Icelandic
Environment and
Energy Agency

2026

Informative Inventory Report

Emissions of Air Pollutants in Iceland from 1990 to 2024

Submitted under the Convention on Long-Range Transboundary Air Pollution

Informative Inventory Report 2026

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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} associated with volcanic eruptions.

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

Icelandic Environment and Energy Agency, Reykjavík, 15 March 2026

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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
LFI	Land and Forest Iceland
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
SCSI	Soil Conservation Service of Iceland (Landgræðslan)
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
Particulate Matter	
$PM_{2.5}$	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
POPs (Persistent Organic Pollutants)	
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 1990-2024.

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.2 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.

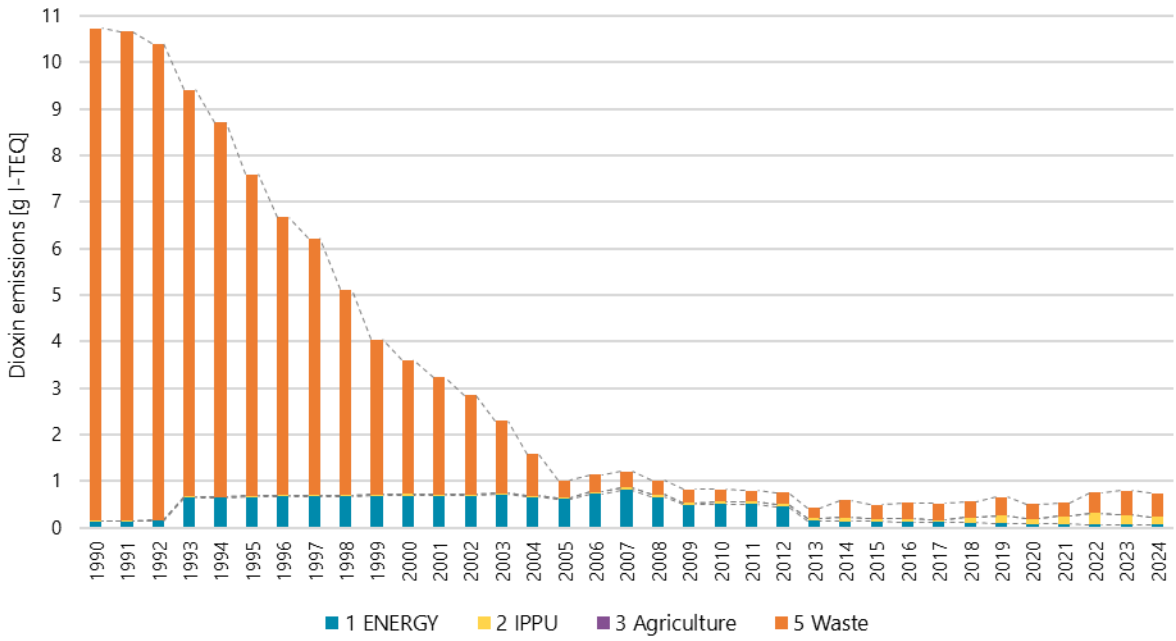


Figure ES.1 Trends in dioxin emissions by source, since 1990.

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.

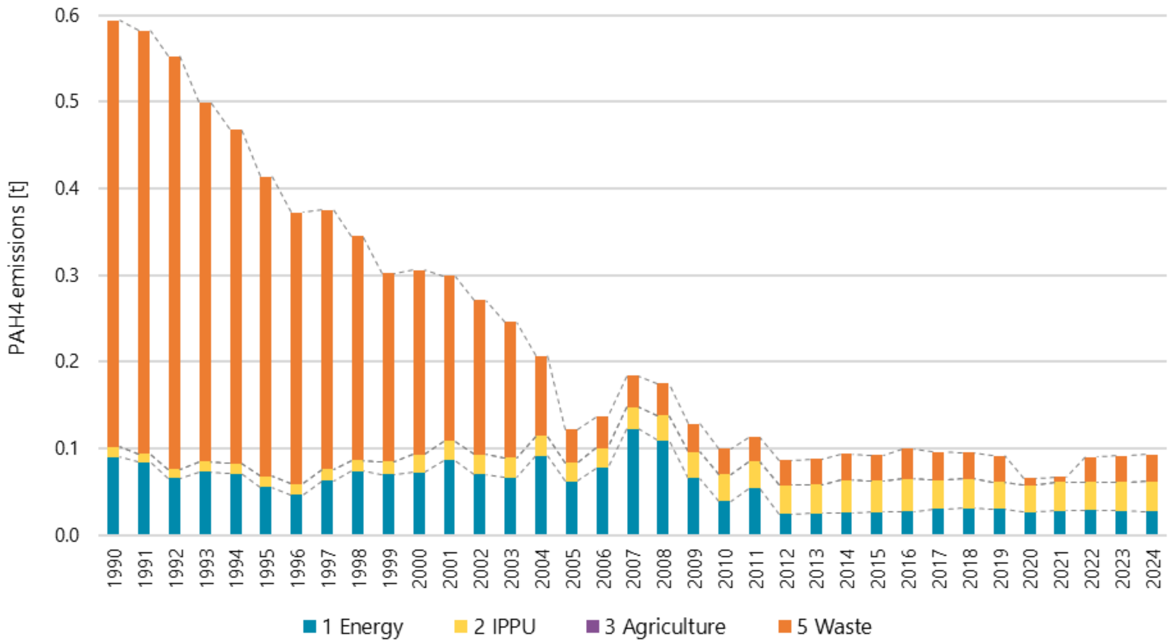


Figure ES.2 Trends in PAH4 emissions by source, since 1990.

PAH4 (Benzo(a)pyrene-BaP, Benzo(b)fluoranthene-BbF, Benzo(k)fluoranthene-BkF, Indeno(1,2,3-cd)pyrene-IPy) emissions 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.

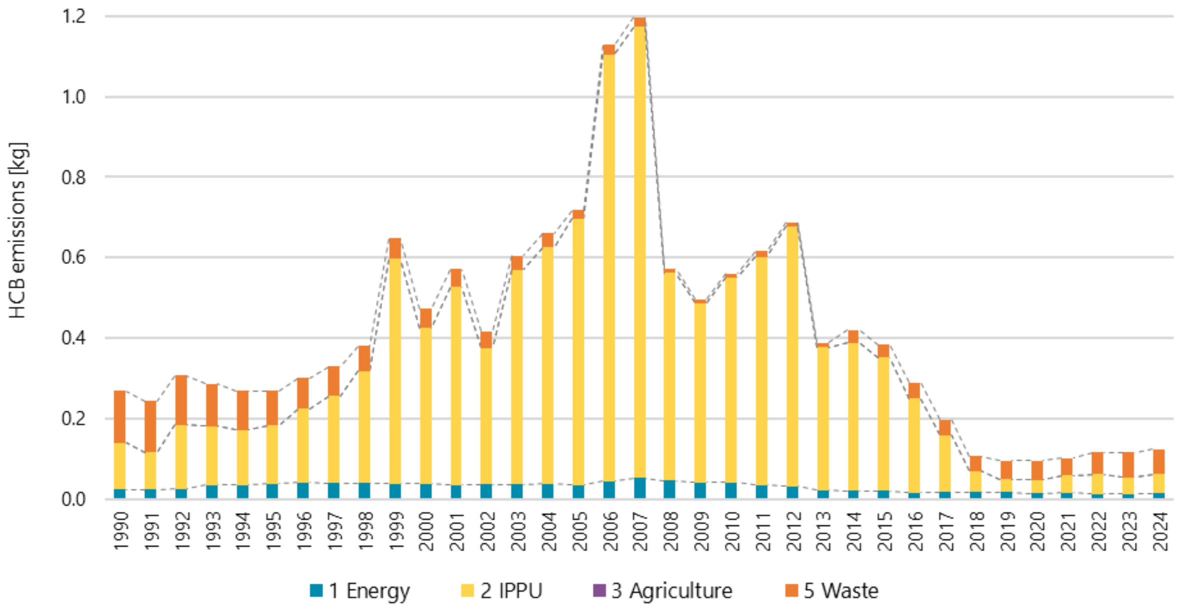


Figure ES.3 Trends in HCB emissions by sector, since 1990.

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.

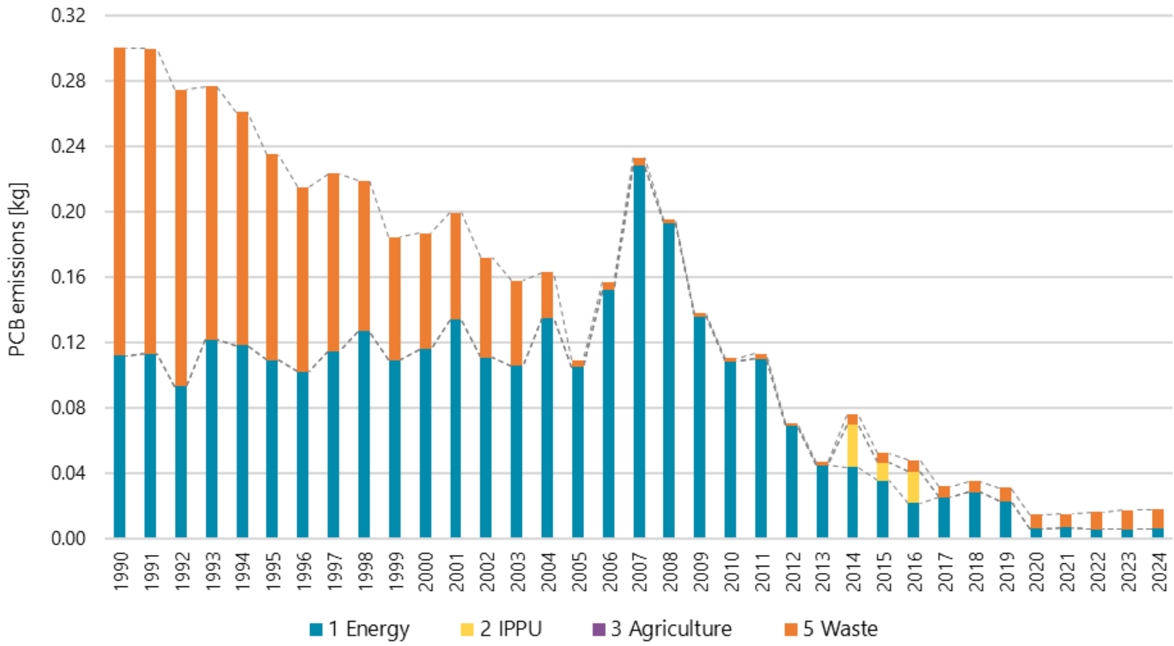


Figure ES.4 Trends in PCB emissions by sector, since 1990.

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

[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

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 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]).

The present report and associated NFR (Nomenclature for Reporting) tables are Iceland's contribution to the 2026 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 (2023-2024) 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

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

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 7/1998 (*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. The IEEA is a newly formed institution, consisting of part of what used to be the Environment Agency of Iceland (EAI, Umhverfisstofnun) and what used to be the National Energy Authority (NEA, Orkustofnun); the merger took place 1 January 2025. The same/ 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.

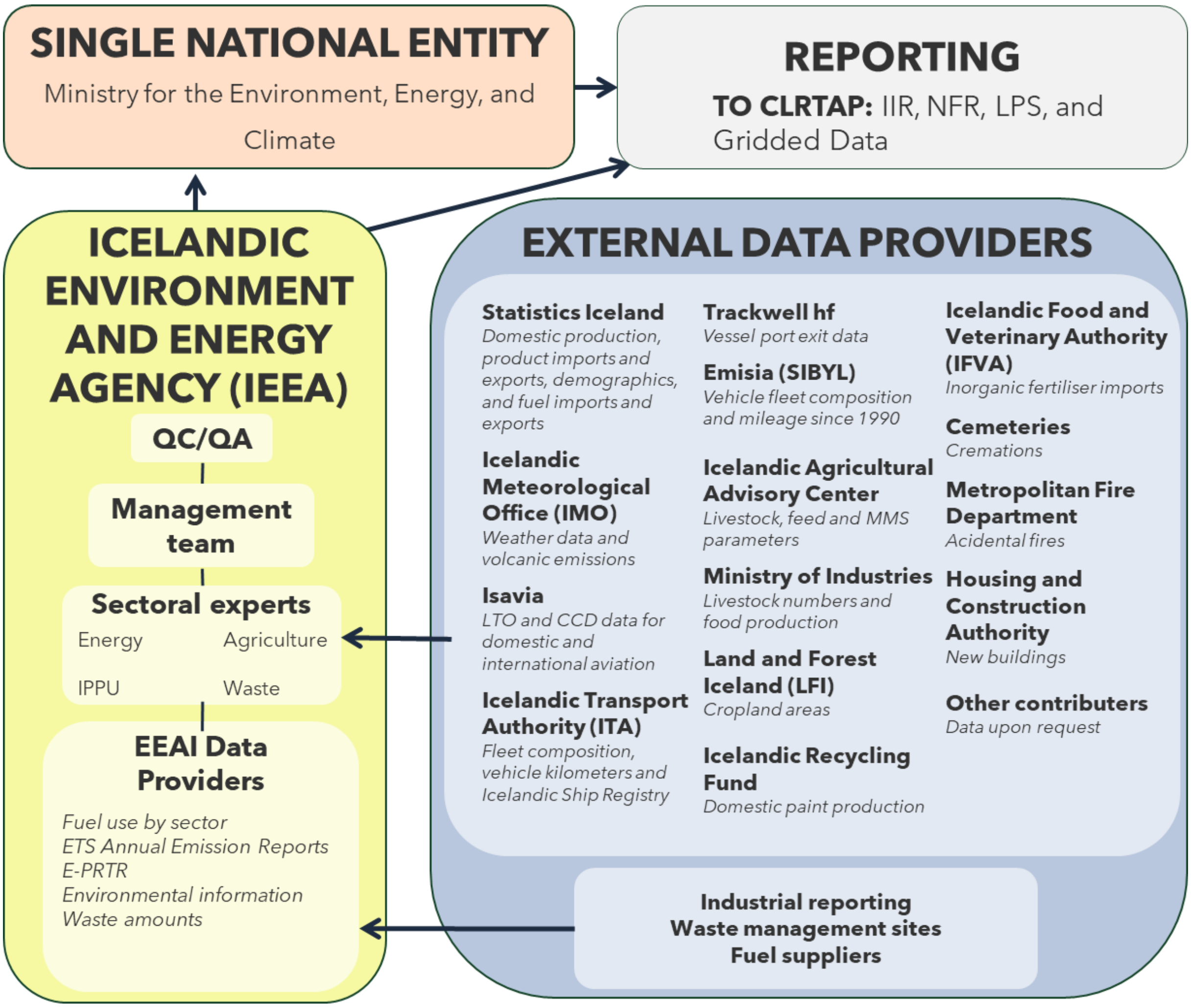


Figure 1.1 Information flow and distribution of responsibilities in the Icelandic emissions inventory system for reporting to the CLRTAP.

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 teams within the IEEA. The main data streams are the following:

1. The IEEA 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.
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 fuel distributors (who submit data to the Department of Energy Transition and Circular Economy of the IEEA), 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 inventory team 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 and improvement of the national inventory. 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.

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

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 national total. The KCA has been undertaken based on Approach 1 outlined in the 2023 EMEP/EEA Guidebook, and was performed for each pollutant, calculating both the level assessment for the base year (1990) and the most recent inventory year (2024) as well as the trend assessment (1990-2024). Memo items are excluded from the KCA. Table 1-2, Table 1-3 and Table 1-4 present the results of the KCA for the year 2024. The KCAs for 1990 as well as the 1990-2024 trend assessment are presented in KCA Results for 1990 and Trends 1990-24 in Annex 2.

Table 1-2 Key Category Analysis for reported main pollutants in 2024.

Component	Key Categories (Sorted from high to low, from left to right, and from top to bottom)					Total (%)
NO_x	National fishing NFR 1A4ciii 54.1%	Ferroalloy production NFR 2C2 12.0%	Road transport: Heavy duty vehicles and buses NFR 1A3biii 5.3%	Road transport: Passenger cars NFR 1A3bi 3.9%	Aluminium production NFR 2C3 3.8%	82.5%
	Mobile Combustion in manufacturing industries and construction NFR 1A2gvii 3.4%					
NMVOC	Domestic solvent use including fungicides NFR 2D3a 29.3%	Food and beverages industry NFR 2H2 9.8%	Manure managment: horses NFR 3B4e 8.6%	International aviation LTO (civil) NFR 1A3ai(i) 7.9%	Manure management - Dairy cattle NFR 3B1a 6.9%	82.6%
	Coating applications NFR 2D3d 6.4%	National Fishing NFR 1A4ciii 5.3%	Distribution of oil products NFR 1B2av 5.3%	Manure management - Non-dairy cattle NFR 3B1b 2.9%		
SO_x	Other fugitive emissions from energy production (Geothermal energy) NFR 1B2d 76.0%	Aluminium production NFR 2C3 19.4%				95.4%

Component	Key Categories (Sorted from high to low, from left to right, and from top to bottom)					Total (%)
NH_3	Animal Manure Applied to Soils NFR 3Da2a 27.6%	Inorganic N-fertilizers (includes also urea application) NFR 3Da1 14.5%	Urine and Dung Deposited by Grazing Animals NFR 3Da3 14.2%	Manure Management - Dairy Cattle NFR 3B1a 13.7%	Manure Management - Sheep NFR 3B2 10.0%	89.0%
	Manure Management - Non-dairy Cattle NFR 3B1b 9.1%					
$PM_{2.5}$	Aluminium production NFR 2C3 30.2%	Road transport: Automobile road abrasion NFR 1A3bvii 23.6%	National Fishing NFR 1A4ciii 13.2%	Road Transport: Automobile Tyre and Brake Wear NFR 1A3bvi 5.0%	Construction and Demolition NFR 2A5b 4.6%	80.2%
	Ferroalloys production NFR 2C2 3.6%					
PM_{10}	Construction and demolition NFR 2A5b 22.5%	Aluminium production NFR 2C3 22.2%	Road transport: Automobile road abrasion NFR 1A3bvii 21.4%	National Fishing NFR 1A4ciii 7.6%	Road transport: Automobile tyre and brake wear NFR 1A3bvi 4.7%	81.9%
	Quarrying and mining of minerals other than coal NFR 2A5a 3.5%					
TSP	Construction and demolition NFR 2A5b 40.1%	Road transport: Automobile road abrasion NFR 1A3bvii 22.9%	Aluminium production NFR 2C3 14.2%	National Fishing NFR 1A4ciii 4.1%		81.3%
BC	Mobile Combustion in manufacturing industries and construction NFR 1A2gvii 21.4%	Road transport: Automobile tyre and brake wear NFR 1A3bvi 13.5%	Road transport: Automobile road abrasion NFR 1A3bvii 10.9%	Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco NFR 1A2e 10.0%	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery NFR 1A4cii 8.7%	85.9%

Component	Key Categories (Sorted from high to low, from left to right, and from top to bottom)					Total (%)
	National fishing NFR 1A4ciii 8.2%	Aluminium production NFR 2C3 6.6%	Road transport: Heavy duty vehicles and buses NFR 1A3biii 6.5%			
CO	Aluminium production NFR 2C3 96.5%					96.5%

Table 1-3: Key Category Analysis for reported POPs in 2024.

Component	Key Categories (Sorted from high to low and from left to right)					Total (%)
Dioxin	Clinical waste incineration NFR 5C1biii 30.2%	Accidental fires NFR 5E 20.9%	Ferroalloys production NFR 2C2 16.8%	Open burning of waste NFR 5C2 13.9%		81.7%
PAH4	Open burning of waste NFR 5C2 25.5%	Ferroalloys production NFR 2C2 18.5%	Aluminium production NFR 2C3 18.1%	Road Transport: Passenger Cars NFR 1A3bi 11.3%	Accidental fires NFR 5E 8.1%	81.5%
HCB	Clinical waste incineration NFR 5C1biii 44.9%	Other product use (Fireworks) NFR 2Gfw 24.4%	Aluminium production NFR 2C3 14.2%			83.6%
PCB	Clinical waste incineration NFR 5C1biii 61.8%	National fishing NFR 1A4ciii 34.4%				96.3%

Table 1-4: Key Category Analysis for reported heavy metals in 2024.

Component	Key Categories (Sorted from high to low and from left to right)					Total (%)
Pb	Road transport: Automobil tyre and brake wear NFR 1A3bvi 47.3%	Aluminium production NFR 2C3 19.7%	Domestic aviation LTO (civil) NFR 1A3aii(i) 11.5%	Accidental fires NFR 5E 8.3%		86.8%
Cd	Aluminium production NFR 2C3 93.7%					93.7%

Component	Key Categories (Sorted from high to low and from left to right)					Total (%)
Hg	National fishing NFR 1A4ciii 45.7%	Cremation NFR 5C1bv 17.1%	Road transport: Passenger cars NFR 1A3bi 11.9%	Clinical waste incineration NFR 5C1biii 8.4%		83.1%
As	Aluminium production NFR 2C3 89.9%					89.9%
Cr	Road transport: Automobil tyre and brake wear NFR 1A3bvi 57.8%	Aluminium production NFR 2C3 32.2%				90.1%
Cu	Road transport: Automobil tyre and brake wear NFR 1A3bvi 84.1%					84.1%
Ni	Aluminium production NFR 2C3 88.7%					88.5%
Se	National fishing NFR 1A4ciii 75.8%	Road transport: Automobil tyre and brake wear NFR 1A3bvi 12.7%				88.5%
Zn	Aluminium production NFR 2C3 69.3%	Road transport: Automobil tyre and brake wear NFR 1A3bvi 18.0%				87.3%

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 inventory team at the IEEA. It provides a centralised basis for the team 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 team, 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 team members who are responsible for completing the task and signing it as complete.

1.6.2 Roles and Responsibilities Overview

The same inventory team takes care of the greenhouse gas (GHG) inventory and the air pollutant inventory. Sectoral experts thus calculate emissions from their respective sector both for GHG and air pollutants.

The overall responsibility over the inventory lies with the inventory team leader 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 inventory team leader is assisted by the IIR coordinator who oversees daily tasks relating to the generation of the IIR. Within the inventory team at the IEEA there are two sectoral subgroups within the team, 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 team leader. The various roles within the inventory team are described below:

- Inventory Team Leader – 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 team leader is responsible for the communication with the Icelandic ministries, as well as communication with the UNECE, the EU and CLRTAP expert review teams. The team leader 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 as well as understanding Iceland's various commitments regarding air pollutants and greenhouse gases.

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 and since 2022, Iceland has undergone a Stage 3 review with focus on a different topic each year.[6]

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

[6] EMEP Centre on Emission Inventories and Projections, 2026. https://www.ceip.at/review-of-emission-inventories/in-depth-review-of-ae-inventories.

countries, where inventory compilers from Norway, Sweden, Finland, Denmark, and Iceland meet annually to discuss specific topics/sectors/air pollutants.

Furthermore, Iceland participates in the annual TFEIP meetings.

1.6.4 Quality Control (QC)

The team uses notation protocols in the calculation files to document changes, possible issues, and necessary improvements.

Aether 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 10Annex 110Annex 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 not set in stone and may change, especially, as the sectors continue to improve, some sector- and subsector-specific guidelines will change and/or be added, 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 must 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?

Check	Description
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 with total input data in calculations files to ensure that all fuels are accounted for. • Meetings are held 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 team 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. • A comparison between the Icelandic country-specific (CS) data on imports of synthetic fertiliser and fertiliser usage data from the International Fertiliser Association (IFA) and synthetic fertiliser consumption estimates from the Food and Agriculture Organization of the United Nations (FAO). • To ensure that no double counting or omissions occur during the nitrogen calculations in the N flow tool, a nitrogen balance is carried out, where the total input of nitrogen (animal excretion plus addition through bedding minus loss in the manure management system) should match the amount of nitrogen available for application to soil as animal manure.

Sector	QC Checks
Waste	• The Waste sector emissions are presented to the interdisciplinary waste expert group at the IEEA 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 General Uncertainty Assessment

Starting with the 2026 submission a comprehensive quantitative assessment of uncertainties has been carried out covering the main pollutants (NO_x, NMVOC, SO_2, NH_3), particulate matter (TSP, PM_{10}, $PM_{2.5}$, BC), heavy metals (Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn), persistent organic pollutants (PAH4, dioxin, HCB, PCB), and CO.

1.7.1 Method and Data Sources

Generally, Approach 1, described in the EMEP/EEA Guidebook 2023, section A.5, estimation of uncertainties by source category using error propagation via addition and multiplication rules defined therein, was followed.

Aggregation within a single NFR for which different uncertainties per pollutant related to different types of fuel or technologies are applicable was performed by taking the respective pollutant-specific maxima, while aggregated uncertainty values across NFRs were calculated using the addition rule defined in the guidebook. Combining these methods, a quantitative estimate of the overall uncertainty of the inventory, as well as aggregated on sector level, for the latest year was compiled. In addition, pollutant-specific uncertainty trend calculations were carried out using 1990 as the base year.

1.7.1.1 Data Sources

Uncertainty is estimated by combining uncertainty related to the reported activity data and uncertainty inherent in applied emission factors. Important constituents of activity data, such as fuel sales data reported by fuel distributors in the Energy sector, or production volumes and use of materials provided by manufacturing companies in the IPPU sector, are typically accurate, and the associated uncertainty is assumed to be accordingly low. Activity data that are provided by or tightly correlate with data from Statistics Iceland are in most cases associated with the upper boundary of the respective default uncertainty range specified in the EMEP/EEA guidebook (chapter 5, table 2-1). Expert judgement is an important aspect in the assessment of activity data uncertainty in all sectors.

Emission factors related uncertainty is for most pollutants and most sources based on either uncertainty values specified in the sectoral chapters of the EMEP/EEA guidebook or calculated from average values and the associated 95% confidence interval boundaries of the specific Tier 1 or Tier 2 emission factors. For a few source-pollutant combinations, in particular in IPPU emission or fuel related pollutants, emission factors are based on plant-specific measurement or laboratory analysis, for which expert judgement-based uncertainty values have been assumed. For sources for which different technologies or fuels yield different uncertainty values, the pollutant-specific maximum values were used. In the waste sector the EF uncertainty for accidental fires is gathered from the Danish IIR (Nielsen, et al., 2024) alongside emission factors. For source-pollutant pairs for which no specific emission factor uncertainty could be determined, quantitative uncertainty values are derived from the qualitative uncertainty ratings proposed in the EMEP/EEA guidebook, chapter 5, table 2-2, and the proposed associated quantitative ranges.

Where applicable, the sector specific chapters of this report provide more details related to the uncertainty assessment process on sectoral level.

1.7.2 Quantitative Uncertainty Assessment

A quantitative uncertainty assessment was carried out in accordance with Approach 1, outlined in the EMEP/EEA Guidebook 2023, for the set of pollutants specified in Table 1-7. The assessment provides a quantitative characterisation of the uncertainty for each pollutant as percentage of the total national emissions aggregated over all source categories, the associated uncertainty introduced into the trend in total national emissions, as well as the absolute uncertainty in terms of mass of emissions of the respective pollutant.

Even though in particular emission factor uncertainties are to a large extent based on default values from the EMEP/EEA Guidebook or expert judgement, the results of the uncertainty assessment give a good indication as to which pollutants contribute to which extent to the overall uncertainty, and can provide useful pointers for targeted improvements efforts.

Table 1-7 National totals and quantitative uncertainty estimates by pollutant.

Inventory	Pollutant	Unit	National emissions total 1990 [Unit]	National emissions total 2024 [Unit]	Uncertainty in national total [%]	Absolute uncertainty in 2024 emissions [Unit]	Uncertainty in national total trend [%]
Main pollutants	NO_x	kt	25.0	14.7	18	2.6	3.3
	NMVOC	kt	8.4	6.0	96	5.7	59
	SO_2	kt	22.9	54.1	9.1	4.9	19
	NH_3	kt	5.3	5.1	45	2.3	30
Particulate Matter	$PM_{2.5}$	kt	1.3	1.1	42	0.47	29
	PM_{10}	kt	3.0	2.3	54	1.2	32
	TSP	kt	6.5	4.2	87	3.7	34
	BC	kt	0.21	0.09	26	0.025	10
Other	CO	kt	54.2	106	84	89	133
Priority Heavy Metals	Pb	t	3.0	0.86	31	0.26	39
	Cd	t	0.02	0.13	33	0.045	231
	Hg	t	0.14	0.011	165	0.018	18
Additional Heavy Metals	As	t	0.07	0.15	32	0.047	135
	Cr	t	0.13	0.26	46	0.12	69
	Cu	t	1.9	3.9	50	2.0	46
	Ni	t	1.7	1.9	32	0.62	85
	Se	t	0.035	0.021	98	0.021	29
	Zn	t	2.3	6.1	39	2.4	168
POPs	Dioxin	g I-TEQ	10.7	0.74	8735	64	12
	BaP	t	0.12	0.014	103	0.014	15
	BbF	t	0.22	0.042	75	0.032	26
	BkF	t	0.24	0.025	90	0.023	13
	Ipy	t	0.020	0.012	205	0.024	58
	PAH	t	0.59	0.093	72	0.067	19
	HCB	kg	0.27	0.12	362	0.45	110
	PCB	kg	0.30	0.018	562	0.10	34

Table 1-8 provides an overview of emissions of the latest year and associated uncertainties per pollutant aggregated by sector and describes the sectoral contributions to total emissions and overall uncertainties.

Table 1-8 Emissions 2024 and associated Uncertainties aggregated by Sector.

Pollutant			Energy		IPPU		Agriculture		Waste	
		Unit	Emis-sions 2024 [Unit]	Uncer-tainty 2024 [%]	Emis-sions 2024 [Unit]	Uncer-tainty 2024 [%]	Emis-sions 2024 [Unit]	Uncer-tainty 2024 [%]	Emis-sions 2024 [Unit]	Uncer-tainty 2024 [%]
Main pollutants	NO_x	kt	11.4	22	2.3	17	0.90	91	0.068	49
	NMVOC	kt	1.6	51	2.9	193	1.4	55	0.057	226
	SO_2	kt	41.4	10	12.6	21	NA	-	0.017	269
	NH_3	kt	0.054	102	0.016	12	5.0	46	0.0079	187
Particulate Matter	$PM_{2.5}$	kt	0.56	24	0.50	90	0.035	50	0.013	119
	PM_{10}	kt	0.86	25	1.2	97	0.17	112	0.014	122
	TSP	kt	1.4	32	2.6	140	0.22	87	0.014	123
	BC	kt	0.083	29	0.0075	63	NA	-	0.0030	76
Other	CO	kt	3.3	24	102	87	NA	-	0.13	163
Priority Heavy Metals	Pb	t	0.58	39	0.20	52	NA	-	0.077	123
	Cd	t	0.0041	84	0.13	35	NA	-	7.6.E-04	56
	Hg	t	0.0075	84	4.3.E-05	666	NA	-	0.0031	531
Additional Heavy Metals	As	t	0.012	67	0.13	35	NA	-	8.7.E-04	168
	Cr	t	0.16	48	0.10	94	NA	-	5.4.E-04	142
	Cu	t	3.5	49	0.43	231	NA	-	0.0042	297
	Ni	t	0.19	85	1.7	35	NA	-	0.0011	138
	Se	t	0.021	99	1.4.E-06	50	NA	-	2.5.E-04	221
	Zn	t	1.4	44	4.4	42	NA	-	0.31	454
POPs	Dioxin	g I-TEQ	0.063	91	0.16	119	NA	-	0.51	12625
	BaP	t	0.0056	135	0.0026	131	NA	-	0.0056	205
	BbF	t	0.010	86	0.023	106	NA	-	0.010	191
	BkF	t	0.0076	69	0.0065	106	NA	-	0.011	188
	Ipy	t	0.0046	113	0.0024	106	NA	-	0.0046	503
	PAH	t	0.028	27	0.034	78	NA	-	0.031	196
	HCB	kg	0.013	97	0.048	95	NA	-	0.062	714
	PCB	kg	0.0064	195	NA	-	NA	-	0.012	862

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)

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 1-9 below.

Table 1-9 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 1-10 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.

1.9 Recalculations and improvements

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 detail in each subsector in the relevant chapter.

1.9.1 Energy

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

- Mistake in dioxin emission calculation was corrected in 1A4ai Commercial Stationary. Led to recalculation for dioxin for all years in which waste was used, 1990-2012.
- In 1A5a Other Stationary, for residual fuel oil, the SO_2 emission factor for diesel oil was previously used. This mistake has now been corrected. This led to recalculations for SO_2 for all years in which residual fuel oil was used, 1990-1996, 1998-2003, 2007-2008 and 2010-2011.
- In Mobile machinery (1A2gvii, 1A3eii, and 1A4cii) in the previous submission, the Gas/Diesel Oil split for the years 1990 to 2018 was extrapolated based on the average proportion of categories 1A2gvii, 1A3eii, and 1A4cii as reported for 2019 to 2022, while activity data for 2019 and following years was considered correctly attributed to these categories. This approach was revised for the 2026 submission, with fuel for the years 1990-2018 split between categories based on category-specific activity data. Fuel assignment for the years 2019 and 2020 was corrected for suspected attribution inaccuracies. The recalculations affect all relevant air pollutants in all three categories over the entire timeline up to and including year 2020.
- Updates in COPERT and to vehicle stock data led to recalculation in road transport (see in detail in the chapter about 1A3b Road Transport in the Energy chapter). The recalculation affected most air pollutants throughout the entire timeline.
- Updates to the methodology in navigation and fishing categories led to recalculations of most air pollutants in International Maritime and Domestic Navigation (1A3di(i) and 1A3dii) as well as Fishing (1A4ciii) for the entire timeline.
- In 1B2d Geothermal Energy, updates in activity data from the geothermal power plants led to recalculations for SO_2 emissions for the whole timeline.

1.9.2 Industrial Processes and Product Use (IPPU)

The main recalculations and improvements for IPPU are:

- 2A5b Road Construction: Previously unidentified historical data on the length of new road and lane construction from IRCA annual reports were incorporated for the years 2000–2002. As years without activity data are estimated based on the average of the first ten years with available data, this update resulted in recalculations for the period 1990–2002.
- 2C3 Primary Aluminium Production: The default emission factor for NO_x emissions at one aluminium plant was replaced by an emission factor based on on-site measurements.
- 2C3 Secondary Aluminium Production: Emissions of TSP, PM_{10}, $PM_{2.5}$ and BC for the years 2022 and 2023 were recalculated following correction of the activity data.
- 2D3a Solvent and Product Use: The methodology for estimating NMVOC emissions was upgraded from Tier 1 (population-based) to Tier 2b (product-based). This methodological improvement led to recalculations for the entire time series, with lower emissions for 1990–1999 and higher emissions from 2000 onwards, better reflecting economic trends in Iceland.
- 2G Tobacco: Activity data were corrected by excluding waterpipe tobacco as its consumption does not involve combustion. This correction resulted in recalculations and lower emissions from 2012 onwards.
- 2H2 Food and Beverage Industry: The estimation of animal feed production was revised and is now based on GDP trends. The quantity of coffee roasted domestically is now based on import statistics of unroasted beans. The import/export categorisation for spirits was also revised. These changes affected NMVOC emissions across the entire time series, resulting in generally lower emissions for 1990–2011 and higher emissions from 2012 onwards.

1.9.3 Agriculture

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

- There are recalculations for the whole timeline 1990-2023 for NO_x, NMVOC and NH_3 due to updated digestibility of feed and ash content of feed for cattle and sheep and due to updated weights of cattle.
- New information on the use of straw in solid storage for sheep and calves was also updated with new data from the IAAC, causing recalculation of NO_x and NH_3 emissions from cattle and sheep manure management. This change affects the year 1990-2007 for calves (up to 49% higher values for straw usage), and the whole timeline 1990-2023 for sheep (70% lower values for straw usage).

- Updated manure management system (MMS) fractions caused recalculations of NO_x, NMVOC, NH_3 and particulate matter emissions, for cattle and sheep. The change in MMS fraction was largest for Calves where the fraction of solid storage was decreased while the slurry fraction increased, and days on pasture were introduced as well, all based on better data from the IAAC.
- For goats updated gender fractions were received, updated number of kids per doe and updated slaughter age, affecting the population size of goats. This caused recalculations of NH_3, NO_x, NMVOC and particulate matter emissions for goats.
- There are recalculations for the whole timeline due to updated weight of young horses affecting NOx and NH_3 emissions.
- Errors were fixed in the synthetic fertiliser calculation sheets for the years 2012 and 2023 causing recalculations of NOx and NH_3 emissions for those years. The amount of inorganic fertiliser used in forestry was also updated causing small recalculations for the years 2009-2023. However, due to how small those changes were, the only considerable changes in NOx emissions are 2.9% increase in 2012 and a 4.2% decrease in 2023. Updated categorisation of fertilisers and a change in EF used for NPK mixtures led to recalculations of NH_3 emissions.
- Recalculation in NOx and NH_3 emissions due to updated feed digestibility and ash content of feed for sheep and cattle, error fixed in days in a year for mature dairy cattle, updated animal mass for cattle and horses, updated early mortality for lambs, updated goat population size, updated number of days outside for calves, and updated amount of straw used for calves and sheep.
- Updated activity data for compost affected NO_x and NH_3 emissions from 3Da2c Other Organic Fertilisers Applied to Soils in the year 2023 only.
- There are recalculations in 3Dc for particulate matter emissions and 3De for NMVOC emissions due to updated area information from Land and Forest Iceland affecting the whole timeline from 1990.

1.9.4 Waste

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

- Methane recovery data was updated, leading to recalculations of NMVOC emissions, due to:
    - New data for the years 1997-2003.
    - An overestimation that occurred for the years since GAJA opened in 2020, resulting in double counting.
- In previous submission waste from GAJA was only included in 5B2 anaerobic digestion, but now the waste amount is added to 5B1 Composting as well. This results in recalculations for NH_3 and CO in 2022 and 2023.
- Recalculations were made in the sector 5E Other Waste due to:
    - Updated EF from the Danish IIR.

- Large scale fires in car repair shops were added in 2010 and 2020.

1.10 Planned Improvements

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

1.10.1 Energy

For future submissions the main improvements are:

- in collaboration with the ITA, to develop procedures to obtain enhanced data on vehicle stock and mileage data for COPERT.

1.10.2 Industrial Processes and Product Use (IPPU)

The main improvements planned for the IPPU sector consist 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.

1.10.3 Agriculture

The main improvements planned for the Agriculture sector consist 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.

1.10.4 Waste

The main improvements planned for the Waste sector consist of:

- Obtaining the activity data necessary to estimate emissions from wastewater handling for future submissions.
- Reviewing the methodology used to estimate emissions from accidental fires for future submissions.

- Obtaining 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 for future submissions.

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).
- Between 80% and 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 2024.

	SO_x [kt SO_2]	NO_x [kt NO_2]	NH_3 [kt]	NMVOC [kt]	$PM_{2.5}$ [kt]	PM_{10} [kt]	TSP [kt]	BC [kt]	CO [kt]
1990	22.9	25.0	5.29	8.42	1.32	2.98	6.51	0.213	54.2
2024	54.1	14.7	5.09	5.99	1.11	2.26	4.22	0.094	106
Change 1990-2024	136%	-41%	-4%	-29%	-16%	-24%	-35%	-56%	95%

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 1998.
NH_3	8 kt	Emissions have been stable between 4 and 5 kt since 1990.
NMVOC	31 kt	Emissions have been decreasing since 1992 when the maximum of NMVOC emissions occurred (8.6 kt in that year).

As of March 2026, 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.

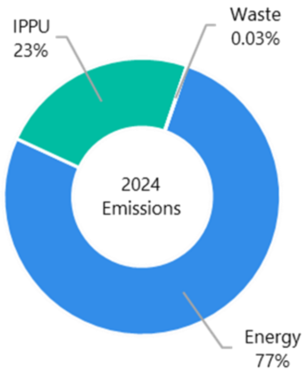
2.2.1 Trends in SO_x Emissions

SO_x (SO_2)

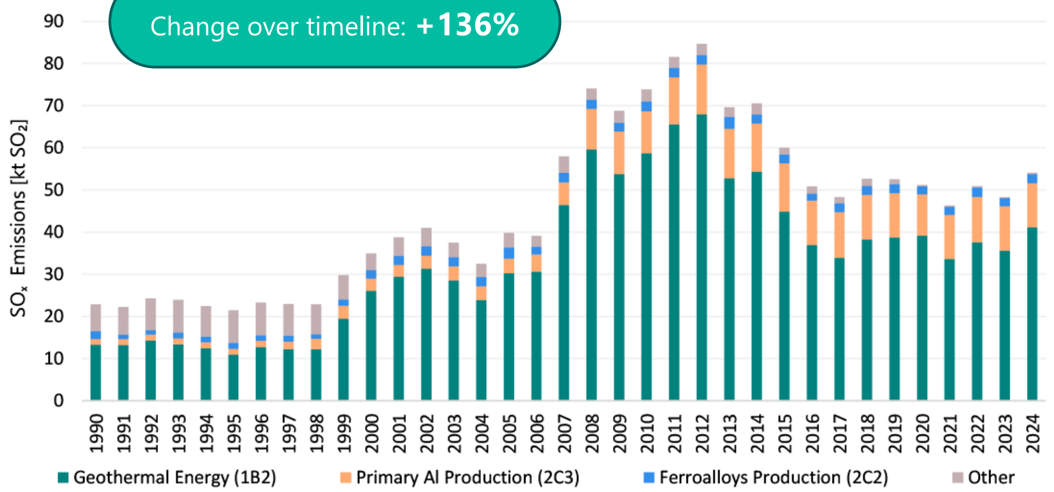
The main sources for SO_x include:

- **Geothermal Energy (1B2d):** Geothermal energy is the largest source of sulphur emissions in Iceland. Emissions have increased substantially since 1990 due to increased geothermal energy production. A sulphur capture and storage project started in 2014 which proportionally lowers the SO_x emissions per prod. 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.

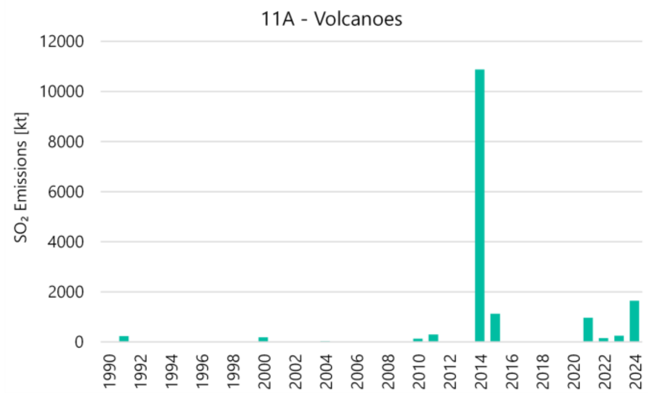
Total SO_x emissions: **54 kt**



Change over timeline: **+136%**



Volcanic eruptions contribute significantly to sulphur emissions (11A, memo). Emissions from this source are reported as a memo item and therefore do not contribute to the national total. Chapter 7.1 provide a description of the volcanic eruptions in Iceland and the associated emissions.



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	2023	2024	Change		
										'90-'24	'05-'24	'23-'24
Geothermal Energy (1B2)	13.3	11.0	26.0	30.3	58.7	44.9	39.1	35.6	41.1	+209 %	+36%	+15.6 %
Primary Al Production (2C3)	1.34	1.36	2.94	3.41	9.93	11.5	9.8	10.53	10.5	+684 %	+207 %	-0.6%
Ferroalloys Production (2C2)	1.85	1.38	2.04	2.64	2.37	2.06	1.95	1.92	2.15	+17%	-18%	+12%
Other	6.44	7.78	3.95	3.49	2.90	1.64	0.338	0.309	0.34	-95%	-90%	+11%
Total [kt]	**22.9**	**21.5**	**35.0**	**39.8**	**73.9**	**60.0**	**51.2**	**48.3**	**54.1**	**+136 %**	**+36%**	**+11.9 %**

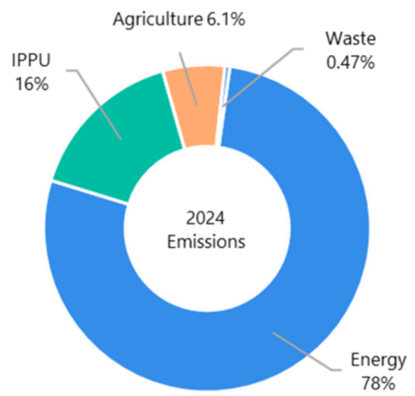
2.2.2 Trends in NO_x Emissions

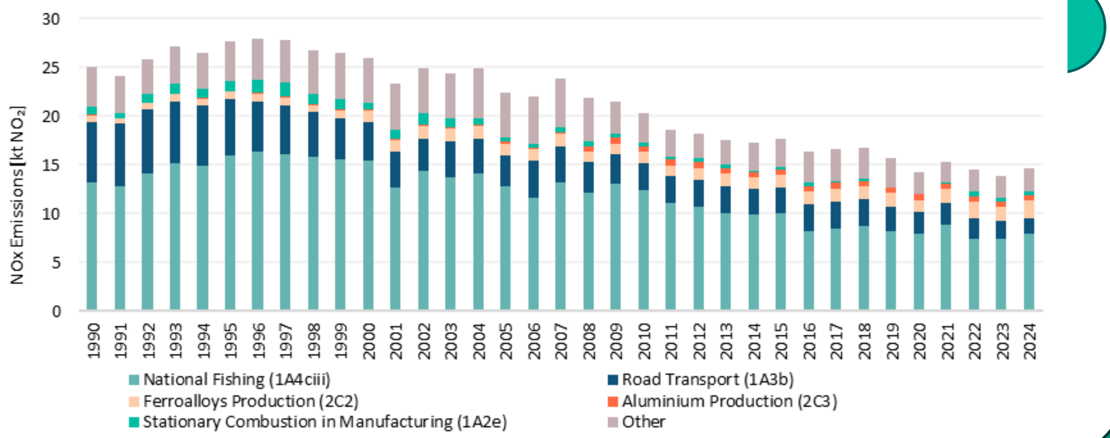
NO_x (NO_2)

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, and due to the transition to electromobility in recent years.

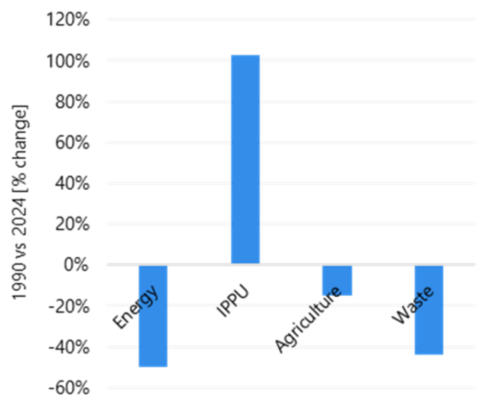
Total NO_x emissions: **15 kt**





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):** Most 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 lower 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 used 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. A significant factor in NO_x emission reductions in recent years is the transition to electromobility.
- **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	2023	2024	Change '90-'24	'05-'24	'23-'24
National Fishing (1A4ciii)	13.2	16.0	15.4	12.8	12.5	10.0	7.9	7.5	7.9	-40%	-38%	6.3%
Road Transport (1A3b)	6.19	5.74	3.89	3.22	2.77	2.66	2.18	1.83	1.62	-74%	-50%	-11.22%

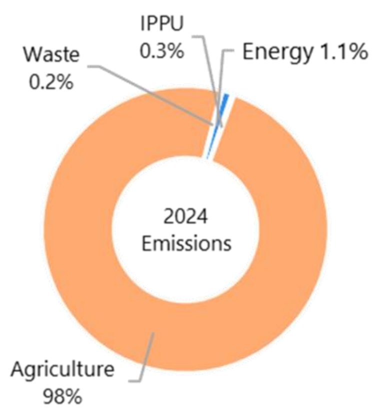
NO_x Emissions [kt NO_2]	1990	1995	2000	2005	2010	2015	2020	2023	2024	Change '90-'24	Change '05-'24	Change '23-'24
Ferroalloys Production (2C2)	0.69	0.79	1.20	1.22	1.12	1.30	1.30	1.45	1.77	+156%	+45%	22.3%
Aluminium Production (2C3)	0.061	0.069	0.13	0.15	0.55	0.55	0.53	0.56	0.56	+821%	+286%	-0.13%
Stationary Combustion in Manufacturing (1A2e)	0.85	1.01	0.75	0.44	0.37	0.30	0.11	0.29	0.43	-49%	-3%	47%
Other	4.03	4.14	4.54	4.57	3.04	2.88	2.13	2.26	2.36	-41%	-48%	4.2%
Total [kt]	**25.0**	**27.7**	**25.9**	**22.4**	**20.3**	**17.7**	**14.2**	**13.9**	**14.7**	**-41%**	**-34%**	**5.9%**

2.2.3 Trends in NH_3 Emissions

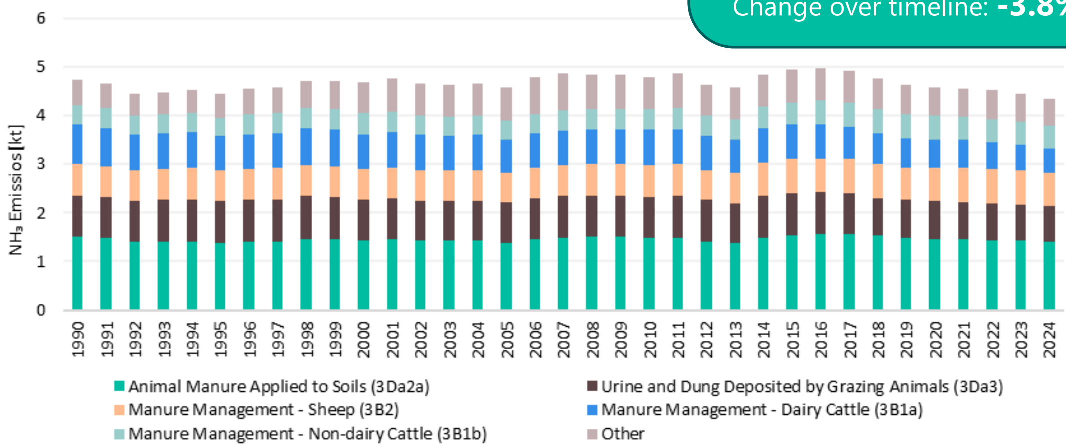
Ammonia (NH_3) emissions mostly originate from the Agriculture sector. Emissions have been fluctuating between 5 and 6 kt NH_3 since 1990. The main driver behind the general trend and its oscillations is the trend in livestock population and fertiliser use. There is also a small amount of NH_3 from other sources, including:

- **Road Transport (1A3b):** Catalytic converters cause a small amount of NH_3 emissions. Emissions peaked in 2003 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.

Total NH_3 emissions: **5.1 kt**

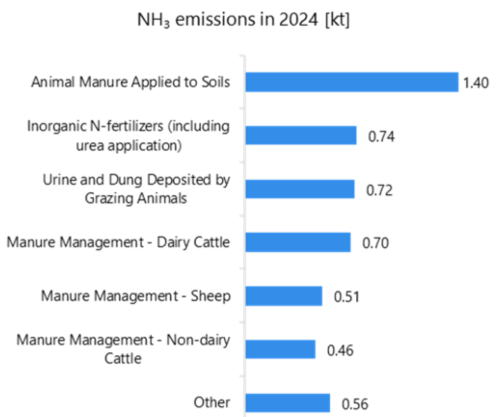


Change over timeline: **-3.8%**



Animal Manure Applied to Soils (3Da2), Manure Management (3B), Urine and Dung Deposited by Grazing Animals (3Da3), and Inorganic Fertiliser Application (3Da1) 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 around 80% of NH_3 emissions from manure management.



The trend overview for ammonia (NH_3) emissions is provided above. Emissions have been fluctuating between 5 and 6 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.
- **Inorganic Fertiliser Application (3Da1):** These emissions fluctuate due to fluctuations in fertiliser imports to Iceland.
- **Animal Manure Applied to Soils (3Da2a):** Mainly affected by the trend in livestock population as for 3B.
- **Urine and Dung Deposited by Grazing Animals (3Da3):** Mainly affected by the trend in livestock population as for 3B.

Table 2-5 NH_3 emissions by main sources since 1990 [kt].

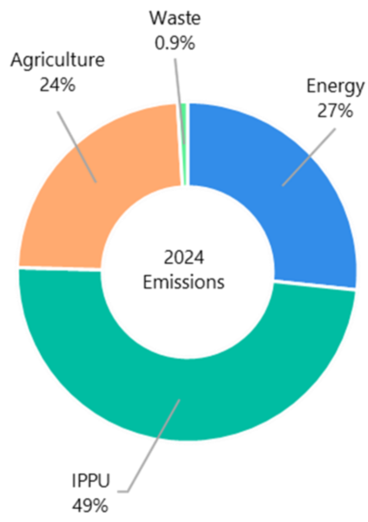
NH_3 Emissions [kt]	1990	1995	2000	2005	2010	2015	2020	2023	2024	Change		
										'90-'24	'05-'24	'23-'24
Animal Manure Applied to Soils (3Da2a)	1.51	1.38	1.44	1.39	1.47	1.54	1.46	1.43	1.40	-6.7%	1.0%	-1.5%
Urine and Dung Deposited by Grazing Animals (3Da3)	0.85	0.85	0.83	0.83	0.86	0.86	0.78	0.74	0.72	-15%	-13%	-2.9%
Manure Management - Sheep (3B2)	0.82	0.69	0.72	0.70	0.73	0.70	0.57	0.53	0.51	-38%	-27%	-3.9%
Manure Management - Dairy Cattle (3B1a)	0.64	0.64	0.62	0.60	0.64	0.71	0.68	0.70	0.70	8%	17%	-0.5%
Manure Management - Non-dairy Cattle (3B1b)	0.39	0.39	0.43	0.38	0.44	0.46	0.49	0.47	0.46	17%	21%	-1.5%
Inorganic N-fertilizers (3D11)	0.55	0.49	0.56	0.43	0.53	0.60	0.60	0.58	0.74	35%	72%	27%
Other	0.53	0.47	0.63	0.69	0.66	0.67	0.59	0.58	0.56	+5.7%	-19%	-2.9%
Total [kt]	**5.29**	**4.92**	**5.23**	**5.01**	**5.33**	**5.54**	**5.17**	**5.02**	**5.09**	**-3.8%**	**1.6%**	**1.4%**

2.2.4 Trends in NMVOC Emissions

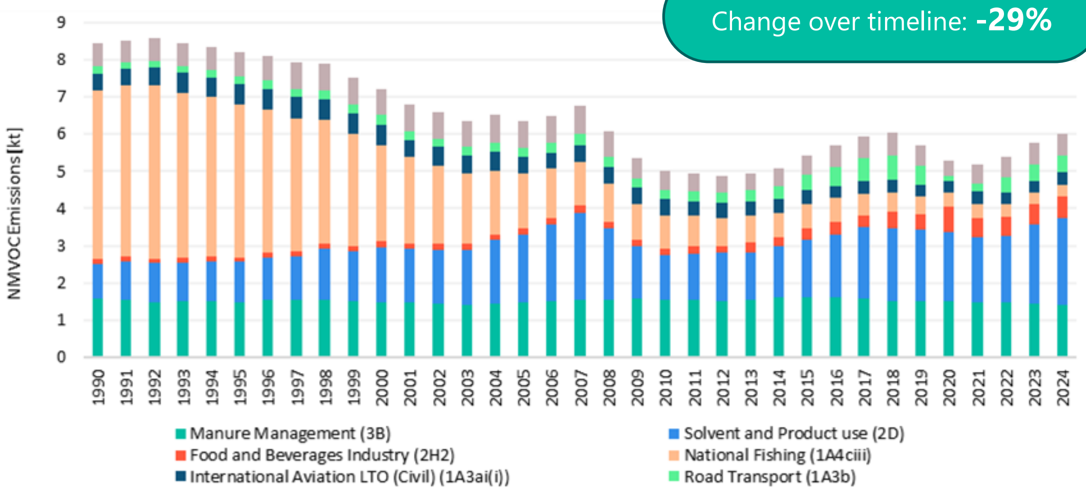
Many sources contribute to NMVOC emissions in Iceland. The main sources are:

- **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.
- **Solvent and Product Use (2D3):** The emissions are mainly from domestic solvent use and have increased steadily since 1990 due to its link to population size.
- **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 decrease in emissions over the timeline exists due to improved emissions-limiting technologies in newer vehicles and the trend towards electromobility.
- **National Fishing (1A4ciii):** Annual variations are inherent to the nature of fisheries, but improved technologies in newer vessels have led to a general decrease in emissions.
- **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.

Total NMVOC emissions: **6.0 kt**



Change over timeline: **-29%**



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.

- **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.
- **Solvent and Product Use (2D):** The emissions from solvent and product use have increased steadily over the timeline, partly due to increased population size in Iceland and consequent increased usage of solvents.
- **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, as well as the on-going transition to electric vehicles.
- **National Fishing (1A4ciii):** The decrease in emissions over the timeline is mainly due to a lower fuel consumption 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 years are around a third lower than the 1990 level. Annual variations are inherent to the nature of fisheries.
- **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.

Table 2-6 NMVOC emissions by main sources since 1990 [kt].

NMVOC Emissions [kt]	1990	1995	2000	2005	2010	2015	2020	2023	2024	Change		
										'90-'24	'05-'24	'23-'24
Manure Management (3B)	1.57	1.49	1.48	1.47	1.53	1.62	1.51	1.43	1.41	-10%	-4.1%	-1.4%
Solvent and Product use (2D)	0.95	1.07	1.49	1.82	1.22	1.55	1.87	2.15	2.33	+146%	+28%	8.1%
Food and Beverages Industry (2H2)	0.12	0.13	0.15	0.18	0.18	0.29	0.67	0.52	0.59	+411%	+230%	13%
National Fishing (1A4ciii)	0.46	0.56	0.55	0.45	0.44	0.37	0.31	0.30	0.32	-31%	-29%	7.1%
International Aviation LTO (Civil) (1A3ai(i))	0.18	0.21	0.26	0.26	0.25	0.40	0.16	0.46	0.47	+157%	+78%	1.8%

NMVOC Emissions [kt]	1990	1995	2000	2005	2010	2015	2020	2023	2024	Change		
										'90-'24	'05-'24	'23-'24
Road Transport (1A3b)	4.53	4.09	2.58	1.46	0.88	0.67	0.37	0.33	0.31	-93%	-79%	-4.9%
Other	0.62	0.64	0.71	0.70	0.50	0.51	0.40	0.57	0.57	-8%	-19%	-1.2%
Total [kt]	**8.42**	**8.18**	**7.21**	**6.34**	**4.99**	**5.41**	**5.29**	**5.76**	**5.99**	**-29%**	**-5.5%**	**4.0%**

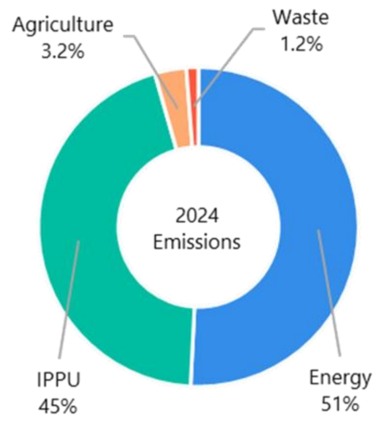
2.2.5 Trends in $PM_{2.5}$ Emissions

$PM_{2.5}$

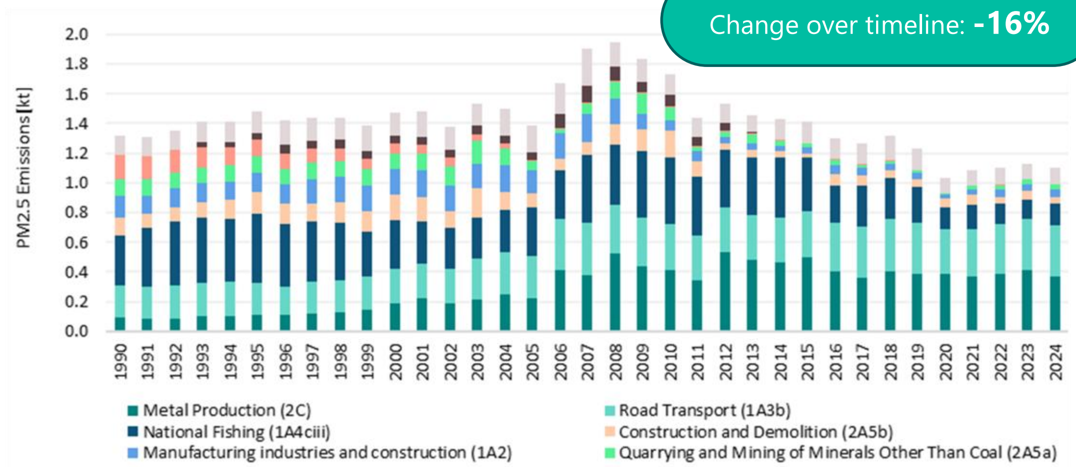
Emissions of $PM_{2.5}$ are dominated by the Energy and IPPU sectors; the main sources are:

- **Metal Production (2C):** Production capacity in the metal production sector has increased substantially.
- **Road Transport (1A3b):** An increasing trend in emissions until 2007 is followed by a relatively constant level of emissions in recent years. Annual 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 in recent years remain below 1990 levels, with 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.

Total $PM_{2.5}$ emissions: **1.1**

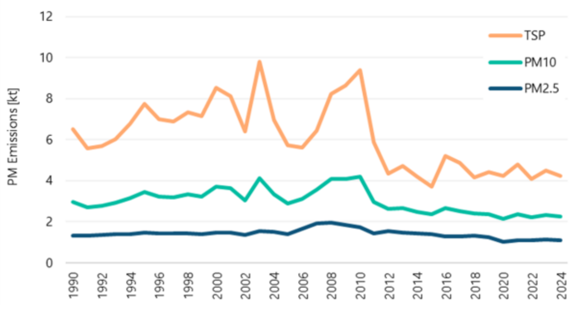


Change over timeline: **-16%**



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 lower 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):** PM emissions remained on approximately the same level throughout recent years. Annual fluctuations result from the combination of changes in the pollution control standards, increased fuel usage, and vehicle activity.
- **National Fishing (1A4ciii):** The decrease in emissions over the timeline is mainly due to decreasing 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 less than half of 1990 emission levels. 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	2023	2024	Change '90-'24	Change '05-'24	Change '23-'24
Metal production (2C)	95	108	188	219	411	496	385	415	373	+293%	+70%	-10%
Road Transport (1A3b)	212	220	230	290	308	311	306	339	338	+59%	+16.6%	-0.4%

$PM_{2.5}$ Emissions [t]	1990	1995	2000	2005	2010	2015	2020	2023	2024	Change '90-'24	Change '05-'24	Change '23-'24
National Fishing (1A4ciii)	340	461	329	324	452	360	143	136	146	-57%	-55%	7%
Construction and Demolition (2A5b)	123	153	175	93	185	29	62	58	51	-59%	-45%	-13%
Quarrying and Mining of Minerals Other Than Coal (2A5a)	109	109	103	57	89	22	6.8	28	28	-74%	-51%	0%
Manufacturi ng industries and construction (1A2)	147	126	170	160	65	45	25	46	52	-65%	-68%	13%
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	0.05	0.00	-100%	-100%	-100%
Other	132	149	150	174	142	139	109	99	111	-16%	-36%	11.5%
Total [t]	**1,319**	**1,483**	**1,469**	**1,382**	**1,734**	**1,409**	**1,037**	**1,128**	**1,105**	**-16%**	**-20%**	**-2.1%**

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 2-9Table 2- 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	2023	2024	Change '90-'24	Change '05-'24	Change '23-'24
Construction and Demolition (2A5b)	1.23	1.53	1.75	0.93	1.85	0.29	0.62	0.58	0.51	-59%	-45%	-13%
Road Transport (1A3b)	0.32	0.33	0.36	0.46	0.50	0.52	0.54	0.61	0.61	+91%	+33%	0.2%
Metal production (2C)	0.17	0.20	0.32	0.37	0.59	0.72	0.52	0.61	0.55	+219%	+51%	-9%
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%

PM_{10} Emissions [kt]	1990	1995	2000	2005	2010	2015	2020	2023	2024	Change '90-'24	Change '05-'24	Change '23-'24
National Fishing (1A4ciii)	0.40	0.54	0.39	0.38	0.53	0.42	0.17	0.16	0.17	-57%	-55%	7%
Fireworks (2G)	0.011	0.014	0.038	0.064	0.049	0.060	0.049	0.044	0.064	+464%	+0.7%	45%
Open Burning of Waste (5C2)	0.17	0.12	0.073	0.011	8.2E-3	7.7E-3	9.2E-4	7.7E-3	7.7E-3	-96%	-27%	0%
Other	0.37	0.42	0.49	0.51	0.41	0.27	0.24	0.26	0.26	-29%	-48%	3.4%
Total [kt]	**2.98**	**3.47**	**3.70**	**2.89**	**4.19**	**2.35**	**2.16**	**2.35**	**2.26**	**-24%**	**-22%**	**-3.8%**

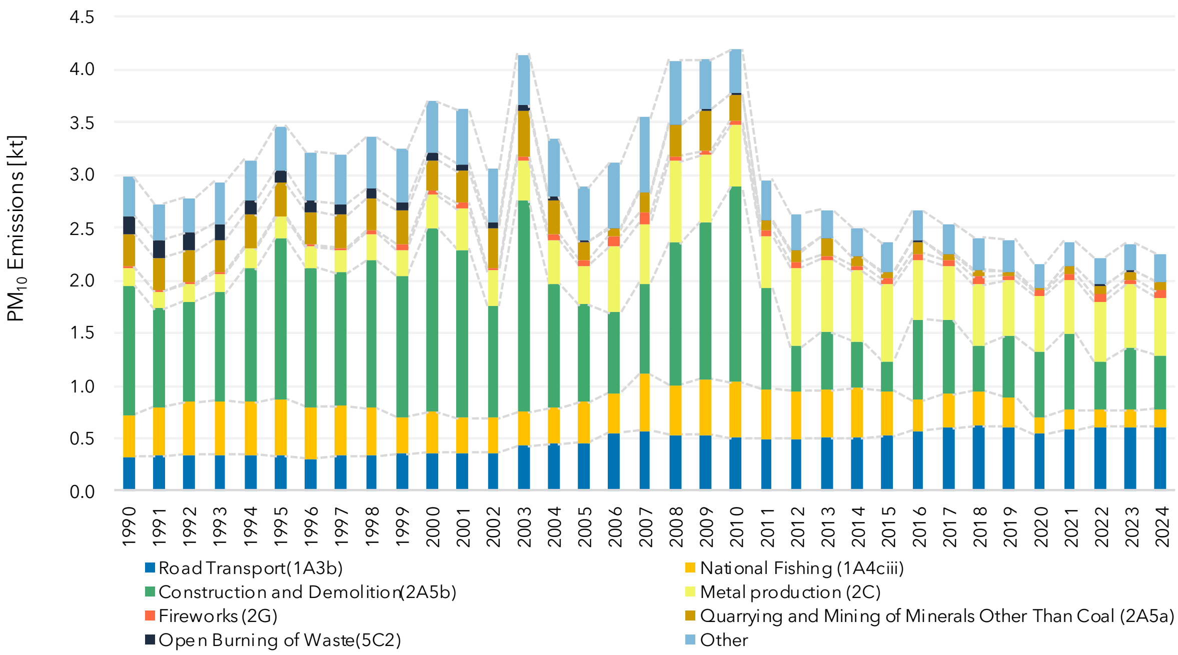


Figure 2.1 PM_{10} emissions by sector, since 1990.

Table 2-9 TSP emissions by main sources since 1990 [kt].

TSP Emissions [kt]	1990	1995	2000	2005	2010	2015	2020	2023	2024	Change '90-'24	Change '05-'24	Change '23-'24
Construction and Demolition (2A5b)	4.11	5.11	5.85	3.10	6.19	0.96	2.08	1.94	1.69	-59%	-45%	-13%
Road Transport (1A3b)	0.52	0.54	0.59	0.77	0.86	0.91	0.97	1.12	1.12	+118%	+45%	0.6%
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	0.73	0.66	+221%	+51%	-9%
National Fishing (1A4ciii)	0.40	0.54	0.39	0.38	0.53	0.42	0.17	0.16	0.17	-57%	-55%	7%
Other	0.63	0.65	0.71	0.69	0.58	0.41	0.36	0.38	0.41	-36%	-41%	8%
Total [kt]	**6.51**	**7.73**	**8.53**	**5.73**	**9.39**	**3.70**	**4.24**	**4.49**	**4.22**	**-35%**	**-26%**	**-6%**

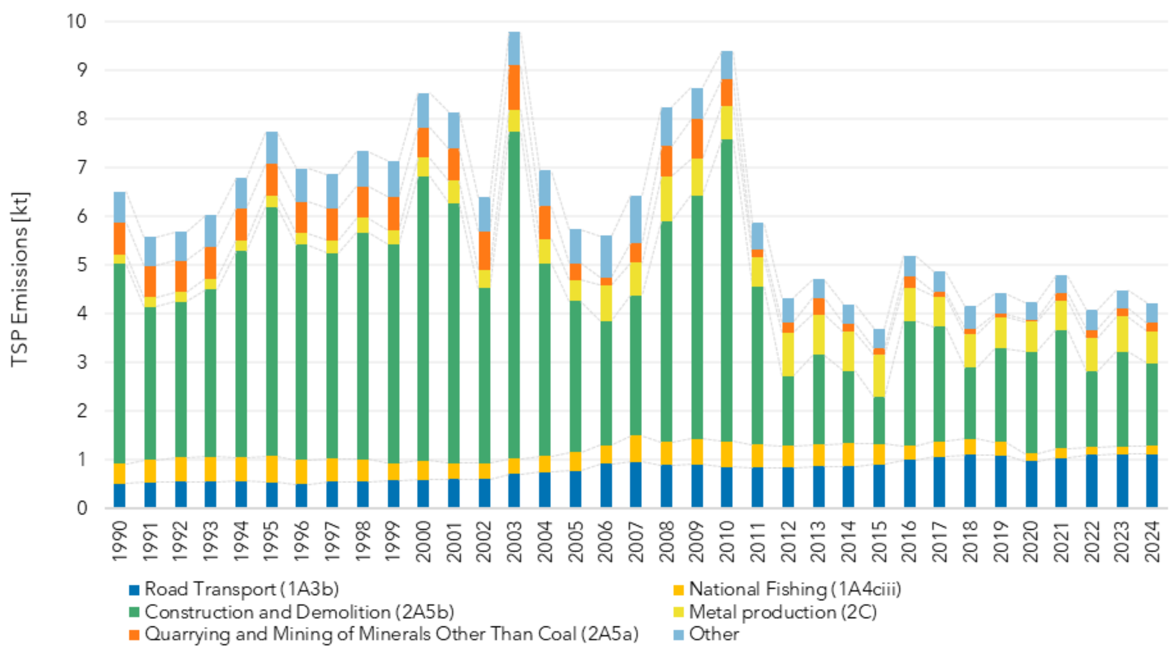


Figure 2.2 TSP emissions by sector, since 1990.

2.2.6 Trends in BC (Black Carbon) Emissions

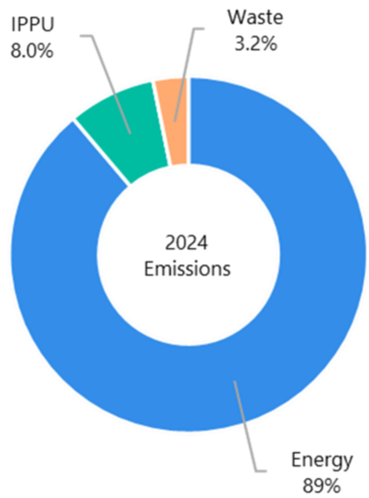
BC

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:

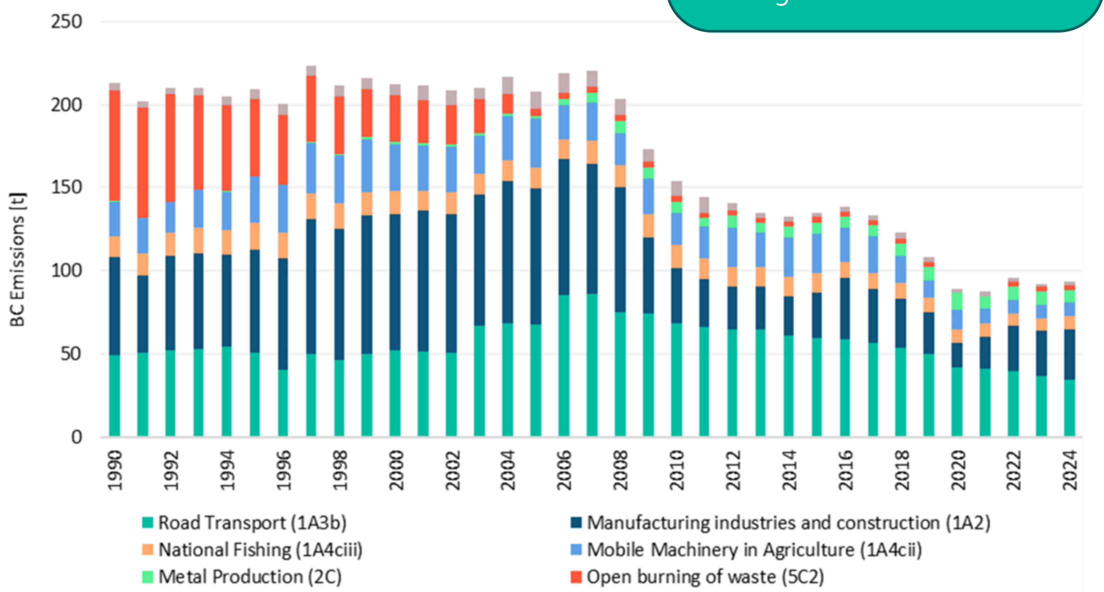
- **Road Transport (1A3b)**
- **Manufacturing Industries and Construction (1A2)**
- **Fishing (1A4ciii)**
- **Mobile Machinery in Agriculture (1A4cii)**

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.

Total BC emissions: **94 kt**



Change over timeline: **-56%**



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 lower 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 BC emissions can be observed since they peaked in 2007, in recent years mostly driven by fleet turnover and the on-going shift to electric propulsion. Annual fluctuations 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 fleet turnover and lower fuel consumption within the fishing fleet. Annual fluctuations, including the slight increase in the most recent years, are sector inherent.
- **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 in 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	2023	2024	Change		
										'90-'24	'05-'24	'23-'24
Road Transport (1A3b)	49	51	52	68	69	60	42	37	34	-30%	-49%	-6.80%
Mobile Machinery in Agriculture (1A4cii)	21	28	28	29	19	24	12.3	8.2	8.1	-61%	-72%	-0.8%

BC Emissions [t]	1990	1995	2000	2005	2010	2015	2020	2023	2024	Change		
										'90-'24	'05-'24	'23-'24
Manufacturing industries and construction (1A2)	59	62	82	82	33	27	15	27	31	-48%	-62%	12%
National Fishing (1A4ciii)	13	16	14	12	14	12	7.5	7.2	7.7	-40%	-38%	7%
Metal production (2C)	0.15	0.17	1.13	1.8	6.8	6.7	9.9	8.0	7.3	+4820%	+304%	-9%
Open burning of waste (5C2)	67	47	28	4.1	3.2	3.0	0.36	2.99	3.0	-96%	-27%	0%
Other	3.8	6	7	10	9	2.7	2.1	1.7	2.5	-35%	-76%	48%
Total [t]	**213**	**209**	**212**	**207**	**154**	**135**	**89**	**92**	**94**	**-56%**	**-55%**	**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 a shift from petrol to Diesel in passenger cars as well as advances in pollution control equipment in vehicles. Road transport has been contributing only a small percentage to the total CO emissions in recent years.
- **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	2023	2024	Change '90-'24	Change '05-'24	Change '23-'24
Aluminium Production (2C3)	11	12	27	33	98	103	100	104	102	+869%	+212%	-1.69%
Road Transport (1A3b)	39	32	19	12	7.5	5.7	2.4	1.9	1.8	-95%	-85%	-7.4%
National Fishing (1A4ciii)	1	1	1	1	1.0	0.9	0.7	0.7	0.7	-31%	-30%	7.1%
Manufacturing Industries and Construction (1A2)	0.84	0.64	0.91	0.85	0.33	0.20	0.11	0.21	0.23	-72%	-72%	10%
Open Burning of Waste (5C2)	2.12	1.48	0.90	0.13	0.10	0.09	0.01	0.09	0.09	-96%	-27%	0%
Other	1.0	1.1	1.3	1.3	1.0	1.0	0.9	0.9	0.9	-16%	-34%	-3.1%
Total [kt]	**54**	**48**	**51**	**48**	**108**	**111**	**104**	**108**	**106**	**+95%**	**+120%**	**-1.73%**

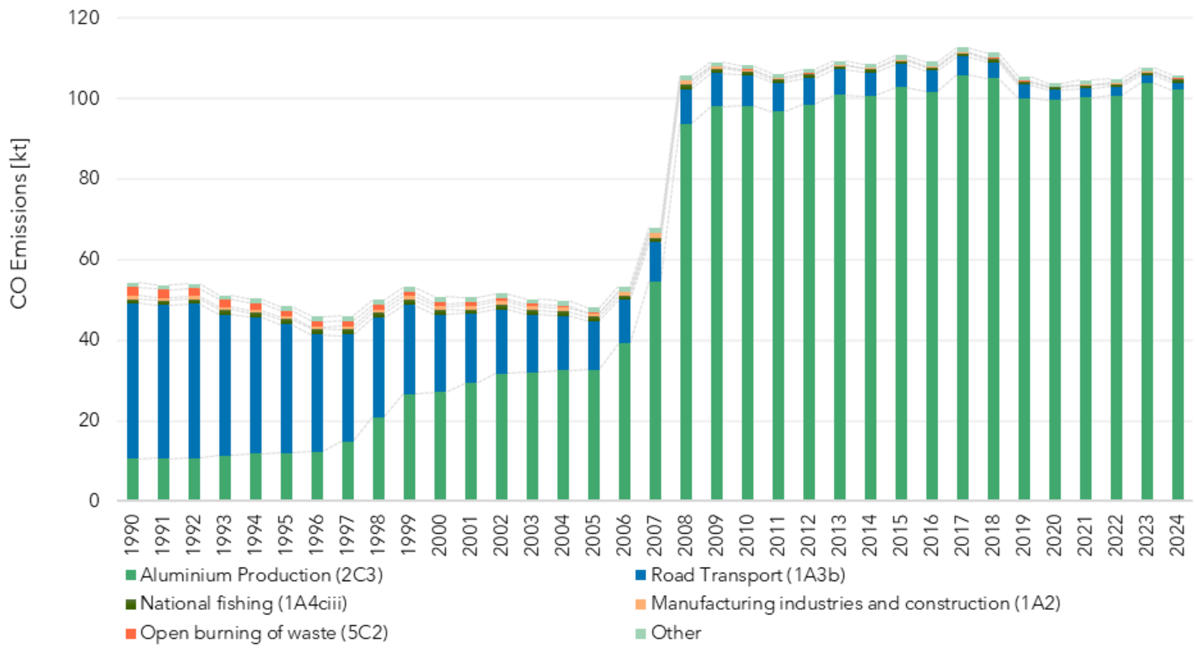


Figure 2.3 CO emissions by sector, since 1990.

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 2024.

Year	Dioxin [g I-TEQ]	PAH4 [t]	HCB [kg]	PCB [kg]
1990	10.73	0.594	0.268	0.300
2024	0.736	0.093	0.124	0.018
Change 1990-2024	-93%	-84%	-54%	-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, since 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):** Accidental building and vehicle fires. 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.
- **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	2023	2024	Change		
										'90-'24	'05-'24	'23-'24
Open Burning of Waste (5C2)	10	6.8	2.8	0.15	0.12	0.10	0.012	0.10	0.10	-99%	-33%	0%
Clinical Waste Incineration (5C1biii)	NO	NO	NO	0.078	0.033	0.11	0.16	0.22	0.22	-	184%	-0.3%
Metal production (2C)	0.014	0.016	0.027	0.030	0.047	0.064	0.11	0.21	0.16	1081%	436%	-24%
Road Transport (1A3b)	0.068	0.073	0.085	0.09	0.09	0.075	0.045	0.034	0.030	-55%	-65%	-11%
National Fishing (1A4ciii)	0.043	0.057	0.044	0.041	0.053	0.043	0.021	0.020	0.021	-51%	-49%	7.1%
Public Electricity and Heat Generation (1A1a)	3.3E-4	0.38	0.39	0.38	0.29	3.9E-5	1.8E-5	7.4E-5	1.0E-4	-68%	-100%	41%
Accidental Fires (5E)	0.085	0.085	0.085	0.14	0.11	0.070	0.11	0.17	0.15	80%	11%	-8.8%
Other	0.026	0.16	0.18	0.11	0.074	0.024	0.036	0.041	0.045	75%	-60%	9.1%
Total [g I-TEQ]	**11**	**7.6**	**3.6**	**1.0**	**0.83**	**0.49**	**0.50**	**0.80**	**0.74**	**-93%**	**-28%**	**-8.0%**

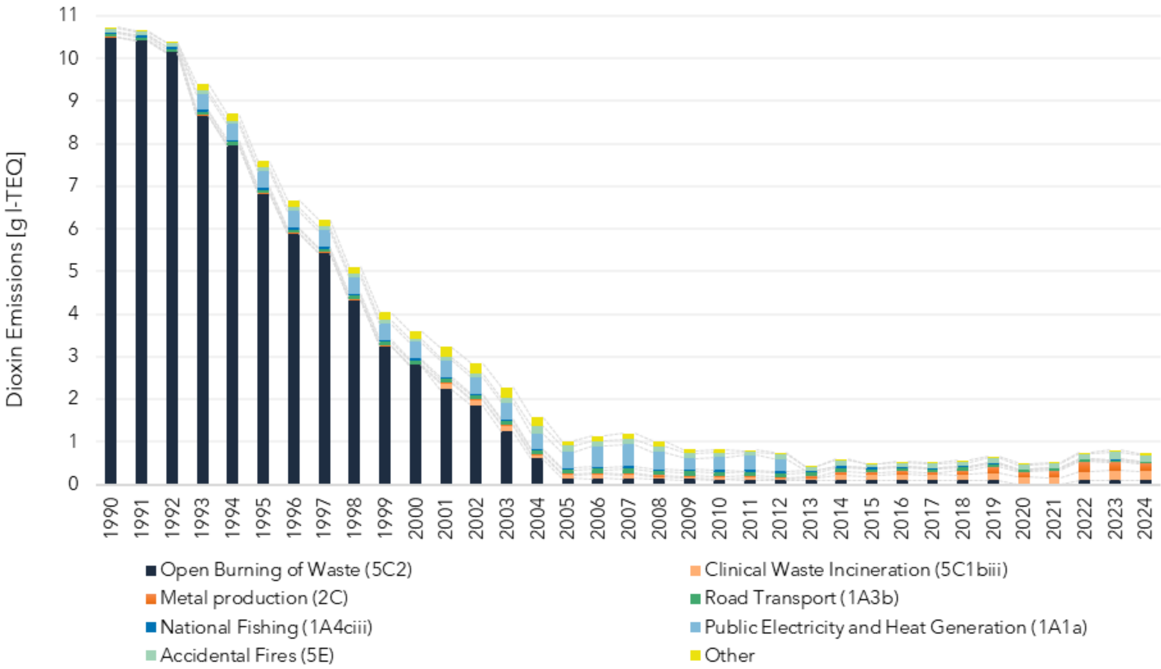


Figure 2.4 Dioxin emissions by main sources since 1990 [g I-TEQ].

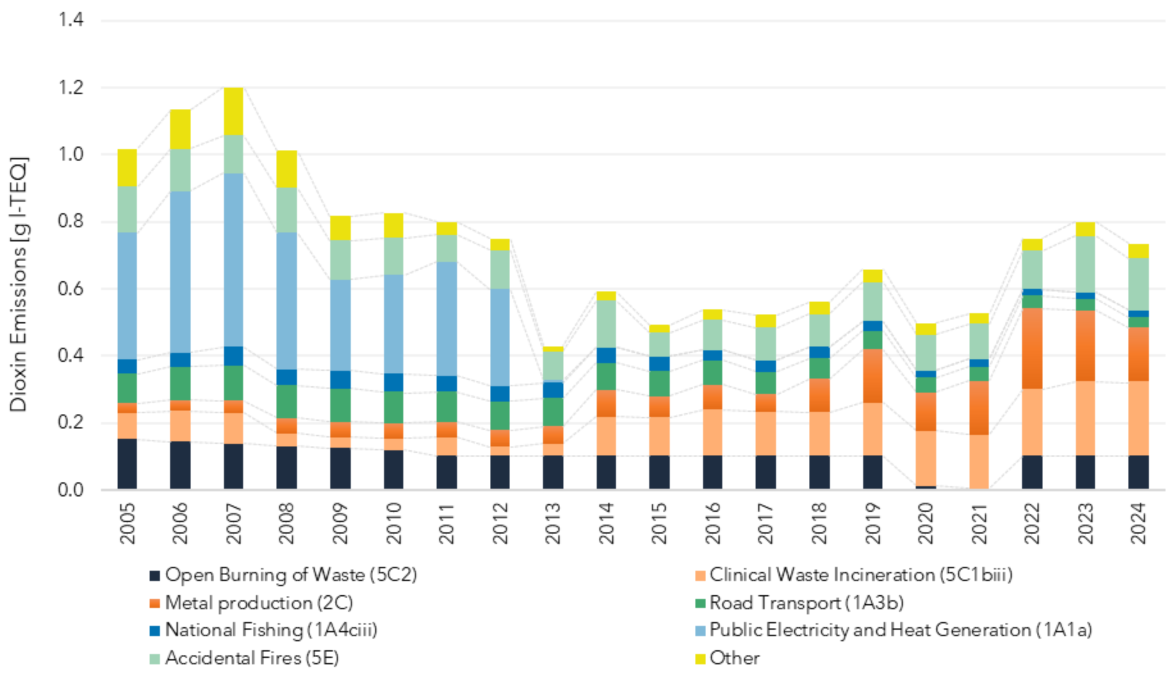


Figure 2.5 Dioxin emissions by main sources since 2005 [g I-TEQ].

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), Road Transport (1A3b), Aluminium Production (2C3), and Ferroalloys Production (2C2).

PAH4 emissions in Iceland have been 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 0 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 and have assumed a largely constant level starting from 2017. Reasons for the trend in the past is an increase in vehicle kilometres travelled and a 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	2023	2024	Change '90-'24	Change '05-'24	Change '23-'24
Open Burning of Waste (5C2)	0.49	0.34	0.21	0.033	0.025	0.024	2.8E-3	0.024	0.024	-95%	-27%	0%
Stationary Combustion: Non-metallic Minerals (1A2f)	0.070	0.033	0.050	0.038	0.014	9.2E-8	1.1E-7	1.2E-7	1.4E-7	-100%	-100%	18%
Aluminium Production (2C3)	2.0E-3	2.2E-3	4.8E-3	5.8E-3	0.016	0.017	0.016	0.017	0.017	759%	192%	-1.8%
Ferroalloys Production (2C2)	9.0E-3	0.010	0.016	0.016	0.015	0.017	0.015	0.016	0.017	90%	7.7%	10%
Road Transport (1A3b)	7.5E-3	7.3E-3	7.3E-3	0.010	0.012	0.015	0.019	0.020	0.020	163%	103%	-2.1%

PAH4 Emissions [t]	1990	1995	2000	2005	2010	2015	2020	2023	2024	Change '90-'24	Change '05-'24	Change '23-'24
Accidental Fires (5E)	5.6E-3	5.7E-3	5.2E-3	5.8E-3	4.5E-3	6.2E-3	5.2E-3	7.1E-3	7.6E-3	35%	30%	6.4%
Other	0.013	0.016	0.015	0.015	0.013	1.4E-2	7.3E-3	8.2E-3	8.0E-3	-37%	-45%	-1.9%
Total [t]	**0.59**	**0.41**	**0.31**	**0.12**	**0.100**	**0.093**	**0.066**	**0.092**	**0.093**	**-84%**	**-24%**	**1.3%**

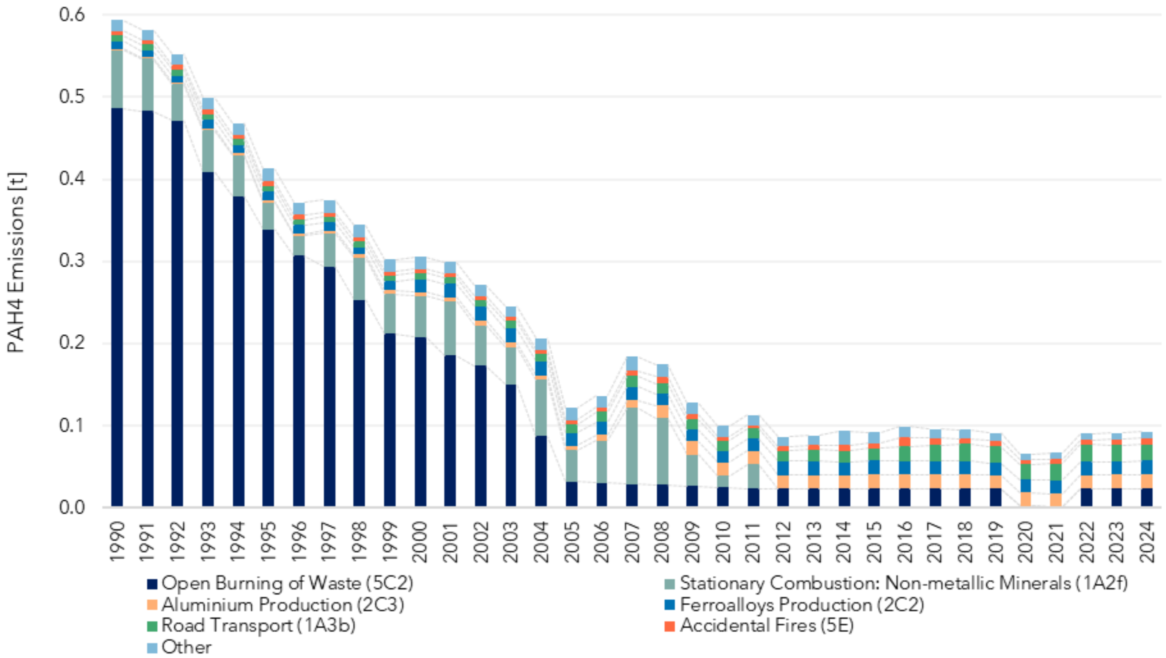


Figure 2.6 PAH emissions by sector, since 1990.

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 2023 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 (fleet turnover, 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.

Table 2-15 HCB emissions by main sources since 1990 [kg].

HCB Emissions [kg]	1990	1995	2000	2005	2010	2015	2020	2023	2024	Change		
										'90-'24	'05-'24	'23-'24
Fireworks (2G)	0.12	0.14	0.39	0.65	0.50	0.32	0.023	0.021	0.030	-74%	-95%	45%
Clinical Waste Incineration (5C1biii)	NO	NO	NO	0.020	8.3E-3	0.029	0.041	0.056	0.056	-	184%	-0.32%
National Fishing (1A4ciii)	0.021	0.027	0.024	0.021	0.022	0.019	0.013	0.012	0.013	-39%	-37%	7.1%
Aluminium Production (2C3)	NA	NA	NA	0.011	0.010	0.011	0.011	0.019	0.018	-	57%	-9.5%
Open Burning of Waste (5C2)	0.13	0.085	0.048	3.8E-4	2.9E-4	1.5E-4	1.8E-5	1.5E-4	1.5E-4	-100%	-60%	0%
Other	2.7E-3	0.013	0.016	0.016	0.020	3.4E-3	6.1E-3	6.6E-3	7.2E-3	162%	-55%	9.3%
Total [kg]	**0.27**	**0.27**	**0.47**	**0.72**	**0.56**	**0.38**	**0.094**	**0.12**	**0.12**	**-54%**	**-83%**	**7.6%**

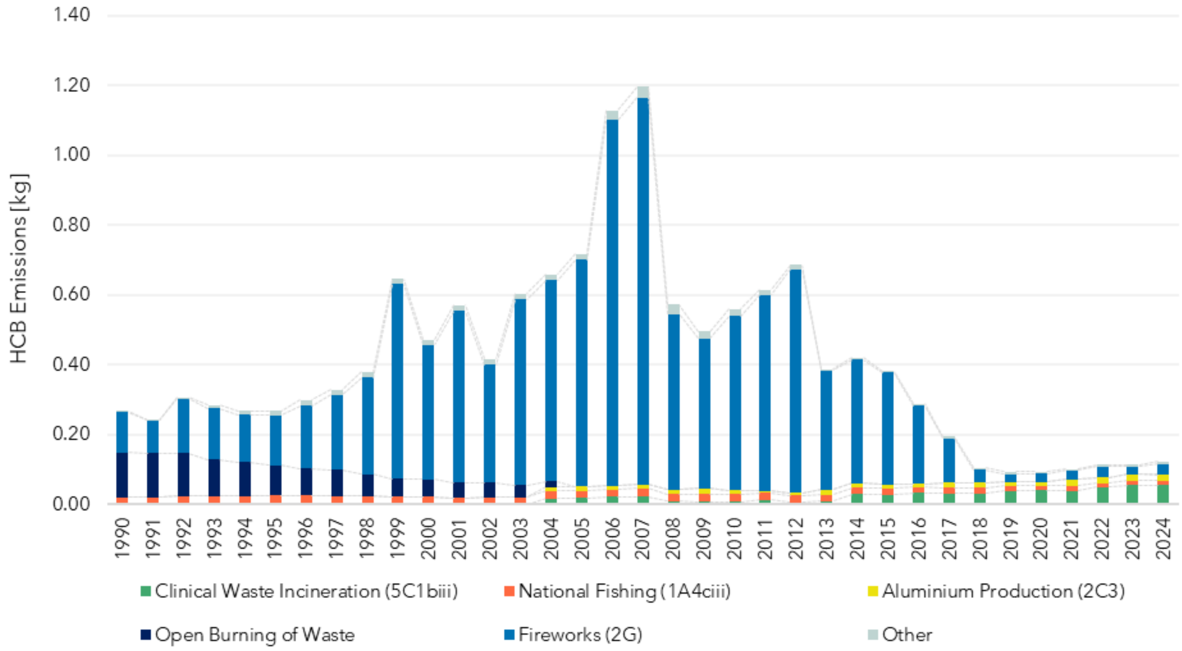


Figure 2.7 HCB emissions by sector, since 1990.

Hexachlorobenzene (HCB) or perchlorobenzene is a chlorocarbon with the molecular formula C_6Cl_6. 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 a probable human carcinogen and 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 most 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 (fleet turnover, 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 0 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	2023	2024	Change		
										'90-'24	'05-'24	'23-'24
Clinical Waste Incineration (5C1biii)	NO	NO	NO	3.9E-3	1.7E-3	5.7E-3	8.2E-3	0.011	0.011	-	184%	-0.32%
National Fishing (1A4ciii)	0.028	0.041	0.022	0.026	0.046	0.035	6.0E-3	5.8E-3	6.2E-3	-78%	-76%	7.1%
Open Burning of Waste (5C2)	0.19	0.13	0.071	2.6E-4	2.5E-4	1.8E-6	2.2E-7	1.8E-6	1.8E-6	-100%	-99%	0%
Stationary Combustion: Non-metallic Minerals (1A2f)	0.082	0.038	0.058	0.043	0.016	NA	NA	NA	NA	-	-	-
Heat Plants (1A1aiii)	NA	0.025	0.032	0.032	0.043	NA	NO	NA	NO	-	-	-
Secondary Steel Production (2C1)	NO	NO	NO	NO	NO	0.011	NO	NO	NO	-	-	-
Other	2.6E-3	5.4E-3	3.6E-3	4.0E-3	3.9E-3	0.012	7.1E-4	6.9E-4	6.7E-4	-74%	-83%	-2.8%
Total [kg]	**0.30**	**0.24**	**0.19**	**0.11**	**0.11**	**0.053**	**0.015**	**0.018**	**0.018**	**-94%**	**-84%**	**2.0%**

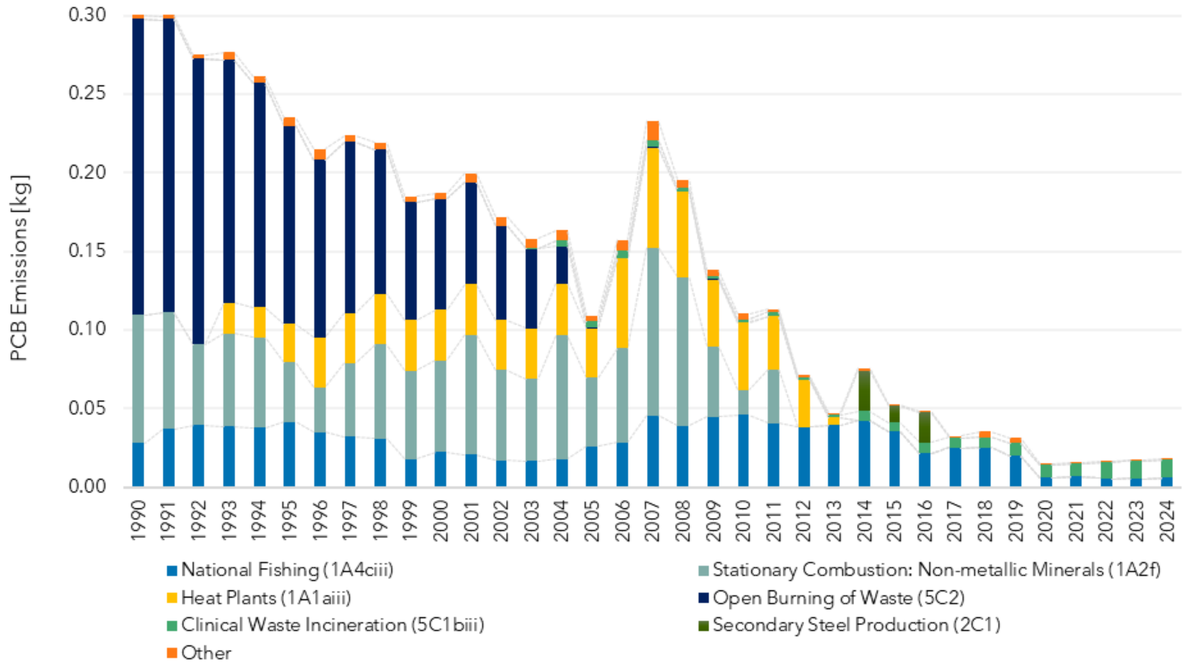


Figure 2.8 PCB emissions by sector, since 1990.

2.4 Emission Trends for Heavy Metals

Emission estimates for 1990 and 2024 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, for which National Fishing is the largest source of emissions.

Table 2-17 Estimated emissions of heavy metals, 1990 and 2024.

	Pb [t]	Cd [t]	Hg [t]	As [t]	Cr [t]	Cu [t]	Ni [t]	Se [t]	Zn [t]
1990	2.99	0.022	0.140	0.071	0.13	1.92	1.72	0.035	2.35
2024	0.86	0.135	0.011	0.145	0.26	3.94	1.90	0.021	6.07
Change 1990-2024	-71%	500%	-92%	106%	97%	105%	11%	-39%	159%

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

Pb, Cd and Hg emissions in Iceland originate mainly from the subsectors described below. The Pb emissions from the main sources can be seen in Table 2-18 and Figure 2.9. The Cd emissions from the main sources can be seen in Table 2-19 and Figure 2.10. The Hg emissions from the main sources are reported in Table 2-20 and Figure 2.11.

- **Road Transport (1A3b):** Road Transport contributes close to 50% of current Pb and around 20% of Hg emission totals. After the phase-out of leaded petrol in the 1990s. Pb emissions stem mainly from tyre and brake wear and have increased over the timeline since 1997 due to a growing car fleet. The Hg emissions have steadily 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. After emissions peaked in 1998, a steady decrease can be reported 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 1996, Hg emissions have been following a generally decreasing trend, but with fluctuations due to varying conditions in the fishing industry (fleet turnover, 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	2023	2024	Change		
										'90-'24	'05-'24	'23-'24
Fireworks (2G)	0.089	0.11	0.30	0.50	0.22	0.029	0.024	0.022	0.031	-65%	-94%	+45%
Road transport: Automobile tyre and brake wear (1A3bvi)	0.19	0.20	0.23	0.29	0.33	0.36	0.38	0.41	0.40	+116%	+37%	-0.9%
Accidental Fires (5E)	0.056	0.058	0.051	0.053	0.041	0.065	0.049	0.064	0.071	+27%	+35%	+10.9%
Stationary Combustion: Non-metallic Minerals (1A2f)	0.064	0.030	0.046	0.034	0.013	4E-7	4E-7	5E-7	6E-7	-100%	-100%	+18.0%
Heat Plants (1A1aiii)	6E-4	0.48	0.63	0.62	0.84	3E-5	NO	3E-4	NO	-	-	-
Domestic Aviation LTO (Civil) (1A3aii(i))	0.26	0.22	0.31	0.30	0.20	0.11	0.20	0.13	0.10	-62%	-67%	-26.2%
Aluminium Production (2C3)	0.02	0.02	0.04	0.05	0.16	0.17	0.16	0.17	0.17	+869%	+212%	-1.69%
Other	2.59	1.09	0.61	0.60	0.52	0.40	0.44	0.38	0.35	-87%	-42%	-9.1%
Total [t]	**2.99**	**2.0**	**1.9**	**2.1**	**2.0**	**0.86**	**0.89**	**0.88**	**0.86**	**-71%**	**-59%**	**-2.5%**

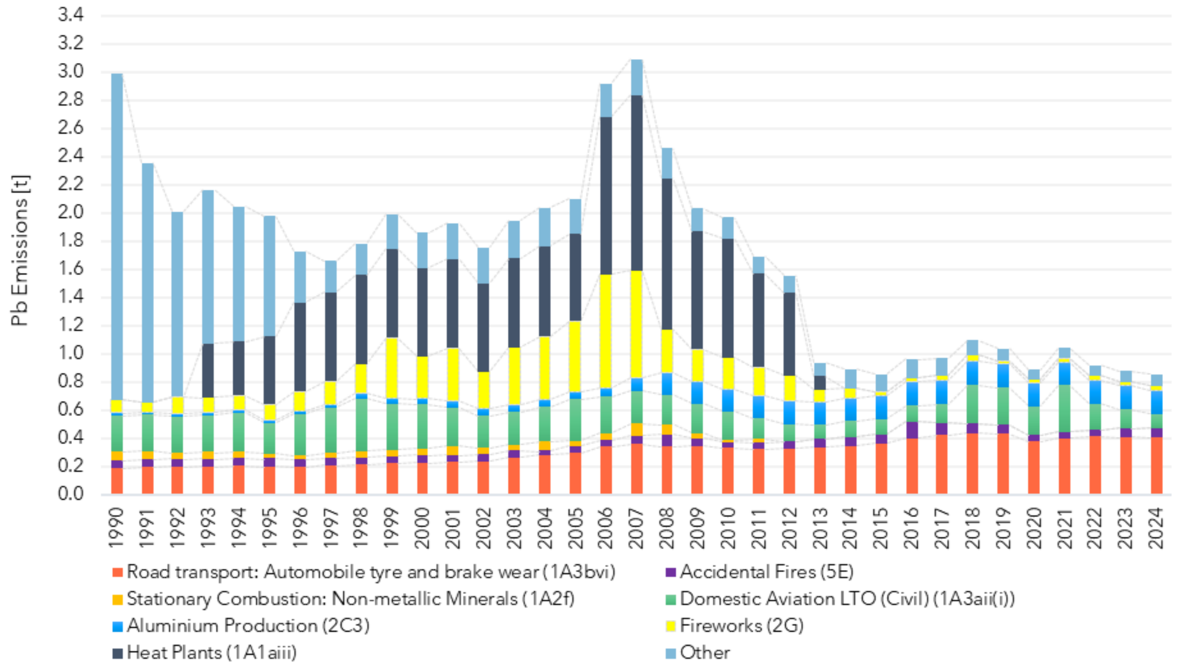


Figure 2.9 Pb emissions by sector, since 1990.

Table 2-19 Cd emissions by main sources since 1990 [kg].

Cd Emissions [kg]	1990	1995	2000	2005	2010	2015	2020	2023	2024	Change '90-'24	Change '05-'24	Change '23-'24
Aluminium Production (2C3)	13	15	34	40	121	127	123	128	126	+869%	+212%	-1.69%
National Fishing (1A4ciii)	2.7	3.5	3.0	2.7	3.0	2.5	1.6	1.5	1.6	-41%	-39%	+7%
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	0.08	NO	-	-	-
Other	2.7	4.0	5.2	5.8	4.4	4.4	4.4	4.1	6.7	+144%	+16%	+64%
Total [kg]	**22**	**41**	**64**	**69**	**157**	**134**	**129**	**134**	**135**	**+500%**	**+94%**	**+0.4%**

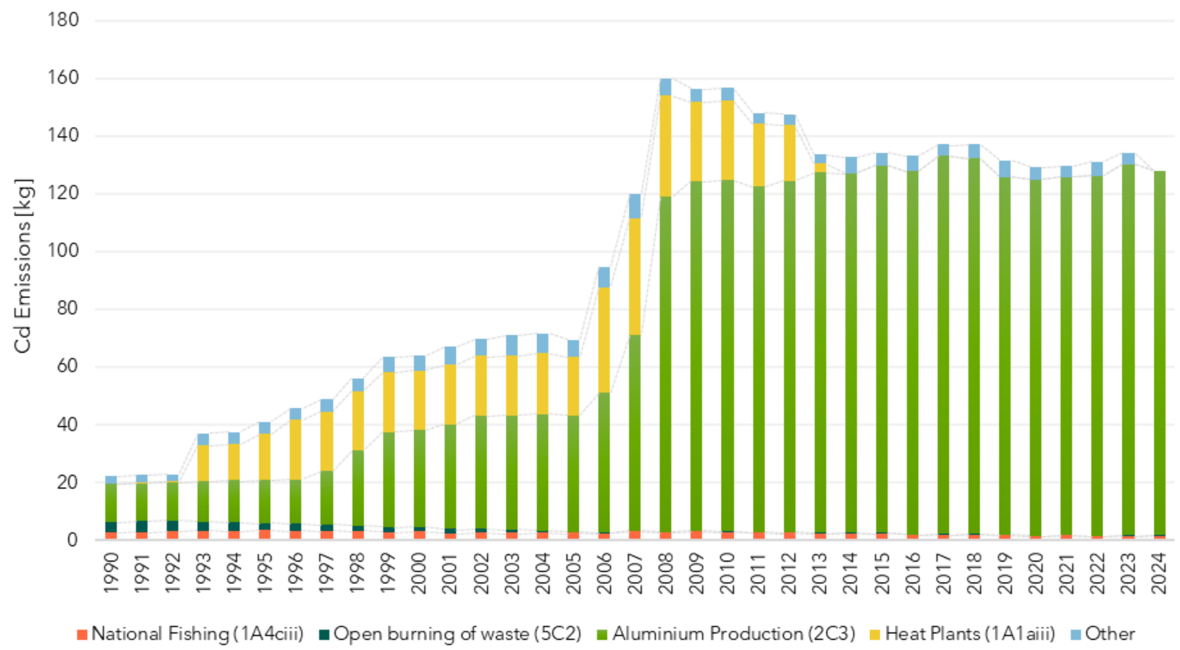


Figure 2.10 Cd emissions by sector, since 1990.

Table 2-20 Hg emissions by main sources since 1990 [kg].

Hg Emissions [kg]	1990	1995	2000	2005	2010	2015	2020	2023	2024	Change		
										'90-'24	'05-'24	'23-'24
National Fishing (1A4ciii)	6.8	8.1	8.2	6.7	6.1	5.3	4.8	4.6	4.9	-28%	-27%	+7%
Road Transport (1A3b)	1.3	1.4	1.5	1.8	1.9	1.9	1.8	2.0	2.0	+56%	+13%	+0.2%
Cremation (5C1bv)	0.19	0.25	0.32	0.52	0.67	0.94	1.5	1.7	1.8	+873%	+249%	+5%
Clinical waste incineration (5C1biii)	NO	NO	NO	0.32	0.13	0.46	0.67	0.90	0.90	-	+184%	-0.3%
Heat Plants (1A1aiii)	0.041	13	17	17	23	0.002	NO	8.4E-2	NO	-	-	-
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	7.4	7.9	-41%	-44%	+7.6%
Total [kg]	**140**	**112**	**81**	**32**	**35**	**12**	**9.5**	**10**	**11**	**-92%**	**-67%**	**+5.5%**

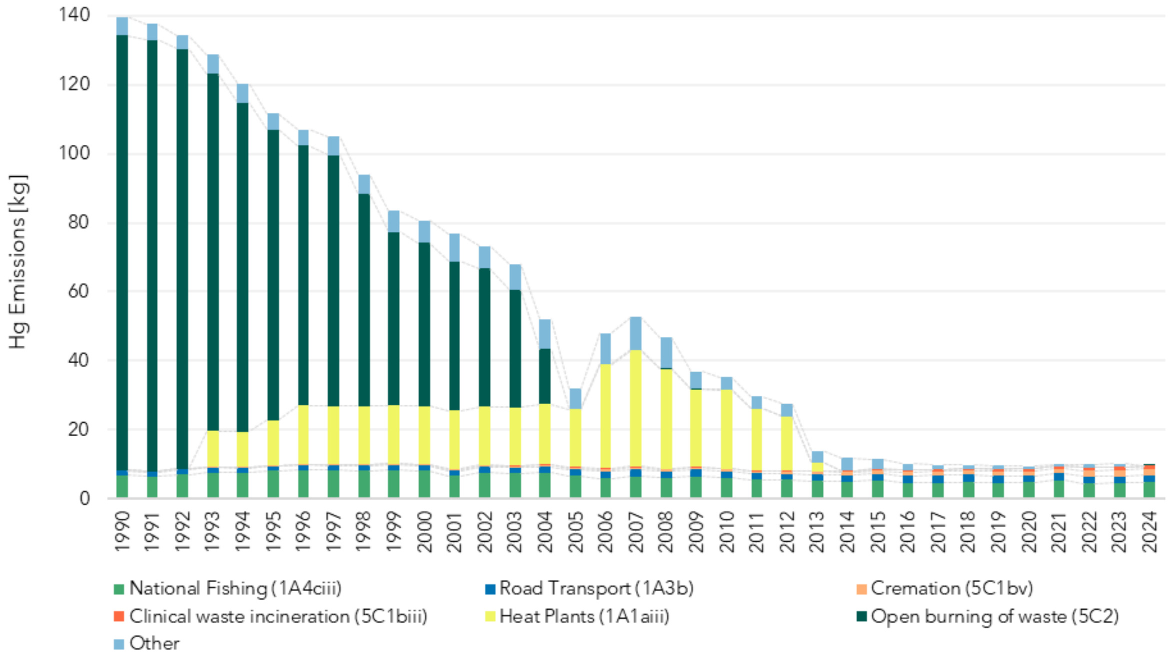


Figure 2.11 Hg emissions by sector, since 1990.

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. Se emissions have been following a generally decreasing trend after they peaked in 1995, while As and Ni emissions drastically decreased after reaching their maxima in 2010. Emission levels of all pollutants are subject to fluctuations due to varying conditions in the fishing industry (fleet turnover, 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 associated with tyre and brake wear. The emissions have increased over the timeline due to an increased driving activity 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 further contributor to the Cr, Ni and Se emissions is National Navigation, with maxima in 2007. A decrease in emissions in

recent years is in parts related to the factual ban[7] 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	2023	2024	Change		
										'90-'24	'05-'24	'23-'24
National Fishing (1A4ciii)	32	48	25	30	54	41	6.4	6.1	6.5	-80%	-78%	+7%
Road Transport (1A3b)	2.2	2.4	2.7	3.4	3.8	4.2	4.3	4.7	4.7	+116%	+37%	-0.8%
Aluminium Production (2C3)	13	15	35	42	125	131	127	133	130	+869%	+212%	-1.7%
Heat Plants (1A1aiii)	0.48	10	13	13	17	0.02	NO	0.11	NO	-	-	-
Open burning of waste (5C2)	16	11	6.6	1.0	0.75	0.70	0.08	0.70	7E-04	-100%	-100%	-100%
Other	6.5	7.2	5.9	6.0	5.7	5.6	3.6	2.4	3.5	-47.1%	-42.5%	+42%
Total [kg]	**71**	**94**	**88**	**95**	**207**	**183**	**142**	**147**	**145**	**+106%**	**+53%**	**-1.1%**

[7] Since January 1, 2020, Iceland has effectively prohibited the use of heavy fuel oil in its territorial and internal waters by imposing very low sulphur limits (0.1 %), unless vessels use abatement technologies that reduce sulphur emissions.

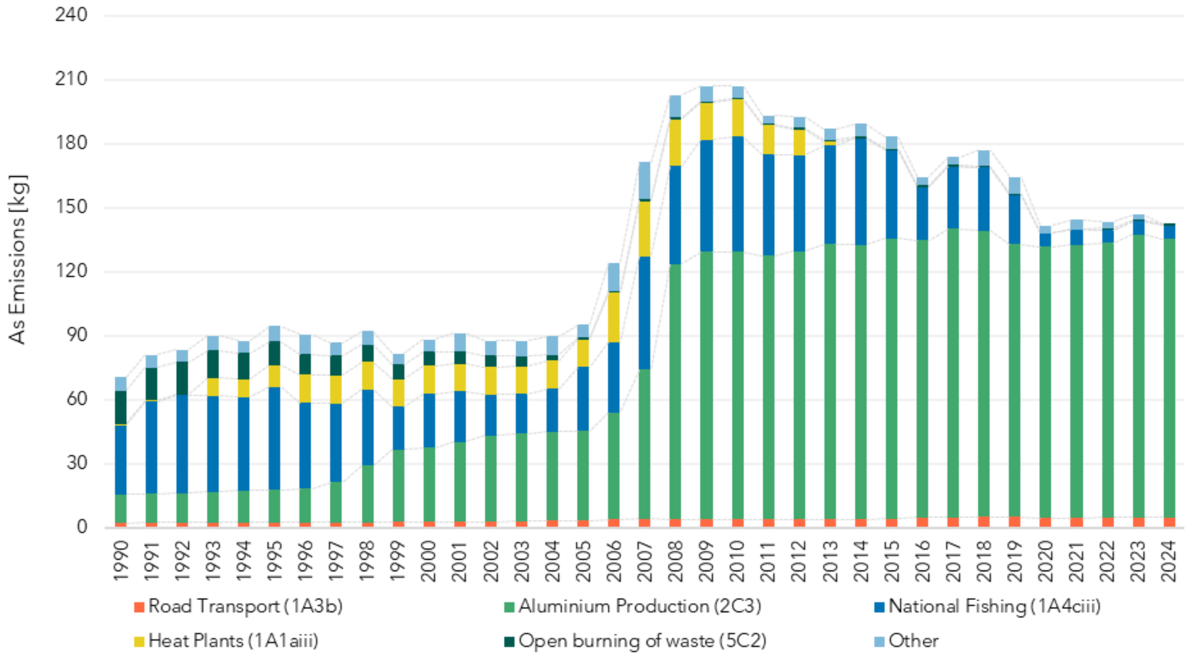


Figure 2.12 As emissions by sector, since 1990.

Table 2-22 Cr emissions by main sources since 1990 [kg].

Cr Emissions [kg]	1990	1995	2000	2005	2010	2015	2020	2023	2024	Change		
										'90-'24	'05-'24	'23-'24
Road transport: Automobile tyre and brake wear (1A3bvi)	70	76	86	110	125	136	141	152	151	+116%	+37%	-1.0%
National Fishing (1A4ciii)	36	53	29	33	58	45	7.9	7.6	8.1	-77%	-76%	+7%
Fireworks (2G)	1.8	2.2	5.9	10.0	7.7	9.4	7.7	6.9	10	+464%	+0.7%	+45%
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%	+18%
Aluminium Production (2C3)	8.7	9.9	22	27	81	85	82	86	84	+869%	+212%	-1.69%
Other	9.7	11.6	9.5	10.1	9.5	11.0	8.7	7.9	7.8	-19%	-22.8%	-1.6%
Total [kg]	**132**	**155**	**158**	**194**	**282**	**286**	**247**	**261**	**261**	**+97%**	**+34%**	**+0.2%**

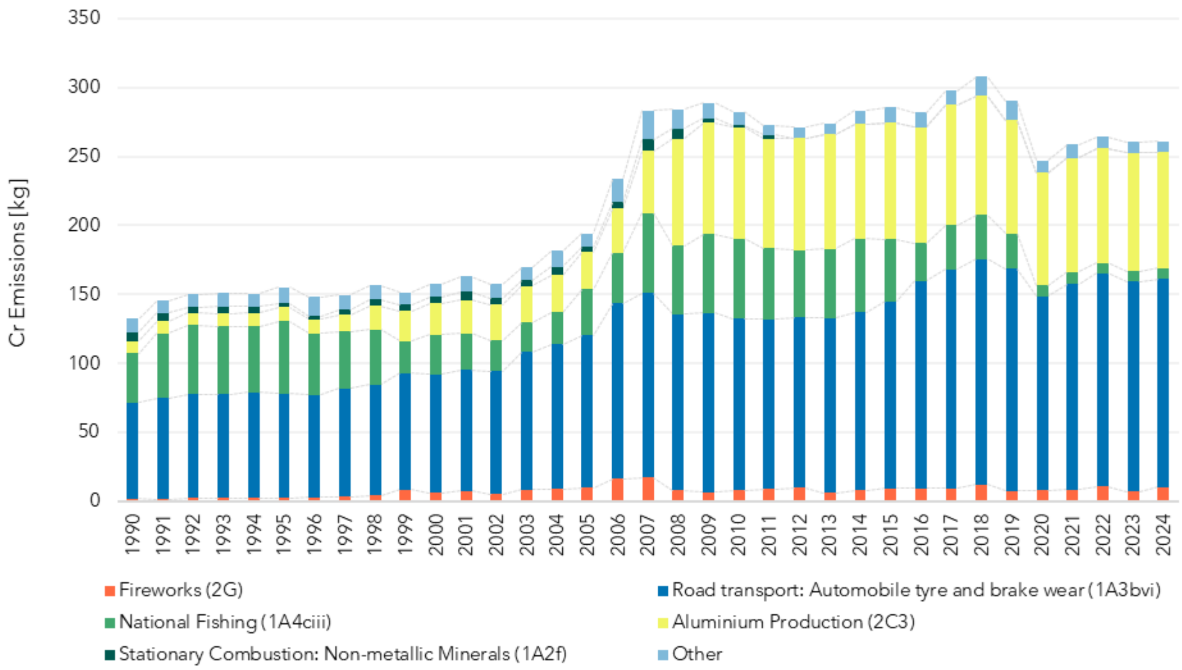


Figure 2.13 Cr emissions by sector, since 1990.

Table 2-23 Cu emissions by main sources since 1990 [t].

Cu Emissions [t]	1990	1995	2000	2005	2010	2015	2020	2023	2024	Change		
										'90-'24	'05-'24	'23-'24
Road transport: Automobile tyre and brake wear (1A3bvi)	1.54	1.67	1.89	2.42	2.74	2.98	3.09	3.35	3.31	+116%	+37%	-1.0%
Fireworks (2G)	0.05	0.06	0.17	0.28	0.22	0.27	0.22	0.20	0.29	+464%	+1%	+45%
National Fishing (1A4ciii)	0.22	0.28	0.25	0.22	0.23	0.19	0.14	0.13	0.14	-36%	-34%	+7%
Aluminium Production (2C3)	0.01	0.02	0.04	0.04	0.13	0.14	0.14	0.14	0.14	+869%	+212%	-1.7%
Other	0.10	0.11	0.12	0.13	0.08	0.08	0.06	0.06	0.06	-41%	-57%	+1%
Total [t]	**1.92**	**2.13**	**2.48**	**3.10**	**3.39**	**3.66**	**3.64**	**3.88**	**3.94**	**+105%**	**+27%**	**+2%**

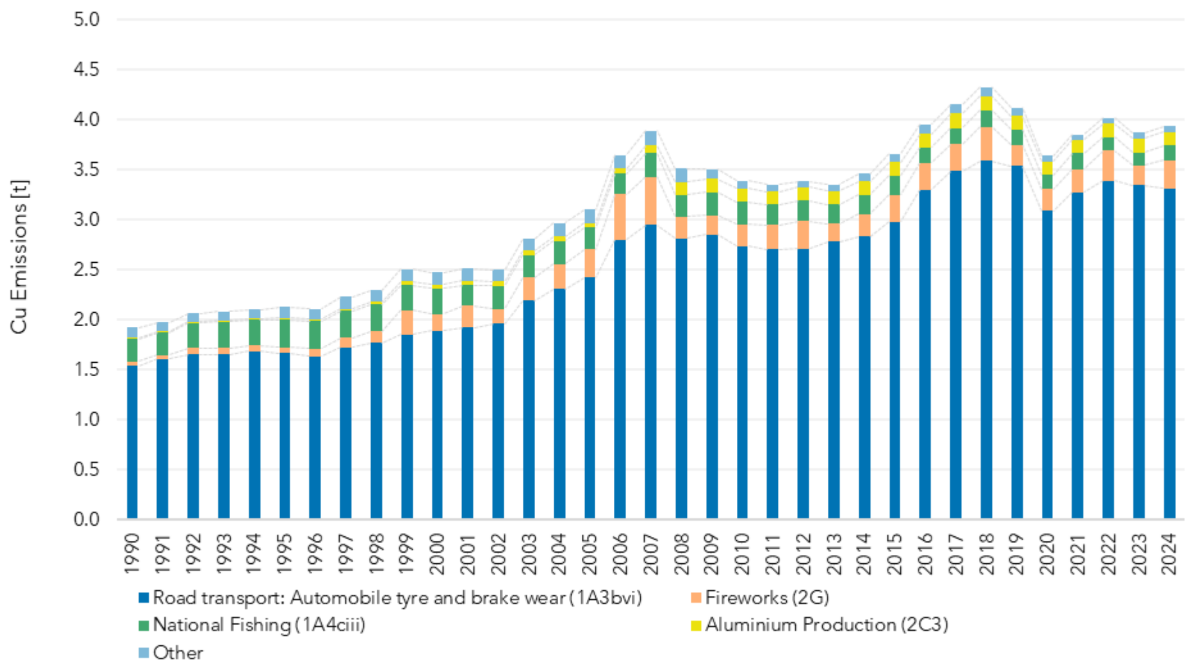


Figure 2.14 Cu emissions by sector, since 1990.

Table 2-24 Ni emissions by main sources since 1990 [t].

Ni Emissions [t]	1990	1995	2000	2005	2010	2015	2020	2023	2024	Change '90-'24	Change '05-'24	Change '23-'24
National Fishing (1A4ciii)	1.34	2.06	0.97	1.24	2.39	1.82	0.16	0.15	0.16	-88%	-87%	+7%
Aluminium Production (2C3)	0.17	0.20	0.45	0.54	1.62	1.70	1.64	1.71	1.68	+869%	+212%	-2%
National Navigation (Shipping) (1A3dii)	0.13	0.16	0.02	0.03	0.09	0.02	0.01	0.01	0.00	-97%	-88%	-20%
Other	0.07	0.07	0.05	0.05	0.04	0.05	0.04	0.04	0.05	-30%	-10%	+17%
Total [t]	**1.72**	**2.48**	**1.48**	**1.87**	**4.15**	**3.59**	**1.85**	**1.91**	**1.90**	**+11%**	**+2%**	**-1%**

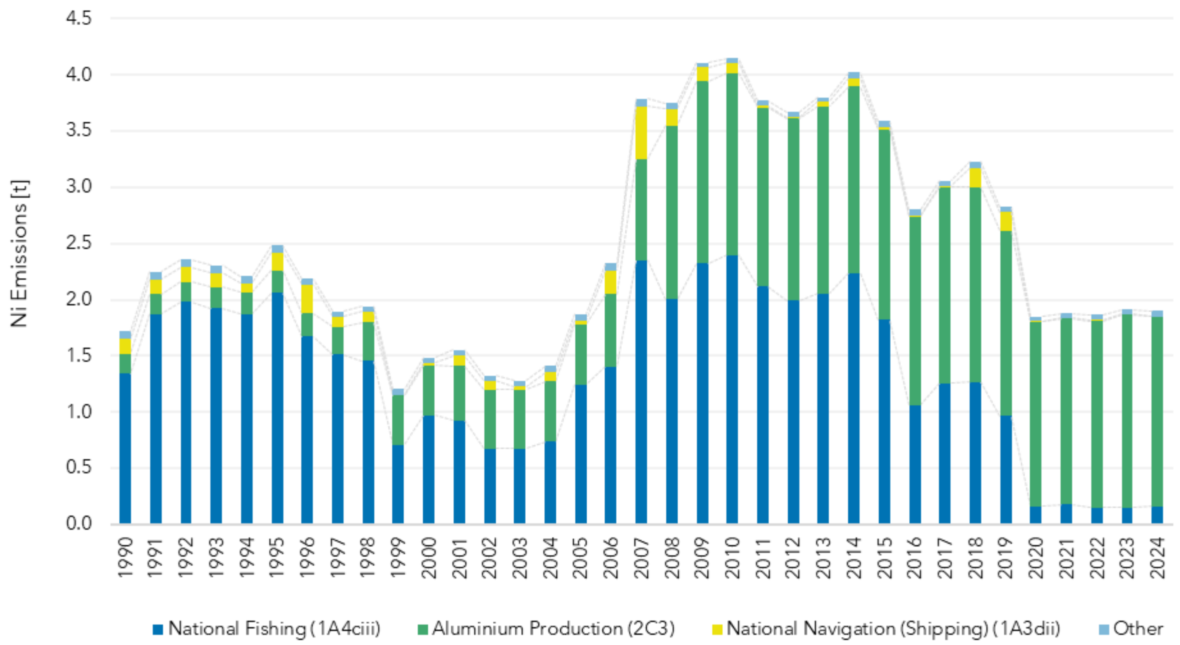


Figure 2.15 Ni emissions by sector, since 1990.

Table 2-25 Se emissions by main sources since 1990 [kg].

Se Emissions [kg]	1990	1995	2000	2005	2010	2015	2020	2023	2024	Change '90-'24	Change '05-'24	Change '23-'24
National Fishing (1A4ciii)	28	35	30	27	31	25	16	15	16	-41%	-39%	+7%
Road transport: Automobile tyre and brake wear (1A3bvi)	1.2	1.2	1.4	1.8	2.1	2.2	2.4	2.7	2.7	+135%	+49%	+0%
National Navigation (Shipping) (1A3dii)	1.47	1.70	0.46	0.80	1.39	0.88	0.78	0.53	0.42	-71%	-48%	-20%
Stationary Combustion: Non-metallic Minerals (1A2f)	0.87	0.42	0.64	0.50	0.17	5E-04	6E-04	7E-04	8E-07	-100%	-100%	-100%
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	1.33	1.41	1.33	1.20	1.02	1.09	0.65	1.60	2.05	+54%	+71%	+29%
Total [kg]	**35**	**42**	**35**	**31**	**35**	**29**	**20**	**20**	**21**	**-39%**	**-31%**	**+7%**

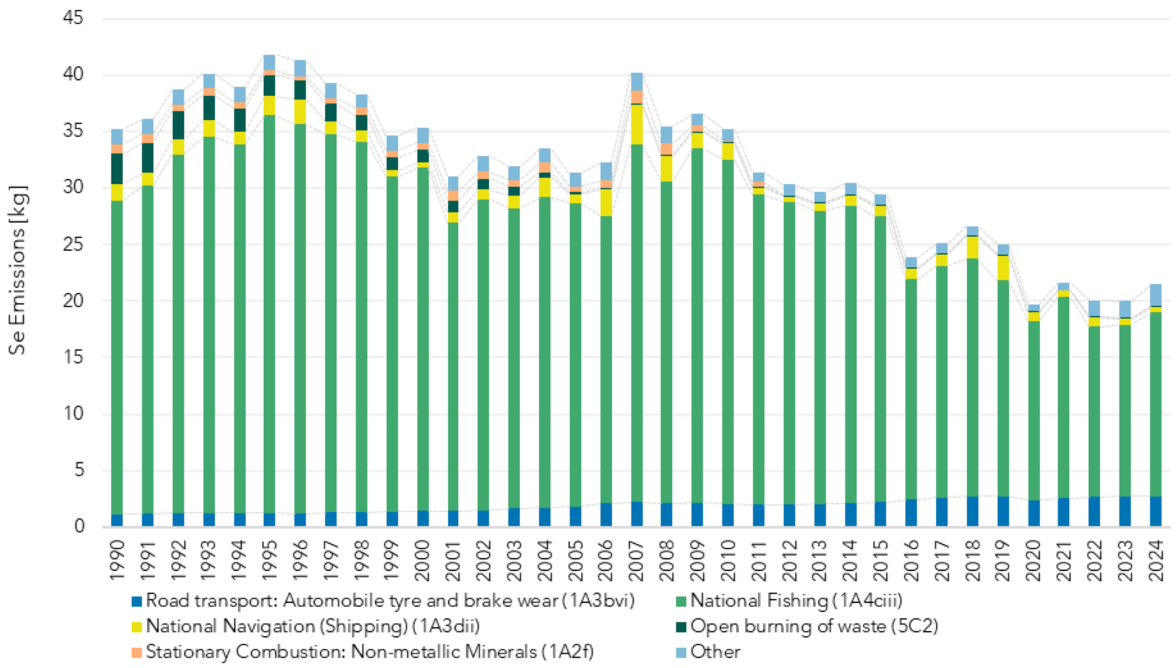


Figure 2.16 Se emissions by sector, since 1990.

Table 2-26 Zn emissions by main sources since 1990 [t].

Zn Emissions [t]	1990	1995	2000	2005	2010	2015	2020	2023	2024	Change '90-'24	Change '05-'24	Change '23-'24
Road transport: Automobile tyre and brake wear (1A3bvi)	0.47	0.50	0.57	0.74	0.83	0.90	0.97	1.09	1.09	+133%	+48%	+0%
National Fishing (1A4ciii)	0.29	0.35	0.33	0.28	0.27	0.23	0.19	0.18	0.20	-32%	-30%	+7%
Accidental Fires (5E)	0.22	0.22	0.20	0.21	0.16	0.25	0.19	0.25	0.28	+27%	+35%	+11%
Fireworks (2G)	0.03	0.04	0.10	0.17	0.13	0.16	0.13	0.12	0.17	+464%	+0.7%	+45%
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	4.28	4.21	+869%	+212%	-2%
Other	0.24	0.21	0.23	0.22	0.12	0.11	0.088	0.081	0.10	-58%	-53%	+26%
Total [t]	**2.35**	**2.28**	**2.84**	**2.99**	**5.59**	**5.93**	**5.68**	**6.03**	**6.07**	**+159%**	**+103%**	**+1%**

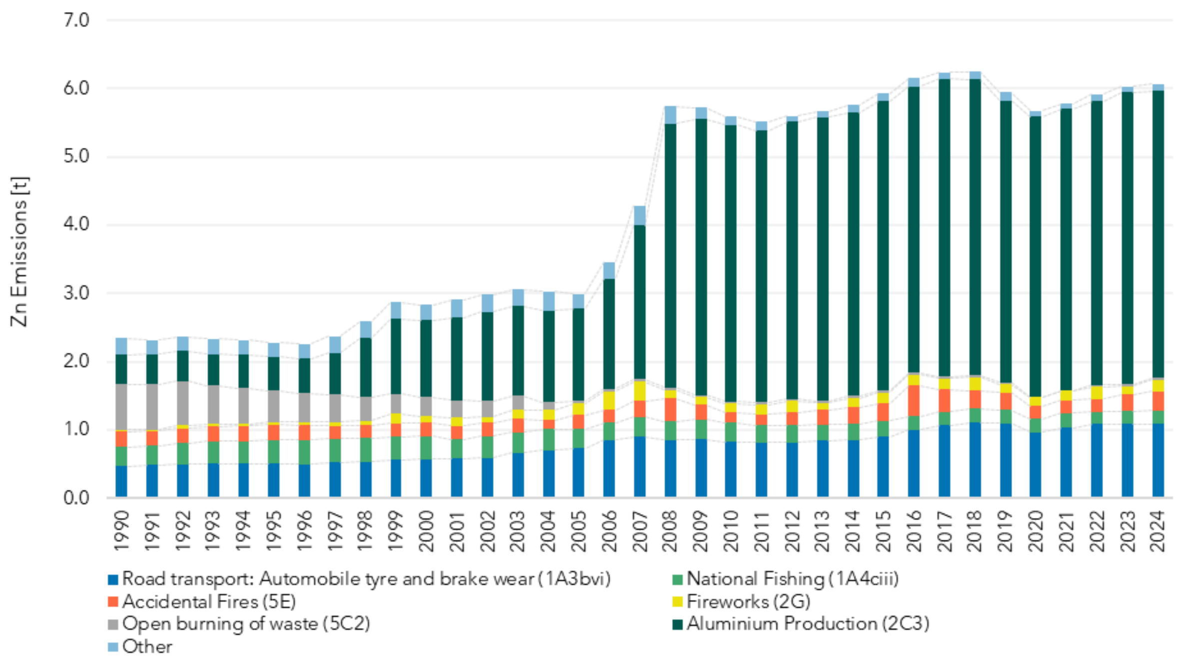


Figure 2.17 Zn emissions by sector, since 1990.

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)

A summary of the categories included in the Energy sector (NFR 1) by pollutant, including the methodology tier used, is presented in Table 3-1, Table 3-2, and Table 3-3.

Table 3-1 Tier overview table for NECD gases, PM and CO (NA - not applicable, 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
1A1a	Public electricity and heat production	T1	T1	T1/2(1)	NA	T1	T1	T1	T1	T1
1A1b	Petroleum refining	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
1A1c	Manufacture of Solid Fuels and Other Energy Industries	NO	NO	NO	NO	NO	NO	NO	NO	NO
1A2a	Stationary combustion in manufacturing industries and construction – Iron and steel	T1	T1	T1/2[(2)]	NA	T1	T1	T1	T1	T1
1A2b	Stationary combustion in manufacturing industries and construction – Non-ferrous metals	T1	T1	T1/2[(2)]	NA	T1	T1	T1	T1	T1
1A2c	Stationary combustion in manufacturing industries and construction – Chemicals[(3)]	NO	NO	NO	NO	NO	NO	NO	NO	NO
1A2d	Stationary combustion in manufacturing industries and construction – Pulp, paper and print	NO	NO	NO	NO	NO	NO	NO	NO	NO
1A2e	Stationary combustion in manufacturing industries and construction – Food processing, beverages and tobacco	T1	T1	T1/2[(1, 2)]	NA	T1	T1	T1	T1	T1
1A2f	Stationary combustion in manufacturing industries and construction – Non-metallic minerals	T1	T1	T2[(2)]	NA	T1	T1	T1	T1	T1
1A2gvii	Mobile Combustion in manufacturing industries and construction - Off-road vehicles and mobile machinery	T1	T1	T2[(2)]	T1	T1	T1	T1	T1	T1
1A2gviii	Combustion in manufacturing industries and construction – Other industry	T1	T1	T1/2[(2)]	NA	T1	T1	T1	T1	T1
1A3ai(i)	International aviation	T3	T3	T3	NA	T3	T3	T3	T3	T3
1A3aii(i)	Domestic aviation[(4)]	T1/3	T1/3	T1/3	NA	T1/3	T1/3	T1/3	T1/3	T1/3
1A3bi	Road transport – Passenger cars	T3	T3	T3	T3	T3	T3	T3	T3	T3
1A3bii	Road transport – Light duty vehicles	T3	T3	T3	T3	T3	T3	T3	T3	T3
1A3biii	Road transport – Heavy duty vehicles and buses	T3	T3	T3	T3	T3	T3	T3	T3	T3
1A3biv	Road transport – L-category	T3	T3	T3	T3	T3	T3	T3	T3	T3
1A3bv	Road transport – Gasoline evaporation	NA	T3	NA	NA	NA	NA	NA	NA	NA
1A3bvi	Road transport – Automobile tyre and brake wear	NA	NA	NA	NA	T3	T3	T3	T3	NA
1A3bvii	Road transport – Automobile road abrasion	NA	NA	NA	NA	T3	T3	T3	T3	NA
1A3c	Railways	NO	NO	NO	NO	NO	NO	NO	NO	NO
1A3di(ii)	International inland waterways	NO	NO	NO	NO	NO	NO	NO	NO	NO
1A3dii	National navigation (shipping)	T2	T1/2[(5)]	T2[(1, 7)]	NA	T2	T2	T1	T1/2[(5)]	T2
1A3ei	Pipeline transport	NO	NO	NO	NO	NO	NO	NO	NO	NO
1A3eii	Other mobile machinery	T1	T1	T2[(2)]	T1	T1	T1	T1	T1	T1

Sector		NECD Gases					PM			
		NO_x	NMVOC	SO_x	NH_3	$PM_{2.5}$	PM_{10}	TSP	BC	CO
1A4ai	Commercial/institutional – Stationary combustion	T1	T1	T1/2(2)	NA(6)	T1	T1	T1	T1	T1
1A4aii	Commercial/institutional – Mobile combustion	NO	NO	NO	NO	NO	NO	NO	NO	NO
1A4bi	Residential – Stationary combustion	T1	T1	T1/2(2)	T1	T1	T1	T1	T1	T1
1A4bii	Residential – Household and gardening (mobile)	IE	IE	IE	IE	IE	IE	IE	IE	IE
1A4ci	Agriculture/Forestry/Fishing – Stationary	T1	T1	T1	NA	T1	T1	T1	T1	T1
1A4cii	Agriculture/Forestry/Fishing – Off-road vehicles and other machinery	T1	T1	T2(2)	T1	T1	T1	T1	T1	T1
1A4ciii	Agriculture/Forestry/Fishing – Fishing	T2	T1/2(5)	T2(1, 7)	NA	T2	T2	T1	T1/2(5)	T2
1A5a	Other – Stationary	T1	T1	T1/2(2)	NA	T1	T1	T1	T1	T1
1A5b	Other – Mobile	NO	NO	NO	NO	NO	NO	NO	NO	NO
1B1a	Fugitive emissions from solid fuels – Coal mining and handling	NO	NO	NO	NO	NO	NO	NO	NO	NO
1B1b	Fugitive emissions from solid fuels – Solid fuel transformation	NO	NO	NO	NO	NO	NO	NO	NO	NO
1B1c	Fugitive emissions from solid fuels - Other	NO	NO	NO	NO	NO	NO	NO	NO	NO
1B2ai	Fugitive emissions from oil products – Exploration, production, transport	NO	NO	NO	NO	NO	NO	NO	NO	NO
1B2aiv	Fugitive emissions from oil products – Refining and storage	NO	NO	NO	NO	NO	NO	NO	NO	NO
1B2av	Fugitive emissions from oil products – Distribution of oil products	NA	T1	NA	NA	NA	NA	NA	NA	NA
1B2b	Fugitive emissions from natural gas – Transport and distribution	NA	T1	NA	NA	NA	NA	NA	NA	NA
1B2c	Venting and flaring – Oil, gas, combined oil and gas	NO	NO	NO	NO	NO	NO	NO	NO	NO
1B2d	Other fugitive emissions from energy production – Geothermal energy	NA	NA	T3(8)	NA	NA	NA	NA	NA	NA

[1] Country specific S-content value for Residual fuel oil from 2012, tier 1 in earlier years.
[2] Country specific S-content value for Diesel from 2006, tier 1 in earlier years.
[3] Activity in sector 1A2c (chemicals) occurred from 1990 to 2004. Tier 1 methodology was used in these years for all pollutants (other than NH_3, PCB and HCB which were NA). No activity from 2005 onwards.
[4] Training activities according to tier 1, regular flights according to tier 3 methodology.
[5] Tier 1 methodology for turbine engines, tier 2 for reciprocating Diesel engines.
[6] Emissions from 1993-2012 according to tier 1 methodology.
[7] Country specific S-content value for MDO/MGO from 2012, tier 1 in earlier years.
[8] Derived from on-site H_2S measurements.

Table 3-2 Tier overview table for POPs (NA - not applicable, NO - not occurring, IE – included elsewhere).

Sector		POPs			
		Dioxin	PAH	HCB	PCB
1A1a	Public electricity and heat production	T1	T1	NA	NA
1A1b	Petroleum refining	NO	NO	NO	NO
1A1c	Manufacture of Solid Fuels and Other Energy Industries	NO	NO	NO	NO
1A2a	Stationary combustion in manufacturing industries and construction – Iron and steel	T1	T1	NA	NA
1A2b	Stationary combustion in manufacturing industries and construction – Non-ferrous metals	T1	T1	NA	NA
1A2c	Stationary combustion in manufacturing industries and construction – Chemicals(1)	NO	NO	NO	NO
1A2d	Stationary combustion in manufacturing industries and construction – Pulp, paper and print	NO	NO	NO	NO
1A2e	Stationary combustion in manufacturing industries and construction – Food processing, beverages and tobacco	T1	T1	NA	NA
1A2f	Stationary combustion in manufacturing industries and construction – Non-metallic minerals	T1	T1	NA	NA
1A2gvii	Mobile Combustion in manufacturing industries and construction - Off-road vehicles and mobile machinery	T1	T1	NA	NA
1A2gviii	Combustion in manufacturing industries and construction – Other industry	T1	T1	NA	NA
1A3ai(i)	International aviation	T3	NA	NA	NA
1A3aii(i)	Domestic aviation	T1/3(2)	NA	NA	NA
1A3bi	Road transport – Passenger cars	T3	T3	T3	T3
1A3bii	Road transport – Light duty vehicles	T3	T3	T3	T3
1A3biii	Road transport – Heavy duty vehicles and buses	T3	T3	T3	T3
1A3biv	Road transport – L-category	T3	T3	T3	T3
1A3bv	Road transport – Gasoline evaporation	NA	NA	NA	NA
1A3bvi	Road transport – Automobile tyre and brake wear	NA	NA	NA	NA
1A3bvii	Road transport – Automobile road abrasion	NA	NA	NA	NA
1A3c	Railways	NO	NO	NO	NO
1A3di(ii)	International inland waterways	NO	NO	NO	NO
1A3dii	National navigation (shipping)	T1	T1	T1	T1
1A3ei	Pipeline transport	NO	NO	NO	NO
1A3eii	Other mobile machinery	T1	T1	NA	NA
1A4ai	Commercial/institutional – Stationary combustion	T1	T1	T1	T1
1A4aii	Commercial/institutional – Mobile combustion	NO	NO	NO	NO
1A4bi	Residential – Stationary combustion	T1	T1	T1	T1
1A4bii	Residential – Household and gardening (mobile)	IE	IE	IE	IE
1A4ci	Agriculture/Forestry/Fishing – Stationary	NA	NA	NA	NA
1A4cii	Agriculture/Forestry/Fishing – Off-road vehicles and other machinery	T1	T1	NA	NA
1A4ciii	Agriculture/Forestry/Fishing - Fishing	T1	T1	T1	T1
1A5a	Other – Stationary	T1	T1	NA	NA

Sector		POPs			
		Dioxin	PAH	HCB	PCB
1A5b	Other – Mobile	NO	NO	NO	NO
1B1a	Fugitive emissions from solid fuels – Coal mining and handling	NO	NO	NO	NO
1B1b	Fugitive emissions from solid fuels – Solid fuel transformation	NO	NO	NO	NO
1B1c	Fugitive emissions from solid fuels - Other	NO	NO	NO	NO
1B2ai	Fugitive emissions from oil products – Exploration, production, transport	NO	NO	NO	NO
1B2aiv	Fugitive emissions from oil products – Refining and storage	NO	NO	NO	NO
1B2av	Fugitive emissions from oil products – Distribution of oil products	NA	NA	NA	NA
1B2b	Fugitive emissions from natural gas – Transport and distribution	NA	NA	NA	NA
1B2c	Venting and flaring – Oil, gas, combined oil and gas	NO	NO	NO	NO
1B2d	Other fugitive emissions from energy production – Geothermal energy	NA	NA	NA	NA

[1] Activity in sector 1A2c (chemicals) occurred from 1990 to 2004. Tier 1 methodology was used in these years for all pollutants (other than NH_3, PCB and HCB which were NA). No activity from 2005 onwards.
[2] Training activities according to tier 1, regular flights according to tier 3 methodology.

Table 3-3 Tier overview table for heavy metals (NA - not applicable, NO - not occurring, IE – included elsewhere).

Sector		Heavy Metals								
		Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
1A1a	Public electricity and heat production	T1	T1	T1	T1	T1	T1	T1	T1	T1
1A1b	Petroleum refining	NO	NO	NO	NO	NO	NO	NO	NO	NO
1A1c	Manufacture of Solid Fuels and Other Energy Industries	NO	NO	NO	NO	NO	NO	NO	NO	NO
1A2a	Stationary combustion in manufacturing industries and construction – Iron and steel	T1	T1	T1	T1	T1	T1	T1	T1	T1
1A2b	Stationary combustion in manufacturing industries and construction – Non-ferrous metals	T1	T1	T1	T1	T1	T1	T1	T1	T1
1A2c	Stationary combustion in manufacturing industries and construction – Chemicals(1)	NO	NO	NO	NO	NO	NO	NO	NO	NO
1A2d	Stationary combustion in manufacturing industries and construction – Pulp, paper and print	NO	NO	NO	NO	NO	NO	NO	NO	NO
1A2e	Stationary combustion in manufacturing industries and construction – Food processing, beverages and tobacco	T1	T1	T1	T1	T1	T1	T1	T1	T1
1A2f	Stationary combustion in manufacturing industries and	T1	T1	T1	T1	T1	T1	T1	T1	T1

Sector		Heavy Metals								
		Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
	construction – Non-metallic minerals									
1A2gvii	Mobile Combustion in manufacturing industries and construction - Off-road vehicles and mobile machinery	T1	T1	NA	NA	T1	T1	T1	T1	T1
1A2gviii	Combustion in manufacturing industries and construction – Other industry	T1	T1	T1	T1	T1	T1	T1	T1	T1
1A3ai(i)	International aviation	NA	NA	NA	NA	NA	NA	NA	NA	NA
1A3aii(i)	Domestic aviation	T1(2)	NA	NA	NA	NA	NA	NA	NA	NA
1A3bi	Road transport – Passenger cars	T3	T3	T3	T3	T3	T3	T3	T3	T3
1A3bii	Road transport – Light duty vehicles	T3	T3	T3	T3	T3	T3	T3	T3	T3
1A3biii	Road transport – Heavy duty vehicles and buses	T3	T3	T3	T3	T3	T3	T3	T3	T3
1A3biv	Road transport – L-category	T3	T3	T3	T3	T3	T3	T3	T3	T3
1A3bv	Road transport – Gasoline evaporation	NA	NA	NA	NA	NA	NA	NA	NA	NA
1A3bvi	Road transport – Automobile tyre and brake wear	T3	T3	NA	T3	T3	T3	T3	T3	T3
1A3bvii	Road transport – Automobile road abrasion	NA	NA	NA	NA	NA	NA	NA	NA	NA
1A3c	Railways	NO	NO	NO	NO	NO	NO	NO	NO	NO
1A3di(ii)	International inland waterways	NO	NO	NO	NO	NO	NO	NO	NO	NO
1A3dii	National navigation (shipping)	T1	T1	T1	T1	T1	T1	T1	T1	T1
1A3ei	Pipeline transport	NO	NO	NO	NO	NO	NO	NO	NO	NO
1A3eii	Other mobile machinery	T1	T1	NA	NA	T1	T1	T1	T1	T1
1A4ai	Commercial/institutional – Stationary combustion	T1	T1	T1	T1	T1	T1	T1	T1	T1
1A4aii	Commercial/institutional – Mobile combustion	NO	NO	NO	NO	NO	NO	NO	NO	NO
1A4bi	Residential – Stationary combustion	T1	T1	T1	T1	T1	T1	T1	T1	T1
1A4bii	Residential – Household and gardening (mobile)	IE	IE	IE	IE	IE	IE	IE	IE	IE
1A4ci	Agriculture/Forestry/Fishing – Stationary	T1	T1	T1	T1	T1	T1	T1	T1	T1
1A4cii	Agriculture/Forestry/Fishing – Off-road vehicles and other machinery	T1	T1	NA	NA	T1	T1	T1	T1	T1
1A4ciii	Agriculture/Forestry/Fishing - Fishing	T1	T1	T1	T1	T1	T1	T1	T1	T1
1A5a	Other – Stationary	T1	T1	T1	T1	T1	T1	T1	T1	T1
1A5b	Other – Mobile	NO	NO	NO	NO	NO	NO	NO	NO	NO
1B1a	Fugitive emissions from solid fuels – Coal mining and handling	NO	NO	NO	NO	NO	NO	NO	NO	NO

Sector		Heavy Metals								
		Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
1B1b	Fugitive emissions from solid fuels – Solid fuel transformation	NO	NO	NO	NO	NO	NO	NO	NO	NO
1B1c	Fugitive emissions from solid fuels - Other	NO	NO	NO	NO	NO	NO	NO	NO	NO
1B2ai	Fugitive emissions from oil products – Exploration, production, transport	NO	NO	NO	NO	NO	NO	NO	NO	NO
1B2aiv	Fugitive emissions from oil products – Refining and storage	NO	NO	NO	NO	NO	NO	NO	NO	NO
1B2av	Fugitive emissions from oil products – Distribution of oil products	NA	NA	NA	NA	NA	NA	NA	NA	NA
1B2b	Fugitive emissions from natural gas – Transport and distribution	NA	NA	NA	NA	NA	NA	NA	NA	NA
1B2c	Venting and flaring – Oil, gas, combined oil and gas	NO	NO	NO	NO	NO	NO	NO	NO	NO
1B2d	Other fugitive emissions from energy production – Geothermal energy	NA	NA	NA	NA	NA	NA	NA	NA	NA

[1] Activity in sector 1A2c (chemicals) occurred from 1990 to 2004. Tier 1 methodology was used in these years for all pollutants (other than NH_3, PCB and HCB which were NA). No activity from 2005 onwards.
[2] Flight training activities only.

Table 3-4 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 3-4 Key categories for air pollutants within Energy.

SO_x, NO_x, NH_3, NMVOCs, PM, BC, and CO	1990	2024	Trend
1A2e Stationary Combustion in Manufacturing Industries and Construction: Food Processing and Beverages	NO_x, BC	BC	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	NO_x, $PM_{2.5}$, BC	NO_x, BC	BC
1A3ai(i) International Aviation LTO (Civil)		NMVOC	NO_x, NMVOC
1A3bi Road Transport: Passenger Cars	NO_x, $PM_{2.5}$, CO	NO_x	NO_x, NMVOC, CO
1A3bii Road transport: Light duty vehicles			NO_x
1A3biii Road Transport: Heavy-duty Vehicles and Buses	NO_x, $PM_{2.5}$, BC	NO_x, BC	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}, TSP, BC	NO_x, SO_x, $PM_{2.5}$, PM_{10}
1B2av Distribution of Oil Products	NMVOC	NMVOC	NMVOC
1B2d Other Fugitive Emissions from Energy Production (Geothermal Energy)	SO_x	SO_x	SO_x
Persistent Organic Pollutants (POPs)	**1990**	**2024**	**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**	**2024**	**Trend**
1A1a Public electricity and heat production			Se
1A3aii(i) Domestic aviation LTO (civil)	Pb	Pb	
1A3bi Road Transport: Passenger Cars	Pb	Hg	Pb, Hg
1A3bvi Road Transport: Automobile Tire and Brake Wear	Pb, Cr, Cu, Zn	Pb, Cr, Cu, Se, Zn	Pb, Cr, 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 5.9.2, which follows the methodology presented in the 2023 EEA/EMEP Guidebook. A more detailed description is provided in Chapter 3.5.3.

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 Environmental Information reports (in accordance with Regulation 990/2008, previously Green Accounting reports pursuant to Regulation No 851/2002 which has been repealed) 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.

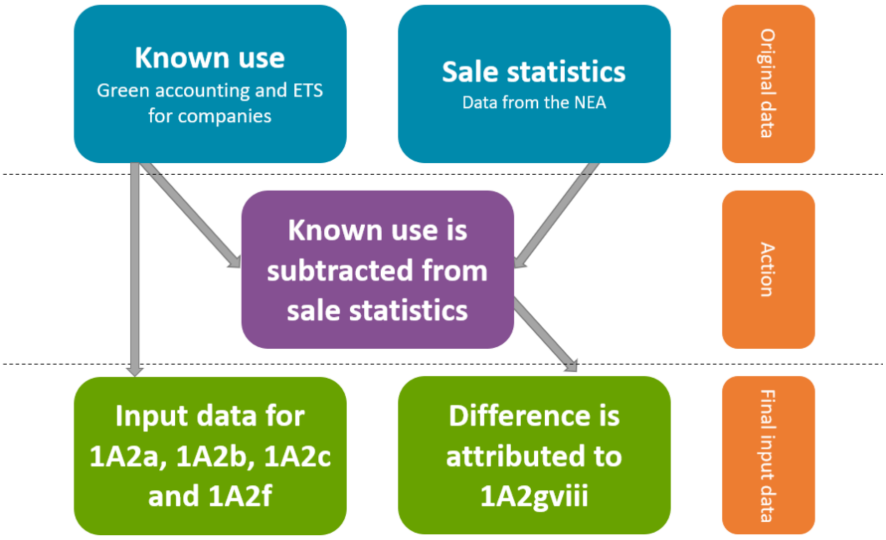


Figure 3.1 Description of adjustments in input data for IPCC/NFR category 1A2.

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 Uncertainty Assessment

Table 3-5 summarises the quantitative uncertainties for all pollutants aggregated for the entire Energy sector, comprised of stationary and mobile combustion, as well as fugitive emissions. Uncertainties were assessed according to Approach 1, described in the EMEP/EEA Guidebook 2023. See section 1.7.1 for details on the general methodology.

Activity Data Uncertainty

Activity data in the Energy sector is primarily defined by the sold and distributed amounts of different types of fuel. It can be assumed that the quantification of sold volumes is accurate. The associated uncertainty characterises therefore essentially the distribution of fuels to different source categories/consumers, or the deferred use of distributed fuel. The related uncertainty is assessed as 5% on the basis of expert judgement for fuel amounts reported by fuel distributors and 2% for fuel consumption reported by companies which are subject to reporting under ETS (in 1A2).

A specific assessment of activity data uncertainty was performed for the major mobile sources: aviation, navigation, and road transport. Emissions from **aviation** (1A3a) are estimated in a Tier 3 process using the EMEP/EEA master emissions calculator tool, attached as an annex to the 2023 EMEP/EEA guidebook. The respective activity data uncertainty is combined from uncertainties associated with the completeness of flight data and the accuracy of the Tier 3 fuel calculation per flight. Flight data are received from the national airport operator and ATC services provider ISAVIA and are assumed to be complete and accurate, with very few exceptions, for international flights, yielding a completeness related uncertainty quantified with 2%. Data on domestic movements, however, contain a considerable number of flights, including training related activity and local flights, that are not fully specified in terms of flown distance/destination and aircraft type, which leads to an assumed completeness uncertainty of 50% for domestic aviation. Uncertainty associated with the Tier 3 calculations of combusted fuel for each movement, which is not accounting for wind/weather conditions and actual routing, is estimated to be 10%. The combined activity data uncertainty is therefore 10.2% for international and 51% for domestic aviation. All activity data uncertainty assessment in aviation is based on expert judgement.

Activity data uncertainty in **navigation** (1A3d) results mostly from uncertainty linked to fuel amounts and fuel distribution (5%) as well as from a considerable uncertainty related to classifying vessel movements into international and domestic activity, which is estimated to amount to 50% since this classification relies to a large extent on vessel type information. This yields a combined activity data uncertainty of 50.2% for NFR 1A3d. Classification of fishing vessel activity (1A4ciii), on the other hand, is assumed to be accurately determined by the vessel type, so that only fuel related activity data uncertainty applies to this category.

Activity data uncertainty in **road transport** (1A3b) is, in addition to the general fuel related uncertainty of 5%, comprised of two further components. The uncertainty associated with the vehicle stock numbers, provided by the Icelandic Transport Authority (Samgöngustofa), and the correct classification of vehicles according to Euro standard compliance, derived from the year of first registration and year-specific Euro standard distribution data sets received from Emisia[8], is estimated to be 5% combined. Estimation of yearly average driven mileage and lifetime cumulative activity per vehicle class is provided by Emisia, since no suitably categorised mileage data is available from national sources, and introduces further uncertainty which is expert-estimated to amount to 10%. The resulting combined activity data uncertainty for NFRs 1A3bi-iv is therefore 12.2%.

Geothermal energy production emissions are reported as extrapolated on-site measurement data. As the associated uncertainties characterise primarily the pollutant/gas specific measurement inherent uncertainty, all uncertainty estimates are projected onto the respective emission factors while the activity data uncertainty is set to 0%.

Emission Factor Uncertainty

For a large subset of particularly Tier 1 emission factors the associated uncertainty values could be derived from the confidence interval specified in the EMEP/EEA Guidebook. In other

[8] Emisia SA, Thessaloniki, Greece, https://copert.emisia.com/

cases, they are defined by expert judgement based on information received from operators or other competent bodies. Some emission factor uncertainties were derived from a qualitative assessment in accordance with the rating definitions of table 2-2, chapter 5 on uncertainties in the EMEP/EEA Guidebook.

Emission factor uncertainty values in **stationary combustion** (1A1 and 1A2) as well as **mobile machinery** (1A2gvii, 1A3eii, and 1A4cii) could be derived from the Tier 1 emission factors specified in the guidebook for the respective NFR-groups, with the exception of the sulphur content of Diesel which is based on country-specific analysis with an assumed uncertainty of 10%.

Main pollutant and particulate matter emissions in **aviation** (1A3a) are calculated using the Master Emissions Calculator spreadsheet (1.A.3.a Aviation – Annex 1 of the EMEP/EEA guidebook) which uses the ICAO EEDB[9] emission factors maintained by the EU Aviation Safety Agency (EASA). Communication from Eurocontrol and EASA suggest a high measurement and test accuracy and therefore low emission factor uncertainty for most gaseous emissions, but higher uncertainty for particulate matter, specifically with modern engine types. We assumed 5% and 20% emission factor uncertainty, respectively. Pb, NMVOC, and SO_x emission factor uncertainties are derived from the Tier 1 emission factor specifications of the guidebook. For dioxin in 1A3a an emission factor published by Statistics Norway is used[10]; the associated uncertainty is assumed as the upper boundary of the qualitative assessment rating C of the guidebook (200%).

Emissions for all pollutants in **road transport** (1A3b) are estimated in a Tier 3 approach, based on country-specific input data, such as vehicle stock or driven mileage (see section 3.5.3 for details). The related emission factor uncertainties for the main pollutants (except NH_3), particulate matter, and CO are determined from combined uncertainty values reported in the EMEP/EEA guidebook (section 1A3bi-iv, Tier 1, table 4-3, assuming “poor statistics with correction for energy consumption”). Emission factor uncertainties for NH_3 and PAHs, even though emission are estimated using a Tier 3 methodology, are based on Tier 1 emission factors defined in the guidebook. No emission factor uncertainty relevant information could be found for the tier 3 calculation of heavy metals, dioxin, HCB, and PCB. The qualitative uncertainty rating values defined in the guidebook were therefore translated into quantitative assumptions, rating C upper boundary of 200%, for these pollutants. Table 3-4 of section 1A3bv (**gasoline evaporation**) of the guidebook provides different NMVOC emission factors

[9] ICAO Aircraft Engine Emission Databank. https://www.easa.europa.eu/en/domains/environment/icao-aircraft-engine-emissions-databank

[10] Emission factors used in the estimations of emissions from combustion, https://www.ssb.no/_attachment/404602/

for different vehicle classes. The maximum of the class-specific uncertainties was used in our assessment.

Particulate matter emissions from **road abrasion** (1A3bvii) are tier 3 calculated. Emission factor uncertainties, however, are based on vehicle class specific tier 1 emission factors from the EMEP/EEA guidebook (section 1A3bvi-vii, table 3-2). Again, the maximum of the resulting uncertainty values is assumed as a generalised value for this NFR. The same procedure was followed for **road vehicle tyre and brake wear** (1A3bvi) particulate matter (guidebook section 1A3bvi-vii, table 3-1). For heavy metals in 1A3bvi the emission factor uncertainty suggested in the guidebook, section 1.A.3.b.vi-vii, pp. 27, was assumed (50%).

For **navigation** (1A3d) and **fishing** (1A4ciii) the EMEP/EEA guidebook (table 4-1, page 41) specifies emission factor uncertainties for the main pollutants as well as particulate matter for the different operational modes (“at sea”, “manoeuvring”, “in port”). The maximum uncertainty over all modes associated with each listed pollutant was assumed for our assessment. The emission factor uncertainty for SO_x is assumed to be 10% based on country-specific fuel analyses. Quantitative uncertainties (200%) derived from a qualitative rating (C) was used for PAH emission factors in these NFRs.

NMVOC emission factor uncertainties related to the **distribution of oil and gas products** (1B2a, 1B2b) are assumed to be 200% (2019 Refinements of IPCC 2006 guidelines, table 4.2.4B, Tanker Trucks and Rail Cars), while the emission factor uncertainty associated with SO_2 emission from **geothermal energy production** (1B2d) was set to 10% based on expert judgement from the Department of Energy Transition and Circular Economy of the IEEA.

Table 3-5 Quantitative Uncertainties aggregated for the Energy sector.

NFR 1 Energy	Pollutant	Unit	Energy emissions 1990 [Unit]	Energy emissions 2024 [Unit]	Uncertainty in Energy [%]	Absolute uncertainty in 2024 emissions [Unit]	Uncertainty in Energy trend [%]
Main pollutants	NOx	kt	22.7	11.4	22	2.5	16
	NMVOC	kt	5.7	1.6	51	0.81	25
	SO_2	kt	19.7	41.4	9.9	4.1	40
	NH_3	kt	0.0074	0.054	102	0.055	9.7
Particulate Matter	$PM_{2.5}$	kt	0.76	0.56	24	0.13	28
	PM_{10}	kt	0.94	0.86	25	0.22	24
	TSP	kt	1.1	1.4	32	0.44	23
	BC	kt	0.14	0.083	29	0.024	23
Other	CO	kt	41.4	3.3	24	0.80	43
Priority Heavy Metals	Pb	t	2.8	0.58	39	0.22	63
	Cd	t	0.0053	0.0041	84	0.0034	91

NFR 1 Energy	Pollutant	Unit	Energy emissions 1990 [Unit]	Energy emissions 2024 [Unit]	Uncertainty in Energy [%]	Absolute uncertainty in 2024 emissions [Unit]	Uncertainty in Energy trend [%]
	Hg	t	0.013	0.0075	84	0.0063	20
Additional Heavy Metals	As	t	0.040	0.012	67	0.0079	93
	Cr	t	0.12	0.16	48	0.078	72
	Cu	t	1.8	3.5	49	1.7	57
	Ni	t	1.5	0.19	85	0.16	89
	Se	t	0.033	0.021	99	0.021	53
	Zn	t	1.0	1.4	44	0.59	54
POPs	Dioxin	g I-TEQ	0.13	0.063	91	0.058	6.8
	BaP	t	0.025	0.0056	135	0.0076	24
	BbF	t	0.037	0.010	86	0.0084	18
	BkF	t	0.016	0.0076	69	0.0053	14
	Ipy	t	0.012	0.0046	113	0.0052	41
	PAH	t	0.090	0.028	27	0.0075	9.5
	HCB	kg	0.023	0.013	97	0.013	11
	PCB	kg	0.11	0.0064	195	0.012	17

For an uncertainty summary, disaggregated into Energy related NFRs, covering the main pollutants and particulate matter see Annex 3.

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

3.4.1 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 3-6, 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 3-6 Electricity production in Iceland [GWh]

	1990	1995	2000	2005	2010	2015	2020	2023	2024
Hydropower	4159	4677	6350	7015	12592	13781	13157	14226	13604
Geothermal	283	290	1323	1658	4465	5003	5961	6006	5986
Fuel Combustion	4.6	8.4	4.4	7.8	1.7	3.9	3.1	4.2	3.3
Wind Power	—	—	—	—	—	11	6.7	7.2	12.7
Total [GWh]	**4446**	**4976**	**7678**	**8681**	**17059**	**18799**	**19127**	**20244**	**19606**

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.

3.4.1.1 Activity Data

Activity data for electricity and heat production with fuel combustion and waste incineration are given in Table 3-7. 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 3-7 Fuel combustion and waste incineration [kt] for Electricity and Heat Production.

	1990	1995	2000	2005	2010	2015	2020	2023	2024
1A1ai – Gas/Diesel Oil	1.30	1.09	1.07	0.021	1.01	1.19	0.82	2.02	4.87
1A1ai – Residual Fuel Oil	NO	NO	0.030	NO	NO	NO	NO	NO	NO
1A1ai – Biomethane	NO	NO	NO	0.92	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	1.44	NO
1A1aiii – Residual Fuel Oil	2.99	3.08	0.12	0.20	NO	0.14	NO	NO	NO
1A1aiii – Biodiesel	NO	NO	NO	NO	NO	NO	NO	NO	NO
1A1aiii – Solid Waste	NO	4.65	6.05	5.95	8.11	NO	NO	NO	NO

Emission factors are Tier 1 factors taken from the 2023 EMEP/EEA Guidebook (Chapter 1.A.1. Energy Industries, Tables 3-6 (residual 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}, $PM_{2.5}$.

3.4.1.2 Recalculations and Improvements

1A1ai Electricity Generation: Recalculations occurred due to updates in the activity data for residual oil for the year 2000. The usage was updated from zero to 0.030 t. This led to minor recalculations for all air pollutants for the year 2000. For most air pollutants the change was within 0.1% of the emissions within 1A1ai. The exceptions are SO_x, Ni, Zn, and PAH4 where the recalculations can be seen in the table below.

Table 3-8 Recalculations in 1A1ai Electricity Generation for the year 2000.

1A1ai Electricity Generation	2000
2025 submission SO_x [kt]	0.00213
2026 submission SO_x [kt]	0.00375
Change relative to the 2025 submission SO_x [kt]	1.6E-03
Change relative to the 2025 submission SO_x [%]	76%
2025 submission Ni [t]	0.000062
2026 submission Ni [t]	0.000063
Change relative to the 2025 submission Ni [t]	3.1E-07
Change relative to the 2025 submission Ni [%]	0.50%
2025 submission Zn [t]	8.29E-05
2026 submission Zn [t]	8.30E-05

1A1ai Electricity Generation	2000
Change relative to the 2025 submission Zn [t]	1.06E-07
Change relative to the 2025 submission Zn [%]	0.13%
2025 submission PAH4 [t]	3.17E-07
2026 submission PAH4 [t]	3.36E-07
Change relative to the 2025 submission PAH4 [t]	1.93E-08
Change relative to the 2025 submission PAH4 [%]	6.1%

1A1aiii Heat Plants: Recalculations occurred due to a correction in the NCV of biodiesel. Since biodiesel was only used in the year 2019, the recalculations only apply to that year. For all estimated air pollutants, the emissions are now about 1% higher than in the previous submission. The exception is SO_x where emissions are now about 1.3% higher. The recalculations can be seen in the table below.

Table 3-9 Recalculations in 1A1aiii Heat Plants for the year 2019.

1A1aiii Heat Plants	2019
2025 submission SO_x [kt]	6.89E-04
2026 submission SO_x [kt]	6.98E-04
Change relative to the 2025 submission SO_x [kt]	9.1E-06
Change relative to the 2025 submission SO_x [%]	1.3%

3.4.1.3 Planned Improvements

No improvements are currently planned for this subsector.

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

3.4.2.1 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 Environmental Information reports submitted by the industry in accordance with regulation No 206/2025 (formally called green accounts in accordance with regulation No 851/2002 which is no longer in force). 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 3-10.

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 3-10 Fuel use [kt], Stationary Combustion in the Manufacturing Industry.

Fuel Type	1990	1995	2000	2005	2010	2015	2020	2023	2024
1A2a - Iron and Steel									
Gas/Diesel Oil	0.11	0.22	0.56	0.46	0.46	0.29	0.21	0.22	0.39
LPG	NO	NO	NO	NO	NO	0.10	0.20	0.19	0.27
1A2b - Non-ferrous Metals									
Gas/Diesel Oil	NO	NO	0.55	5.37	1.35	0.046	1.72	0.13	0.023
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	1.26	1.36
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	5.33	13.76
Residual Fuel Oil	41.03	48.54	36.37	21.44	9.61	8.41	1.22	1.91	2.49
Waste Oil	NO	NO	NO	NO	1.36	1.59	0.37	4.18	1.99
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	2.22	1.59
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	0.14	0.16
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	2.40	2.23
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	0.25	0.99
Other Bituminous Coal	NO	NO	NO	NO	NO	NO	NO	NO	NO

3.4.2.2 Emission Factors

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

Table 3-11 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 and therefore the notation key *not applicable* was used:

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

3.4.2.3 Recalculations and Improvements

An updated LPG usage from one company was obtained for the year 2020 and updated diesel usage from one company was obtained for the year 2022. This led to minor recalculations (within 0.02%) for all estimated air pollutants within non-ferrous metals (1A2b) for the year 2020 and (within -0.005%) for all estimated air pollutants within non-ferrous metals (1A2b) for the year 2022.

Due to the previously mentioned activity-data adjustments, the 2020 LPG change and 2022 diesel change leads to equal and opposite adjustments in Other industry (1A2gviii) for all estimated air pollutants, within 0.005% of 1A2gviii for 2020 and within -0.02% of 1A2gviii for 2022. The total effect of the updated LPG and diesel usage on 1A2 emissions is therefore none.

In 1A2f Other, a mistake was corrected where the NK NA had been used for HCB emissions for the years 1990-2011 (as cement was produced). Now the emissions are reported. The amount is less than 1 kg HCB per year.

3.4.2.4 Planned Improvements

No improvements are currently planned for this subsector.

3.4.3 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.

3.4.3.1 Activity Data

Activity data for fuel use is collected from fuel sales by sector. The IEEA adjusts the data provided, as further explained in Chapter 1. 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 3-12. It should be noted that data reported indicates negligible solid fuel use for subcategory 1A4bi, and therefore condensables are also negligible.

Table 3-12 Fuel use [kt] from Stationary Combustion from subsectors of NFR 1A4.

Fuel Type	1990	1995	2000	2005	2010	2015	2020	2023	2024
1A4ai Commercial/Institutional									
Gas/Diesel Oil	1.800	1.600	1.600	1.000	0.300	0.300	0.127	0.121	0.170
LPG	0.777	0.834	0.460	0.496	0.174	0.371	0.411	0.635	0.627
Waste – Fossil	NO	0.145	0.186	0.186	0.147	NO	NO	NO	NO
Waste – Biogenic	NO	0.305	0.394	0.394	0.202	NO	NO	NO	NO
1A4bi Residential									
Gas/Diesel Oil	8.82	6.94	6.03	3.24	1.34	0.994	1.06	0.414	0.440
LPG	NO	NO	0.717	0.930	1.42	0.927	1.10	0.971	1.01
Charcoal	0.197	0.197	0.197	0.197	0.197	0.197	0.183	0.227	0.227
Biodiesel	NO	NO	NO	NO	NO	NO	NO	0.0053	NO
1A4ci Agriculture									
LPG	NO	NO	NO	NO	NO	0.0040	0.0080	0.0040	0.0040

3.4.3.2 Emission Factors

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

Emissions from Waste Incineration with Recovery, where the energy is used for swimming pools/school buildings are reported here in Commercial (1A4ai). The emissions per unit waste 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 dioxin emissions per unit waste is considerably higher than for liquid fuel.

Table 3-13 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.

Fuel Type	Reference	Exception
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 emission factor from Statistics Norway, 2002.

3.4.3.3 Recalculations and Improvements

3.4.3.3.1.1 1A4ai Commercial Stationary

Dioxin emissions from waste are now included but were missing in the calculations due to a mistake. This leads to recalculations for dioxin for all years in which waste was used, 1990-2012, see table below.

Table 3-14 Recalculations in 1A4ai Commercial Stationary.

1A4ai Commercial Stationary	1993	1995	2000	2005	2010	2012
2025 submission dioxin [mg]	4.13E-04	4.13E-04	4.13E-04	2.58E-04	7.74E-05	7.74E-05
2026 submission dioxin [mg]	0.1354	0.1354	0.1484	0.0843	0.0541	0.0183
Change relative to the 2025 submission dioxin [mg]	0.1350	0.1350	0.1480	0.0840	0.0540	0.0182
Change relative to the 2025 submission dioxin [%]	32703%	32703%	35853%	32558%	69751%	23514%

3.4.3.3.1.2 1A4bi Residential Stationary

No category-specific recalculations were done for this submission.

3.4.3.3.1.3 1A4ci Agriculture Stationary

No category-specific recalculations were done for this submission.

3.4.3.4 Planned Improvements

No improvements are currently planned for this subsector.

3.4.4 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.

3.4.4.1 Activity Data

Activity data is collected from fuel sales by sector.

Table 3-15 Fuel use [kt] from sector 1A5 Other.

Fuel Type	1990	1995	2000	2005	2010	2015	2020	2023	2024
Gas/Diesel Oil	NO	0.46	1.39	8.93	2.73	NO	0.084	0.52	1.42
Residual Fuel Oil	0.039	0.052	0.067	NO	1.63	NO	NO	NO	NO
Other Kerosene	NO	NO	NO	0.15	0.047	0.029	0.030	0.031	0.037
LPG	NO	NO	NO	NO	NO	0.032	NO	0.0051	NO
Biodiesel	NO	NO	NO	NO	NO	NO	0.044	0.023	0.088
Biomethane	NO	NO	NO	NO	NO	NO	0.111	NO	0.166
Biogasoline	NO	NO	NO	NO	NO	NO	0.0010	NO	0.0056

3.4.4.2 Emission Factors

All emission factors are the same as for 1A2 and are presented in Table 3-11.

3.4.4.3 Recalculations and Improvements

For residual fuel oil, the SO_2 emission factor for diesel oil was previously used. This mistake has now been corrected. This leads to recalculations for SO_2 for all years in which residual fuel oil was used, 1990-1996, 1998-2003, 2007-2008 and 2010-2011, see table below.

Table 3-16 Recalculations in 1A5a Other Stationary.

1A5a Other Stationary	1990	1995	2000	2003	2007	2010
2025 submission SO_x [kt]	3.12E-5	4.08E-4	8.72E-4	1.38E-3	1.98E-5	3.08E-5
2026 submission SO_x [kt]	2.11E-3	3.17E-3	4.45E-3	1.84E-2	1.37E-3	4.89E-2
Change relative to the 2025 submission SO_x [kt]	2.07E-3	2.77E-3	3.58E-3	1.70E-2	1.35E-3	4.89E-2
Change relative to the 2025 submission SO_x [%]	6650%	678%	410%	1232%	6833%	158488%

3.4.4.4 Planned Improvements

No improvements are currently planned for this subsector.

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

3.5.1 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, and which are not otherwise considered under specific NFR codes.

3.5.1.1 Activity Data

Before 2019, activity data related to Gas/Diesel Oil combustion in off-road mobile machinery was registered as the total of fuel directly distributed to the users by fuel delivery trucks, as opposed to fuel sold at petrol stations. No breakdown of fuel sold for off-road vehicles in agriculture, construction, or other applications is available for 1990-2018. Starting from 2019, a dedicated attribution of directly distributed fuel to categories 1A2gvii, 1A3eii, and 1A4cii was introduced. However, the relative proportion of fuel sales reported in category 1A3eii is significantly higher for 2019 (29%) and 2020 (21%) than 2021-2024 (average 1.86%), indicating possible inaccuracies in the initial allocation of fuel to these categories (see Table 3-17).

Prior to the 2023 submission, category 1A3eii, Other Off-road Vehicles and Machinery, included all emissions estimated from fuel sold to off-road machinery for 1990-2018, including Mobile Machinery in Construction (1A2gvii) and Agriculture/Forestry/Fishing: Off-road Vehicles and Other Machinery (1A4cii). Categories 1A2gvii and 1A4cii were, thus, considered "included elsewhere". The approach followed in the submissions of 2023 to 2025 was to extrapolate the Gas/Diesel Oil split for the years 1990 to 2018 based on the average proportion of each category as reported for 2019 to 2022, while activity data for 2019 and following years was considered correctly attributed to the three categories.

Due to this proportional split projecting historic activity fluctuations across categories, in particular from construction onto agriculture, as well as the above-mentioned concerns regarding the accurate attribution of fuel to categories in 2019 and 2020, an improved approach was implemented for the 2026 submission:

Addressing the attribution inaccuracies of 2019 and 2020, the fuel assigned to 1A3eii (Other Off-road Vehicles and Machinery) in 2019 and 2020, that exceeds the average proportion of fuel attributed to 1A3eii in 2021 to 2024, was added to the fuel reported for categories 1A2gvii and 1A4cii according to the relative proportions of these two categories in the respective year, 2019 and 2020 (Table 3-17).

Table 3-17 Fuel sold in 1A2gvii, 1A3eii, and 1A4cii. Reported data and 2019 and 2020 adjusted.

	2019	2020	2021	2022	2023	2024
Fuel sold, reported [kt]						
1A2gvii - Mobile Machinery in Construction	12.31	6.41	9.87	10.36	15.09	15.38
1A4cii - Mobile Machinery in Agriculture	5.40	7.57	6.45	6.27	6.26	6.22
1A3eii - Other Mobile Machinery	7.12	3.72	0.73	0.32	0.00	0.28
Proportion of total fuel sales of these 3 categories						
1A2gvii - Mobile Machinery in Construction	50%	36%	58%	61%	71%	70%
1A4cii - Mobile Machinery in Agriculture	22%	43%	38%	37%	29%	28%
1A3eii - Other Mobile Machinery	29%	21%	4%	2%	0%	1%
Fuel sold, adjusted in 2019 and 2020 [kt]						
1A2gvii - Mobile Machinery in Construction	16.94	7.96	9.87	10.36	15.09	15.38
1A4cii - Mobile Machinery in Agriculture	7.44	9.41	6.45	6.27	6.26	6.22
1A3eii - Other Mobile Machinery	0.46	0.33	0.73	0.32	0.00	0.28

The revised fuel split between categories 1A2gvii, 1A3eii, and 1A4cii for the years 1990-2018 is based on category-specific activity data, i.e. m^2 of constructed building area and paved road surface (1A2gvii), as well as livestock numbers in key animal categories (cattle, sheep, horses. 1A4cii). These data are available for the entire timeline and are used to calculate the weighted totals of activity per category and year (1990-2024), with dimensionless weights representing the assumed relative fuel intensities of production or farming of units of activity data (m^2 or single animal) of the different types[11] within a category (see Table 3-18).

Table 3-18 Weighted Activity Data, categories 1A2gvii and 1A4cii.

Activity	Weight	1990	1995	2000	2005	2010	2015	2020	2023	2024
Activity in 1A2gvii - Mobile Machinery in Construction [m^2]										
Buildings	1.00	485097	364013	617323	636931	323762	268420	585750	658055	635737
New roads	0.10	757636	757636	757636	693000	1161000	324000	513000	477000	477000
Weighted total		560860	439777	693086	706231	439862	300820	637050	705755	683437
Activity in 1A4cii - Mobile Machinery in Agriculture [livestock]										

[11] Buildings and paved roads in 1A2gvii. Cattle, adult sheep, and horses in 1A4cii.

Activity	Weight	1990	1995	2000	2005	2010	2015	2020	2023	2024
Adult sheep	0.20	548707	458367	465637	454726	477294	473553	401839	356182	344996
Cattle	1.00	74903	73199	72144	65970	72509	78776	81170	78702	76971
Horses	0.50	73867	80246	75630	76629	78849	79433	73465	68505	63452
Weighted total		221578	204995	203086	195230	207392	213203	198270	184191	177696

Category-specific fuel sales data and the calculated weighted totals of activity data of the years 2019 to 2024 are used to calculate a single average fuel factor/investment (in kg) per unit of activity data for each category (1A2gvii and 1A4cii, see Table 3-19).

Table 3-19 Category-specific Fuel Factors (Fuel per unit of Activity Data) for 1A2gvii and 1A4cii.

Category	Fuel factor	2019	2020	2021	2022	2023	2024	Average
1A2gvii	kg / m^2	27.2	12.5	17.5	17.6	21.4	22.5	19.8
1A4cii	kg / animal	37.1	47.4	33.4	33.2	34.0	35.0	36.7

The weighted sums of activity data of the years 1990 to 2018 of both categories are multiplied by these category-specific average fuel factors and equally scaled to sum up to the total fuel sales reported for 1A3eii for each year, minus the fuel that remains attributed to 1A3eii according to its average proportion in 2021 to 2024. Table 3-20 summarises the fuel attributed to categories 1A2gvii, 1A3eii, and 1A4cii at selected points along the timeline.

Table 3-20 Fuel use (in kt) from Mobile Combustion in the Construction Industry (1A2gv), Agriculture (1A4cii), and Other (1A2gvii).

	1990	1995	2000	2005	2010	2015	2020	2023	2024
1A2gvii - Mobile Machinery in Construction									
Gas/Diesel Oil	21.52	24.6	39.36	43.98	16.88	14.03	7.96	15.09	15.38
1A3eii - Other Mobile Machinery									
Gas/Diesel Oil	0.71	0.87	1.15	1.26	0.60	0.62	0.33	NO	0.28
Other Kerosene	NO	NO	NO	0.022	1.17	0.16	0.33	0.022	0.011
Biodiesel	NO	NO	NO	NO	NO	NO	NO	NO	NO
1A4cii - Mobile Machinery in Agriculture									
Gas/Diesel Oil	15.76	21.26	21.38	22.54	14.75	18.44	9.41	6.26	6.22

3.5.1.2 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 4-2.

Table 3-21 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	

3.5.1.3 Recalculations and Improvements

For the previous submission, the Gas/Diesel Oil split for the years 1990 to 2018 was extrapolated based on the average proportion of categories 1A2gvii, 1A3eii, and 1A4cii as reported for 2019 to 2022, while activity data for 2019 and following years was considered correctly attributed to these categories.

This approach was revised for the 2026 submission, with fuel for the years 1990-2018 split between categories based on category-specific activity data. Fuel assignment for the years 2019 and 2020 was corrected for suspected attribution inaccuracies. See section 3.5.1.1 for a detailed description of this procedure.

The recalculations affect all relevant air pollutants in all three categories over the entire timeline up to and including year 2020.

3.5.1.3.1 1A2gvii Mobile Machinery in Construction

Table 3-22 Recalculations for 1990-2020, all air pollutants, in 1A2gvii Mobile Machinery in Construction between submissions.

1A2gvii Mobile Machinery in Construction	1990	1995	2000	2005	2010	2015	2020
2025 submission SO_2 [kt]	0.0156	0.0191	0.0190	0.0028	0.0001	0.0003	0.0001
2026 submission SO_2 [kt]	0.0172	0.0197	0.0236	0.0035	0.0001	0.0002	0.0001
Change relative to the 2025 submission SO_2 [kt]	1.7E-03	5.4E-04	4.6E-03	7.4E-04	2.6E-06	-5.1E-05	2.7E-05
Change relative to the 2025 submission SO_2 [%]	10.6%	2.8%	24.2%	26.7%	2.3%	-17.2%	24.3%
2025 submission NOx [kt]	0.635	0.781	1.034	1.132	0.538	0.553	0.209
2026 submission NOx [kt]	0.702	0.803	1.284	1.435	0.551	0.458	0.260

1A2gvii Mobile Machinery in Construction	1990	1995	2000	2005	2010	2015	2020
Change relative to the 2025 submission NOx [kt]	0.068	0.022	0.250	0.303	0.012	-0.095	0.051
Change relative to the 2025 submission NOx [%]	10.6%	2.8%	24.2%	26.7%	2.3%	-17.2%	24.3%
2025 submission CO [kt]	0.210	0.258	0.341	0.374	0.178	0.182	0.069
2026 submission CO [kt]	0.232	0.265	0.424	0.474	0.182	0.151	0.086
Change relative to the 2025 submission CO [kt]	0.022	0.007	0.083	0.100	0.004	-0.031	0.017
Change relative to the 2025 submission CO [%]	10.6%	2.8%	24.2%	26.7%	2.3%	-17.2%	24.3%
2025 submission NMVOC [kt]	0.066	0.081	0.107	0.117	0.056	0.057	0.022
2026 submission NMVOC [kt]	0.073	0.083	0.133	0.149	0.057	0.047	0.027
Change relative to the 2025 submission NMVOC [kt]	0.007	0.002	0.026	0.031	0.001	-0.010	0.005
Change relative to the 2025 submission NMVOC [%]	10.6%	2.8%	24.2%	26.7%	2.3%	-17.2%	24.3%
2025 submission NH3 [kt]	0.00016	0.00019	0.00025	0.00028	0.00013	0.00014	0.00005
2026 submission NH3 [kt]	0.00017	0.00020	0.00031	0.00035	0.00014	0.00011	0.00006
Change relative to the 2025 submission NH3 [kt]	1.7E-05	5.4E-06	6.1E-05	7.4E-05	3.0E-06	-2.3E-05	1.2E-05
Change relative to the 2025 submission NH3 [%]	10.6%	2.8%	24.2%	26.7%	2.3%	-17.2%	24.3%
2025 submission dioxin [g]	0.00194	0.00239	0.00317	0.00347	0.00165	0.00169	0.00064
2026 submission dioxin [g]	0.00215	0.00246	0.00394	0.00440	0.00169	0.00140	0.00080
Change relative to the 2025 submission dioxin [g]	2.1E-04	6.8E-05	7.7E-04	9.3E-04	3.8E-05	-2.9E-04	1.6E-04
Change relative to the 2025 submission dioxin [%]	10.6%	2.8%	24.2%	26.7%	2.3%	-17.2%	24.3%
2025 submission PM2.5 [kt]	0.041	0.050	0.067	0.073	0.035	0.036	0.013
2026 submission PM2.5 [kt]	0.045	0.052	0.083	0.093	0.036	0.030	0.017
Change relative to the 2025 submission PM2.5 [kt]	0.004	0.001	0.016	0.020	0.001	-0.006	0.003
Change relative to the 2025 submission PM2.5 [%]	10.6%	2.8%	24.2%	26.7%	2.3%	-17.2%	24.3%
2025 submission PM10 [kt]	0.041	0.050	0.067	0.073	0.035	0.036	0.013
2026 submission PM10 [kt]	0.045	0.052	0.083	0.093	0.036	0.030	0.017
Change relative to the 2025 submission PM10 [kt]	0.004	0.001	0.016	0.020	0.001	-0.006	0.003
Change relative to the 2025 submission PM10 [%]	10.6%	2.8%	24.2%	26.7%	2.3%	-17.2%	24.3%
2025 submission TSP [kt]	0.041	0.050	0.067	0.073	0.035	0.036	0.013
2026 submission TSP [kt]	0.045	0.052	0.083	0.093	0.036	0.030	0.017
Change relative to the 2025 submission TSP [kt]	0.004	0.001	0.016	0.020	0.001	-0.006	0.003
Change relative to the 2025 submission TSP [%]	10.6%	2.8%	24.2%	26.7%	2.3%	-17.2%	24.3%
2025 submission BC [kt]	0.025	0.031	0.041	0.045	0.022	0.022	0.008

1A2gvii Mobile Machinery in Construction	1990	1995	2000	2005	2010	2015	2020
2026 submission BC [kt]	0.028	0.032	0.051	0.057	0.022	0.018	0.010
Change relative to the 2025 submission BC [kt]	0.003	0.001	0.010	0.012	0.000	-0.004	0.002
Change relative to the 2025 submission BC [%]	10.6%	2.8%	24.2%	26.7%	2.3%	-17.2%	24.3%
2025 submission Pb [t]	0.044	0.054	0.071	0.078	0.037	0.038	0.014
2026 submission Pb [t]	0.048	0.055	0.089	0.099	0.038	0.032	0.018
Change relative to the 2025 submission Pb [t]	0.005	0.002	0.017	0.021	0.001	-0.007	0.003
Change relative to the 2025 submission Pb [%]	10.6%	2.8%	24.2%	26.7%	2.3%	-17.2%	24.3%
2025 submission Cd [t]	0.00019	0.00024	0.00032	0.00035	0.00016	0.00017	0.00006
2026 submission Cd [t]	0.00022	0.00025	0.00039	0.00044	0.00017	0.00014	0.00008
Change relative to the 2025 submission Cd [t]	2.1E-05	6.8E-06	7.7E-05	9.3E-05	3.8E-06	-2.9E-05	1.6E-05
Change relative to the 2025 submission Cd [%]	10.6%	2.8%	24.2%	26.7%	2.3%	-17.2%	24.3%
2025 submission Cu [t]	0.033	0.041	0.054	0.059	0.028	0.029	0.011
2026 submission Cu [t]	0.037	0.042	0.067	0.075	0.029	0.024	0.014
Change relative to the 2025 submission Cu [t]	0.004	0.001	0.013	0.016	0.001	-0.005	0.003
Change relative to the 2025 submission Cu [%]	10.6%	2.8%	24.2%	26.7%	2.3%	-17.2%	24.3%
2025 submission Cr [t]	0.0010	0.0012	0.0016	0.0017	0.0008	0.0008	0.0003
2026 submission Cr [t]	0.0011	0.0012	0.0020	0.0022	0.0008	0.0007	0.0004
Change relative to the 2025 submission Cr [t]	1.0E-04	3.4E-05	3.8E-04	4.6E-04	1.9E-05	-1.5E-04	7.8E-05
Change relative to the 2025 submission Cr [%]	10.6%	2.8%	24.2%	26.7%	2.3%	-17.2%	24.3%
2025 submission Ni [t]	0.0014	0.0017	0.0022	0.0024	0.0012	0.0012	0.0004
2026 submission Ni [t]	0.0015	0.0017	0.0028	0.0031	0.0012	0.0010	0.0006
Change relative to the 2025 submission Ni [t]	1.4E-04	4.7E-05	5.4E-04	6.5E-04	2.6E-05	-2.0E-04	1.1E-04
Change relative to the 2025 submission Ni [%]	10.6%	2.8%	24.2%	26.7%	2.3%	-17.2%	24.3%
2025 submission Se [t]	0.00019	0.00024	0.00032	0.00035	0.00016	0.00017	0.00006
2026 submission Se [t]	0.00022	0.00025	0.00039	0.00044	0.00017	0.00014	0.00008
Change relative to the 2025 submission Se [t]	2.1E-05	6.8E-06	7.7E-05	9.3E-05	3.8E-06	-2.9E-05	1.6E-05
Change relative to the 2025 submission Se [%]	10.6%	2.8%	24.2%	26.7%	2.3%	-17.2%	24.3%
2025 submission Zn [t]	0.019	0.024	0.032	0.035	0.016	0.017	0.006
2026 submission Zn [t]	0.022	0.025	0.039	0.044	0.017	0.014	0.008
Change relative to the 2025 submission Zn [t]	2.1E-03	6.8E-04	7.7E-03	9.3E-03	3.8E-04	-2.9E-03	1.6E-03
Change relative to the 2025 submission Zn [%]	10.6%	2.8%	24.2%	26.7%	2.3%	-17.2%	24.3%

1A2gvii Mobile Machinery in Construction	1990	1995	2000	2005	2010	2015	2020
2025 submission PAH4 [t]	0.0016	0.0019	0.0025	0.0028	0.0013	0.0014	0.0005
2026 submission PAH4 [t]	0.0017	0.0020	0.0031	0.0035	0.0014	0.0011	0.0006
Change relative to the 2025 submission PAH4 [t]	1.7E-04	5.4E-05	6.1E-04	7.4E-04	3.0E-05	-2.3E-04	1.2E-04
Change relative to the 2025 submission PAH4 [%]	10.6%	2.8%	24.2%	26.7%	2.3%	-17.2%	24.3%

3.5.1.3.2 1A3eii Other Mobile Machinery

Table 3-23 Recalculations for 1990-2020, all air pollutants, in 1A3eii Other Mobile Machinery between submissions.

1A3eii Other Mobile Machinery	1990	1995	2000	2005	2010	2015	2020
2025 submission SO2 [kt]	0.0042	0.0052	0.0052	0.00076	4.0.E-05	8.4.E-05	7.1.E-05
2026 submission SO2 [kt]	0.0006	0.0007	0.0007	0.00010	1.2.E-05	1.4.E-05	1.2.E-05
Change relative to the 2025 submission SO2 [kt]	-3.7E-03	-4.5E-03	-4.5E-03	-6.6E-04	-2.7E-05	-7.0E-05	-6.0E-05
Change relative to the 2025 submission SO2 [%]	-86.7%	-86.7%	-86.7%	-86.5%	-68.8%	-83.8%	-83.8%
2025 submission NOx [kt]	0.173	0.213	0.282	0.310	0.185	0.156	0.132
2026 submission NOx [kt]	0.023	0.028	0.038	0.042	0.058	0.025	0.021
Change relative to the 2025 submission NOx [kt]	-0.150	-0.185	-0.244	-0.268	-0.127	-0.131	-0.111
Change relative to the 2025 submission NOx [%]	-86.7%	-86.7%	-86.7%	-86.5%	-68.8%	-83.8%	-83.8%
2025 submission CO [kt]	0.057	0.070	0.093	0.102	0.061	0.051	0.044
2026 submission CO [kt]	0.008	0.009	0.012	0.014	0.019	0.008	0.007
Change relative to the 2025 submission CO [kt]	-0.050	-0.061	-0.081	-0.088	-0.042	-0.043	-0.037
Change relative to the 2025 submission CO [%]	-86.7%	-86.7%	-86.7%	-86.5%	-68.8%	-83.8%	-83.8%
2025 submission NMVOC [kt]	0.018	0.022	0.029	0.032	0.019	0.016	0.014
2026 submission NMVOC [kt]	0.002	0.003	0.004	0.004	0.006	0.003	0.002
Change relative to the 2025 submission NMVOC [kt]	-0.016	-0.019	-0.025	-0.028	-0.013	-0.014	-0.011
Change relative to the 2025 submission NMVOC [%]	-86.7%	-86.7%	-86.7%	-86.5%	-68.8%	-83.8%	-83.8%
2025 submission NH3 [kt]	4.2.E-05	5.2.E-05	6.9.E-05	7.6.E-05	4.5.E-05	3.8.E-05	3.2.E-05
2026 submission NH3 [kt]	5.7.E-06	7.0.E-06	9.2.E-06	1.0.E-05	1.4.E-05	6.2.E-06	5.2.E-06
Change relative to the 2025 submission NH3 [kt]	-3.7E-05	-4.5E-05	-6.0E-05	-6.6E-05	-3.1E-05	-3.2E-05	-2.7E-05
Change relative to the 2025 submission NH3 [%]	-86.7%	-86.7%	-86.7%	-86.5%	-68.8%	-83.8%	-83.8%
2025 submission dioxin [g]	5.3.E-04	6.5.E-04	8.6.E-04	9.5.E-04	5.7.E-04	4.8.E-04	4.0.E-04
2026 submission dioxin [g]	7.1.E-05	8.7.E-05	1.2.E-04	1.3.E-04	1.8.E-04	7.7.E-05	6.6.E-05
Change relative to the 2025 submission dioxin [g]	-4.6E-04	-5.7E-04	-7.5E-04	-8.2E-04	-3.9E-04	-4.0E-04	-3.4E-04

1A3eii Other Mobile Machinery	1990	1995	2000	2005	2010	2015	2020
Change relative to the 2025 submission dioxin [%]	-86.7%	-86.7%	-86.7%	-86.5%	-68.8%	-83.8%	-83.8%
2025 submission PM2.5 [kt]	0.011	0.014	0.018	0.020	0.012	0.010	0.009
2026 submission PM2.5 [kt]	0.001	0.002	0.002	0.003	0.004	0.002	0.001
Change relative to the 2025 submission PM2.5 [kt]	-0.010	-0.012	-0.016	-0.017	-0.008	-0.008	-0.007
Change relative to the 2025 submission PM2.5 [%]	-86.7%	-86.7%	-86.7%	-86.5%	-68.8%	-83.8%	-83.8%
2025 submission BC [kt]	0.0069	0.0085	0.0113	0.0124	0.0074	0.0062	0.0053
2026 submission BC [kt]	0.0009	0.0011	0.0015	0.0017	0.0023	0.0010	0.0009
Change relative to the 2025 submission BC [kt]	-0.0060	-0.0074	-0.0098	-0.0107	-0.0051	-0.0052	-0.0044
Change relative to the 2025 submission BC [%]	-86.7%	-86.7%	-86.7%	-86.5%	-68.8%	-83.8%	-83.8%
2025 submission PM10 [kt]	0.011	0.014	0.018	0.020	0.012	0.010	0.009
2026 submission PM10 [kt]	0.001	0.002	0.002	0.003	0.004	0.002	0.001
Change relative to the 2025 submission PM10 [kt]	-0.010	-0.012	-0.016	-0.017	-0.008	-0.008	-0.007
Change relative to the 2025 submission PM10 [%]	-86.7%	-86.7%	-86.7%	-86.5%	-68.8%	-83.8%	-83.8%
2025 submission TSP [kt]	0.011	0.014	0.018	0.020	0.012	0.010	0.009
2026 submission TSP [kt]	0.001	0.002	0.002	0.003	0.004	0.002	0.001
Change relative to the 2025 submission TSP [kt]	-0.010	-0.012	-0.016	-0.017	-0.008	-0.008	-0.007
Change relative to the 2025 submission TSP [%]	-86.7%	-86.7%	-86.7%	-86.5%	-68.8%	-83.8%	-83.8%
2025 submission Pb [t]	0.012	0.015	0.019	0.021	0.013	0.011	0.009
2026 submission Pb [t]	0.002	0.002	0.003	0.003	0.004	0.002	0.001
Change relative to the 2025 submission Pb [t]	-0.010	-0.013	-0.017	-0.018	-0.009	-0.009	-0.008
Change relative to the 2025 submission Pb [%]	-86.7%	-86.7%	-86.7%	-86.5%	-68.8%	-83.8%	-83.8%
2025 submission Cd [t]	5.3.E-05	6.5.E-05	8.6.E-05	9.5.E-05	5.7.E-05	4.8.E-05	4.0.E-05
2026 submission Cd [t]	7.1.E-06	8.7.E-06	1.2.E-05	1.3.E-05	1.8.E-05	7.7.E-06	6.6.E-06
Change relative to the 2025 submission Cd [t]	-4.6E-05	-5.7E-05	-7.5E-05	-8.2E-05	-3.9E-05	-4.0E-05	-3.4E-05
Change relative to the 2025 submission Cd [%]	-86.7%	-86.7%	-86.7%	-86.5%	-68.8%	-83.8%	-83.8%
2025 submission Cu [t]	0.0090	0.0111	0.0147	0.0161	0.0096	0.0081	0.0069
2026 submission Cu [t]	0.0012	0.0015	0.0020	0.0022	0.0030	0.0013	0.0011
Change relative to the 2025 submission Cu [t]	-0.0078	-0.0096	-0.0127	-0.0139	-0.0066	-0.0068	-0.0058
Change relative to the 2025 submission Cu [%]	-86.7%	-86.7%	-86.7%	-86.5%	-68.8%	-83.8%	-83.8%
2025 submission Cr [t]	2.7.E-04	3.3.E-04	4.3.E-04	4.7.E-04	2.8.E-04	2.4.E-04	2.0.E-04
2026 submission Cr [t]	3.5.E-05	4.3.E-05	5.8.E-05	6.4.E-05	8.9.E-05	3.9.E-05	3.3.E-05

1A3eii Other Mobile Machinery	1990	1995	2000	2005	2010	2015	2020
Change relative to the 2025 submission Cr [t]	-2.3E-04	-2.8E-04	-3.7E-04	-4.1E-04	-2.0E-04	-2.0E-04	-1.7E-04
Change relative to the 2025 submission Cr [%]	-86.7%	-86.7%	-86.7%	-86.5%	-68.8%	-83.8%	-83.8%
2025 submission Ni [t]	3.7.E-04	4.6.E-04	6.1.E-04	6.6.E-04	4.0.E-04	3.3.E-04	2.8.E-04
2026 submission Ni [t]	4.9.E-05	6.1.E-05	8.1.E-05	9.0.E-05	1.2.E-04	5.4.E-05	4.6.E-05
Change relative to the 2025 submission Ni [t]	-3.2E-04	-4.0E-04	-5.2E-04	-5.7E-04	-2.7E-04	-2.8E-04	-2.4E-04
Change relative to the 2025 submission Ni [%]	-86.7%	-86.7%	-86.7%	-86.5%	-68.8%	-83.8%	-83.8%
2025 submission Se [t]	5.3.E-05	6.5.E-05	8.6.E-05	9.5.E-05	5.7.E-05	4.8.E-05	4.0.E-05
2026 submission Se [t]	7.1.E-06	8.7.E-06	1.2.E-05	1.3.E-05	1.8.E-05	7.7.E-06	6.6.E-06
Change relative to the 2025 submission Se [t]	-4.6E-05	-5.7E-05	-7.5E-05	-8.2E-05	-3.9E-05	-4.0E-05	-3.4E-05
Change relative to the 2025 submission Se [%]	-86.7%	-86.7%	-86.7%	-86.5%	-68.8%	-83.8%	-83.8%
2025 submission Zn [t]	0.0053	0.0065	0.0086	0.0095	0.0057	0.0048	0.0040
2026 submission Zn [t]	0.0007	0.0009	0.0012	0.0013	0.0018	0.0008	0.0007
Change relative to the 2025 submission Zn [t]	-0.0046	-0.0057	-0.0075	-0.0082	-0.0039	-0.0040	-0.0034
Change relative to the 2025 submission Zn [%]	-86.7%	-86.7%	-86.7%	-86.5%	-68.8%	-83.8%	-83.8%
2025 submission PAH4 [t]	4.2.E-04	5.2.E-04	6.9.E-04	7.6.E-04	4.5.E-04	3.8.E-04	3.2.E-04
2026 submission PAH4 [t]	5.7.E-05	7.0.E-05	9.2.E-05	1.0.E-04	1.4.E-04	6.2.E-05	5.2.E-05
Change relative to the 2025 submission PAH4 [t]	-3.7E-04	-4.5E-04	-6.0E-04	-6.6E-04	-3.1E-04	-3.2E-04	-2.7E-04
Change relative to the 2025 submission PAH4 [%]	-86.7%	-86.7%	-86.7%	-86.5%	-68.8%	-83.8%	-83.8%

3.5.1.3.3 1A4cii Mobile Machinery in Agriculture

Table 3-24 Recalculations for 1990-2020, all air pollutants, in 1A4cii Mobile Machinery in Agriculture between submissions.

1A4cii Mobile Machinery in Agriculture	1990	1995	2000	2005	2010	2015	2020
2025 submission SO2 [kt]	0.0106	0.0130	0.0129	0.0019	7.9.E-05	2.0.E-04	1.3.E-04
2026 submission SO2 [kt]	0.0126	0.0170	0.0128	0.0018	1.0.E-04	3.2.E-04	1.7.E-04
Change relative to the 2025 submission SO2 [kt]	0.0020	0.0040	-0.0001	-0.0001	2.5.E-05	1.2.E-04	3.2.E-05
Change relative to the 2025 submission SO2 [%]	19.1%	30.6%	-0.8%	-4.5%	31.4%	60.0%	24.3%
2025 submission NOx [kt]	0.43	0.53	0.70	0.77	0.37	0.38	0.25
2026 submission NOx [kt]	0.51	0.69	0.70	0.74	0.48	0.60	0.31
Change relative to the 2025 submission NOx [kt]	0.08	0.16	-0.01	-0.03	0.12	0.23	0.06
Change relative to the 2025 submission NOx [%]	19.1%	30.6%	-0.8%	-4.5%	31.4%	60.0%	24.3%

1A4cii Mobile Machinery in Agriculture	1990	1995	2000	2005	2010	2015	2020
2025 submission CO [kt]	0.14	0.18	0.23	0.25	0.12	0.12	0.08
2026 submission CO [kt]	0.17	0.23	0.23	0.24	0.16	0.20	0.10
Change relative to the 2025 submission CO [kt]	0.03	0.05	0.00	-0.01	0.04	0.07	0.02
Change relative to the 2025 submission CO [%]	19.1%	30.6%	-0.8%	-4.5%	31.4%	60.0%	24.3%
2025 submission NMVOC [kt]	0.045	0.055	0.073	0.080	0.038	0.039	0.026
2026 submission NMVOC [kt]	0.053	0.072	0.072	0.076	0.050	0.062	0.032
Change relative to the 2025 submission NMVOC [kt]	0.009	0.017	-0.001	-0.004	0.012	0.023	0.006
Change relative to the 2025 submission NMVOC [%]	19.1%	30.6%	-0.8%	-4.5%	31.4%	60.0%	24.3%
2025 submission NH3 [kt]	1.1.E-04	1.3.E-04	1.7.E-04	1.9.E-04	9.0.E-05	9.2.E-05	6.1.E-05
2026 submission NH3 [kt]	1.3.E-04	1.7.E-04	1.7.E-04	1.8.E-04	1.2.E-04	1.5.E-04	7.5.E-05
Change relative to the 2025 submission NH3 [kt]	2.0.E-05	4.0.E-05	-1.4.E-06	-8.6.E-06	2.8.E-05	5.5.E-05	1.5.E-05
Change relative to the 2025 submission NH3 [%]	19.1%	30.6%	-0.8%	-4.5%	31.4%	60.0%	24.3%
2025 submission dioxin [g]	0.0013	0.0016	0.0022	0.0024	0.0011	0.0012	0.0008
2026 submission dioxin [g]	0.0016	0.0021	0.0021	0.0023	0.0015	0.0018	0.0009
Change relative to the 2025 submission dioxin [g]	2.5.E-04	5.0.E-04	-1.8.E-05	-1.1.E-04	3.5.E-04	6.9.E-04	1.8.E-04
Change relative to the 2025 submission dioxin [%]	19.1%	30.6%	-0.8%	-4.5%	31.4%	60.0%	24.3%
2025 submission PM2.5 [kt]	0.028	0.034	0.045	0.050	0.024	0.024	0.016
2026 submission PM2.5 [kt]	0.033	0.045	0.045	0.047	0.031	0.039	0.020
Change relative to the 2025 submission PM2.5 [kt]	0.005	0.010	0.000	-0.002	0.007	0.015	0.004
Change relative to the 2025 submission PM2.5 [%]	19.1%	30.6%	-0.8%	-4.5%	31.4%	60.0%	24.3%
2025 submission BC [kt]	0.017	0.021	0.028	0.031	0.015	0.015	0.010
2026 submission BC [kt]	0.021	0.028	0.028	0.029	0.019	0.024	0.012
Change relative to the 2025 submission BC [kt]	0.003	0.007	0.000	-0.001	0.005	0.009	0.002
Change relative to the 2025 submission BC [%]	19.1%	30.6%	-0.8%	-4.5%	31.4%	60.0%	24.3%
2025 submission PM10 [kt]	0.028	0.034	0.045	0.050	0.024	0.024	0.016
2026 submission PM10 [kt]	0.033	0.045	0.045	0.047	0.031	0.039	0.020
Change relative to the 2025 submission PM10 [kt]	0.005	0.010	0.000	-0.002	0.007	0.015	0.004
Change relative to the 2025 submission PM10 [%]	19.1%	30.6%	-0.8%	-4.5%	31.4%	60.0%	24.3%
2025 submission TSP [kt]	0.028	0.034	0.045	0.050	0.024	0.024	0.016
2026 submission TSP [kt]	0.033	0.045	0.045	0.047	0.031	0.039	0.020
Change relative to the 2025 submission TSP [kt]	0.005	0.010	0.000	-0.002	0.007	0.015	0.004

1A4cii Mobile Machinery in Agriculture	1990	1995	2000	2005	2010	2015	2020
Change relative to the 2025 submission TSP [%]	19.1%	30.6%	-0.8%	-4.5%	31.4%	60.0%	24.3%
2025 submission Pb [t]	0.030	0.037	0.049	0.053	0.025	0.026	0.017
2026 submission Pb [t]	0.035	0.048	0.048	0.051	0.033	0.041	0.021
Change relative to the 2025 submission Pb [t]	0.006	0.011	0.000	-0.002	0.008	0.016	0.004
Change relative to the 2025 submission Pb [%]	19.1%	30.6%	-0.8%	-4.5%	31.4%	60.0%	24.3%
2025 submission Cd [t]	1.3.E-04	1.6.E-04	2.2.E-04	2.4.E-04	1.1.E-04	1.2.E-04	7.6.E-05
2026 submission Cd [t]	1.6.E-04	2.1.E-04	2.1.E-04	2.3.E-04	1.5.E-04	1.8.E-04	9.4.E-05
Change relative to the 2025 submission Cd [t]	2.5.E-05	5.0.E-05	-1.8.E-06	-1.1.E-05	3.5.E-05	6.9.E-05	1.8.E-05
Change relative to the 2025 submission Cd [%]	19.1%	30.6%	-0.8%	-4.5%	31.4%	60.0%	24.3%
2025 submission Cu [t]	0.022	0.028	0.037	0.040	0.019	0.020	0.013
2026 submission Cu [t]	0.027	0.036	0.036	0.038	0.025	0.031	0.016
Change relative to the 2025 submission Cu [t]	0.004	0.008	0.000	-0.002	0.006	0.012	0.003
Change relative to the 2025 submission Cu [%]	19.1%	30.6%	-0.8%	-4.5%	31.4%	60.0%	24.3%
2025 submission Cr [t]	6.6.E-04	8.1.E-04	1.1.E-03	1.2.E-03	5.6.E-04	5.8.E-04	3.8.E-04
2026 submission Cr [t]	7.9.E-04	1.1.E-03	1.1.E-03	1.1.E-03	7.4.E-04	9.2.E-04	4.7.E-04
Change relative to the 2025 submission Cr [t]	1.3.E-04	2.5.E-04	-8.9.E-06	-5.4.E-05	1.8.E-04	3.5.E-04	9.2.E-05
Change relative to the 2025 submission Cr [%]	19.1%	30.6%	-0.8%	-4.5%	31.4%	60.0%	24.3%
2025 submission Ni [t]	9.3.E-04	1.1.E-03	1.5.E-03	1.7.E-03	7.9.E-04	8.1.E-04	5.3.E-04
2026 submission Ni [t]	1.1.E-03	1.5.E-03	1.5.E-03	1.6.E-03	1.0.E-03	1.3.E-03	6.6.E-04
Change relative to the 2025 submission Ni [t]	1.8.E-04	3.5.E-04	-1.2.E-05	-7.5.E-05	2.5.E-04	4.8.E-04	1.3.E-04
Change relative to the 2025 submission Ni [%]	19.1%	30.6%	-0.8%	-4.5%	31.4%	60.0%	24.3%
2025 submission Se [t]	1.3.E-04	1.6.E-04	2.2.E-04	2.4.E-04	1.1.E-04	1.2.E-04	7.6.E-05
2026 submission Se [t]	1.6.E-04	2.1.E-04	2.1.E-04	2.3.E-04	1.5.E-04	1.8.E-04	9.4.E-05
Change relative to the 2025 submission Se [t]	2.5.E-05	5.0.E-05	-1.8.E-06	-1.1.E-05	3.5.E-05	6.9.E-05	1.8.E-05
Change relative to the 2025 submission Se [%]	19.1%	30.6%	-0.8%	-4.5%	31.4%	60.0%	24.3%
2025 submission Zn [t]	0.013	0.016	0.022	0.024	0.011	0.012	0.008
2026 submission Zn [t]	0.016	0.021	0.021	0.023	0.015	0.018	0.009
Change relative to the 2025 submission Zn [t]	0.003	0.005	0.000	-0.001	0.004	0.007	0.002
Change relative to the 2025 submission Zn [%]	19.1%	30.6%	-0.8%	-4.5%	31.4%	60.0%	24.3%
2025 submission PAH4 [t]	1.1.E-03	1.3.E-03	1.7.E-03	1.9.E-03	9.0.E-04	9.2.E-04	6.1.E-04
2026 submission PAH4 [t]	1.3.E-03	1.7.E-03	1.7.E-03	1.8.E-03	1.2.E-03	1.5.E-03	7.5.E-04

1A4cii Mobile Machinery in Agriculture	1990	1995	2000	2005	2010	2015	2020
Change relative to the 2025 submission PAH4 [t]	2.0.E-04	4.0.E-04	-1.4.E-05	-8.6.E-05	2.8.E-04	5.5.E-04	1.5.E-04
Change relative to the 2025 submission PAH4 [%]	19.1%	30.6%	-0.8%	-4.5%	31.4%	60.0%	24.3%

3.5.1.4 Planned Improvements

No improvements are currently planned for this subsector.

3.5.2 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 tool.

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.

3.5.2.1 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 onwards. 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 3-25 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 3-25 Percentage of regular flights specified in terms of distance and type of aircraft.

Flights w/ data	1997	1998	2000	2006	2007	2011	2012	2020	2023	2024
1A3a(i) International aviation										
LTO [%]	1.7%	36.8%	41.3%	43.5%	50.1%	56.2%	62.4%	95.5%	98.1%	98.4%
CCD [%]	1.7%	34.9%	39.9%	41.2%	47.6%	49.0%	51.4%	95.3%	98.0%	98.3%
1A3a(ii) Domestic aviation										
LTO [%]	0.0%	0.0%	0.0%	0.2%	0.2%	33.9%	59.9%	85.8%	67.9%	62.0%
CCD [%]	0.0%	0.0%	0.0%	0.2%	0.2%	31.1%	55.9%	84.2%	65.7%	60.8%

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).

The following additional activity data related aspects are considered in the emissions estimation:

- Categorisation of flights with unknown destination 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.
- Climb, cruise, and descent (CCD) emissions of flights of distances < 125 nm (60% of domestic flights according to 2022 data) are estimated according to the actual calculated distance, linearly extrapolating from the minimum distance supported by EMEP/EEA master emission calculator (125 nm).
- CCD emissions of flights longer than the maximum distance supported by the EMEP/EEA master emission calculator for the particular type of aircraft (0.3% of all flights according to 2022 data) are linearly extrapolated beyond the emission values of the two highest supported distances.
- Emissions resulting from flights having identical departure and destination aerodromes (23% of domestic flights according to 2022 data), thus, a flown distance of zero, are extrapolated based on the set of domestic flights with emission estimates available.
- A distance of 485 km (262 nm), the maximum extent of the country, is assumed for flights to destination to unknown domestic destinations.

- Military flights are contained in the flight data recordings provided by ISAVIA and are marked with a specific flight type identifier. They excluded from the calculations for this report.

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.

3.5.2.2 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 3-25, 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).

3.5.2.3 Recalculations and Improvements

No recalculations in NFR 1A3a were performed for this submission.

3.5.2.4 Planned Improvements

No improvements are currently planned for this subsector.

3.5.3 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

3.5.3.1 Methodology

The modelling software COPERT[12] version 5.9.2 was used to estimate emission for all pollutants for the entire time series. The methodology implemented by COPERT corresponds to the methodology defined in the EMEP/EEA air pollutant emission inventory Guidebook for the calculation of air pollutant emissions[13] and estimates emissions for all relevant vehicle categories and all principal driving modes (urban, rural, highway) and engine states (cold, warm).

Emission estimates retrieved from COPERT were adjusted for emissions of $PM_{2.5}$, PM_{10}, TSP, and BC from Automobile Road Abrasion (1A3bvii), considering the extensive use of studded tyres in Iceland. It should be noted that condensable PM is included in COPERT estimations.

3.5.3.2 Activity Data

Total use of Diesel oil, gasoline, and biofuels in NFR 1A3b, along with the amounts of hydrogen and electricity attributed to road transport, are based on the annual sales statistics maintained by IEEA and Table 3-26.

Table 3-26 Fuel [kt] and electrical energy [GWh] use in Road Transport.

Fuel Type	1990	1995	2000	2005	2010	2015	2020	2023	2024
Gasoline	67.1	117.6	142.6	156.7	148.2	132.5	91.6	93.9	101
Gasoline, leaded	60.7	18.0	NO	NO	NO	NO	NO	NO	NO

[12] Emisia SA, Thessaloniki, Greece, https://copert.emisia.com/

[13] https://copert.emisia.com/, section Background.

Fuel Type	1990	1995	2000	2005	2010	2015	2020	2023	2024
Diesel oil	36.6	36.9	47.5	83.5	106.4	126.4	167.9	193	179
Biomethane	NO	NO	0.006	0.039	0.595	2.18	1.44	1.57	1.61
Biodiesel	NO	NO	NO	NO	NO	11.9	13.0	2.9	20.5
Biogasoline/ Bioethanol	NO	NO	NO	NO	NO	1.93	11.0	20.7	12.2
Hydrogen	NO	NO	NO	9.0E-06	0.0022	NO	4.2E-04	2.1E-03	1.9E-03
Electricity [GWh]	NO	NO	NO	NO	NO	1.92	28.42	90.9	109

Vehicle stock data for the entire time series were obtained from the vehicle registry maintained by the Icelandic Transport Authority (Samgöngustofa, ITA). The data set allows to group vehicles according to category (cars, light duty vehicles, heavy duty trucks, buses, L-category), type of fuel, segment or weight class, and year of registration and deregistration. For a further classification of vehicles according to Euro emission standards, a respective distribution data set was provided by Emisia. Table 3-27 summarises the vehicle stock per category.

Table 3-27 Vehicle stock according to vehicle categories.

Vehicle category		1990	1995	2000	2005	2010	2015	2020	2023	2024
1A3bi	Cars	108860	110993	141244	164080	171466	186652	219050	246041	248465
1A3bii	Light-duty trucks	7890	8830	10778	14354	16714	18064	22632	26367	27664
1A3biii	Heavy duty-truck and buses	4108	4839	6068	8061	7284	8134	8973	10625	10845
1A3biv	Motorcycles	1063	441	637	2544	7419	6446	6393	6139	5984

A comprehensive activity data set comprising yearly average driven mileage as well as lifetime cumulative activity for each vehicle class was obtained from Emisia since no suitably categorised mileage data was available from national sources. Activity shares according to driving modes (urban, rural, highway) were kept constant over the timeline, with a 35% urban share for cars and light-duty trucks, a 90% urban share for urban buses, 70% rural activities of heavy-duty trucks, and an 80% rural share driven by coaches.

In addition, the following country-specific data was supplied as input data to COPERT:

- Average temperature values were obtained from the Icelandic Meteorological Office (*Veðurstofa Íslands*, IMO).
- 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, assuming that all sulphur is converted to SO_x. Since country-specific sulphur measurements are only available from 2006 onwards, the maximum allowed sulphur content according to European regulations was used as an approximation for the years before.
- Measurements of carbon content (%C/%H/%O) in gasoline and Diesel oil used in Road Transport were performed using fuel samples taken in 2019, 2020, and 2021.

The 2019 value was applied for 1990-2019 while the 2021 value was assumed for 2021 and the following years.
The measurements for gasoline were based on 5% blended fuel. A respective correction was applied before emissions were calculated in order for the carbon content to represent pure fossil gasoline.

As an additional aspect of activity data, datasets regarding the usage of studded tyres (for $PM_{2.5}$, PM_{10}, TSP, and BC emissions within 1A3bvii, Automobile Road Abrasion) were obtained from the city of Reykjavík (for 2000-2019) and the town of Akureyri (for 1990-2019).

3.5.3.3 Emission Factors

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

Considerations on Studded Tyres

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 applied emission factor for PM_{10} for studded tyres for passenger cars and light-duty trucks is 50 times higher than for non-studded friction 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 average yearly ratio of 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 April 15 to October 31 each year. During this period, the usage is assumed to be zero.
- Frequency of use during studded tyre season (November 1 to April 14) is based on counting of studded tyre equipped vehicles in two municipalities, in the greater Reykjavík area and in Akureyri, a town in the north of Iceland of approximately 20,000 inhabitants.
- Since 1990, the percentage of the Icelandic population living in the Capital Region has been 62% on average. The remaining 38% of the population live outside of the Capital Region. Studded tyre usage patterns outside the Capital Region are assumed to be the same as in Akureyri.

The share of heavy-duty trucks, buses, and motorcycles equipped with studded tyres is very low and considered to be zero in this estimation.

3.5.3.4 Recalculations and Improvements

Changes of the source and level of completeness of activity data as well as an update of the COPERT emission estimation software required a recalculation of emissions of all NFR 1A3b subcategories for the entire timeline.

Vehicle Stock and Classification

In previous submissions, vehicle stock numbers were obtained from the Icelandic Transport Authority for the years starting from 2017. While for years before 2017, vehicle numbers from a dataset provided by Emisia were used. Starting from the 2026 submission, vehicle stock data for the entire time series is obtained from the vehicle registry maintained by the Icelandic Transport Authority. In that context, the classification scheme of vehicles according to category, type of fuel, segment, and years of activity based on the Icelandic vehicle registry was extended to the entire timeline.

Methodological Changes in COPERT

With COPERT version 5.9.1 a number of methodological changes were introduced based on recent measurement data and studies[14]. The most notable impact on emission estimates is attributed to revisions related to the consumption profile of light-duty vehicles (LDV), impacting also consumption factors for passenger cars and vans, as well as a revision of emission factors for Diesel in light-duty and heavy-duty vehicles.

Revision of consumption of LDVs running on liquid fuels

On-board fuel and energy consumption monitoring (OBFCM[15]) data is available from 2021 onwards. Analyses of data from new cars registered in 2021 and 2022 led to notable changes in the correlation of consumed fuel and driven mileage, specifically for cars and other light-duty vehicles. Most significantly, the consumption of liquid fuel was overestimated by an average of 14% for passenger cars and an average of 11% for vans. In the preparation of the 2026 inventory the fuel balancing feature of COPERT was used, respectively yielding fuel-adjusted mileage figures, plus 14% for cars and plus 11% for vans.

Revision of N_2O, CO, NO_x, NH_3, PM and consumption of Diesel HDTs and coaches

Engine-out and tailpipe measurement data yielded differences in N_2O, CO, NO_x, NH_3, PM emission factors for mainly Euro 5/6 and Euro V/VI Diesel vehicles in comparison to the

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[14] For details consult https://copert.emisia.com/wp-content/uploads/2025/10/COPERT_update_2025.pdf

[15] Starting from 2021, new vehicles have to be equipped with on-board fuel and energy consumption monitoring devices (OBFCM) to record the amount of fuel or electric energy used in relation to actually driven distances. See https://climate-energy.eea.europa.eu/topics/transport/real-world-emissions/intro

emission factors used in the emission estimations and led to respective updates in COPERT. For heavy-duty trucks this resulted in higher emissions of CO, PM, and heavy metals, as well as lower VOC and NH_3 emissions, while a significant increase in VOC and PM emissions as well as a reduction of emitted CO and SO_2 is a consequence for light-duty vehicles.

Revision of PM emission factors from brake wear for light-duty vehicles

Updated PM emissions factors from brake wear increased by an average of 14% for combustion engine vehicles, while PM emission factors decreased by approximately 10% for electric vehicles.

Update of Pb content of leaded gasoline

Leaded gasoline was used in Iceland until 1996. In the preparation for the 2026 submission, the lead content of leaded gasoline was corrected to 35.94 g/t of fuel[16], which yielded a significant increase in the overall 1A3b Pb emissions in the years 1990 to 1996.

The recalculations resulting from the set of improvements outlined below are summarised in Table 3-28.

Table 3-28 Recalculations in 1A3b, Road Transport, between submissions.

1A3b Road Transport	1990	1995	2000	2005	2010	2015	2020	2022	2023
2025 submission NO_x [kt]	5.86	5.27	3.92	3.41	2.50	2.50	1.77	1.75	1.61
2026 submission NO_x [kt]	6.19	5.74	3.89	3.22	2.77	2.66	2.18	2.07	1.83
Change relative to the 2025 submission NO_x [kt]	0.33	0.47	-0.02	-0.19	0.28	0.16	0.42	0.31	0.22
Change relative to the 2025 submission NO_x [%]	5.6%	9.0%	-0.6%	-5.5%	11.0%	6.5%	23.5%	17.9%	13.5%
2025 submission NMVOC [kt]	4.62	4.14	3.00	2.00	1.13	0.73	0.33	0.30	0.29
2026 submission NMVOC [kt]	4.53	4.09	2.58	1.46	0.88	0.67	0.37	0.35	0.33
Change relative to the 2025 submission NMVOC [kt]	-0.09	-0.04	-0.42	-0.53	-0.24	-0.06	0.04	0.04	0.04
Change relative to the 2025 submission NMVOC [%]	-2.0%	-1.0%	-13.8%	-26.8%	-21.7%	-7.9%	12.2%	14.2%	15.1%
2025 submission SO_x [kt]	0.071	0.074	0.065	0.019	0.003	4.3E-3	4.1E-3	4.5E-3	4.2E-3
2026 submission SO_x [kt]	0.071	0.074	0.065	0.019	0.003	4.3E-3	4.1E-3	4.5E-3	4.2E-3
Change relative to the 2025 submission SO_x [kt]	1.1E-6	-3.7E-6	1.0E-5	5.0E-6	7.9E-7	8.4E-7	-8.6E-7	-6.9E-6	-6.9E-6
Change relative to the 2025 submission SO_x [%]	0.002%	-0.005%	0.015%	0.026%	0.025%	0.020%	-0.021%	-0.153%	-0.165%
2025 submission NH_3 [kt]	0.007	0.036	0.133	0.154	0.123	0.082	0.043	0.046	0.046
2026 submission NH_3 [kt]	0.007	0.031	0.137	0.144	0.113	0.079	0.047	0.052	0.053

[16] Estimation of Pb content is based on data from Newell R. G., Rogers K., The U.S. Experience with the Phasedown of Lead in Gasoline, Resources for the Future, June 2003. https://web.mit.edu/ckolstad/www/Newell.pdf

1A3b Road Transport	1990	1995	2000	2005	2010	2015	2020	2022	2023
Change relative to the 2025 submission NH_3 [kt]	0.0001	-0.005	0.004	-0.010	-0.010	-0.003	0.005	0.006	0.007
Change relative to the 2025 submission NH_3 [%]	0.8%	-14.2%	3.0%	-6.6%	-8.0%	-3.4%	10.5%	12.8%	14.3%
2025 submission $PM_{2.5}$ [kt]	0.24	0.25	0.26	0.32	0.31	0.28	0.27	0.30	0.30
2026 submission $PM_{2.5}$ [kt]	0.21	0.22	0.23	0.29	0.31	0.31	0.31	0.34	0.34
Change relative to the 2025 submission $PM_{2.5}$ [kt]	-0.02	-0.03	-0.03	-0.03	0.00	0.03	0.04	0.04	0.03
Change relative to the 2025 submission $PM_{2.5}$ [%]	-10.3%	-13.4%	-12.6%	-9.3%	0.9%	10.1%	13.2%	12.0%	11.1%
2025 submission PM_{10} [kt]	0.34	0.36	0.39	0.48	0.48	0.48	0.48	0.54	0.55
2026 submission PM_{10} [kt]	0.32	0.33	0.36	0.46	0.50	0.52	0.54	0.61	0.61
Change relative to the 2025 submission PM_{10} [kt]	-0.02	-0.03	-0.03	-0.02	0.02	0.05	0.06	0.06	0.06
Change relative to the 2025 submission PM_{10} [%]	-6.0%	-8.3%	-7.6%	-5.0%	4.1%	9.8%	12.9%	12.0%	11.4%
2025 submission TSP [kt]	0.53	0.57	0.62	0.79	0.81	0.84	0.87	0.99	1.01
2026 submission TSP [kt]	0.52	0.54	0.59	0.77	0.86	0.91	0.97	1.10	1.12
Change relative to the 2025 submission TSP [kt]	-0.02	-0.03	-0.03	-0.02	0.04	0.07	0.10	0.11	0.11
Change relative to the 2025 submission TSP [%]	-3.2%	-4.9%	-4.6%	-2.5%	5.5%	8.3%	12.0%	11.3%	11.0%
2025 submission BC [kt]	0.059	0.063	0.065	0.080	0.072	0.052	0.036	0.035	0.034
2026 submission BC [kt]	0.049	0.051	0.052	0.068	0.069	0.060	0.042	0.040	0.037
Change relative to the 2025 submission BC [kt]	-0.010	-0.012	-0.013	-0.013	-0.004	0.008	0.007	0.005	0.003
Change relative to the 2025 submission BC [%]	-17.0%	-19.1%	-19.3%	-15.6%	-5.1%	16.1%	18.2%	13.5%	9.0%
2025 submission CO [kt]	41.3	32.9	21.8	14.4	8.28	5.31	1.93	1.75	1.67
2026 submission CO [kt]	38.6	32.0	19.2	12.1	7.52	5.67	2.43	2.11	1.94
Change relative to the 2025 submission CO [kt]	-2.62	-0.92	-2.52	-2.28	-0.75	0.37	0.50	0.35	0.27
Change relative to the 2025 submission CO [%]	-6.4%	-2.8%	-11.6%	-15.9%	-9.1%	6.9%	25.9%	20.2%	16.0%
2025 submission Pb [t]	0.16	0.18	0.20	0.26	0.28	0.29	0.31	0.34	0.34
2026 submission Pb [t]	2.36	0.85	0.23	0.30	0.33	0.36	0.38	0.41	0.41
Change relative to the 2025 submission Pb [t]	2.20	0.67	0.030	0.039	0.056	0.077	0.070	0.072	0.069
Change relative to the 2025 submission Pb [%]	1350%	381%	15.1%	15.0%	20.2%	26.9%	22.9%	21.2%	20.3%
2025 submission Cd [t]	7.8E-4	8.5E-4	9.5E-4	0.0012	0.0013	0.0013	0.0015	0.0016	0.0016
2026 submission Cd [t]	8.3E-4	9.0E-4	1.0E-3	0.0013	0.0015	0.0016	0.0017	0.0018	0.0018
Change relative to the 2025 submission Cd [t]	4.8E-5	5.0E-5	6.7E-5	1.0E-4	1.5E-4	2.5E-4	1.8E-4	1.9E-4	1.8E-4
Change relative to the 2025 submission Cd [%]	6.1%	5.9%	7.1%	8.7%	11.6%	18.6%	12.4%	11.6%	10.7%
2025 submission Hg [t]	0.0013	0.0014	0.0015	0.0018	0.0019	0.0019	0.0019	0.0020	0.0020

1A3b Road Transport	1990	1995	2000	2005	2010	2015	2020	2022	2023
2026 submission Hg [t]	0.0013	0.0014	0.0015	0.0018	0.0019	0.0019	0.0018	0.0020	0.0020
Change relative to the 2025 submission Hg [t]	3.0E-8	-9.9E-8	3.4E-7	5.4E-7	4.3E-7	4.8E-7	-7.9E-7	-5.0E-6	-6.3E-6
Change relative to the 2025 submission Hg [%]	0.002%	-0.007%	0.023%	0.030%	0.023%	0.025%	-0.043%	-0.25%	-0.31%
2025 submission As [t]	0.0019	0.0021	0.0023	0.0030	0.0032	0.0033	0.0036	0.0040	0.0039
2026 submission As [t]	0.0022	0.0024	0.0027	0.0034	0.0038	0.0042	0.0043	0.0048	0.0047
Change relative to the 2025 submission As [t]	2.7E-4	3.0E-4	3.4E-4	4.3E-4	6.2E-4	8.6E-4	7.9E-4	8.1E-4	7.7E-4
Change relative to the 2025 submission As [%]	14.3%	14.4%	14.4%	14.3%	19.4%	26.0%	22.1%	20.5%	19.6%
2025 submission Cr [t]	0.062	0.067	0.076	0.097	0.11	0.11	0.12	0.13	0.13
2026 submission Cr [t]	0.071	0.077	0.087	0.112	0.13	0.14	0.14	0.16	0.15
Change relative to the 2025 submission Cr [t]	0.009	0.010	0.011	0.015	0.021	0.029	0.026	0.027	0.026
Change relative to the 2025 submission Cr [%]	14.7%	14.9%	14.9%	14.9%	19.9%	26.5%	22.4%	20.8%	19.8%
2025 submission Cu [t]	1.34	1.45	1.65	2.11	2.28	2.35	2.52	2.80	2.79
2026 submission Cu [t]	1.54	1.67	1.89	2.43	2.74	2.98	3.09	3.39	3.35
Change relative to the 2025 submission Cu [t]	0.20	0.22	0.25	0.32	0.46	0.63	0.57	0.59	0.56
Change relative to the 2025 submission Cu [%]	14.8%	15.0%	15.0%	15.1%	20.1%	26.9%	22.6%	21.0%	20.0%
2025 submission Ni [t]	0.010	0.011	0.012	0.015	0.017	0.017	0.019	0.021	0.021
2026 submission Ni [t]	0.011	0.012	0.013	0.017	0.019	0.021	0.022	0.024	0.024
Change relative to the 2025 submission Ni [t]	0.001	0.001	0.001	0.002	0.003	0.004	0.003	0.003	0.003
Change relative to the 2025 submission Ni [%]	10.3%	10.3%	10.9%	11.8%	15.7%	22.6%	17.4%	16.2%	15.2%
2025 submission Se [t]	0.0011	0.0012	0.0014	0.0018	0.0019	0.0020	0.0022	0.0025	0.0025
2026 submission Se [t]	0.0012	0.0013	0.0015	0.0019	0.0021	0.0023	0.0024	0.0027	0.0028
Change relative to the 2025 submission Se [t]	4.0E-5	3.5E-5	5.0E-5	8.8E-5	1.5E-4	2.9E-4	2.2E-4	2.3E-4	2.2E-4
Change relative to the 2025 submission Se [%]	3.5%	2.8%	3.6%	4.9%	7.8%	14.7%	9.8%	9.3%	8.6%
2025 submission Zn [t]	0.44	0.48	0.54	0.69	0.75	0.77	0.86	0.97	0.97
2026 submission Zn [t]	0.47	0.51	0.58	0.74	0.84	0.91	0.98	1.09	1.10
Change relative to the 2025 submission Zn [t]	0.03	0.03	0.04	0.05	0.08	0.14	0.12	0.13	0.12
Change relative to the 2025 submission Zn [%]	7.12%	6.53%	6.74%	7.30%	11.19%	18.03%	13.99%	13.10%	12.45%
2025 submission Dioxins [g]	0.064	0.069	0.088	0.105	0.110	0.072	0.043	0.039	0.035
2026 submission Dioxins [g]	0.068	0.073	0.085	0.087	0.093	0.075	0.045	0.039	0.034
Change relative to the 2025 submission Dioxins [t]	0.004	0.004	-0.003	-0.018	-0.017	2.9E-3	2.0E-3	1.7E-4	-1.5E-3
Change relative to the 2025 submission Dioxins [%]	5.6%	5.5%	-3.0%	-16.9%	-15.6%	4.00%	4.67%	0.43%	-4.12%

1A3b Road Transport	1990	1995	2000	2005	2010	2015	2020	2022	2023
2025 submission B(a)P [t]	0.0013	0.0013	0.0015	0.0021	0.0027	0.0027	0.0038	0.0040	0.0038
2026 submission B(a)P [t]	0.0012	0.0012	0.0013	0.0017	0.0022	0.0029	0.0038	0.0041	0.0039
Change relative to the 2025 submission B(a)P [t]	-1.1E-4	-1.7E-4	-2.4E-4	-4.3E-4	-4.4E-4	2.1E-4	3.1E-5	1.2E-4	1.1E-4
Change relative to the 2025 submission B(a)P [%]	-8.5%	-12.4%	-15.7%	-20.4%	-16.5%	7.74%	0.81%	2.96%	2.84%
2025 submission B(b)f [t]	0.0025	0.0025	0.0025	0.0034	0.0039	0.0046	0.0056	0.0062	0.0060
2026 submission B(b)f [t]	0.0025	0.0025	0.0024	0.0032	0.0039	0.0048	0.0060	0.0066	0.0064
Change relative to the 2025 submission B(b)f [t]	4.9E-6	-9.2E-6	-1.4E-4	-2.6E-4	-3.0E-5	2.0E-4	3.9E-4	4.3E-4	4.0E-4
Change relative to the 2025 submission B(b)f [%]	0.2%	-0.4%	-5.5%	-7.5%	-0.8%	4.41%	7.00%	6.92%	6.65%
2025 submission B(k)f [t]	0.0015	0.0016	0.0019	0.0029	0.0034	0.0042	0.0048	0.0053	0.0052
2026 submission B(k)f [t]	0.0015	0.0016	0.0018	0.0028	0.0036	0.0043	0.0054	0.0059	0.0058
Change relative to the 2025 submission B(k)f [t]	1.6E-5	1.4E-6	-2.5E-5	-4.5E-5	1.8E-4	1.4E-4	5.7E-4	6.1E-4	5.9E-4
Change relative to the 2025 submission B(k)f [%]	1.0%	0.1%	-1.4%	-1.6%	5.3%	3.38%	11.93%	11.48%	11.33%
2025 submission I(1,2,3)p [t]	0.0023	0.0022	0.0021	0.0025	0.0028	0.0029	0.0039	0.0042	0.0041
2026 submission I(1,2,3)p [t]	0.0022	0.0021	0.0018	0.0020	0.0025	0.0031	0.0039	0.0042	0.0040
Change relative to the 2025 submission I(1,2,3)p [t]	-4.4E-5	-7.3E-5	-2.3E-4	-4.3E-4	-3.5E-4	2.1E-4	-5.8E-5	-5.1E-5	-7.7E-5
Change relative to the 2025 submission I(1,2,3)p [%]	-2.0%	-3.3%	-11.1%	-17.4%	-12.5%	7.43%	-1.47%	-1.21%	-1.88%
2025 submission PAH 1-4 [t]	0.0076	0.0076	0.0079	0.0109	0.013	0.014	0.018	0.020	0.019
2026 submission PAH 1-4 [t]	0.0075	0.0073	0.0073	0.0097	0.012	0.015	0.019	0.021	0.020
Change relative to the 2025 submission PAH 1-4 [t]	-1.3E-4	-2.5E-4	-6.3E-4	-1.2E-3	-6.4E-4	7.6E-4	9.3E-4	0.001	0.001
Change relative to the 2025 submission PAH 1-4 [%]	-1.7%	-3.2%	-7.9%	-10.7%	-5.0%	5.34%	5.17%	5.61%	5.34%
2025 submission HCB [kg]	5.8E-5	6.4E-5	8.3E-5	1.0E-4	1.1E-4	7.0E-5	4.2E-5	3.7E-5	3.4E-5
2026 submission HCB [kg]	6.0E-5	6.6E-5	8.1E-5	8.5E-5	9.1E-5	7.3E-5	4.3E-5	3.6E-5	3.2E-5
Change relative to the 2025 submission HCB [t]	2.4E-6	2.8E-6	-2.5E-6	-1.6E-5	-1.7E-5	3.0E-6	1.3E-6	-6.4E-7	-2.2E-6
Change relative to the 2025 submission HCB [%]	4.2%	4.4%	-3.0%	-15.8%	-15.7%	4.32%	3.08%	-1.73%	-6.55%
2025 submission PCBs [kg]	1.4E-5	1.6E-5	1.9E-5	2.2E-5	2.3E-5	1.4E-5	8.5E-6	7.5E-6	6.9E-6
2026 submission PCBs [kg]	1.5E-5	1.5E-5	1.7E-5	1.8E-5	1.9E-5	1.5E-5	8.8E-6	7.4E-6	6.5E-6
Change relative to the 2025 submission PCBs [kg]	4.9E-7	-2.1E-7	-1.9E-6	-4.6E-6	-4.3E-6	3.6E-7	2.7E-7	-9.9E-8	-4.1E-7
Change relative to the 2025 submission PCBs [%]	3.4%	-1.3%	-9.7%	-20.7%	-18.9%	2.51%	3.23%	-1.32%	-5.96%

3.5.3.5 Planned Improvements

As of now, yearly average and lifetime cumulative mileage data for all years and all vehicle classes is obtained from Emisia. For future submissions, it is planned to investigate the possibility to obtain these data from domestic sources for all years available.

3.5.4 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.

3.5.4.1.1 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[17]. 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.

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

Engine power, required to determine fuel proportions by vessel type, are obtained from Icelandic Transport Authority (ITA) for ships registered[18] 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, 2013, and 2014 (see Table 3-29. Fishing, 1A4ciii, covered in section 3.5.5, is included for the sake of consistent totals). The years 1990 to 2014 are backward extrapolated on the basis of 2015 to 2023.

Table 3-29 Recorded and consolidated port exits by NFR

NFR	1990	2010	2011	2012	2013	2014	2020	2022	2023
1A3di(i) International Navigation	0	0	10	986	877	1657	3359	3278	3684
1A3dii Domestic Navigation	0	0	106	14969	14575	28986	32954	45847	53401
1A4ciii Fishing	0	0	465	57381	53857	75224	85151	72252	72633
Annual total	0	0	581	73336	69309	105867	121464	121377	129718

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 2015.

[18] Registered as well as recently deregistered ships are considered in order to cover ships that were deregistered between points in time of vessel activity and database snapshot.

3.5.4.2 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 3-30. 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 3-30 Fuel use [kt], International and Domestic Navigation.

Fuel type	1990	1995	2000	2005	2010	2015	2020	2023	2024
1A3di(i) International									
Residual Fuel Oil	0.25	NO	2.00	0.44	0.080	13.25	NO	6.2	0.39
Gas/Diesel Oil	8.5	1.1	15.0	0.12	NO	33.6	24.3	98.0	101.0
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	5.3	4.2
Biodiesel	NO	NO	NO	NO	NO	NO	NO	NO	0.005

Table 3-31 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 2015 are extrapolated as described above.

Table 3-31 Port exits by NFR and vessel type.

NFR/vessel type	1990	1995	2000	2005	2010	2015	2020	2023	2024
1A3di(i) International									
Liquid bulk carriers	532	546	560	579	592	488	568	735	759
Dry bulk carriers	55	51	48	44	41	48	34	9	40
Container	362	432	502	577	647	497	899	1143	967
General cargo	1654	1623	1592	1573	1538	1446	1692	1269	1634
Ro Ro cargo	1	16	30	45	59	18	104	187	163
Passenger ships	333	318	303	290	273	255	57	292	360
Tugboats	5	0	1	2	3	0	0	32	2
Other	32	30	28	26	23	30	5	17	20
NFR Total	2974	3016	3064	3136	3176	2782	3359	3684	3945
1A3dii Domestic									
Liquid bulk carriers	122	119	115	112	108	148	88	82	83
Dry bulk carriers	30	27	24	21	18	23	7	4	3

NFR/vessel type	1990	1995	2000	2005	2010	2015	2020	2023	2024
Container	239	294	351	411	468	286	725	811	779
General cargo	1768	1667	1567	1478	1373	2081	1076	988	1221
Ro Ro cargo	1712	1716	1719	408	896	8	3151	3749	4035
Passenger ships	46510	44344	42177	40322	38036	36070	18362	33846	32640
Tugboats	4561	4559	4556	4591	4579	4075	4018	5248	4874
Other	5114	5234	5354	5520	5630	4835	5527	8673	8534
NFR Total	60056	57960	55863	52863	51108	47526	32954	53401	52169

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 3-30 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 3-32 details the sold fuel (in kilotonnes) 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 3-32 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	2023	2024
1A3di(i) International										
Liquid bulk carriers	MGO/MDO	0.13	0.017	0.25	0.002	NO	0.62	0.63	1.56	1.58
	RFO	0.013	NO	0.092	0.020	0.003	0.67	NO	0.22	0.014
Dry bulk carriers	MGO/MDO	0.006	0.001	0.010	0.000	NO	0.021	0.030	0.014	0.061
	RFO	0.002	NO	0.016	0.003	0.001	0.11	NO	0.009	0.002
Container	MGO/MDO	0.089	0.018	0.35	0.004	NO	0.80	2.66	6.22	5.27
	RFO	0.029	NO	0.46	0.12	0.026	3.04	NO	3.01	0.16
General cargo	MGO/MDO	3.85	0.46	6.27	0.046	NO	16.4	12.6	16.3	19.1
	RFO	0.11	NO	0.72	0.14	0.023	5.47	NO	0.70	0.052
Ro Ro cargo	MGO/MDO	0.036	0.016	0.39	0.004	NO	0.34	3.26	10.2	8.95

Vessel type	Fuel type	1990	1995	2000	2005	2010	2015	2020	2023	2024
	RFO	0.001	NO	0.029	0.009	0.002	0.074	NO	0.29	0.016
Passenger ships	MGO/MDO	4.00	0.50	7.21	0.056	NO	14.1	4.83	57.5	63.9
	RFO	0.094	NO	0.67	0.14	0.024	3.82	NO	1.99	0.14
Tugboats	MGO/MDO	0.068	NO	0.018	0.000	NO	NO	NO	4.05	0.13
	RFO	0.000	NO	0.000	0.000	0.000	NO	NO	0.002	0.000
Other	MGO/MDO	0.35	0.041	0.55	0.004	NO	1.24	0.26	2.02	2.05
	RFO	0.002	NO	0.011	0.002	0.000	0.071	NO	0.015	0.001
1A3dii Domestic										
Liquid bulk carriers	MGO/MDO	0.009	0.009	0.004	0.008	0.010	0.018	0.007	0.003	0.002
	RFO	0.032	0.038	0.004	0.007	0.020	0.006	NO	NO	NO
Dry bulk carriers	MGO/MDO	0.000	3.0E-4	1.3E-4	2.1E-4	2.5E-4	3.7E-4	1.4E-4	2.8E-5	1.4E-5
	RFO	0.005	0.005	0.001	0.001	0.002	0.001	NO	NO	NO
Container	MGO/MDO	0.005	0.009	0.006	0.016	0.025	0.015	0.055	0.022	0.016
	RFO	0.060	0.13	0.022	0.050	0.18	0.019	NO	NO	NO
General cargo	MGO/MDO	0.147	0.15	0.067	0.12	0.14	0.23	0.091	0.037	0.029
	RFO	0.164	0.19	0.020	0.033	0.090	0.025	NO	NO	NO
Ro Ro cargo	MGO/MDO	0.460	0.50	0.24	0.11	0.32	0.005	1.13	0.55	0.46
	RFO	0.336	0.41	0.048	0.020	0.13	0.000	NO	NO	NO
Passenger ships	MGO/MDO	3.554	3.73	1.73	3.14	3.98	4.07	2.06	1.72	1.42
	RFO	3.199	3.78	0.42	0.72	2.03	0.37	NO	NO	NO
Tugboats	MGO/MDO	1.543	1.82	0.95	1.92	2.72	2.47	2.82	1.93	1.48
	RFO	0.019	0.025	0.003	0.006	0.019	0.003	NO	NO	NO
Other	MGO/MDO	0.681	0.82	0.43	0.89	1.27	1.08	1.66	1.01	0.81
	RFO	0.129	0.17	0.022	0.043	0.14	0.020	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)[19] need to be determined. Table 3-33 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)

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

designated under regulation 13 of MARPOL Annex VI (NO_x emission control)[20]. 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 3-33 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	2023	2024
1A3di(i) International										
NO_x Tier 0	MGO/MDO	8.532	1.053	14.563	0.094	NO	16.066	6.009	28.847	28.380
	RFO	0.252	NO	1.917	0.335	0.045	4.984	NO	0.362	0.008
NO_x Tier I	MGO/MDO	NO	NO	0.478	0.022	NO	12.023	9.390	31.259	31.490
	RFO	NO	NO	0.078	0.103	0.035	5.682	NO	2.655	0.164
NO_x Tier II	MGO/MDO	NO	NO	NO	NO	NO	5.465	8.876	37.866	41.110
	RFO	NO	NO	NO	NO	NO	2.583	NO	3.216	0.214
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	3.319	5.036	5.510	4.828	2.279	1.211	1.102
	RFO	3.944	4.755	0.521	0.679	1.514	0.232	NO	NO	NO
NO_x Tier I	MGO/MDO	NO	NO	0.106	1.163	2.954	1.793	2.015	1.422	1.032
	RFO	NO	NO	0.021	0.202	1.098	0.122	NO	NO	NO
NO_x Tier II	MGO/MDO	NO	NO	NO	NO	NO	1.272	3.540	2.640	2.087
	RFO	NO	NO	NO	NO	NO	0.087	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).

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

3.5.4.3 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 3-34 provides a summary.

Table 3-34 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 3-36.	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 3-35.
Turbine engine types	Tier 2 EFs for TSP, PM_{10}, $PM_{2.5}$ 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 3-37.	
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 3-35 Sulphur content values [%]. Tier 1 default values from 1990 to 2011, country specific from 2012.

Fuel type	1990	1995	2000	2005	2010	2015	2020	2023	2024
Marine gas/Diesel oil	0.500	0.500	0.200	0.200	0.100	0.145	0.090	0.065	0.076
Residual fuel oil	2.700	2.700	2.700	2.700	1.500	0.980	0.500	0.500	0.500

3.5.4.3.1 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 3-36 summarises the resulting EF values.

Table 3-36 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 3-37.

Table 3-37 Year-specific NO_x emission factors for turbine engines [kg/t].

Engine type	1990	1995	2000	2005	2010	2015	2020	2023	2024
Gas turbine, Marine gas/Diesel oil	19.70	19.70	19.70	19.03	18.36	17.69	17.02	16.62	16.48
Gas turbine, Residual fuel oil	20.00	20.00	20.00	19.32	18.64	17.96	17.28	16.87	16.74
Steam turbine, Marine gas/Diesel oil	6.90	6.90	6.90	6.67	6.43	6.20	5.96	5.82	5.77
Steam turbine, Residual fuel oil	6.90	6.90	6.90	6.67	6.43	6.20	5.96	5.82	5.77

3.5.4.3.2 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.

3.5.4.4 Recalculations and Improvements

In preparation of the 2026 submission a number of modifications were introduced related to the preprocessing of vessel fleet and vessel activity data sets.

- For the previous submission, the callsign or IMO number was used to uniquely identify a vessel. A significant number of Icelandic ships recorded in the activity data, however, have neither of these identifiers assigned. In those cases, the identifiers in the activity data are matched with the registration number of the Icelandic ship registry, increasing the number of vessels for which vessel type and technical data is available. In addition, a dedicated listing of deregistered Icelandic ships is now used to obtain information of vessels that have been deregistered between recorded activity and creation of the Icelandic ship registry snapshot.
- The destination information as far as contained in SOLAS data records is used to infer the operations context related to recorded activity for ship that operate under the SOLAS conventions. This led to a shift of activity attribution between domestic and international operations.
- Activity data records created by tender boats or lifeboats of bigger vessels are removed as no respective technical data is available and they typically do not create emissions (battery powered).
- For the estimation of NO_x emissions, the amount of sold fuel per fuel type needs to be partitioned in relation to the IMO NO_x tier level the engines in which the fuel is burnt comply with. Section 3.5.4.3.1 describes this approach in detail. In the previous submission the share of fuel attributed to vessels for which no NO_x tier information is available, and which, thus, has to be partitioned according to calculated standard NO_x-proportions, was derived from the share of port exits only. For the 2026 submission this approach was changed to consider the activity-based cumulative engine power of NO_x-uncategorised vessels.
- Following a detailed review, it was concluded that the original activity data for 2014 is probably incomplete. It was therefore decided to extrapolate activity in 2014 along with the years 2013 and earlier.

These improvements led primarily to a shift in CO and NMVOC emissions from domestic to international navigation as well as a reduction of particulate matter and NO_x emissions in both operational domains (Table 3-38).

Table 3-38 Recalculation according to Tier 2 for 1A3di(i) and 1A3dii.

1A3di(i), 1A3dii, tier 2	1990	1995	2000	2005	2010	2015	2020	2022	2023
1A3di(i) International Navigation									
2025 submission CO [kt]	0.037	0.004	0.071	0.002	0.000	0.190	0.100	0.369	0.429
2026 submission CO [kt]	0.037	0.004	0.071	0.002	0.000	0.192	0.102	0.371	0.432

1A3di(i), 1A3dii, tier 2	1990	1995	2000	2005	2010	2015	2020	2022	2023
Change relative to the 2025 submission [kt CO]	6.8E-5	1.3E-5	4.2E-4	3.1E-5	4.2E-6	0.0012	0.0018	0.0017	0.0026
Change relative to the 2025 submission [%]	0.2%	0.3%	0.6%	1.5%	1.5%	0.6%	1.8%	0.5%	0.6%
2025 submission NMVOC [kt]	0.018	0.002	0.034	0.001	0.000	0.091	0.049	0.178	0.207
2026 submission NMVOC [kt]	0.018	0.002	0.034	0.001	0.000	0.092	0.050	0.179	0.209
Change relative to the 2025 submission [kt NMVOC]	0.0000	0.0000	0.0002	0.0000	0.0000	0.0004	0.0007	0.0012	0.0026
Change relative to the 2025 submission [%]	0.3%	0.3%	0.6%	0.8%	0.7%	0.5%	1.4%	0.7%	1.3%
2025 submission TSP [kt]	0.008	0.001	0.022	0.002	0.000	0.097	0.025	0.096	0.098
2026 submission TSP [kt]	0.008	0.001	0.022	0.002	0.000	0.096	0.022	0.100	0.106
Change relative to the 2025 submission [kt TSP]	-1.6E-4	-9.3E-6	-1.3E-5	-2.1E-6	-2.4E-7	-3.4E-4	-0.0026	0.0040	0.0077
Change relative to the 2025 submission [%]	-1.8%	-1.1%	-0.1%	-0.1%	-0.1%	-0.4%	-10.3%	4.2%	7.8%
2025 submission PM_{10} [kt]	0.008	0.001	0.022	0.002	4.1E-4	0.097	0.025	0.096	0.098
2026 submission PM_{10} [kt]	0.008	0.001	0.022	0.002	4.1E-4	0.096	0.022	0.100	0.106
Change relative to the 2025 submission [kt PM_{10}]	-1.6E-4	-9.3E-6	-1.3E-5	-2.1E-6	-2.4E-7	-3.4E-4	-0.0026	0.0040	0.0077
Change relative to the 2025 submission [%]	-1.8%	-1.1%	-0.1%	-0.1%	-0.1%	-0.4%	-10.3%	4.2%	7.8%
2025 submission $PM_{2.5}$ [kt]	0.007	0.001	0.019	0.002	3.5E-4	0.082	0.021	0.082	0.084
2026 submission $PM_{2.5}$ [kt]	0.007	0.001	0.019	0.002	3.5E-4	0.082	0.019	0.085	0.090
Change relative to the 2025 submission [kt $PM_{2.5}$]	-1.3E-4	-7.8E-6	-9.4E-6	-1.7E-6	-2.0E-7	-2.8E-4	-0.0022	0.0034	0.0065
Change relative to the 2025 submission [%]	-1.8%	-1.1%	0.0%	-0.1%	-0.1%	-0.3%	-10.3%	4.2%	7.8%
2025 submission BC [kt]	4.2E-4	4.9E-5	8.8E-4	4.5E-5	7.2E-6	2.8E-3	1.1E-3	0.00453	0.00514
2026 submission BC [kt]	4.2E-4	4.9E-5	8.8E-4	4.5E-5	7.2E-6	2.8E-3	1.1E-3	0.00453	0.00512
Change relative to the 2025 submission [kt BC]	-2.7E-7	-3.9E-8	-8.0E-7	-2.2E-9	8.5E-10	-1.1E-6	-2.4E-6	-7.2E-6	-1.7E-5
Change relative to the 2025 submission [%]	-0.07%	-0.08%	-0.09%	0.00%	0.01%	-0.04%	-0.21%	-0.16%	-0.34%
2025 submission NO_x [kt]	0.418	0.049	0.844	0.037	0.006	2.347	1.227	3.407	3.764
2026 submission NO_x [kt]	0.407	0.048	0.829	0.036	0.005	2.285	1.092	3.555	4.008
Change relative to the 2025 submission [kt NO_x]	-0.011	-0.001	-0.015	-0.001	0.000	-0.062	-0.136	0.148	0.243
Change relative to the 2025 submission [%]	-2.6%	-2.0%	-1.7%	-2.3%	-1.9%	-2.6%	-11.1%	4.3%	6.5%
1A3dii Domestic Navigation									
2025 submission CO [kt]	0.043	0.050	0.017	0.030	0.047	0.036	0.034	0.033	0.023
2026 submission CO [kt]	0.043	0.049	0.017	0.030	0.047	0.035	0.034	0.033	0.023

1A3di(i), 1A3dii, tier 2	1990	1995	2000	2005	2010	2015	2020	2022	2023
Change relative to the 2025 submission [kt CO]	-1.1E-4	-1.9E-4	-6.4E-5	-1.4E-4	-2.8E-4	-1.3E-4	-1.0E-4	-2.0E-4	-2.2E-4
Change relative to the 2025 submission [%]	-0.3%	-0.4%	-0.4%	-0.5%	-0.6%	-0.4%	-0.3%	-0.6%	-1.0%
2025 submission NMVOC [kt]	0.021	0.023	0.008	0.015	0.023	0.018	0.017	0.017	0.011
2026 submission NMVOC [kt]	0.020	0.023	0.008	0.015	0.023	0.018	0.017	0.017	0.011
Change relative to the 2025 submission [kt NMVOC]	-5.0E-5	-6.8E-5	-3.4E-5	-4.4E-5	-7.4E-5	-4.2E-5	3.4E-5	-4.1E-5	-3.2E-5
Change relative to the 2025 submission [%]	-0.2%	-0.3%	-0.4%	-0.3%	-0.3%	-0.2%	0.2%	-0.2%	-0.3%
2025 submission TSP [kt]	0.025	0.029	0.005	0.009	0.020	0.009	0.007	0.007	0.005
2026 submission TSP [kt]	0.025	0.029	0.005	0.009	0.020	0.008	0.007	0.007	0.005
Change relative to the 2025 submission [kt TSP]	-5.1E-5	-9.2E-5	-4.8E-5	-1.6E-4	-2.3E-4	-1.7E-4	-7.5E-5	-3.1E-4	-3.7E-4
Change relative to the 2025 submission [%]	-0.2%	-0.3%	-0.9%	-1.7%	-1.2%	-1.9%	-1.1%	-4.6%	-7.6%
2025 submission PM_{10} [kt]	0.025	0.029	0.005	0.009	0.020	0.009	0.007	0.007	0.005
2026 submission PM_{10} [kt]	0.025	0.029	0.005	0.009	0.020	0.008	0.007	0.007	0.005
Change relative to the 2025 submission [kt PM_{10}]	-5.1E-5	-9.2E-5	-4.8E-5	-1.6E-4	-2.3E-4	-1.7E-4	-7.5E-5	-3.1E-4	-3.7E-4
Change relative to the 2025 submission [%]	-0.2%	-0.3%	-0.9%	-1.7%	-1.2%	-1.9%	-1.1%	-4.6%	-7.6%
2025 submission $PM_{2.5}$ [kt]	0.021	0.025	0.005	0.008	0.017	0.007	0.006	0.006	0.004
2026 submission $PM_{2.5}$ [kt]	0.021	0.025	0.005	0.008	0.017	0.007	0.006	0.006	0.004
Change relative to the 2025 submission [kt $PM_{2.5}$]	-4.3E-5	-7.9E-5	-4.1E-5	-1.4E-4	-2.0E-4	-1.4E-4	-6.4E-5	-2.7E-4	-3.1E-4
Change relative to the 2025 submission [%]	-0.2%	-0.3%	-0.9%	-1.7%	-1.2%	-1.9%	-1.1%	-4.6%	-7.6%
2025 submission BC [kt]	6.5E-4	7.5E-4	2.1E-4	3.6E-4	6.2E-4	4.0E-4	3.6E-4	3.5E-4	2.4E-4
2026 submission BC [kt]	6.5E-4	7.5E-4	2.1E-4	3.6E-4	6.2E-4	4.0E-4	3.6E-4	3.5E-4	2.4E-4
Change relative to the 2025 submission [kt BC]	2.2E-7	2.6E-7	1.7E-7	1.3E-7	1.6E-7	1.3E-7	-4.5E-7	3.5E-9	-9.8E-8
Change relative to the 2025 submission [%]	0.03%	0.03%	0.08%	0.04%	0.03%	0.03%	-0.12%	0.00%	-0.04%
2025 submission NO_x [kt]	0.494	0.572	0.178	0.315	0.508	0.345	0.318	0.306	0.216
2026 submission NO_x [kt]	0.495	0.573	0.177	0.311	0.502	0.335	0.299	0.283	0.194
Change relative to the 2025 submission [kt NO_x]	6.7E-4	4.9E-4	-7.8E-4	-0.0044	-0.0052	-0.0102	-0.0188	-0.0223	-0.0220
Change relative to the 2025 submission [%]	0.1%	0.1%	-0.4%	-1.4%	-1.0%	-3.0%	-5.9%	-7.3%	-10.2%

3.5.4.5 Planned Improvements

No planned improvement for this category.

3.5.5 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 2014 are backward extrapolated on the basis of 2015 to 2023. The extrapolation follows the algorithm detailed in section 3.5.4.

3.5.5.1 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 3-39.

Table 3-39 Fuel use [kt], Fishing sector.

Fuel type	1990	1995	2000	2005	2010	2015	2020	2023	2024
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	151.9	162.8
Biodiesel	NO	NO	NO	NO	NO	0.094	0.075	NO	NO

The number of yearly port exits attributed to NFR 1A4ciii are summarised in Table 3-40. Port exit numbers before 2015 are extrapolated as described in section 3.5.4. For the purpose of emissions calculations biodiesel is added to marine gas/diesel oil.

Table 3-40 Port exits in NFR 1A4ciii.

Vessel type	1990	1995	2000	2005	2010	2015	2020	2023	2024
Fishing vessels	131325	125034	118736	113316	106684	128625	85151	72633	71105

3.5.5.2 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 3.5.4.3 and specifically Table 3-34 for more information on source and use of emission factors.

The sulphur content time series reported in Table 3-35 is used for calculating SO_2 emissions for all engine types, while Table 3-36 provides NO_x tier adjusted NO_x emissions factors for reciprocating engines and Table 3-37 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.

3.5.5.3 Recalculations and Improvements

Emissions in NFR 1A4ciii are estimated following the same approach as international and domestic navigation (NFRs 1A3di(i), 1A3dii). The improvements introduced in these categories (see section 3.5.4.4) yielded a minor increase in NO_x emissions in recent years in Fishing (Table 3-41).

Table 3-41 Recalculation according to Tier 2 for NFR 1A4ciii, Fishing, between submissions.

1A4ciii, tier 2	1990	1995	2000	2005	2010	2015	2020	2022	2023
2025 submission NOx [kt]	13.19	15.99	15.43	12.77	12.45	10.11	7.87	7.33	7.33
2026 submission NOx [kt]	13.19	15.99	15.43	12.77	12.45	10.01	7.95	7.47	7.46
Change relative to the 2025 submission [kt NOx]	0.000	0.000	0.000	0.000	0.000	-0.100	0.084	0.140	0.135
Change relative to the 2025 submission [%]	0.0%	0.0%	0.0%	0.0%	0.0%	-1.0%	1.1%	1.9%	1.8%

3.5.5.4 Planned Improvements

No planned improvements for this category.

3.6 Fugitive Emissions (NFR 1B2)

In Iceland, fugitive emissions occur only from two sources: Distribution of Oil Products and Gas Products (1B2av and 1B2bv) and Geothermal Energy Production (1B2d).

3.6.1 Distribution of Oil and Gas Products (NFR 1B2av and 1B2bv)

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

3.6.1.1 Activity Data

The calculations are based on yearly fuel sales data provided by fuel sales companies, see Table 3-42.

Table 3-42 Fuel as acitivy data in distribution of oil products 1B2av and gas products 1B2bv.

Fuel sold, reported [kt]	1990	1995	2000	2005	2010	2015	2020	2023	2024
Gasoline	67.1	118	143	157	148	132	91.6	93.9	101
Gasoline, lead	60.7	18.0	NO	NO	NO	NO	NO	NO	NO
Aviation Gasoline	1.88	1.32	1.13	1.27	0.66	0.51	0.20	0.17	0.12
Jet Kerosene	78.3	83.0	137	141	126	220	86.9	311	323
Other Kerosene	NO	NO	NO	0.173	1.22	0.186	0.356	0.053	0.048
Gas/Diesel Oil	309	335	404	386	318	353	386	485	494
Residual Fuel Oil	98.8	121	71.2	59.1	89.1	76.5	1.22	8.15	2.88
LPG	1.19	1.15	2.03	2.35	2.64	2.14	2.52	3.32	4.26
Biogasoline	NO	NO	NO	NO	NO	1.93	11.0	20.7	12.2
Biodiesel	NO	NO	NO	NO	NO	12.0	13.1	2.94	20.6
Biomethane	NO	NO	0.0060	0.96	0.60	2.18	1.55	1.57	1.78

3.6.1.2 Emission Factors

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

For liquid biofuels, the NMVOC emission factors are taken from Table 4.2.4D (New), Vol. 2, Ch. 4 of the 2019 Refinements. This is done as a conservative approach since there is no specific emission factor for bioethanol and biodiesel. For bioethanol, the emission factor for Refined Product Distribution – Gasoline is used, it is 2.27 t per 1,000 m^3 product consumed. For biodiesel, the emission factor for Refined Product Distribution – Other is used, it is 0.15 t per 1,000 m^3 product consumed.

For biomethane, the NMVOC emission factor from Table 4.2.4J (New), Vol. 2, Ch. 4 of the 2019 Refinements, Gas Distribution with leak detection, is used. It is 0.009 t per 1,000,000 m^3 gas consumption.

3.6.1.3 Recalculations and Improvements

The activity data for residual fuel oil for the year 2000 was updated from the fuel sale statistics. The activity data for gas/diesel oil for the 2022 was updated from industrial reports. Biofuels are now included in the activity data. This caused recalculations for 2000-2023 that can be seen in the table below.

Table 3-43 Recalculations of NMVOC in 1B2av and 1B2bv Distribution of oil and gas products.

1B2av & 1B2bv Distribution of oil and gas products	2000	2005	2010	2015	2020	2022	2023
2025 submission NMVOC [kt]	0.228117	0.22551	0.20612	0.237	0.171	0.260	0.272
2026 submission NMVOC [kt]	0.228125	0.22552	0.20613	0.245	0.207	0.323	0.335
Change relative to the 2025 submission NMVOC [kt]	8.2E-06	1.2E-05	7.5E-06	8.0E-03	0.036	0.063	0.063
Change relative to the 2025 submission [%]	0.0036%	0.0053%	0.0036%	3.4%	20.7%	24.1%	23.1%

3.6.1.4 Planned Improvements

No improvements are currently planned for this subsector.

3.6.2 Geothermal Energy (NFR 1B2d)

This category includes emissions from all geothermal power plants in Iceland, mostly combined heat and power (CHP) plants but also power-only or heat-only plants. Currently there is no disaggregation into emissions associated with district heating and those associated with electricity production.

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.

3.6.2.1 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 3-44 shows the electricity production with geothermal energy and the net sulphur emissions (calculated as SO_2).

Table 3-44 Electricity production and emissions from geothermal energy in Iceland.

	1990	1995	2000	2005	2010	2015	2020	2023	2024
Electricity production [GWh]	283	290	1,323	1,658	4,465	5,003	5,961	6,006	5,986
Sulphur emissions [kt SO_2]	13.3	11.0	26.0	30.3	58.7	44.9	39.1	35.6	41.1

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 3-45 shows the amount of H_2S mineralized with the SulFix method (calculated as SO_2). The amount of SO_2 that is mineralized is subtracted from the total SO_2 emissions and the net emissions are reported (see the table below).

Table 3-45 Amount of H_2S mineralized with the SulFix method (calculated as SO_2).

	1990	1995	2000	2005	2010	2015	2020	2023	2024
SulFix – Mineralised [kt SO_2]	NO	NO	NO	NO	NO	-3.0	-5.7	-5.9	-5.1

3.6.2.2 Recalculations and Improvements

Due to updates in activity data from the geothermal power plants, recalculations were performed for SO_2 emissions for the whole timeline. The table below shows the recalculations.

Table 3-46 Recalculations of SO_x emissions in 1B2d Geothermal energy.

1B2d Geothermal Energy	1990	1995	2000	2005	2010	2015	2020	2022	2023
2025 submission SO_x [kt]	13.33	11.01	26.02	30.31	58.68	42.4	39.3	37.1	33.7
2026 submission SO_x [kt]	13.29	10.96	26.03	30.26	58.69	44.9	39.1	37.6	35.6
Change relative to the 2025 submission SO_x [kt]	-0.048	-0.048	0.008	-0.05	0.008	2.50	-0.14	0.43	1.90
Change relative to the 2025 submission [%]	-0.36%	-0.44%	0.032 %	-0.15%	0.014 %	5.9%	-0.35%	1.15%	5.7%

3.6.2.3 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 (2C); 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 air pollutant emissions from the industrial processes sector can be traced back to the metal production, exceptions include NMVOC, which mostly originate from solvents and product use (2D); NH_3, which is emitted by the mineral wool industry (2A) and capacitor production (2C); and heavy metals Hg, Cu and Se, which are emitted during the use of fireworks and tobacco (2G). 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, Table 4-2 and 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 Production1	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 Production2	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
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	Diatomite3	NO	NO	NO	NO	NO	NO	NO	NO	NO
2B10a	Fertiliser2	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 Production4	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	Creosotes5	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
2G	Tobacco	T2	T2	NA	T2	T2	T2	T2	T2	T2
2G	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

Sector		NECD Gases				PM				
		NO_x	NMVOC	SO_x	NH_3	$PM_{2.5}$	PM_{10}	TSP	BC	CO
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
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

Sector		POPs			
		Dioxin	PAH	HCB	PCB
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
2G	Tobacco	T2	T2	NA	NA
2G	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

Sector		Heavy Metals								
		Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
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
2G	Tobacco	T2	T2	T2	T2	T2	T2	T2	T2	T2
2G	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
2H3	Other Industrial Processes	NO	NO	NO	NO	NO	NO	NO	NO	NO

Sector		Heavy Metals								
		Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn
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	2024	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	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	**2024**	**Trend**
2C2 Ferroalloys Production		PCDD/F, PAH4	PCDD/F, PAH4
2C3 Aluminium Production		PAH4, HCB	PAH4
2G Other Product Use: Fireworks	HCB	HCB	HCB
Heavy Metals (HMs)			
	1990	**2024**	**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			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 Uncertainty Assessment

Table 4-5 summarises the quantitative uncertainties for all pollutants aggregated for the entire IPPU sector. Uncertainties were assessed according to Approach 1, described in the EMEP/EEA Guidebook 2023; see Section 1.7.1 for details on the general methodology.

Activity Data Uncertainty

Uncertainties in activity data for the IPPU sector vary by data category and subsector. Key categories include imports and production. Other categories include product use, population, GDP and combined data.

Import data are provided by Statistics Iceland and are used to estimate the emissions from Coating Applications (2D3d), Degreasing (2D3e), Chemical Products (2D3g), Printing (2D3h), Organic Solvent-Borne Preservatives (2D3i), Tobacco (2G), Fireworks (2G), and Coffee Roasting (2H2). A 2% uncertainty is assigned to import data, following the guidance in the EMEP/EEA Guidebook 2023 for national statistics.

Production data are reported directly by producers and used to estimate emissions from quarrying and mining of minerals (2A5a), construction and demolition (2A5b), metal production (2C2, 2C3, 2C7c), road paving with asphalt (2D3b), and beer and malt production (2H2). Assigned uncertainties are:

- 35% for aggregates produced (2A5a), based on expert judgement and trends in previous years.
- 2% for area of new constructed buildings (2A5b), based on expert judgement, treating the data as national statistics.

- 20% for length of new paved roads (2A5b), based on expert judgement and trends in previous years.
- 1.5% for metal production (2C2, 2C3) as the data are reported directly by EU ETS operators.
- 2% for other metal production (2C7c), based on expert judgement, treating the data as national statistics (the data are provided directly by the operators).
- 2% for asphalt production (2D3b) and beer and malt production (2H2), based on expert judgement, treating the data as national statistics (the data are provided directly by the manufacturers).

As mentioned above, **other data** can be divided in product use, population, GDP and combined data.

- The use of de-icing liquids (2D3i) is used to estimate the emissions from de-icing and is directly reported by airport operators. Assigned uncertainty is 30%, following the guidance in the EMEP/EEA Guidebook 2023 for other data.
- Population number is used to estimate emissions from domestic solvent use (2D3a) and dry cleaning (2D3f) and is provided by Statistics Iceland. Assigned uncertainty is 2%, following the guidance in the EMEP/EEA Guidebook 2023 for national statistics.
- GDP trends are used to estimate the emissions from animal feed production (2H2) and are provided by Statistics Iceland. Assigned uncertainty is 2%, following the guidance in the EMEP/EEA Guidebook 2023 for national statistics.
- Combination of different types of activity data and are used to estimate the emissions from mineral wool (2A6) and other categories within food and beverage industry (2H2). Assigned uncertainties are between 2.25% to 3.46%. The majority of the activity data were provided by Statistics Iceland.

Emission Factor Uncertainty

Mineral Industry: Emission factor uncertainties are 20% for Quarrying and Mining (2A5a, Tier 2) based on expert judgement; 200–210% for construction and demolition (2A5b, Tier 1) based on the confidence intervals specified in the EMEP/EEA Guidebook 2023; and 10–20% for mineral wool (2A6, Tiers 1–3), except 150% for dioxin, based on expert judgement.

Metal Production: Emission factor uncertainties derive almost entirely from expert judgement.

- Ferroalloy Production (2C2, Tiers 1–3): 15–30% for main pollutants; generally very high for PMs, up to 900%; 20% for heavy metals, except Ni at 200%; 150% for POPs.
- Primary Aluminium Production (2C3, Tiers 2–3): 25–54% for main pollutants; 74–87% for PMs; 35% for heavy metals; 150% for POPs.
- Secondary Aluminium Production (2C3, Tiers 2–3): 50–122% for PMs; 150% for POPs.
- Capacitor Production (2C7c, Tier 3): 20% for NH_3.

Solvent and Product Use: The majority of emission factor uncertainties derive from the confidence intervals specified in the EMEP/EEA Guidebook 2023.

- Domestic Solvent Use (2D3a, Tier 2): 106% for NMVOC.
- Road Paving with Asphalt (2D3b, Tier 1-2): 525% for NMVOC and 93-900% for PMs. Emission factor uncertainty for dioxin is 150% and is based on expert judgement.
- Other Solvent Use (2D3d-i, Tier 1-2): 36-320% for NMVOC.

Other Product Use: The majority of emission factor uncertainties derive from the confidence intervals specified in the EMEP/EEA Guidebook 2023.

- Fireworks (2G, Tier 2-3): 5-100% for main/other pollutants, 55-81% for PMs and 283-877% for heavy metals. Emission factor uncertainty for HCB is 123% and is based on expert judgement.
- Tobacco (2G, Tier 2): 4-100% for main/other pollutants, 11% for PMs except 99% for BC, 50-307% for heavy metals, and around 100% for POPs.

Other Industry: This group contains various subcategories within the subsector Food and Beverages Industry (2H2, Tier 2). The only emissions are exclusively NMVOC, with emission factor uncertainties between 197-900%, derived from the confidence intervals specified in the EMEP/EEA Guidebook 2023.

Table 4-5 Quantitative Uncertainties aggregated for the IPPU sector.

NFR 2 IPPU	Pollutant	Unit	IPPU emissions 1990 [Unit]	IPPU emissions 2024 [Unit]	Uncertainty in IPPU [%]	Absolute uncertainty in 2024 emissions [Unit]	Uncertainty in IPPU trend [%]
Main pollutants	NOx	kt	1.1	2.3	17	0.40	12
	NMVOC	kt	1.1	2.9	193	5.6	76
	SO2	kt	3.2	12.6	21	2.7	29
	NH3	kt	0.0087	0.016	12	0.0019	0.67
Particulate Matter	PM2.5	kt	0.36	0.50	90	0.45	45
	PM10	kt	1.8	1.2	97	1.2	55
	TSP	kt	5.0	2.6	140	3.7	58
	BC	kt	6.4E-4	0.0075	63	0.0047	15
Other	CO	kt	10.7	102.5	87	88.9	114
Priority Heavy Metals	Pb	t	0.11	0.20	52	0.106	14
	Cd	t	0.013	0.13	35	0.045	87
	Hg	t	9.1E-4	4.3E-5	666	2.8.E-04	4.5
Additional Heavy Metals	As	t	0.015	0.13	35	0.046	72
	Cr	t	0.011	0.10	94	0.091	68

NFR 2 IPPU	Pollutant	Unit	IPPU emissions 1990 [Unit]	IPPU emissions 2024 [Unit]	Uncertainty in IPPU [%]	Absolute uncertainty in 2024 emissions [Unit]	Uncertainty in IPPU trend [%]
	Cu	t	0.066	0.43	231	1.0	58
	Ni	t	0.18	1.7	35	0.59	55
	Se	t	5.6E-6	1.4E-6	50	6.8.E-07	0.54
	Zn	t	0.47	4.4	42	1.9	73
POPs	Dioxin	g I-TEQ	0.021	0.16	119	0.19	13
	BaP	t	5.1E-4	0.0026	131	0.0034	17
	BbF	t	0.0076	0.023	106	0.024	32
	BkF	t	0.0022	0.0065	106	0.0070	17
	Ipy	t	7.7E-4	0.0024	106	0.0026	33
	PAH	t	0.011	0.034	78	0.027	21
	HCB	kg	0.12	0.048	95	0.046	33
	PCB	kg	0.0	0.0	-	-	-

For an uncertainty summary, disaggregated into IPPU related NFRs, covering the main pollutants and particulate matter see Annex 3.

4.4 Mineral Industry (NFR 2A)

4.4.1 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.

4.4.1.1 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.

4.4.1.2 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 4-6 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%

4.4.1.3 Recalculations

No category-specific recalculations were done for this submission.

4.4.1.4 Planned Improvements

No improvements are currently planned for this subsector.

4.4.2 Lime Production (NFR 2A2)

This activity does not occur in Iceland.

4.4.3 Glass Production (NFR 2A3)

This activity does not occur in Iceland.

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

4.4.4.1 Activity Data

The activity data were obtained from the IRCA, which provided a time series from of aggregates used for road construction from 1999 onwards, disaggregated by deposit type. However, assumptions were required for the most recent years. For 2021 and 2022, the activity data was estimated by IRCA using the 2015–2019 average, assuming a 15% annual increase. For 2023 and 2024, data had not yet been provided by IRCA, and these values were therefore preliminarily assumed to be identical to the 2022 value.

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.).

4.4.4.2 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 4-7 shows the emission factors used that show the emissions per tonne of aggregate production.

Table 4-7 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

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
$PM_{2.5}$ [g/t]	0.637	0.685	0.577	NE	0.764	0.164	8.26	4.13

4.4.4.3 Recalculations

No category-specific recalculations were done for this submission.

4.4.4.4 Planned Improvements

No improvements are currently planned for this subsector.

4.4.5 Construction and Demolition (NFR 2A5b)

4.4.5.1 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*). Data about road construction is retrieved from the IRCA for the years since 2000 and is estimated as average 2000-2009 for the years 1990-1999.

4.4.5.2 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.

4.4.5.3 Recalculations

For the 2026 submission, the source for length of new road/lane constructed (IRCA annual reports) were reviewed. It had previously been concluded that the IRCA reports did not provide data on the length of new road/ lane constructed beyond 2003. However, for the years 2000 to 2002 were identified in the 2015 report. These data have now been incorporated into the inventory, resulting in recalculations not only for 2000-2002 but also back to 1990, as years without activity data are estimated based on the average of the first ten years with available activity data.

Table 4-8 Recalculations in 2A5b Construction and Demolition between submissions

2A5b Construction and Demolition	1990	1999	2000	2001	2002	2023
2025 submission TSP [kt]	3.91	4.29	4.28	4.68	3.87	1.99
2026 submission TSP [kt]	4.11	4.50	5.85	5.34	3.58	1.94
Change relative to the 2025 submission TSP [kt]	0.20	0.21	1.6	0.65	-0.29	-0.054
Change relative to the 2025 submission TSP [%]	5.0%	5.0%	37%	14%	-7.5%	-2.7%
2025 submission PM_{10} [kt]	1.17	1.28	1.28	1.40	1.16	0.597
2026 submission PM_{10} [kt]	1.23	1.35	1.75	1.60	1.07	0.581
Change relative to the 2025 submission PM_{10} [kt]	0.059	0.064	0.47	0.20	-0.087	-0.016
Change relative to the 2025 submission PM_{10} [%]	5.0%	5.0%	37%	14%	-7.5%	-2.7%
2025 submission $PM_{2.5}$ [kt]	0.12	0.128	0.128	0.140	0.116	0.0597
2026 submission $PM_{2.5}$ [kt]	0.12	0.135	0.175	0.160	0.107	0.0581
Change relative to the 2025 submission $PM_{2.5}$ [kt]	0.0059	0.0064	0.047	0.020	-0.0087	-0.0016
Change relative to the 2025 submission $PM_{2.5}$ [%]	5.0%	5.0%	37%	14%	-7.5%	-2.7%

4.4.5.4 Planned Improvements

No improvements are currently planned for this subsector.

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

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

4.4.7 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.

4.4.7.1 Activity Data

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

4.4.7.2 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. The table below shows the emission factors used for Mineral Wool Production.

Table 4-9 Emission factors for Mineral Wool Production for the year 2024.

	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	0.630	0.310	114%	0.669	77.6%	2.00%	1.60

4.4.7.3 Recalculations

No category-specific recalculations were done for this submission.

4.4.7.4 Planned Improvements

No improvements are currently planned for this subsector.

4.5 Chemical Industry (NFR 2B)

4.5.1 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.

4.5.2 Nitric Acid Production (NFR 2B2)

This activity does not occur in Iceland.

4.5.3 Adipic Acid Production (NFR 2B3)

This activity does not occur in Iceland.

4.5.4 Carbide Production (NFR 2B5)

This activity does not occur in Iceland.

4.5.5 Titanium Dioxide Production (NFR 2B6)

This activity does not occur in Iceland.

4.5.6 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.

4.5.7 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.

4.5.7.1 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 the table below.

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

4.5.7.2 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.

4.5.7.3 Recalculations

No category-specific recalculations were done for this submission.

4.5.7.4 Planned Improvements

No improvements are currently planned for this subsector.

4.6 Metal Production (NFR 2C)

4.6.1 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.

4.6.1.1 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.

4.6.1.2 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.

4.6.1.3 Recalculations

No category-specific recalculations were done for this submission.

4.6.1.4 Planned Improvements

No improvements are currently planned for this subsector.

4.6.2 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).

4.6.2.1 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 the table below.

Table 4-11 Raw materials use [kt] and production [kt], ferrosilicon and silicon production.

	1990	1995	2000	2005	2010	2015	2020	2023	2024
Electrodes	3.83	3.88	5.73	6.00	4.79	4.86	4.82	4.66	4.66
Coking Coal	45.1	52.4	73.2	86.9	96.1	115	129	128	173
Coke Oven Coke	24.9	30.1	46.6	42.6	30.3	30.9	23.5	19.8	22.7
Charcoal	NA	NA	NA	2.08	NA	NA	1.67	14.0	14.4
Wood	16.7	7.73	16.2	15.6	11.3	27.2	59.9	72.0	101
Limestone	NA	NA	0.469	1.62	0.497	2.19	0.950	2.08	2.62
Production (FeSi, Si)	62.8	71.4	109	111	102	118	116	128	154
Microsilica	14.0	15.9	22.7	25.8	18.1	22.2	30.3	25.3	34.6
Slag	NO	NO	NO	NO	NO	NO	NO	NO	NO

4.6.2.2 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 the table below.

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 the table below.

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	0.31	0.31 kg/t	0.31 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	29.7	9.39
Si	10%	3.16	NA	NA	NA	NA

4.6.2.3 Recalculations

No category-specific recalculations were done for this submission.

4.6.2.4 Planned Improvements

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

4.6.3 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.

4.6.3.1 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 the table below.

Table 4-14 Primary Aluminium Production [kt].

	1990	1995	2000	2005	2010	2015	2020	2023	2024
Primary Al Production [kt]	87,8	100	226	272	819	857	831	866	851

4.6.3.2 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 4-15 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 4-15.

Table 4-15 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: 0.0742	CS: 0.0189 PS: 0.0222	CS: 13%	CS: 61%	CS: 18%	CS: 7.6%
	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 PS: 0.224	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 the table below.

Table 4-16 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

4.6.3.3 Recalculations

For the 2026 submission, NO_x emissions from one of the aluminium plants were recalculated for the applicable years on the time series. Previously, the emissions were estimated using default emission factor in the 2023 EMEP/EEA Guidebook but are now based on on-site NO_x measurement conducted in 2024. The overall impact of this change on NO_x emission from the sector is shown in the table below.

Table 4-17 Recalculations in 2C3 Primary Aluminium Production between submissions.

2C3 Primary Aluminium Production	1998	2000	2005	2010	2015	2020	2022	2023
2025 submission NO_x [kt]	0.124	0.175	0.217	0.760	0.796	0.774	0.778	0.802
2026 submission NO_x [kt]	0.115	0.129	0.145	0.546	0.553	0.532	0.540	0.561
Change relative to the 2025 submission NO_x [kt]	-0.0089	-0.045	-0.072	-0.21	-0.24	-0.24	-0.24	-0.24
Change relative to the 2025 submission NO_x [%]	-7.2%	-26%	-33%	-28%	-30%	-31%	-31%	-30%

4.6.3.4 Planned Improvements

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

4.6.4 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.

4.6.4.1 Activity Data

All activity data, consisting of produced secondary aluminium, is obtained in Green Accounting reports submitted yearly to the IEEA, and can be seen in the table below.

Table 4-18 Secondary Aluminium Production [kt].

	1990	1995	2000	2005	2010	2015	2020	2023	2024
Secondary Al Production [kt]	NO	NO	NO	2.25	2.04	2.20	2.20	3.90	3.53

4.6.4.2 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 4-19 Emission factors, Secondary Aluminium Production. TSP IEF is the average of the years 2012-2024.

	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	0.43	70%	28%	2.3%

4.6.4.3 Recalculations

In previous submissions, emissions of TSP, PM_{10}, $PM_{2.5}$ and BC for the years 2022 and 2023 were estimated using incorrect activity data (the amount of air released from the facility). Emissions for these two years have therefore been recalculated accordingly (see in table below).

Table 4-20 Recalculations in 2C3 Primary Aluminium Production between submissions.

2C3 Secondary Aluminium Production	2022	2023
2025 submission TSP [t]	3.29	0.867
2026 submission TSP [t]	2.82	0.846
Change relative to the 2025 submission TSP [t]	-0.47	-0.021
Change relative to the 2025 submission TSP [%]	-14%	-2.4%
2025 submission PM_{10} [t]	2.30	0.607
2026 submission PM_{10} [t]	1.97	0.592
Change relative to the 2025 submission PM10 [t]	-0.332	-0.015
Change relative to the 2025 submission PM10 [%]	-14%	-2.4%
2025 submission $PM_{2.5}$ [t]	0.905	0.238
2026 submission $PM_{2.5}$ [t]	0.775	0.233
Change relative to the 2025 submission $PM_{2.5}$ [t]	-0.130	-0.0058

2C3 Secondary Aluminium Production	2022	2023
Change relative to the 2025 submission $PM_{2.5}$ [%]	-14%	-2.4%
2025 submission BC [t]	0.0208	0.00548
2026 submission BC [t]	0.0178	0.00535
Change relative to the 2025 submission BC [t]	-0.0030	-0.00013
Change relative to the 2025 submission BC [%]	-14%	-2.4%

4.6.4.4 Planned Improvements

No improvements are currently planned for this subsector.

4.6.5 Magnesium Production (NFR 2C4)

This activity does not occur in Iceland.

4.6.6 Lead Production (NFR 2C5)

This activity does not occur in Iceland.

4.6.7 Zinc Production (NFR 2C6)

This activity does not occur in Iceland.

4.6.8 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.

4.6.8.1 Activity Data

All activity data, consisting of used ammonium hydroxide, is obtained in Green Accounting reports submitted yearly to the IEEA, see Table 4-21.

Table 4-21 Ammonium hydroxide used during production [t].

	2009	2010	2015	2020	2023	2024
Ammonium hydroxide used [t]	50.9	111.9	65.4	49.4	38.8	36.1

4.6.8.2 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%.

4.6.8.3 Recalculations

No category-specific recalculations were done for this submission.

4.6.8.4 Planned Improvements

No improvements are currently planned for this subsector.

4.7 Solvent and Product Use (NFR 2D)

Activities reported under 2D Solvent and Product Use predominantly generate NMVOC emissions. When volatile chemicals are exposed to air, emissions occur through evaporation. The use of solvents and other organic compounds in industrial processes and households is therefore an important source of NMVOC emissions.

Emissions of other air pollutants are estimated for the category 2D3b Road Paving with Asphalt (dioxin, PMs, and BC), 2D3i Creosotes (PAHs), 2G Fireworks (all pollutants except BC, NMVOC, dioxin, PAH4, and Se), and 2G Tobacco (all pollutants except SO_2 and HCB).

The activity data used to estimate emissions from 2D are primarily based on import statistics for relevant goods provided by Statistics Iceland (SI) (*Hagstofa Íslands*). Other activity data include the use of de-icing fluid provide by aviation operators in Iceland, the quantity of asphalt produced as reported by asphalt producers and the quantity of domestically produced paint provided by the Icelandic Recycling Fund (*Úrvinnslusjóður*).

Emission factors for the subcategories of 2D3 are presented in Table 4-22 and Table 4-23. References and further details on individual emission factors are provided in the respective subchapters.

Table 4-22 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	—	—	—	—

		Unit	NMVOC [g/unit]	TSP [g/unit]	PM_{10} [g/unit]	$PM_{2.5}$ [g/unit]	BC [% of $PM_{2.5}$]
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 4-23 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	—	—	—	—	—
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	—	—	—	—	—

4.7.1 Domestic Solvent Use Including Fungicides (NFR 2D3a)

The emission factors for 2D3a Domestic Solvent Use are Tier 2b from Table 3-4 and Table 3-5 in chapter 2.D.3.a of the 2023 EMEP/EEA Guidebook (EEA, 2023).

4.7.1.1 Activity Data

Activity data consists of population and relevant import statistics provided by SI, including cosmetics and toiletries, household products, car care products, adhesives, sealants/filling agents and pesticides.

According to the 2023 EMEP/EEA Guidebook, between 5%-50% of NMVOCs are assumed to be emitted to the atmosphere from products that are removed with water after performing their function (e.g. shampoos, soaps, toothpaste, and household cleaners). A value of 27.5% (the midpoint of this range) is applied. The activity data are accordingly divided into two categories, i.e. rinse-off and non-rinse-off cosmetic and toiletries.

Similarly, 1% of NMVOCs is assumed to be emitted from products that used by being diluted in water (e.g. dishwasher detergents, fabric detergents, and bleach). The activity data are therefore divided into diluted and non-diluted categories.

4.7.1.2 Emission Factors

The NMVOC emission factors for different product types were taken from Chapter 2.D.3.a (EEA, 2023). Emission factors per quantity of product from Table 3-4 were applied to most product types, while emission factors per person from Table 3-5 were used for pharmaceutical products, paint thinners, and paint and varnish removers. This approach was necessary as pharmaceutical products could not be entirely isolated from total import statistics, and emission factors for paint thinners and paint and varnish removers are only provided in g/person.

Table 4-24 Emission factors in sector 2D3a

Product/product type	EFs from Table 3-4 [g NMVOC/kg product]	EFs from Table 3-5 [g NMVOC/person]
Cosmetics and toiletries (all)	127	
Household products (all)	16	
Car care products (all)	180	
DIY/buildings (adhesives)	66	
DIY/buildings (sealants, filling agents)	45	
Pesticides	150	
DIY/buildings — paint thinner		205
DIY/buildings — paint and varnish removers, solvents		68
Pharmaceutical products		48

The emissions of Hg are 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.

4.7.1.3 Recalculations

For the 2026 submission, the methodology used to estimate NMVOC emissions in 2D3a was upgraded from Tier 1 (population-based approach) to Tier 2b (product-based approach). The Tier upgrade resulted in recalculations for the entire time series, with lower emissions for 1990-1999 but higher emissions from 2000 onwards (see table and figure below). The recalculated emissions differ significantly from the previous estimates but more accurately reflect economic trends in Iceland, such as period during the 2008 financial crisis and the COVID-19 pandemic.

Table 4-25 Recalculations in 2D3a Domestic Solvent Use between submissions.

2D3a Domestic Solvent Use	1990	1995	2000	2005	2010	2015	2020	2022	2023
2025 submission NMVOC [t]	457	481	502	528	572	581	637	657	675
2026 submission NMVOC [t]	218	277	565	976	626	909	1216	1218	1598
Change relative to 2025 submission NMVOC [t]	-239	-203	63	448	54	327	579	561	923
Change relative to 2025 submission NMVOC [%]	-52%	-42%	12%	85%	9.5%	56%	91%	85%	137%

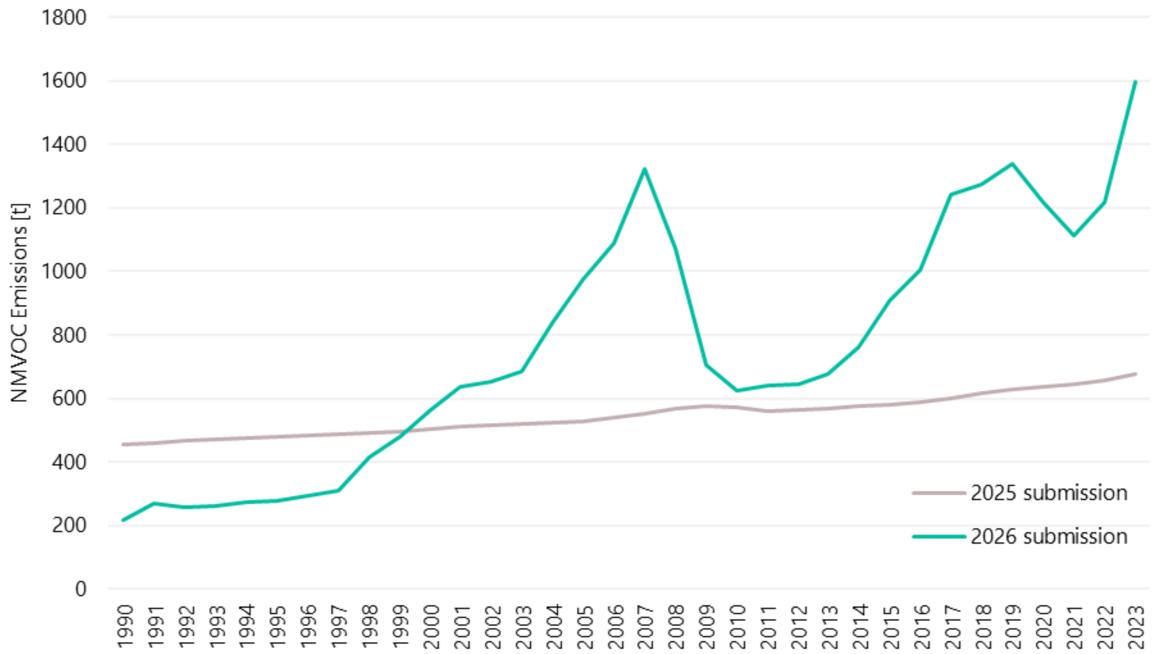

Figure 4.1 Recalculations in 2D3a Domestic Solvent Use between submissions.

4.7.1.4 Planned Improvements

No improvements are currently planned for this subsector.

4.7.2 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.

4.7.2.1 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 4-26.

Table 4-26 Production of asphalt for road paving [kt].

	1990	1995	2000	2005	2010	2015	2020	2023	2024
Road Paving with Asphalt Production [kt]	172	172	324	335	235	194	263	283	289

4.7.2.2 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.

4.7.2.3 Recalculations

No category-specific recalculations were done for this submission.

4.7.2.4 Planned Improvements

No improvements are currently planned for this subsector.

4.7.3 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.

4.7.3.1 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 4-27. 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 4-27 Total solvent-based paint (domestic production and imports) [kt].

	1990	1995	2000	2005	2010	2015	2020	2023	2024
Total solvent-based paint [kt]	2.21	2.38	2.44	1.49	1.26	1.38	1.92	1.52	1.68

4.7.3.2 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.

4.7.3.3 Recalculations

For the 2026 submission, minor recalculations were made in 2D3d Coating for 2002, 2006, and 2010 due to updated activity data for imported solvent-based paint. This update resulted in increases of 2.8 kg, 1.1 kg, and 0.69 kg in NMVOC emissions for those years, respectively, which is less than 0.001%.

At the time of submission, data on domestic paint production were not available. The 2023 value was therefore applied. A recalculation is planned for the 2027 submission, when the 2024 production data became available.

4.7.3.4 Planned Improvements

No improvements are currently planned for this subsector.

4.7.4 Degreasing (NFR 2D3e)

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

4.7.4.1 Activity Data

The data on the amount of imported cleaning products imported provided by SI (see Table 4-28). 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 4-28 Imports of cleaning products [t].

	1990	1995	2000	2005	2010	2015	2020	2023	2024
Cleaning product imports [t]	166	123	185	125	83	101	94	122	107

4.7.4.2 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.

4.7.4.3 Recalculations

No category-specific recalculations were done for this submission.

4.7.4.4 Planned Improvements

No improvements are currently planned for this subsector.

4.7.5 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.

4.7.5.1 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.

4.7.5.2 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:

$$EF_{\text{technology,abated}} = (1 - \eta_{\text{abatement}}) \cdot EF_{\text{technology,unabated}} = (1 - 0.89) \cdot 177 = 19.47 \text{ g/kg}$$

4.7.5.3 Recalculations

No category-specific recalculations were done for this submission.

4.7.5.4 Planned Improvements

No improvements are currently planned for this subsector.

4.7.6 Chemical Products (NFR 2D3g)

The only activity identified for the subcategory Chemical Products, Manufacture and Processing is domestic manufacture of paints. NMVOC emissions from the manufacture of paints were calculated using Tier 2 of the Guidebook (EEA, 2023).

4.7.6.1 Activity Data

The activity data consists of the amount of paint produced domestically, as discussed above in chapter 4.7.3 Coating Applications (see Table 4-27). At the time of submission, the total quantity of domestically produced paint in 2024 had not yet been finalised by the Icelandic Recycling Fund. The 2024 value was therefore assumed to be the same as 2023.

Table 4-29 Domestically produced solvent-based paint [t].

	1990	1995	2000	2005	2010	2015	2020	2023	2024
Solvent-based Paint Domestic Production [t]	1418	1418	1110	492	291	301	715	259	259

4.7.6.2 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.

4.7.6.3 Recalculations

No category-specific recalculations were done for this submission.

4.7.6.4 Planned Improvements

No improvements are currently planned for this subsector.

4.7.7 Printing (NFR 2D3h)

4.7.7.1 Activity Data

Import data on ink was received from SI, see Table 3-25.

Table 4-30 Total imports of ink [t]

	1990	1995	2000	2005	2010	2015	2020	2023	2024
Print/ink import [t]	155	218	396	610	378	413	157	89	56

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).

4.7.7.2 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.

4.7.7.3 Recalculations

No category-specific recalculations were done for this submission.

4.7.7.4 Planned Improvements

No improvements are currently planned for this subsector.

4.7.8 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.

4.7.8.1 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 4-31 Total import of preservatives [kg] and total de-icing fluid used [l].

	1990	1995	2000	2005	2010	2015	2020	2023	2024
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	33,510	24,685
De-icing fluid used [l]	664,772	664,772	664,772	664,772	664,772	570,614	690,152	1,117,215	1,349,801

4.7.8.2 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).

4.7.8.3 Recalculations

No category-specific recalculations were done for this submission.

4.7.8.4 Planned Improvements

No improvements are currently planned for this subsector.

4.8 Other Solvent and Product Use (NFR 2G)

4.8.1 Tobacco and Fireworks

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.

4.8.1.1 Activity Data

Activity data consist of all smoking tobacco and all fireworks imported and are provided by SI.

4.8.1.2 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 4-3.

Table 4-32 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	27.0	27.0	0.45%	55.1
Fireworks	0.260	NA	3.02	NA	109.8	99.9	51.9	NA	7.15

	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

	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	0.020	0.010	0.159	0.152	0.354	0.030	0.010	1.61
Fireworks	48.53	1.48	0.057	1.33	15.6	444	30	NA	260

[1] Conversion from mg/cigarette to kg/t is based on the information that one cigarette contains 1 g of tobacco.
[2] Value from 1990-2012 is 1.019 g/t and linearly lowered to the value from the 2018 measurements.
[3] Value is linearly lowered from the default EMEP/EEA guidebook value to the measurement value between 2007 and 2015.

4.8.1.3 Recalculations

For the 2026 submission, the activity data for tobacco were corrected by removing waterpipe tobacco (customs code 24031109), as its consumption does not involve combustion and is therefore not application for this emission category. The adjustment led to recalculations and lower emissions from 2012 onwards (see table below). As the emissions are directly proportional to the activity data, the resulting percentage reduction for each year is the same across all air pollutants.

Table 4-33 Recalculations in 2G Other: Tobacco between submissions.

2G4 Other: Tobacco Change relative to the 2025 submission [%]	2012 -1.7%	2015 -4.4%	2020 -4.0%	2022 -4.1%	2023 -11.3%
2025 submission TSP [t]	9.18	7.47	6.55	4.91	4.33
2026 submission TSP [t]	9.02	7.14	6.29	4.71	4.82
Change relative to the 2025 submission TSP [t]	-0.15	-0.33	-0.26	-0.20	0.49
2025 submission PM_{10} [t]	9.18	7.47	6.55	4.91	4.33
2026 submission PM_{10} [t]	9.02	7.14	6.29	4.71	4.82
Change relative to the 2025 submission PM_{10} [t]	-0.15	-0.33	-0.26	-0.20	0.49
2025 submission $PM_{2.5}$ [t]	9.18	7.47	6.55	4.91	4.33

2G4 Other: Tobacco Change relative to the 2025 submission [%]	2012 -1.7%	2015 -4.4%	2020 -4.0%	2022 -4.1%	2023 -11.3%
2026 submission $PM_{2.5}$ [t]	9.02	7.14	6.29	4.71	4.82
Change relative to the 2025 submission $PM_{2.5}$ [t]	-0.15	-0.33	-0.26	-0.20	0.49
2025 submission BC [kg]	41.30	33.59	29.49	22.10	19.48
2026 submission BC [kg]	40.60	32.12	28.32	21.18	21.68
Change relative to the 2025 submission BC [kg]	-0.69	-1.48	-1.17	-0.92	2.20
2025 submission NOx [kg]	611.8	497.7	436.9	327	289
2026 submission NOx [kg]	601.5	475.8	419.6	314	321
Change relative to the 2025 submission NOx [kg]	-10.27	-21.89	-17.31	-13.57	32.60
2025 submission NMVOC [kg]	1645	1338	1175	880	776
2026 submission NMVOC [kg]	1617	1279	1128	844	864
Change relative to the 2025 submission NMVOC [kg]	-27.62	-58.85	-46.55	-36.49	87.67
2025 submission CO [t]	18.73	15.23	13.38	10.02	8.83
2026 submission CO [t]	18.41	14.56	12.85	9.60	9.83
Change relative to the 2025 submission CO [t]	-0.31	-0.67	-0.53	-0.42	1.00
2025 submission NH_3 [kg]	1411	1147	1007	754.7	665.3
2026 submission NH_3 [kg]	1387	1097	967	723.4	740.5
Change relative to the 2025 submission NH_3 [kg]	-23.68	-50.46	-39.91	-31.29	75.17
2025 submission PAH4 [g]	83.61	68.02	59.71	44.74	39.44
2026 submission PAH4 [g]	82.21	65.03	57.35	42.88	43.89
Change relative to the 2025 submission PAH4 [g]	-1.40	-2.99	-2.37	-1.85	4.46
2025 submission PCDD/F [g]	3.40E-05	2.76E-05	2.43E-05	1.82E-05	1.60E-05
2026 submission PCDD/F [g]	3.34E-05	2.64E-05	2.33E-05	1.74E-05	1.78E-05
Change relative to the 2025 submission PCDD/F [g]	-5.71E-07	-1.22E-06	-9.62E-07	-7.54E-07	1.81E-06
2025 submission Pb [g]	218	177	155	116	103
2026 submission Pb [g]	214	169	149	112	114
Change relative to the 2025 submission Pb [g]	-3.65	-7.78	-6.16	-4.83	11.59
2025 submission Cd [g]	6.80	5.53	4.85	3.64	3.21
2026 submission Cd [g]	6.68	5.29	4.66	3.49	3.57
Change relative to the 2025 submission Cd [g]	-0.11	-0.24	-0.19	-0.15	0.36
2025 submission Hg [g]	3.40	2.76	2.43	1.82	1.60
2026 submission Hg [g]	3.34	2.64	2.33	1.74	1.78

2G4 Other: Tobacco Change relative to the 2025 submission [%]	2012 -1.7%	2015 -4.4%	2020 -4.0%	2022 -4.1%	2023 -11.3%
Change relative to the 2025 submission Hg [g]	-0.06	-0.12	-0.10	-0.08	0.18
2025 submission As [g]	54.04	43.96	38.60	28.91	25.49
2026 submission As [g]	53.14	42.03	37.07	27.72	28.37
Change relative to the 2025 submission As [g]	-0.91	-1.93	-1.53	-1.20	2.88
2025 submission Cr [g]	51.66	42.03	36.90	27.64	24.37
2026 submission Cr [g]	50.80	40.18	35.43	26.50	27.12
Change relative to the 2025 submission Cr [g]	-0.87	-1.85	-1.46	-1.15	2.75
2025 submission Cu [g]	120.32	97.88	85.93	64.38	56.75
2026 submission Cu [g]	118.30	93.57	82.53	61.71	63.16
Change relative to the 2025 submission Cu [g]	-2.02	-4.30	-3.40	-2.67	6.41
2025 submission Ni [g]	10.20	8.29	7.28	5.46	4.81
2026 submission Ni [g]	10.03	7.93	6.99	5.23	5.35
Change relative to the 2025 submission Ni [g]	-0.17	-0.36	-0.29	-0.23	0.54
2025 submission Se [g]	3.40	2.76	2.43	1.82	1.60
2026 submission Se [g]	3.34	2.64	2.33	1.74	1.78
Change relative to the 2025 submission Se [g]	-0.06	-0.12	-0.10	-0.08	0.18
2025 submission Zn [g]	547	445	391	293	258
2026 submission Zn [g]	538	426	375	281	287
Change relative to the 2025 submission Zn [g]	-9.19	-19.58	-15.48	-12.14	29.16

4.8.1.4 Planned Improvements

No improvements are currently planned for this subsector.

4.9 Other Industry Production (NRF 2H)

4.9.1 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.

4.9.1.1 Activity Data

Animal Feed: Production statistics for animal feed are available for 2005-2013. For the remaining years in the time series, values were extrapolated based on GDP.

Beer/malt/pilsner: Production data were obtained from the main producers, who were the only producers until 2006. From 2006 onwards, new breweries entered the market. Based on expert judgement, the main producers are estimated to account for at least 90% of total production since 2006. This factor is therefore applied as a conservative estimate of the total production since 2006. Production data are available for one main producer for the full time series (1990 onwards), while data for the other main producer are available only from 2002. For the period 1990–2001, production for the second producer was estimated using the production ratio between the two observed in 2002.

Bread, cakes/biscuits, meat, fish, and poultry: Estimated production was based on domestic consumption of each food category, derived from the *Diet of Icelanders*[21] surveys. These surveys provide average per-capita consumption for the years 1990, 2002, 2011, and 2020. The values for the remaining years in the time series were therefore interpolated. Total consumption was then calculated by using the population data and adjusted by applying a waste factor of 33% (FAO, 2011). For bread, cakes/biscuits, meat, fish, and poultry, it is assumed that the total production in Iceland serves the domestic market. Although fish and meat are exported, they are almost exclusively fresh or frozen and therefore not cooked in Iceland.

Coffee: The quantity of domestically roasted coffee is estimated entirely on the basis of import statistics of unroasted coffee beans obtained by SI.

Spirit: Net-import statistics were obtained from SI. Domestic production was estimated by subtracting the net-import from calculated domestic consumption, considering only the adult population. A waste factor of 33% mentioned above was applied. On those years where the quantity net-import exceed consumption, the domestic production is forced to be none.

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.

4.9.1.2 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 3-20.

[21] (Embætti Landlæknis, 2022), (Embætti Landlæknis, 2011), (Embætti Landlæknis, 2002), (Embætti Landlæknis, 1990)

Table 4-34 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

4.9.1.3 Recalculations

For the 2026, recalculations were done in sector 2H2 for three reasons:

- The estimation of animal feed production for years with missing data was revised to follow GDP trends.
- The methodology for coffee was updated by replacing per-capita consumption estimates with import-based data.
- Import and export categories for spirits were revised.

These changes together affected NMVOC emissions across the entire time series, resulting in lower emissions for the period 1990-2011 and higher emissions in 2012 onwards, with the exception for 2014, for which the recalculated emissions was 2% lower (see table and figure below).

Table 4-35 Recalculations in 2H2 Food and Beverages Industry between submissions.

2H2 Food and Beverages Industry	1990	1995	2000	2005	2010	2015	2020	2022	2023
2025 submission NMVOC [t]	153	163	174	180	176	284	403	402	414
2026 submission NMVOC [t]	115	125	152	179	175	289	668	503	521
Change relative to the 2025 submission NMVOC [t]	-37	-37	-22	-0.95	-0.83	4.28	266	102	107
Change relative to the 2025 submission NMVOC [%]	-24%	-23%	-13%	-0.53%	-0.47%	1.5%	66%	25%	26%

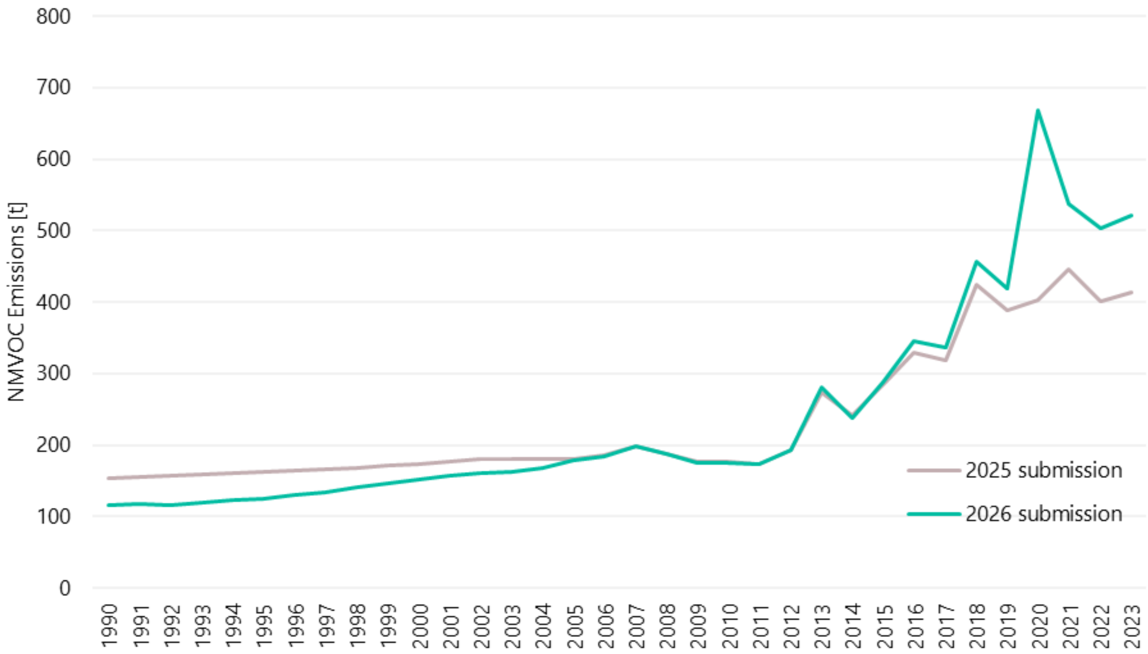

Figure 4.2 Recalculations in 2H2 Food and Beverages Industry between submissions.

4.9.1.4 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 of an ancient Nordic origin, e.g., dairy cattle, sheep, horses, and goats. 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 the cold climate and short growing season. Cropland in Iceland consists mainly of cultivated hayfields, although potatoes, barley, root crops and brassicas 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 quarter 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]	5.09	14.7	5.99	4.22	2.26	1.11
Agriculture total [kt]	5.01	0.902	1.42	0.225	0.168	0.0353
Agriculture shares of nat. total	98%	6.1%	24%	5.3%	7.4%	3.2%

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)
- Field Burning of Agricultural Residues (NFR 3F)

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) in the Agriculture sector.

Buffalos, mules, and asses are not farmed in Iceland and, therefore, are not occurring (NO) in the Icelandic inventory. Field Burning of Agricultural Residues (3F) and Agriculture other (3I) are also identified as NO in Iceland.

A summary of the categories included in the Agriculture sector by pollutant, including the methodology tier 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	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	NE	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	2024	Trend
3B1a Manure Management – Dairy Cattle	NMVOC, NH_3	NMVOC, NH_3	NH_3
3B1b Manure Management – Non-dairy Cattle	-	NMVOC, NH_3	NH_3
3B2 Manure Management – Sheep	NMVOC, NH_3	NH_3	NH_3
3B4e Manure Management – Horses	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	NH_3
3Da2a Animal Manure Applied to Soils	NH_3	NH_3	-
3Da3 Urine and Dung Deposited by Grazing Animals	NH_3	NH_3	NH_3

5.2 General Methodology

The methodology is based on Chapters 3B and 3D of the 2023 EMEP/EEA Guidebook wherever possible, except in a few instances where the 2013 and 2019 versions are used (EEA, 2013; EEA, 2019; EEA, 2023). All equations, as well as most 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 2023 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 2023 EMEP/EEA Guidebook was applied to more disaggregated livestock categories than the NFR methodology demands, as can be seen in Table 5-5. 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 Uncertainty Assessment

Table 5-4 summarises the quantitative uncertainties for all pollutants aggregated for the entire Agriculture sector. Uncertainties were assessed according to Approach 1, described in the EMEP/EEA Guidebook 2023. See section 1.7.1 for details on the general methodology.

Activity Data Uncertainty

The activity data uncertainties, affecting emissions from **manure management**, are the livestock number uncertainty, the uncertainty related to the manure management system distribution and allocation and N excretion rate uncertainty. Annual livestock data is based on a national census, and a 5% activity data uncertainty is assigned to all animal categories except Horses, which are assigned 10% due to the shifting in the registration system over the past few years. The uncertainties for the manure management system distribution are 50% for Sheep and 10% for all other animal classes. These uncertainties were assigned based on expert judgement. The uncertainty of nitrogen excreted is 20% for cattle, 30% for sheep and 50% for all other animal categories. All these activity data uncertainties are calculated and aggregated using both Equation 3.1 and Equation 3.2 of the 2006 IPCC Guidelines and differ for each animal category ranging from 20% for Cattle to 50% for Poultry. The resulting combined activity data uncertainty for mature management is consequently between 23%-60% depending on the animal category.

The variability in activity data uncertainties **Crop Production and Agricultural Soils** is considerable. For Inorganic N fertilizers the uncertainty is 5% based on expert judgement and since the amount of imported N-fertilisers are part of national statistics. The activity data uncertainty for Animal Manure Applied to Soils is derived from the average uncertainty of the activity data for manure management and is 50%, while for Sewage Sludge and Other Organic Fertilisers this uncertainty is 10% and 20%, respectively, considering the uncertainty of completeness. For subcategory Urine and Dung Deposited by Grazing Animals the activity data uncertainty is derived from the maximum uncertainty values used in 3B (livestock uncertainty, distribution of manure management systems and nitrogen excretion) and is 78%. The activity data uncertainty for Crop Residues applied to soils suffers mainly from completeness issues and is estimated to be 200%. The activity data uncertainty for Cultivated crops is estimated to be 21%, based on expert judgement for the uncertainty of each land category and the size of the relevant categories. Lastly AD uncertainty for Farm-level agricultural operations is 2% based on expert judgement and the fact that the data is used to get farming subsidies (jarðræktarstyrkir).

Emission Factor Uncertainty

Emission factor uncertainty values for **Manure management** were derived from the confidence intervals specified in the EMEP/EEA Guidebook and are 100% for all animal categories and pollutants with emissions in this sector. For **Crop production and agricultural soils**, the emission factor uncertainty varies mainly by pollutant. For NO_x, the uncertainty ranges between 100% and 160%, while for NH_3 it is 100% for all subsectors. For NMVOC, where emissions occur only from cultivated crops, the emission factor uncertainty is 300%. For particulate matter, where emissions are reported only for farm-level agricultural operations, the uncertainty is 400%.

Table 5-4 Quantitative Uncertainties aggregated for the Agriculture sector.

NFR 3 Agriculture	Pollutant	Unit	Agriculture emissions 1990 [Unit]	Agriculture emissions 2024 [Unit]	Uncertainty in Agriculture [%]	Absolute uncertainty in 2024 emissions [Unit]	Uncertainty in Agriculture trend [%]
Main pollutants	NOx	kt	1.1	0.90	91	0.8	13
	NMVOC	kt	1.6	1.4	55	0.8	25
	SO2	kt	0.0	0.0	-	-	-
	NH3	kt	5.3	5.0	46	2.3	55
Particulate Matter	PM2.5	kt	0.029	0.035	50	0.0	8.8
	PM10	kt	0.13	0.17	112	0.2	14
	TSP	kt	0.19	0.22	87	0.2	11
	BC	kt	0.0	0.0	-	-	-

For an uncertainty summary, disaggregated into Agriculture related NFRs, covering the main pollutants and particulate matter see Annex 3.

5.4 Manure Management (NFR 3B)

5.4.1 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)[22]. 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.

Livestock data is available on a more disaggregated level than requested by the reporting requirements, as can be seen in Table 5-5. Therefore, the emissions are estimated on a more disaggregated level and then combined to the NFR categories.

Table 5-5: 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; Heifers; Young bulls; 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 5-6 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 5-6: Annual average population of livestock according to NFR categorization in Iceland (1000s).

NFR code	Livestock sector (1000s)	1990	1995	2000	2005	2010	2015	2020	2023	2024
3B1a	Dairy Cattle	31.6	30.4	27.1	24.5	25.4	27.4	25.9	25.7	25.5
3B1b	Non-Dairy Cattle	43.3	43.6	45.1	41.5	47.1	51.3	55.2	53.0	52.6
3B2	Sheep	851	712	724	707	747	746	629	558	548
3B3	Swine	29.3	30.7	32.2	39.3	38.0	42.5	39.3	38.1	38.1
3B4a	Buffalo	NO	NO	NO	NO	NO	NO	NO	NO	NO
3B4d	Goats	0.53	0.56	0.60	0.72	1.12	1.62	2.65	3.01	3.09
3B4e	Horses	73.9	80.2	75.6	76.6	78.8	79.4	73.5	68.6	66.2

[22] Statistics Iceland, livestock and harvest data.

NFR code	Livestock sector (1000s)	1990	1995	2000	2005	2010	2015	2020	2023	2024
3B4f	Mules and Asses	NO	NO	NO	NO	NO	NO	NO	NO	NO
3B4gi	Laying Hens	506	186	285	213	164	171	241	242	242
3B4gii	Broilers	161	165	245	548	461	529	580	586	600
3B4giii	Turkeys	3.5	3.0	10.8	8.0	9.0	11.7	12.3	14.4	14.7
3B4giv	Other Poultry	5.8	5.2	2.5	1.8	1.3	1.1	0.58	0.47	0.50
3B4h	Other (Fur Animals)	47.8	37.8	40.7	36.8	39.7	47.7	15.8	5.2	4.8

5.4.2 Emission Factors and Associated Parameters

NH_3 and NO_x 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. 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[23], 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 must 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*) (IAAC) 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 70 kg/animal/year in 1990. In 2025, the IAAC provided new data for

[23] According to the 2019 refinements to the 2006 IPCC Guidelines, Eq. 10.32 is valid for Cattle, Sheep, and Goats.

solid storage on sheep farms, 40 kg/animal/year, for the whole timeline. This value is also applied for goats. Straw amounts for 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. The above-mentioned parameters are summarised in Table 5-7.

Table 5-7: Parameters used in the N-flow calculations, for the newest submission year.

NFR Code	Animal Category	Nex [kg/head/yr]	Prop. TAN (of N)	Fraction Slurry	Fraction Solid	Housing Period [days]	Straw [t/yr]
3B1a	Dairy Cattle	99	0.6	1	0	309	-
3B1b	Non-Dairy Cattle[1]	38	0.6	0.93	0.07	271	1222
3B2	Sheep[2]	9	0.5	0.35	0.65	200	9068
3B3	Swine	18	0.7	1	0	365	-
3B4d	Goats	7.8	0.5	0	1	200	124
3B4e	Horses	31	0.6	0	1	51	8327
3B4gi	Laying Hens	0.60	0.7	0	1	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, Heifers, Young bulls, and Calves.

[2] Values for Sheep are weighted averages for the subcategories Ewes, Rams, Animals for Replacement, and Lambs. However, manure from lambs is not part of the emissions from manure management, since 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 5-8.

Table 5-8: 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[1]
3B1a	Dairy Cattle	Slurry	0.24	0.25	0.55	0.0001	0.01
		Solid	0.08	0.32	0.68	0.01	0.04
3B1b	Non-dairy Cattle	Slurry	0.24	0.25	0.55	0.0001	0.01
		Solid	0.08	0.32	0.68	0.01	0.04
3B2	Sheep	Slurry[2]	0.24	0.25	0.55	0.0001	0.01
		Solid	0.22	0.32	0.9	0.01	0.033
3B3	Swine	Slurry	0.35	0.11	0.29	0.003	0
		Solid	0.24	0.29	0.45	0.01	0.025
3B3	Piglets	Slurry	0.27	0.11	0.40	0.0001	0

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[1]
		Solid	0.23	0.29	0.45	0.01	0.025
3B4d	Goats	Solid	0.22	0.28	0.90	0.01	0.033
3B4e	Horses	Solid	0.22	0.35	0.90	0.01	0.04
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[3]	0.01	0.037

[1] The factors in Table 3.8 of the 2023 EMEP/EEA Guidebook are adjusted using Table A1.8 to fit with the update in the 2019 IPCC Refinements (see Table 10.21, Vol. 4).

[2] No emission factor exists for NH_3 emissions from slurry for Sheep in the 2023 EMEP/EEA Guidebook. Hence, the emission factors for cattle are applied.

[3] 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 5-9. When default emission factors with silage feeding are available, these are used.

Table 5-9: Emission factors used for calculating NMVOC emissions.

NFR code	Animal Category	EF NMVOC [kg AAP^{-1} a^{-1}]
3B1a	Dairy Cattle	16.3[1]
3B1b	Non-Dairy Cattle	3.33[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 5-7 above). The applied emission factors are reported in Table 5-10 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 5-10: 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.

5.4.3 Recalculations

There are recalculations for the whole timeline 1990-2023 for NO_x, NMVOC and NH_3 due to updated digestibility of feed and ash content of feed for cattle and sheep and due to updated weights of cattle.

New information on the use of straw in solid storage for sheep and calves was also updated with new data from the IAAC, causing recalculation of NO_x and NH_3 emissions from cattle and sheep manure management. This change affects the year 1990-2007 for calves (up to 49% higher values for straw usage), and the whole timeline 1990-2023 for sheep (70% lower values for straw usage).

Updated manure management system (MMS) fractions caused recalculations of NO_x, NMVOC, NH_3 and particulate matter emissions, for cattle and sheep. The change in MMS fraction was largest for Calves where the fraction of solid storage was decreased while the slurry fraction increased, and days on pasture were introduced as well, all based on better data from the IAAC.

The recalculations for Cattle are shown in Table 5-11 and for Sheep in Table 5-12.

For goats updated gender fractions were received (12% adult males instead of 15%), updated number of kids per doe (1.5 instead of 1.3) and updated slaughter age (5.5 months instead of 5 months), affecting the population size of goats. This caused recalculations of NH_3, NO_x, NMVOC and particulate matter emissions for goats, see Table 5-13.

There are recalculations for the whole timeline due to updated weight of young horses affecting NO_x and NH_3 emissions, see Table 5-14.

Table 5-11: Recalculation for NO_x, NMVOC, NH_3 and particulate matter emissions for 3B1 Cattle.

3B1		1990	1995	2000	2005	2010	2015	2020	2022	2023
NOx	2025 submission [kt]	1.1E-3	1.3E-3	2.5E-3	3.0E-3	4.7E-3	4.9E-3	4.8E-3	4.7E-3	4.6E-3
	2026 submission [kt]	6.3E-4	7.4E-4	8.3E-4	8.6E-4	1.0E-3	1.2E-3	1.3E-3	1.3E-3	1.3E-3
	Change relative to the 2025 submission [kt]	-4.6E-4	-5.8E-4	-1.7E-3	-2.1E-3	-3.6E-3	-3.7E-3	-3.5E-3	-3.4E-3	-3.4E-3
	Change relative to the 2025 submission [%]	-42%	-44%	-67%	-71%	-78%	-75%	-72%	-73%	-73%
NMVOC	2025 submission [kt]	0.60	0.59	0.56	0.52	0.57	0.62	0.62	0.62	0.62
	2026 submission [kt]	0.54	0.52	0.51	0.48	0.53	0.58	0.59	0.60	0.59
	Change relative to the 2025 submission [kt]	-0.060	-0.068	-0.049	-0.041	-0.045	-0.039	-0.031	-0.017	-0.025
	Change relative to the 2025 submission [%]	-10.1%	-11.5%	-8.8%	-8.0%	-7.8%	-6.3%	-4.9%	-2.8%	-4.0%
NH_3	2025 submission [kt]	1.15	1.17	1.13	1.04	1.12	1.18	1.16	1.15	1.14
	2026 submission [kt]	1.04	1.03	1.06	0.98	1.08	1.17	1.17	1.17	1.17
	Change relative to the 2025 submission [kt]	-0.113	-0.135	-0.077	-0.061	-0.045	-0.017	0.012	0.020	0.028
	Change relative to the 2025 submission [%]	-9.8%	-11.6%	-6.8%	-5.9%	-4.0%	-1.5%	1.0%	1.7%	2.5%
$PM_{2.5}$	2025 submission [kt]	0.017	0.016	0.015	0.014	0.015	0.017	0.017	0.016	0.016
	2026 submission [kt]	0.016	0.016	0.015	0.014	0.015	0.016	0.016	0.016	0.016
	Change relative to the 2025 submission [kt]	-4.2E-4	-1.7E-4	-3.7E-4	-3.8E-4	-4.2E-4	-4.7E-4	-4.6E-4	-4.6E-4	-4.0E-4
	Change relative to the 2025 submission [%]	-2.5%	-1.0%	-2.4%	-2.7%	-2.7%	-2.8%	-2.8%	-2.8%	-2.5%

3B1		1990	1995	2000	2005	2010	2015	2020	2022	2023
PM_{10}	2025 submission [kt]	0.026	0.025	0.024	0.022	0.023	0.026	0.025	0.025	0.025
	2026 submission [kt]	0.025	0.025	0.023	0.021	0.023	0.025	0.025	0.024	0.024
	Change relative to the 2025 submission [kt]	-6.5E-4	-2.7E-4	-6.2E-4	-6.5E-4	-7.6E-4	-8.5E-4	-8.3E-4	-8.2E-4	-7.4E-4
	Change relative to the 2025 submission [%]	-2.5%	-1.1%	-2.6%	-3.0%	-3.2%	-3.3%	-3.3%	-3.3%	-3.0%
TSP	2025 submission [kt]	0.056	0.054	0.052	0.048	0.052	0.057	0.056	0.055	0.054
	2026 submission [kt]	0.055	0.054	0.051	0.046	0.050	0.055	0.054	0.054	0.053
	Change relative to the 2025 submission [kt]	-1.5E-3	-5.9E-4	-1.3E-3	-1.4E-3	-1.6E-3	-1.7E-3	-1.7E-3	-1.7E-3	-1.5E-3
	Change relative to the 2025 submission [%]	-2.6%	-1.1%	-2.5%	-2.9%	-3.0%	-3.1%	-3.1%	-3.1%	-2.8%

Table 5-12: Recalculation for NO_x, NMVOC and NH_3 emissions for 3B2 Sheep.

3B2		1990	1995	2000	2005	2010	2015	2020	2022	2023
NOx	2025 submission [kt]	0.017	0.015	0.015	0.015	0.016	0.014	0.011	0.011	0.011
	2026 submission [kt]	0.022	0.019	0.020	0.019	0.020	0.019	0.016	0.015	0.014
	Change relative to the 2025 submission [kt]	0.0049	0.0042	0.0043	0.0042	0.0044	0.0047	0.0041	0.0037	0.0037
	Change relative to the 2025 submission [%]	28.1%	28.3%	28.6%	28.5%	27.9%	32.8%	36.1%	33.9%	35.0%
NMVOC	2025 submission [kt]	0.240	0.200	0.204	0.199	0.210	0.210	0.177	0.164	0.158
	2026 submission [kt]	0.237	0.199	0.202	0.197	0.208	0.208	0.176	0.161	0.156
	Change relative to the 2025 submission [kt]	-0.0022	-0.0019	-0.0018	-0.0017	-0.0018	-0.0018	-0.0018	-0.0023	-0.0017
	Change relative to the 2025 submission [%]	-0.92%	-0.93%	-0.90%	-0.87%	-0.85%	-0.84%	-1.02%	-1.43%	-1.10%
NH_3	2025 submission [kt]	0.751	0.634	0.650	0.629	0.661	0.622	0.503	0.479	0.460
	2026 submission [kt]	0.817	0.693	0.717	0.695	0.733	0.700	0.572	0.543	0.527
	Change relative to the 2025 submission [kt]	0.066	0.059	0.067	0.067	0.072	0.078	0.070	0.064	0.067
	Change relative to the 2025 submission [%]	8.84%	9.33%	10.34%	10.60%	10.83%	12.62%	13.89%	13.33%	14.57%

Table 5-13: Recalculation for NO_x, NMVOC, NH_3 and particulate matter emissions for 3B4d Goats.

3B4d		1990	1995	2000	2005	2010	2015	2020	2022	2023
NOx	2025 submission [kt]	1.2E-5	1.3E-5	1.4E-5	1.7E-5	2.6E-5	3.7E-5	6.1E-5	6.9E-5	6.7E-5
	2026 submission [kt]	2.4E-5	2.6E-5	2.8E-5	3.3E-5	5.1E-5	7.4E-5	1.2E-4	1.4E-4	1.4E-4

3B4d		1990	1995	2000	2005	2010	2015	2020	2022	2023
	Change relative to the 2025 submission [kt]	1.2E-5	1.3E-5	1.4E-5	1.6E-5	2.5E-5	3.7E-5	6.1E-5	7.2E-5	7.0E-5
	Change relative to the 2025 submission [%]	100%	100%	100%	100%	100%	100%	100%	104%	104%
NMVOC	2025 submission [kt]	3.0E-4	3.2E-4	3.4E-4	4.1E-4	6.3E-4	9.2E-4	1.5E-3	1.7E-3	1.7E-3
	2026 submission [kt]	3.3E-4	3.5E-4	3.8E-4	4.5E-4	7.0E-4	1.0E-3	1.7E-3	1.9E-3	1.9E-3
	Change relative to the 2025 submission [kt]	3.0E-5	3.2E-5	3.4E-5	4.1E-5	6.3E-5	9.1E-5	1.5E-4	2.2E-4	2.1E-4
	Change relative to the 2025 submission [%]	9.9%	9.9%	9.9%	9.9%	9.9%	9.9%	9.9%	12.5%	12.4%
NH_3	2025 submission [kt]	4.0E-4	4.2E-4	4.5E-4	5.4E-4	8.4E-4	1.2E-3	2.0E-3	2.3E-3	2.2E-3
	2026 submission [kt]	5.5E-4	5.9E-4	6.3E-4	7.5E-4	1.2E-3	1.7E-3	2.8E-3	3.2E-3	3.1E-3
	Change relative to the 2025 submission [kt]	1.5E-4	1.6E-4	1.7E-4	2.1E-4	3.2E-4	4.7E-4	7.6E-4	9.5E-4	9.2E-4
	Change relative to the 2025 submission [%]	38%	38%	38%	38%	38%	38%	38%	41%	41%
$PM_{2.5}$	2025 submission [kt]	4.5E-6	4.8E-6	5.1E-6	6.1E-6	9.5E-6	1.4E-5	2.2E-5	2.6E-5	2.5E-5
	2026 submission [kt]	5.0E-6	5.2E-6	5.6E-6	6.7E-6	1.0E-5	1.5E-5	2.5E-5	2.9E-5	2.8E-5
	Change relative to the 2025 submission [kt]	4.5E-7	4.7E-7	5.1E-7	6.1E-7	9.4E-7	1.4E-6	2.2E-6	3.2E-6	3.1E-6
	Change relative to the 2025 submission [%]	9.9%	9.9%	9.9%	9.9%	9.9%	9.9%	9.9%	12.5%	12.4%
PM_{10}	2025 submission [kt]	1.5E-5	1.6E-5	1.7E-5	2.0E-5	3.1E-5	4.5E-5	7.4E-5	8.5E-5	8.2E-5
	2026 submission [kt]	1.6E-5	1.7E-5	1.8E-5	2.2E-5	3.4E-5	5.0E-5	8.1E-5	9.5E-5	9.2E-5
	Change relative to the 2025 submission [kt]	1.5E-6	1.6E-6	1.7E-6	2.0E-6	3.1E-6	4.5E-6	7.3E-6	1.1E-5	1.0E-5
	Change relative to the 2025 submission [%]	9.9%	9.9%	9.9%	9.9%	9.9%	9.9%	9.9%	12.5%	12.4%
TSP	2025 submission [kt]	3.7E-5	3.9E-5	4.2E-5	5.0E-5	7.7E-5	1.1E-4	1.8E-4	2.1E-4	2.0E-4
	2026 submission [kt]	4.1E-5	4.3E-5	4.6E-5	5.5E-5	8.5E-5	1.2E-4	2.0E-4	2.4E-4	2.3E-4
	Change relative to the 2025 submission [kt]	3.7E-6	3.9E-6	4.1E-6	5.0E-6	7.7E-6	1.1E-5	1.8E-5	2.6E-5	2.5E-5
	Change relative to the 2025 submission [%]	9.9%	9.9%	9.9%	9.9%	9.9%	9.9%	9.9%	12.5%	12.4%

Table 5-14 Recalculation for NO_x and NH_3 emissions for 3B4e Horses.

3B4e		1990	1995	2000	2005	2010	2015	2020	2022	2023
NO_x	2025 submission [kt]	2.1E-03	2.2E-03	2.2E-03	2.4E-03	2.3E-03	2.4E-03	2.2E-03	2.1E-03	2.0E-03
	2026 submission [kt]	2.6E-03	2.8E-03	2.7E-03	2.8E-03	2.8E-03	2.8E-03	2.6E-03	2.5E-03	2.4E-03

3B4e		1990	1995	2000	2005	2010	2015	2020	2022	2023
	Change relative to the 2025 submission [kt]	4.6E-4	6.0E-4	4.9E-4	4.1E-4	4.8E-4	4.7E-4	4.3E-4	4.1E-4	4.0E-4
	Change relative to the 2025 submission [%]	21%	27%	22%	17%	21%	20%	20%	20%	20%
NH_3	2025 submission [kt]	7.1E-02	7.4E-02	7.5E-02	7.8E-02	7.7E-02	7.8E-02	7.2E-02	6.9E-02	6.8E-02
	2026 submission [kt]	8.2E-02	8.8E-02	8.6E-02	8.7E-02	8.8E-02	8.9E-02	8.2E-02	7.9E-02	7.7E-02
	Change relative to the 2025 submission [kt]	1.1E-2	1.4E-2	1.2E-2	9.6E-3	1.1E-2	1.1E-2	1.0E-2	9.7E-3	9.5E-3
	Change relative to the 2025 submission [%]	15%	19%	15%	12%	15%	14%	14%	14%	14%

5.4.4 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, since data collection is needed to be able to move calculations for other animal categories up a tier.

5.5 Crop Production and Agricultural Soils (NFR 3D)

5.5.1 Activity Data

Activity data for NH_3 and NO emissions consists of the amount of fertiliser nitrogen applied to agricultural soils (Table 5-15). 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 the Icelandic Food and Veterinary Authority (*Matvælastofnun*) (IFVA). No official data exists that provides information on the types of nitrogen fertilisers imported. However, an expert on fertilisers at the 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 5-15. The fertiliser type data is still incomplete and will be improved for future submissions.

Table 5-15: Total amount of synthetic nitrogen fertilisers applied to agricultural soils.

	1990	1995	2000	2005	2010	2015	2020	2023	2024
N applied in inorganic N-fertilizer [kt N]	12.5	11.2	12.7	9.78	10.9	11.7	11.4	8.7	10.7
Ammonium nitrate [%]	67%	0%	0%	0%	0%	12%	22%	12%	12%
Calcium ammonium nitrate [%]	0%	67%	67%	67%	58%	43%	42%	29%	28%
Urea [%]	0%	0%	0%	0%	0%	0.018%	5.9%	6.5%	8.0%
Other NK and NPK [%]	33%	33%	33%	33%	42%	45%	30%	52%	52%

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*) (LFI) organic fertilisers have been applied on a small scale since 2009. 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 5-16. The total amount of cropland is recorded in the Icelandic Geographic Land-use Database (IGLUD), which is maintained by the LFI. Part of that area is though resting each year. The Icelandic Agricultural Advisory Centre (IAAC) has a database with all area farmers applied for hay cultivation grants for in the years 2017-2024. According to IAAC experts that area is around 90% of all cultivated area each year. The IAAC also have the amount of hay harvested for the years 2018-2024 in dry-matter mass. The area and harvest information from the IAAC are used to extrapolate the hay cultivation area back to 1990, using the IGLUD area as an upper limit, excluding area used for other purposes than hay cultivation. Data regarding the area of cereal, mainly barley, fields is obtained from Statistics Iceland for the years 2020-2024 and that data, along with harvest data from Statistics Iceland, is used to extrapolate the area back to 1990. Cereal fields are cultivated and harvested once a year and the produce are cleaned and dried. Grass fields are renewed about once every 23 years and hay is cut once to twice per year (Bragason, written communication). The total area of active cropland is used to estimate the NMVOC emissions.

Table 5-16: Areas of cropland in Iceland, distinguished by barley cultivation and grassland for haymaking.

	1990	1995	2000	2005	2010	2015	2020	2023	2024
Area Barley cultivation [ha]	0	175	1,095	3,519	4,744	1,683	2,734	3,067	2,768
Area Grass cultivation [ha]	134,611	132,498	129,539	124,910	118,324	111,226	92,666	91,644	92,161

5.5.2 Emission Factors

NH_3 emission factors from synthetic fertilisers are taken from Table 3.2 in the 2023 EMEP/EEA Guidebook. The emission factors for normal pH are applied as can be seen in Table 5-17.

Table 5-17: 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

	EF [g NH_3/ kg N applied]
Ammonium phosphates	84
Other NK and NPK[1]	84

[1] The EF for NPK mixtures.

The emission factors for NO, NMVOC, and NH_3 are taken from the 2023 EMEP/EEA Guidebook and are reported in Table 5-18 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. Hence the EF for NMVOC emissions from grass at 15°C from Table 3.4 in the 2023 EMEP/EEA Guidebook is used directly (which is just on part of the default Tier 1 NMVOC EF).

Table 5-18: 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 3.4 2023 EMEP/EEA Guidebook

PM_{10} and $PM_{2.5}$ emission factors for barley and grass were taken from Tables 3.6 and 3.8 of the 2023 EMEP/EEA Guidebook and are reported in Table 5-19.

Table 5-19: 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	—	—

5.5.3 Recalculations

Multiple updates were done for the 2026 submission, affecting the emissions from Crop Production and Agricultural Soils. They are:

- Errors were fixed in the synthetic fertiliser calculation sheets for the years 2012 and 2023 causing recalculations of NO_x and NH_3 emissions for those years. The amount of inorganic fertiliser used in forestry was also updated causing small recalculations for the years 2009-2023. However, due to how small those changes were, the only considerable changes in NO_x emissions are 2.9% increase in 2012 and a 4.2% decrease in 2023. Updated categorisation of fertilisers and a change in EF used for NPK mixtures led to recalculations of NH_3 emissions, see Table 5-20.
- Recalculation in NO_x and NH_3 emissions due to updated feed digestibility and ash content of feed for sheep and cattle, error fixed in days in a year for mature dairy cattle, updated animal mass for cattle and horses, updated early mortality for lambs, updated goat population size, updated number of days outside for calves, and updated amount of straw used for calves and sheep. The recalculations are shown in Table 5-21.
- Updated activity data for compost affected NO_x and NH_3 emissions from 3Da2c Other Organic Fertilisers Applied to Soils in the year 2023 only, shown in Table 5-22.
- There are recalculations in 3Dc for particulate matter emissions and 3De for NMVOC emissions due to updated area information from Land and Forest Iceland affecting the whole timeline from 1990. These recalculations are shown in Table 5-23 and Table 5-24.

Table 5-20: Recalculation for category 3Da1 Inorganic N-fertilizers.

3Da1		1990	1995	2000	2005	2010	2015	2020	2022	2023
NH_3	2025 submission [kt]	0.42	0.38	0.43	0.33	0.40	0.29	0.55	0.46	0.37
	2026 submission [kt]	0.55	0.49	0.56	0.43	0.53	0.60	0.60	0.63	0.58
	Change relative to the 2025 submission [kt]	0.12	0.11	0.13	0.10	0.13	0.30	0.04	0.17	0.20
	Change relative to the 2025 submission [%]	29%	29%	29%	29%	34%	104%	8%	37%	54%

Table 5-21: Recalculation for category 3Da2a Animal Manure Applied to Soils and 3Da3 Urine and Dung Deposited by Grazing Animals.

3Da2a + 3Da3		1990	1995	2000	2005	2010	2015	2020	2022	2023
NO_x	2025 submission [kt]	0.57	0.52	0.52	0.51	0.54	0.54	0.48	0.46	0.45
	2026 submission [kt]	0.53	0.49	0.49	0.48	0.51	0.52	0.46	0.45	0.44
	Change relative to the 2025 submission [kt]	-0.042	-0.038	-0.032	-0.031	-0.031	-0.025	-0.017	-0.016	-0.0097
	Change relative to the 2025 submission [%]	-7.3%	-7.2%	-6.0%	-6.0%	-5.8%	-4.6%	-3.5%	-3.5%	-2.2%
NH_3	2025 submission [kt]	2.33	2.22	2.21	2.15	2.23	2.28	2.11	2.06	2.02
	2026 submission [kt]	2.36	2.23	2.27	2.22	2.33	2.40	2.25	2.20	2.17

3Da2a + 3Da3		1990	1995	2000	2005	2010	2015	2020	2022	2023
	Change relative to the 2025 submission [kt]	0.026	0.011	0.060	0.066	0.10	0.13	0.14	0.14	0.15
	Change relative to the 2025 submission [%]	1.1%	0.5%	2.7%	3.1%	4.4%	5.6%	6.6%	6.6%	7.5%

Table 5-22: Recalculation for category 3Da2c Other Organic Fertilisers Applied to Soils.

3Da2c		2023
NO_x	2025 submission [kt]	0.012
	2026 submission [kt]	0.013
	Change relative to the 2025 submission [kt]	0.0011
	Change relative to the 2025 submission [%]	9.1%
NH_3	2025 submission [kt]	0.024
	2026 submission [kt]	0.026
	Change relative to the 2025 submission [kt]	0.0022
	Change relative to the 2025 submission [%]	9.1%

Table 5-23 Recalculations for category 3Dc Off-farm storage, handling and transport of bulk agricultural products.

3Dc		1990	1995	2000	2005	2010	2015	2020	2022	2023
$PM_{2.5}$	2025 submission [kt]	2.0E-3	2.0E-3	2.1E-3	2.5E-3	2.7E-3	2.4E-3	2.5E-3	2.8E-3	2.7E-3
	2026 submission [kt]	2.1E-3	2.1E-3	2.2E-3	2.5E-3	2.6E-3	2.0E-3	1.9E-3	2.0E-3	1.9E-3
	Change relative to the 2025 submission [kt]	1.5E-4	9.7E-5	6.9E-5	8.7E-5	-1.7E-5	-3.8E-4	-6.1E-4	-7.7E-4	-7.5E-4
	Change relative to the 2025 submission [%]	7.5%	4.8%	3.2%	3.5%	-0.6%	-16%	-24%	-28%	-28%
PM_{10}	2025 submission [kt]	0.048	0.049	0.051	0.057	0.061	0.057	0.060	0.065	0.064
	2026 submission [kt]	0.052	0.052	0.053	0.059	0.061	0.048	0.044	0.046	0.045
	Change relative to the 2025 submission [kt]	4.1E-3	2.8E-3	2.0E-3	2.0E-3	-7.2E-4	-9.1E-3	-0.016	-0.019	-0.019
	Change relative to the 2025 submission [%]	8.6%	5.8%	3.8%	3.5%	-1.2%	-16%	-26%	-29%	-29%
TSP	2025 submission [kt]	0.048	0.049	0.051	0.057	0.061	0.057	0.060	0.065	0.064
	2026 submission [kt]	0.052	0.052	0.053	0.059	0.061	0.048	0.044	0.046	0.045
	Change relative to the 2025 submission [kt]	4.1E-3	2.8E-3	2.0E-3	2.0E-3	-7.2E-4	-9.1E-3	-0.016	-0.019	-0.019
	Change relative to the 2025 submission [%]	8.6%	5.8%	3.8%	3.5%	-1.2%	-16%	-26%	-29%	-29%

Table 5-24 Recalculation for category 3De Cultivated crops.

3De		1990	1995	2000	2005	2010	2015	2020	2022	2023
NMVOC	2025 submission [kt]	9.2E-3	9.3E-3	9.4E-3	9.5E-3	9.8E-3	0.010	0.011	0.011	0.011
	2026 submission [kt]	0.014	0.013	0.013	0.013	0.012	0.011	9.6E-3	9.9E-3	9.5E-3
	Change relative to the 2025 submission [kt]	4.4E-3	4.0E-3	3.7E-3	3.4E-3	2.6E-3	1.1E-3	-1.2E-3	-1.1E-3	-1.5E-3
	Change relative to the 2025 submission [%]	47%	43%	40%	36%	27%	11%	-11%	-10%	-14%

5.5.4 Planned Improvements

For future submissions, improvements are planned for the registration of different inorganic N fertiliser types in Iceland's inventory.

5.6 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

Pesticide	Last Recorded Use	Year of Ban
Pentachlorophenol (PCP)	No recorded use	1998
Lindane	1992	2009

5.7 Field burning of Agricultural Residues (NFR 3F)

This activity is not occurring in Iceland.

6 Waste (NFR 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 in 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 of waste 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. Emissions from all air pollutants are estimated for 5C1a and estimates for all air pollutants except NH_3 are estimated for 5C1bi, 5C1bii, 5C1biii, 5C1biv and 5C1bv and included in 5C1a. 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
5C1bv	Cremation	T1	T1	T1	NA	T1	T1	T1	NA	T1
5C2	Open Burning	T1	T1	T1	T1	T1	T1	T1	T1	T1
5D	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 – Kalka1	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	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 – Kalka[1]	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	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 6.5 to 6.9. 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 1-9 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.

SO_x, NO_x, NH_3, NMVOC, PM, BC, and CO				
		1990	2024	Trend
5C2	Open Burning of Waste	$PM_{2.5}$, PM_{10}, BC		$PM_{2.5}$, PM_{10}, BC
Persistent Organic Pollutants (POPs)				
		1990	**2024**	**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	**2024**	**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	Zn	Pb	

6.2 General Methodology

The methodology is mainly based on the 2023 EMEP/EEA air pollutant emission inventory guidebook (EEA, 2023). Emission estimates are calculated by multiplying relevant activity data by source with pollutant specific emission factors. Emission factors are taken from the 2019 Emission Inventory Guidebook (EEA, 2019), the 2023 Emission Inventory Guidebook (EEA, 2023), the Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases (UNEP, 2005), the 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). Waste that is exported and treated outside of Iceland, and its associated emissions, is excluded from the Icelandic. 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 Uncertainty Assessment

Emission factor uncertainty values for **Manure management** were derived from the confidence intervals specified in the EMEP/EEA Guidebook and are 100% for all animal categories and pollutants with emissions in this sector. For **Crop production and agricultural soils**, the emission factor uncertainty varies mainly by pollutant. For NOx, the uncertainty ranges between 100% and 160%, while for NH_3 it is 100% for all subsectors. For NMVOC, where emissions occur only from cultivated crops, the emission factor uncertainty is

300%. For particulate matter, where emissions are reported only for farm-level agricultural operations, the uncertainty is 400%.

Table 6-5 summarises the quantitative uncertainties for all pollutants aggregated for the entire Waste sector, Uncertainties were assessed according to Approach 1, described in the EMEP/EEA Guidebook 2023. See section 1.7.1 for details on the general methodology.

Activity Data Uncertainty

Activity data uncertainties for **Solid Waste Disposal** are based on expert judgement within the IEEA on the uncertainty of total waste amount going to SWDS (10%) and composition uncertainty (20-25%, for 5A1a and 5A1b and 5A2 respectively).

In **Biological Treatment of Solid Waste**, the uncertainty of total waste amount going to composting and anaerobic digestion (15%) and composition uncertainty (5%) based on expert judgement within the IEEA. The Combined activity data uncertainty for Biological Treatment of Solid Waste is 16%.

Activity data uncertainties for **Waste Incineration and Open Burning** based on expert judgement from the IEEA regarding the uncertainty of the total waste amount sent to incineration (5C1) is 15% while the open burning og waste (5C2) is 30% and the uncertainty in waste composition is 20%. The Combined activity data uncertainty for Waste Incineration is 18% and 36% for Open Burning.

The combined activity data uncertainties for **Other Waste** is 49% calculated using Eq. 3.1 in IPCC Vol 1, Ch3 using NO_x as a proxy.

Emission Factor Uncertainty

For a large subset of emission factors, the associated uncertainty values could be derived from the confidence interval specified in the EMEP/EEA Guidebook. For hazardous and sewage sludge waste incineration the emission factor for industrial incineration is used for NMVOC, Pb, Cd, Hg, As, Ni, dioxin and PAH4 therefore the emission factor uncertainties for industrial waste incineration are used as well. Lastly the emission factor uncertainty for 5E is derived from the latest version of the Danish IIR for the categories where emissions factors from the latest version of the Danish IIR are used.

Table 6-5 Quantitative Uncertainties aggregated for the Waste sector.

NFR 5 Waste	Pollutant	Unit	Waste emissions 1990 [Unit]	Waste emissions 2024 [Unit]	Uncertainty in Waste [%]	Absolute uncertainty in 2024 emissions [Unit]	Uncertainty in Waste trend [%]
Main pollutants	NOx	kt	0.12	0.068	49	0.033	7.3
	NMVOC	kt	0.072	0.057	226	0.13	8.8

NFR 5 Waste	Pollutant	Unit	Waste emissions 1990 [Unit]	Waste emissions 2024 [Unit]	Uncertainty in Waste [%]	Absolute uncertainty in 2024 emissions [Unit]	Uncertainty in Waste trend [%]
	SO2	kt	0.012	0.017	269	0.046	3.3
	NH3	kt	7.1E-4	0.0079	187	0.015	1.1
Particulate Matter	PM2.5	kt	0.16	0.013	119	0.016	44
	PM10	kt	0.18	0.014	122	0.017	28
	TSP	kt	0.18	0.014	123	0.017	18
	BC	kt	0.067	0.003	76	0.0023	29
Other	CO	kt	2.1	0.13	163	0.21	39
Priority Heavy Metals	Pb	t	0.075	0.077	123	0.094	17
	Cd	t	0.0039	7.6E-4	56	4.3.E-04	142
	Hg	t	0.13	0.0031	531	0.016	42
Additional Heavy Metals	As	t	0.016	8.7E-4	168	0.0015	95
	Cr	t	6.6E-4	5.4E-4	142	7.7.E-04	11
	Cu	t	0.0095	0.0042	297	0.013	12
	Ni	t	0.0045	0.0011	138	0.0015	14
	Se	t	0.0027	2.5E-4	221	5.4.E-04	28
	Zn	t	0.89	0.31	454	1.4	125
POPs	Dioxin	g I-TEQ	10.6	0.51	12625	64.3	34
	BaP	t	0.090	0.0056	205	0.011	36
	BbF	t	0.18	0.010	191	0.019	48
	BkF	t	0.22	0.011	188	0.021	35
	Ipy	t	0.0072	0.0046	503	0.023	74
	PAH	t	0.49	0.031	196	0.061	43
	HCB	kg	0.13	0.062	714	0.45	105
	PCB	kg	0.19	0.012	862	0.10	58

For an uncertainty summary, disaggregated into Waste related NFRs, covering the main pollutants and particulate matter see Annex 3.

6.4 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 1.6 on Quality Assurance and Quality Control.

6.5 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. The amount of waste landfilled has been reduced even further in recent years, since separate collection of food waste from households started in late 2023. However, landfilling is still the dominant waste management practice in Iceland.

6.5.1 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.

6.5.2 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 (*Hagstofa Íslands*) (SI)[24].

- 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.

[24] Available at https://statice.is/statistics/environment/material-flow/waste/

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.

6.5.3 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 the 2023 EMEP/EE Guidebook.

6.5.4 Recalculations

Methane recovery data was updated due to new data from 1997-2003 and an overestimation that occurred since GAJA opened in 2020, resulting in a double counting, leading to recalculations in NMVOC emissions in 5A. These changes are shown in Table 6-6Table 6-.

Table 6-6: Recalculations of NMVOC emissions in 5A Solid Waste Disposal.

5A Solid Waste Disposal - NMVOC	1990	1995	2000	2005	2010	2015	2020	2022	2023
2025 submission NMVOC [kt]	0.022	0.029	0.034	0.036	0.036	0.030	0.029	0.028	0.026
2026 submission NMVOC [kt]	0.022	0.029	0.034	0.036	0.036	0.030	0.030	0.029	0.028
Change relative to 2025 submission NMVOC [kt]	0	0	-2.9E-4	0	0	0	7.8E-5	1.5E-3	1.8E-3
Change relative to 2025 submission NMVOC [%]	0%	0%	-0.85%	0%	0%	0%	0.27%	5.6%	7.1%

6.5.5 Planned Improvements

No improvements are currently planned for this subsector.

6.6 Biological Treatment of Solid Waste (NRF 5B)

6.6.1 Composting (NRF 5B1)

6.6.1.1 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.

6.6.1.2 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 have been 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.

6.6.1.3 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.

6.6.1.4 Recalculations

In previous submissions, waste from GAJA was only included in 5B2 anaerobic digestion, but now the waste amount is added to 5B1 Composting as well. This results in recalculations for NH_3 in 2022 and 2023.

Table 6-7: Recalculations of NH_3 emissions in 5B1 Composting in 2022 and 2023 as a result of including waste from GAJA in both anaerobic digestion and composting.

5B1 Composting	2022	2023
2025 submission NH_3 [kt]	2.7E-3	2.9E-3
2026 submission NH_3 [kt]	9.1E-3	1.0E-2
Change relative to 2025 submission NH_3 [kt]	6.5E-3	7.1E-3
Change relative to 2025 submission NH_3 [%]	243%	244%
2025 submission CO [kt]	6.2E-3	6.8E-3

5B1 Composting	2022	2023
2026 submission CO [kt]	2.1E-2	2.3E-2
Change relative to 2025 submission CO [kt]	1.5E-2	1.7E-2
Change relative to 2025 submission CO [%]	243%	244%

6.6.1.5 Planned Improvements

No improvements are currently planned for this subsector.

6.6.2 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.

6.6.2.1 Methodology

No methodology is used due to the lack of relevant activity data.

6.6.2.2 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.

6.6.2.3 Emission Factors

No emission factors used due to lack of activity data.

6.6.2.4 Recalculations

No recalculations were made for this submission.

6.6.2.5 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*.

6.7 Waste Incineration and Open Burning (NFR 5C)

This section discusses the emission estimates from the 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[25] 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 burning 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.

6.7.1 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.

6.7.1.1 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.

6.7.1.2 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 a

[25] A quantitative definition of waste incineration with energy recovery is found in Annex IV of regulation 1040/2016 (IS).

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.

6.7.1.3 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, are 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.

6.7.1.4 Recalculations

No recalculations were made for this submission.

6.7.1.5 Planned Improvements

No improvements are currently planned for this subsector.

6.7.2 Industrial Waste Incineration (NFR 5C1bi)

6.7.2.1 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.

6.7.2.2 Activity Data

Activity data for this category has been included for the year 2014 onward. Activity data for previous years are included in 5C1a.

6.7.2.3 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.

6.7.2.4 Recalculations

No recalculations were made for this submission.

6.7.2.5 Planned Improvements

No improvements are currently planned for this subsector.

6.7.3 Hazardous Waste Incineration (NFR 5C1bii)

6.7.3.1 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.

6.7.3.2 Activity Data

Activity data for incinerated hazardous waste is available from 2006 and is collected by the IEEA.

6.7.3.3 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.

6.7.3.4 Recalculations

No recalculations were made for this submission.

6.7.3.5 Planned Improvements

No improvements are currently planned for this subsector.

6.7.4 Clinical Waste Incineration (NFR 5C1biii)

6.7.4.1 Methodology

The Tier 2 approach of Chapter 5C1biii in the 2023 EMEP/EEA Guidebook is used for the emission estimates.

6.7.4.2 Activity Data

Activity data for incinerated clinical waste under this sector is available from 2001, when the first incineration plant opened.

6.7.4.3 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.

6.7.4.4 Recalculations

No recalculations were made for this submission.

6.7.4.5 Planned Improvements

No improvements are currently planned for this subsector.

6.7.5 Sewage Sludge Incineration (NFR 5C1biv)

6.7.5.1 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.

6.7.5.2 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.

6.7.5.3 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.

6.7.5.4 Recalculations

No recalculations were made for this submission.

6.7.5.5 Planned Improvements

No improvements are currently planned for this subsector.

6.7.6 Cremation (NFR 5C1bv)

6.7.6.1 Methodology

The total number of human remains incinerated is multiplied by a pollutant specific emission factor from the Tier 1 approach of the 2023 EMEP/EEA Guidebook, Chapter 5C1bv.

6.7.6.2 Activity Data

Cremation is performed at a single facility located in Reykjavik where human remains are incinerated along with the coffin. The activity data, total number of remains incinerated, is provided by the facility.

6.7.6.3 Emission Factors

Emission factors (Tier 1) are taken from Table 3-1, Chapter 5C1bv in the 2023 EMEP/EEA Guidebook.

6.7.6.4 Recalculations

No recalculations were made for this submission.

6.7.6.5 Planned Improvements

No improvements are currently planned for this subsector.

6.7.6.6 Other Waste Incineration (NFR 5C1bvi)

No other waste incineration is occurring in Iceland.

6.7.7 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 31st) and Epiphany/Twelfth Night (January 6th). 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.

6.7.7.1 Methodology

Tier 1 methodology from Chapter 5C2 in the 2023 EMEP/EEA Guidebook is used. See more detailed descriptions in the following sections.

6.7.7.2 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 it is estimated that 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 were burned there annually.

For the December 31st and January 6th bonfires, activity data is not easily obtained. In 2011, the EAI (predecessor of IEEA), along with the municipality of Reykjavik, 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 in 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.

6.7.7.3 Emission Factors

For the emissions 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 the 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.

6.7.7.4 Recalculations

No recalculations were made for this submission.

6.7.7.5 Planned Improvements

No improvements are currently planned for this subsector.

6.8 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 coarse pre-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.

6.8.1 Methodology

No methodology is used due to the lack of relevant activity data.

6.8.2 Activity Data

No relevant activity data.

6.8.3 Emission Factors

No emission factors used.

6.8.4 Recalculations

No recalculations were made for this submission.

6.8.5 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.

6.9 Other Waste (NFR 5E)

This section discusses the emission estimates from other waste, for which Iceland estimates emissions from accidental building and vehicle fires. 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.

6.9.1 Methodology

For accidental building 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 emission factor from Danish Informative Inventory Report (IIR) (Nielsen, et al., 2024).

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 (Nielsen, et al., 2024). 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.

6.9.2 Activity Data

Activity data for building and vehicle 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 6-8. 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 6-9, 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 to 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- shows the total scaled building fires. This scaling is similar to the scaling used in the 2024 Danish IIR (Nielsen, et al., 2024), 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.

A few fires with higher dioxin emissions are recorded separately. 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 as in 2004, 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. In 2010, 2020 and 2024 there were tire fires at vehicle service workshops. At the fire in 2024 approximately 600 cars were burned. The 2010 and 2020 fires are estimated to be ½ and ¼ of the size of the 2024 fire, respectively.

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 (Nielsen, et al., 2024). 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 6-8: 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
2023	47	103	28	18	37
2024	47	103	28	18	37

Table 6-9: 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
2023	71	155	42	27	56
2024	71	155	42	27	56

6.9.3 Emission Factors

The emission factor for non-detached 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 non-detached 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 (Nielsen, et al., 2024). 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.

6.9.4 Recalculations

Recalculations were made in the sector 5E Other Waste due to updated EFs in the 2025 Danish IIR for B(b)F and B(k)F from vehicle fires, affecting the PAH emissions from vehicle fires, shown in Table 6-10.

Additionally, two fires in car repair shops, in 2010 and 2020, were added to the large-scale fires category due to their higher dioxin emissions. The recalculations are shown in Table 6-11.

Table 6-10 Recalculation for 5E Other Waste due to EF changed between Danish IIR 2021 and Danish IIR 2025.

5E Other Waste	1990	1995	2000	2005	2010	2015	2020	2022	2023
2025 submission B(b)F [t]	2.5E-3	2.6E-3	2.3E-3	2.6E-3	2.0E-3	2.8E-3	2.3E-3	2.3E-3	3.1E-3
2026 submission B(b)F [t]	1.4E-3	1.4E-3	1.3E-3	1.5E-3	1.2E-3	1.5E-3	1.3E-3	1.4E-3	1.9E-3
Change relative to 2025 submission B(b)F [t]	-1.1E-3	-1.1E-3	-1.0E-3	-1.0E-3	-7.9E-4	-1.3E-3	-9.6E-4	-9.4E-4	-1.3E-3
Change relative to 2025 submission B(b)F [%]	-44%	-44%	-43%	-40%	-40%	-46%	-42%	-41%	-40%
2025 submission B(k)F [t]	2.3E-3	2.4E-3	2.1E-3	2.2E-3	1.7E-3	2.7E-3	2.1E-3	2.0E-3	2.7E-3
2026 submission B(k)F [t]	1.2E-3	1.2E-3	1.1E-3	1.2E-3	9.4E-4	1.4E-3	1.1E-3	1.1E-3	1.5E-3
Change relative to 2025 submission B(k)F [t]	-1.1E-3	-1.1E-3	-1.0E-3	-1.0E-3	-7.9E-4	-1.3E-3	-9.6E-4	-9.4E-4	-1.3E-3
Change relative to 2025 submission B(k)F [%]	-48%	-48%	-47%	-46%	-46%	-48%	-47%	-46%	-46%
2025 submission PAH4 [t]	7.8E-3	8.0E-3	7.2E-3	7.9E-3	6.1E-3	8.8E-3	7.1E-3	7.1E-3	9.6E-3
2026 submission PAH4 [t]	5.6E-3	5.7E-3	5.2E-3	5.8E-3	4.5E-3	6.2E-3	5.2E-3	5.2E-3	7.1E-3
Change relative to 2025 submission PAH4 [t]	-2.2E-3	-2.3E-3	-2.0E-3	-2.1E-3	-1.6E-3	-2.6E-3	-1.9E-3	-1.9E-3	-2.5E-3
Change relative to 2025 submission PAH4 [%]	-28%	-28%	-28%	-26%	-26%	-29%	-27%	-27%	-26%

Table 6-11 Recalculation for 5E Other Waste due to added car repair shop fires in 2010 and 2020.

5E Other Waste	2010	2020
2025 submission NO_x [kt]	7.0E-4	6.9E-4

5E Other Waste	2010	2020
2026 submission NO_x [kt]	6.0E-4	6.0E-4
Change relative to 2025 submission NO_x [kt]	-9.6E-5	-8.9E-5
Change relative to 2025 submission NO_x [%]	-14%	-13%
2025 submission NMVOC [kt]	3.4E-3	3.4E-3
2026 submission NMVOC [kt]	2.9E-3	2.9E-3
Change relative to 2025 submission NMVOC [kt]	-5.1E-4	-4.6E-4
Change relative to 2025 submission NMVOC [%]	-15%	-14%
2025 submission SO_x [kt]	1.0E-2	9.4E-3
2026 submission SO_x [kt]	8.0E-3	8.0E-3
Change relative to 2025 submission SO_x [kt]	-2.2E-3	-1.4E-3
Change relative to 2025 submission SO_x [%]	-21%	-15%
2025 submission $PM_{2.5}$ [kt]	4.0E-3	4.3E-3
2026 submission $PM_{2.5}$ [kt]	4.2E-3	4.3E-3
Change relative to 2025 submission $PM_{2.5}$ [kt]	2.6E-4	-4.3E-5
Change relative to 2025 submission $PM_{2.5}$ [%]	6.6%	-1.0%
2025 submission PM_{10} [kt]	4.0E-3	4.3E-3
2026 submission PM_{10} [kt]	4.2E-3	4.3E-3
Change relative to 2025 submission PM_{10} [kt]	2.6E-4	-4.3E-5
Change relative to 2025 submission PM_{10} [%]	6.6%	-1.0%
2025 submission TSP [kt]	4.0E-3	4.3E-3
2026 submission TSP [kt]	4.2E-3	4.3E-3
Change relative to 2025 submission TSP [kt]	2.6E-4	-4.3E-5
Change relative to 2025 submission TSP [%]	6.6%	-1.0%
2025 submission CO [kt]	1.2E-2	1.2E-2
2026 submission CO [kt]	1.1E-2	1.1E-2
Change relative to 2025 submission CO [kt]	-6.8E-4	-9.0E-4
Change relative to 2025 submission CO [%]	-5.9%	-7.6%
2025 submission Pb [t]	4.1E-2	4.9E-2
2026 submission Pb [t]	5.6E-2	5.8E-2
Change relative to 2025 submission Pb [t]	1.6E-2	8.4E-3
Change relative to 2025 submission Pb [%]	38%	17%
2025 submission Cd [t]	9.6E-5	1.1E-4

5E Other Waste	2010	2020
2026 submission Cd [t]	1.3E-4	1.3E-4
Change relative to 2025 submission Cd [t]	3.0E-5	1.5E-5
Change relative to 2025 submission Cd [%]	31%	13%
2025 submission Hg [t]	1.2E-5	1.2E-5
2026 submission Hg [t]	9.5E-6	9.5E-6
Change relative to 2025 submission Hg [t]	-2.7E-6	-2.5E-6
Change relative to 2025 submission Hg [%]	-22%	-21%
2025 submission As [t]	3.2E-5	3.5E-5
2026 submission As [t]	3.3E-5	3.3E-5
Change relative to 2025 submission As [t]	6.2E-7	-1.4E-6
Change relative to 2025 submission As [%]	1.9%	-4.0%
2025 submission Cr [t]	2.1E-4	2.5E-4
2026 submission Cr [t]	2.7E-4	2.8E-4
Change relative to 2025 submission Cr [t]	6.8E-5	3.5E-5
Change relative to 2025 submission Cr [%]	33%	14%
2025 submission Cu [t]	1.4E-3	1.7E-3
2026 submission Cu [t]	1.9E-3	1.9E-3
Change relative to 2025 submission Cu [t]	5.0E-4	2.7E-4
Change relative to 2025 submission Cu [%]	36%	16%
2025 submission PCDD/F [g I-TEQ]	1.1E-1	1.0E-1
2026 submission PCDD/F [g I-TEQ]	8.5E-2	8.5E-2
Change relative to 2025 submission PCDD/F [g I-TEQ]	-2.3E-2	-1.9E-2
Change relative to 2025 submission PCDD/F [%]	-21%	-18%
2025 submission B(a)P [t]	9.8E-4	1.1E-3
2026 submission B(a)P [t]	1.2E-3	1.2E-3
Change relative to 2025 submission B(a)P [t]	2.2E-4	1.0E-4
Change relative to 2025 submission B(a)P [%]	23%	9.1%
2025 submission B(b)F [t]	2.0E-3	2.3E-3
2026 submission B(b)F [t]	1.4E-3	1.4E-3
Change relative to 2025 submission B(b)F [t]	-5.8E-4	-8.7E-4
Change relative to 2025 submission B(b)F [%]	-29%	-38%
2025 submission B(k)F [t]	1.7E-3	2.1E-3

5E Other Waste	2010	2020
2026 submission B(k)F [t]	1.2E-3	1.2E-3
Change relative to 2025 submission B(k)F [t]	-5.2E-4	-8.2E-4
Change relative to 2025 submission B(k)F [%]	-30%	-40%
2025 submission I(1,2,3-cd)P [t]	1.4E-3	1.6E-3
2026 submission I(1,2,3-cd)P [t]	1.8E-3	1.8E-3
Change relative to 2025 submission I(1,2,3-cd)P [t]	3.8E-4	1.9E-4
Change relative to 2025 submission I(1,2,3-cd)P [%]	27%	12%
2025 submission 4PAH [t]	6.1E-3	7.1E-3
2026 submission 4PAH [t]	5.6E-3	5.7E-3
Change relative to 2025 submission 4PAH [t]	-4.9E-4	-1.4E-3
Change relative to 2025 submission 4PAH [%]	-8.0%	-20%

6.9.5 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)

Volcanic emissions are frequent in Iceland and 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 natural, 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
2024	Sundhnúksgígar	1650	N/A	N/A	See Section 7.1.8

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

The Eyjafjallajökull eruption lasted from 14 April until 23 May 2010. For this eruption, emissions of sulphur dioxide (SO_2) and particulate matter (PM_{10}, $PM_{2.5}$) were estimated and reported. The emissions estimates are based on satellite observations on a daily basis during the eruption[26] 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.

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.

[26] https://wiki.met.no/emep/emep_volcano_plume

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 and is associated with 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 in 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 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 Mt. 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. However, Fagradalsfjall is the least active volcanic system of the peninsula. 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 Icelandic Meteorological Office 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, 2023, in Meradalir valley on the Reykjanes Peninsula 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 Icelandic Meteorological Office 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 the mountain Litli-Hrútur, located between mountains Keilir and Fagradalsfjall on the Reykjanes Peninsula. 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 Icelandic Meteorological Office estimate 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 north of the town Grindavík and the geothermal area Svartsengi on the Reykjanes Peninsula. 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 Icelandic Meteorological Office estimate 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.

7.1.8 Sundhnúksgígar Eruptions 2024

In 2024, several short-lived fissure eruptions occurred at Sundhnúksgígar craters, continuing the activity that began in December 2023. The first occurred in mid-January, when fissures opened near the mountain Hagafell and close to Grindavík, destroying several houses and causing temporary power and hot-water outages[27]. Further eruptions followed in February and March, with lava flows repeatedly advancing toward roads and infrastructure. Renewed activity took place in late May, August, and November 2024 along the same crater row, each preceded by earthquake swarms. These eruptions prompted repeated evacuations and closures in the Grindavík area. All activity had ceased by December 2024, but the eruptions highlighted the persistence of the ongoing volcanic episode in the region.

The Icelandic Meteorological Office estimates that a total of 1650 kt of SO_2 were emitted during the eruption, with an uncertainty of 24% (400 kt). This estimate is based on the volume of lava-flow, SO_2 content in lava samples, Scanning-DOAS and Traverse-DOAS measurements, and TROPOMI satellite observations. Data were provided by the Icelandic Meteorological Office, the University of Iceland and the University of Manchester.

[27] https://www.visir.is/g/20242514675d/eldgos-er-hafid

8 Spatially Distributed Emissions on a Grid – last updated for 2025 submission

8.1 Scope

Emissions of air pollutants are mapped to a grid on a quadrennial basis. This chapter reports gridded emissions for 2023 and explains the methodology and the data sources used. Gridded emissions are mapped to the EMEP grid with a resolution of 0.1°x 0.1° for the following components: NO_x, NMVOC, SO_x, NH_3, $PM_{2.5}$, PM_{10}, BC, CO, Pb, Cd, Hg, PCDD/PCDF (dioxins/furans), PAHs, HCB, and PCBs. Previously (2021) gridded emissions were reported for 2015 and 2019, but not as comprehensive.

The gridded emissions were aggregated into the following GNFR sectors:

- A_PublicPower
- B_Industry
- C_OtherStationaryComb
- D_Fugitive
- E_Solvents
- F_RoadTransport
- G_Shipping
- H_Aviation
- I_Offroad
- J_Waste
- K_AgriLivestock
- L_AgriOther
- N_Natural

There were no emissions in sectors M_Other and z_Memo. With increasing data availability, the aim is to include emissions from O_AviCruise and P_IntShipping the next time gridded data is submitted in 2029.

8.2 Methodology

The methodology follows the approach described in the EMEP/EEA Air Pollutant Emission Inventory Guidebook 2023. 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
  - For land-based emissions: Iceland (IS) grid, (2,273 grid cells.
  - For sea-based emissions: Remaining North-East Atlantic Ocean (ATL) grid truncated to the outline of the Icelandic Exclusive Economic Zone (*efnahagslögsaga*), 14.268 additional grid cells.
- 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, most of which were found through the Icelandic Metadata Portal (*Lýsigagnagátt*). Data was accessed mainly by using the WFS (web feature service) of public geoservers. General data was gathered from the LMÍ (*Landmælingar Íslands*) geoserver. Locations of point sources were gathered from work permits on the UOS website. Information on roads was gathered from The Icelandic Road and Coastal Administration (IRCA, *Vegagerðin*) geoserver. Agricultural data was gathered from the Icelandic Food and Veterinary Authority (*Matvælastofnun*, MAST) geoserver. Flight statistics for international and domestic flights were collected from Isavia, the operator of all airports and manager of air traffic in Iceland. Heat maps were used to assess distribution of shipping (CAMS-GLOB-SHIP) and fishing emissions (Global Fishing Watch). 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	Two main areas in Iceland where electricity is still produced by fossil fuels, 80% assigned to Grímsey and 20% to Grímsstaðir.
B_Industry	1A2a	Stationary Combustion in Manufacturing Industries and Construction: Iron and Steel	Fuel consumption of Ferroalloy producers known, NEA – NID/IIR and work permits.
B_Industry	1A2b	Stationary Combustion in Manufacturing Industries and Construction: Non-ferrous Metals	Fuel consumption of Aluminium producers known, NEA – NID/IIR and work permits.
B_Industry	1A2e	Stationary Combustion in Manufacturing Industries and Construction: Food Processing, Beverages, and Tobacco	These emissions stem from the fishmeal factories; work permits. Are used to distribute emissions based on how much the factories can produce.
B_Industry	1A2f	Stationary Combustion in Manufacturing Industries and Construction: Non-metallic Minerals	Fuel consumption of mineral wool producers known, NEA – NID/IIR and work permits.

GNFR Code	NFR Code	Long Name	Source and Proxy Spatial Dataset Used
I_Offroad	1A2gvii	Mobile Combustion in Manufacturing Industries and Construction	Population density used as proxy for the spatial dataset.
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, so it was decided to use the CORINE landcover map and divided the emissions on industrial areas.
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.
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.
F_Road-Transport	1A3bi	Road Transport: Passenger Cars	Annual average daily traffic and road length data from the IRCA geoserver. No distinction made between different vehicles.
F_Road-Transport	1A3bii	Road transport: Light-duty Vehicles	Annual average daily traffic and road length data from the IRCA geoserver. No distinction made between different vehicles.
F_Road-Transport	1A3biii	Road Transport: Heavy-duty Vehicles and Buses	Annual average daily traffic and road length data from the IRCA geoserver. No distinction made between different vehicles.
F_Road-Transport	1A3biv	Road transport: Mopeds and Motorcycles	Annual average daily traffic and road length data from the IRCA geoserver. No distinction made between different vehicles.
G_Shipping	1A3dii	National Navigation (Shipping)	The global Copernicus shipping heat map (CAMS-GLOB-SHIP) was used to distribute domestic shipping emissions. The heat map was truncated to the outline of Icelandic territorial waters (*landhelgi*, 12 nm) to demarcate domestic shipping and exclude international shipping.
I_Offroad	1A3eii	Other	Energy expert assign this to harbour machinery and airport machinery and the emissions where split 50/50.
C_Other-StationaryComb	1A4ai	Commercial/Institutional: Stationary	This category comprises of swimming pools heated by fossil fuels; according to the Energy experts, 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 for the spatial dataset.
C_Other-StationaryComb	1A4ci	Agriculture/Forestry/Fishing: Stationary	Emissions were distributed using a dataset From MAST with all animal farms.
I_Offroad	1A4cii	Agriculture/Forestry/Fishing: Off-road Vehicles and Other Machinery	Emissions were distributed using the CORINE landcover map and distributing the emissions on all agricultural soils.
I_Offroad	1A4ciii	Agriculture/Forestry/Fishing: National Fishing	The Global Fishing Watch heat map was used to distribute national fishing emissions. The heat map was truncated to the outline of the Icelandic exclusive economic area (*efnahagslögsaga*, 200 nm) to demarcate

GNFR Code	NFR Code	Long Name	Source and Proxy Spatial Dataset Used
			national fishing and exclude international fishing.
C_Other-StationaryComb	1A5a	Other Stationary (including Military)	Population density used as proxy for the spatial dataset.
D_Fugitive	1B2av	Distribution of oil products	Based on expert judgement the emissions were divided onto airports (35%), roads (35%) and ports (30%).
D_Fugitive	1B2d	Other fugitive emissions from energy production	Emissions reported by geothermal power plants.
B_Industry	2A5a	Quarrying and mining of minerals other than coal	Emissions distributed using a map of mines from IRCA (*Vegagerðin*).
B_Industry	2A5b	Construction and demolition	Population density used as proxy for the spatial dataset.
B_Industry	2A6	Other Mineral Products (please specify in the IIR)	Fuel consumption from the mineral wool producers are known, NEA – NID/IIR
B_Industry	2C2	Ferroalloys Production	Fuel consumption from the ferroalloys producers are known, NEA – NID/IIR
B_Industry	2C3	Aluminium Production	Fuel consumption from the aluminium producers are known, NEA – NID/IIR
B_Industry	2C7c	Other metal production	Fuel consumption from other metal producers are known, NEA – NID/IIR
E_Solvents	2D3a	Domestic solvent use including fungicides	Population density used as proxy for the spatial dataset.
B_Industry	2D3b	Road Paving with Asphalt	The asphalt production is known, and the emissions distributed accordingly. – NID/IIR
E_Solvents	2D3d	Coating applications	Population density used as proxy for the spatial dataset.
E_Solvents	2D3e	Degreasing	Population density used as proxy for the spatial dataset.
E_Solvents	2D3f	Dry cleaning	Population density used as proxy for the spatial dataset.
E_Solvents	2D3g	Chemical products	Population density used as proxy for the spatial dataset.
E_Solvents	2D3h	Printing	Population density used as proxy for the spatial dataset.
E_Solvents	2D3i	Other solvent use	De-icing fluid for aircrafts. Emissions are distributed on to airport based on number of flights.
E_Solvents	2G	Other product use (firework and tobacco)	Population density used as proxy for the spatial dataset.
B_Industry	2H2	Food and beverages industry	Meat, fish, poultry and animal feed emissions are distributed using maps from Mast, emissions from breweries are distributed with point data and emissions from coffee,

GNFR Code	NFR Code	Long Name	Source and Proxy Spatial Dataset Used
			bread, cakes and biscuits uses population data as a proxy.
K_AgriLivestock	3B1a	Manure management - Dairy cattle	Emissions were distributed using a dataset from MAST with cattle farms and the number of cattle on each farm.
K_AgriLivestock	3B1b	Manure management - Non-dairy cattle	Emissions were distributed using a dataset from MAST with cattle farms and the number of cattle on each farm.
K_AgriLivestock	3B2	Manure management - Sheep	Emissions were distributed using a dataset from MAST with sheep farms and the number of sheep on each farm.
K_AgriLivestock	3B3	Manure management - Swine	Emissions were distributed using a dataset from MAST with swine animal farms and the number of pigs on each farm.
K_AgriLivestock	3B4d	Manure management - Goats	Emissions were distributed using a dataset from MAST with goat farms and the number of goats on each farm.
K_AgriLivestock	3B4e	Manure management - Horses	Emissions were distributed using a dataset from MAST with horse farms and the number of horses on each farm.
K_AgriLivestock	3B4g	Manure management - Poultry	Emissions were distributed using a dataset From MAST with poultry farms and the number of fowls on each farm.
K_AgriLivestock	3B4h	Manure management - Other animals	Emissions were distributed using a dataset From MAST with fur animal farms and the number of animals on each farm.
L_AgriOther	3Da1	Inorganic N-fertilizers	Emissions were distributed using the CORINE landcover map and distributing the emissions on all agricultural soils.
L_AgriOther	3Da2a	Animal manure applied to soils	Emissions were distributed using the CORINE landcover map and distributing the emissions on all agricultural soils.
L_AgriOther	3Da2b	Sewage sludge applied to soils	Emissions were distributed using the CORINE landcover map and distributing the emissions on all agricultural soils.
L_AgriOther	3Da2c	Other organic fertilisers applied to soils	Emissions were distributed using the CORINE landcover map and distributing the emissions on all agricultural soils.
L_AgriOther	3Da3	Urine and dung deposited by grazing animals	Emissions were distributed using the CORINE landcover map and distributing the emissions on all agricultural soils.
L_AgriOther	3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products	Emissions were distributed using the CORINE landcover map and distributing the emissions on all agricultural soils.
L_AgriOther	3De	Cultivated crops	Emissions were distributed using the CORINE landcover map and distributing the emissions on all agricultural soils.
J_Waste	5A	Solid Waste Disposal on Land	The location of landfilling sites is found using work permits at UOS. The emissions are split up using the amount of waste that each site is allowed to deposit.
J_Waste	5B	Biological treatment of waste	Emissions from biological treatment of waste occurs at two facilities.

GNFR Code	NFR Code	Long Name	Source and Proxy Spatial Dataset Used
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 for the spatial dataset.

8.3 Emissions 2023

The following figures show the national total emissions of NO_x, NMVOC, SO_x, NH_3, $PM_{2.5}$, PM_{10}, BC, CO, Pb, Cd, Hg, PCDD/PCDF (dioxins/furans), PAHs, HCB, and PCB for the year 2023.

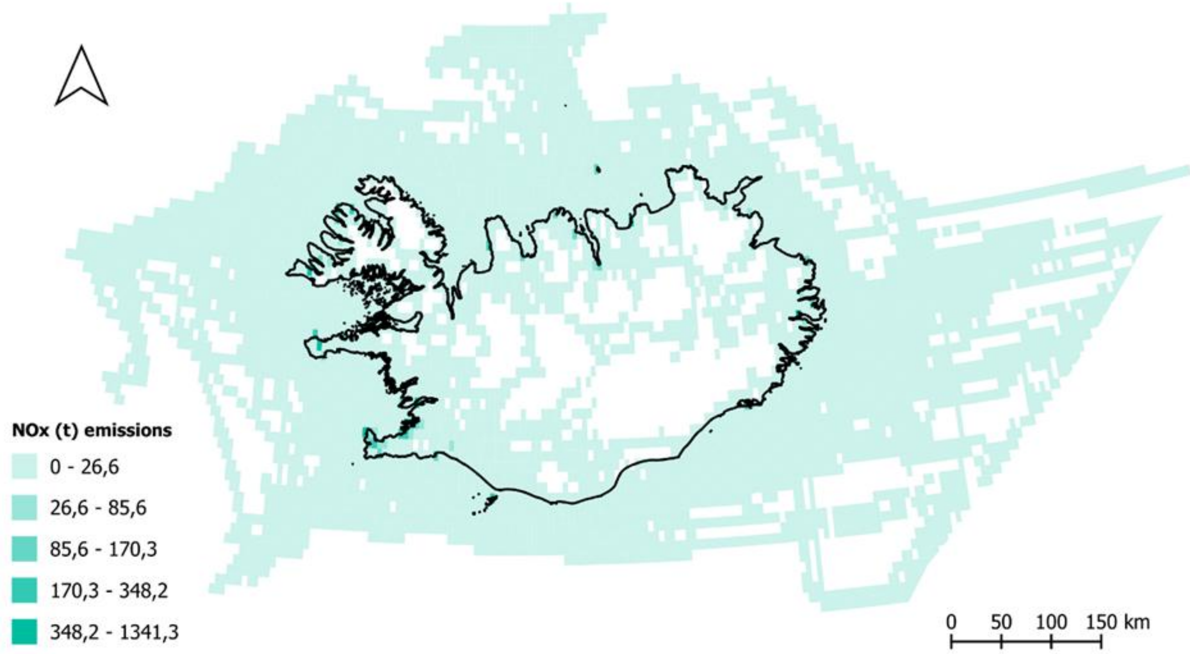

Figure 8.1 Emissions of NO_x [t] in 2023.

Figure 8.2 Emissions of NMVOC [t] in 2023.

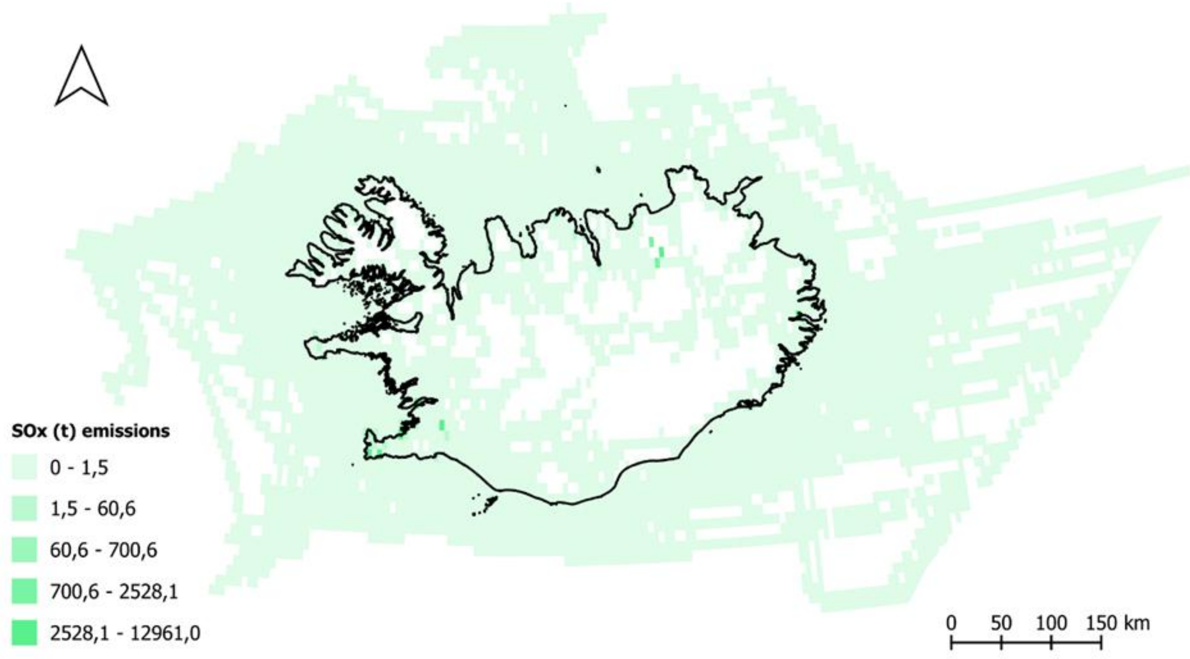

Figure 8.3 Emissions of SO_x [t] jn 2023.

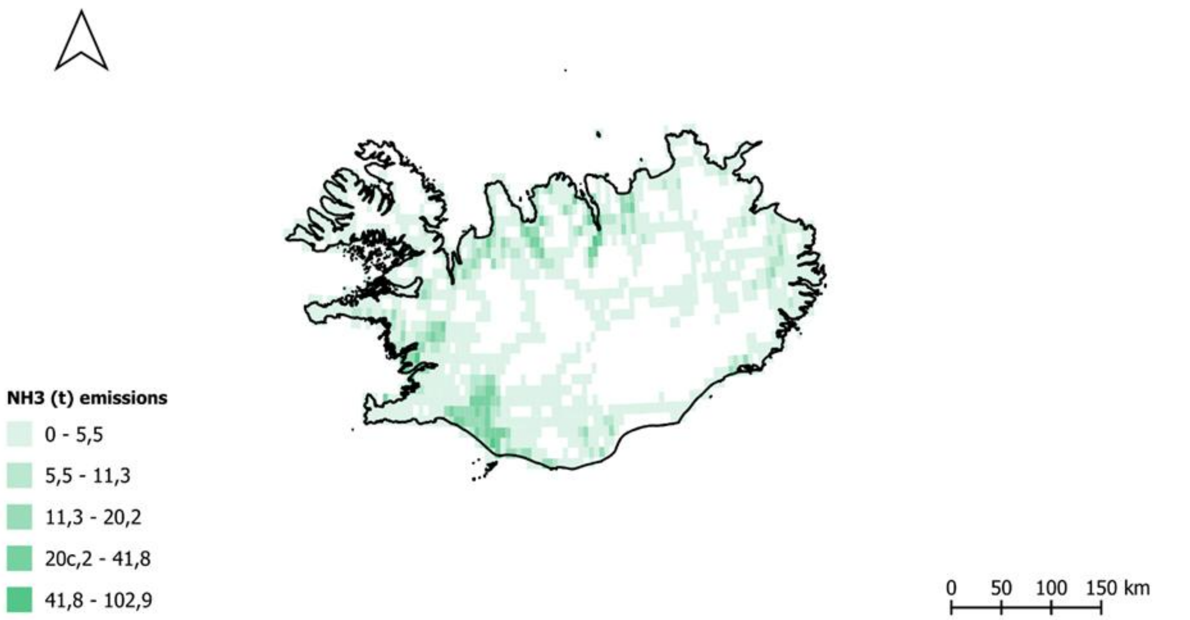

Figure 8.4 Emissions of NH_3 [t] in 2023.

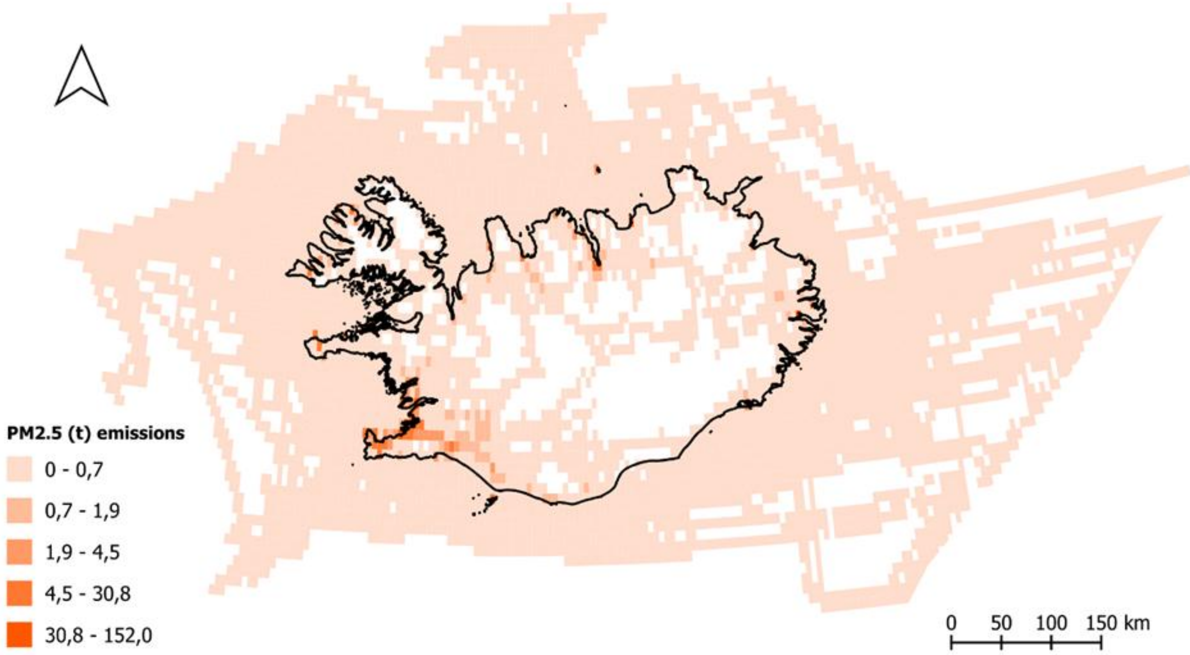

Figure 8.5 Emissions of $PM_{2.5}$ [t] in 2023.

Figure 8.6 Emissions of PM_{10} [t] in 2023.

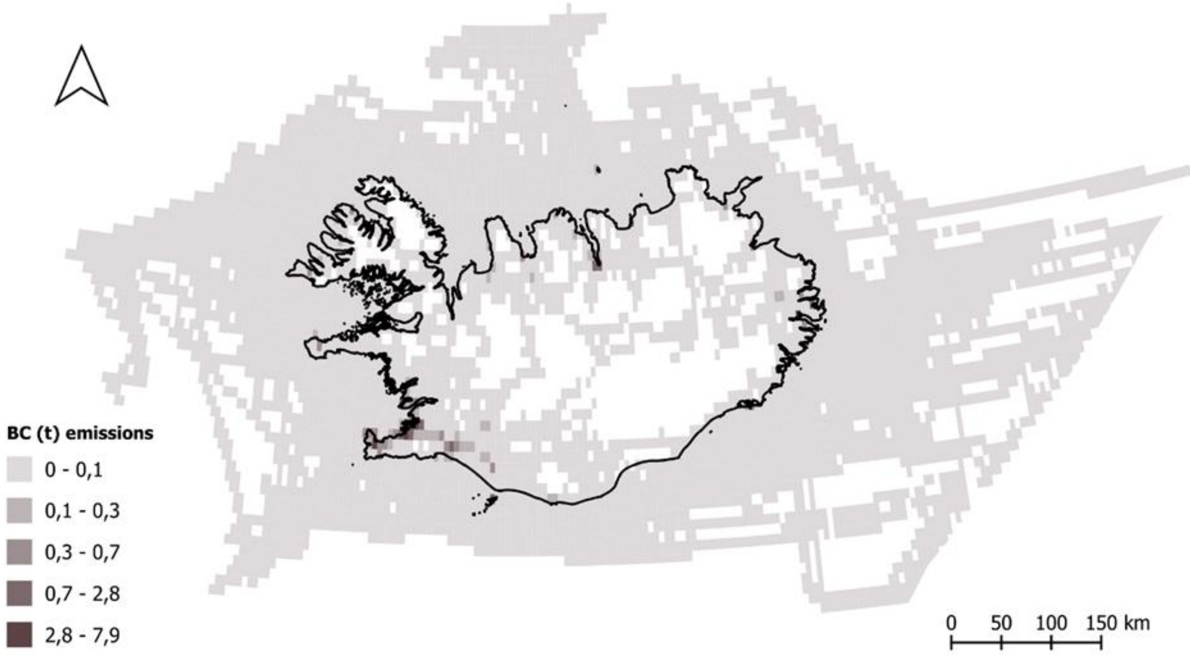

Figure 8.7 Emissions of BC [t] in 2023.

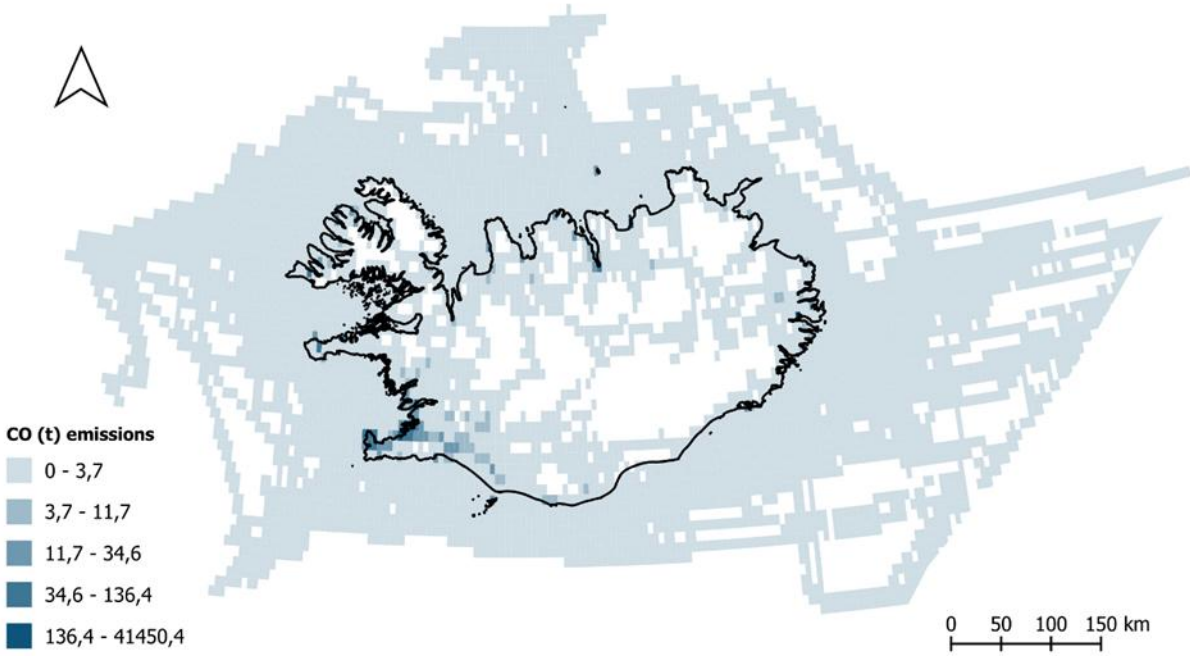

Figure 8.8 Emissions of CO [t] in 2023.

Figure 8.9 Emissions of Pb [kg] in 2023.

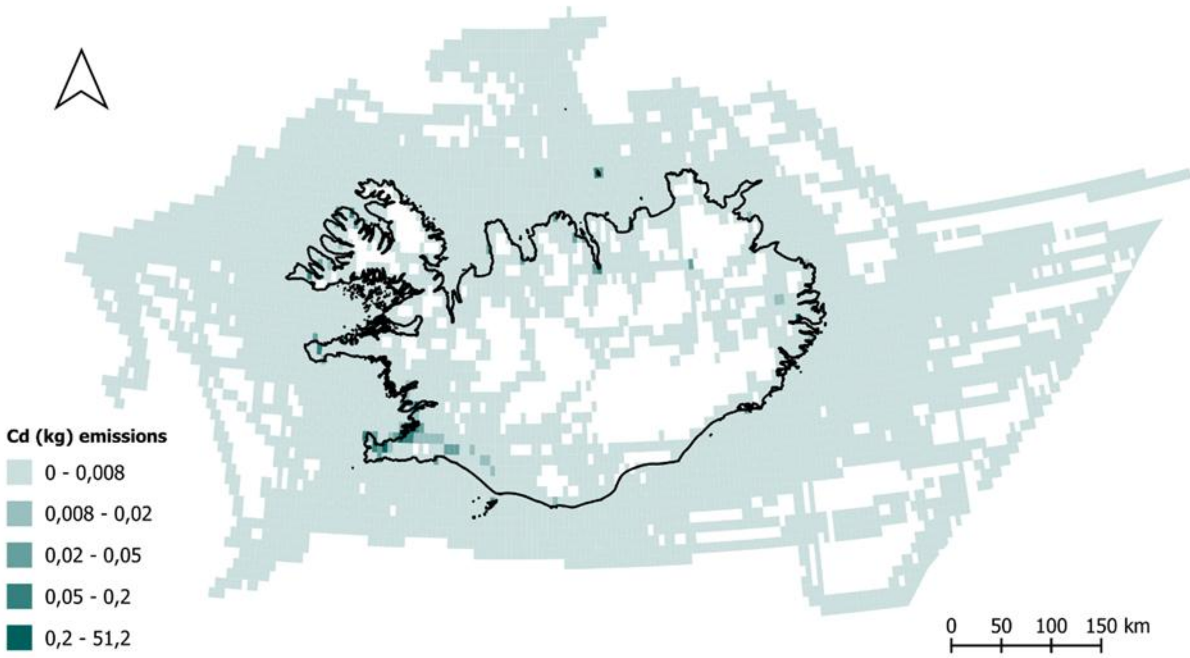

Figure 8.10 Emissions of Cd [kg] in 2023.

Figure 8.11 Emissions of Hg [kg] in 2023.

Figure 8.12 Emissions of dioxin/furans [g I-TEQ] in 2023.

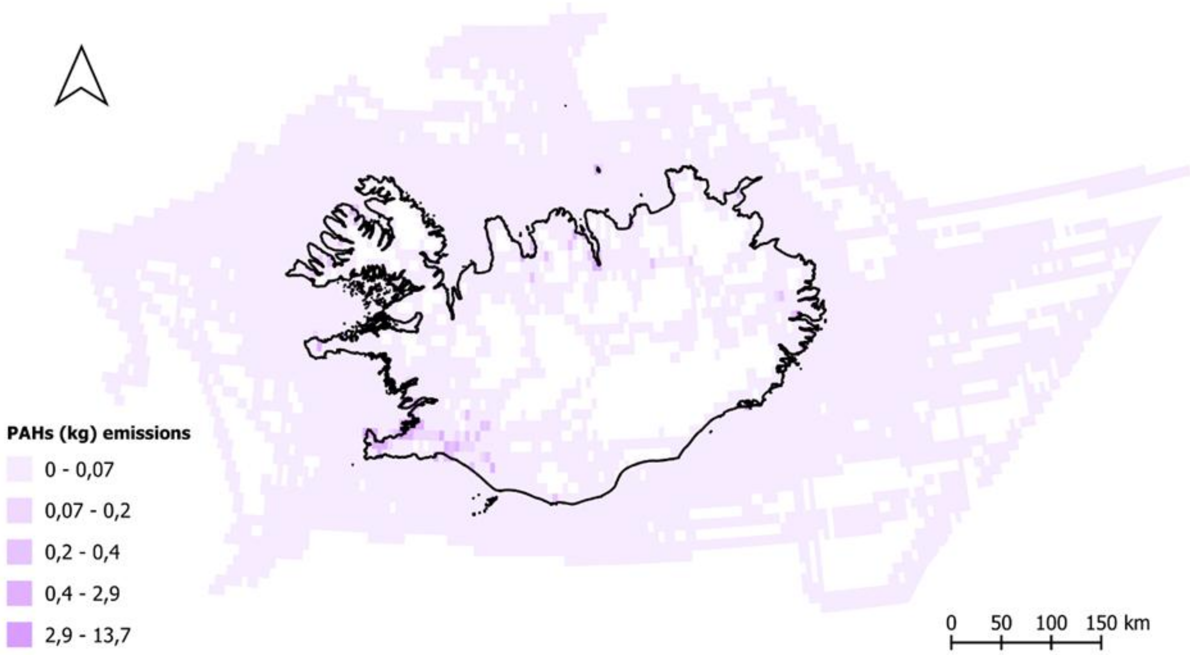

Figure 8.13 Emissions of PAHs [kg] in 2023.

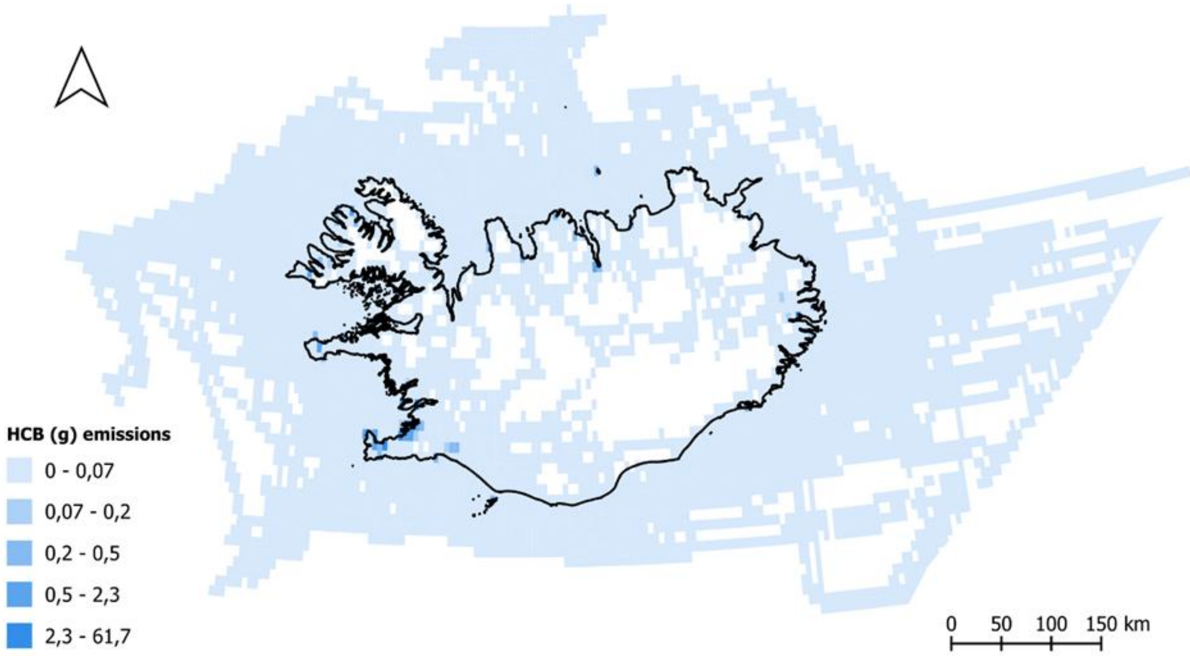

Figure 8.14 Emissions of HCB [g] in 2023.

Figure 8.15 Emissions of PCBs [g] in 2023.

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. The projections are based on historical trends, and, where applicable, on the current implementation strategy of Iceland's climate action plan (see also chapter 1.1.4 of Iceland's National Inventory Document 2026). Additional measures to reduce emissions are not included in the projections. 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 2024 and projected emissions for 2030, 2040, 2050 and 2055.

Pollutant	Unit	1990	2005	2024	2030	2040	2050	2055	Change '24-'50	Change '05-'50
NO_x	[kt NO_2]	25	22	15	12	12	9.6	8.6	-41%	-61%
NMVOC	[kt]	8.4	6.3	6.0	8.1	11.8	14.4	15.7	+161.7%	+147%
SO_x	[kt SO_2]	23	40	54	34	34	34	34	-37%	-15%
NH_3	[kt]	5.3	5.0	5.1	5.0	4.8	4.6	4.5	-11%	-9%
$PM_{2.5}$	[kt]	1.3	1.4	1.1	1.1	1.2	1.2	1.2	+10%	-12%
PM_{10}	[kt]	3.0	2.9	2.3	2.4	2.6	2.7	2.7	+18%	-7.3%
TSP	[kt]	6.5	5.7	4.2	4.8	5.1	5.2	5.3	+25%	-8%
BC	[t]	213	207	94	79	82	83	83	-11%	-60%
CO	[kt]	54	48	106	109	109	108	108	+2.21%	+125%
Dioxin	[g I-TEQ]	11	1.02	0.74	1.34	2.05	2.04	2.04	+176.6%	+100%
PAH4	[t]	0.59	0.12	0.093	0.090	0.080	0.073	0.072	-22%	-41%
HCB	[kg]	0.27	0.72	0.12	0.286	0.478	0.487	0.491	+296%	-32%
PCB	[kg]	0.30	0.11	0.018	0.045	0.077	0.076	0.075	+319%	-31%
Pb	[t]	2.99	2.1	0.86	0.88	0.68	0.53	0.53	-38%	-75%
Cd	[kg]	22	69	135	140	142	142	142	+5.1%	+104%
Hg	[kg]	140	32	11	13	16.8	16.1	15.9	+49%	-50%
As	[kg]	71	95	145	151	151	149	148	+2.08%	+56%
Cr	[kg]	132	194	261	236	184	159	159	-39%	-18.0%
Cu	[t]	1.9	3.1	3.9	3.3	2.2	1.7	1.7	-56%	-45%
Ni	[t]	1.7	1.9	1.9	1.9	1.9	1.9	1.9	+0.1%	+1.64%
Se	[kg]	35	31	21	19	18	15	13	-41%	-59%
Zn	[t]	2.3	3.0	6.1	6.2	6.3	6.3	6.3	+4.1%	+111%

9.1 Projected Trends by Pollutant

9.1.1 Nitrogen Oxides (NO_x)

The projected decrease in emissions in the next decade is due to a decrease in fuel use. Figure 9.1 shows historical NO_x emissions from 2005 and projected emissions to 2055.

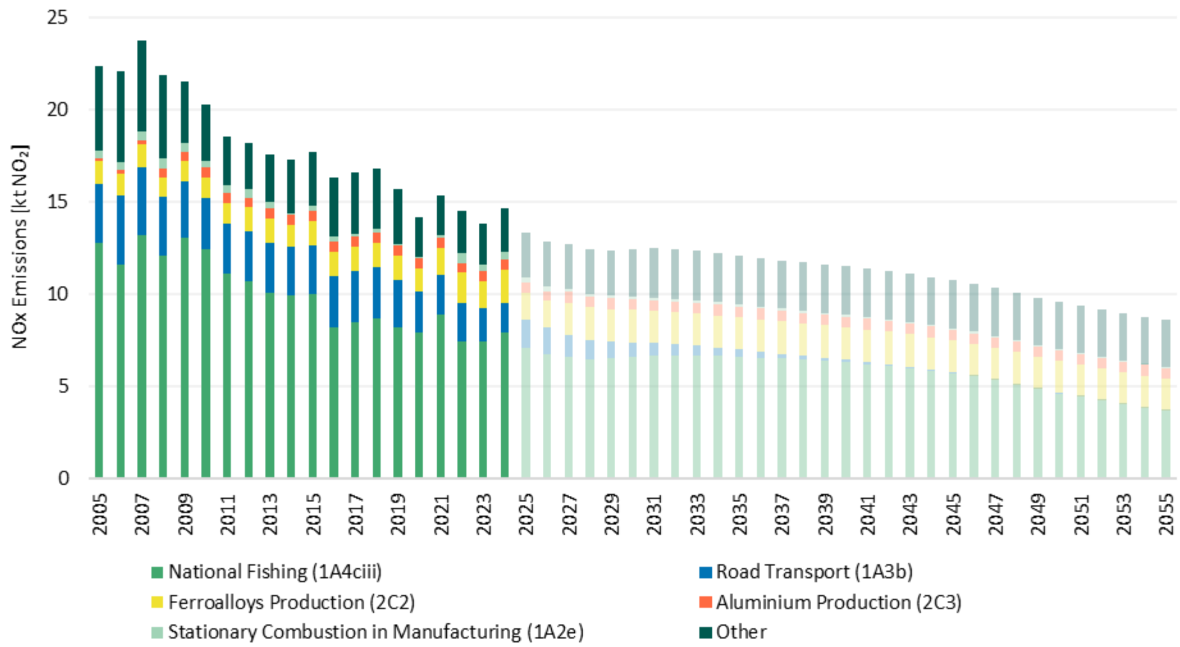

Figure 9.1 NO_x emissions by main sources. Historical data and projections, 2005-2055.

9.1.2 Non-methane Volatile Organic Compounds (NMVOCs)

The decrease 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. One reason for the projected reduction in waste emissions is a ban on landfilling organic waste in the year 2023. Increased projected emissions from 2D Solvent and Product Use reflect the historical emission trends on which they are based, starting from 2010. Figure 9.2 shows the historical NMVOC emissions from 2005 and projected emissions to 2055.[28]

[28] 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.

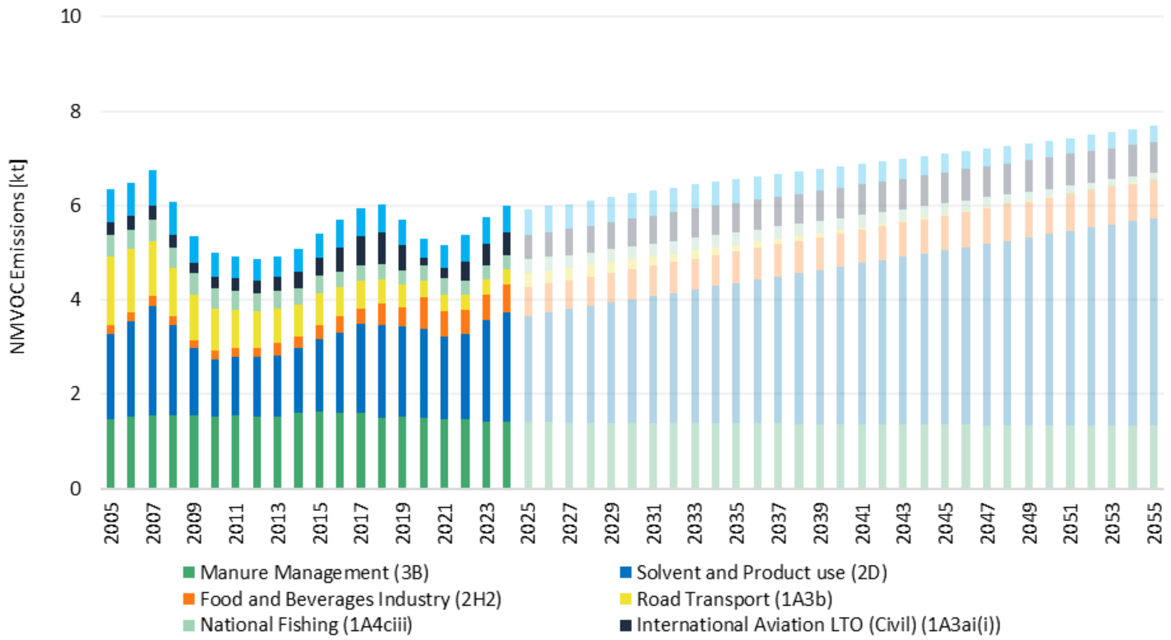

Figure 9.2 NMVOC emissions by main sources. Historical data and projections, 2005-2055.

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 1B2d Other Fugitive Emissions from Energy Production) 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 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 and projected emissions to 2055.

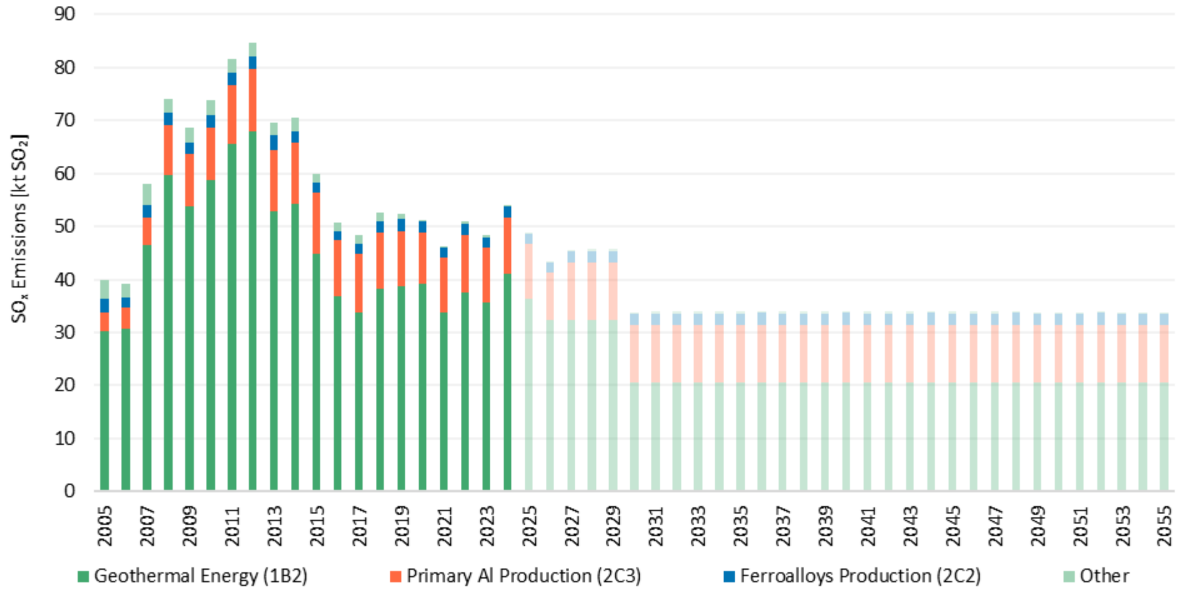

Figure 9.3 SO_x emissions by main sources. Historical data and projections, 2005-2055.

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 and projected emissions to 2055.

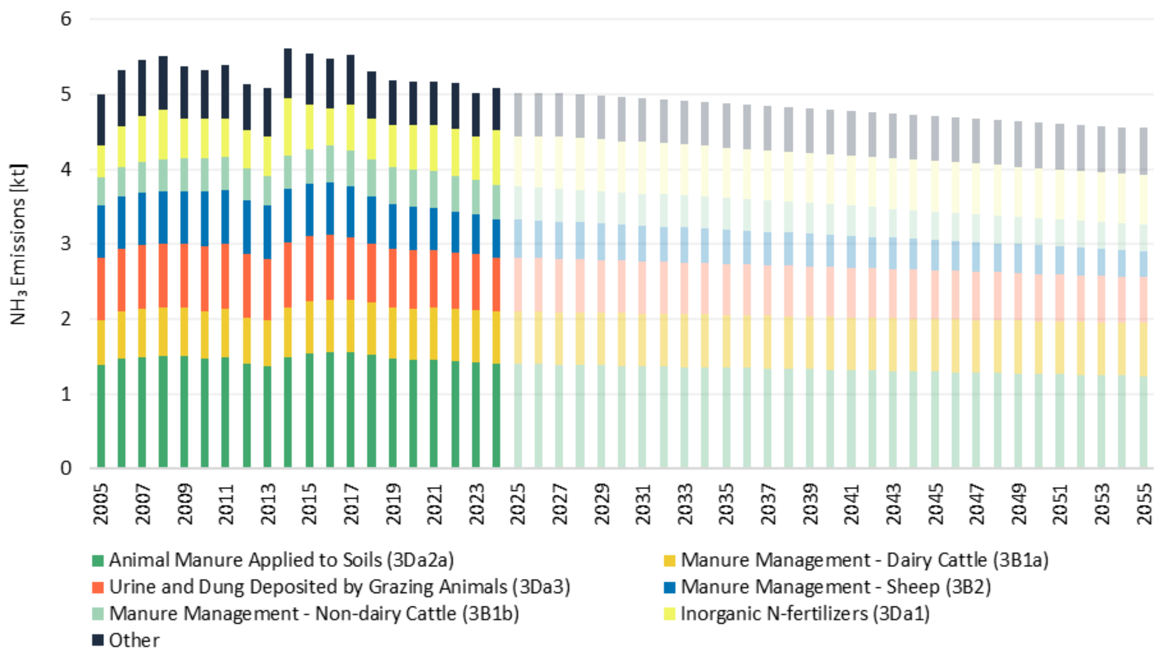

Figure 9.4 NH_3 emissions by main sources. Historical data and projections, 2005-2055.

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 and projected emissions to 2055. PM emissions from sector 2C are projected to decline between 2025 and 2026, primarily due to a temporary decreased production at one of the aluminium plants.

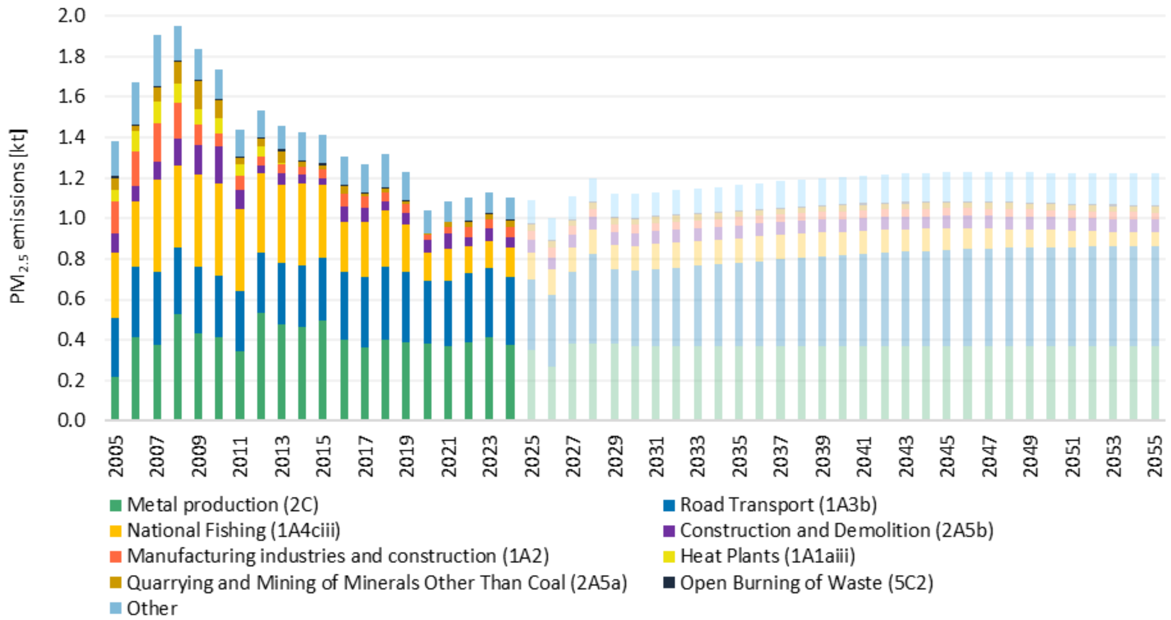

Figure 9.5 $PM_{2.5}$ emissions by main sources. Historical data and projections, 2005-2055.

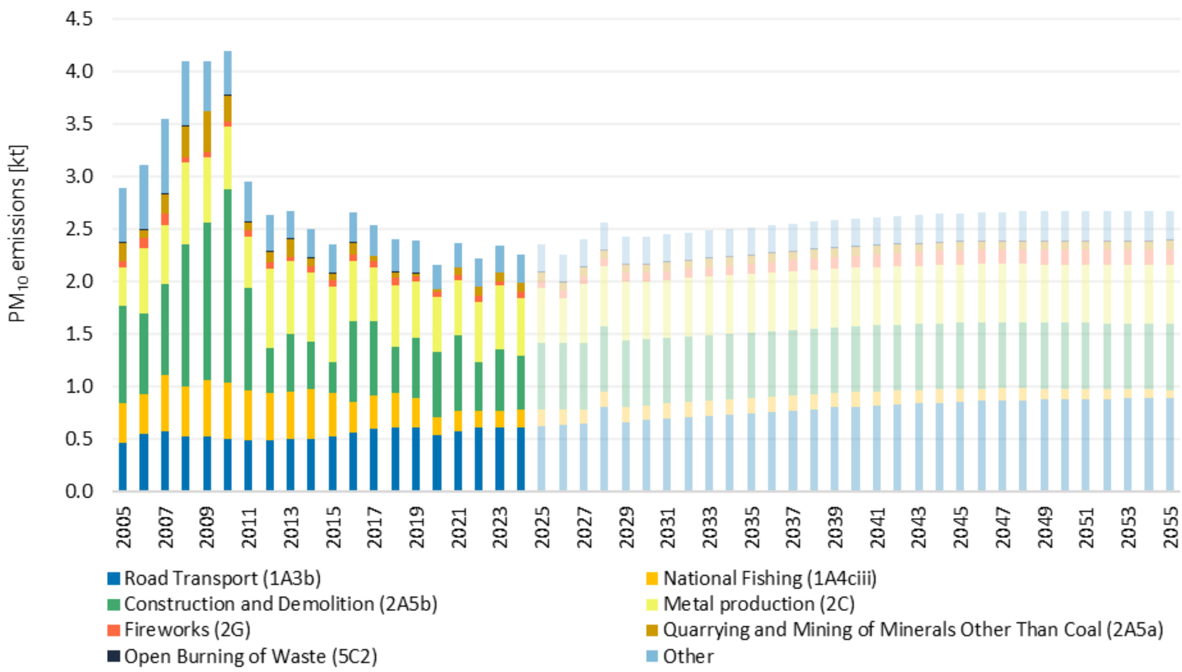

Figure 9.6 PM_{10} emissions by main sources. Historical data and projections, 2005-2055.

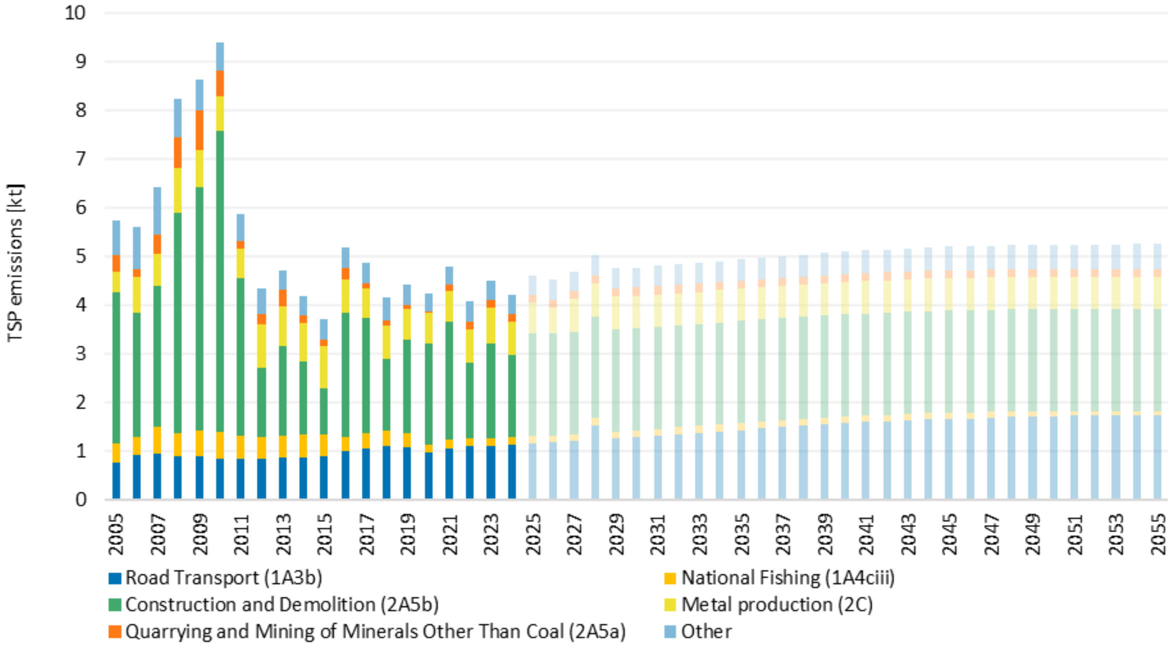

Figure 9.7 TSP emissions by main sources. Historical data and projections, 2005-2055.

9.1.6 Black Carbon (BC)

Black carbon emissions have decreased in the last years and are projected to decrease further. The main reason for the expected decrease is that emission control systems in vehicle engines have improved. Figure 9.8 shows the historical BC emissions from 2005 and projected emissions to 2055.

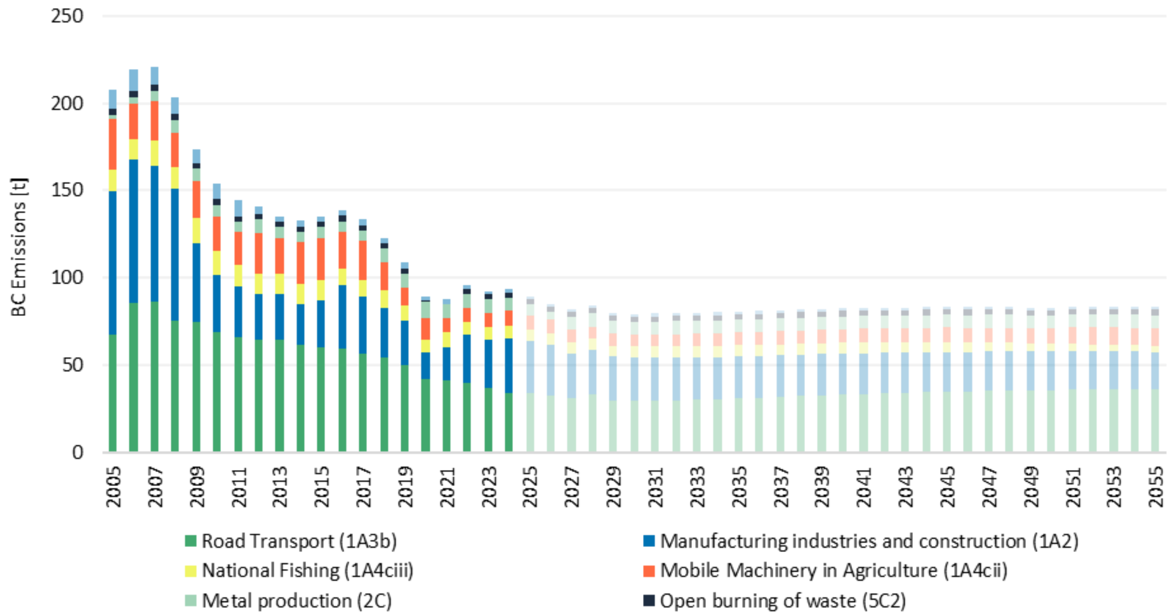

Figure 9.8 BC emissions by main sources. Historical data and projections, 2005-2055.

9.1.7 Carbon Monoxide (CO)

Carbon Monoxide emissions are dominated by 2C3 Aluminium Production and are expected to remain relatively stable. Figure 9.9 shows the historical CO emissions from 2005 and projected emissions to 2055. CO emissions from sector 2C3 are projected to decline significantly between 2025 and 2026 due to a temporary decreased production at one of the aluminium plants.

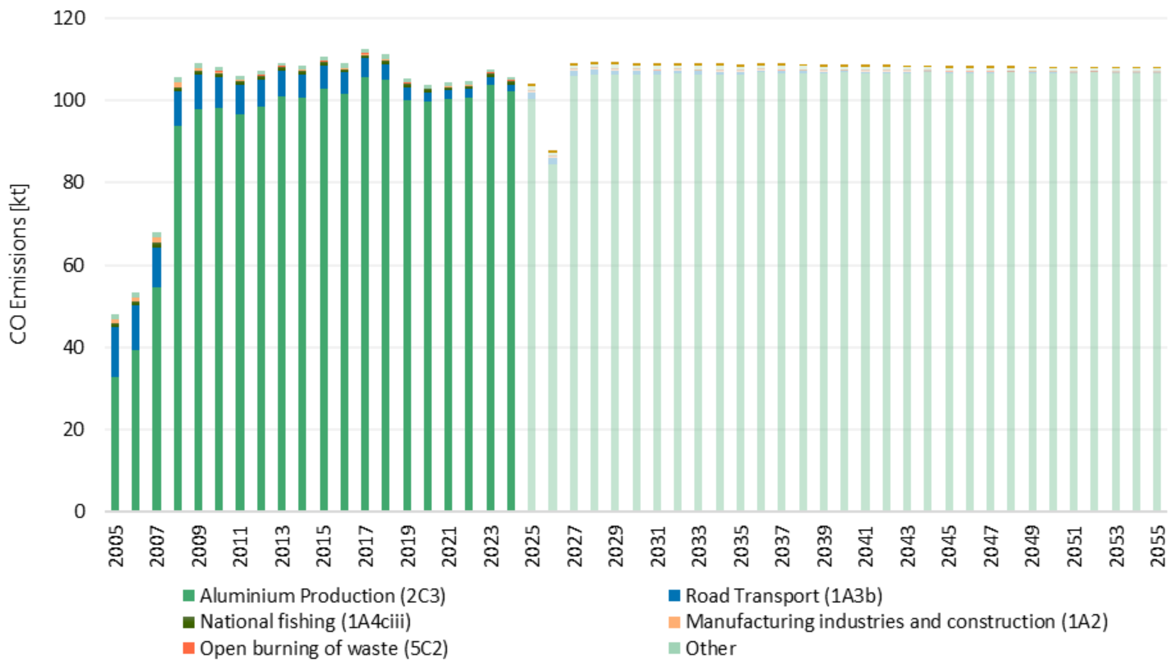

Figure 9.9 CO emissions by main sources. Historical data and projections, 2005-2055.

9.1.8 Dioxin

Dioxin emissions are projected to remain relatively stable from the present to 2050. Figure 9.10 shows the historical dioxin emissions from 2005 and projected emissions to 2055. Dioxin emissions from sector 2C are projected to decline significantly between 2025 and 2026, primarily due to a temporary operational shutdown at one of the aluminium plants.

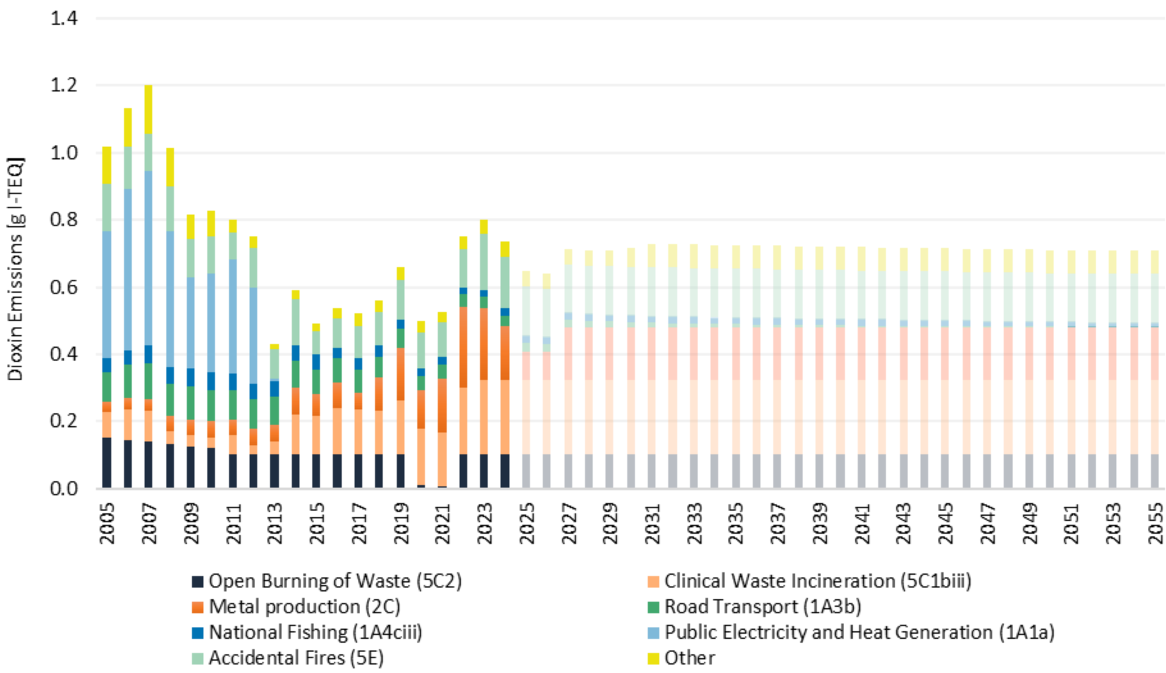

Figure 9.10 Dioxin emissions by main sources. Historical data and projections, 2005-2055.

9.1.9 Polycyclic Aromatic Hydrocarbons (PAHs)

PAH emissions are expected to trend slightly downwards until 2055, highlighted by projected reductions in 1A3b Road Transport. Figure 9.11 shows the historical PAH emissions from 2005 and projected emissions to 2055. PAH emissions from sector 2C3 are projected to decline slightly between 2025 and 2026 due to a temporary decreased production at one of the aluminium plants.

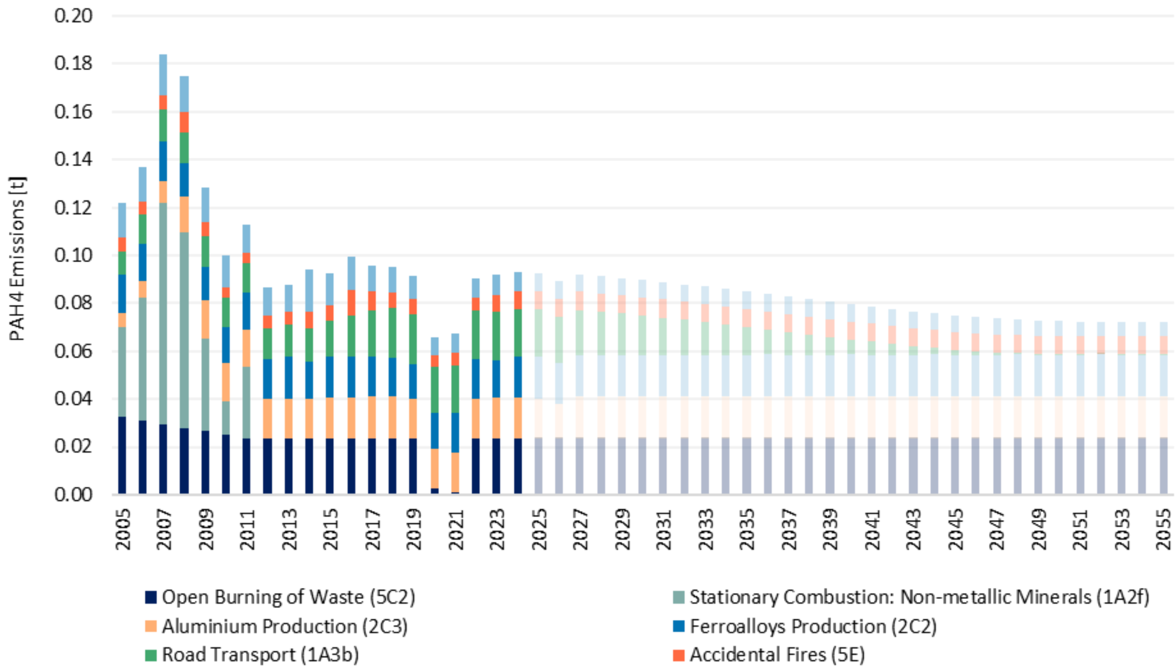

Figure 9.11 PAH4 emissions by main sources. Historical data and projections, 2005-2055.

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 and projected emissions to 2055.

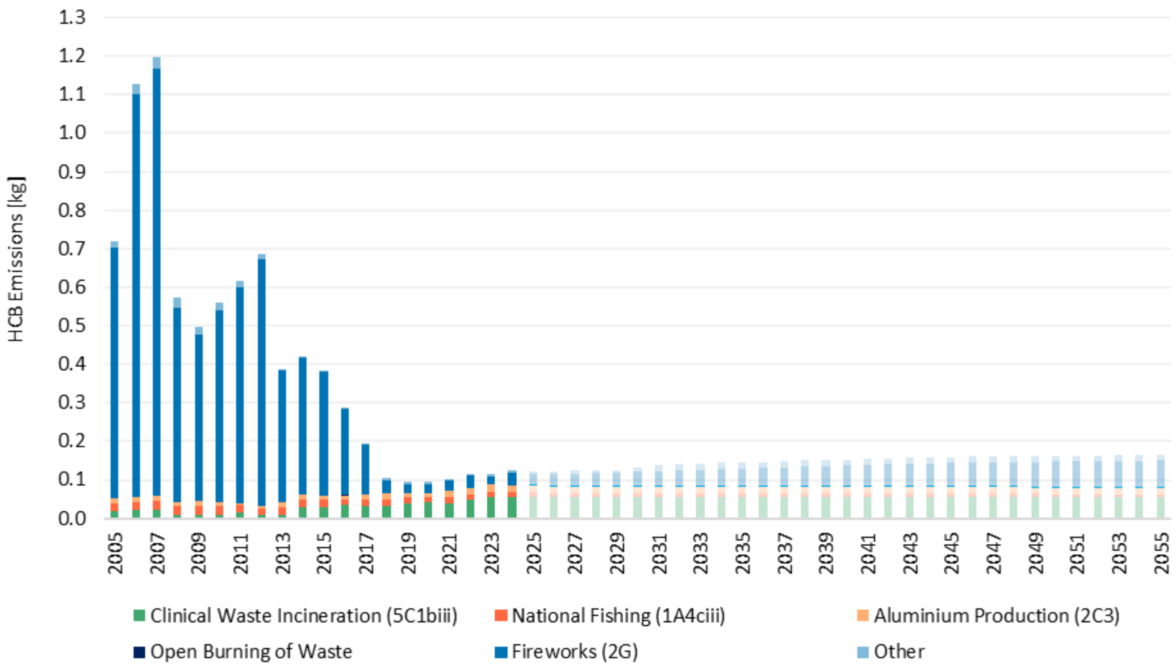

Figure 9.12 HCB emissions by main sources. Historical data and projections, 2005-2055.

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 and projected emissions to 2055.

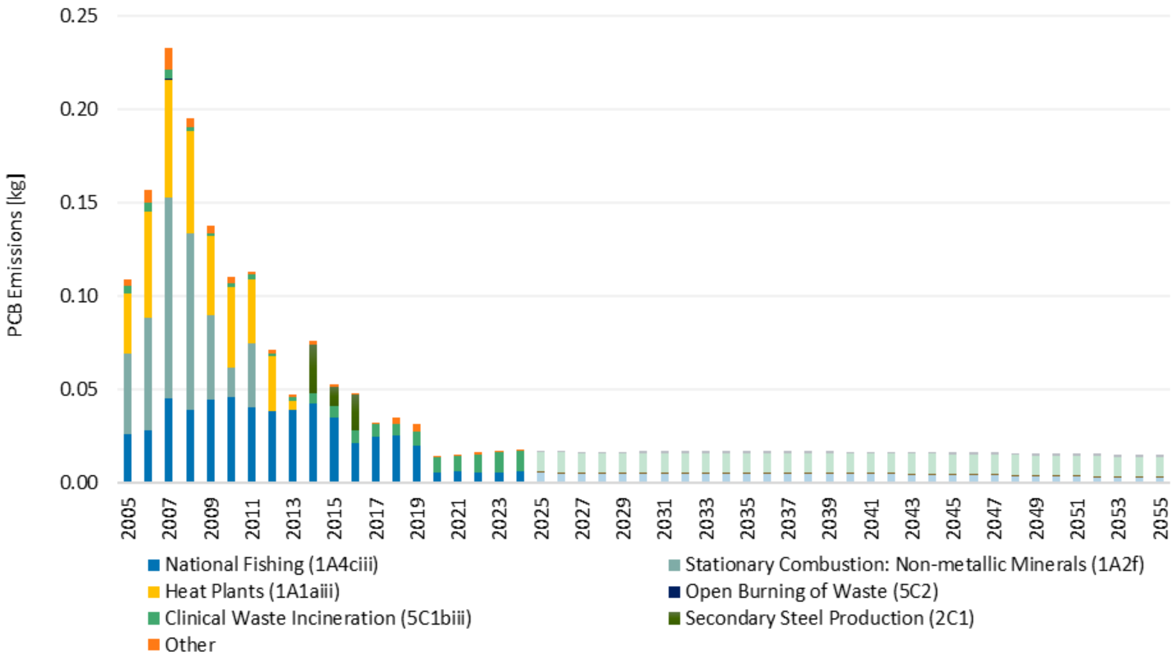

Figure 9.13 PCB emissions by main sources. Historical data and projections, 2005-2055.

9.1.12 Priority Heavy Metals (Pb, Cd, Hg)

Projections for the main heavy metals (lead, cadmium, and mercury) are displayed here in Figures Figure 9.14, Figure 9.15, and Figure 9.16, respectively. These figures include historical data from 2005 and projected emissions to 2055. Cd emissions from sector 2C3 are projected to decline significantly between 2025 and 2026 due to a temporary decreased production at one of the aluminium plants.

9.1.12.1 Lead (Pb)

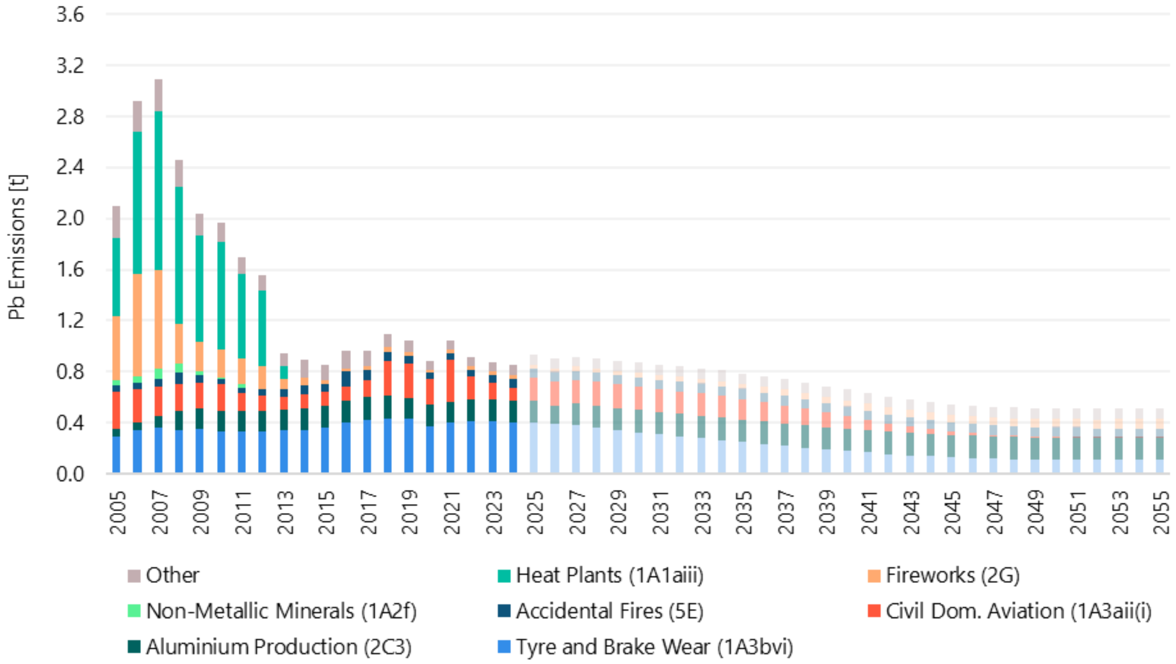

Figure 9.14 Pb emissions by main sources. Historical data and projections, 2005-2055.

9.1.12.2 Cadmium (Cd)

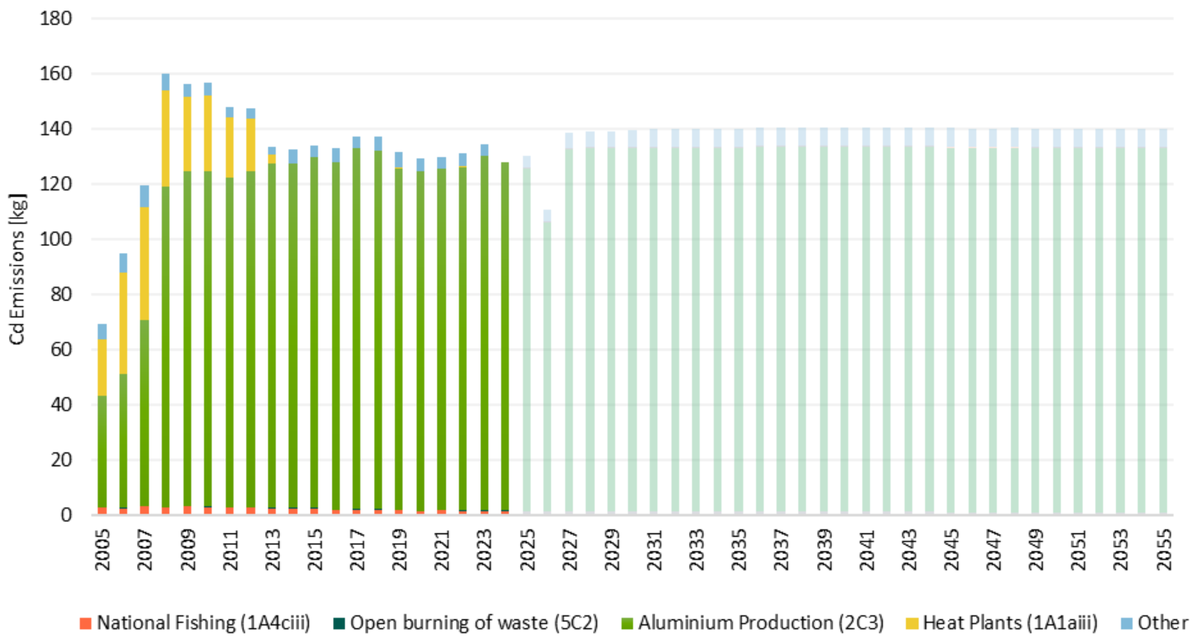

Figure 9.15 Cd emissions by main sources. Historical data and projections, 2005-2055.

9.1.12.3 Mercury (Hg)

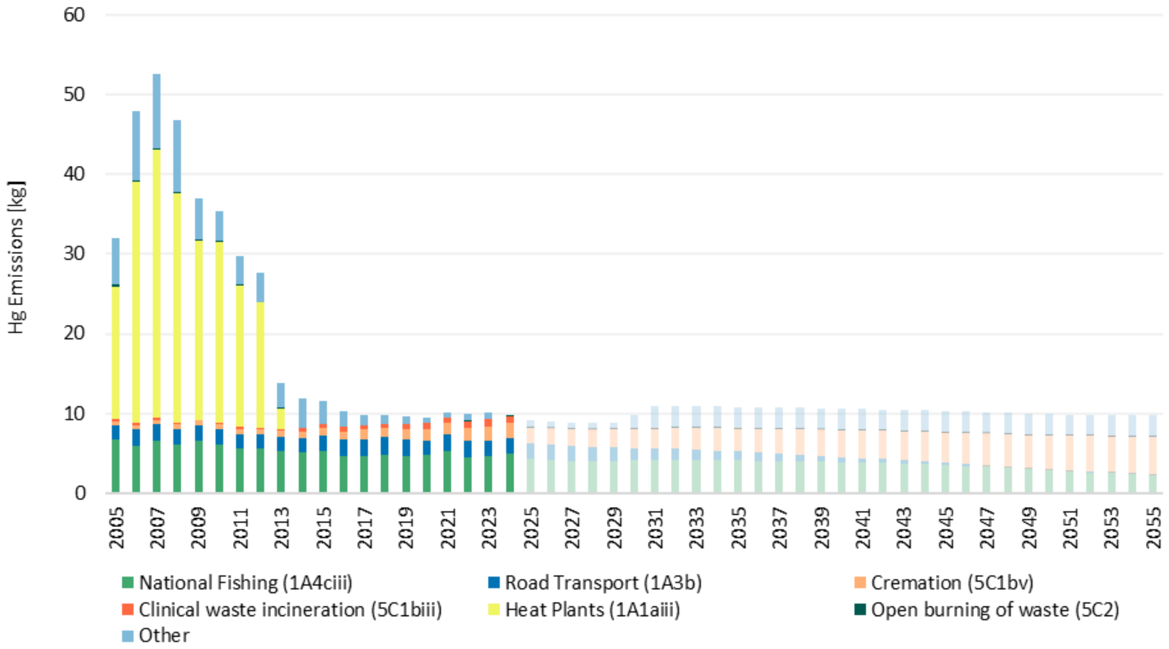

Figure 9.16 Hg emissions by main sources. Historical data and projections, 2005-2055.

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 Figures 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 and projected emissions to 2055. The emissions of these heavy metals from sector 2C3 are projected to decline significantly between 2025 and 2026 due to a temporary decreased production at one of the aluminium plants. However, the overall impact of this change on Cu emissions is insignificant and there is no impact on Se emissions, as sector 2C3 accounts for only a small share of total Cu emissions and Se emissions are non-applicable for this sector.

9.1.13.1 Arsenic (As)

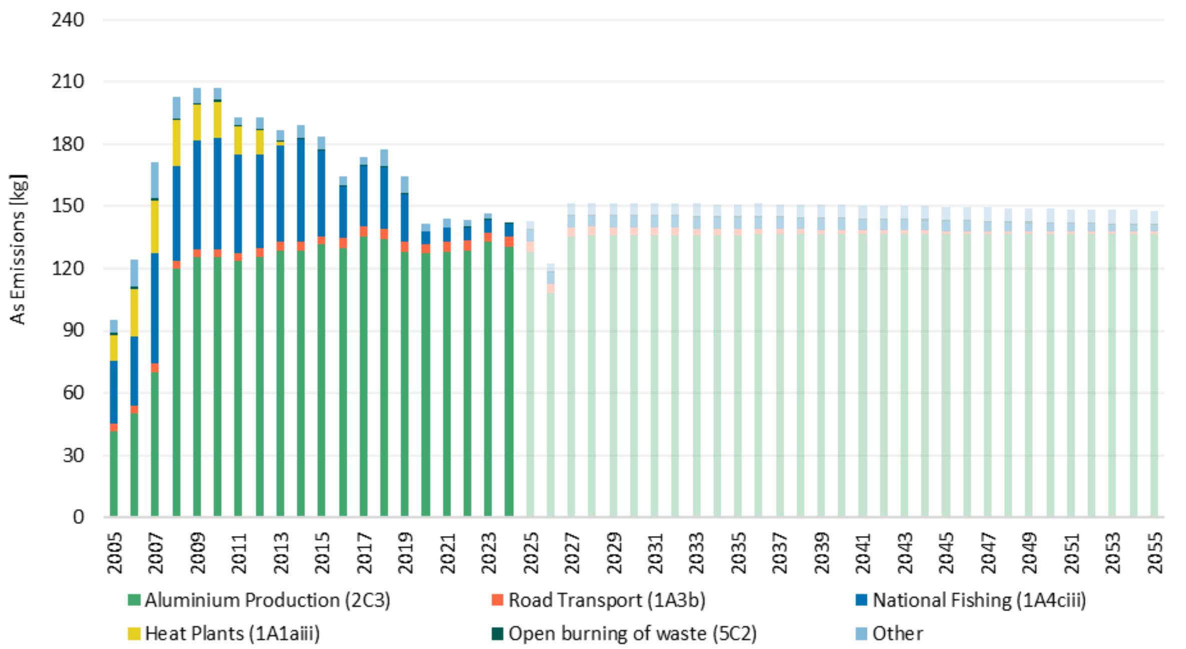

Figure 9.17 As emissions by main sources. Historical data and projections, 2005-2055.

9.1.13.2 Chromium (Cr)

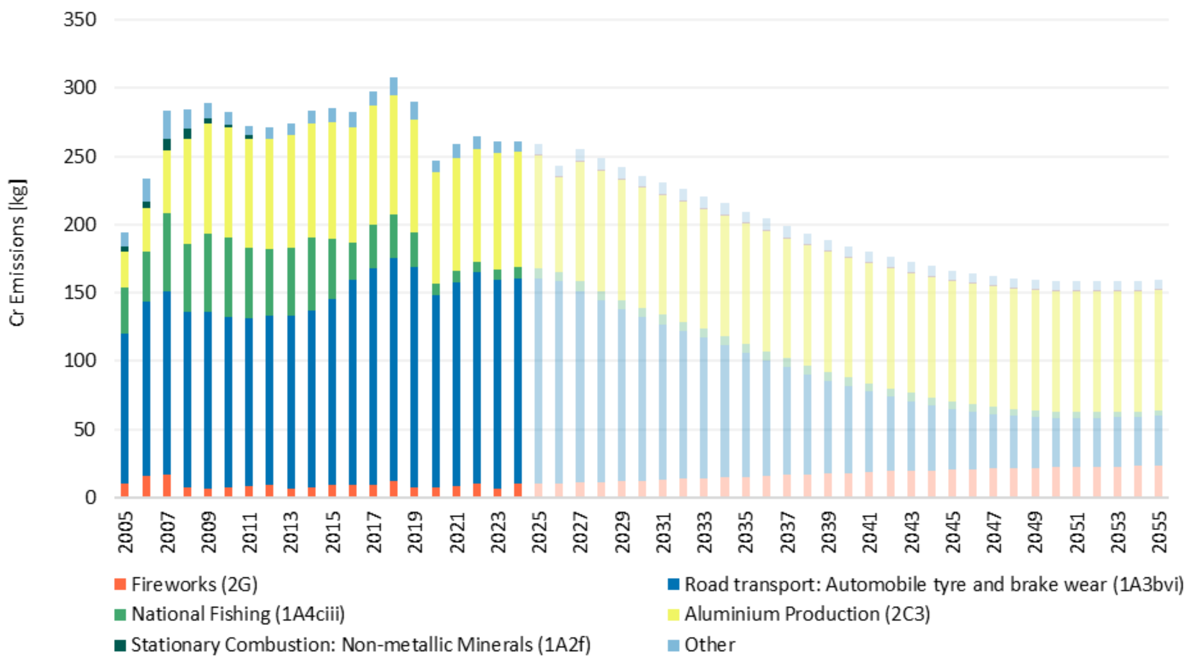

Figure 9.18 Cr emissions by main sources. Historical data and projections, 2005-2055.

9.1.13.3 Copper (Cu)

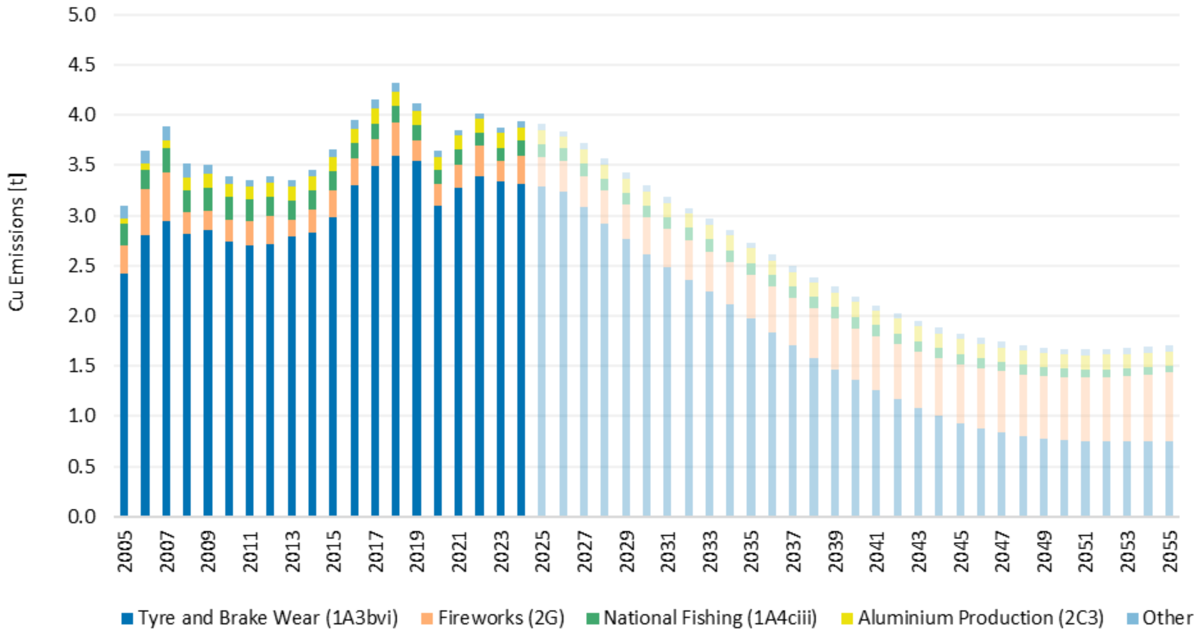

Figure 9.19 Cu emissions by main sources. Historical data and projections, 2005-2055.

9.1.13.4 Nickel (Ni)

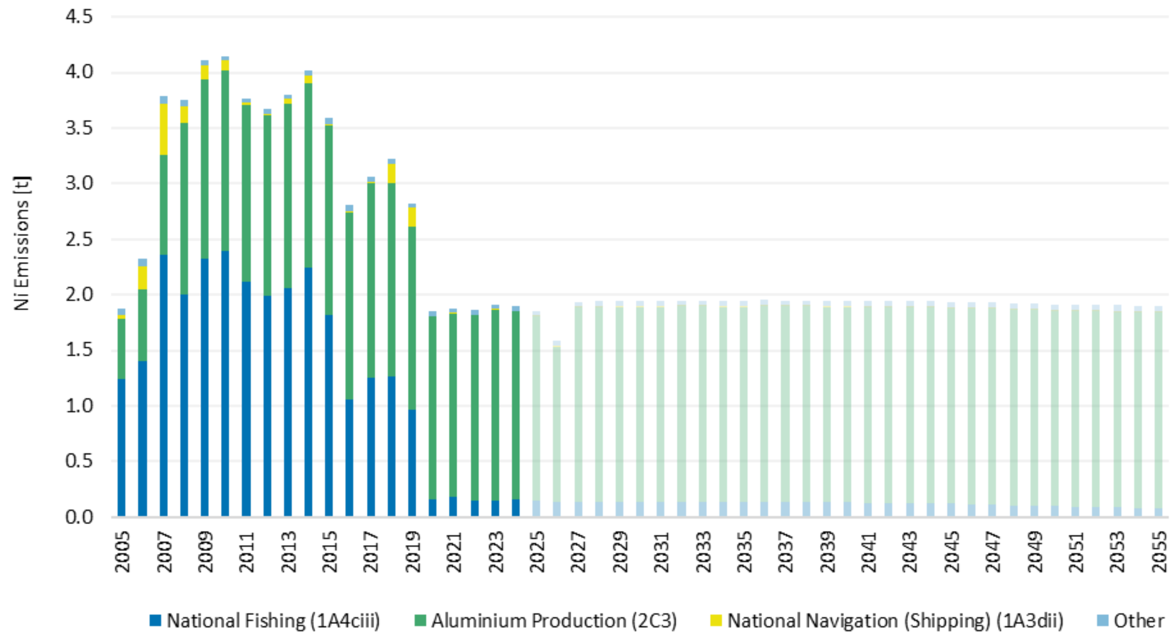

Figure 9.20 Ni emissions by main sources. Historical data and projections, 2005-2055.

9.1.13.5 Selenium (Se)

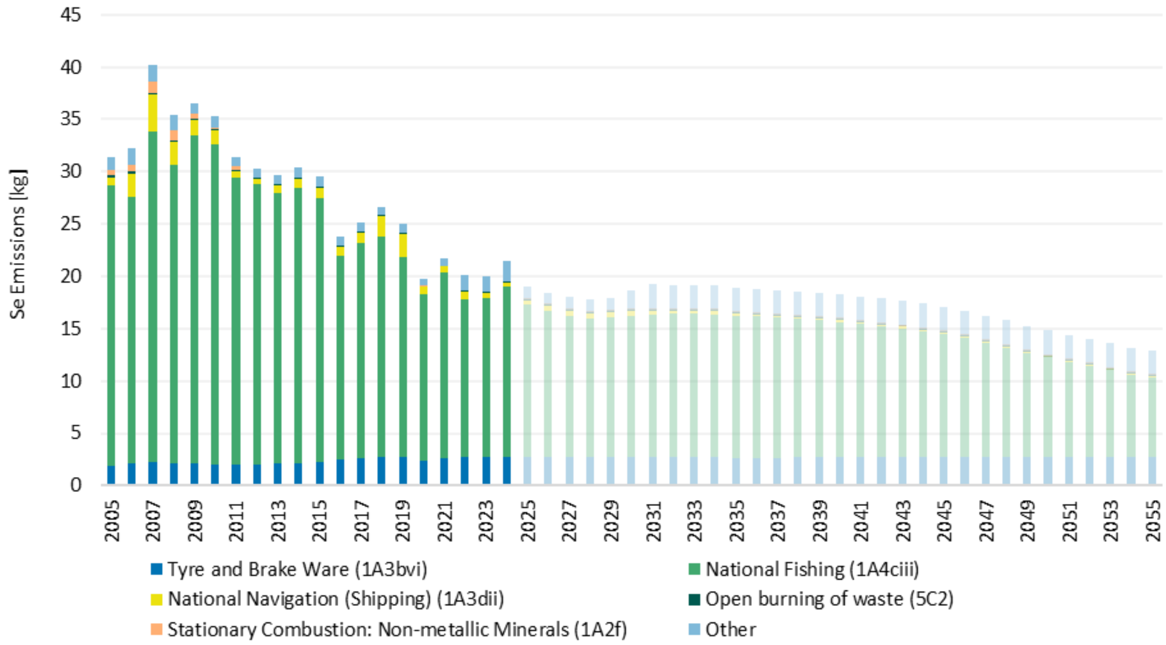

Figure 9.21 Se emissions by main sources. Historical data and projections, 2005-2055.

9.1.13.6 Zinc (Zn)

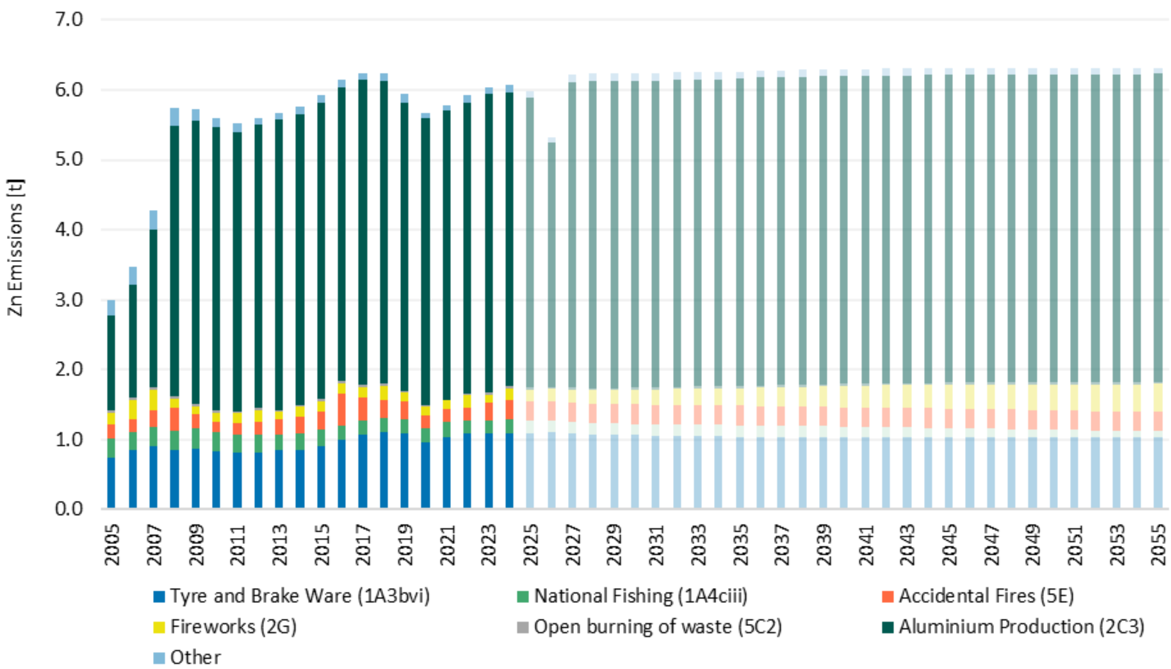

Figure 9.22 Zn emissions by main sources. Historical data and projections, 2005-2055.

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[29] was purchased from Emisia to run COPERT 5.9.2 which follows the methodology presented in 2023 EEA/EMEP Guidebook.[30] 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

[29] *Emisia*. https://www.emisia.com/utilities/sibyl-baseline/

[30] COPERT. https://www.emisia.com/utilities/copert/

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[31]. 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.

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.

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

[31] Energy Forecast: https://orkuspaislands.is/

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 for greenhouse gases some policies and measures, aimed at reducing greenhouse gas emissions in the energy sector, also influence emissions of air pollutants from the sector. The impact of policies and measures for greenhouse gases is represented in the projections presented in this document. The website co2.is provides an overview of measures that are either implemented or planned at any given time. The projections are based on an implementation plan published at the end of 2025.[32]

[32] The implementation plan from 2025 is available in Icelandic online.

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

- 2A Mineral Industry: The activity data are either provided directly by the operators or estimated based on historical activity data, e.g. average from past years with selected time range chosen on a case-by-case basis.

- 2C Metal Industry: For the 2C2 Ferroalloys Production and 2C3 Primary Aluminium Production, projected production amounts are provided by individual companies. For other subsectors, activity data are estimated based on average production levels from previous years, with the selected time range determined on a case-by-case basis.

- 2D Non-Energy Products from Fuels and Solvent Use: Activity data vary by subcategory. These data are not projected, as total projected emissions are based on historical emission trends starting from 2010 (post-financial crisis).

- 2G Other Product Manufacture and Use: Activity data for 2G4 Tobacco are projected using a 10-year historical trend. For 2G4 Fireworks, projected GDP trends are used as a proxy for activity data. GDP projection is the one used in the IEEA's Energy Forecast 2025-2060.

- 2H Food and Beverages Industry: The projection of activity data in this sector varies by subcategory. Animal feed production is projected using GDP trends (as described above). Coffee roasting and beer and pilsner production are projected based on 10-year historical trends. Spirit production is assumed to remain stable. Activity data for the remaining subcategories are projected using population trends from Statistics Iceland.

2B Chemical Industry and 2E Electronics Industry are not relevant in Iceland.

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

Historical livestock data is collected from the Ministry of Industries (Atvinnuvegaráðuneytið) (MI) and are the same numbers which are used for agriculture calculations in the latest NIR.

To assess which trends to use and to obtain expert judgement on the necessary assumptions for the projections, inquiries were sent out to specialists from the Agricultural University of Iceland and the Icelandic Agricultural Advisory Centre. Inventory experts provided these specialists with multiple scenarios and requested them to select the most likely one, accompanied by a justification for their choice.

The conclusion was that livestock numbers for cattle (dairy cattle, other mature cattle and growing cattle) were projected based on the trend over the latest 10 historical years for all cattle categories other than dairy and suckler cows, for which the projections were based on the trend over all historical years from 1990. For the categories sheep, swine, horses and poultry, the livestock numbers were projected using the historical data from 1990. Livestock numbers for goats were extrapolated using the activity data for the 10 latest historical years and livestock numbers for fur animals are kept constant based on the latest historical data.

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 NIR submission, except for the milk yield. Because the milk yield per dairy cow has historically been increasing, the milk yield per dairy cow was projected based on the trend from 1990.

The projections for the use of fertilisers are affected by three policies by the Icelandic government aimed at reducing the amount of fertilisers used. Further explanations on how they affects the projections can be found in Section 3.6.3 of Iceland's latest Report on Policies, Measures and Projections. The projections are an extrapolation based on the activity data on N-fertiliser imports from 1990, with a certain percentage reduction each projected year based on the ex-ante estimation of the policies affecting the fertiliser use in Iceland.

The areas for the calculations of emissions from drained organic soils are communicated from the Soil Conservation Service of Iceland, which is calculating projections for the LULUCF sector. National measures regarding wetland restoration affect the projected grassland area. Other sources of emissions, such as the use of organic N-fertilisers, liming, and the use of urea are predicted by using trends in historical activity data, without any measures affecting the predictions.

9.4.3 Emission Factors

The emission factors used in the emission projections are the same as are used for the emission inventory as described in Chapter 5.

9.4.4 Policies and Measures

Iceland's Climate Action Plan (2024) for greenhouse gases contains three measures aimed at reducing greenhouse gas emissions through decreased fertiliser needs. These measures will also affect NO_x and NH_3 emissions due to fertiliser application and are collectively used in the projection calculations. These measures are:

- S.4.B.1. To collect soil samples from cultivated land in a more systematic way and use that information to improve the utilisation of fertiliser nutrients.
- S.4.B.2. Support for the introduction of technology for precision distribution of fertilisers: Various technical solutions can contribute to improved utilisation of fertilisers leading to reduced emissions of NO_x and NH_3. Farmers can apply for grants to purchase technology for precision application of inorganic and organic fertilizers.
- S.4.B.3. Support for farmers for measures to reduce fertiliser needs: The measure introduces support for measures such as liming of agricultural land to increase acidity, using nitrogen-fixing species in crops, and shelterbelt cultivation to reduce fertiliser needs leading to reduced emissions of NO_x and NH_3.

Another measure in Iceland's Climate Action Plan (2024), which will affect the emissions from agriculture, even though it could not be included in the current projections, is:

- S.4.A.3 Preparation of an efficient subsidy environment for agriculture: Agricultural contracts are revised every 10 years, and the current ones are valid until the end of 2026. The support system in the current contracts does not encourage reduction in emissions but could include performance-based incentives aimed at increasing productivity per animal, improved and targeted fertiliser use and improved cultivation methods, i.e., not leaving fields unprotected and open.

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 each estimated based on the annual amount of waste handled in each sector, as well as from the CH_4 emissions from landfills, projected in correlation with historical data, taking into account the existing policies and operating permits of waste handling companies.

Waste amounts landfilled and CH_4 emissions from landfills are expected to decrease drastically over the next two decades. The main drivers of the reduction are the export of all mixed waste from the capital region for incineration abroad, an initial nation-wide reduction in landfilling biodegradable waste and an eventual ban on landfilling such waste, and the planned building of a large incineration plant and a bioenergy plant. Further information on the projections of activity data for category 5.A Solid Waste Disposal can be found in Iceland's latest Report on Policies, Measures and Projections.

Due to the planned building of an additional incineration plant in Iceland, the emissions of all air pollutants due to waste incineration are projected to increase. The activity data for clinical, slaughterhouse waste and sewage sludge are extrapolated based on latest historical data, ignoring the planned incineration plant since the waste amounts in these categories are not predicted to change. However, MSW and hazardous waste amounts, are scaled up using the latest proportions between their subcategories.

The relevant activity data to calculate emissions of air pollutants from categories 5.B.2 Anaerobic Digestion at Biogas Facilities and 5.D Wastewater Handling is currently not available.

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

In Iceland's Climate Action Plan (2024) for greenhouse gases some measures aimed at reducing greenhouse gas emissions from the waste sector also affect emissions of air pollutants from the sector. Four of them directly affect the projected emissions from the waste sector. These are measures:

- S.7.B.3 Ban on landfilling of biowaste,
- S.7.B.4 Ban on landfilling of organic waste,
- S.7.B.5 Collaborative project on developing a bioenergy plant, and
- S.7.B.6. Collaborative project for developing incineration plant(s).

Measure S.7.B.6 increases the emissions of all air pollutants, which are emitted through waste incineration, while the other three decrease the amount of NMVOC and particulate matter emissions from landfilling.

Further information on measures affecting the waste sector is available at CO2.is.

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Annexes to the Informative 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 (2024) and previous (2023) versions of the inventory for the base year (1990) and the most recent year covered by both versions (2023).
- 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.

A1.1 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.

A1.2 Negative and Zero Values Check

Checks were performed to identify whether any negative or zero values occur in the NFR Annex I submission file.

A1.3 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.

A1.4 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.

A1.5 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 ≥ PM_{10} ≥ $PM_{2.5}$. 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.

A1.6 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 1990-2024

A2.1 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 NFR 1A4ciii 52.7%	Road Transport: Passenger Cars NFR 1A3bi 18.5%	Road Transport: Heavy Duty Vehicles and Buses NFR 1A3biii 5.4%	Stationary Combustion in Manufacturing Industries and Construction: Food Processing and Beverages NFR 1A2e 3.4%	Mobile Combustion in manufacturing industries and construction NFR 1A2gvii 2.8%	82.8%
NMVOC	*Road Transport: Passenger Cars* *NFR 1A3bi* 44.8%	*Manure Management - Horses* *NFR 3B4e* 6.8%	*Coating Applications* *NFR 2D3d* 6.0%	*National Fishing* *NFR 1A4ciii* 5.5%	*Road Transport: Gasoline Evaporation* *NFR 1A3bv* 5.1%	80.5%
	Manure Management - Dairy Cattle *NFR 3B1a* 4.6%	*Manure Management - Sheep* *NFR 3B2* 2.8%	*Domestic Solvent Use Including Fungicides* *NFR 2D3a* 2.6%	*Distribution of oil products* *NFR 1B2av* 2.2%		
SO_x	Other Fugitive Emissions from Energy Production (Geothermal Energy) NFR 1B2d 58.0%	National fishing NFR 1A4ciii 17.2%	Ferroalloys Production NFR 2C2 8.1%			83.3%
NH_3	Animal Manure Applied to Soils NFR 3Da2a 28.5%	Urine and Dung Deposited by Grazing Animals NFR 3Da3 16.1%	Manure Management - Sheep NFR 3B2 15.5%	Manure Management - Dairy Cattle NFR 3B1a 12.2%	Inorganic N-fertilizers (includes also urea application) NFR 3Da1 10.3%	82.6%
$PM_{2.5}$	National Fishing NFR 1A4ciii 25.8%	Open Burning of Waste NFR 5C2 12.1%	Construction and Demolition NFR 2A5b 9.3%	Quarrying and Mining of Minerals other than Coal NFR 2A5a 8.2%	Road Transport: Automobile Road Abrasion NFR 1A3bvii 7.5%	81.5%

Component	Key Categories (Sorted from high to low from left to right and top to bottom)					Total (%)
	Ferroalloy Production NFR 2C2 4.5%	Road Transport: Heavy Duty Vehicles and Buses NFR 1A3biii 4.0%	Stationary Combustion in Manufacturing Industries and Construction: Non-metallic Minerals NFR 1A2f 4.0%	Mobile Combustion in manufacturing industries and construction NFR 1A2gvii 3.4%	Aluminium production NFR 2C3 2.7%	
PM_{10}	Construction and demolition NFR 2A5b 41.1%	National Fishing NFR 1A4ciii 13.4%	Quarrying and mining of minerals other than coal NFR 2A5a 10.3%	Road Transport: Automobile Road Abrasion NFR 1A3bvii 6.2%	Open burning of waste NFR 5C2 5.8%	82.6%
	Aluminium Production NFR 2C3 2.9%	Ferroalloy Production NFR 2C2 2.8%				
TSP	Construction and demolition NFR 2A5b 63.1%	Quarrying and mining of minerals other than coal NFR 2A5a 10.0%	National Fishing NFR 1A4ciii 6.1%	Road transport: Automobile road abrasion NFR 1A3bvii 5.7%		84.8%
BC	Open Burning of Waste NFR 5C2 31.5%	Mobile Combustion in Manufacturing Industries and Construction NFR 1A2gvii 13.2%	Road Transport: Heavy-duty Vehicles and Buses NFR 1A3biii 12.3%	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery NFR 1A4cii 9.7%	Stationary Combustion in Manufacturing Industries and Construction: Food Processing and Beverages NFR 1A2e 8.7%	81.5%
	National fishing NFR 1A4ciii 6.0%					
CO	Road transport: Passenger cars NFR 1A3bi 67.0%	Aluminium production NFR 2C3 19.4%				86.5%

Table A2.2 Key categories for NO_x, NMVOC, SO_x, NH_3, $PM_{2.5}$, PM_{10}, TSP, BC and CO, trend 1990-2024.

Component	Key Categories (Sorted from high to low from left to right and top to bottom)					Total (%)
NO_x	Road transport: Passenger cars NFR 1A3bi 37.0%	Ferroalloy production NFR 2C2 23.6%	Aluminium production NFR 2C3 9.1%	International aviation LTO (civil) NFR 1A3ai(i) 5.3%	National fishing NFR 1A4ciii 3.4%	80.9%
	Road transport: Light duty vehicles NFR 1A3bii 2.5%					
NMVOC	Road transport: Passenger cars NFR 1A3bi 40.9%	Domestic solvent use including fungicides NFR 2D3a 25.3%	Food and beverages industry NFR 2H2 8.0%	International aviation LTO (civil) NFR 1A3ai(i) 5.4%	Distribution of oil products NFR 1B2av 3.0%	82.5%
SO_x	Other fugitive emissions from energy production (Geothermal NFR 1B2d 28.8%	National fishing energy) NFR 1A4ciii 26.8%	Aluminium production NFR 2C3 21.6%	Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco NFR 1A2e 7.6%		84.9%
NH_3	Manure management - Sheep NFR 3B2 22.8%	Inorganic N-fertilizers (includes also urea application) NFR 3Da1 17.3%	Urine and Dung Deposited by Grazing Animals NFR 3Da3 8.0%	Manure management - Fur animals NFR 3B4h 7.6%	Manure mangement - Laying hens NFR 3B4gi 7.2%	82.7%
	Manure management - Non-dairy cattle NFR 3B1b 6.8%	Manure mangement - Broilers NFR 3B4gii 6.6%	Manure Management - Dairy Cattle NFR 3B1a 6.4%			
$PM_{2.5}$	Aluminium Production NFR 2C3 27.1%	Road Transport: Automobile Road Abrasion NFR 1A3bvii 15.8%	National fishing NFR 1A4ciii 12.3%	Open burning of waste NFR 5C2 11.2%	Quarrying and Mining of Minerals other than Coal NFR 2A5a 5.6%	80.5%

Component	Key Categories (Sorted from high to low from left to right and top to bottom)					Total (%)
	Construction and Demolition NFR 2A5b 4.6%	Stationary combustion in manufacturing industries and construction: Non-metallic minerals NFR 1A2f 3.9%				
PM_{10}	Aluminium production NFR 2C3 21.8%	Construction and demolition NFR 2A5b 21.1%	Road transport: Automobile road abrasion NFR 1A3bvii 17.2%	Quarrying and mining of minerals other than coal NFR 2A5a 7.7%	National fishing NFR 1A4ciii 6.5%	80.5%
	Open burning of waste NFR 5C2 6.1%					
TSP	Construction and demolition NFR 2A5b 31.3%	Road transport: Automobile road abrasion NFR 1A3bvii 23.5%	Aluminium production NFR 2C3 17.2%	Quarrying and mining of minerals other than coal NFR 2A5a 8.2%		80.1%
BC	Open burning of waste NFR 5C2 34.0%	Road transport: Automobile tyre and brake wear NFR 1A3bvi 13.3%	Road transport: Automobile road abrasion NFR 1A3bvii 10.9%	Mobile combustion in manufacturing industries and construction NFR 1A2gvii 9.9%	Aluminium production NFR 2C3 7.9%	82.9%
	Road transport: Heavy duty vehicles and buses NFR 1A3biii 6.9%					
CO	Aluminium production NFR 2C3 50.0%	Road transport: Passenger cars NFR 1A3bi 42.6%				92.6%

A2.2 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 NFR 5C2 97.8%					97.8%
PAH4	Open burning of waste NFR 5C2 81.9%					81.9%
HCB	Open burning of waste NFR 5C2 47.7%	Other product use (Fireworks) NFR 2Gfw 43.4%				91.1%
PCB	Open burning of waste NFR 5C2 62.7%	Stationary combustion in manufacturing industries and construction: Non-metallic minerals NFR 1A2f 27.2%				89.8%

Table A2.4 Key categories for POPs, trend 1990-2024.

Component	Key Categories (Sorted from high to low from left to right)					Total (%)
Dioxin	Open burning of waste NFR 5C2 50.0%	Clinical waste incineration NFR 5C1biii 18.0%	Accidental fires NFR 5E 11.9%	Ferroalloys production NFR 2C2 10.0%		89.9%
PAH4	Open burning of waste NFR 5C2 41.3%	Aluminium production NFR 2C3 13.0%	Ferroalloys production NFR 2C2 12.4%	Stationary combustion in manufacturing industries and construction: Non-metallic minerals NFR 1A2f 8.7%	Road transport: Passenger cars NFR 1A3bi 7.6%	83.0%
HCB	Open burning of waste NFR 5C2 35.5%	Clinical waste incineration NFR 5C1biii 33.5%	Other product use (Fireworks) NFR 2Gfw 14.1%			83.2%
PCB	Open burning of waste NFR 5C2 41.1%	Clinical waste incineration NFR 5C1biii 40.6%				81.7%

A2.3 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	Road transport: Passenger cars NFR 1A3bi 67.7%	Domestic aviation LTO (civil) NFR 1A3aii(i) 8.7%	Road transport: Automobile tyre and brake wear NFR 1A3bvi 6.3%			82.6%
Cd	Aluminium production NFR 2C3 58.0%	Open burning of waste NFR 5C2 16.9%	National fishing NFR 1A4ciii 12.2%			87.1%
Hg	Open burning of waste NFR 5C2 90.2%					90.2%
As	National fishing NFR 1A4ciii 45.8%	Open burning of waste NFR 5C2 22.1%	Aluminium production NFR 2C3 19.1%			87.0%
Cr	Road transport: Automobil tyre and brake wear NFR 1A3bvi 52.9%	National fishing NFR 1A4ciii 27.0%	Aluminium production NFR 2C3 6.6%			86.5%
Cu	Road transport: Automobil tyre and brake wear NFR 1A3bvi 80.0%	National fishing NFR 1A4ciii 11.6%				91.6%
Ni	National fishing NFR 1A4ciii 78.2%	Aluminium production NFR 2C3 10.1%				88.3%
Se	National fishing NFR 1A4ciii 78.8%	Open burning of waste NFR 5C2 7.6%				86.3%
Zn	Open burning of waste NFR 5C2 28.4%	Road transport: Automobil tyre and brake wear NFR 1A3bvi 19.9%	Aluminium production NFR 2C3 18.5%	National fishing NFR 1A4ciii 12.2%	Accidental fires NFR 5E 9.3%	88.4%

Table A2.6 Key categories for heavy metals, trend 1990-2024.

Component	Key Categories (Sorted from high to low from left to right and top to bottom)					Total (%)
Pb	Road transport: Passenger cars NFR 1A3bi 44.9%	Road transport: Automobil tyre and brake wear NFR 1A3bvi 27.2%	Aluminium production NFR 2C3 12.7%			84.7%
Cd	Aluminium production NFR 2C3 47.2%	Open burning of waste NFR 5C2 22.2%	National fishing NFR 1A4ciii 14.5%			84.0%
Hg	Open burning of waste NFR 5C2 48.2%	National fishing NFR 1A4ciii 21.9%	Cremation NFR 5C1bv 9.1%	Road transport: Passenger cars NFR 1A3bi 6.0%		85.2%
As	Aluminium production NFR 2C3 49.6%	National fishing NFR 1A4ciii 28.9%	Open burning of waste NFR 5C2 15.1%			93.6%
Cr	Aluminium production NFR 2C3 38.0%	National fishing NFR 1A4ciii 35.4%	Road transport: Automobil tyre and brake wear NFR 1A3bvi 7.3%			80.7%
Cu	National fishing NFR 1A4ciii 33.8%	Other product use (Fireworks) NFR 2Gfw 19.6%	Road transport: Automobil tyre and brake wear NFR 1A3bvi 17.6%	Aluminium production NFR 2C3 11.8%		82.8%
Ni	Aluminium production NFR 2C3 49.0%	National fishing NFR 1A4ciii 43.5%				92.5%
Se	Road transport: Automobil tyre and brake wear NFR 1A3bvi 31.2%	Open burning of waste NFR 5C2 23.3%	Public electricity and heat production NFR 1A1a 16.0%	National fishing NFR 1A4ciii 9.8%		80.3%
Zn	Aluminium production NFR 2C3 48.2%	Open burning of waste NFR 5C2 26.5%	National fishing NFR 1A4ciii 8.5%			83.2%

Annex 3 Uncertainty Assessment by NFR group

A3.1 Energy

Table A3-1 summarises the uncertainty values (in %) for the main pollutants, particulate matter, and CO in the Energy sector, aggregated according to NFR level.

Table A3-1 NFR-level aggregated uncertainty in Energy 2024 [values as %].

NFR 1 Energy	NO_x	NMVOC	SO_2	NH_3	$PM_{2.5}$	PM_{10}	TSP	BC	CO
1A1a	200	60	900	-	213	213	208	15	301
1A1b	-	-	-	-	-	-	-	-	-
1A1c	-	-	-	-	-	-	-	-	-
1A2a	40	44	40	-	40	40	40	75	66
1A2b	40	44	40	-	40	40	40	75	66
1A2c	-	-	-	-	-	-	-	-	-
1A2d	-	-	-	-	-	-	-	-	-
1A2e	40	40	41	-	40	40	40	41	41
1A2f	40	40	11	-	40	40	40	57	40
1A2g	91	94	11	100	94	94	94	95	96
1A3a	11	68	68	-	22	22	22	22	25
1A3b	7.5	27	10	103	34	33	36	27	15
1A3c	-	-	-	-	-	-	-	-	-
1A3d	59	112	51	-	63	63	112	63	112
1A3e	100	100	11	100	100	100	100	100	100
1A4a	331	250	70	-	233	281	110	79	115
1A4b	200	400	264	138	100	100	100	104	150
1A4c	30	94	11	100	36	37	93	55	92
1A5a	331	250	70	-	233	281	110	79	115
1A5b	-	-	-	-	-	-	-	-	-
1B1a	-	-	-	-	-	-	-	-	-
1B1b	-	-	-	-	-	-	-	-	-
1B1c	-	-	-	-	-	-	-	-	-
1B2a	-	200	-	-	-	-	-	-	-
1B2b	-	-	-	-	-	-	-	-	-
1B2c	-	-	-	-	-	-	-	-	-
1B2d	-	-	10	-	-	-	-	-	-

Table , Table , and Table A3-4 summarise emissions, estimated uncertainty in percent and absolute emission mass, as well as uncertainty in the trend (in %), aggregated by NFR group within the Energy sector for all pollutants.

Table A3-2 Uncertainties in NFR group Stationary Combustion.

Stationary Combustion	Pollutant	Unit	Emissions 1990 [Unit]	Emissions 2024 [Unit]	Uncertainty total 2024 [%]	Absolute uncertainty 2024 [Unit]	Trend uncertainty 2024 [%]
Main pollutants	NO_x	kt	1.4	0.56	38	0.21	7.3
	NMVOC	kt	0.11	0.034	57	0.019	4.2
	SO_2	kt	2.1	0.042	208	0.088	40
	NH_3	kt	4.7.E-05	5.4.E-05	138	7.4.E-05	0.16
Particulate Matter	$PM_{2.5}$	kt	0.11	0.026	35	0.0090	12
	PM_{10}	kt	0.12	0.027	35	0.0094	7.8
	TSP	kt	0.12	0.028	34	0.0093	5.0
	BC	kt	0.032	0.012	33	0.0040	9.5
Other	CO	kt	0.67	0.11	48	0.051	8.3
Priority Heavy Metals	Pb	t	0.066	0.0012	642	0.0075	7.1
	Cd	t	0.0012	3.8.E-04	764	0.0029	71
	Hg	t	0.0043	4.9.E-04	578	0.0029	14
Additional Heavy Metals	As	t	0.0026	4.3.E-04	881	0.0038	35
	Cr	t	0.0083	7.2.E-04	403	0.0029	30
	Cu	t	0.010	8.6.E-04	668	0.0057	9.3
	Ni	t	0.047	0.0012	368	0.0045	45
	Se	t	0.0018	0.0015	855	0.013	52
	Zn	t	0.18	0.034	81	0.027	39
POPs	Dioxin	g I-TEQ	0.011	0.0071	414	0.029	5.0
	BaP	t	0.023	8.1.E-04	898	0.0073	24
	BbF	t	0.029	7.6.E-04	882	0.0067	17
	BkF	t	0.012	2.8.E-04	894	0.0025	10
	Ipy	t	0.0094	4.8.E-04	894	0.0043	38
	PAH	t	0.073	0.0023	0.0	0.0	0.0
	HCB	kg	3.4.E-04	3.5.E-05	477	1.7.E-04	1.9
	PCB	kg	0.082	4.0.E-07	494	2.0.E-06	0.25

Table A3-3 Uncertainties in NFR group Mobile Combustion.

Mobile Combustion	Pollutant	Unit	Emissions 1990 [Unit]	Emissions 2024 [Unit]	Uncertainty total 2024 [%]	Absolute uncertainty 2024 [Unit]	Trend uncertainty 2024 [%]
Main pollutants	NO_x	kt	21.3	10.8	23	2.5	16
	NMVOC	kt	5.4	1.2	40	0.49	21
	SO_2	kt	4.3	0.28	11	0.032	20
	NH_3	kt	0.0073	0.054	102	0.055	10
Particulate Matter	$PM_{2.5}$	kt	0.65	0.54	25	0.13	28
	PM_{10}	kt	0.83	0.83	26	0.22	24
	TSP	kt	1.0	1.3	32	0.44	23
	BC	kt	0.11	0.071	33	0.024	23
Other	CO	kt	40.7	3.2	25	0.80	43
Priority Heavy Metals	Pb	t	2.7	0.57	39	0.22	63
	Cd	t	0.0041	0.0037	51	0.0019	82
	Hg	t	0.0084	0.0070	80	0.0056	19
Additional Heavy Metals	As	t	0.037	0.011	61	0.0069	92
	Cr	t	0.11	0.16	48	0.078	71
	Cu	t	1.8	3.5	49	1.7	57
	Ni	t	1.5	0.19	85	0.16	88
	Se	t	0.031	0.020	83	0.016	23
	Zn	t	0.81	1.3	45	0.59	50
POPs	Dioxin	g I-TEQ	0.12	0.056	88	0.050	6.2
	BaP	t	0.0029	0.0048	41	0.0020	13
	BbF	t	0.0077	0.0090	57	0.0051	14
	BkF	t	0.0044	0.0073	63	0.0046	13
	Ipy	t	0.0028	0.0041	70	0.0029	30
	PAH	t	0.018	0.025	30	0.0075	9.5
	HCB	kg	0.022	0.013	97	0.013	11
	PCB	kg	0.031	0.0064	195	0.012	17

Table A3-4 Uncertainties in NFR-group Fugitive Emissions.

Fugitive Emissions	Pollutant	Unit	Emissions 1990 [Unit]	Emissions 2024 [Unit]	Uncertainty total 2024 [%]	Absolute uncertainty 2024 [Unit]	Trend uncertainty 2024 [%]
Main pollutants	NO_x	kt	0.0	0.0	-	-	-
	NMVOC	kt	0.18	0.32	200	0.64	21

Fugitive Emissions	Pollutant	Unit	Emissions 1990 [Unit]	Emissions 2024 [Unit]	Uncertainty total 2024 [%]	Absolute uncertainty 2024 [Unit]	Trend uncertainty 2024 [%]
	SO_2	kt	13.3	41.1	10	4.1	21
	NH_3	kt	0.0	0.0	-	-	-
Particulate Matter	$PM_{2.5}$	kt	0.0	0.0	-	-	-
	PM_{10}	kt	0.0	0.0	-	-	-
	TSP	kt	0.0	0.0	-	-	-
	BC	kt	0.0	0.0	-	-	-
Other	CO	kt	0.0	0.0	-	-	-
Priority Heavy Metals	Pb	t	0.0	0.0	-	-	-
	Cd	t	0.0	0.0	-	-	-
	Hg	t	0.0	0.0	-	-	-
Additional Heavy Metals	As	t	0.0	0.0	-	-	-
	Cr	t	0.0	0.0	-	-	-
	Cu	t	0.0	0.0	-	-	-
	Ni	t	0.0	0.0	-	-	-
	Se	t	0.0	0.0	-	-	-
	Zn	t	0.0	0.0	-	-	-
POPs	Dioxin	g I-TEQ	0.0	0.0	-	-	-
	BaP	t	0.0	0.0	-	-	-
	BbF	t	0.0	0.0	-	-	-
	BkF	t	0.0	0.0	-	-	-
	Ipy	t	0.0	0.0	-	-	-
	PAH	t	0.0	0.0	-	-	-
	HCB	kg	0.0	0.0	-	-	-
	PCB	kg	0.0	0.0	-	-	-

A3.2 Industrial Processes and Product Use (IPPU)

Table A3-5 summarises the uncertainty values (in %) for the main pollutants, particulate matter, and CO in the IPPU sector, aggregated according to NFR level.

Table A3-5 NFR-level aggregated uncertainty in IPPU 2024 [values as %].

NFR	NO_x	NMVOC	SO_2	NH_3	$PM_{2.5}$	PM_{10}	TSP	BC	CO
2A1	-	-	-	-	-	-	-	-	-
2A2	-	-	-	-	-	-	-	-	-
2A3	-	-	-	-	-	-	-	-	-
2A5a	-	-	-	-	40	40	40	-	-
2A5b	-	-	-	-	205	201	211	-	-
2A5c	-	-	-	-	-	-	-	-	-
2A6	-	-	20	10	10	10	10	10	10
2B1	-	-	-	-	-	-	-	-	-
2B2	-	-	-	-	-	-	-	-	-
2B3	-	-	-	-	-	-	-	-	-
2B5	-	-	-	-	-	-	-	-	-
2B6	-	-	-	-	-	-	-	-	-
2B7	-	-	-	-	-	-	-	-	-
2B10a	-	-	-	-	-	-	-	-	-
2B10b	-	-	-	-	-	-	-	-	-
2C1	-	-	-	-	-	-	-	-	-
2C2	15	30	30	-	900	900	43	100	20
2C3	54	-	25	-	74	74	122	74	87
2C4	-	-	-	-	-	-	-	-	-
2C5	-	-	-	-	-	-	-	-	-
2C6	-	-	-	-	-	-	-	-	-
2C7a	-	-	-	-	-	-	-	-	-
2C7b	-	-	-	-	-	-	-	-	-
2C7c	-	-	-	20	-	-	-	-	-
2C7d	-	-	-	-	-	-	-	-	-
2D3a	-	106	-	-	-	-	-	-	-
2D3b	-	525	-	-	400	233	900	93	-
2D3c	-	-	-	-	-	-	-	-	-
2D3d	-	46	-	-	-	-	-	-	-
2D3e	-	96	-	-	-	-	-	-	-

NFR	NO_x	NMVOC	SO_2	NH_3	$PM_{2.5}$	PM_{10}	TSP	BC	CO
2D3f	-	44	-	-	-	-	-	-	-
2D3g	-	36	-	-	-	-	-	-	-
2D3h	-	320	-	-	-	-	-	-	-
2D3i	-	109	-	-	-	-	-	-	-
2G	41	100	50	6.3	73	57	52	99	3.3
2H1	-	-	-	-	-	-	-	-	-
2H2	-	900	-	-	-	-	-	-	-
2H3	-	-	-	-	-	-	-	-	-
2I	-	-	-	-	-	-	-	-	-
2J	-	-	-	-	-	-	-	-	-
2K	-	-	-	-	-	-	-	-	-
2L	-	-	-	-	-	-	-	-	-

Table to Table A3-10 summarise emissions, estimated uncertainty in percent and absolute emission mass, as well as uncertainty in the trend (in %), aggregated by NFR group within the IPPU sector for all pollutants. Chemical Industry is not occurring in Iceland; the respective NFR group is therefore skipped.

Table A3-6 Uncertainties in NFR group Mineral Industry.

Mineral Industry	Pollutant	Unit	Emissions 1990 [Unit]	Emissions 2024 [Unit]	Uncertainty total 2024 [%]	Absolute uncertainty 2024 [Unit]	Trend uncertainty 2024 [%]
Main pollutants	NO_x	kt	0.0	0.0	-	-	-
	NMVOC	kt	0.0	0.0	-	-	-
	SO_2	kt	0.0019	3.1.E-05	20	6.3.E-06	0.42
	NH_3	kt	0.0063	0.0066	10	6.8.E-04	0.64
Particulate Matter	$PM_{2.5}$	kt	0.25	0.085	123	0.10	29
	PM_{10}	kt	1.6	0.59	172	1.0	53
	TSP	kt	4.8	1.9	191	3.6	56
	BC	kt	4.2.E-04	1.2.E-04	10	1.3.E-05	0.68
Other	CO	kt	0.016	0.0032	10	3.3.E-04	0.73
Priority Heavy Metals	Pb	t	0.0	0.0	-	-	-
	Cd	t	0.0	0.0	-	-	-
	Hg	t	0.0	0.0	-	-	-
Additional Heavy Metals	As	t	0.0	0.0	-	-	-
	Cr	t	0.0	0.0	-	-	-

Mineral Industry	Pollutant	Unit	Emissions 1990 [Unit]	Emissions 2024 [Unit]	Uncertainty total 2024 [%]	Absolute uncertainty 2024 [Unit]	Trend uncertainty 2024 [%]
	Cu	t	0.0	0.0	-	-	-
	Ni	t	0.0	0.0	-	-	-
	Se	t	0.0	0.0	-	-	-
	Zn	t	0.0	0.0	-	-	-
POPs	Dioxin	g I-TEQ	0.0058	5.0.E-05	150	7.5.E-05	0.26
	BaP	t	0.0	0.0	-	-	-
	BbF	t	0.0	0.0	-	-	-
	BkF	t	0.0	0.0	-	-	-
	Ipy	t	0.0	0.0	-	-	-
	PAH	t	0.0	0.0	-	-	-
	HCB	kg	0.0	0.0	-	-	-
	PCB	kg	0.0	0.0	-	-	-

Table A3-7 Uncertainties in NFR group Metal Production.

Metal Production	Pollutant	Unit	Emissions 1990 [Unit]	Emissions 2024 [Unit]	Uncertainty total 2024 [%]	Absolute uncertainty 2024 [Unit]	Trend uncertainty 2024 [%]
Main pollutants	NO_x	kt	0.75	2.3	17	0.40	12
	NMVOC	kt	0.0028	0.0054	30	0.0016	1.1
	SO_2	kt	3.18	12.6	21	2.70	29
	NH_3	kt	0.0	0.0088	20	0.0018	0
Particulate Matter	$PM_{2.5}$	kt	0.10	0.37	116	0.43	43
	PM_{10}	kt	0.17	0.55	107	0.59	34
	TSP	kt	0.21	0.66	111	0.73	32
	BC	kt	1.5.E-04	0.0073	64	0.0047	15
Other	CO	kt	10.7	102.5	87	88.9	114
Priority Heavy Metals	Pb	t	0.018	0.17	34	0.059	14
	Cd	t	0.013	0.13	34	0.044	87
	Hg	t	9.0.E-04	4.8.E-06	20	9.6.E-07	1.0
Additional Heavy Metals	As	t	0.015	0.13	35	0.046	71
	Cr	t	0.010	0.087	34	0.029	42
	Cu	t	0.015	0.15	33	0.049	14
	Ni	t	0.17	1.7	35	0.59	55

Metal Production	Pollutant	Unit	Emissions 1990 [Unit]	Emissions 2024 [Unit]	Uncertainty total 2024 [%]	Absolute uncertainty 2024 [Unit]	Trend uncertainty 2024 [%]
	Se	t	0.0	0.0	-	-	-
	Zn	t	0.44	4.2	35	1.5	68
POPs	Dioxin	g I-TEQ	0.014	0.16	120	0.19	13
	BaP	t	4.3.E-04	0.0026	132	0.0034	17
	BbF	t	0.0076	0.023	106	0.024	32
	BkF	t	0.0022	0.0065	106	0.0070	17
	Ipy	t	7.4.E-04	0.0024	106	0.0026	33
	PAH	t	0.011	0.034	78	0.027	21
	HCB	kg	0.0	0.018	150	0.026	0
	PCB	kg	0.0	0.0	-	-	-

Table A3-8 Uncertainties in NFR group Solvent and Product Use.

Solvent and Product Use	Pollutant	Unit	Emissions 1990 [Unit]	Emissions 2024 [Unit]	Uncertainty total 2024 [%]	Absolute uncertainty 2024 [Unit]	Trend uncertainty 2024 [%]
Main pollutants	NO_x	kt	0.0	0.0	-	-	-
	NMVOC	kt	0.95	2.3	81	1.9	45
	SO_2	kt	0.0	0.0	-	-	-
	NH_3	kt	0.0	0.0	-	-	-
Particulate Matter	$PM_{2.5}$	kt	9.9.E-05	1.5.E-04	400	5.8.E-04	1.4
	PM_{10}	kt	7.4.E-04	0.0011	233	0.0026	2.0
	TSP	kt	0.0034	0.0051	900	0.046	6.3
	BC	kt	5.6.E-06	8.3.E-06	93	7.7.E-06	0.51
Other	CO	kt	0.0	0.0	-	-	-
Priority Heavy Metals	Pb	t	0.0	0.0	-	-	-
	Cd	t	0.0	0.0	-	-	-
	Hg	t	0.0	0.0	-	-	-
Additional Heavy Metals	As	t	0.0	0.0	-	-	-
	Cr	t	0.0	0.0	-	-	-
	Cu	t	0.0	0.0	-	-	-
	Ni	t	0.0	0.0	-	-	-
	Se	t	0.0	0.0	-	-	-
	Zn	t	0.0	0.0	-	-	-

Solvent and Product Use	Pollutant	Unit	Emissions 1990 [Unit]	Emissions 2024 [Unit]	Uncertainty total 2024 [%]	Absolute uncertainty 2024 [Unit]	Trend uncertainty 2024 [%]
POPs	Dioxin	g I-TEQ	0.0012	0.0020	150	0.0	1.6
	BaP	t	0.0	0.0	-	-	-
	BbF	t	0.0	0.0	-	-	-
	BkF	t	0.0	0.0	-	-	-
	Ipy	t	0.0	0.0	-	-	-
	PAH	t	0.0	0.0	-	-	-
	HCB	kg	0.0	0.0	-	-	-
	PCB	kg	0.0	0.0	-	-	-

Table A3-9 Uncertainties in NFR group Other Product Use.

Other Product Use	Pollutant	Unit	Emissions 1990 [Unit]	Emissions 2024 [Unit]	Uncertainty total 2024 [%]	Absolute uncertainty 2024 [Unit]	Trend uncertainty 2024 [%]
Main pollutants	NO_x	kt	0.0010	4.1.E-04	41	1.7.E-04	0.25
	NMVOC	kt	0.0027	6.6.E-04	100	6.6.E-04	1.2
	SO_2	kt	3.4.E-04	0.0019	50	0.0010	0.50
	NH_3	kt	0.0023	5.6.E-04	6.3	3.6.E-05	0.44
Particulate Matter	$PM_{2.5}$	kt	0.0211	0.037	73	0.027	13
	PM_{10}	kt	0.027	0.068	57	0.039	11
	TSP	kt	0.028	0.074	52	0.039	7.2
	BC	kt	6.8.E-05	1.7.E-05	99	1.6.E-05	0.79
Other	CO	kt	0.032	0.012	3.3	4.0.E-04	0.61
Priority Heavy Metals	Pb	t	0.090	0.031	282	0.088	7.28
	Cd	t	1.8.E-04	0.0010	844	8.0.E-03	15.6
	Hg	t	1.2.E-05	3.8.E-05	749	0.000	4.5
Additional Heavy Metals	As	t	2.4.E-04	8.8.E-04	856	7.5.E-03	26.0
	Cr	t	0.0019	0.0100	860	0.086	65
	Cu	t	0.051	0.29	350	1.00	58
	Ni	t	0.0034	0.019	400	0.077	19.0
	Se	t	5.6.E-06	1.4.E-06	50	6.8.E-07	0.54
	Zn	t	0.031	0.17	668	1.12	51
POPs	Dioxin	g I-TEQ	5.6.E-05	1.4.E-05	100	1.4.E-05	0.10
	BaP	t	6.2.E-05	1.5.E-05	98	1.5.E-05	0.81

Other Product Use	Pollutant	Unit	Emissions 1990 [Unit]	Emissions 2024 [Unit]	Uncertainty total 2024 [%]	Absolute uncertainty 2024 [Unit]	Trend uncertainty 2024 [%]
	BbF	t	2.5.E-05	6.1.E-06	100	6.1.E-06	0.25
	BkF	t	2.5.E-05	6.1.E-06	100	6.1.E-06	0.38
	Ipy	t	2.5.E-05	6.1.E-06	100	6.1.E-06	2.0
	PAH	t	1.4.E-04	3.3.E-05	59	2.0.E-05	0.35
	HCB	kg	0.12	0.030	123	0.037	33
	PCB	kg	0.0	0.0	-	-	-

Table A3-10 Uncertainties in NFR group Other Industry.

Other Industry	Pollutant	Unit	Emissions 1990 [Unit]	Emissions 2024 [Unit]	Uncertainty total 2024 [%]	Absolute uncertainty 2024 [Unit]	Trend uncertainty 2024 [%]
Main pollutants	NO_x	kt	0.0	0.0	-	-	-
	NMVOC	kt	0.12	0.59	900	5.3	74
	SO_2	kt	0.0	0.0	-	-	-
	NH_3	kt	0.0	0.0	-	-	-
Particulate Matter	$PM_{2.5}$	kt	0.0	0.0	-	-	-
	PM_{10}	kt	0.0	0.0	-	-	-
	TSP	kt	0.0	0.0	-	-	-
	BC	kt	0.0	0.0	-	-	-
Other	CO	kt	0.0	0.0	-	-	-
Priority Heavy Metals	Pb	t	0.0	0.0	-	-	-
	Cd	t	0.0	0.0	-	-	-
	Hg	t	0.0	0.0	-	-	-
Additional Heavy Metals	As	t	0.0	0.0	-	-	-
	Cr	t	0.0	0.0	-	-	-
	Cu	t	0.0	0.0	-	-	-
	Ni	t	0.0	0.0	-	-	-
	Se	t	0.0	0.0	-	-	-
	Zn	t	0.0	0.0	-	-	-
POPs	Dioxin	g I-TEQ	0.0	0.0	-	-	-
	BaP	t	0.0	0.0	-	-	-
	BbF	t	0.0	0.0	-	-	-
	BkF	t	0.0	0.0	-	-	-

Other Industry	Pollutant	Unit	Emissions 1990 [Unit]	Emissions 2024 [Unit]	Uncertainty total 2024 [%]	Absolute uncertainty 2024 [Unit]	Trend uncertainty 2024 [%]
	Ipy	t	0.0	0.0	-	-	-
	PAH	t	0.0	0.0	-	-	-
	HCB	kg	0.0	0.0	-	-	-
	PCB	kg	0.0	0.0	-	-	-

A3.3 Agriculture

Table summarises the uncertainty values (in %) for the main pollutants, particulate matter, and CO in the Agriculture sector, aggregated according to NFR level.

Table A3-11 NFR-level aggregated uncertainty in Agriculture 2024 [values as %]

NFR	NO_x	NMVOC	SO_2	NH_3	$PM_{2.5}$	PM_{10}	TSP	BC	CO
3B1a	103	103	-	103	103	103	103	-	-
3B1b	103	103	-	103	103	103	103	-	-
3B2	116	116	-	116	116	116	116	-	-
3B3	116	116	-	116	116	116	116	-	-
3B4d	116	116	-	116	116	116	116	-	-
3B4e	117	117	-	117	117	117	117	-	-
3B4g	82	79	-	87	76	76	76	-	-
3B4h	123	123	-	123	123	123	123	-	-
3Da1	160	-	-	100	-	-	-	-	-
3Da2	159	-	-	114	-	-	-	-	-
3Da3	127	-	-	127	-	-	-	-	-
3Da4	-	-	-	-	-	-	-	-	-
3Db	-	-	-	-	-	-	-	-	-
3Dc	-	-	-	-	400	400	400	-	-
3Dd	-	-	-	-	-	-	-	-	-
3De	-	301	-	-	-	-	-	-	-
3Df	-	-	-	-	-	-	-	-	-
3F	-	-	-	-	-	-	-	-	-
3I	-	-	-	-	-	-	-	-	-

Table A3-12 and

Table summarise emissions, estimated uncertainty in percent and absolute emission mass, as well as uncertainty in the trend (in %), aggregated by NFR group within the Agriculture sector for all pollutants.

Table A3-12 Uncertainties in NFR group Manure Management.

Manure Management	Pollutant	Unit	Emissions 1990 [Unit]	Emissions 2024 [Unit]	Uncertainty total 2024 [%]	Absolute uncertainty 2024 [Unit]	Trend uncertainty 2024 [%]
Main pollutants	NO_x	kt	0.034	0.026	67	0.018	2.4
	NMVOC	kt	1.6	1.4	56	0.79	25

Manure Management	Pollutant	Unit	Emissions 1990 [Unit]	Emissions 2024 [Unit]	Uncertainty total 2024 [%]	Absolute uncertainty 2024 [Unit]	Trend uncertainty 2024 [%]
	SO_2	kt	0.0	0.0	-	-	-
	NH_3	kt	2.4	2.1	51	1.1	35
Particulate Matter	$PM_{2.5}$	kt	0.027	0.033	48	0.016	8.8
	PM_{10}	kt	0.077	0.12	52	0.065	14
	TSP	kt	0.14	0.18	46	0.083	10
	BC	kt	0.0	0.0	-	-	-
Other	CO	kt	0.0	0.0	-	-	-
Priority Heavy Metals	Pb	t	0.0	0.0	-	-	-
	Cd	t	0.0	0.0	-	-	-
	Hg	t	0.0	0.0	-	-	-
Additional Heavy Metals	As	t	0.0	0.0	-	-	-
	Cr	t	0.0	0.0	-	-	-
	Cu	t	0.0	0.0	-	-	-
	Ni	t	0.0	0.0	-	-	-
	Se	t	0.0	0.0	-	-	-
	Zn	t	0.0	0.0	-	-	-
POPs	Dioxin	g I-TEQ	0.0	0.0	-	-	-
	BaP	t	0.0	0.0	-	-	-
	BbF	t	0.0	0.0	-	-	-
	BkF	t	0.0	0.0	-	-	-
	Ipy	t	0.0	0.0	-	-	-
	PAH	t	0.0	0.0	-	-	-
	HCB	kg	0.0	0.0	-	-	-
	PCB	kg	0.0	0.0	-	-	-

Table A3-13 Uncertainties in NFR group Crop and Agricultural Soils.

Crop and Agricultural Soils	Pollutant	Unit	Emissions 1990 [Unit]	Emissions 2024 [Unit]	Uncertainty total 2024 [%]	Absolute uncertainty 2024 [Unit]	Trend uncertainty 2024 [%]
Main pollutants	NO_x	kt	1.0	0.88	94	0.82	13
	NMVOC	kt	0.014	0.010	301	0.029	1.9
	SO_2	kt	0.0	0.0	-	-	-
	NH_3	kt	2.9	2.9	70	2.0	53

Crop and Agricultural Soils	Pollutant	Unit	Emissions 1990 [Unit]	Emissions 2024 [Unit]	Uncertainty total 2024 [%]	Absolute uncertainty 2024 [Unit]	Trend uncertainty 2024 [%]
Particulate Matter	$PM_{2.5}$	kt	0.0021	0.0019	400	0.0076	2.1
	PM_{10}	kt	0.052	0.044	400	0.18	8.4
	TSP	kt	0.052	0.044	400	0.18	8.1
	BC	kt	0.0	0.0	-	-	-
Other	CO	kt	0.0	0.0	-	-	-
Priority Heavy Metals	Pb	t	0.0	0.0	-	-	-
	Cd	t	0.0	0.0	-	-	-
	Hg	t	0.0	0.0	-	-	-
Additional Heavy Metals	As	t	0.0	0.0	-	-	-
	Cr	t	0.0	0.0	-	-	-
	Cu	t	0.0	0.0	-	-	-
	Ni	t	0.0	0.0	-	-	-
	Se	t	0.0	0.0	-	-	-
	Zn	t	0.0	0.0	-	-	-
POPs	Dioxin	g I-TEQ	0.0	0.0	-	-	-
	BaP	t	0.0	0.0	-	-	-
	BbF	t	0.0	0.0	-	-	-
	BkF	t	0.0	0.0	-	-	-
	Ipy	t	0.0	0.0	-	-	-
	PAH	t	0.0	0.0	-	-	-
	HCB	kg	0.0	0.0	-	-	-
	PCB	kg	0.0	0.0	-	-	-

A3.4 Waste

Table A3-14 summarises the uncertainty values (in %) for the main pollutants, particulate matter, and CO in the Waste sector, aggregated according to NFR level.

Table A3-14 NFR-level aggregated uncertainty in Agriculture 2024 [values as %]

NFR	NO_x	NMVOC	SO_2	NH_3	$PM_{2.5}$	PM_{10}	TSP	BC	CO
5A	-	101	-	-	386	129	378	-	-
5B1	-	-	-	194	-	-	-	-	95
5B2	-	-	-	-	-	-	-	-	-
5C1a	49	121	436	510	178	178	178	102	518
5C1b	900	524	900	-	900	900	900	-	900
5C2	204	204	194	144	203	203	203	76	203
5D1	-	-	-	-	-	-	-	-	-
5D2	-	-	-	-	-	-	-	-	-
5D3	-	-	-	-	-	-	-	-	-
5E	502	502	304	-	111	111	111	-	502

Table to Table A3-18 summarise emissions, estimated uncertainty in percent and absolute emission mass, as well as uncertainty in the trend (in %), aggregated by NFR group within the Waste sector for all pollutants. Air pollutant emissions from Wastewater Treatment do not occur in Iceland; the respective NFR group is therefore skipped.

Table A3-15 Uncertainties in NFR group Solid Waste Disposal.

Solid Waste Disposal	Pollutant	Unit	Emissions 1990 [Unit]	Emissions 2024 [Unit]	Uncertainty total 2024 [%]	Absolute uncertainty 2024 [Unit]	Trend uncertainty 2024 [%]
Main pollutants	NO_x	kt	0.0	0.0	-	-	-
	NMVOC	kt	0.022	0.026	101	0.026	3.9
	SO_2	kt	0.0	0.0	-	-	-
	NH_3	kt	0.0	0.0	-	-	-
Particulate Matter	$PM_{2.5}$	kt	1.0.E-05	2.7.E-06	386	1.0.E-05	0.42
	PM_{10}	kt	6.9.E-05	1.8.E-05	129	2.3.E-05	0.38
	TSP	kt	1.5.E-04	3.7.E-05	378	1.4.E-04	0.57
	BC	kt	0.0	0.0	-	-	-
Other	CO	kt	0.0	0.0	-	-	-
	Pb	t	0.0	0.0	-	-	-

Solid Waste Disposal	Pollutant	Unit	Emissions 1990 [Unit]	Emissions 2024 [Unit]	Uncertainty total 2024 [%]	Absolute uncertainty 2024 [Unit]	Trend uncertainty 2024 [%]
Priority Heavy Metals	Cd	t	0.0	0.0	-	-	-
	Hg	t	0.0	0.0	-	-	-
Additional Heavy Metals	As	t	0.0	0.0	-	-	-
	Cr	t	0.0	0.0	-	-	-
	Cu	t	0.0	0.0	-	-	-
	Ni	t	0.0	0.0	-	-	-
	Se	t	0.0	0.0	-	-	-
	Zn	t	0.0	0.0	-	-	-
POPs	Dioxin	g I-TEQ	0.0	0.0	-	-	-
	BaP	t	0.0	0.0	-	-	-
	BbF	t	0.0	0.0	-	-	-
	BkF	t	0.0	0.0	-	-	-
	Ipy	t	0.0	0.0	-	-	-
	PAH	t	0.0	0.0	-	-	-
	HCB	kg	0.0	0.0	-	-	-
	PCB	kg	0.0	0.0	-	-	-

Table A3-16 Uncertainties in NFR group Biological Treatment.

Biological Treatment	Pollutant	Unit	Emissions 1990 [Unit]	Emissions 2024 [Unit]	Uncertainty total 2024 [%]	Absolute uncertainty 2024 [Unit]	Trend uncertainty 2024 [%]
Main pollutants	NO_x	kt	0.0	0.0	-	-	-
	NMVOC	kt	0.0	0.0	-	-	-
	SO_2	kt	0.0	0.0	-	-	-
	NH_3	kt	0.0	0.0076	194	0.015	0
Particulate Matter	$PM_{2.5}$	kt	0.0	0.0	-	-	-
	PM_{10}	kt	0.0	0.0	-	-	-
	TSP	kt	0.0	0.0	-	-	-
	BC	kt	0.0	0.0	-	-	-
Other	CO	kt	0.0	0.018	95	0.017	0
Priority Heavy Metals	Pb	t	0.0	0.0	-	-	-
	Cd	t	0.0	0.0	-	-	-
	Hg	t	0.0	0.0	-	-	-

Biological Treatment	Pollutant	Unit	Emissions 1990 [Unit]	Emissions 2024 [Unit]	Uncertainty total 2024 [%]	Absolute uncertainty 2024 [Unit]	Trend uncertainty 2024 [%]
Additional Heavy Metals	As	t	0.0	0.0	-	-	-
	Cr	t	0.0	0.0	-	-	-
	Cu	t	0.0	0.0	-	-	-
	Ni	t	0.0	0.0	-	-	-
	Se	t	0.0	0.0	-	-	-
	Zn	t	0.0	0.0	-	-	-
POPs	Dioxin	g I-TEQ	0.0	0.0	-	-	-
	BaP	t	0.0	0.0	-	-	-
	BbF	t	0.0	0.0	-	-	-
	BkF	t	0.0	0.0	-	-	-
	Ipy	t	0.0	0.0	-	-	-
	PAH	t	0.0	0.0	-	-	-
	HCB	kg	0.0	0.0	-	-	-
	PCB	kg	0.0	0.0	-	-	-

Table A3-17 Uncertainties in NFR group Waste Incineration.

Waste Incineration	Pollutant	Unit	Emissions 1990 [Unit]	Emissions 2024 [Unit]	Uncertainty total 2024 [%]	Absolute uncertainty 2024 [Unit]	Trend uncertainty 2024 [%]
Main pollutants	NO_x	kt	0.12	0.067	49	0.033	7.3
	NMVOC	kt	0.047	0.025	480	0.12	8.6
	SO_2	kt	0.0042	0.0022	376	0.0083	2.8
	NH_3	kt	7.1.E-04	2.7.E-04	139	3.8.E-04	1.1
Particulate Matter	$PM_{2.5}$	kt	0.16	0.0073	199	0.014	44
	PM_{10}	kt	0.17	0.0078	200	0.016	28
	TSP	kt	0.18	0.0080	200	0.016	18
	BC	kt	0.067	0.0030	76	0.0023	29
Other	CO	kt	2.1	0.095	202	0.19	39
Priority Heavy Metals	Pb	t	0.019	0.0054	57	0.0031	5.5
	Cd	t	0.0038	5.9.E-04	65	3.9.E-04	142
	Hg	t	0.13	0.0031	534	0.016	42
Additional Heavy Metals	As	t	0.016	8.2.E-04	178	0.0015	95
	Cr	t	0.000	1.9.E-04	351	6.6.E-04	11

Waste Incineration	Pollutant	Unit	Emissions 1990 [Unit]	Emissions 2024 [Unit]	Uncertainty total 2024 [%]	Absolute uncertainty 2024 [Unit]	Trend uncertainty 2024 [%]
	Cu	t	0.0076	0.0018	669	0.012	12
	Ni	t	0.0043	8.7.E-04	108	9.5.E-04	14
	Se	t	0.0027	2.5.E-04	221	5.4.E-04	28
	Zn	t	0.67	0.030	201	0.061	120
POPs	Dioxin	g I-TEQ	10.5	0.36	18071	64.3	34
	BaP	t	0.089	0.0040	203	0.0080	34
	BbF	t	0.18	0.0079	203	0.016	48
	BkF	t	0.22	0.010	203	0.020	34
	Ipy	t	0.0054	0.0022	901	0.020	65
	PAH	t	0.49	0.024	203	0.048	42
	HCB	kg	0.13	0.062	714	0.45	105
	PCB	kg	0.19	0.012	862	0.10	58

Table A3-18 Uncertainties in NFR group Other Waste.

Other Waste	Pollutant	Unit	Emissions 1990 [Unit]	Emissions 2024 [Unit]	Uncertainty total 2024 [%]	Absolute uncertainty 2024 [Unit]	Trend uncertainty 2024 [%]
Main pollutants	NO_x	kt	6.0.E-04	0.0010	502	0.0051	1.2
	NMVOC	kt	0.0029	0.0050	502	0.025	4.2
	SO_2	kt	0.0080	0.015	304	0.045	2.6
	NH_3	kt	0.0	0.0	-	-	-
Particulate Matter	$PM_{2.5}$	kt	0.0042	0.0062	111	0.0069	6.2
	PM_{10}	kt	0.0042	0.0062	111	0.0069	4.2
	TSP	kt	0.0042	0.0062	111	0.0069	2.9
	BC	kt	0.0	0.0	-	-	-
Other	CO	kt	0.011	0.017	502	0.087	2.0
Priority Heavy Metals	Pb	t	0.056	0.071	132	0.094	17
	Cd	t	1.3.E-04	1.6.E-04	107	1.8.E-04	16
	Hg	t	9.5.E-06	1.7.E-05	107	1.8.E-05	1.2
Additional Heavy Metals	As	t	3.3.E-05	5.0.E-05	118	5.9.E-05	2.4
	Cr	t	2.7.E-04	3.6.E-04	112	4.0.E-04	4.8
	Cu	t	0.0019	0.0024	114	0.0027	3.4
	Ni	t	1.9.E-04	2.4.E-04	502	0.0012	1.2

Other Waste	Pollutant	Unit	Emissions 1990 [Unit]	Emissions 2024 [Unit]	Uncertainty total 2024 [%]	Absolute uncertainty 2024 [Unit]	Trend uncertainty 2024 [%]
	Se	t	0.0	0.0	-	-	-
	Zn	t	0.22	0.28	502	1.4	79
POPs	Dioxin	g I-TEQ	0.085	0.15	106	0.16	13
	BaP	t	0.0012	0.0016	502	0.0082	26
	BbF	t	0.0014	0.0019	502	0.010	20
	BkF	t	0.0012	0.0016	502	0.0080	18
	Ipy	t	0.0018	0.0024	502	0.012	59
	PAH	t	0.0056	0.0076	502	0.038	24
	HCB	kg	0.0	0.0	-	-	-
	PCB	kg	0.0	0.0	-	-	-