7	1.91E-06
2025 submission IPy [t]	8.88E-3	4.13E-03	6.33E-3	4.73E-03	1.74E-3	1.17E-6	5.82E-7	8.15E-7	1.83E-06
Change relative to the 2024 submission IPy [t]	-2.09E-8	-1.59E-8	-4.38E-8	-4.73E-8	-5.34E-8	-4.12E-8	-5.10E-8	-5.00E-8	-8.19E-8
Change relative to the 2024 submission IPy [%]	-0.0002%	-0.0004%	-0.001%	-0.001%	-0.003%	-3.40%	-8.06%	-5.78%	-4.28%
2024 submission HCB [t]	7.03E-2	3.27E-02	5.02E-2	3.75E-02	1.38E-2	2.74E-6	2.10E-6	2.51E-6	2.23E-06
2025 submission HC [t]	7.03E-2	3.27E-02	5.02E-2	3.75E-02	1.38E-2	2.65E-6	1.94E-6	2.33E-6	2.07E-06
Change relative to the 2024 submission HCB [t]	0	0	-5.10E-8	-7.41E-8	-1.21E-7	-8.77E-8	-1.55E-7	-1.7E-7	-1.61E-7
Change relative to the 2024 submission HCB [%]	0%	0%	-0.0001%	-0.0002%	-0.001%	-3.20%	-7.40%	-6.96%	-7.20%
2024 submission PAH4 [t]	3.86E-5	4.58E-05	3.86E-5	2.26E-05	1.89E-5	1.32E-5	5.97E-6	8.68E-6	2.28E-05
2025 submission PAH4 [t]	3.85E-5	4.57E-05	3.84E-5	2.24E-05	1.87E-5	1.30E-5	5.85E-6	8.59E-6	2.25E-05
Change relative to the 2024 submission PAH4 [t]	-1.12E-7	-8.56E-8	-1.84E-7	-1.80E-7	-1.66E-7	-1.34E-7	-1.19E-7	-9.2E-8	-3.34E-7
Change relative to the 2024 submission PAH4 [%]	-0.29%	-0.19%	-0.48%	-0.79%	-0.88%	-1.01%	-1.99%	-1.06%	-1.46%

Recalculations for the 2024 Submission

In the 2024 submission, several changes were made in emission factors used to calculate emissions from various fuels in the Energy sector. These changes led to recalculations in most subcategories within the Energy sector, including categories in this chapter.

- Default sulphur content values for diesel was updated to more appropriate default values for 1990-2005 while it was replaced by country specific values for 2006 onwards. This led to large decrease in emissions and recalculations of SO_2 **through the time series**. This led to recalculations in 1A2a Iron and Steel, 1A2b Non-Ferrous Metal, 1A2e Food Processing, 1A2f Other – Non-Metallic Minerals, and 1A2gviii Other Industry.

- As for sulphur content in residual fuel, an error in the default for 1990-2011 was fixed and country specific values were applied for 2012 onwards. This led to recalculations **through the time series** in 1A2b Non-Ferrous Metal, 1A2c Chemicals, 1A2e Food Processing, 1A2f Other – Non-Metallic Minerals, and 1A2gviii Other Industry.

- A country specific NCV for diesel was missing for 2016. This has been fixed and led to minor recalculations of all air pollutants for the year **2016** in 1A2a Iron and Steel, 1A2b Non-Ferrous Metal, 1A2e Food Processing, 1A2f Other – Non-Metallic Minerals, and 1A2gviii Other Industry.

1A2a Iron and Steel

Table 3.14 Recalculations of SO_2 in 1A2a Iron and Steel between submissions.

1A2a Iron and Steel	1990	1995	2000	2005	2010	2015	2020	2021
2023 submission SO_2 [kt]	4.5 E-04	9.0 E-04	2.2 E-03	1.8 E-03	1.8 E-03	1.4 E-03	1.3 E-03	1.2 E-03
2024 submission SO_2 [kt]	8.9 E-05	1.8 E-04	3.3 E-04	3.6 E-05	3.2 E-06	6.1 E-06	5.9 E-06	5.7 E-06
Change relative to the 2023 submission SO_2 [%]	-80.0%	-80.0%	-85.0%	-98.0%	-99.8%	-99.5%	-99.5%	-99.5%

Table 3.15 Recalculations of all air pollutants except SO_2 in 1A2a Iron and Steel between submissions.

1A2a Iron and Steel	2016
2023 submission NO_X [kt]	0.007862
2024 submission NO_X [kt]	0.007895
Change relative to the 2023 submission NO_X [%]	0.43%
2023 submission CO [kt]	0.0011710
2024 submission CO [kt]	0.0011753
Change relative to the 2023 submission CO [%]	0.37%
2023 submission NMVOC [kt]	0.0005419
2024 submission NMVOC [kt]	0.0005436
Change relative to the 2023 submission NMVOC [%]	0.30%
2023 submission dioxin [mg]	0.000019801
2024 submission dioxin [mg]	0.000019893
Change relative to the 2023 submission dioxin [%]	0.47%
2023 submission TSP [kt]	0.000289
2024 submission TSP [kt]	0.000291
Change relative to the 2023 submission TSP [%]	0.45%
2023 submission PM_{10} [kt]	0.000289
2024 submission PM_{10} [kt]	0.000291
Change relative to the 2023 submission PM_{10} [%]	0.45%
2023 submission $PM_{2.5}$ [kt]	0.000289
2024 submission $PM_{2.5}$ [kt]	0.000291
Change relative to the 2023 submission $PM_{2.5}$ [%]	0.45%
2023 submission BC [kt]	0.0001587
2024 submission BC [kt]	0.0001594
Change relative to the 2023 submission BC [%]	0.46%
2023 submission Pb [t]	0.0000012216
2024 submission Pb [t]	0.0000012268
Change relative to the 2023 submission Pb [%]	0.43%
2023 submission Cd [t]	0.00000009223
2024 submission Cd [t]	0.00000009263
Change relative to the 2023 submission Cd [%]	0.43%
2023 submission Hg [t]	0.0000061195
2024 submission Hg [t]	0.0000061274

1A2a Iron and Steel	2016
Change relative to the 2023 submission Hg [%]	0.13%
2023 submission As [t]	0.0000012433
2024 submission As [t]	0.0000012452
Change relative to the 2023 submission As [%]	0.16%
2023 submission Cr [t]	0.000002935
2024 submission Cr [t]	0.000002948
Change relative to the 2023 submission Cr [%]	0.45%
2023 submission Cu [t]	0.000003133
2024 submission Cu [t]	0.000003147
Change relative to the 2023 submission Cu [%]	0.46%
2023 submission Ni [t]	0.0000002196
2024 submission Ni [t]	0.0000002201
Change relative to the 2023 submission Ni [%]	0.24%
2023 submission Se [t]	0.0000020308
2024 submission Se [t]	0.0000020380
Change relative to the 2023 submission Se [%]	0.36%
2023 submission Zn [t]	0.0004161
2024 submission Zn [t]	0.0004180
Change relative to the 2023 submission Zn [%]	0.46%
2023 submission BaP [t]	0.00000003277
2024 submission BaP [t]	0.00000003289
Change relative to the 2023 submission BaP [%]	0.38%
2023 submission BbF [t]	0.0000002359
2024 submission BbF [t]	0.0000002369
Change relative to the 2023 submission BbF [%]	0.42%
2023 submission BkF [t]	0.00000003305
2024 submission BkF [t]	0.00000003316
Change relative to the 2023 submission BkF [%]	0.34%
2023 submission IPy [t]	0.00000003006
2024 submission IPy [t]	0.00000003016
Change relative to the 2023 submission IPy [%]	0.33%
2023 submission PAH4 [t]	0.0000003318
2024 submission PAH4 [t]	0.0000003331
Change relative to the 2023 submission PAH4 [%]	0.40%

1A2b Non-Ferrous Metal

Table 3.16 Recalculations of SO_2 in 1A2b Non-Ferrous Metal between submissions.

1A2b Non-Ferrous Metal	1990	1995	2000	2005	2010	2015	2020	2021
2023 submission SO_2 [kt]	0.14	0.19	0.27	0.02280	0.126	0.051	0.007324	0.011226
2024 submission SO_2 [kt]	0.21	0.28	0.41	0.00044	0.099	0.027	0.000033	0.000049
Change relative to the 2023 submission SO_2 [%]	49%	49%	48%	-98.1%	-21%	-47%	-99.6%	-99.6%

Table 3.17 Recalculations of all air pollutants except SO_2 in 1A2b Non-Ferrous Metal between submissions.

1A2b Non-Ferrous Metal	2016
2023 submission NO_X [kt]	0.03290479
2024 submission NO_X [kt]	0.03290492
Change relative to the 2023 submission NO_X [%]	0.00040%
2023 submission CO [kt]	0.004510756
2024 submission CO [kt]	0.004510773
Change relative to the 2023 submission CO [%]	0.00037%
2023 submission NMVOC [kt]	0.001879717
2024 submission NMVOC [kt]	0.001879723
Change relative to the 2023 submission NMVOC [%]	0.00034%
2023 submission dioxin [mg]	0.0000943277
2024 submission dioxin [mg]	0.0000943281
Change relative to the 2023 submission dioxin [%]	0.00038%
2023 submission TSP [kt]	0.0012528626
2024 submission TSP [kt]	0.0012528676
Change relative to the 2023 submission TSP [%]	0.00040%
2023 submission PM_{10} [kt]	0.0012528626
2024 submission PM_{10} [kt]	0.0012528676
Change relative to the 2023 submission PM_{10} [%]	0.00040%
2023 submission $PM_{2.5}$ [kt]	0.0012528626
2024 submission $PM_{2.5}$ [kt]	0.0012528676
Change relative to the 2023 submission $PM_{2.5}$ [%]	0.00040%
2023 submission BC [kt]	0.000695827
2024 submission BC [kt]	0.000695830
Change relative to the 2023 submission BC [%]	0.00041%
2023 submission Pb [t]	0.000005123662
2024 submission Pb [t]	0.000005123683
Change relative to the 2023 submission Pb [%]	0.00040%
2023 submission Cd [t]	0.0000003853427
2024 submission Cd [t]	0.0000003853442
Change relative to the 2023 submission Cd [%]	0.00039%
2023 submission Hg [t]	0.000015140197
2024 submission Hg [t]	0.000015140228

1A2b Non-Ferrous Metal	2016
Change relative to the 2023 submission Hg [%]	0.00020%
2023 submission As [t]	0.000003286645
2024 submission As [t]	0.000003286653
Change relative to the 2023 submission As [%]	0.00023%
2023 submission Cr [t]	0.00001260267
2024 submission Cr [t]	0.00001260272
Change relative to the 2023 submission Cr [%]	0.00040%
2023 submission Cu [t]	0.000013696332
2024 submission Cu [t]	0.000013696388
Change relative to the 2023 submission Cu [%]	0.00041%
2023 submission Ni [t]	0.0000006818237
2024 submission Ni [t]	0.0000006818257
Change relative to the 2023 submission Ni [%]	0.00030%
2023 submission Se [t]	0.00000765558
2024 submission Se [t]	0.00000765561
Change relative to the 2023 submission Se [%]	0.00036%
2023 submission Zn [t]	0.0018109404
2024 submission Zn [t]	0.0018109478
Change relative to the 2023 submission Zn [%]	0.00041%
2023 submission BaP [t]	0.0000001282196
2024 submission BaP [t]	0.0000001282201
Change relative to the 2023 submission BaP [%]	0.00038%
2023 submission BbF [t]	0.0000009726128
2024 submission BbF [t]	0.0000009726166
Change relative to the 2023 submission BbF [%]	0.00039%
2023 submission BkF [t]	0.00000012121333
2024 submission BkF [t]	0.00000012121376
Change relative to the 2023 submission BkF [%]	0.00036%
2023 submission IPy [t]	0.00000010851098
2024 submission IPy [t]	0.00000010851136
Change relative to the 2023 submission IPy [%]	0.00035%
2023 submission PAH4 [t]	0.000001330557
2024 submission PAH4 [t]	0.000001330562
Change relative to the 2023 submission PAH4 [%]	0.00038%

1A2c Chemicals

Table 3.18 Recalculations of SO_2 in 1A2c Chemicals between submissions.

1A1ai Electricity Generation	1990	1995	2000	2004
2023 submission SO_2 [kt]	0.086	0.083	0.082	0.058
2024 submission SO_2 [kt]	0.128	0.125	0.122	0.086
Change relative to the 2023 submission SO_2 [%]	50%	50%	50%	50%

1A2e Food Processing

Table 3.19 Recalculations of SO_2 in 1A2e Food Processing between submissions.

1A2e Food Processing	1990	1995	2000	2005	2010	2015	2020	2021
2023 submission SO_2 [kt]	1.48	1.75	1.31	0.77	0.37	0.32	0.048	0.047
2024 submission SO_2 [kt]	1.11	1.31	0.98	0.58	0.18	0.10	0.010	0.026
Change relative to the 2023 submission SO_2 [%]	-25%	-25%	-25%	-25%	-50%	-68%	-79%	-45%

Table 3.20 Recalculations of all air pollutants except SO_2 in 1A2e Food Processing between submissions.

1A2e Food Processing	2016
2023 submission NO_x [kt]	0.2974
2024 submission NO_x [kt]	0.2982
Change relative to the 2023 submission NO_x [%]	0.27%
2023 submission CO [kt]	0.03826
2024 submission CO [kt]	0.03836
Change relative to the 2023 submission CO [%]	0.27%
2023 submission NMVOC [kt]	0.01449
2024 submission NMVOC [kt]	0.01453
Change relative to the 2023 submission NMVOC [%]	0.27%
2023 submission dioxin [mg]	0.0008116
2024 submission dioxin [mg]	0.0008138
Change relative to the 2023 submission dioxin [%]	0.27%
2023 submission TSP [kt]	0.011594
2024 submission TSP [kt]	0.011626
Change relative to the 2023 submission TSP [%]	0.27%
2023 submission PM_{10} [kt]	0.01159
2024 submission PM_{10} [kt]	0.01163
Change relative to the 2023 submission PM_{10} [%]	0.27%
2023 submission $PM_{2.5}$ [kt]	0.01159
2024 submission $PM_{2.5}$ [kt]	0.01163
Change relative to the 2023 submission $PM_{2.5}$ [%]	0.27%
2023 submission BC [kt]	0.00649
2024 submission BC [kt]	0.00651
Change relative to the 2023 submission BC [%]	0.27%
2023 submission Pb [t]	0.00004638
2024 submission Pb [t]	0.00004650
Change relative to the 2023 submission Pb [%]	0.27%
2023 submission Cd [t]	0.000003478
2024 submission Cd [t]	0.000003488

1A2e Food Processing	2016
Change relative to the 2023 submission Cd [%]	0.27%
2023 submission Hg [t]	0.00006956
2024 submission Hg [t]	0.00006975
Change relative to the 2023 submission Hg [%]	0.27%
2023 submission As [t]	0.00001739
2024 submission As [t]	0.00001744
Change relative to the 2023 submission As [%]	0.27%
2023 submission Cr [t]	0.0001159
2024 submission Cr [t]	0.0001163
Change relative to the 2023 submission Cr [%]	0.27%
2023 submission Cu [t]	0.00012753
2024 submission Cu [t]	0.00012788
Change relative to the 2023 submission Cu [%]	0.27%
2023 submission Ni [t]	0.000004638
2024 submission Ni [t]	0.000004650
Change relative to the 2023 submission Ni [%]	0.27%
2023 submission Se [t]	0.00006377
2024 submission Se [t]	0.00006394
Change relative to the 2023 submission Se [%]	0.27%
2023 submission Zn [t]	0.016811
2024 submission Zn [t]	0.016857
Change relative to the 2023 submission Zn [%]	0.27%
2023 submission BaP [t]	0.0000011014
2024 submission BaP [t]	0.0000011044
Change relative to the 2023 submission BaP [%]	0.27%
2023 submission BbF [t]	0.000008695
2024 submission BbF [t]	0.000008719
Change relative to the 2023 submission BbF [%]	0.27%
2023 submission BkF [t]	0.0000009855
2024 submission BkF [t]	0.0000009882
Change relative to the 2023 submission BkF [%]	0.27%
2023 submission IPy [t]	0.0000008695
2024 submission IPy [t]	0.0000008719
Change relative to the 2023 submission IPy [%]	0.27%
2023 submission PAH4 [t]	0.000011652
2024 submission PAH4 [t]	0.000011684
Change relative to the 2023 submission PAH4 [%]	0.27%

1A2f Other: Non-Metallic Minerals

Besides the causes mentioned earlier in this section, the recalculations in 1A2f were also caused by changes in emission factors for pet coke (emissions factors for liquid fuel were mistaken for solid). These changes led to recalculations of all air pollutants for all occurring years of pet coke in this category (2004-2007).

Table 3.21 Recalculations of SO_2 in 1A2f Other between submissions.

1A2f Other Non-Metallic Minerals	1990	1995	2000	2005	2010	2015	2020	2021
2023 submission SO_2 [kt]	2.1 E-02	5.8 E-04	6.8 E-04	6.3 E-04	3.0 E-04	4.3 E-04	5.1 E-04	5.1 E-04
2024 submission SO_2 [kt]	3.2 E-02	1.2 E-04	1.0 E-04	1.3 E-05	5.2 E-07	1.9 E-06	2.3 E-06	2.2 E-06
Change relative to the 2023 submission SO_2 [%]	50%	-80%	-85%	-98.0%	-99.8%	-99.6%	-99.6%	-99.6%

Table 3.22 Recalculations of all air pollutants except SO_2 in 1A2f Other between submissions.

1A2f Other: Non-Metallic Minerals	2004	2005	2006	2007	2016
2023 submission NO_X [kt]	0.1080	0.1314	0.1119	0.1150	0.002274
2024 submission NO_X [kt]	0.1196	0.2213	0.2032	0.1176	0.002284
Change relative to the 2023 submission NO_X [%]	10.8%	68%	82%	2.3%	0.47%
2023 submission CO [kt]	0.108	0.13	0.11	0.1150	0.002274
2024 submission CO [kt]	0.120	0.22	0.20	0.1176	0.002284
Change relative to the 2023 submission CO [%]	10.8%	68%	82%	2.3%	0.47%
2023 submission NMVOC [kt]	0.466	0.49	0.58	0.594	0.0002925
2024 submission NMVOC [kt]	0.436	0.26	0.35	0.588	0.0002939
Change relative to the 2023 submission NMVOC [%]	-6.4%	-47%	-40%	-1.1%	0.47%
2023 submission dioxin [mg]	No recalculation				0.000006205
2024 submission dioxin [mg]					0.000006234
Change relative to the 2023 submission dioxin [%]					0.47%
2023 submission TSP [kt]	0.062	0.066	0.077	0.0793	0.0000886
2024 submission TSP [kt]	0.059	0.039	0.049	0.0785	0.0000891
Change relative to the 2023 submission TSP [%]	-5.7%	-42%	-36%	-1.0%	0.47%
2023 submission PM_{10} [kt]	0.0590	0.062	0.073	0.0748	0.0000886
2024 submission PM_{10} [kt]	0.0557	0.037	0.047	0.0741	0.0000891
Change relative to the 2023 submission PM_{10} [%]	-5.6%	-41%	-36%	-1.0%	0.47%
2023 submission $PM_{2.5}$ [kt]	0.0545	0.058	0.067	0.0691	0.0000886
2024 submission $PM_{2.5}$ [kt]	0.0515	0.035	0.043	0.0684	0.0000891
Change relative to the 2023 submission $PM_{2.5}$ [%]	-5.5%	-40%	-35%	-1.0%	0.47%
2023 submission BC [kt]	0.0039	0.0045	0.0044	0.004510	0.00004964
2024 submission BC [kt]	0.0041	0.0056	0.0055	0.004542	0.00004987
Change relative to the 2023 submission BC [%]	3.7%	25%	26%	0.73%	0.47%
2023 submission Pb [t]	0.0666	0.070	0.083	0.0855	0.0000003546
2024 submission Pb [t]	0.0620	0.034	0.047	0.0845	0.0000003562
Change relative to the 2023 submission Pb [%]	-6.9%	-51%	-43%	-1.2%	0.47%
2023 submission Cd [t]	0.000895	0.00094	0.00112	0.001148	0.00000002659
2024 submission Cd [t]	0.000834	0.00046	0.00063	0.001135	0.00000002672
Change relative to the 2023 submission Cd [%]	-6.9%	-51%	-43%	-1.2%	0.47%
2023 submission Hg [t]	0.00393	0.0041	0.0049	0.00504	0.0000005319

1A2f Other: Non-Metallic Minerals	2004	2005	2006	2007	2016
2024 submission Hg [t]	0.00367	0.0021	0.0028	0.00498	0.0000005343
Change relative to the 2023 submission Hg [%]	-6.8%	-50%	-43%	-1.2%	0.47%
2023 submission As [t]	0.00199	0.0021	0.0025	0.00255	0.00000013296
2024 submission As [t]	0.00185	0.0010	0.0014	0.00252	0.00000013358
Change relative to the 2023 submission As [%]	-6.8%	-50%	-43%	-1.2%	0.47%
2023 submission Cr [t]	0.00672	0.0070	0.0084	0.00861	0.000000886
2024 submission Cr [t]	0.00626	0.0035	0.0048	0.00851	0.000000891
Change relative to the 2023 submission Cr [%]	-6.8%	-50%	-43%	-1.2%	0.47%
2023 submission Cu [t]	0.00871	0.0091	0.0108	0.01116	0.000000975
2024 submission Cu [t]	0.00812	0.0046	0.0062	0.01103	0.000000980
Change relative to the 2023 submission Cu [%]	-6.8%	-50%	-43%	-1.2%	0.47%
2023 submission Ni [t]	0.00646	0.0068	0.0081	0.00829	0.00000003546
2024 submission Ni [t]	0.00602	0.0033	0.0046	0.00819	0.00000003562
Change relative to the 2023 submission Ni [%]	-6.9%	-51%	-43%	-1.2%	0.47%
2023 submission Se [t]	0.00090	0.00094	0.00112	0.00115	0.000000488
2024 submission Se [t]	0.00084	0.00050	0.00066	0.00114	0.000000490
Change relative to the 2023 submission Se [%]	-6.4%	-47%	-41%	-1.1%	0.47%
2023 submission Zn [t]	0.101	0.106	0.124	0.1278	0.0001285
2024 submission Zn [t]	0.095	0.061	0.078	0.1265	0.0001291
Change relative to the 2023 submission Zn [%]	-5.8%	-42%	-37%	-1.0%	0.47%
2023 submission PCB [t]	0.084	0.088	0.105	0.1084	
2024 submission PCB [t]	0.079	0.043	0.060	0.1071	No recalculation
Change relative to the 2023 submission PCB [%]	-6.9%	-51%	-43%	-1.2%	
2023 submission BaP [t]	0.0226	0.024	0.028	0.0290	0.000000008421
2024 submission BaP [t]	0.0211	0.012	0.016	0.0287	0.000000008460
Change relative to the 2023 submission BaP [%]	-6.9%	-51%	-43%	-1.2%	0.47%
2023 submission BbF [t]	0.0293	0.031	0.036	0.0376	0.00000006648
2024 submission BbF [t]	0.0273	0.015	0.021	0.0371	0.00000006679
Change relative to the 2023 submission BbF [%]	-6.9%	-51%	-43%	-1.2%	0.47%
2023 submission BkF [t]	0.01178	0.0123	0.0147	0.0151	0.000000007535
2024 submission BkF [t]	0.01097	0.0061	0.0083	0.0149	0.000000007570
Change relative to the 2023 submission BkF [%]	-6.9%	-51%	-43%	-1.2%	0.47%
2023 submission IPy [t]	0.0092	0.0096	0.0115	0.01180	0.000000006648
2024 submission IPy [t]	0.0086	0.0047	0.0065	0.01166	0.000000006679
Change relative to the 2023 submission IPy [%]	-6.9%	-51%	-43%	-1.2%	0.47%
2023 submission PAH4 [t]	0.073	0.076	0.091	0.0935	0.00000008909
2024 submission PAH4 [t]	0.068	0.038	0.051	0.0924	0.00000008950
Change relative to the 2023 submission PAH4 [%]	-6.9%	-51%	-43%	-1.2%	0.47%

1A2gviii Other Industry

Besides the causes mentioned earlier in this section, the recalculations in 1A2gviii were also caused by an update in activity data on LPG for 2021.

Table 3.23 Recalculations of SO_2 in 1A2gviii Other Industry between submissions.

1Agviii Other Industry	1990	1995	2000	2005	2010	2015	2020	2021
2023 submission SO_2 [kt]	0.304638	0.008871	0.030928	0.165546	0.011502	0.014183	0.009640	0.010722
2024 submission SO_2 [kt]	0.431162	0.009363	0.004586	0.193086	0.008855	0.001079	0.000043	0.000051
Change relative to the 2023 submission SO_2 [%]	42%	6%	-85%	17%	-23%	-92%	-99.6%	-99.5%

Table 3.24 Recalculations of all air pollutants except SO_2 in 1A2gviii Other Industry between submissions.

1Agviii Other Industry	2016	2021
2023 submission NO_x [kt]	0.05235	0.0574
2024 submission NO_x [kt]	0.05246	0.0589
Change relative to the 2023 submission NO_x [%]	0.23%	2.6%
2023 submission CO [kt]	0.00709	0.0076
2024 submission CO [kt]	0.00711	0.0082
Change relative to the 2023 submission CO [%]	0.22%	7.7%
2023 submission NMVOC [kt]	0.002908	0.0030
2024 submission NMVOC [kt]	0.002913	0.0035
Change relative to the 2023 submission NMVOC [%]	0.20%	16%
2023 submission dioxin [mg]	0.0001487	0.000160
2024 submission dioxin [mg]	0.0001490	0.000170
Change relative to the 2023 submission dioxin [%]	0.22%	6.6%
2023 submission TSP [kt]	0.0020020	0.002216
2024 submission TSP [kt]	0.0020067	0.002232
Change relative to the 2023 submission TSP [%]	0.23%	0.71%
2023 submission PM_{10} [kt]	0.0020020	0.002216
2024 submission PM_{10} [kt]	0.0020067	0.002232
Change relative to the 2023 submission PM_{10} [%]	0.23%	0.71%
2023 submission $PM_{2.5}$ [kt]	0.0020020	0.002216
2024 submission $PM_{2.5}$ [kt]	0.0020067	0.002232
Change relative to the 2023 submission $PM_{2.5}$ [%]	0.23%	0.71%
2023 submission BC [kt]	0.0011137	0.00123705
2024 submission BC [kt]	0.0011163	0.00123768
Change relative to the 2023 submission BC [%]	0.23%	0.05%
2023 submission Pb [t]	0.000008153	0.0000089
2024 submission Pb [t]	0.000008172	0.0000092
Change relative to the 2023 submission Pb [%]	0.23%	2.5%
2023 submission Cd [t]	0.0000006129	0.000000672
2024 submission Cd [t]	0.0000006143	0.000000690
Change relative to the 2023 submission Cd [%]	0.23%	2.7%

1Agviii Other Industry	2016	2021
2023 submission Hg [t]	0.000021857	0.0000187
2024 submission Hg [t]	0.000021885	0.0000296
Change relative to the 2023 submission Hg [%]	0.13%	59%
2023 submission As [t]	0.0000048206	0.0000043
2024 submission As [t]	0.0000048276	0.0000063
Change relative to the 2023 submission As [%]	0.14%	47%
2023 submission Cr [t]	0.000020116	0.00002221
2024 submission Cr [t]	0.000020163	0.00002248
Change relative to the 2023 submission Cr [%]	0.23%	1.2%
2023 submission Cu [t]	0.000021913	0.000024319
2024 submission Cu [t]	0.000021964	0.000024372
Change relative to the 2023 submission Cu [%]	0.23%	0.22%
2023 submission Ni [t]	0.0000010342	0.00000101
2024 submission Ni [t]	0.0000010360	0.00000128
Change relative to the 2023 submission Ni [%]	0.18%	26%
2023 submission Se [t]	0.000011999	0.0000127
2024 submission Se [t]	0.000012025	0.0000139
Change relative to the 2023 submission Se [%]	0.21%	9.2%
2023 submission Zn [t]	0.002896	0.003210
2024 submission Zn [t]	0.002902	0.003224
Change relative to the 2023 submission Zn [%]	0.23%	0.46%
2023 submission BaP [t]	0.00000020207	0.000000217
2024 submission BaP [t]	0.00000020251	0.000000232
Change relative to the 2023 submission BaP [%]	0.22%	6.7%
2023 submission BbF [t]	0.0000015441	0.00000169
2024 submission BbF [t]	0.0000015476	0.00000174
Change relative to the 2023 submission BbF [%]	0.23%	3.5%
2023 submission BkF [t]	0.00000018918	0.000000199
2024 submission BkF [t]	0.00000018958	0.000000221
Change relative to the 2023 submission BkF [%]	0.21%	11%
2023 submission IPy [t]	0.0000001689	0.000000176
2024 submission IPy [t]	0.0000001693	0.000000198
Change relative to the 2023 submission IPy [%]	0.21%	12%
2023 submission PAH4 [t]	0.0000021043	0.00000228
2024 submission PAH4 [t]	0.0000021090	0.00000240
Change relative to the 2023 submission PAH4 [%]	0.22%	5.2%

3.3.2.4 *Planned Improvements*

No improvements are currently planned for this subsector.

3.3.3 Commercial/Institutional, Residential, and Agricultural Stationary Fuel Combustion (NFR 1A4ai, 1A4bi, and 1A4ci)

Since Iceland relies largely on its renewable energy sources, fuel use for residential, commercial, and institutional heating is low. Residential heating with electricity is subsidised and occurs in areas far from public heat plants. Previously, there were two waste incineration plants that used waste to produce heat. One of them used the heat for heating a swimming pool and a school building (*Skaftárhreppur*, closed in December 2012), and the other one used the heat for heating a swimming pool (*Svínafell*, closed in 2010). Commercial/Institutional fuel combustion also includes the heating of swimming pools with gas oil, but only a few swimming pools in the country are heated with oil.

3.3.3.1 Activity Data

Activity data for fuel use is collected on fuel sales by sector. The IEEA adjusts the data provided, as further explained in Chapter 3.2. Activity data for waste incineration is collected by the IEEA directly. Activity data for stationary fuel combustion and waste incineration in 1A4 are given in Table 3.25. It should be noted that data reported indicates negligible solid fuel use for subcategory 1A4bi, and by extension condensables are also negligible.

Table 3.25 Fuel use [kt] from Stationary Combustion from subsectors of NFR 1A4.

Fuel Type	1990	1995	2000	2005	2010	2015	2020	2022	2023
1A4ai Commercial/Institutional									
Gas/Diesel Oil	1.80	1.60	1.60	1.00	0.30	0.30	0.13	0.12	0.12
LPG	0.78	0.83	0.46	0.50	0.17	0.37	0.41	0.58	0.64
Waste – Fossil	NO	0.14	0.19	0.19	0.15	NO	NO	NO	NO
Waste – Biogenic	NO	0.31	0.39	0.39	0.20	NO	NO	NO	NO
1A4bi Residential									
Gas/Diesel Oil	8.82	6.94	6.03	3.24	1.34	0.99	1.06	0.52	0.41
Biodiesel	NO	NO	NO	NO	NO	NO	NO	NO	0.0053
LPG	NO	NO	0.72	0.93	1.42	0.93	1.10	1.00	0.97
1A4ci Agriculture									
LPG	NO	NO	NO	NO	NO	0.0040	0.0080	0.0070	0.0040

3.3.3.2 Emission Factors

Emission factors for Stationary Combustion are taken from the Chapter 1A4 Small Combustion in 2023 EMEP/EEA Guidebook except emission factor for dioxin from stationary combustion of LPG and waste oil. They are taken from *Utslipp til luft av dioksiner i Norge* (Statistics Norway, 2002) which is 0.06 µg/t fuel for LPG (for 1A4bi) and 4 µg/t fuel for waste oil.

Emissions from Waste Incineration with Recovery, where the energy is used for swimming pools/school buildings are reported here. The IEF for dioxin in the sector shows fluctuations over the time series. From 1994 to 2012 (as stated above, one plant was closed in 2010 and the other one in 2012) waste was incinerated to produce heat at two locations (swimming pool, school building). The IEF for dioxin for waste is considerably higher than for liquid fuel.

Table 3.26 Emission factors for 1A4ai, 1A4ci, and 1A4bi.

Fuel Type	Reference	Exception
1A4ai & 1A4ci		
Gas/Diesel Oil	Tier 1 EF for liquid fuels from **Table 3-9** from Chapter 1.A.4 of the 2023 EMEP/EEA Guidebook	SO_2 emissions are based on Tier 1 sulphur content from Table 3-14 in chapter 1A3b Road Transport of the 2023 EMEP/EEA Guidebook for 1990-2005. The emissions are then based country specific sulphur content from 2006.
LPG	Tier 1 EF for gaseous fuels from **Table 3-8** from Chapter 1.A.4 of the 2023 EMEP/EEA Guidebook	SO_2 emissions are based on 0.00052% sulphur content which was calculated by using the equation from chapter 4.3.2 with value from Table A 22, 1A4 Small Combustion of the 2023 EMEP/EEA Guidebook).
Waste	Tier 2 EF for municipal waste incineration from **Table 3-2** from Chapter 5.C.1.a of the 2023 EMEP/EEA Guidebook	NH_3, Se & IPy estimated with T1 EF from **Table 3-1** in same chapter.
1A4bi		
Gas/Diesel Oil	Tier 1 EF for liquid fuels from **Table 3-5** from Chapter 1.A.4 of the 2023 EMEP/EEA Guidebook	SO_2 emissions are based on Tier 1 sulphur content from table 3-14 in chapter 1A3b Road Transport in the 2023 EMEP/EEA Guidebook. The emissions are then based on country specific sulphur content from 2006.
LPG	Tier 1 EF for gaseous fuels from **Table 3-4** from Chapter 1.A.4 of the 2023 EMEP/EEA Guidebook	SO_2 emissions are based on 0.00052% sulphur content which was calculated by using the equation from chapter 4.3.2 with value from Table A 22, 1A4 Small Combustion of the 2023 EMEP/EEA Guidebook).
		Dioxin emissions from (Statistics Norway, 2002).

3.3.3.3 *Recalculations and Improvements*

Recalculations for the 2025 Submission

1A4ai Commercial Stationary

For the 2025 submission, recalculations were due to following changes (the results can be seen in the tables below):

- A more precise NCV for diesel was obtained for the years 2021 and 2022 resulting in recalculations for these two years for all air pollutants.
- The S content of LPG was corrected. Causes recalculations for SO_2 for the whole timeline.
- The emission factor for dioxin and all the four PAH4 for LPG is NA in the 2023 EMEP/EEA Guidebook. In last submission, the emission factors were taken from the 2019 EMEP/EEA Guidebook. This led to recalculations of dioxin, BaP, Bbf, BkF, IpY and PAH4 for the whole timeline.

- The emission factor for PCB from diesel was corrected (unit conversion). This led to recalculations for the whole timeline.

Table 3.27 Recalculations in 1A4ai, Commercial Stationary between submissions.

1A4ai Commercial Stationary	1990	1995	2000	2005	2010	2015	2020	2021	2022
2024 submission SO_2 [kt]	1.45E-3	2.05E-3	1.95E-3	1.07E-3	5.97E-4	9.14E-6	6.51E-6	6.80E-6	7.90E-6
2025 submission SO_2 [kt]	1.44E-3	2.05E-3	1.95E-3	1.07E-3	5.95E-4	5.67E-6	2.66E-6	2.50E-6	2.53E-6
Change relative to the 2024 submission SO_2 [kt]	-7.28E-6	-7.81E-6	-4.31E-6	-4.65E-6	-1.63E-6	-3.47E-6	-3.85E-6	-4.30E-6	-5.38E-6
Change relative to the 2024 submission SO_2 [%]	-0.5%	-0.4%	-0.2%	-0.4%	-0.3%	-38.0%	-59.1%	-63.2%	-68.0%
2024 submission NO_x [kt]	2.64E-2	2.48E-2	2.37E-2	1.59E-2	5.18E-3	5.25E-3	3.10E-3	3.14E-3	3.60E-3
2025 submission NO_x [kt]	2.64E-2	2.48E-2	2.37E-2	1.59E-2	5.18E-3	5.25E-3	3.10E-3	3.14E-3	3.59E-3
Change relative to the 2024 submission NO_x [kt]	0	0	0	0	0	0	0	7.80E-7	-7.71E-6
Change relative to the 2024 submission NO_x [%]	0%	0%	0%	0%	0%	0%	0%	0.0%	-0.2%
2024 submission CO [kt]	8.26E-3	7.86E-3	7.44E-3	5.09E-3	1.68E-3	1.71E-3	1.07E-3	1.09E-3	1.27E-3
2025 submission CO [kt]	8.26E-3	7.86E-3	7.44E-3	5.09E-3	1.68E-3	1.71E-3	1.07E-3	1.10E-3	1.27E-3
Change relative to the 2024 submission CO [kt]	0	0	0	0	0	0	0	2.37E-7	-2.34E-6
Change relative to the 2024 submission CO [%]	0%	0%	0%	0%	0%	0%	0%	0.0%	-0.2%
2024 submission NMVOC [kt]	2.39E-3	2.29E-3	1.89E-3	1.41E-3	4.54E-4	6.62E-4	5.56E-4	5.99E-4	7.29E-4
2025 submission NMVOC [kt]	2.39E-3	2.29E-3	1.89E-3	1.41E-3	4.54E-4	6.62E-4	5.56E-4	5.99E-4	7.28E-4
Change relative to the 2024 submission NMVOC [kt]	0	0	0	0	0	0	0	5.10E-8	-5.04E-7
Change relative to the 2024 submission NMVOC [%]	0%	0%	0%	0%	0%	0%	0%	0.0%	-0.1%
2024 submission dioxin [g]	5.11E-4	4.63E-4	4.40E-4	2.88E-4	8.78E-5	9.97E-5	5.73E-5	5.76E-5	6.55E-5
2025 submission dioxin [g]	4.64E-4	4.13E-4	4.13E-4	2.58E-4	7.74E-5	7.74E-5	3.26E-5	3.01E-5	3.09E-5
Change relative to the 2024 submission dioxin [g]	-4.66E-5	-5.00E-5	-2.76E-5	-2.98E-5	-1.04E-5	-2.23E-5	-2.47E-5	-2.75E-5	-3.47E-5
Change relative to the 2024 submission dioxin [%]	-9.1%	-10.8%	-6.3%	-10.3%	-11.9%	-22.3%	-43.1%	-47.7%	-52.9%
2024 submission TSP [kt]	1.65E-3	9.71E-3	1.21E-2	1.15E-2	6.66E-3	2.85E-4	1.29E-4	1.22E-4	1.30E-4
2025 submission TSP [kt]	1.65E-3	9.71E-3	1.21E-2	1.15E-2	6.66E-3	2.85E-4	1.29E-4	1.22E-4	1.29E-4
Change relative to the 2024 submission TSP [kt]	0	0	0	0	0	0	0	5.35E-8	-5.29E-7
Change relative to the 2024 submission TSP [%]	0%	0%	0%	0%	0%	0%	0%	0.0%	-0.4%
2024 submission PM_{10} [kt]	1.65E-3	7.64E-3	9.41E-3	8.87E-3	5.05E-3	2.85E-4	1.29E-4	1.22E-4	1.30E-4
2025 submission PM_{10} [kt]	1.65E-3	7.64E-3	9.41E-3	8.87E-3	5.05E-3	2.85E-4	1.29E-4	1.22E-4	1.29E-4
Change relative to the 2024 submission PM_{10} [kt]	0	0	0	0	0	0	0	5.35E-8	-5.29E-7
Change relative to the 2024 submission PM_{10} [%]	0%	0%	0%	0%	0%	0%	0%	0.0%	-0.4%
2024 submission $PM_{2.5}$ [kt]	1.42E-3	5.41E-3	6.59E-3	6.13E-3	3.45E-3	2.46E-4	1.13E-4	1.07E-4	1.14E-4
2025 submission $PM_{2.5}$ [kt]	1.42E-3	5.41E-3	6.59E-3	6.13E-3	3.45E-3	2.46E-4	1.13E-4	1.07E-4	1.14E-4
Change relative to the 2024 submission $PM_{2.5}$ [kt]	0	0	0	0	0	0	0	4.59E-8	-4.54E-7
Change relative to the 2024 submission $PM_{2.5}$ [%]	0%	0%	0%	0%	0%	0%	0%	0.0%	-0.4%
2024 submission BC [kt]	7.81E-4	8.40E-4	8.81E-4	6.21E-4	2.43E-4	1.31E-4	5.54E-5	5.13E-5	5.30E-5

1A4ai Commercial Stationary	1990	1995	2000	2005	2010	2015	2020	2021	2022
2025 submission BC [kt]	7.81E-4	8.40E-4	8.81E-4	6.21E-4	2.43E-4	1.31E-4	5.54E-5	5.13E-5	5.27E-5
Change relative to the 2024 submission BC [kt]	0	0	0	0	0	0	0	2.6E-8	-2.5E-7
Change relative to the 2024 submission BC [%]	0%	0%	0%	0%	0%	0%	0%	0.1%	-0.5%
2024 submission Pb [t]	6.20E-4	4.74E-2	6.09E-2	6.07E-2	3.64E-2	1.03E-4	4.37E-5	4.04E-5	4.17E-5
2025 submission Pb [t]	6.20E-4	4.74E-2	6.09E-2	6.07E-2	3.64E-2	1.03E-4	4.37E-5	4.04E-5	4.15E-5
Change relative to the 2024 submission Pb [t]	0	0	0	0	0	0	0	2.0E-8	-2.0E-7
Change relative to the 2024 submission Pb [%]	0%	0%	0%	0%	0%	0%	0%	0.1%	-0.5%
2024 submission Cd [t]	1.16E-5	1.54E-3	1.98E-3	1.98E-3	1.19E-3	1.95E-6	8.33E-7	7.72E-7	8.00E-7
2025 submission Cd [t]	1.16E-5	1.54E-3	1.98E-3	1.98E-3	1.19E-3	1.95E-6	8.33E-7	7.73E-7	7.96E-7
Change relative to the 2024 submission Cd [t]	0	0	0	0	0	0	0	3.8E-10	-3.8E-9
Change relative to the 2024 submission Cd [%]	0%	0%	0%	0%	0%	0%	0%	0.0%	-0.5%
2024 submission Hg [t]	1.14E-5	1.27E-3	1.63E-3	1.63E-3	9.78E-4	3.04E-6	2.49E-6	2.67E-6	3.24E-6
2025 submission Hg [t]	1.14E-5	1.27E-3	1.63E-3	1.63E-3	9.78E-4	3.04E-6	2.49E-6	2.67E-6	3.23E-6
Change relative to the 2024 submission Hg [t]	0	0	0	0	0	0	0	2.6E-10	-2.5E-9
Change relative to the 2024 submission Hg [%]	0%	0%	0%	0%	0%	0%	0%	0.0%	-0.1%
2024 submission As [t]	4.24E-5	1.00E-3	1.28E-3	1.27E-3	7.53E-4	8.20E-6	4.66E-6	4.68E-6	5.31E-6
2025 submission As [t]	4.24E-5	1.00E-3	1.28E-3	1.27E-3	7.53E-4	8.20E-6	4.66E-6	4.68E-6	5.29E-6
Change relative to the 2024 submission As [t]	0	0	0	0	0	0	0	1.27E-9	-1.26E-8
Change relative to the 2024 submission As [%]	0%	0%	0%	0%	0%	0%	0%	0.0%	-0.2%
2024 submission Cr [t]	7.74E-4	7.72E-4	7.96E-4	5.38E-4	1.94E-4	1.29E-4	5.46E-5	5.05E-5	5.21E-5
2025 submission Cr [t]	7.74E-4	7.72E-4	7.96E-4	5.38E-4	1.94E-4	1.29E-4	5.46E-5	5.05E-5	5.18E-5
Change relative to the 2024 submission Cr [t]	0	0	0	0	0	0	0	2.55E-8	-2.52E-7
Change relative to the 2024 submission Cr [%]	0%	0%	0%	0%	0%	0%	0%	0.1%	-0.5%
2024 submission Cu [t]	2.32E-4	2.48E-4	2.60E-4	1.83E-4	7.11E-5	3.87E-5	1.64E-5	1.51E-5	1.56E-5
2025 submission Cu [t]	2.32E-4	2.48E-4	2.60E-4	1.83E-4	7.11E-5	3.87E-5	1.64E-5	1.51E-5	1.55E-5
Change relative to the 2024 submission Cu [t]	0	0	0	0	0	0	0	7.65E-9	-7.56E-8
Change relative to the 2024 submission Cu [%]	0%	0%	0%	0%	0%	0%	0%	0.1%	-0.5%
2024 submission Ni [t]	9.68E-3	8.65E-3	8.67E-3	5.44E-3	1.65E-3	1.61E-3	6.80E-4	6.28E-4	6.47E-4
2025 submission Ni [t]	9.68E-3	8.65E-3	8.67E-3	5.44E-3	1.65E-3	1.61E-3	6.80E-4	6.28E-4	6.44E-4
Change relative to the 2024 submission Ni [t]	0	0	0	0	0	0	0	3.19E-7	-3.15E-6
Change relative to the 2024 submission Ni [%]	0%	0%	0%	0%	0%	0%	0%	0.1%	-0.5%
2024 submission Se [t]	9.87E-6	1.44E-5	1.49E-5	1.24E-5	5.85E-6	2.31E-6	1.67E-6	1.76E-6	2.09E-6
2025 submission Se [t]	9.87E-6	1.44E-5	1.49E-5	1.24E-5	5.85E-6	2.31E-6	1.67E-6	1.76E-6	2.09E-6
Change relative to the 2024 submission Se [t]	0	0	0	0	0	0	0	2.55E-10	-2.52E-9
Change relative to the 2024 submission Se [%]	0%	0%	0%	0%	0%	0%	0%	0.0%	-0.1%
2024 submission Zn [t]	1.42E-3	1.67E-3	1.78E-3	1.31E-3	5.52E-4	2.45E-4	1.12E-4	1.06E-4	1.13E-4
2025 submission Zn [t]	1.42E-3	1.67E-3	1.78E-3	1.31E-3	5.52E-4	2.45E-4	1.12E-4	1.06E-4	1.12E-4
Change relative to the 2024 submission Zn [t]	0	0	0	0	0	0	0	4.59E-8	-4.54E-7
Change relative to the 2024 submission Zn [%]	0%	0%	0%	0%	0%	0%	0%	0.0%	-0.4%

1A4ai Commercial Stationary	1990	1995	2000	2005	2010	2015	2020	2021	2022
2024 submission PCB [t]	1.01E-5	2.39E-3	3.08E-3	3.08E-3	1.85E-3	1.68E-6	7.07E-7	6.52E-7	6.72E-7
2025 submission PCB [t]	1.01E-8	2.39E-3	3.07E-3	3.07E-3	1.85E-3	1.68E-9	7.1E-10	6.5E-10	6.69E-10
Change relative to the 2024 submission PCB [t]	-1.01E-5	-8.94E-6	-8.94E-6	-5.58E-6	-1.68E-6	-1.68E-6	-7.06E-7	-6.52E-7	-6.72E-7
Change relative to the 2024 submission PCB [%]	-99.9%	-0.4%	-0.3%	-0.2%	-0.1%	-99.9%	-99.9%	-99.9%	-99.9%
2024 submission HCB [t]	1.70E-5	9.15E-4	1.18E-3	1.17E-3	7.00E-4	2.84E-6	1.20E-6	1.10E-6	1.14E-6
2025 submission HCB [t]	1.70E-5	9.15E-4	1.18E-3	1.17E-3	7.00E-4	2.84E-6	1.20E-6	1.10E-6	1.13E-6
Change relative to the 2024 submission HCB [t]	0	0	0	0	0	0	0	5.61E-10	-5.54E-9
Change relative to the 2024 submission HCB [%]	0%	0%	0%	0%	0%	0%	0%	0.1%	-0.5%
2024 submission BaP [t]	2.66E-5	3.04E-5	1.82E-5	1.94E-5	7.41E-6	1.27E-5	1.40E-5	1.56E-5	1.96E-5
2025 submission BaP [t]	1.47E-7	2.02E-6	2.57E-6	2.52E-6	1.49E-6	2.45E-8	1.03E-8	9.54E-9	9.78E-9
Change relative to the 2024 submission BaP [t]	-2.65E-5	-2.84E-5	-1.57E-5	-1.69E-5	-5.93E-6	-1.26E-5	-1.40E-5	-1.56E-5	-1.96E-5
Change relative to the 2024 submission BaP [%]	-99.4%	-93.4%	-85.9%	-87.0%	-79.9%	-99.8%	-99.9%	-99.9%	-100.0%
2024 submission BbF [t]	1.08E-4	1.17E-4	6.60E-5	7.05E-5	2.52E-5	5.11E-5	5.65E-5	6.29E-5	7.90E-5
2025 submission BbF [t]	1.16E-6	2.47E-6	2.89E-6	2.50E-6	1.31E-6	1.94E-7	8.15E-8	7.53E-8	7.72E-8
Change relative to the 2024 submission BbF [t]	-1.07E-4	-1.14E-4	-6.31E-5	-6.80E-5	-2.39E-5	-5.09E-5	-5.64E-5	-6.28E-5	-7.89E-5
Change relative to the 2024 submission BbF [%]	-98.9%	-97.9%	-95.6%	-96.5%	-94.8%	-99.6%	-99.9%	-99.9%	-99.9%
2024 submission BkF [t]	4.06E-5	4.49E-5	2.58E-5	2.77E-5	1.02E-5	1.93E-5	2.14E-5	2.38E-5	2.99E-5
2025 submission BkF [t]	1.32E-7	1.51E-6	1.91E-6	1.87E-6	1.10E-6	2.19E-8	9.24E-9	8.54E-9	8.75E-9
Change relative to the 2024 submission BkF [t]	-4.04E-5	-4.34E-5	-2.39E-5	-2.58E-5	-9.05E-6	-1.93E-5	-2.14E-5	-2.38E-5	-2.99E-5
Change relative to the 2024 submission BkF [%]	-99.7%	-96.6%	-92.6%	-93.2%	-89.1%	-99.9%	-100.0%	-100.0%	-100.0%
2024 submission IPy [t]	3.98E-5	4.27E-5	2.36E-5	2.54E-5	8.91E-6	1.90E-5	2.10E-5	2.34E-5	2.94E-5
2025 submission IPy [t]	1.16E-7	1.08E-7	1.10E-7	7.12E-8	2.34E-8	1.94E-8	8.15E-9	7.53E-9	7.72E-9
Change relative to the 2024 submission IPy [t]	-3.97E-5	-4.26E-5	-2.35E-5	-2.53E-5	-8.89E-6	-1.90E-5	-2.10E-5	-2.34E-5	-2.94E-5
Change relative to the 2024 submission IPy [%]	-99.7%	-99.7%	-99.5%	-99.7%	-99.7%	-99.9%	-100.0%	-100.0%	-100.0%
2024 submission PAH4 [t]	2.15E-4	2.35E-4	1.34E-4	1.43E-4	5.17E-5	1.02E-4	1.13E-4	1.26E-4	1.58E-4
2025 submission PAH4 [t]	1.56E-6	6.11E-6	7.48E-6	6.96E-6	3.92E-6	2.59E-7	1.09E-7	1.01E-7	1.03E-7
Change relative to the 2024 submission PAH4 [t]	-2.13E-4	-2.29E-4	-1.26E-4	-1.36E-4	-4.77E-5	-1.02E-4	-1.13E-4	-1.3E-4	-1.6E-4
Change relative to the 2024 submission PAH4 [%]	-99.3%	-97.4%	-94.4%	-95.1%	-92.4%	-99.7%	-99.9%	-99.9%	-99.9%

1A4bi Residential Stationary

For the 2025 submission, recalculations were due to following changes (the results can be seen in the tables below):

- Charcoal activity data was added for the years 1990-2018 resulting in recalculations for these years for all air pollutants. Charcoal activity data for the year 2022 was updated resulting in recalculations for that year.
- A more precise NCV for diesel was obtained for the years 2021 and 2022 resulting in recalculations for these two years for all air pollutants.
- The S content of LPG was corrected. Causes recalculations for SO_2 for 1996-2022.

- The emission factor all the four PAH4 for LPG is NA in the 2023 EMEP/EEA Guidebook. In last submission, the emission factors were taken from the 2019 EMEP/EEA Guidebook. This led to recalculations of dioxin, BaP, Bbf, BkF, IpY and PAH4 for the whole timeline.

Table 3.28 Recalculations in 1A4bi, Residential Stationary between submissions.

1A4bi Residential Stationary	1990	1995	2000	2005	2010	2015	2020	2021	2022
2024 submission SO_2 [kt]	7.06E-3	5.55E-3	3.62E-3	2.69E-4	2.41E-5	2.71E-5	8.94E-5	9.51E-5	8.00E-5
2025 submission SO_2 [kt]	7.12E-3	5.61E-3	3.68E-3	3.24E-4	7.48E-5	8.24E-5	7.90E-5	8.52E-5	9.29E-5
Change relative to the 2024 submission SO_2 [kt]	6.39E-5	6.39E-5	5.72E-5	5.52E-5	5.07E-5	5.53E-5	-1.03E-5	-9.96E-6	1.30E-5
Change relative to the 2024 submission SO_2 [%]	0.9%	1.2%	1.6%	20.5%	210.2%	203.6%	-11.5%	-10.5%	16.2%
2024 submission NO_x [kt]	1.93E-2	1.52E-2	1.49E-2	9.35E-3	6.35E-3	4.42E-3	5.24E-3	4.27E-3	3.85E-3
2025 submission NO_x [kt]	1.96E-2	1.55E-2	1.52E-2	9.64E-3	6.64E-3	4.71E-3	5.24E-3	4.27E-3	3.94E-3
Change relative to the 2024 submission NO_x [kt]	2.91E-4	2.91E-4	2.91E-4	2.91E-4	2.91E-4	2.91E-4	0.00E+0	7.03E-7	9.59E-5
Change relative to the 2024 submission NO_x [%]	1.5%	1.9%	1.9%	3.1%	4.6%	6.6%	0.0%	0.0%	2.5%
2024 submission CO [kt]	2.16E-2	1.70E-2	1.56E-2	9.08E-3	5.02E-3	3.58E-3	2.55E-2	2.94E-2	2.48E-2
2025 submission CO [kt]	4.49E-2	4.03E-2	3.89E-2	3.23E-2	2.83E-2	2.68E-2	2.55E-2	2.94E-2	3.29E-2
Change relative to the 2024 submission CO [kt]	2.33E-2	2.33E-2	2.33E-2	2.33E-2	2.33E-2	2.33E-2	0.00E+0	7.86E-7	8.11E-3
Change relative to the 2024 submission CO [%]	108%	137%	149%	256%	463%	650%	0.0%	0.0%	32.7%
2024 submission NMVOC [kt]	2.62E-4	2.06E-4	2.43E-4	1.80E-4	1.67E-4	1.13E-4	3.36E-3	4.10E-3	3.44E-3
2025 submission NMVOC [kt]	3.75E-3	3.69E-3	3.73E-3	3.67E-3	3.65E-3	3.60E-3	3.36E-3	4.10E-3	4.66E-3
Change relative to the 2024 submission NMVOC [kt]	3.49E-3	3.49E-3	3.49E-3	3.49E-3	3.49E-3	3.49E-3	0.00E+0	9.52E-9	1.22E-3
Change relative to the 2024 submission NMVOC [%]	1332%	1695%	1434%	1941%	2088%	3092%	0.0%	0.0%	35.4%
2024 submission dioxin [g]	2.24E-3	1.76E-3	1.57E-3	8.78E-4	4.24E-4	3.08E-4	4.64E-3	5.54E-3	4.64E-3
2025 submission dioxin [g]	6.89E-3	6.41E-3	6.22E-3	5.53E-3	5.07E-3	4.96E-3	4.64E-3	5.54E-3	6.26E-3
Change relative to the 2024 submission dioxin [g]	4.65E-3	4.65E-3	4.65E-3	4.65E-3	4.65E-3	4.65E-3	0.00E+0	8.14E-8	1.62E-3
Change relative to the 2024 submission dioxin [%]	208%	264%	296%	530%	1096%	1511%	0.0%	0.0%	35.0%
2024 submission TSP [kt]	7.21E-4	5.67E-4	5.33E-4	3.17E-4	1.90E-4	1.34E-4	4.46E-3	5.43E-3	4.55E-3
2025 submission TSP [kt]	5.37E-3	5.22E-3	5.18E-3	4.97E-3	4.84E-3	4.78E-3	4.46E-3	5.43E-3	6.17E-3
Change relative to the 2024 submission TSP [kt]	4.65E-3	4.65E-3	4.65E-3	4.65E-3	4.65E-3	4.65E-3	0.00E+0	2.62E-8	1.62E-3
Change relative to the 2024 submission TSP [%]	645%	821%	873%	1465%	2452%	3475%	0.0%	0.0%	35.7%
2024 submission PM_{10} [kt]	7.21E-4	5.67E-4	5.33E-4	3.17E-4	1.90E-4	1.34E-4	4.24E-3	5.16E-3	4.33E-3
2025 submission PM_{10} [kt]	5.14E-3	4.98E-3	4.95E-3	4.74E-3	4.61E-3	4.55E-3	4.24E-3	5.16E-3	5.87E-3
Change relative to the 2024 submission PM_{10} [kt]	4.42E-3	4.42E-3	4.42E-3	4.42E-3	4.42E-3	4.42E-3	0.00E+0	2.62E-8	1.54E-3
Change relative to the 2024 submission PM_{10} [%]	613%	780%	829%	1392%	2329%	3301%	0.0%	0.0%	35.6%
2024 submission $PM_{2.5}$ [kt]	7.21E-4	5.67E-4	5.33E-4	3.17E-4	1.90E-4	1.34E-4	4.13E-3	5.03E-3	4.22E-3
2025 submission $PM_{2.5}$ [kt]	5.02E-3	4.87E-3	4.83E-3	4.62E-3	4.49E-3	4.44E-3	4.13E-3	5.03E-3	5.72E-3
Change relative to the 2024 submission $PM_{2.5}$ [kt]	4.30E-3	4.30E-3	4.30E-3	4.30E-3	4.30E-3	4.30E-3	0.00E+0	2.62E-8	1.50E-3
Change relative to the 2024 submission $PM_{2.5}$ [%]	597%	759%	807%	1355%	2268%	3214%	0.0%	0.0%	35.6%

1A4bi Residential Stationary	1990	1995	2000	2005	2010	2015	2020	2021	2022
2024 submission BC [kt]	6.13E-5	4.82E-5	4.40E-5	2.54E-5	1.36E-5	9.74E-6	4.09E-4	4.99E-4	4.18E-4
2025 submission BC [kt]	4.91E-4	4.78E-4	4.74E-4	4.56E-4	4.44E-4	4.40E-4	4.09E-4	4.99E-4	5.68E-4
Change relative to the 2024 submission BC [kt]	4.30E-4	4.30E-4	4.30E-4	4.30E-4	4.30E-4	4.30E-4	0.00E+0	2.23E-9	1.50E-4
Change relative to the 2024 submission BC [%]	702.1%	893%	977%	1697%	3157%	4415%	0.0%	0.0%	35.9%
2024 submission Pb [t]	4.55E-6	3.58E-6	3.16E-6	1.74E-6	7.90E-7	5.79E-7	1.46E-4	1.80E-4	1.50E-4
2025 submission Pb [t]	1.62E-4	1.61E-4	1.60E-4	1.59E-4	1.58E-4	1.58E-4	1.46E-4	1.80E-4	2.05E-4
Change relative to the 2024 submission Pb [t]	1.57E-4	1.57E-4	1.57E-4	1.57E-4	1.57E-4	1.57E-4	0.00E+0	1.7E-10	5.48E-5
Change relative to the 2024 submission Pb [%]	3448%	4386%	4967%	9032%	19857%	27123%	0.0%	0.0%	36.4%
2024 submission Cd [t]	3.79E-7	2.98E-7	2.68E-7	1.50E-7	7.42E-8	5.37E-8	7.01E-5	8.64E-5	7.23E-5
2025 submission Cd [t]	7.60E-5	7.59E-5	7.58E-5	7.57E-5	7.56E-5	7.56E-5	7.01E-5	8.64E-5	9.87E-5
Change relative to the 2024 submission Cd [t]	7.56E-5	7.56E-5	7.56E-5	7.56E-5	7.56E-5	7.56E-5	0.00E+0	1.4E-11	2.64E-5
Change relative to the 2024 submission Cd [%]	19919%	25342%	28245%	50275%	101784 %	140719 %	0.0%	0.0%	36.5%
2024 submission Hg [t]	4.55E-5	3.58E-5	3.45E-5	2.11E-5	1.36E-5	9.51E-6	1.37E-5	1.20E-5	1.06E-5
2025 submission Hg [t]	4.88E-5	3.90E-5	3.77E-5	2.44E-5	1.69E-5	1.28E-5	1.37E-5	1.20E-5	1.17E-5
Change relative to the 2024 submission Hg [t]	3.26E-6	3.26E-6	3.26E-6	3.26E-6	3.26E-6	3.26E-6	0.00E+0	1.66E-9	1.12E-6
Change relative to the 2024 submission Hg [%]	7.2%	9.1%	9.4%	15%	24%	34%	0.0%	0.0%	10.6%
2024 submission As [t]	7.59E-7	5.96E-7	4.59E-6	5.56E-6	8.16E-6	5.35E-6	7.37E-6	7.32E-6	6.80E-6
2025 submission As [t]	1.86E-6	1.70E-6	2.74E-6	2.83E-6	3.43E-6	2.64E-6	2.83E-6	2.97E-6	3.05E-6
Change relative to the 2024 submission As [t]	1.10E-6	1.10E-6	-1.85E-6	-2.72E-6	-4.73E-6	-2.71E-6	-4.53E-6	-4.35E-6	-3.75E-6
Change relative to the 2024 submission As [%]	146%	185%	-40%	-49%	-58%	-51%	-62%	-59%	-55%
2024 submission Cr [t]	7.59E-5	5.96E-5	5.18E-5	2.79E-5	1.15E-5	8.58E-6	1.33E-4	1.58E-4	1.32E-4
2025 submission Cr [t]	2.10E-4	1.93E-4	1.86E-4	1.62E-4	1.45E-4	1.42E-4	1.33E-4	1.58E-4	1.79E-4
Change relative to the 2024 submission Cr [t]	1.34E-4	1.34E-4	1.34E-4	1.34E-4	1.34E-4	1.34E-4	0.00E+0	2.76E-9	4.66E-5
Change relative to the 2024 submission Cr [%]	176%	224%	258%	479%	1158%	1558%	0.0%	0.0%	35.2%
2024 submission Cu [t]	4.93E-5	3.88E-5	3.37E-5	1.81E-5	7.48E-6	5.56E-6	3.82E-5	4.34E-5	3.63E-5
2025 submission Cu [t]	8.42E-5	7.36E-5	6.86E-5	5.30E-5	4.24E-5	4.04E-5	3.82E-5	4.34E-5	4.84E-5
Change relative to the 2024 submission Cu [t]	3.49E-5	3.49E-5	3.49E-5	3.49E-5	3.49E-5	3.49E-5	0.00E+0	1.79E-9	1.22E-5
Change relative to the 2024 submission Cu [%]	71%	90%	104%	193%	466%	627%	0.0%	0.0%	33.5%
2024 submission Ni [t]	1.90E-6	1.49E-6	1.31E-6	7.19E-7	3.22E-7	2.36E-7	1.10E-5	1.35E-5	1.13E-5
2025 submission Ni [t]	1.35E-5	1.31E-5	1.29E-5	1.23E-5	1.19E-5	1.19E-5	1.10E-5	1.35E-5	1.53E-5
Change relative to the 2024 submission Ni [t]	1.16E-5	1.16E-5	1.16E-5	1.16E-5	1.16E-5	1.16E-5	0.00E+0	6.90E-11	4.06E-6
Change relative to the 2024 submission Ni [%]	613%	780%	886%	1617%	3615%	4925%	0.0%	0.0%	36.0%
2024 submission Se [t]	7.59E-7	5.96E-7	8.91E-7	7.63E-7	8.52E-7	5.68E-7	3.36E-6	3.93E-6	3.35E-6
2025 submission Se [t]	3.67E-6	3.50E-6	3.80E-6	3.67E-6	3.76E-6	3.47E-6	3.36E-6	3.93E-6	4.36E-6
Change relative to the 2024 submission Se [t]	2.91E-6	2.91E-6	2.91E-6	2.91E-6	2.91E-6	2.91E-6	0.00E+0	2.76E-11	1.01E-6
Change relative to the 2024 submission Se [%]	383%	487%	326%	381%	341%	512%	0.0%	0.0%	30.3%
2024 submission Zn [t]	1.59E-4	1.25E-4	1.09E-4	5.86E-5	2.42E-5	1.80E-5	2.78E-3	3.41E-3	2.86E-3
2025 submission Zn [t]	3.14E-3	3.10E-3	3.09E-3	3.03E-3	3.00E-3	2.99E-3	2.78E-3	3.41E-3	3.90E-3
Change relative to the 2024 submission Zn [t]	2.98E-3	2.98E-3	2.98E-3	2.98E-3	2.98E-3	2.98E-3	0.00E+0	5.79E-9	1.04E-3

1A4bi Residential Stationary	1990	1995	2000	2005	2010	2015	2020	2021	2022
Change relative to the 2024 submission Zn [%]	1868%	2376%	2734%	5081%	12275%	16519%	0.0%	0.0%	36.4%
2024 submission NH_3 [t]	NE	NE	NE	NE	NE	NE	3.77E-4	4.65E-4	3.89E-4
2025 submission NH_3 [t]	4.65.E-5	4.65E-5	4.65E-5	4.65E-5	4.65E-5	4.65E-5	4.31E-5	5.32E-5	6.07E-5
Change relative to the 2024 submission NH_3 [t]	4.65.E-5	4.65E-5	4.65E-5	4.65E-5	4.65E-5	4.65E-5	-3.34E-4	-4.12E-4	-3.29E-4
Change relative to the 2024 submission NH_3 [%]	-	-	-	-	-	-	-88.6%	-88.6%	-84.4%
2024 submission PCB [t]	NE	NE	NE	NE	NE	NE	3.23E-7	3.99E-7	3.34E-7
2025 submission PCB [t]	3.49E-7	3.49E-7	3.49E-7	3.49E-7	3.49E-7	3.49E-7	3.23E-7	3.99E-7	4.55E-7
Change relative to the 2024 submission PCB [t]	3.49E-7	3.49E-7	3.49E-7	3.49E-7	3.49E-7	3.49E-7	0.00E+0	0.00E+0	1.22E-7
Change relative to the 2024 submission PCB [%]	-	-	-	-	-	-	0.0%	0.0%	36.5%
2024 submission BaP [t]	3.04E-5	2.39E-5	2.07E-5	1.12E-5	4.64E-6	3.44E-6	6.55E-4	8.06E-4	6.75E-4
2025 submission BaP [t]	7.34E-4	7.27E-4	7.24E-4	7.15E-4	7.08E-4	7.07E-4	6.55E-4	8.06E-4	9.20E-4
Change relative to the 2024 submission BaP [t]	7.03E-4	7.03E-4	7.03E-4	7.03E-4	7.03E-4	7.03E-4	-2.92E-8	-2.69E-8	2.45E-4
Change relative to the 2024 submission BaP [%]	2318%	2948%	3391%	6297%	15169%	20424%	0.0%	0.0%	36.4%
2024 submission BbF [t]	1.52E-5	1.19E-5	1.04E-5	5.61E-6	2.36E-6	1.75E-6	6.00E-4	7.39E-4	6.18E-4
2025 submission BbF [t]	6.60E-4	6.57E-4	6.56E-4	6.51E-4	6.48E-4	6.47E-4	6.00E-4	7.39E-4	8.43E-4
Change relative to the 2024 submission BbF [t]	6.45E-4	6.45E-4	6.45E-4	6.45E-4	6.45E-4	6.45E-4	-4.38E-8	-4.15E-8	2.25E-4
Change relative to the 2024 submission BbF [%]	4252%	5410%	6209%	11502%	27386%	36944%	0.0%	0.0%	36.4%
2024 submission BkF [t]	2.66E-5	2.09E-5	1.82E-5	9.79E-6	4.08E-6	3.03E-6	2.29E-4	2.81E-4	2.35E-4
2025 submission BkF [t]	2.71E-4	2.65E-4	2.62E-4	2.54E-4	2.48E-4	2.47E-4	2.29E-4	2.81E-4	3.20E-4
Change relative to the 2024 submission BkF [t]	2.44E-4	2.44E-4	2.44E-4	2.44E-4	2.44E-4	2.44E-4	-4.38E-8	-4.11E-8	8.52E-5
Change relative to the 2024 submission BkF [%]	919%	1170%	1344%	2494%	5982%	8060%	0.0%	0.0%	36.2%
2024 submission IPy [t]	6.07E-5	4.77E-5	4.15E-5	2.23E-5	9.25E-6	6.88E-6	3.90E-4	4.76E-4	3.98E-4
2025 submission IPy [t]	4.73E-4	4.60E-4	4.54E-4	4.35E-4	4.22E-4	4.20E-4	3.90E-4	4.76E-4	5.42E-4
Change relative to the 2024 submission IPy [t]	4.13E-4	4.13E-4	4.13E-4	4.13E-4	4.13E-4	4.13E-4	-4.38E-8	-3.98E-8	1.44E-4
Change relative to the 2024 submission IPy [%]	680%	865%	995%	1848%	4459%	6002%	0.0%	0.0%	36.1%
2024 submission HCB [t]	NE	NE	NE	NE	NE	NE	2.69E-5	3.32E-5	2.78E-5
2025 submission HCB [t]	2.91E-5	2.91E-5	2.91E-5	2.91E-5	2.91E-5	2.91E-5	2.69E-5	3.32E-5	3.80E-5
Change relative to the 2024 submission HCB [t]	2.91E-5	2.91E-5	2.91E-5	2.91E-5	2.91E-5	2.91E-5	00E+0	0.00E+0	1.01E-5
Change relative to the 2024 submission HCB [%]	-	-	-	-	-	-	0.0%	0.0%	36.5%
2024 submission PAH4 [t]	1.33E-4	1.04E-4	9.08E-5	4.89E-5	2.03E-5	1.51E-5	1.87E-3	2.30E-3	1.93E-3
2025 submission PAH4 [t]	2.14E-3	2.11E-3	2.10E-3	2.05E-3	2.03E-3	2.02E-3	1.87E-3	2.30E-3	2.63E-3
Change relative to the 2024 submission PAH4 [t]	2.01E-3	2.01E-3	2.01E-3	2.01E-3	2.01E-3	2.01E-3	-1.60E-7	-1.49E-7	7.00E-4
Change relative to the 2024 submission PAH4 [%]	1510%	1922%	2209%	4101%	9865%	13285%	0.0%	0.0%	36.3%

1A4ci Agriculture Stationary

For the 2025 submission, recalculations were due to following changes (the results can be seen in the tables below):

- The S content of LPG was corrected. Causes recalculations for SO_2 for the years 2012-2022.

- The emission factor for dioxin and all the four PAH4 for LPG is NA in the 2023 EMEP/EEA Guidebook. In last submission, the emission factors were taken from the 2019 EMEP/EEA Guidebook. This led to recalculations of dioxin, BaP, Bbf, BkF, IpY and PAH4 for the years 2012-2022.

Table 3.29 Recalculations in 1A4ci, Agriculture Stationary between submissions.

1A4ci Agriculture Stationary	2012	2013	2014	2015	2020	2021	2022
2024 submission SO_2 [kt]	4.89E-7	7.08E-7	4.16E-8	4.16E-8	8.32E-8	7.28E-8	7.28E-8
2025 submission SO_2 [kt]	4.89E-8	7.08E-8	4.16E-9	4.16E-9	8.32E-9	7.28E-9	7.28E-9
Change relative to the 2024 submission SO_2 [kt]	-4.40E-7	-6.37E-7	-3.75E-8	-3.75E-8	-7.49E-8	-6.56E-8	-6.56E-8
Change relative to the 2024 submission SO_2 [%]	-90.0%	-90.0%	-90.0%	-90.0%	-90.0%	-90.0%	-90.0%
2024 submission dioxin [g]	2.82E-6	4.08E-6	2.40E-7	2.40E-7	4.80E-7	4.20E-7	4.20E-7
2025 submission dioxin [g]	NA	NA	NA	NA	NA	NA	NA
Change relative to the 2024 submission dioxin [g]	-2.82E-6	-4.08E-6	-2.40E-7	-2.40E-7	-4.80E-7	-4.20E-7	-4.20E-7
Change relative to the 2024 submission dioxin [%]	-100%	-100%	-100%	-100%	-100%	-100%	-100%
2024 submission BaP [t]	1.60E-6	2.32E-6	1.36E-7	1.36E-7	2.72E-7	2.38E-7	2.38E-7
2025 submission BaP [t]	NA	NA	NA	NA	NA	NA	NA
Change relative to the 2024 submission BaP [t]	-1.60E-6	-2.32E-6	-1.36E-7	-1.36E-7	-2.72E-7	-2.38E-7	-2.38E-7
Change relative to the 2024 submission BaP [%]	-100%	-100%	-100%	-100%	-100%	-100%	-100%
2024 submission BbF [t]	6.45E-6	9.33E-6	5.49E-7	5.49E-7	1.10E-6	9.60E-7	9.60E-7
2025 submission BbF [t]	NA	NA	NA	NA	NA	NA	NA
Change relative to the 2024 submission BbF [t]	-6.45E-6	-9.33E-6	-5.49E-7	-5.49E-7	-1.10E-6	-9.60E-7	-9.60E-7
Change relative to the 2024 submission BbF [%]	-100%	-100%	-100%	-100%	-100%	-100%	-100%
2024 submission BkF [t]	2.45E-6	3.54E-6	2.08E-7	2.08E-7	4.16E-7	3.64E-7	3.64E-7
2025 submission BkF [t]	NA	NA	NA	NA	NA	NA	NA
Change relative to the 2024 submission BkF [t]	-2.45E-6	-3.54E-6	-2.08E-7	-2.08E-7	-4.16E-7	-3.64E-7	-3.64E-7
Change relative to the 2024 submission BkF [%]	-100%	-100%	-100%	-100%	-100%	-100%	-100%
2024 submission IPy [t]	2.40E-6	3.47E-6	2.04E-7	2.04E-7	4.09E-7	3.58E-7	3.58E-7
2025 submission IPy [t]	NA	NA	NA	NA	NA	NA	NA
Change relative to the 2024 submission IPy [t]	-2.40E-6	-3.47E-6	-2.04E-7	-2.04E-7	-4.09E-7	-3.58E-7	-3.58E-7
Change relative to the 2024 submission IPy [%]	-100%	-100%	-100%	-100%	-100%	-100%	-100%
2024 submission PAH4 [t]	2.40E-6	3.47E-6	2.04E-7	2.04E-7	4.09E-7	3.58E-7	3.58E-7
2025 submission PAH4 [t]	NA	NA	NA	NA	NA	NA	NA
Change relative to the 2024 submission PAH4 [t]	-2.40E-6	-3.47E-6	-2.04E-7	-2.04E-7	-4.09E-7	-3.58E-7	-3.58E-7
Change relative to the 2024 submission PAH4 [%]	-100%	-100%	-100%	-100%	-100%	-100%	-100%

Recalculations for the 2024 Submission

For the 2024 submission, a lot of changes were made regarding emissions factors used in the Energy sector, mainly in terms of sulphur content. This includes the default sulphur content for diesel being updated to more appropriate defaults for 1990-2005 while it was replaced by country specific values for 2006 onwards. Simultaneously, the default sulphur content for LPG was also updated. These changes together led to large recalculations of SO_2 in all three categories of 1A4 Stationary through the time series.

Furthermore, the country specific NCV for diesel was accidently excluded in the last submission. This has been fixed and let to minor recalculations of all air pollutants in both 1A4ai Commercial Stationary and 1A4bi Residential Stationary for 2016.

1A4ai Commercial Stationary

Table 3.30 Recalculations of SO_2 in 1A4ai Commercial Stationary between submissions.

1A4ai Commercial Stationary	1990	1995	2000	2005	2010	2015	2020	2021
2023 submission SO_2 [kt]	8.8 E-03	8.8 E-03	8.3 E-03	6.0 E-03	2.1 E-03	1.9 E-03	1.3 E-03	1.4 E-03
2024 submission SO_2 [kt]	1.4 E-03	2.1 E-03	2.0 E-03	1.1 E-03	6.0 E-04	9.1 E-06	6.5 E-06	6.8 E-06
Change relative to the 2023 submission SO_2 [%]	-83%	-77%	-77%	-82%	-72%	-99.5%	-99.5%	-99.5%

Table 3.31 Recalculations of all air pollutants except SO_2 in 1A4ai Commercial Stationary between submissions.

1A4ai Commercial Stationary	2016
2023 submission NO_X [kt]	0.003409
2024 submission NO_X [kt]	0.003418
Change relative to the 2023 submission NO_X [%]	0.27%
2023 submission CO [kt]	0.0011622
2024 submission CO [kt]	0.0011650
Change relative to the 2023 submission CO [%]	0.24%
2023 submission NMVOC [kt]	0.00057504
2024 submission NMVOC [kt]	0.00057564
Change relative to the 2023 submission NMVOC [%]	0.10%
2023 submission dioxin [mg]	0.00006330
2024 submission dioxin [mg]	0.00006348
Change relative to the 2023 submission dioxin [%]	0.28%
2023 submission TSP [kt]	0.0001506
2024 submission TSP [kt]	0.0001512
Change relative to the 2023 submission TSP [%]	0.42%
2023 submission PM_{10} [kt]	0.0001506
2024 submission PM_{10} [kt]	0.0001512
Change relative to the 2023 submission PM_{10} [%]	0.42%
2023 submission $PM_{2.5}$ [kt]	0.00013123
2024 submission $PM_{2.5}$ [kt]	0.00013177
Change relative to the 2023 submission $PM_{2.5}$ [%]	0.41%
2023 submission BC [kt]	0.00006562
2024 submission BC [kt]	0.00006592
Change relative to the 2023 submission BC [%]	0.46%
2023 submission Pb [t]	0.00005181
2024 submission Pb [t]	0.00005205
Change relative to the 2023 submission Pb [%]	0.46%

1A4ai Commercial Stationary	2016
2023 submission Cd [t]	0.0000009850
2024 submission Cd [t]	0.0000009895
Change relative to the 2023 submission Cd [%]	0.46%
2023 submission Hg [t]	0.0000025843
2024 submission Hg [t]	0.0000025873
Change relative to the 2023 submission Hg [%]	0.12%
2023 submission As [t]	0.000005164
2024 submission As [t]	0.000005179
Change relative to the 2023 submission As [%]	0.29%
2023 submission Cr [t]	0.00006475
2024 submission Cr [t]	0.00006505
Change relative to the 2023 submission Cr [%]	0.46%
2023 submission Cu [t]	0.000019400
2024 submission Cu [t]	0.000019490
Change relative to the 2023 submission Cu [%]	0.46%
2023 submission Ni [t]	0.0008065
2024 submission Ni [t]	0.0008103
Change relative to the 2023 submission Ni [%]	0.46%
2023 submission Se [t]	0.0000017698
2024 submission Se [t]	0.0000017728
Change relative to the 2023 submission Se [%]	0.17%
2023 submission Zn [t]	0.00013026
2024 submission Zn [t]	0.00013080
Change relative to the 2023 submission Zn [%]	0.41%
2023 submission PCB [kg]	0.000000839
2024 submission PCB [kg]	0.000000842
Change relative to the 2023 submission PCB [%]	0.47%
2023 submission HCB [kg]	0.000001419
2024 submission HCB [kg]	0.000001426
Change relative to the 2023 submission HCB [%]	0.47%
2023 submission BaP [t]	0.000013975215
2024 submission BaP [t]	0.000013975272
Change relative to the 2023 submission BaP [%]	0.00041%
2023 submission BbF [t]	0.00005633645
2024 submission BbF [t]	0.00005633690
Change relative to the 2023 submission BbF [%]	0.00080%
2023 submission BkF [t]	0.00002134327
2024 submission BkF [t]	0.00002134332
Change relative to the 2023 submission BkF [%]	0.00024%
2023 submission IPy [t]	0.000020954115
2024 submission IPy [t]	0.000020954160

1A4ai Commercial Stationary	2016
Change relative to the 2023 submission IPy [%]	0.00021%
2023 submission PAH4 [t]	0.00011260905
2024 submission PAH4 [t]	0.00011260965
Change relative to the 2023 submission PAH4 [%]	0.00054%

1A4bi Residential Stationary

Table 3.32 Recalculations of SO_2 in 1A4bi Residential Stationary between submissions.

1A4bi Residential Stationary	1990	1995	2000	2005	2010	2015	2020	2021
2023 submission SO_2 [kt]	3.5 E-02	2.8 E-02	2.6 E-02	1.5 E-02	8.2 E-03	5.8 E-03	6.5 E-03	4.7 E-03
2024 submission SO_2 [kt]	7.1 E-03	5.5 E-03	3.6 E-03	2.7 E-04	2.4 E-05	2.7 E-05	8.9 E-05	9.5 E-05
Change relative to the 2023 submission SO_2 [%]	-80%	-80%	-86%	-98.2%	-99.7%	-99.5%	-98.6%	-98.0%

Table 3.33 Recalculations of air pollutants except SO_2 in 1A4bi Residential Stationary between submissions.

1A4bi Residential Stationary	2016
2023 submission NO_X [kt]	0.00429
2024 submission NO_X [kt]	0.00430
Change relative to the 2023 submission NO_X [%]	0.21%
2023 submission CO [kt]	0.00339
2024 submission CO [kt]	0.00340
Change relative to the 2023 submission CO [%]	0.30%
2023 submission NMVOC [kt]	0.00011319
2024 submission NMVOC [kt]	0.00011331
Change relative to the 2023 submission NMVOC [%]	0.11%
2023 submission dioxin [mg]	0.0002856
2024 submission dioxin [mg]	0.0002867
Change relative to the 2023 submission dioxin [%]	0.37%
2023 submission TSP [kt]	0.00012803
2024 submission TSP [kt]	0.00012837
Change relative to the 2023 submission TSP [%]	0.27%
2023 submission PM_{10} [kt]	0.00012803
2024 submission PM_{10} [kt]	0.00012837
Change relative to the 2023 submission PM_{10} [%]	0.27%
2023 submission $PM_{2.5}$ [kt]	0.00012803
2024 submission $PM_{2.5}$ [kt]	0.00012837
Change relative to the 2023 submission $PM_{2.5}$ [%]	0.27%
2023 submission BC [kt]	0.00000919
2024 submission BC [kt]	0.00000922
Change relative to the 2023 submission BC [%]	0.32%
2023 submission Pb [t]	0.0000005317
2024 submission Pb [t]	0.0000005338
Change relative to the 2023 submission Pb [%]	0.41%

1A4bi Residential Stationary	2016
2023 submission Cd [t]	0.0000000500
2024 submission Cd [t]	0.0000000502
Change relative to the 2023 submission Cd [%]	0.36%
2023 submission Hg [t]	0.00000919
2024 submission Hg [t]	0.00000921
Change relative to the 2023 submission Hg [%]	0.23%
2023 submission As [t]	0.00000554322
2024 submission As [t]	0.00000554358
Change relative to the 2023 submission As [%]	0.01%
2023 submission Cr [t]	0.000007757
2024 submission Cr [t]	0.000007793
Change relative to the 2023 submission Cr [%]	0.46%
2023 submission Cu [t]	0.000005023
2024 submission Cu [t]	0.000005047
Change relative to the 2023 submission Cu [%]	0.46%
2023 submission Ni [t]	0.0000002163
2024 submission Ni [t]	0.0000002172
Change relative to the 2023 submission Ni [%]	0.42%
2023 submission Se [t]	0.00000057828
2024 submission Se [t]	0.00000057864
Change relative to the 2023 submission Se [%]	0.06%
2023 submission Zn [t]	0.00001629
2024 submission Zn [t]	0.00001636
Change relative to the 2023 submission Zn [%]	0.46%
2023 submission BaP [kg]	0.000003115
2024 submission BaP [kg]	0.000003129
Change relative to the 2023 submission BaP [%]	0.46%
2023 submission BbF [t]	0.000001583
2024 submission BbF [t]	0.000001590
Change relative to the 2023 submission BbF [%]	0.45%
2023 submission BkF [t]	0.000002741
2024 submission BkF [t]	0.000002754
Change relative to the 2023 submission BkF [%]	0.46%
2023 submission IPy [t]	0.000006217
2024 submission IPy [t]	0.000006245
Change relative to the 2023 submission IPy [%]	0.46%
2023 submission PAH4 [t]	0.00001366
2024 submission PAH4 [t]	0.00001372
Change relative to the 2023 submission PAH4 [%]	0.46%

1A4ci Agriculture Stationary

Table 3.34 Recalculations of SO_2 in 1A4ci Agriculture Stationary between submissions.

1A4ci Agriculture Stationary	2012	2015	2020	2021
2023 submission SO_2 [kt]	9.4 E-05	8.0 E-06	1.6 E-05	1.4 E-05
2024 submission SO_2 [kt]	4.9 E-07	4.2 E-08	8.3 E-08	7.3 E-08
Change relative to the 2023 submission SO_2 [%]	-99.5%	-99.5%	-99.5%	-99.5%

3.3.3.4 Planned Improvements

No improvements are currently planned for this subsector.

3.3.4 Other, Stationary (NFR 1A5a)

All fuels categorised as "Other" in sales statistics without any explanation of type of use, are allocated to NFR Category 1A5. Efforts have been made in recent years to minimize the amount of fuel that is allocated to category 1A5.

The emissions from this sector are calculated by multiplying energy use with a pollutant specific emission factor from the 2023 EMEP/EEA Guidebook.

3.3.4.1 Activity Data

Activity data is collected on fuel sales by sector.

Table 3.35 Fuel use [kt] from sector 1A5 Other.

Fuel Type	1990	1995	2000	2005	2010	2015	2020	2022	2023
Gas/Diesel Oil	NO	0.46	1.4	8.9	2.7	NO	0.084	0.16	0.52
Residual Fuel Oil	0.039	0.05	0.067	NO	1.6	NO	NO	NO	NO
Other Kerosene	NO	NO	NO	0.15	0.047	0.029	0.030	0.08	0.031
LPG	NO	NO	NO	NO	NO	0.032	NO	0.0	0.0051
Biodiesel	NO	NO	NO	NO	NO	NO	0.044	0.030	0.023
Biomethane	NO	NO	NO	NO	NO	NO	0.11	0.020	NO
Biogasoline	NO	NO	NO	NO	NO	NO	0.0010	0.0	NO

3.3.4.2 Emission Factors

All emission factors are the same as for 1A2 which are presented in Table 3.12.

3.3.4.3 Recalculations and Improvements

Recalculations for the 2025 Submission

For the 2025 submission, recalculations were due to following changes (the results can be seen in the tables below):

- A more precise NCV for diesel was obtained for the years 2021 and 2022 resulting in recalculations for these two years for all air pollutants.
- The S content of LPG was corrected. Causes recalculations for SO_2 for the years when LPG was used, 2011, 2013, 2015-2018, 2022.

- The emission factor for dioxin and all the four PAH4 for gaseous fuels (biomethane) is NA in the 2023 EMEP/EEA Guidebook. In last submission, the emission factors were taken from the 2019 EMEP/EEA Guidebook. This led to recalculations of dioxin, BaP, Bbf, BkF, IpY and PAH4 for the years when biomethane was used, 2013, 2015-2018, 2022.

Table 3.36 Recalculations in 1A5a, Other between submissions.

1A5a Other	2011	2013	2015	2016	2020	2021	2022
2024 submission SO_2 [kt]	1.53E-5	9.71E-6	8.43E-7	1.11E-6	3.95E-6	1.52E-5	4.45E-6
2025 submission SO_2 [kt]	1.53E-5	9.43E-6	5.44E-7	5.82E-7	2.91E-6	1.45E-5	4.23E-6
Change relative to the 2024 submission SO_2 [kt]	-2.81E-8	-2.81E-7	-3.00E-7	-5.26E-7	-1.04E-6	-6.87E-7	-2.26E-7
Change relative to the 2024 submission SO_2 [%]	-0.2%	-2.9%	-35.5%	-47.5%	-26.3%	-4.5%	-5.1%
2024 submission NO_x [kt]	4.72E-2	9.65E-3	1.43E-3	1.69E-3	3.56E-3	1.85E-2	5.77E-3
2025 submission NO_x [kt]	4.72E-2	9.65E-3	1.43E-3	1.69E-3	3.56E-3	1.85E-2	5.76E-3
Change relative to the 2024 submission NO_x [kt]	0	0	0	0	0	5.78E-6	-1.67E-5
Change relative to the 2024 submission NO_x [%]	0%	0%	0%	0%	0%	0.031%	-0.29%
2024 submission CO [kt]	6.08E-3	1.24E-3	1.84E-4	2.26E-4	5.66E-4	2.44E-3	7.63E-4
2025 submission CO [kt]	6.08E-3	1.24E-3	1.84E-4	2.26E-4	5.66E-4	2.44E-3	7.61E-4
Change relative to the 2024 submission CO [kt]	0	0	0	0	0	7.44E-7	-2.15E-6
Change relative to the 2024 submission CO [%]	0%	0%	0%	0%	0%	0.030%	-0.3%
2024 submission NMVOC [kt]	2.30E-3	4.73E-4	6.96E-5	9.12E-5	2.82E-4	9.66E-4	3.013E-4
2025 submission NMVOC [kt]	2.30E-3	4.73E-4	6.96E-5	9.12E-5	2.82E-4	9.66E-4	3.005E-4
Change relative to the 2024 submission NMVOC [kt]	0	0	0	0	0	2.82E-7	-8.14E-7
Change relative to the 2024 submission NMVOC [%]	0%	0%	0%	0%	0%	0.029%	-0.27%
2024 submission dioxin [g]	1.29E-4	2.64E-5	3.90E-6	4.76E-6	1.15E-5	5.15E-5	1.61E-5
2025 submission dioxin [g]	1.29E-4	2.63E-5	3.90E-6	4.52E-6	8.57E-6	4.98E-5	1.55E-5
Change relative to the 2024 submission dioxin [g]	0	-7.86E-8	0.00E+0	-2.40E-7	-2.91E-6	-1.71E-6	-5.81E-7
Change relative to the 2024 submission dioxin [%]	0%	-0.30%	0%	-5.0%	-25.3%	-3.3%	-3.6%
2024 submission TSP [kt]	1.84E-3	3.76E-4	5.57E-5	6.49E-5	1.27E-4	7.14E-4	2.23E-4
2025 submission TSP [kt]	1.84E-3	3.76E-4	5.57E-5	6.49E-5	1.27E-4	7.14E-4	2.22E-4
Change relative to the 2024 submission TSP [kt]	0	0	0	0	0	2.25E-7	-6.51E-7
Change relative to the 2024 submission TSP [%]	0%	0%	0%	0%	0%	0.032%	-0.29%
2024 submission PM_{10} [kt]	1.84E-3	3.76E-4	5.57E-5	6.49E-5	1.27E-4	7.14E-4	2.23E-4
2025 submission PM_{10} [kt]	1.84E-3	3.76E-4	5.57E-5	6.49E-5	1.27E-4	7.14E-4	2.22E-4
Change relative to the 2024 submission PM_{10} [kt]	0	0	0	0	0	2.25E-7	-6.51E-7
Change relative to the 2024 submission PM_{10} [%]	0%	0%	0%	0%	0%	0.032%	-0.29%
2024 submission $PM_{2.5}$ [kt]	1.84E-3	3.76E-4	5.57E-5	6.49E-5	1.27E-4	7.14E-4	2.23E-4
2025 submission $PM_{2.5}$ [kt]	1.84E-3	3.76E-4	5.57E-5	6.49E-5	1.27E-4	7.14E-4	2.22E-4
Change relative to the 2024 submission $PM_{2.5}$ [kt]	0	0	0	0	0	2.25E-7	-6.51E-7
Change relative to the 2024 submission $PM_{2.5}$ [%]	0%	0%	0%	0%	0%	0.032%	-0.29%
2024 submission BC [kt]	1.03E-3	2.11E-4	3.12E-5	3.61E-5	6.88E-5	3.98E-4	1.244E-4
2025 submission BC [kt]	1.03E-3	2.11E-4	3.12E-5	3.61E-5	6.88E-5	3.98E-4	1.240E-4
Change relative to the 2024 submission BC [kt]	0	0	0	0	0	1.26E-7	-3.65E-7

1A5a Other	2011	2013	2015	2016	2020	2021	2022
Change relative to the 2024 submission BC [%]	0%	0%	0%	0%	0%	0.032%	-0.29%
2024 submission Pb [t]	7.37E-6	1.51E-6	2.23E-7	2.63E-7	5.51E-7	2.88E-6	9.00E-7
2025 submission Pb [t]	7.37E-6	1.51E-6	2.23E-7	2.63E-7	5.51E-7	2.88E-6	8.97E-7
Change relative to the 2024 submission Pb [t]	0	0	0	0	0	9.0E-10	-2.60E-9
Change relative to the 2024 submission Pb [%]	0%	0%	0%	0%	0%	0.031%	-0.29%
2024 submission Cd [t]	5.52E-7	1.13E-7	1.67E-8	1.98E-8	4.18E-8	2.16E-7	6.76E-8
2025 submission Cd [t]	5.52E-7	1.13E-7	1.67E-8	1.98E-8	4.18E-8	2.16E-7	6.74E-8
Change relative to the 2024 submission Cd [t]	0	0	0	0	0	6.8E-11	-1.95E-10
Change relative to the 2024 submission Cd [%]	0%	0%	0%	0%	0%	0.031%	-0.29%
2024 submission Hg [t]	1.10E-5	2.34E-6	3.34E-7	6.36E-7	3.76E-6	6.06E-6	1.89E-6
2025 submission Hg [t]	1.10E-5	2.34E-6	3.34E-7	6.36E-7	3.76E-6	6.06E-6	1.88E-6
Change relative to the 2024 submission Hg [t]	0	0	0	0	0	1.35E-9	-3.91E-9
Change relative to the 2024 submission Hg [%]	0%	0%	0%	0%	0%	0.022%	-0.21%
2024 submission As [t]	2.76E-6	5.79E-7	8.35E-8	1.43E-7	7.43E-7	1.40E-6	4.36E-7
2025 submission As [t]	2.76E-6	5.79E-7	8.35E-8	1.43E-7	7.43E-7	1.40E-6	4.35E-7
Change relative to the 2024 submission As [t]	0	0	0	0	0	3.4E-10	-9.77E-10
Change relative to the 2024 submission As [%]	0%	0%	0%	0%	0%	0.024%	-0.22%
2024 submission Cr [t]	1.84E-5	3.76E-6	5.57E-7	6.51E-7	1.30E-6	7.15E-6	2.234E-6
2025 submission Cr [t]	1.84E-5	3.76E-6	5.57E-7	6.51E-7	1.30E-6	7.16E-6	2.228E-6
Change relative to the 2024 submission Cr [t]	0	0	0	0	0	2.25E-9	-6.51E-9
Change relative to the 2024 submission Cr [%]	0%	0%	0%	0%	0%	0.031%	-0.29%
2024 submission Cu [t]	2.03E-5	4.14E-6	6.12E-7	7.11E-7	1.36E-6	7.83E-6	2.45E-6
2025 submission Cu [t]	2.03E-5	4.14E-6	6.12E-7	7.11E-7	1.36E-6	7.83E-6	2.44E-6
Change relative to the 2024 submission Cu [t]	0	0	0	0	0	2.48E-9	-7.16E-9
Change relative to the 2024 submission Cu [%]	0%	0%	0%	0%	0%	0.032%	-0.29%
2024 submission Ni [t]	7.37E-7	1.52E-7	2.23E-8	3.18E-8	1.22E-7	3.28E-7	1.022E-7
2025 submission Ni [t]	7.37E-7	1.52E-7	2.23E-8	3.18E-8	1.22E-7	3.28E-7	1.020E-7
Change relative to the 2024 submission Ni [t]	0	0	0	0	0	9.0E-11	-2.60E-10
Change relative to the 2024 submission Ni [%]	0%	0%	0%	0%	0%	0.028%	-0.25%
2024 submission Se [t]	1.01E-5	2.08E-6	3.06E-7	3.82E-7	9.98E-7	4.10E-6	1.28E-6
2025 submission Se [t]	1.01E-5	2.08E-6	3.06E-7	3.82E-7	9.98E-7	4.10E-6	1.28E-6
Change relative to the 2024 submission Se [t]	0	0	0	0	0	1.24E-9	-3.58E-9
Change relative to the 2024 submission Se [%]	0%	0%	0%	0%	0%	0.030%	-0.28%
2024 submission Zn [t]	2.67E-3	5.45E-4	8.07E-5	9.39E-5	1.82E-4	1.03E-3	3.23E-4
2025 submission Zn [t]	2.67E-3	5.45E-4	8.07E-5	9.39E-5	1.82E-4	1.03E-3	3.22E-4
Change relative to the 2024 submission Zn [t]	0	0	0	0	0	3.27E-7	-9.44E-7
Change relative to the 2024 submission Zn [%]	0%	0%	0%	0%	0%	0.032%	-0.29%
2024 submission BaP [t]	1.75E-7	3.58E-8	5.29E-9	6.46E-9	1.57E-8	6.99E-8	2.18E-8
2025 submission BaP [t]	1.75E-7	3.57E-8	5.29E-9	6.13E-9	1.16E-8	6.76E-8	2.10E-8
Change relative to the 2024 submission BaP [t]	0	-1.1E-10	0	-3.2E-10	-4.03E-9	-2.36E-9	-8.03E-10

1A5a Other	2011	2013	2015	2016	2020	2021	2022
Change relative to the 2024 submission BaP [%]	0%	-0.30%	0%	-5.1%	-25.7%	-3.4%	-3.7%
2024 submission BbF [t]	1.38E-6	2.82E-7	4.18E-8	4.97E-8	1.08E-7	5.43E-7	1.70E-7
2025 submission BbF [t]	1.38E-6	2.82E-7	4.18E-8	4.84E-8	9.19E-8	5.34E-7	1.66E-7
Change relative to the 2024 submission BbF [t]	0	-4.4E-10	0	-1.34E-9	-1.62E-8	-9.44E-9	-3.47E-9
Change relative to the 2024 submission BbF [%]	0%	-0.16%	0%	-2.7%	-15.0%	-1.7%	-2.0%
2024 submission BkF [t]	1.57E-7	3.21E-8	4.73E-9	5.99E-9	1.66E-8	6.41E-8	2.00E-8
2025 submission BkF [t]	1.57E-7	3.20E-8	4.73E-9	5.48E-9	1.04E-8	6.05E-8	1.88E-8
Change relative to the 2024 submission BkF [t]	0	-1.7E-10	0	-5.1E-10	-6.16E-9	-3.63E-9	-1.19E-9
Change relative to the 2024 submission BkF [%]	0%	-0.52%	0%	-8.5%	-37.2%	-5.7%	-5.9%
2024 submission IPy [t]	1.38E-7	2.84E-8	4.18E-9	5.34E-9	1.52E-8	5.69E-8	1.78E-8
2025 submission IPy [t]	1.38E-7	2.82E-8	4.18E-9	4.84E-9	9.19E-9	5.34E-8	1.66E-8
Change relative to the 2024 submission IPy [t]	0	-1.6E-10	0	-5.0E-10	-6.04E-9	-3.56E-9	-1.16E-9
Change relative to the 2024 submission IPy [%]	0%	-0.58%	0%	-9.3%	-39.7%	-6.3%	-6.5%
2024 submission PAH4 [t]	1.85E-6	3.79E-7	5.60E-8	6.75E-8	1.56E-7	7.34E-7	2.29E-7
2025 submission PAH4 [t]	1.85E-6	3.78E-7	5.60E-8	6.48E-8	1.23E-7	7.15E-7	2.23E-7
Change relative to the 2024 submission PAH4 [t]	0	-8.8E-10	0	-2.68E-9	-3.25E-8	-1.90E-8	-6.63E-9
Change relative to the 2024 submission PAH4 [%]	0%	-0.23%	0%	-4.0%	-20.9%	-2.6%	-2.9%

Recalculations for the 2024 Submission

For this submission, a lot of changes were made regarding emissions factors used in the Energy sector, mainly in terms of sulphur content. This includes the default sulphur content value for diesel being updated to more appropriate default values for 1990-2005 while it was replaced by country specific values for 2006 onwards. Simultaneously, the default sulphur content value for LPG was also updated. These changes together led to large recalculations of SO_2 in 1A5 Other Energy through the time series.

Table 3.37 Recalculations of SO_2 in 1A5 Other Energy between submissions.

1A5 Other Energy	1990	1995	2000	2005	2010	2015	2020	2021
2023 submission SO_2 [kt]	1.6 E-04	2.0 E-03	5.8 E-03	3.6 E-02	1.8 E-02	1.8 E-04	8.6 E-04	3.5 E-03
2024 submission SO_2 [kt]	3.1 E-05	4.1 E-04	8.7 E-04	7.3 E-04	3.1 E-05	8.4 E-07	4.0 E-06	1.5 E-05
Change relative to the 2023 submission SO_2 [%]	-80%	-80%	-85%	-98.0%	-99.8%	-99.5%	-99.5%	-99.6%

3.3.4.4 *Planned Improvements*

No improvements are currently planned for this subsector.

3.4 Transport and Other Mobile Sources (NFR 1A2, 1A3, and 1A4)

3.4.1 Mobile Machinery (NFR 1A2gvii, 1A3eii, and 1A4cii)

This section includes all non-road mobile machinery sources that are included under NFR 1A2, 1A3, and 1A4.

3.4.1.1 Activity Data

Improvements were made in the gas/diesel oil data gathering and it became possible to distinguish between off-road vehicles in agriculture and construction, but only from the inventory years 2019 onwards. As such, an extrapolation was made for 1990-2018 to split the gas/diesel oil previously reported under 1A3eii to the other categories for Mobile Machinery. The categorical proportions used to extrapolate for 1990-2018 can be seen in Table 3.38.

Table 3.38 Proportion used for 1990-2018 extrapolation of gas/diesel oil in Mobile Machinery.

NFR code	Sector name	Proportion used for 1990-2018 extrapolation
1A2gvii	Off-road Vehicles and Other Machinery in Construction	51%
1A3eii	Off-road Vehicles and Other Machinery	14%
1A4cii	Agriculture/Forestry/Fishing: Off-road Vehicles and Other Machinery	35%

Since 2019, 1A2gvii Mobile Machinery in Construction and 1A4cii Mobile Machinery in Agriculture are reported separately, but other transport activities not reported under Road Transport (such as ground activities in airports and harbours) are still reported under 1A3eii Other Mobile Machinery.

Activity data for fuel combustion is given in Table 3.39.

Table 3.39 Fuel use [kt] for Mobile Machinery in Construction (1A2gvii), Other Mobile Machinery (1A3eii), and Agriculture (1A4cii).

Fuel Type	1990	1995	2000	2005	2010	2015	2020	2022	2023
1A2gvii - Mobile Machinery in Construction									
Gas/Diesel Oil	19.4	23.9	31.7	34.7	16.5	16.9	6.4	10.4	15.1
Biodiesel	NO	NO	NO	NO	NO	NO	NO	NO	NO
1A3eii - Other Mobile Machinery									
Gas/Diesel Oil	5.3	6.5	8.6	9.5	4.5	4.6	3.7	0.32	NO
Other Kerosene	NO	NO	NO	0.022	1.2	0.16	0.33	0.026	0.022
Biodiesel	NO	NO	NO	NO	NO	NO	NO	NO	NO
1A4cii - Mobile Machinery in Agriculture									
Gas/Diesel Oil	13.2	16.3	21.6	23.6	11.2	11.5	7.6	6.3	6.3
Biodiesel	NO	NO	NO	NO	NO	NO	NO	NO	NO

3.4.1.2 Emission Factors

Emission factors for dioxins from this sector are taken from *Utslipp til luft av dioksiner i Norge* (Statistics Norway, 2002). They are 0.1 µg/t fuel. SO_x emissions are calculated from the S-content of the fuels (default and country specific). All other emission factors are from Table 3-1 from Chapter 1A4 Non-Road Mobile Machinery in the 2023 EMEP/EEA Guidebook. Emission factor information can be found in Table 3.40.

Table 3.40 Emission factor information for non-road Mobile Machinery (NFR 1A2gvii, 1A3eii, 1A4cii)

Fuel Type	Reference	Exception
Gas/Diesel Oil	Tier 1 EF for liquid fuels from **Table 3-1** from Chapter *1.A.4 Non-Road Mobile Machinery* of the 2023 EMEP/EEA Guidebook	SO_2 emissions are based on Tier 1 sulphur contents from Table 3-14 in chapter 1A3b Road Transport in the 2019 EMEP/EEA Guidebook for 1990-2005. The emissions are then based on country specific sulphur content from 2006. Dioxin emissions from (Statistics Norway, 2002).
Kerosene	Same EFs as for gas/diesel oil as kerosene is most likely used for similar engines as diesel engines	
Biodiesel	Same EFs as for gas/diesel oil as biodiesel is used in diesel engines	

3.4.1.3 Recalculations and Improvements

Recalculations for the 2025 Submission

For the 2025 submission, a more precise NCV for diesel was obtained for the years 2021 and 2022 resulting in recalculations for these two years for SO_2, see tables below.

Table 3.41 Recalculations in 1A2gvii Mobile Machinery in Construction between submissions.

1A2gvii Mobile Machinery in Construction	2021	2022
2024 submission SO_2 [kt]	1.72E-04	1.66E-04
2025 submission SO_2 [kt]	1.71E-04	1.67E-04
Change relative to the 2024 submission SO_2 [kt]	-8.43E-07	8.40E-07
Change relative to the 2024 submission SO_2 [%]	-0.49%	0.51%

Table 3.42 Recalculations in 1A3eii Other Mobile Machinery between submissions.

1A3eii Other Mobile Machinery	2021	2022
2024 submission SO_2 [kt]	1.55E-05	5.52E-06
2025 submission SO_2 [kt]	1.54E-05	5.55E-06
Change relative to the 2024 submission SO_2 [kt]	-7.60E-08	2.79E-08
Change relative to the 2024 submission SO_2 [%]	-0.49%	0.51%

Table 3.43 Recalculations in 1A4cii Mobile Machinery in Agriculture between submissions.

1A4cii Mobile Machinery in Agriculture	2021	2022
2024 submission SO_2 [kt]	1.12E-04	1.00E-04
2025 submission SO_2 [kt]	1.12E-04	1.01E-04
Change relative to the 2024 submission SO_2 [kt]	-5.51E-07	5.08E-07
Change relative to the 2024 submission SO_2 [%]	-0.49%	0.51%

Recalculations for the 2024 Submission

As explained above, an extrapolation of data from 2019- the latest year was performed for the years in the time series where data was not available (1990-2018). This will be done for every submission, and cause recalculations in all air pollutants for 1990-2018, until a constant proportion between the three Mobile Machinery categories is available.

Table 3.45, Table 3.47 and Table 3.49 show the recalculations caused by the extrapolation done for the 2024 submission.

Beside the extrapolation, the recalculations in Mobile Machinery were also caused by changes in emission factors including the update of sulphur content value for diesel (to more appropriate default values for 1990-2005 and to country specifics from 2006) which caused large recalculations of SO_2 (see Table 3.44, Table 3.46 and Table 3.48).

1A2gvii Mobile Machinery in Construction

Table 3.44 Recalculations of SO_2 in 1A2gvii Mobile Machinery in Construction between submissions.

1A2gvii Mobile Machinery in Construction	1990	1995	2000	2005	2010	2015	2020	2021
2023 submission SO_2 [kt]	0.073	0.090	0.119	0.1298	0.06172	0.06337	0.02563	0.03949
2024 submission SO_2 [kt]	0.016	0.019	0.019	0.0028	0.00012	0.00030	0.00011	0.00017
Change relative to the 2023 submission SO_2 [%]	-79%	-79%	-84%	-97.9%	-99.8%	-99.5%	-99.6%	-99.6%

Table 3.45 Recalculations of all air pollutants except SO_2 in 1A2gvii Mobile Machinery in Construction between submissions.

1A2gvii Mobile Machinery in Construction	1990	1995	2000	2005	2010	2015	2018
2023 submission NO_X [kt]	0.593	0.730	0.967	1.059	0.503	0.517	0.491
2024 submission NO_X [kt]	0.635	0.781	1.034	1.132	0.538	0.553	0.525
Change relative to the 2023 submission NO_X [%]	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%
2023 submission CO [kt]	0.196	0.241	0.319	0.350	0.166	0.171	0.162
2024 submission CO [kt]	0.210	0.258	0.341	0.374	0.178	0.182	0.173
Change relative to the 2023 submission CO [%]	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%
2023 submission NMVOC [kt]	0.0614	0.0756	0.1001	0.1096	0.0521	0.0535	0.0508
2024 submission NMVOC [kt]	0.0657	0.0808	0.1070	0.1172	0.0557	0.0572	0.0544
Change relative to the 2023 submission NMVOC [%]	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%
2023 submission NH_3 [kt]	0.000145	0.000179	0.000237	0.000260	0.000123	0.000127	0.000120
2024 submission NH_3 [kt]	0.000156	0.000191	0.000253	0.000278	0.000132	0.000136	0.000129
Change relative to the 2023 submission NH_3 [%]	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%
2023 submission dioxin [g]	0.00182	0.00224	0.00296	0.00325	0.00154	0.00158	0.00151
2024 submission dioxin [g]	0.00194	0.00239	0.00317	0.00347	0.00165	0.00169	0.00161
Change relative to the 2023 submission dioxin [%]	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%
2023 submission $PM_{2.5}$ [kt]	0.0383	0.0471	0.0623	0.0683	0.0325	0.0333	0.0317
2024 submission $PM_{2.5}$ [kt]	0.0409	0.0503	0.0667	0.0730	0.0347	0.0356	0.0339
Change relative to the 2023 submission $PM_{2.5}$ [%]	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%
2023 submission PM_{10} [kt]	0.0383	0.0471	0.0623	0.0683	0.0325	0.0333	0.0317
2024 submission PM_{10} [kt]	0.0409	0.0503	0.0667	0.0730	0.0347	0.0356	0.0339
Change relative to the 2023 submission PM_{10} [%]	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%
2023 submission TSP [kt]	0.0383	0.0471	0.0623	0.0683	0.0325	0.0333	0.0317
2024 submission TSP [kt]	0.0409	0.0503	0.0667	0.0730	0.0347	0.0356	0.0339
Change relative to the 2023 submission TSP [%]	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%
2023 submission BC [kt]	0.0238	0.0292	0.0387	0.0424	0.0202	0.0207	0.0197
2024 submission BC [kt]	0.0254	0.0313	0.0414	0.0453	0.0215	0.0221	0.0210
Change relative to the 2023 submission BC [%]	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%

1A2gvii Mobile Machinery in Construction	1990	1995	2000	2005	2010	2015	2018
2023 submission Pb [t]	0.0409	0.0504	0.0667	0.0730	0.0347	0.0356	0.0339
2024 submission Pb [t]	0.0438	0.0538	0.0713	0.0781	0.0371	0.0381	0.0362
Change relative to the 2023 submission Pb [%]	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%
2023 submission Cd [t]	0.000182	0.000224	0.000296	0.000325	0.000154	0.000158	0.000151
2024 submission Cd [t]	0.000194	0.000239	0.000317	0.000347	0.000165	0.000169	0.000161
Change relative to the 2023 submission Cd [%]	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%
2023 submission Cu [t]	0.0309	0.0380	0.0504	0.0552	0.0262	0.0269	0.0256
2024 submission Cu [t]	0.0331	0.0407	0.0539	0.0590	0.0280	0.0288	0.0274
Change relative to the 2023 submission Cu [%]	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%
2023 submission Cr [t]	0.000909	0.001119	0.001482	0.001623	0.00077	0.00079	0.00075
2024 submission Cr [t]	0.000972	0.001196	0.001584	0.001735	0.00082	0.00085	0.00080
Change relative to the 2023 submission Cr [%]	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%
2023 submission Ni [t]	0.00127	0.00157	0.00207	0.00227	0.00108	0.00111	0.00105
2024 submission Ni [t]	0.00136	0.00168	0.00222	0.00243	0.00115	0.00119	0.00113
Change relative to the 2023 submission Ni [%]	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%
2023 submission Se [t]	0.000182	0.000224	0.000296	0.000325	0.000154	0.000158	0.000151
2024 submission Se [t]	0.000194	0.000239	0.000317	0.000347	0.000165	0.000169	0.000161
Change relative to the 2023 submission Se [%]	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%
2023 submission Zn [t]	0.0182	0.0224	0.0296	0.0325	0.0154	0.0158	0.0151
2024 submission Zn [t]	0.0194	0.0239	0.0317	0.0347	0.0165	0.0169	0.0161
Change relative to the 2023 submission Zn [%]	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%
2023 submission BaP [t]	0.000546	0.000671	0.000889	0.000974	0.000463	0.000475	0.000452
2024 submission BaP [t]	0.000583	0.000718	0.000951	0.001041	0.000495	0.000508	0.000483
Change relative to the 2023 submission BaP [%]	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%
2023 submission BbF [t]	0.000909	0.001119	0.001482	0.001623	0.000772	0.000792	0.00075
2024 submission BbF [t]	0.000972	0.001196	0.001584	0.001735	0.000825	0.000847	0.00080
Change relative to the 2023 submission BbF [%]	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%
2023 submission PAH4 [t]	0.00145	0.00179	0.00237	0.00260	0.00123	0.00127	0.001204
2024 submission PAH4 [t]	0.00156	0.00191	0.00253	0.00278	0.00132	0.00136	0.001288
Change relative to the 2023 submission PAH4 [%]	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%

1A3eii Other Mobile Machinery

Table 3.46 Recalculations of SO_2 in 1A3eii Other Mobile Machinery between submissions.

1A3eii Other Mobile Machinery	1990	1995	2000	2005	2010	2015	2020	2021
2023 submission SO_2 [kt]	2.7 E-02	3.4 E-02	4.5 E-02	4.9 E-02	2.8 E-02	2.4 E-02	1.6 E-02	3.6 E-03
2024 submission SO_2 [kt]	4.2 E-03	5.2 E-03	5.2 E-03	7.6 E-04	4.0 E-05	8.4 E-05	7.1 E-05	1.5 E-05
Change relative to the 2023 submission SO_2 [%]	-84%	-84%	-88%	-98.4%	-99.9%	-99.7%	-99.6%	-99.6%

Table 3.47 Recalculations in all air pollutants except SO_2 in 1A3eii Other Mobile Machinery between submissions.

1A3eii Other Mobile Machinery	1990	1995	2000	2005	2010	2015	2018
2023 submission NO_X [kt]	0.223	0.274	0.363	0.399	0.227	0.199	0.186
2024 submission NO_X [kt]	0.173	0.213	0.282	0.310	0.185	0.156	0.145
Change relative to the 2023 submission NO_X [%]	-22%	-22%	-22%	-22%	-19%	-22%	-22%
2023 submission CO [kt]	0.074	0.091	0.120	0.132	0.075	0.066	0.062
2024 submission CO [kt]	0.057	0.070	0.093	0.102	0.061	0.051	0.048
Change relative to the 2023 submission CO [%]	-22%	-22%	-22%	-22%	-19%	-22%	-22%
2023 submission NMVOC [kt]	0.023	0.028	0.038	0.041	0.024	0.021	0.019
2024 submission NMVOC [kt]	0.018	0.022	0.029	0.032	0.019	0.016	0.015
Change relative to the 2023 submission NMVOC [%]	-22%	-22%	-22%	-22%	-19%	-22%	-22%
2023 submission NH_3 [kt]	0.000055	0.000067	0.000089	0.000098	0.000056	0.000049	0.000046
2024 submission NH_3 [kt]	0.000042	0.000052	0.000069	0.000076	0.000045	0.000038	0.000036
Change relative to the 2023 submission NH3 [%]	-22%	-22%	-22%	-22%	-19%	-22%	-22%
2023 submission dioxin [g]	0.000683	0.000841	0.001114	0.001222	0.000697	0.000611	0.000571
2024 submission dioxin [g]	0.000530	0.000653	0.000864	0.000949	0.000567	0.000478	0.000445
Change relative to the 2023 submission dioxin [%]	-22%	-22%	-22%	-22%	-19%	-22%	-22%
2023 submission $PM_{2.5}$ [kt]	0.0144	0.0177	0.0234	0.0257	0.0147	0.0129	0.0120
2024 submission $PM_{2.5}$ [kt]	0.0112	0.0137	0.0182	0.0200	0.0119	0.0101	0.0094
Change relative to the 2023 submission $PM_{2.5}$ [%]	-22%	-22%	-22%	-22%	-19%	-22%	-22%
2023 submission PM_{10} [kt]	0.0144	0.0177	0.0234	0.0257	0.0147	0.0129	0.0120
2024 submission PM_{10} [kt]	0.0112	0.0137	0.0182	0.0200	0.0119	0.0101	0.0094
Change relative to the 2023 submission PM_{10} [%]	-22%	-22%	-22%	-22%	-19%	-22%	-22%
2023 submission TSP [kt]	0.0144	0.0177	0.0234	0.0257	0.0147	0.0129	0.0120
2024 submission TSP [kt]	0.0112	0.0137	0.0182	0.0200	0.0119	0.0101	0.0094
Change relative to the 2023 submission TSP [%]	-22%	-22%	-22%	-22%	-19%	-22%	-22%
2023 submission BC [kt]	0.0089	0.0110	0.0145	0.0160	0.0091	0.0080	0.0075
2024 submission BC [kt]	0.0069	0.0085	0.0113	0.0124	0.0074	0.0062	0.0058
Change relative to the 2023 submission BC [%]	-22%	-22%	-22%	-22%	-19%	-22%	-22%
2023 submission Pb [t]	0.0154	0.0189	0.0251	0.0275	0.0157	0.0137	0.0129
2024 submission Pb [t]	0.0119	0.0147	0.0194	0.0214	0.0128	0.0107	0.0100
Change relative to the 2023 submission Pb [%]	-22%	-22%	-22%	-22%	-19%	-22%	-22%
2023 submission Cd [t]	0.000068	0.000084	0.000111	0.000122	0.000070	0.000061	0.000057
2024 submission Cd [t]	0.000053	0.000065	0.000086	0.000095	0.000057	0.000048	0.000044
Change relative to the 2023 submission Cd [%]	-22%	-22%	-22%	-22%	-19%	-22%	-22%
2023 submission Cu [t]	0.0116	0.0143	0.0189	0.0208	0.0118	0.0104	0.0097
2024 submission Cu [t]	0.0090	0.0111	0.0147	0.0161	0.0096	0.0081	0.0076
Change relative to the 2023 submission Cu [%]	-22%	-22%	-22%	-22%	-19%	-22%	-22%

1A3eii Other Mobile Machinery	1990	1995	2000	2005	2010	2015	2018
2023 submission Cr [t]	0.00034	0.00042	0.00056	0.00061	0.00035	0.00031	0.00029
2024 submission Cr [t]	0.00027	0.00033	0.00043	0.00047	0.00028	0.00024	0.00022
Change relative to the 2023 submission Cr [%]	-22%	-22%	-22%	-22%	-19%	-22%	-22%
2023 submission Ni [t]	0.00048	0.00059	0.00078	0.00086	0.00049	0.00043	0.00040
2024 submission Ni [t]	0.00037	0.00046	0.00061	0.00066	0.00040	0.00033	0.00031
Change relative to the 2023 submission Ni [%]	-22%	-22%	-22%	-22%	-19%	-22%	-22%
2023 submission Se [t]	0.000068	0.000084	0.000111	0.000122	0.000070	0.000061	0.000057
2024 submission Se [t]	0.000053	0.000065	0.000086	0.000095	0.000057	0.000048	0.000044
Change relative to the 2023 submission Se [%]	-22%	-22%	-22%	-22%	-19%	-22%	-22%
2023 submission Zn [t]	0.0068	0.0084	0.0111	0.0122	0.0070	0.0061	0.0057
2024 submission Zn [t]	0.0053	0.0065	0.0086	0.0095	0.0057	0.0048	0.0044
Change relative to the 2023 submission Zn [%]	-22%	-22%	-22%	-22%	-19%	-22%	-22%
2023 submission BaP [t]	0.00021	0.00025	0.00033	0.00037	0.00021	0.00018	0.00017
2024 submission BaP [t]	0.00016	0.00020	0.00026	0.00028	0.00017	0.00014	0.00013
Change relative to the 2023 submission BaP [%]	-22%	-22%	-22%	-22%	-19%	-22%	-22%
2023 submission BbF [t]	0.00034	0.00042	0.00056	0.00061	0.00035	0.00031	0.00029
2024 submission BbF [t]	0.00027	0.00033	0.00043	0.00047	0.00028	0.00024	0.00022
Change relative to the 2023 submission BbF [%]	-22%	-22%	-22%	-22%	-19%	-22%	-22%
2023 submission PAH4 [t]	0.00055	0.00067	0.00089	0.00098	0.00056	0.00049	0.00046
2024 submission PAH4 [t]	0.00042	0.00052	0.00069	0.00076	0.00045	0.00038	0.00036
Change relative to the 2023 submission PAH4 [%]	-22%	-22%	-22%	-22%	-19%	-22%	-22%

1A4cii Mobile Machinery in Agriculture

Table 3.48 Recalculations of SO_2 in 1A4cii Mobile Machinery in Agriculture between submissions.

1A4cii Mobile Machinery in Agriculture	1990	1995	2000	2005	2010	2015	2020	2021
2023 submission SO_2 [kt]	5.2 E-02	6.4 E-02	8.4 E-02	9.3 E-02	4.4 E-02	4.5 E-02	3.0 E-02	2.6 E-02
2024 submission SO_2 [kt]	1.1 E-02	1.3 E-02	1.3 E-02	1.9 E-03	7.9 E-05	2.0 E-04	1.3 E-04	1.1 E-04
Change relative to the 2023 submission SO_2 [%]	-80%	-80%	-85%	-98.0%	-99.8%	-99.6%	-99.6%	-99.6%

Table 3.49 Recalculations of all air pollutants except SO_2 in 1A4cii Mobile Machinery in Agriculture between submissions.

Mobile Machinery in Agriculture	1990	1995	2000	2005	2010	2015	2018
2023 submission NO_x [kt]	0.422852	0.520324	0.688981	0.754623	0.358769	0.368321	0.349985
2024 submission NO_x [kt]	0.431679	0.531185	0.703364	0.770375	0.366258	0.376010	0.357291
Change relative to the 2023 submission NO_x [%]	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%
2023 submission CO [kt]	0.139625	0.171809	0.227500	0.249174	0.118465	0.121619	0.115564
2024 submission CO [kt]	0.142539	0.175396	0.232249	0.254376	0.120937	0.124157	0.117976

Mobile Machinery in Agriculture	1990	1995	2000	2005	2010	2015	2018
Change relative to the 2023 submission CO [%]	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%
2023 submission NMVOC [kt]	0.043764	0.053852	0.071307	0.078101	0.037131	0.038120	0.036222
2024 submission NMVOC [kt]	0.044677	0.054976	0.072796	0.079731	0.037907	0.038916	0.036978
Change relative to the 2023 submission NMVOC [%]	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%
2023 submission NH3 [kt]	0.000104	0.000128	0.000169	0.000185	0.000088	0.000090	0.000086
2024 submission NH3 [kt]	0.000106	0.000130	0.000172	0.000189	0.000090	0.000092	0.000088
Change relative to the 2023 submission NH3 [%]	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%
2023 submission dioxin [g]	0.001296	0.001595	0.002112	0.002313	0.001100	0.001129	0.001073
2024 submission dioxin [g]	0.001323	0.001628	0.002156	0.002361	0.001122	0.001152	0.001095
Change relative to the 2023 submission dioxin [%]	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%
2023 submission $PM_{2.5}$ [kt]	0.027267	0.033552	0.044427	0.048660	0.023134	0.023750	0.022568
2024 submission $PM_{2.5}$ [kt]	0.027836	0.034252	0.045355	0.049676	0.023617	0.024246	0.023039
Change relative to the 2023 submission $PM_{2.5}$ [%]	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%
2023 submission BC [kt]	0.016925	0.020826	0.027577	0.030204	0.014360	0.014742	0.014008
2024 submission BC [kt]	0.017278	0.021261	0.028153	0.030835	0.014660	0.015050	0.014301
Change relative to the 2023 submission BC [%]	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%
2023 submission PM_{10} [kt]	0.027267	0.033552	0.044427	0.048660	0.023134	0.023750	0.022568
2024 submission PM_{10} [kt]	0.027836	0.034252	0.045355	0.049676	0.023617	0.024246	0.023039
Change relative to the 2023 submission PM_{10} [%]	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%
2023 submission TSP [kt]	0.027267	0.033552	0.044427	0.048660	0.023134	0.023750	0.022568
2024 submission TSP [kt]	0.027836	0.034252	0.045355	0.049676	0.023617	0.024246	0.023039
Change relative to the 2023 submission TSP [%]	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%
2023 submission Pb [t]	0.029159	0.035880	0.047510	0.052037	0.024740	0.025398	0.024134
2024 submission Pb [t]	0.029767	0.036629	0.048502	0.053123	0.025256	0.025929	0.024638
Change relative to the 2023 submission Pb [%]	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%
2023 submission Cd [t]	0.000130	0.000159	0.000211	0.000231	0.000110	0.000113	0.000107
2024 submission Cd [t]	0.000132	0.000163	0.000216	0.000236	0.000112	0.000115	0.000110
Change relative to the 2023 submission Cd [%]	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%
2023 submission Cu [t]	0.022031	0.027109	0.035897	0.039317	0.018692	0.019190	0.018235
2024 submission Cu [t]	0.022491	0.027675	0.036646	0.040137	0.019082	0.019590	0.018615
Change relative to the 2023 submission Cu [%]	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%
2023 submission Cr [t]	0.000648	0.000797	0.001056	0.001156	0.000550	0.000564	0.000536
2024 submission Cr [t]	0.000661	0.000814	0.001078	0.001181	0.000561	0.000576	0.000548
Change relative to the 2023 submission Cr [%]	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%
2023 submission Ni [t]	0.000907	0.001116	0.001478	0.001619	0.000770	0.000790	0.000751
2024 submission Ni [t]	0.000926	0.001140	0.001509	0.001653	0.000786	0.000807	0.000767
Change relative to the 2023 submission Ni [%]	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%

Mobile Machinery in Agriculture	1990	1995	2000	2005	2010	2015	2018
2023 submission Se [t]	0.000130	0.000159	0.000211	0.000231	0.000110	0.000113	0.000107
2024 submission Se [t]	0.000132	0.000163	0.000216	0.000236	0.000112	0.000115	0.000110
Change relative to the 2023 submission Se [%]	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%
2023 submission Zn [t]	0.012959	0.015947	0.021116	0.023127	0.010995	0.011288	0.010726
2024 submission Zn [t]	0.013230	0.016280	0.021556	0.023610	0.011225	0.011524	0.010950
Change relative to the 2023 submission Zn [%]	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%
2023 submission BaP [t]	0.000389	0.000478	0.000633	0.000694	0.000330	0.000339	0.000322
2024 submission BaP [t]	0.000397	0.000488	0.000647	0.000708	0.000337	0.000346	0.000329
Change relative to the 2023 submission BaP [%]	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%
2023 submission BbF [t]	0.000648	0.000797	0.001056	0.001156	0.000550	0.000564	0.000536
2024 submission BbF [t]	0.000661	0.000814	0.001078	0.001181	0.000561	0.000576	0.000548
Change relative to the 2023 submission BbF [%]	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%
2023 submission PAH4 [t]	0.001037	0.001276	0.001689	0.001850	0.000880	0.000903	0.000858
2024 submission PAH4 [t]	0.001058	0.001302	0.001725	0.001889	0.000898	0.000922	0.000876
Change relative to the 2023 submission PAH4 [%]	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%

3.4.1.4 Planned Improvements

No improvements are currently planned for this subsector.

3.4.2 Civil Aviation (NFR 1A3a)

Emissions from aviation are divided into four groups: International Landing and Take-Off (LTO) (1A3ai(i)), Domestic LTO (1A3aii(i)), International Climb, Cruise, and Descent (CCD) (1A3ai(ii)), and Domestic CCD (1A3aii(ii)). As defined by Eurocontrol, LTO includes taxi out, take off, climb out (up to a height of 3,000 ft.), final approach (from a height of 3,000 ft), landing, and taxi in. CCD includes climb from a height of 3,000 ft up to the cruise level, cruise, and descent down to a height of 3,000 ft. Emissions occurring during LTO of both domestic and international flights are included in national totals, whereas emissions occurring during the CCD part of the flights are reported as "memo" items and are thus not counted in the national totals.

A Tier 3 methodology is used for reporting, which uses a complete flight list containing data on the origin and destination airport, aircraft type, and date of each flight for a range of years for both domestic and international flights. The EMEP/EEA master emissions calculator tool, attached as an annex to the 2023 EMEP/EEA guidebook, is used to obtain estimates for NO_x, SO_x, CO, and PM emissions based on flight distances and aircraft types. Emissions of flights with incomplete data are extrapolated from calculated emissions within the same year. Flight totals are used as proxies to project the results backwards to years pre-2012 in the case of domestic flights, and pre-2007 for international flights, with years 2008 and 2010 also being projected, as complete detailed flight data is not available for these years.

BC emissions are estimated using the suggested fraction of PM equal to 0.15 that is provided in the 2023 EMEP/EEA Guidebook. The ratio of TSP to $PM_{2.5}$ to PM_{10} emissions is assumed to be 1.

A Tier 1 method is used for NMVOC, Pb in domestic aviation, and dioxins using fuel consumption data, as these pollutants are not included in the EMEP/EEA calculator.

NH_3, heavy metals other than Pb in domestic aviation, and PAHs are currently reported as NA due to lack of available emission factors.

Aviation training operations are considered domestic activities. Emissions resulting from training flights are added to the totals of domestic aviation. Calculation of training related emissions is based on the EMEP/EEA master emissions calculator tool for aircraft types covered by the tool, with emissions split into LTO and CCD as with regular flights. While a Tier 1 method is used for all other, mostly smaller aviation gasoline burning piston engine types of aircraft. Emissions from these flights are attributed to domestic LTO emissions.

3.4.2.1 Activity Data

In Iceland, there is one main airport for international flights, Keflavík International Airport (KEF). Under normal circumstances almost all international flights to and from Iceland depart and arrive from KEF, except for a small number of commercial flights and some flights with private airplanes which depart and arrive from Reykjavík Airport. As of recent, a small number of international flights is scheduled from/to Akureyri Airport (AEY). Domestic flights sometimes depart from KEF in case of special weather conditions.

Activity data is provided by ISAVIA, the national airport and air navigation service provider of Iceland. This is in the form of Station Reports compiling detailed, timestamped data on every flight passing through each of Iceland's airports. This data includes the origin and destination airports, and aircraft type used for each flight. It is therefore straightforward to distinguish between national and international flights using the Origin and Destination fields. This detailed data is available to a sufficient level of completeness for the years since 2012 for domestic flights, and since 2007 for international flights. In addition to the Station Reports, totals of international and domestic regular and other flights are provided by ISAVIA in form yearly movement statistics ("Fact Files") from 1993 to 2023, and linearly interpolated for years 2007 and 2009 missing in the ISAVIA data. These totals are used as a proxy to project emissions data, using linear extrapolation, for years for which detailed flight data is not available.

Table 3.50 reflects the percentages of flights sufficiently specified (distance and type of aircraft) to calculate emissions using the EMEP/EEA master emissions calculator tool of the total number of regular flights as extracted from Station Reports, for more recent years, or flights number totals, for years for with Station Reports are unavailable or incomplete, as provided by ISAVIA.

Table 3.50 Percentage of regular flights specified in terms of distance and type of aircraft.

Flights w/ data	1997	1998	2000	2006	2007	2011	2012	2020	2022	2023
1A3a(i) International aviation										
LTO [%]	1.7%	36.8%	41.3%	43.5%	50.1%	56.2%	62.4%	95.5%	97.7%	98.1%
CCD [%]	1.7%	34.9%	39.9%	41.2%	47.6%	49.0%	51.4%	95.3%	97.6%	98.0%
1A3a(ii) Domestic aviation										
LTO [%]	0.0%	0.0%	0.0%	0.2%	0.2%	33.9%	59.9%	85.8%	75.7%	67.9%
CCD [%]	0.0%	0.0%	0.0%	0.2%	0.2%	31.1%	55.9%	84.2%	74.5%	65.7%

For both, domestic and international flights, the emissions calculated for the year 1993 are reported also for the years 1990-1992 as the most plausible approximation in the absence of a clear trend in domestic flights and increasing yearly changes for international flights with smaller changes in the first years from 1993 onward.

Flight distances are calculated as great circle distances (GCD), assuming the Earth to be a perfect sphere, for each origin/destination combination. In cases where the distance cannot be obtained, a conservative figure of the width of Iceland is applied for domestic flights, and the average figure found for the relevant country of destination in the case of international flights. Emissions for flights for which no destination or aircraft type information is available are extrapolated on the basis of flight numbers and calculated emissions for respective years.

In consultation with ISAVIA, the number of flights pertaining to aviation training are determined as the difference between the sum of domestic regular and domestic other flights in ISAVIA's Fact Files and the number of domestic flights as recorded in the detailed Station Reports. Due to lack of respective data, it is further assumed that a training flight using an aviation gasoline powered type of aircraft takes one hour on average, and training flights performed by aircraft supported by the 2023 EMEP/EEA master emissions calculator each consist of a default LTO phase and a CCD phase with a flown distance of 125 nautical miles (nm).

All Tier 1 method calculations, i.e. NMVOC and dioxins for kerosene fuelled flights, as well as all emissions resulting from the combustion of aviation gasoline, are based on the calculated fuel consumption data.

3.4.2.2 Emission Factors

LTO and CCD emissions from kerosene fuelled flights that are fully specified in terms of distance and aircraft type are calculated using the emission factors inherent in the 2023 EMEP/EEA master emissions calculator. The fraction of flights for which this tool, due to lack of detailed flight data or unsupported distance or type of aircraft, cannot be used increases with earlier years. As summarised in Table 3.50, these flights amounted to only a few percent in the most recent years, steadily increasing to 98% in 1997 and 100% from 1990 to 1996 of the calculated total number of international flights. In case of domestic flights, the 2023 EMEP/EEA master emissions calculator tool can be used for approximately two thirds of flights in recent years, but only for 30% in 2011 and for practically 0% of flights for 2010 and before.

The emissions totals were therefore afterwards multiplied by a correction factor based on the total number of regular kerosene fuelled flights in that year and category, which is equivalent to assigning the average amount of emissions produced per flight in the same year and category, to each missing flight. In this way, complete estimates are provided for NO_x, SO_x, CO, and PM emissions.

For NMVOC emissions, the default emission factor from Table 3.3 of the EMEP/EEA Guidebook 2023, part 1.A.3.a, is used.

Emission factors for dioxin were taken from the Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases (UNEP, 2005) and from Utslipp til luft av dioksiner i Norge (Statistics Norway, 2002).

Emissions from aviation training operations are either based on the EMEP/EEA master emissions calculator tool and its emission factors in case of kerosene consuming aircraft types, and on Tier 1 emission factors defined in Table 3.3 of the EMEP/EEA Guidebook 2023 for aircraft types using aviation gasoline. The calculation of Pb emissions from aviation gasoline burning aircraft are based on the default emission factor recommended in Annex 2 of EMEP/EEA Guidebook 2023, part 1.A.3.a (0.6 g/l gasoline).

3.4.2.3 Recalculations and Improvements

Recalculations for the 2025 Submission

Recalculations, summarised in Table 3.51 to

Table 3.54, were performed for the entire timeline due to the following methodological improvements:

- Calculation of emissions from aviation training related operations and aggregation with domestic aviation emissions.
- A review of input data showed that each single domestic flight is recorded as two aircraft movements, as departing flight at the departure airport, and as an arriving flight at the destination airport. This led to taking the same flights into account twice in the last submission and resulted in an overestimation of domestic flights.
- Categorisation of flights with destination ZZZZ into international and domestic Flights takes the wake turbulence category according to ICAO WTC specification into account. Flights performed by aircraft categorised as "light" are considered domestic flights.
- According to 2022 input data 26% of all domestic flights were shorter than the minimum distance of 125 nm supported by the EMEP/EEA master emission calculator. Therefore, climb, cruise, and descent emission estimates for flights of distances < 125 nm are now extrapolated according to the calculated distance. The previous calculation did not estimate CCD emissions of flights of distances of less than 125 nm but extrapolated them based on the set of flights longer than or equal to 125 nm.
- According to 2022 input data 0.3% of flights were longer than the maximum distance supported by the EMEP/EEA master emission calculator for the particular type of aircraft. Therefore, CCD emissions of these flights are linearly extrapolated beyond the emission values of the two highest supported distances on the basis of the calculated distance and type of aircraft. The previous calculation did not estimate CCD emissions for these flights but extrapolated them based on all flights with valid CCD data available.

- The previous calculation set the distance to 485 km (262 nm) for all domestic flights for which the destination is unspecified (BIZZ) or the destination aerodrome is the same as the departure aerodrome. Review of 2022 data showed that 23% of all domestic flights had the destination aerodrome same as the departure aerodrome. Therefore, a distance of 485 km is only set for flights to destination BIZZ but emissions of zero-distance flights are extrapolated based on the set of domestic flights with emission estimates available.
- Military flights are contained in the flight data recordings provided by ISAVIA and are marked with a specific flight type identifier. They were included in international flights in the previous submission but are now excluded from the calculations for this report.

Table 3.51 Recalculations in International Aviation (1A3a(i)) LTO due to method improvements.

1A3a(i) Int. Aviation LTO	1990	1995	2000	2005	2010	2015	2020	2021	2022
2024 submission LTO NOx [kt]	0.062	0,079	0.130	0.165	0.157	0.272	0.113	0.170	0.318
2025 submission LTO NOx [kt]	0.106	0,123	0.164	0.170	0.156	0.256	0.106	0.158	0.305
Change relative to 2024 submission LTO NOx [kt]	0.043	0,045	0.034	0.005	0.000	-0.016	-0.008	-0.012	-0.013
Change relative to 2024 submission LTO NOx [%]	70%	57%	26%	2.8%	-0.3%	-5.8%	-6.7%	-6.9%	-4.0%
2024 submission LTO CO [kt]	0.061	0,073	0.106	0.134	0.130	0.216	0.105	0.157	0.248
2025 submission LTO CO [kt]	0.086	0,096	0.119	0.123	0.115	0.175	0.082	0.122	0.199
Change relative to 2024 submission LTO CO [kt]	0.025	0,023	0.013	-0.011	-0.015	-0.040	-0.023	-0.034	-0.049
Change relative to 2024 submission LTO CO [%]	41%	32%	12%	-8.0%	-12%	-19%	-22%	-22%	-20%
2024 submission LTO NMVOC [kt]	0.132	0,155	0.223	0.280	0.265	0.444	0.178	0.251	0.449
2025 submission LTO NMVOC [kt]	0.183	0,206	0.257	0.264	0.247	0.397	0.156	0.218	0.405
Change relative to 2024 submission LTO NMVOC [kt]	0.052	0,051	0.033	-0.016	-0.018	-0.047	-0.022	-0.032	-0.044
Change relative to 2024 submission LTO NMVOC [%]	39%	33%	15%	-5.7%	-6.8%	-11%	-12%	-13%	-10%
2024 submission LTO SOx [kt]	0.006	0,007	0.010	0.012	0.012	0.020	0.008	0.011	0.020
2025 submission LTO SOx [kt]	0.008	0,009	0.011	0.012	0.011	0.018	0.007	0.010	0.018
Change relative to 2024 submission LTO SOx [kt]	0.002	0,002	0.001	-0.001	-0.001	-0.002	-0.001	-0.001	-0.002
Change relative to 2024 submission LTO SOx [%]	39%	33%	15%	-5.7%	-6.8%	-11%	-12%	-13%	-10%
2024 submission LTO TSP [kt]	0.0012	0,0014	0.0019	0.0024	0.0022	0.0037	0.0013	0.0016	0.0026
2025 submission LTO TSP [kt]	0.0016	0,0018	0.0021	0.0022	0.0021	0.0034	0.0012	0.0014	0.0024
Change relative to 2024 submission LTO TSP [kt]	0.0005	0,0004	0.0002	-0.0002	-0.0002	-0.0003	-0.0001	-0.0002	-0.0002
Change relative to 2024 submission LTO TSP [%]	39%	32%	12%	-7.2%	-7.0%	-7.4%	-8.2%	-9.5%	-6.9%
2024 submission LTO PM_{10} [kt]	0.0012	0,0014	0.0019	0.0024	0.0022	0.0037	0.0013	0.0016	0.0026

1A3a(i) Int. Aviation LTO	1990	1995	2000	2005	2010	2015	2020	2021	2022
2025 submission LTO PM_{10} [kt]	0.0016	0,0018	0.0021	0.0022	0.0021	0.0034	0.0012	0.0014	0.0024
Change relative to 2024 submission LTO PM_{10} [kt]	0.0005	0,0004	0.0002	-0.0002	-0.0002	-0.0003	-0.0001	-0.0002	-0.0002
Change relative to 2024 submission LTO PM_{10} [%]	39%	32%	12%	-7.2%	-7.0%	-7.4%	-8.2%	-9.5%	-6.9%
2024 submission LTO $PM_{2.5}$ [kt]	0.0012	0,0014	0.0019	0.0024	0.0022	0.0037	0.0013	0.0016	0.0026
2025 submission LTO $PM_{2.5}$ [kt]	0.0016	0,0018	0.0021	0.0022	0.0021	0.0034	0.0012	0.0014	0.0024
Change relative to 2024 submission LTO $PM_{2.5}$ [kt]	0.0005	0,0004	0.0002	-0.0002	-0.0002	-0.0003	-0.0001	-0.0002	-0.0002
Change relative to 2024 submission LTO $PM_{2.5}$ [%]	39%	32%	12%	-7.2%	-7.0%	-7.4%	-8.2%	-9.5%	-6.9%
2024 submission LTO BC [kt]	0.00018	0,00020	0.00029	0.00036	0.00034	0.00055	0.00020	0.00024	0.00038
2025 submission LTO BC [kt]	0.00025	0,00027	0.00032	0.00033	0.00031	0.00051	0.00018	0.00022	0.00036
Change relative to 2024 submission LTO BC [kt]	0.00007	0,00007	0.00003	-0.00003	-0.00002	-0.00004	-0.00002	-0.00002	-0.00003
Change relative to 2024 submission LTO BC [%]	39%	32%	12%	-7.2%	-7.0%	-7.4%	-8.2%	-9.5%	-6.9%
2024 submission LTO dioxin [g]	0.00054	0,00054	0.00079	0.00091	0.00074	0.00127	0.00048	0.00068	0.00124
2025 submission LTO dioxin [g]	0.00058	0,00065	0.00081	0.00083	0.00078	0.00125	0.00049	0.00069	0.00128
Change relative to 2024 submission LTO dioxin [g]	0.00004	0,00010	0.00002	-0.00007	0.00004	-0.00002	0.00001	0.00001	0.00004
Change relative to 2024 submission LTO dioxin [%]	7.6%	19%	3.0%	-8.0%	5.7%	-1.6%	1.9%	0.8%	2.9%

Table 3.52 Recalculations in International Aviation (1A3a(i)) CCD due to method improvements.

1A3a(i) Int. Aviation CCD	1990	1995	2000	2005	2010	2015	2020	2021	2022
2024 submission CCD NOx [kt]	0.421	0,585	1.117	1.409	1.353	2.419	1.067	1.750	3.141
2025 submission CCD NOx [kt]	0.961	1,143	1.565	1.629	1.487	2.521	1.013	1.652	3.077
Change relative to 2024 submission CCD NOx [kt]	0.540	0,558	0.447	0.220	0.134	0.103	-0.054	-0.099	-0.063
Change relative to 2024 submission CCD NOx [%]	128%	95%	40%	16%	10%	4.2%	-5.0%	-5.6%	-2.0%
2024 submission CCD CO [kt]	0.110	0,133	0.197	0.245	0.248	0.418	0.197	0.301	0.453
2025 submission CCD CO [kt]	0.222	0,246	0.300	0.308	0.290	0.454	0.193	0.300	0.459
Change relative to 2024 submission CCD CO [kt]	0.112	0,112	0.103	0.063	0.042	0.036	-0.004	-0.001	0.007
Change relative to 2024 submission CCD CO [%]	102%	84%	52%	26%	17%	8.5%	-2.1%	-0.4%	1.5%
2024 submission CCD NMVOC [kt]	0.985	1,222	1.994	2.433	2.317	4.027	1.651	2.623	4.581
2025 submission CCD NMVOC [kt]	1.763	2,020	2.613	2.703	2.504	4.215	1.560	2.456	4.466

1A3a(i) Int. Aviation CCD	1990	1995	2000	2005	2010	2015	2020	2021	2022
Change relative to 2024 submission CCD NMVOC [kt]	0.778	0,798	0.619	0.270	0.187	0.187	-0.091	-0.167	-0.116
Change relative to 2024 submission CCD NMVOC [%]	79%	65%	31%	11%	8.1%	4.7%	-5.5%	-6.4%	-2.5%
2024 submission CCD SOx [kt]	0.044	0,054	0.088	0.108	0.102	0.178	0.073	0.116	0.203
2025 submission CCD SOx [kt]	0.078	0,089	0.116	0.120	0.111	0.186	0.069	0.109	0.197
Change relative to 2024 submission CCD SOx [kt]	0.034	0,035	0.027	0.012	0.008	0.008	-0.004	-0.007	-0.005
Change relative to 2024 submission CCD SOx [%]	79%	65%	31%	11%	8.1%	4.7%	-5.5%	-6.4%	-2.5%
2024 submission CCD TSP [kt]	0.0154	0,0190	0.0323	0.0377	0.0356	0.0636	0.0222	0.0304	0.0466
2025 submission CCD TSP [kt]	0.0255	0,0290	0.0370	0.0382	0.0355	0.0646	0.0210	0.0290	0.0460
Change relative to 2024 submission CCD TSP [kt]	0.0101	0,0100	0.0047	0.0005	-0.0001	0.0011	-0.0011	-0.0013	-0.0006
Change relative to 2024 submission CCD TSP [%]	65%	53%	14%	1.4%	-0.3%	1.7%	-5.2%	-4.4%	-1.3%
2024 submission CCD PM_{10} [kt]	0.0154	0,0190	0.0323	0.0377	0.0356	0.0636	0.0222	0.0304	0.0466
2025 submission CCD PM_{10} [kt]	0.0255	0,0290	0.0370	0.0382	0.0355	0.0646	0.0210	0.0290	0.0460
Change relative to 2024 submission CCD PM_{10} [kt]	0.0101	0,0100	0.0047	0.0005	-0.0001	0.0011	-0.0011	-0.0013	-0.0006
Change relative to 2024 submission CCD PM_{10} [%]	65%	53%	14%	1.4%	-0.3%	1.7%	-5.2%	-4.4%	-1.3%
2024 submission CCD $PM_{2.5}$ [kt]	0.0154	0,0190	0.0323	0.0377	0.0356	0.0636	0.0222	0.0304	0.0466
2025 submission CCD $PM_{2.5}$ [kt]	0.0255	0,0290	0.0370	0.0382	0.0355	0.0646	0.0210	0.0290	0.0460
Change relative to 2024 submission CCD $PM_{2.5}$ [kt]	0.0101	0,0100	0.0047	0.0005	-0.0001	0.0011	-0.0011	-0.0013	-0.0006
Change relative to 2024 submission CCD $PM_{2.5}$ [%]	65%	53%	14%	1.4%	-0.3%	1.7%	-5.2%	-4.4%	-1.3%
2024 submission CCD BC [kt]	0.00232	0,00285	0.00485	0.00565	0.00535	0.00953	0.00333	0.00455	0.00699
2025 submission CCD BC [kt]	0.00383	0,00435	0.00555	0.00573	0.00533	0.00969	0.00315	0.00435	0.00690
Change relative to 2024 submission CCD BC [kt]	0.00151	0,00150	0.00070	0.00008	-0.00002	0.00016	-0.00017	-0.00020	-0.00009
Change relative to 2024 submission CCD BC [%]	65%	53%	14%	1.4%	-0.3%	1.7%	-5.2%	-4.4%	-1.3%
2024 submission CCD dioxin [g]	0.00402	0,00430	0.00703	0.00788	0.00645	0.01157	0.00449	0.00716	0.01267
2025 submission CCD dioxin [g]	0.00557	0,00638	0.00825	0.00854	0.00791	0.01331	0.00493	0.00776	0.01410
Change relative to 2024 submission CCD dioxin [g]	0.00155	0,00208	0.00122	0.00066	0.00146	0.00174	0.00044	0.00060	0.00144
Change relative to 2024 submission CCD dioxin [%]	38%	48%	17%	8.4%	23%	15%	10%	8.3%	11%

Table 3.53 Recalculations in Domestic Aviation (1A3a(ii)) LTO due to method improvements.

1A3a(ii) Dom. Aviation LTO	1990	1995	2000	2005	2010	2015	2020	2021	2022
2024 submission LTO NOx [kt]	0.036	0,034	0.035	0.029	0.033	0.028	0.023	0.045	0.046
2025 submission LTO NOx [kt]	0.039	0,039	0.041	0.037	0.028	0.022	0.015	0.028	0.026
Change relative to 2024 submission LTO NOx [kt]	0.002	0,005	0.006	0.008	-0.005	-0.006	-0.008	-0.017	-0.020
Change relative to 2024 submission LTO NOx [%]	6.5%	14%	18%	28%	-16%	-21%	-34%	-39%	-44%
2024 submission LTO CO [kt]	0.095	0,091	0.092	0.082	0.089	0.084	0.053	0.106	0.096
2025 submission LTO CO [kt]	0.470	0,417	0.552	0.516	0.353	0.211	0.316	0.521	0.308
Change relative to 2024 submission LTO CO [kt]	0.375	0,326	0.460	0.434	0.263	0.127	0.263	0.414	0.212
Change relative to 2024 submission LTO CO [%]	393%	359%	500%	529%	294%	152%	494%	390%	220%
2024 submission LTO NMVOC [kt]	0.083	0,078	0.079	0.068	0.076	0.066	0.055	0.103	0.103
2025 submission LTO NMVOC [kt]	0.087	0,086	0.091	0.084	0.062	0.051	0.035	0.061	0.056
Change relative to 2024 submission LTO NMVOC [kt]	0.003	0,008	0.012	0.016	-0.014	-0.015	-0.020	-0.042	-0.048
Change relative to 2024 submission LTO NMVOC [%]	4.0%	10%	15%	23%	-19%	-23%	-37%	-41%	-46%
2024 submission LTO SOx [kt]	0.004	0,003	0.004	0.003	0.003	0.003	0.002	0.005	0.005
2025 submission LTO SOx [kt]	0.004	0,004	0.004	0.004	0.003	0.002	0.002	0.003	0.002
Change relative to 2024 submission LTO SOx [kt]	0.000	0,000	0.001	0.001	-0.001	-0.001	-0.001	-0.002	-0.002
Change relative to 2024 submission LTO SOx [%]	5.3%	12%	16%	25%	-18%	-22%	-35%	-39%	-45%
2024 submission LTO TSP [kt]	0.00006	0,00006	0.00006	0.00006	0.00006	0.00008	0.00002	0.00005	0.00007
2025 submission LTO TSP [kt]	0.00010	0,00009	0.00011	0.00010	0.00008	0.00005	0.00006	0.00010	0.00008
Change relative to 2024 submission LTO TSP [kt]	0.00003	0,00002	0.00005	0.00004	0.00001	-0.00003	0.00004	0.00005	0.00001
Change relative to 2024 submission LTO TSP [%]	51%	39%	75%	70%	21%	-39%	199%	110%	11%
2024 submission LTO PM_{10} [kt]	0.00006	0,00006	0.00006	0.00006	0.00006	0.00008	0.00002	0.00005	0.00007
2025 submission LTO PM_{10} [kt]	0.00010	0,00009	0.00011	0.00010	0.00008	0.00005	0.00006	0.00010	0.00008
Change relative to 2024 submission LTO PM_{10} [kt]	0.00003	0,00002	0.00005	0.00004	0.00001	-0.00003	0.00004	0.00005	0.00001
Change relative to 2024 submission LTO PM_{10} [%]	51%	39%	75%	70%	21%	-39%	199%	110%	11%
2024 submission LTO $PM_{2.5}$ [kt]	0.00006	0,00006	0.00006	0.00006	0.00006	0.00008	0.00002	0.00005	0.00007
2025 submission LTO $PM_{2.5}$ [kt]	0.00010	0,00009	0.00011	0.00010	0.00008	0.00005	0.00006	0.00010	0.00008

1A3a(ii) Dom. Aviation LTO	1990	1995	2000	2005	2010	2015	2020	2021	2022
Change relative to 2024 submission LTO $PM_{2.5}$ [kt]	0.00003	0,00002	0.00005	0.00004	0.00001	-0.00003	0.00004	0.00005	0.00001
Change relative to 2024 submission LTO $PM_{2.5}$ [%]	51%	39%	75%	70%	21%	-39%	199%	110%	11%
2024 submission LTO BC [kt]	0.00001	0,00001	0.00001	0.00001	0.00001	0.00001	0.00000	0.00001	0.00001
2025 submission LTO BC [kt]	0.00001	0,00001	0.00002	0.00002	0.00001	0.00001	0.00001	0.00002	0.00001
Change relative to 2024 submission LTO BC [kt]	0.00000	0,00000	0.00001	0.00001	0.00000	0.00000	0.00001	0.00001	0.00000
Change relative to 2024 submission LTO BC [%]	51%	39%	75%	70%	21%	-39%	199%	110%	11%
2024 submission LTO dioxin [g]	0.00106	0,00076	0.00073	0.00060	0.00045	0.00038	0.00018	0.00024	0.00025
2025 submission LTO dioxin [g]	0.00087	0,00078	0.00101	0.00095	0.00067	0.00041	0.00058	0.00096	0.00061
Change relative to 2024 submission LTO dioxin [g]	-0.00019	0,00002	0.00028	0.00035	0.00021	0.00003	0.00040	0.00071	0.00035
Change relative to 2024 submission LTO dioxin [%]	-18%	3.1%	38%	58%	46%	7.4%	224%	294%	141%
2024 submission LTO Pb [t]	0.351	0,237	0.231	0.183	0.136	0.108	0.043	0.052	0.048
2025 submission LTO Pb [t]	0.259	0,220	0.314	0.296	0.204	0.108	0.204	0.332	0.187
Change relative to 2024 submission LTO Pb [t]	-0.093	-0,017	0.083	0.113	0.068	0.001	0.162	0.280	0.139
Change relative to 2024 submission LTO Pb [%]	-26%	-7.1%	36%	62%	50%	0.6%	379%	535%	291%

Table 3.54 Recalculations in Domestic Aviation (1A3a(ii)) CCD due to method improvements.

1A3a(ii) Dom. Aviation CCD	1990	1995	2000	2005	2010	2015	2020	2021	2022
2024 submission CCD NOx [kt]	0.149	0,138	0.141	0.117	0.134	0.107	0.091	0.181	0.180
2025 submission CCD NOx [kt]	0.120	0,122	0.124	0.113	0.083	0.067	0.038	0.074	0.072
Change relative to 2024 submission CCD NOx [kt]	-0.029	-0,016	-0.017	-0.004	-0.051	-0.040	-0.053	-0.107	-0.108
Change relative to 2024 submission CCD NOx [%]	-20%	-12%	-12%	-3%	-38%	-38%	-58%	-59%	-60%
2024 submission CCD CO [kt]	0.242	0,241	0.241	0.241	0.241	0.255	0.039	0.207	0.079
2025 submission CCD CO [kt]	0.053	0,054	0.055	0.048	0.031	0.028	0.011	0.021	0.019
Change relative to 2024 submission CCD CO [kt]	-0.189	-0,187	-0.187	-0.193	-0.210	-0.227	-0.027	-0.186	-0.059
Change relative to 2024 submission CCD CO [%]	-78%	-78%	-77%	-80%	-87%	-89%	-71%	-90%	-75%
2024 submission CCD NMVOC [kt]	0.222	0,208	0.211	0.180	0.203	0.169	0.137	0.263	0.258
2025 submission CCD NMVOC [kt]	0.180	0,184	0.186	0.169	0.124	0.104	0.059	0.110	0.107

1A3a(ii) Dom. Aviation CCD	1990	1995	2000	2005	2010	2015	2020	2021	2022
Change relative to 2024 submission CCD NMVOC [kt]	-0.041	-0,024	-0.025	-0.010	-0.078	-0.065	-0.079	-0.153	-0.152
Change relative to 2024 submission CCD NMVOC [%]	-19%	-12%	-12%	-5.6%	-39%	-38%	-57%	-58%	-59%
2024 submission CCD SOx [kt]	0.010	0,009	0.009	0.008	0.009	0.007	0.006	0.012	0.011
2025 submission CCD SOx [kt]	0.008	0,008	0.008	0.007	0.005	0.005	0.003	0.005	0.005
Change relative to 2024 submission CCD SOx [kt]	-0.002	-0,001	-0.001	0.000	-0.003	-0.003	-0.003	-0.007	-0.007
Change relative to 2024 submission CCD SOx [%]	-19%	-12%	-12%	-5.6%	-39%	-38%	-57%	-58%	-59%
2024 submission CCD TSP [kt]	0.00034	0,00034	0.00034	0.00035	0.00034	0.00041	0.00007	0.00025	0.00019
2025 submission CCD TSP [kt]	0.00011	0,00010	0.00013	0.00012	0.00009	0.00005	0.00007	0.00012	0.00009
Change relative to 2024 submission CCD TSP [kt]	-0.00023	-0,00024	-0.00021	-0.00022	-0.00025	-0.00036	0.00001	-0.00012	-0.00009
Change relative to 2024 submission CCD TSP [%]	-67%	-71%	-62%	-65%	-74%	-87%	10%	-50%	-50%
2024 submission CCD PM_{10} [kt]	0.00034	0,00034	0.00034	0.00035	0.00034	0.00041	0.00007	0.00025	0.00019
2025 submission CCD PM_{10} [kt]	0.00011	0,00010	0.00013	0.00012	0.00009	0.00005	0.00007	0.00012	0.00009
Change relative to 2024 submission CCD PM_{10} [kt]	-0.00023	-0,00024	-0.00021	-0.00022	-0.00025	-0.00036	0.00001	-0.00012	-0.00009
Change relative to 2024 submission CCD PM_{10} [%]	-67%	-71%	-62%	-65%	-74%	-87%	10%	-50%	-50%
2024 submission CCD $PM_{2.5}$ [kt]	0.00034	0,00034	0.00034	0.00035	0.00034	0.00041	0.00007	0.00025	0.00019
2025 submission CCD $PM_{2.5}$ [kt]	0.00011	0,00010	0.00013	0.00012	0.00009	0.00005	0.00007	0.00012	0.00009
Change relative to 2024 submission CCD $PM_{2.5}$ [kt]	-0.00023	-0,00024	-0.00021	-0.00022	-0.00025	-0.00036	0.00001	-0.00012	-0.00009
Change relative to 2024 submission CCD $PM_{2.5}$ [%]	-67%	-71%	-62%	-65%	-74%	-87%	10%	-50%	-50%
2024 submission CCD BC [kt]	0.00005	0,00005	0.00005	0.00005	0.00005	0.00006	0.00001	0.00004	0.00003
2025 submission CCD BC [kt]	0.00002	0,00002	0.00002	0.00002	0.00001	0.00001	0.00001	0.00002	0.00001
Change relative to 2024 submission CCD BC [kt]	-0.00003	-0,00004	-0.00003	-0.00003	-0.00004	-0.00005	0.00000	-0.00002	-0.00001
Change relative to 2024 submission CCD BC [%]	-67%	-71%	-62%	-65%	-74%	-87%	10%	-50%	-50%
2024 submission CCD dioxin [g]	0.00283	0,00201	0.00194	0.00159	0.00121	0.00098	0.00045	0.00062	0.00063
2025 submission CCD dioxin [g]	0.00057	0,00058	0.00059	0.00053	0.00039	0.00033	0.00019	0.00035	0.00034
Change relative to 2024 submission CCD dioxin [g]	-0.00226	-0,00143	-0.00136	-0.00105	-0.00081	-0.00065	-0.00026	-0.00028	-0.00029
Change relative to 2024 submission CCD dioxin [%]	-80%	-71%	-70%	-66%	-67%	-66%	-59%	-44%	-47%

1A3a(ii) Dom. Aviation CCD	1990	1995	2000	2005	2010	2015	2020	2021	2022
2024 submission CCD Pb [t]	0.935	0,629	0.613	0.484	0.360	0.277	0.107	0.134	0.119
2025 submission CCD Pb [t]	NO	NO	NO	NO	NO	NO	NO	NO	NO
Change relative to 2024 submission CCD Pb [t]	-0.935	-0,629	-0.613	-0.484	-0.360	-0.277	-0.107	-0.134	-0.119
Change relative to 2024 submission CCD Pb [%]	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%

Recalculations for the 2024 Submission

Recalculations were made for the whole timeline due to the new master emissions calculator tool for 2023. Major changes were made to the emission factors for PM and CO for domestic flights between the 2016 and 2023 master emissions calculator tool as well as a significant change to the PM emission factor for international flights. LTO and CCD fuel usage activity data changes, and other emission factor changes, were minor. See emission changes due to the update of the master emissions calculator tool in Table 3.55 to Table 3.58.

Table 3.55 Recalculations for International LTO (1A3ai(i)) due to update of master emissions calculator tool.

International LTO	Submission	Emissions [kt]							
		1990	1995	2000	2005	2010	2015	2020	2021
PM	2023	0.00082	0.00096	0.00139	0.00173	0.00167	0.00275	0.00114	0.00164
	2024	0.00118	0.00136	0.00192	0.00237	0.00224	0.00367	0.00132	0.00159
CO	2023	0.06202	0.07384	0.10654	0.13379	0.12809	0.21247	0.10696	0.16660
	2024	0.06072	0.07281	0.10621	0.13353	0.13009	0.21557	0.10461	0.15694
NO_x	2023	0.05915	0.07638	0.13036	0.16510	0.15640	0.27422	0.12755	0.19489
	2024	0.06213	0.07857	0.12976	0.16514	0.15661	0.27161	0.11344	0.16977
SO_x	2023	0.00581	0.00685	0.00994	0.01243	0.01174	0.01967	0.00856	0.01256
	2024	0.00583	0.00684	0.00987	0.01239	0.01173	0.01962	0.00788	0.01108

Table 3.56 Recalculations for International CCD (1A3ai(ii)) due to update of master emissions calculator tool.

International CCD	Submission	Emissions [kt]							
		1990	1995	2000	2005	2010	2015	2020	2021
PM	2023	0.0091	0.0114	0.0199	0.0230	0.0218	0.0393	0.0169	0.0267
	2024	0.0154	0.0190	0.0323	0.0377	0.0356	0.0636	0.0222	0.0304
CO	2023	0.1114	0.1325	0.1984	0.2380	0.2288	0.3829	0.1818	0.2918
	2024	0.1100	0.1333	0.1972	0.2454	0.2476	0.4179	0.1970	0.3008
NO_x	2023	0.3590	0.5194	1.1001	1.3056	1.2043	2.2359	1.1000	1.8368
	2024	0.4205	0.5853	1.1175	1.4093	1.3531	2.4188	1.0667	1.7504
SO_x	2023	0.0428	0.0525	0.0872	0.1019	0.0932	0.1628	0.0731	0.1179
	2024	0.0436	0.0540	0.0882	0.1076	0.1024	0.1781	0.0730	0.1160

Table 3.57 Recalculations for Domestic LTO (1A3aii(i)) due to update of master emissions calculator tool.

Domestic LTO	Submissio n	Emissions [kt]							
		1990	1995	2000	2005	2010	2015	2020	2021
PM	2023	3.4E-05	3.5E-05	3.4E-05	3.5E-05	3.5E-05	5.3E-05	9.8E-06	2.7E-05
	2024	6.3E-05	6.3E-05	6.3E-05	6.1E-05	6.2E-05	8.3E-05	1.9E-05	4.9E-05
CO	2023	0.0658	0.0621	0.0629	0.0546	0.0607	0.0502	0.0537	0.0999
	2024	0.0954	0.0910	0.0920	0.0821	0.0894	0.0840	0.0532	0.1062
NO_x	2023	0.0427	0.0406	0.0410	0.0364	0.0398	0.0368	0.0265	0.0488
	2024	0.0364	0.0341	0.0346	0.0293	0.0332	0.0283	0.0232	0.0450

Domestic LTO	Submission	1990	1995	2000	2005	2010	2015	2020	2021
		Emissions [kt]							
SO_x	2023	0.0042	0.0040	0.0040	0.0035	0.0039	0.0035	0.0028	0.0050
	2024	0.0037	0.0035	0.0035	0.0030	0.0034	0.0029	0.0024	0.0045

Table 3.58 Recalculations for Domestic CCD (1A3aii(ii)) due to update of master emissions calculator tool.

Domestic CCD	Submission	1990	1995	2000	2005	2010	2015	2020	2021
		Emissions [kt]							
PM	2023	0.0001	0.0001	0.0001	0.0001	0.0001	2.0E-04	3.5E-05	8.5E-05
	2024	0.0003	0.0003	0.0003	0.0003	0.0003	0.0004	0.0001	0.0002
CO	2023	0.1501	0.1457	0.1467	0.1369	0.1441	0.1395	0.0518	0.1850
	2024	0.2416	0.2414	0.2414	0.2408	0.2412	0.2547	0.0389	0.2072
NO_x	2023	0.1240	0.1196	0.1206	0.1109	0.1181	0.1144	0.0745	0.1285
	2024	0.1489	0.1382	0.1406	0.1167	0.1344	0.1068	0.0913	0.1810
SO_x	2023	0.0085	0.0082	0.0083	0.0076	0.0081	0.0076	0.0056	0.0097
	2024	0.0098	0.0092	0.0093	0.0079	0.0090	0.0075	0.0061	0.0116

3.4.2.4 Planned Improvements

No improvements are currently planned for this subsector.

3.4.3 Road Transport (NFR 1A3b)

Emissions from the Road Transport category is split into seven subcategories:

- 1A3bi Cars
- 1A3bii Light-duty Trucks
- 1A3biii Heavy-duty Trucks and Buses
- 1A3biv Motorcycles
- 1A3bv Gasoline Evaporation
- 1A3bvi Automobile Tyre and Brake Wear
- 1A3bvii Automobile Road Abrasion

3.4.3.1 Methodology

The transport model COPERT 5.8.1 (developed by EMISIA SA) was used to produce emission estimates for all pollutants for the whole time series. The following text is taken from the COPERT website regarding the applied methodology[6]: *"The COPERT methodology is part of the EMEP/EEA air pollutant emission inventory Guidebook for the calculation of air pollutant emissions."* Results from the COPERT model were adjusted to calculate the emissions of $PM_{2.5}$, PM_{10}, TSP, and BC within Automobile Road Abrasion because of studded tyre use. It should be noted that condensable PM is included in COPERT calculations.

[6] https://www.emisia.com/utilities/copert/

3.4.3.2 Activity Data

Country-specific data was used where it was available. That data is:

- Average temperature values were obtained from the Icelandic Meteorological Office (*Veðurstofa Íslands*) (IMO).
- Yearly vehicle stock numbers since 2017 were obtained from the ITA.
- Measurements collected by the IEEA for energy content, density, and sulphur content were used where available. Calculations of SO_x emissions in COPERT are based on country-specific sulphur content in fuels, where it is assumed that all sulphur is converted to SO_x. Country-specific measurements are only available from 2006, so for previous years the maximum allowed sulphur content according to European regulations was used as an approximation.
- Total fuel sales were obtained from sales statistics collected for the whole timeseries.
- Measurements of carbon content (%C/%H/%O) in gasoline and diesel oil used in Road Transport were done from fuel samples from 2019, 2020, and 2021. The 2019 value was applied for 1990-2019 and the 2021 value was applied for the years after 2021. The measurements for gasoline were done on 5% blended fuel. A correction was made before emissions were calculated so that the carbon content represents pure fossil gasoline.

A comprehensive dataset was purchased from EMISIA, the company that develops COPERT. That data was used where country-specific data was not available.

Total fuels sales were obtained from sales statistics collected for the whole timeseries.

In Table 3.59 the total use of diesel oil, gasoline, biofuels, and electricity can be seen. They are based on the annual sales statistics for fuels in Road Transport.

Table 3.59 Fuel use [kt] and [GWh] in Road Transport.

Fuel Type	1990	1995	2000	2005	2010	2015	2020	2022	2023
Gasoline	67.1	117.6	142.6	156.7	148.2	132.5	91.6	91.8	93.9
Gasoline, leaded	60.7	18.0	NO	NO	NO	NO	NO	NO	NO
Diesel oil	36.6	36.9	47.5	83.5	106.4	126.4	167.9	197.1	193.5
Biomethane	NO	NO	0.006	0.039	0.595	2.18	1.44	1.6	1.6
Biodiesel	NO	NO	NO	NO	NO	11.9	13.0	4.2	2.9
Biogasoline/ Bioethanol	NO	NO	NO	NO	NO	1.93	11.0	20.6	20.7
Hydrogen	NO	NO	NO	0.00001	0.0022	NO	4.2E-04	0.0025	0.0021
Electricity [GWh]	NO	NO	NO	NO	NO	1.92	28.42	60.92	90.86

A dataset about the usage of studded tyres (for $PM_{2.5}$, PM_{10}, TSP, and BC emissions within Automobile Road Abrasion) was obtained from the city of Reykjavík (for 2000-2019) and the city of Akureyri (for 1990-2019).

3.4.3.3 Emission Factors

All emission factors in COPERT are based on the Tier 3 methodology in the 2023 EMEP/EEA Guidebook which are presented in Chapter 3.4 in section 1A3bi-iv in the guidebook. The updated version of COPERT does, however, use updated emission factors.

Emission factors for 1A3bvii Automobile Road Abrasion due to studded tyres are based on Swedish research on studded tyre wear from pavement (Gustafsson, et al., 2005). The emission factor for PM_{10} for studded tyres for passenger cars and light-duty trucks is 50 times higher than for non-studded tyres.

The same particle size fraction factors and BC fraction factors based on 2023 EMEP/EEA Guidebook are used for both studded and non-studded tyres.

The use of studded tyres on passenger cars and light duty trucks is 25% based on following information and assumptions:

- Studded tyres are banned in Iceland from 15 April to 31 October each year. During this period, the usage is assumed to be zero.
- Usage during studded tyre season (1 November to 14 April) is based on counting of studded tyres in two municipalities, one in the greater Reykjavík area and one in Akureyri, a city in the north of approximately 20,000 people.
- Since 1990, the percentage of the Icelandic population living in the Capital Region has been 62% on average. The other 38% of the population live outside of the Capital Region. There, studded tyre usage is assumed to be the same as in Akureyri.

Studded tyre usage of heavy-duty trucks, buses, and motorcycles is very low and considered to be zero in this estimation.

3.4.3.4 Recalculations and Improvements

Recalculations for the 2025 Submission

With the latest version of COPERT some methodological changes were done based on new data and measurements. These changes are based on the September 2023 update and September 2024 update of COPERT (documentation on these changes can be found on the website of Emisia[7]). The main updates include the following:

2023 update: Euro VI diesel buses

Based on new data the CO, NOx and PM emissions are higher than previously reported for all speeds. Euro VI diesel buses were introduced into the vehicle fleet in Iceland in 2014 and therefore the recalculations are for all years from 2014.

2023 update: Passenger cars

Vehicle weight impact on non-exhaust emissions was updated for passenger cars. This led to recalculations for non-exhaust PM emissions from passenger cars for the all years.

2024 update: Euro 6 HEV/PHEV cars

Passenger cars with Euro standard 6 using petrol were revised. The energy consumption was affected. Euro 6 HEV/PHEV cars were introduced into the car fleet in Iceland in 2012 and therefore this has an impact on the recalculations from that year for CO, PM and NOx.

[7] September 2023 update: https://copert.emisia.com/wp-content/uploads/2023/09/COPERT-v5.7-Report.pdf
September 2024 update: https://copert.emisia.com/wp-content/uploads/2024/10/What-is-new-in-COPERT-v5.8.pdf

2024 update: Euro 5/6 light duty vehicles

Passenger cars and light commercial vehicles with Euro standard 5 and 6 using petrol/diesel were updated regarding NMVOC. These vehicles were introduced into the car fleet in Iceland in 2010 and therefore this has an impact on the recalculations from that year for NMVOC.

2024 update: Euro 5/6 light duty vehicles

Cold PM and BC emissions from passenger cars and light-commercial vehicles with Euro standard 5 and 6 were revised. These vehicles were introduced into the car fleet in Iceland in 2010 and therefore this has an impact on the recalculations from that year for PM and BC.

2024 update: Euro 5 motorcycles

Motorcycles with Euro standard 5 using petrol were revised. The energy consumption was affected and emissions of CO, NOx and PM. Euro 5 motorcycles were introduced into the car fleet in Iceland in 2020 and therefore this has an impact on the recalculations from that year.

Total recalculations

These reasons with other minor updates in COPERT causes recalculations for all vehicle types. The summary of the recalculations can be found in the table below:

Table 3.60 Recalculations in Road Transport between 2024 and 2025 submissions

1A3b Road Transport	1990	1995	2000	2005	2010	2015	2020	2021	2022
2024 submission NO_x [kt]	5.86	5.27	3.9173	3.4095	2.4978	2.4996	1.8114	1.7616	1.7557
2025 submission NO_x [kt]	5.86	5.27	3.9174	3.4099	2.4983	2.5020	1.7666	1.7647	1.7517
Change relative to the 2024 submission NO_x [kt]	0	0	1.42E-4	3.67E-4	5.12E-4	2.36E-3	-4.48E-2	3.08E-3	-3.95E-3
Change relative to the 2024 submission [%]	0%	0%	0.004%	0.011%	0.020%	0.094%	-2.5%	0.18%	-0.23%
2024 submission NMVOC [kt]	4.619	4.143	3.009	2.004	1.122	0.775	0.598	0.620	0.661
2025 submission NMVOC [kt]	4.619	4.136	2.998	1.996	1.125	0.731	0.331	0.309	0.302
Change relative to the 2024 submission NMVOC [kt]	-0.0002	-0.0079	-0.0109	-0.0072	0.0035	-0.0439	-0.2667	-0.3106	-0.3581
Change relative to the 2024 submission [%]	0.0%	-0.2%	-0.4%	-0.4%	0.3%	-5.7%	-44.6%	-50.1%	-54.2%
2024 submission SO_x [kt]	0.071	0.074	0.065	0.019	0.003	4.26E-3	4.07E-3	4.58E-3	4.49E-3
2025 submission SO_x [kt]	0.071	0.074	0.065	0.019	0.003	4.26E-3	4.07E-3	4.55E-3	4.51E-3
Change relative to the 2024 submission SO_x [kt]	0	0	0	0	0	2.58E-11	1.15E-9	-2.23E-5	1.49E-5
Change relative to the 2024 submission [%]	0%	0%	0%	0%	0%	0.0%	0.0%	-0.5%	0.3%
2024 submission NH_3 [kt]	0.0070	0.0359	0.1335	0.15410	1.23E-1	8.20E-2	0.0433	0.0446	0.0469
2025 submission NH_3 [kt]	0.0070	0.0359	0.1335	0.15411	1.23E-1	8.20E-2	0.0428	0.0439	0.0459
Change relative to the 2024 submission NH_3 [kt]	0	0	0	5.30E-6	5.19E-5	3.95E-5	-4.82E-4	-6.80E-4	-9.98E-4
Change relative to the 2024 submission [%]	0%	0%	0%	0.0%	0.0%	0.0%	-1.1%	-1.5%	-2.1%
2024 submission $PM_{2.5}$ [kt]	0.235	0.252	0.261	0.315	0.297	0.275	0.264	0.281	0.297
2025 submission $PM_{2.5}$ [kt]	0.237	0.254	0.263	0.319	0.305	0.282	0.271	0.287	0.303

1A3b Road Transport	1990	1995	2000	2005	2010	2015	2020	2021	2022
Change relative to the 2024 submission $PM_{2.5}$ [kt]	0.0017	0.0018	0.0024	0.0046	0.0081	0.0078	0.0064	0.0063	0.0055
Change relative to the 2024 submission [%]	0.7%	0.7%	0.9%	1.4%	2.7%	2.8%	2.4%	2.2%	1.9%
2024 submission PM_{10} [kt]	0.337	0.362	0.385	0.476	0.467	0.462	0.466	0.500	0.531
2025 submission PM_{10} [kt]	0.340	0.365	0.389	0.485	0.482	0.476	0.477	0.511	0.541
Change relative to the 2024 submission PM_{10} [kt]	0.0032	0.0034	0.0045	0.0086	0.0151	0.0142	0.0113	0.0110	0.0097
Change relative to the 2024 submission [%]	0.9%	0.9%	1.2%	1.8%	3.2%	3.1%	2.4%	2.2%	1.8%
2024 submission TSP [kt]	0.527	0.564	0.615	0.776	0.782	0.813	0.844	0.911	0.971
2025 submission TSP [kt]	0.533	0.571	0.623	0.793	0.811	0.839	0.866	0.933	0.990
Change relative to the 2024 submission TSP [kt]	0.0063	0.0067	0.0087	0.0166	0.0294	0.0269	0.0220	0.0216	0.0192
Change relative to the 2025 submission [%]	1.2%	1.2%	1.4%	2.1%	3.8%	3.3%	2.6%	2.4%	2.0%
2024 submission BC [kt]	0.068	0.074	0.075	0.092	0.084	0.057	0.040	0.038	0.038
2025 submission BC [kt]	0.059	0.063	0.065	0.080	0.072	0.052	0.036	0.035	0.035
Change relative to the 2024 submission BC [kt]	-0.0087	-0.0106	-0.0101	-0.0116	-0.0119	-0.0056	-3.83E-3	-3.10E-3	-3.05E-3
Change relative to the 2024 submission [%]	-12.8%	-14.4%	-13.4%	-12.6%	-14.2%	-9.9%	-9.7%	-8.1%	-7.9%
2024 submission CO [kt]	41.27	33.07	22.11	14.72	8.40	5.59	2.62	2.50	2.58
2025 submission CO [kt]	41.26	32.89	21.76	14.37	8.28	5.31	1.93	1.77	1.75
Change relative to the 2024 submission CO [kt]	-0.010	-0.183	-0.349	-0.348	-0.124	-0.280	-0.687	-0.731	-0.827
Change relative to the 2024 submission [%]	0.0%	-0.6%	-1.6%	-2.4%	-1.5%	-5.0%	-26.2%	-29.2%	-32.1%
2024 submission Pb [t]	0.162	0.175	0.199	0.253	0.272	0.281	0.307	0.328	0.344
2025 submission Pb [t]	0.163	0.176	0.200	0.257	0.277	0.286	0.307	0.327	0.341
Change relative to the 2024 submission Pb [t]	0.0008	0.0009	0.0014	0.0033	0.0051	0.0053	1.13E-4	-9.91E-4	-2.51E-3
Change relative to the 2024 submission [%]	0.5%	0.5%	0.7%	1.3%	1.9%	1.9%	0.0%	-0.3%	-0.7%
2024 submission Cd [t]	0.00074	0.00080	0.00090	0.00115	0.00123	0.00127	0.00139	0.00149	0.00156
2025 submission Cd [t]	0.00078	0.00085	0.00095	0.00120	0.00131	0.00134	0.00148	0.00157	0.00164
Change relative to the 2024 submission Cd [t]	4.48E-5	4.95E-5	4.76E-5	4.95E-5	8.03E-5	7.51E-5	9.13E-5	8.49E-5	8.27E-5
Change relative to the 2024 submission [%]	6.1%	6.2%	5.3%	4.3%	6.5%	5.9%	6.6%	5.7%	5.3%
2024 submission Hg [t]	0.0013	0.0014	0.0015	0.0018	0.0019	1.90E-3	1.85E-3	1.99E-3	2.04E-3
2025 submission Hg [t]	0.0013	0.0014	0.0015	0.0018	0.0019	1.90E-3	1.85E-3	1.99E-3	2.04E-3
Change relative to the 2024 submission Hg [t]	0	0	0	0	0	1.48E-11	9.17E-10	1.47E-9	-5.29E-8
Change relative to the 2024 submission [%]	0%	0%	0%	0%	0%	0.000%	0.000%	0.000%	-0.003%
2024 submission As [t]	1.89E-3	2.05E-3	2.32E-3	2.95E-3	3.17E-3	3.26E-3	3.56E-3	3.81E-3	3.99E-3
2025 submission As [t]	1.90E-3	2.05E-3	2.33E-3	2.99E-3	3.22E-3	3.32E-3	3.56E-3	3.79E-3	3.96E-3
Change relative to the 2024 submission As [t]	8.14E-6	9.25E-6	1.50E-5	3.68E-5	5.76E-5	5.92E-5	1.10E-6	-1.14E-5	-2.88E-5
Change relative to the 2024 submission [%]	0.4%	0.5%	0.6%	1.2%	1.8%	1.8%	0.0%	-0.3%	-0.7%
2024 submission Cr [t]	0.0615	0.0664	0.0754	0.0961	0.1033	0.1067	0.1163	0.1244	0.1304
2025 submission Cr [t]	0.0619	0.0670	0.0761	0.0975	0.1055	0.1089	0.1168	0.1244	0.1298
Change relative to the 2024 submission Cr [t]	4.72E-4	5.29E-4	7.04E-4	1.41E-3	2.21E-3	2.23E-3	4.30E-4	9.13E-6	-5.42E-4
Change relative to the 2024 submission [%]	0.8%	0.8%	0.9%	1.5%	2.1%	2.1%	0.4%	0.0%	-0.4%
2024 submission Cu [t]	1.33	1.43	1.63	2.07	2.23	2.30	2.51	2.68	2.81

1A3b Road Transport	1990	1995	2000	2005	2010	2015	2020	2021	2022
2025 submission Cu [t]	1.34	1.45	1.65	2.11	2.28	2.35	2.52	2.69	2.80
Change relative to the 2024 submission Cu [t]	0.0138	0.0154	0.0189	0.0340	0.0534	0.0535	0.0166	0.0072	-0.0045
Change relative to the 2024 submission [%]	1.0%	1.1%	1.2%	1.6%	2.4%	2.3%	0.7%	0.3%	-0.2%
2024 submission Ni [t]	9.58E-3	1.04E-2	1.17E-2	1.49E-2	1.60E-2	1.64E-2	1.79E-2	1.92E-2	2.01E-2
2025 submission Ni [t]	9.92E-3	1.07E-2	1.21E-2	1.53E-2	1.67E-2	1.71E-2	1.86E-2	1.97E-2	2.06E-2
Change relative to the 2024 submission Ni [t]	3.36E-4	3.71E-4	3.72E-4	4.38E-4	7.04E-4	6.72E-4	6.42E-4	5.68E-4	5.12E-4
Change relative to the 2024 submission [%]	3.5%	3.6%	3.2%	2.9%	4.4%	4.1%	3.6%	3.0%	2.5%
2024 submission Se [t]	1.10E-3	1.20E-3	1.36E-3	1.72E-3	1.86E-3	1.91E-3	2.14E-3	2.30E-3	2.43E-3
2025 submission Se [t]	1.15E-3	1.24E-3	1.40E-3	1.77E-3	1.94E-3	1.99E-3	2.23E-3	2.38E-3	2.51E-3
Change relative to the 2024 submission Se [t]	4.24E-5	4.69E-5	4.54E-5	4.92E-5	8.08E-5	7.68E-5	8.97E-5	8.14E-5	7.60E-5
Change relative to the 2024 submission [%]	3.8%	3.9%	3.4%	2.9%	4.3%	4.0%	4.2%	3.5%	3.1%
2024 submission Zn [t]	0.437	0.473	0.537	0.683	0.737	0.757	0.847	0.910	0.963
2025 submission Zn [t]	0.441	0.478	0.542	0.692	0.751	0.772	0.856	0.916	0.966
Change relative to the 2024 submission Zn [t]	0.0044	0.0049	0.0055	0.0089	0.0147	0.0148	0.0086	0.0058	0.0023
Change relative to the 2024 submission [%]	1.00%	1.03%	1.03%	1.31%	1.99%	1.95%	1.01%	0.64%	0.24%
2024 submission dioxin [t]	0.064	0.069	0.088	0.105	0.110	0.0723	0.0436	0.0402	0.0392
2025 submission dioxin [t]	0.064	0.069	0.088	0.105	0.110	0.0722	0.0434	0.0399	0.0387
Change relative to the 2024 submission dioxin [t]	0	0	0	0	0	-5.43E-5	-2.24E-4	-3.21E-4	-5.45E-4
Change relative to the 2024 submission [%]	0%	0%	0%	0%	0%	-0.08%	-0.51%	-0.80%	-1.39%
2024 submission B(a)P [t]	0.0013	0.0013	0.0015	0.0021	0.0027	2.66E-3	3.77E-3	3.90E-3	4.01E-3
2025 submission B(a)P [t]	0.0013	0.0013	0.0015	0.0021	0.0027	2.66E-3	3.76E-3	3.88E-3	3.96E-3
Change relative to the 2024 submission B(a)P [t]	0	0	0	0	0	-2.23E-6	-1.31E-5	-2.05E-5	-4.29E-5
Change relative to the 2024 submission [%]	0%	0%	0%	0%	0%	-0.08%	-0.35%	-0.53%	-1.07%
2024 submission B(b)F [t]	0.0025	0.0025	0.0025	0.0034	0.0039	4.58E-3	5.61E-3	5.97E-3	6.22E-3
2025 submission B(b)F [t]	0.0025	0.0025	0.0025	0.0034	0.0039	4.58E-3	5.59E-3	5.95E-3	6.16E-3
Change relative to the 2024 submission B(b)F [t]	0	0	0	0	0	-4.17E-6	-1.77E-5	-2.84E-5	-6.33E-5
Change relative to the 2024 submission [%]	0%	0%	0%	0%	0%	-0.09%	-0.32%	-0.48%	-1.02%
2024 submission B(k)F [t]	0.0015	0.0016	0.0019	0.0029	0.0034	4.20E-3	4.80E-3	5.16E-3	5.39E-3
2025 submission B(k)F [t]	0.0015	0.0016	0.0019	0.0029	0.0034	4.19E-3	4.79E-3	5.14E-3	5.33E-3
Change relative to the 2024 submission B(k)F [t]	0	0	0	0	0	-3.94E-6	-1.44E-5	-2.33E-5	-5.34E-5
Change relative to the 2024 submission [%]	0%	0%	0%	0%	0%	-0.09%	-0.30%	-0.45%	-0.99%
2024 submission I(1,2,3)p [t]	0.0023	0.0022	0.0021	0.0025	0.0028	2.87E-3	3.96E-3	4.13E-3	4.27E-3
2025 submission I(1,2,3)p [t]	0.0023	0.0022	0.0021	0.0025	0.0028	2.87E-3	3.94E-3	4.11E-3	4.23E-3
Change relative to the 2024 submission I(1,2,3)p [t]	0	0	0	0	0	-2.31E-6	-1.49E-5	-2.32E-5	-4.73E-5
Change relative to the 2024 submission [%]	0%	0%	0%	0%	0%	-0.08%	-0.38%	-0.56%	-1.11%
2024 submission PAH4 [t]	0.00761	0.00759	0.00795	0.01086	0.01282	0.01432	0.01814	0.01916	0.01989
2025 submission PAH4 [t]	0.00761	0.00759	0.00795	0.01086	0.01282	0.01431	0.01808	0.01907	0.01968

1A3b Road Transport	1990	1995	2000	2005	2010	2015	2020	2021	2022
Change relative to the 2024 submission PAH4 [t]	0	0	0	0	0	-1.27E-5	-6.01E-5	-9.55E-5	-2.07E-4
Change relative to the 2024 submission [%]	0%	0%	0%	0%	0%	-0.09%	-0.33%	-0.50%	-1.04%
2024 submission HCB [t]	0.0001	0.0001	0.0001	0.0001	0.0001	6.99E-5	4.20E-5	3.85E-5	3.75E-5
2025 submission HCB [t]	0.0001	0.0001	0.0001	0.0001	0.0001	6.98E-5	4.18E-5	3.82E-5	3.70E-5
Change relative to the 2024 submission HCB [t]	0	0	0	0	0	-5.06E-8	-2.18E-7	-3.10E-7	-5.25E-7
Change relative to the 2024 submission [%]	0%	0%	0%	0%	0%	-0.07%	-0.52%	-0.81%	-1.40%
2024 submission PCBs [t]	0.0000	0.0000	0.0000	0.0000	0.0000	1.45E-5	8.55E-6	7.83E-6	7.62E-6
2025 submission PCBs [t]	0.0000	0.0000	0.0000	0.0000	0.0000	1.44E-5	8.50E-6	7.76E-6	7.52E-6
Change relative to the 2024 submission PCBs [t]	0	0	0	0	0	-1.02E-8	-4.53E-8	-6.45E-8	-1.08E-7
Change relative to the 2024 submission [%]	0%	0%	0%	0%	0%	-0.07%	-0.53%	-0.82%	-1.41%

Recalculations for the 2024 Submission

Recalculations for the 2024 submission were only due to minor reallocation of fuels for 2016 and 2021. See changes in emissions in Table 3.61.

Table 3.61 Recalculations in Road Transport due to minor reallocation of fuels between the 2023 and 2024 submission

1A3b Road Transport	2016	2021
2023 Submission NO_x [kt]	2.52	1.7621
2024 Submission NO_x [kt]	2.53	1.7616
Change relative to the 2023 Submission [kt]	0.01	-0.0005
Change relative to the 2023 Submission [%]	0.4%	-0.03%
2023 Submission NMVOC [kt]	0.7735	0.6199
2024 Submission NMVOC [kt]	0.7738	0.6196
Change relative to the 2023 Submission [kt]	0.0003	-0.0002
Change relative to the 2023 Submission [%]	0.04%	-0.04%
2023 Submission NH_3 [kt]	0.08067	0.04460
2024 Submission NH_3 [kt]	0.08070	0.04455
Change relative to the 2023 Submission [kt]	0.00003	-0.00005
Change relative to the 2023 Submission [%]	0.04%	-0.12%
2023 Submission $PM_{2.5}$ [kt]	0.2887	0.2808
2024 Submission $PM_{2.5}$ [kt]	0.2895	0.2807
Change relative to the 2023 Submission [kt]	0.0008	-0.0001
Change relative to the 2023 Submission [%]	0.29%	-0.02%
2023 Submission PM_{10} [kt]	0.4923	0.5002
2024 Submission PM_{10} [kt]	0.4937	0.5000
Change relative to the 2023 Submission [kt]	0.0014	-0.0001
Change relative to the 2023 Submission [%]	0.28%	-0.03%
2023 Submission TSP [kt]	0.873	0.912
2024 Submission TSP [kt]	0.876	0.911
Change relative to the 2023 Submission [kt]	0.0024	-0.0002
Change relative to the 2024 Submission [%]	0.27%	-0.02%
2023 Submission BC [kt]	0.05529	0.03802
2024 Submission BC [kt]	0.05550	0.03801
Change relative to the 2023 Submission [kt]	0.00021	-0.00001

1A3b Road Transport	2016	2021
Change relative to the 2023 Submission [%]	0.38%	-0.01%
2023 Submission CO [kt]	5.000	2.504
2024 Submission CO [kt]	5.002	2.501
Change relative to the 2023 Submission [kt]	0.002	-0.004
Change relative to the 2023 Submission [%]	0.04%	-0.14%
2023 Submission Pb [t]	0.3100	0.3280
2024 Submission Pb [t]	0.3108	0.3278
Change relative to the 2023 Submission [t]	0.0007	-0.0002
Change relative to the 2023 Submission [%]	0.2%	-0.1%
2023 Submission Cd [t]	1.397E-3	1.486E-3
2024 Submission Cd [t]	1.400E-3	1.485E-3
Change relative to the 2023 Submission [t]	3.2E-6	-7.7E-7
Change relative to the 2023 Submission [%]	0.2%	-0.1%
2023 Submission As [t]	3.601E-3	3.807E-3
2024 Submission As [t]	3.609E-3	3.805E-3
Change relative to the 2023 Submission [t]	8.448E-6	-2.174E-6
Change relative to the 2023 Submission [%]	0.2%	-0.1%
2023 Submission Cr [t]	0.1178	0.1245
2024 Submission Cr [t]	0.1181	0.1244
Change relative to the 2023 Submission [t]	0.0003	-0.0001
Change relative to the 2023 Submission [%]	0.2%	-0.1%
2023 Submission Cu [t]	2.538	2.681
2024 Submission Cu [t]	2.544	2.680
Change relative to the 2023 Submission [t]	0.006	-0.002
Change relative to the 2023 Submission [%]	0.2%	-0.1%
2023 Submission Ni [t]	0.01814	0.01918
2024 Submission Ni [t]	0.01818	0.01917
Change relative to the 2023 Submission [t]	0.00004	-0.00001
Change relative to the 2023 Submission [%]	0.2%	-0.1%
2023 Submission Se [t]	0.002112	0.002296
2024 Submission Se [t]	0.002117	0.002296
Change relative to the 2023 Submission [t]	0.000005	-0.000001
Change relative to the 2023 Submission [%]	0.23%	-0.04%
2023 Submission Zn [t]	0.8375	0.9102
2024 Submission Zn [t]	0.8394	0.9098
Change relative to the 2023 Submission [t]	0.0020	-0.0004
Change relative to the 2023 Submission [%]	0.23%	-0.04%
2023 Submission Dioxin [t]	0.06920	0.04022
2024 Submission Dioxin [t]	0.06940	0.04019
Change relative to the 2023 Submission [t]	0.00020	-0.00002
Change relative to the 2023 Submission [%]	0.3%	-0.1%
2023 Submission B(a)P [t]	3.271E-3	3.898E-3
2024 Submission B(a)P [t]	3.283E-3	3.897E-3
Change relative to the 2023 Submission [t]	1.155E-5	-1.166E-6
Change relative to the 2023 Submission [%]	0.35%	-0.03%
2023 Submission B(b)F [t]	5.25E-3	5.98E-3
2024 Submission B(b)F [t]	5.27E-3	5.97E-3
Change relative to the 2023 Submission [t]	1.98E-5	-1.67E-6
Change relative to the 2023 Submission [%]	0.38%	-0.03%

1A3b Road Transport	2016	2021
2023 Submission B(k)F [t]	4.715E-3	5.162E-3
2024 Submission B(k)F [t]	4.733E-3	5.160E-3
Change relative to the 2023 Submission [t]	1.833E-5	-1.384E-6
Change relative to the 2023 Submission [%]	0.39%	-0.03%
2023 Submission I(1,2,3)p [t]	3.440E-3	4.131E-3
2024 Submission I(1,2,3)p [t]	3.451E-3	4.129E-3
Change relative to the 2023 Submission [t]	1.162E-5	-1.446E-6
Change relative to the 2023 Submission [%]	0.34%	-0.04%
2023 Submission PAH [t]	1.668E-2	1.917E-2
2024 Submission PAH [t]	1.674E-2	1.916E-2
Change relative to the 2023 Submission [t]	6.128E-5	-5.669E-6
Change relative to the 2023 Submission [%]	0.37%	-0.03%
2023 Submission HCB [t]	6.66E-5	3.86E-5
2024 Submission HCB [t]	6.68E-5	3.85E-5
Change relative to the 2023 Submission [t]	1.92E-7	-2.32E-8
Change relative to the 2023 Submission [%]	0.3%	-0.06%
2023 Submission PCBs [t]	1.366E-5	7.831E-6
2024 Submission PCBs [t]	1.369E-5	7.826E-6
Change relative to the 2023 Submission [t]	3.830E-8	-4.700E-9
Change relative to the 2023 Submission [%]	0.3%	-0.1%

3.4.3.5 Planned Improvements

For future submissions it is planned, in collaboration with the ITA, to develop procedures to obtain enhanced data on vehicle stock and mileage data for COPERT.

3.4.4 International Maritime and Domestic Navigation (NFRs 1A3di(i) and 1A3dii)

Emissions calculation in navigation follows a tier 2 technology specific approach as defined in section 3.3 of chapter 1.A.3.d Navigation of the 2023 EMEP/EEA Guidebook for all pollutants except for Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3- cd)pyrene, hexachlorobenzene, polychlorinated biphenyls, dioxin, and heavy metals. These compounds are tier 1-calculated based on sold fuel and tier 1 emission factors in accordance with section 3.2, chapter 1.A.3.d of the 2023 EMEP/EEA Guidebook.

Tier 2 Approach

In accordance with the EMEP/EEA Guidebook, the tier 2 calculation is based on consumed fuel by fuel type obtained from annual national fuel sales statistics. The consumed fuel is split according to country specific proportions by fuel type (residual fuel oil, marine gas/diesel oil, and biodiesel), and engine type (slow-, medium-, and high-speed reciprocating diesel engines, as well as gas/steam turbine engines).

The obtained fuel sales statistics partition fuel sales into domestic navigation, international navigation, and fishing, enabling an unambiguous attribution of total fuel quantities of different fuel types to these operations contexts as a precondition for NFR specific emissions calculation.

Vessel and port exit data related to Icelandic ports is aggregated from different data sources, with port exit data obtained from a specialised Icelandic company (Trackwell hf.), collecting port entry/exit data on behalf of the Icelandic coast guard, as the primary source. These data are matched and complemented with port call data obtained from a further company (Samsýn ehf.), covering vessels that fall under the SOLAS convention[8]. The aggregated data is consolidated in order to remove duplicate records, records of platforms other than vessels, and spurious ports exit recordings presumably caused e.g. by GPS drift.

Engine power, required to determine fuel proportions by vessel type, are obtained from Icelandic Transport Authority (ITA) for ships registered in Iceland. The association between port exit data and ship registry is established via a vessel's IMO number, if available, or its callsign. If engine power is not available but gross tonnage is available, engine power is estimated according to table 3-17 of the 2023 EMEP/EEA Guidebook. The estimated average engine power by ship category from table 3-9 (2010 fleet) of the 2023 EMEP/EEA Guidebook is used if neither engine power nor gross tonnage is available.

Vessel type information is available from all three data sources and is mapped onto the categories defined in table 3-9 of the guidebook. The national vessel type categorisation obtained from Trackwell and ITA data sets also serves as a basis for correlating individual vessels with an operational context/NFR, in particular international maritime or domestic navigation, if no destination information for the next leg is available.

Available port exit data covers the years from 2011 onwards, with only incomplete data available for 2011, 2012, and 2013 (see Table 3.62. Fishing, 1A4ciii, covered in section 3.4.5, is included for the sake of consistent totals). The years 1990 to 2013 are backward extrapolated on the basis of 2014 to 2023.

Table 3.62 Recorded and consolidated port exits by NFR

NFR	1990	2010	2011	2012	2013	2014	2020	2022	2023
1A3di(i) International Navigation	0	0	10	1060	889	2400	4394	4635	5363
1A3dii Domestic Navigation	0	0	113	16979	16889	45936	40342	53305	60793
1A4ciii Fishing	0	0	458	55541	51528	116641	88679	75381	75670
Annual total	0	0	581	73580	69307	164977	133415	133321	141826

Extrapolation is performed in three stages, with the first stage extrapolating the total number of port exits as well as the total installed engine power, cumulated over all exits, irrespective of vessel type or operational context (international or domestic navigation, or fishing). The second stage separately extrapolates the port exit counts and total installed engine power, again cumulated over exits, per vessel type and operational context, using the previously calculated total port exits per year as independent variable. A third stage normalises the vessel type and context specific extrapolated values with respect to the calculated totals per year of port exits and total installed engine power. This extrapolation approach preserves trends in vessel type and operational context specific port exits numbers and associated engine power inherent in the data of years since 2014.

8 International Convention for the Safety of Life at Sea (SOLAS), International Maritime Organization (IMO), 1974.

3.4.4.1 Activity Data

Total use of residual fuel oil, marine gas/diesel oil, and biodiesel for International and Domestic Navigation is based on the annual sales statistics, split by fuel type and operations context (NFR), as reported in Table 3.63. These fuel sales figures are used for the tier 2 as well as for the tier 1 (for PAH4 compounds, HCB, PCB, dioxin, and heavy metals) calculations.

Table 3.63 Fuel use [kt], International and Domestic Navigation.

Fuel type	1990	1995	2000	2005	2010	2015	2020	2022	2023
1A3di(i) International									
Residual Fuel Oil	0.25	NO	2.00	0.44	0.080	13.25	NO	7.5	6.2
Gas/Diesel Oil	8.5	1.1	15.0	0.12	NO	33.6	24.3	82.5	98.0
Biodiesel	NO	NO	NO	NO	NO	NO	NO	NO	NO
1A3dii Domestic									
Residual Fuel Oil	3.9	4.8	0.54	0.88	2.6	0.44	NO	NO	NO
Gas/Diesel Oil	6.4	7.0	3.4	6.2	8.5	7.9	7.8	7.7	5.3
Biodiesel	NO	NO	NO	NO	NO	NO	NO	NO	NO

Table 3.64 summarises the number of yearly port exits, categorised by NFR and vessel type as per table 3-9 of the 2023 EMEP/EEA Guidebook. Port exit numbers before 2014 are extrapolated as described above.

Table 3.64 Port exits by NFR and vessel type.

NFR/vessel type	1990	1995	2000	2005	2010	2015	2020	2022	2023
1A3di(i) International									
Liquid bulk carriers	689	693	698	707	710	637	668	683	825
Dry bulk carriers	58	54	51	48	44	50	33	23	10
Container	629	741	854	975	1088	783	1624	1617	1954
General cargo	1827	1815	1804	1807	1792	1755	2055	1695	1702
Ro Ro cargo	0	0	0	0	0	0	0	1	3
Passenger ships	303	317	333	351	365	298	13	616	864
Other	3	3	3	3	3	2	1	0	5
NFR Total	3509	3623	3743	3891	4002	3525	4394	4635	5363
1A3dii Domestic									
Liquid bulk carriers	2	2	2	2	2	4	0	4	1
Dry bulk carriers	27	24	22	20	17	21	7	5	3
Container	0	0	0	0	0	0	0	0	0
General cargo	1261	1181	1100	1026	942	1621	644	230	438
Ro Ro cargo	1618	1622	1625	444	899	26	3257	3473	3936
Passenger ships	43931	42198	40463	38991	37149	34771	19141	30580	33378
Tugboats	4472	4467	4463	4490	4475	4078	4018	4533	5281
Other	10976	11334	11694	12139	12478	11629	13275	14480	17756
NFR Total	62287	60828	59369	57112	55962	52150	40342	53305	60793

Since no specific information on the proportions of engine types (slow-, medium-, high-speed diesel engines, gas/steam turbine engines) per vessel type/category and per type of combusted fuel is available, engine type proportions per vessel type and type of fuel are assigned in accordance with table 3-10 of the 2023 EMEP/EEA Guidebook and assumed constant over the years.

The total sold fuel per fuel type and NFR code as per Table 3.63 is attributed to combinations of vessel type, type of fuel, and engine type using the calculated total installed engine power per vessel type, proportionally split according to fuel types and engine types, and the specific fuel oil consumption (SFOC) per engine type and fuel type obtained from table 3-7 of the EMEP/EEA Guidebook.

Table 3.65 details the sold fuel (in kilo tonnes) per fuel type and NFR code to vessel types according to the proportions based on cumulated total installed engine power per vessel type, engine type, and SFOC.

Table 3.65 Sold fuel per fuel type and NFR assigned to vessel types [kt]. MGO/MDO: Marine gas/Diesel oil, RFO: Residual fuel oil.

Vessel type	Fuel type	1990	1995	2000	2005	2010	2015	2020	2022	2023
1A3di(i) International										
Liquid bulk carriers	MGO/MDO	0.248	0.029	0.395	0.003	NO	1.046	1.050	1.166	1.134
	RFO	0.020	NO	0.125	0.025	0.004	0.994	NO	0.220	0.162
Dry bulk carriers	MGO/MDO	0.007	0.001	0.011	0.000	NO	0.021	0.032	0.026	0.009
	RFO	0.003	NO	0.016	0.003	0.000	0.091	NO	0.022	0.005
Container	MGO/MDO	0.176	0.031	0.576	0.005	NO	1.175	5.477	5.530	5.561
	RFO	0.049	NO	0.634	0.159	0.032	3.869	NO	3.613	2.751
General cargo	MGO/MDO	4.351	0.496	6.548	0.047	NO	17.304	17.129	13.261	11.911
	RFO	0.107	NO	0.635	0.122	0.020	5.016	NO	0.763	0.519
Ro Ro cargo	MGO/MDO	NO	NO	NO	NO	NO	NO	NO	0.034	0.090
	RFO	NO	NO	NO	NO	NO	NO	NO	0.001	0.003
Passenger ships	MGO/MDO	3.699	0.490	7.438	0.061	NO	13.937	0.547	62.460	78.984
	RFO	0.074	NO	0.584	0.129	0.024	3.275	NO	2.914	2.790
Other	MGO/MDO	0.051	0.006	0.074	0.001	NO	0.070	0.042	NO	0.284
	RFO	0.000	NO	0.001	0.000	0.000	0.003	NO	NO	0.002
1A3dii Domestic										
Liquid bulk carriers	MGO/MDO	0.000	0.000	0.000	0.000	0.000	0.000	NO	0.000	0.000
	RFO	0.000	0.000	0.000	0.000	0.000	0.000	NO	NO	NO
Dry bulk carriers	MGO/MDO	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	RFO	0.005	0.005	0.001	0.001	0.002	0.001	NO	NO	NO
Container	MGO/MDO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	RFO	NO	NO	NO	NO	NO	NO	NO	NO	NO
General cargo	MGO/MDO	0.111	0.107	0.049	0.075	0.085	0.160	0.021	0.007	0.004
	RFO	0.131	0.147	0.017	0.025	0.064	0.020	NO	NO	NO
Ro Ro cargo	MGO/MDO	0.454	0.483	0.007	0.124	0.306	0.017	0.989	0.782	0.402
	RFO	0.353	0.436	0.002	0.027	0.152	0.001	NO	NO	NO
Passenger ships	MGO/MDO	3.392	3.462	1.668	2.739	3.394	3.668	1.951	1.915	0.923
	RFO	3.256	3.854	0.474	0.735	2.075	0.377	NO	NO	NO
Tugboats	MGO/MDO	1.562	1.770	0.945	1.718	2.354	2.262	2.293	2.387	1.290

Vessel type	Fuel type	1990	1995	2000	2005	2010	2015	2020	2022	2023
	RFO	0.020	0.027	0.004	0.006	0.019	0.003	NO	NO	NO
Other	MGO/MDO	0.880	1.220	0.756	1.544	2.325	1.787	2.579	2.592	2.655
	RFO	0.178	0.285	0.045	0.087	0.299	0.039	NO	NO	NO

In order to calculate NO_x emissions of reciprocating diesel engines, the proportions of fuel per fuel type that is combusted in engines conforming to distinct Nitrogen Oxide control requirements (NO_x Tier I, II, and III)[9] need to be determined. Table 3.66 summarises the attribution of marine gas/diesel oil and residual fuel oil to NO_x engine tier levels. It must be noted in this context that Iceland is not currently a NO_x Emission Control Area (NECA) designated under regulation 13 of MARPOL Annex VI (NO_x emission control)[10]. Further, no data on the extent of utilisation of abatement equipment, required to ensure NO_x Tier III compliance, outside NECAs, specifically in Icelandic waters, is available. It is therefore conservatively assumed that NO_x emission reduction in Iceland primarily results from a transition to NO_x Tier I and II compliant engines/vessels. All NO_x Tier III ships, as by their year of construction, are considered NO_x Tier II for the purpose of NO_x emissions calculations.

Table 3.66 Sold fuel per fuel type and NFR assigned to NO_X tier levels of reciprocating Diesel engines [kt]. MGO/MDO: Marine gas/Diesel oil, RFO: Residual fuel oil.

NO_X Tier	Fuel type	1990	1995	2000	2005	2010	2015	2020	2022	2023
1A3di(i) International										
NO_x Tier 0	MGO/MDO	8.532	1.053	14.564	0.094	NO	17.614	3.817	30.263	35.570
	RFO	0.252	NO	1.917	0.335	0.045	5.739	NO	0.697	0.385
NO_x Tier I	MGO/MDO	NO	NO	0.477	0.022	NO	10.959	9.713	22.232	26.147
	RFO	NO	NO	0.078	0.103	0.035	5.163	NO	2.911	2.450
NO_x Tier II	MGO/MDO	NO	NO	NO	NO	NO	4.981	10.745	29.982	36.254
	RFO	NO	NO	NO	NO	NO	2.347	NO	3.925	3.398
NO_x Tier III	MGO/MDO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	RFO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1A3dii Domestic										
NO_x Tier 0	MGO/MDO	6.399	7.043	3.317	4.998	5.406	4.950	3.440	2.589	1.660
	RFO	3.944	4.755	0.521	0.680	1.515	0.246	NO	NO	NO
NO_x Tier I	MGO/MDO	NO	NO	0.108	1.201	3.058	2.101	2.118	2.421	1.616
	RFO	NO	NO	0.021	0.201	1.097	0.139	NO	NO	NO
NO_x Tier II	MGO/MDO	NO	NO	NO	NO	NO	0.843	2.276	2.673	1.998
	RFO	NO	NO	NO	NO	NO	0.056	NO	NO	NO
NO_x Tier III	MGO/MDO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	RFO	NO	NO	NO	NO	NO	NO	NO	NO	NO

No specific activity data is available for recreational boats (NFR 1A3dii-Small Boats).

[9] Defined according to Regulation 13 of MARPOL Annex VI (NO_x emission control). https://www.imo.org/

[10] https://www.imo.org/en/OurWork/Environment/Pages/Emission-Control-Areas-(ECAs)-designated-under-regulation-13-of-MARPOL-Annex-VI-(NOx-emission-control).aspx

3.4.4.2 Emission Factors

The use of emissions factors depends on the type of engine. While for reciprocating diesel engines Tier 2 emission factors obtained from table 3-7 of the 2023 EMEP/EEA Guidebook are utilised for all pollutants apart from NO_X and SO_2, for gas/steam turbine engines Tier 2 emission factors are only available for TSP, PM_{10}, and $PM_{2.5}$ (table 3-5 of the EMEP/EEA Guidebook), while Tier 1 emission factors are used for CO, NMVOC, and BC for these engine types (table 3-1 of the EMEP/EEA Guidebook). Table 3.67 provides a summary.

Table 3.67 Summary of emission factors sources for International and Domestic Navigation (1A3di(i) and 1A3dii).

Engine Type	All pollutants except NO_x, SO_2	NO_x	SO_2
Reciprocating diesel engine types	Tier 2 EFs for Residual Fuel Oil, Marine Gas/Diesel Oil, and LNG from Table 3-7 in chapter 1A3d of the 2023 EMEP/EEA Guidebook.	NO_x EF base values for Residual Fuel Oil, Marine Gas/Diesel Oil, and LNG from table 3-7, and NO_X tier (I, II, III) dependent reduction values from table 3-6 in chapter 1A3d of the 2023 EMEP/EEA Guidebook. See Table 3.69.	Tier 1 sulphur content from Table 3-1 in chapter 1A3d of the 2016 EMEP/EEA Guidebook for years 1990-2011. Country specific sulphur content from year 2012 onwards. See Table 3.68.
Turbine engine types	Tier 2 EFs for TSP, PM10, PM2.5 for Residual Fuel Oil and Marine Gas/Diesel Oil from Table 3-5 in chapter 1A3d of the 2023 EMEP/EEA Guidebook. Tier 1 EFs for CO, NMVOC, BC from table 3-1 for Residual Fuel Oil and table 3-2 for Marine Gas/Diesel Oil.	NO_X year 2000 EF base value for Residual Fuel Oil, Marine Gas/Diesel Oil from table 3-5 in chapter 1A3d of the 2023 EMEP/EEA Guidebook. With an assumed NO_X reduction of 17% for post-2000 engines and a fleet turnover rate of 4%/year. See Table 3.70.	
For Biodiesel the same EFs as for Marine Gas/Diesel Oil are used.			

Calculation of SO_2 emissions is based on country specific sulphur content values which are available for residual fuel oil as well as marine gas/diesel oil from year 2012 onwards. For years 1990 to 2011 Tier 1 sulphur content values from table 3-1 of the 2016 EMEP/EEA Guidebook are used.

Table 3.68 Sulphur content values [%]. Tier 1 default values from 1990 to 2011, country specific from 2012.

Fuel type	1990	1995	2000	2005	2010	2015	2020	2022	2023
Marine gas/Diesel oil	0.500	0.500	0.200	0.200	0.100	0.145	0.090	0.082	0.065
Residual fuel oil	2.700	2.700	2.700	2.700	1.500	0.980	0.500	0.500	0.500

Emission Factors for NO_x

For reciprocating Diesel engines, the NO_x emission factor depends on the technology regulation of the engine (NO_x Tier I, II, and III). The emission factors are calculated from base values for Residual Fuel Oil and Marine Gas/Diesel Oil obtained from table 3-7 of the 2023 EMEP/EEA Guidebook, reduced by NO_x Tier and engine type specific reduction factors provided in table 3-6 of the Guidebook. Table 3.69 summarises the resulting EF values.

Table 3.69 NO_x Tier adjusted NO_x EFs for reciprocating Diesel engine types [kg/t].

NO_x engine Tier	Slow-speed Diesel		Medium-speed Diesel		High-speed Diesel	
	Marine gas/Diesel oil	Residual fuel oil	Marine gas/Diesel oil	Residual fuel oil	Marine gas/Diesel oil	Residual fuel oil
NO_x Tier 0	94.30	90.20	57.90	55.30	39.60	37.90
NO_x Tier I	77.04	73.69	56.53	53.99	34.41	32.94
NO_x Tier II	60.26	57.64	44.47	42.47	27.64	26.45
NO_x Tier III	10.66	10.19	5.44	5.20	5.82	5.57

The NO_x emission factor for gas/steam turbine engines depends on the year of engine construction. Engines constructed to meet the IMO NO_x Technical Code (built after 2000) are assumed to emit 17% less NO_x emissions compared to pre-2000 engines. Presuming a continuous replacement of engines over the years yields a time series of NO_x emission factors for the total fleet of gas/steam turbine engine powered vessels. Since for a large share of ships no information about the construction years of engines is available, the approach proposed in section 3.3.2 of chapter 1.A.3.d of the 2023 EMEP/EEA Guidebook is adopted, assuming the year of engine construction to coincide with the built-year of the ship, and further assuming a fleet turn-over (replacement) rate of 4% per year. The resulting emission factors are summarised in Table 3.70.

Table 3.70 Year-specific NO_x emission factors for turbine engines [kg/t].

Engine type	1990	1995	2000	2005	2010	2015	2020	2022	2023
Gas turbine, Marine gas/Diesel oil	19.70	19.70	19.70	19.03	18.36	17.69	17.02	16.75	16.62
Gas turbine, Residual fuel oil	20.00	20.00	20.00	19.32	18.64	17.96	17.28	17.01	16.87
Steam turbine, Marine gas/Diesel oil	6.90	6.90	6.90	6.67	6.43	6.20	5.96	5.87	5.82
Steam turbine, Residual fuel oil	6.90	6.90	6.90	6.67	6.43	6.20	5.96	5.87	5.82

Emission Factors for Tier 1-calculated Compounds

BbF, BkF, BaP, Ipy, HCB, and PCB compounds, as well as dioxin and heavy metals are calculated according to a tier 1 approach. The emission factors used for the calculation are obtained from table 3-1, chapter 1.A.3.d, of the EMEP/EEA Guidebook 2023.

3.4.4.3 Recalculations and Improvements

Recalculations for the 2025 Submission

The transition from a tier 1 to a tier 2 technology specific approach as defined in section 3.3 of chapter 1.A.3.d Navigation of the 2023 EMEP/EEA Guidebook required a recalculation of emissions in 1A3di(i) and 1A3dii for all pollutants (which are calculated with tier 2) and for the entire timeline of the last submission, 1990 to 2022. In the course of the tier 2 calculation a scaling error in SO_2, introduced in the last submission, was corrected. See Table 3.71.

Table 3.71 Recalculation according to Tier 2 for 1A3di(i) and 1A3dii.

1A3di(i), 1A3dii, tier 2	1990	1995	2000	2005	2010	2015	2020	2021	2022
1A3di(i) International Navigation									
2024 submission CO [kt]	0.034	0.004	0.065	0.002	0.000	0.177	0.093	0.154	0.344
2025 submission CO [kt]	0.037	0.004	0.071	0.002	0.000	0.190	0.100	0.162	0.369
Change relative to the 2024 submission [kt CO]	0.0036	0.0004	0.0058	0.0000	0.0000	0.0130	0.0072	0.0081	0.0249
Change relative to the 2024 submission [%]	11%	11%	8.9%	0.8%	-2.2%	7.3%	7.7%	5.3%	7.2%
2024 submission NMVOC [kt]	0.015	0.002	0.030	0.001	0.000	0.081	0.042	0.070	0.157
2025 submission NMVOC [kt]	0.018	0.002	0.034	0.001	0.000	0.091	0.049	0.079	0.178
Change relative to the 2024 submission [kt NMVOC]	0.0027	0.0003	0.0045	0.0000	0.0000	0.0103	0.0066	0.0085	0.0210
Change relative to the 2024 submission [%]	17%	18%	15%	3.3%	-0.6%	13%	15%	12%	13%
2024 submission TSP [kt]	0.010	0.001	0.026	0.002	0.000	0.105	0.026	0.057	0.127
2025 submission TSP [kt]	0.008	0.001	0.022	0.002	0.000	0.097	0.025	0.048	0.096
Change relative to the 2024 submission [kt TSP]	-0.0020	-0.0003	-0.0040	-0.0001	0.0000	-0.0083	-0.0010	-0.0099	-0.0311
Change relative to the 2024 submission [%]	-19%	-23%	-15%	-2.8%	-1.6%	-7.9%	-3.7%	-17%	-24%
2024 submission PM_{10} [kt]	0.010	0.001	0.026	0.002	0.000	0.105	0.026	0.057	0.127
2025 submission PM_{10} [kt]	0.008	0.001	0.022	0.002	0.000	0.097	0.025	0.048	0.096
Change relative to the 2024 submission [kt PM_{10}]	-0.0020	-0.0003	-0.0040	-0.0001	0.0000	-0.0083	-0.0010	-0.0099	-0.0311
Change relative to the 2024 submission [%]	-19%	-23%	-15%	-2.8%	-1.6%	-7.9%	-3.7%	-17%	-24%
2024 submission $PM_{2.5}$ [kt]	0.010	0.001	0.026	0.002	0.000	0.105	0.026	0.057	0.127
2025 submission $PM_{2.5}$ [kt]	0.007	0.001	0.019	0.002	0.000	0.082	0.021	0.040	0.082
Change relative to the 2024 submission [kt $PM_{2.5}$]	-0.0032	-0.0004	-0.0073	-0.0004	-0.0001	-0.0227	-0.0047	-0.0170	-0.0455
Change relative to the 2024 submission [%]	-31%	-34%	-28%	-17%	-16%	-22%	-18%	-30%	-36%
2024 submission BC [kt]	0.00043	0.00005	0.00091	0.00005	0.00001	0.00282	0.00117	0.00209	0.00466
2025 submission BC [kt]	0.00042	0.00005	0.00088	0.00004	0.00001	0.00275	0.00113	0.00203	0.00453
Change relative to the 2024 submission [kt BC]	-0.00002	0.00000	-0.00003	0.00000	0.00000	-0.00006	-0.00004	-0.00006	-0.00013
Change relative to the 2024 submission [%]	-3.7%	-3.8%	-3.0%	-0.6%	-0.2%	-2.3%	-3.6%	-2.7%	-2.8%
2024 submission SO_2 [kt]	0.0010	0.0001	0.0017	0.0002	0.0000	0.0036	0.0004	0.0010	0.0023
2025 submission SO_2 [kt]	0.0989	0.0105	0.1679	0.0241	0.0024	0.3570	0.0437	0.0983	0.2112
Change relative to the 2024 submission [kt SO_2]	0.0979	0.0104	0.1662	0.0239	0.0024	0.3534	0.0433	0.0973	0.2088
Change relative to the 2024 submission [%]	9900%	9900%	9900%	9900%	9900%	9900%	9900%	9627%	9001%
2024 submission NO_x [kt]	0.633	0.076	1.224	0.039	0.006	3.338	1.753	2.897	6.475
2025 submission NO_x [kt]	0.418	0.049	0.844	0.037	0.006	2.347	1.227	1.760	3.407
Change relative to the 2024 submission [kt NO_x]	-0.216	-0.027	-0.380	-0.002	0.000	-0.991	-0.525	-1.136	-3.069
Change relative to the 2024 submission [%]	-34%	-35%	-31%	-5.4%	1.1%	-30%	-30%	-39%	-47%
1A3dii Domestic Navigation									
2024 submission CO [kt]	0.039	0.044	0.015	0.027	0.042	0.032	0.030	0.021	0.030

1A3di(i), 1A3dii, tier 2	1990	1995	2000	2005	2010	2015	2020	2021	2022
2025 submission CO [kt]	0.043	0.050	0.017	0.030	0.047	0.036	0.034	0.024	0.033
Change relative to the 2024 submission [kt CO]	0.0044	0.0051	0.0017	0.0031	0.0049	0.0037	0.0038	0.0027	0.0037
Change relative to the 2024 submission [%]	11%	11%	11%	12%	12%	12%	12%	13%	13%
2024 submission NMVOC [kt]	0.018	0.020	0.007	0.012	0.019	0.015	0.014	0.010	0.013
2025 submission NMVOC [kt]	0.021	0.023	0.008	0.015	0.023	0.018	0.017	0.012	0.017
Change relative to the 2024 submission [kt NMVOC]	0.0027	0.0031	0.0014	0.0025	0.0036	0.0031	0.0032	0.0023	0.0032
Change relative to the 2024 submission [%]	15%	15%	20%	20%	19%	21%	24%	24%	24%
2024 submission TSP [kt]	0.027	0.032	0.006	0.011	0.023	0.011	0.008	0.006	0.008
2025 submission TSP [kt]	0.025	0.029	0.005	0.009	0.020	0.009	0.007	0.005	0.007
Change relative to the 2024 submission [kt TSP]	-0.0028	-0.0030	-0.0010	-0.0017	-0.0026	-0.0021	-0.0015	-0.0009	-0.0014
Change relative to the 2024 submission [%]	-10%	-9.4%	-16%	-16%	-11%	-20%	-17%	-16%	-17%
2024 submission PM_{10} [kt]	0.027	0.032	0.006	0.011	0.023	0.011	0.008	0.006	0.008
2025 submission PM_{10} [kt]	0.025	0.029	0.005	0.009	0.020	0.009	0.007	0.005	0.007
Change relative to the 2024 submission [kt PM_{10}]	-0.0028	-0.0030	-0.0010	-0.0017	-0.0026	-0.0021	-0.0015	-0.0009	-0.0014
Change relative to the 2024 submission [%]	-10%	-9.4%	-16%	-16%	-11%	-20%	-17%	-16%	-17%
2024 submission $PM_{2.5}$ [kt]	0.027	0.032	0.006	0.011	0.023	0.011	0.008	0.006	0.008
2025 submission $PM_{2.5}$ [kt]	0.021	0.025	0.005	0.008	0.017	0.007	0.006	0.004	0.006
Change relative to the 2024 submission [kt $PM_{2.5}$]	-0.0064	-0.0074	-0.0019	-0.0032	-0.0056	-0.0034	-0.0025	-0.0017	-0.0024
Change relative to the 2024 submission [%]	-24%	-23%	-29%	-28%	-25%	-32%	-30%	-29%	-29%
2024 submission BC [kt]	0.00067	0.00077	0.00021	0.00038	0.00064	0.00042	0.00038	0.00027	0.00037
2025 submission BC [kt]	0.00065	0.00075	0.00021	0.00036	0.00062	0.00040	0.00036	0.00025	0.00035
Change relative to the 2024 submission [kt BC]	-0.00001	-0.00002	-0.00001	-0.00002	-0.00002	-0.00002	-0.00002	-0.00001	-0.00002
Change relative to the 2024 submission [%]	-2.2%	-2.2%	-3.8%	-4.0%	-3.3%	-4.5%	-5.3%	-5.3%	-5.4%
2024 submission SO_2 [kt]	0.0028	0.0033	0.0004	0.0007	0.0010	0.0003	0.0001	0.0001	0.0001
2025 submission SO_2 [kt]	0.2770	0.3272	0.0430	0.0724	0.0953	0.0315	0.0141	0.0095	0.0127
Change relative to the 2024 submission [kt SO_2]	0.2742	0.3239	0.0425	0.0716	0.0943	0.0312	0.0140	0.0094	0.0125
Change relative to the 2024 submission [%]	9900%	9900%	9900%	9900%	9900%	9900%	9900%	9484%	8568%
2024 submission NO_X [kt]	0.735	0.837	0.285	0.508	0.792	0.600	0.566	0.396	0.555
2025 submission NO_X [kt]	0.494	0.572	0.178	0.315	0.508	0.345	0.318	0.223	0.306
Change relative to the 2024 submission [kt NO_X]	-0.2400	-0.2646	-0.1068	-0.1932	-0.2840	-0.2551	-0.2474	-0.1732	-0.2492
Change relative to the 2024 submission [%]	-33%	-32%	-38%	-38%	-36%	-42%	-44%	-44%	-45%

The EMEP/EEA 2023 Guidebook introduced emission factors for BbF, BkF, BaP, and Ipy compounds (table 3-1) which were not part (NA) of the Icelandic emission inventory in the 2024 submission. Table 3.72 summarises the emissions calculated for these compounds using a Tier 1 approach.

Table 3.72 Recalculation according to Tier 1 for PAH4 compounds in 1A3di(i) and 1A3dii.

1A3di(i), 1A3dii, tier 1	1990	1995	2000	2005	2010	2015	2020	2021	2022
1A3di(i) International Navigation									
2024 submission BbF [t]	NA	NA	NA	NA	NA	NA	NA	NA	NA
2025 submission BbF [t]	0.00009	0.00001	0.00021	0.00001	0.00000	0.00073	0.00024	0.00047	0.00105
Change relative to the 2024 submission [kt BbF]	0.00009	0.00001	0.00021	0.00001	0.00000	0.00073	0.00024	0.00047	0.00105
Change relative to the 2024 submission [%]	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2024 submission BkF [t]	NA	NA	NA	NA	NA	NA	NA	NA	NA
2025 submission BkF [t]	0.00009	0.00001	0.00019	0.00001	0.00000	0.00060	0.00024	0.00044	0.00098
Change relative to the 2024 submission [kt BkF]	0.00009	0.00001	0.00019	0.00001	0.00000	0.00060	0.00024	0.00044	0.00098
Change relative to the 2024 submission [%]	100%	100%	100%	100%	100%	100%	100%	100%	100%
2024 submission BaP [t]	NA	NA	NA	NA	NA	NA	NA	NA	NA
2025 submission BaP [t]	0.00002	0.00000	0.00004	0.00000	0.00000	0.00013	0.00005	0.00009	0.00020
Change relative to the 2024 submission [kt BaP]	0.00002	0.00000	0.00004	0.00000	0.00000	0.00013	0.00005	0.00009	0.00020
Change relative to the 2024 submission [%]	100%	100%	100%	100%	100%	100%	100%	100%	100%
2024 submission Ipy [t]	NA	NA	NA	NA	NA	NA	NA	NA	NA
2025 submission Ipy [t]	0.00001	0.00000	0.00003	0.00000	0.00000	0.00015	0.00002	0.00007	0.00015
Change relative to the 2024 submission [kt Ipy]	0.00001	0.00000	0.00003	0.00000	0.00000	0.00015	0.00002	0.00007	0.00015
Change relative to the 2024 submission [%]	100%	100%	100%	100%	100%	100%	100%	100%	100%
2024 submission PAH4 [t]	NA	NA	NA	NA	NA	NA	NA	NA	NA
2025 submission PAH4 [t]	0.00021	0.00002	0.00047	0.00003	0.00001	0.00162	0.00056	0.00107	0.00238
Change relative to the 2024 submission [t PAH4]	0.00021	0.00002	0.00047	0.00003	0.00001	0.00162	0.00056	0.00107	0.00238
Change relative to the 2024 submission [%]	100%	100%	100%	100%	100%	100%	100%	100%	100%
1A3dii Domestic Navigation									
2024 submission BbF [t]	NA	NA	NA	NA	NA	NA	NA	NA	NA
2025 submission BbF [t]	0.00018	0.00021	0.00005	0.00009	0.00016	0.00009	0.00008	0.00005	0.00008
Change relative to the 2024 submission [kt BbF]	0.00018	0.00021	0.00005	0.00009	0.00016	0.00009	0.00008	0.00005	0.00008
Change relative to the 2024 submission [%]	100%	100%	100%	100%	100%	100%	100%	100%	100%
2024 submission BkF [t]	NA	NA	NA	NA	NA	NA	NA	NA	NA
2025 submission BkF [t]	0.00014	0.00017	0.00005	0.00008	0.00014	0.00009	0.00008	0.00005	0.00008
Change relative to the 2024 submission [kt BkF]	0.00014	0.00017	0.00005	0.00008	0.00014	0.00009	0.00008	0.00005	0.00008
Change relative to the 2024 submission [%]	100%	100%	100%	100%	100%	100%	100%	100%	100%
2024 submission BaP [t]	NA	NA	NA	NA	NA	NA	NA	NA	NA
2025 submission BaP [t]	0.00003	0.00004	0.00001	0.00002	0.00003	0.00002	0.00002	0.00001	0.00002
Change relative to the 2024 submission [kt BaP]	0.00003	0.00004	0.00001	0.00002	0.00003	0.00002	0.00002	0.00001	0.00002
Change relative to the 2024 submission [%]	100%	100%	100%	100%	100%	100%	100%	100%	100%
2024 submission Ipy [t]	NA	NA	NA	NA	NA	NA	NA	NA	NA
2025 submission Ipy [t]	0.00004	0.00005	0.00001	0.00001	0.00003	0.00001	0.00001	0.00001	0.00001
Change relative to the 2024 submission [kt Ipy]	0.00004	0.00005	0.00001	0.00001	0.00003	0.00001	0.00001	0.00001	0.00001

1A3di(i), 1A3dii, tier 1	1990	1995	2000	2005	2010	2015	2020	2021	2022
Change relative to the 2024 submission [%]	100%	100%	100%	100%	100%	100%	100%	100%	100%
2024 submission PAH4 [t]	NA	NA	NA	NA	NA	NA	NA	NA	NA
2025 submission PAH4 [t]	0.00040	0.00047	0.00011	0.00020	0.00036	0.00021	0.00018	0.00013	0.00018
Change relative to the 2024 submission [t PAH4]	0.00040	0.00047	0.00011	0.00020	0.00036	0.00021	0.00018	0.00013	0.00018
Change relative to the 2024 submission [%]	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Recalculations for the 2024 Submission

As for sulphur content of residual fuel and marine diesel/gas oil, an error has been fixed for 1990-2011 and changed to country specific from 2012. This led to large recalculations of SO_2 through the time series (see Table 3.73 and Table 3.74).

Table 3.73 Recalculations of SO_2 in 1A3dii Domestic Navigation between submissions.

1A3dii Domestic Navigation	1990	1995	2000	2005	2010	2015	2020	2021
2023 submission SO_2 [kt]	2.8 E-01	3.3 E-01	4.3 E-02	7.2 E-02	9.5 E-02	2.9 E-02	1.4 E-02	9.9 E-03
2024 submission SO_2 [kt]	2.8 E-03	3.3 E-03	4.3 E-04	7.2 E-04	9.5 E-04	3.2 E-04	1.4 E-04	9.9 E-05
Change relative to the 2023 submission SO_2 [%]	-99.0%	-99.0%	-99.0%	-99.0%	-99.0%	-99.2%	-99.0%	-99.0%

Table 3.74 Recalculations of SO_2 in 1A3di(i) International Navigation between submissions.

1A3di(i) International Navigation (memo item)	1990	1995	2000	2005	2010	2015	2020	2021
2023 submission SO_2 [kt]	0.09893	0.01053	0.16789	0.02412	0.00240	0.46458	0.04370	0.09837
2024 submission SO_2 [kt]	0.00099	0.00011	0.00168	0.00024	0.00002	0.00357	0.00044	0.00101
Change relative to the 2023 submission SO_2 [%]	-99.0%	-99.0%	-99.0%	-99.0%	-99.0%	-99.2%	-99.0%	-99.0%

NEA's reallocation of fuel for 2021 between domestic and international navigation led to minor recalculations of all air pollutants for 2021 (see Table 3.75 and Table 3.76).

Table 3.75 Recalculations of all air pollutants except SO_2 in 1A3dii Domestic Navigation between submissions.

1A3dii Domestic Navigation	2021
2023 submission PCB [kg]	0.0002084
2024 submission PCB [kg]	0.0002085
Change relative to the 2023 submission PCB [%]	0.091%
2023 submission HCB [kg]	0.0004386
2024 submission HCB [kg]	0.0004390
Change relative to the 2023 submission HCB [%]	0.091%
2023 submission PCDD/F [g]	0.0007128
2024 submission PCDD/F [g]	0.0007134
Change relative to the 2023 submission PCDD/F [%]	0.091%
2023 submission NO_x [kt]	0.3959
2024 submission NO_x [kt]	0.3962
Change relative to the 2023 submission NO_x [%]	0.091%

1A3dii Domestic Navigation	2021
2023 submission CO [kt]	0.021055
2024 submission CO [kt]	0.021074
Change relative to the 2023 submission CO [%]	0.091%
2023 submission NMVOC [kt]	0.009595
2024 submission NMVOC [kt]	0.009604
Change relative to the 2023 submission NMVOC [%]	0.091%
2023 submission TSP [kt]	0.005867
2024 submission TSP [kt]	0.005872
Change relative to the 2023 submission TSP [%]	0.091%
2023 submission PM_{10} [kt]	0.005867
2024 submission PM_{10} [kt]	0.005872
Change relative to the 2023 submission PM_{10} [%]	0.091%
2023 submission $PM_{2.5}$ [kt]	0.005867
2024 submission $PM_{2.5}$ [kt]	0.005872
Change relative to the 2023 submission $PM_{2.5}$ [%]	0.091%
2023 submission BC [kt]	0.0002648
2024 submission BC [kt]	0.0002651
Change relative to the 2023 submission BC [%]	0.091%
2023 submission Pb [t]	0.0007128
2024 submission Pb [t]	0.0007134
Change relative to the 2023 submission Pb [%]	0.091%
2023 submission Cd [t]	0.000054830
2024 submission Cd [t]	0.000054880
Change relative to the 2023 submission Cd [%]	0.091%
2023 submission Hg [t]	0.00016449
2024 submission Hg [t]	0.00016464
Change relative to the 2023 submission Hg [%]	0.091%
2023 submission As [t]	0.00021932
2024 submission As [t]	0.00021952
Change relative to the 2023 submission As [%]	0.091%
2023 submission Cr [t]	0.00027415
2024 submission Cr [t]	0.00027440
Change relative to the 2023 submission Cr [%]	0.091%
2023 submission Cu [t]	0.0048250
2024 submission Cu [t]	0.0048294
Change relative to the 2023 submission Cu [%]	0.091%
2023 submission Ni [t]	0.0054830
2024 submission Ni [t]	0.0054880
Change relative to the 2023 submission Ni [%]	0.091%
2023 submission Se [t]	0.00054830
2024 submission Se [t]	0.00054880

1A3dii Domestic Navigation	2021
Change relative to the 2023 submission Se [%]	0.091%
2023 submission Zn [t]	0.0065796
2024 submission Zn [t]	0.0065856
Change relative to the 2023 submission Zn [%]	0.091%

Table 3.76 Recalculations of all air pollutants except SO_2 in 1A3di(i) International Navigation between submissions.

1A3di(i) International Navigation (memo item)	2021
2023 submission PCB [kg]	0.003327
2024 submission PCB [kg]	0.003383
Change relative to the 2023 submission PCB [%]	1.7%
2023 submission HCB [kg]	0.00331
2024 submission HCB [kg]	0.00343
Change relative to the 2023 submission HCB [%]	3.6%
2023 submission PCDD/F [g]	0.00623
2024 submission PCDD/F [g]	0.00642
Change relative to the 2023 submission PCDD/F [%]	3.1%
2023 submission NO_X [kt]	2.79
2024 submission NO_X [kt]	2.90
Change relative to the 2023 submission NO_X [%]	3.8%
2023 submission CO [kt]	0.148
2024 submission CO [kt]	0.154
Change relative to the 2023 submission CO [%]	3.8%
2023 submission NMVOC [kt]	0.068
2024 submission NMVOC [kt]	0.070
Change relative to the 2023 submission NMVOC [%]	3.8%
2023 submission TSP [kt]	0.0559
2024 submission TSP [kt]	0.0575
Change relative to the 2023 submission TSP [%]	2.8%
2023 submission PM_{10} [kt]	0.0559
2024 submission PM_{10} [kt]	0.0575
Change relative to the 2023 submission PM_{10} [%]	2.8%
2023 submission $PM_{2.5}$ [kt]	0.0559
2024 submission $PM_{2.5}$ [kt]	0.0575
Change relative to the 2023 submission $PM_{2.5}$ [%]	2.8%
2023 submission BC [kt]	0.00202
2024 submission BC [kt]	0.00209
Change relative to the 2023 submission BC [%]	3.6%
2023 submission Pb [t]	0.00522
2024 submission Pb [t]	0.00541
Change relative to the 2023 submission Pb [%]	3.7%
2023 submission Cd [t]	0.000423

1A3di(i) International Navigation (memo item)	2021
2024 submission Cd [t]	0.000438
Change relative to the 2023 submission Cd [%]	3.5%
2023 submission Hg [t]	0.001129
2024 submission Hg [t]	0.001173
Change relative to the 2023 submission Hg [%]	3.9%
2023 submission As [t]	0.00378
2024 submission As [t]	0.00384
Change relative to the 2023 submission As [%]	1.6%
2023 submission Cr [t]	0.00427
2024 submission Cr [t]	0.00435
Change relative to the 2023 submission Cr [%]	1.7%
2023 submission Cu [t]	0.0354
2024 submission Cu [t]	0.0367
Change relative to the 2023 submission Cu [%]	3.7%
2023 submission Ni [t]	0.1468
2024 submission Ni [t]	0.1482
Change relative to the 2023 submission Ni [%]	1.0%
2023 submission Se [t]	0.00426
2024 submission Se [t]	0.00441
Change relative to the 2023 submission Se [%]	3.5%
2023 submission Zn [t]	0.0465
2024 submission Zn [t]	0.0483
Change relative to the 2023 submission Zn [%]	3.8%

3.4.4.4 Planned Improvements

No planned improvement for this category.

3.4.5 Fishing (NFR 1A4ciii)

Emissions from the Fishing sector in Iceland are significant as the fishing industry is one of the main industries and fish products are one of Iceland's primary exports. Same as for International maritime and Domestic navigation (1A3di(i) and 1A3dii), emissions from Iceland's fishing fleet are calculated following a tier 2 technology specific approach as defined in section 3.3, chapter 1.A.3.d, of the 2023 EMEP/EEA Guidebook for all pollutants except for Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, and Indeno(1,2,3- cd)pyrene as well as, hexachlorobenzene, polychlorinated biphenyls, dioxin, and heavy metals. These emission calculations follow the tier 1 default approach and are based on sold fuel and tier 1 emission factors in accordance with section 3.2, chapter 1.A.3.d, of the 2023 EMEP/EEA Guidebook.

The data availability situation regarding recorded port exits is the same as for the other navigation-related NFRs (1A3di(i), 1A3dii). Data is available starting from 2011, with years

2011 to 2013 considered incomplete, so that port exits in the period from 1990 to 2013 are backward extrapolated on the basis of 2014 to 2023. The extrapolation follows the algorithm detailed in section 3.4.4.

3.4.5.1 Activity Data

Total use of residual fuel oil and gas/Diesel oil for commercial fishing is based on the annual fuel sales statistics and includes both, Domestic and International Fishing. Activity data for fuel combustion in the Fishing sector is given in Table 3.77.

Table 3.77 Fuel use [kt], Fishing sector.

Fuel type	1990	1995	2000	2005	2010	2015	2020	2022	2023
Residual Fuel Oil	35.6	57.2	22.3	32.6	69.9	52.4	NO	NO	NO
Gas/Diesel Oil	202.6	231.8	256.9	199.9	158.3	142.5	158.7	150.4	151.9
Biodiesel	NO	NO	NO	NO	NO	0.094	0.075	0.032	NO

The number of yearly port exits attributed to NFR 1A4ciii are summarised in Table 3.78. Port exit numbers before 2014 are extrapolated as described in section 3.4.4. For the purpose of emissions calculations biodiesel is added to marine gas/diesel oil.

Table 3.78 Port exits in NFR 1A4ciii.

Vessel type	1990	1995	2000	2005	2010	2015	2020	2022	2023
Fishing vessels	126196	121634	117066	113267	108398	126064	88679	75381	75670

3.4.5.2 Emission Factors

The same emission factors as for International maritime and Domestic navigation are used for calculating fishing related emissions. Tier 2 emissions factors are utilised for reciprocating diesel engines for all pollutants apart from NO_x and SO_2. For gas/steam turbine engines Tier 2 emission factors are only available for TSP, PM_{10}, and $PM_{2.5}$. Tier 1 emission factors are used for CO, NMVOC, and BC for these engine types. See section 3.4.4.2 and specifically Table 3.67 for more information on source and use of emission factors.

The sulphur content time series reported in Table 3.68 is used for calculating SO_2 emissions for all engine types, while Table 3.69 provides NO_x tier adjusted NO_x emissions factors for reciprocating engines and Table 3.70 reports year-adjusted NO_x emission factors for turbine engines.

PAH4 compounds (BbF, BkF, BaP, and Ipy as well as HCB, PCB, dioxin, and heavy metals) are calculated using default tier 1 emission factors obtained from table 3-1 of the EMEP/EEA 2023 Guidebook independent of the engine type.

3.4.5.3 Recalculations and Improvements

Recalculations for the 2025 Submission

The transition from a tier 1 to a tier 2 technology specific approach required a recalculation of emissions in 1A4ciii for all pollutants (which are calculated with tier 2) and for the entire timeline of the last submission, covering 1990 to 2022, summarised in Table 3.79.

Table 3.79 Recalculation according to Tier 2 for NFR 1A4ciii, Fishing, between submissions.

1A4ciii, tier 2	1990	1995	2000	2005	2010	2015	2020	2021	2022
2024 submission CO [kt]	0.909	1.100	1.068	0.887	0.864	0.740	0.610	0.685	0.578
2025 submission CO [kt]	1.050	1.271	1.234	1.025	0.999	0.855	0.704	0.791	0.667
Change relative to the 2024 submission [kt CO]	0.141	0.171	0.166	0.138	0.135	0.115	0.094	0.106	0.089
Change relative to the 2024 submission [%]	16%	16%	16%	16%	16%	16%	15%	15%	15%
2024 submission NMVOC [kt]	0.414	0.501	0.487	0.404	0.394	0.337	0.278	0.312	0.263
2025 submission NMVOC [kt]	0.462	0.558	0.545	0.452	0.436	0.374	0.313	0.351	0.296
Change relative to the 2024 submission [kt NMVOC]	0.048	0.057	0.059	0.047	0.042	0.037	0.035	0.039	0.033
Change relative to the 2024 submission [%]	12%	11%	12%	12%	11%	11%	12%	12%	12%
2024 submission TSP [kt]	0.4022	0.5452	0.3906	0.3835	0.5328	0.4253	0.1699	0.1908	0.1610
2025 submission TSP [kt]	0.3994	0.5422	0.3869	0.3808	0.5310	0.4237	0.1674	0.1881	0.1587
Change relative to the 2024 submission [kt TSP]	-0.0027	-0.0030	-0.0037	-0.0027	-0.0017	-0.0017	-0.0024	-0.0027	-0.0023
Change relative to the 2024 submission [%]	-0.7%	-0.5%	-0.9%	-0.7%	-0.3%	-0.4%	-1.4%	-1.4%	-1.4%
2024 submission PM_{10} [kt]	0.4022	0.5452	0.3906	0.3835	0.5328	0.4253	0.1699	0.1908	0.1610
2025 submission PM_{10} [kt]	0.3994	0.5422	0.3869	0.3808	0.5310	0.4237	0.1674	0.1881	0.1587
Change relative to the 2024 submission [kt PM_{10}]	-0.0027	-0.0030	-0.0037	-0.0027	-0.0017	-0.0017	-0.0024	-0.0027	-0.0023
Change relative to the 2024 submission [%]	-0.7%	-0.5%	-0.9%	-0.7%	-0.3%	-0.4%	-1.4%	-1.4%	-1.4%
2024 submission $PM_{2.5}$ [kt]	0.4022	0.5452	0.3906	0.3835	0.5328	0.4253	0.1699	0.1908	0.1610
2025 submission $PM_{2.5}$ [kt]	0.3398	0.4613	0.3292	0.3240	0.4517	0.3604	0.1425	0.1601	0.1351
Change relative to the 2024 submission [kt $PM_{2.5}$]	-0.0623	-0.0839	-0.0614	-0.0595	-0.0811	-0.0649	-0.0273	-0.0307	-0.0259
Change relative to the 2024 submission [%]	-16%	-15%	-16%	-16%	-15%	-15%	-16%	-16%	-16%
2024 submission BC [kt]	0.01301	0.01636	0.01442	0.01260	0.01395	0.01162	0.00767	0.00861	0.00727
2025 submission BC [kt]	0.01285	0.01619	0.01422	0.01245	0.01385	0.01153	0.00754	0.00847	0.00715
Change relative to the 2024 submission [kt BC]	-1.52E-4	-1.69E-4	-2.00E-4	-1.51E-4	-1.06E-4	-9.90E-5	-1.28E-4	-1.43E-4	-1.21E-4
Change relative to the 2024 submission [%]	-1.2%	-1.0%	-1.4%	-1.2%	-0.8%	-0.9%	-1.7%	-1.7%	-1.7%
2024 submission SO_2 [kt]	0.040	0.054	0.022	0.026	0.024	0.014	0.003	0.003	0.003
2025 submission SO_2 [kt]	3.951	5.404	2.230	2.561	2.413	1.442	0.286	0.308	0.248
Change relative to the 2024 submission [kt SO_2]	3.911	5.350	2.208	2.535	2.389	1.427	0.283	0.304	0.245
Change relative to the 2024 submission [%]	9900%	9900%	9900%	9900%	9900%	9900%	9900%	9484%	8568%
2024 submission NO_x [kt]	17.09	20.69	20.08	16.69	16.26	13.92	11.46	12.87	10.86
2025 submission NO_x [kt]	13.19	15.99	15.43	12.77	12.45	10.11	7.87	8.74	7.33
Change relative to the 2024 submission [kt NO_x]	-3.91	-4.69	-4.66	-3.92	-3.80	-3.81	-3.60	-4.13	-3.54
Change relative to the 2024 submission [%]	-23%	-23%	-23%	-23%	-23%	-27%	-31%	-32%	-33%

Table 3-1 of the EMEP/EEA 2023 Guidebook introduced emission factors for BbF, BkF, BaP, and Ipy compounds which were not available for the 2024 submission. Table 3.80 summarises the emissions calculated for these compounds using a Tier 1 approach.

Table 3.80 Recalculation of PAH4 compounds according to Tier 1 for NFR 1A4ciii, Fishing, between submissions.

1A4ciii, tier 1	1990	1995	2000	2005	2010	2015	2020	2021	2022
2024 submission BbF [t]	NA	NA	NA	NA	NA	NA	NA	NA	NA
2025 submission BbF [t]	0.00310	0.00403	0.00324	0.00298	0.00368	0.00300	0.00159	0.00178	0.00150
Change relative to the 2024 submission [kt BbF]	0.00310	0.00403	0.00324	0.00298	0.00368	0.00300	0.00159	0.00178	0.00150
Change relative to the 2024 submission [%]	100%	100%	100%	100%	100%	100%	100%	100%	100%
2024 submission BkF [t]	NA	NA	NA	NA	NA	NA	NA	NA	NA
2025 submission BkF [t]	0.00274	0.00346	0.00301	0.00265	0.00298	0.00248	0.00159	0.00178	0.00150
Change relative to the 2024 submission [kt BkF]	0.00274	0.00346	0.00301	0.00265	0.00298	0.00248	0.00159	0.00178	0.00150
Change relative to the 2024 submission [%]	100%	100%	100%	100%	100%	100%	100%	100%	100%
2024 submission BaP [t]	NA	NA	NA	NA	NA	NA	NA	NA	NA
2025 submission BaP [t]	0.00058	0.00075	0.00063	0.00056	0.00067	0.00055	0.00032	0.00036	0.00030
Change relative to the 2024 submission [kt BaP]	0.00058	0.00075	0.00063	0.00056	0.00067	0.00055	0.00032	0.00036	0.00030
Change relative to the 2024 submission [%]	100%	100%	100%	100%	100%	100%	100%	100%	100%
2024 submission Ipy [t]	NA	NA	NA	NA	NA	NA	NA	NA	NA
2025 submission Ipy [t]	0.00052	0.00075	0.00046	0.00049	0.00079	0.00061	0.00016	0.00018	0.00015
Change relative to the 2024 submission [kt Ipy]	0.00052	0.00075	0.00046	0.00049	0.00079	0.00061	0.00016	0.00018	0.00015
Change relative to the 2024 submission [%]	100%	100%	100%	100%	100%	100%	100%	100%	100%
2024 submission PAH4 [t]	NA	NA	NA	NA	NA	NA	NA	NA	NA
2025 submission PAH4 [t]	0.00694	0.00899	0.00733	0.00669	0.00811	0.00664	0.00365	0.00410	0.00346
Change relative to the 2024 submission [t PAH4]	0.00694	0.00899	0.00733	0.00669	0.00811	0.00664	0.00365	0.00410	0.00346
Change relative to the 2024 submission [%]	100%	100%	100%	100%	100%	100%	100%	100%	100%

Recalculations for the 2024 Submission

As for sulphur content of residual fuel and marine diesel/gas oil, an error has been fixed for 1990-2011 and changed to country specific from 2012. This led to large recalculations of SO_2 through the time series (see Table 3.81).

Table 3.81 Recalculations of SO_2 in 1A4ciii Fishing between submissions.

1A4ciii Fishing	1990	1995	2000	2005	2010	2015	2020	2021
2023 submission SO_2 [kt]	3.9510	5.4042	2.2298	2.5608	2.4132	1.8586	0.2858	0.3237
2024 submission SO_2 [kt]	0.0395	0.0540	0.0223	0.0256	0.0241	0.0144	0.0029	0.0032
Change relative to the 2023 submission SO_2 [%]	-99.0%	-99.0%	-99.0%	-99.0%	-99.0%	-99.2%	-99.0%	-99.0%

NEA’s reallocation of fuel for 2021 between domestic and international navigation also led to minor recalculations of all air pollutants in 1A4ciii Fishing for 2021 (see Table 3.82).

Table 3.82 Recalculations of all air pollutants except SO_2 in 1A4ciii Fishing between submissions.

1A4ciii Fishing	2021
2023 submission PCB [kg]	0.00683
2024 submission PCB [kg]	0.00678

1A4ciii Fishing	2021
Change relative to the 2023 submission PCB [%]	-0.83%
2023 submission HCB [kg]	0.01438
2024 submission HCB [kg]	0.01427
Change relative to the 2023 submission HCB [%]	-0.83%
2023 submission PCDD/F [g]	0.02338
2024 submission PCDD/F [g]	0.02318
Change relative to the 2023 submission PCDD/F [%]	-0.83%
2023 submission NO_X [kt]	12.98
2024 submission NO_X [kt]	12.87
Change relative to the 2023 submission NO_X [%]	-0.83%
2023 submission CO [kt]	0.690
2024 submission CO [kt]	0.685
Change relative to the 2023 submission CO [%]	-0.83%
2023 submission NMVOC [kt]	0.3147
2024 submission NMVOC [kt]	0.3121
Change relative to the 2023 submission NMVOC [%]	-0.83%
2023 submission TSP [kt]	0.1924
2024 submission TSP [kt]	0.1908
Change relative to the 2023 submission TSP [%]	-0.83%
2023 submission PM_{10} [kt]	0.1924
2024 submission PM_{10} [kt]	0.1908
Change relative to the 2023 submission PM_{10} [%]	-0.83%
2023 submission $PM_{2.5}$ [kt]	0.1924
2024 submission $PM_{2.5}$ [kt]	0.1908
Change relative to the 2023 submission $PM_{2.5}$ [%]	-0.83%
2023 submission BC [kt]	0.008685
2024 submission BC [kt]	0.008613
Change relative to the 2023 submission BC [%]	-0.83%
2023 submission Pb [t]	0.02338
2024 submission Pb [t]	0.02318
Change relative to the 2023 submission Pb [%]	-0.83%
2023 submission Cd [t]	0.001798
2024 submission Cd [t]	0.001783
Change relative to the 2023 submission Cd [%]	-0.83%
2023 submission Hg [t]	0.005394
2024 submission Hg [t]	0.005350
Change relative to the 2023 submission Hg [%]	-0.83%
2023 submission As [t]	0.007192
2024 submission As [t]	0.007133
Change relative to the 2023 submission As [%]	-0.83%
2023 submission Cr [t]	0.008990

1A4ciii Fishing	2021
2024 submission Cr [t]	0.008916
Change relative to the 2023 submission Cr [%]	-0.83%
2023 submission Cu [t]	0.1582
2024 submission Cu [t]	0.1569
Change relative to the 2023 submission Cu [%]	-0.83%
2023 submission Ni [t]	0.1798
2024 submission Ni [t]	0.1783
Change relative to the 2023 submission Ni [%]	-0.83%
2023 submission Se [t]	0.01798
2024 submission Se [t]	0.01783
Change relative to the 2023 submission Se [%]	-0.83%
2023 submission Zn [t]	0.2158
2024 submission Zn [t]	0.2140
Change relative to the 2023 submission Zn [%]	-0.83%

3.4.5.4 Planned Improvements

No planned improvements for this category.

3.5 Fugitive Emissions (NFR 1B2)

In Iceland, fugitive emissions occur only from two sources: Distribution of Oil Products (1B2av) and Geothermal Energy Production (1B2d).

3.5.1 Distribution of Oil Products (NFR 1B2av)

NMVOC emissions from distribution of oil products are estimated by multiplying the total imported fuel with an emission factor.

3.5.1.1 Activity Data

The calculations are based on yearly fuel sales data provided by fuel sales companies.

3.5.1.2 Emission Factors

The emission factor is taken from Table 4.2.4 2006 IPCC Guidelines Tanker Trucks and Rail Cards and is 0.00025 Gg per 1,000 m^3 total oil transported.

3.5.1.3 Recalculations and Improvements

Recalculations for the 2025 Submission

In the previous submissions, the activity data was the total imported fuel. It is now the total fuel sold which is considered to be more representative of oil distributed. This caused recalculations for the whole timeline as can be seen in the table below.

Table 3.83 Recalculations of SO_2 in 1B2av Distribution of oil products.

1B2av Distribution of oil products	1990	1995	2000	2005	2010	2015	2020	2021	2022
2024 submission NMVOC [kt]	0.195	0.198	0.240	0.238	0.196	0.243	0.177	0.193	48.9
2025 submission NMVOC [kt]	0.185	0.202	0.228	0.226	0.206	0.237	0.171	0.206	37.1
Change relative to the 2024 submission NMVOC [kt]	-0.010	0.004	-0.011	-0.012	0.010	-0.006	-0.006	0.014	-11.7
Change relative to the 2024 submission [%]	-5.0%	2.0%	-4.8%	-5.1%	5.0%	-2.6%	-3.4%	7.1%	-24%

Recalculations for the 2024 Submission

No recalculations were performed for this sector.

3.5.1.4 Planned Improvements

No improvements are currently planned for this subsector.

3.5.2 Geothermal Energy (NFR 1B2d)

This category includes emissions from all geothermal power plants in Iceland, including (as of 2023) two power plants, one heat plant and five combined heat and power plants (CHP plants). Iceland relies heavily on geothermal energy for space heating (90%) and to a significant extent for electricity production (around 30% in the past few years). Geothermal energy is generally considered to have a relatively low environmental impact. Considerable quantities of sulphur in the form of hydrogen sulphide (H_2S) are emitted from geothermal power plants. The H_2S values are stoichiometrically converted to SO_2 and reported as such.

3.5.2.1 Activity Data and Emissions

The H_2S concentration in the geothermal steam is site and time-specific and can vary greatly between areas and the wells within an area as well as by the time of extraction. The total emissions estimate of H_2S is based on direct measurements. The enthalpy and flow of each well are measured and the H_2S concentration of the steam fraction determined at the wellhead pressure. The steam fraction of the fluid and its H_2S concentration at the wellhead pressure and the geothermal plant inlet pressure are calculated for each well. Information about the period each well discharged in each year is then used to calculate the annual H_2S discharge from each well and finally the total H_2S is determined by adding up the H_2S discharge from individual wells.

Table 3.84 shows the electricity production with geothermal energy and the total sulphur emissions (calculated as SO_2).

Table 3.84 Electricity production and emissions from geothermal energy in Iceland.

	1990	1995	2000	2005	2010	2015	2020	2022	2023
Electricity production [GWh]	283	290	1,323	1,658	4,465	5,003	5,961	5,916	6,006
Sulphur emissions [kt SO_2]	13.3	11.0	26.0	30.3	58.7	42.4	39.3	37.1	33.7

The *CarbFix* project, located at the *Hellisheiði Power Plant* and *Nesjavellir*, has been pioneering CO_2 capture and reinjection on site into the basaltic subsurface, and has proven rapid and complete reaction to calcium carbonate precipitates (Matter, et al., 2016). A sister project, *SulFix*, involves separating H_2S from the steam and also reinjecting the gas into the subsurface and mineralizing on contact with the basalt host rock. Injection of H_2S started in 2014 at *Hellisheiði* and in 2023 at *Nesjavellir*. This project has had a significant impact on sulphur emissions from geothermal power production. Table 3.85 shows the amount of H_2S mineralized with the SulFix method (calculated as SO_2).

Table 3.85 Amount of H_2S mineralized with the SulFix method (calculated as SO_2).

	1990	1995	2000	2005	2010	2015	2020	2022	2023
SulFix – Mineralised [kt SO_2]	NO	NO	NO	NO	NO	-3.0	-5.7	-6.2	-5.7

3.5.2.2 Recalculations and Improvements

Recalculations for the 2025 Submission

Recalculations were performed for H_2S (as SO_2) emission in this sector for the 2025 submission. For 2021 and 2022 emission numbers were updated due to calculation error. This caused a change in the emissions for 2021 and 2022.

Table 3.86 Recalculations of SO_2 in 1B2d Geothermal between submissions.

1B2d Geothermal SO_2	2021	2022
2024 submission SO_2 [kt]	47.7	48.9
2025 submission SO_2 [kt]	33.5	37.1
Change relative to the 2024 submission [kt]	-14.2	-11.7
Change relative to the 2024 submission [%]	-30%	-24%

Recalculations for the 2024 Submission

No recalculations were performed for this sector.

3.5.2.3 Planned Improvements

No improvements are currently planned for this subsector.

4 Industrial Processes and Product Use (IPPU) (NFR Sector 2)

4.1 Overview

As a result of the expansion of the Industrial sector, the contribution of this sector to the total emissions has been increasing since 1990. By far the main contributor to the emissions from this sector is metal production (aluminium, ferrosilicon alloy, and silicon metal in recent years). The emission trends of the various pollutants closely match the opening and closing of various facilities.

While most of the air pollutant emissions from the industrial processes sector can be traced back to the metal production industry, exceptions include NMVOC, which mostly originate from solvents and product use, NH_3 which comes from the mineral wool industry and Capacitor Production, and most heavy metals that are emitted during the use of fireworks and tobacco (2G Other Solvent and Product Use).

The Industrial Processes and Product Use (IPPU) sector is divided into the following subsectors:

- Mineral Industry (NFR 2A)
- Chemical Industry (NFR 2B)
- Metal Production (NFR 2C)
- Solvent and Product Use (NFR 2D)
- Other Solvent and Product Use (NFR 2G)
- Other Industry Production (NRF 2H)

Food and Beverages Industry (NFR 2H2)A summary of the categories included in the IPPU sector by pollutant, including the tier methodology used, is presented in Table 4.1 to Table 4.3.

Table 4.1 Overview table NECD gases, PM, and CO (NA – not available, NO – not occurring).

Sector		NECD Gases				PM				
		NO_X	NMVOC	SO_X	NH_3	$PM_{2.5}$	PM_{10}	TSP	BC	CO
2A1	Cement Production[1]	NO	NO	NO	NO	NO	NO	NO	NO	NO
2A2	Lime Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2A3	Glass production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2A5a	Quarrying and Mining of Minerals other than Coal	NA	NA	NA	NA	T2	T2	T2	NA	NA
2A5b	Construction and Demolition	NA	NA	NA	NA	T1	T1	T1	NA	NA
2A5c	Storage, Handling, and Transport of Mineral Products	NO	NO	NO	NO	NO	NO	NO	NO	NO
2A6	Other Mineral Products (Mineral Wool)	NA	NA	T3	T3	T2	T3	T2	T2	T3
2B1	Ammonia Production[2]	NO	NO	NO	NO	NO	NO	NO	NO	NO
2B2	Nitric Acid Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2B3	Adipic Acid Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2B5	Carbide Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2B6	Titanium Dioxide Production	NO	NO	NO	NO	NO	NO	NO	NO	NO

Sector		NECD Gases				PM				
		NO_x	NMVOC	SO_x	NH_3	$PM_{2.5}$	PM_{10}	TSP	BC	CO
2B7	Soda Ash Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2B10a	Diatomite[3]	NO	NO	NO	NO	NO	NO	NO	NO	NO
2B10a	Fertiliser[2]	NO	NO	NO	NO	NO	NO	NO	NO	NO
2B10 b	Storage, Handling, and Transport of Chemical Products	NO	NO	NO	NO	NO	NO	NO	NO	NO
2C1	Iron and Steel Production[4]	NO	NO	NO	NO	NO	NO	NO	NO	NO
2C2	Ferroalloys Production	T2	T2	T3	NA	T1/T3	T1/T3	T3	T1	T2
2C3	Primary Aluminium Production	T2/T3	NA	T3	NA	T2/T3	T3	T2	T2/T3	T2
2C3	Secondary Aluminium Production	NA	NA	NA	NA	T2	T2	T3	T2	NA
2C4	Magnesium Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2C5	Lead Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2C6	Zinc Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2C7a	Copper Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2C7b	Nickel Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2C7c	Capacitor Production	NO	NO	NO	T3	NO	NO	NO	NO	NO
2C7d	Storage, Handling, and Transport of Metal Products	NO	NO	NO	NO	NO	NO	NO	NO	NO
2D3a	Domestic Solvent Use Including Fungicides	NA	T2b	NA	NA	NA	NA	NA	NA	NA
2D3b	Road Paving with Asphalt	NA	T1	NA	NA	T1	T1	T3	T1	NA
2D3c	Asphalt Roofing	NO	NO	NO	NO	NO	NO	NO	NO	NO
2D3d	Coating Applications	NA	T2	NA	NA	NA	NA	NA	NA	NA
2D3e	Degreasing	NA	T1	NA	NA	NA	NA	NA	NA	NA
2D3f	Dry Cleaning	NA	T2	NA	NA	NA	NA	NA	NA	NA
2D3g	Chemical Products	NA	T2	NA	NA	NA	NA	NA	NA	NA
2D3h	Printing	NA	T1	NA	NA	NA	NA	NA	NA	NA
2D3i	Creosotes[5]	NO	NO	NO	NO	NO	NO	NO	NO	NO
2D3i	Organic Solvent-borne Preservatives	NA	T2	NA	NA	NA	NA	NA	NA	NA
2D3i	Aircraft De-icing	NA	T2	NA	NA	NA	NA	NA	NA	NA
2G4	Tobacco	T2	T2	NA	T2	T2	T2	T2	T2	T2
2G4	Fireworks	T2	NA	T2	NA	T2	T2	T2	NA	T2
2H1	Pulp and Paper Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO
2H2	Food and Beverages Industry	NA	T2	NA	NA	NA	NA	NA	NA	NA
2H3	Other Industrial Processes	NO	NO	NO	NO	NO	NO	NO	NO	NO
2I	Wood Processing	NO	NO	NO	NO	NO	NO	NO	NO	NO
2J	Production of POPs	NO	NO	NO	NO	NO	NO	NO	NO	NO
2K	Consumption of POPs and Heavy Metals	NO	NO	NO	NO	NO	NO	NO	NO	NO
2L	Other Production, Consumption, Storage, Transportation, or Handling of Bulk Products	NO	NO	NO	NO	NO	NO	NO	NO	NO

[1] Cement Production was operational until 2011 and used Tier 3 and Tier 1 methodology.
[2] Fertiliser Production (2B10a) was operational until 2001 and used Tier 3 methodology (NO_x only).
[3] Diatomite Production was operational until 2004 and used Tier 3 methodology (NO_x only).
[4] Iron Production was operational from 2014 to 2016 and used Tier 2 methodology for all pollutants except HCB which used Tier 1 methodology.
[5] Creosotes were imported until 2011 and used Tier 2 methodology.

Table 4.2 Overview table POPs (NA – not available, NO – not occurring).

Sector		POPs			
		Dioxin	PAH	HCB	PCB
2A1	Cement Production	NO	NO	NO	NO
2A2	Lime Production	NO	NO	NO	NO

Sector		POPs			
		Dioxin	PAH	HCB	PCB
2A3	Glass Production	NO	NO	NO	NO
2A5a	Quarrying and Mining of Minerals other than Coal	NA	NA	NA	NA
2A5b	Construction and Demolition	NA	NA	NA	NA
2A5c	Storage, Handling, and Transport of Mineral Products	NO	NO	NO	NO
2A6	Other Mineral Products (Mineral Wool)	T1	NA	NA	NA
2B1	Ammonia Production	NO	NO	NO	NO
2B2	Nitric Acid Production	NO	NO	NO	NO
2B3	Adipic Acid Production	NO	NO	NO	NO
2B5	Carbide Production	NO	NO	NO	NO
2B6	Titanium Dioxide Production	NO	NO	NO	NO
2B7	Soda Ash Production	NO	NO	NO	NO
2B10a	Diatomite	NO	NO	NO	NO
2B10a	Fertiliser	NO	NO	NO	NO
2B10b	Storage, Handling, and Transport of Chemical Products	NO	NO	NO	NO
2C1	Iron and Steel Production	NO	NO	NO	NO
2C2	Ferroalloys Production	T3	T3	NA	NA
2C3	Primary Aluminium Production	T2/T3	T2/T3	NA	NA
2C3	Secondary Aluminium Production	T3	NA	T2	NA
2C4	Magnesium Production	NO	NO	NO	NO
2C5	Lead Production	NO	NO	NO	NO
2C6	Zinc Production	NO	NO	NO	NO
2C7a	Copper Production	NO	NO	NO	NO
2C7b	Nickel Production	NO	NO	NO	NO
2C7c	Capacitor Production	NO	NO	NO	NO
2C7d	Storage, Handling, and Transport of Metal Products	NO	NO	NO	NO
2D3a	Domestic Solvent Use Including Fungicides	NA	NA	NA	NA
2D3b	Road Paving with Asphalt	T2	NA	NA	NA
2D3c	Asphalt Roofing	NO	NO	NO	NO
2D3d	Coating Applications	NA	NA	NA	NA
2D3e	Degreasing	NA	NA	NA	NA
2D3f	Dry Cleaning	NA	NA	NA	NA
2D3g	Chemical Products	NA	NA	NA	NA
2D3h	Printing	NA	NA	NA	NA
2D3i	Creosotes	NO	NO	NO	NO
2D3i	Organic Solvent-borne Preservatives	NA	NE	NA	NA
2D3i	Aircraft De-icing	NA	NA	NA	NA
2G4	Tobacco	T2	T2	NA	NA
2G4	Fireworks	NA	NA	T3	NA
2H1	Pulp and Paper Industry	NO	NO	NO	NO
2H2	Food and Beverages Industry	NA	NA	NA	NA
2H3	Other Industrial Processes	NO	NO	NO	NO
2I	Wood Processing	NO	NO	NO	NO
2J	Production of POPs	NO	NO	NO	NO
2K	Consumption of POPs and Heavy Metals	NO	NO	NO	NO
2L	Other Production, Consumption, Storage, Transportation, or Handling of Bulk Products	NO	NO	NO	NO

Table 4.3 Overview table heavy metals (NA – not available, NO – not occurring).

Sector		Heavy Metals								
		Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
2A1	Cement Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2A2	Lime Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2A3	Glass Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2A5a	Quarrying and Mining of Minerals other than Coal	NA	NA	NA	NA	NA	NA	NA	NA	NA
2A5b	Construction and Demolition	NA	NA	NA	NA	NA	NA	NA	NA	NA
2A5c	Storage, Handling, and Transport of Mineral Products	NO	NO	NO	NO	NO	NO	NO	NO	NO
2A6	Other Mineral Products (Mineral Wool)	NA	NA	NA	NA	NA	NA	NA	NA	NA
2B1	Ammonia Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2B2	Nitric Acid Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2B3	Adipic Acid Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2B5	Carbide Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2B6	Titanium Dioxide Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2B7	Soda Ash Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2B10a	Diatomite	NO	NO	NO	NO	NO	NO	NO	NO	NO
2B10a	Fertiliser	NO	NO	NO	NO	NO	NO	NO	NO	NO
2B10b	Storage, Handling, and Transport of Chemical Products	NO	NO	NO	NO	NO	NO	NO	NO	NO
2C1	Iron and Steel Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2C2	Ferroalloys Production	T3	T3	T3	T3	T3	T3	T3	NA	T3
2C3	Primary Aluminium Production	T3	T3	NA	T3	T3	T3	T3	NA	T3
2C3	Secondary Aluminium Production	NA	NA	NA	NA	NA	NA	NA	NA	NA
2C4	Magnesium Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2C5	Lead Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2C6	Zinc Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2C7a	Copper Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2C7b	Nickel Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2C7c	Capacitor Production	NO	NO	NO	NO	NO	NO	NO	NO	NO
2C7d	Storage, Handling, and Transport of Metal Products	NO	NO	NO	NO	NO	NO	NO	NO	NO
2D3a	Domestic Solvent Use Including Fungicides	NA	NA	NA	NA	NA	NA	NA	NA	NA
2D3b	Road Paving with Asphalt	NA	NA	NA	NA	NA	NA	NA	NA	NA
2D3c	Asphalt Roofing	NO	NO	NO	NO	NO	NO	NO	NO	NO
2D3d	Coating Applications	NA	NA	NA	NA	NA	NA	NA	NA	NA
2D3e	Degreasing	NA	NA	NA	NA	NA	NA	NA	NA	NA
2D3f	Dry Cleaning	NA	NA	NA	NA	NA	NA	NA	NA	NA
2D3g	Chemical Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
2D3h	Printing	NA	NA	NA	NA	NA	NA	NA	NA	NA
2D3i	Creosotes	NO	NO	NO	NO	NO	NO	NO	NO	NO
2D3i	Organic Solvent-borne Preservatives	NA	NA	NA	NA	NA	NA	NA	NA	NA
2D3i	Aircraft De-icing	NA	NA	NA	NA	NA	NA	NA	NA	NA
2G4	Tobacco	T2	T2	T2	T2	T2	T2	T2	T2	T2
2G4	Fireworks	T3	T2	T2	T2	T2	T2	T2	NA	T2
2H1	Pulp and Paper Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO
2H2	Food and Beverages Industry	NA	NA	NA	NA	NA	NA	NA	NA	NA

Sector		Heavy Metals								
		Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
2H3	Other Industrial Processes	NO	NO	NO	NO	NO	NO	NO	NO	NO
2I	Wood Processing	NO	NO	NO	NO	NO	NO	NO	NO	NO
2J	Production of POPs	NO	NO	NO	NO	NO	NO	NO	NO	NO
2K	Consumption of POPs and Heavy Metals	NO	NO	NO	NO	NO	NO	NO	NO	NO
2L	Other Production, Consumption, Storage, Transportation, or Handling of Bulk Products	NO	NO	NO	NO	NO	NO	NO	NO	NO

Table 4.4 shows which subsectors in IPPU are key categories for which air pollutants. A key category is one that is prioritised within the national inventory system because it is significantly important for one or a number of air pollutants in a country's national inventory of air pollutants in terms of the absolute level, the trend, or the uncertainty in emissions (EEA, 2023). Categories whose cumulative percentage contribution is greater than 80% should be identified as key.

Table 4.4 Key categories for air pollutants within IPPU.

SO_x, NO_x, NH_3, NMVOC, PM, BC, and CO			
	1990	2023	Trend
2A5a Quarrying and Mining of Minerals other than Coal	$PM_{2.5}$, PM_{10}, TSP	PM_{10}, TSP	$PM_{2.5}$, PM_{10}, TSP
2A5b Construction and Demolition	$PM_{2.5}$, PM_{10}, TSP	$PM_{2.5}$, PM_{10}, TSP	$PM_{2.5}$, PM_{10}, TSP
2C2 Ferroalloys Production	NO_x, SO_x, $PM_{2.5}$, PM_{10}	NO_x, $PM_{2.5}$	NO_x
2C3 Aluminium Production	$PM_{2.5}$, PM_{10}, CO	NO_x, SO_x, $PM_{2.5}$, PM_{10}, TSP, BC, CO	NO_x, SO_x $PM_{2.5}$, PM_{10}, TSP, BC, CO
2D3a Domestic Solvent Use Including Fungicides	NMVOC	NMVOC	NMVOC
2D3d Coating Applications	NMVOC	NMVOC	
2H2 Food and Beverages Industry		NMVOC	NMVOC
Persistent Organic Pollutants (POPs)			
	1990	**2023**	**Trend**
2C2 Ferroalloys Production		PCDD/F, PAH4	PCDD/F, PAH4
2C3 Aluminium Production		PAH4, HCB	PAH4
2G Other Product Use (Fireworks, tobacco)	HCB	HCB	HCB
Heavy Metals (HMs)			
	1990	**2023**	**Trend**
2C3 Aluminium Production	Cd, As, Cr, Ni, Zn	Pb, Cd, As, Cr, Ni, Zn	Pb, Cd, As, Cr, Cu, Ni, Zn
2G Other Product Use (Fireworks, Tobacco)	Pb		Pb, Cu

4.2 General Methodology

Methodology is generally based on the most recent EMEP/EEA air pollutant emission inventory Guidebook (EEA, 2023). In most cases, emissions are calculated by multiplying the quantities of production or product use with pollutant-specific emissions factors. Emissions factors are also taken from the Standardized Toolkit for Identification and Quantification of Releases of Dioxins, Furans and Other Unintentional POPs (UNEP, 2003), *Utslipp til luft av dioksiner I Norge* (Statistics Norway, 2002), the 2006 IPCC Guidelines for Greenhouse Gas Inventories (IPCC, 2006) as well as plant-specific emission factors derived from direct measurements at the plants. Activity data is collected from data reported under the EU ETS (as per Directive 2003/87/EC of the European Parliament and of the

Council), Statistics Iceland (*Hagstofa Íslands*) (SI), Green Accounting, Icelandic Road and Coastal Administration (*Vegagerðin*) (IRCA) or directly from the operators. Detailed, activity-specific methodology for emission estimates is described for each subsector. Work is underway to harmonise this reporting with data reported under the E-PRTR Regulation (Regulation (EC) No 166/2006).

4.3 Mineral Industry (NFR 2A)

4.3.1 Cement Production (NFR 2A1)

The single cement plant in Iceland produced cement from shell sand and rhyolite in a rotary kiln using a wet process. The raw material calcium carbonate, which came from shell sand, was calcinated in the production process. The resulting calcium oxide was heated to form clinker and then crushed to form cement.

The production at the cement plant in Iceland slowly decreased after 2000. The construction of the *Kárahnjúkar Hydropower Plant* (building time from 2002 to 2007) along with increased activity in the construction sector (from 2003 to 2007) increased demand for cement, and the production at the cement plant increased again between 2004 and 2007, although most of the cement used in the country was imported. In 2011, clinker production at the plant was 69% less than in 2007, due to the collapse of the construction sector. Late 2011 the plant ceased operation.

4.3.1.1 Activity Data

Process specific data on cement production, clinker production and amounts of coal were collected by the Icelandic Environment and Energy Agency (*Umhverfis- og orkustofnun*) (IEEA) directly from the cement production plant.

4.3.1.2 Emission Factors

Emission factor for dioxin is taken from the Toolkit for Identification and Quantification of Dioxin and Furan Releases (UNEP, 2003). The factor applies for wet kilns, with ESP/FF temperature < 200°C and is 0.05 µg I-TEQ/t cement. The HCB emission factor is based on the chapter Sources of HCB emissions from the Emission Inventory Guidebook (EEA, 2007). Emission factors for TSP, PM_{10}, and $PM_{2.5}$ are based on measurements, and the BC emission factor (3% of $PM_{2.5}$) is based on the 2023 EMEP/EEA Guidebook. Emission estimates for SO_2 are based on measurements from the plant but include both process-related and combustion-related emissions, and the total SO_2 emissions are reported under 2A1 Cement Production. Emissions of PAH, NO_x, CO, and NMVOC originate mainly from combustion and are reported under 1A2f (Stationary Combustion in Manufacturing Industries and Construction: Non-metallic Minerals); process-related emissions for those pollutants are not applicable. All emission factors used are summarised in the table below.

Table 4.5 Emission factors for 2A1 Cement Production.

	Dioxin [µg/t I-TEQ]	HCB [µg/t]	TSP [kg/kt]	PM_{10} [kg/kt]	$PM_{2.5}$ [kg/kt]	BC % of $PM_{2.5}$
Cement Production	0.050	11	220	200	100	3.0%

4.3.1.3 Recalculations and Improvements

Recalculations for the 2025 Submission

No category-specific recalculations were done for the 2025 submission.

Recalculations for the 2024 Submission

No category-specific recalculations were done for the 2024 submission.

4.3.1.4 Planned Improvements

No improvements are currently planned for this subsector.

4.3.2 Lime Production (NFR 2A2)

This activity does not occur in Iceland.

4.3.3 Glass Production (NFR 2A3)

This activity does not occur in Iceland.

4.3.4 Quarrying and Mining of Minerals other than Coal (NFR 2A5a)

4.3.4.1 Activity Data

The activity data was retrieved from the IRCA who provided a timeseries from 1999 of aggregates with used by the IRCA for road construction, divided by the nature of the deposit. Currently no data is available prior to 1999, so the average 1999-2001 has been used for the years 1990-1999. Data from the IRCA was also used to estimate which proportion of aggregate production is used by others (municipalities, private companies, etc.).

4.3.4.2 Emission Factors

Only particulate matter emissions (TSP, PM_{10}, and $PM_{2.5}$) arise from this category. The methodology follows Tier 2 technology-specific approach of the 2023 EMEP/EEA Guidebook and divides the emission into drilling and blasting, material processing, internal transport, material handling operations, and wind erosion from stockpiles.

The parameters to calculate the emission factors are taken from Section 3.3, Chapter 2.A.5.a of the Guidebook. Parameters concerning the nature of the quarries within Iceland were retrieved from the IRCA. Where country-specific parameters are not available, the sample parameters based on French context from the 2023 EMEP/EEA Guidebook are used. Average values are used as an input in the spreadsheet model provided by the 2023 EMEP/EEA Guidebook to calculate the emission factors used. All quarries in Iceland are small quarries (yearly production less than 100 kt). No data is available on the amount of recycled aggregate, produced from Construction and Demolition residues. Therefore, the emissions from recycled aggregate are not estimated. No data is available on the distance travelled by dumpers within the quarries and the emissions from that part are therefore not estimated. Table 4.6 shows the emission factors used that show the emissions per tonne of aggregate production.

Table 4.6 Emission factors used within 2A5a Quarrying and Mining of Minerals.

Emission Factors – Quarrying and Mining (2A5a)	Drilling and Blasting	Material Processing		Internal Transport	Material Handling Operation		Wind Erosion from Stockpiles	
	Crushed Rock	Crushed Rock	Sand & Gravel		Crushed Rock	Sand & Gravel	Crushed Rock	Sand & Gravel
TSP [g/t]	1.23	10.5	5.73	NE	10.7	2.29	41.3	20.7
PM_{10} [g/t]	0.647	3.80	2.17	NE	5.04	1.08	20.7	10.3
$PM_{2.5}$ [g/t]	0.637	0.685	0.577	NE	0.764	0.164	8.26	4.13

4.3.4.3 Recalculations and Improvements

Recalculations for the 2025 Submission.

No category-specific recalculations were done for the 2025 submission.

Activity data for 2023 was not yet provided by IRCA and is preliminarily assumed to be identical to the 2022 value. Production values for 2021 and 2022 are, in turn, estimated on the basis of the average production between 2015 and 2019, with a 15% yearly increase.

The estimation will be recalculated, subject to availability of production data, for future submissions.

Recalculations for the 2024 Submission

The recalculations in 2A5a for the 2024 submission were caused by an update in the activity data (see Table 4.7). For the previous submission, the IRCA did not manage to provide the IEEA (at that time EAI) with their production data for 2021, as such, a three-year average was applied instead. For the 2024 submission, the production data for 2021 was still unavailable, but the IRCA made an expert judgement and estimated the 2021 production to be the average of the production between 2015-2019 multiplied by 1.15 (2020 was excluded in the five-year-average as it was not accurate enough according to the IRCA). This estimation is only temporary and will be replaced by more accurate data for future submissions.

Table 4.7 Recalculations in 2A5a Quarrying and Mining of Minerals Other Than Coal between submissions.

2A5a Quarrying and Mining of Minerals Other Than Coal	2021
2023 submission TSP [kt]	0.074
2024 submission TSP [kt]	0.146
Change relative to the 2023 submission TSP [%]	96%
2023 submission PM_{10} [kt]	0.035
2024 submission PM_{10} [kt]	0.069
Change relative to the 2023 submission PM_{10} [%]	96%
2023 submission $PM_{2.5}$ [kt]	0.012
2024 submission $PM_{2.5}$ [kt]	0.024
Change relative to the 2023 submission $PM_{2.5}$ [%]	96%

4.3.4.4 *Planned Improvements*

For future submissions, the production data from the IRCA for 2020 to 2023 will be updated with more accurate data.

4.3.5 Construction and Demolition (NFR 2A5b)

4.3.5.1 *Activity Data*

To retrieve activity data, the number of buildings per construction year, subdivided by the type of houses (terraced, detached, semi-detached, apartment buildings, non-residential buildings) is obtained from the Housing and Construction Authority (*Húsnæðis- og mannvirkjastofnun, HMS*). Data about road construction is retrieved from the IRCA for the years since 2003 and is estimated as average 2003-2011 for the years 1990-2002.

4.3.5.2 *Emission Factors*

The methodology follows Tier 1 of the 2023 EMEP/EEA Guidebook. Default values from the Guidebook are used for the duration of construction (houses 0.5, apartment buildings 0.75, non-residential 0.83, and roads 1.00 years), for the control efficiency (houses 0, apartment buildings 0, non-residential 0.5, roads 0.5), silt content is assumed to be 20% and the Thornthwaite Precipitation-Evaporation Index was calculated with precipitation and temperature data recorded at a weather station in Reykjavík. Only particulate matter emissions, that is TSP, PM_{10}, and $PM_{2.5}$ arise from this category.

The implementation of a Tier 3 method is not feasible since it is not possible to source any of the required data. US EPA provides methodologies with AP-42 that require very detailed local data. The 2023 EMEP/EEA Guidebook states that collection of such data is likely to be possible only for individual large point sources. This data is not available for any Construction and Demolition sites in Iceland.

4.3.5.3 *Recalculations and Improvements*

Recalculations for the 2025 Submission

A change of assignment of buildings categories data provided by the Housing and Construction Authority to types of construction defined in chapter 2.A.5.b, section 3.2, of 2023 EMEP/EEA Guidebook, as well as updated data from IRCA regarding paved road length for the year 2021 necessitated a recalculation for the period from 1990 to 2005, excluding 1993, 1997, 2001, and for the period from 2013 to 2021.

Table 4.8 Recalculations in 2A5b Construction and Demolition between submissions

2A5b Construction and Demolition	1990	1995	2000	2002	2005	2015	2020	2021
2024 submission TSP [kt]	3.9098	4.86266	4.2791	3.8675	3.1030	0.9612	2.0707	2.2663
2025 submission TSP [kt]	3.9111	4.86270	4.2803	3.8716	3.1040	0.9620	2.0833	2.4368
Change relative to the 2024 submission TSP [kt]	0.0013	0.00004	0.0011	0.0041	0.0010	0.0009	0.0126	0.1706
Change relative to the 2024 submission TSP [%]	0.033%	0.001%	0.027%	0.107%	0.031%	0.090%	0.607%	7.528%
2024 submission PM10 [kt]	1.1691	1.45373	1.2801	1.1566	0.9288	0.2877	0.6200	0.6783

2A5b Construction and Demolition	1990	1995	2000	2002	2005	2015	2020	2021
2025 submission PM10 [kt]	1.1695	1.45375	1.2805	1.1579	0.9291	0.2879	0.6237	0.7293
Change relative to the 2024 submission PM10 [kt]	0.0004	0.00001	0.0003	0.0012	0.0003	0.0003	0.0038	0.0510
Change relative to the 2024 submission PM10 [%]	0.033 %	0.001 %	0.027 %	0.107 %	0.031 %	0.091 %	0.609 %	7.514 %
2024 submission PM2.5 [kt]	0.1169	0.14537	0.1280	0.1157	0.0929	0.0288	0.0620	0.0678
2025 submission PM2.5 [kt]	0.1169	0.14537	0.1280	0.1158	0.0929	0.0288	0.0624	0.0729
Change relative to the 2024 submission PM2.5 [kt]	0.0000	0.00000	0.0000	0.0001	0.0000	0.0000	0.0004	0.0051
Change relative to the 2024 submission PM2.5 [%]	0.033 %	0.001 %	0.027 %	0.107 %	0.031 %	0.091 %	0.609 %	7.514 %

Moreover, activity data for 2023, new road or lane construction length, was not yet provided by IRCA and is preliminarily assumed to be identical to the year 2022 value.

The estimation will be recalculated, subject to availability of production data, for future submissions.

Recalculations for the 2024 Submission

No category-specific recalculations were done for the 2024 submission.

4.3.5.4 Planned Improvements

No improvements are currently planned for this subsector.

4.3.6 Storage, Handling, and Transport of Mineral Products (NFR 2A5c)

This emissions within the sector are insignificant and therefore not estimated.

4.3.7 Mineral Wool Production (NFR 2A6)

There is one mineral wool production plant in operation in Iceland. Although it is an activity falling under Annex I of Directive 2003/87/E (ETS Directive), it is excluded from the EU ETS scheme following the conditions described in Article 27 of the ETS Directive. The operator submits annual emission reports for GHGs to the IEEA, using the same template as the companies reporting within the EU ETS scheme.

4.3.7.1 Activity Data

Activity data for the mineral wool plant originates from the annual emission reports mentioned above, as well as annual Green Accounting reports.

4.3.7.2 Emission Factors

Emissions of dioxins are calculated from the amount (weight) of electrodes used in the production process. The emission factor is taken from *Utslipp til luft av dioksiner i Norge* (Statistics Norway, 2002). PAH emissions are not applicable. Emissions of SO_2 are calculated using the S content of the electrodes used. Emission Factors of CO, NH_3, and PM_{10} were calculated based on measurements at the factory. In the case of NH_3 and PM_{10}, measurements were available every second year from 2002-2017. For those years, the actual measurements were used to derive a year-specific emission factor. For the years in between, the average of the emission factor of the previous year and of the following year was used. For all years prior to 2002, the average IEF of measurements 2002, 2004, 2006, 2009, 2011, 2013, and 2015 was used. Since 2018 yearly total emissions for NH_3 are communicated by the company directly. TSP and $PM_{2.5}$ were calculated from PM_{10} using the TSP vs. PM_{10} vs. $PM_{2.5}$ ratios given in Table 3.5 in Chapter 2.A.3 in the EMEP/EEA Guidebook (EEA, 2023). BC was calculated using the ratio to $PM_{2.5}$ given in the EMEP/EEA Guidebook (EEA, 2023). NO_x and NMVOC emissions originate from combustion and are reported under 1A2f. Table 4.9 shows the emission factors used for Mineral Wool Production.

Table 4.9 Emission factors for Mineral Wool Production for the year 2023.

	NH_3 [t/kt]	CO [t/kt]	TSP % of PM_{10}	PM_{10} [t/kt]	$PM_{2.5}$ % of TSP	BC % of $PM_{2.5}$	Dioxin [µg/t I-TEQ/t]
Mineral Wool Production	1.83	0.31	114%	0.488	77.6%	2.00%	1.60

4.3.7.3 Recalculations and Improvements

Recalculations for the 2025 Submission

No category-specific recalculations were done for the 2025 submission.

Recalculations for the 2024 Submission

No category-specific recalculations were done for the 2024 submission.

4.3.7.4 Planned Improvements

No improvements are currently planned for this subsector.

4.4 Chemical Industry (NFR 2B)

4.4.1 Ammonia Production (NFR 2B1)

Ammonia was produced amongst other fertilisers during the period 1990-2001. The associated emissions are marked as Included Elsewhere under 2B1 Ammonia Production and are included in the emissions reported under 2B10a other: Fertiliser Production. The emission estimation methodology associated with Ammonia Production is also described there.

4.4.2 Nitric Acid Production (NFR 2B2)

This activity does not occur in Iceland.

4.4.3 Adipic Acid Production (NFR 2B3)

This activity does not occur in Iceland.

4.4.4 Carbide Production (NFR 2B5)

This activity does not occur in Iceland.

4.4.5 Titanium Dioxide Production (NFR 2B6)

This activity does not occur in Iceland.

4.4.6 Soda Ash Production (NFR 2B7)

This activity does not occur in Iceland. Emissions from the use of soda ash in the silica (diatomite) industry (NFR 2B10a; reported until 2004) are reported under that NFR code.

4.4.7 Chemical Industry: Other (NFR 2B10a)

The only chemical industry that existed in Iceland was the production of fertiliser and diatomite. The fertiliser production plant ceased its operations in 2001, and the diatomite production plant shut down in 2004. This industry is not considered to be a source of POPs nor heavy metals.

The fertiliser production plant was operational until there was an explosion at the site in 2001. In the early days of the factory, only one type of fertiliser was produced (a nitrogen fertiliser), whereas at the end of its production phase it was producing over 20 different types of fertilisers. CO_2 and CH_4 emissions are considered insignificant, as the fertiliser plant used H_2 produced on-site by electrolysis. Methodology NO_x and N_2O emissions were reported directly by the factory to the IEEA.

4.4.7.1 Activity Data

When the fertiliser production plant was operational it reported its emissions of NO_X and N_2O to the IEEA. At the diatomite production plant, silica containing sludge was burned to remove organic material. Emissions of CO_2 and NO_X were estimated based on the C-content and N-content of the sludge provided by the operator. Activity data for both industries are presented in Table 4.10.

Table 4.10 Production data for 1990, 1995, and 2000 for fertiliser and silica production [kt].

	1990	1995	2000	Notes
Fertiliser Production [kt]	63.7	58.5	41.5	Facility closed in 2001
Diatomite Production [kt]	26.1	28.1	27.6	Facility closed in 2004

4.4.7.2 Emission Factors

For diatomite production, emissions of CO_2 and NO_x were estimated based on the C-content and N-content of the sludge provided by the operator. Average NO_X implied EF for the period 1990-2004 was 15.6 t NO_x/kt Si production. Other emissions from soda ash use were not estimated and are considered to be small.

For the fertiliser production, the average implied EF for NO_x for the period 1990-2001 was 0.296 t NO_x/kt fertiliser production. As there is no data readily available about the types of fertilisers produced at the time, no other pollutants were estimated for this industry.

4.4.7.3 Recalculations and Improvements

Recalculations for the 2025 Submission

No category-specific recalculations were done for the 2025 submission.

Recalculations for the 2024 Submission

No category-specific recalculations were done for the 2024 submission.

4.4.7.4 Planned Improvements

No improvements are currently planned for this subsector.

4.5 Metal Production (NFR 2C)

4.5.1 Iron and Steel Production (NFR 2C1)

From 2014 to 2016, a secondary steelmaking facility was operating. It produced steel from scrap iron and steel from the aluminium smelters. Carbonates and slags were added to the smelting process, which occurred in an electric arc furnace.

4.5.1.1 Activity Data

Activity data used to estimate emissions from secondary steel production are total steel production, which is obtained from yearly Green Accounting reports submitted by the facility to the IEEA.

4.5.1.2 Emission Factors

All emissions are calculated using Tier 2 emission factors for electric arc furnaces (Table 3.15 in Chapter 2.C.1 from the 2023 EMEP/EEA Guidebook (EEA, 2023)), except for HCB for which there is no Tier 2 estimate. In this case we used the Tier 1 emission factor, which is unrelated to technology. It should be noted that Tier 1 and Tier 2 exclude condensable PM.

4.5.1.3 Recalculations and Improvements

Recalculations for the 2025 Submission

No category-specific recalculations were done for the 2025 submission.

Recalculations for the 2024 Submission

No category-specific recalculations were done for the 2024 submission.

4.5.1.4 Planned Improvements

No improvements are currently planned for this subsector.

4.5.2 Ferroalloys Production (NFR 2C2)

Two factories produce ferroalloys in Iceland. One company has been producing FeSi75 since 1979 and another one started production of ≥98.5% pure silicon metal in 2018. A third company was operating between 2016-2017 producing silicon metal but has stopped production in 2017. Both active operators are under the EU Emission Trading Scheme (as per Directive 2003/87/EC).

In both factories, raw ore, carbon material and slag forming materials are mixed and heated to high temperatures for reduction and smelting. For the production of FeSi75 electric (submerged) arc furnaces with consumable Söderberg electrodes are used. The furnaces are semi-covered. The other factory is using submerged arc furnaces using pre-baked graphite electrodes.

Waste gases are cleaned via dry absorption units (bag-house filters). When the temperature inside the units gets too high, emergency bypass of the bag-house filters is induced. The operating permit for the ferrosilicon plant contains provisions on the maximal duration of such incidences (in percent over the year).

4.5.2.1 Activity Data

The consumption of reducing agents and electrodes is collected by the IEEA directly from the plants and provided by the plants through annual emission reports submitted within the EU ETS. Activity data for raw materials and products are given in Table 4.11.

Table 4.11 Raw materials use [kt] and production [kt], ferrosilicon and silicon production.

	1990	1995	2000	2005	2010	2015	2020	2022	2023
Electrodes	3.83	3.88	5.73	6.00	4.79	4.86	4.82	5.37	4.66
Coking Coal	45.1	52.4	73.2	86.9	96.1	115	129	165	128
Coke Oven Coke	24.9	30.1	46.6	42.6	30.3	30.9	23.5	21.7	19.8
Charcoal	NA	NA	NA	2.08	NA	NA	1.67	9.83	14.02
Wood	16.7	7.73	16.2	15.6	11.3	27.2	59.9	100.3	72
Limestone	NA	NA	0.469	1.62	0.497	2.19	0.950	3.01	2.08
Production (FeSi, Si)	62.8	71.4	109	111	102	118	116	144	128
Microsilica	14.0	15.9	22.7	25.8	18.1	22.2	30.3	38.4	25.3
Slag	NA	NA	NA	NA	NA	NA	NA	NA	NA

4.5.2.2 Emission Factors

FeSi Production: In 2011, emissions of dioxin and PAH4 (BaP, BaF, BkF, IPy) were measured at the ferrosilicon plant. These measurements were used to obtain plant-specific emission factors per tonne of production that were used for the whole time series. Emission factors for CO, NO_X, and NMVOC were taken from Table 8.18 of the Best Available Techniques Reference (BREF) document for the non-ferrous metals industries (Cusano, et al., 2017). In the case where a range was given, the highest value of the range was chosen. The emission factors are presented in Table 4.13. Sulphur emissions were calculated from S-content of the reducing agents for the time period 1990-2002 and were taken directly from Green Accounting reports submitted yearly by the factory since 2003.

Emissions of particulates for the period 1990-2011 are calculated by adding up the emissions from filtered exhaust and the amount of particulates that are released during emergency bypass of the exhaust. The emission factor for filtered exhaust is taken from Table 8.12 of the BREF document for Best Available Techniques for the non-ferrous metals industries (Cusano, et al., 2017). It is 5 mg/Nm^3. This factor is multiplied with the plant-specific yearly amount of exhaust (in Nm^3). To calculate the bypass emissions, first the total microsilica, fine (collected and sold e.g. to cement producers) and coarse (cyclone dust) are added up and divided by the hours per year (8,760 hrs.) to get microsilica production rate per hour. This is known for all years since 2005. The production rate is then multiplied with the bypass time per furnace and the ratio of the FeSi production per furnace of the total FeSi production each year. The bypass rate is known since 2002 and taken from Green Accounting reports, submitted in accordance with Regulation No 851/2002. The bypass rate for previous years was calculated as the average of 2002-2006. Microsilica (fine and coarse) production rate and production per furnace were extrapolated for the years 1990 to 2001 based on total produced FeSi at the plant each year. Since 2012, TSP are obtained from the yearly Green Accounting report submitted to IEEA. Emissions factors of PM_{10} and $PM_{2.5}$ relative to TSP are Tier 1 default values from the 2023 EMEP/EEA Guidebook (EEA, 2023); this excludes condensable PM. The emission factor for BC is taken from (Aasestad, 2013) in accordance with the Norwegian IIR (Norwegian Environment Agency, 2020).

Several heavy metals (As, Cd, Cr, Cu, Hg, Pb, and Zn) were measured in silicon dust in the ferrosilicon plant in 2014 and 2019. These measurements were used in combination with the emitted TSP to calculate heavy metals emissions since 1990. Hg was found to be below detectability (i.e., < 9 mg/kg silicon dust in 2014 and <0.1 mg/kg in 2019) in all samples. Prior to 2014 the values from the 2014 measurements are used, after 2019 the values from the 2019 measurements are used and between 2014 and 2019 a linear interpolation of the IEF from 2014 and 2019 was done. The heavy metal contents in silica dust are shown in Table 4.12.

Table 4.12 Heavy metal contents in silica dust in 2014 and 2019 [mg metal / kg dust].

	As [mg/kg]	Cd [mg/kg]	Cr [mg/kg]	Cu [mg/kg]	Hg [mg/kg]	Pb [mg/kg]	Zn [mg/kg]
Content in silicon dust 2014	11.8	0.460	8.80	10.8	< 9	8.70	25.2
Content in silicon dust 2019	23.3	0.600	59.0	160.7	< 0.1	41.7	186.7

Si Production: Emission factors for filterable particulate matter, excluding condensables, are Tier 3 plant specific and for BC are Tier 1 default values as published in the 2023 EMEP/EEA Guidebook based on the ratio of BC to $PM_{2.5}$. The NO_X emission factor is taken from the BREF document on non-ferrous minerals (Cusano, et al., 2017). SO_2 emissions as well as emission of the heavy metals Pb, Cd, Cu, and Zn and dioxin are reported by the operator to the IEEA in the annual Green Accounting report. Emissions from the other pollutants are not estimated due to lack of available information in the EMEP/EEA Guidebooks and in the BREF document cited above.

All emission factors used for calculating emissions from FeSi and Si production are presented in Table 4.13.

Table 4.13 Emission factors from FeSi and Si production.

	NO_x [kg/t]	NMVOC [kg/t]	CO [kg/t]	TSP [kg/t]	PM_{10}	$PM_{2.5}$
FeSi	11	0.045	2.5	0.49	85% of TSP	60% of TSP
Si	13	NA	NA	0.45	0.45 kg/t	0.45 kg/t
	BC % of $PM_{2.5}$	**Dioxin [µg/t FeSi]**	**B(a)P [mg/t FeSi]**	**B(b)F [mg/t FeSi]**	**B(k)F [mg/t FeSi]**	**IPy [mg/t FeSi]**
FeSi	0.23%	0.114	2.79	102.22	29.68	9.39
Si	10%	8.22	NA	NA	NA	NA

4.5.2.3 Recalculations

Recalculations for the 2025 Submission

One active facility submitted updated measurement values for dioxin, arsenic (As), and chromium (Cr) for the year 2022 in their Green Accounting report to the IEEA, necessitating an update of the reported totals for 2022 of these pollutants.

Table 4.14 Recalculations of dioxin, As, and Cr for Ferroalloys production.

2C2 Ferroalloys Production	2022
2024 submission Dioxin [g]	0.194
2025 submission Dioxin [g]	0.203
Change relative to the 2024 submission Dioxin [g]	0.009
Change relative to the 2024 submission Dioxin [%]	4%
2024 submission As [kg]	4.00
2025 submission As [kg]	1.52
Change relative to the 2024 submission As [kg]	-2.48
Change relative to the 2024 submission As [%]	-62%
2024 submission Cr [kg]	5.92
2025 submission Cr [kg]	3.85
Change relative to the 2024 submission Cr [kg]	-2.07
Change relative to the 2024 submission Cr [%]	-35%

Recalculations for the 2024 Submission

One change resulted in recalculations. The dioxin emissions from the Si plant were corrected which also changes the IEF. This led to recalculations for 2018-2021.

Table 4.15 Recalculations of dioxin for Ferroalloys production.

2C2 Ferroalloys Production	2018	2019	2020	2021
2023 Submission dioxin [g]	0.048	0.093	0.060	0.093
2024 Submission dioxin [g]	0.061	0.123	0.078	0.123
Change relative to the 2023 Submission dioxin	27%	33%	30%	32%

4.5.2.4 Planned Improvements

Work is underway to harmonise this reporting with the E-PRTR reports.

4.5.3 Primary Aluminium Production (NFR 2C3)

Aluminium is currently produced at three primary aluminium plants in Iceland. Best Available Technology (BAT) is used at all plants, i.e., closed prebake systems with point feeding of alumina, efficient process control, hoods covering the entire pot and efficient collection of air pollutants.

Primary Aluminium Production results in emissions of dioxins, PAH4, NO_X, CO, particulate matter, heavy metals, and SO_2. Emissions originate from the consumption of electrodes during the electrolysis process.

4.5.3.1 Activity Data

The IEEA collects annual process specific data from the three operators through EU ETS and Green Accounting reports. The total production of the three aluminium plants is given in Table 4.16.

Table 4.16 Primary Aluminium Production [kt].

	1990	1995	2000	2005	2010	2015	2020	2022	2023
Primary Al Production [kt]	88	100	226	272	819	857	831	840	866

4.5.3.2 Emission Factors

In 2011, emissions of dioxin were measured at one of the aluminium plants. The same plant also measured PAH4 in 2002 and in 2011, and the average emission factors from these two measurements were calculated. The measurements were used to obtain country specific emission factors per tonne of production that were used for the whole time series. Of the total pot gases 98.5% are collected and cleaned via dry adsorption unit. Thus, 1.5% of the pot gases leak unfiltered to the atmosphere. Both dioxin and PAH4 are below detection limit in the cleaned gas. Emission factors are derived from the concentration of dioxin and PAH4 in the raw gas. They are presented in Table 4.17 and used for two factories as country specific emission factors. In 2023 one plant had an updated operating licence and reported emissions from PAH4 and dioxin.

NO_x (for two plants) and CO (for all plants) are Tier 2 emission factor, taken from Table 3.2 of the 2023 EMEP/EEA Guidebook (EEA, 2023). Particulate matter was calculated from information on particulates per tonne of produced aluminium that the aluminium plants report in their Green Accounting reports submitted to the IEEA. Ratios of TSP:PM_{10}:$PM_{2.5}$ as well as the BC emission factor were also taken from the 2023 EMEP/EEA Guidebook. Green Accounting includes filterable PM, condensable PM is therefore excluded. Emissions of SO_2 are estimated from S-content of alumina and electrodes for the time prior to reporting of SO_2 emission in the Green Accounts (2003-2013, depending on the company), and from SO_2 emission calculations reported in the Green Accounting reports in the later years. One plant operating under an updated licence has an updated plant specific emission factor for NO_X and updated ratios for BC and $PM_{2.5}$. Emission factors are presented in Table 4.17.

Table 4.17 Emission factors, Primary Aluminium Production. CS: Country Specific, PS: Plant Specific, and GB: EMEP/EEA Guidebook.

	Dioxin [µg/t Al]	PAH4 [g/t Al]	B(a)P % of PAH4	B(b)F % of PAH4	B(k)F % of PAH4	IPy % of PAH4
Emission factors	CS: 0.0329 PS: 0.074	CS: 0.0189 PS: 0.022	CS: 13%	CS: 61%	CS: 18%	CS: 8.0%
	CO [kg/t Al]	**NO_x [kg/t Al]**	**TSP % of PM_{10}**	**$PM_{2.5}$ % of PM_{10}**	**BC % of $PM_{2.5}$**	
Emission factors	GB: 120	GB: 1.0 PS: 0.692	GB: 120%	GB: 80% PS: 40%	GB: 2.3% PS: 0.03%	

For the 2024 submission, heavy metal emissions from primary aluminium were reported for the first time. Implied emission factors were calculated from emissions reported from the updated operating license of one plant and applied as country specific emission factors. Emission factors for heavy metals are presented in Table 4.18.

Table 4.18 Emission factors for heavy metals, Primary Aluminium Production.

	As [g/t]	Cd [g/t]	Cr [g/t]	Cu [g/t]	Ni [g/t]	Pb [g/t]	Zn [g/t]
Emission factors	0.153	0.148	0.0989	0.163	1.98	0.198	4.94

4.5.3.3 Recalculations and Improvements

Recalculations for the 2025 Submission

Corrections to the calculations of $PM_{2.5}$ and BC emissions of two plants were applied in accordance with the ratios between TSP, PM_{10}, and $PM_{2.5}$, as derived from table 3.2 of the 2023 EMEP/EEA Guidebook. $PM_{2.5}$ and BC emissions of a third plant were recalculated based on the ratio between PM_{10} and $PM_{2.5}$ derived from measurements done in 2022. Recalculations of $PM_{2.5}$ and BC emission totals affect the entire timeline from 1990 to 2022.

Table 4.19 Recalculations for 2C3 Primary Aluminium Production.

2C3 Aluminium Production	1990	2000	2005	2010	2015	2020	2021	2022
2024 Submission $PM_{2.5}$ [kt]	0.04	0.07	0.09	0.19	0.20	0.17	0.18	0.20
2025 Submission $PM_{2.5}$ [kt]	0.04	0.09	0.13	0.33	0.33	0.31	0.32	0.33
Change relative to the 2024 Submission $PM_{2.5}$ [kt]	0.00	0.02	0.03	0.14	0.14	0.14	0.14	0.13
Change relative to the 2024 Submission $PM_{2.5}$ [%]	-0.31%	27.29%	35.76%	74.85%	69.92%	80.14%	77.55%	67.24%
2024 Submission BC [kt]	1.081E-5	0.0005	0.0008	0.0033	0.0032	0.0032	0.0032	0.0031
2025 Submission BC [kt]	1.078E-5	0.0009	0.0016	0.0066	0.0063	0.0064	0.0064	0.0062
Change relative to the 2024 Submission BC [kt]	-3.3E-08	0.0004	0.0008	0.0033	0.0031	0.0032	0.0032	0.0031
Change relative to the 2024 Submission BC [%]	-0.31%	96.59%	97.67%	99.55%	99.43%	99.67%	99.61%	99.35%

Recalculations for the 2024 Submission

Recalculations were made for the whole timeline due to several improvements. Mainly due to an updated operating permit of one plant resulting in plant specific emission factors. As well as an update to TSP:PM_{10}:$PM_{2.5}$ ratios since what was thought to be TSP reported by the plants was PM_{10}. Heavy metal emissions were added for the first time.

Table 4.20 Recalculations for 2C3 Primary Aluminum Production.

2C3 Aluminium Production	1990	1995	2000	2005	2010	2015	2020	2021
2023 Submission TSP [kt]	0.088	0.10	0.17	0.24	0.48	0.49	0.44	0.44
2024 Submission TSP [kt]	0.105	0.12	0.21	0.28	0.57	0.59	0.52	0.53
Change relative to the 2023 Submission TSP	20%	20%	20%	20%	20%	20%	20%	20%
2023 Submission PM_{10} [kt]	0.073	0.083	0.14	0.20	0.40	0.41	0.36	0.37
2024 Submission PM_{10} [kt]	0.088	0.100	0.17	0.24	0.48	0.49	0.44	0.44
Change relative to the 2023 Submission PM_{10}	20%	20%	20%	20%	20%	20%	20%	20%
2023 Submission $PM_{2.5}$ [kt]	0.059	0.067	0.116	0.157	0.32	0.33	0.29	0.30
2024 Submission $PM_{2.5}$ [kt]	0.035	0.040	0.070	0.094	0.19	0.20	0.17	0.18
Change relative to the 2023 Submission $PM_{2.5}$	-40%	-40%	-40%	-40%	-40%	-40%	-40%	-40%
2023 Submission BC [kt]	0.001347	0.001536	0.00267	0.00361	0.0073	0.0075	0.0067	0.0068
2024 Submission BC [kt]	0.000011	0.000012	0.00046	0.00080	0.0033	0.0032	0.0032	0.0032
Change relative to the 2023 Submission BC	-99%	-99%	-83%	-78%	-55%	-58%	-52%	-53%
2023 Submission NO_x [kt]	0.088	0.100	0.23	0.27	0.82	0.86	0.83	0.84
2024 Submission NO_x [kt]	0.061	0.069	0.17	0.22	0.76	0.80	0.77	0.77
Change relative to the 2023 Submission NO_x	-31%	-31%	-23%	-20%	-7.1%	-7.2%	-6.8%	-7.5%
2023 Submission PAH4 [kg]	1.7	1.9	4.3	5.2	15.5	16.2	15.7	15.8
2024 Submission PAH4 [kg]	2.0	2.2	4.8	5.8	16.1	16.9	16.3	16.5
Change relative to the 2023 Submission PAH4	17%	17%	13%	12%	4.1%	4.1%	3.9%	4.2%
2023 Submission BaP [kg]	0.22	0.25	0.57	0.69	2.06	2.16	2.09	2.10
2024 Submission BaP [kg]	0.26	0.30	0.64	0.76	2.14	2.24	2.17	2.19
Change relative to the 2023 Submission BaP	17%	17%	13%	12%	4.1%	4.1%	3.9%	4.2%
2023 Submission BbF[kg]	1.0	1.2	2.6	3.2	9.5	10.0	9.6	9.7
2024 Submission BbF [kg]	1.2	1.4	3.0	3.5	9.9	10.4	10.0	10.1
Change relative to the 2024 Submission BbF	17%	17%	13%	12%	4.1%	4.1%	3.9%	4.2%
2023 Submission BkF [kg]	0.30	0.34	0.76	0.92	2.8	2.9	2.8	2.8
2024 Submission BkF [kg]	0.35	0.40	0.86	1.02	2.9	3.0	2.9	2.9
Change relative to the 2023 Submission BkF	17%	17%	13%	12%	4.1%	4.1%	3.9%	4.2%
2023 Submission IPy [kg]	0.13	0.14	0.33	0.39	1.18	1.24	1.20	1.21
2024 Submission IPy [kg]	0.15	0.17	0.37	0.44	1.23	1.29	1.25	1.26
Change relative to the 2023 Submission Ipy	17%	17%	13%	12%	4.1%	4.1%	3.9%	4.2%
2023 Submission PCDD/F [g]	0.0029	0.0033	0.0074	0.0090	0.027	0.028	0.027	0.027
2024 Submission PCDD/F [g]	0.0065	0.0074	0.0144	0.0164	0.035	0.036	0.035	0.036
Change relative to the 2023 Submission PCDD/F	126%	126%	93%	83%	29%	29%	28%	30%

4.5.3.4 Planned Improvements

Work is underway to harmonise this reporting with the E-PRTR reports.

4.5.4 Secondary Aluminium Production (NFR 2C3)

Secondary Aluminium Production started in 2004. In 2012, a second facility opened. At the end of 2014 the facilities merged and only one production area is active now. The plant recycles aluminium skimmings and scrap aluminium from two primary aluminium plants by melting scrap metal in batches in a rotary kiln. The re-melt process is carried out under a layer of salt and the resulting salt slag traps part of the contaminants. The scrap aluminium is not treated with organic material such as paints, lacquers, oils, and greases prior to recycling and comes directly from the primary aluminium plants.

4.5.4.1 Activity Data

All activity data, consisting of produced secondary aluminium, is obtained in Green Accounting reports submitted yearly to the IEEA, see Table 4.21.

Table 4.21 Secondary Aluminium Production [kt].

	1990	1995	2000	2005	2010	2015	2020	2022	2023
Secondary Al Production [kt]	NO	NO	NO	2.25	2.04	2.20	2.20	3.15	3.90

4.5.4.2 Emission Factors

Emissions of dioxin, HCB, and PM (excluding condensable PM) are estimated. The dioxin implied emission factor is based on four on-site measurements at the factory in different years. The average of these four measurements (0.45 µg/t aluminium) is in accordance with the emissions factor from the *Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases* (UNEP, 2003) for production where high efficiency controls are in place (0.5 µg/t aluminium). The plant only recycles scrap metal from primary aluminium plants and no coated aluminium, so organic compounds in the input material is minimum. Also, no chlorine is added in the process and no further oxy-fuel burners are used.

The TSP emissions are based on on-site measurements in 2014 and every year since 2016. For the year 2015, the average of the implied emission factor for 2014 and 2016 is used. For the years 2012 and 2013 the implied emission factor for 2014 is used. For the first factory (before 2004) the emission factors are taken from the Table 3.4 in the EMEP/EEA Guidebook (EEA, 2023). The PM_{10} and $PM_{2.5}$ emission factors are based on the same ratios to TSP as in Table 3.4 in the EMEP/EEA Guidebook. The BC emission factor is taken from the same table.

The emission factor for HCB was chosen as a value in the lower range (0.04-40 mg/t) given in Table 5-9 and Figure 5-18 of BiPRO (2006). As the recycled scrap material is directly coming from the primary aluminium smelters, contamination with organic substances in form of paintings or lacquers is expected to be insignificant and subsequently emissions of organochloride are expected to be low as well. A comparison across Nordic Countries shows that the used emissions factors are 1.365 mg/t in Finland, 1.7 mg/t in Norway and 20 mg/t in Denmark (from the IIR of the respective countries).

Table 4.22 Emission factors, Secondary Aluminium Production. TSP IEF is the average of the years 2012-2023.

	Dioxin [µg/t Al]	HCB [mg/t Al]	TSP [kg/t]	PM_{10} [% of TSP]	$PM_{2.5}$ [% of TSP]	BC [% of $PM_{2.5}$]
Emission factors	0.45	5.0	0.44	70%	28%	2.3%

4.5.4.3 Recalculations

Recalculations for the 2025 Submission

No category-specific recalculations were done for the current submission.

Recalculations for the 2024 Submission

No category-specific recalculations were done for the 2024 submission.

4.5.4.4 Planned Improvements

No improvements are currently planned for this subsector.

4.5.5 Magnesium Production (NFR 2C4)

This activity does not occur in Iceland.

4.5.6 Lead Production (NFR 2C5)

This activity does not occur in Iceland.

4.5.7 Zinc Production (NFR 2C6)

This activity does not occur in Iceland.

4.5.8 Capacitor Production (NFR 2C7c)

Production of the dielectric of aluminium electrolytic capacitor started in 2009 in a single plant and achieved full capacity in 2011. The plant receives aluminium sheets and a thin layer of aluminium oxide "forms" on the surface of the etched aluminium foil during a process called "formation." During the formation the aluminium sheet is submerged in a liquid bath and ammonium hydroxide is used to control the pH level of the liquid.

4.5.8.1 Activity Data

All activity data, consisting of used ammonium hydroxide, is obtained in Green Accounting reports submitted yearly to the IEEA, see Table 4.23.

Table 4.23 Ammonium hydroxide used during production [kt].

	2009	2010	2015	2020	2022	2023
Ammonium hydroxide used [kt]	0.0509	0.1119	0.0654	0.0494	0.0776	0.0388

4.5.8.2 Emission Factors

The plant only emits NH_3. In Green Accounting, the concentration, and thereby the emission factor of NH_3, of the ammonium hydroxide is given as 24.5%.

4.5.8.3 Recalculations

Recalculations for the 2025 Submission

No category-specific recalculations were done for the 2025 submission.

Recalculations for the 2024 Submission

No category-specific recalculations were done for the 2024 submission.

4.5.8.4 Planned Improvements

No improvements are currently planned for this subsector.

4.6 Solvent and Product Use (NFR 2D)

Activities related to 2D Solvent and product use mostly generate NMVOC. When volatile chemicals are exposed to air, emissions are produced through evaporation of the chemicals. The use of solvents and other organic compounds in industrial processes and households is an important source of NMVOC evaporation. Emissions of other pollutants than NMVOC were only estimated from Road Paving with Asphalt (2D3b - Dioxin, PM, and BC), and other solvent use (Creosotes - 2D3i - PAH). The categories Coating, Degreasing, and Other NMVOC emissions from printing and other product use have in common that their activity data consists of data about imported goods. This data was received from SI.

Emission factors for subcategories of 2D3 are presented in Table 4.24 and

Table 4.25. References and more details about individual emission factors are included in the respective subchapters.

Table 4.24 Emission factors for NMVOC, PM and BC in sector 2D3.

		Unit	NMVOC [g/unit]	TSP [g/unit]	PM_{10} [g/unit]	$PM_{2.5}$ [g/unit]	BC [% of $PM_{2.5}$]
2D3b	Road Paving with Asphalt	t asphalt	16	20	4.3	0.57	5.7%
2D3d	Coating Applications	kg paint	230	-	-	-	-
2D3e	Degreasing	kg cleaning product	460	-	-	-	-
2D3f	Dry Cleaning[1]	kg textile treated	19.5	-	-	-	-
2D3g	Chemical Products: Paint Manufacturing	kg product	11	-	-	-	-
2D3h	Printing	kg ink	500	-	-	-	-
2D3i	Creosotes	kg creosote	105	-	-	-	-
2D3i	Organic Solvent-borne Preservatives	kg preservative	945	-	-	-	-
2D3i	Aircraft De-icing	kg de-icing fluid	53	-	-	-	-

[1]The mission factor is 177 g/kg textiles cleaned with abatement efficiency of 89%.

Table 4.25 Emission factors for dioxin and PAH in sector 2D3.

		Unit	Dioxin [µg I-TEQ/unit]	BaP [mg/unit]	BbF [mg/unit]	BkF [mg/unit]	IPy [mg/unit]
2D3b	Road Paving with Asphalt	t asphalt	0.0070	-	-	-	-
2D3d	Coating Applications	kg paint	-	-	-	-	-
2D3e	Degreasing	kg cleaning product	-	-	-	-	-
2D3f	Dry Cleaning	kg textile treated	-	-	-	-	-
2D3g	Chemical Products: Paint Manufacturing	kg product	-	-	-	-	-

		Unit	Dioxin [µg I-TEQ/unit]	BaP [mg/unit]	BbF [mg/unit]	BkF [mg/unit]	IPy [mg/unit]
2D3h	Printing	kg ink	-	-	-	-	-
2D3i	Creosotes	kg creosote	-	1.05	0.53	0.53	0.53
2D3i	Organic Solvent-borne Preservatives	kg preservative	-	-	-	-	-
2D3i	Aircraft De-icing	kg de-icing fluid	-	-	-	-	-

4.6.1 Domestic Solvent Use Including Fungicides (NFR 2D3a)

The emission factors for 2D3a Domestic Solvent Use are Tier 1 from Table 3.1 in chapter 2.D.3.a of the 2023 EMEP/EEA Guidebook (EEA, 2023).

4.6.1.1 Activity Data

Activity data consists of the Icelandic population and is given by Statistics Iceland (SI) (*Hagstofa Íslands*).

4.6.1.2 Emission Factors

The emission factor for NMVOC for different products and product types per person was taken from Table 3.5, Chapter 2.D.3.a (EEA, 2023).

Hg is not estimated due to uncertainty around the releases according to the 2023 EMEP/EEA Guidebook (EEA, 2023). The Hg emissions may be accounted for elsewhere in the inventory since emissions of Hg could arise from the use of fluorescent tubes.

4.6.1.3 Recalculations and Improvements

Recalculations for the 2025 Submission

For the 2025 submission, recalculations within the 2D3a subsector were done since the emissions are now based on population only as in tier 1 but not tier 2b, since no data on product use is available. See table below.

Table 4.26 Recalculations in 2D3a Domestic Solvent Use between submissions.

2D3a Domestic Solvent Use	1990	1995	2000	2005	2010	2015	2020	2021	2022
2024 submission NMVOC [t]	625	657	687	723	782	810	896	908	926
2025 submission NMVOC [t]	457	481	502	528	572	581	637	645	657
Change relative to 2024 submission NMVOC [t]	-168	-177	-185	-194	-210	-229	-259	-263	-269
Change relative to 2024 submission NMVOC [%]	-26.9%	-26.9%	-26.9%	-26.9%	-26.9%	-28.2%	-28.9%	-29.0%	-29.1%

Recalculations for the 2024 Submission

No category-specific recalculations were done for the 2024 submission.

4.6.1.4 Planned Improvements

No improvements are currently planned for this subsector.

4.6.2 Road Paving with Asphalt (NFR 2D3b)

Asphalt road surfaces are composed of compacted aggregate and asphalt binder. Gases are emitted from the asphalt plant itself, the road surfacing operations, and subsequently from the road surface.

4.6.2.1 Activity Data

Information on the amount of asphalt produced comes from SI until 2011, and directly from the companies producing asphalt since 2012, see Table 4.27.

Table 4.27 Production of asphalt for road paving [kt].

	1990	1995	2000	2005	2010	2015	2020	2022	2023
Road Paving with Asphalt Production [kt]	172	172	324	335	235	194	263	371	283

4.6.2.2 Emission Factors

The emission factor for NMVOC is taken from Table 3.1 in Chapter 2.D.3.b, Tier 1, in the EMEP/EEA Guidebook (EEA, 2023). Emissions factors for TSP are based on measurements from the second-largest asphalt production plant. BC, $PM_{2.5}$, and PM_{10} emission factors are then calculated by using the same ratio to TSP as given in Table 3.1, Chapter 2.D.3.b in the Guidebook (EEA, 2023), this excludes condensable PM. Emissions of dioxin are based on emission factor 0.007 µg TEQ/t from the Toolkit for Identification and Quantification of Releases of Dioxins, Furans, and Other Unintentional POPs (UNEP, 2003). Emissions of SO_2, NO_x, and CO are expected to originate mainly from combustion and are therefore not estimated here but accounted for under sector 1A2gvii.

4.6.2.3 Recalculations and Improvements

Recalculations for the 2025 Submission

No category-specific recalculations were done for the 2025 submission.

Recalculations for the 2024 Submission

Recalculations were made for the 2024 submissions due to updates in activity data (see Table 4.28). One asphalt producing company was added to the inventory for the 2024 submission. The company has been operating since 2020, meaning that its production data for 2020 and 2021 have been missing from the inventory.

Table 4.28 Recalculations in 2D3 Other: Road Paving with Asphalt between submissions.

2D3 Other: Road Paving with Asphalt	2020	2021
2023 submission TSP [kt]	0.0048	0.0055
2024 submission TSP [kt]	0.0053	0.0066
Change relative to 2023 submission TSP [%]	9.6%	21%
2023 submission PM_{10} [kt]	0.00103	0.00117
2024 submission PM_{10} [kt]	0.00113	0.00141
Change relative to 2023 submission PM_{10} [%]	9.6%	21%
2023 submission $PM_{2.5}$ [kt]	0.000137	0.000156

2D3 Other: Road Paving with Asphalt	2020	2021
2024 submission $PM_{2.5}$ [kt]	0.000150	0.000188
Change relative to 2023 submission $PM_{2.5}$ [%]	9.6%	21%
2023 submission BC [kt]	0.0000078	0.0000089
2024 submission BC [kt]	0.0000086	0.0000107
Change relative to 2023 submission BC [%]	9.6%	21%
2023 submission NMVOC [kt]	0.0038	0.0044
2024 submission NMVOC [kt]	0.0042	0.0053
Change relative to 2023 submission NMVOC [%]	9.6%	21%
2023 submission PCDD/F [g]	0.00168	0.00191
2024 submission PCDD/F [g]	0.00184	0.00231
Change relative to 2023 submission PCDD/F [%]	9.6%	21%

4.6.2.4 Planned Improvements

No improvements are currently planned for this subsector.

4.6.3 Coating Applications (NFR 2D3d)

The emissions in this category stem from paint applications. Only NMVOC emissions are estimated; emissions from other pollutants are either considered minimal or non-existent.

4.6.3.1 Activity Data

Data exists on imported paint since 1990 (SI) and on domestic production of paint since 1998 from the Icelandic Recycling Fund annual report (Icelandic Recycling Fund, 2019) or via direct communication, see Table 4.29. The total amount of solvent-based paint is multiplied with the emission factor. For the time before 1998 no data exists about the amount of solvent-based paint produced domestically. Therefore, the domestically produced paint amount of 1998, which happens to be the highest of the time period for which data exists, is used for the period from 1990-1997.

Table 4.29 Total solvent-based paint (domestic production and imports) [kt].

	1990	1995	2000	2005	2010	2015	2020	2022	2023
Total solvent-based paint [kt]	2.21	2.38	2.44	1.49	1.26	1.38	1.92	1.56	1.52

4.6.3.2 Emission Factors

The emission factor for NMVOC is taken from Table 3.4 in Chapter 2.D.3.d, Tier 2, in the EMEP/EEA Guidebook (EEA, 2023). The EMEP/EEA Guidebook (EEA, 2023) provides emission factors based on amounts of paint applied. The Tier 1 emission factor from the EMEP/EEA Guidebook (EEA, 2023) refers to all paints applied, e.g., waterborne, powder, high solid, and solvent-based paints. The existing data on produced and imported paints, however, makes it possible to narrow activity data down to conventional solvent-based paints. Therefore, Tier 2 emission factors for conventional solvent-based paints could be applied. The activity data does not allow for a distinction between decorative coating application for construction of buildings and domestic use of paints. Their NMVOC emission factors, however, are identical: 230 g/kg paint applied. It is assumed that all paint imported and produced domestically is applied domestically during the same year. Therefore, the total amount of solvent-based paint is multiplied with the emission factor.

4.6.3.3 Recalculations and Improvements

Recalculations for the 2025 Submission

For the 2025 submission, recalculations within the 2D3d subsector were due to updated import data from Statistic Iceland from the year 1995, see table below.

Table 4.30 Recalculations in 2D3d: Coating Applications between submissions.

2D3d, Coating	1995	2000	2005	2010	2015	2020	2021	2022
2024 submission NMVOC [t]	547.6	562	360	294	322	468	411	363
2025 submission NMVOC [t]	547.4	560	342	289	318	442	406	359
Change relative to 2024 submission NMVOC [t]	-0.13	-1.8	-17	-5.1	-3.7	-26	-4.5	-4.1
Change relative to 2024 submission NMVOC [%]	-0.02%	-0.3%	-4.8%	-1.7%	-1.2%	-5.6%	-1.1%	-1.1%

Recalculations for the 2024 Submission

Minor recalculations were made through the time series from 1995-2021 due to updates in import/export data from SI (see Table 4.31).

Table 4.31 Recalculations of NMVOC in 2D3d Coating between submissions.

2D3d Coating	1995	2000	2005	2010	2015	2020	2021
2023 submission NMVOC [kg]	547419	560077	342397	288710	318265	442115	409674
2024 submission NMVOC [kg]	547552	561879	359634	293804	321996	468208	410659
Change relative to 2023 submission NMVOC [%]	0.024%	0.32%	5.0%	1.8%	1.2%	5.9%	0.24%

4.6.3.4 Planned Improvements

No improvements are currently planned for this subsector.

4.6.4 Degreasing (NFR 2D3e)

Degreasing only generates NMVOC emissions. Emissions are estimated by Tier 1, based on amounts of cleaning products used.

4.6.4.1 Activity Data

The data on the amount of imported cleaning products imported provided by SI (see Table 4.32). Of the chemicals listed by the EMEP/EEA Guidebook, activity data is available for: methylene chloride (MC), tetrachloroethylene (PER), trichloroethylene (TRI), and xylenes (XYL). In Iceland though, PER is mainly used for Dry Cleaning (expert judgement). In order to estimate emissions from degreasing with more accuracy and without underestimating them, half of the imported PER was allocated to degreasing. Emissions from Dry Cleaning are estimated without using data on solvents used (see below). However, the use of PER in Dry Cleaning is implicitly contained in the method. In Iceland, xylenes are mainly used in paint production (expert judgement). Furthermore, only half of the imported xylenes were allocated to degreasing. Emissions from paint production are estimated without using data on solvents used but xylene use is implicitly contained in the method.

In addition to the solvents mentioned above, 1,1,1-trichloroethylene (TCA), now banned by the Montreal Protocol, is added for the time period during which it was imported and used. Another category included is paint and varnish removers.

Table 4.32 Imports of cleaning products [kt].

	1990	1995	2000	2005	2010	2015	2020	2022	2023
Cleaning product imports [kt]	0.166	0.123	0.185	0.125	0.083	0.101	0.094	0.101	0.122

4.6.4.2 Emission Factors

The amount of imported solvents for degreasing was multiplied with the NMVOC Tier 1 emission factor from Table 3-1 in chapter 2.D.3.e of the EMEP/EEA Guidebook (EEA, 2023) for degreasing: 460 g/kg cleaning product.

4.6.4.3 Recalculations and Improvements

Recalculations for the 2025 Submission

For the 2025 submission, recalculations within the 2D3d subsector were due to updated import data from Statistic Iceland from the year 2010, see table below.

Table 4.33 Recalculations in 2D3e: Degreasing.

2D3e Degreasing	2010	2011	2014	2016	2018	2019	2020	2021	2022
2024 submission NMVOC [t]	37.955	34.060	36.986	50.02	54.89	58.20	46.43	51.80	46.78
2025 submission NMVOC [t]	37.950	34.054	36.989	49.92	54.86	57.82	43.06	51.71	46.51
Change relative to 2024 submission NMVOC [t]	-0.004	-0.006	0.003	-0.10	-0.024	-0.38	-3.38	-0.081	-0.27
Change relative to 2024 submission NMVOC [%]	-0.01%	-0.02%	0.01%	-0.2%	0.0%	-0.7%	-7.3%	-0.2%	-0.6%

Recalculations for the 2024 Submission

Minor recalculations were made for 2010, 2011, 2016, 2018, 2019, 2020 and 2021 between 2023 and 2024 submissions due to updates in import/export data from SI (see Table 4.34).

Table 4.34 Recalculations of NMVOC in 2D3e Degreasing between submissions.

2D3e Degreasing	2010	2011	2016	2018	2019	2020	2021
2023 submission NMVOC [kg]	37950	34054	49915	54863	57822	43055	51762
2024 submission NMVOC [kg]	37955	34060	50017	54887	58204	46433	51795
Change relative to 2023 submission NMVOC [%]	0.012%	0.019%	0.20%	0.044%	0.66%	7.8%	0.064%

4.6.4.4 Planned Improvements

No improvements are currently planned for this subsector.

4.6.5 Dry Cleaning (NFR 2D3f)

Dry Cleaning only generates NMVOC emissions. Emissions related to Dry Cleaning were estimated by Tier 2, based on the default amount of textile cleaned per capita.

4.6.5.1 Activity Data

Activity data for calculation of NMVOC emissions is the amount of textile treated annually, which is assumed to be 0.3 kg/head, default value from chapter 2.D.3.f of the 2019 EMEP/EEA Guidebook and calculated using demographic data.

4.6.5.2 Emission Factors

Emissions from Dry Cleaning were calculated using the Tier 2 emission factor from for conventional closed-circuit PER machines with abatement efficiency provided in Table 3-2 in chapter 2.D.3.f of the 2023 EMEP/EEA Guidebook. The unabated NMVOC emission factor is 177 g/kg textile treated. Since all dry-cleaning machines used in Iceland are conventional closed-circuit PER machines, the emission factor was reduced using the respective EMEP/EEA Guidebook reduction default value of $\eta_{\text{abatement}} = 89\%$. The abated emission factor is therefore:

$$EF_{\text{technology,abated}} = (1 - \eta_{\text{abatement}}) \cdot EF_{\text{technology,unabated}} = (1 - 0.89) \cdot 177 = 19.47 \text{ g/kg}$$

4.6.5.3 Recalculations and Improvements

Recalculations for the 2025 Submission

For the 2025 submission, recalculations within the 2D3f subsector were due to updated data from Statistics Iceland regarding population statistics from the year 2011, see table below.

Table 4.35 Recalculations in 2D3f: Dry Cleaning.

2D3f Dry Cleaning	2011	2015	2020	2021	2022
2024 submission NMVOC [t]	1860	1922	2127	2154	2198
2025 submission NMVOC [t]	1821	1887	2068	2093	2131
Change relative to 2024 submission NMVOC [t]	-39	-35	-59	-61	-66
Change relative to 2024 submission NMVOC [%]	-2.1%	-1.8%	-2.8%	-2.8%	-3.0%

Recalculations for the 2024 Submission

No category-specific recalculations were done for the 2024 submission.

4.6.5.4 Planned Improvements

No improvements are currently planned for this subsector.

4.6.6 Chemical Products (NFR 2D3g)

The only activity identified for the subcategory Chemical Products, manufacture and processing is manufacture of paints. NMVOC emissions from the manufacture of paints were calculated using Tier 2 of the Guidebook (EEA, 2023).

4.6.6.1 Activity Data

The activity data consists of the amount of paint produced domestically as discussed above in chapter 4.6.3 Coating Applications, see Table 4.36.

Table 4.36 Domestically produced solvent-based paint [kt].

	1990	1995	2000	2005	2010	2015	2020	2022	2023
Solvent-based Paint Domestic Production [kt]	1.42	1.42	1.11	0.492	0.291	0.301	0.715	0.257	0.259

4.6.6.2 Emission Factors

NMVOC emissions from the manufacture of paints were calculated using Tier 2 emission factor of 11 g/kg product from Table 3-11 in chapter 2D3g in the 2023 EMEP/EEA Guidebook.

4.6.6.3 Recalculations and Improvements

Recalculations for the 2025 Submission

No category-specific recalculations were done for the 2025 submission.

Recalculations for the 2024 Submission

No category-specific recalculations were done for the 2024 submission.

4.6.6.4 Planned Improvements

No improvements are currently planned for this subsector.

4.6.7 Printing (NFR 2D3h)

4.6.7.1 Activity Data

Import data on ink was received from SI, see Table 4.37.

Table 4.37 Total imports of ink [kt]

	1990	1995	2000	2005	2010	2015	2020	2022	2023
Print/ink import [kt]	0.155	0.218	0.396	0.610	0.378	0.413	0.157	0.179	0.089

The inter-annual variations of import can be explained partly by the total economic activity in Iceland (explaining the decrease in import during the COVID pandemic), partly by the relative price of printing in Iceland vs. printing abroad and partly by increase in demand in electronic media resulting in less demand for printing (explaining why this sector does not see the same recovery as many other sectors in the years following the collapse in 2008).

4.6.7.2 Emission Factors

NMVOC emissions for printing were calculated using the 2023 EMEP/EEA Guidebook (EEA, 2023). Tier 1 emission factor of 500 g/kg ink used.

4.6.7.3 Recalculations and Improvements

Recalculations for the 2025 Submission

For the 2025 submission, recalculations within the 2D3h subsector were due to updated data from Statistics Iceland, see table below.

Table 4.38 Recalculations in 2D3h: Printing.

2D3h Printing	1997	2000	2005	2010	2015	2020	2021	2022
2024 submission NMVOC [t]	149.347	198.15	307	188.86	206.8	81	85.6	89.8
2025 submission NMVOC [t]	149.342	198.18	305	188.78	206.7	78	85.3	89.6
Change relative to 2024 submission NMVOC [t]	-0.005	0.04	-2	-0.081	-0.11	-2	-0.3	-0.2
Change relative to 2024 submission NMVOC [%]	-0.003%	0.02%	-0.7%	-0.04%	-0.1%	-3.1%	-0.4%	-0.3%

Recalculations for the 2024 Submission

Recalculations were done for 1997, 2000 and 2002-2021 for the 2024 submission due to updates in import/export data from SI (see Table 4.39).

Table 4.39 Recalculations of NMVOC in 2D3h Printing between submissions.

2D3h Printing	1997	2000	2002	2005	2010	2015	2020	2021
2023 submission NMVOC [kg]	149342	198147	172747	305126	188777	206688	78365	85538
2024 submission NMVOC [kg]	149347	198147	172753	307163	188859	206795	80846	85634
Change relative to 2023 submission NMVOC [%]	0.0033%	0.0002%	0.0035%	0.67%	0.043%	0.052%	3.2%	0.11%

4.6.7.4 Planned Improvements

No improvements are currently planned for this subsector.

4.6.8 Other Product Use (NFR 2D3i)

Wood is preserved to protect it against fungal and insect attack and also against weathering. There are three main types of preservative: creosote, organic solvent-based (often referred to as "light organic solvent-based preservatives" (LOSP)) and water borne. Creosote is oil prepared from coal tar distillation and contains a high proportion of aromatic compounds such as polycyclic aromatic hydrocarbons (PAHs). In Iceland, creosotes have been banned since 2011. Other wood preservation substances used in Iceland are Organic Solvent-borne Preservatives. De-icing fluid is used to de-ice aircrafts at airports. NMVOC emissions occur from the propylene glycol in the de-icing fluid.

4.6.8.1 Activity Data

Activity data consists of annual import of creosotes and organic solvent-borne preservatives, and the assumption that all these products are applied during the year of import. Import data on both wood preservatives is provided by SI. Data on de-icing fluid used are provided by Icelandair/Jet Centre and Airport Associates Keflavík.

Table 4.40 Total import of preservatives [kg] and total de-icing fluid used [l].

	1990	1995	2000	2005	2010	2015	2020	2022	2023
Creosote preservative import [kg]	12,450	6,930	2,245	300	1,968	NO	NO	NO	NO
Organic solvent-borne preservative import [kg]	7,795	19,021	26,666	90,871	32,513	28,019	39,799	27,416	33,510
De-icing fluid used [l]	664,772	664,772	664,772	664,772	664,772	570,614	690,152	894,213	1,117,215

4.6.8.2 Emission Factors

All emission factors used in sector 2D3i are from chapter 2.D.3.i of the 2023 EMEP/EEA Guidebook (EEA, 2023).

NMVOC emissions from wood preservation were calculated using Tier 2 emissions factor from Table 3-5 for creosote preservative type (105 g/kg creosote).

NMVOC emissions from organic solvent borne preservative were calculated using Tier 2 emission factor from Table 3-6 (945 g/kg preservative).

NMVOC emission from aircraft de-icing were calculated using Tier 2 emission factor from Table 3-12 (53 kg/t de-icing fluid)

PAH emissions from wood preservation are calculated using Tier 2 emission factors from Table 3-5 in chapter 2.D.3.i, 2.G of the 2023 EMEP/EEA Guidebook (1.05 mg BaP per kg of creosote; 0.53 mg BbF/BkF/IPy per kg creosote).

4.6.8.3 Recalculations and Improvements

Recalculations for the 2025 Submission

For the 2025 submission, recalculations within the 2D3i subsector were due to updated data from Statistics Iceland, see table below.

Table 4.41 Recalculations in 2D3i: Organic Solvent Borne Preservative.

2D3i Organic Solvent Borne Preservative	1997	1999	2005	2008	2011	2013	2020	2022
2024 submission NMVOC [t]	15.32	16.5	86.2	91.7	23.3	17.9	37.611	25.93
2025 submission NMVOC [t]	15.27	14.7	85.9	91.4	8.9	17.4	37.610	25.91
Change relative to 2024 submission NMVOC [t]	-0.05	-1.8	-0.4	-0.3	-14.4	-0.5	-0.001	-0.02
Change relative to 2024 submission NMVOC [%]	-0.31%	-11.0%	-0.4%	-0.4%	-62%	-2.9%	-0.003%	-0.1%

Recalculations for the 2024 Submission

Recalculations were made for the 2024 submission due to updates in import/export data from SI.

Table 4.42 Recalculations of NMVOC in 2D3i Other Solvent Borne Preservative between submissions.*

2D3i Organic Solvent Borne Preservative	1997	1998	1999	2004	2005	2006	2008	2011	2013
2023 submission NMVOC [kg]	15275	10711	14707	81273	85873	96388	91367	8909	17383
2024 submission NMVOC [kg]	15322	15428	16524	82255	86227	97541	91713	23332	17894
Change relative to 2023 submission NMVOC [%]	0.31%	44%	12%	1.2%	0.41%	1.2%	0.38%	162%	2.9%

*Recalculations for 2001, 2003 and 2020 are smaller than 0.1% and are therefore not shown.

4.6.8.4 Planned Improvements

No improvements are currently planned for this subsector.

4.7 Other Solvent and Product Use (NFR 2G)

4.7.1 Other: Tobacco and Fireworks (NFR 2G4)

The two emission sources estimated in this category are use of tobacco and fireworks.

Tobacco smoking is a minor source of dioxins, PAH, and other pollutants including heavy metals, whereas fireworks are one of the most significant source of some heavy metals in the IPPU sector. The yearly imported amount of tobacco shows a downward trend over the time series, which is reflected also in the emissions.

Firework imports follow in general the economic development of the country. A prominent peak around 2007 is due to a very sharp rise in the economy leading to the financial collapse of 2008.

4.7.1.1 Activity Data

Activity data consist of all smoking tobacco and all fireworks imported and are provided by SI.

4.7.1.2 Emission Factors

For tobacco use, Tier 2 emission factors for NO_x, CO, NH_3, TSP, PM, BC, NMVOC, dioxin, and PAH4 were taken from Table 3-15 in Chapter 2.D.3.i, 2.G in the 2023 EMEP/EEA Guidebook (EEA, 2023). Emission factors for heavy metals are taken from the Danish IIR (Nielsen, et al., 2024), which uses emission factors derived from burning of wood.

For firework use, Tier 2 emission factors for SO_2, CO, NO_x, TSP, PM, and heavy metals (except for Pb and HCB) were taken from Table 3-14 in Chapter 2.D.3.i, 2.G of the 2023 EMEP/EEA Guidebook (EEA, 2023). The emissions factors for Pb and HCB are based on measurements of the average Pb and HCB content in a sample of different fireworks sold in Iceland from 2018. HCB content was higher in the past. Measurements from 2012 showed significantly higher HCB content and the emission factor is linearly lowered from the 2012 value to the 2018 value. The Pb emission factor is linearly lowered from the default guidebook value to the measurement value between 2007 and 2015. EU law on PE markings for fireworks (2007/23/EB) was implemented into Icelandic law in 2015. All emission factors are presented in Table 4.43.

Table 4.43 Emission factors for use of tobacco and of fireworks, per mass unit of imported goods.

	NO_x [kg/t]	NMVOC [kg/t]	SO_2 [kg/t]	NH_3 [kg/t]	TSP [kg/t]	PM_{10} [kg/t]	$PM_{2.5}$ [kg/t]	BC % of $PM_{2.5}$	CO [kg/t]
Tobacco	1.80	4.84	NA	4.15	27.0[1]	27.0	27.0	0.45%	55.1
Fireworks	0.260	NA	3.02	NA	109.8	99.9	51.9	NA	7.15

[1]Conversion from mg/cigarette to kg/t is based on the information that one cigarette contains 1 g of tobacco.

	Dioxin [ng I-TEQ/t]	B(a)P [g/t]	B(b)F [g/t]	B(k)F [g/t]	IPy [g/t]	HCB [g/t]
Tobacco	100	0.11	0.045	0.045	0.045	NA
Fireworks	NA	NA	NA	NA	NA	0.047[2]

[2]Value from 1990-2012 is 1.019 g/t and linearly lowered to the value from the 2018 measurements.

	Pb [g/t]	Cd [g/t]	Hg [g/t]	As [g/t]	Cr [g/t]	Cu [g/t]	Ni [g/t]	Se [g/t]	Zn [g/t]
Tobacco	0.640	0.0200	0.0100	0.159	0.152	0.354	0.0300	0.0100	1.61
Fireworks	48.5[3]	1.48	0.057	1.33	15.6	444	30	NA	260

[3]Value is linearly lowered from the default EMEP/EEA guidebook value to the measurement value between 2007 and 2015.

4.7.1.3 *Recalculations and Improvements*

Recalculations for the 2025 Submission

Tobacco: Recalculations were made for the 2025 submission due to updates in import/export data from SI. These recalculations occurred in all air pollutants in this category for the years 2005, 2007-2010, 2020-2022, see table below.

Table 4.44 Recalculations in 2G4 Other: Tobacco between submission.

2G4 Other: Tobacco	2005	2010	2020	2021	2022
2024 submission TSP [kt]	0.0103858	0.009364	0.006547	0.005836	0.004911
2025 submission TSP [kt]	0.0103857	0.009332	0.006554	0.005824	0.004910
Change relative to the 2024 submission TSP [kt]	-8.1E-08	-3.2E-05	7.2E-06	-1.2E-05	-1.3E-06
Change relative to the 2024 submission TSP [%]	-0.00078%	-0.34%	0.110%	-0.204%	-0.026%
2024 submission PM10 [kt]	0.0103858	0.009364	0.006547	0.005836	0.004911
2025 submission PM10 [kt]	0.0103857	0.009332	0.006554	0.005824	0.004910
Change relative to the 2024 submission PM10 [kt]	-8.1E-08	-3.2E-05	7.2E-06	-1.2E-05	-1.3E-06
Change relative to the 2024 submission PM10 [%]	-0.00078%	-0.34%	0.110%	-0.204%	-0.026%
2024 submission PM2.5 [kt]	0.0103858	0.009364	0.006547	0.005836	0.004911
2025 submission PM2.5 [kt]	0.0103857	0.009332	0.006554	0.005824	0.004910
Change relative to the 2024 submission PM2.5 [kt]	-8.1E-08	-3.2E-05	7.2E-06	-1.2E-05	-1.3E-06
Change relative to the 2024 submission PM2.5 [%]	-0.00078%	-0.34%	0.110%	-0.204%	-0.026%
2024 submission BC [kt]	4.674E-05	4.21E-05	2.9461E-05	2.6261E-05	2.2101E-05
2025 submission BC [kt]	4.674E-05	4.20E-05	2.9493E-05	2.6207E-05	2.2095E-05

2G4 Other: Tobacco	2005	2010	2020	2021	2022
Change relative to the 2024 submission BC [kt]	-3.6E-10	-1.4E-07	3.2E-08	-5.4E-08	-5.8E-09
Change relative to the 2024 submission BC [%]	-0.00078%	-0.34%	0.110%	-0.204%	-0.026%
2024 submission NOx [kt]	6.924E-04	6.24E-04	4.365E-04	3.890E-04	3.274E-04
2025 submission NOx [kt]	6.924E-04	6.22E-04	4.369E-04	3.883E-04	3.273E-04
Change relative to the 2024 submission NOx [kt]	-5.4E-09	-2.1E-06	4.8E-07	-8.0E-07	-8.6E-08
Change relative to the 2024 submission NOX [%]	-0.00078%	-0.34%	0.110%	-0.204%	-0.026%
2024 submission NMVOC [kt]	0.001862	0.001679	0.001174	0.001046	8.804E-04
2025 submission NMVOC [kt]	0.001862	0.001673	0.001175	0.001044	8.802E-04
Change relative to the 2024 submission NMVOC [kt]	-1.5E-08	-5.7E-06	1.3E-06	-2.1E-06	-2.3E-07
Change relative to the 2024 submission NMVOC [%]	-0.00078%	-0.34%	0.110%	-0.204%	-0.026%
2024 submission CO [kt]	0.021195	0.01911	0.013360	0.01191	0.010023
2025 submission CO [kt]	0.021195	0.01904	0.013375	0.01188	0.010020
Change relative to the 2024 submission CO [kt]	-1.7E-07	-6.5E-05	1.5E-05	-2.4E-05	-2.6E-06
Change relative to the 2024 submission CO [%]	-0.00078%	-0.34%	0.110%	-0.204%	-0.026%
2024 submission NH3 [kt]	1.596E-03	1.439E-03	0.001006	8.970E-04	7.549E-04
2025 submission NH3 [kt]	1.596E-03	1.434E-03	0.001007	8.951E-04	7.547E-04
Change relative to the 2024 submission NH3 [kt]	-1.2E-08	-4.9E-06	1.1E-06	-1.8E-06	-2.0E-07
Change relative to the 2024 submission NH3 [%]	-0.00078%	-0.34%	0.110%	-0.204%	-0.026%
2024 submission PAH4 [t]	9.463E-05	8.53E-05	5.965E-05	5.317E-05	4.475E-05
2025 submission PAH4 [t]	9.463E-05	8.50E-05	5.971E-05	5.306E-05	4.474E-05
Change relative to the 2024 submission PAH4 [t]	-7.4E-10	-2.9E-07	6.5E-08	-1.1E-07	-1.2E-08
Change relative to the 2024 submission PAH4 [%]	-0.00078%	-0.34%	0.110%	-0.204%	-0.026%
2024 submission BaP [t]	4.270E-05	3.850E-05	2.691E-05	2.399E-05	2.019E-05
2025 submission BaP [t]	4.270E-05	3.836E-05	2.694E-05	2.394E-05	2.019E-05
Change relative to the 2024 submission TSP [kt]	-3.3E-10	-1.3E-07	3.0E-08	-4.9E-08	-5.3E-09
Change relative to the 2024 submission BaP [%]	-0.00078%	-0.34%	0.110%	-0.204%	-0.026%
2024 submission BbF [t]	1.731E-05	1.561E-05	1.091E-05	9.726E-06	8.186E-06
2025 submission BbF [t]	1.731E-05	1.555E-05	1.092E-05	9.706E-06	8.183E-06
Change relative to the 2024 submission BbF [t]	-1.4E-10	-5.3E-08	1.2E-08	-2.0E-08	-2.2E-09
Change relative to the 2024 submission BbF [%]	-0.00078%	-0.34%	0.110%	-0.204%	-0.026%
2024 submission BkF [t]	1.731E-05	1.561E-05	1.091E-05	9.726E-06	8.186E-06
2025 submission BkF [t]	1.731E-05	1.555E-05	1.092E-05	9.706E-06	8.183E-06
Change relative to the 2024 submission BkF [t]	-1.4E-10	-5.3E-08	1.2E-08	-2.0E-08	-2.2E-09
Change relative to the 2024 submission BkF [%]	-0.00078%	-0.34%	0.110%	-0.204%	-0.026%
2024 submission IPy [t]	1.731E-05	1.561E-05	1.091E-05	9.726E-06	8.186E-06
2025 submission IPy [t]	1.731E-05	1.555E-05	1.092E-05	9.706E-06	8.183E-06

2G4 Other: Tobacco	2005	2010	2020	2021	2022
Change relative to the 2024 submission IPy [t]	-1.4E-10	-5.3E-08	1.2E-08	-2.0E-08	-2.2E-09
Change relative to the 2024 submission IPy [%]	-0.00078%	-0.34%	0.110%	-0.204%	-0.026%
2024 submission PCDD/F [g]	3.8466E-05	3.468E-05	2.425E-05	2.161E-05	1.819E-05
2025 submission PCDD/F [g]	3.8466E-05	3.456E-05	2.427E-05	2.157E-05	1.819E-05
Change relative to the 2024 submission PCDD/F [g]	-3.0E-10	-1.2E-07	2.7E-08	-4.4E-08	-4.8E-09
Change relative to the 2024 submission PCDD/F [%]	-0.00078%	-0.34%	0.110%	-0.204%	-0.026%
2024 submission Pb [g]	246.1824	221.95	155.18	138.33	116.42
2025 submission Pb [g]	246.1805	221.20	155.35	138.04	116.39
Change relative to the 2024 submission Pb [g]	-1.9E-03	-0.76	0.170	-0.283	-0.031
Change relative to the 2024 submission Pb [%]	-0.00078%	-0.34%	0.110%	-0.204%	-0.026%
2024 submission Cd [g]	7.6932	6.936	4.8495	4.3227	3.6380
2025 submission Cd [g]	7.6931	6.912	4.8548	4.3139	3.6371
Change relative to the 2024 submission Cd [g]	-6.0E-05	-0.024	0.00532	-0.00884	-0.00096
Change relative to the 2024 submission Cd [%]	-0.0008%	-0.3%	0.110%	-0.204%	-0.026%
2024 submission Hg [g]	3.84660	3.468	2.4248	2.1614	1.8190
2025 submission Hg [g]	3.84657	3.456	2.4274	2.1570	1.8185
Change relative to the 2024 submission Hg [g]	-3.0E-05	-0.012	0.00266	-0.00442	-0.00048
Change relative to the 2024 submission Hg [%]	-0.0008%	-0.3%	0.110%	-0.204%	-0.026%
2024 submission As [g]	61.1609	55.14	38.55	34.37	28.92
2025 submission As [g]	61.1605	54.95	38.60	34.30	28.91
Change relative to the 2024 submission As [g]	-4.8E-04	-0.188	0.042	-0.070	-0.008
Change relative to the 2024 submission As [%]	-0.0008%	-0.3%	0.110%	-0.204%	-0.026%
2024 submission Cr [g]	58.4683	52.71	36.86	32.85	27.65
2025 submission Cr [g]	58.4679	52.53	36.90	32.79	27.64
Change relative to the 2024 submission Cr [g]	-4.6E-04	-0.180	0.040	-0.067	-0.007
Change relative to the 2024 submission Cr [%]	-0.0008%	-0.3%	0.110%	-0.204%	-0.026%
2024 submission Cu [g]	136.170	122.77	85.84	76.51	64.39
2025 submission Cu [g]	136.169	122.35	85.93	76.36	64.38
Change relative to the 2024 submission Cu [g]	-1.1E-03	-0.419	0.094	-0.156	-0.017
Change relative to the 2024 submission Cu [%]	-0.0008%	-0.3%	0.110%	-0.204%	-0.026%
2024 submission Ni [g]	11.5398	10.40	7.274	6.484	5.457
2025 submission Ni [g]	11.5397	10.37	7.282	6.471	5.456
Change relative to the 2024 submission Ni [g]	-9.0E-05	-0.036	0.0080	-0.0133	-0.0014
Change relative to the 2024 submission Ni [%]	-0.0008%	-0.3%	0.110%	-0.204%	-0.026%
2024 submission Se [g]	3.84660	3.468	2.425	2.161	1.819
2025 submission Se [g]	3.84657	3.456	2.427	2.157	1.819

2G4 Other: Tobacco	2005	2010	2020	2021	2022
Change relative to the 2024 submission Se [g]	-3.0E-05	-0.012	0.0027	-0.0044	-4.8E-04
Change relative to the 2024 submission Se [%]	-0.0008%	-0.3%	0.110%	-0.204%	-0.026%
2024 submission Zn [g]	619.303	558.35	390.38	347.98	292.86
2025 submission Zn [g]	619.298	556.45	390.81	347.27	292.78
Change relative to the 2024 submission Zn [g]	-4.8E-03	-1.906	0.43	-0.71	-0.08
Change relative to the 2024 submission Zn [%]	-0.0008%	-0.3%	0.110%	-0.204%	-0.026%

Fireworks: Recalculations were made for the 2025 submission due to updates in import/export data from SI. These recalculations occurred in all air pollutants in this category for the years 2007, 2009-2010, 2012, 2016, 2018, and 2020, see table below.

Table 4.45 Recalculations of emissions within 2G4 Fireworks submissions.

2G4 Fireworks	2007	2009	2010	2012	2016	2018	2020
2024 submission TSP [kt]	0.1198	0.0465	0.05387	0.068977	0.06612	0.083408	0.054247
2025 submission TSP [kt]	0.1194	0.0463	0.05386	0.068975	0.06611	0.083407	0.054245
Change relative to the 2024 submission TSP [kt]	-4.2E-04	-2.0E-04	-6.8E-06	-1.2E-06	-7.5E-06	-9.9E-07	-2.6E-06
Change relative to the 2024 submission TSP [%]	-0.35%	-0.42%	-0.013%	-0.0018%	-0.011%	-0.0012%	-0.0049%
2024 submission PM10 [kt]	0.1090	0.04228	0.049006	0.062753	0.060151	0.0758824	0.049352
2025 submission PM10 [kt]	0.1087	0.04211	0.049000	0.062752	0.060144	0.0758815	0.049350
Change relative to the 2024 submission PM10 [kt]	-3.8E-04	-1.8E-04	-6.2E-06	-1.1E-06	-6.8E-06	-9.0E-07	-2.4E-06
Change relative to the 2024 submission PM10 [%]	-0.35%	-0.42%	-0.013%	-0.0018%	-0.011%	-0.0012%	-0.0049%
2024 submission PM2.5 [kt]	0.0567	0.021980	0.025474	0.032620	0.031268	0.039445	0.025654
2025 submission PM2.5 [kt]	0.0565	0.021887	0.025471	0.032619	0.031264	0.039444	0.025653
Change relative to the 2024 submission PM2.5 [kt]	-2.0E-04	-9.3E-05	-3.2E-06	-5.7E-07	-3.5E-06	-4.7E-07	-1.2E-06
Change relative to the 2024 submission PM2.5 [%]	-0.35%	-0.42%	-0.013%	-0.0018%	-0.011%	-0.0012%	-0.0049%
2024 submission NOx [kt]	2.84E-04	1.10E-04	1.28E-04	1.63E-04	1.5652E-04	1.9745E-04	1.2842E-4
2025 submission NOx [kt]	2.83E-04	1.10E-04	1.28E-04	1.63E-04	1.5650E-04	1.9745E-04	1.2841E-4
Change relative to the 2024 submission NOx [kt]	-9.9E-07	-4.6E-07	-1.6E-08	-2.9E-09	-1.8E-08	-2.3E-09	-6.2E-09
Change relative to the 2024 submission NOx [%]	-0.35%	-0.42%	-0.013%	-0.0018%	-0.011%	-0.0012%	-0.0049%
2024 submission SO2 [kt]	0.003295	0.001278	0.001481	0.0018967	0.0018180	0.00229348	0.00149164
2025 submission SO2 [kt]	0.003284	0.001273	0.001481	0.0018966	0.0018178	0.00229346	0.00149157
Change relative to the 2024 submission SO2 [kt]	-1.2E-05	-5.4E-06	-1.9E-07	-3.3E-08	-2.1E-07	-2.7E-08	-7.2E-08

2G4 Fireworks	2007	2009	2010	2012	2016	2018	2020
Change relative to the 2024 submission SO2 [%]	-0.35%	-0.42%	-0.013%	-0.0018%	-0.011%	-0.0012%	-0.0049%
2024 submission CO [kt]	0.007802	0.003026	0.003507	0.0044904	0.0043043	0.00542994	0.003532
2025 submission CO [kt]	0.007775	0.003013	0.003506	0.0044903	0.0043038	0.00542987	0.003531
Change relative to the 2024 submission CO [kt]	-2.7E-05	-1.3E-05	-4.4E-07	-7.9E-08	-4.9E-07	-6.4E-08	-1.7E-07
Change relative to the 2024 submission CO [%]	-0.35%	-0.42%	-0.013%	-0.0018%	-0.011%	-0.0012%	-0.0049%
2024 submission As [kg]	1.451	0.5628	0.65231	0.835280	0.80065	1.010045	0.65691
2025 submission As [kg]	1.446	0.5605	0.65222	0.835265	0.80056	1.010033	0.65688
Change relative to the 2024 submission As [kg]	-5.1E-03	-2.4E-03	-8.2E-05	-1.5E-05	-9.0E-05	-1.2E-05	-3.2E-05
Change relative to the 2024 submission As [%]	-0.35%	-0.42%	-0.013%	-0.0018%	-0.011%	-0.0012%	-0.0049%
2024 submission Cd [kg]	1.615	0.62630	0.72587	0.929484	0.890951	1.123959	0.731002
2025 submission Cd [kg]	1.609	0.62366	0.72578	0.929468	0.890850	1.123946	0.730966
Change relative to the 2024 submission Cd [kg]	-0.0057	-2.6E-03	-9.2E-05	-1.6E-05	-1.0E-04	-1.3E-05	-3.6E-05
Change relative to the 2024 submission Cd [%]	-0.35%	-0.4%	-0.013%	-0.0018%	-0.011%	-0.0012%	-0.0049%
2024 submission Cr [kg]	17.02	6.602	7.651	9.7973	9.3911	11.8471	7.7052
2025 submission Cr [kg]	16.96	6.574	7.650	9.7971	9.3900	11.8470	7.7048
Change relative to the 2024 submission Cr [kg]	-0.060	-0.028	-9.7E-04	-1.7E-04	-1.1E-03	-1.4E-04	-3.7E-04
Change relative to the 2024 submission Cr [%]	-0.35%	-0.42%	-0.013%	-0.0018%	-0.011%	-0.0012%	-0.0049%
2024 submission Cu [kg]	484.5	187.89	217.76	278.85	267.29	337.19	219.30
2025 submission Cu [kg]	482.8	187.10	217.73	278.84	267.26	337.18	219.29
Change relative to the 2024 submission Cu [kg]	-1.7	-0.79	-0.028	-4.9E-03	-0.030	-0.0040	-0.0107
Change relative to the 2024 submission Cu [%]	-0.35%	-0.42%	-0.013%	-0.0018%	-0.011%	-0.0012%	-0.0049%
2024 submission Hg [kg]	0.0622	0.024121	0.027956	0.035798	0.034314	0.043288	0.028153
2025 submission Hg [kg]	0.0620	0.024019	0.027952	0.035797	0.034310	0.043287	0.028152
Change relative to the 2024 submission Hg [kg]	-2.2E-04	-1.0E-04	-3.5E-06	-6.3E-07	-3.9E-06	-5.1E-07	-1.4E-06
Change relative to the 2024 submission Hg [%]	-0.35%	-0.4%	-0.013%	-0.0018%	-0.011%	-0.0012%	-0.0049%
2024 submission Ni [kg]	32.74	12.70	14.714	18.8409	18.0598	22.7830	14.8176

2G4 Fireworks	2007	2009	2010	2012	2016	2018	2020
2025 submission Ni [kg]	32.62	12.64	14.712	18.8406	18.0578	22.7827	14.8169
Change relative to the 2024 submission Ni [kg]	-0.11	-0.054	-0.0019	-3.3E-04	-2.0E-03	-2.7E-04	-7.2E-04
Change relative to the 2024 submission Ni [%]	-0.35%	-0.4%	-0.013%	-0.0018%	-0.011%	-0.0012%	-0.0049%
2024 submission Pb [kg]	766.3	228.0	224.20	184.442	29.213	36.8524	23.968
2025 submission Pb [kg]	763.7	227.1	224.17	184.439	29.209	36.8520	23.967
Change relative to the 2024 submission Pb [kg]	-2.69	-0.96	-0.028	-3.2E-03	-3.3E-03	-4.4E-04	-1.2E-03
Change relative to the 2024 submission Pb [%]	-0.35%	-0.42%	-0.013%	-0.0018%	-0.011%	-0.0012%	-0.0049%
2024 submission Zn [kg]	283.717	110.0	127.52	163.288	156.52	197.452	128.42
2025 submission Zn [kg]	282.722	109.6	127.50	163.285	156.50	197.450	128.41
Change relative to the 2024 submission Zn [kg]	-0.99	-0.46	-0.016	-2.9E-03	-1.8E-02	-2.3E-03	-6.2E-03
Change relative to the 2024 submission Zn [%]	-0.35%	-0.42%	-0.013%	-0.0018%	-0.011%	-0.0012%	-0.0049%
2024 submission HCB [g]	1.1124	0.4314	0.5000	0.64020	0.2235	0.0357732	0.023266
2025 submission HCB [g]	1.1085	0.4296	0.4999	0.64019	0.2234	0.0357728	0.023265
Change relative to the 2024 submission HCB [g]	-0.0039	-1.8E-03	-6.3E-05	-1.1E-05	-2.5E-05	-4.2E-07	-1.1E-06
Change relative to the 2024 submission HCB [%]	-0.35%	-0.42%	-0.013%	-0.0018%	-0.011%	-0.0012%	-0.0049%

Recalculations for the 2024 Submission

Tobacco: Recalculations were made for the 2024 submission due to updates in import/export data from SI. These recalculations were minor but occurred in all air pollutants in this category (see Table 4.46).

Table 4.46 Recalculations in 2G4 Other: Tobacco between submission.

2G4 Other: Tobacco	2005	2007	2008	2009	2010	2020	2021
2023 submission TSP [kt]	1.038574 E-02	1.12707 E-02	1.094021 E-02	1.02 E-02	9.332 E-03	6.54656 E-03	5.824 E-03
2024 submission TSP [kt]	1.038582 E-02	1.12715 E-02	1.094045 E-02	1.02 E-02	9.364 E-03	6.54683 E-03	5.836 E-03
Change relative to the 2023 submission TSP [%]	0.00078%	0.0067%	0.0022%	0.00053%	0.34%	0.0041%	0.20%
2023 submission PM_{10} [kt]	1.038574 E-02	1.12707 E-02	1.094021 E-02	1.02 E-02	9.332 E-03	6.54656 E-03	5.824 E-03
2024 submission PM_{10} [kt]	1.038582 E-02	1.12715 E-02	1.094045 E-02	1.02 E-02	9.364 E-03	6.54683 E-03	5.836 E-03
Change relative to the 2023 submission PM_{10} [%]	0.00078%	0.0067%	0.0022%	0.00053%	0.34%	0.0041%	0.20%
2023 submission $PM_{2.5}$ [kt]	1.038574 E-02	1.12707 E-02	1.094021 E-02	1.02 E-02	9.332 E-03	6.54656 E-03	5.824 E-03
2024 submission $PM_{2.5}$ [kt]	1.038582 E-02	1.12715 E-02	1.094045 E-02	1.02 E-02	9.364 E-03	6.54683 E-03	5.836 E-03

2G4 Other: Tobacco	2005	2007	2008	2009	2010	2020	2021
Change relative to the 2023 submission $PM_{2.5}$ [%]	0.00078%	0.0067%	0.0022%	0.00053%	0.34%	0.0041%	0.20%
2023 submission BC [kt]	4.67358 E-05	5.0718 E-05	4.92309 E-05	4.580465 E-05	4.199 E-05	2.94595 E-05	2.6208 E-05
2024 submission BC [kt]	4.67362 E-05	5.0722 E-05	4.92320 E-05	4.580489 E-05	4.214 E-05	2.94607 E-05	2.6261 E-05
Change relative to the 2023 submission BC [%]	0.00078%	0.0067%	0.0022%	0.00053%	0.34%	0.0041%	0.20%
2023 submission NOx [kt]	6.92383 E-04	7.5138 E-04	7.29347 E-04	6.785874 E-04	6.221 E-04	4.36437 E-04	3.883 E-04
2024 submission NOx [kt]	6.92388 E-04	7.5143 E-04	7.29364 E-04	6.785910 E-04	6.242 E-04	4.36455 E-04	3.890 E-04
Change relative to the 2023 submission NOX [%]	0.00078%	0.0067%	0.0022%	0.00053%	0.34%	0.0041%	0.20%
2023 submission NMVOC [kt]	1.861740 E-03	2.02038 E-03	1.961134 E-03	1.824646 E-03	1.6728 E-03	1.173531 E-03	1.0440 E-03
2024 submission NMVOC [kt]	1.861754 E-03	2.02052 E-03	1.961178 E-03	1.824656 E-03	1.6785 E-03	1.173579 E-03	1.0461 E-03
Change relative to the 2023 submission NMVOC [%]	0.00078%	0.0067%	0.0022%	0.00053%	0.34%	0.0041%	0.20%
2023 submission CO [kt]	2.119460 E-02	2.30006 E-02	2.232613 E-02	2.077231 E-02	1.904 E-02	1.33598 E-02	1.189 E-02
2024 submission CO [kt]	2.119477 E-02	2.30022 E-02	2.232663 E-02	2.077242 E-02	1.911 E-02	1.33604 E-02	1.191 E-02
Change relative to the 2023 submission CO [%]	0.00078%	0.0067%	0.0022%	0.00053%	0.34%	0.0041%	0.20%
2023 submission NH3 [kt]	1.596327 E-03	1.73235 E-03	1.681551 E-03	1.564521 E-03	1.4343 E-03	1.006230 E-03	8.952 E-04
2024 submission NH3 [kt]	1.596339 E-03	1.73247 E-03	1.681588 E-03	1.564529 E-03	1.4392 E-03	1.006271 E-03	8.970 E-04
Change relative to the 2023 submission NH3 [%]	0.00078%	0.0067%	0.0022%	0.00053%	0.34%	0.0041%	0.20%
2023 submission PAH4 [t]	9.46256 E-05	1.02689 E-04	9.96775 E-05	9.274028 E-05	8.502 E-05	5.96464 E-05	5.306 E-05
2024 submission PAH4 [t]	9.46264 E-05	1.02696 E-04	9.96797 E-05	9.274077 E-05	8.531 E-05	5.96489 E-05	5.317 E-05
Change relative to the 2023 submission PAH4 [%]	0.00078%	0.0067%	0.0022%	0.00053%	0.34%	0.0041%	0.20%
2023 submission BaP [t]	4.26969 E-05	4.63352 E-05	4.49764 E-05	4.184622 E-05	3.836 E-05	2.69136 E-05	2.3943 E-05
submission BaP [t]	4.26973 E-05	4.63383 E-05	4.49774 E-05	4.184645 E-05	3.850 E-05	2.69147 E-05	2.3991 E-05
Change relative to the 2023 submission BaP [%]	0.00078%	0.0067%	0.0022%	0.00053%	0.34%	0.0041%	0.20%
2023 submission BbF [t]	1.730957 E-05	1.87845 E-05	1.82337 E-05	1.696469 E-05	1.555 E-05	1.09109 E-05	9.707 E-06
submission BbF [kg]	1.730970 E-05	1.87858 E-05	1.82341 E-05	1.696478 E-05	1.561 E-05	1.09114 E-05	9.726 E-06
Change relative to the 2023 submission BbF [%]	0.00078%	0.0067%	0.0022%	0.00053%	0.34%	0.0041%	0.20%
2023 submission BkF [t]	1.730957 E-05	1.87845 E-05	1.82337 E-05	1.696469 E-05	1.555 E-05	1.09109 E-05	9.707 E-06
submission BkF [t]	1.730970 E-05	1.87858 E-05	1.82341 E-05	1.696478 E-05	1.561 E-05	1.09114 E-05	9.726 E-06
Change relative to the 2023 submission BkF [%]	0.00078%	0.0067%	0.0022%	0.00053%	0.34%	0.0041%	0.20%
2023 submission IPy [t]	1.730957 E-05	1.87845 E-05	1.82337 E-05	1.696469 E-05	1.555 E-05	1.09109 E-05	9.707 E-06
2024 submission IPy [t]	1.730970 E-05	1.87858 E-05	1.82341 E-05	1.696478 E-05	1.561 E-05	1.09114 E-05	9.726 E-06
Change relative to the 2023 submission IPy [%]	0.00078%	0.0067%	0.0022%	0.00053%	0.34%	0.0041%	0.20%
2023 submission PCDD/F [g]	3.84657 E-05	4.17434 E-05	4.0519 E-05	3.769930 E-05	3.4562 E-05	2.42465 E-05	2.157 E-05
2024 submission PCDD/F [g]	3.84660 E-05	4.17462 E-05	4.0520 E-05	3.769950 E-05	3.4680 E-05	2.42475 E-05	2.161 E-05

2G4 Other: Tobacco	2005	2007	2008	2009	2010	2020	2021
Change relative to the 2023 submission PCDD/F [%]	0.00078%	0.0067%	0.0022%	0.00053%	0.34%	0.0041%	0.20%
2023 submission Pb [g]	246.1805	267.158	259.3235	241.2755	221.20	155.178	138.05
2024 submission Pb [g]	246.1824	267.176	259.3293	241.2768	221.95	155.184	138.33
Change relative to the 2023 submission Pb [%]	0.00078%	0.0067%	0.0022%	0.00053%	0.34%	0.0041%	0.20%
2023 submission Cd [g]	7.69314	8.3487	8.1039	7.53986	6.912	4.849	4.314
2024 submission Cd [g]	7.69320	8.3492	8.1040	7.53990	6.936	4.850	4.323
Change relative to the 2023 submission Cd [%]	0.00078%	0.0067%	0.0022%	0.00053%	0.34%	0.0041%	0.20%
2023 submission Hg [g]	3.84657	4.17434	4.0519	3.7699	3.456	2.42465	2.157
2024 submission Hg [g]	3.84660	4.17462	4.0520	3.7700	3.468	2.42475	2.161
Change relative to the 2023 submission Hg [%]	0.00078%	0.0067%	0.0022%	0.00053%	0.34%	0.0041%	0.20%
2023 submission As [g]	61.16046	66.3720	64.4257	59.9419	54.95	38.5519	34.296
2024 submission As [g]	61.16094	66.3765	64.4271	59.9422	55.14	38.5535	34.366
Change relative to the 2023 submission As [%]	0.00078%	0.0067%	0.0022%	0.00053%	0.34%	0.0041%	0.20%
2023 submission Cr [g]	58.4679	63.4500	61.5893	57.3029	52.53	36.8547	32.79
2024 submission Cr [g]	58.4683	63.4542	61.5907	57.3032	52.71	36.8562	32.85
Change relative to the 2023 submission Cr [%]	0.00078%	0.0067%	0.0022%	0.00053%	0.34%	0.0041%	0.20%
2023 submission Cu [g]	136.1686	147.772	143.438	133.4555	122.35	85.8326	76.36
submission Cu [g]	136.1696	147.782	143.442	133.4562	122.77	85.8362	76.51
Change relative to the 2023 submission Cu [%]	0.00078%	0.0067%	0.0022%	0.00053%	0.34%	0.0041%	0.20%
2023 submission Ni [g]	11.53971	12.52302	12.1558	11.30979	10.37	7.27395	6.471
2024 submission Ni [g]	11.53980	12.52386	12.1561	11.30985	10.40	7.27425	6.484
Change relative to the 2023 submission Ni [%]	0.00078%	0.0067%	0.0022%	0.00053%	0.34%	0.0041%	0.20%
2023 submission Se [g]	3.84657	4.17434	4.0519	3.769930	3.456	2.42465	2.157
2024 submission Se [g]	3.84660	4.17462	4.0520	3.769950	3.468	2.42475	2.161
Change relative to the 2023 submission Se [%]	0.00078%	0.0067%	0.0022%	0.00053%	0.34%	0.0041%	0.20%
2023 submission Zn [g]	619.298	672.069	652.361	606.959	556.447	390.369	347.277
2024 submission Zn [g]	619.303	672.114	652.375	606.962	558.353	390.385	347.981
Change relative to the 2023 submission Zn [%]	0.00078%	0.0067%	0.0022%	0.00053%	0.34%	0.0041%	0.20%

Fireworks: For the 2024 submission, there were major recalculations for HCB and Pb due to updated emission factors (see Table 4.47) and minor recalculations were due to updated activity data (see Table 4.48).

Table 4.47 Recalculations of Pb and HCB emission within 2G4 (Fireworks) between 2023 and 2024 Submissions.

2G4 Other: Fireworks	1990	1995	2000	2005	2010	2015	2020
2023 Submission Pb [kg]	5.5	6.9	18	31	24	No recalculation	23.9670
2024 Submission Pb [kg]	89	111	296	500	224		23.9681
Change relative to the 2023 Submission Pb	1516%	1516%	1516%	1516%	842%		0.0049%
2023 Submission HCB [g]	0.0054	0.0067	0.018	0.030	0.023	0.028	0.0232651
2024 Submission HCB [g]	0.1161	0.1439	0.385	0.650	0.500	0.321	0.0232662
Change relative to the 2023 Submission HCB	2064%	2064%	2064%	2064%	2064%	1032%	0.0049%

Table 4.48 Recalculations of emissions within 2G4 Fireworks for the years 2007, 2009, 2010, 2012, 2016, and 2020, between the 2023 and 2024 Submissions.

2G4 Fireworks	2007	2009	2010	2012	2016	2018	2020
2023 Submission TSP [kt]	0.11943	0.04628	0.0538600	0.0689753	0.0661095	0.0834074	0.0542446
2024 Submission TSP [kt]	0.11985	0.04648	0.0538668	0.0689765	0.0661170	0.0834084	0.0542472
Change relative to the 2023 Submission TSP	0.35%	0.42%	0.013%	0.0018%	0.011%	0.0012%	0.0049%
2023 Submission PM_{10} [kt]	0.1087	0.04211	0.0490002	0.0627517	0.060144	0.0758815	0.0493501
2024 Submission PM_{10} [kt]	0.1090	0.04228	0.0490064	0.0627528	0.060151	0.0758824	0.0493525
Change relative to the 2023 Submission PM_{10}	0.35%	0.42%	0.013%	0.0018%	0.011%	0.0012%	0.0049%
2023 Submission $PM_{2.5}$ [kt]	0.05648	0.02189	0.0254711	0.03261931	0.0312640	0.03944443	0.0256530
2024 Submission $PM_{2.5}$ [kt]	0.05668	0.02198	0.0254743	0.03261988	0.0312676	0.03944490	0.0256542
Change relative to the 2023 Submission $PM_{2.5}$	0.35%	0.42%	0.013%	0.0018%	0.011%	0.0012%	0.0049%
2023 Submission NO_x [kt]	2.827 E-04	1.096 E-04	1.27502 E-04	1.63285 E-04	1.56501 E-04	1.974500 E-04	1.284130 E-04
2024 Submission NO_x [kt]	2.837 E-04	1.100 E-04	1.27519 E-04	1.63288 E-04	1.56518 E-04	1.974523 E-04	1.284192 E-04
Change relative to the 2023 Submission NO_x	0.35%	0.42%	0.013%	0.0018%	0.011%	0.0012%	0.0049%
2023 Submission SO_2 [kt]	3.284 E-03	1.2726 E-03	1.48099 E-03	1.896617 E-03	1.8178 E-03	1.8337 E-03	2.293457 E-03
2024 Submission SO_2 [kt]	3.295 E-03	1.2780 E-03	1.48118 E-03	1.896651 E-03	1.8180 E-03	1.8337 E-03	2.293485 E-03
Change relative to the 2023 Submission SO_2	0.35%	0.42%	0.013%	0.0018%	0.011%	0.0012%	0.0049%
2023 Submission CO [kt]	7.77 E-03	3.013 E-03	3.50632 E-03	4.49034 E-03	4.3038 E-03	5.42987 E-03	3.53136 E-03
2024 Submission CO [kt]	7.80 E-03	3.026 E-03	3.50676 E-03	4.49041 E-03	4.3043 E-03	5.42994 E-03	3.53153 E-03
Change relative to the 2023 Submission CO	0.35%	0.42%	0.013%	0.0018%	0.011%	0.0012%	0.0049%
2023 Submission As [kg]	1.446	0.5605	0.65222	0.835265	0.80056	1.010033	0.65688
2024 Submission As [kg]	1.451	0.5628	0.65231	0.835280	0.80065	1.010045	0.65691
Change relative to the 2023 Submission As	0.35%	0.42%	0.013%	0.0018%	0.011%	0.0012%	0.0049%
2023 Submission Cd [kg]	1.609	0.6237	0.72578	0.929468	0.89085	1.123946	0.73097
2024 Submission Cd [kg]	1.615	0.6263	0.72587	0.929484	0.89095	1.123959	0.73100
Change relative to the 2023 Submission Cd	0.35%	0.42%	0.013%	0.0018%	0.011%	0.0012%	0.0049%

2G4 Fireworks	2007	2009	2010	2012	2016	2018	2020
2023 Submission Cr [kg]	16.96	6.57	7.6501	9.79710	9.3900	11.84700	7.7048
2024 Submission Cr [kg]	17.02	6.60	7.6511	9.79727	9.3911	11.84714	7.7052
Change relative to the 2023 Submission Cr	0.35%	0.42%	0.013%	0.0018%	0.011%	0.0012%	0.0049%
2023 Submission Cu [kg]	482.8	187.10	217.735	278.8404	267.255	337.1838	219.29
2024 Submission Cu [kg]	484.5	187.89	217.762	278.8453	267.285	337.1878	219.30
Change relative to the 2023 Submission Cu	0.35%	0.42%	0.013%	0.0018%	0.011%	0.0012%	0.0049%
2023 Submission Hg [kg]	0.06198	0.02402	0.0279525	0.03579708	0.0343098	0.04328711	0.0281521
2024 Submission Hg [kg]	0.06220	0.02412	0.0279560	0.03579771	0.0343137	0.04328762	0.0281534
Change relative to the 2023 Submission Hg	0.35%	0.42%	0.013%	0.0018%	0.011%	0.0012%	0.0049%
2023 Submission Ni [kg]	32.62	12.64	14.7118	18.84057	18.0578	22.78269	14.8169
2024 Submission Ni [kg]	32.74	12.70	14.7137	18.84090	18.0598	22.78296	14.8176
Change relative to the 2023 Submission Ni	0.35%	0.42%	0.013%	0.0018%	0.011%	0.0012%	0.0049%
2023 Submission Zn [kg]	282.7	109.6	127.502	163.2849	156.501	197.4500	128.4130
2024 Submission Zn [kg]	283.7	110.0	127.519	163.2878	156.518	197.4523	128.4192
Change relative to the 2023 Submission Zn	0.35%	0.42%	0.013%	0.0018%	0.011%	0.0012%	0.0049%

4.7.1.4 Planned Improvements

No improvements are currently planned for this subsector.

4.8 Other Industry Production (NRF 2H)

4.8.1 Food and Beverages Industry (NFR 2H2)

The only other industry production occurring in Iceland is the Food and Beverages Industry. The only pollutant emitted in this industry is NMVOC.

4.8.1.1 Activity Data

Production statistics for animal feed are available for 2005-2013. The statistics were linearly extrapolated for earlier and later years in the timeseries.

Production data of beer and malt/pilsner is obtained from the main producers. These were the only producers until 2006 when other breweries started. Based on expert judgement the main producers produce at least 90% of the total production since 2006. This factor is used as a conservative estimate of the total production since 2006.

Production of bread, cakes/biscuits, meat, fish, poultry, coffee, and spirits was estimated as follows. The total consumption within the country was estimated by using results of the survey *The Diet of Icelanders* (Embætti Landlæknis, 2022) (Embætti Landlæknis, 2011), (Embætti Landlæknis, 2002), (Embætti Landlæknis, 1990). The results give average consumption figures per person for the years 1990, 2002, 2011, and 2020. The consumption figures were interpolated for the years in between. The total consumption was calculated by using the population (or adult population in the case of coffee and spirits). A waste factor of 33% was also used when produced amounts were calculated from consumption figures (FAO, 2011). In the case of bread, cakes/biscuits, meat, fish, and poultry, it is assumed that the total production in Iceland is for the domestic market. There is an export of fish and meat, but it is almost exclusively fresh or frozen and therefore not cooked in Iceland. In the case of coffee and spirits, the import and export statistics were available from Statistic Iceland. The net import (import minus export) was subtracted from the calculated consumption to estimate the domestic production.

There is no distinction made between industry and household emissions in these calculations. All NMVOC emission from bread and cake baking and fish/meat/poultry cooking is therefore estimated.

4.8.1.2 Emission Factors

Tier 2 emission factors for NMVOC were taken from chapter 2.H.2 Food and Beverages of the 2023 EMEP/EEA Guidebook (EEA, 2023) and are presented in Table 4.49.

Table 4.49 NMVOC emission factors for the production of various food and beverage products.

	NMVOC
Meat, fish, and poultry	0.30 kg/t
Cakes, biscuits, and breakfast cereals	1.0 kg/t
Beer and malt	0.035 kg/hl
Spirits	15 kg/hl
Bread (European)	4.5 kg/t
Coffee roasting	0.55 kg/t
Animal feed	1.0 kg/t

4.8.1.3 Recalculations and Improvements

Recalculations for the 2025 Submission

The method of estimating NMVOC emissions from beer and malt was changed. In the 2024 submission, it was based on the survey about the diet of Icelanders and the import/export, as in the case of spirits (see above). Now, production data from the main producers was gathered which is considered a better estimate. This led to recalculations for the NMVOC emissions for the whole timeline. Another reason for recalculations were updates in import/export data from SI and updated data from Statistics Iceland regarding population statistics from the year 2011. The recalculations can be seen in the table below.

Table 4.50 Recalculations of NMVOC in 2H Food and Beverages between submissions.

2H Food and Beverages Industry	1990	1995	2000	2005	2010	2015	2020	2021	2022
2024 submission NMVOC [kt]	0.1532	0.1614	0.1704	0.1758	0.1717	0.2820	0.4021	0.479	0.455
2025 submission NMVOC [kt]	0.1525	0.1627	0.1740	0.1798	0.1762	0.2844	0.4027	0.446	0.402
Change relative to the 2024 submission NMVOC [kt]	-0.0007	0.0013	0.0036	0.0039	0.0045	0.0024	0.0006	-0.034	-0.054
Change relative to the 2024 submission NMVOC [%]	-0.43%	0.80%	2.1%	2.2%	2.6%	0.86%	0.15%	-7.0%	-11.8%

Recalculations for the 2024 Submission

Recalculations were made for the 2024 submission due to updates in import/export data from SI (see Table 4.51).

Table 4.51 Recalculations of NMVOC in 2H Food and Beverages between submissions.

2H Food and Beverages Industry	2020	2021
2023 submission NMVOC [kt]	0.40235	0.51
2024 submission NMVOC [kt]	0.40207	0.48
Change relative to the 2023 submission NMVOC [%]	-0.072%	-5.6%

4.8.1.4 Planned Improvements

No improvements are currently planned for this subsector.

5 Agriculture (NFR Sector 3)

5.1 Overview

Iceland is self-sufficient in all major livestock products, such as meat, milk, and eggs. Traditional livestock production is grassland-based, and most farm animals are native breeds, i.e., dairy cattle, sheep, horses, and goats, which are all of ancient Nordic origin, one breed for each species. These animals are generally smaller than the breeds common elsewhere in Europe. Beef production, however, is partly through imported breeds, as is most poultry and all pork production. There is not much arable crop production in Iceland, due to a cold climate and short growing season. Cropland in Iceland consists mainly of cultivated hayfields, but barley, rapeseed and some other crops are grown on limited acreage.

The main pollutant emitted from the Agriculture sector is ammonia (NH_3) and the largest source is manure management. Almost all of Iceland's NH_3 emissions come from the Agriculture sector. Furthermore, one third of all non-methane volatile organic compound (NMVOC) emissions come from this sector. This can be seen in Table 5.1 below.

Table 5.1 Contribution from the agriculture sector to the national total for the newest submission year.

	NH_3	NO_x	NMVOC	TSP	PM_{10}	$PM_{2.5}$
National total [kt]	4.39	19.6	6.07	3.90	2.09	1.07
Agriculture total [kt]	4.30	0.972	1.55	0.248	0.188	0.0366
Agriculture shares of nat. total	98%	5.0%	26%	6.3%	9.0%	3.4%

Emission estimates from the Agriculture sector include emission estimates from the following sources:

- Manure Management (NFR 3B)
- Crop Production and Agricultural Soils (NFR 3D)
- Agriculture Other Including Use of Pesticides (NFR 3Df and 3I)

Each of these sources are described in more detail in Sections 5.3 to 5.5.

NH_3, nitric oxide (NO_x), NMVOCs, and particulate matter (PM) emissions are estimated for Animal Husbandry and Manure Management (3B), as well as Crop Production and Agricultural Soils (3D).

Dioxin, polycyclic aromatic hydrocarbons (PAH4), hexachlorobenzene (HCB), polychlorinated biphenyl (PCB) and heavy metals emissions are not applicable (NA), not occurring (NO) or not estimated (NE).

Buffalos, mules, and asses are not farmed in Iceland and, therefore, these animal categories are not NO in the Icelandic inventory. Field Burning of Agricultural Residues (3F) is also identified as NO in Iceland.

A summary of the categories included in the Agriculture sector by pollutant, including the Tier methodology used, is presented in Table 5.2.

Table 5.2 Overview table NECD gases and PM for the newest submission year (NA: not applicable, NO: not occurring).

Sector		NECD Gases			PM		
		NO_x	NMVOC	NH_3	$PM_{2.5}$	PM_{10}	TSP
3B1a	Manure Management – Dairy cattle	T2	T2	T2	T2	T2	T2
3B1b	Manure Management – Non-dairy Cattle	T2	T2	T2	T2	T2	T2
3B2	Manure Management – Sheep	T2	T1	T2	T2	T2	T2
3B3	Manure Management – Swine	T2	T1	T2	T2	T2	T2
3B4a	Manure Management – Buffalo	NO	NO	NO	NO	NO	NO
3B4d	Manure Management – Goats	T2	T1	T2	T2	T2	T2
3B4e	Manure Management – Horses	T2	T1	T2	T2	T2	T2
3B4f	Manure Management – Mules and Asses	NO	NO	NO	NO	NO	NO
3B4gi	Manure Management – Laying Hens[1]	T2	T1	T2	T2	T2	T2
3B4gii	Manure Management – Broilers	T2	T1	T2	T2	T2	T2
3B4giii	Manure Management – Turkeys	T2	T1	T2	T1	T1	T1
3B4giv	Manure Management – Other Poultry	T2	T1	T2	T1	T1	T1
3B4h	Manure Management – Other Animals (Fur Animals)	T2	T1	T2	T2	T2	T2
3Da1	Inorganic N-fertilisers (incl. Urea Application)	T1	NA	T2	NA	NA	NA
3Da2a	Animal Manure Applied to Soils	T1	NA	T2	NA	NA	NA
3Da2b	Sewage Sludge Applied to Soils	T1	NA	T1	NA	NA	NA
3Da2c	Other Organic Fertilisers Applied to Soils (incl. Compost)	T1	NA	T1	NA	NA	NA
3Da3	Urine and Dung Deposited by Grazing Animals	T1	NA	T2	NA	NA	NA
3Da4	Crop Residues Applied to Soils	NA	NA	NA	NA	NA	NA
3Db	Indirect Emissions from Managed Soils	NA	NA	NA	NA	NA	NA
3Dc	Farm-level Agricultural Operations incl. Storage, Handling, and Transport of Agricultural Products	NA	NA	NA	T2	T2	T2
3Dd	Off-farm Storage, Handling, and Transport of Bulk Agricultural Products	NA	NA	NA	NA	NA	NA
3De	Cultivated Crops	NA	T1	NA	NA	NA	NA
3Df	Use of Pesticides	NA	NA	NA	NA	NA	NA
3F	Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO

Table 5.3 shows which subsectors in Agriculture are key categories for which air pollutants. A key category is one that is prioritised within the national inventory system because it is significantly important for one or a number of air pollutants in a country's national inventory of air pollutants in terms of the absolute level, the trend, or the

uncertainty in emissions (EEA, 2023). Categories whose cumulative percentage contribution is greater than 80% should be identified as key.

Table 5.3 Key categories for air pollutants within Agriculture.

Sector	NO_x, NH_3, NMVOC, and PM		
	1990	2023	Trend
3B1a Manure Management – Dairy Cattle		NMVOC, NH_3	NMVOC, NH_3
3B1b Manure Management – Non-dairy Cattle	NH_3	NMVOC, NH_3	NH_3
3B2 Manure Management – Sheep	NMVOC, NH_3	NMVOC, NH_3	NH_3
3B3 Manure Management – Swine			NH_3
3B4e Manure Management – Horses	NMVOC	NMVOC	NMVOC
3B4gi Manure Management – Laying Hens			NH_3
3B4gii Manure Management – Broilers			NH_3
3B4h Manure Management – Other Animals			NH_3
3Da1 Inorganic N-fertilisers (incl. urea application)		NH_3	NH_3
3Da2a Animal Manure Applied to Soils	NH_3	NH_3	NH_3
3Da3 Urine and Dung Deposited by Grazing Animals	NH_3	NH_3	

5.2 General Methodology

The methodology is based on Chapters 3B and 3D of the 2013, 2019 and 2023 EMEP/EEA Guidebooks (EEA, 2013; EEA, 2019; EEA, 2023). All equations, as well as the majority of emission factors (EF) and other parameters, stem from the corresponding EMEP/EEA Guidebook chapters.

For estimating emissions of NH_3 and NO_x in 3B Manure Management, the N-flow approach is used as outlined in the 2023 EMEP/EEA Guidebook. This considers the flow of total ammoniacal nitrogen (TAN) through the manure management system. In the 2019 EMEP/EEA Guidebook, this flow is modelled by a series of equations that considers the amount of TAN and losses at all different stages of the manure management process. The set of equations provided by the 2019 EMEP/EEA Guidebook was applied to more disaggregated livestock categories than the NFR methodology demands, as can be seen in Table 5.4. The resulting emissions were then aggregated to the respective NFR categories.

NH_3 and NO_x emissions from grazing animals are part of this N flow approach and are, therefore, calculated in this context, although they are reported under Agricultural Soils (3D). Similarly, the manure that is available as organic fertiliser for application to land is determined from the N-flow approach and is used as an input term in estimating the NH_3 and NO_x. Activity data, emission factors and other parameters used in these calculations will be discussed in the following chapters.

5.3 Manure Management (NFR 3B)

5.3.1 Activity Data

Animal population numbers are directly retrieved from the livestock database (www.bustofn.is) of the Ministry of Industries (Atvinnuvegaráðuneytið) (MI) and annual average populations (AAP) are calculated according to the 2006 IPCC Guidelines. Since the data from the annual census of MI represents livestock populations at a certain point in time (in November) it does not reflect their seasonal changes, e.g., animals with a life spanning only one summer. Also, for some livestock categories, it does not include data on young animals, e.g., fattening pigs. Therefore, the number of animals not included in the census is estimated using information on fertility rates, number of offspring, number of animals slaughtered, etc. The inclusion of young animals leads to livestock populations being considerably higher for some categories than the ones published by the MI or by other public sources such as Statistics Iceland (*Hagstofa Íslands*) (SI)[11]. For the complete methodology of calculating the AAP and a comparison with published livestock numbers please refer to Iceland's latest National Inventory Document on Greenhouse Gas Emissions (Icelandic Environment- and Energy Agency, 2025).

Livestock data is available on a more disaggregated level than requested by the reporting requirements, as can be seen in Table 5.4. Therefore, the emissions are estimated on a more disaggregated level and then combined to the NFR categories.

Table 5.4 Livestock as reported in NFR tables and as calculated in the Icelandic inventory on a more disaggregated level.

NFR Code	Animal Category	Disaggregation in Icelandic Inventory
3B1a	Dairy cattle	Mature Dairy Cattle
3B1b	Non-dairy cattle	Other Mature Cattle; Pregnant Heifers; Young bulls and Non-Inseminated Heifers; Calves
3B2	Sheep	Ewes; Rams; Young sheep; Lambs
3B3	Swine	Swine; Piglets
3B4a	Buffalo	NO
3B4d	Goats	Goats
3B4e	Horses	Horses; Young Horses; Foals
3B4f	Mules and asses	NO
3B4gi	Laying hens	Hens
3B4gii	Broilers	Pullets; Broilers
3B4giii	Turkeys	Turkeys
3B4giv	Other poultry	Ducks; Geese
3B4h	Other (fur animals)	Minks; Foxes; Rabbits

Table 5.5 shows the AAP of Icelandic livestock categories for selected years since 1990. The most prominent trends in the development of livestock populations since 1990 are a decrease in the dairy cattle and sheep populations and an increase in non-dairy, swine, and poultry populations.

Table 5.5 Annual average population of livestock according to NFR categorization in Iceland.

NFR code	Livestock sector	1990	1995	2000	2005	2010	2015	2020	2022	2023
3B1a	Dairy Cattle	32,249	30,428	27,066	24,488	25,379	27,441	25,941	25,841	25,638
3B1b	Non-Dairy Cattle	43,299	42,771	45,078	41,482	47,130	51,335	55,229	54,161	52,396
3B2	Sheep	858,833	718,544	730,177	713,419	753,148	752,515	635,916	586,548	564,691

[11] https://hagstofa.is/talnaefni/atvinnuvegir/landbunadur/bufe-og-uppskera/

NFR code	Livestock sector	1990	1995	2000	2005	2010	2015	2020	2022	2023
3B3	Swine	29,333	30,746	32,242	39,350	38,032	42,542	39,253	38,435	38,116
3B4a	Buffalo	NO	NO	NO	NO	NO	NO	NO	NO	NO
3B4d	Goats	485	511	548	657	1,015	1,476	2,414	2,759	2,680
3B4e	Horses	73,867	80,246	75,630	76,629	78,849	79,433	73,465	70,060	68,565
3B4f	Mules and Asses	NO	NO	NO	NO	NO	NO	NO	NO	NO
3B4gi	Laying Hens	506,165	186,295	284,612	212,795	164,374	171,161	240,853	254,770	241,745
3B4gii	Broilers	161,209	165,013	244,717	548,302	460,504	528,617	579,518	602,002	585,879
3B4giii	Turkeys	3,497	3,007	10,821	8,041	9,035	11,664	12,252	13,147	14,406
3B4giv	Other Poultry	5,783	5,247	2,481	1,769	1,347	1,056	581	477	468
3B4h	Other (Fur Animals)	47,778	37,809	40,725	36,823	39,739	47,695	15,768	12,862	5,167

5.3.2 Emission Factors and Associated Parameters

NH_3 and NO Tier 2 emissions depend on the total amounts of nitrogen and total TAN in manure. Total nitrogen is calculated by multiplying livestock AAP with the nitrogen excretion (Nex) rate per animal. TAN is calculated by multiplying total nitrogen with livestock specific TAN fractions provided in the 2023 EMEP/EEA Guidebook. The Nex rate per livestock category is calculated using default values from the 2019 IPCC Refinements to the 2006 IPCC Guidelines that take animal weight, and therefore, the smaller size of Icelandic breeds into account. For most animal categories other than Cattle and Sheep, the animal parameters are not changing over the timeseries, and the Nex rate is, therefore, also constant. Cattle and Sheep subcategories have a variable Nex rate over the timeline, since they are calculated by the Tier 2 approach, and for Horses and Poultry the Nex rate has been calculated on a more disaggregated level and reported as a weighted average in relation to the population data. The calculation method for the Nex rate for Cattle and Sheep follows the Tier 2 methodology from the 2019 IPCC Refinements by applying Equation 10.31, Equation 10.32[12], and Equation 10.33 for cattle and $N_{retention\_frac}$ of 0.10 from Table 10.20 for Sheep. Detailed calculations and explanations can be found in the newest edition of the National Inventory Document for Iceland.

Total nitrogen and TAN have to be allocated to either slurry or solid manure management. Fractions for slurry and solid manure management are country specific and identical to the ones used in Iceland's National Inventory Document. The same is valid for the fractions of the year spent inside versus outside. Two more parameters used in the calculation of TAN mass flow are the amount of straw used in animal housing and the amount of nitrogen contained in it (only for solid manure management). Calves are the only cattle subcategory whose manure is stored in solid storage. In 2022, the Icelandic Agricultural Advisory Centre (*Ráðgjafamiðstöð landbúnaðarins*) interviewed farmers on their use of straw for bedding for calves and came up with the estimate of 350 kg straw/animal/year for 2021, which is an increase from 47 kg/animal/year in 1990, when only 10% of calf manure was stored in solid storage. Straw amounts for sheep, goats, and horses are based on 2023 EMEP/EEA Guidebook default data (Table 3.7) of hay used per day, adjusted for the time periods animals stay inside. As an example, sheep have a default housing period of 30 days (Table 3.7 of the 2023 EMEP/EEA Guidebook) but in Iceland it is 200 days. So, the

[12] According to the 2019 refinements to the 2006 IPCC Guidelines, Eq. 10.32 is valid for Cattle, Sheep, and Goats.

default straw value of 20 kg/yr is multiplied by 200/30 to obtain 133.3 kg/yr. The above-mentioned parameters are summarised in Table 5.6.

Table 5.6 Parameters used in the N-flow calculations, for the newest submission year.

NFR Code	Animal Category	Nex [kg head^{-1} yr^{-1}]	Prop. TAN (of N)	Fraction Slurry	Fraction Solid	Housing Period [days]	Straw [t/yr]
3B1a	Dairy Cattle	97	0.6	1	0	309	
3B1b	Non-Dairy Cattle[1]	38	0.6	0.70	0.30	305	7544
3B2	Sheep[2]	10	0.5	0.35	0.65	200	30803
3B3	Swine	18	0.7	1	0	365	
3B4d	Goats	7.8	0.5	0	1	200	357
3B4e	Horses	28	0.6	0	1	51	8621
3B4gi	Laying Hens	0.60	0.7	0.09	0.91	365	
3B4gii	Broilers	0.48	0.7	0	1	365	
3B4giii	Turkeys	1.8	0.7	0	1	365	
3B4giv	Other Poultry	0.82	0.7	0	1	365	
3B4h	Other (Fur Animals)	7.3	0.6	0	1	365	

1 Values for Non-dairy Cattle are weighted averages for the subcategories Other Mature Cattle, Pregnant Heifers, Steers and Non-inseminated Heifers, and Calves.
2 Values for Sheep are weighted averages for the subcategories Ewes, Animals for Replacement, Rams, and Lambs. However, lambs are not taken into account for the housing period. Lambs only live 4.5 months in Iceland (over the summer) and spend all their days outside.

All manure is assumed to be stored before spreading. Emission factors for animal manure, either managed as slurry or solid manure during housing and storage, as well as emission factors for manure spreading and manure deposited by grazing animals, are given as shares of TAN by livestock category in the 2023 EMEP/EEA Guidebook. In the absence of default values for sheep slurry, 2023 EMEP/EEA Guidebook default values for cattle were used instead. The emissions factors are shown in Table 5.7.

Table 5.7 Emission factors for NH_3, NO, and N_2O used in the N-flow methodology. The emission factors are a fraction of Total Ammoniacal Nitrogen (TAN).

NFR Code	Animal Category	MMS	EF NH_3-N Housing	EF NH_3-N Storage	EF NH_3-N Application	EF NO-N Storage	EF N_2O-N Storage
3B1a	Dairy Cattle	Slurry	0.24	0.25	0.55	0.0001	0.01
		Solid	0.08	0.32	0.68	0.01	0.02
3B1b	Non-dairy Cattle	Slurry	0.24	0.25	0.55	0.0001	0.01
		Solid	0.08	0.32	0.68	0.01	0.02
3B2	Sheep	Slurry[1]	0.24	0.25	0.55	0.0001	0.001
		Solid	0.22	0.32	0.9	0.01	0.02
3B3	Swine	Slurry	0.35	0.11	0.29	0.003	0
		Solid	0.24	0.29	0.45	0.01	0.01
3B3	Piglets	Slurry	0.27	0.11	0.4	0.0001	0
		Solid	0.23	0.29	0.45	0.01	0.01
3B4d	Goats	Solid	0.22	0.28	0.9	0.01	0.02
3B4e	Horses	Solid	0.22	0.35	0.9	0.01	0.02
3B4gi	Laying Hens	Slurry	0.41	0.14	0.69	0.003	0
		Solid	0.20	0.08	0.45	0.01	0.002
3B4gii	Broilers	Solid	0.21	0.30	0.38	0.01	0.002
3B4giii	Turkeys	Solid	0.35	0.24	0.54	0.01	0.002
3B4giv	Other Poultry - Ducks	Solid	0.24	0.24	0.54	0.01	0.002
3B4giv	Other Poultry - Geese	Solid	0.57	0.16	0.45	0.01	0.002
3B4h	Other (Fur Animals)	Solid	0.27	0.09	NA[2]	0.01	0.002

1 No emission factor exists for NH3 emissions from slurry for Sheep in the 2023 EMEP/EEA Guidebook. Hence, the emission factors for cattle are applied.
2 The emission factor is Not Applicable in the 2023 EMEP/EEA Guidebook and Iceland does not have a country-specific emission factor.

NMVOC emissions are calculated using methodology from the 2023 EMEP/EEA Guidebook. Tier 2 methodology is used for dairy cattle and non-dairy cattle, but Tier 1 methodology for other animal categories, applying the default emission factors from Table 3.4, shown here in Table 5.8. When default emission factors with silage feeding are available, these are used.

Table 5.8 Emission factors used for calculating NMVOC emissions.

NFR code	Animal Category	EF NMVOC [kg AAP^{-1} a^{-1}]
3B1a	Dairy Cattle	17.1[1]
3B1b	Non-Dairy Cattle	3.43[1]
3B2	Sheep	0.28
3B3	Swine - Fattening pigs	0.55
3B3	Swine - Sows	1.70
3B4d	Goats	0.62
3B4e	Horses	7.78
3B4gi	Laying hens	0.17
3B4gii	Broilers	0.11
3B4giii	Turkeys	0.49
3B4giv	Other Poultry (Ducks, Geese)	0.49
3B4h	Other Animals (Fur Animals)	1.94
3B4h	Other Animals (Rabbits)	0.059

1 Implicit emission factor, since Tier 2 methodology used for cattle.

Tier 2 calculations of particulate matter emissions are based on information on the amount of time livestock spends in housing and the fractions of manure either managed as slurry or as solid manure (see Table 5.6 above). The applied emission factors are reported in Table 5.9 and derive from the 2023 EMEP/EEA Guidebook and from the 2013 EMEP/EEA Guidebook. In the case of turkeys, ducks, and geese, the Tier 1 emission factors are applied.

Table 5.9 Emission factors used for calculating particulate emissions, Tier 2.

NFR Code	Animal Category	MMS	EF TSP [kg AAP^{-1} a^{-1}]	EF PM_{10} [kg AAP^{-1} a^{-1}]	EF $PM_{2.5}$ [kg AAP^{-1} a^{-1}]	Source
3B1a	Dairy Cattle	Slurry Solid	1.81 0.94	0.83 0.43	0. 54 0.28	Table A1.7 2023 EMEP/EEA Guidebook
3B1b	Non-dairy Cattle[1]	Slurry Solid	0.69 0.52	0.32 0.24	0.21 0.16	Table A1.7 2023 EMEP/EEA Guidebook
3B1b	Calves[1]	Slurry Solid	0.34 0.35	0.15 0.16	0.1 0.1	Table A1.7 2023 EMEP/EEA Guidebook
3B2	Sheep	Slurry Solid	--- 0.14	--- 0.056	--- 0.017	Table A1.7 2023 EMEP/EEA Guidebook
3B3	Swine – Piglets	Slurry Solid	0.7 0.83	0.31 0.37	0.06 0.07	Table A3-4 2013 EMEP/EEA Guidebook
3B3	Swine – Sows	Slurry Solid	1.36 1.77	0.61 0.8	0.11 0.14	Table A3-4 2013 EMEP/EEA Guidebook
3B4d	Goats	Solid	0.139	0.056	0.017	Table A1.7 2023 EMEP/EEA Guidebook
3B4e	Horses	Solid	0.48	0.22	0.14	Table A1.7 2023 EMEP/EEA Guidebook
3B4gi	Laying Hens	Slurry Solid	0.025 0.119	0.025 0.119	0.003 0.023	Table A3-4 2013 EMEP/EEA Guidebook
3B4gii	Broilers	Solid	0.069	0.069	0.009	Table A3-4 2013 EMEP/EEA Guidebook
3B4giii	Turkeys	Solid	0.52	0.52	0.07	Table 3.3 2013 EMEP/EEA Guidebook
3B4giv	Other Poultry - Ducks	Solid	0.14	0.14	0.018	Table A1.7 2023 EMEP/EEA Guidebook
3B4giv	Other Poultry - Geese	Solid	0.24	0.24	0.032	Table A1.7 2023 EMEP/EEA Guidebook
3B4h	Other - Fur Animals	Solid	0.018	0.0081	0.0042	Table A1.7 2019 EMEP/EEA Guidebook

1 Non-dairy Cattle and Calves are calculated separately and subsequently aggregated in the category 3B1b Non-Dairy Cattle.

5.3.3 Recalculations and Improvements

5.3.3.1 Recalculations for the 2025 submission

For the 2025 submission, the livestock numbers were updated so they are synchronized with the livestock database from www.bustofn.is. This has a small effect on emissions multiple animal categories in on some years where livestock numbers have been updated later on. Multiple other updates were done for the 2025 submission, affecting the emissions from Manure Management. They are:

- Updated fractions of slurry stored with and without crust for cattle affecting NOx, NMVOC, NH3 in 3B1. The recalculations are shown in Table 5.10.
- Calculation error for young sheep and lambs affecting PM2.5, as shown in Table 5.11.
- Recalculations to NOx, NH3 and PM2.5 due to converting from 2006 IPCC Guidelines to 2019 Refinements and updated weight affecting Nex for swine (3B3) and goats (3B4d). The recalculations are shown in Table 5.12 and Table 5.13.
- NOx, NMVOC, NH3, PM2.5, PM10, and TSP in 3B4g due to converting Laying Hens and Broilers from 2006 IPCC Guidelines to 2019 Refinements and Chickens being moved from Laying Hens to Broilers, as shown in Table 5.14.
- Updated weight affecting Nex for fur-animals (3B4h) affecting NOx and NH3, as shown in Table 5.15.
- Corrected notation key from NA to NO affecting all reported air pollutants in Sewage sludge applied to soils (3Da2a) and Other organic fertilisers applied to soils (3Da2b) from 1990-2004 and 1990-2011 respectively.

Table 5.10 Recalculation for NO_x, NMVOC, NH_3 due to updated fractions of slurry stored with and without crust for cattle, affecting the whole time series.

3B1		1990	1995	2000	2005	2010	2015	2020	2021	2022
NO_x	2024 submission [kt]	0.00110	0.00130	0.00250	0.00298	0.00463	0.00493	0.00480	0.00473	0.00466
	2025 submission [kt]	0.00109	0.00132	0.00253	0.00299	0.00466	0.00494	0.00481	0.00474	0.00468
	Change relative to 2024 submission [kt]	-6.2E-06	2.1E-05	3.3E-05	1.9E-05	2.2E-05	1.6E-05	1.3E-05	1.3E-05	1.1E-05
	Change relative to 2024 submission [%]	-0.56%	1.7%	1.3%	0.62%	0.47%	0.33%	0.27%	0.27%	0.23%
NMVOC	2024 submission [kt]	0.609	0.601	0.567	0.528	0.582	0.634	0.637	0.638	0.634
	2025 submission [kt]	0.597	0.589	0.555	0.518	0.570	0.621	0.624	0.625	0.620
	Change relative to 2024 submission [kt]	-0.012	-0.012	-0.012	-0.010	-0.012	-0.013	-0.014	-0.014	-0.013
	Change relative to 2024 submission [%]	-1.9%	-1.9%	-2.1%	-1.9%	-2.0%	-1.9%	-2.0%	-2.0%	-2.0%
NH_3	2024 submission [kt]	1.167	1.135	1.089	1.001	1.080	1.151	1.134	1.138	1.128
	2025 submission [kt]	1.149	1.169	1.133	1.038	1.123	1.183	1.160	1.164	1.153
	Change relative to 2024 submission [kt]	-0.018	0.034	0.044	0.037	0.044	0.033	0.026	0.026	0.025
	Change relative to 2024 submission [%]	-1.6%	3.1%	4.1%	3.8%	4.1%	2.9%	2.3%	2.3%	2.2%

Table 5.11 Recalculation for $PM_{2.5}$ due to a calculation error for young sheep and lambs, affecting the whole time series.

3B2		1990	1995	2000	2005	2010	2015	2020	2021	2022
$PM_{2.5}$	2024 submission [kt]	0.00361	0.00302	0.00308	0.00303	0.00319	0.00316	0.00268	0.00258	0.00245
	2025 submission [kt]	0.00332	0.00278	0.00282	0.00275	0.00289	0.00287	0.00243	0.00234	0.00223
	Change relative to 2024 submission [kt]	-2.9E-04	-2.4E-04	-2.6E-04	-2.7E-04	-3.0E-04	-2.9E-04	-2.5E-04	-2.4E-04	-2.2E-04
	Change relative to 2024 submission [%]	-8.0%	-8.0%	-8.5%	-9.0%	-9.5%	-9.1%	-9.2%	-9.3%	-9.0%

Table 5.12 Recalculation for NO_x, NH_3 and $PM_{2.5}$ due to converting from 2006 IPCC Guidelines to 2019 Refinements and updated weight affecting Nex for swine, affecting the whole time series.

3B3		1990	1995	2000	2005	2010	2015	2020	2021	2022
NO_x	2024 submission [kt]	4.7E-05	5.0E-05	5.2E-05	6.2E-05	5.9E-05	6.5E-05	6.0E-05	5.9E-05	5.9E-05
	2025 submission [kt]	9.2E-05	9.7E-05	1.0E-04	1.2E-04	1.2E-04	1.3E-04	1.2E-04	1.2E-04	1.2E-04
	Change relative to 2024 submission [kt]	4.5E-05	4.7E-05	4.9E-05	6.1E-05	5.9E-05	6.7E-05	6.2E-05	6.0E-05	6.0E-05
	Change relative to 2024 submission [%]	94%	94%	94%	98%	100%	102%	103%	103%	103%
NH_3	2024 submission [kt]	0.09	0.09	0.10	0.11	0.11	0.12	0.11	0.11	0.11
	2025 submission [kt]	0.16	0.17	0.18	0.22	0.21	0.23	0.21	0.21	0.21
	Change relative to 2024 submission [kt]	0.077	0.081	0.085	0.10	0.10	0.11	0.11	0.10	0.10
	Change relative to 2024 submission [%]	88%	87%	87%	92%	95%	96%	98%	98%	98%
$PM_{2.5}$	2024 submission [kt]	0.00194	0.00230	0.00241	0.00292	0.00280	0.00312	0.00287	0.00281	0.00281
	2025 submission [kt]	0.00192	0.00203	0.00213	0.00256	0.00245	0.00273	0.00251	0.00245	0.00246
	Change relative to 2024 submission [kt]	-2.6E-05	-2.7E-04	-2.8E-04	-3.5E-04	-3.5E-04	-3.9E-04	-3.6E-04	-3.5E-04	-3.5E-04
	Change relative to 2024 submission [%]	-1.3%	-12%	-12%	-12%	-12%	-13%	-13%	-13%	-13%

Table 5.13 Recalculation for NO_x and NH_3 due to converting from 2006 IPCC Guidelines to 2019 Refinements and updated weight affecting Nex for goats, affecting the whole time series.

3B4d		1990	1995	2000	2005	2010	2015	2020	2021	2022
NO_x	2024 submission [kt]	5.5E-05	5.8E-05	6.2E-05	7.4E-05	1.2E-04	1.7E-04	2.7E-04	2.8E-04	3.1E-04
	2025 submission [kt]	1.2E-05	1.3E-05	1.4E-05	1.7E-05	2.6E-05	3.7E-05	6.1E-05	6.1E-05	6.9E-05
	Change relative to 2024 submission [kt]	-4.3E-05	-4.5E-05	-4.8E-05	-5.8E-05	-8.9E-05	-1.3E-04	-2.1E-04	-2.2E-04	-2.4E-04
	Change relative to 2024 submission [%]	-78%	-78%	-78%	-78%	-78%	-78%	-77%	-78%	-78%
NH_3	2024 submission [kt]	0.0013	0.0014	0.0015	0.0017	0.0027	0.0039	0.0063	0.0065	0.0073
	2025 submission [kt]	0.0004	0.0004	0.0005	0.0005	0.0008	0.0012	0.0020	0.0020	0.0023
	Change relative to 2024 submission [kt]	-0.0009	-0.0009	-0.0010	-0.0012	-0.0019	-0.0027	-0.0043	-0.0045	-0.0050
	Change relative to 2024 submission [%]	-69%	-69%	-69%	-69%	-69%	-69%	-68%	-69%	-69%

Table 5.14 Recalculation for NO_x, NMVOC, NH_3, $PM_{2.5}$, PM_{10}, and TSP due to converting Laying Hens and Broilers from 2006 IPCC Guidelines to 2019 Refinements and chickens being moved from Laying Hens to Broilers, affecting the whole time series.

3B4g		1990	1995	2000	2005	2010	2015	2020	2021	2022
NO_x	2024 submission [kt]	0.0016	0.0012	0.0020	0.0031	0.0030	0.0043	0.0069	0.0070	0.0080
	2025 submission [kt]	0.0019	0.0017	0.0027	0.0049	0.0046	0.0058	0.0073	0.0075	0.0079
	Change relative to 2024 submission [kt]	0.00032	0.00053	0.00067	0.00172	0.00167	0.00145	0.00038	0.00046	-0.00007
	Change relative to 2024 submission [%]	21%	44%	33%	55%	57%	34%	5.5%	6.5%	-0.8%
NMVOC	2024 submission [kt]	0.1042	0.0511	0.0762	0.0868	0.0780	0.0875	0.1053	0.1037	0.1099
	2025 submission [kt]	0.1055	0.0526	0.0799	0.0991	0.0819	0.0916	0.1086	0.1090	0.1137
	Change relative to 2024 submission [kt]	0.0013	0.0015	0.0036	0.0124	0.0040	0.0040	0.0033	0.0053	0.0038
	Change relative to 2024 submission [%]	1.2%	3.0%	4.8%	14%	5.1%	4.6%	3.1%	5.1%	3.5%
NH_3	2024 submission [kt]	0.311	0.124	0.189	0.171	0.130	0.130	0.148	0.141	0.149
	2025 submission [kt]	0.160	0.079	0.121	0.148	0.127	0.139	0.156	0.155	0.160
	Change relative to 2024 submission [kt]	-0.151	-0.045	-0.068	-0.023	-0.003	0.009	0.008	0.015	0.011
	Change relative to 2024 submission [%]	-49%	-36%	-36%	-13%	-2.1%	7.3%	5.2%	11%	7.1%
$PM_{2.5}$	2024 submission [kt]	0.00373	0.00251	0.00413	0.00568	0.00571	0.00733	0.00998	0.01002	0.01098
	2025 submission [kt]	0.00383	0.00264	0.00443	0.00670	0.00603	0.00766	0.01025	0.01046	0.01129
	Change relative to 2024 submission [kt]	0.00011	0.00013	0.00030	0.00103	0.00033	0.00033	0.00027	0.00044	0.00031
	Change relative to 2024 submission [%]	2.8%	5.0%	7.3%	18%	5.7%	4.5%	2.7%	4.4%	2.8%
PM_{10}	2024 submission [kt]	0.0280	0.0187	0.0304	0.0422	0.0417	0.0518	0.0666	0.0666	0.0721
	2025 submission [kt]	0.0288	0.0197	0.0327	0.0501	0.0443	0.0543	0.0687	0.0700	0.0745
	Change relative to 2024 submission [kt]	0.0008	0.0010	0.0023	0.0079	0.0025	0.0025	0.0021	0.0034	0.0024
	Change relative to 2024 submission [%]	2.9%	5.2%	7.6%	19%	6.0%	4.9%	3.1%	5.1%	3.3%

Table 5.15 Recalculation for NO_x and NH_3 due to updated weight affecting Nex for fur-animals, affecting the whole time series.

3B4h		1990	1995	2000	2005	2010	2015	2020	2021	2022
NO_x	2024 submission [kt]	0.0039	0.0033	0.0032	0.0026	0.0026	0.0032	0.0011	0.0011	0.0009
	2025 submission [kt]	0.0062	0.0053	0.0051	0.0041	0.0042	0.0051	0.0017	0.0018	0.0014
	Change relative to 2024 submission [kt]	0.0023	0.0020	0.0019	0.0015	0.0016	0.0019	0.0006	0.0007	0.0005
	Change relative to 2024 submission [%]	60%	60%	60%	60%	60%	60%	60%	60%	60%
NH_3	2024 submission [kt]	0.066	0.056	0.055	0.043	0.045	0.054	0.018	0.019	0.015
	2025 submission [kt]	0.106	0.090	0.088	0.069	0.072	0.087	0.029	0.030	0.023
	Change relative to 2024 submission [kt]	0.040	0.034	0.033	0.026	0.027	0.033	0.011	0.011	0.009
	Change relative to 2024 submission [%]	60%	60%	60%	60%	60%	60%	60%	60%	60%

5.3.3.2 *Recalculations for the 2024 Submission*

For the 2024 submission, the NMVOC emissions methodology for Cattle was moved up to Tier 2 and the manure management allocations for laying hens were also updated,

Other changes with smaller impacts are the reporting of NMVOC emissions from rabbits with other fur animals, small livestock number corrections for the years 2020-2021, and a corrected pregnancy ratio for non-dairy cattle,

5.3.4 Planned Improvements

As suggested by the 2020 Step 3 review, it is planned to change from Tier 1 to Tier 2 calculations for NMVOC emissions. NMVOC emissions methodology for Cattle was moved up a tier and is now Tier 2, but other animal categories still use Tier 1 methodology. As a first step, a detailed investigation will be made about which data are easily available in Iceland and which data needs to be collected specifically for this task.

5.4 Crop Production and Agricultural Soils (NFR 3D)

5.4.1 Activity Data

Activity data for NH_3 and NO emissions consists of the amount of fertiliser nitrogen applied to agricultural soils (Table 5.16). For NH_3 this amount is divided into type of nitrogen fertilisers. The total amount of nitrogen in fertiliser, which is imported annually, is obtained from SI[13]. No official data exists that provides information on the types of nitrogen fertilisers imported. However, an expert on fertilisers at the Icelandic Food and Veterinary Authority (*Matvælastofnun*) (IFVA) has helped provide a rudimentary split into ammonium nitrate, calcium ammonium nitrate, urea, and other nitrogen fertilisers. The fraction of each type varies over the time series, as shown in Table 5.16. The fertiliser type data is still incomplete and will be improved for future submissions.

Table 5.16 Total amount of synthetic nitrogen fertilisers applied to agricultural soils.

	1990	1995	2000	2005	2010	2015	2020	2022	2023
N applied in inorganic N-fertilizer [kt N]	12.5	11.2	12.7	9.78	10.9	11.7	11.4	11.2	9.09
Ammonium nitrate [%]	67%	–	–	–	–	55%	26%	35%	36%
Calcium ammonium nitrate [%]	–	67%	67%	67%	58%	41%	32%	35%	33%
Urea [%]	–	–	–	–	–	0.018%	8.3%	5.6%	5.6%
Other NK and NPK [%]	33%	33%	33%	33%	42%	3.8%	35%	25%	25%

Other organic fertilisers in the form of bone meal and compost are also included in the inventory. According to the Land and Forest Iceland (*Land og skógur*) (LaSI) organic fertilisers have been applied on a small scale since 2009, especially for land reclamation purposes. Even though their use is still small compared to other fertilisers, they are still taken into account for the calculation of NH_3 and NO_x emissions from agricultural soils.

Activity data for PM and NMVOC emissions consists of the areas of crops cultivated, as can be seen in Table 5.17. The total amount of cropland is recorded in the Icelandic Geographic Land-use Database (IGLUD), which is maintained by the LaFI. Data regarding

[13] https://hagstofa.is/talnaefni/atvinnuvegir/landbunadur/aburdur/

the area of barley fields was exported from the FAO database[14] for the time series available (2015-2023) and gap filled using the ratio between the annual areas harvested with the crop field for known years. A more detailed explanation is provided in the most recent National Inventory Document. The area of grass fields is calculated by subtracting the area of barley fields from the total cropland area. Barley fields are cultivated and harvested once a year and the produce are cleaned and dried. Grass fields are cultivated about once every 10 years and hay is cut twice per year on average (Brynjólfsson, written communication). The total area of active cropland is used to estimate the NMVOC emissions.

Table 5.17 Areas of cropland in Iceland, distinguished by barley cultivation and grassland for haymaking.

	1990	1995	2000	2005	2010	2015	2020	2022	2023
Area Barley cultivation [ha]	0	146	916	2,944	3,968	1,455	1,500	3,000	2,313
Area Grass cultivation [ha]	92,159	92,997	93,211	92,167	93,699	101,118	105,990	105,473	106,160

5.4.2 Emission Factors

NH_3 emission factors were taken from Table 3.2 in the 2023 EMEP/EEA Guidebook. These emission factors depend on the mean spring air temperature, i.e., the mean temperature of the three-month period following the day when accumulated day degrees since January 1st have reached 400°C. According to this definition, the mean spring temperature in Iceland is about 9°C, therefore the emission factors for cool climate and normal pH are applied as can be seen in Table 5.18

Table 5.18 Emission factors for NH_3 emissions from inorganic fertilisers for a cool climate and normal pH used in Iceland.

	EF [g NH_3/ kg N applied]
Ammonium sulphate	84
Ammonium nitrate	24
Calcium ammonium nitrate	24
Anhydrous ammonia	20
Urea	195
Ammonium phosphates	84
Other NK and NPK[1]	54

[1] Average between NK mixtures and NPK mixtures.

The emission factors for NO, NMVOC, and NH_3 are taken from the 2023 EMEP/EEA Guidebook and are reported in Table 5.19 with the respective sources and NFR codes. The biggest contributor to the Tier 1 emission factor for NMVOC is grass at 25°C, which is not relevant for Iceland, where the average temperature during the summer is 10°C. Grass for hay making is, however, the greatest source of NMVOC emissions in Iceland and hence the EF for NMVOC emissions from grass at 15°C is used.

[14] The data can be retrieved from the FAO database (FAO.org/faostat/en/#data) under „Production“ and „Crops and livestock products“.

Table 5.19 Emission factors for NO, NMVOC, and NH_3 in NFR category 3D.

Category	NFR Code	EF	Unit	Source
NH_3 from sewage sludge	3Da2b	0.13	kg NH_3 (kg N applied)$^{-1}$	Annex 1 2023 EMEP/EEA Guidebook
NH_3 from other organic fertilisers	3Da2c	0.08	kg NH_3 (kg N applied)$^{-1}$	Table 3.1 2023 EMEP/EEA Guidebook
NO from N applied in fertiliser, manure, and excreta	3Da1, 3Da2a, 3Da3	0.04	kg NO_2 (kg fertilizer and manure N applied)$^{-1}$	Table 3.1 2023 EMEP/EEA Guidebook
NO from sewage sludge	3Da2b	0.04	kg NO_2 (kg sewage sludge)$^{-1}$	Annex 2 A2.3 2023 EMEP/EEA Guidebook
NO from other organic fertilisers	3Da2c	0.04	kg NO_2 (kg organic waste)$^{-1}$	Table 3.1 2023 EMEP/EEA Guidebook
NMVOC from standing crops	3De	0.1	kg ha^{-1}	Table 3.3 2023 EMEP/EEA Guidebook[1]

[1] The biggest contributor to the Tier 1 emissions factor for NMVOC is grass at 25°C, which is not relevant for Iceland, where the average temperature during the summer is 10°C. Grass for hay making is, however, the greatest source of NMVOC emissions in Iceland and hence the EF for NMVOC emissions from grass at 15°C is used.

PM_{10} and $PM_{2.5}$ emission factors for barley and grass were taken from Tables 3.5 and 3.7 of the 2023 EMEP/EEA Guidebook and are reported in Table 5.20.

Table 5.20 Emission factors for PM_{10} and $PM_{2.5}$ for agricultural crop operations in wet climate conditions, in kg ha^{-1}, from the 2023 EMEP/EEA Guidebook.

Air Pollutant	Crop	Soil Cultivation	Harvesting	Cleaning	Drying
PM_{10} [kg/ha]	Barley	0.25	2.3	0.16	0.43
PM_{10} [kg/ha]	Grass	0.25	0.25	–	–
$PM_{2.5}$ [kg/ha]	Barley	0.015	0.016	0.008	0.129
$PM_{2.5}$ [kg/ha]	Grass	0.015	0.01	–	–

5.4.3 Recalculations and Improvements

5.4.3.1 Recalculations for the 2025 submission

Multiple updates were done for the 2025 submission, affecting the emissions from Crop Production and Agricultural Soils. They are:

- Updated activity data, changed fractions of fertilizers and updated emission factor for NH3 in 2023 EMEP/EEA Guidebook, affecting NOx and NH3 for the whole time series in 3Da2a Inorganic N-fertilisers. The recalculations are shown in Table 5.21.
- Recalculation due to updated animal numbers, using milk protein content to calculate nitrogen retention, affecting the Nex rate and from transitioning from emission factor in the 2006 IPCC Guidelines to 2019 Refinements for Tier 1 animals, affecting the whole time series for NOx and NH3, as shown in
- Table 5.22.
- Updated activity data affected NOx and NH3 emissions from 3Da2c Other Organic Fertilisers Applied to Soils, as shown in Table 5.23.
- In 3Da4 Crop Residues Applied to Soils, an update from 2019 EMEP/EEA Guidebook to 2023 Guidebook caused recalculations for NH3, as shown in Table 5.24.
- In 3Dc, updated area for potatoes, barley, turnips, and carrots caused minor changes to PM2.5, PM10, and TSP, affecting the whole time series.

Table 5.21 Recalculation for 3Da2a Inorganic N-fertilizers, due to updated activity data, changed fractions of fertilisers and updated emission factor for NH_3 in 2023 EMEP/EEA Guidebook, affecting NO_x and NH_3 for the whole time series.

3Da1		1990	1995	2000	2005	2010	2015	2020	2021	2022
NO_x	2024 submission [kt]	0.50	0.45	0.51	0.39	0.44	0.4660	0.4563	0.4898	0.448440
	2025 submission [kt]	0.50	0.45	0.51	0.39	0.44	0.4665	0.4554	0.4914	0.448429
	Change relative to 2024 submission [kt]	—	—	—	—	—	0.00057	-0.00096	0.0016	-0.000011
	Change relative to 2024 submission [%]	—	—	—	—	—	0.12%	-0.21%	0.33%	-0.0025%
NH_3	2024 submission [kt]	0.26	0.18	0.20	0.16	0.24	0.27	0.30	0.30	0.34
	2025 submission [kt]	0.42	0.38	0.43	0.33	0.40	0.29	0.55	0.45	0.46
	Change relative to 2024 submission [kt]	0.16	0.20	0.23	0.17	0.16	0.021	0.25	0.15	0.12
	Change relative to 2024 submission [%]	63%	111%	111%	111%	64%	7.8%	81%	51%	34%

Table 5.22 Recalculation due to updated animal numbers, using milk protein content to calculate nitrogen retention, affecting the Nex rate and from transitioning from emission factor in the 2006 IPCC Guidelines to 2019 Refinements for Tier 1 animals, affecting the whole time series.

3Da2a + 3Da3		1990	1995	2000	2005	2010	2015	2020	2021	2022
NO_x	2024 submission [kt]	0.514	0.452	0.459	0.438	0.461	0.471	0.429	0.426	0.433
	2025 submission [kt]	0.567	0.512	0.513	0.499	0.522	0.525	0.467	0.464	0.454
	Change relative to 2024 submission [kt]	0.052	0.060	0.054	0.060	0.061	0.055	0.038	0.039	0.020
	Change relative to 2024 submission [%]	10%	13%	12%	14%	13%	12%	8.8%	9.1%	4.7%
NH_3	2024 submission [kt]	2.247	2.141	2.127	2.050	2.121	2.167	2.021	2.003	2.045
	2025 submission [kt]	2.408	2.175	2.175	2.086	2.145	2.186	2.036	2.017	1.993
	Change relative to 2024 submission [kt]	0.161	0.034	0.049	0.036	0.025	0.019	0.016	0.014	-0.051
	Change relative to 2024 submission [%]	7.2%	1.6%	2.3%	1.7%	1.2%	0.86%	0.77%	0.72%	-2.5%

Table 5.23 Recalculation for NO_x and NH_3 emissions from 3Da2c Other Organic Fertilisers Applied to Soils, due to updated activity data.

3Da2c		1990	1995	2000	2005	2010	2015	2020	2021	2022
NO_x	2024 submission [kt]	NO	NO	NO	NO	0.00413	0.00698	0.00777	0.00877	0.01308
	2025 submission [kt]	NO	NO	NO	0.00084	0.00436	0.00715	0.00838	0.00967	0.01298
	Change relative to 2024 submission [kt]	—	—	—	0.00084	0.00024	0.00017	0.00061	0.00090	-0.00010
	Change relative to 2024 submission [%]	—	—	—	—	5.7%	2.4%	7.9%	10%	-0.74%
NH_3	2024 submission [kt]	NO	NO	NO	NO	0.00825	0.01396	0.01553	0.01754	0.02616
	2025 submission [kt]	NO	NO	NO	0.00168	0.00873	0.01430	0.01676	0.01933	0.02596
	Change relative to 2024 submission [kt]	—	—	—	0.00168	0.00047	0.00034	0.00123	0.00179	-0.00019
	Change relative to 2024 submission [%]	—	—	—	—	5.7%	2.4%	7.9%	10%	-0.74%

Table 5.24 Recalculation for NH_3 emissions from 3Da4 Crop residues applied to soils update 2023 EMEP/EEA Guidebook, affecting the whole time series.

3Da4		1990	1995	2000	2005	2010	2015	2020	2021	2022
NH_3	2024 submission	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2025 submission	NE	NE	NE	NE	NE	NE	NE	NE	NE

5.4.3.2 Recalculations for the 2024 Submission

Multiple updates were done for the 2024 submission, affecting the emissions from Crop Production and Agricultural Soils. They are:

- The fraction between N fertiliser types were updated for ammonium nitrate, urea, CAN and other NPK fertilisers, affecting NH_3 emissions from 3Da1 Inorganic N-fertilisers.
- Updated livestock numbers for Cattle, Sheep, and Horses, as well as updated livestock parameters for Non-dairy cattle. These updates affect NO_x and NH_3 emissions from 3Da2a Livestock Manure Applied to Soils and 3Da3 Urine and Dung Deposited by Grazing Livestock, over the whole timeline.
- Updated nitrogen amount in sewage sludge used as fertiliser affected NO_x and NH_3 emissions from 3Da2b Sewage sludge applied to soils.
- 3Da2c Other organic fertilisers applied to soils were updated due to updated activity data on bone meal, which led to recalculation of NO_x and NH_3 emissions.
- Updated cropland area, affecting PM2.5, PM10 and TSP emissions in 2021.

5.4.4 Planned Improvements

For future submissions, improvements are planned for the registration of different inorganic N fertiliser types in Iceland's inventory.

5.5 Other Agriculture Including Use of Pesticides (NFR 3Df and 3I)

The POP-protocol focuses on a list of 16 substances, 11 of which are pesticides. A number of pesticides, however, had already been banned in Iceland in 1996 in order to conform to EU legislation (Iceland is part of the European Economic Area). The only pesticide of the ones listed in Chapter 3Df of the EMEP/EEA Guidebook not banned until 2009 is lindane, a gamma-Hexachlorocyclohexane (HCH). The last recorded sale of lindane took place in 1992 when 1 kg was sold. In 1990 and 1991, 2 and 16.2 kg were sold, respectively. It is assumed that the lindane sold was applied during the same year. An emission factor of 0.5 kg/kg, as listed in Table 3.1 in Chapter 3Df in the 2013 EMEP/EEA Guidebook, was applied to these values resulting in HCH emissions of 1, 8, and 0.5 kg for the years 1990-1992. HCH is no longer included in the reporting obligations which explains the use of an emission factor from the 2013 EMEP/EEA Guidebook.

Table 5.25 gives an overview of the use of pesticides in Iceland.

Table 5.25 Pesticide use and regulation in Iceland.

Pesticide	Last Recorded Use	Year of Ban
Aldrin	1975	1996
Chlordane	No recorded use	1996
DDT	1975	1996
Dieldrin	No recorded use	1996
Endrin	No recorded use	1996
Heptachlor	1975	1996
Hexachlorobenzene (HCB)	No recorded use	1996
Mirex	No recorded use	1998
Toxaphene	No recorded use	1998
Pentachlorophenol (PCP)	No recorded use	1998
Lindane	1992	2009

6 Waste (NRF Sector 5)

6.1 Overview

Most air pollutant emissions from the Waste sector originate from 5C Incineration and Open Burning of Waste. Currently, the emissions from the Waste sector are only a small part of the national emissions, however, open pit burning was a common procedure until the early 1990s causing large emissions. From around 1990, incinerators were built around the country but without satisfactory emission controls, especially regarding air pollutants such as dioxin. All these incinerators are considered as open burning and are included in category 5C2 due to the lack of emission controls. In 2004, the incineration plant *Kalka*, located at the southwest Iceland, began operations; this facility is currently the only operational waste incineration plant in Iceland. Open burning of waste was banned in 1999. The last location to practice open burning was Grímsey, an island in northern Iceland, which ceased this activity by the end of 2010. From 1993-2013, waste incineration with energy recovery was conducted in Iceland, and those emissions are accounted for under the Energy sector.

NMVOC and PM emissions are estimated from 5A Solid Waste Disposal on land and CO and NH_3 emissions from 5B1 Composting. Estimations from 5B2 Anaerobic Digestion and 5D Wastewater Handling are not available due to lack of activity data. Summaries of the categories included in the Waste sector by pollutants, including the Tier methodologies used, are presented in Table 6.1, Table 6.2, and Table 6.3.

Table 6.1 Overview table NECD gases, PM, and CO (NA: not available, NE: not estimated, NO: not occurring, IE: included elsewhere).

Sector		NECD Gases				PM				
		NO_x	NMVOC	SO_x	NH_3	$PM_{2.5}$	PM_{10}	TSP	BC	CO
5A	Solid Waste Disposal on Land	NA	T1	NA	NA	T1	T1	T1	NA	NA
5B1	Composting	NA	NA	NA	T2	NA	NA	NA	NA	T2
5B2	Anaerobic Digestion	NA	NA	NA	NE	NA	NA	NA	NA	NA
5C1a	MSW Incineration – *Kalka*[1]	T1	T1	T1	T1	T1	T1	T1	T1	T1
5C1bi	Industrial Waste Incineration[2]	IE	T1	IE	NA	IE	IE	IE	IE	IE
5C1bii	Hazardous Waste Incineration[2]	IE	T1	IE	NA	IE	IE	IE	IE	IE
5C1biii	Clinical Waste Incineration[2]	IE	T2	IE	NA	IE	IE	IE	IE	IE
5C1biv	Sewage Sludge Incineration[2]	IE	T1	IE	NA	IE	IE	IE	IE	IE
5B2	Anaerobic Digestion	NA	NA	NA	NE	NA	NA	NA	NA	NA
5C1a	MSW Incineration – *Kalka*[1]	T1	T1	T1	T1	T1	T1	T1	T1	T1
5C1bi	Industrial Waste Incineration[2]	IE	T1	IE	NA	IE	IE	IE	IE	IE
5C1bii	Hazardous Waste Incineration2	IE	T1	IE	NA	IE	IE	IE	IE	IE
5C1biii	Clinical Waste Incineration[2]	IE	T2	IE	NA	IE	IE	IE	IE	IE
5C1biv	Sewage Sludge Incineration[2]	IE	T1	IE	NA	IE	IE	IE	IE	IE
5C1bv	Cremation	T1	T1	T1	NA	T1	T1	T1	NA	T1
5C2	Open Burning	T1	T1	T1	T1	T1	T1	T1	T1	T1
5D1	Domestic Wastewater Handling	NA	NE	NA	NA	NA	NA	NA	NA	NA
5D2	Industrial Wastewater Handling	NA	NE	NA	NA	NA	NA	NA	NA	NA
5E	Other Waste: Accidental fires	T2	T2	T2	NA	T2	T2	T2	NA	T2

[1] Emissions from another incinerator falling under 5C1a only occurred in Iceland in the years 2001-2004, during which tier 2 emission factors were used for the emission estimates, where possible.
[2] Emissions are included in 5C1a, except for NMVOC emissions.

Table 6.2 Overview table POPs (NA – not available, NO – not occurring).

Sector		POPs			
		Dioxin	PAH	HCB	PCB
5A	Solid Waste Disposal on Land	NA	NA	NA	NA
5B1	Composting	NA	NA	NA	NA
5B2	Anaerobic Digestion	NA	NA	NA	NA
5C1a	MSW Incineration – Kalka[1]	T1	T1	T1	T1
5C1bi	Industrial Waste Incineration	T1	T1	T1	NA
5C1bii	Hazardous Waste Incineration	T1	T1	T1	NA
5C1biii	Clinical Waste Incineration	T2	T2	T2	T2
5C1biv	Sewage Sludge Incineration	T1	T1	T1	NA
5C1bv	Cremation	T1	T1	T1	T1
5C2	Open Burning	T1	T1	T1	T1
5D1	Domestic Wastewater Handling	NA	NA	NA	NA
5D2	Industrial Wastewater Handling	NA	NA	NA	NA
5E	Other Waste: Accidental fires	T2	T2	NA	NA

[1] Emissions from another incinerator falling under 5C1a only occurred in Iceland in the years 2001-2004, during which tier 2 emission factors were used for the emission estimates, where possible.

Table 6.3 Overview table heavy metals (NA – not available, NO – not occurring).

Sector		Heavy Metals								
		Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
5A	Solid Waste Disposal on Land	NA	NA	NA	NA	NA	NA	NA	NA	NA
5B1	Composting	NA	NA	NA	NA	NA	NA	NA	NA	NA
5B2	Anaerobic Digestion	NA	NA	NA	NA	NA	NA	NA	NA	NA
5C1a	MSW Incineration – Kalka1	T1	T1	T1	T1	T1	T1	T1	T1	T1
5C1bi	Industrial Waste Incineration	T1	T1	T1	T1	NA	NA	T1	NA	NA
5C1bii	Hazardous Waste Incineration	T1	T1	T1	T1	NA	NA	T1	NA	NA
5C1biii	Clinical Waste Incineration	NO	T2	T2	T2	T2	T2	T2	NA	NA
5C1biv	Sewage Sludge Incineration	T1	T1	T1	T1	NA	NA	T1	NA	NA
5C1bv	Cremation	T1	T1	T1	T1	T1	T1	T1	T1	T1
5C2	Open Burning	T1	T1	T1	T1	T1	T1	T1	T1	T1
5D1	Domestic Wastewater Handling	NA	NA	NA	NA	NA	NA	NA	NA	NA
5D2	Industrial Wastewater Handling	NA	NA	NA	NA	NA	NA	NA	NA	NA
5E	Other Waste: Accidental fires	T2	T2	T2	T2	T2	T2	T2	NA	T2

[1] Emissions from another incinerator falling under 5C1a only occurred in Iceland in the years 2001-2004, during which tier 2 emission factors were used for the emission estimates, where possible.

Each of these sources is described in more detail in Sections 6.3 to 6.8. Emission estimates for Waste Incineration without Energy Recovery are included in this section, while emission estimates for Waste Incineration with Energy Recovery are reported under Sector 1A Energy.

Table 6.4 shows which subsectors in Waste are key categories for which air pollutants. A key category is one that is prioritised within the national inventory system because it is significantly important for one or a number of air pollutants in a country's national inventory of air pollutants in terms of the absolute level, the trend, or the uncertainty in emissions (EEA, 2023). The largest categories, whose cumulative percentage contribution is greater than 80%, should be identified as key.

Table 6.4 Key categories for air pollutants within Waste.

SOx, NOx, NH3, NMVOC, PM, BC, and CO				
		1990	2023	Trend
5A	Solid Waste Disposal on Land	NMVOC	NMVOC	
5C2	Open Burning of Waste	$PM_{2.5}$, PM_{10}, BC		$PM_{2.5}$, PM_{10}, BC
Persistent Organic Pollutants (POPs)				
		1990	**2023**	**Trend**
5C1biii	Clinical Waste Incineration		PCDD/F, HCB, PCB	PCDD/F, HCB, PCB
5C2	Open Burning of Waste	PCDD/F, PAH4, HCB, PCB	PCDD/F, PAH4	PCDD/F, PAH4, HCB, PCB
5E	Accidental Fires		PCDD/F, PAH4	PCDD/F
Heavy Metals				
		1990	**2023**	**Trend**
5C1biii	Clinical Waste Incineration		Hg	
5C1bv	Cremation		Hg	Hg
5C2	Open Burning of Waste	Cd, Hg, As, Se, Zn		Cd, Hg, As, Se, Zn
5E	Accidental Fires	Pb, Zn	Pb	

6.2 General Methodology

The methodology is mainly based on the 2023 EMEP/EEA air pollutant emission inventory guidebook (EEA, 2023). Emissions estimates are calculated by multiplying relevant activity data by source with pollutant specific emissions factors. Emission factors are taken from the 2019 Emissions Inventory Guidebook (EEA, 2019) the 2023 Emissions Inventory Guidebook (EEA, 2023), the Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases (UNEP, 2005), Annual Danish Informative Inventory Report to the UNECE (Nielsen, et al., 2023), and measurements at incineration plants.

The activity data used for the emission estimates is mainly based on treated waste in Iceland which is reported annually to the Icelandic Environment and Energy Agency (*Umhverfis- og orkustofnun*) (IEEA). This follows an exclusion of waste being treated outside of Iceland and its associated emissions. In addition to data on treated waste in Iceland, activity data for accidental fires, cremation, and bonfires is used for estimating emissions from these sources.

6.3 Sector-Specific QA/QC

The QC activities include general methods such as accuracy checks on data acquisition and calculations as well as the use of approved standardised procedures for emission calculations, archiving information, and reporting. Further information can be found in 0 on Quality Assurance and Quality Control.

6.4 Solid Waste Disposal (NFR 5A)

For most of the 20th century, solid waste disposal sites (SWDSs) in Iceland were numerous, small, and located close to the locations of waste generation so that the waste did not have to be transported far for disposal. In 1967, the waste disposal site in Gufunes started operating and most of the waste generated in the capital area was landfilled there. Prior to that year, the waste of the capital area was landfilled in smaller SWDSs. Since 2004, all SWDSs have been managed. Recycling of waste has increased due to efforts made by the government, local municipalities, recovery companies, and others, decreasing the proportion of waste ending up in landfills. However, landfilling is still the dominant waste management practise in Iceland.

6.4.1 Methodology

The Tier 1 approach of Chapter 5A in the 2023 EMEP/EEA Guidebook is used for the emission estimates for all estimated pollutants, NMVOC and PMs. The PM emissions are estimated by multiplying together the total mass of waste disposed of in all landfill sites in Iceland and the pollutant-specific emission factors. The NMVOC emissions are estimated by multiplying the mass of landfill gas emitted from the landfills and the relevant emission factor.

6.4.2 Activity Data

Total mass of waste landfilled and CH_4 emissions from landfills is used for the emission estimates. The IEEA compiles data on total amounts of waste generated since 1995. This data is published by Statistics Iceland (*Hasteful Íslands*) (SI)[15].

- 1950-1995: Estimated using gross domestic product (GDP) as surrogate data.
- 1995-2004: Relies on assumptions and estimation and is less reliable than the data generated since 2005.
- 2005-2014: Received from the biggest operators according to the European Waste Catalogue (EWC) categorisation. Smaller operators did not submit data on waste amounts during that period, so some gap-filling estimations were performed by experts at the IEEA.
- From 2014: IEEA (previously EAI) has received data according to the WStatR categorisation from all waste operators in Iceland.

Further information on the annual mass of waste landfilled and the source of data can be found in Iceland's National Inventory Document on Greenhouse Gas Emissions.

6.4.3 Emission Factors

Emission factors from the Tier 1 approach of Tables 3-1 and 3-2, Chapter 5A in the 2023 EMEP/EEA Guidebook, are used for estimating emissions from solid waste disposal. Emission factors are assumed to be constant for all the years in the calculations. This section discusses the emission estimates from Solid Waste Disposal on Land and covers the emissions of NMVOCs, TSP, PM_{10}, and $PM_{2.5}$.

The 2023 EMEP/EEA Guidebook mentions the possibility of small quantities of NO_X, NH_3, CO, SO_x and POPs, being emitted from this activity. However, no emission factors are provided in the guidebook, and these emissions have not been estimated in Iceland. Other pollutants are considered not applicable in accordance with that same table.

[15] Available at https://statice.is/statistics/environment/material-flow/waste/

6.4.4 Recalculations and Improvements

6.4.4.1 Recalculations for the 2025 submission

Due to updated methodology in the 2023 EMEP/EEA Guidebook for NMVOC emissions, recalculations were made for NMVOC in sector 5A for the entire time series. These changes are shown in Table 6.5.

Recalculations were also made for PM emissions. The recalculations for 2019, 2021 and 2022 in sector 5A were caused by updated activity data. The update in activity data was due to late submission of final number for the waste amounts that went to landfills. Additionally, the fixing of calculation error led to the recalculations for 2004-2022 in 5A1b. These changes are shown in Table 6.7.

Table 6.5 Recalculations of NMVOC emissions in 5A Solid Waste Disposal for the whole time series due to updated methodology.

5A Solid Waste Disposal – NMVOC	1990	1995	2000	2005	2010	2015	2020	2021	2022
2024 submission [kt]	0.49	0.49	0.53	0.54	0.26	0.31	0.30	0.27	0.23
2025 submission [kt]	0.022	0.029	0.034	0.036	0.036	0.030	0.029	0.029	0.028
Change relative to 2024 submission [kt]	-0.47	-0.46	-0.50	-0.50	-0.22	-0.28	-0.27	-0.24	-0.20
Change relative to the 2024 submission [%]	-95.5%	-94%	-94%	-93%	-86%	-90%	-90%	-89%	-88%

Table 6.6 Recalculations of PM emissions in 5A Solid Waste Disposal for 2004-2022 due to error fixing (2004-2022) and updated activity data (2019 and 2022) and

5A Solid Waste Disposal – PM	2004	2010	2015	2019	2020	2021	2022
2024 Submission TSP [kt]	1.7E-02	2.1E-02	2.4E-02	2.2E-02	2.0E-02	2.0E-02	1.9E-02
2025 Submission TSP [kt]	1.1E-05	5.4E-06	6.5E-06	7.2E-06	6.2E-06	5.8E-06	4.8E-06
Change relative to 2024 submission TSP [kt]	-0.017	-0.021	-0.024	-0.022	-0.020	-0.020	-0.019
Change relative to the 2024 submission TSP	-99.93%	-99.97%	-99.97%	-99.97%	-99.97%	-99.97%	-99.97%
2024 Submission PM_{10} [kt]	7.9E-03	9.8E-03	1.2E-02	1.0E-02	9.5E-03	9.5E-03	8.8E-03
2025 Submission PM_{10} [kt]	1.1E-05	5.4E-06	6.5E-06	7.2E-06	6.2E-06	5.8E-06	4.8E-06
Change relative to 2024 submission PM10 [kt]	-0.008	-0.010	-0.012	-0.010	-0.0095	-0.0095	-0.0088
Change relative to the 2024 submission PM_{10}	-99.86%	-99.94%	-99.94%	-99.93%	-99.93%	-99.94%	-99.95%
2024 Submission $PM_{2.5}$ [kt]	1.2E-03	1.5E-03	1.7E-03	1.6E-03	1.4E-03	1.4E-03	1.3E-03
2025 Submission $PM_{2.5}$ [kt]	1.1E-05	5.4E-06	6.5E-06	7.2E-06	6.2E-06	5.8E-06	4.8E-06
Change relative to 2024 submission PM2.5 [kt]	-0.0012	-0.0015	-0.0017	-0.0016	-0.0014	-0.0014	-0.0013
Change relative to the 2024 submission $PM_{2.5}$	-99.06%	-99.63%	-99.63%	-99.54%	-99.56%	-99.60%	-99.64%

6.4.4.2 Recalculations for the 2024 submission

Recalculations were made for the 2024 submission in sector 5A Solid waste disposal on land for the years 1990-2021 due to updated activity data, error, fixing and updated methodology.

The methodology to estimate waste amount activity data was updated for the years 1950-1994. Previously, the waste generation for those years was estimated using a linear regression with GDP from 1995-2007 as surrogate data. Now it is estimated using a linear regression with GDP from 1995-2022 as surrogate data.

Furthermore, the classification into Solid Waste Disposal Sites (SWDS) types was updated alongside the 5A transition to the 2019 IPCC Refinements for the greenhouse gas inventory. Before the transition, the smaller managed sites were still classified as 5A2 Unmanaged – shallow after they became managed, because no classification matched these sites. They were managed, but too small for fully anaerobic conditions to form and did not fulfil all the criteria for 5A1b Managed well – semi-aerobic SWDS as they were defined in the 2006 IPCC Guidelines. However, since they all had a permeable cover layer, they did fit the definition of 5A1b Managed well – semi-aerobic SWDS as they are defined in the 2019 IPCC Refinements. Since Act No 55/2003 required all SWDS in Iceland to be managed and follow the rules stated in the operation permits, it was decided to reclassify the small SWDS from 5A2 to 5A1b from the year 2004 and onwards. The change for the inventory is though large since all 5A2 emissions are moved over to 5A1 in the year 2004. Further information on the annual mass of waste landfilled and the source of data can be found in Iceland's National Inventory Document on Greenhouse Gas Emissions.

6.4.5 Planned Improvements

For future submissions, it is planned to update the uncertainty analysis for the Waste sector.

6.5 Biological Treatment of Solid Waste (NRF 5B)

6.5.1 Composting (NRF 5B1)

6.5.1.1 Methodology

Composting of waste started on a larger scale in the middle of the 1990s. Their share of total waste management increased rapidly since then, even though only about 1-2% of reported waste is composted. The Tier 2 approach of Chapter 5B1 in the 2023 EMEP/EEA Guidebook is used for the emission estimates.

6.5.1.2 Activity Data

Compost production as a means of waste treatment started in Iceland in 1995 and the amount of waste going to compost production facilities is submitted to the IEEA annually. Reliable activity data for the amount of waste composted has, however, only been reported to the IEEA since 2005. Therefore, the amounts composted from 1995-2004 are estimated to be between 2 and 3 kt each year. The collected data refers to wet weight and is transformed to dry matter. Further information on the annual mass of waste composted and the source of data can be found in Iceland's National Inventory Document on Greenhouse Gas Emissions.

6.5.1.3 Emission Factors

For composting, Tier 2 emission factors from Table 3-1 and Table 3-2, Chapter 5B1 in the 2023 EMEP/EEA Guidebook are used for estimating NH_3 and CO emissions. The emission factors are assumed constant between years. Emission factors for other pollutants are not provided in the 2023 EMEP/EEA Guidebook.

6.5.1.4 Recalculations and improvements

Recalculations from the 2024 submission.

No recalculations were made for this submission.

Recalculations from the 2023 submission

For the 2023 submission, recalculations were performed on sector 5B1. The cause was late arrival (post-2022 submission date) of the final annual amount of MSW composted in 2020. The amount was slightly, leading to smaller NH_3 and CO_2 emission for the year 2020.

6.5.1.5 Planned Improvements

For future submissions, it is planned to update the uncertainty analysis for the Waste sector.

6.5.2 Anaerobic Digestion at Biogas Facilities (NFR 5B2)

In 2020, the gas and composting facility *GAJA* started operating. It is the only one of its kind in Iceland. In *GAJA*, organic waste from the capital area is processed into CH_4 gas and soil amendment. Chapter 5B2 in the 2023 EMEP/EEA Guidebook provides a methodology for the estimation of NH_3 emissions, however, due to lack of activity data these emissions have not been estimated in the Icelandic inventory.

6.5.2.1 Methodology

No methodology is used due to the lack of relevant activity data.

6.5.2.2 Activity Data

The Tier 1 method requires the total amount of nitrogen in the feedstock entering the biogas plants annually, which is currently not available.

6.5.2.3 Emission Factors

No emission factors used due to lack of activity data.

6.5.2.4 Recalculations and improvements

Recalculations from the 2025 submission.

No recalculations were made for this submission.

Recalculations from the 2024 submission.

No recalculations were made for this submission.

6.5.2.5 *Planned Improvements*

For the future submissions, it is planned to estimate NH_3 emissions. To be able to do so, the total amount of nitrogen in the feedstock is required from *GAJA*. It is also planned to update the uncertainty analysis for the Waste sector.

6.6 Waste Incineration and Open Burning (NFR 5C)

This section discusses the emission estimates from burning of waste, which falls under the subcategories; 5C1 Waste Incineration and 5C2 Open Burning of Waste. Waste Incineration covers the emission estimates from waste incineration plants without energy recovery[16] and not from Waste Incineration with Energy Recovery. Emission estimates for Waste Incineration with Energy Recovery are reported in the relevant subsector under NFR sector 1A1 (Chapter 3.3.1). Waste Incineration is separated further into 5C1a Municipal Waste Incineration, 5C1bi Industrial Waste Incineration, 5C1bii Hazardous Waste Incineration, 5C1biii Clinical Waste Incineration, 5C1biv Sewage Sludge Incineration, 5C1bv Cremation, and 5C1bvi Other Waste Incineration.

Open Burning of Waste covers the emission estimates from open pit burnings and bonfires as well as combustion in incineration devices that do not control the combustion air to maintain adequate temperature and do not provide sufficient residence time for complete combustion.

Data on waste generation and waste management practices is published by Statistics Iceland.

6.6.1 Municipal Waste Incineration (NFR 5C1a)

Waste Incineration in incineration plants started in 1993 in Iceland and waste incineration in incineration plants without energy recovery started in 2001. Sector 5C1a includes emissions from two incineration plants, the plant in Tálknafjörður which operated from 2001 to 2004 and *Kalka* incineration plant which has been operating from 2004. Since 2004, *Kalka* has been the only operating waste incineration plant in Iceland. From around 1990, incinerators were built around the country with higher combustion temperatures but still no satisfactory emission controls, especially regarding air pollutants such as dioxin. All these incinerators are considered as open burning and are included in category 5C2 due to the lack of emission controls.

6.6.1.1 *Methodology*

The Tier 1 approach of Chapter 5C1a in the 2023 EMEP/EEA Guidebook is used for the emission estimates of all pollutants other than NO_x, SO_2, PM ($PM_{2.5}$, PM_{10}, TSP, and BC), and CO emissions from *Kalka* as *Kalka* runs continuous measurements for these pollutants. The total amount of waste incinerated in both waste incineration plants without energy recovery is multiplied with its pollutant-specific emission factor.

[16] A quantitative definition of waste incineration with energy recovery is found in Annex IV of regulation 1040/2016 (IS).

6.6.1.2 Activity Data

Activity data on incinerated waste from major incineration plants has been collected by the IEEA since 2000. There is a sharp increase in the amount of 5C1 Waste Incinerated (5C1) and corresponding decrease in 5C2 Open Burning of Waste in 2004 due to the opening of the *Kalka* incineration plant. This trend is also seen in the emissions. Furthermore, emissions of NO_x, SO_2, PM, and CO from *Kalka* are available from *Kalka*'s Green Accounting from the start of operation in 2004.

6.6.1.3 Emission Factors

Tier 1 emission factors are used for *Kalka* for all pollutants except NO_x, SO_2, PM, and CO *and* are taken from Table 3-1, Chapter 5C1a in the 2023 EMEP/EEA Guidebook. Lower emission factors were used for *Kalka* than for the Tálknafjörður plant due to the following abatement technologies present at *Kalka*:

- Dry cleaning process.
- Hydrated lime.
- Combustion at approximately 1100°C.
- Particle abatement (bag filters with capacity 50 kg/hr).

For the incineration plant in Tálknafjörður, Tier 2 emission factors from Table 3-2, Chapter 5C1a in the 2023 EMEP/EEA Guidebook, is used for all pollutants except for NH_3, Se, Indeno(1,2,3-cd)pyrene (IPy) and PCDD/F. As Tier 2 emission factors are unavailable for NH_3, Se, and IPy, the Tier 1 emission factors from Table 3-1, Chapter 5C1a in the 2023 EMEP/EEA Guidebook have been used. The Tier 2 emission factors are used without abatement for the Tálknafjörður plant due to lack of abatement technologies. For PCDD/F emissions the UNEP 2013 emission factor from Table II.1.3 for controlled combustion with minimal APC systems is used since it matches best with the few point measurements available from the Tálknafjörður incineration plant.

6.6.1.4 Recalculations and Improvements

Recalculations from the 2025 submission

Recalculations in this subsector are due to updated split of mixed household and commercial waste into waste types for the years 2014-2022 and a correction of waste amounts incinerated in 2019. The effects can be seen in Table 6.7. The updated split between 5C1a Municipal Waste Incineration and 5B1bii Hazardous Waste Incineration and updated waste amount incinerated in 2019 affect all air pollutants equally and hence the relative change is the same for all of them.

Table 6.7 Recalculations in 5C1a due to updated split of mixed household and commercial waste into waste types for the years 2014-2022 and a correction of waste amounts incinerated in 2019.

5C1a Municipal Waste Incineration	2014	2015	2016	2017	2018	2019	2020	2021	2022
2024 submission NMVOC [kt]	5.6E-05	5.6E-05	5.8E-05	6.5E-05	5.9E-05	1.1E-04	5.6E-05	6.6E-05	5.8E-05
2025 submission NMVOC [kt]	6.6E-05	6.6E-05	6.8E-05	7.5E-05	7.0E-05	6.3E-05	5.5E-05	6.4E-05	5.7E-05
Change relative to 2024 submission NMVOC [kt]	1.0E-05	1.0E-05	1.0E-05	9.8E-06	1.1E-05	-4.7E-05	-8.7E-07	-1.2E-06	-4.7E-07

5C1a Municipal Waste Incineration	2014	2015	2016	2017	2018	2019	2020	2021	2022
Change relative to 2024 submission NMVOC [%]	18%	18%	17%	15%	19%	-43%	-1.6%	-1.8%	-0.81%
2024 submission NH_3 [kt]	2.8E-05	2.9E-05	3.0E-05	3.3E-05	3.0E-05	5.6E-05	2.8E-05	3.3E-05	2.9E-05
2025 submission NH_3 [kt]	3.3E-05	3.4E-05	3.5E-05	3.8E-05	3.5E-05	3.2E-05	2.8E-05	3.3E-05	2.9E-05
Change relative to 2024 submission NH_3 [kt]	5.1E-06	5.1E-06	5.1E-06	5.0E-06	5.7E-06	-2.4E-05	-4.4E-07	-5.9E-07	-2.4E-07
Change relative to 2024 submission NH_3 [%]	18%	18%	17%	15%	19%	-43%	-1.6%	-1.8%	-0.81%
2024 submission Pb [t]	5.5E-04	5.5E-04	5.7E-04	6.4E-04	5.8E-04	1.1E-03	5.5E-04	6.4E-04	5.7E-04
2025 submission Pb [t]	6.5E-04	6.5E-04	6.7E-04	7.4E-04	6.8E-04	6.2E-04	5.4E-04	6.3E-04	5.6E-04
Change relative to 2024 submission Pb [t]	9.8E-05	9.8E-05	9.8E-05	9.7E-05	1.1E-04	-4.6E-04	-8.5E-06	-1.1E-05	-4.6E-06
Change relative to 2024 submission Pb [%]	18%	18%	17%	15%	19%	-43%	-1.6%	-1.8%	-0.81%
2024 submission Cd [t]	4.3E-05	4.4E-05	4.5E-05	5.1E-05	4.6E-05	8.6E-05	4.3E-05	5.1E-05	4.5E-05
2025 submission Cd [t]	5.1E-05	5.2E-05	5.3E-05	5.8E-05	5.4E-05	4.9E-05	4.3E-05	5.0E-05	4.5E-05
Change relative to 2024 submission Cd [t]	7.8E-06	7.8E-06	7.8E-06	7.7E-06	8.7E-06	-3.7E-05	-6.8E-07	-9.1E-07	-3.7E-07
Change relative to 2024 submission Cd [%]	18%	18%	17%	15%	19%	-43%	-1.6%	-1.8%	-0.81%
2024 submission Hg [t]	1.8E-04	1.8E-04	1.9E-04	2.1E-04	1.9E-04	3.5E-04	1.8E-04	2.1E-04	1.8E-04
2025 submission Hg [t]	2.1E-04	2.1E-04	2.2E-04	2.4E-04	2.2E-04	2.0E-04	1.7E-04	2.1E-04	1.8E-04
Change relative to 2024 submission Hg [t]	3.2E-05	3.2E-05	3.2E-05	3.1E-05	3.5E-05	-1.5E-04	-2.8E-06	-3.7E-06	-1.5E-06
Change relative to 2024 submission Hg [%]	18%	18%	17%	15%	19%	-43%	-1.6%	-1.8%	-0.81%
2024 submission As [t]	5.8E-05	5.9E-05	6.1E-05	6.8E-05	6.2E-05	1.2E-04	5.9E-05	6.9E-05	6.1E-05
2025 submission As [t]	6.9E-05	7.0E-05	7.2E-05	7.9E-05	7.3E-05	6.6E-05	5.8E-05	6.8E-05	6.0E-05
Change relative to 2024 submission As [t]	1.1E-05	1.1E-05	1.1E-05	1.0E-05	1.2E-05	-4.9E-05	-9.1E-07	-1.2E-06	-5.0E-07
Change relative to 2024 submission As [%]	18%	18%	17%	15%	19%	-43%	-1.6%	-1.8%	-0.81%
2024 submission Cr [t]	1.5E-04	1.6E-04	1.6E-04	1.8E-04	1.6E-04	3.1E-04	1.5E-04	1.8E-04	1.6E-04
2025 submission Cr [t]	1.8E-04	1.8E-04	1.9E-04	2.1E-04	1.9E-04	1.8E-04	1.5E-04	1.8E-04	1.6E-04
Change relative to 2024 submission Cr [t]	2.8E-05	2.8E-05	2.8E-05	2.7E-05	3.1E-05	-1.3E-04	-2.4E-06	-3.2E-06	-1.3E-06
Change relative to 2024 submission Cr [%]	18%	18%	17%	15%	19%	-43%	-1.6%	-1.8%	-0.81%
2024 submission Cu [t]	1.3E-04	1.3E-04	1.4E-04	1.5E-04	1.4E-04	2.6E-04	1.3E-04	1.5E-04	1.3E-04
2025 submission Cu [t]	1.5E-04	1.5E-04	1.6E-04	1.7E-04	1.6E-04	1.5E-04	1.3E-04	1.5E-04	1.3E-04
Change relative to 2024 submission Cu [t]	2.3E-05	2.3E-05	2.3E-05	2.3E-05	2.6E-05	-1.1E-04	-2.0E-06	-2.7E-06	-1.1E-06
Change relative to 2024 submission Cu [%]	18%	18%	17%	15%	19%	-43%	-1.6%	-1.8%	-0.81%
2024 submission Ni [t]	2.0E-04	2.1E-04	2.1E-04	2.4E-04	2.1E-04	4.0E-04	2.0E-04	2.4E-04	2.1E-04
2025 submission Ni [t]	2.4E-04	2.4E-04	2.5E-04	2.7E-04	2.6E-04	2.3E-04	2.0E-04	2.4E-04	2.1E-04
Change relative to 2024 submission Ni [t]	3.7E-05	3.7E-05	3.7E-05	3.6E-05	4.1E-05	-1.7E-04	-3.2E-06	-4.3E-06	-1.7E-06
Change relative to 2024 submission Ni [%]	18%	18%	17%	15%	19%	-43%	-1.6%	-1.8%	-0.81%
2024 submission Se [t]	1.1E-04	1.1E-04	1.2E-04	1.3E-04	1.2E-04	2.2E-04	1.1E-04	1.3E-04	1.1E-04
2025 submission Se [t]	1.3E-04	1.3E-04	1.4E-04	1.5E-04	1.4E-04	1.3E-04	1.1E-04	1.3E-04	1.1E-04
Change relative to 2024 submission Se [t]	2.0E-05	2.0E-05	2.0E-05	2.0E-05	2.2E-05	-9.3E-05	-1.7E-06	-2.3E-06	-9.4E-07
Change relative to 2024 submission Se [%]	18%	18%	17%	15%	19%	-43%	-1.6%	-1.8%	-0.81%
2024 submission Zn [t]	2.3E-04	2.3E-04	2.4E-04	2.7E-04	2.4E-04	4.6E-04	2.3E-04	2.7E-04	2.4E-04
2025 submission Zn [t]	2.7E-04	2.8E-04	2.8E-04	3.1E-04	2.9E-04	2.6E-04	2.3E-04	2.7E-04	2.4E-04

5C1a Municipal Waste Incineration	2014	2015	2016	2017	2018	2019	2020	2021	2022
Change relative to 2024 submission Zn [t]	4.2E-05	4.2E-05	4.2E-05	4.1E-05	4.6E-05	-1.9E-04	-3.6E-06	-4.8E-06	-2.0E-06
Change relative to 2024 submission Zn [%]	18%	18%	17%	15%	19%	-43%	-1.6%	-1.8%	-0.81%
2024 submission PCB [kg]	3.2E-08	3.3E-08	3.4E-08	3.8E-08	3.4E-08	6.3E-08	3.2E-08	3.8E-08	3.3E-08
2025 submission PCB [kg]	3.8E-08	3.8E-08	3.9E-08	4.3E-08	4.0E-08	3.6E-08	3.2E-08	3.7E-08	3.3E-08
Change relative to 2024 submission PCB [kg]	5.8E-09	5.8E-09	5.8E-09	5.7E-09	6.4E-09	-2.7E-08	-5.0E-10	-6.7E-10	-2.7E-10
Change relative to 2024 submission PCB [%]	18%	18%	17%	15%	19%	-43%	-1.6%	-1.8%	-0.81%
2024 submission PCDD/F [g I-TEQ]	5.0E-04	5.0E-04	5.2E-04	5.8E-04	5.2E-04	9.8E-04	5.0E-04	5.8E-04	5.2E-04
2025 submission PCDD/F [g I-TEQ]	5.8E-04	5.9E-04	6.1E-04	6.7E-04	6.2E-04	5.6E-04	4.9E-04	5.7E-04	5.1E-04
Change relative to 2024 submission PCDD/F [g I-TEQ]	8.9E-05	8.9E-05	8.9E-05	8.8E-05	9.9E-05	-4.2E-04	-7.7E-06	-1.0E-05	-4.2E-06
Change relative to 2024 submission PCDD/F [%]	18%	18%	17%	15%	19%	-43%	-1.6%	-1.8%	-0.81%
2024 submission 4PAH [t]	4.5E-07	4.5E-07	4.7E-07	5.2E-07	4.7E-07	8.8E-07	4.5E-07	5.3E-07	4.7E-07
2025 submission 4PAH [t]	5.3E-07	5.3E-07	5.5E-07	6.0E-07	5.6E-07	5.1E-07	4.4E-07	5.2E-07	4.6E-07
Change relative to 2024 submission 4PAH [t]	8.0E-08	8.0E-08	8.0E-08	7.9E-08	8.9E-08	-3.8E-07	-7.0E-09	-9.3E-09	-3.8E-09
Change relative to 2024 submission 4PAH [%]	18%	18%	17%	15%	19%	-43%	-1.6%	-1.8%	-0.81%
2024 submission HCB [kg]	4.3E-04	4.3E-04	4.5E-04	5.0E-04	4.5E-04	8.4E-04	4.3E-04	5.0E-04	4.4E-04
2025 submission HCB [kg]	5.0E-04	5.1E-04	5.2E-04	5.7E-04	5.3E-04	4.8E-04	4.2E-04	4.9E-04	4.4E-04
Change relative to 2024 submission HCB kg]	7.7E-05	7.7E-05	7.7E-05	7.5E-05	8.5E-05	-3.6E-04	-6.7E-06	-8.9E-06	-3.6E-06
Change relative to 2024 submission HCB [%]	18%	18%	17%	15%	19%	-43%	-1.6%	-1.8%	-0.81%

Recalculations for PCDD/F emissions from 5C1a are due to switching from using the Tier 2 EF from the 2023 EMEP/EEA Guidebook to using the UNEP 2013 emission factor from Table II.1.3 for controlled combustion with minimal APC systems, see Table 6.8. The change was made since the UNEP EF matches better with the few point measurements available from the Tálknafjörður incineration plant.

Table 6.8 Recalculation for Dioxin (PCDD/F) for 5C1a for the years 2001-2004 due to updated EF, to match the one used in 1A1a.

5C1a Municipal Waste Incineration	2001	2002	2003	2004
2024 submission PCDD/F [g I-TEQ]	6.3E-04	6.3E-04	6.3E-04	8.2E-04
2025 submission PCDD/F [g I-TEQ]	0.063	0.063	0.063	0.032
Change relative to 2024 submission PCDD/F [g I-TEQ]	0.062	0.062	0.062	0.032
Change relative to 2024 submission PCDD/F [%]	9900%	9900%	9900%	3862%

Recalculations from the 2024 submission

Recalculations were made in the sector 5C1a Municipal Waste Incineration due to updated activity data which affected the 2021 emission.

6.6.1.5 Planned Improvements

An uncertainty analysis is in progress.

6.6.2 Industrial Waste Incineration (NFR 5C1bi)

6.6.2.1 Methodology

The Tier 1 approach of Chapter 5C1b in the 2023 EMEP/EEA Guidebook is used for the emission estimates. Slaughterhouse waste is the only type of waste in this category. Total reported slaughterhouse waste is multiplied by pollutant specific emission factors to estimate these emissions.

6.6.2.2 Activity Data

Activity data for this category has been included for the year 2014 onward. Activity data for previous years are included in 5C1a.

6.6.2.3 Emission Factors

Emission factors (T1) are taken from Table 3-1, Chapter 5C1b in the 2023 EMEP/EEA Guidebook for all pollutants, except for NO_X, SO_2, PM, and CO as they are included in 5C1a.

6.6.2.4 Recalculations and Improvements

Recalculations from the 2025 submission

Recalculations in this sector are only due to small updates on waste amounts for the year 2022. Proportional difference in emissions for each pollutant is 0.00078%.

Recalculations from the 2024 submission

Recalculations were made for the for the sectors 5C1bi Industrial Waste Incineration, 5C1bii Hazardous Waste Incineration and 5C1biv Sewage Sludge Incineration for the whole timeseries due the updated emission factor for Dioxin (PCDD/F).

6.6.2.5 Planned Improvements

An uncertainty analysis is in progress.

6.6.3 Hazardous Waste Incineration (NFR 5C1bii)

6.6.3.1 Methodology

The Tier 1 approach of Chapter 5C1b in the 2023 EMEP/EEA Guidebook is used for the emission estimates. Total amount of hazardous waste is multiplied by a pollutant specific emission factor.

6.6.3.2 Activity Data

Activity data for incinerated hazardous waste is available from 2006 and is collected by the IEEA.

6.6.3.3 Emission Factors

Emission factors (T1) are taken from Table 3-1, Chapter 5C1b in the 2023 EMEP/EEA Guidebook for all pollutants, except for NO_X, SO_2, PM, and CO, as they are included in 5C1a.

6.6.3.4 Recalculations and Improvements

Recalculations from the 2025 submission

Recalculations in this subsector are due to updated split of mixed household and commercial waste into waste types for the years 2014-2022 and a correction of waste amounts incinerated in 2019. The effects can be seen in Table 6.9. The updated split between 5C1a Municipal Waste Incineration and 5B1bii Hazardous Waste Incineration and updated waste amount incinerated in 2019 affect all air pollutants equally and hence the relative change is the same for all of them.

Table 6.9 Recalculation for 5C1bii Hazardous Waste Incineration due to updated split of mixed household and commercial waste into waste types and updated waste amount incinerated in 2019.

5C1bii Hazardous Waste Incineration	2014	2015	2016	2017	2018	2019	2020	2021	2022
2024 submission NMVOC [kt]	4.5E-03	5.4E-03	8.9E-03	9.6E-03	9.3E-03	9.3E-03	9.0E-03	3.9E-03	3.2E-03
2025 submission NMVOC [kt]	4.5E-03	5.4E-03	8.9E-03	9.8E-03	7.9E-03	9.8E-03	1.0E-02	5.3E-03	9.4E-03
Change relative to 2024 submission NMVOC [kt]	2.0E-05	1.3E-05	2.5E-05	2.4E-04	-1.4E-03	5.3E-04	1.1E-03	1.5E-03	6.2E-03
Change relative to 2024 submission NMVOC [%]	0.46%	0.25%	0.28%	2.5%	-15%	5.7%	12%	38%	197%
2024 submission Pb [t]	7.8E-04	9.5E-04	1.6E-03	1.7E-03	1.6E-03	1.6E-03	1.6E-03	6.8E-04	5.5E-04
2025 submission Pb [t]	7.9E-04	9.5E-04	1.6E-03	1.7E-03	1.4E-03	1.7E-03	1.8E-03	9.3E-04	1.6E-03
Change relative to 2024 submission Pb [t]	3.6E-06	2.3E-06	4.4E-06	4.2E-05	-2.4E-04	9.3E-05	1.9E-04	2.6E-04	1.1E-03
Change relative to 2024 submission Pb [%]	0.46%	0.25%	0.28%	2.5%	-15%	5.7%	12%	38%	197%
2024 submission Cd [t]	6.0E-05	7.3E-05	1.2E-04	1.3E-04	1.3E-04	1.3E-04	1.2E-04	5.2E-05	4.3E-05
2025 submission Cd [t]	6.0E-05	7.3E-05	1.2E-04	1.3E-04	1.1E-04	1.3E-04	1.4E-04	7.2E-05	1.3E-04
Change relative to 2024 submission Cd [t]	2.8E-07	1.8E-07	3.4E-07	3.3E-06	-1.9E-05	7.2E-06	1.5E-05	2.0E-05	8.4E-05
Change relative to 2024 submission Cd [%]	0.46%	0.25%	0.28%	2.5%	-15%	5.7%	12%	38%	197%
2024 submission Hg [t]	3.4E-05	4.1E-05	6.7E-05	7.3E-05	7.0E-05	7.0E-05	6.8E-05	2.9E-05	2.4E-05
2025 submission Hg [t]	3.4E-05	4.1E-05	6.7E-05	7.4E-05	6.0E-05	7.4E-05	7.6E-05	4.0E-05	7.1E-05
Change relative to 2024 submission Hg [t]	1.5E-07	1.0E-07	1.9E-07	1.8E-06	-1.0E-05	4.0E-06	8.2E-06	1.1E-05	4.7E-05
Change relative to 2024 submission Hg [%]	0.46%	0.25%	0.28%	2.5%	-15%	5.7%	12%	38%	197%
2024 submission As [t]	9.6E-06	1.2E-05	1.9E-05	2.1E-05	2.0E-05	2.0E-05	1.9E-05	8.3E-06	6.8E-06
2025 submission As [t]	9.7E-06	1.2E-05	1.9E-05	2.1E-05	1.7E-05	2.1E-05	2.2E-05	1.1E-05	2.0E-05
Change relative to 2024 submission As [t]	4.4E-08	2.9E-08	5.4E-08	5.2E-07	-3.0E-06	1.1E-06	2.4E-06	3.1E-06	1.3E-05
Change relative to 2024 submission As [%]	0.46%	0.25%	0.28%	2.5%	-15%	5.7%	12%	38%	197%
2024 submission Ni [t]	8.4E-05	1.0E-04	1.7E-04	1.8E-04	1.8E-04	1.8E-04	1.7E-04	7.3E-05	6.0E-05
2025 submission Ni [t]	8.5E-05	1.0E-04	1.7E-04	1.9E-04	1.5E-04	1.9E-04	1.9E-04	1.0E-04	1.8E-04
Change relative to 2024 submission Ni [t]	3.9E-07	2.5E-07	4.7E-07	4.6E-06	-2.6E-05	1.0E-05	2.1E-05	2.8E-05	1.2E-04
Change relative to 2024 submission Ni [%]	0.46%	0.25%	0.28%	2.5%	-15%	5.7%	12%	38%	197%

5C1bii Hazardous Waste Incineration	2014	2015	2016	2017	2018	2019	2020	2021	2022
2024 submission PCDD/F [g I-TEQ]	6.0E-03	7.3E-03	1.2E-02	1.3E-02	1.3E-02	1.3E-02	1.2E-02	5.2E-03	4.3E-03
2025 submission PCDD/F [g I-TEQ]	6.0E-03	7.3E-03	1.2E-02	1.3E-02	1.1E-02	1.3E-02	1.4E-02	7.2E-03	1.3E-02
Change relative to 2024 submission PCDD/F [g I-TEQ]	2.8E-05	1.8E-05	3.4E-05	3.3E-04	-1.9E-03	7.2E-04	1.5E-03	2.0E-03	8.4E-03
Change relative to 2024 submission PCDD/F [%]	0.46%	0.25%	0.28%	2.5%	-15%	5.7%	12%	38%	197%
2024 submission 4PAH [t]	1.2E-05	1.5E-05	2.4E-05	2.6E-05	2.5E-05	2.5E-05	2.4E-05	1.0E-05	8.5E-06
2025 submission 4PAH [t]	1.2E-05	1.5E-05	2.4E-05	2.7E-05	2.1E-05	2.7E-05	2.7E-05	1.4E-05	2.5E-05
Change relative to 2024 submission 4PAH [t]	5.5E-08	3.6E-08	6.7E-08	6.5E-07	-3.7E-06	1.4E-06	2.9E-06	3.9E-06	1.7E-05
Change relative to 2024 submission 4PAH [%]	0.46%	0.25%	0.28%	2.5%	-15%	5.7%	12%	38%	197%
2024 submission HCB [kg]	1.2E-03	1.5E-03	2.4E-03	2.6E-03	2.5E-03	2.5E-03	2.4E-03	1.0E-03	8.5E-04
2025 submission HCB [kg]	1.2E-03	1.5E-03	2.4E-03	2.7E-03	2.1E-03	2.7E-03	2.7E-03	1.4E-03	2.5E-03
Change relative to 2024 submission HCB [kg]	5.5E-06	3.6E-06	6.7E-06	6.5E-05	-3.7E-04	1.4E-04	2.9E-04	3.9E-04	1.7E-03
Change relative to 2024 submission HCB [%]	0.46%	0.25%	0.28%	2.5%	-15%	5.7%	12%	38%	197%

Recalculations from the 2024 submission

Recalculations were made for the for the sectors 5C1bi Industrial Waste Incineration, 5C1bii Hazardous Waste Incineration and 5C1biv Sewage Sludge Incineration for the whole timeseries due the updated emission factor for Dioxin (PCDD/F).

Furthermore, recalculations were made for 2021 for 5C1bii Hazardous Waste Incineration due to updated activity data.

6.6.3.5 Planned Improvements

An uncertainty analysis is in progress.

6.6.4 Clinical Waste Incineration (NFR 5C1biii)

6.6.4.1 Methodology

The Tier 2 approach of Chapter 5C1biii in the 2023 EMEP/EEA Guidebook is used for the emission estimates.

6.6.4.2 Activity Data

Activity data for incinerated clinical waste under this sector is available from 2001, when the first incineration plant opened.

6.6.4.3 Emission Factors

The emission factors (Tier 2) are taken from Table 3-2, Chapter 5Cbiii in the 2023 EMEP/EEA Guidebook. As for abatement efficiencies, default abatement efficiencies (Tier 2) from Table 3-3, Chapter 5C1biii in 2019 EMEP/EEA Guidebook are used for Pb, Cd, Hg, As, Cr, Cu, and Ni from the year 2004 (when *Kalka* opened), since these values are not in the 2023 EMEP/EEA Guidebook, and the default abatement efficiencies (Tier 2) from Table

3-3, Chapter 5C1biii in 2023 EMEP/EEA Guidebook are used for dioxin. NO_X, SO_2, PM, and CO emissions from *Kalka* are included in 5C1a.

6.6.4.4 Recalculations and Improvements

Recalculations from the 2025 submission

Recalculations in this subsector are due to a correction of waste amounts incinerated in 2019. Proportional difference in emissions for each pollutant is 0.00005%.

Recalculations were also made for polycyclic aromatic hydrocarbon (PAH) due to a calculation error, see Table 6.10.

Table 6.10 Recalculation for 4PAH in 5C1bi Industrial Waste Incineration for the whole timeseries due to calculation error.

5C1biii Clinical Waste Incineration	1990	1995	2005	2010	2015	2020	2021	2022
2024 submission 4PAH [t]	NO	NO	7.8E-06	3.3E-06	1.1E-05	1.6E-05	1.6E-05	2.0E-05
2025 submission 4PAH [t]	NO	NO	7.8E-09	3.3E-09	1.1E-08	1.6E-08	1.6E-08	2.0E-08
Change relative to 2024 submission 4PAH [t]	–	–	-7.8E-06	-3.3E-06	-1.1E-05	-1.6E-05	-1.6E-05	-2.0E-05
Change relative to 2024 submission 4PAH [%]	–	–	-99.9%	-99.9%	-99.9%	-99.9%	-99.9%	-99.9%

Recalculations from the 2024 submission

Recalculations were in the sector 5C1biii Clinical Waste Incineration due to updated emission factors for $PM_{2.5}$ and PM_{10} which only affected emissions in the years 2001-2003, since measurements are used for these emissions from the incinerator Kalka, which has been the only waste incinerator burning clinical waste in Iceland since 2004.

6.6.4.5 Planned Improvements

An uncertainty analysis is in progress.

6.6.5 Sewage Sludge Incineration (NFR 5C1biv)

6.6.5.1 Methodology

The Tier 1 approach of Chapter 5C1b in the 2023 EMEP/EEA Guidebook is used for the emission estimates. Total amount of sewage sludge is multiplied by a pollutant-specific emission factor.

6.6.5.2 Activity Data

Activity data for Sewage Sludge Incineration was included in NFR sector 5C1a until 2014. This is because it was not possible to distinguish between the waste categories until then, as the IEEA has only received data according to the WStatR categorisation from all waste operators in Iceland since 2014.

6.6.5.3 Emission Factors

Emission factors (Tier 1) are taken from Table 3-1, Chapter 5C1b in the 2023 EMEP/EEA Guidebook, except for NO_X, SO_2, PM, and CO as they are included in 5C1a.

6.6.5.4 Recalculations and Improvements

Recalculations from the 2025 submission

No recalculations were made for this submission.

Recalculations from the 2024 submission

Recalculations were made for the for the sectors 5C1bi Industrial Waste Incineration, 5C1bii Hazardous Waste Incineration and 5C1biv Sewage Sludge Incineration for the whole timeseries due the updated emission factor for Dioxin (PCDD/F).

6.6.5.5 Planned Improvements

An uncertainty analysis is in progress.

6.6.6 Cremation (NFR 5C1bv)

6.6.6.1 Methodology

The total number of bodies incinerated is multiplied by a pollutant specific emission factor from the Tier 1 approach of the 2023 EMEP/EEA Guidebook, Chapter 5C1bv.

6.6.6.2 Activity Data

Cremation is performed at a single facility located in Reykjavík where human remains are incinerated along with the coffin. The activity data, total number of remains incinerated, is provided by the facility.

6.6.6.3 Emission Factors

Emission factors (Tier 1) are taken from Table 3-1, Chapter 5C1bv in the 2023 EMEP/EEA Guidebook.

6.6.6.4 Recalculations and Improvements

Recalculations from the 2025 submission

No recalculations were made for this submission.

Recalculations from the 2024 submission

No recalculations were made for this submission.

6.6.6.5 Planned Improvements

An uncertainty analysis is in progress.

6.6.6.6 *Other Waste Incineration (NFR 5C1bvi)*

No other waste incineration is occurring in Iceland.

6.6.7 Open Burning of Waste (NFR 5C2)

Open Burning of Waste includes combustion in nature and open dumps, as well as combustion in incineration devices that do not control the combustion air to maintain adequate temperature and do not provide sufficient residence time for complete combustion. Incineration devices on the other hand are characterised by creating conditions for complete combustion. Therefore, the burning of waste in historic incineration devices that did not ensure conditions for complete combustion is allocated to Open Burning of Waste. Open pit burning was a common procedure in the early 1990s. In general, open pit burning results in poor combustion conditions due to inhomogeneous and poorly mixed fuel material, chlorinated precursors, humidity, or catalytically active metals. All these factors influence the dioxin formation and therefore it can be hard to come up with reasonable emission factors. In addition, the activity data is quite uncertain, as no official statistics are available.

It is a tradition in Iceland to light bonfires on New Year's Eve (December 31) and Epiphany/Twelfth Night (January 6). These are quite common throughout the country. In the early 1990s, there were no restrictions and no supervision with these bonfires. In the early 1990s, some surveillance officers from the Environmental and Public Health Offices (Local Competent Authority) started to control these fires, by informing the bonfire personnel. In 2000 restrictions were put on the size, burnout time, and the material allowed in bonfires. Since that time, only wood and paper are allowed on bonfires. Additionally, the Environmental and Public Health Offices supervise all bonfires. Now bonfires are fewer and better organised.

6.6.7.1 *Methodology*

Tier 1 methodology from Chapter 5C2 in the 2023 EMEP/EEA Guidebook is used. See more detailed descriptions in the following sections.

6.6.7.2 *Activity Data*

Historic data on open pit burning was estimated with the assumption that 500 kg of waste was incinerated, per inhabitant, in the communities where waste is known to have been incinerated. The estimate was made for the years 1990, 1995, and 2000 and interpolated for the years in between. These communities were mapped by the EAI (predecessor of IEEA) in the respective years. Open pit burning is likely to be still occurring at various rural sites, but this has not been estimated, and no public statistics or estimations are currently available. The amount of waste burned in open pits has decreased rapidly since the early 1990s, when more than 30,000 tonnes of waste were burned. Between 2005 and 2010, there was only one site left which was burning waste openly, on the island of Grímsey. This site was closed by the end of 2010. Based on the population, it was assumed that around 50 tonnes of waste was burned there annually.

For the 31 December and 6 January bonfires, activity data is not easily obtained. In 2011, the EAI (predecessor of IEEA), along with the municipality of Reykjavík, decided to weigh all the material of a single bonfire. Then the piled material was photographed, and its height, width, and length measured. The weight was then correlated to the more readily measurable parameters, pile height and diameter. The Environmental and Public Health Offices were asked to measure the height and diameter of the bonfires in their areas, take photos and send them to the EAI. From this information the total weight of bonfires was estimated for the whole country. The amount was further extrapolated back to 1990, in cooperation with an expert from one Environmental and Public Health Office that has been involved with this field of work for a long time. This tradition as well as the number of bonfires has remained consistent in Iceland and, therefore, the same estimate is used for all years since 2011 with the exception of 2020 and 2021, as the COVID-19 pandemic caused most bonfires to be cancelled. Emissions from bonfires for 2020 and 2021 are consequently distinctively low.

6.6.7.3 Emission Factors

For the emission from open burning of MSW, hazardous and clinical waste, Tier 1 emission factors from Table 3-1 in Chapter 5C2, 2023 EMEP/EEA Guidebook, are used for most pollutants with following exceptions:

- NH_3 and IPy from MSW: Tier 1 emission factor from Table 3-1 in Chapter 5C1a.
- Hg, Ni, PCB and HCB from MSW: Tier 2 emission factor from Table 3-2 in Chapter 5C1a.
- NH_3, Hg, Ni, PCB, HCB and IPy from hazardous waste: Tier 1 emission factors from Table 3-1 in Chapter 5C1bii.
- NH_3, Hg, Ni, PCB, HCB and IPy from clinical waste: Tier 2 emission factors from Table 3-2 in Chapter 5C1biii
- For dioxin, emission factor is taken from Table 54, Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases (UNEP, 2005). The emission factor is approx. 300 µg/t waste (given for uncontrolled domestic waste burning).

As for bonfires, Tier 1 emission factors from Table 3-1 in Chapter 5C2, 2023 EMEP/EEA Guidebook, are also used for most pollutants except for NH_3, Hg, Ni, PCB, HCB and IPy where the Tier 2 emission factors from Table 3-39 in Chapter 1A4bi are applied. Regarding dioxin, the dioxin emission factor has been estimated historically, based on assumptions. From 2003 onwards an emission factor of 60 µg/t is used. For 1990 to 1995 an emission factor of 400 µg/t of burnt material was used. Both factors are taken from Table II.6.5, Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases (UNEP 2012) and is given for open burning of wood and accidental fires in houses. This relates to the fact that the burnt material was very miscellaneous at that time. It was common practice to burn tires, discarded home interiors and even boats at the bonfires. Furthermore, some businesses used the opportunity to get rid of all kinds of waste. Therefore, this dioxin emission factor was considered suitable for bonfires for the years 1990 to 1995. The emission factor was then interpolated from 400 µg to 60 µg/t burnt material from 1996 to 2003.

6.6.7.4 Recalculations and Improvements

Recalculations from the 2025 submission

There was a recalculation due to a new emission factor for NH_3 in Table 3-39, Chapter 1A4bi, 2023 EMEP/EEA Guidebook for wood combustion. This recalculation affects the whole time series 1990-2022, see Table 6.11.

Table 6.11 Recalculation for NH_3 emission from 5C2 Open Burning of Waste for the whole timeseries due to an updated emission factor for NH_3 emissions from wood burning.

5C2 Open burning of waste	1990	1995	2000	2005	2010	2015	2020	2021	2022
2024 submission NH_3 [kt]	5.8E-03	5.2E-03	4.6E-03	3.1E-03	2.4E-03	2.3E-03	2.7E-04	1.1E-04	2.3E-03
2025 submission NH_3 [kt]	7.1E-04	6.3E-04	4.4E-04	3.3E-04	2.6E-04	2.4E-04	2.9E-05	1.2E-05	2.4E-04
Change relative to 2024 submission NH_3 [kt]	-5.0E-03	-4.6E-03	-4.1E-03	-2.7E-03	-2.1E-03	-2.0E-03	-2.4E-04	-1.0E-04	-2.0E-03
Change relative to 2024 submission NH_3 [%]	-88%	-88%	-88%	-89%	-89%	-89%	-89%	-89%	-89%

Recalculations from the 2024 submission

No recalculations were made for this submission.

6.6.7.5 Planned Improvements

An uncertainty analysis is in progress.

6.7 Wastewater Handling (NFR 5D)

According to Chapter 5D in the 2023 EMEP/EEA Guidebook, wastewater handling is an insignificant source of air pollutants. However, in urban areas, NMVOC emissions from wastewater treatment plants can be of local importance. Activities considered within this sector are biological treatment plants and latrines (storage tanks of human excreta, located under naturally ventilated wooden shelters).

In Iceland, most wastewater is discharged into the sea, either untreated or after primary treatment. Only a small amount of wastewater is treated with secondary treatment and latrines are not occurring. Therefore, emissions have not been estimated from wastewater handling.

6.7.1 Methodology

No methodology is used due to the lack of relevant activity data.

6.7.2 Activity Data

No relevant activity data.

6.7.3 Emission Factors

No emission factors used.

6.7.4 Recalculations and Improvements

6.7.4.1 Recalculations from the 2025 submission

No recalculations were made for this submission.

6.7.4.2 Recalculations from the 2024 submission

No recalculations were made for the last submission.

6.7.5 Planned Improvements

It is planned to contact the relevant companies and investigate if it is possible to get the volume of handled wastewater. This would make it possible to report the NMVOC emissions from wastewater handling.

6.8 Other Waste (NFR 5E)

This section discusses the emission estimates from other waste, for which Iceland estimates emissions from accidental house and vehicle burning. Emission estimates for all reported pollutants are provided, except for NH_3, BC, Se, HCB, and PCB, where emission factors have not been found or are considered not applicable.

6.8.1 Methodology

For accidental house fires, emission estimates are calculated as follows: the number of fire events are multiplied with a pollutant specific emission factor from the Tier 2 approach of Chapter 5E in the 2023 EMEP/EEA Guidebook and the most recent Danish Informative Inventory Report (IIR).

For accidental vehicle fires, emission estimates are calculated as the mass of vehicles burned multiplied with a pollutant-specific emission factor from the most recent Danish IIR. The weight of different types of vehicles is used in the calculations and taken from the most recent Danish IIR. The assumption is made that 70% of the total mass is burned.

6.8.2 Activity Data

Activity data for vehicle and building fires were obtained from the Capital District Fire and Rescue Service (CDFRS) for the years 2003 onward. Building fires are classified by duration of response into small (<60 min.), medium (60-120 min.) and large fires (>120 min.) The data is presented in Table 6.12. As two thirds of the Icelandic population lives in the capital area, it is assumed that the CDFRS serves two thirds of the incidents in Iceland.

In Table 6.13, data on vehicle and building fires, extrapolated for Iceland, is presented. As the emission factors used comply for full scale building fires, the activity data is scaled as a full-scale equivalent where it is assumed that a small and medium fire leads to 5% and 50%

of a large fire respectively, and that a large fire is a full-scale fire. The rightmost column in Table 6.13 shows the total scaled building fires. This scaling is similar to the scaling used in the 2024 Danish IIR, although the scaling in Denmark is based on response activity rather than response time. It does, however, seem appropriate to scale the fires in this way for the Icelandic data. It is further assumed that 10% of each year's building fires, are industrial building fires.

In 2004, a major industrial fire broke out at a recycling company *Hringrás*. In the fire, 300 t of tires among other separated waste materials burned. In 2011, a fire broke out at the same company, but that fire is assumed to have been about 10% of the size of the one in 2004. In 2014, a major fire incident occurred when fire broke out in an industrial laundry service *Fönn*. The building had a thick layer of asphalt roll roofing with an estimated weight of around 80 t.

For 1990 to 2002, an average of the total scaled building fires (38) and vehicle fires (60) was used. The possibility to obtain better data for 1990 to 2002 has been further explored. However, the reports on accidental fires for that period are in a completely different format, making them both difficult to obtain and interpret. As the extra information gained would not be of that much importance, it is not a priority to further explore this subject.

The yearly combusted mass is calculated by multiplying the number of different vehicles fires with the average weight of the given vehicle type.

As the types of vehicles that have caught fire are not registered at the CDFRS, the average ratio of vehicle type caught on fire are taken from the Danish IIR. The ratios for the year 2021 are:

- Passenger Cars 81%
- Buses 1%
- Light-duty Vehicles 3%
- Heavy-duty Vehicles 5%
- Motorcycles 9%

The total amount of vehicle mass involved in fires is then calculated from the number of vehicle fires and the average weights of the different vehicle types (weight is also taken from the Danish IIR, as national data was not available). It is assumed that 70% of the total vehicle mass involved in a fire burns.

Table 6.12 Vehicle and building fires, Icelandic Capital Area.

Year	Vehicle Fires	Building Fires			
		<60 min	60-120 min	>120 min	Total Scaled
2005	43	141	24	11	30
2010	34	118	17	9	23
2015	56	88	14	3	14
2020	41	69	13	13	23
2022	38	89	13	14	25
2023	47	103	28	18	37

Table 6.13 Vehicle and building fires scaled for all of Iceland (scaled using data from the Capital Area) and population data.

Year	Vehicle Fires	Building Fires			
		<60 min	60-120 min	>120 min	Total Scaled
2005	65	212	36	17	45
2010	51	177	26	14	35
2015	84	132	21	5	22
2020	62	104	20	20	34
2022	57	134	20	21	37
2023	71	155	42	27	56

6.8.3 Emission Factors

The emission factor for undetached houses is used for all building fires, except for industrial building fires. This is because Icelandic regulations demand more fire resistance than the regulations in other Scandinavian countries. Emission factors for undetached building fires are taken from Table 3-3, Chapter 5E in the 2023 EMEP/EEA Guidebook, for all estimated pollutants provided in the Guidebook except for dioxin, which is taken from the most recent Danish IIR. Other non-estimated sources of the 2023 EMEP/EEA Guidebook are taken from Table 6.24 in the most recent Danish IIR. No emission factors are provided for BC, Ni, Se, Zn, HCB, and PCB. NH_3 is considered not applicable as the 2023 EMEP/EEA Guidebook suggests.

Similarly, for industrial building fires, emission factors from Table 3-5, Chapter 5E in the 2023 EMEP/EEA Guidebook is used except for dioxin which is taken from the most recent Danish IIR. Other non-estimated sources of the 2023 EMEP/EEA Guidebook are taken from Table 6.24 in the most recent Danish IIR. No emission factors are provided for BC, Ni, Se, Zn, HCB, and PCB. NH_3 is considered not applicable as the 2023 EMEP/EEA Guidebook suggests.

For vehicle fires, the burned mass is multiplied with a pollutant specific emission factor taken from Table 6.32 of the most recent Danish IIR.

For the major industrial fire at *Hringrás* in 2004, an emission factor of 220 µg/t of tires, from the Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases (UNEP, 2005), was taken. Using this factor, this single fire was estimated to be the size of around 16 industrial building fires and other emissions were scaled accordingly.

Asphalt roll roofing, which burned in the 2014 industrial laundry fire *Fönn*, was assumed to emit dioxin levels comparable to scrap tires and, therefore, the same emission factor for dioxin was used as for the industrial fire at the recycling company (Hringrás). Dioxin emissions from other materials that burned were included by assuming that the scale of the fire was comparable to five industrial buildings. Thus, the emission from this particular fire corresponds to five industrial building fires plus the special assessment of the asphalt roll roofing, in total around nine industrial fires. Other POP's emission estimates were calculated by using emission factors from Table 6.24 in the most recent Danish IIR for industrial buildings, scaled according to the estimation of corresponding industrial building fires. Emission factors for NO_x, NMVOC, SO_2, and CO are also taken from Table 6.24 in the most recent Danish IIR. Other reported pollutants are taken from Table 3-5, Chapter 5E in the 2023 EMEP/EEA Guidebook. No emission factors are provided for BC, Ni, Se, Zn, HCB, and PCB. NH_3 is considered not applicable as the 2023 EMEP/EEA Guidebook suggests.

6.8.4 Recalculations and Improvements

Recalculations from the 2025 submission

Recalculations were made in the sector 5E Other Waste due to a correction of the number of vehicles burned in Iceland in the years 2013-2022, shown in Table 6.14.

Table 6.14 Recalculation for 5E Other Waste due to corrected activity data for the number of vehicle fires in Iceland in 2013-2022.

5E Other Waste	2013	2015	2017	2019	2021	2022
2024 submission NO_x [kt]	5.6E-04	4.9E-04	6.8E-04	7.4E-04	6.4E-04	6.9E-04
2025 submission NO_x [kt]	6.0E-04	5.4E-04	7.3E-04	7.9E-04	6.9E-04	7.5E-04
Change relative to 2024 submission NO_x [kt]	4.3E-05	4.9E-05	5.6E-05	5.0E-05	5.5E-05	5.6E-05
Change relative to 2024 submission NO_x [%]	7.7%	10%	8.3%	6.8%	8.6%	8.1%
2024 submission NMVOC [kt]	2.7E-03	2.4E-03	3.3E-03	3.6E-03	3.1E-03	3.4E-03
2025 submission NMVOC [kt]	2.9E-03	2.6E-03	3.5E-03	3.8E-03	3.4E-03	3.7E-03
Change relative to 2024 submission NMVOC [kt]	1.8E-04	2.1E-04	2.4E-04	2.1E-04	2.3E-04	2.4E-04
Change relative to 2024 submission NMVOC [%]	6.7%	8.9%	7.3%	5.9%	7.4%	7.0%
2024 submission SO_x [kt]	7.9E-03	6.3E-03	8.9E-03	1.1E-02	9.3E-03	1.1E-02
2025 submission SO_x [kt]	8.0E-03	6.4E-03	9.0E-03	1.1E-02	9.4E-03	1.1E-02
Change relative to 2024 submission SO_x [kt]	1.1E-04	1.2E-04	1.4E-04	1.3E-04	1.4E-04	1.4E-04
Change relative to 2024 submission SO_x [%]	1.4%	2.0%	1.6%	1.2%	1.5%	1.3%
2024 submission TSP [kt]	3.4E-03	3.4E-03	4.7E-03	4.3E-03	3.2E-03	3.4E-03
2025 submission TSP [kt]	4.2E-03	4.4E-03	5.8E-03	5.2E-03	4.3E-03	4.4E-03
Change relative to 2024 submission TSP [kt]	8.2E-04	9.4E-04	1.1E-03	9.5E-04	1.0E-03	1.1E-03
Change relative to 2024 submission TSP [%]	24%	27%	23%	22%	32%	32%
2024 submission PM_{10} [kt]	3.4E-03	3.4E-03	4.7E-03	4.3E-03	3.2E-03	3.4E-03
2025 submission PM_{10} [kt]	4.2E-03	4.4E-03	5.8E-03	5.2E-03	4.3E-03	4.4E-03
Change relative to 2024 submission PM_{10} [kt]	8.2E-04	9.4E-04	1.1E-03	9.5E-04	1.0E-03	1.1E-03
Change relative to 2024 submission PM10 [%]	24%	27%	23%	22%	32%	32%
2024 submission $PM_{2.5}$ [kt]	3.4E-03	3.4E-03	4.7E-03	4.3E-03	3.2E-03	3.4E-03
2025 submission $PM_{2.5}$ [kt]	4.2E-03	4.4E-03	5.8E-03	5.2E-03	4.3E-03	4.4E-03
Change relative to 2024 submission $PM_{2.5}$ [kt]	8.2E-04	9.4E-04	1.1E-03	9.5E-04	1.0E-03	1.1E-03
Change relative to 2024 submission $PM_{2.5}$ [%]	24%	27%	23%	22%	32%	32%
2024 submission CO [kt]	9.5E-03	8.7E-03	1.2E-02	1.2E-02	1.0E-02	1.1E-02
2025 submission CO [kt]	1.1E-02	1.0E-02	1.4E-02	1.4E-02	1.2E-02	1.3E-02
Change relative to 2024 submission CO [kt]	1.4E-03	1.6E-03	1.8E-03	1.6E-03	1.7E-03	1.8E-03
Change relative to 2024 submission CO [%]	14%	18%	15%	13%	17%	16%
2024 submission Pb [t]	3.8E-02	4.5E-02	6.2E-02	4.5E-02	2.6E-02	2.5E-02
2025 submission Pb [t]	5.6E-02	6.5E-02	8.5E-02	6.5E-02	4.8E-02	4.8E-02
Change relative to 2024 submission Pb [t]	1.8E-02	2.0E-02	2.3E-02	2.1E-02	2.2E-02	2.3E-02
Change relative to 2024 submission Pb [%]	46%	45%	37%	46%	87%	92%

5E Other Waste	2013	2015	2017	2019	2021	2022
2024 submission Cd [t]	8.9E-05	1.0E-04	1.4E-04	1.1E-04	6.5E-05	6.5E-05
2025 submission Cd [t]	1.3E-04	1.4E-04	1.9E-04	1.5E-04	1.1E-04	1.1E-04
Change relative to 2024 submission Cd [t]	3.6E-05	4.2E-05	4.8E-05	4.3E-05	4.7E-05	4.8E-05
Change relative to 2024 submission Cd [%]	41%	42%	34%	40%	71%	74%
2024 submission As [t]	2.7E-05	2.7E-05	3.7E-05	3.5E-05	2.7E-05	2.9E-05
2025 submission As [t]	3.3E-05	3.3E-05	4.5E-05	3.9E-05	3.5E-05	3.6E-05
Change relative to 2024 submission As [t]	5.6E-06	6.4E-06	7.3E-06	4.1E-06	7.1E-06	7.3E-06
Change relative to 2024 submission As [%]	20%	24%	20%	12%	26%	26%
2024 submission Cr [t]	1.9E-04	2.2E-04	3.0E-04	2.3E-04	1.4E-04	1.4E-04
2025 submission Cr [t]	2.7E-04	3.1E-04	4.1E-04	3.2E-04	2.4E-04	2.4E-04
Change relative to 2024 submission Cr [t]	8.2E-05	9.4E-05	1.1E-04	9.5E-05	1.0E-04	1.1E-04
Change relative to 2024 submission Cr [%]	42%	43%	35%	42%	76%	79%
2024 submission Cu [t]	1.3E-03	1.5E-03	2.1E-03	1.5E-03	8.9E-04	8.7E-04
2025 submission Cu [t]	1.9E-03	2.2E-03	2.8E-03	2.2E-03	1.6E-03	1.6E-03
Change relative to 2024 submission Cu [t]	5.8E-04	6.7E-04	7.6E-04	6.8E-04	7.4E-04	7.6E-04
Change relative to 2024 submission Cu [%]	45%	44%	37%	45%	83%	87%
2024 submission Ni [t]	1.3E-04	1.5E-04	2.1E-04	1.5E-04	8.8E-05	8.5E-05
2025 submission Ni [t]	1.9E-04	2.2E-04	2.9E-04	2.2E-04	1.6E-04	1.6E-04
Change relative to 2024 submission Ni [t]	6.0E-05	6.9E-05	7.9E-05	7.0E-05	7.7E-05	7.9E-05
Change relative to 2024 submission Ni [%]	46%	45%	37%	46%	87%	92%
2024 submission Zn [t]	1.5E-01	1.8E-01	2.4E-01	1.7E-01	1.0E-01	9.8E-02
2025 submission Zn [t]	2.2E-01	2.5E-01	3.3E-01	2.5E-01	1.9E-01	1.9E-01
Change relative to 2024 submission Zn [t]	6.9E-02	7.9E-02	9.0E-02	8.0E-02	8.8E-02	9.0E-02
Change relative to 2024 submission Zn [%]	46%	45%	37%	46%	87%	92%
2024 submission PCDD/F [g I-TEQ]	8.4E-02	6.9E-02	9.7E-02	1.1E-01	1.0E-01	1.1E-01
2025 submission PCDD/F [g I-TEQ]	8.5E-02	7.0E-02	9.8E-02	1.2E-01	1.0E-01	1.1E-01
Change relative to 2024 submission PCDD/F [g I-TEQ]	8.6E-04	9.9E-04	1.1E-03	1.0E-03	1.1E-03	1.1E-03
Change relative to 2024 submission PCDD/F [%]	1.0%	1.4%	1.2%	0.88%	1.1%	1.0%
2024 submission 4PAH [t]	5.6E-03	6.3E-03	8.7E-03	6.7E-03	4.2E-03	4.2E-03
2025 submission 4PAH [t]	7.8E-03	8.8E-03	1.2E-02	9.3E-03	7.0E-03	7.1E-03
Change relative to 2024 submission 4PAH [t]	2.2E-03	2.5E-03	2.9E-03	2.6E-03	2.8E-03	2.9E-03
Change relative to 2024 submission 4PAH [%]	39%	40%	33%	39%	67%	68%

Recalculations from the 2024 submission

Recalculations were made in the sector 5E Other Waste due to updated activity data on vehicle fires for the year 2021 and updated emission factors for the whole timeline.

6.8.5 Planned Improvements

A review is planned of the data used for 1990 to 2002 for the number of accidental house and vehicle fires, as well as a collaboration with the Iceland Building Authority with the aim of providing better estimates of emissions from building fires.

7 Natural Sources (NFR Sector 11)

7.1 Volcanoes (NFR 11A)

Iceland is a geologically active island and volcanic eruptions are frequent. Both remote and in-situ analytical techniques allow for a good estimation of associated emissions. While the following chapters describe the eruptions from 2010 in detail, Table 7.1 reports the emissions for the whole time series and the respective sources of information. As emissions from these eruptions are not anthropogenic, they are reported in this chapter and in the NFR Tables under Memo Item 11A but are not included in national totals.

Table 7.1 Volcanic eruptions and associated SO_x and particulate emissions from 1990.

Year	Volcano	Emissions [kt] SO_x	$PM_{2.5}$	PM_{10}	Measurement Method/Source
1991	Hekla	230	N/A	N/A	Satellite Nimbus-7 TOMS volcano.si.edu
1996	Grímsvötn	10	N/A	N/A	Satellite Aura OMI volcano.si.edu
2000	Hekla	183	N/A	N/A	Satellite Earth Probe TOMS volcano.si.edu
2004	Grímsvötn	30	N/A	N/A	Satellite Aura OMI volcano.si.edu
2010	Eyjafjallajökull	127	1,673	5,970	See Section 7.1.1
2011	Grímsvötn	300	13,184	47,039	Satellite Aura OMI volcano.si.edu
2014-2015	Holuhraun	12,006	N/A	N/A	See Section 7.1.3
2021	Fagradalsfjall	967	N/A	N/A	See Section 7.1.4
2022	Meradalir	152	N/A	N/A	See Section 7.1.5
2023	Litli-Hrútur	140	N/A	N/A	See Section 7.1.6
2023	Sundhnúksgígar	110	N/A	N/A	See Section 7.1.7

The last seven volcanic eruptions (Eyjafjallajökull, April-May 2010; Grímsvötn, May 2011; Holuhraun, September 2014-February 2015; Fagradalsfjall, March-September 2021; Meradalir, August 2022; Litli-Hrútur July-August 2023; and Sundhnúksgígar, December 2023) are reported in detail below.

7.1.1 Eyjafjallajökull Eruption 2010

Eyjafjallajökull is situated in South Iceland and is covered by a glacier. The Eyjafjallajökull eruption lasted from 14 April until 23 May 2010. As the eruption occurred under ice, it generated significant amounts of ash which had a widely noticed impact on air traffic, as well as at times extreme impacts on the local air quality. Emissions of sulphur dioxide (SO_2) and particulate matter (PM_{10}, $PM_{2.5}$) were estimated and reported as described below. The emissions estimates are based on satellite observations on a daily basis during the eruption[17] and amounted to approximately 127 kt of SO_2, 5,970 kt of PM_{10}, and 1,673 kt. of $PM_{2.5}$. These 5,970 kt of PM_{10} were around 3,500 times more than the total estimated anthropogenic PM_{10} emissions in Iceland in 2010.

[17] https://wiki.met.no/emep/emep_volcano_plume

Figure 7.1 Eyjafjallajökull eruption at its peak in April 2010. Photo: Þorsteinn Jóhannsson.

7.1.2 Grímsvötn Eruption 2011

Grímsvötn volcano lays below the biggest glacier in Iceland, Vatnajökull, in the southeast of the country, and reaches 1,725 m above sea level. It is one of Iceland's most active volcanoes and has erupted frequently in the past century (1934, 1983, 1996, 1998, 2004, and 2011).

The 2011 Grímsvötn eruption lasted from 21 May until 28 May. The eruption at Grímsvötn was much larger than that of Eyjafjallajökull the year before, and it has been estimated that during the first day, more sulphur and particulates were emitted than during the entirety Eyjafjallajökull eruption. SO_2 emissions from Grímsvötn have been estimated to be around 1,000 kt. The total mass of particulates emitted has not been estimated, but the Icelandic Environment and Energy Agency (*Umhverfis- og orkustofnun*) (IEEA) has scaled the emissions of particulates using the ratio of sulphur emissions from the two eruptions (1,000/127). This gives an approximate estimate of 47,000 kt PM_{10} and 13,000 kt of $PM_{2.5}$. Figure 7.2, a NASA MODIS satellite image acquired at 05:15 UTC on 22 May 2011, shows the plume from Grímsvötn casting shadow to the west.

Figure 7.2 Grímsvötn eruption in May 2011. Photo: NASA/GSFC/Jeff Schmaltz/MODIS Land Rapid Response Team.

7.1.3 Holuhraun Eruption 2014-2015

Holuhraun is located to the north of Vatnajökull glacier in the center of Iceland and the erupted lava originates from the volcano Bárðabunga situated beneath Vatnajökull. Prior to the eruption, seismic measurements showed the emplacement of a dike, originating from the Bárðabunga caldera and migrating to the northeast over the course of a few weeks. The eruption at Holuhraun began on 31 August 2014, just to the north of the northern edge of Vatnajökull and ended on 27 February 2015. It was the biggest eruption in Iceland (in terms of erupted material) since the Laki eruption 1783.

Emission estimates from the Holuhraun eruption were done by the volcanic hazard team at the Icelandic Meteorological Office (*Veðurstofa Íslands*) (IMO). According to information from Sara Barsotti and Melissa Anne Pfeffer, specialists at the IMO, the estimates were conducted as follows: the emission rate of SO_2 was calculated using wind parameters provided by the HARMONIE numerical prediction model, and column concentrations of SO_2 detected with different types of Differential Optical Absorption Spectroscopy (DOAS) measurements. The DOAS techniques used include two NOVAC scanning DOAS instruments (Galle, et al., 2010): one installed 7 km from the main degassing vent, Baugur, but moved during the eruption due to the advancing lava to 10 km from the main vent; a second scanning DOAS installed 10 km from the main vent but damaged by advancing lava two weeks after the start of the eruption; campaign DOAS traverses, made as close to the main vent as conditions allowed; and ring road DOAS traverses (Gíslason, 2015). All measurements were analysed closely to remove the data most impacted by scattering. For all techniques, good quality measurements were used to calculate daily averages of the SO_2 emission rate. On days when good quality data was acquired from more than one DOAS technique, the larger value was used, and then these daily values were used to calculate the monthly averages. Some minor degassing from the cooling lava continued after the end of the eruption (maximum 3 kg/s; Simmons et al., 2016); this contribution to the emissions is not included here.

Total SO_2 emission from this eruption was estimated 12,006 kt, as communicated in 2016 by the IMO. Divided on calendar years, 10,880 kt of SO_2 were emitted in 2014 and 1,126 kt of SO_2 in 2015. To put these numbers in in perspective, it can be said that the total SO_2 emissions from all the European Union (EU) countries for 2012 was 4,576 kt. This means that the emissions from the eruption in 2014 (i.e., from 29 August 2014 to 31 December 2014) were more than twice the total SO_2 emissions from all the EU for the whole year. For September alone, during the most intensive period of the eruption, the SO_2 emissions from the eruption were similar to the annual SO_2 emissions of the EU.

Because the eruption occurred in an area free of ice, emissions of ash were negligible. Further information about SO_2 emissions from the eruption are in Table 7.2 below. As these emissions are natural, they are not included in national totals.

Table 7.2 Monthly emission rates (Pfeffer (IMO), 2016, email communication).

Date	Average monthly emission rates [kg/s]	SO_2 per month [kt]
August 2014	124	332
September 2014	1,708	4,427
October 2014	1,051	2,815
November 2014	1,143	2,963
December 2014	128	343
January 2015	304	814
February 2015	129	312

Figure 7.3 Holuhraun eruption in September 2014. The height of the lava fountains was around 100 m. Photo: Ólafur F. Gíslason.

7.1.4 Fagradalsfjall Eruption 2021

A basaltic effusive eruption started at Fagradalsfjall along a fissure on 19 March and lasted until 18 September 2021 (Figure 7.4). This eruption ended a 781-year dormancy on the Reykjanes peninsula in the southwest of Iceland. This peninsula is an onshore continuation of the Mid-Atlantic plate boundary and has volcanic systems consisting of 10-40 km long NE-SW-trending fissure swarms and geothermal areas. The March-September mean bulk effusion rate was 9.5 ±0.2 m^3/s, ranging between 1 and 8 m^3/s in March-April and increasing to 9-13 m^3/s in May-September. This is uncommon for recent Icelandic eruptions, where the highest discharge usually occurs in the opening phase (Pedersen, 2022).

Measurements of SO_2 emissions were done by the IMO in the following way: the flux of SO_2 was measured with ground-based UV spectrometers. A three-instrument network of DOAS instruments (10 km NNW of the eruption site, 6 km to the NW, and 4.5 km to the SW) was augmented by traverses directly under the eruption cloud which were primarily car-borne, but a few measurements were also made by foot and by aircraft. These measurements are used together with plume height and meteorological conditions to calculate the emission rate of SO_2. The scanning instruments measured the SO_2 flux 4,900 times over the duration of the eruption. These measurements include only those where the plume was within ±15 degrees of line of site from the eruption to the instrument and the measurements were not obviously impacted by the low solar angle during sunrise and sunset. Additionally, 148 traverse measurements were made. The traverse calculations attempt to include the uncertainty related to wind properties to have the true measurement uncertainty represented in the results. The total SO_2 emissions are 967 ±538 kt.

Figure 7.4 Fagradalsfjall eruption on 1 May 2021. Photo: Nicole Keller.

7.1.5 Meradalir Eruption 2022

A basaltic effusive eruption started on August 3, 2022, in Meradalir along a 300-metre-long fissure. It was approximately 1 km northeast of the Fagradalsfjall eruption site and is a part of the same volcanic system. The eruption lasted until the August 21 and was in exponential decay in terms of lava effusion.

The IMO estimate that a total of 152 kt of SO_2 were emitted during the eruption with a range of 136-169 kt. This is based on the average of six DOAS traverses made in the middle of the eruption.

Figure 7.5 Meradalir eruption in August 2021. Photo: Vísir/Arnar.

7.1.6 Litli-Hrútur Eruption 2023

On July 10, 2023, an eruption began near Litli-Hrútur, located between peaks locally known as Keilir and Fagradalsfjall. A fissure opened north of Litli-Hrútur, rapidly expanding to a length of 700-800 meters. After 24 hours, activity has significantly decreased and eventually concentrated into one single crater.

Significant gas pollution was present in the area, with volcanic smog reaching as far as the Westfjords. Furthermore, large wildfires broke out, burning over 231 hectares of vegetation, mostly moss.

The activity steadily declined until it ceased on August 5. The lava flow reached in total 15.2 million m^3 , covering an area of 1.5 km^2.

The IMO estimates that a total of 140 kt of SO_2 were emitted during the eruption, with an uncertainty of 50%. This estimate is based on gas measurements on eruption site.

Figure 7.6 A crater at the eruption site near Litli-Hrútur, 2023. Photo: Institute of Earth Sciences.

Figure 7.7 Burned vegetation at the eruption site near Litli-Hrútur, July 14, 2023. Photo: Járngerður Grétarsdóttir

7.1.7 Sundhnúksgígar Eruption 2023

On December 18, 2023, an eruption started at Sundhnúksgígar craters, located to the north-east of the town of Grindavík and east of the Svartsengi geothermal power plant. The eruption was characterised by high lava flow rate along a 4 km fissure during its first hours. Activity soon declined significantly, and the eruption was considered over by December 21. The lava flow reached in total 12 million m^3, covering an area of 3.4 km^2.

The IMO estimates that a total of 110 kt of SO_2 were emitted during the eruption, with an uncertainty of 50%. This estimate is based on the total lava volume and the sulphur in lava samples.

8 Spatially Distributed Emissions on a Grid – Not updated for this submission [will be updated and new gridded data will be submitted in May 2025]

8.1 Scope

The present document provides explanations about the methodology and the data sources used. Gridded emissions were reported in 2021 for the years 2015 and 2019 and for the following components: PCDD/PCDF (dioxins/furans), PAHs, HCB, and PCB. It should be noted that no updates were made between the 2021 Submission and this one, as gridded data only needs to be submitted every four years. Iceland intends to include updates to this section in the 2025 Submission.

The gridded emissions were aggregated into the following GNFR sectors: A_PublicPower, B_Industry, C_OtherStationaryComb, E_Solvents, F_RoadTransport, G_Shipping, H_Aviation, I_Offroad, J_Waste. POPs emissions do not originate in the Agriculture sector therefore no emissions are reported under the GNFR codes K_AgriLivestock and L_AgriOther.

As a geographical basis the EMEP grid with resolution of 0.1°x 0.1° was used for the first time, as in the 2016 submission the former 50 km x 50 km grid was used.

8.2 Methodology

The methodology follows the approach described in the EMEP/EEA Air Pollutant Emission Inventory Guidebook 2019. Following steps were carried out in order to provide a spatial allocation of the emissions reported in the NFR tables:

- Understand type and origin of emissions (point or diffuse source);
- Associate geographical locations;
- Find proxy datasets for the emissions which could not be allocated to a location;
- Assign to each grid cell of the EMEP 0.1°x 0.1° resolution grid a unique number (2,273 grid cells in total);
- Allocate the emissions to the grid cells subdivided per GNFR code;
- Sum emissions within one grid cell to obtain total emission within that grid cell;
- Consistency check: crosscheck sum of emissions of all grid cells with national total emissions reported in NFR tables.

The spatially distributed emissions are based on the data collected for the Informative Inventory Report with addition of geographical datasets which can be downloaded from the website of the National Land Survey of Iceland (Landmælingar Íslands) (NLSI)18. Population density maps and the locations of major ports and airports were extracted from

[18] https://www.lmi.is/

these datasets with the help of GIS software. Locations of point locations were extracted from the EPRTR registry. Some statistical data (tonnage of fish landed, farm numbers per region) was retrieved from Statistics Iceland (Hagstofa Íslands) (SI)[19]. Flight statistics for international and domestic flights were collected from Isavia[20], the operator of all airports and manager of air traffic in Iceland. In some cases, expert judgement from the national inventory compiler was applied to ensure a correct allocation of emissions.

Table 8.1 summarises source of the datasets and proxy spatial dataset used, if necessary.

Table 8.1 Summary of the source of emission allocation and/or proxy spatial dataset used for the spatial mapping of emissions.

GNFR Code	NFR Code	Long Name	Source and Proxy Spatial Dataset Used
A_PublicPower	1A1a	Public Electricity and Heat Production	National Energy Authority (*Orkustofnun*) (NEA), two main areas in Iceland where electricity is still produced by fossil fuels, 80% assigned to Grímsey and 20% to Grímsstaðir. The third area, Flatey, is an island which is not inhabited all year round.
B_Industry	1A2a	Stationary Combustion in Manufacturing Industries and Construction: Iron and Steel	Fuel consumption of Ferroalloy producers known, NEA – NIR/IIR, EPRTR registry
B_Industry	1A2b	Stationary Combustion in Manufacturing Industries and Construction: Non-ferrous Metals	Fuel consumption of Aluminium producers known, NEA – NIR/IIR, EPRTR registry
B_Industry	1A2e	Stationary Combustion in Manufacturing Industries and Construction: Food Processing, Beverages, and Tobacco	These emissions stem from the fishmeal factories; the oil consumption numbers were looked up from their annual Green reports and the emissions distributed accordingly.
B_Industry	1A2f	Stationary Combustion in Manufacturing Industries and Construction: Non-metallic Minerals	Fuel consumption of mineral wool producers known, NEA – NIR/IIR, EPRTR registry
I_Offroad	1A2gvii	Mobile Combustion in Manufacturing Industries and Construction	Population density used as proxy spatial dataset, dataset from NLSI.
B_Industry	1A2gviii	Stationary Combustion in Manufacturing Industries and Construction: Other	This category is not very well defined, and the origin of emissions is not clearly stated by the NEA, so it was decided to split these emissions onto all known big industries.
H_Aviation	1A3ai(i)	International Aviation LTO (Civil)	Flight statistics published from Isavia, the operator of all airports and manager of air traffic in Iceland. Exact location of airports from dataset from NLSI.
H_Aviation	1A3aii(i)	Domestic Aviation LTO (Civil)	Flight statistics published from Isavia, the operator of all airports and manager of air traffic in Iceland. Exact location of airports from dataset from NLSI.
F_Road-Transport	1A3bi	Road Transport: Passenger Cars	Population density used as proxy, dataset from NLSI
F_Road-Transport	1A3bii	Road transport: Light-duty Vehicles	Population density used as proxy, dataset from NLSI
F_Road-Transport	1A3biii	Road Transport: Heavy-duty Vehicles and Buses	Population density used as proxy, dataset from NLSI
F_Road-Transport	1A3biv	Road transport: Mopeds and Motorcycles	Population density used as proxy, dataset from NLSI
G_Shipping	1A3dii	National Navigation (Shipping)	This category comprises ferries, whale watching boats, and (probably) the coast guard, even though there are no information on the latter. From NIR/IIR data, the annual fuel use was split between ferries and whale watching (the consumption of the main ferry to Westman Islands is known). Expert

[19] https://statice.is/
[20] https://www.isavia.is/en

GNFR Code	NFR Code	Long Name	Source and Proxy Spatial Dataset Used
			judgement from the Energy sector compiler split then the fuel to the rest of ferries/whale watching ports.
C_Other-StationaryComb	1A4ai	Commercial/Institutional: Stationary	This category comprises pools heated by fossil fuels; according to the NEA, there is only one public pool left heated with fossil fuels (Grundarfjörður and the school building as well).
C_Other-StationaryComb	1A4bi	Residential: Stationary	Population density used as proxy, dataset from NLSI
C_Other-StationaryComb	1A4ci	Agriculture/Forestry/Fishing: Stationary	A) Farm numbers per region for sheep and cattle farmers retrieved from Statistics Iceland, combined percentage per region calculated. B) In GIS all houses located (no info about farm houses available) and intersected with the regions. C) Grid cells with fewer than 10 houses excluded. D) Percentage from A assigned to each grid cell within a region having >10 houses according to the houses present in one grid cell. Geographical dataset from NLSI.
I_Offroad	1A4cii	Agriculture/Forestry/Fishing: Off-road Vehicles and Other Machinery	A) Farm numbers per region for sheep and cattle farmers retrieved from Statistics Iceland, combined percentage per region calculated. B) In GIS all houses located (no info about farm houses available) and intersected with the regions. C) Grid cells with less than 10 houses excluded. D) Percentage from A assigned to each grid cell within a region having >10 houses according to the houses present in one grid cell. Geographical dataset from NLSI.
I_Offroad	1A4ciii	Agriculture/Forestry/Fishing: National Fishing	Main ports defined from the tonnage landed, dataset from SI and emissions split accordingly.
C_Other-StationaryComb	1A5a	Other Stationary (including Military)	Population density used as proxy, dataset from NLSI
B_Industry	2A6	Other Mineral Products (please specify in the IIR)	Fuel consumption from the mineral wool producers are known, NEA – NIR/IIR
B_Industry	2C2	Ferroalloys Production	Fuel consumption from the ferroalloys producers are known, NEA – NIR/IIR
B_Industry	2C3	Aluminium Production	Fuel consumption from the aluminium producers are known, NEA – NIR/IIR
B_Industry	2D3b	Road Paving with Asphalt	The asphalt production is known, and the emissions distributed accordingly. – NIR/IIR
E_Solvents	2G	Tobacco	Population density used as proxy, dataset from NLSI
J_Waste	5C1a	Municipal Waste Incineration	All incineration occurs in one incinerator in the Reykjanes peninsula.
J_Waste	5C1bi	Industrial Waste Incineration	All incineration occurs in one incinerator in the Reykjanes peninsula.
J_Waste	5C1bii	Hazardous Waste Incineration	All incineration occurs in one incinerator in the Reykjanes peninsula.
J_Waste	5C1biii	Clinical Waste Incineration	All incineration occurs in one incinerator in the Reykjanes peninsula.
J_Waste	5C1biv	Sewage Sludge Incineration	All incineration occurs in one incinerator in the Reykjanes peninsula.
J_Waste	5C1bv	Cremation	Cremation occurs only in one crematorium in Reykjavík.
J_Waste	5C2	Open Burning of Waste	This comprises the yearly New Year's eve bonfires. Locations have been determined by searching newspapers and local news, 76 locations determined; emissions split equally as no information about size of single bonfires is known.
J_Waste	5E	Other Waste	Population density used as proxy, dataset from NLSI

8.3 Emissions 2019

The following figures show the national total emissions of dioxin/furans, PAHs, HCB, and PCB for the year 2019.

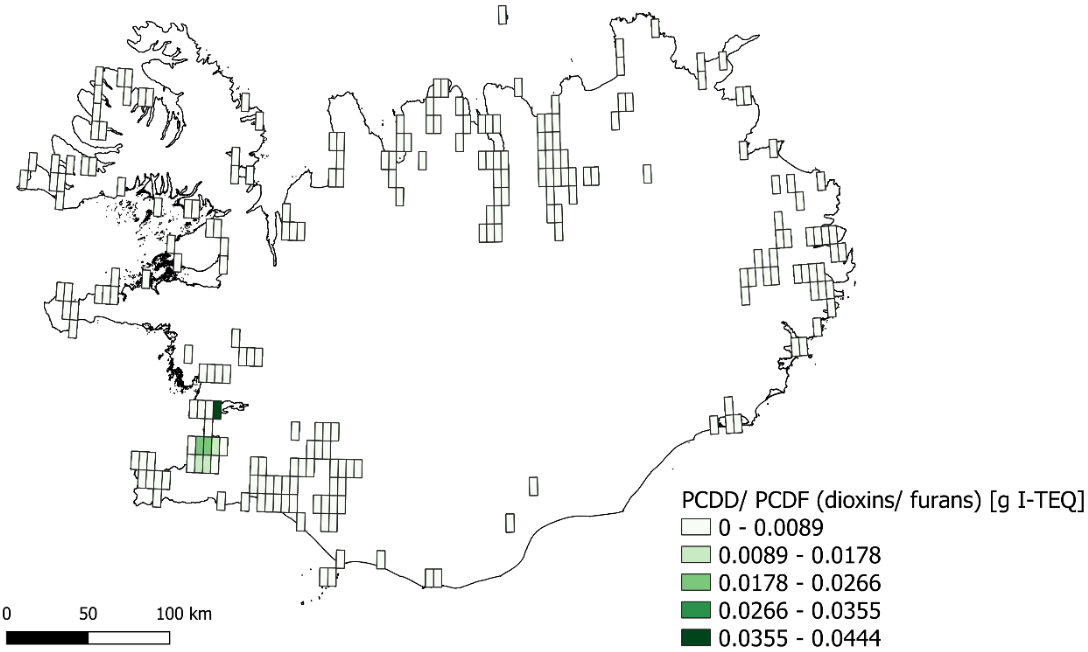


Figure 8.1 Emissions of dioxin/furans 2019 [g I-TEQ].

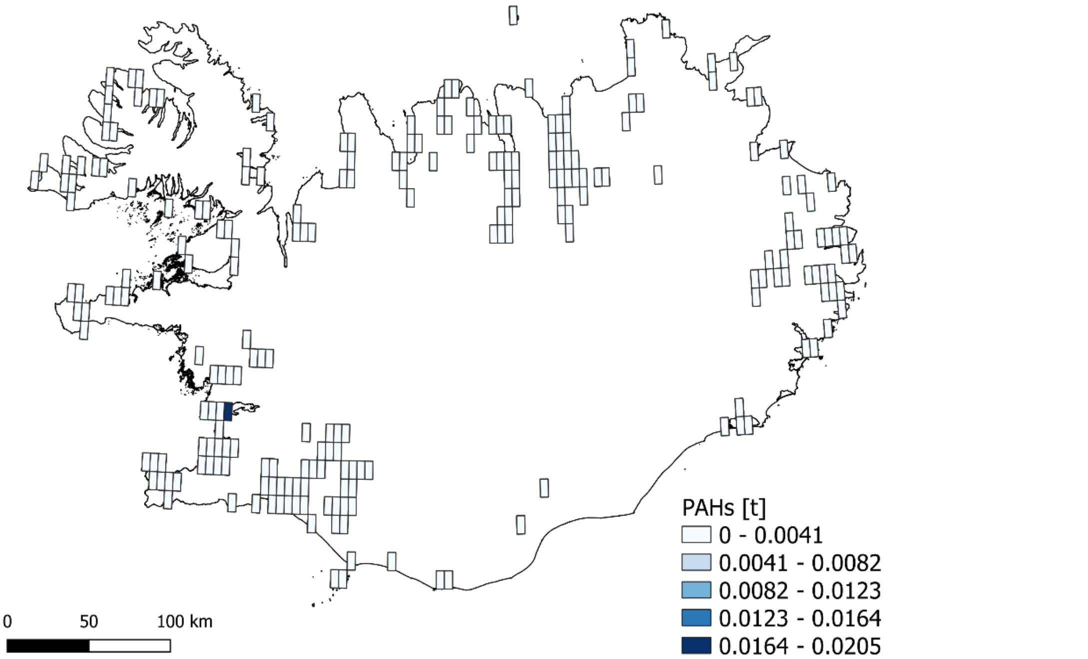


Figure 8.2 Emissions of PAHs [t] in 2019.

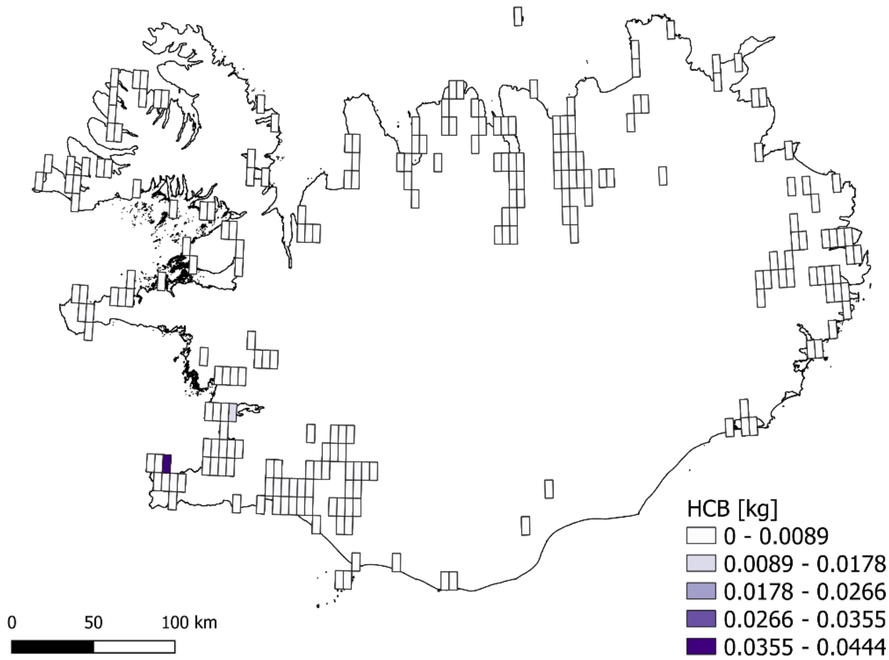


Figure 8.3 Emissions of HCB [kg] in 2019.

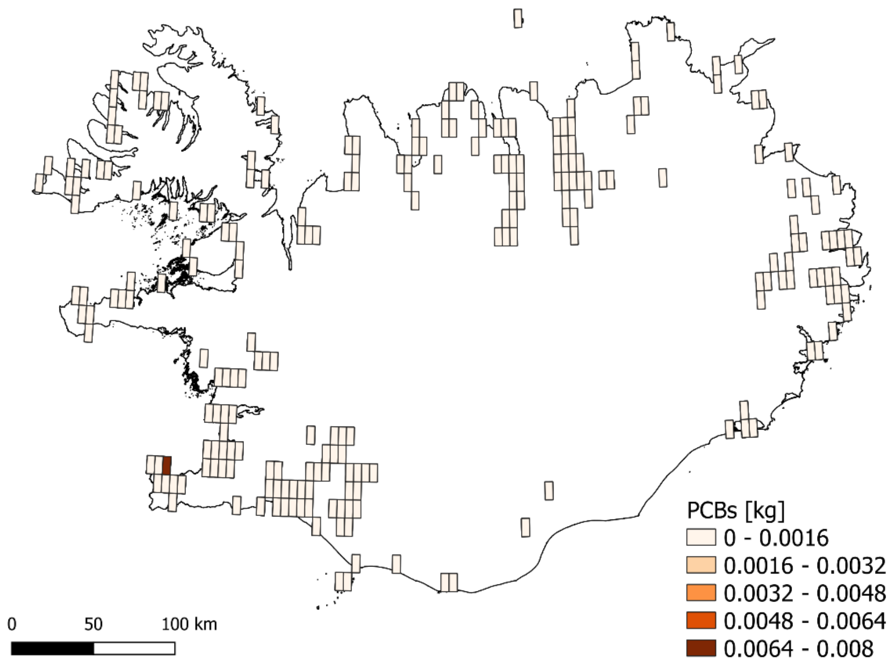


Figure 8.4 Emissions of PCBs [kg] in 2019.

8.4 Emissions 2015

The following figures show the national total emissions of dioxin/furans, PAHs, HCB, and PCB for the year 2015.

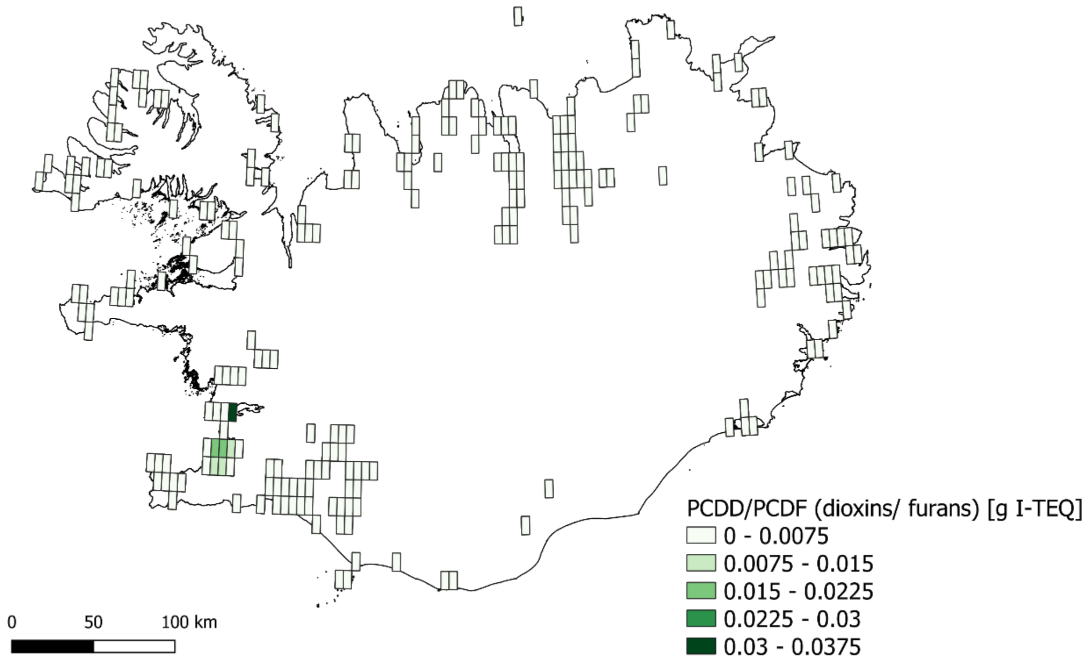


Figure 8.5 Emissions of Dioxin/furans 2015 in [g I-TEQ].

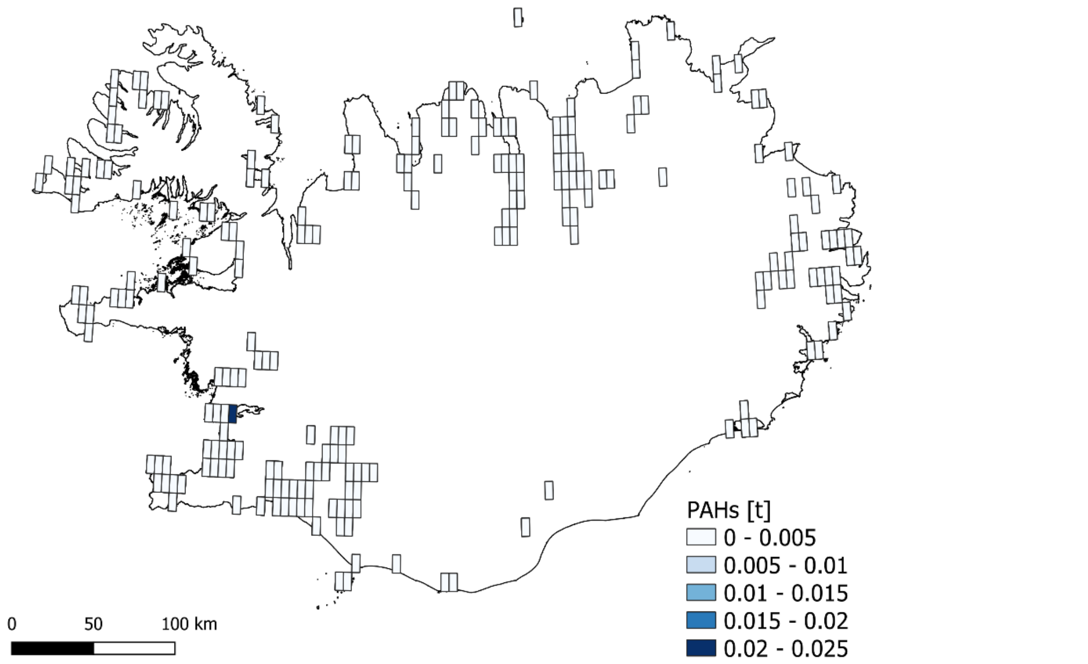


Figure 8.6 Emissions of PAHs [t] in 2015.

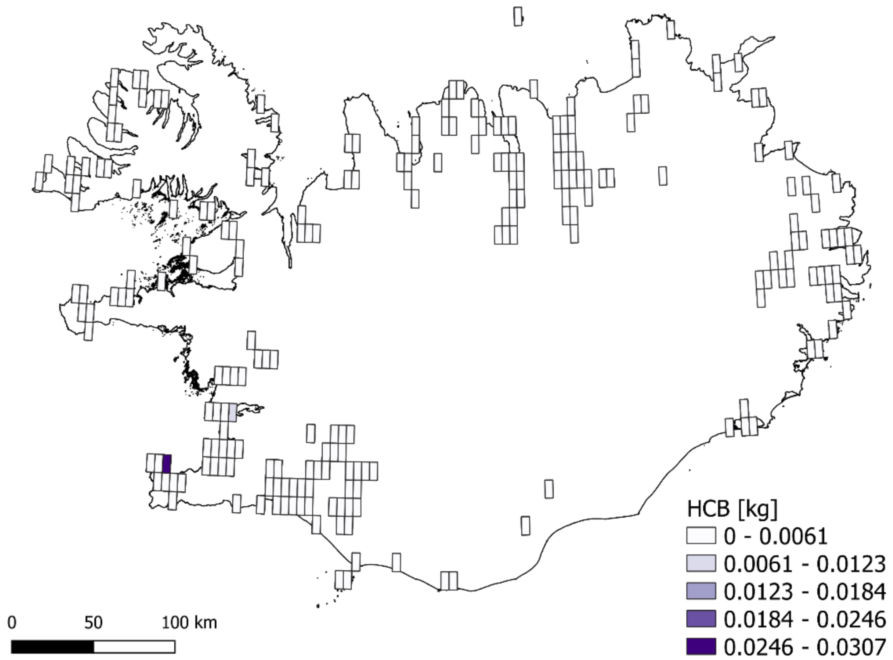


Figure 8.7 Emissions of HCB [kg] in 2015.

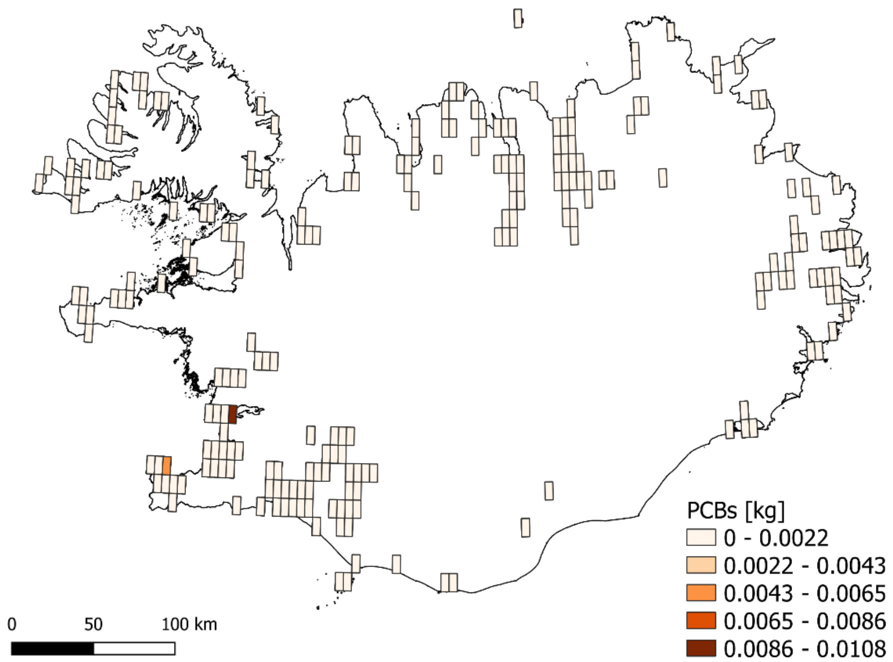


Figure 8.8 Emissions of PCBs [kg] in 2015.

9 Projections

Emissions of NO_x, NMVOC, SO_x, NH_3, $PM_{2.5}$, BC, CO, dioxin, PAHs, HCB, PCB, and heavy metals are projected until 2055. A summary of the projected emissions for these pollutants is presented in Table 9.1.

The projections include existing measures based on current legislation and Iceland's most recent Climate Action Plan (published in 2024) and are built on the **W**ith **E**xisting **M**easures (WEM) scenario in accordance with the WEM scenario for greenhouse gas emissions reported in Iceland's 2025 report on policies, measures and projections. Details about relevant measures and projections are described further for each sector in sections 9.2-9.5. The trend by pollutant is presented in Chapter 2. The methodology and underlying assumptions for the projections are presented for each sector in the following subchapters.

Table 9.1 Emissions of all air pollutants. Historical data for 1990, 2005 and 2023 and projected emissions for 2030, 2040, 2050 and 2055.

Pollutant	Unit	1990	2005	2023	2030	2040	2050	2055	Change '22-'50	Change '05-'50
NO_x	[kt NO_2]	25	23	14	14	12	9.3	8.5	-39%	-63%
NMVOC	[kt]	8.9	6.5	4.7	5.0	4.9	4.9	4.9	+6.2%	-24%
SO_x	[kt SO_2]	23	40	46	45	35	35	35	-25%	-13%
NH_3	[kt]	5.2	4.8	4.5	4.3	4.1	3.9	3.7	-18%	-23%
$PM_{2.5}$	[kt]	1.3	1.4	1.1	1.2	1.2	1.3	1.3	+16%	-10%
PM_{10}	[kt]	3.0	2.9	2.3	2.5	2.6	2.7	2.7	+16%	-8.2%
TSP	[kt]	6.4	5.8	4.5	4.7	4.9	5.2	5.2	+17%	-10%
BC	[t]	223	220	89	104	106	114	120	+34%	-46%
CO	[kt]	57	50	107	111	109	108	108	+0.90%	+115%
Dioxin	[g I-TEQ]	11	0.95	0.80	0.82	0.80	0.79	0.78	-2.3%	-18%
PAH4	[t]	0.60	0.13	0.093	0.095	0.084	0.076	0.076	-19%	-39%
HCB	[kg]	0.27	0.72	0.12	0.092	0.092	0.092	0.093	-19%	-87%
PCB	[kg]	0.30	0.11	0.018	0.014	0.013	0.012	0.011	-38%	-90%
Pb	[t]	0.79	2.1	0.81	0.92	0.76	0.59	0.57	-29%	-72%
Cd	[kg]	22	69	134	139	139	139	138	+3.2%	+100%
Hg	[kg]	140	32	10	10	8.9	7.7	7.6	-25%	-76%
As	[kg]	70	95	146	152	150	148	147	+0.53%	+55%
Cr	[kg]	123	180	235	239	211	191	190	-19%	+5.8%
Cu	[t]	1.7	2.8	3.3	3.3	2.8	2.4	2.4	-29%	-16%
Ni	[t]	1.7	1.9	1.9	2.0	1.9	1.9	1.9	-2.5%	-0.43%
Se	[kg]	35	31	20	19	16	12	10	-48%	-67%
Zn	[t]	2.3	2.9	5.9	6.2	6.3	6.3	6.3	+7.3%	+115%

9.1 Projected Trends by Pollutant

9.1.1 Nitrogen Oxides (NO_x)

The projected reduction in emissions over the next decade is due to a decline in fuel use. Figure 9.1 shows historical NO_x emissions from 2005-2023 as historical emissions and projected emissions 2024-2055.

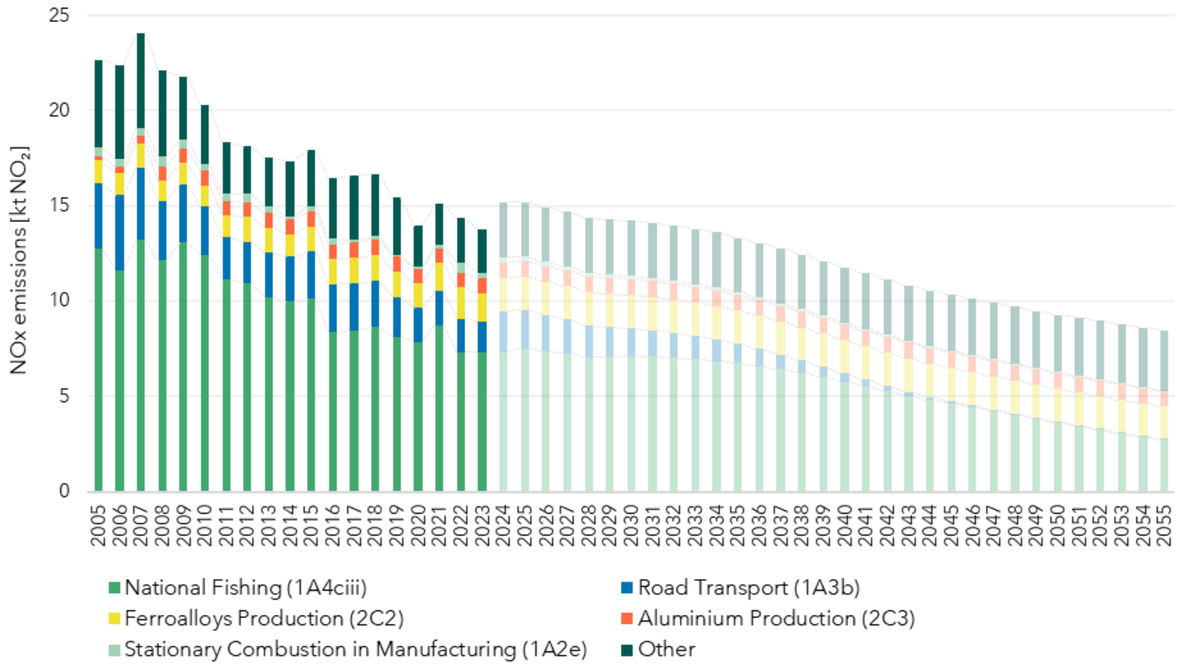


Figure 9.1 NO_x emissions by main sources. Historical data and projections, 2005-2055.

9.1.2 Non-Methane Volatile Organic Compounds (NMVOCs)

The decline in emissions since 2005 is mainly due to the renewal of the car fleet. This trend is projected to continue until 2055. A further decrease in NMVOC emissions is due to reduced emissions from Waste sector. One reason for the projected reduction in waste emissions is a ban on landfilling organic waste in the year 2023. An increase in the emissions from the subsector Food and Beverages Industry (2H2) is due to increased production and export of spirits. Figure 9.2 shows the historical NMVOC emissions from 2005-2023 as historical emissions and projected emissions 2024-2055[21].

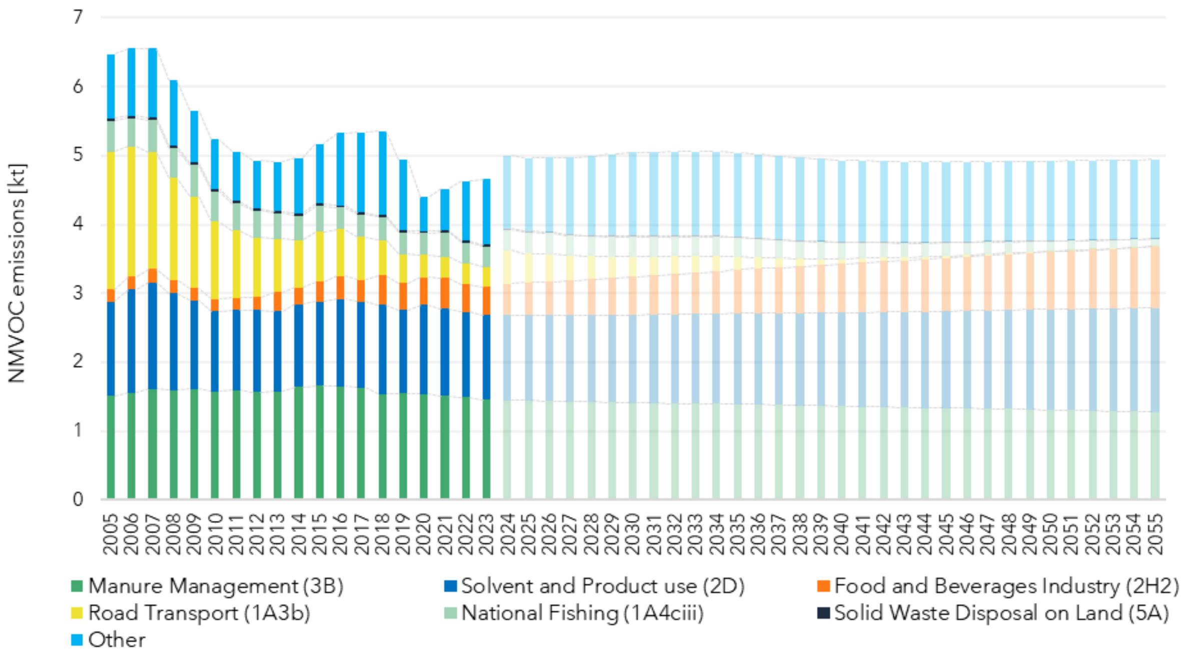


Figure 9.2 NMVOC emissions by main sources. Historical data and projections, 2005-2055.

[21] The figure includes emissions from 3B Manure Management and 3D Agricultural Soils, but these emissions are not accounted for in the national emission reduction commitments (see Article 4, paragraph 3d of Directive (EU) 2016/2284). At the time of this writing, work is underway by the Icelandic government to evaluate and work at the incorporation of the new National Emissions Ceilings Directive (Directive (EU) 2016/2284) into the EEA agreement.

9.1.3 Sulphur Oxides (SO_x)

Geothermal energy exploitation is the largest source of sulphur emissions in Iceland. Sulphur is emitted from geothermal power plants in the form of H_2S. Emissions from this source (shown in Figure 9.3 as Other Fugitive Emissions from Energy Production (1B2d)) have increased substantially since 2005 due to an increase in electricity production at geothermal power plants. However, in recent years, SO_2 emissions have started decreasing following the onset in 2014 of a sulphur capture and storage project (*Sulfix*) at one of the geothermal power plants (*Hellisheiði Power Plant*).

Further capture and storage project are planned at *Hellisheiði* and another geothermal plant (*Nesjavellir Power Plant*). This explains the projected decrease in emissions between 2029 and 2030, overall emissions increase again with increasing energy production. Figure 9.3 shows the historical SO_x emissions from 2005-2023 as historical emissions and projected emissions 2024-2055.

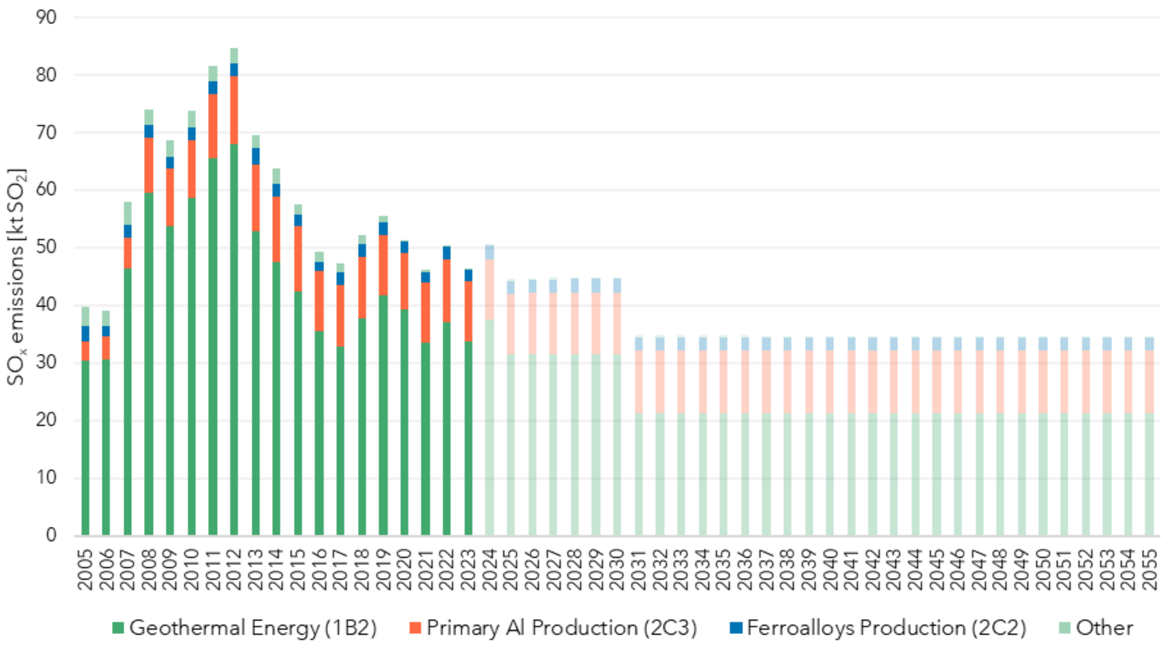


Figure 9.3 SO_x emissions by main sources. Historical data and projections, 2005-2055.

9.1.4 Ammonia (NH_3)

Projected emissions of NH_3 are expected to decrease over the next decade due to a decrease in livestock numbers. Figure 9.4 shows historical NH_3 emissions from 2005-2023 as historical emissions and projected emissions 2024-2055.

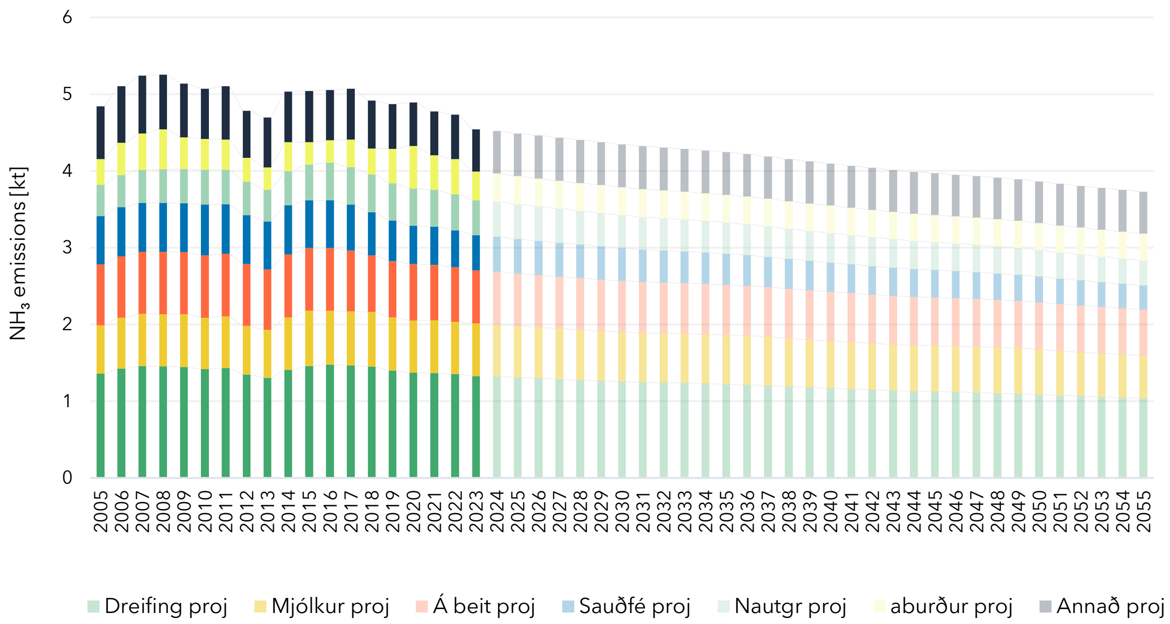


Figure 9.4 NH_3 emissions by main sources. Historical data and projections, 2005-2055.

9.1.5 Particulate Matter ($PM_{2.5}$, PM_{10}, TSP)

Particulate matter emissions are projected to remain relatively constant until 2055. Figure 9.5, Figure 9.6, and Figure 9.7 show the historical particulate emissions from 2005-2023 as historical emissions and projected emissions 2024-2055.

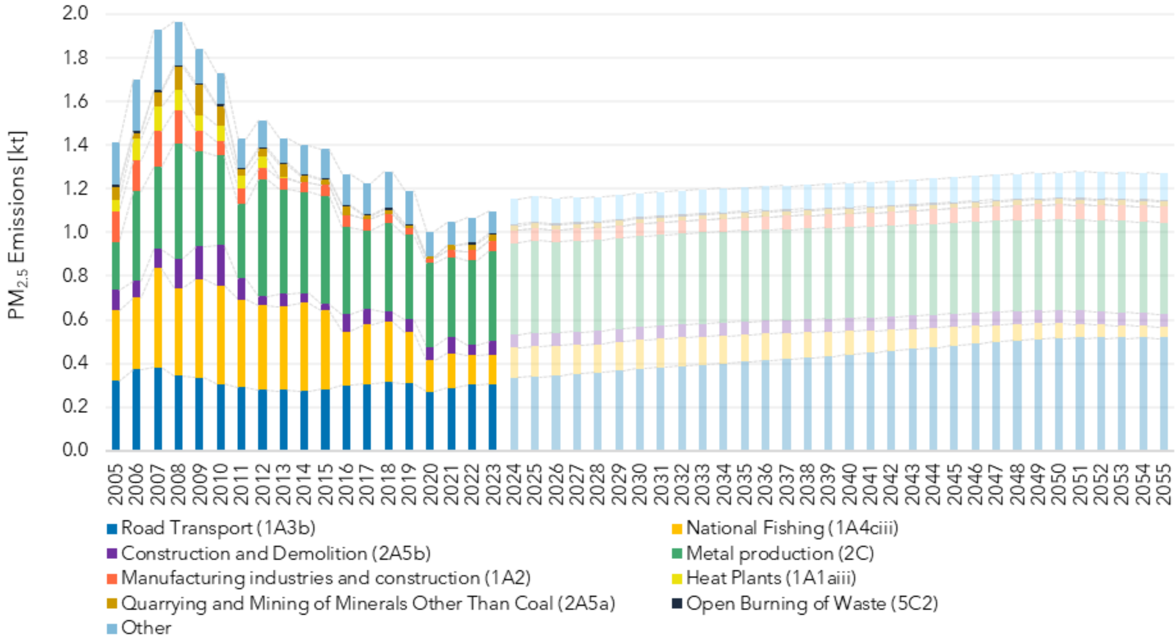


Figure 9.5 $PM_{2.5}$ emissions by main sources. Historical data and projections, 2005-2055.

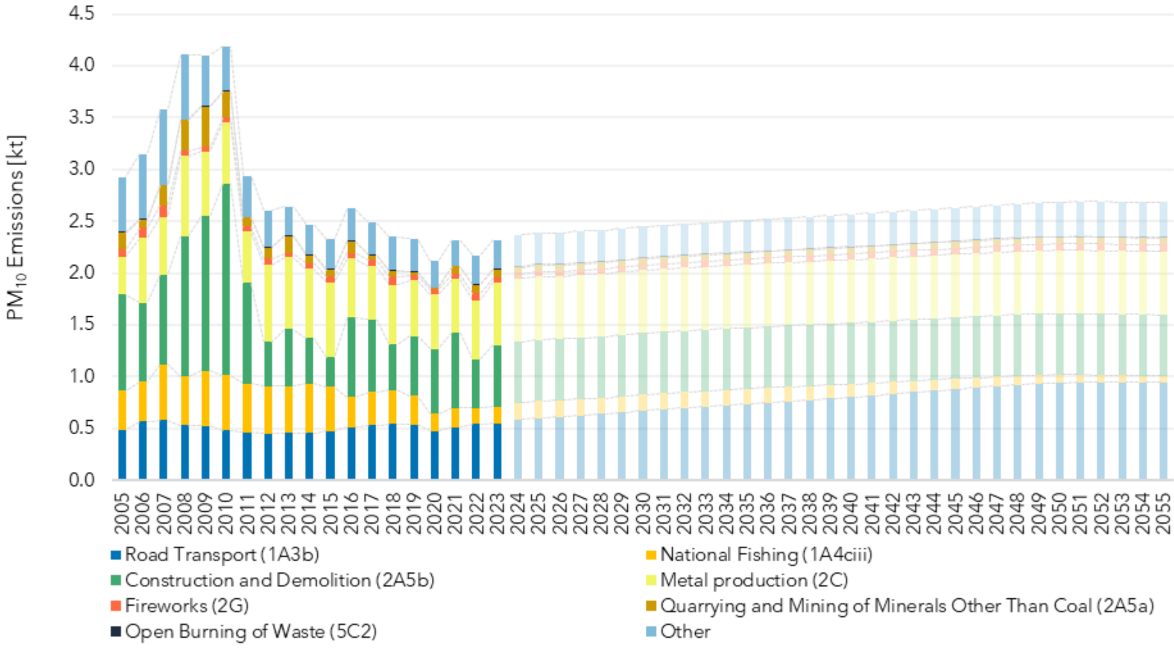


Figure 9.6 PM_{10} emissions by main sources. Historical data and projections, 2005-2055.

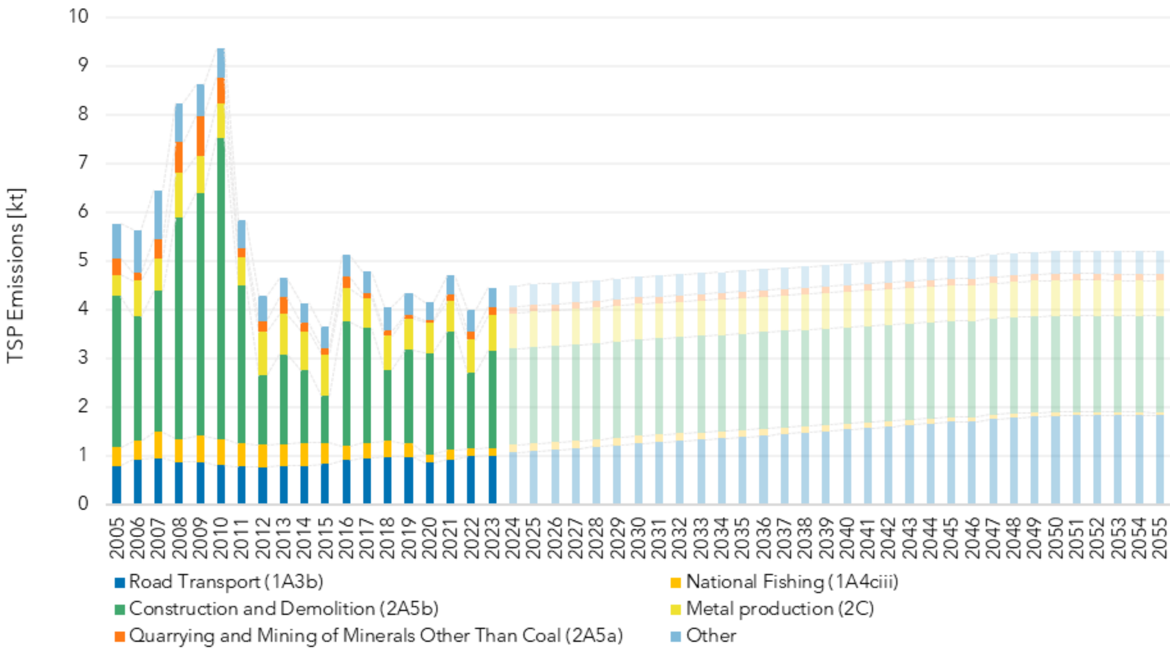


Figure 9.7 TSP emissions by main sources. Historical data and projections, 2005-2055.

9.1.6 Black Carbon (BC)

Black carbon emissions have declined in recent years and are projected to decline further. The main reason for the expected decrease is improvement of emission control systems in vehicle engines. Figure 9.8 shows the historical BC emissions from 2005-2023 as historical emissions and projected emissions 2024-2055.

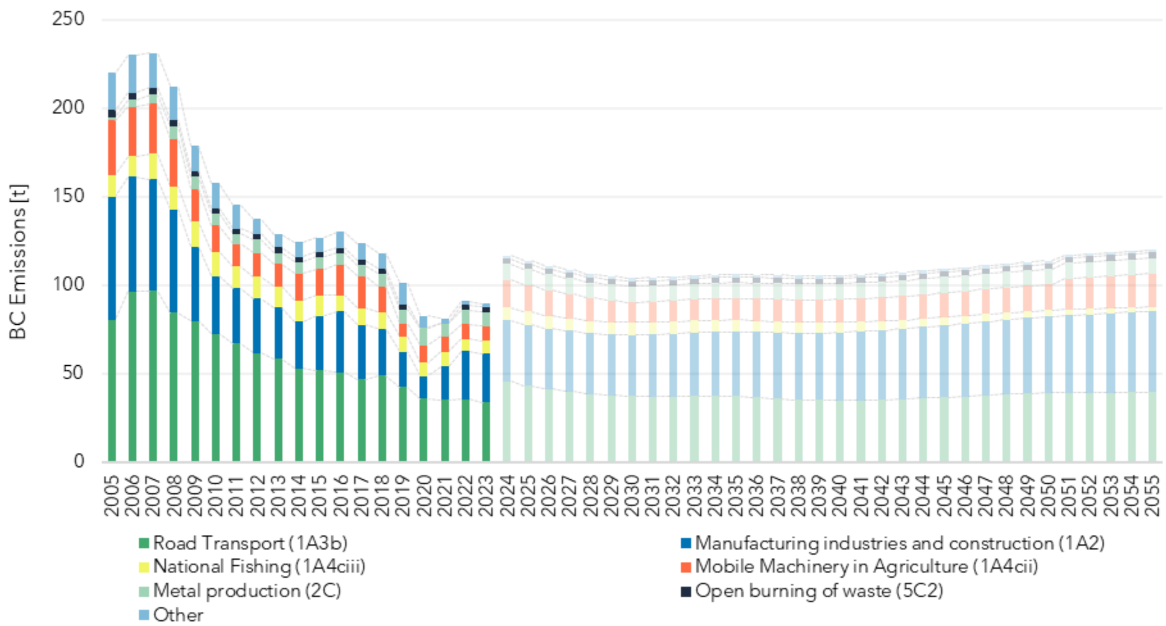


Figure 9.8 BC emissions by main sources. Historical data and projections, 2005-2055.

9.1.7 Carbon Monoxide (CO)

Carbon monoxide emissions are dominated by Aluminium Production (2C3) and are expected to remain relatively stable. Figure 9.9 shows the historical CO emissions from 2005-2023 as historical emissions and projected emissions 2024-2055.

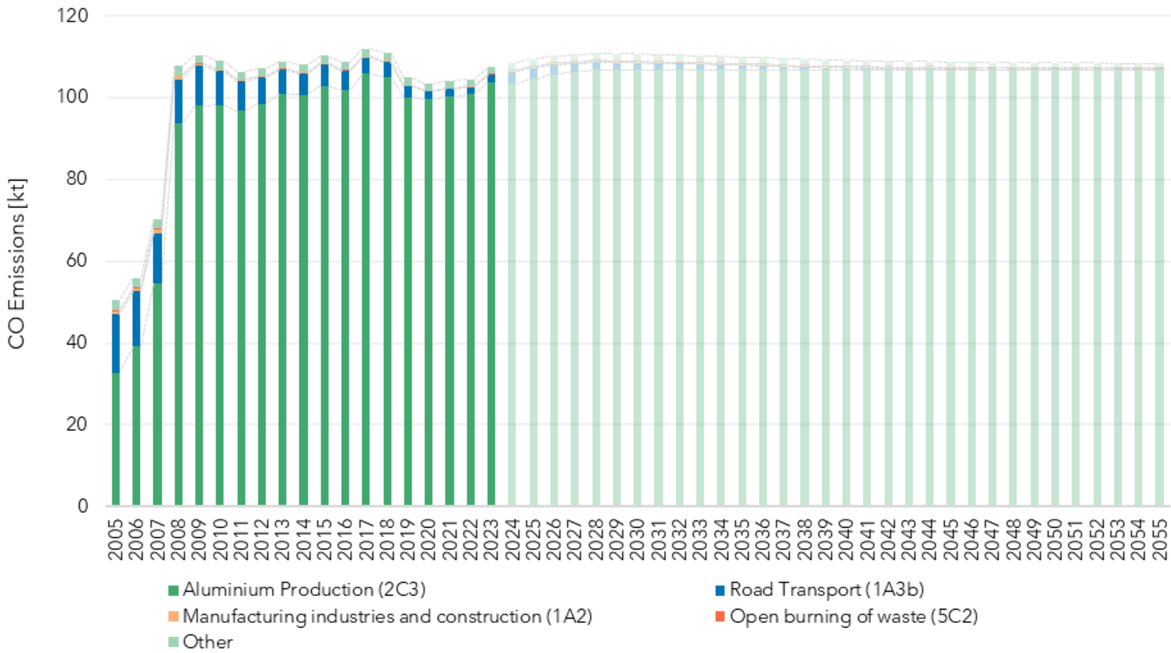


Figure 9.9 CO emissions by main sources. Historical data and projections, 2005-2055.

9.1.8 Dioxin

Dioxin emissions are projected to remain relatively stable from the present to 2055. Figure 9.10 shows the historical dioxin emissions from 2005-2023 as historical emissions and projected emissions 2024-2055.

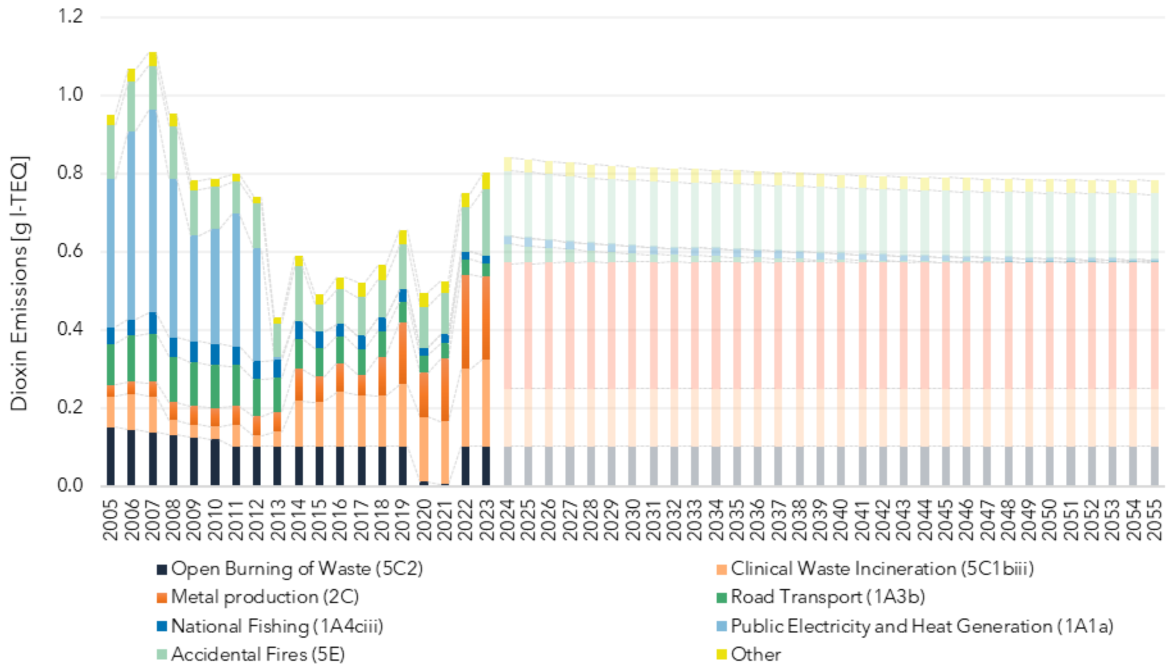


Figure 9.10 Dioxin emissions by main sources. Historical data and projections, 2005-2055.

9.1.9 Polycyclic Aromatic Hydrocarbons (PAHs)

PAH emissions are expected to trend slightly downwards until 2055, highlighted by projected reductions in Road Transport (1A3b). Figure 9.11 shows the historical PAH emissions from 2005-2023 as historical emissions and projected emissions 2024-2055.

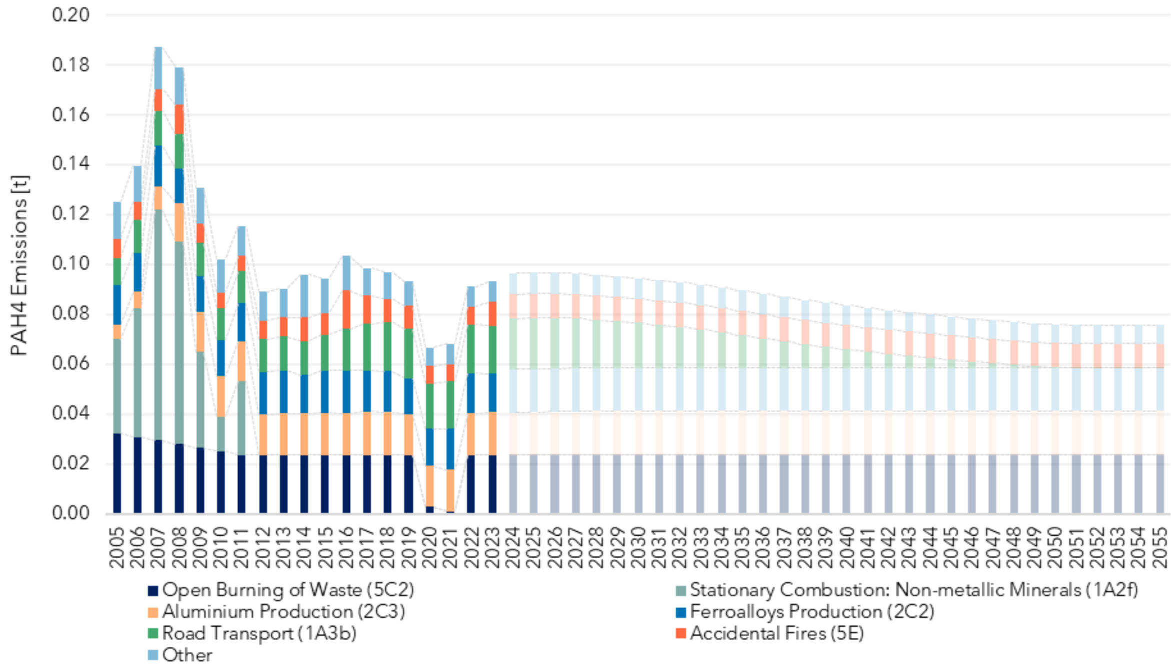


Figure 9.11 PAH4 emissions by main sources. Historical data and projections, 2005-2055.

9.1.10 Hexachlorobenzene (HCB)

HCB emissions are projected to remain relatively stable from the present to 2055. Figure 9.12 shows the historical HCB emissions from 2005-2023 as historical emissions and projected emissions 2024-2055.

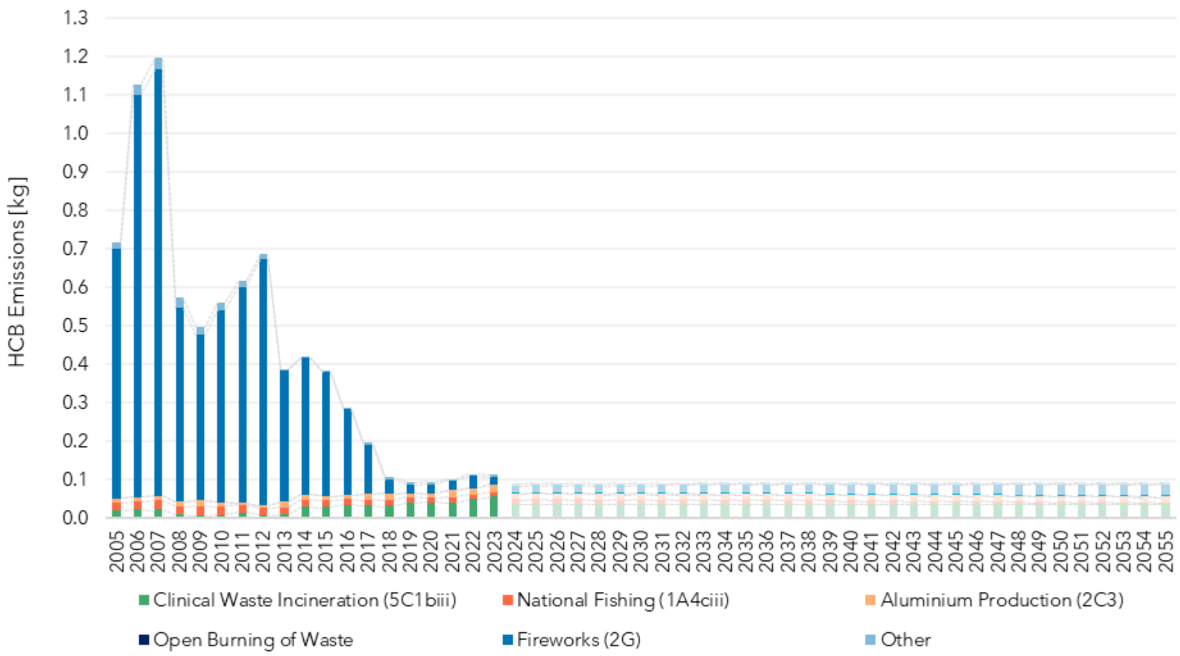


Figure 9.12 HCB emissions by main sources. Historical data and projections, 2005-2055.

9.1.11 Polychlorinated Biphenyl (PCB)

PCB emissions are projected to remain relatively stable from the present to 2055. Figure 9.13 shows the historical PCB emissions from 2005-2023 as historical emissions and projected emissions 2024-2055.

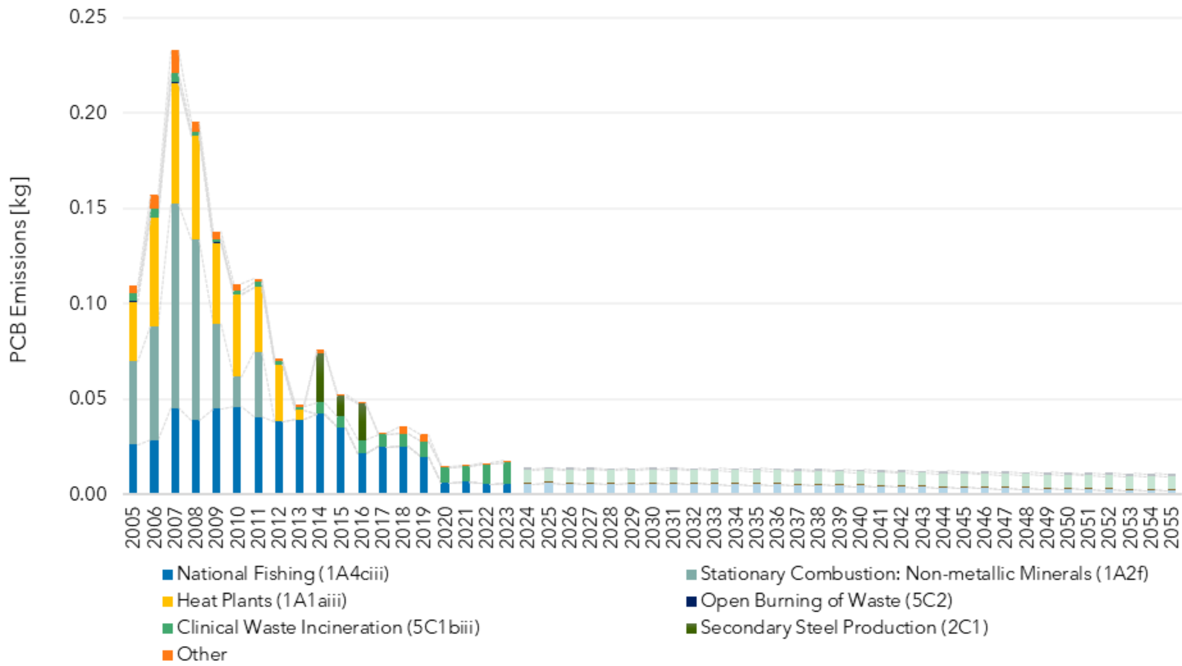


Figure 9.13 PCB emissions by main sources. Historical data and projections, 2005-2055.

9.1.12 Priority Heavy Metals (Pb, Cd, Hg)

Projections for the main heavy metals (lead, cadmium, and mercury) are displayed in Figure 9.14, Figure 9.15, and Figure 9.16, respectively. These figures include historical data from 2005-2023 as historical emissions and projected emissions 2024-2055.

9.1.12.1 Lead (Pb)

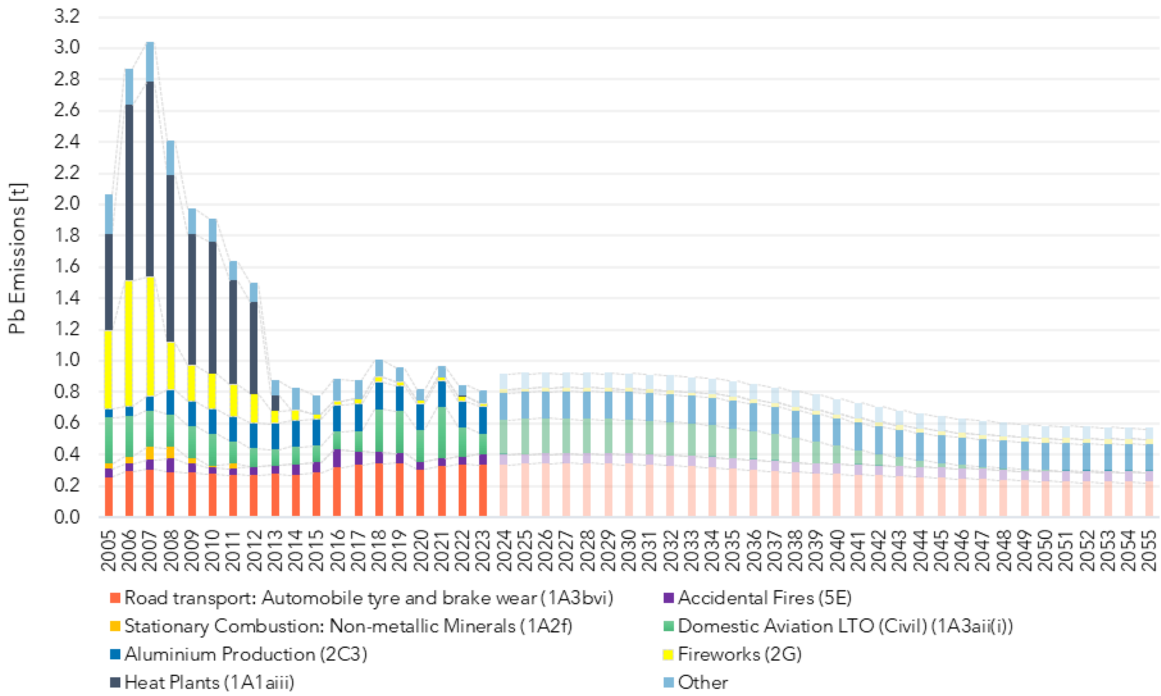


Figure 9.14 Pb emissions by main sources. Historical data and projections, 2005-2055.

9.1.12.2 Cadmium (Cd)

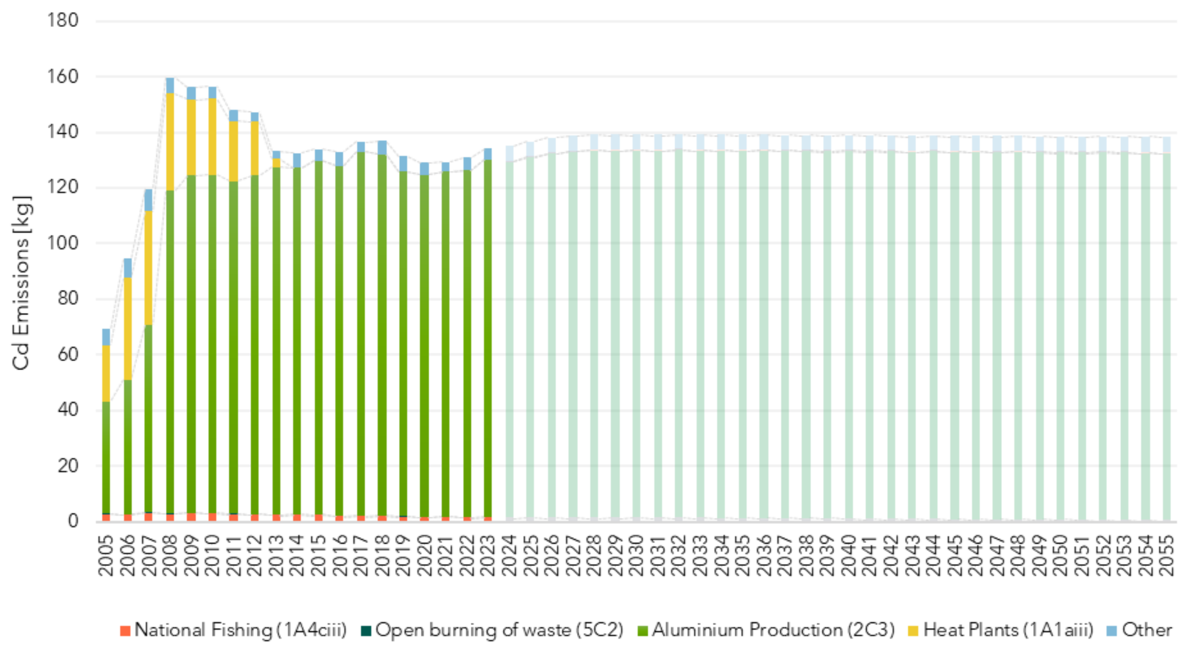


Figure 9.15 Cd emissions by main sources. Historical data and projections, 2005-2055.

9.1.12.3 Mercury (Hg)

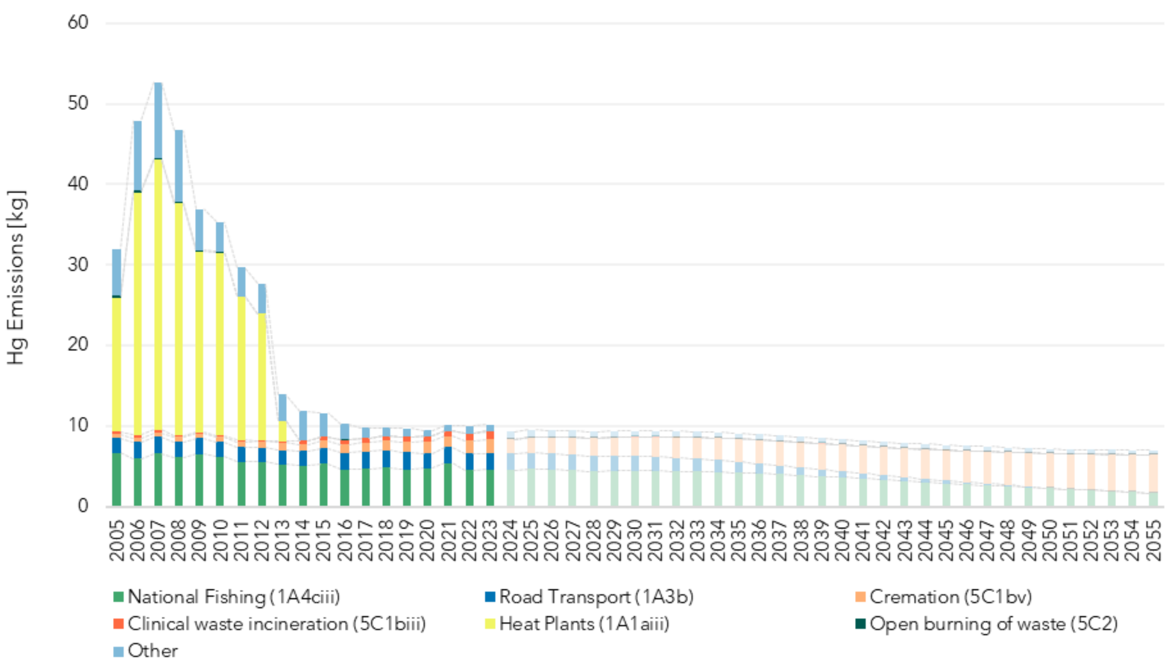


Figure 9.16 Hg emissions by main sources. Historical data and projections, 2005-2055.

9.1.13 Additional Heavy Metals (As, Cr, Cu, Ni, Se, Zn)

Projections for additional heavy metals (arsenic, chromium, copper, nickel, selenium, and zinc) are displayed here in Figure 9.17, Figure 9.18, Figure 9.19, Figure 9.20, Figure 9.21, and Figure 9.22, respectively. These figures include historical data from 2005-2023 as historical emissions and projected emissions 2024-2055.

9.1.13.1 Arsenic (As)

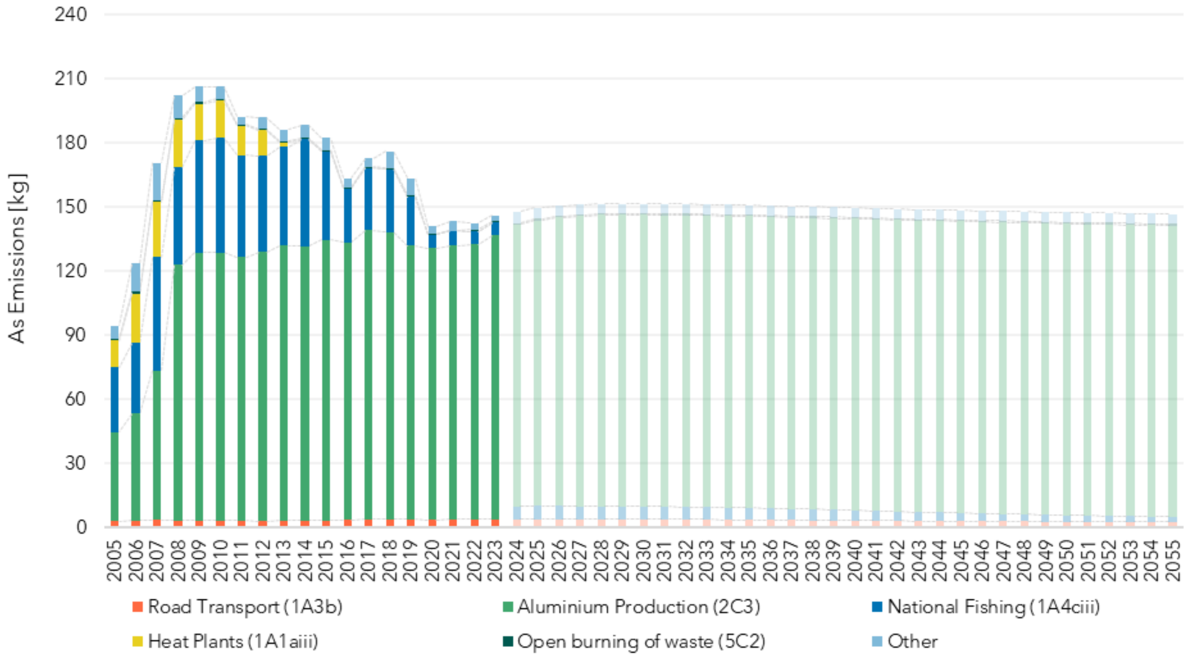


Figure 9.17 As emissions by main sources. Historical data and projections, 2005-2055.

9.1.13.2 Chromium (Cr)

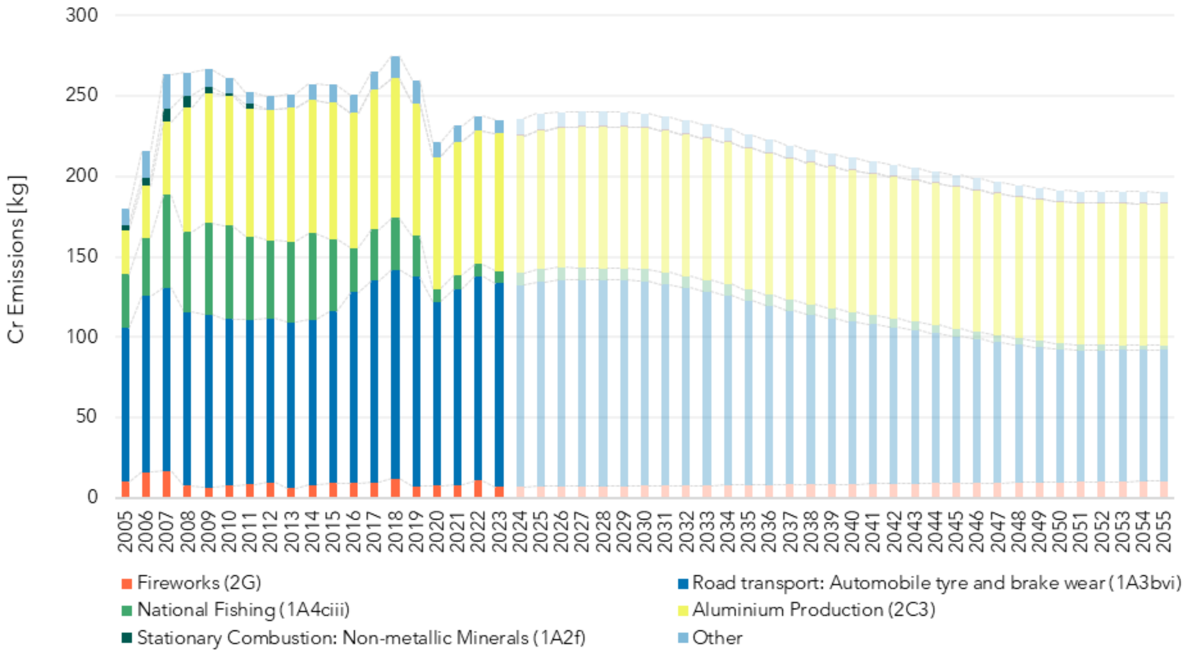


Figure 9.18 Cr emissions by main sources. Historical data and projections, 2005-2055.

9.1.13.3 Copper (Cu)

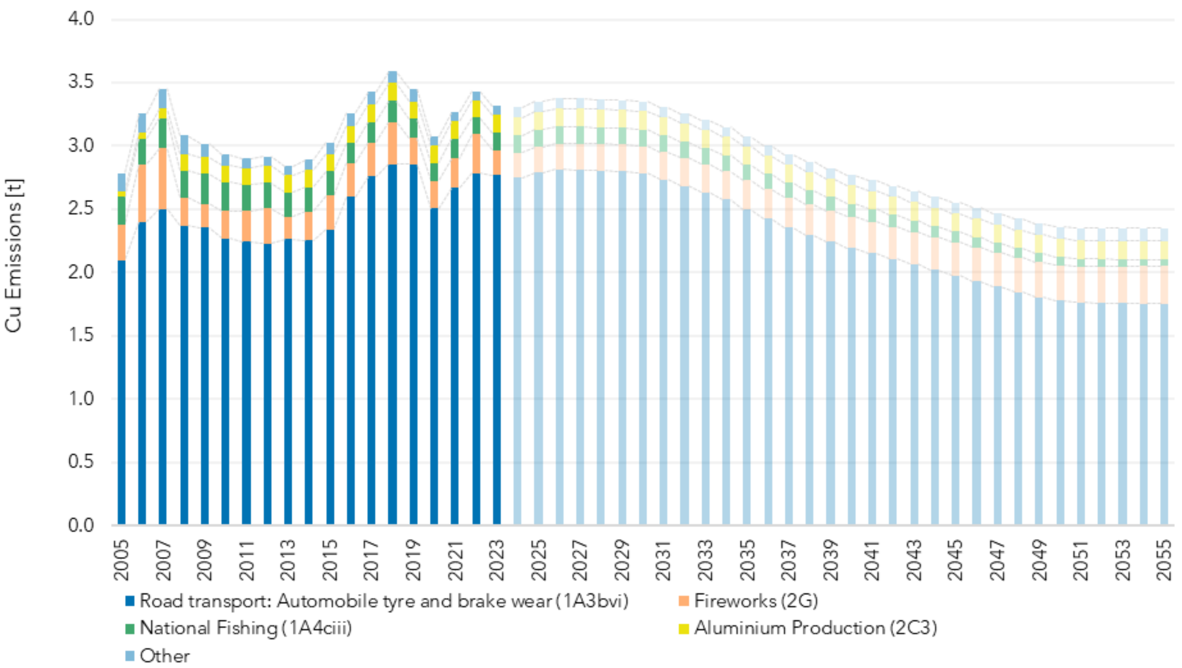


Figure 9.19 Cu emissions by main sources. Historical data and projections, 2005-2055.

9.1.13.4 Nickel (Ni)

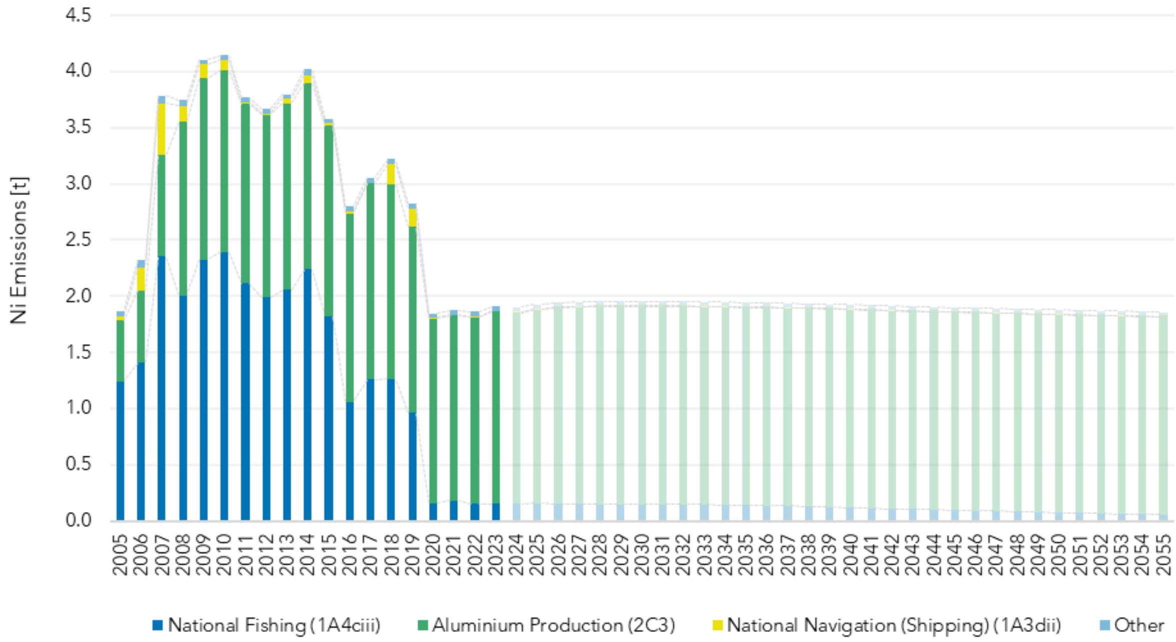


Figure 9.20 Ni emissions by main sources. Historical data and projections, 2005-2055.

9.1.13.5 Selenium (Se)

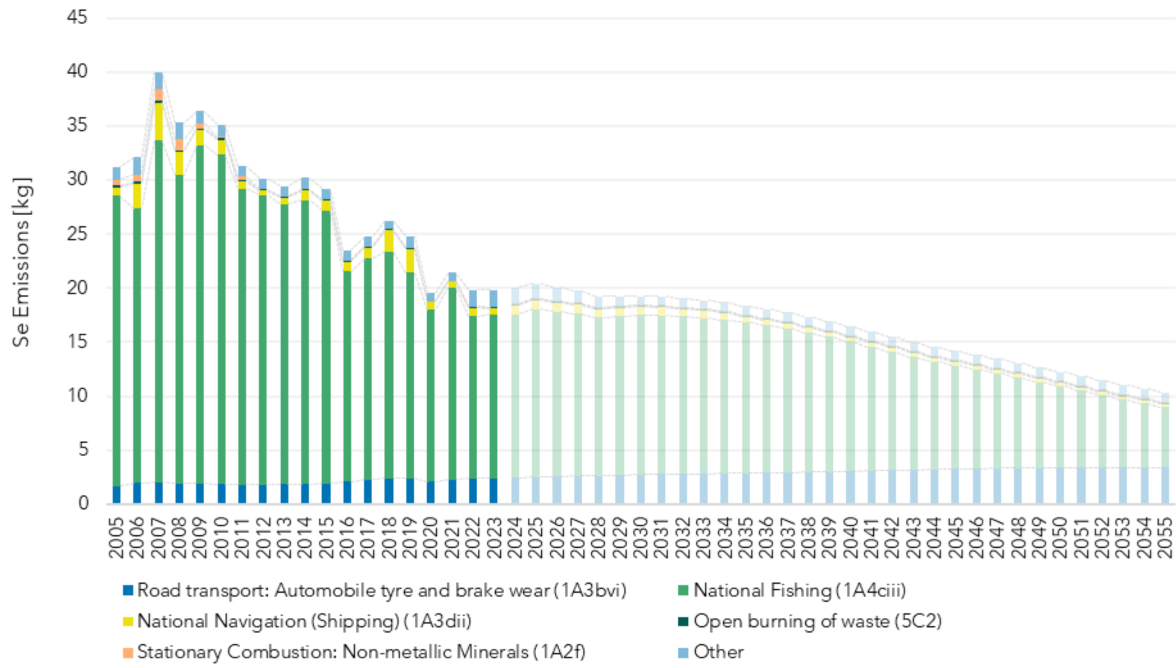


Figure 9.21 Se emissions by main sources. Historical data and projections, 2005-2055.

9.1.13.6 Zinc (Zn)

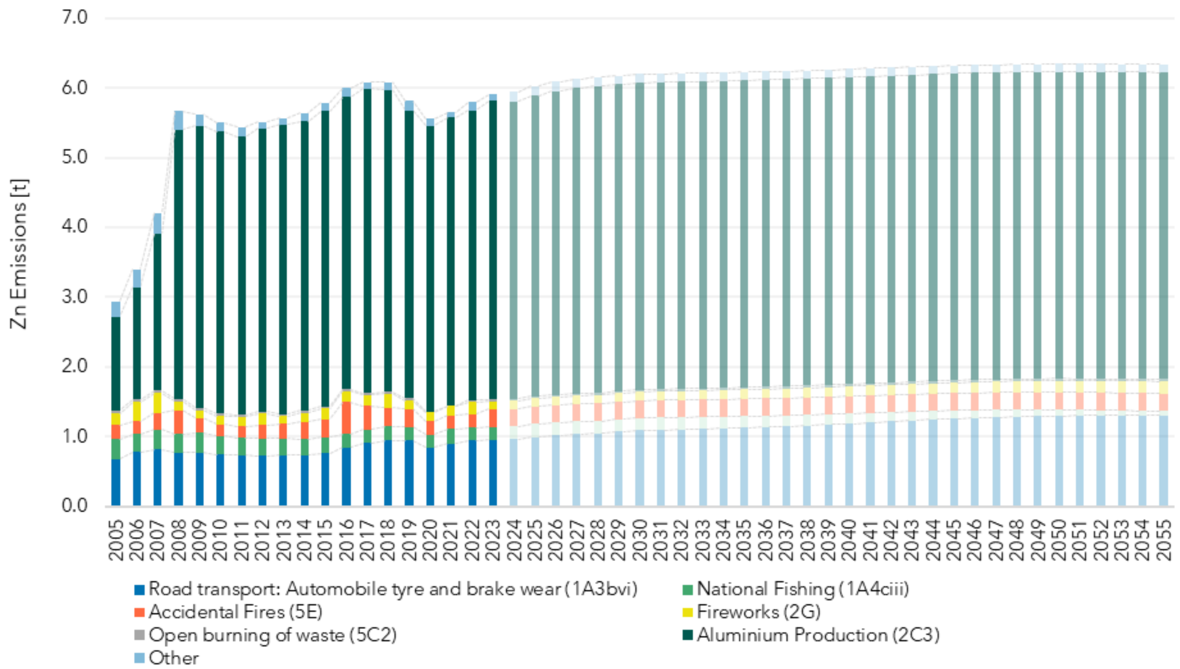


Figure 9.22 Zn emissions by main sources. Historical data and projections, 2005-2055.

9.2 Energy

9.2.1 Methodology

The methods used in the emission projections follow the methodologies for the emission inventory as described in Chapter 2.4.2.

Projections for the energy sector are based on the energy forecast generated by the IEEA, except for emission projections for geothermal power which were mostly obtained directly from the geothermal power companies. Description of the energy forecast is provided in chapter 9.2.2.1. In addition to the energy forecast, data from sibyl baseline[22] was purchased from Emisia to run COPERT 5.8.1 which follows the methodology presented in 2023 EEA/EMEP Guidebook.[23] An overview of the data and assumptions used as a basis for the energy projections is presented in Table 9.2.

Table 9.2 Activity data basis for Energy sector projections.

Energy	Basis for projections
1.A.1 Energy industries	Energy forecast (2025)
1.A.2 Manufacturing industries and construction	Energy forecast (2025)
1.A.3.a Aviation	Energy forecast (2025)
1.A.3.b Road Transport	Energy forecast (2025), Sibyl baseline data
1.A.3.d Navigation	Energy forecast (2025)
1.A.3.e Mobile machinery	Energy forecast (2025)
1.A.4.a Commercial/ Institutional	Energy forecast (2025)
1A.4.b Residential	Energy forecast (2025)
1.A.4.c Fishing and Agriculture	Energy forecast (2025)
1.B.2.a Oil distribution	Energy forecast (2025)
1.B.2.d Geothermal	Emission projections from operators of geothermal power plants in Iceland

9.2.2 Activity Data

The projections for the Energy sector are based on the energy forecast which were done by the Icelandic Environment and Energy Agency, except for geothermal projections which are based on information from the geothermal operators in Iceland.

9.2.2.1 Energy forecast

The IEEA publishes on an annual basis an energy forecast for Iceland[24]. The forecast for fuel consumption is based on assumptions regarding the development of population, GDP, seafood production, and transportation, both domestically and internationally, with tourism playing a significant role. It considers all fuel sales within the country, both to domestic and foreign entities.

[22] *Emisia*. https://www.emisia.com/utilities/sibyl-baseline/
[23] COPERT. https://www.emisia.com/utilities/copert/
[24] Energy forecast: https://orkustofnun.is/orkuskipti/orkuspa_2024

Fuel consumption in Iceland is influenced by numerous domestic and international factors, including population size, income levels, industrial output, the composition of the economy, and fuel prices. Economic growth projections are used to assess these factors since many aspects depend on the nation's overall economic performance.

Over the coming decades, fuel consumption is expected to transition from fossil fuels to new energy sources. It is not entirely clear which energy sources will replace fossil fuels in all cases—they could include electricity, geothermal energy, methane, methanol, hydrogen, ammonia, or biofuels derived from biomass such as plants. In some cases, such as automobiles, historical data on the use of alternative energy sources is available and is used to indicate future development. In other cases, where no historical data exists, estimates are made of how much energy demand will shift to electricity, biofuels or e-fuels.

New energy sources are expected to replace oil to a significant extent during the forecast period, primarily through the adoption of electricity. The volatility in oil markets over the past 15 years has increased the urgency of seeking alternative energy sources. Therefore, calculations for transitioning from fossil fuels to other energy sources have been incorporated into the forecasting model. Initially, the adoption of new energy sources is expected to grow slowly, then increase rapidly once they gain a strong foothold.

Fuel consumption in Iceland is influenced by numerous domestic and international factors, including population size, income levels, industrial output, the composition of the economy, and fuel prices. Economic growth projections are used to assess these factors since many aspects depend on the nation's overall economic performance.

The main categories of fuel consumption are transportation and fisheries. Before COVID-19, international aviation was the largest consumer of fuel, but passenger vehicles took the lead, followed by fishing vessels during the effects of the pandemic. The aviation sector is again the largest consumer of fossil fuels.

Energy consumption in vehicles is determined by forecasts on car ownership and driving habits, the distribution of vehicle energy sources, and trends in energy consumption per kilometre driven. The forecast for fuel consumption in international aviation is based on projections for air transport and expected developments in aircraft energy consumption. Regarding fishing vessels, the forecast considers scientific estimates of fish catches from Icelandic waters in the coming years, the composition of the fishing fleet, and changes in energy consumption due to fuel-saving measures and improved fishing technology.

Car ownership is estimated based on the age distribution of the population and ownership rates. Driving trends are then derived from car ownership, while freight truck usage is linked to economic growth. International aviation is assessed based on passenger travel flows to and from the country and forecasted trend. Domestic aviation is responsible for a very small portion of the country's fuel consumption, and its future development is expected to be tied to population trends and technological development over the forecast period.

The transition to new-energy vehicles as a share of newly registered cars is expected to follow a logistic function, an S-shaped curve where the rate of adoption is slow at the beginning and end but steep in the middle. This pattern is common in technological shifts, where changes start gradually, accelerate as a large portion of the market transitions, and then slow again as the last remnants of the older technology phase out.

9.2.3 Emission Factors

The emission factors used in the emissions projections are the same as are used for the emission inventory as described in Chapter 2.4.2 for the last historical year of the inventory.

9.2.4 Policies and Measures

No specific policies and measures regarding emission reduction of air pollutants in the energy sector were considered in the projection calculations.

In Iceland's Climate Action Plan (2024) for greenhouse gases some policies and measures, aimed at reducing greenhouse gas emissions in the energy sector, also have an effect on emissions of air pollutants from the sector. The impact of 25 policies and measures for greenhouse gases is represented in the projections presented in this document. Six are energy related policies and measures (policies and measures no. 103, 104, 105, 106, 108 and 109 in the 2025 Report on Policies, Measures, and Projections) and 18 are transport related (policies and measures no. 201, 202, 203, 204, 205, 206, 208, 209, 210, 212, 218, 219, 220, 221, 223, 224, 225 and 227 in the 2025 Report on Policies, Measures, and Projections).

9.3 Industrial Processes and Product Use (IPPU)

9.3.1 Methodology

The methods used in the emission projections follow the methodologies for the emission inventory as described in Chapter 4.

9.3.2 Activity Data

For the 2C2 Ferroalloys Production and 2C3 Primary Aluminium Production, the projected production amount is communicated from the individual companies. For activity within other subsectors (2A, 2D, 2G, 2H, and 2C3 Secondary Aluminium), the projected activity data is in some cases assumed to be the same as the average of the activity data in the past (appropriate range is chosen on a case-by-case basis). In other cases, where there is good correlation in the past with proxy data, the projected proxy data are used as a proxy to project the activity data. The most common proxy data are population number and GDP. The projected population is from Statistics Iceland (*Hagstofa Íslands*) (SI) and the GDP projection is the one used in the Fuel Use Projection 2024-2060 by IEEA, based on the GDP projection by Statistics Iceland. An overview of the activity data and assumptions used as a basis for the IPPU projections can be found in Table 9.3. Where the application of default or tier 3 facility specific emission factors was not possible due to the lack of data, averages of historical data were used to provide implied emission factors.

Table 9.3 Activity data basis for IPPU projections.

IPPU	Basis for projections
2.A Mineral Industry	Activity data provided by the operators. In certain subsectors averages of activity data of past years.
2.B Chemical Industry	Not relevant in Iceland.
2.C Metal Industry	Activity/emission data provided by the operators.
2.D Non-energy products from fuels and solvent use	GDP, population and fuel projection, trends over the past years.
2.E Electronics Industry	Not relevant in Iceland.
2.G Other product manufacture and use	GDP and population projection, trends over the past years.
2.H.2 Food and Beverages Industry	GDP and population projection, trends over the past years.

9.3.3 Emission Factors

The emission factors used in the emissions projections are the same as are used for the emission inventory as described in Chapter 4 for the last historical year of the inventory. Communication between the IEEA and the primary aluminium and ferroalloys plants aimed at assessing whether other emission factors are expected in the future. That is not the case for this projection.

9.3.4 Policies and Measures

No specific policies and measures regarding emission reduction of air pollutants in the IPPU sector were considered in the projection calculations.

In Iceland's Climate Action Plan (2024) for greenhouse gases some policies and measure aimed at reducing greenhouse gas emissions in the IPPU sector also affect emissions of air pollutants from the sector.

9.4 Agriculture

9.4.1 Methodology

The methods used in the emission projections follow the methodologies for the emission inventory as described in Chapter 5.

9.4.2 Activity Data

The projections for how the Agriculture sector will develop have been based on historical trends in the activity data and expert judgment. The trend in livestock populations has been projected by extrapolation to 2055 using available historical data. The historical data were collected from the Ministry of Industries (*Atvinnuvegaráðuneytið*) (MI) and are the same numbers used for agriculture calculations in the latest IIR.

To assess the best possible trends while accounting for the variability of the historical data, experts from the MI and the Icelandic Agricultural Advisory Centre, were consulted. These experts determined the most representative projections for each livestock category, based on their expectations of future developments in each agricultural sector. The impacts of agricultural contracts, consumer behaviour and the level of imports of agricultural goods were also taken into consideration. Agricultural contracts are set to be renegotiated in 2026, at which point the projections in each livestock category revised.

The conclusion was that livestock numbers for cattle (dairy cattle, other mature cattle, and growing cattle) were linearly projected based on the last 10 years (2014-2023), as the more recent years better reflect the actual development in cattle. For the category sheep (mature ewes, other mature sheep, animals for replacement, and lambs), the livestock numbers were projected using the available historical data from 1990-2023. Horses, as well as fur animals (including minks and rabbits), were also extrapolated using the available historical data. Swine, goats, and poultry are also calculated using the 10-year trend.

All other parameters necessary for livestock characterisation (such as pregnancy rates, days on pastures/in housing, feed digestibility, weight, and age at slaughter) were kept constant over the projected time series and correspond to the values in the latest IIR submission, except for milk yield. Because milk yield per dairy cow has historically increased, it was projected based on the linear historical trend.

Other sources of emissions, such as the use of organic and inorganic nitrogen-fertilizers, liming, and the use of urea are projected by linear interpolation of historical trends. The areas used for the calculations of emissions from drained organic soils are communicated from the Land and Forest Iceland which calculates projections for the LULUCF sector.

9.4.3 Emission Factors

The emission factors used in the emissions projections are the same as are used for the emission inventory as described in Chapter 5.

9.4.4 Policies and Measures

No specific policies and measures in the agriculture sector were considered in the projection calculations.

In Iceland's Climate Action Plan (2024) for greenhouse gases, some policies and measures aimed at reducing greenhouse gas emissions in the agricultural sector also affect emissions of air pollutants from the sector. These measures are planned and could influence the projected emissions in the future. These policies are:

- Establishment of an effective subsidy framework for agriculture: Agricultural contracts are revised every 10 years, with the current ones valid until 2026. The support system in the current contracts does not encourage reduction in emissions but could incorporate performance-based incentives aimed at enhancing productivity per animal, optimising fertiliser use and improving cultivation methods, such as avoiding leaving fields unprotected and exposed.
- Support for the Adoption of Technology for Precision Fertiliser Distribution: Various technical solutions can improve fertiliser efficiency, leading to reduced emissions of NO_x and NH_3.
- Support for Farmers for Measures to Reduce Fertiliser Needs: This measure introduces support for practices such as liming of agricultural land to regulate soil acidity,

incorporating nitrogen-fixing species in crops, and implementing shelterbelt cultivation to reduce fertiliser needs, thereby lowering emissions of NO_x and NH_3.

9.5 Waste

9.5.1 Methodology

The methods used in the emission projections follow the methodologies for the emission inventory as described in Chapter 6.

9.5.2 Activity Data

The projections in the Waste sector for the subcategories Solid Waste Disposal (5A), Biological Treatment of Solid Waste (5B), and Incineration and Open Burning of Waste (5C) are estimated based on the annual amount of waste handled in each sector. These projections are correlated with historical data while considering existing policies and the operating permit of waste handling companies.

9.5.3 Emission Factors

The emission factors and parameters used in the emission projections are the same as in the emission inventory as described in Chapter 6.

9.5.4 Policies and Measures

No specific policies and measures in the Waste sector were considered in the projection calculations.

In Iceland's Climate Action Plan (2024) for greenhouse gases some policies and measure aimed at reducing greenhouse gas emissions in the Waste sector also effect emissions of air pollutants from the sector are planned and could affect the projected emissions in the future. Some of those policies and measures are waste stream segregation and a ban on landfilling of organic waste.

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Annexes to the National Inventory Report

Annex 1 Iceland QA/QC Checks

Additionally, the following QA/QC checks have been performed on the Icelandic inventory:

- Recalculation Check – Comparing the values reported in the current (2023) and previous (2022) versions of the inventory for the base year (1990) and the most recent year covered by both versions (2022).
- Negative and Zero Values Checks – To highlight the occurrence of negative values and zero values in the inventory.
- Notation Keys Check – To summarise the occurrence of each notation key to ensure consistency and accuracy in the inventory.
- PAHs Sum Check – To ensure that the sum of the four reported PAHs equals the reported "total" PAH emissions.
- Particulate Matter Check - To ensure that reported TSP emissions are greater than or equal to PM_{10}, and similarly that reported PM_{10} emissions are greater than or equal to $PM_{2.5}$.
- Trends Check – To draw attention to large changes in emissions between any two adjacent years, from 2015 onwards.

In all cases, the findings of the checks are reviewed, not only to identify where corrections may be required, but also to consider whether there are any steps of the inventory compilation process that need improvement. In addition, reviewing the results also provides information on whether the individual checks are well designed and comprehensive.

This ensures that all results from the QA/QC process feed back into the continuous improvement programme.

Recalculation Check

This QA/QC file compares the emissions between the current and previous submissions, for the base year and the latest common year in both submissions (current year – 3). The data has been compiled in a way that changes in the data are easily identified. Justifications for change are provided where required. The current recalculation check considers all of the reported pollutants and sectors.

The recalculations check calculates the actual difference between the current and previous submission. If one or both values are notation keys, and are not the same in both submissions, then this is highlighted. If the values in both submissions are numeric but not equal, then the difference in submissions as a percentage of the current submissions is also shown. In addition, where differences occur the cells are highlighted for ease of reference. This process of identifying recalculation changes and the documentation of changes is in line with Chapter A.4 of the 2023 EMEP/EEA Guidebook regarding the reporting of recalculations. Where a recalculation change occurs, it is necessary to check that the underlying reasons are understood and considered reasonable.

Negative and Zero Values Check

Checks were performed to identify whether any negative or zero values occur in the NFR Annex I submission file.

Notation Keys Check

The number of occurrences of notation keys (NA, NE, NO, and IE) in the NFR Annex I submission file are presented. This QA/QC check is used to ensure that notation keys are applied consistently and accurately within the inventory. The occurrence of notation keys is presented as a count for each NFR code with highlighted cells for ease of reference.

PAH Sum Check

This is a sum check to identify whether the sum of the reported emissions for benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and Indeno(1,2,3-cd)pyrene equals the reported emissions for "total" four PAHs. This check is performed for each reported NFR code and year for the current submission. Where the sum of the PAHs does not equal the "total," cells are highlighted for ease of reference and where required the cause for differences are documented.

Particulate Matter Check

This check identifies any categories where the emissions reported for TSP are less than PM_{10} emissions and where PM_{10} emissions are less than $PM_{2.5}$ emissions. This enables the identification of errors in reported PM emissions based on the assumption that TSP $\geq PM_{10} \geq PM_{2.5}$. This check is performed for each reported NFR code and year for the current submission. Where errors in reported PM emissions are identified, cells are highlighted for ease of reference and where required documentation is provided.

Trends Check

This check highlights large changes in emissions between any two adjacent years from 2015 onwards, using a colour scale which makes larger percentage changes stand out. Documentation is provided where needed.

Annex 2 KCA Results for 1990 and Trends 1990-2022

NO_x, NMVOC, SO_x, NH_3, $PM_{2.5}$, PM_{10}, TSP, BC, and CO

Table A2.1 Key categories for NO_x, NMVOC, SO_x, NH_3, $PM_{2.5}$, PM_{10}, TSP, BC, and CO, 1990.

Component	Key Categories (Sorted from high to low from left to right and top to bottom)					Total (%)
NO_x	National Fishing	Road Transport: Passenger Cars	Road Transport: Heavy Duty Vehicles and Buses	Stationary Combustion in Manufacturing Industries and Construction: Food Processing and Beverages		82.3%
	NFR 1A4ciii	NFR 1A3bi	NFR 1A3biii	NFR 1A2e		
	53.4%	18.5%	4.3%	3.4%		
NMVOC	Road Transport: Passenger Cars	Manure Management - Horses	Coating Applications	National Fishing	Domestic Solvent Use Including Fungicides	81.8%
	NFR 1A3bi	NFR 3B4e	NFR 2D3d	NFR 1A4ciii	NFR 2D3a	
	42.5%	6.5%	5.7%	5.2%	5.2%	
	Road Transport: Gasoline Evaporation	Manure Management - Dairy Cattle	Manure Management - Sheep	Distribution of oil products	International aviation LTO (civil)	
	NFR 1A3bv	NFR 3B1a	NFR 3B2	NFR 1B2av	NFR 1A3ai(i)	
	4.9%	4.9%	2.7%	2.1%	2.1%	
SO_x	Other Fugitive Emissions from Energy Production (Geothermal Energy)	National fishing	Ferroalloys Production			83.3%
	NFR 1B2d	NFR 1A4ciii	NFR 2C2			
	58.1%	17.2%	8.0%			
NH_3	Animal Manure Applied to Soils	Urine and Dung Deposited by Grazing Animals	Manure Management - Sheep	Manure Management - Dairy Cattle	Manure Management - Non-dairy Cattle	81.8%
	NFR 3Da2a	NFR 3Da3	NFR 3B2	NFR 3B1a	NFR 3B1b	
	29.3%	15.8%	14.5%	13.6%	8.6%	
$PM_{2.5}$	National Fishing	Open Burning of Waste	Construction and Demolition	Quarrying and Mining of Minerals other than Coal	Road Transport: Automobile Road Abrasion	82.5%
	NFR 1A4ciii	NFR 5C2	NFR 2A5b	NFR 2A5a	NFR 1A3bvii	
	25.4%	11.9%	8.7%	8.1%	7.3%	
	Ferroalloy Production	Stationary Combustion in Manufacturing Industries and Construction: Non-metallic Minerals	Road Transport: Heavy Duty Vehicles and Buses	Road Transport: Passenger Cars	Mobile Combustion in manufacturing industries and construction	
	NFR 2C2	NFR 1A2f	NFR 1A3biii	NFR 1A3bi	NFR 1A2gvii	
	4.5%	3.9%	3.5%	3.5%	3.1%	
	Aluminium production					
	NFR 2C3					
	2.6%					

Component	Key Categories (Sorted from high to low from left to right and top to bottom)					Total (%)
PM_{10}	Construction and demolition	National Fishing	Quarrying and mining of minerals other than coal	Road Transport: Automobile Road Abrasion	Open burning of waste	80.5%
	NFR 2A5b	NFR 1A4ciii	NFR 2A5a	NFR 1A3bvii	NFR 5C2	
	39.2%	13.4%	10.3%	6.1%	5.8%	
	Aluminium Production	Ferroalloy Production				
	NFR 2C3	NFR 2C2				
	2.9%	2.8%				
TSP	Construction and demolition	Quarrying and mining of minerals other than coal	National Fishing	Road transport: Automobile road abrasion		83.5%
	NFR 2A5b	NFR 2A5a	NFR 1A4ciii	NFR 1A3bvii		
	61.4%	10.2%	6.3%	5.7%		
BC	Open Burning of Waste	Mobile Combustion in Manufacturing Industries and Construction	Road Transport: Heavy-duty Vehicles and Buses	Stationary Combustion in Manufacturing Industries and Construction: Food Processing and Beverages	Road Transport: Passenger Cars	82.0%
	NFR 5C2	NFR 1A2gvii	NFR 1A3biii	NFR 1A2e	NFR 1A3bi	
	30.1%	11.4%	10.7%	8.3%	8.0%	
	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	National fishing				
	NFR 1A4cii	NFR 1A4ciii				
	7.8%	5.8%				
CO	Road transport: Passenger cars	Aluminium production				87.0%
	NFR 1A3bi	NFR 2C3				
	68.4%	18.5%				

Table A2.2 Key categories for NO_x, NMVOC, SO_x, NH_3, $PM_{2.5}$, PM_{10}, TSP, BC and CO, Trend 1990-2022.

Component	Key Categories (Sorted from high to low from left to right and top to bottom)					Total (%)
NO_x	Road transport: Passenger cars	Ferroalloy production	Aluminium production	International aviation LTO (civil)	Road transport: Light duty vehicles	81.4%
	NFR 1A3bi	NFR 2C2	NFR 2C3	NFR 1A3ai(i)	NFR 1A3bii	
	35.1%	19.7%	14.3%	5.5%	3.4%	
	Stationary Combustion in Manufacturing Industries and Construction: Food Processing and Beverages					
	NFR 1A2e					
	3.4%					
NMVOC	Road transport: Passenger cars	Domestic solvent use including fungicides	International aviation LTO (civil)	Food and beverages industry	Manure management: horses	80.6%
	NFR 1A3bi	NFR 2D3a	NFR 1A3ai(i)	NFR 2H2	NFR 3B4e	
	41.9%	9.6%	8.1%	7.4%	5.1%	
	Manure management - Dairy cattle	Distribution of oil products				
	NFR 3B1a	NFR 1B2av				
	4.6%	3.9%				
SO_x	Aluminium production	National fishing energy)	Other fugitive emissions from energy production (Geothermal	Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco		85.1%
	NFR 2C3	NFR 1A4ciii	NFR 1B2d	NFR 1A2e		
	27.2%	27.0%	23.3%	7.6%		
NH_3	Manure management - Sheep	Manure management - Fur animals	Manure management - Broilers	Manure management - Laying hens	Manure management - Dairy cattle	81.1%
	NFR 3B2	NFR 3B4h	NFR 3B4gii	NFR 3B4gi	NFR 3B1a	
	25.4%	10.7%	10.3%	9.7%	8.8%	
	Manure management - Swine	Manure management - Non-dairy cattle				
	NFR 3B3	NFR 3B1b				
	8.2%	7.9%				
$PM_{2.5}$	Aluminium Production	Road Transport: Automobile Road Abrasion	National fishing	Open burning of waste	Quarrying and Mining of Minerals other than Coal	81.6%
	NFR 2C3	NFR 1A3bvii	NFR 1A4ciii	NFR 5C2	NFR 2A5a	
	31.2%	13.8%	12.8%	11.1%	5.5%	
	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	Construction and Demolition				
	NFR 1A2f	NFR 2A5b				

Component	Key Categories (Sorted from high to low from left to right and top to bottom)					Total (%)
	3.9%	3.3%				
PM_{10}	Aluminium production	Construction and demolition	Road transport: Automobile road abrasion	Quarrying and mining of minerals other than coal	National fishing	81.1%
	NFR 2C3	NFR 2A5b	NFR 1A3bvii	NFR 2A5a	NFR 1A4ciii	
	25.8%	16.5%	15.5%	8.5%	8.0%	
	Open burning of waste					
	NFR 5C2					
	6.7%					
TSP	Construction and demolition	Road transport: Automobile road abrasion	Aluminium production	Quarrying and mining of minerals other than coal	National Fishing	82.1%
	NFR 2A5b	NFR 1A3bvii	NFR 2C3	NFR 2A5a	NFR 1A4ciii	
	25.8%	21.4%	20.7%	10.1%	4.2%	
BC	Open burning of waste	Mobile combustion in manufacturing industries and construction	Road transport: Automobile tyre and brake wear	Road transport: Automobile road abrasion	Aluminium production	81.2%
	NFR 5C2	NFR 1A2gvii	NFR 1A3bvi	NFR 1A3bvii	NFR 2C3	
	30.9%	12.3%	12.3%	9.9%	9.1%	
	Road transport: Heavy duty vehicles and buses					
	NFR 1A3biii					
	6.7%					
CO	Aluminium production	Road transport: Passenger cars				93.0%
	NFR 2C3	NFR 1A3bi				
	50.0%	43.0%				

Persistent Organic Pollutants (POPs)

Table A2.3 Key categories for POPs, 1990.

Component	Key Categories (Sorted from high to low from left to right)					Total (%)
Dioxin	Open burning of waste					97.8%
	NFR 5C2					
	97.8%					
PAH4	Open burning of waste					81.7%
	NFR 5C2					
	81.7%					
HCB	Open burning of waste	Other product use (Tobacco, Fireworks)				91.2%
	NFR 5C2	NFR 2G				
	47.7%	43.4%				
PCB	Open burning of waste	Stationary combustion in manufacturing industries and construction: Non-metallic minerals				89.8%
	NFR 5C2	NFR 1A2f				
	62.7%	27.2%				

Table A2.4 Key categories for POPs, Trend 1990-2022.

Component	Key Categories (Sorted from high to low from left to right)					Total (%)
Dioxin	Open burning of waste	Clinical waste incineration	Ferroalloys production	Accidental fires		90.8%
	NFR 5C2	NFR 5C1biii	NFR 2C2	NFR 5E		
	50.0%	16.3%	12.6%	11.9%		
PAH4	Open burning of waste	Aluminium production	Ferroalloys production	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	Road transport: Passenger cars	82.5%
	NFR 5C2	NFR 2C3	NFR 2C2	NFR 1A2f	NFR 1A3bi	
	41.3%	13.2%	11.2%	8.7%	8.1%	
HCB	Clinical waste incineration	Open burning of waste	Other product use (Tobacco, Fireworks)			83.0%
	NFR 5C1biii	NFR 5C2	NFR 2G			
	33.1%	32.6%	17.2%			
PCB	Clinical waste incineration	Open burning of waste				82.6%
	NFR 5C1biii	NFR 5C2				
	41.5%	41.1%				

Priority Heavy Metals (Pb, Cd, Hg) and Additional Heavy Metals (As, Cr, Cu, Ni, Se, Zn)

Table A2.5 Key categories for heavy metals, 1990.

Component	Key Categories (Sorted from high to low from left to right and top to bottom)					Total (%)
Pb	Domestic aviation LTO (civil)	Road transport: Automobile tyre and brake wear	Other product use (Tobacco, Fireworks)	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	Accidental fires	85.5%
	NFR 1A3aii(i)	NFR 1A3bvi	NFR 2G	NFR 1A2f	NFR 5E	
	32.8%	20.6%	11.3%	8.1%	7.1%	
	Stationary combustion in manufacturing industries and construction: Other					
	NFR 1A2gvii					
	5.5%					
Cd	Aluminium production	Open burning of waste	National fishing			87.3%
	NFR 2C3	NFR 5C2	NFR 1A4ciii			
	58.1%	17.0%	12.2%			
Hg	Open burning of waste					90.2%
	NFR 5C2					
	90.2%					
As	National fishing	Open burning of waste	Aluminium production			87.3%
	NFR 1A4ciii	NFR 5C2	NFR 2C3			
	46.0%	22.2%	19.1%			
Cr	Road transport: Automobile tyre and brake wear	National fishing	Aluminium production			85.5%
	NFR 1A3bvi	NFR 1A4ciii	NFR 2C3			
	49.2%	29.1%	7.0%			
Cu	Road transport: Automobile tyre and brake wear	National fishing				90.2%
	NFR 1A3bvi	NFR 1A4ciii				
	77.3%	12.9%				
Ni	National fishing	Aluminium production				88.4%
	NFR 1A4ciii	NFR 2C3				
	78.2%	10.1%				
Se	National fishing	Open burning of waste				86.4%
	NFR 1A4ciii	NFR 5C2				
	78.8%	7.6%				
Zn	Open burning of waste	Aluminium production	Road transport: Automobile tyre and brake wear	National fishing	Accidental fires	88.1%
	NFR 5C2	NFR 2C3	NFR 1A3bvi	NFR 1A4ciii	NFR 5E	
	28.8%	18.8%	18.7%	12.4%	9.5%	

Table A2.6 Key categories for heavy metals, trend 1990-2022.

Component	Key Categories (Sorted from high to low from left to right and top to bottom)					Total (%)
Pb	Road transport: Automobile tyre and brake wear	Aluminium production	Domestic aviation LTO (civil)	Other product use (Tobacco, Fireworks)	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	87.1%
	NFR 1A3bvi	NFR 2C3	NFR 1A3aii(i)	NFR 2G	NFR 1A2f	
	25.4%	22.5%	19.3%	10.3%	9.7%	
Cd	Aluminium production	Open burning of waste	National fishing			85.9%
	NFR 2C3	NFR 5C2	NFR 1A4ciii			
	49.3%	22.1%	14.5%			
Hg	Open burning of waste	National fishing	Cremation	Road transport: Passenger cars		86.0%
	NFR 5C2	NFR 1A4ciii	NFR 5C1bv	NFR 1A3bi		
	48.2%	21.5%	9.2%	7.1%		
As	Aluminium production	National fishing	Open burning of waste			94.0%
	NFR 2C3	NFR 1A4ciii	NFR 5C2			
	49.9%	29.1%	15.1%			
Cr	Aluminium production	National fishing	Stationary combustion in manufacturing industries and construction: Non-metallic minerals			83.3%
	NFR 2C3	NFR 1A4ciii	NFR 1A2f			
	40.5%	35.5%	7.2%			
Cu	National fishing	Road transport: Automobile tyre and brake wear	Aluminium production	Other product use (Tobacco, Fireworks)		82.7%
	NFR 1A4ciii	NFR 1A3bvi	NFR 2C3	NFR 2G		
	34.1%	24.1%	13.1%	11.5%		
Ni	Aluminium production	National fishing				92.9%
	NFR 2C3	NFR 1A4ciii				
	49.3%	43.5%				
Se	Road transport: Automobile tyre and brake wear	Open burning of waste	Public electricity and heat production	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	National fishing	87.4%
	NFR 1A3bvi	NFR 5C2	NFR 1A1a	NFR 1A2f	NFR 1A4ciii	
	33.1%	25.5%	12.1%	9.0%	7.9%	
Zn	Aluminium production	Open burning of waste	National fishing			83.7%
	NFR 2C3	NFR 5C2	NFR 1A4ciii			
	49.2%	26.0%	8.5%			