# INFORMATIVE INVENTORY REPORT
# AIR POLLUTANTS

## SUBMISSION TO THE SECRETARIAT OF THE UNECE CONVENTION ON LONG-RANGE TRANSBOUNDARY AIR POLLUTION AND TO THE EUROPEAN UNION UNDER DIRECTIVE (EU) 2016/2284

2026 EDITION (1990-2024)
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Edition 2026

MINISTERIO PARA LA TRANSICIÓN ECOLÓGICA
Y EL RETO DEMOGRÁFICO

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Executive summary: Castillo d'Acher (Huesca, Spain), by Sofía Bueno Hernández

Introduction: Ares beach (A Coruña, Spain), by Sara Torre Sales

Explanation of key trends: Illa de l'Aire (Balearic Islands, Spain), by David Sánchez Vicente

Energy (NFR 1): Almendra Dam (Salamanca-Zamora, Spain), by David Sánchez Vicente

IPPU (NFR 2): Oil refinery, Cartagena (Murcia, Spain), by Martín Fernández Díez-Picazo

Agriculture (NFR 3): Olive grove landscape (Jaén, Spain), by Mario Fernández Barrena

Waste (NFR 5): Municipal Solid Waste (MSW) Cañada Hermosa (Murcia, Spain), by Mario Fernández Barrena

Natural emissions (NFR 11): Valley of Iruelas (Ávila, Spain), by Sonia Lázaro Navas

Recalculations and planned improvements: Sardón de los Frailes (Salamanca, Spain), by David Sánchez Vicente

Projections: Cíes Islands (Pontevedra, Spain), by Nuria Escudero Aguado

Reporting of gridded emissions and LPS: Valley of Iruelas (Ávila, Spain), by Sonia Lázaro Navas

Adjustments: Abandoned village of "Poncieda" (Cantabria, Spain), by Sofía Bueno Hernández

Annexes: "Bardenas Reales" (Navarra, Spain), by Sonia Lázaro Navas

Glossary: Albarracín (Teruel, Spain), by Sara Torre Sales

References: (Madrid, Spain), by Sonia Lázaro Navas

# CONTENTS

# 0. EXECUTIVE SUMMARY

# CONTENTS

## FIGURES



## TABLES

# 0. EXECUTIVE SUMMARY

Chapter updated in March, 2026.

## 0.1. General introduction

The 2026 edition of the Informative Inventory Report (IIR) has been elaborated by the Spanish National Inventory System (SEI) within the Ministry for the Ecological Transition and the Demographic Challenge (MITECO) in accordance with its regulatory framework established by Law 34/2007 for air quality and atmosphere protection, and Royal Decrees 818/2018, 503/2024, and 91/2025.

This report is compiled to accompany the Spain's 2026 emissions inventory data submission under the United Nations Economic Commission for Europe (UNECE) Convention on Long-Range Transboundary Air Pollution (CLRTAP) and its Protocols, and under Directive (EU) 2016/2284 of the European Parliament and of the Council, on the reduction of national emissions of certain atmospheric pollutants. It contains detailed information on annual emission estimates of air pollutants by source in Spain for the whole national territory, in the case of the CLRTAP report, and for the national territory excluding the Canary Islands, in the case of the Directive (EU) 2016/2284 (as established by its article 2.2).

## 0.2. Emissions and geographical coverage

Pollutants covered by the Inventory and for which emissions data are reported, are indicated in the following table.

**Table 0.2.1 Pollutants emission data reported**

| | | | |
|---|---|---|---|
| **Pollutant's coverage** | Main Pollutants. | $SO_2$, $NH_3$ | 1990-2024 |
| | | NOx (*) | 1987-2024 |
| | | NMVOC (*) | 1988-2024 |
| | Particulate Matter (PM). | $PM_{2.5}$, $PM_{10}$, TSP, BC | 2000-2024 |
| | Heavy Metals (priority). | Pb, Cd, Hg | 1990-2024 |
| | Heavy Metals (additional). | As, Cr, Cu, Ni, Se, Zn | 1990-2024 |
| | Carbon monoxide. | CO | 1990-2024 |
| | Persistent Organic Pollutants (POPs). | PCDD/F, PAHs, HCB, PCBs | 1990-2024 |

(*) data per sector: only from 1990 onwards.

The Spanish National Emission Inventory under CLRTAP covers the whole national territory, while the Spanish National Emission Inventory under Directive (EU) 2016/2284 does not cover emissions in the Canary Islands.

**Table 0.2.2 Geographical coverage under the different reporting obligations**

| Report obligation | Emissions geographical coverage | Observations |
|---|---|---|
| NEC Directive 2016/2284 | NEC Directive 2016/2284 | Canary Islands excluded |
| LRTAP Convention | Total National Territory | Including Canary Islands |
| Governance Regulation (EU) 2018/1999 | Total National Territory | Including Canary Islands |

| Report obligation | Emissions geographical coverage | Observations |
|---|---|---|
| UNFCCC Inventory for greenhouse gas emissions | Total National Territory | Including Canary Islands |

The different geographic coverage (including or excluding the Canary Islands) is the main reason for differences in pollutants emission national totals reported under Directive (EU) 2016/2284 and under the Regulation (EU) 2018/1999 and UNFCCC (CO, NMVOC, NOx, $SO_2$ and $NH_3$ are reported to the EU and to UNFCCC under obligations related to climate change, as precursors of greenhouse gases).

Total emissions of NOx and NMVOC pollutants from 1987 and 1988, respectively, are included in compliance with the Sofia Protocol concerning the Control of Emissions of Nitrogen Oxides or their Transboundary Fluxes and the Geneva Protocol concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes.

## 0.3. Summary of main emissions

Total emission data reported under CLRTAP (whole national territory) and under Directive (EU) 2016/2284 (excluding the Canary Islands) in the 2026 edition of the National Inventory, excluding Memo items, are shown in the following table for all covered pollutants.

**Table 0.3.1 Total emissions data, whole national territory**

| Year | NOx (kt) | NMVOC (kt) | $SO_2$ (kt) | $NH_3$ (kt) | $PM_{2.5}$ (kt) | $PM_{10}$ (kt) | TSP (kt) | BC (kt) | CO (kt) |
|---|---|---|---|---|---|---|---|---|---|
| **1987** | 1,169 | - | - | - | - | - | - | - | - |
| **1988** | 1,205 | 918 | - | - | - | - | - | - | - |
| **1989** | 1,314 | 945 | - | - | - | - | - | - | - |
| **1990** | 1,342 | 1,042 | 2,123 | 535 | - | - | - | - | 4,166 |
| **1995** | 1,384 | 929 | 1,820 | 520 | - | - | - | - | 3,177 |
| **2000** | 1,401 | 901 | 1,419 | 615 | 177 | 298 | 456 | 45 | 2,540 |
| **2005** | 1,386 | 732 | 1,230 | 522 | 157 | 287 | 476 | 43 | 1,864 |
| **2010** | 971 | 603 | 260 | 479 | 143 | 236 | 355 | 41 | 1,588 |
| **2015** | 854 | 564 | 270 | 497 | 132 | 217 | 318 | 35 | 1,443 |
| **2019** | 753 | 553 | 167 | 492 | 112 | 194 | 293 | 31 | 1,251 |
| **2020** | 639 | 564 | 120 | 499 | 108 | 186 | 277 | 31 | 1,150 |
| **2021** | 663 | 552 | 118 | 500 | 105 | 184 | 281 | 31 | 1,207 |
| **2023** | 592 | 513 | 101 | 447 | 91 | 165 | 253 | 24 | 943 |
| **2024** | 588 | 501 | 97 | 453 | 91 | 165 | 254 | 24 | 978 |

| Year | Pb (t) | Cd (t) | Hg (t) | As (t) | Cr (t) | Cu (t) | Ni (t) | Se (t) | Zn (t) | PCDD/F (g I TEQ) | PAHs (t) | HCB (kg) | PCB (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1990** | 3,285 | 29 | 12 | 11 | 30 | 82 | 201 | 8 | 273 | 489 | 114 | 58 | 2,241 |
| **1995** | 812 | 23 | 14 | 10 | 32 | 95 | 235 | 8 | 247 | 505 | 93 | 60 | 2,286 |
| **2000** | 305 | 18 | 10 | 11 | 37 | 126 | 254 | 9 | 303 | 269 | 74 | 16 | 2,116 |
| **2005** | 154 | 12 | 9 | 10 | 37 | 144 | 234 | 10 | 307 | 253 | 62 | 5 | 1,594 |
| **2010** | 134 | 8 | 5 | 6 | 29 | 137 | 147 | 7 | 308 | 247 | 61 | 12 | 851 |
| **2015** | 110 | 7 | 5 | 6 | 28 | 125 | 85 | 7 | 304 | 244 | 58 | 10 | 606 |
| **2019** | 103 | 7 | 4 | 4 | 26 | 128 | 91 | 7 | 283 | 207 | 42 | 13 | 504 |

| Year | Pb (t) | Cd (t) | Hg (t) | As (t) | Cr (t) | Cu (t) | Ni (t) | Se (t) | Zn (t) | PCDD/F (g I TEQ) | PAHs (t) | HCB (kg) | PCB (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2020 | 84 | 6 | 3 | 4 | 23 | 106 | 68 | 7 | 278 | 191 | 37 | 9 | 455 |
| 2021 | 98 | 6 | 3 | 4 | 23 | 119 | 66 | 7 | 291 | 205 | 37 | 2 | 391 |
| 2023 | 114 | 6 | 3 | 4 | 23 | 119 | 61 | 6 | 258 | 169 | 33 | 2 | 93 |
| 2024 | 96 | 6 | 3 | 3 | 22 | 122 | 59 | 6 | 257 | 171 | 34 | 2 | 92 |

**Table 0.3.2 Total emissions data, excluding the Canary Islands**

| Year | NOx (kt) | NMVOC (kt) | $SO_2$ (kt) | $NH_3$ (kt) | $PM_{2.5}$ (kt) | $PM_{10}$ (kt) | TSP (kt) | BC (kt) | CO (kt) |
|---|---|---|---|---|---|---|---|---|---|
| 1990 | 1,281 | 1,013 | 2,046 | 528 | - | - | - | - | 4,088 |
| 1995 | 1,293 | 904 | 1,765 | 516 | - | - | - | - | 3,110 |
| 2000 | 1,300 | 867 | 1,387 | 611 | 172 | 292 | 446 | 44 | 2,425 |
| 2005 | 1,292 | 707 | 1,206 | 517 | 153 | 280 | 465 | 42 | 1,781 |
| 2010 | 900 | 586 | 243 | 475 | 139 | 231 | 347 | 40 | 1,547 |
| 2015 | 792 | 549 | 259 | 493 | 129 | 212 | 311 | 34 | 1,412 |
| 2019 | 683 | 539 | 150 | 489 | 108 | 189 | 286 | 30 | 1,223 |
| 2020 | 580 | 549 | 112 | 496 | 105 | 181 | 271 | 30 | 1,127 |
| 2021 | 604 | 538 | 111 | 497 | 102 | 180 | 275 | 30 | 1,184 |
| 2023 | 535 | 500 | 93 | 444 | 89 | 161 | 247 | 24 | 922 |
| 2024 | 530 | 489 | 90 | 450 | 88 | 161 | 248 | 23 | 956 |

| Year | Pb (t) | Cd (t) | Hg (t) | As (t) | Cr (t) | Cu (t) | Ni (t) | Se (t) | Zn (t) | PCDD/F (g I TEQ) | PAHs (t) | HCB (kg) | PCB (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990 | 3,181 | 28 | 11 | 10 | 27 | 79 | 164 | 7 | 268 | 484 | 113 | 57 | 2,185 |
| 1995 | 790 | 22 | 13 | 10 | 29 | 91 | 192 | 7 | 241 | 493 | 92 | 60 | 2,221 |
| 2000 | 278 | 16 | 9 | 10 | 34 | 117 | 201 | 8 | 295 | 258 | 74 | 16 | 2,053 |
| 2005 | 142 | 10 | 7 | 9 | 33 | 132 | 179 | 8 | 298 | 249 | 62 | 4 | 1,544 |
| 2010 | 127 | 6 | 4 | 5 | 25 | 129 | 98 | 6 | 301 | 243 | 60 | 12 | 824 |
| 2015 | 105 | 6 | 4 | 5 | 25 | 118 | 45 | 6 | 297 | 241 | 57 | 10 | 587 |
| 2019 | 98 | 6 | 3 | 4 | 23 | 121 | 48 | 6 | 275 | 204 | 42 | 13 | 488 |
| 2020 | 81 | 5 | 3 | 3 | 20 | 100 | 37 | 6 | 272 | 188 | 37 | 9 | 440 |
| 2021 | 94 | 6 | 3 | 3 | 21 | 112 | 38 | 6 | 285 | 202 | 37 | 2 | 378 |
| 2023 | 108 | 5 | 2 | 3 | 21 | 112 | 33 | 6 | 251 | 167 | 33 | 2 | 90 |
| 2024 | 92 | 5 | 2 | 3 | 20 | 115 | 32 | 5 | 251 | 168 | 33 | 2 | 90 |

**Table 0.3.3 Total emissions data, excluding the Canary Islands, Ceuta and Melilla**

| Year | NOx (kt) | NMVOC (kt) | $SO_2$ (kt) | $NH_3$ (kt) | $PM_{2.5}$ (kt) | $PM_{10}$ (kt) | TSP (kt) | BC (kt) | CO (kt) |
|---|---|---|---|---|---|---|---|---|---|
| 1990 | 1,256 | 1,010 | 2,028 | 528 | - | - | - | - | 4,074 |
| 1995 | 1,272 | 901 | 1753 | 516 | - | - | - | - | 3,100 |
| 2000 | 1,278 | 865 | 1368 | 611 | 171 | 291 | 444 | 44 | 2,420 |
| 2005 | 1,272 | 705 | 1193 | 517 | 152 | 279 | 464 | 42 | 1,777 |
| 2010 | 870 | 585 | 235 | 475 | 138 | 230 | 345 | 40 | 1,544 |
| 2015 | 774 | 548 | 254 | 493 | 128 | 211 | 310 | 34 | 1,410 |
| 2019 | 657 | 538 | 141 | 489 | 107 | 187 | 284 | 30 | 1,220 |
| 2020 | 560 | 548 | 109 | 496 | 104 | 180 | 270 | 30 | 1,124 |

| Year | NOx (kt) | NMVOC (kt) | $SO_2$ (kt) | $NH_3$ (kt) | $PM_{2.5}$ (kt) | $PM_{10}$ (kt) | TSP (kt) | BC (kt) | CO (kt) |
|---|---|---|---|---|---|---|---|---|---|
| **2021** | 584 | 537 | 108 | 497 | 101 | 179 | 274 | 30 | 1,182 |
| **2023** | 511 | 499 | 89 | 444 | 88 | 160 | 245 | 24 | 919 |
| **2024** | 505 | 488 | 86 | 450 | 87 | 160 | 246 | 23 | 953 |

| Year | Pb (t) | Cd (t) | Hg (t) | As (t) | Cr (t) | Cu (t) | Ni (t) | Se (t) | Zn (t) | PCDD/F (g I TEQ) | PAHs (t) | HCB (kg) | PCB (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1990** | 3,164 | 28 | 11 | 10 | 27 | 78 | 158 | 7 | 267 | 484 | 113 | 57 | 2,185 |
| **1995** | 786 | 22 | 13 | 10 | 29 | 90 | 187 | 7 | 240 | 493 | 92 | 60 | 2,221 |
| **2000** | 277 | 16 | 9 | 10 | 34 | 116 | 193 | 8 | 294 | 258 | 74 | 16 | 2,053 |
| **2005** | 142 | 10 | 7 | 9 | 33 | 131 | 172 | 8 | 297 | 249 | 62 | 4 | 1,544 |
| **2010** | 127 | 6 | 4 | 5 | 25 | 128 | 88 | 6 | 300 | 243 | 60 | 12 | 824 |
| **2015** | 105 | 6 | 4 | 5 | 25 | 117 | 38 | 6 | 296 | 241 | 57 | 10 | 587 |
| **2019** | 98 | 6 | 3 | 4 | 23 | 120 | 37 | 6 | 274 | 204 | 42 | 13 | 488 |
| **2020** | 81 | 5 | 3 | 3 | 20 | 99 | 29 | 6 | 271 | 188 | 37 | 9 | 440 |
| **2021** | 94 | 6 | 3 | 3 | 21 | 111 | 30 | 6 | 284 | 202 | 37 | 2 | 378 |
| **2023** | 108 | 5 | 2 | 3 | 21 | 111 | 23 | 6 | 250 | 167 | 33 | 2 | 90 |
| **2024** | 92 | 5 | 2 | 3 | 20 | 114 | 21 | 5 | 250 | 168 | 33 | 2 | 90 |

Detailed emission data of the Spanish Inventory are available from the MITECO-SEI webpage WebTable.

## 0.4. Adjustments

For the 2026 edition, no adjustments have been presented.

## 0.5. Compliance with National Emission Reduction Commitments

Emission data for compliance are shown in the following tables and compared to the emission reduction commitments set by the Directive (EU) 2016/2284 and the CLRTAP's Gothenburg Protocol. The reduction commitments have the year 2005 as base year. Reductions of emissions that are over the commitment (marked in green) indicate compliance, while increases of emissions (marked in red) would indicate non-compliance.

In the following compliance assessment under Directive (EU) 2016/2284, the emissions from the national territory excluding the Canary Islands are considered:

**Table 0.5.1 Directive (EU) 2016/2284 compliance assessment**

| | NOx (*) | | NMVOC (*) | | $SO_2$ | | $NH_3$ | | $PM_{2.5}$ | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Reduction commitment: 41% | | Reduction commitment: 22% | | Reduction commitment: 67% | | Reduction commitment: 3% | | Reduction commitment: 15% | |
| | Emissions (kt) | Reduction attained | Emissions (kt) | Reduction attained | Emissions (kt) | Reduction attained | Emissions (kt) | Reduction attained | Emissions (kt) | Reduction attained |
| **2005** | 1,215 | - | 595 | - | 1,206 | - | 517 | - | 153 | - |
| **2020** | 498 | 59.0% | 427 | 28.3% | 112 | 90.7% | 496 | 4.1% | 105 | 31.1% |
| **2021** | 522 | 57.0% | 414 | 30.4% | 111 | 90.8% | 497 | 4.0% | 102 | 33.2% |
| **2023** | 465 | 61.7% | 380 | 36.1% | 93 | 92.3% | 444 | 14.1% | 89 | 41.9% |
| **2024** | 457 | 62.4% | 368 | 38.1% | 90 | 92.5% | 450 | 13.0% | 88 | 42.2% |

(*) Emissions of both nitrogen oxides and non-methane volatile organic compounds from activities falling under NFR categories 3B (manure management) and 3D (agricultural soils) are not accounted for the purpose of compliance¸ according to the article 4.3.d) of Directive EU/2016/2284.

The inventoried emissions result in compliance with the national Emission Reduction Commitments set by the Directive (EU) 2016/2284, for all the pollutants and for all the years.

Following consultation to LRTAP Convention, the Inventory has been informed that Spain is not exempt from reporting for the Canary Islands, the main reason being that Spain has not excluded certain parts of its territory from the Gothenburg Protocol, but has only made territorial specifications in footnotes in the Annexes that refer to Emission Reduction Commitments ("Figures apply to the European part within the EMEP area" in the Gothenburg Protocol and "Figures apply to the European part of the country" in the amended Gothenburg Protocol). Provided that the annual emission estimates by source (NFR Tables) include the whole national territory, we provide the following additional totals for compliance:

**Table 0.5.2 Additional compliance totals, excluding Ceuta and Melilla**

| Year | NOx (kt) | NOx, NFR 3D excluded (kt) | NMVOC (kt) | $SO_2$ (kt) | $NH_3$ (kt) | $PM_{2.5}$ (kt) |
|---|---|---|---|---|---|---|
| **1990** | 1,317 | 1,247 | 1,039 | 2,105 | 535 | 0 |
| **1991** | 1,354 | 1,284 | 1,042 | 2,121 | 527 | 0 |
| **1992** | 1,368 | 1,301 | 1,028 | 2,100 | 525 | 0 |
| **1993** | 1,311 | 1,250 | 949 | 2,000 | 498 | 0 |

| Year | NOx (kt) | NOx, NFR 3D excluded (kt) | NMVOC (kt) | $SO_2$ (kt) | $NH_3$ (kt) | $PM_{2.5}$ (kt) |
|---|---|---|---|---|---|---|
| **1994** | 1,356 | 1,288 | 948 | 1,954 | 523 | 0 |
| **1995** | 1,363 | 1,297 | 926 | 1,808 | 520 | 0 |
| **1996** | 1,360 | 1,283 | 971 | 1,581 | 579 | 0 |
| **1997** | 1,353 | 1,280 | 962 | 1,635 | 570 | 0 |
| **1998** | 1,355 | 1,277 | 971 | 1,506 | 606 | 0 |
| **1999** | 1,371 | 1,290 | 947 | 1,525 | 597 | 0 |
| **2000** | 1,379 | 1,294 | 899 | 1,400 | 615 | 176 |
| **2001** | 1,326 | 1,246 | 868 | 1,337 | 610 | 162 |
| **2002** | 1,358 | 1,282 | 854 | 1,485 | 595 | 161 |
| **2003** | 1,374 | 1,291 | 783 | 1,235 | 607 | 170 |
| **2004** | 1,397 | 1,320 | 764 | 1,266 | 572 | 160 |
| **2005** | 1,366 | 1,296 | 730 | 1,217 | 522 | 156 |
| **2006** | 1,314 | 1,242 | 699 | 1,089 | 526 | 155 |
| **2007** | 1,326 | 1,253 | 682 | 1,061 | 535 | 155 |
| **2008** | 1,135 | 1,073 | 640 | 396 | 472 | 143 |
| **2009** | 1,006 | 943 | 608 | 298 | 468 | 146 |
| **2010** | 941 | 871 | 602 | 252 | 479 | 142 |
| **2011** | 937 | 872 | 581 | 287 | 464 | 143 |
| **2012** | 892 | 827 | 560 | 291 | 461 | 132 |
| **2013** | 814 | 746 | 541 | 227 | 469 | 138 |
| **2014** | 809 | 734 | 545 | 246 | 494 | 127 |
| **2015** | 836 | 761 | 563 | 265 | 497 | 131 |
| **2016** | 800 | 729 | 523 | 221 | 494 | 112 |
| **2017** | 805 | 730 | 533 | 227 | 508 | 113 |
| **2018** | 782 | 708 | 556 | 205 | 501 | 121 |
| **2019** | 727 | 653 | 552 | 158 | 492 | 111 |
| **2020** | 619 | 543 | 563 | 117 | 499 | 107 |
| **2021** | 643 | 568 | 551 | 115 | 500 | 104 |
| **2022** | 595 | 532 | 531 | 110 | 450 | 93 |
| **2023** | 568 | 505 | 512 | 97 | 447 | 90 |
| **2024** | 563 | 496 | 500 | 93 | 453 | 90 |

(**) Nitrogen oxides emissions from soils (NFR 3D) are not included in the estimates for European Union member States, according to Annex II of the Gothenburg Protocol.

## Table 0.5.3 Additional compliance totals, excluding the Canary Islands, Ceuta and Melilla

| Year | NOx (kt) | NOx, NFR 3D excluded (kt) | NMVOC (kt) | $SO_2$ (kt) | $NH_3$ (kt) | $PM_{2.5}$ (kt) |
|---|---|---|---|---|---|---|
| **1990** | 1,256 | 1,211 | 1,009 | 2,028 | 528 | - |
| **1991** | 1,296 | 1,251 | 1,013 | 2,050 | 524 | - |
| **1992** | 1,310 | 1,265 | 1,001 | 2,035 | 521 | - |
| **1993** | 1,251 | 1,214 | 923 | 1,936 | 493 | - |
| **1994** | 1,264 | 1,216 | 923 | 1,888 | 520 | - |
| **1995** | 1,272 | 1,227 | 901 | 1,753 | 516 | - |
| **1996** | 1,252 | 1,200 | 939 | 1,538 | 575 | - |

| Year | NOx (kt) | NOx, NFR 3D excluded (kt) | NMVOC (kt) | $SO_2$ (kt) | $NH_3$ (kt) | $PM_{2.5}$ (kt) |
|---|---|---|---|---|---|---|
| **1997** | 1,274 | 1,226 | 931 | 1,606 | 567 | - |
| **1998** | 1,274 | 1,222 | 940 | 1,476 | 600 | - |
| **1999** | 1,280 | 1,222 | 909 | 1,493 | 593 | - |
| **2000** | 1,278 | 1,215 | 865 | 1,368 | 611 | 171 |
| **2001** | 1,231 | 1,180 | 834 | 1,308 | 605 | 157 |
| **2002** | 1,266 | 1,218 | 822 | 1,454 | 591 | 156 |
| **2003** | 1,279 | 1,221 | 757 | 1,202 | 602 | 165 |
| **2004** | 1,300 | 1,244 | 737 | 1,238 | 568 | 156 |
| **2005** | 1,272 | 1,222 | 706 | 1,193 | 517 | 152 |
| **2006** | 1,221 | 1,181 | 678 | 1,068 | 522 | 151 |
| **2007** | 1,233 | 1,191 | 662 | 1,037 | 531 | 151 |
| **2008** | 1,044 | 1,011 | 620 | 374 | 468 | 138 |
| **2009** | 918 | 886 | 590 | 277 | 464 | 142 |
| **2010** | 870 | 830 | 584 | 235 | 475 | 138 |
| **2011** | 867 | 829 | 565 | 272 | 461 | 140 |
| **2012** | 824 | 789 | 543 | 276 | 458 | 128 |
| **2013** | 751 | 706 | 526 | 215 | 466 | 135 |
| **2014** | 752 | 699 | 530 | 235 | 490 | 124 |
| **2015** | 773 | 718 | 548 | 253 | 493 | 128 |
| **2016** | 736 | 685 | 509 | 209 | 491 | 109 |
| **2017** | 734 | 682 | 520 | 211 | 504 | 110 |
| **2018** | 714 | 663 | 541 | 189 | 498 | 117 |
| **2019** | 657 | 610 | 537 | 142 | 489 | 107 |
| **2020** | 560 | 505 | 547 | 109 | 496 | 104 |
| **2021** | 584 | 529 | 537 | 108 | 497 | 101 |
| **2022** | 534 | 496 | 516 | 102 | 447 | 90 |
| **2023** | 510 | 472 | 499 | 89 | 444 | 88 |
| **2024** | 505 | 464 | 488 | 86 | 450 | 87 |

(**) Nitrogen oxides emissions from soils (NFR 3D) are not included in the estimates for European Union member States, according to Annex II of the Gothenburg Protocol.

## 0.6. Data analysis for year 2024

The following chart shows relative emissions in the year 2024 broken down by main NFR categories, as well as relative reduction of emissions in 2024 (versus 1990 levels, or 2000 for the case of fine particulate matter and black carbon).

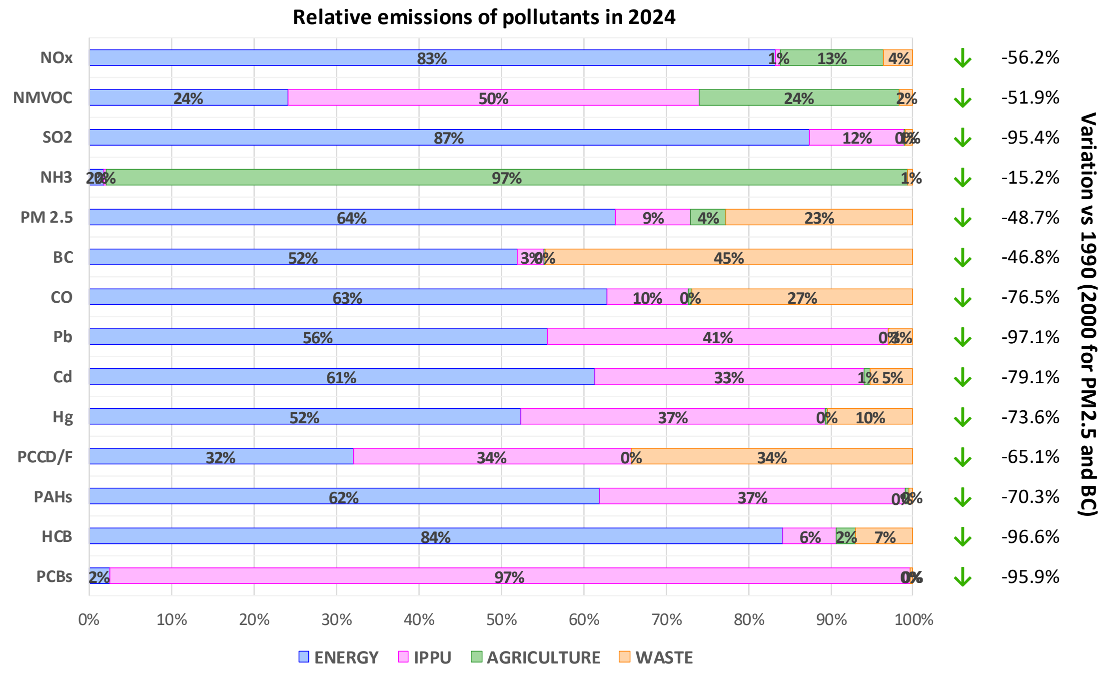



**Figure 0.6.1 Distribution of emissions in year 2024 by main activity sectors**

Energy activities (NFR 1) are the main contributors to most of the covered pollutants, especially $SO_2$, NOx, $PM_{2.5}$, BC, CO, heavy metals, PAHs and HCB. Industrial Processes and Product Use (IPPU) (NFR 2) are the main contributors for NMVOC and PCBs emissions. Agricultural activities (NFR 3) are responsible for the most part of $NH_3$ and have some share in NMVOC and NOx emissions. Finally, Waste sector (NFR 5) is a residual contributor to most of the pollutants, except for $PM_{2.5}$, black carbon (BC), CO, and PCDD/PCDF.

Detailed emission data of the Spanish Inventory are available from the MITECO-SEI webpage WebTable.

In 2024, approximately 588 kt of nitrogen oxides (NOx) (530 kt without Canary Islands), expressed as nitrogen dioxide, were released in Spain. The major contributors to NOx emissions were F_Road transport (34% of total NOx emissions, 36% without Canary Islands), B_Industry (16%, 17% without Canary Islands) and L_AgriOther (soil cultivation, being 11%, 13% without Canary Islands).

Approximately 501 kt of NMVOC were released in 2024 (489 kt without Canary Islands). The major contributor to total NMVOC emissions was E_Solvents (43%, 43% without Canary Islands). Livestock is the following contributing activity generating 16%, (16% without Canary Islands) of the national NMVOC emissions, and then B_Industry with 12% (12% without Canary Islands).

$SO_2$ emissions in 2024 accounted for 97 kt (90 kt without Canary Islands), with B_Industry 49%, (53% without Canary Islands), D_Fugitive emissions 21%, (23% without Canary Islands), C_Other stationary combustion 13%, (15% without Canary Islands) and A_Public power generation 9%, (4% without Canary Islands) as the main contributors to these emissions.

Approximately 453 kt of ammonia ($NH_3$) (450 kt without Canary Islands) were released in Spain in 2024, being the agriculture activities the main sources of emissions (97.2% of the total, 97.3% without Canary Islands). L_AgriOther was the largest subsector, representing 55% of total ammonia emissions (55% without Canary Islands), with k_AgriLivestock accounting for 42% (42% without Canary Islands).

Finally, approximately 91 kt of Fine Particulate Matter ($PM_{2.5}$) (88 kt without Canary Islands) were emitted in Spain in 2024. C_Other stationary combustion was the largest contributing activity with 32% of total $PM_{2.5}$ emissions (33% without Canary Islands), followed by J_Waste and B_Industry with 23% and 20%, respectively (23% and 20% without Canary Islands).

## 0.7. Key trends

Reduction in emissions can be observed for the priority and mandatory pollutants covered by the National Inventory between 1990 and 2024 (see figure 0.7.1 below). More information is provided in Chapter 2 "Key trends" and in the corresponding sectorial sections of this IIR.

NOx emissions in 2024 decreased by -56.2% when compared to 1990 (-58.6% without Canary Islands) and decreased by -0.7% reduction compared to 2023 (-0.8% without Canary Islands). Road transport (F_RoadTransport) was the first contributing activity with 34.0% of total NOx emissions (36.4% without Canary Islands), and decreased by -63.2% when compared to 1990 and continued the trend with a -2.6% reduction compared to 2023, the figures being -63.4% and -2.5% without Canary Islands. Industries (B_Industry) sector was the second contributor, accounting for 15.6% of total NOx in 2024 (17.2% without Canary Islands).

NMVOC emissions in 2024 declined by -51.9% compared to 1990 (-51.7% without Canary Islands) and decreased by -2.4% compared to 2023 (-2.3% without Canary Islands). Solvents (E_Solvents) was the largest contributing activity with 42.9% of the total NMVOC emissions (42.6% without Canary Islands), with Domestic solvent use (2D3a) as the main emitting sector, with 13.7% of the total of NMVOC in 2024 (13.4% without Canary Islands), followed by Coating applications (2D3d) with 11.6% and Chemical products (2D3g) with 9.6% of the total NMVOC emissions (same figures without Canary Islands).

$SO_2$ emissions in 2024 decreased by -95.4% compared to 1990 (-95.6% without Canary Islands) and continued that trend with a -3.3% reduction compared to 2023 (with and without Canary Islands). B_Industry was the first contributing activity, accounting for 48.9% of emissions (52.7% without Canary Islands), with combustion in manufacturing industries and construction, namely Non-metallic minerals (1A2f) and Non-ferrous metals (1A2b) being respectively 18.3% and 7.4% of the total of the inventory (19.7% without Canary Islands and 8.0% without Canary Islands). Fugitive emissions (D_Fugitive), representing 21.0% of total $SO_2$ emissions (22.7% without Canary Islands), were the next contributing group of activities, with Fugitive emissions from oil refining and storage (1B2aiv) accounting for 18.3% of the total estimate (19.7% without Canary Islands).

$NH_3$ emissions in 2024 decreased by -15.2% compared to 1990 (-14.8% without Canary Islands) and increased by 1.4% when compared to 2023 (the same without Canary Islands). Agricultural soil (L_AgriOther) was the largest contributing activity, with 55.2% of total ammonia emissions (55.3% without Canary Islands). In more detail, Inorganic N-fertilizers including urea application (3Da1) was the largest emitter representing 22.8% (22.9% without Canary Islands), followed by Animal manure applied to soils (3Da2a) accounting for 22.5% of the total ammonia emissions of the inventory (with and without Canary Islands) and Urine and dung deposited by grazing animals (3Da3), accounting for 7.7% of total $NH_3$ emissions (with and without Canary Islands). Livestock (K_AgriLivestock) was the second contributing activity, accounting for 42.0% of the total ammonia emissions of the inventory (same figures without Canary Islands), with Manure management-Swine (3B3) accounting for 14.2% (14.3% without Canary Islands), followed by Manure management-Dairy cattle (3B1a), accounting for 7.3% (with and without Canary Islands). Total ammonia emissions increase with respect to 2023 is mainly due to the increase of 3.5% in L_AgriOther emissions (same figure including and excluding Canary Islands), mainly due to the registered increase in the use of urea.

$PM_{2.5}$ emissions in 2024 decreased by -48.7% compared to 2000 (-48.8% without Canary Islands), and -0.7% with respect to 2023 (-0.6% without Canary Islands). Small Stationary Combustion (C_OtherStationaryComb) is the largest contributing activity in 2024, with 32.3% of total $PM_{2.5}$ emissions (32.7% without Canary Islands), with Residential stationary combustion (1A4bi) representing 29.1% of the emissions' total of the Spanish Inventory (29.4% without Canary Islands). Waste (J_Waste) was the second contributor, accounting for 22.8% of the total (23.1% without Canary Islands), with the Open burning of pruning remains (5C2) accounting for 21.1% of the total of emissions (21.4% without Canary Islands).

In the following graphs, relative variations of emissions with respect to the base year are shown for the main air pollutants, BC, CO, priority heavy metals and POPs.

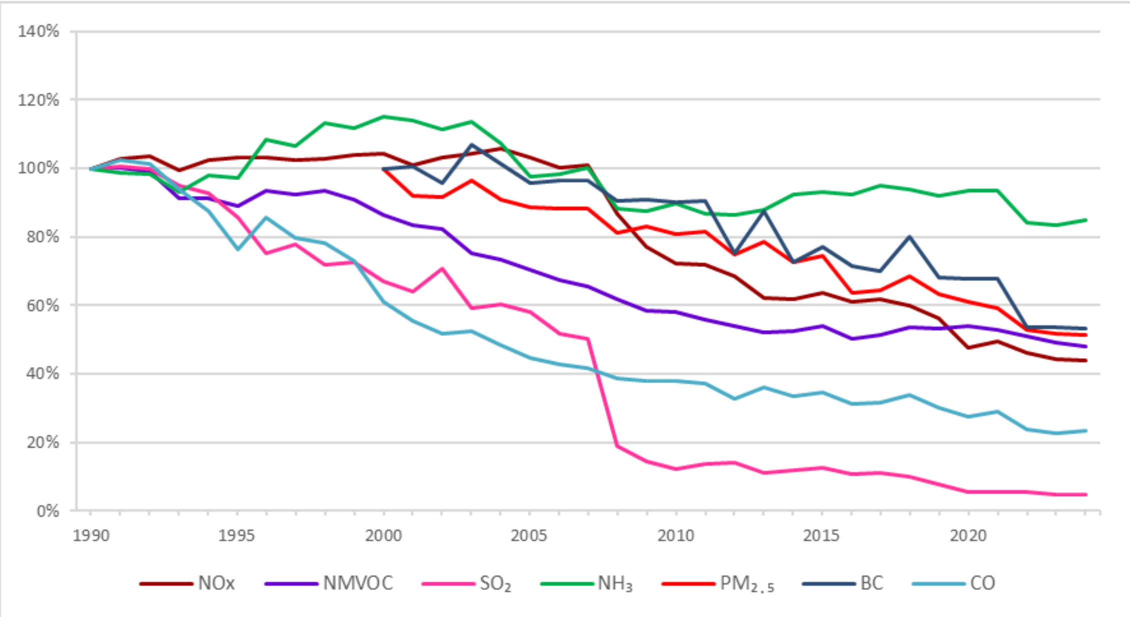



**Figure 0.7.1 Relative variation of air pollutants emissions, national total (100% in 1990 or 2000 for PM and BC)**

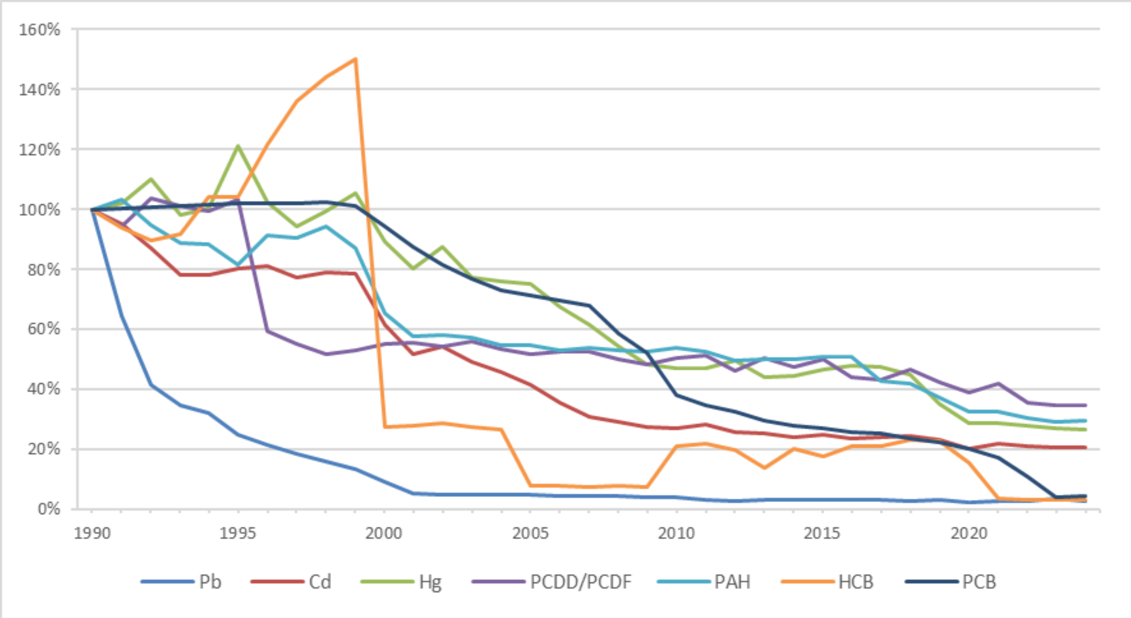



**Figure 0.7.2 Relative variation of priority heavy metals and POPs emissions, national total (100% in 1990)**

## 0.8. Inventory recalculations and summary of main differences since last Inventory edition

Throughout the Spanish Inventory, emission estimates are updated annually across the fulltime series in response to new research and revisions to data sources, as well as error corrections and methodology changes or as a result of the implementation of reviews' recommendations. Main features regarding revised estimates are presented below:

In this edition of the Inventory, 63 categories[1] (61% of the total accounting for the National Total) have been recalculated in the time series 1990-2023. Among them, for one category, recalculations involved new estimations for one or more pollutants[2] for which no estimations had been provided in the last edition. For details on completeness and use of notation keys, please refer to section 1.8.

As a summary, the relative impact of recalculations in the National Totals of Emissions in the last edition of the Inventory, for each pollutant and for pivot years, is shown in the following tables.

[1] Only categories and pollutants with more than a ±0.00001% variation have been accounted for as a real recalculation. Minor variations could be found under this threshold due to rounding effects in the calculation process or minor error corrections performed.

[2] New estimations have been performed in this inventory edition for individual PAH following the recommendation ES-0A-2019-0001 made by the TERT in the 2019 NECD.

### Table 0.8.1 Relative impact of recalculations in the National Totals

| Year | NOx | NMVOC | $SO_2$ | $NH_3$ | $PM_{2.5}$ | $PM_{10}$ | TSP | BC | CO |
|---|---|---|---|---|---|---|---|---|---|
| **1990** | -2.9% | -0.7% | -0.2% | 0.0% | NA | NA | NA | NA | -5.3% |
| **2005** | -3.1% | -0.8% | 0.0% | 0.0% | -10.9% | -6.5% | -4.0% | -20.5% | -12.2% |
| **2010** | -4.5% | -0.9% | -0.3% | 0.0% | -13.2% | -8.8% | -6.0% | -24.0% | -15.9% |
| **2015** | -5.4% | -0.9% | -0.4% | 0.3% | -15.1% | -10.3% | -7.3% | -27.6% | -18.0% |
| **2020** | -6.0% | -1.2% | 0.1% | 1.9% | -18.5% | -12.3% | -8.6% | -31.5% | -22.9% |
| **2021** | -5.5% | -1.4% | -0.7% | 2.3% | -21.1% | -13.8% | -9.7% | -32.1% | -23.5% |
| **2022** | -4.6% | -1.3% | -0.2% | 2.9% | -15.9% | -9.8% | -6.6% | -26.7% | -19.2% |
| **2023** | -5.1% | -0.9% | -0.4% | 3.0% | -16.8% | -11.2% | -7.7% | -27.3% | -19.6% |
| **1990-2023** | -3.9% | -0.9% | -0.2% | 0.3% | -14.0% | -9.2% | -6.3% | -25.0% | -13.1% |

| Year | Pb | Cd | Hg | As | Cr | Cu | Ni | Se | Zn | PCDD/ PCDF | PAHs | HCB | PCBs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1990** | 0.0% | -0.6% | 0.3% | -0.9% | 1.4% | -1.5% | 0.1% | -0.9% | -18.9% | -17.9% | 1.1% | 0.0% | 0.0% |
| **2005** | -1.8% | -5.8% | -0.4% | -1.0% | 2.4% | -1.1% | 2.3% | -0.9% | -19.0% | -46.0% | 0.9% | -1.7% | 0.0% |
| **2010** | -3.7% | -14.5% | -2.0% | -2.0% | 3.1% | -1.5% | 4.5% | -1.6% | -21.5% | -57.5% | -0.3% | -1.4% | 0.0% |
| **2015** | -4.7% | -14.7% | -1.9% | -2.8% | 0.7% | -1.9% | 0.5% | -1.7% | -22.7% | -55.3% | -1.1% | -1.4% | 0.0% |
| **2020** | -6.2% | -16.2% | -2.9% | -5.0% | 1.2% | -2.2% | 4.4% | -2.4% | -25.8% | -58.6% | -2.6% | -1.4% | 0.0% |
| **2021** | -5.3% | -15.1% | -2.9% | -5.1% | 1.3% | -1.7% | 2.3% | -2.2% | -25.1% | -57.8% | -6.7% | -5.5% | 0.0% |
| **2022** | -4.0% | -13.0% | -2.6% | -3.5% | 1.7% | -1.7% | 0.8% | -1.2% | -18.4% | -59.1% | -6.3% | -4.5% | -24.2% |
| **2023** | -3.4% | -14.5% | -2.2% | -3.0% | 1.8% | -1.6% | 0.1% | -1.3% | -18.0% | -59.9% | -6.6% | -4.2% | -70.9% |
| **1990-2023** | -2.6% | -8.2% | -1.0% | -1.8% | 1.8% | -1.4% | 1.8% | -1.3% | -20.6% | -48.7% | -0.1% | -1.3% | -0.7% |

In the IIR chapter 8 “Recalculations”, a detailed analysis by pollutant is performed, a summary of which is provided in the following tables, corresponding to estimates for the whole national territory.

## Table 0.8.2 Summary of recalculations for NOx

**NOx**

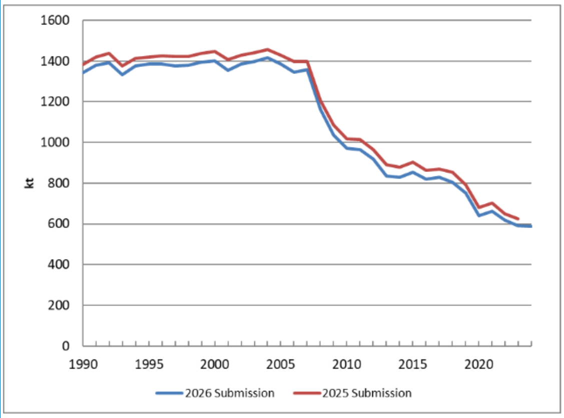
In the 2026 inventory edition, 41 out of 61 categories with NOx emissions (67%) were recalculated for reported year 2023.

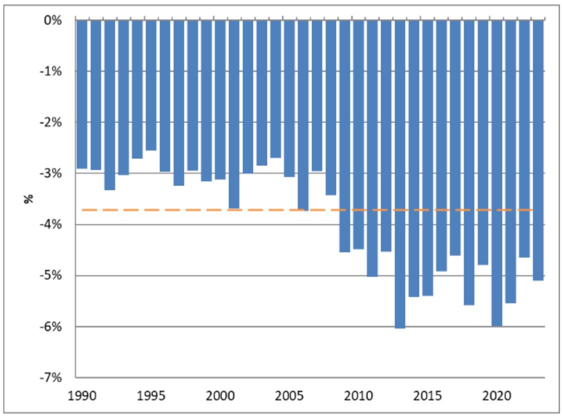
For reported year 2023 recalculations implied a revised estimation of total NOx emissions of -31.9 kt (-5.1%). On average, for the whole inventoried time series, revised emissions estimations were -3.7% lower.

Main contributor to the recalculation was category 5C2 – Open burning of waste: Recalculation affecting all pollutants because the activity data for open-burned pruning residues from woody crops have been updated throughout the time series.

Furthermore, 1A4cii category (Off-road vehicles and other machinery in Agriculture/Forestry) has been recalculated for the whole time series (fuel consumption estimation based in Agriculture Gross Value Added).

**Evolution of the difference**




## Table 0.8.3 Summary of recalculations for NMVOC

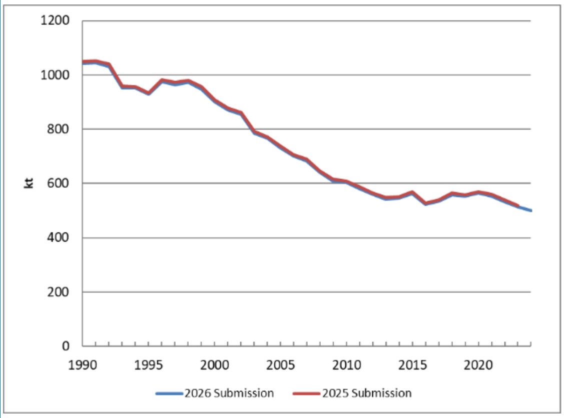
**NMVOC**

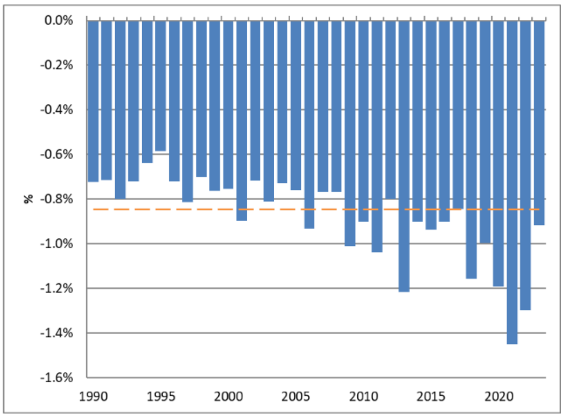
In the 2026 inventory edition, 47 out of 72 categories with NMVOC emissions (65%) recalculated for reported year 2023. For reported year 2023 recalculations implied a revised estimation of total emissions of -4.8 kt (-0.9%) On average, for the whole inventoried time series, revised emissions estimations were -0.8% lower.

Main contributor to the recalculation for the whole series (1990-2023) was category 5C2 – Open burning of waste: Recalculation affecting all gases and pollutants because the activity data for open-burned pruning residues from woody crops have been updated throughout the time series.

With relation to reported year 2023, the 3B4gii category (Manure management – Broilers) is the main contributor to the recalculation, due to the methodology from EMEP/EEA 2023 Guidebook that advises to monitor the effect of $NH_3$ reductions through BATs to avoid distorting NMVOC emissions. The NMVOC emissions calculation methodology has been updated to ensure that $NH_3$ BATs do not affect the calculations.

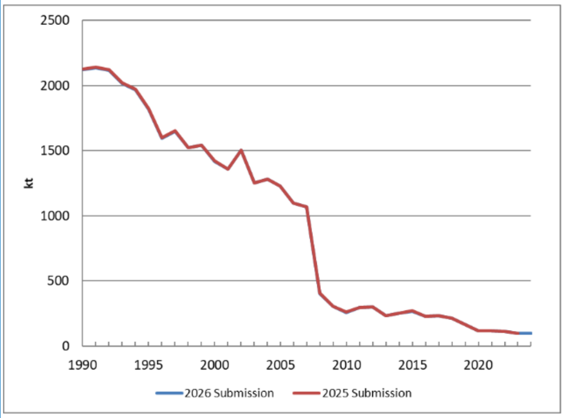
**Evolution of the difference**

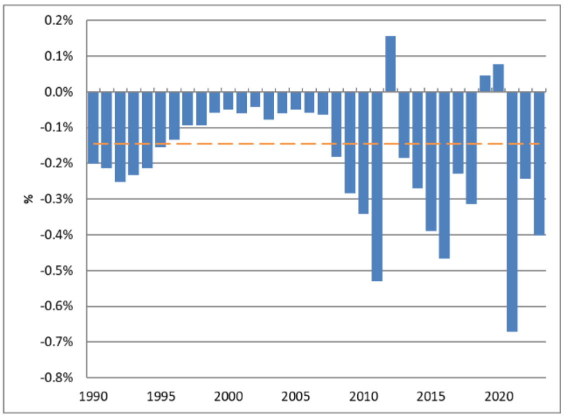


## Table 0.8.4 Summary of recalculations for $SO_2$

| $SO_2$ |
|---|
| In the 2026 inventory edition, 25 out of 43 categories with $SO_2$ emissions (58%) recalculated for reported year 2023.<br>For reported year 2023 recalculations implied a revised estimation of total emissions of -0.4 kt (-0.4%). On average, for the whole inventoried time series, revised emissions estimations were -0.1% lower.<br>The main category implied in recalculations of the whole series (1990-2023) is 1A4cii (Off-road vehicles and other machinery in Agriculture/Forestry, for which new fuel consumption is estimated based in Agriculture Gross Value Added).<br>Main contributor to the recalculation for the reported year 2023 was category 5C2 – Open burning of waste: Recalculation affecting all gases and pollutants because the activity data for open-burned pruning residues from woody crops have been updated throughout the time series. |
| **Evolution of the difference** |



### Table 0.8.5 Summary of recalculations for $NH_3$

**$NH_3$**

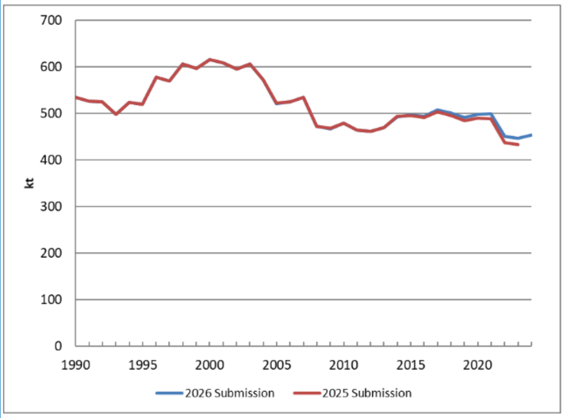
In the 2026 inventory edition, 32 out of 48 categories with $NH_3$ emissions (67%) recalculated for reported year 2023.

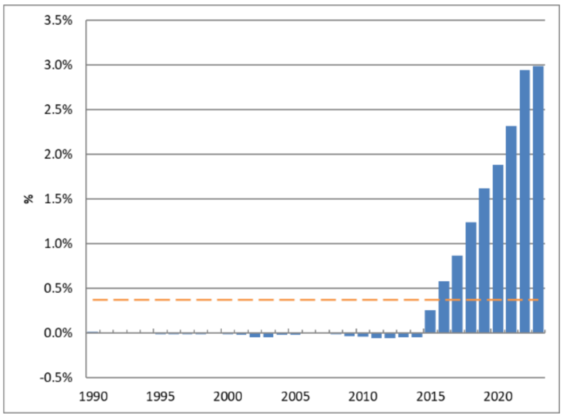
For reported year 2023 recalculations implied a revised estimation of total emissions of 13.0 kt (3.0%). On average, for the whole inventoried time series, revised emissions estimations were 0.4% higher.

Main contributor to the recalculation was category 3B3 – Manure management - Swine: Recalculation that affects white and iberian swine due to updating implementation rate of $NH_3$ BATs from ECOGAN, that has been revised with weighted implementation adjustment to the data of the populations of the Agricultural Statistics Yearbook over the time series, including the BAT-3 affecting to the nitrogen excreted. In addition, the manure management guidelines for white and Iberian pigs in 1990 have been updated to the average values in the new Tables 10A.6, 10A.7 and 10A.9 of the IPCC 2019 Refinement guide.

Second contributor to recalculations was 3Da2a category, Animal manure applied to soils, due to variations in population or zootechnical parameters (nitrogen excreted, grazing animal distribution data, ratios of BATs implementation throughout the time series, etc.) owing to animals with the recalculations cited for 3B categories.

**Evolution of the difference**




### Table 0.8.6 Summary of recalculations for $PM_{2.5}$

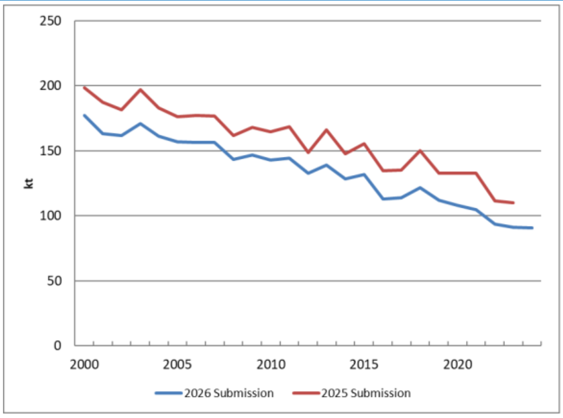
**$PM_{2.5}$**

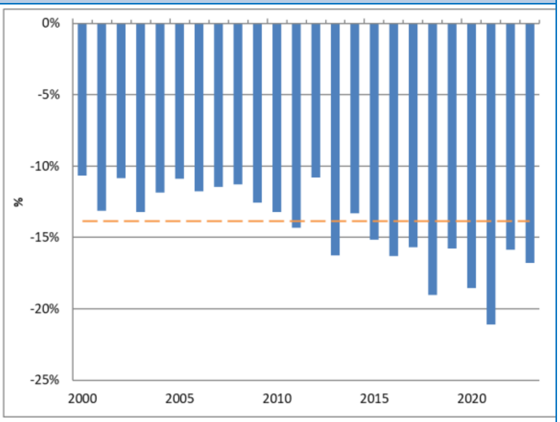
In the 2026 inventory edition, 44 out of 73 categories estimated (60%) recalculated for reported year 2023.

For reported year 2023 recalculations implied a revised estimation of total emissions of -18.4 kt (-16.8%). On average, for the whole inventoried time series, revised emissions estimations were -13.9% lower.

Main contributor to the recalculation was category 5C2 – Open burning of waste: Recalculation affecting all gases and pollutants because the activity data for open-burned pruning residues from woody crops have been updated throughout the time series.

**Evolution of the difference**



## 0.9. Planned improvements

Detailed information on planned improvements is included in IIR section 8.4, as well as in the sectorial IIR chapters. The following actions can be highlighted for the entire Inventory as planned improvements:

- Harmonization of the Inventory with other registers (EU ETS, E-PRTR, etc.).
- Beginning of analysis for the implementation of the EMEP/EEA GB 2023.

The review of the methodology for the elaboration of the national fuel balance will continue, in collaboration with the relevant departments of the Secretary of State for Energy at MITECO. The collaboration with the IDAE-MITECO continues in the sense of providing specific information for the balance.

## 0.10. Reporting of PM condensable component

Condensable emissions are organic compounds that are in vapour phase at stack conditions, but which condensate and form particles upon cooling, when discharged into ambient air.

Within the CLRTAP, the Executive Body at its thirty-eight session formally requested that Parties describe their practices for reporting the condensable component of PM in their IIRs. (ECE/EB.AIR/142 para 18.f). The purpose is to provide transparent information that can easily be used by the modellers. To this end, information regarding the inclusion or not of the condensable component of PM in the reported emissions is provided in annex V and the corresponding sector chapters of the IIR. Reporting of this issue has been done following the revised template for of Annex II_v2021 (Recommended Structure for Informative Inventory Report).

In general, according to current information available within the Inventory, particulate matter emissions in Energy industries (NFR 1A1) and Manufacturing industries and construction (NFR 1A2) exclude the condensable component. However, emissions from the Transport categories (NFR 1A3) include the condensable component. Within categories 1A4 there is a mixture of criteria depending on the fuel used. Finally, a general lack of information is found for Fugitive emissions (NFR 1B), IPPU (NFR 2), Agriculture (NFR 3) and Waste (NFR 5) sectors.

## 0.11. Implementation of EMEP/EEA Guidebook 2019

The table below shows the chapters of EMEP/EEA Guidebook 2019 indicating those that have been implemented:

**Table 0.11.1 Summary of implementation of updated chapters from EMEP/EEA GB 2019**

| NFR | Chapter title | Description of change | Status | Observation |
|---|---|---|---|---|
| **General chapter** | 2. Key Category analysis and methodological choice | General update for calculating key categories | Implemented | |
| **General chapter** | 9. Projections | Refinement and improved guidance and methodology to estimate projections | Implemented | |

| NFR | Chapter title | Description of change | Status | Observation |
|---|---|---|---|---|
| **1.A.1.a** | Public electricity and heat production | Emissions of PAHs for both Large Point Sources (LPS) and small power plants (Area Sources) in previous editions of the Inventory | Implemented | |
| **1.A.1.c** | Manufacture of solid fuels and other energy industries | Main Pollutants and Particulate Matter emissions. Heavy metals and POPs emissions | Implemented | |
| **1.A.3.b** | Road transport | All pollutants | Implemented | |
| **1.A.3.b.v** | Gasoline evaporation | COVs | | |
| **1.A.3.d** | National navigation | All pollutants | Implemented | |
| **1.A.4** | Small Combustion | All pollutants | Implemented | |
| **1.B.1.b** | Fugitive emission from solid fuels: Solid fuel transformation | Emission factors for CO under category 1B1b have been updated | Implemented | |
| **1.B.2.c** | Venting and flaring | New Tier 2 Emission Factors | Implemented | |
| **2.A.5.a** | Quarrying and mining | New methodology and new spreadsheet calculation tool | Implemented | |
| **2.C.1** | Iron and steel production | Relocation of CO to category 1A2a, according to EMEP/EEA 2019 Guidebook | Implemented | |
| **2.C.2** | Ferroalloys production | Deletion of CO emissions according to EMEP/EEA 2019 Guidebook | Implemented | |
| **2.C.6** | Zinc production | Correction of the units for the Pb EF, according to EMEP/EEA 2019 Guidelines | Implemented | |
| **2.D.3.a** | Domestic solvent use of fungicides | Removed Hg EF from Table 3-1 and Table 3-6 | Not applicable to Spain's Inventory | Spain uses a country-specific EF for Hg, so no changes to methodology have been applied |
| **2.D.3.g** | Chemical products | New PAH EF in Table 3-8, 3-9 and 3-10 | Not applicable to Spain's Inventory | Asphalt blowing does not occur in Spain, so no changes are deemed necessary in this category |
| **3.D.a.3** | Urine and dung deposited by grazing animals | Updating $NH_3$-EFs from EMEP/EEA Guidebook (2019) for grazing animals emission | Implemented | |
| **3.F** | Field burning of agricultural residues | PAHs EFs update from EMEP/EEA Guidebook (2019) | Implemented | |

## 0.12. Web-page and contact details

Further information can be consulted at the Spanish Inventory National Systems webpage:

https://www.miteco.gob.es/es/calidad-y-evaluacion-ambiental/temas/sistema-espanol-de-inventario-sei-/

Detailed emission data of the Spanish Inventory are available from the MITECO-SEI website WebTable.

**Contact:**

Inventories Unit
Spanish Ministry for Ecological Transition and the Demographic Challenge
Ministerio para la Transición Ecológica y el Reto Demográfico
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# 1. INTRODUCTION

# CONTENTS

## FIGURES



## TABLES

# 1. INTRODUCTION

Chapter updated in March, 2026

## 1.1. National Inventory background

The 2026 edition of the Informative Inventory Report (IIR) has been elaborated by the Spanish National Inventory System (SEI) within the Ministry for the Ecological Transition and the Demographic Challenge (MITECO).

This report is compiled to accompany the Spain's 2026 emissions inventory data submission under:

- Directive (EU) 2016/2284 of the European Parliament and of the Council, on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC, and
- United Nations Economic Commission for Europe (UNECE) Convention on Long-Range Transboundary Air Pollution (CLRTAP).

It contains detailed information on annual emission estimates of air pollutants by source in Spain from 1990 onwards.

Main features of the Spanish IIR and emissions data included in the 2026 edition are summarised in Table 1.1.1.

**Table 1.1.1 Main features of Spanish IIR 2026**

<table>
<tr><td>Title</td><td colspan="3">Spanish Inventory Informative Report (IIR)</td></tr>
<tr><td>Edition</td><td colspan="3">2026</td></tr>
<tr><td>Formal internal national approval</td><td colspan="3">15.01.2026 – Approval by the DG for Environmental Quality and Assessment (MITECO)</td></tr>
<tr><td>Submission Emission Data (NFR tables)</td><td colspan="2">v1.0 (15.02.2026)</td><td>REPDAB run: yes</td></tr>
<tr><td>Date of release-IIR</td><td colspan="3">13.03.2026</td></tr>
<tr><td>Time series</td><td colspan="3">1990-2024</td></tr>
<tr><td rowspan="5">Pollutant's coverage</td><td>Main Pollutants</td><td>$SO_2$, NOx, $NH_3$, CO, NMVOC</td><td>1990-2024</td></tr>
<tr><td>Particulate Matter</td><td>TSP, $PM_{10}$, $PM_{2.5}$, Black Carbon (BC)</td><td>2000-2024</td></tr>
<tr><td>Heavy Metals (priority)</td><td>Pb, Cd, Hg</td><td>1990-2024</td></tr>
<tr><td>Heavy Metals (additional)</td><td>As, Cr, Cu, Ni, Se, Zn</td><td>1990-2024</td></tr>
<tr><td>Persistent Organic Pollutants</td><td>PCDD/PCDF, PAHs, HCB, PCBs</td><td>1990-2024</td></tr>
<tr><td>Geographical scope</td><td colspan="3">Spain national territory, in the case of the CLRTAP report, and national territory excluding the Canary Islands, in the case of the Directive 2016/2284 (as established by its article 2.2).</td></tr>
<tr><td>Emission data reported</td><td colspan="3">Annual emission estimates of by source in Spain, for the air pollutants, time and geographical coverage mentioned above.</td></tr>
<tr><td>Reporting guidelines</td><td colspan="3">Guidelines for reporting emissions and projections data under the CLRTAP Convention (ECE/EB.AIR/150/Add.1 - 27 March 2023).</td></tr>
<tr><td>Reporting Nomenclature</td><td colspan="3">NFR-2019. Annexes to the 2023 Reporting Guidelines:<br>Annex I: Emissions reporting template (National totals and NFR sector emissions for main pollutants, PM, POPs, HMs and activity data, revised version, 18.11.2019) approved by EMEP SB during its 5th Joint Session. Annex II: Recommended structure for IIR including a table for reporting information on the condensable fraction of PM.</td></tr>
</table>

| | | |
|---|---|---|
| **Numeric format used** | English standard numeric format is used in the report (comma to separate groups of thousands and point to indicate the decimal place). | |
| **Latest Reviews** | 2025. Review of National Air Pollutant Emission Inventory Data 2022 under Directive (EU) 2016/2284 (National Emission reduction Commitments Directive).<br>2025. Review of emission data reported under the LRTAP Convention. | |
| **Emissions Sources** | LPS, area sources | National totals and NFR sector emissions for main pollutants, Particulate Matter, Persistent Organic Pollutants and Heavy Metals. |
| | Air traffic | Emissions from domestic and international aviation during the landing and take-off included.<br>Cruise emissions reported separately as memo items. |
| | International navigation | Emissions from domestic maritime shipping included.<br>Emissions from international maritime shipping reported separately as memo items. |
| | Natural sources | Emissions from natural sources (volcanoes, forest fires, etc.) reported separately as memo items. |
| **Record keeping** | Official data, documentation and information are kept (electronic or in paper format) by the Spanish National Inventory System. | |
| **Inventory Database System** | Spanish National Inventory System Database is based on Oracle. | |
| **Projections** | Emissions projections for Main Pollutants ($SO_2$, NOx, $NH_3$, NMVOC) and Particulate Matter ($PM_{2.5}$) reported in 2025. | |
| **Gridded and LPS data** | Gridded data in 0.1 x 0.1 degree (GNFR-14) and 472 Large Point Sources identified by the Inventory for years 2024 that exceed any of the thresholds identified in the Guidelines for Reporting Emissions and Projections Data under the CLRTAP, to be reported in 2026. | |

## 1.2. Institutional arrangements

The General Directorate for Environmental Quality and Assessment (DGCEA), at the Ministry for the Ecological Transition and the Demographic challenge (MITECO), is the competent authority in charge of the elaboration and reporting of the National Inventory of Emissions and the Projections. The General Subdirectorate for Pollution Prevention (SGPC), within the DGCEA, is the body in charge of the Spanish Emissions Inventory System (SEI), that performs these tasks.

The National System for the elaboration of Emissions Inventories and Projections is set and ruled by the following legal framework:

- Law 34/2007, of 15 November, on air quality and protection of the atmosphere, establishes in article 27.3 the Spanish Emissions Inventory and Projections System (SEI).
- Royal Decree 818/2018, of 6 July, on measures for the reduction of national emissions of certain atmospheric pollutants sets in article 10 the rules of functioning of the Spanish Emissions Inventory and Projections System.
- Royal Decree 503/2024, of 21 May, which develops the basic organic structure of the Ministry for the Ecological Transition and the Demographic Challenge, designates, in article 8.c), the Directorate General of Environmental Quality and Assessment as competent authority of the Spanish Emissions Inventory and Projections System.
- Royal Decree 91/2025, of 11 February, establishing the governance mechanism for energy, climate change and air quality, develops the national system and mechanisms for reporting under obligations on climate change and air pollution.
- Emission Inventories are considered a statistic operation within the National Statistic Plans 2017-2020, 2021-2024 and 2025-2028 (statistic operation numbers 7105 for plan

2017-2020, 8105 for plan 2021-2024, and 9104 for plan 2025-2028) and according to Law 12/1989, it is compulsory to provide the necessary information for its development.

The SEI structure can be summarized in the following figure:

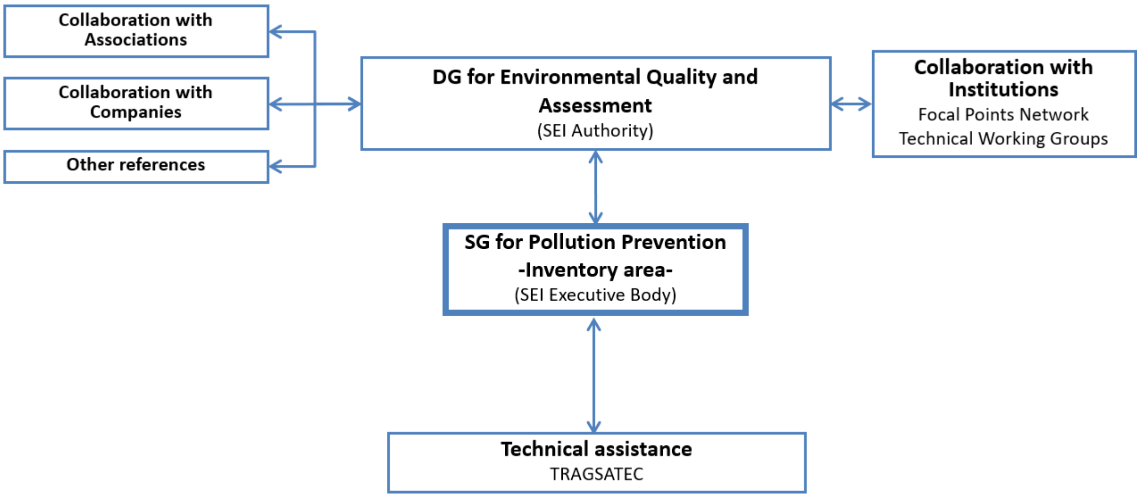



**Figure 1.2.1 SEI's organisation**

Within the Directorate-General for Environmental Quality and Assessment (DGCEA) of the MITECO, the Emissions Inventory Area manages the ordinary function of the SEI. Additionally, the DGCEA as National Authority of the SEI awarded in 2017 the public society TRAGSATEC a contract for the technical assistance in the management, maintenance and updating of the SEI.

Altogether, the SEI is formed by 23 specialists in total as detailed in the following table:

**Table 1.2.1 Composition of the SEI**

| Name | Role | Organization |
|---|---|---|
| Carmen Ramos Schlegel | Inventories coordinator and sector expert-Waste and Agriculture | IU |
| Fco. Javier Pérez-Ilzarbe Serrano | Projections coordinator and sector expert-IPPU and Energy | IU |
| Guillermo Martínez López | Sector expert-IPPU | IU |
| Ramiro Oliveri Martínez-Pardo | Sector expert-LULUCF and Agriculture | IU |
| Iván José Díaz Rey | IT expert | Ttec |
| Juan Luis Hernández Briz | IT expert | Ttec |
| Miguel García Rodríguez | QA/QC Coordinator and cross-cutting issues | Ttec |
| José Ángel Gil Gutiérrez | Technical assistance coordinator and sector expert –Energy and IPPU | Ttec |
| Máximo Oyágüez Reyes | Sector expert-Energy | Ttec |
| José Luis Llorente Montoro | Sector expert-Energy and cross-cutting issues | Ttec |
| Sofía Bueno Hernández | Sector expert-Transport | Ttec |
| Sonia Lázaro Navas | Sector expert-Transport | Ttec |
| Mª Ángela Haro Maestro | Sector expert-IPPU | Ttec |
| Olalla González Fontaíña | Sector expert-IPPU | Ttec |
| Anselmo Espinosa Vergara | Sector expert-IPPU | Ttec |
| Jose Maria Cantarero Alonso | Sector expert- IPPU | Ttec |
| Fco. Javier Flores Sanz | Sector expert-Agriculture | Ttec |
| Mª del Mar Esteban García | Sector expert-LULUCF | Ttec |
| Susana Pérez Pérez | Sector expert-LULUCF | Ttec |
| Nuria Escudero Aguado | Sector expert-Waste | Ttec |
| Mario Fernández Barrena | Sector expert-Projections | Ttec |

| Name | Role | Organization |
|---|---|---|
| David Sánchez Vicente | Sector expert-Projections | Ttec |
| Manuel Velazquez Arauzo | Sector expert-Projections | Ttec |

IU: Inventory Unit-DGCEA; Ttec: TRAGSATEC

Additionally, the functional structure of the SEI relies on national ministries and other public institutions articulated by the SEI's National Focal Points Network with the representation of the relevant departments. On an annual basis, the SEI's National Focal Points Network meets in order to enhance interdepartmental cooperation and coordination.

**Table 1.2.2 SEI's National Focal Points Network**

| Name | Unit |
|---|---|
| Ministry of Defence | D.G. for Infrastructure |
| Ministry of Home Affairs | D.G. for Traffic |
| Ministry of Transport and Sustainable Mobility | D.G. for Roads |
| | State Air Safety Agency |
| | D.G. Merchant Navy |
| | State Ports Authority |
| | D.G. for Economic Programming and Budget |
| | D.G. for Road Transport |
| | S.G. for Infrastructure Planning and Transport |
| | D.G. National Geographic Institute |
| Ministry of Health | Spanish Agency of Medicines and Health-Care Products |
| Ministry of Economic Affairs and Digital Transformation | National Statistical Institute |
| Ministry for the Ecological Transition and the Demographic Challenge | Secretariat of State for Energy |
| | D.G. for Environmental Quality and Assessment |
| | D.G. for Water |
| | Spanish Office for Climate Change |
| | State Meteorological Agency |
| | D.G. for Biodiversity, Forests and Desertification |
| Ministry of Agriculture, Fisheries and Food | National Agency for Agricultural Insurance (ENESA) |
| | D.G. for Agricultural Production Health |
| | D.G. for Production and Agricultural Markets |
| | S.G. for Analysis, Coordination and Statistics |
| | D.G. for Food Industry |
| | D.G. for Fisheries and Aquaculture Management |

Working groups have been set within the SEI framework in various thematic contexts.

The SEI's structure is completed by the collaboration links established with private companies and sectoral associations. These stakeholders actively participate by providing data on production or emissions, as well as expertise for the elaboration of the National Inventories.

Finally, a contact group of regional administrations linked to emission inventories was created whose main purpose is the share of information.

## 1.3. Inventory preparation process

The Inventory preparation process is managed by the SEI, together with the technical assistance of TRAGSATEC.

The milestones of Inventory preparation are the following:

**Table 1.3.1 Milestones of Inventory preparation (edition 2026)**

| Date | Milestones |
|---|---|
| 26-Mar-25 | Official start of Edition 2026 of the Inventory |
| 23-Apr-25 | Start of data collection |
| 11-Jun-25 | Start of data processing |
| 18-Nov-25 | End of data processing |
| 2-Dec-25 | Submission of data for internal national approval |
| 15-Jan-26 | Start of reports' preparation |
| 11-Feb-26 | First Submission of NFR tables |
| 13-Mar-26 | Submission of IIR |

The main stages and features in the elaboration process are:

### 1.3.1. Key categories analysis and Inventory improvement plan

The analysis of the key categories identified in the previous edition of the Inventory constitutes the starting point for assigning the priorities in order to improve the Inventory and accomplish the remaining activities. A review of the improvement plan is performed at this stage in order to identify priority areas for improvement. After the international reviews of the 2025 edition of the Inventory, a total of 6 recommendations from previous review processes were still not fully resolved (2 not resolved and 4 addressing). Furthermore, 23 internal points of improvements of different relevance had been identified. The result of the alignment of key categories analysis with the improvement plan conditioned the following steps of the Inventory preparation process.

### 1.3.2. Choice of methods

This stage may include the initial selection of methods for categories not previously considered in the Inventory, as well as the revision of the selected methods for categories where a methodological change is proposed.

### 1.3.3. Data collection

This phase entails the collection of the necessary data and information for applying the selected methods to each different activity (activity parameters and variables; algorithms and emission factors; measured or estimated emissions). This stage started on the 21$^{st}$ of April 2025 with the submission of requests for information via email to the different data providers and collaborators. Preparation of the questionnaires, letters, emails and forms to request for information was done during the previous weeks. Two main groups of data providers can be distinguished in the process: the private sector, with the deadline for submitting information by 31$^{st}$ May 2025 and the public sector with the deadline by 30$^{th}$ June 2025.

In this stage, a total of 107 requests of information were delivered containing 201 questionnaires. For the data collection process, an Access database is used to manage all the contact details, create emails to data providers and register delivery and reception dates of the requests (for details on the data request database, please refer to section 1.6.7 of this document). Data collection is completed with information available on the Internet, such as yearbooks, annual reports, statistics, etc.

The evolution of the data collection process is presented in the figure below. As shown, by early June, 89.5% of the total pieces of information requested had been received. It must be highlighted how the proximity of the 2nd of June deadline accelerates the reception of information. The 54% of data providers answered after the deadlines, of which a 15% needed a second request (remainder mail).

At the end of the data collection phase, 99.4% of the requests sent to private data providers were answered. Regarding the public data providers, 64% of the information requested was sent. Some of the missing information was secondary information not essential for the estimation of emissions, and in cases where information was essential, splicing techniques were used.

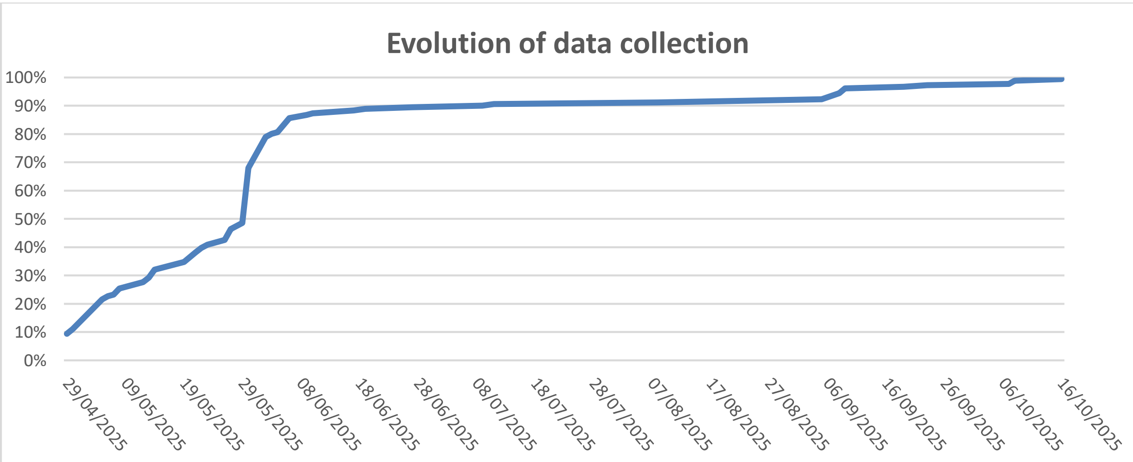



**Figure 1.3.1 Evolution of data collection (edition 2026)**

In summary, taking into account, both private and public data providers, 99% of total pieces of information requested were received.

## 1.3.4. Data processing

The object of this phase is the integration of the collected data in order to feed the Core Inventory Emissions Database (CIEDB) with the necessary activity data, emission factors and parameters to estimate emissions. This stage goes from May up to the beginning of December and comprises two simultaneous activities: data processing as such and quality checks. With the arrival of the official energy statistics by the end of October and some other pieces of information due, 100% of data processed could be reached by the 8th of November 2025. Following data processing, sector experts and the QA/QC coordinator performs quality checks with an evolution line similar to data processing but showing a certain time lag.

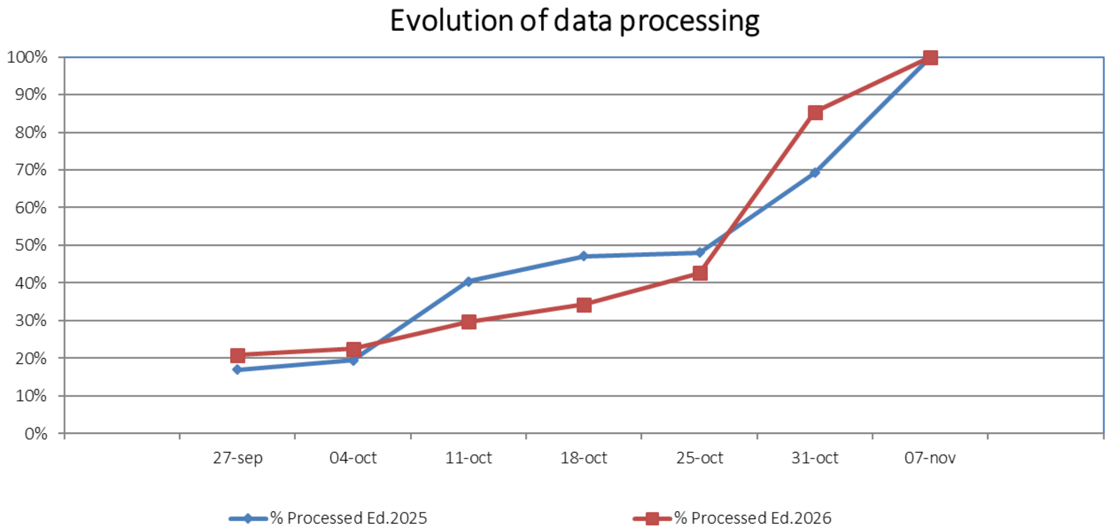



**Figure 1.3.2 Evolution of data processing**

## 1.3.5. Submission of results for approval

The pollutants emissions data for the 2026 Air Pollutants Inventory were approved on 13 January 2026 by the D.G. for Environmental Quality and Assessment.

Once the inventory has been approved, the Inventory Unit elaborates, publishes and sends all the required reports and information —in the format required for each case— to the international bodies.

## 1.3.6. Preparation of reports

At this stage, reports and tables of results for air pollutant emissions required by the different bodies to which the SEI reports, are prepared in accordance with the established format, content and time periods. Preparation of reports is based on the performed analysis of key categories and improvement plan, and includes the revision of the notation keys used in the corresponding reporting tables.

A drafting committee has been set within the SEI at the beginning of this stage in order to establish a work timetable, to share duties and responsibilities and to agree on contents, format and style of the reports. This committee, integrated by the members of the SEI and representatives of the technical assistance, met regularly after the kick-off meeting on the 7th January 2026.

The calendar for the development of these stages is schematised in the following figure.

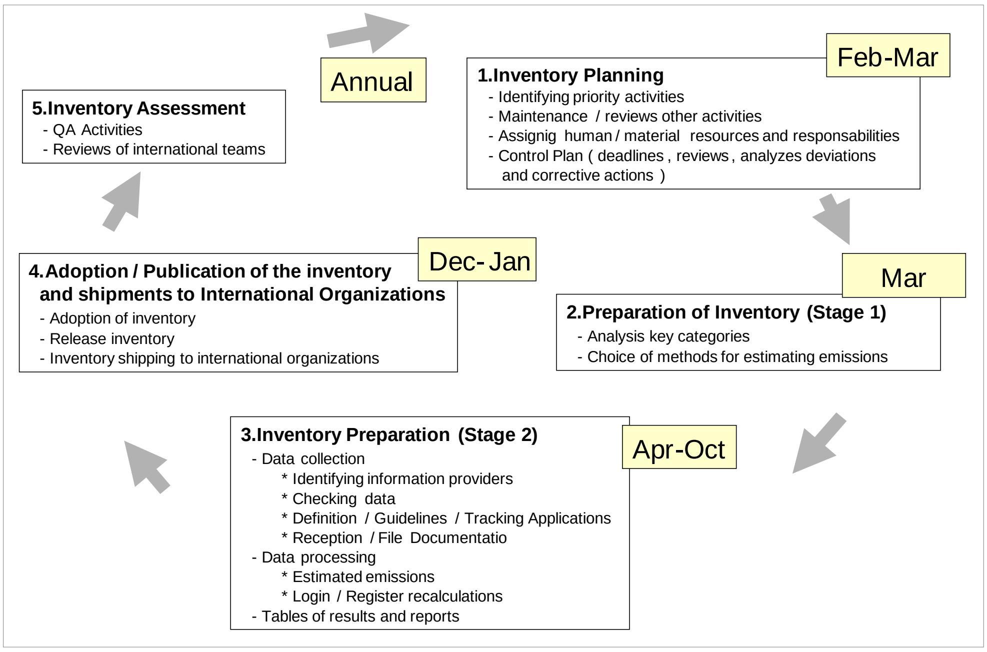



**Figure 1.3.3 Diagram of the annual cycle of activities for the inventory**

## 1.4. Methods and data sources

### 1.4.1. Selection of methods

The emission estimation methods applied in the Inventory depend on the nature of the activity being considered and the availability of basic data. Based on the availability of information on the emissions themselves, two major categories can be differentiated:

I. Methods based on observed emission data. Based on direct measurement of the emissions. Two types can be distinguished between these methods:

a. Continuous measurement.

b. Measurement at regular intervals.

In this Inventory edition, data based on direct measurements have mainly been used in connection with the Large Point Sources, excluding airports. Data is frequently available from these sources due to their environmental importance and the size of the activity involved, whose authorization normally includes the need to measure and report certain pollutants. This information is collected from the plants themselves through individualized questionnaires.

– Activities and pollutants where direct measurements have been used are included in the next table:

**Table 1.4.1 Main activities with direct measures for main pollutants, TSP and CO**

| Activity | NOx | NMVOC | $SO_2$ | $NH_3$ | TSP | CO |
|---|---|---|---|---|---|---|
| **Thermal power plants** | X | X* | X | - | X* | X |
| **Oil refineries** | X | X | X | - | X | X |
| **Integrated steel plants** | X* | X* | X* | X* | X* | X* |
| **Coke oven furnaces** | X* | X* | X* | X* | X* | X* |

| Activity | NOx | NMVOC | $SO_2$ | $NH_3$ | TSP | CO |
|---|---|---|---|---|---|---|
| **Car manufacturing** | X | X | X | - | X | X |
| **Aluminium** | - | - | X | - | X | - |
| **Paper pulp** | X* | - | X* | - | X* | X* |
| **Sulphuric acid** | - | - | X* | - | X* | - |
| **Nitric acid** | X* | - | - | X* | X* | - |
| **Ammonia** | X* | - | - | X* | X* | - |
| **Urea** | X* | - | - | X* | X* | - |
| **Ammonium phosphate** | - | - | X* | X | - | - |
| **NPK fertilizers** | X* | - | X* | X* | - | - |
| **Soda ash** | - | - | - | - | - | - |
| **Carbon black** | X | - | X | - | X | - |
| **Waste incineration** | X* | X | X | - | - | X |

* Partially covered: only available for some plants and in certain years

– Other pollutants in point sources for which it has been possible to collect direct data. This is the case in:

- Coal-fired thermal power plants (1995-1998) for cadmium, mercury and lead.
- Urban waste incinerators, mainly with respect to heavy metals and dioxins.
- Industrial waste incinerators, mainly with respect to heavy metals and dioxins.
- Chlorine production (years 1998-2017) for mercury emissions.

II. Methods based on calculation procedures. This category can be split into procedures based on:

a. Simple balance of materials. This method has been applied for the estimation of sulphur dioxide in combustion facilities where information is available regarding the amount of sulphur present in the various fuels used and the retention coefficients for ash and specific parts of the combustion facilities. In installations with desulphurisation units where information was available on emission abatement techniques, the estimation of potential emissions has been corrected, where necessary, with a reduction coefficient. This procedure was also used to estimate lead emissions and other heavy metals in internal combustion engines in vehicles for road transport and mobile machinery. This has been also the approach adopted for estimating NMVOC emissions from painting lines at automobile manufacturing plants.

b. Complete balance. This method comprises the determination of all inputs and outputs of different chemical elements (using data on the types of process and facilities as well as the amounts of materials and the elements in their composition), although it was not, in fact, possible to apply it effectively in the estimation of pollutants emissions due to its complexity. In any case, it has been retained as a reference method for validating atypical estimates.

c. Methods based on functional statistical models: Modelling-correlation. This method is based on the results of earlier works into the estimation of functional relationships or correlations between certain physical and chemical variables and emissions from certain activities. This kind of simulation models has been applied to estimate emissions of pollutants in categories 1A3a Air transport and 1A3b Road transport.

d. Methods based on emission factors: activity factors and variables. This method has been the most generally used in preparing the Inventory and applied when no other more precise option was available to estimate the emissions for an activity.

### 1.4.2. Consideration of the effect of abatement techniques

One point of great importance for the correct application of the estimation methods based on algorithms is the consideration of the efficiency of the abatement which is assumed in the functional relationships and in the emission factors used. For this purpose, the appropriate corrections were applied to take into account the degree of application of emission abatement techniques in the various emitting activities included in the Inventory. The following examples, among others, can be given as important illustrations of this criterion:

- Heavy metal emission factors at coal-fired thermal power plants depending on whether or not gas desulphurisation techniques in addition to particulate control techniques are used or not (please refer to table 31, Chapter B111, EMEP/CORINAIR Guidebook (2007)).
- $SO_2$ emission factors at primary zinc and copper production plants when there is an associated sulphuric acid production plant capable of reducing the emissions from the first plants by between 90% and 99%. Furthermore, in $SO_2$ emissions at the refineries, the number of sulphur recovery phases in Claus plants has been taken into account so as to select the most representative factor in those cases where no direct estimation was provided by the plants themselves.
- Regarding incineration plants, the emission factors have been updated to 2019 EMEP/EEA Guidebook. For the period 1996-2023, each plant has its own abatement techniques but the control technique “Particle abatement + acid gas abatement” has been considered as a minimum and thus the values shown in table 3-1 EMEP/EEA(Chapter 5C1a) have been adopted. For the period 1990-1995, it was assumed only “particle abatement”, so values from table 3-2 have been applied. In the case of particle matter and heavy metals (except mercury), table 3-1 values were considered more appropriate. Finally, abatement efficiency has been applied to PCBs and dioxin values (table 3-3).
- In cases where point sources report direct measures of TSP emissions together with the implementation of particulate abatement techniques in their facilities (including especially dry electrostatic precipitators, whose effectiveness exceeds 99% reduction and fabric filters), this information has been used for the selection of the appropriate $PM_{2.5}$/TSP or $PM_{10}$/TSP ratio for the estimation of $PM_{2.5}$ and $PM_{10}$. In these cases, the possible existence of control measures has been used to evaluate the appropriate level of abatement and its comparison with the four abatement levels indicated by the CEPMEIP, for each unit, and this parameter determines the emission factor assigned.
- Emission factors for conventional pollutants ($SO_2$, NOx, NMVOC and CO), heavy metals (As, Cd, Cr, Cu, Hg, Ni, Pb and Zn) and particles (TSP) in the manufacture of cement (clinker) according to the estimated rate of penetration of emission control techniques in the sector in the sub-periods 1990-2000 and 2001-2004. From 2005, country-specific emission factors are used based on average measured values.
- Emission factors for mercury in the manufacture of chlorine according to the estimated rate of penetration of emission control techniques in the sector and the implementation of less polluting processes during the 1998-2011 sub-period.

## 1.4.3. General Reference to Information sources on Activity Variables

The most important references to activity variables are listed in the following table.

**Table 1.4.2 Most important activity data IIR 2026**

| NFR Code | Activity | Main Source of information on activity data |
|---|---|---|
| **1A1a** | Public electricity and heat production | Individualized questionnaire + Energy international statistics by the Secretariat of State for Energy of the Ministry for the ecological transition and demographic challenge (MITECO) + EU ETS data |
| **1A1b** | Petroleum refining | Individualized questionnaire + EU ETS data |
| **1A1c** | Manufacture of solid fuels and other energy industries | Individualized questionnaire + statistics by MITECO |
| **1A2** | Stationary combustion in manufacturing industries and construction. | Individualized questionnaires from plants + information from the main business associations + Energy international statistics by MITECO+ EU ETS Data |
| **1A3ai(i)** | International aviation LTO (civil) | EUROCONTROL |
| **1A3aii(i)** | Domestic aviation LTO (civil) | EUROCONTROL + Energy international statistics by MITECO |
| **1A3b** | Road transportation | National Statistics of Road Traffic and “Standing Survey of Road Freight” EPTMC by Ministry of Transport and Sustainable Mobility + Energy international statistics by MITECO + “General Statistical Yearbook” published by the DGT (Spanish Traffic Department) of the Ministry of Interior + Studies of road sampling in Madrid (General Directorate of Sustainability and Environmental Control of Madrid City Council) |
| **1A3c** | Railways | Individualized questionnaire + Energy international statistics by MITECO |
| **1A3dii** | National navigation (shipping) | Energy international statistics by MITECO |
| **1A3ei** | Pipeline transport | Individualized questionnaire |
| **1A4a** | Commercial/institutional | Energy international statistics by MITECO |
| **1A4bi** | Residential | Energy international statistics by MITECO |
| **1A4bii** | Residential: Household and gardening (mobile) | Energy international statistics by MITECO |
| **1A4ci** | Agriculture/Forestry/Fishing: Stationary | Ministry of Agriculture and Fishing and Food (MAPA) Statistics |
| **1A4cii** | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | Energy international statistics by MITECO + Expert judgement |
| **1A4ciii** | Agriculture/Forestry/Fishing: National fishing | Energy international statistics by MAPA Statistics |
| **1A5b** | Other, Mobile (including military, land based and recreational boats) | Energy international statistics by MITECO + Ministry of Defence |
| **1B1a** | Fugitive emissions from solid fuels: Coal mining and handling | MITECO Statistics |
| **1B1b** | Fugitive emissions from solid fuels: Solid fuel transformation | Individualized questionnaire + Energy international statistics by MITECO |
| **1B2** | Fugitive emissions Oil & Natural Gas | Individualized questionnaire + Energy international statistics by MITECO + National energy balances (IEA and EUROSTAT) + information from the main business associations + State Meteorological Agency (AEMET) |
| **2A1** | Cement production | Main business association |
| **2A2** | Lime production | Main business association + Individualized questionnaire |
| **2A3** | Glass production | Main business association + Individualized questionnaire |

| NFR Code | Activity | Main Source of information on activity data |
|---|---|---|
| **2A5a** | Quarrying and mining of minerals other than coal | Geological and Mining Institute of Spain (IGME) + Mining statistic by MITECO |
| **2A5b** | Construction and demolition | National Statistical Data (INE) + Ministry of Transport and Sustainable Mobility |
| **2A5c** | Storage, handling and transport of mineral products | Spanish State ports agency |
| **2A6** | Other mineral products: Batteries manufacturing | Industry production statistics by the Ministry of Industry, Trade and Tourism |
| **2B1** | Ammonia production | Individualized questionnaire |
| **2B2** | Nitric acid production | Individualized questionnaire + Main business association + Ministry of Industry, Trade and Tourism |
| **2B5** | Carbide production | Individualized questionnaire |
| **2B6** | Titanium dioxide production | Information from the main business association |
| **2B7** | Soda ash production | Individualized questionnaire |
| **2B10a** | Other chemical industry: Processes in organic and inorganic chemical industry except for adipic acid | Individualized questionnaire + information from the main business associations |
| **2C1** | Iron and steel production | Individualized questionnaire + information from the main business association |
| **2C2** | Ferroalloys production | Individualized questionnaire |
| **2C3** | Aluminium production | Individualized questionnaire |
| **2C5** | Lead production | Individualized questionnaire + information from the main business association |
| **2C6** | Zinc production | Individualized questionnaire + international statistics yearbooks |
| **2C7a** | Copper production | Individualized questionnaire + information from the main business association + international statistics yearbooks |
| **2D3a** | Domestic solvent use including fungicides | National Statistical Data (INE)<br>European Solvents Industry Group |
| **2D3b** | Road paving with asphalt | Information from the main business association |
| **2D3c** | Asphalt roofing | National Statistical Data (INE) + Information from the main business associations |
| **2D3d** | Coating applications | National Statistical Data (INE) + Information from the main business associations |
| **2D3e** | Degreasing | Individualized questionnaire |
| **2D3f** | Dry cleaning | National Statistical Data (INE) |
| **2D3g** | Chemical products | Information from the main business associations |
| **2D3h** | Printing | Information from the main business associations |
| **2D3i** | Other solvent use | National Statistical Data + Individualized questionnaire |
| **2G** | Other product use | EUROSTAT |
| **2H1** | Pulp and paper industry | Individualized questionnaires + Information from the main business associations |
| **2H2** | Food and beverages industry | National Statistical Data (INE) + MITECO Statistics |
| **2I** | Wood processing | FAOSTAT |
| **2K** | Consumption of POPs and heavy metals | MITECO Statistics |
| **2L** | Other production, consumption, storage, transportation or handling of bulk products: $NH_3$ Consumption in Refrigeration and Air conditioning | Information from the main producers of $NH_3$ for refrigeration and air conditioning |

| NFR Code | Activity | Main Source of information on activity data |
|---|---|---|
| **3B** | Manure management | MAPA Statistics + Husbandry Surveys + Livestock Farm Registry (REGA) + Animal Individual Identification Registry (RIIA) |
| **3D** | Agricultural Soils | MAPA Statistics + Husbandry Surveys |
| **3F** | Field burning of agricultural residues | MAPA Statistics + Nitrogen and Phosphorous Balance in Spanish Agriculture (BNyPAE) |
| **5A** | Biological treatment of waste - Solid waste disposal on land | Individualized questionnaire + MITECO Statistics |
| **5B1** | Biological treatment of waste - Composting | MITECO Statistics |
| **5B2** | Biological treatment of waste - Anaerobic digestion at biogas facilities | Individualized questionnaire + MITECO Statistics |
| **5C1a** | Municipal waste incineration | Individualized questionnaire + MITECO Statistics |
| **5C1biv** | Sewage sludge incineration | MITECO Statistics |
| **5C1bv** | Cremation | Estimation based on National Statistical Data (INE) + Information from the main business associations |
| **5C2** | Open burning of waste | MAPA Statistics |
| **5D1** | Domestic wastewater handling | Data from OECC + National Statistical Data (INE) |
| **5D2** | Industrial wastewater handling | Estimation based on National Statistical Data (INE) |
| **5E** | Other waste | Madrid City Council statistics + MAPFRE foundation |

The most important information required from the National Focal Points is listed in the following table.

**Table 1.4.3 Information provided from the focal points**

| Ministry | Department | Information required |
|---|---|---|
| Ministry of Defence | D.G. for Infrastructure | - Fuel consumption in military tactical equipment.<br>- Breakdown of consumption grouped by multilateral and unilateral operations. |
| Ministry of Interior | D.G. for Traffic | - Registration and de-registration of vehicles in the fleet.<br>- Characteristics of registered vehicles (propulsion system...).<br>- Vehicle fleet distribution by type of vehicle, fuel and age.<br>- Historical technical inspection of vehicles data information. |
| Ministry of Transport and Sustainable Mobility | D.G. for Roads | - Distances travelled by vehicles (broken down by institution responsible for the road).<br>- Map of roads.<br>- Historical information on running fleet.<br>- Kilometres of roads by type of road and pavement. |
| | State Air Safety Agency | - Statistics on movements of civil aircraft |
| | D.G. for Merchant Navy<br>State Ports Authority | - Statistics on movements of vessels, lengths of stay and port entry and departure times.<br>- National / international shipping traffic.<br>- Register of vessels.<br>- Cartographic information on routes. |
| | D.G. for Economic Planning and Budget<br>D.G. for Road Transport | - Permanent survey on haulage of goods by road. |
| | S.G. for Infrastructure, Planning and Transportation | - Passenger and freight mobility by means of transport. |
| | D.G. National Geographic Institute | - Soil maps (1:1.000.000). |

| Ministry | Department | Information required |
|---|---|---|
| Ministry of Health | Spanish Agency of Medicines and Health-Care Products | - Medicinal $N_2O$ consumption data. |
| Ministry of Economic Affairs and Digital Transformation | National Statistical Institute | - Industrial survey of companies and products.<br>- Industrial production index.<br>- National accounts. |
| Ministry for the Ecological Transition and the Demographic Challenge | Secretariat of State for Energy | - IEA and Eurostat international questionnaires:<br>· Heat and electricity.<br>· Natural gas.<br>· Oil-based products.<br>· Coals.<br>· Renewable energies and waste.<br>- Other energy-related statistics.<br>- Service stations.<br>- Institute for the Diversification and Saving of Energy (IDAE): co-generation, biomass and activity variables in RC&I sector and in combustion plants with a thermal capacity lower than 50 MWth.<br>NOTE: This source also edits the publication entitled "La Energía en España" (Energy in Spain) used as background information on energy. |
| | D.G. for Environmental Quality and Assessment | - Incinerators of waste oil.<br>- Information of the National Sludge Register.<br>- Generation/treatment balance of waste.<br>- Composition of waste landfilled.<br>- Managed landfills.<br>- Unmanaged landfills.<br>- Municipal waste composting plants.<br>- Update of the survey entitled "Estimation of sewage sludge production and treatment at wastewater treatment plants" provided by CEDEX.<br>- Information on chlor-alkali sector. |
| | D.G. for Water | - Information on wastewater. |
| | Spanish Office for Climate Change | - Basic information for the drafting of the $CO_2$ verification reports from the plants subject to the emissions trading regime.<br>- Information on the accounting of Kyoto Protocol units.<br>- Information on the national register.<br>- Information on Article 3, paragraph 14 of the Kyoto Protocol. |
| | State Meteorological Agency | - Temperature (air and land) wind speed and wind direction, cloudiness, precipitation and insolation. |
| | D.G. for Biodiversity, Forests and Desertification | - Estimation of living biomass in afforestation and reforestation.<br>- Wildfires statistics.<br>- Controlled burning statistics.<br>- Estimation of living biomass in forest land remaining as such.<br>- Forest Statistics Yearbook.<br>- Carbon stocks in dead wood and the detritus of forest land remaining as such. |
| Ministry of Agriculture and Fishing and Food | National Agency for Agricultural Insurance (ENESA) | - Accident claims information due to fire in insured agricultural and forestry productions. |
| | D.G. for Agricultural Production Health | - Information of biomethanization plants (slurry). |

| Ministry | Department | Information required |
|---|---|---|
| | D.G. for Production and Agricultural Markets | - Surface, yield and production of crops.<br>- Burning of agricultural residues.<br>- Consumption of synthetic fertilizers.<br>- Application of fertilizers.<br>- Consumption of pesticides and phytosanitary products.<br>- Fleet on self-propelled mobile farm machinery.<br>- Stationary combustion plants.<br>- Functions and parameters for the estimation of the growing biomass function in woody crops. |
| | S.G. for Analysis, Coordination and Statistics | - Crop transitions including, at least, a woody crop.<br>- Soil conservative management practices.<br>- Censuses/Surveys of cattle breeding assets.<br>- Statistics on husbandry production (milk, meat, etc.).<br>- Transitions of areas that can be exploited by grazing and / or harvesting to feed livestock. |
| | D.G. for Food Industry | - Diet (protein content). |
| | D.G. for Fisheries and Aquaculture Management | - Statistics on the operational fishing fleet.<br>- Database on the fishing fleet. |

### 1.4.4. Geographical distribution of data

The present 2026 IIR edition contains detailed information on annual emission estimates of air pollutants by source in Spain for the whole national territory, in the case of the CLRTAP report, and for the national territory excluding the Canary Islands, in the case of the Directive 2016/2284 (as established by its article 2.2). Unless explicitly said, emission data quoted in this IIR refer to the whole Spanish territory including the Canary Islands.

The Inventory team is currently working on the update and improvement of geo-location of emissions in Spain. In this light, important efforts are being carried out to widen the number of installations identified as punctual emissions sources, aiming at closing the gap between inventory point sources and installations reporting under ETS and PRTR systems. Similarly, the Inventory team is actively working in improving the estimative geo-location of other emissions, such as those related to transport activities and those occurring in urban areas.

## 1.5. Key categories

The Spanish Inventory System applies the Approach 1 to calculate the Key Categories, by level (Level Assessment) and trend (Trend Assessment) following the EMEP/EEA Guidebook (2023).

The identification of the key sources has been calculated for the main pollutants (NOx, NMVOC, $SO_2$, $NH_3$ and CO), Particulate Matter (TSP, $PM_{10}$, $PM_{2.5}$ and Black Carbon), Priority Heavy Metals (Pb, Cd and Hg) and POPs (PCDD/PCDF, PAHs and PCBs).

For ***Level Assessment***, a threshold of 95% is defined for the cumulative distribution function of the emissions according to the activities in the Inventory. All activities included in the cumulative distribution function can be considered within that threshold to account for approximately 90% of the overall inventory uncertainty.

For ***Trend Assessment***, Approach 1 also specifies a threshold of 95% but defined in this case with regard to the contribution of the activities to the trend metrics[1].

The results obtained in the identification of key categories by pollutant are shown in a summary table below. It is indicated by pollutants and the identification for level (L) or trend (T).

For further details per pollutant and NFR sector are provided in Appendix 1 “Key category analysis”.

[1] The respective metrics for the level and trend are calculated by the following formulae:

(1) $L_{x,t} = {E_{x,t}}/{E_t}$

(2) $T_{x,t} = \left| {(E_{x,t} - E_{x,0})}/{(E_t - E_0)} \right|$

where:

$L_{x,t}$ is the level assessment for category x in year t.

$T_{x,t}$ is the trend assessment for category x in year t.

$E_{x,t}$ and $E_{x,0}$ are the emission estimations for category x in year t and 0, respectively.

0 is the base year (i.e. 1990 for main pollutants, metals and persistent organic pollutants; and 2000 for particulate matter).

### Table 1.5.1 Assignation of KC

| NFR | NFR Category | NOx | NMVOC | $SO_2$ | $NH_3$ | $PM_{2.5}$ | $PM_{10}$ | TSP | BC | CO | Pb | Cd | Hg | PCDD PCDF | PAHs | HCB | PCBs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1A1a** | Public electricity and heat production | L-T | L-T | L-T | - | L-T | L-T | L-T | - | L | - | L-T | L-T | T | L | L | - |
| **1A1b** | Petroleum refining | L-T | - | T | - | - | - | - | - | - | - | L | - | - | - | - | - |
| **1A1c** | Manufacture of solid fuels and other energy industries | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **1A2** | Manufacturing Industries and Construction | L-T | L | L-T | - | L-T | L-T | L-T | L-T | L-T | L | L-T | L-T | L | L | L | - |
| **1A3a** | Aviation LTO (civil) | L | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **1A3b** | Road transport | L-T | L-T | T | T | L-T | L-T | L-T | L-T | L-T | L-T | L | L | L | L | - | - |
| **1A3c + 1A3e + 1A5** | Other transport | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **1A3d** | Navigation | L-T | - | L | - | L | L | - | - | - | - | - | - | - | - | L | - |
| **1A4a + 1A4b** | Commercial/institutional/residential | L | L-T | L | - | L-T | L-T | L-T | L-T | L-T | L | L | L | L-T | L-T | L | - |
| **1A4c** | Agriculture/Forestry/Fishing | L-T | - | L | - | L-T | T | T | L-T | L | - | - | - | - | - | - | - |
| **1B** | Fugitive Emissions from Fuels | - | L-T | L-T | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **2A** | Mineral products | - | - | - | - | L-T | L-T | L-T | - | - | L | L | - | - | - | - | - |
| **2B** | Chemical industry | - | L | L | T | L | L | L | - | - | - | - | T | - | - | - | - |
| **2C** | Metal production | - | - | L | - | - | - | - | - | L | L | L | L | L-T | L-T | L | L |
| **2D** | Solvents use | - | L-T | - | - | - | - | - | - | - | - | - | L | - | - | - | - |
| **2G + 2H + 2I + 2J + 2K + 2L** | Other products use and industrial processes | - | L | L | - | L-T | L-T | L | - | - | - | L | - | - | - | - | L-T |
| **3B** | Manure management | - | L-T | - | L-T | L | L | L-T | - | - | - | - | - | - | - | - | - |
| **3D** | Crop production and agricultural soils | L | L-T | - | L-T | L | L-T | L-T | - | - | - | - | - | - | - | T | - |
| **3F** | Field burning of agricultural wastes | T | T | - | T | T | T | T | T | T | - | T | T | T | T | - | - |
| **3I** | Agriculture other | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **5A** | Biological treatment of waste: Solid waste disposal on land | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **5B** | Biological treatment of waste | - | - | - | T | - | - | - | - | - | - | - | - | - | - | - | - |
| **5C** | Incineration | L | - | - | - | L-T | L-T | L-T | L-T | L | L | L | L-T | L-T | - | L | - |
| **5D** | Wastewater handling | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **5E** | Other waste | - | - | - | - | - | - | - | - | - | - | - | - | L | - | - | - |
| **6A** | Other | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

L-Level; T-Trend

## 1.6. Quality Assurance and Quality Control (QA/QC) and verification

This section provides an overview of the Spanish Inventory QA/QC system, including verification and treatment of confidential issues. The system has been designed following the guidance provided in the 2006 IPCC Guidelines and the 2023 EMEP/EEA Guidebook. The European Commission Staff Working Document SWD(2013)308[2] has also been used as a reference.

As stated in section 1.2 Institutional arrangements, the Spanish Inventory System (SEI) is in charge of the compilation and maintenance of both the Air Pollutant and the Greenhouse Gas Emissions Inventories, as well as the elaboration of the national emissions projections. A complex network of data providers allows the Inventory gathering the necessary data for inventory compilation (national focal points, organizations, sectoral associations, companies). Despite most of these partners having their own QA/QC systems ensuring high-quality raw data, the Inventory System coordinates and complements QA/QC activities in order to meet quality objectives.

Since the Spanish Inventory System is responsible for the compilation and reporting of both GHG and Air Pollutants Inventories, the QA/QC system follows an integrated approach, covering both Inventories. For this reason, references to the GHG Inventory may appear in this document.

### 1.6.1. The QA/QC system

The Inventory QA/QC system constitutes the general framework for QA/QC planning, QA/QC implementation, documentation and archiving activities. Spanish Inventory QA/QC is well balanced against time and resources availability, and uses the widely known PDCA cycle approach (plan-do-check-act). As good practice suggests, the system consists of the following elements:

- A QA/QC and verification coordinator, also functioning as Inventory compiler.
- A QA/QC plan.
- QC procedures: both general and category-specific procedures.
- QA/QC system interaction with uncertainty analyses.
- Verification activities.
- Reporting, documentation and archiving procedures.

All these elements are included and properly described in the QA/QC Inventory plan, which is revised and implemented throughout the different stages of the annual Inventory compilation and reporting cycle.

### 1.6.2. The QA/QC plan

The plan is conceived as an internal tool for organising verification and QA/QC activities in order to ensure the continuous improvement of the Inventory and the fulfilment of its objectives. The plan affects all stages of the Inventory's development and is periodically reviewed to ensure that

[2] Commission Staff Working Document "Elements of the Union greenhouse gas inventory system and the Quality Assurance and Control (QA/QC) programme", available in SWD(2013)308.

it includes all the changes occurring in activities and inventory processes detected by the Inventory's working group and the recommendations of external review teams.

The QA/QC plan has 6 main purposes:

1. To set general and specific goals for the quality of the Inventory emission estimates and outputs.
2. To set roles and responsibilities within the Inventory system.
3. To set general and category-specific QC activities and a scheduled time frame for its application.
4. To set QA procedures.
5. To assure that key outputs of QA procedures underpin the improvements plan.
6. To provide general procedures for reporting, documentation and archiving.

### 1.6.3. Quality objectives

The Inventory QA/QC system seeks to respond to Spain´s reporting obligations in a timely, transparent, consistent, comparable, complete and accurate manner. Furthermore, the QA/QC system intends to contribute to the improvement of quality of the Inventory. Specific quality objectives are established in order to provide concrete and measurable indicators to assess the quality of the Inventory system. These have been organized around general objectives of: timeliness, transparency, consistency, completeness, comparability and accuracy and inventory improvement:

**Table 1.6.1 General and specific objectives from the QA/QC plan**

| General objectives | Specific objectives |
|---|---|
| **Timeliness** | To meet all the internal stage-specific deadlines during inventory compilation. |
| | To meet all the Inventory reporting obligations on time. |
| **Transparency** | To provide transparent information in the report, including procedures applied for gap filling. |
| | To provide background information on activity data and methodologies. |
| | To include reasonable descriptions and justifications of trends in the report. |
| | To use notation keys in accordance with 2006 IPCC GL and 2019-2023 EMEP/EEA GB reporting guidelines. |
| | To provide transparent explanations for the use of NE and IE notation keys. |
| | To transparently include detailed explanations for recalculations in the report. |
| | To assure that Inventory review recommendations related to transparency are addressed, to the extent possible, in the subsequent inventory edition. |
| | To include information on QA/QC in the report. |
| **Consistency** | To assure a consistent time-series of emissions, activity data and implied emission factor. |
| | To assure internal consistency for emissions aggregations. |
| | To assure that inventory review recommendations related to consistency are addressed, to the extent possible, in the subsequent Inventory edition. |
| | To assure consistency among final emission estimates submitted to different reporting obligations, taking into account reasonable differences in geographical scope, categories, etc. |
| | To use, where possible, same methodologies and datasets along the time-series. |
| | To assure that estimation methods are consistent with the methodological guidance provided by 2006 IPCC GL and 2019-2023 EMEP/EEA GB. |

| General objectives | Specific objectives |
|---|---|
| | To assure consistency between data reported in reporting tables and data included in reports. |
| **Completeness** | To assure that all categories and gases/pollutants have been estimated. In case a category/gas/pollutant is not estimated, the appropriate explanation and notation key has been used (transparency). |
| | To assure that inventory review recommendations related to completeness are addressed, to the extent possible, in the subsequent inventory edition. |
| | To assure that all reporting tables provide an emission estimate or a notation key. |
| | To assure that information on completeness is included in the report. |
| | To assure that a summary of changes related to completeness is provided in the report. |
| | To assure the notation keys NE, NO, NA and IE are correctly used. |
| | To assure that all the information due is included in the submission to meet all the reporting obligations. |
| **Comparability** | To assure that IPCC and EMEP/EEA guidance is followed concerning selection of activity data, methods, use of notation keys and allocation of emissions into the difference categories. |
| | To assure the use of the latest reporting templates and nomenclature consistently with reporting requirements. |
| | To assure that inventory review recommendations related to comparability are addressed, to the extent possible, in the subsequent Inventory edition. |
| | To adequately implement decisions adopted in workshops and expert meetings addressing comparability (e.g. WG I, TFEIP, etc.). |
| **Accuracy** | To assure that category-specific emission factors are used when category-specific activity data is available. |
| | To assure that quantitative uncertainty assessment is performed. |
| | To assure that tier 2 or higher tier methods are used for estimating emissions from key categories. |
| | To assure that high uncertainty key categories are prioritised for methodological reviews and planned improvements. |
| | To assure that inventory review recommendations related to accuracy are addressed, to the extent possible, in the subsequent Inventory edition. |
| | To minimize transcription and unit conversion errors. |
| **Inventory improvement** | To contribute to improving the overall quality of the Inventory. |
| | To assure that review recommendations are prioritized and implemented. |

### 1.6.4. Roles and responsibilities

The DGCEA of the MITECO, as the competent authority of the Spanish Inventory System (SEI), is the body responsible for the Inventory's QA/QC system, acting as QA/QC manager, and has the support of specific technical assistance for undertaking the tasks required by this system.

The main responsibilities of the QA/QC manager are:

- To coordinate QA/QC activities for the SEI.
- To collect and reference the internal procedures for QA/QC used by the information providers and other organisations which cooperate with the SEI.
- To ensure the development and application of the QA/QC plan.

### 1.6.5. Timeline

Throughout the annual Inventory cycle, Spain has to meet an important number of international reporting obligations, starting by the end of July with the submission to European Commission of the Proxy GHG estimates and ending the 15th April with the submission to the UNFCCC of GHG emissions estimates and NIR, or later in May if gridded and LPS emission data are to be submitted under LRTAP Convention or EU NECD. In the middle, a number of submissions are due in compliance with the LRTAP Convention, the EU NECD and the EU Regulation for the reporting of GHG emissions. In addition to these international obligations, Spain has to meet formal internal and other informal and ad-hoc data requests.

The Spanish QA/QC system takes into account this condensed sequence of reporting obligations, stablishing internal deadlines for the different stages of the Inventory cycle. Furthermore, QA/QC activities are scheduled accordingly.

**Table 1.6.2 Main international emission inventory reporting requirements to be met by the SEI**

| Id | Obligation | Organization | GAS/POLLUTANTS | Deadline |
|---|---|---|---|---|
| 1 | Approximated greenhouse gas inventories. | European Commission (EC) | GHG | July, 31st |
| 2 | Greenhouse gas inventories - Regulation (EU) 2018/1999 (Governance). CRT tables. | | | January, 15th |
| 3 | LRTAP Convention. NFR tables. | UNECE | All Air Pollutants | February, 15th |
| 4 | National Emission Ceiling Directive (NECD) - Directive (EU) 2016/2284. NFR tables. | European Commission (EC) | | |
| 5 | LRTAP Convention. NFR tables + IIR. | UNECE | | March, 15th |
| 6 | National Emission Ceiling Directive (NECD) - Directive (EU) 2016/2284. NFR tables + IIR. | European Commission (EC) | | |
| 7 | Greenhouse gas inventories - Regulation (EU) 2018/1999 (Governance). CRT tables + NIR. | | GHG | |
| 8 | Regulation (EU) 2018/841 (LULUCF). | | | |
| 9 | Greenhouse gas inventories - UNFCCC. CRT tables + NID. | UNFCCC | | April, 15th |
| 10 | Gridded and LPS emission data under the National Emission Ceiling Directive (NECD) and LRTAP Convention. | European Commission (EC) UNECE | Air Pollutants | May, 1st |

The next figure shows the main reporting obligations and quality checks throughout the Spain inventory compilation process.

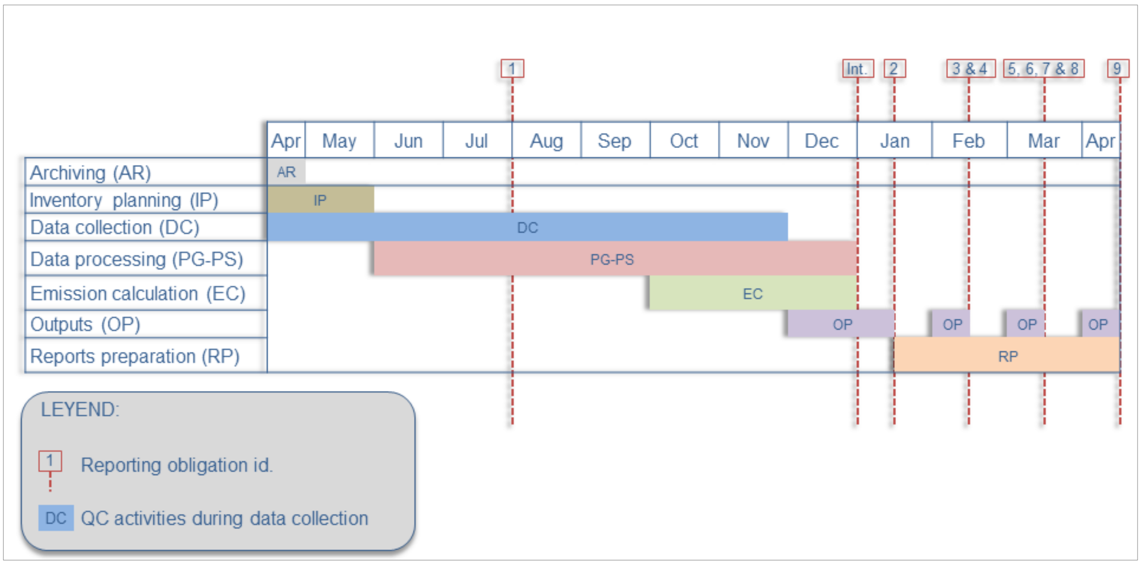



**Figure 1.6.1 Timeline for the Inventory compilation process**

## 1.6.6. Quality control and documentation

Throughout the Inventory cycle, different quality control activities and procedures are performed and properly documented. The next table includes key QC activities organized by the stage of the Inventory cycle where they occur, with details of the target quality objective and the checking and documentation tool used for their performance.

**Table 1.6.3 Key QC activities included in the QA/QC plan**

| Inventory stage | ID | QC actions | Target quality objective[3] | Checking and documentation tools |
|---|---|---|---|---|
| Inventory planning (IP) | IP.01 | Review of reporting obligations. | TIM | - |
| | IP.02 | Prioritisation of improvements (general and sector-specific) based on results from QA activities (reviews and audits), uncertainty analysis, timeliness and resources. | TIM, ACC, IMP | Improvement plan |
| | IP.03 | Development of a timeline of individual tasks, with checkpoints for the preparation of the different stages. | TIM | - |
| | IP.04 | Review of methodologies for new key categories appeared in two consecutive Inventory editions. | IMP | Key categories analysis tool |
| Data collection (DC) | DC.01 | Update of contact details, data format, data contents and deadlines for every data provider. | TIM, CON, COM, COP | DRDB |
| | DC.02 | Check for relationships between every data set and the corresponding CRF/NFR activities. | COM, COP | |
| | DC.03 | Second-person reviewing of every draft data request prior to submitting. | ACC | |
| | DC.04 | Second-person tracking of data requests: dates of request and delivery, state of delivery, deadlines, etc. | TIM, COP | |
| | DC.05 | Completeness and consistency checks on receipt of every data set delivered. | CON, COP | |

[3] TIM: Timeliness; TRA: Transparency; CON: Consistency; COM: Completeness; COP: Comparability; ACC: Accuracy; IMP: Inventory improvement.

| Inventory stage | ID | QC actions | Target quality objective[3] | Checking and documentation tools |
|---|---|---|---|---|
| Data processing - General (PG) | PG.01 | Review of methodologies applied and comparison with methodological guidance provided by 2006 IPCC GL and 2019-2023 EMEP/EEA GB. | CON | Methodological guidelines |
| | PG.02 | Checks of data processing spreadsheets: calculations, units, conversions. | ACC | Data processing spreadsheets |
| | PG.03 | An uncertainty value is provided for every category at the key categories aggregation level. | ACC | Inventory emissions database |
| | PG.04 | Embedded QC checking queries and constraints in the Inventory emissions database for integrity assurance. | CON, COM, ACC | |
| | PG.05 | Automated data import routines. | ACC | Data import tool |
| | PG.06 | Record date of data processing completed for every data request processed. | TIM, COM | DRDB |
| | PG.07 - PG.15 | Source-level completeness, consistency and recalculation checks (activity data, emission factors and emission estimates). | TIM, CON, COM | QC report generating tool |
| | PG.16 | Documentation of any change concerning methodology or activity data from previous years. | TRA | Inventory quality management tool |
| | PG.17 | Second review of data: source-level completeness, consistency and recalculation checks. | CON, COM | QC excel tool |
| | PG.18 - PG.24 | Consistency checks for point sources data loading into the CIEDB. | CON, COM | Inventory emissions database |
| Data processing - Category specific (PS) | PS.01 | Inventory fuel balance vs national fuel statistics. | CON, COM, ACC | |
| | PS.02 | Comparison between reference and sectoral approach for fuel consumption. | CON, COM | Spreadsheet |
| | PS.03 | Product/input ratios:<br>- Transformation of energy.<br>- Production energy requirements (quantity of energy per unit of product).<br>- Agricultural or livestock production.<br>- Generation and processing of wastes. | CON | Source-specific spreadsheets |
| | PS.04 | Composition of materials evolution:<br>- Density<br>- Carbon content<br>- Carbonates content<br>- VOC contents | | |
| | PS.05 | Composition of fuels evolution:<br>- Molar gas composition<br>- Carbon content<br>- Net calorific values | | |
| | PS.06 | Correlation between fuel mix evolution, climatology and energy price. | | |
| | PS.07 | Mass balance checks. | | |
| | PS.08 | Correlation between different data sources for air traffic (EUROCONTROL vs AENA) PS.09 See category-specific chapters for detailed information. | | |
| Emission Calculation (EC) | EC.01 | Verification that the estimation algorithms operate correctly. | ACC | Inventory emissions database |
| | EC.02 | Overall completeness check: estimates for all categories, subcategories, gases/pollutants and years. | COM | QC excel tool |

| Inventory stage | ID | QC actions | Target quality objective[3] | Checking and documentation tools |
|---|---|---|---|---|
| | EC.03 | Overall IEF trend checks: outliers detection. | CON | |
| Outputs (OP) | OP.01 | Database lockage. | TIM, CON | Inventory emissions database |
| | OP.02 | Draft outputs generation for second-person review before submitting. | CON, COM | - |
| | OP.03 | Total emissions cross-check: by sector and by gas/pollutant. | CON | QC excel tool |
| | OP.04 | Checks on the correctness of emissions aggregation and allocation. | CON, COP | |
| | OP.05 | Time-series consistency checks. | CON | |
| | OP.06 | Version checks: current outputs are cross-checked with last edition outputs. Any changes must be explained. | TRA, CON | Recalculation analysis tool Inventory quality management tool |
| | OP.07 | Geographical coverage checks. | COP | Inventory emissions database |
| | OP.08 | Consistency check between Inventory and ETS GHG emissions. | COP, ACC | Annex V Reporting format (Art.10- Reg. (EU) No 749/2014 |
| | OP.9 | Notation keys checks: completeness and harmonisation. | TRA, COM, COP | Inventory notation keys database |
| | OP.10 | Embedded database queries for consistency assurance between data exported from the Inventory database and data entered into reporting tools (CRF Reporter, NFR tables, etc.). | CON | Inventory emissions database |
| | OP.11 | Automated data transfer between the Inventory emission database and the official reporting tools (CRF reporter/NFR) to minimize transcription errors. | CON, ACC | Data transfer tool |
| | OP.12 | Running of the official reporting tools' built-in checks (CRF Reporter and RepDab). | CON, COM | Official reporting tools |
| Report Preparation (RP) | RP.01 | QC checklist for reports preparation. | TRA, CON, ACC | Chapter-specific QC checklist |
| | RP.02 | Second-person review of every draft chapter generated. | TRA, CON, ACC | - |
| Archiving (AR) | AR.01 | Archiving of database files, spreadsheet files, source data, manuals, reports. | - | Inventory folder system |
| | AR.02 | Update of the National Inventory System webpage[4] with all the information submitted during the Inventory cycle. Additional information on emissions at different aggregation levels and a set of methodological fact sheets are included as well. | TRA | MITECO Website |

[4] https://www.miteco.gob.es/es/calidad-y-evaluacion-ambiental/temas/sistema-espanol-de-inventario-sei-/default.aspx

## 1.6.7. Quality control and documentation tools

A short overview of the five main QC tools used by the Inventory is provided below.

### 1.6.7.1. Data request database (DRDB)

Overall management of data collection and registry of QC results during data processing is carried out with the Data Request Database (DRDB). This database includes two different operating modules:

1. The contacts database connected with the data requests tracking system.
2. A QC module for the registration of the progress in data processing and all the issues raised during the performance of QC activities.

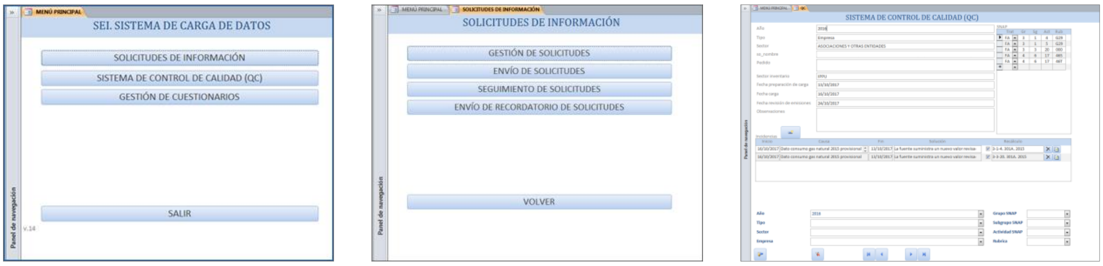



**Figure 1.6.2 Examples of screenshots of the DRDB**

### 1.6.7.2. Data import tool

An Excel-based file with embedded macros allows uploading data into the CIEDB. This tool first checks for data integrity and data structure before uploading. If integrity is not assured, an error message pops-up and a list of errors to solve are provided. Once integrity checks have been successfully passed, data are automatically imported into the database. After importing, the tool automatically executes the necessary compiling and calculating processes and produces a QC report. This report consists of a spreadsheet showing time-series for current and past edition for activity data, emission factors and emissions. Warning messages appear in the QC report if recalculations, outliers on implied emission factors or inconsistencies among particulate matter fractions are detected. The report is checked by the sector expert, if results are satisfactory, the activity is registered as uploaded and checked in the QC module of the DRBD. If the results are unsatisfactory, corrective measures take place.

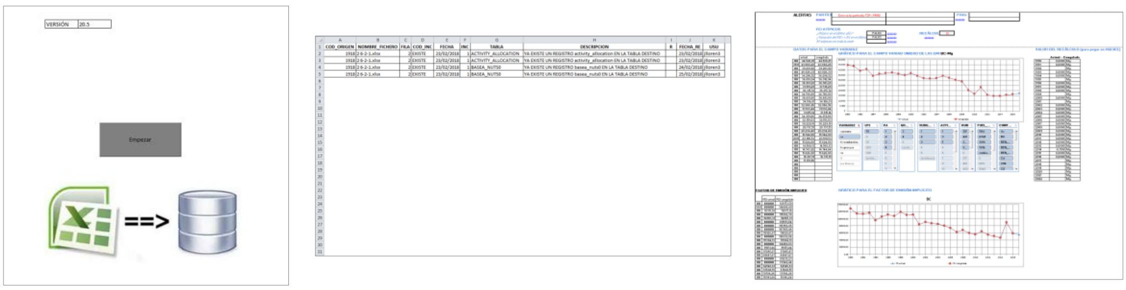



**Figure 1.6.3 Appearance of the Data import tool (left), list of import errors (middle) and QC report (right)**

### 1.6.7.3. QC excel tool

Once the emission calculation stage starts, CIEDB calculating procedures are run on a weekly basis. Resulting emissions and activity data are exported to an excel spreadsheet specially designed for QC and review purposes. With the use of pivot tables, filters and graphs, Inventory compilers are able to check emissions, activity data and IEF trends and recalculations. Checks can be performed at different levels of aggregation (sector, subsector, activity, etc.) and nomenclatures (SNAP, NFR and CRF). Furthermore, an automatic outliers' detector is included as well as annual variations ratio.

This tool, together with the QC report above mentioned, constitutes the main checking tools used in the Inventory for completeness and consistency assurance.

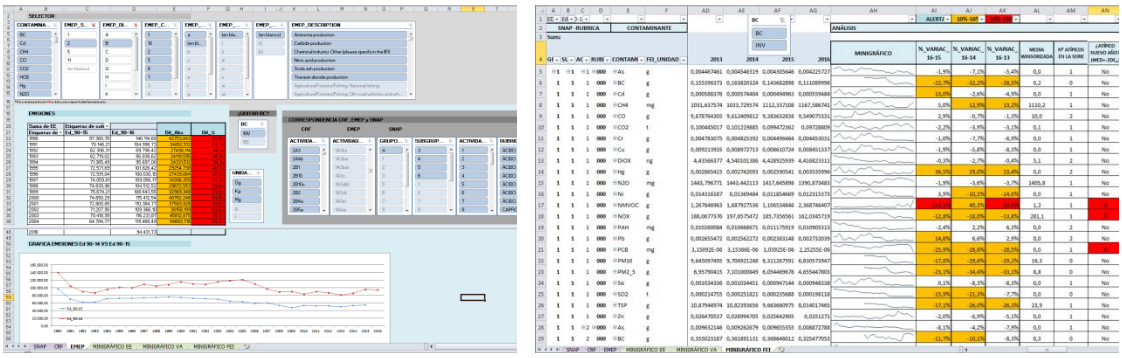


**Figure 1.6.4 Appearance of the QC excel tool**

### 1.6.7.4. Inventory quality management database (IQMDB)

The Inventory uses an Inventory quality management database (IQMDB) to allow the inventory compilers and QA/QC coordinator to register all aspects related to quality management: inventory compilation progress, improvement plan, quality checks and event log. It also allows producing different types of reports.

The current functioning of the IQMDB focuses on the event log module. This module allows registering any event or incident occurred during the data processing stage, being the recording of any change with associated recalculations of priority interest for the Inventory. For every revised estimate occurred in the Inventory, sector expert register details on the plant, category, pollutants, fuel (if any), years affected and impact. Furthermore, connections with the Inventory improvement plan can be established in order to quickly identify that certain revised estimates were due to a planned improvement. Recalculations can be classified by its origin: activity data, emission factors or other. For every origin, a range of options for details is available: error correction, updated methodology, updated activity data by the source, etc. A set of reports are also included in the event log module which presents data in different ways and levels of aggregation. In this edition of the Inventory, a total of 94 events were registered of which 90 (96%) with associated recalculations.


**Figure 1.6.5 Appearance of the Inventory quality management tool**

### 1.6.7.5. Recalculation analysis tool

This tool compares current edition against the past edition of the Inventory for every pollutant or gas estimated, and provides the user with valuable information on the variation of emissions, main categories recalculated, interannual changes, the number of categories recalculated, etc.

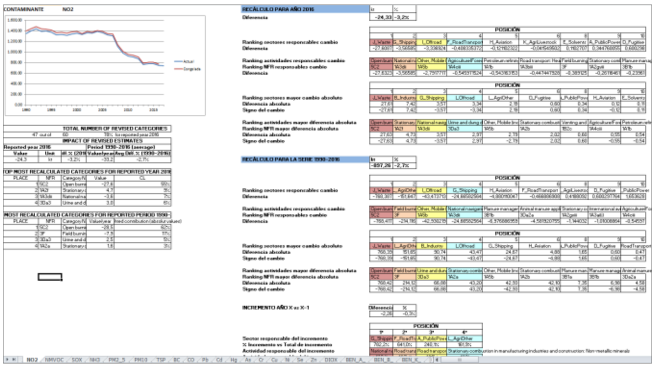


**Figure 1.6.6 Appearance of the recalculation analysis tool**

## 1.6.8. Quality assurance system

The QA system includes a number of activities conducted by third parties, not directly involved in the Inventory development process, intended to verify compliance with reporting requirements and to assess the effectiveness of the QC system.

A number of specific QA activities and procedures are detailed next:

- **Annual Inventory reviews conducted by UNFCCC, UNECE and the EU**: on an annual basis, reviews of the Spain GHG and Air Pollutants Inventories submitted under different information obligations are performed. The main outcome of these reviews is a list of recommendations which feed into the Inventory improvement plan.
- **Inventory users' feedback**: every year, the Inventory receives feedback, consultations and comments from regional authorities, research organizations such as CIEMAT, BSC, Universities and governmental bodies not directly related to the Inventory compilation. All these contributions help to enhance estimates and to strengthen the QA/QC system.

## 1.6.9. Verification

As part of the QA/QC system, two main verification activities are performed, one considered as a QC activity and another one as a QA activity.

- **Comparison between Inventory and EU ETS (QC)**: discrepancies are clarified with plant operators or the national EU ETS authority.
- **Comparison between National Inventory data at the regional level and data from regional inventories (QA)**: some regional governments have emission estimates or assessments, which are compared against data allocated by the Inventory to their region.

Discrepancies may allow the Inventory checking its estimates or the approach used for the spatial distribution of emissions.

Furthermore, in the 2020 edition, initial comparisons between the Inventory and PRTR were performed as a new QC activity. The Inventory and the Spanish PRTR authority have enhanced its collaboration in order to share and cross-check data on emission and activity data (when available).

### 1.6.10. Confidentiality handling

The air pollutant emission inventories are considered to be statistics for State purposes. They are performed on the basis of the exclusive responsibility of the State and follow the rules of statistical secrecy in accordance with the provisions of the 2025-2028 National Statistical Plan.

As a general criterion, emissions data in the SEI are not considered to be confidential. However, some information on activity data related to companies or installations subject to confidentiality is not made public in the Inventory. Data on emission factors are also considered to be confidential whenever it is possible to infer data on activity variables at the company or plant level by using these emissions factors and the information on emissions. The activity variables or emission factors which are subject to confidentiality restrictions are identified with label “C”.

Confidentiality is observed when less than three economic agents operate or provide data for any item in the Inventory (activity variable, general socio-economic data, technological data, etc.).

The list of categories in the Inventory cross-referenced with the emitted substances which are considered confidential is revised annually based on the variation in the number of economic agents which are considered for an item in the Inventory in each edition.

### 1.6.11. Main features from QC activities

Main features and results from a selection of QC activities are presented below:

**Table 1.6.4 Main features from QC activities in the 2026 edition**

| ID | QC actions | MAIN RESULTS |
|---|---|---|
| **IP.01** | Review of reporting obligations. | 10 international obligations. |
| **DC.04** | Second-person tracking of data requests: dates of request and delivery, state of delivery, deadlines, etc. | 99% of the requests to data providers answered, of which 54% delivered information after the deadline.<br>15% of providers needed a reminder mail.<br>For request not answered, secondary sources of information were used. |
| **PG.07 - PG.15** | Source-level completeness, consistency and recalculation checks (activity data, emission factors and emission estimates). | 361 QC reports reviewed. |

| ID | QC actions | MAIN RESULTS |
|---|---|---|
| **PG.16** | Documentation of any change concerning methodology or activity data from previous years. | 90 registries documenting recalculations in the Inventory quality management database. |
| **OP.06** | Version checks: current outputs are cross-checked with last edition outputs. Any changes must be explained. | 61% of emitting NFR source categories recalculated. |

## 1.7. General uncertainty evaluation

The Spanish Inventory System applies in the uncertainty assessment of the Inventory two different approaches to all the activities:

i. a quantitative approach referring to main pollutants ($SO_2$, NOx, NMVOC, $NH_3$, $PM_{2.5}$, and BC),

ii. a qualitative approach, referring to the rest of pollutants.

The uncertainty assessment and classification of data quality labels for activity variable and emission factors observe the "General Guidance Chapters", Chapter 5 "Uncertainties", in the 2019 EMEP/EEA Guidebook.

### 1.7.1. Quantitative Assessment of the Uncertainty

The Spanish Inventory System implemented a quantification of the uncertainty associated to the estimated emissions of the main pollutants based on Approach 1 of 2023 EMEP/EEA GB.

Some relevant particularities for Spain have been considered when quantifying the uncertainty of emission factors and activities variables.

The following tables show the central values and their 95% confidence intervals of $SO_2$, NOx, $NH_3$, NMVOC, $PM_{2.5}$, and BC emissions, both for level (2024) and trend evolution (2024 with respect to the central value of 1990). The following conclusions can be drawn from their analysis:

i. The 95% confidence interval for the emissions level ranges between 15% and 127% for 2024, depending on the considered pollutant; whereas the trend has a more limited confidence interval (between 1% and 31%) depending on the pollutant.

ii. In view of these results, it can be said that the uncertainty in the inventory for 2024 is lower for $SO_2$ and NOx than for $NH_3$, NMVOC and $PM_{2.5}$, and in special BC, in accordance with previous IIR trends.

The results of the Approach 1 quantitative uncertainty analysis for the estimated emissions of the main pollutants and BC by NFR sector are presented in detail in Annex 3. The results can be summarised as follows:

**Table 1.7.1 Emissions Uncertainties (national territory)**

| Pollutant | Emission in 2024 (kt) | Uncertainty in 2024 (%) | Trend Uncertainty 1990-2024 (%) |
|---|---|---|---|
| **NOx** | 588.5 | 15.6 | 4.9 |
| **NMVOC** | 500.9 | 42.4 | 12.5 |
| **$SO_2$** | 97.5 | 20.6 | 0.9 |

| Pollutant | Emission in 2024 (kt) | Uncertainty in 2024 (%) | Trend Uncertainty 1990-2024 (%) |
|---|---|---|---|
| **$NH_3$** | 453.1 | 37.8 | 26.5 |
| **$PM_{2.5}$** | 90.9 | 54.8 | 13.9 |
| **BC** | 24.0 | 127.4 | 31.0 |

## 1.7.2. Qualitative assessment of the uncertainty

The procedure for the qualitative determination of the uncertainty, based on quality label allocation, is described below.

### 1.7.2.1. Quality label allocation criteria

The allocation of quality labels to the emissions estimates is based on the labels associated with the Inventory's basic data (activity variables and emission factors) classified from A (the most precise) to E (the least precise).

Using quality labels for activity variables and emission factors, the Spanish Inventory System has assigned its emissions quality labels, in accordance with the attribution system "DATA ATTRIBUTE RATING SYSTEM", specified in the table below. This attribution system has been adopted by the Inventory Team as it is considered to be the most appropriate for the context of the Spanish Inventory.

**Table 1.7.2 System adopted for the composition of the emissions quality label: "DATA ATTRIBUTE RATING SYSTEM"**

| Labels of the activity variables and emission factors | Labels of the emissions | Labels of the activity variables and emission factors | Labels of the emissions |
|---|---|---|---|
| **E-E** | E | C-C | C |
| **E-D** | E | D-A | D |
| **E-C** | E | C-B | C |
| **D-D** | D | C-A | C |
| **E-B** | E | B-B | B |
| **E-A** | E | B-A | B |
| **D-C** | D | A-A | A |
| **D-B** | **D** | | |

### 1.7.2.2. Quality label allocation procedure

In the present Inventory edition, the Spanish Inventory System has made the qualitative diagnosis of uncertainty by attributing quality labels to emission factors and activity variables. The allocation of a particular quality label from the range of options A-E was established by applying the following criteria:

**For emissions:**

The classification of quality of emissions is based on the classification, using the same categories (A-E), of their activity variables and the estimation methods (mostly emission factors), and on a composition method using the hypothesis of the independence of the quality level (label) in both data inputs (activity variables and emission factors).

**For emissions factors:**

The following general criteria have been applied initially for the assignment of quality labels to emission factors:

"A" for those derived from measured observations ($SO_2$ and NOx) and for those based on materials balance ($CO_2$) in combustion processes.

"B" for those derived from the methods for the balance of materials, basically $SO_2$, Pb and $CO_2$, if they have not been classified with a better quality label as described in the previous paragraph.

“B”, “C” and “D” for those based on default emission factors in highly anthropogenic sectors if these have not been classified with a better label as described in the previous paragraphs.

“C”, “D” and “E” for those based on emission factors and on correlation functions with agriculture and livestock sectors and natural sectors if these have not been classified with a better label as described in the previous paragraphs.

**For activity variables:**

The following general principles have been applied for the assignment of quality labels to the activity variables:

"A" for the data collected from the questionnaires sent by Large Point Sources, as well as the data from the Population Censuses and the Statistical Yearbooks on Registration.

"B" for sector-based statistics based on questionnaires sent to activity centres.

“B”, “C” and “D” for the “Inferred” Statistical Yearbooks (e.g. statistics in the Agricultural Statistical Yearbook from the MAPA).

“C”, “D” and “E” for the diagnoses based on expert opinions.

### 1.7.2.3. Quality labels assigned to the emissions estimates

The following table shows the quality labels associated with the estimated emissions by NFR sector. These labels have been derived using the procedure described in Section 1.7.2.1. The information in the table can be considered representative for the whole of the period in the Inventory.

**Table 1.7.3 Mean quality levels (labels) of emissions**

| NFR | OTHER | PARTICULATE MATTER | | | | POPs | | |
|---|---|---|---|---|---|---|---|---|
| | CO | $PM_{2.5}$ | $PM_{10}$ | TSP | BC | HCB | PCDD/F | PAHs |
| **1A1a** | B | C | C | B | C | D | D | D |
| **1A1b** | B | C | C | B | C | - | D | - |
| **1A1c** | B | C | C | B | C | - | D | D |
| **1A2** | D | D | D | C | D | - | E | D |
| **1A3a** | C | C | C | B | C | - | - | E |

| NFR | OTHER | PARTICULATE MATTER | | | | POPs | | |
|---|---|---|---|---|---|---|---|---|
| | CO | $PM_{2.5}$ | $PM_{10}$ | TSP | BC | HCB | PCDD/F | PAHs |
| **1A3b** | D | C | C | B | B | - | E | E |
| **1A3c + 1A3e + 1A5** | C | C | C | B | C | - | E | E |
| **1A3d** | C | C | C | B | C | E | E | E |
| **1A4a + 1A4b** | E | E | E | D | D | - | E | E |
| **1A4c** | C | C | C | B | E | E | E | E |
| **1B** | D | D | D | C | D | - | - | D |
| **2A** | - | - | - | - | - | - | - | - |
| **2B** | D | D | D | C | D | D | - | - |
| **2C** | D | D | D | C | D | D | D | D |
| **2D** | D | - | - | - | - | - | - | E |
| **2G + 2H + 2I + 2J + 2K + 2L** | D | D | D | C | D | - | - | - |
| **3B** | - | E | E | D | - | - | - | - |
| **3D** | - | - | E | D | - | - | - | - |
| **3F** | D | E | E | D | E | - | E | E |
| **3I** | - | - | - | - | - | - | - | - |
| **5A** | E | D | D | C | - | - | - | - |
| **5B** | E | D | D | C | - | - | - | - |
| **5C** | E | D | D | C | C | D | B | D |
| **5D** | E | D | D | C | - | - | - | - |
| **5E** | - | - | - | - | - | - | - | - |
| **6A** | - | - | - | - | - | - | - | - |

| NFR | HEAVY METALS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | As | Cd | Cr | Cu | Hg | Ni | Pb | Se | Zn |
| **1A1a** | D | D | D | D | D | D | D | D | D |
| **1A1b** | D | D | D | D | D | D | D | D | D |
| **1A1c** | D | D | D | D | D | D | D | D | D |
| **1A2** | D | D | D | D | D | D | D | D | D |
| **1A3a** | - | D | D | D | - | D | - | D | D |
| **1A3b** | - | E | E | E | - | E | A | D | E |
| **1A3c + 1A3e + 1A5** | - | D | D | D | D | D | - | D | D |
| **1A3d** | D | D | D | D | D | D | C | D | D |
| **1A4a + 1A4b** | D | D | D | D | D | D | D | D | D |
| **1A4c** | D | D | D | D | D | D | C | D | D |
| **1B** | - | - | - | - | - | - | - | - | - |
| **2A** | - | D | - | - | - | - | D | - | - |
| **2B** | - | D | - | - | C | - | - | - | - |
| **2C** | D | D | D | C | C | C | D | C | D |
| **2D** | - | - | - | - | - | - | - | - | - |
| **2G + 2H + 2I + 2J + 2K + 2L** | - | - | - | - | - | - | - | - | - |
| **3B** | - | - | - | - | - | - | - | - | - |
| **3D** | - | - | - | - | - | - | - | - | - |
| **3F** | - | - | - | - | - | - | - | - | - |
| **3I** | - | - | - | - | - | - | - | - | - |
| **5A** | - | - | - | - | - | - | - | - | - |
| **5B** | - | - | - | - | - | - | - | - | - |

| NFR | HEAVY METALS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | As | Cd | Cr | Cu | Hg | Ni | Pb | Se | Zn |
| **5C** | D | D | D | D | D | D | D | D | D |
| **5D** | - | - | - | - | - | - | - | - | - |
| **5E** | - | - | - | - | - | - | - | - | - |
| **6A** | - | - | - | - | - | - | - | - | - |

## 1.8. General Assessment Completeness

In this section, detailed explanations are provided on the notations keys reported for categories and pollutants where no emission data could be provided in the Spanish Inventory.

### 1.8.1. Sources not estimated (NE)

Since 2015 Inventory edition, completeness has been increasingly improved, with a substantial reduction of categories in which one or more pollutants are notated as NE, and hence, more emissions estimates have been provided since then. The table below shows this evolution.

**Table 1.8.1 Evolution of the number of categories notated as NE**

| Edition (year of submission) | Number of categories with at least one pollutant with NE | % of the total number of categories with at least one pollutant with NE |
|---|---|---|
| **2026** | 56 out of 127 | 44% |
| **2025** | 56 out of 127 | 44% |
| **2024** | 54 out of 127 | 43% |
| **2023** | 54 out of 127 | 43% |
| **2022** | 58 out of 127 | 46% |
| **2021** | 57 out of 127 | 45% |
| **2015** | 86 out of 127 | 68% |

Spain ensures full adherence to the revised guidelines for reporting emissions and projections data under the LRTAP Convention (ECE/EB.AIR/150/Add.1) in the use of notation keys. The apparently high number of NE used by Spain is mainly due to cases in which the 2019/2023 EMEP/EEA GB include NE for that combination of category/pollutant in the emission factor tables.

For clarity reasons, identifications and explanations for NE are presented in a matrix where any NE is identified by a blue cell and the explanation is codified with a number. In order to reduce the length of this document, only categories with NE are presented.

Descriptions of the codes used are the following:

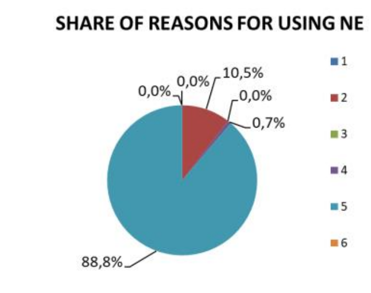
1. Despite being emission factors available in the 2019/2023 EMEP/EEA GB, the Inventory has not been able to estimate these emissions yet.
2. Emission factors are not available in the methodological guidelines.
3. No studies are available on possible traces of metals contained in coal or in its adjacent strata and those are emitted in the mining processes or in the subsequent manipulation of coal in the gaseous or particulate state.

4. There is no information on traces of sulphur originally contained in the hydrocarbons or subsequently incorporated into them in the treatment phase for $SO_2$ emissions; so it has not been possible to estimate these emissions, but it is presumed to be of very low importance to the total Inventory.
5. The Inventory uses NE notation key for categories and pollutants for which the 2019/2023 EMEP/EEA GB included "Not estimated" in the corresponding emission factor table.
6. Emissions are considered negligible. A national expert judgement confirms no emissions of NMVOC in Spanish mines. However, following recommendation ES-1B1a-2017-0001 made by the ERT in the 2017 NECD review, the Spanish Inventory System has used NE notation key instead of NA.

Overall, the main reason for using NE is ID = 5, as shown in table and figure below.

**Table 1.8.2 Share reasons for using NE**

| Reason ID | TIMES NE IS USED |
|---|---|
| **1** | 0 |
| **2** | 42 |
| **3** | 0 |
| **4** | 3 |
| **5** | 356 |
| **6** | 0 |
| **TOTAL** | **401 out of 3302 categories x pollutants (12.1%)** |



## Table 1.8.3 Distribution of reasons for using NE

| NFR Code | $NO_X$ | NMVOC | $SO_2$ | $NH_3$ | $PM_{2.5}$ | $PM_{10}$ | TSP | BC | CO | Pb | Cd | Hg | As | Cr | Cu | Ni | Se | Zn | PCDD PCDF | PAHs | | | | | HCB | PCBs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | benzo(a) pyrene | benzo(b) fluoranthene | benzo(k) fluoranthene | Indeno (1,2,3-cd) pyrene | Total 1-4 | | |
| 1A1a | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1A1b | - | - | - | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1A1c | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1A2a | - | - | - | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1A2b | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1A2c | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1A2d | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1A2e | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1A2f | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1A2gvii | - | - | - | - | - | - | - | - | - | 2 | - | 2 | 2 | - | - | - | - | - | 2 | - | - | - | - | - | - | - |
| 1A2gviii | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1A3ai(i) | - | - | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 | - | - | - | - | - | - | - |
| 1A3aii(i) | - | - | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 | - | - | - | - | - | - | - |
| 1A3bi | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1A3bii | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1A3biii | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1A3biv | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1A3bv | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1A3bvi | - | - | - | - | - | - | - | - | - | - | - | 2 | - | - | - | - | - | - | - | - | - | - | 2 | - | - | - |
| 1A3bvii | - | - | - | - | - | - | - | - | - | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | - | 2 | 2 | 2 | 2 | 2 | - | - |
| 1A3c | - | - | - | - | - | - | - | - | - | 2 | - | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1A3di(ii) | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1A3dii | - | - | - | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1A3ei | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1A3eii | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

| NFR Code | $NO_X$ | NMVOC | $SO_2$ | $NH_3$ | $PM_{2.5}$ | $PM_{10}$ | TSP | BC | CO | Pb | Cd | Hg | As | Cr | Cu | Ni | Se | Zn | PCDD PCDF | PAHs | | | | | HCB | PCBs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | benzo(a) pyrene | benzo(b) fluoranthene | benzo(k) fluoranthene | Indeno (1,2,3-cd) pyrene | Total 1-4 | | |
| 1A4ai | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1A4aii | - | - | - | - | - | - | - | - | - | - | - | 5 | 5 | - | - | - | - | - | 5 | - | - | - | - | - | - | - |
| 1A4bi | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1A4bii | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1A4ci | - | - | - | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1A4cii | - | - | - | - | - | - | - | - | - | 2 | - | 2 | 2 | - | - | - | - | - | 2 | - | - | - | - | - | - | - |
| 1A4ciii | - | - | - | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1A5a | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1A5b | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1B1a | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1B1b | - | - | - | - | - | - | - | 5 | - | - | - | - | - | - | - | - | - | - | - | 5 | - | - | - | 5 | - | - |
| 1B1c | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1B2ai | - | - | 4 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 | - | - | - | - | - | - | - |
| 1B2aiv | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1B2av | - | - | 4 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 | - | - | - | - | - | - | - |
| 1B2b | - | - | 4 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 | - | - | - | - | - | - | - |
| 1B2c | - | - | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 | 2 | 2 | 2 | 2 | 2 | - | - |
| 1B2d | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2A1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2A2 | 5 | 5 | 5 | - | - | - | - | - | 5 | 5 | 5 | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2A3 | 5 | - | 5 | - | - | - | - | - | 5 | - | - | - | - | - | - | - | - | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | - |
| 2A5a | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2A5b | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2A5c | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2A6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2B1 | - | - | - | - | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2B2 | - | - | - | - | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

| NFR Code | NOx | NMVOC | $SO_2$ | $NH_3$ | $PM_{2.5}$ | $PM_{10}$ | TSP | BC | CO | Pb | Cd | Hg | As | Cr | Cu | Ni | Se | Zn | PCDD PCDF | PAHs | | | | | HCB | PCBs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | benzo(a) pyrene | benzo(b) fluoranthene | benzo(k) fluoranthene | Indeno (1,2,3-cd) pyrene | Total 1-4 | | |
| 2B3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2B5 | 5 | 5 | 5 | - | - | - | - | - | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | - |
| 2B6 | - | 5 | - | 5 | - | - | - | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 2B7 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2B10a | - | - | - | - | - | - | - | - | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 2B10b | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2C1 | - | - | - | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2C2 | 5 | 5 | 5 | 5 | - | - | - | - | 5 | - | - | 5 | - | - | - | - | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | - | - |
| 2C3 | - | 5 | - | 5 | - | - | - | - | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | - | - | - | - | - | - | 5 | - |
| 2C4 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2C5 | 5 | 5 | - | 5 | - | - | - | 5 | 5 | - | - | 5 | - | 5 | 5 | 5 | 5 | - | - | 5 | 5 | 5 | 5 | 5 | 5 | - |
| 2C6 | 5 | 5 | - | 5 | - | - | - | 5 | 5 | - | - | - | - | 5 | 5 | 5 | 5 | - | - | 5 | 5 | 5 | 5 | 5 | 5 | - |
| 2C7a | 5 | 5 | - | 5 | - | - | - | - | 5 | - | - | - | - | - | - | - | 5 | - | - | 5 | 5 | 5 | 5 | 5 | 5 | - |
| 2C7b | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2C7c | 5 | - | - | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 2C7d | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2D3a | - | - | - | - | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2D3b | 5 | - | 5 | - | - | - | - | - | 5 | - | - | - | - | - | - | - | - | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | - |
| 2D3c | 5 | - | - | - | - | - | - | - | - | 5 | 5 | 5 | - | - | - | - | - | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | - |
| 2D3d | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2D3e | - | - | - | - | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2D3f | - | - | - | - | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2D3g | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 2D3h | - | - | - | - | 5 | - | - | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2D3i | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | - | - | - | - | - | 5 | - |
| 2G | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 5 | - | - | - | - | - | - | - | 5 | 5 |
| 2H1 | - | - | - | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 5 | 5 | 5 | 5 | 5 | 5 | - |

| NFR Code | $NO_X$ | NMVOC | $SO_2$ | $NH_3$ | $PM_{2.5}$ | $PM_{10}$ | TSP | BC | CO | Pb | Cd | Hg | As | Cr | Cu | Ni | Se | Zn | PCDD PCDF | PAHs | | | | | HCB | PCBs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | benzo(a) pyrene | benzo(b) fluoranthene | benzo(k) fluoranthene | Indeno (1,2,3-cd) pyrene | Total 1-4 | | |
| 2H2 | - | - | - | - | 5 | 5 | 5 | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2H3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2I | 5 | 5 | 5 | 5 | 5 | 5 | - | 5 | 5 | - | - | - | 5 | - | 5 | - | - | - | - | - | - | - | - | - | - | - |
| 2J | 5 | 5 | 5 | 5 | - | - | - | - | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 5 | 5 |
| 2K | - | - | - | - | - | - | - | - | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | - | - | - | - | - | - | 5 | - |
| 2L | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3B1a | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3B1b | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3B2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3B3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3B4a | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3B4d | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3B4e | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3B4f | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3B4gi | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3B4gii | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3B4giii | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3B4giv | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3B4h | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3Da1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3Da2a | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3Da2b | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3Da2c | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3Da3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3Da4 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3Db | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3Dc | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

| NFR Code | NOx | NMVOC | $SO_2$ | $NH_3$ | $PM_{2.5}$ | $PM_{10}$ | TSP | BC | CO | Pb | Cd | Hg | As | Cr | Cu | Ni | Se | Zn | PCDD PCDF | PAHs | | | | | HCB | PCBs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | benzo(a) pyrene | benzo(b) fluoranthene | benzo(k) fluoranthene | Indeno (1,2,3-cd) pyrene | Total 1-4 | | |
| 3Dd | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3De | - | - | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3Df | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3F | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3I | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5A | - | - | - | 5 | - | - | - | - | - | - | - | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5B1 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5B2 | - | 5 | 5 | - | - | - | - | 5 | - | 5 | 5 | 5 | - | 5 | - | - | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 5C1a | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5C1bi | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5C1bii | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5C1biii | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5C1biv | - | - | - | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5C1bv | - | - | - | - | - | - | - | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5C1bvi | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5C2 | - | - | - | 5 | - | - | - | - | - | - | - | 5 | - | - | - | 5 | - | - | - | - | - | - | 5 | - | 5 | - |
| 5D1 | - | - | - | 5 | - | - | - | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | - | - | - | - | - | - | - | - |
| 5D2 | - | - | - | 5 | - | - | - | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | - | - | - | - | - | - | - | - |
| 5D3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5E | 5 | - | 5 | - | - | - | - | - | 5 | - | - | - | - | - | - | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 6A | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

### 1.8.2. Sources included elsewhere (IE)

#### 1.8.2.1. Energy

- **1A4bii Residential: household and gardening (mobile)**: emissions are included within the category related to the stationary source (1A4bi) since no information is available to distinguish consumption between stationary and mobile, being assumed that stationary is predominant. Planned improvements focus on separate emissions reported under 1A4bi.
- **1A5a Other stationary (including military)**: emissions from stationary military activities (fixed facilities) are included within the categories related to the stationary sources of their respective sector (1A4ai).

#### 1.8.2.2. Industrial Processes and other Product Uses

The emissions of some activities from NFR sector 2 are estimated within the corresponding combustion activities associated with these production processes in Energy (NFR 1).

- **2A1 Cement production**: for all pollutants (except PCBs), the Inventory estimates emissions applying a mixed Tier 2/Tier 3 approach, using a national emission factor based on measurements, provided by the main business association (OFICEMEN). These emissions are allocated under the corresponding combustion activity associated with this production process (1A2f).
- **2B1 Ammonia production**: NOx emissions are allocated under category 1A2c and thus associated with combustion, because of the impossibility of splitting emissions between combustion and process, since they are reported as end-of-pipe measurements made in the plants.
- **2B10b Storage, handling and transport of chemical products**: according to sections 3.2.2 and 3.3.2 from chapter 2.B of 2019 EMEP/EEA Guidebook, it is assumed that emissions from the storage and handling of chemical products are included in the process emissions emissions from the storage and handling of chemical products are included in the process emission factors for the chemical industry provided in that chapter, both for Tier 1 and 2.
- **2C7d Storage, handling and transport of metal products:** for $PM_{2.5}$, $PM_{10}$ and TSP, according to chapter 2.C.7.d of 2019 EMEP/EEA Guidebook, it is assumed that emissions from the storage, handling and transport of metal products are included in the process emissions covered by the technical chapters describing the activities.

#### 1.8.2.3. Waste

- **5C1a Municipal waste incineration: Since 2004, emissions are reported under 1A1a as all incineration facilities have undertaken incineration with energy recovery.**
- **5C1bi Industrial waste incineration**: Emissions are reported under 1A1a as all incineration facilities undertake incineration with energy recovery, during the whole time series.

- **5C1biii Clinical waste incineration**: Since 2006 emissions are reported under 1A1a as no incineration without energy recovery takes place.

# 2. EXPLANATION OF KEY TRENDS

# CONTENTS

## FIGURES



## TABLES

# 2. EXPLANATION OF KEY TRENDS

Chapter updated in March, 2026.

## 2.1. Analysis by pollutant

This section analyses and discusses the latest estimates of emissions of the major primary pollutants in Spain, according to the 12 aggregated GNFR[1] sectors, as well as the trends in emissions of each of them, along the studied time series (1990-2024).

Official NFR reported tables are available through these links:

https://cdr.eionet.europa.eu/es/eu/nec_revised/inventories/

https://www.ceip.at/status-of-reporting-and-review-results/2026-submission

Detailed emission data of the Spanish Inventory are available from the MITECO-SEI website WebTable.

In the next pages, separate analyses of the following pollutants are included:

– Nitrogen Oxides (NOx)

– Non-Methane Volatile Organic Compounds (NMVOC)

– Sulphur Oxide ($SO_2$)

– Ammonia ($NH_3$)

– Fine Particulate Matter ($PM_{2.5}$)

– Black Carbon (BC)

– Carbon Monoxide (CO)

– Lead (Pb)

– Cadmium (Cd)

– Mercury (Hg)

– Dioxins and furans (PCDD/PCDF)

– Polycyclic Aromatic Hydrocarbons (PAHs)

– Benzo(*a*)pyrene (BaP)

– Hexachlorobenzene (HCB)

– Polychlorinated biphenyls (PCBs)

[1] NFR aggregated sectors for reporting of Gridded data and Large Point Sources are used (A_PublicPower, B_Industry, C_OtherStationaryComb, D_Fugitive, E_Solvents, F_RoadTransport, G_Shipping, H_Aviation, I_Offroad, J_Waste, K_AgriLivestock, L_AgriOther). GNFR allocation for each NFR category is provided in column A of NFR tables.

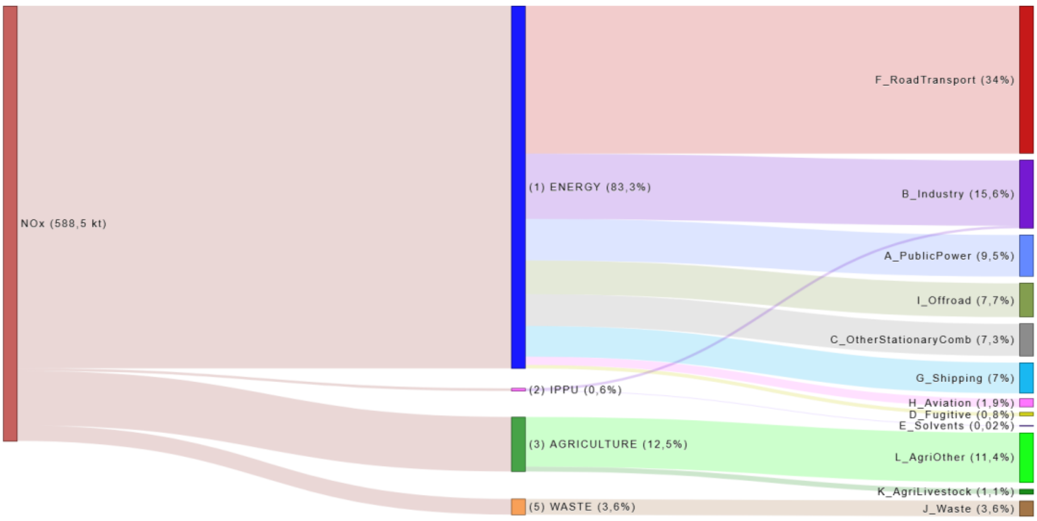
### 2.1.1. Nitrogen Oxides (NOx)

The estimate for 2024 is of 588.5 kt of nitrogen oxides (NOx), expressed as nitrogen dioxide, emitted in Spain (530.4 kt without the Canary Islands).

NOx emissions in 2024 decreased by -56.2% when compared to 1990 and decreased by -0.7% compared to 2023 (-58.6% and -0.8% respectively, excluding the Canary Islands).

The GNFR aggregated sectors most contributing to NOx emissions in 2024 were:

- Road transport (F_RoadTransport) was the first contributing activity with 34.0% (36.4% excluding the Canary Islands) of total NOx emissions, with Passenger cars (1A3bi) and Heavy-duty vehicles and buses (1A3biii) accounting respectively for 20.8% and 8.3% of the total value in the Inventory (22.4% and 8.9% respectively, excluding the Canary Islands).
- The industrial sector (B_Industry) was the second contributor, accounting for 15.6% of total NOx emissions (17.2% without Canary Islands).
- L_AgriOther, emissions from agricultural soils, accounted for 11.4% (12.6% of the data without Canary Islands).
- The emissions from A_PublicPower, one of the former most contributing sectors, only accounted for 9.5% of NOx emissions in 2024 (4.7% when excluding emissions from the Canary Islands; this is due to the different fuel mix used, with a higher share of fuel oil in the islands).
- I_Offroad emissions, coming from off-road vehicles in Agriculture/Forestry, from Fishing, mobile combustion in manufacturing industries and construction, railways, pipeline transport and other minor mobile sources, accounted for 7.7% (8.3% without Canary Islands).
- National navigation (G_Shipping) had a weight of 7.0% of the total of the national Inventory (4.8% without the Canary Islands).




— Agradecimientos: Mike Bostok

**Figure 2.1.1 Distribution of NOx emissions in year 2024 (national territory)**

**Table 2.1.1 NOx emissions by sector (kt)**

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 | Share 2024 | 2024 vs 1990 | 2024 vs 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **A_PublicPower** | 216.0 | 329.4 | 115.7 | 161.2 | 77.1 | 60.9 | 57.7 | 56.1 | 9.5% | -74.0% | -2.7% |
| **B_Industry** | 187.9 | 195.1 | 164.4 | 115.0 | 121.4 | 107.1 | 93.7 | 91.6 | 15.6% | -51.3% | -2.3% |
| **C_OtherStationaryComb** | 33.8 | 49.1 | 51.6 | 44.8 | 44.3 | 44.2 | 42.7 | 43.2 | 7.3% | 27.9% | 1.2% |
| **D_Fugitive** | 6.6 | 4.8 | 4.3 | 4.9 | 5.0 | 3.9 | 4.7 | 4.7 | 0.8% | -29.0% | 0.2% |
| **E_Solvents** | 0.0 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0% | 171.7% | 17.8% |
| **F_RoadTransport** | 543.5 | 485.2 | 376.9 | 315.8 | 279.4 | 218.2 | 205.2 | 199.8 | 34.0% | -63.2% | -2.6% |
| **G_Shipping** | 96.2 | 69.2 | 47.4 | 19.4 | 51.9 | 37.7 | 40.7 | 41.4 | 7.0% | -57.0% | 1.7% |
| **H_Aviation** | 3.3 | 8.1 | 8.2 | 8.2 | 10.3 | 3.8 | 10.1 | 11.2 | 1.9% | 238.8% | 11.0% |
| **I_Offroad** | 128.4 | 143.2 | 97.5 | 74.0 | 56.0 | 48.4 | 46.7 | 45.6 | 7.7% | -64.5% | -2.4% |
| **J_Waste** | 22.5 | 24.1 | 28.2 | 29.1 | 26.9 | 32.0 | 21.1 | 21.1 | 3.6% | -6.5% | 0.0% |
| **K_AgriLivestock** | 5.8 | 7.3 | 6.9 | 6.9 | 7.1 | 7.0 | 6.6 | 6.6 | 1.1% | 13.8% | -0.4% |
| **L_AgriOther** | 98.1 | 70.0 | 69.9 | 74.1 | 73.4 | 75.7 | 63.2 | 67.1 | 11.4% | -31.5% | 6.1% |
| **CLRTAP Total (national territory)** | 1342.2 | 1385.7 | 971.2 | 853.6 | 752.8 | 639.0 | 592.4 | 588.5 | 100.0% | -56.2% | -0.7% |
| ***NECD Total (without Canary Islands)*** | *1280.9* | *1291.8* | *899.8* | *791.6* | *682.8* | *580.4* | *534.8* | *530.4* | *90.1%* | *-58.6%* | *-0.8%* |

Detailed emission data of the Spanish Inventory are available from the MITECO-SEI website WebTable.

### 2.1.1.1. Trend assessment

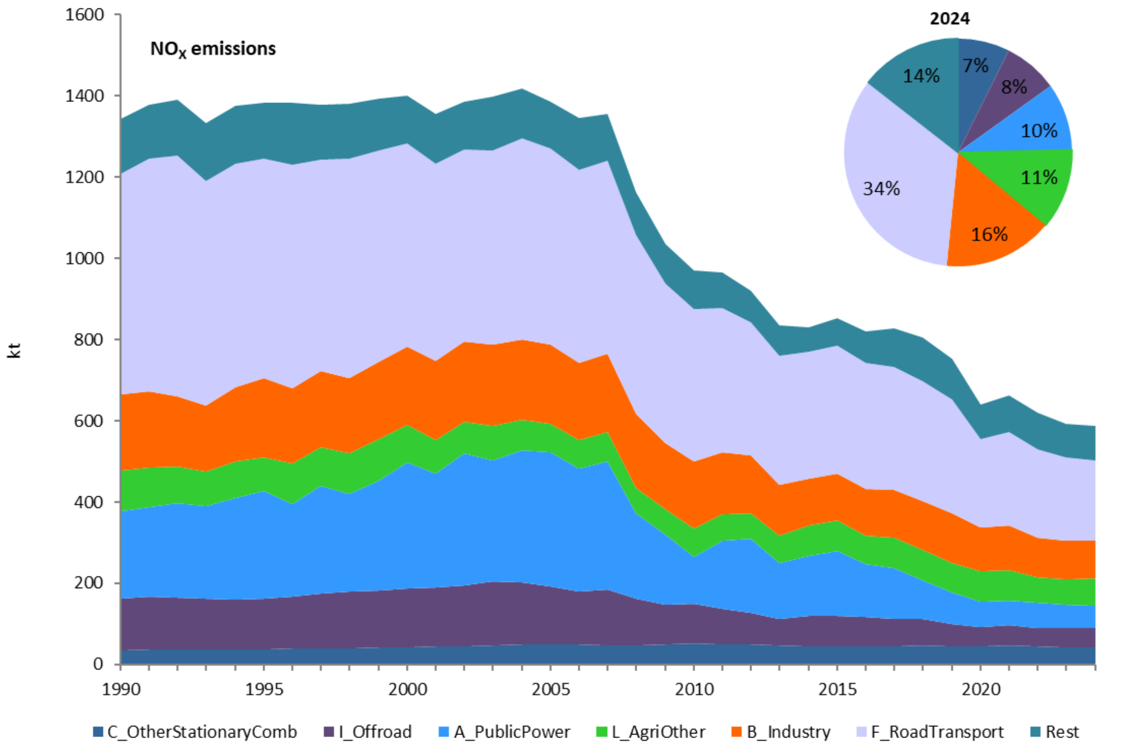



**Figure 2.1.2 Evolution of NOx by category and distribution in year 2024, national territory**

Nitrogen Oxides emissions have clearly decreased since 1990 (-56.2%, -58.6% without Canary Islands), with almost every sector showing emission reductions.

The most relevant quantitative NOx emission reductions affected F_RoadTransport, which dropped its emissions by -63.2% since 1990 (-63.4% without Canary Islands). This marked decline has been caused by the introduction of EURO standards in Passenger cars (1A3bi) since 1993 (Euro 1- 91/441/EEC) and in Heavy duty vehicles and buses (1A3biii) since 2000 (Euro III).

Very relevant reductions too are those from A_PublicPower (1A1a), which decreased by -74.0% since 1990 (-87.9% without Canary Islands). The reduction is driven by the progressive introduction of renewable energies, the introduction of abatement techniques in thermal power plants and the shift to combined cycle gas plants in the Spanish mainland (when including the islands, where there still is a relevant share of fuel oil, this effect is not so marked).

Although the behaviour among the different industries varies, the reduction of NOx emissions from B_Industry by -51.3% in 2024 compared to 1990 (-51.1% without Canary Islands) is mainly due to the reduction by -59.7% (-59.8% without Canary Islands) in the Combustion in Non-metallic minerals industries (1A2f category) and by -62.0% (-60.1% without Canary Islands) in the petroleum refining sector (1A1b). These drops are due to the progressive introduction of abatement techniques and the shift from solid and liquid fuels to natural gas.

On the other hand, NOx emissions from C_OtherStationaryCombustion (Residential, Commercial and Institutional sector) and H_Aviation increased since 1990, reflecting the increases in population and GDP.

The period with stronger reductions of total NOx emissions is between 2007 and 2010, due to the economic downturn in Spain. After this period, the reduction in NOx emissions continues with a lower slope, in a framework of economic recovery.

When comparing 2024 with 2023 emissions, the slight decrease in emissions (-0.7%, -0.8% without Canary Islands) is mainly linked to decreases in F_RoadTransport emissions (-2.6% or -2.5% without Canary Islands) and also B_Industry (-2.3%, with or without Canary Islands), related to better combustion technologies in transport and industrial combustion.

The emissions from electricity generation (A_PublicPower, 1A1a) decreased in 2024 by -2.7% with respect to 2023 (-6.0% without Canary Islands). For the second year in history, the power generation in Spain has been renewable in its majority: 56.8%[2], with an increase of 10.3%, in the renewable generation (led by increases in hydraulic: +35.6% and photovoltaic: +19.1%).

## 2.1.2. Non-Methane Volatile Organic Compounds (NMVOC)

In 2024, the emissions of Non-Methane Volatile Organic Compounds (NMVOC) in Spain were estimated to be 500.9 kt (488.9 kt excluding the Canary Islands).

NMVOC emissions in 2024 declined by -51.9% (-51.7% without Canary Islands) when compared to 1990 and decreased by -2.4% when compared to 2023 (-2.3% without the Canary Islands).

Analysis of the GNFR aggregated sectors more relevant to NMVOC in 2024:

- Solvents use (E Solvents) was the largest contributing activity with 42.9% (42.6% without Canary Islands) of the total NMVOC emissions, with Domestic solvent use

[2] https://www.ree.es/es/balance-diario/nacional/2024/12/31

(2D3a) as the main emitting sector, with 13.7% of the total of NMVOC in the Inventory, followed by Coating applications (2D3d) with 11.6% and Chemical products (2D3g) with 9.6% of the total NMVOC emissions (without the Canary Islands: 13.4%, 11.6% and 9.6%, respectively).

– K_AgriLivestock had a share of 16.0% of the total NMVOC emissions (16.3% without Canary Islands), and cultivated soils (L_AgriOther) had 8.3% in 2024 (8.4% without Canary Islands).

– B_Industry, including both process and combustion emissions, represented 12.2% of the total of the Inventory (12.3% without Canary Islands), from where the most emitting category is Food and beverages industry (2H2 NFR).

– F_RoadTransport, which was a large contributor in the past, in 2024 only accounted for 3.0% of the total NMVOC emissions (the same without Canary Islands).

– Emissions from D_Fugitive activities accounted for 6.6% of the total of NMVOC emissions (the same without Canary Islands).

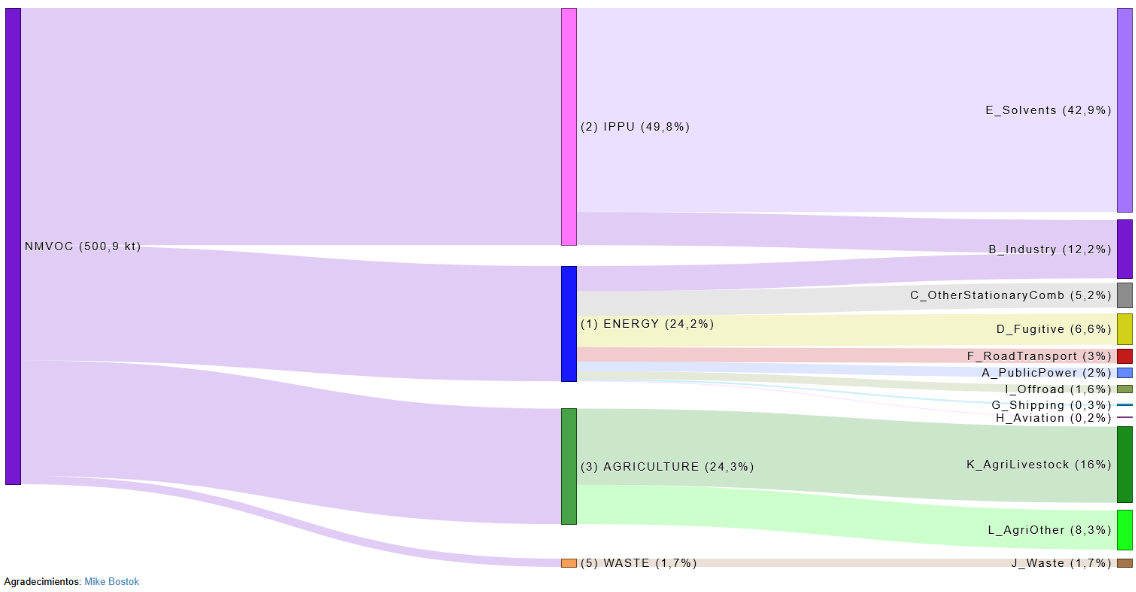



**Figure 2.1.3 Distribution of NMVOC emissions in year 2024 (national territory)**

**Table 2.1.2 NMVOC emissions by sector (kt)**

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 | Share 2024 | 2024 vs 1990 | 2024 vs 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **A_PublicPower** | 0.9 | 2.1 | 2.3 | 7.7 | 8.6 | 9.1 | 8.5 | 10.2 | 2.0% | 1050.4% | 19.8% |
| **B_Industry** | 55.0 | 64.4 | 51.2 | 51.5 | 61.7 | 55.4 | 67.8 | 61.2 | 12.2% | 11.1% | -9.8% |
| **C_OtherStationaryComb** | 45.4 | 44.8 | 54.0 | 50.7 | 33.7 | 33.0 | 26.7 | 26.0 | 5.2% | -42.7% | -2.7% |
| **D_Fugitive** | 53.1 | 38.9 | 33.9 | 33.0 | 32.9 | 26.5 | 28.3 | 32.8 | 6.6% | -38.2% | 15.9% |
| **E_Solvents** | 370.8 | 352.2 | 279.8 | 254.8 | 246.6 | 276.2 | 226.3 | 214.6 | 42.9% | -42.1% | -5.2% |
| **F_RoadTransport** | 334.4 | 89.6 | 49.0 | 29.8 | 23.7 | 16.7 | 15.3 | 15.2 | 3.0% | -95.5% | -0.7% |
| **G_Shipping** | 3.2 | 3.0 | 2.0 | 0.8 | 1.9 | 1.4 | 1.6 | 1.7 | 0.3% | -45.8% | 6.3% |
| **H_Aviation** | 0.3 | 0.7 | 0.8 | 0.8 | 0.9 | 0.3 | 0.8 | 0.8 | 0.2% | 175.2% | 3.3% |
| **I_Offroad** | 18.8 | 13.6 | 7.9 | 8.1 | 12.3 | 11.4 | 7.9 | 8.1 | 1.6% | -56.8% | 3.3% |

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 | Share 2024 | 2024 vs 1990 | 2024 vs 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **J_Waste** | 10.1 | 9.7 | 10.6 | 10.8 | 9.7 | 10.8 | 8.7 | 8.6 | 1.7% | -14.1% | -0.8% |
| **K_AgriLivestock** | 67.4 | 74.8 | 74.2 | 76.1 | 79.7 | 81.2 | 79.8 | 80.2 | 16.0% | 18.9% | 0.5% |
| **L_AgriOther** | 82.4 | 38.2 | 37.5 | 39.5 | 41.3 | 41.9 | 41.5 | 41.4 | 8.3% | -49.8% | -0.3% |
| **CLRTAP Total (national territory)** | **1041.8** | **732.1** | **603.3** | **563.6** | **552.9** | **563.8** | **513.3** | **500.9** | **100.0%** | **-51.9%** | **-2.4%** |
| ***NECD Total (without Canary Islands)*** | *1013.0* | *707.1* | *585.9* | *549.1* | *538.5* | *548.7* | *500.2* | *488.9* | *97.6%* | *-51.7%* | *-2.3%* |

Detailed emission data of the Spanish Inventory are available from the MITECO-SEI website WebTable.

### 2.1.2.1. Trend assessment

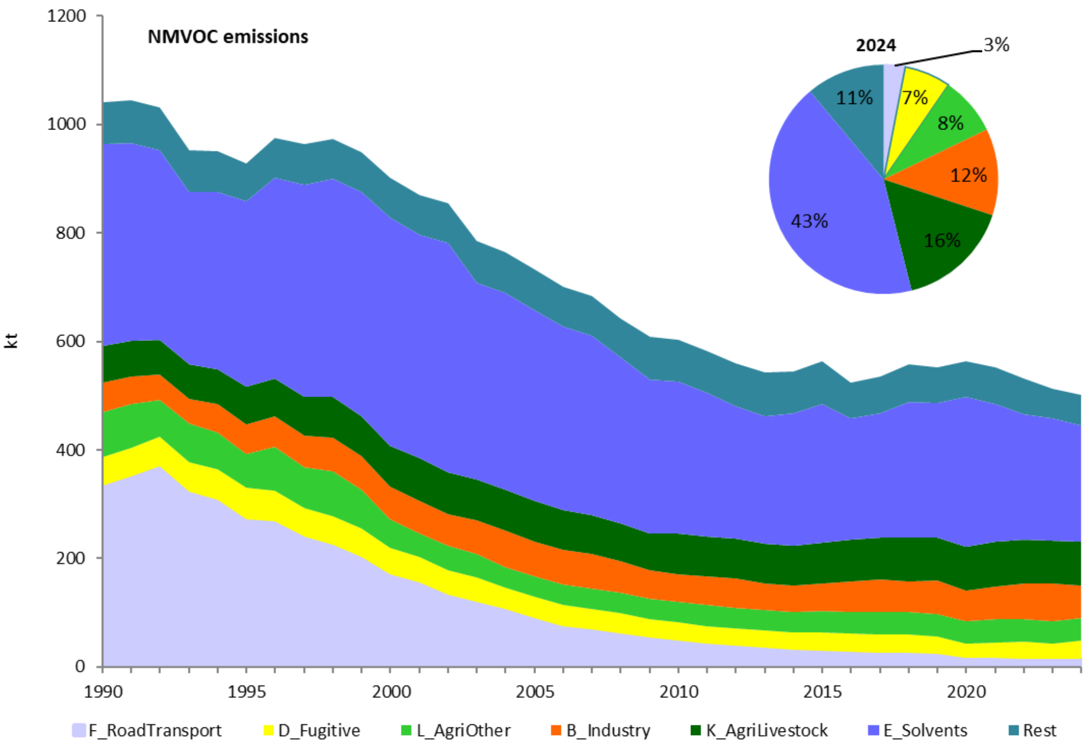



**Figure 2.1.4 Evolution of NMVOC emissions by category and distribution in year 2024, national territory**

The decrease in NMVOC emissions by -51.9% in 2024 with respect to 1990 (-51.7% without Canary Islands) is mainly related to reductions in F_RoadTransport emissions (-95.5%, with and without Canary Islands), secondarily to the drop of emissions under E_Solvents (-42.1%, -42.4% without Canary Islands) and, to a lesser extent, to L_AgriOther (-49.8% and -50.1% without Canary Islands).

Emissions from F_RoadTransport accounted for 40.5% of NMVOC emissions in 1990 (41.2% without Canary Islands), and have been drastically reduced during the time series (both the ones coming from combustion from passenger cars -1A3bi-, as the ones coming from the evaporation of gasoline -1A3bv-), owing to the introduction of the EURO standards for road vehicles since 1996, and to the shift towards a diesel predominant car fleet in Spain.

NMVOC emissions in 2024 for E_Solvents categories have decreased by -42.1% (-42.4% without Canary Islands) when compared to 1990 emissions. The drop since 2002 is a result of different regulations on activities using solvents and on paint products (Royal Decree 117/2003 and Royal Decree 227/2006, transposition of Directives 1999/13 and 2004/42, respectively), that lead to a fall of emissions under Coating applications (2D3d). Also, the economic downturn had a noticeable effect on the contraction of the activity data (consumption of paints). The decrease slowed by 2013, and from then a slighter decreasing slope is observed, with minor fluctuations.

NMVOC emissions under D_Fugitive dropped by -38.2% between 1990 and 2024 (-34.3% without Canary Islands). The reduction in emissions is mainly related to the Distribution of oil products (1B2av), due to the entry into force since 2000 of regulations on the distribution of oil products (RD 2102/1996, RD 1437/2002, RD 2102/1996 and RD 455/2012). The adoption of regulations relating to tanks, distribution of gasoline and gas recovery (Phase II), together with a drop in gasoline consumption, has resulted in a reduction of -61.4% (-60.2% without Canary Islands) in emissions of NMVOC in 1B2av sector in 2024, when compared to 1990.

When comparing NMVOC emissions in years 2024 and 2023, the total decrease of -2.4% (-2.3% without Canary Islands) is mainly due to the E_Solvents and B_Industry categories.

### 2.1.3. Sulphur Dioxide ($SO_2$)

97.5 kt of sulphur dioxide ($SO_2$) were estimated as emitted in Spain (93.6 kt excluding the Canary Islands) in 2024.

$SO_2$ emissions in 2024 decreased by -95.4% compared to 1990 (-95.6%, without Canary Islands) and showed a -3.3% decrease when compared to 2023 (with and without Canary Islands).

The major GNFR aggregated sectors contributing to $SO_2$ emissions in 2024 were:

- Industries (B_Industry) were the first contributing activity in 2024, accounting for 48.9% of emissions (52.7% without Canary Islands), with combustion in manufacturing industries and construction, namely Non-metallic minerals (1A2f) and Non-ferrous metals (1A2b) being respectively 18.3% and 7.4% of the total of the Inventory (19.7% and 8.0%, respectively, without the Canary Islands).
- Fugitive emissions (D_Fugitive), representing 21.0% of total $SO_2$ emissions (22.7% without the Canary Islands), was the next contributing group of activities, with emissions from oil refining processes and storage reported under Fugitive (1B2aiv) accounted in 2024 for 18.3% of the total estimates (19.7% without Canary Islands).
- The small combustion sector, C_Other Stationary Combustion accounted for 13.5% of total emissions in 2024 (14.5% without Canary Islands).
- Public power generation (A_PublicPower) which in the first years of the time series was the largest contributor, in 2024 accounted for 8.9% of total $SO_2$ emissions (4.0% without Canary Islands).
- G_Shipping (national navigation, NFR 1A3dii) accounted in 2024 for 5.0% of the total $SO_2$ emissions (3.3% without Canary Islands).

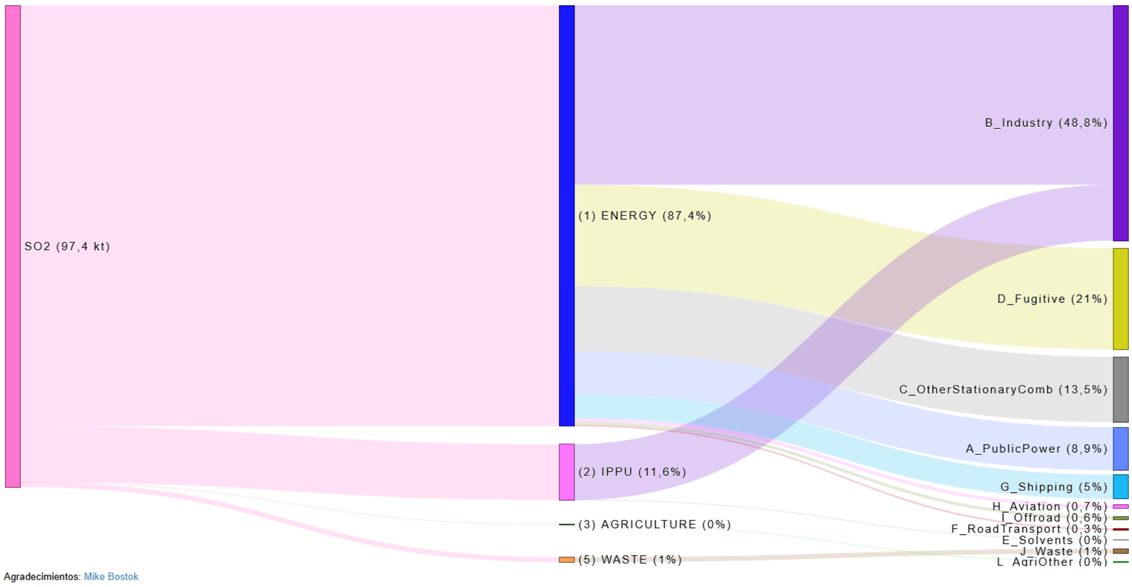



**Figure 2.1.5 Distribution of $SO_2$ emissions in year 2024 (national territory)**

**Table 2.1.3 $SO_2$ emissions by sector (kt)**

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 | Share 2024 | 2024 vs 1990 | 2024 vs 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **A_PublicPower** | 1459.1 | 928.7 | 71.4 | 137.4 | 31.2 | 14.1 | 9.1 | 8.7 | 8.9% | -99.4% | -4.9% |
| **B_Industry** | 437.8 | 202.4 | 128.6 | 82.2 | 72.5 | 60.1 | 47.8 | 47.7 | 48.9% | -89.1% | -0.3% |
| **C_OtherStationaryComb** | 26.1 | 31.9 | 24.4 | 17.7 | 17.6 | 17.2 | 14.2 | 13.1 | 13.5% | -49.7% | -7.5% |
| **D_Fugitive** | 64.7 | 40.2 | 23.5 | 24.9 | 23.7 | 21.5 | 21.9 | 20.5 | 21.0% | -68.3% | -6.3% |
| **E_Solvents** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | 169.7% | -1.7% |
| **F_RoadTransport** | 67.4 | 2.9 | 0.5 | 0.3 | 0.4 | 0.3 | 0.3 | 0.3 | 0.3% | -99.5% | 8.2% |
| **G_Shipping** | 43.4 | 13.3 | 5.7 | 4.0 | 18.5 | 4.4 | 5.0 | 4.9 | 5.0% | -88.8% | -3.2% |
| **H_Aviation** | 0.2 | 0.5 | 0.5 | 0.5 | 0.6 | 0.2 | 0.6 | 0.7 | 0.7% | 205.2% | 8.9% |
| **I_Offroad** | 18.8 | 8.6 | 4.0 | 1.3 | 0.9 | 0.8 | 0.7 | 0.6 | 0.6% | -96.8% | -6.8% |
| **J_Waste** | 1.4 | 1.0 | 1.3 | 1.3 | 1.2 | 1.4 | 1.0 | 1.0 | 1.0% | -28.2% | -0.5% |
| **K_AgriLivestock** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | - | - |
| **L_AgriOther** | 4.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | -99.3% | 889.1% |
| **CLRTAP Total (national territory)** | **2123.0** | **1229.6** | **259.9** | **269.6** | **166.5** | **120.0** | **100.7** | **97.5** | **100.0%** | **-95.4%** | **-3.1%** |
| ***NECD Total (without Canary Islands)*** | *2045.7* | *1206.4* | *243.2* | *258.8* | *150.4* | *112.4* | *93.3* | *90.1* | *92.6%* | *-95.6%* | *-3.3%* |

Detailed emission data of the Spanish Inventory are available from the MITECO-SEI website WebTable.

### 2.1.3.1. Trend assessment

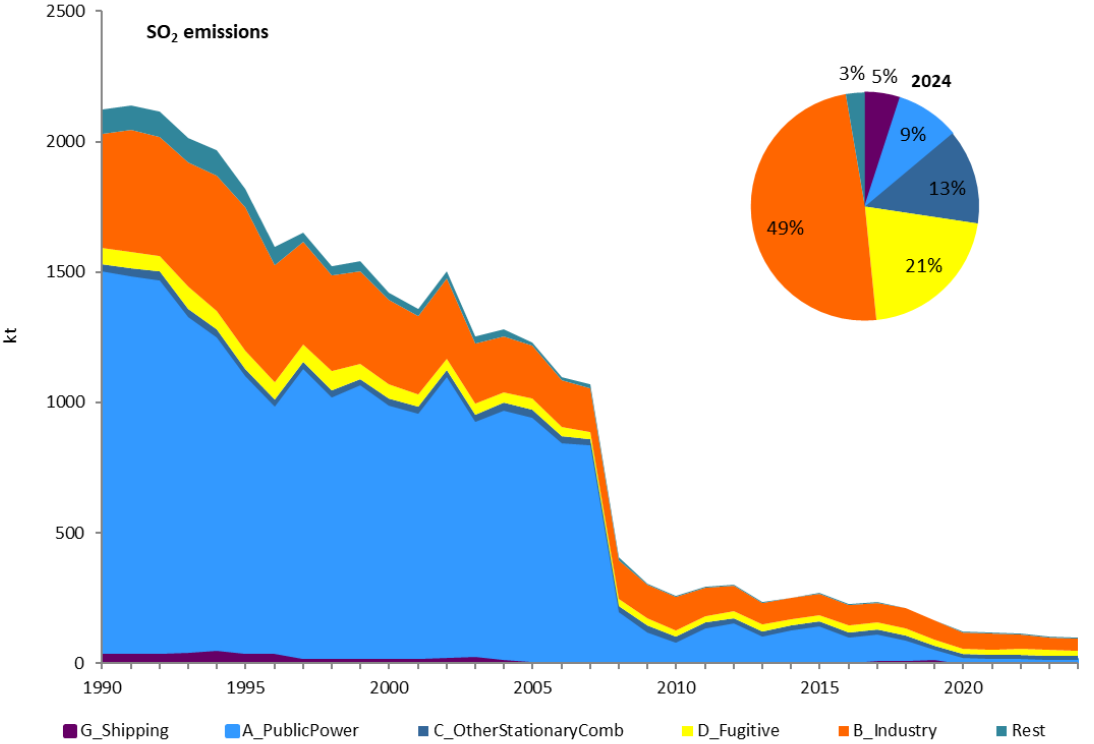



**Figure 2.1.6 Evolution of $SO_2$ emissions by category and distribution in year 2024, national territory**

Sulphur Oxides emissions in Spain have experienced a drastic drop (-95.4%, -95.6% without Canary Islands) since 1990, due to the substantial reduction of $SO_2$ emissions in the main contributing activities:

- A_PublicPower (1A1a) has reduced $SO_2$ emissions by -99.4% since 1990 (-99.7% without Canary Islands). The reduction has been caused by the progressive introduction of desulphurization techniques in thermal power plants and the shift from coal power plants to combined cycle gas plants. The dramatic drop observed in 2008 was due to the closure of the main brown coal mine in Spain in 2007 and the necessary retrofitting in 2008 of the adjacent thermal plant.
- $SO_2$ emissions in B_Industry also decreased by 89.1% since 1990 (-88.9% without Canary Islands). This drop is mainly linked to reductions in Petroleum refining sector (1A1b) by 99.1% (both with and without Canary Islands), followed by Combustion in the non-metallic minerals industry (1A2f) (-78.8%, and -79.9% without Canary Islands) and Stationary combustion in the chemical industry (1A2c) (-90.6%, -90.5% without Canary Islands). Similarly to Public Power production, the reduction of $SO_2$ emissions from the Stationary combustion in industries is directly linked to the progressive introduction of abatement techniques and the decline in the consumption of coal and solid fossil fuels in favor of fuels with less sulphur content.
- D_Fugitive emissions have been reduced by -68.3% (-67,5% without Canary Islands), in which fugitive emissions from refining and storage of oil (1B2aiv) and from oil/gas venting and flaring (1B2c) dropped by -53.8% and -88.9% respectively (-54.5% and

-88.8% without Canary Islands), linked to the aforementioned abatement techniques in the Petroleum refining activity (1A1b).

- Another driver in the $SO_2$ emissions' reduction since 1990 has been F_RoadTransport, whose emissions were almost completely removed (-99.5%, the same without Canary Islands) as a result of the reduction of the sulphur content in road fuels since 1994, due to the effect of the Directive 93/12/EEC relating to the sulphur content of certain liquid fuels.

When comparing the years 2024 and 2023, total $SO_2$ emissions showed a reduction of -3.1% (-3.3% without the Canary Islands), due to decreases of in D_Fugitive and C_OtherStationaryComb emissions, in which the shift to fuels with lower sulphur content in most activity sectors play a role.

### 2.1.4. Ammonia ($NH_3$)

In 2024, an estimate of 453.1 kt of ammonia ($NH_3$) were emitted in Spain (450.1 kt, when excluding the Canary Islands).

This means a decrease by -15.2% (-14.8% without Canary Islands) of the 2024 estimated $NH_3$ emissions when compared to 1990, and an increase by 1.4% (the same without the Canary Islands) when compared to 2023 estimates.

The major GNFR aggregated sectors contributing to $NH_3$ emissions in 2024 were:

- Agricultural soil (L_AgriOther) was the largest contributing activity, with 55.2% (55.3% without Canary Islands) of total ammonia emissions. In more detail, Inorganic N-fertilizers including urea application (3Da1) was the largest emitter representing 22.8% (22.9% without Canary Islands), followed by Animal manure applied to soils (3Da2a) accounting for 22.5% of the total ammonia emissions of the inventory (with and without Canary Islands) and Urine and dung deposited by grazing animals (3Da3) accounting for 7.7% of total $NH_3$ emissions (with and without Canary Islands).

- Livestock (K_AgriLivestock) was the second contributing activity, accounting for 42.0% (with and also without Canary Islands) of the total ammonia emissions of the inventory, with Manure management-Swine (3B3) accounting for 14.2% (14.3% without Canary Islands), followed by Manure management-Dairy cattle (3B1a), accounting for 7.3% (with and without Canary Islands). The categories Manure management-Non-dairy Cattle (3B1b) represented 6.2% and Manure management of poultry (3B4gi+3B4gii+3B4giii+3B4giv) represented 8.1% of $NH_3$ emissions in 2024 (the same figures without Canary Islands).

- B_Industry and F_RoadTransport were the next-largest contributing activities, each representing 0.8% of the total $NH_3$ emissions of the 2024 Spanish Inventory (0.8% and 0.7%, respectively, when including Canary Islands' emissions).

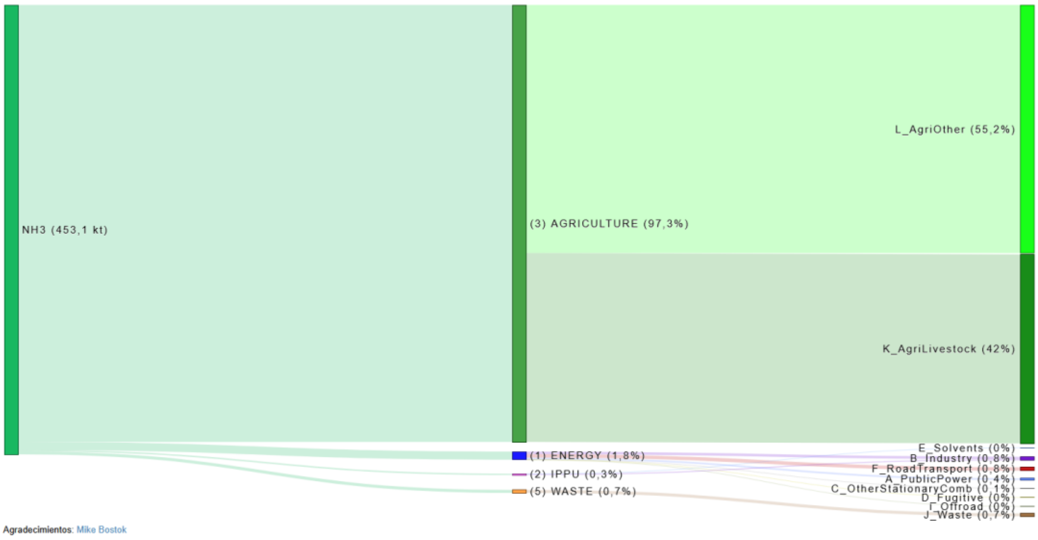



**Figure 2.1.7 Distribution of $NH_3$ emissions in year 2024 (national territory)**

**Table 2.1.4 $NH_3$ emissions by sector (kt)**

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 | Share 2024 | 2024 vs 1990 | 2024 vs 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **A_PublicPower** | 0.0 | 0.1 | 0.2 | 1.1 | 1.3 | 1.6 | 1.6 | 1.6 | 0.4% | - | 3.1% |
| **B_Industry** | 5.3 | 4.4 | 4.0 | 2.5 | 3.5 | 3.1 | 3.9 | 3.7 | 0.8% | -30.4% | -5.3% |
| **C_OtherStationaryComb** | 0.7 | 0.6 | 0.7 | 0.7 | 0.5 | 0.5 | 0.4 | 0.4 | 0.1% | -40.9% | -1.3% |
| **D_Fugitive** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | -49.5% | -15.6% |
| **E_Solvents** | 0.1 | 0.4 | 0.3 | 0.3 | 0.3 | 0.3 | 0.2 | 0.2 | 0.0% | 171.7% | 18.2% |
| **F_RoadTransport** | 0.3 | 5.7 | 3.8 | 2.7 | 2.9 | 2.3 | 3.3 | 3.5 | 0.8% | 909.6% | 7.6% |
| **G_Shipping** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | - | - |
| **H_Aviation** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | - | - |
| **I_Offroad** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | 33.4% | 0.9% |
| **J_Waste** | 0.4 | 0.9 | 1.2 | 1.3 | 1.4 | 1.4 | 1.5 | 3.0 | 0.7% | 585.3% | 98.6% |
| **K_AgriLivestock** | 206.1 | 224.4 | 200.4 | 202.0 | 207.3 | 204.9 | 194.3 | 190.5 | 42.0% | -7.5% | -2.0% |
| **L_AgriOther** | 321.7 | 285.4 | 268.6 | 286.1 | 275.1 | 284.9 | 241.7 | 250.2 | 55.2% | -22.2% | 3.5% |
| **CLRTAP Total (national territory)** | **534.5** | **522.0** | **479.2** | **496.7** | **492.2** | **499.0** | **446.9** | **453.1** | **100.0%** | **-15.2%** | **1.4%** |
| | | | | | | | | | | | |
| ***NECD Total (without Canary Islands)*** | *528.22* | *517.09* | *475.33* | *493.48* | *489.12* | *495.90* | *443.93* | *450.08* | *99.3%* | *-14.8%* | *1.4%* |

Detailed emission data of the Spanish Inventory are available from the MITECO-SEI website WebTable.

#### 2.1.4.1. Trend assessment

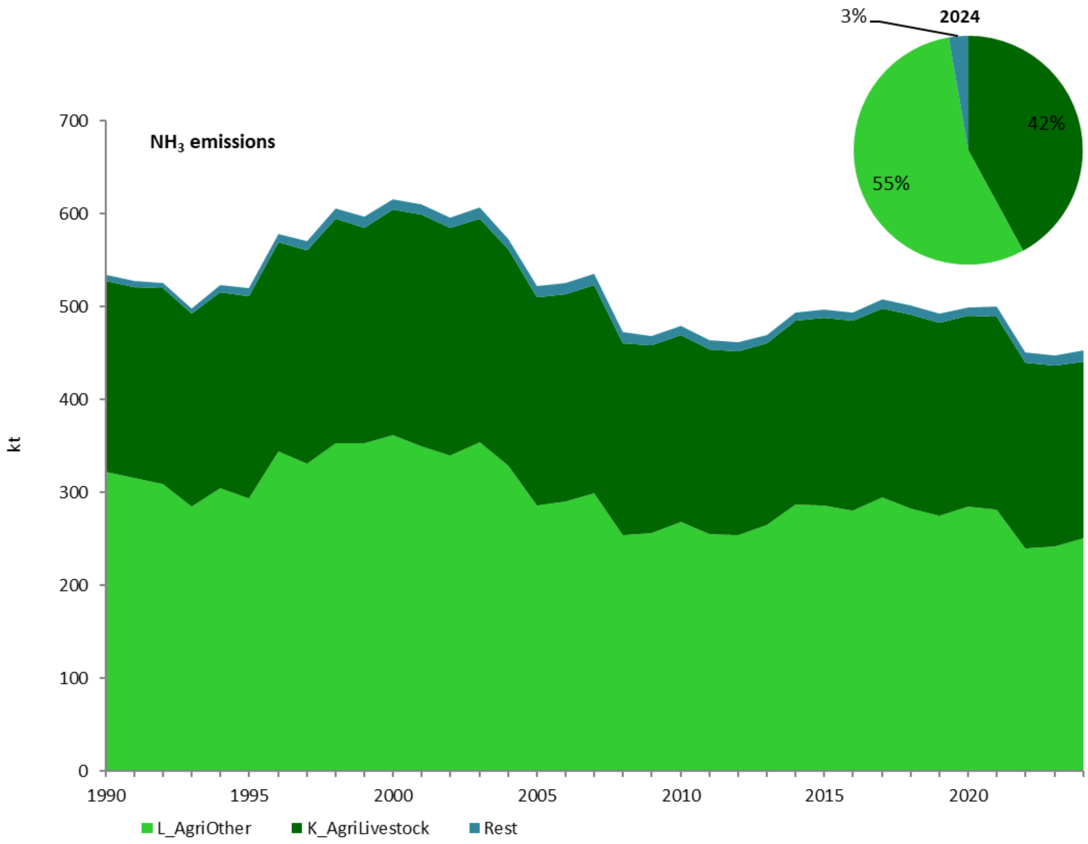



**Figure 2.1.8 Evolution of $NH_3$ emissions by category and distribution in year 2024, national territory**

The trend of Ammonia emissions is essentially ruled by the evolution of Agriculture activities, by far the largest contributing sector to these emissions.

Total $NH_3$ emissions in 2024 have decreased by -15.2% when compared to 1990 level (-14,8% without Canary Islands). Major variations in the time series are related to economic recession periods in Spain, weather conditions that affect the use of N-containing fertilizers, and Best Available Techniques used by farmers. In general, drought episodes lead to decreases in emissions from inorganic N-fertilizers use (3Da1) (the fact that fertilization intensifies drought stress results in a decrease in the use of fertilizers during poor rainfall periods).

Ammonia decreases are greater in the agricultural soil fertilization activities under L_AgriOther (-22.2% compared to 1990, -21.8% without Canary Islands) than in the K_AgriLivestock sector (-7.5% *vs.* 1990, -6.9% without Canary Islands).This is so, even with the increase of some livestock population, mainly non-dairy cattle and white swine, that has effect in L_AgriOther, *via* the ammonia emissions derived from Animal manure applied to soils (3Da2a) and Urine and dung deposited by grazing animals (3Da3).

The introduction of fertilization practices with measures for abatement of $NH_3$ emissions from 2004 onwards and the progressive introduction of abatement techniques in white swine manure management (3B3), improvements in animal feed formulations, as well as the enforcement of animal welfare legislation affecting laying hens since 2010, lead to decreases in the last period of Ammonia emissions.

Total ammonia emissions increased by 1.4% in 2024 with respect to 2023, mainly coming from an increase of 3.5% in L_AgriOther emissions (same figures including and excluding Canary Islands), mainly due to the registered increase in the use of urea, and also of NK-NPK-NP fertilizing mixtures.

### 2.1.5. Fine Particulate Matter ($PM_{2.5}$)

The estimation of Fine Particulate Matter ($PM_{2.5}$: particles with an aerodynamic diameter equal to or less than 2.5 micrometres) for 2024 is 90.9 kt emitted in Spain (88.2 kt, excluding the Canary Islands).

$PM_{2.5}$ emissions in 2024 decreased by -48.7% when compared to 2000, which is the base year for particulate matter, and decreased by -0.7% when compared to 2023 (corresponding to -48.8% and -0.6%, respectively, without the Canary Islands).

The analysis of GNFR aggregated sectors contributing to $PM_{2.5}$ emissions in 2024 is:

– Small Stationary Combustion (C_OtherStationaryComb) is the largest contributing activity in 2024, with 32.3% of total $PM_{2.5}$ emissions (32.7% without Canary Islands), with Residential stationary combustion (1A4bi) representing 29.1% of the emissions' total of the Spanish Inventory (29.4% without Canary Islands).

– (J_Waste) was the second contributor, accounting for 22.8% of the total (23.1% without Canary Islands), with the Open burning of pruning remains (5C2) accounting for 21.1% of the total of emissions (21.4% without Canary Islands).

– Industries (B_Industry) accounted for 19.6% of the total of 2024 fine particulate emissions (19.9% without Canary Islands).

– F_RoadTransport, a former important contributor, represented only 11.8% of the total $PM_{2.5}$ emissions in 2024 (11.7% without the Canary Islands emissions).

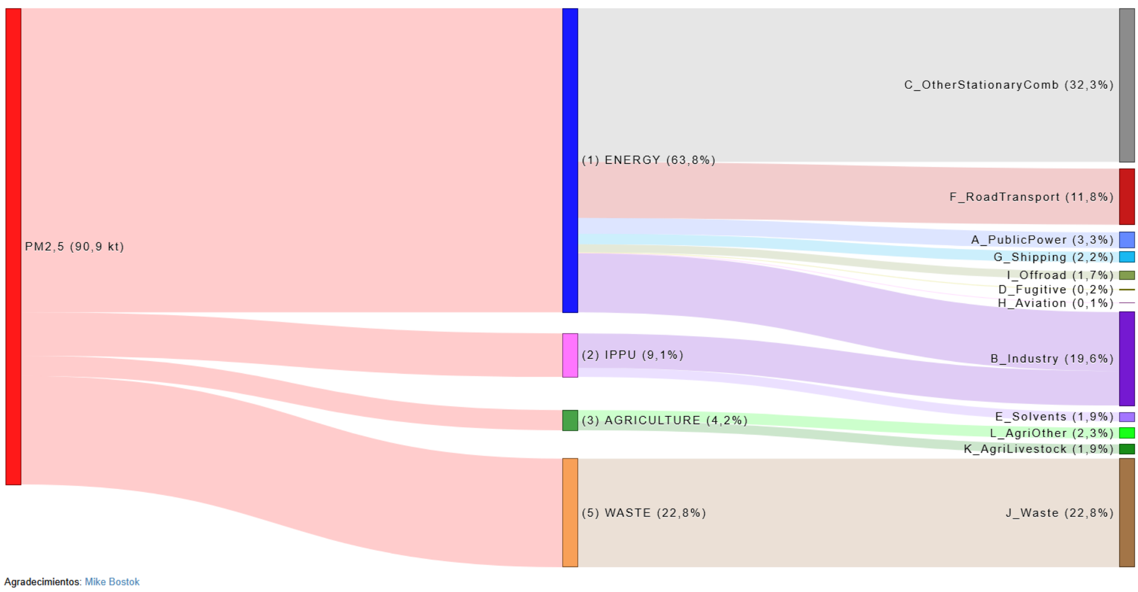



**Figure 2.1.9 Distribution of $PM_{2.5}$ emissions in year 2024 (national territory)**

**Table 2.1.5 $PM_{2.5}$ emissions by sector (kt)**

| | 2000 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 | Share 2024 | 2024 vs 2000 | 2024 vs 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **A_PublicPower** | 10.5 | 10.3 | 2.7 | 5.3 | 3.1 | 3.1 | 2.9 | 3.0 | 3.3% | -71.4% | 1.9% |
| **B_Industry** | 23.2 | 25.7 | 18.1 | 14.0 | 17.9 | 15.7 | 17.8 | 17.8 | 19.6% | -23.2% | 0.2% |
| **C_OtherStationaryComb** | 53.3 | 54.9 | 62.4 | 59.7 | 39.5 | 38.5 | 30.4 | 29.3 | 32.3% | -45.0% | -3.7% |
| **D_Fugitive** | 0.5 | 0.4 | 0.4 | 0.3 | 0.2 | 0.1 | 0.2 | 0.2 | 0.2% | -64.6% | -19.5% |
| **E_Solvents** | 0.8 | 3.2 | 2.4 | 2.2 | 2.2 | 1.8 | 1.5 | 1.7 | 1.9% | 123.0% | 14.6% |
| **F_RoadTransport** | 27.3 | 26.1 | 21.1 | 15.9 | 14.2 | 11.0 | 10.6 | 10.7 | 11.8% | -60.9% | 0.5% |
| **G_Shipping** | 1.8 | 1.3 | 1.2 | 0.7 | 2.8 | 1.8 | 2.1 | 2.0 | 2.2% | 12.2% | -3.9% |
| **H_Aviation** | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 0.1% | 31.3% | 7.8% |
| **I_Offroad** | 8.2 | 6.9 | 4.1 | 2.5 | 1.9 | 1.6 | 1.5 | 1.5 | 1.7% | -81.6% | -0.6% |
| **J_Waste** | 25.9 | 24.1 | 27.0 | 27.9 | 26.2 | 30.7 | 20.7 | 20.7 | 22.8% | -20.2% | 0.1% |
| **K_AgriLivestock** | 2.0 | 1.9 | 1.7 | 1.7 | 1.8 | 1.8 | 1.8 | 1.7 | 1.9% | -11.0% | -0.9% |
| **L_AgriOther** | 23.5 | 2.1 | 1.9 | 1.9 | 1.9 | 1.9 | 1.8 | 2.1 | 2.3% | -91.1% | 15.6% |
| **CLRTAP Total (national territory)** | **177.1** | **157.0** | **143.0** | **132.1** | **111.8** | **108.0** | **91.5** | **90.9** | **100.0%** | **-48.7%** | **-0.7%** |
| ***NECD Total (without Canary Islands)*** | *172.3* | *152.6* | *139.4* | *128.9* | *108.4* | *105.1* | *88.7* | *88.2* | *97.1%* | *-48.8%* | *-0.6%* |

Detailed emission data of the Spanish Inventory are available from the MITECO-SEI website WebTable.

### 2.1.5.1. Trend assessment

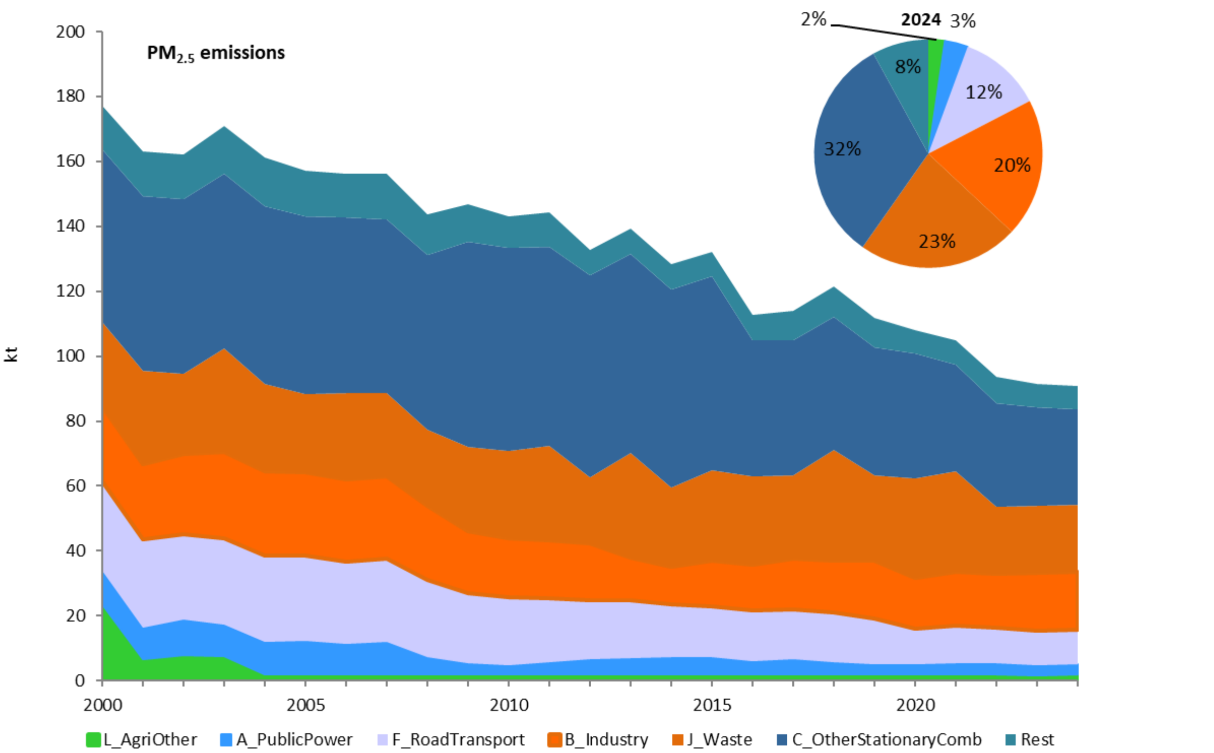



**Figure 2.1.10 Evolution of $PM_{2.5}$ emissions by category and distribution in year 2024, national territory**

Fine Particulate Matter ($PM_{2.5}$) emissions in 2024 have decreased by -48.7% when compared to year 2000 (-48.8% without Canary Islands).

Since the year 2000, L_AgriOther experienced a fall of -91.1% of its $PM_{2.5}$ emissions (both with and without Canary Islands), due to the abandonment of the practice of field burning (3F), restricted by forest fire prevention legislation and the conditionality of CAP (Common Agricultural Policy) payments.

$PM_{2.5}$ emissions coming from C_OtherStationaryComb have decreased by -45.0% since 2000 (-44.9% without Canary Islands), caused by the abandonment of coal as fuel in the Residential stationary sector, and by the increase of use of pellets and advanced stoves and boilers.

The $PM_{2.5}$ emissions from F_RoadTransport have dropped by -60.9% since 2000 (-60.2% without Canary Islands), mostly driven by the introduction of EURO standards in Heavy duty vehicles and buses (1A3biii), which showed a reduction in their $PM_{2.5}$ emissions by -89.6% since 2000 (-89.2% without Canary Islands), and in passenger cars (1A3bi), which showed a reduction of $PM_{2.5}$ by -62.3% (-63.0% without Canary Islands) since 2000.

The fine particulate emissions from A_PublicPower (1A1a) were reduced by -71.4% in 2024 *versus* 2000 (-72.2% without Canary Islands). B_Industry had a similar evolution, and $PM_{2.5}$ emissions decreased by -23.2% since 2000 (-23.3% without Canary Islands), mainly due to the shift from solid and liquid fuels to a more predominant gas consumption, and the installation of abatement techniques.

Comparing 2024 with 2023, the main decrease in $PM_{2.5}$ comes from C_OtherStationaryComb category (-3.7%, and -3.6%, without emissions from the Canary Islands).

### 2.1.6. Black Carbon (BC)

In 2024, 24.0 kt of Black Carbon (BC) were emitted in Spain (23.5 kt excluding the Canary Islands).

Total emissions of BC decreased in 2024 by -46.8% (-46.5% without Canary Islands), when compared to 2000, the base year for particulate matter, and decreased by -0.8% (same figure without Canary Islands) when compared to 2023.

Analysis of GNFR aggregated sectors contributing to BC emissions in 2024:

- (J_Waste) is the largest contributing activity, with 44.7% of BC emissions in 2024 (45.0% without the Canary Islands), almost completely coming from the open burning of pruning remains under 5C2 subcategory.
- F_RoadTransport, although having largely reduced its BC emissons, represented 18.5% of the total of the Spanish Inventory in 2024 (18.4% without Canary Islands).
- Small Stationary Combustion (C_OtherStationaryComb) was the next contributor, accounting for 17.1% of the total of BC (17.3% without Canary Islands), with Residential stationary combustion (1A4bi) representing 14.1% of the emissions of the Spanish Inventory (14.2% without Canary Islands).
- Industries (B_Industry) accounted for 12.4% of the total of 2024 BC emissions (both with and without Canary Islands).

**Table 2.1.6 BC emissions by sector (kt)**

| | 2000 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 | Share 2024 | 2024 vs 2000 | 2024 vs 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A_PublicPower | 0.3 | 0.4 | 0.1 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.5% | -52.9% | -1.6% |
| B_Industry | 3.0 | 3.2 | 2.4 | 1.5 | 2.7 | 2.3 | 3.2 | 3.0 | 12.4% | -1.2% | -6.3% |
| C_OtherStationaryComb | 6.3 | 6.5 | 7.3 | 7.1 | 4.9 | 4.9 | 4.2 | 4.1 | 17.1% | -35.2% | -1.3% |
| D_Fugitive | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | 285.3% | 353.7% |
| E_Solvents | 0.3 | 1.3 | 1.0 | 0.9 | 0.9 | 0.7 | 0.6 | 0.7 | 2.7% | 146.0% | 18.2% |
| F_RoadTransport | 14.9 | 15.6 | 12.8 | 8.9 | 7.3 | 5.4 | 4.5 | 4.4 | 18.5% | -70.3% | -1.5% |
| G_Shipping | 0.1 | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.1 | 0.1 | 0.2% | -15.8% | 0.0% |
| H_Aviation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2% | 31.4% | 7.8% |
| I_Offroad | 4.2 | 3.8 | 2.4 | 1.3 | 1.0 | 0.8 | 0.8 | 0.8 | 3.4% | -80.4% | -0.5% |
| J_Waste | 13.4 | 12.3 | 14.4 | 14.9 | 13.7 | 16.3 | 10.7 | 10.7 | 44.7% | -19.9% | 0.0% |
| K_AgriLivestock | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | - | - |
| L_AgriOther | 2.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1% | -98.9% | 889.1% |
| **CLRTAP Total (national territory)** | **45.0** | **43.1** | **40.5** | **34.8** | **30.7** | **30.6** | **24.2** | **24.0** | **100.0%** | **-46.8%** | **-0.8%** |
| *NECD Total (without Canary Islands)* | *43.8* | *41.9* | *39.7* | *34.1* | *30.1* | *30.0* | *23.6* | *23.5* | *98.6%* | *-46.5%* | *-0.8%* |

Detailed emission data of the Spanish Inventory are available from the MITECO-SEI website WebTable.

### 2.1.6.1. Trend assessment

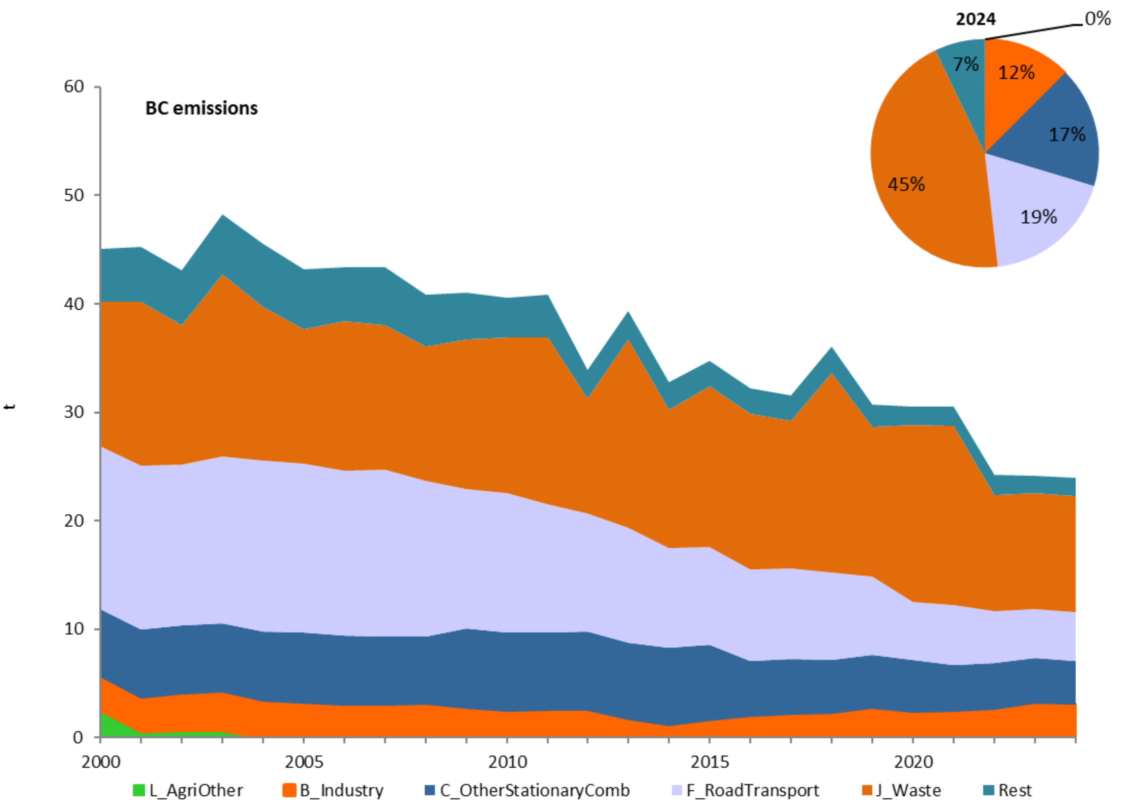



**Figure 2.1.11 Evolution of BC emissions by category and distribution in year 2024, national territory**

Black Carbon emissions have decreased by -46.8% (-46.5% without Canary Islands) in 2024 compared to 2000, as already mentioned.

The decrease is mainly due to F_RoadTransport, whose BC emissions have dropped by -70.3% since 2000 (69.6% without Canary Islands), mostly driven by the introduction of EURO standards in Heavy duty vehicles and buses (1A3biii), which showed a reduction in their BC emissions of -88.2% since 2000, and in passenger cars (1A3bi), which showed a reduction of BC of -57.6% since 2000 (-87.8% and -57.3%, respectively, without Canary Islands).

The most contributing sector to Black Carbon emissions in the last years of the series, J_Waste, shows a decrease of -19.9% in BC emissions since 2000 (-20.3% without Canary Islands).

The BC emissions coming from C_OtherStationaryComb have decreased by -35.2% since 2000 (-35.0% without Canary Islands), mainly due to changes in the fuels used in Residential stationary combustion (1A4bi).

Since the year 2000, L_AgriOther experienced a fall of -98.9% of its BC emissions (-98.8% without Canary Islands), due to the abandonment of the practice of field burning (3F).

Comparing 2024 with 2023, Black Carbon emissions decrease is led by the -6.3% decrease in B_Industry category (-6.4% without Canary Islands).

### 2.1.7. Carbon Monoxide (CO)

In 2024, 978.1 kt of carbon monoxide (CO) were emitted in Spain (956.5 kt excluding the Canary Islands).

CO emissions in 2024 decreased by -76.5% compared to 1990 (-76.6% without Canary Islands) and experienced an increase of 3.7% when compared to 2023 (the same when considering the Canary Islands).

The GNFR aggregated sectors which were the major contributors to CO emissions:

- Industries (B_Industry) contributed with a 27.2% of CO total emissions (27.7% without Canary Islands), with Combustion in Iron and steel industries (1A2a), Iron and steel process emissions (2C1), and Combustion in Non-metallic minerals (1A2f) accounting respectively for 7.5%, 7.5% and 5.0% of the total of the Spanish Inventory (7.7%, 7.7% and 5.1%, respectively, without Canary Islands).
- J_Waste sector accounted for 26.9% of the total CO emissions (27.1% without Canary Islands), was the main emitting sector in 2024, almost completely owing of the 5C2 activity (open burning of pruning remains).
- Small Stationary Combustion (C_OtherStationaryComb) accounted for 21.0% of total CO emissions in 2024 (21.1% without Canary Islands), with Residential sector (1A4bi) as the principal subsector, with 19.7% of total CO emissions (19.8% without Canary Islands).
- F_RoadTransport, which used to be the main contributor to CO emissions, in 2024 accounted for an 15.4% of the total (14.9% without Canary Islands).

**Table 2.1.7 CO emissions by sector (kt)**

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 | Share 2024 | 2024 vs 1990 | 2024 vs 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **A_PublicPower** | 7.3 | 16.4 | 15.2 | 25.1 | 25.1 | 27.0 | 33.7 | 39.8 | 4.1% | 445.7% | 18.1% |
| **B_Industry** | 433.0 | 408.2 | 340.7 | 346.7 | 328.2 | 254.7 | 245.9 | 265.7 | 27.2% | -38.6% | 8.1% |
| **C_OtherStationaryComb** | 407.7 | 380.9 | 428.6 | 396.9 | 269.0 | 261.5 | 207.7 | 205.2 | 21.0% | -49.7% | -1.2% |
| **D_Fugitive** | 2.8 | 2.7 | 2.3 | 2.2 | 2.1 | 1.6 | 2.1 | 2.0 | 0.2% | -26.9% | -2.1% |
| **E_Solvents** | 1.1 | 5.9 | 4.4 | 4.1 | 4.0 | 3.4 | 2.6 | 3.0 | 0.3% | 171.7% | 17.9% |
| **F_RoadTransport** | 2132.4 | 693.4 | 405.7 | 266.3 | 229.5 | 153.5 | 144.7 | 150.9 | 15.4% | -92.9% | 4.3% |
| **G_Shipping** | 6.7 | 6.3 | 4.3 | 1.8 | 4.1 | 3.1 | 3.5 | 3.7 | 0.4% | -44.8% | 6.0% |
| **H_Aviation** | 3.3 | 6.3 | 6.2 | 5.3 | 7.4 | 2.7 | 6.9 | 7.3 | 0.7% | 123.6% | 6.6% |
| **I_Offroad** | 50.2 | 41.3 | 27.5 | 30.2 | 44.6 | 42.0 | 32.8 | 33.4 | 3.4% | -33.3% | 1.8% |
| **J_Waste** | 278.9 | 302.2 | 353.3 | 364.2 | 336.9 | 400.0 | 263.0 | 263.1 | 26.9% | -5.7% | 0.0% |
| **K_AgriLivestock** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | - | - |
| **L_AgriOther** | 842.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 3.9 | 0.4% | -99.5% | 889.1% |
| **CLRTAP Total (national territory)** | **4166.1** | **1863.7** | **1588.0** | **1443.0** | **1251.0** | **1149.6** | **943.3** | **978.1** | **100.0%** | **-76.5%** | **3.7%** |
| | | | | | | | | | | | |
| ***NECD Total (without Canary Islands)*** | *4087.7* | *1780.9* | *1547.5* | *1411.8* | *1222.7* | *1127.3* | *922.1* | *956.5* | *97.8%* | *-76.6%* | *3.7%* |

Detailed emission data of the Spanish Inventory are available from the MITECO-SEI website WebTable.

### 2.1.7.1. Trend assessment

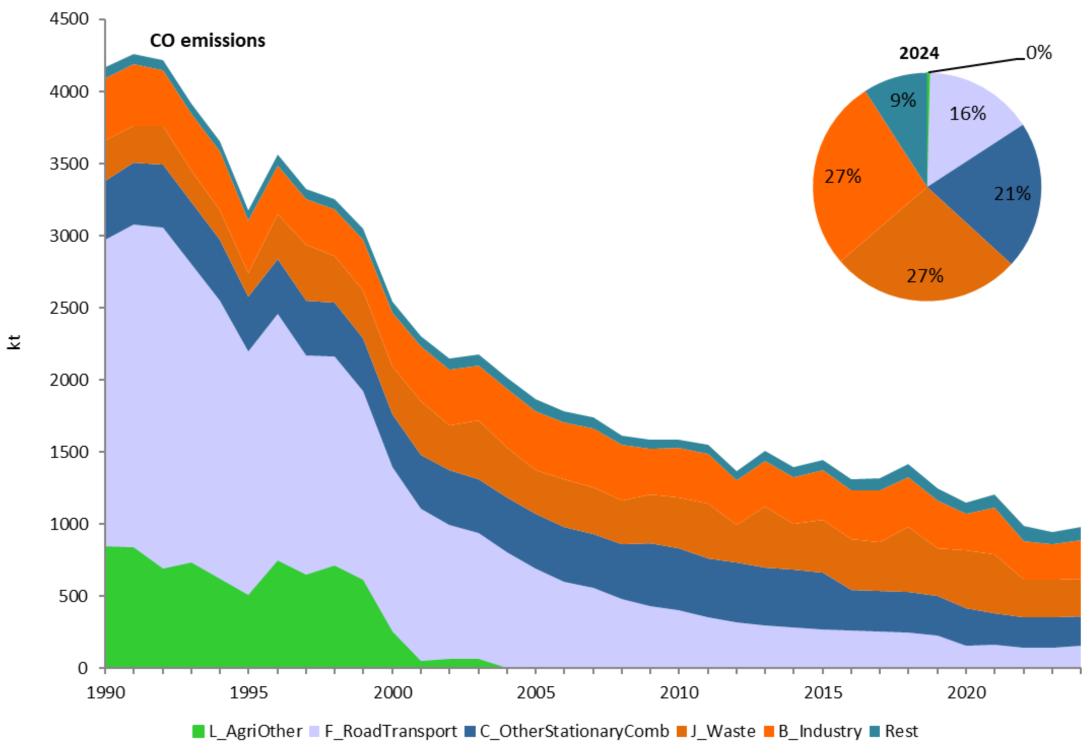



**Figure 2.1.12 Evolution of CO emissions by category and distribution in year 2024, national territory**

Carbon Monoxide emissions have decreased by -76.5% since 1990 (-76.6% without Canary Islands), this drop being essentially driven by the reductions in F_RoadTransport which dropped by -95.9% along the time series (-93.2% without Canary Islands). Reductions were ruled by the introduction of EURO standards, that since 1993 (EURO-1-91/441/EEC) resulted in a global reduction of CO emissions from passenger cars (1A3bi) (-95.2% in 2024 with respect to 1990, -95.5% without Canary Islands).

Particular mention deserves the CO emissions from L_AgriOther, which drastically decreased as from 2000, due to the abandonment of the practice of field burning (3F), restricted by forest fire prevention legislation and the conditionality of CAP (Common Agricultural Policy) payments (-95.1% reduction with respect to 1990, -95.3% without the Canary Islands)).

Regarding CO emissions in B_Industry and C_OtherStationaryComb, reductions since 1990 can be observed (respectively: -38.6% or -38.7% without Canary Islands, and -49.7%, (-49.6% without Canary Islands).

### 2.1.8. Lead (Pb)

In year 2024, an estimate of 96.2 t of lead (Pb) were emitted in Spain (92.3 t excluding the Canary Islands).

Pb emissions in 2024 decreased by -97.1% compared to 1990 (with and without Canary Islands) and decreased by -15.8% (-14.7% without Canary Islands), when compared to year 2023.

The major GNFR aggregated sector contributing to Pb emissions in 2024 was B_Industry, accounting for 51.7% of total Pb emissions (53.7% without Canary Islands), with Iron and steel process emissions (2C1) with a 31.3% of the total of emissions (32.7% without Canary Islands), Glass process emissions (2A3) with 8.2% (8.4% without Canary Islands), and Combustion in Iron and steel (1A2a) with 7.0% of the total (7.3% without Canary Islands).

F_RoadTransport was the second contributing activity, accounting for 40.1% of lead emissions in 2024 (38.9% without Canary Islands).

Next contributing group is J_Waste, with a 3.0% of the total of the Inventory in 2024 (3.1% without Canary Islands).

**Table 2.1.8 Pb emissions by sector (t)**

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 | Share 2024 | 2024 vs 1990 | 2024 vs 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **A_PublicPower** | 4.0 | 6.3 | 3.2 | 3.7 | 2.0 | 1.5 | 1.2 | 1.1 | 1.2% | -71.5% | -8.6% |
| **B_Industry** | 81.4 | 65.6 | 61.2 | 61.9 | 54.5 | 43.1 | 48.1 | 49.8 | 51.7% | -38.8% | 3.5% |
| **C_OtherStationaryComb** | 5.9 | 5.3 | 5.2 | 4.3 | 3.6 | 3.4 | 2.9 | 2.7 | 2.8% | -53.7% | -4.4% |
| **D_Fugitive** | 0.9 | 1.0 | 0.8 | 0.6 | 0.4 | 0.2 | 0.5 | 0.5 | 0.5% | -49.9% | -1.2% |
| **E_Solvents** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | 169.7% | -1.7% |
| **F_RoadTransport** | 3185.8 | 71.0 | 59.0 | 34.5 | 37.9 | 30.8 | 58.1 | 38.6 | 40.1% | -98.8% | -33.6% |
| **G_Shipping** | 0.2 | 0.2 | 0.1 | 0.1 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1% | -40.7% | 3.2% |
| **H_Aviation** | 0.8 | 0.6 | 0.5 | 0.3 | 0.3 | 0.3 | 0.3 | 0.4 | 0.4% | -53.6% | 9.1% |
| **I_Offroad** | 0.9 | 0.4 | 0.3 | 0.3 | 0.4 | 0.4 | 0.2 | 0.1 | 0.2% | -83.4% | -6.7% |
| **J_Waste** | 3.9 | 3.8 | 3.8 | 3.9 | 3.6 | 4.3 | 2.9 | 2.9 | 3.0% | -27.2% | -0.1% |
| **K_AgriLivestock** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | - | - |
| **L_AgriOther** | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | -99.2% | 889.1% |

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 | Share 2024 | 2024 vs 1990 | 2024 vs 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CLRTAP Total (national territory)** | **3284.6** | **154.2** | **134.2** | **109.6** | **102.9** | **84.0** | **114.3** | **96.2** | **100.0%** | **-97.1%** | **-15.8%** |
| ***NECD Total (without Canary Islands)*** | *3180.9* | *141.9* | *126.7* | *105.2* | *98.4* | *80.5* | *108.3* | *92.3* | *96.0%* | *-97.1%* | *-14.7%* |

Detailed emission data of the Spanish Inventory are available from the MITECO-SEI website WebTable.

### 2.1.8.1. Trend assessment

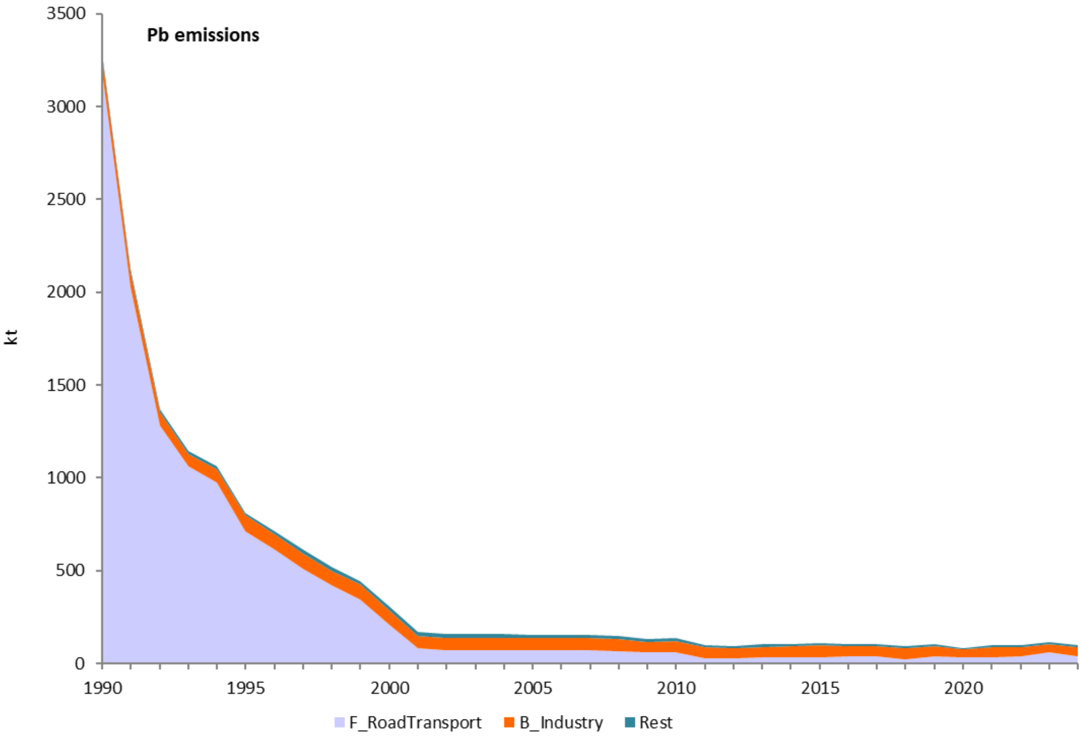



**Figure 2.1.13 Evolution of Pb emissions by category and distribution in year 2024, national territory**

The trend of Pb emissions in Spain is driven by the paramount decrease of emissions from F_RoadTransport (-98.8%) since 1990 (same figure without Canary Islands), due to the introduction of non-leaded petrol since 1989 and the ban of supply of leaded petrol in 2000 (Directive 98/70/CE). Pb content comes from the measurements in the fuels used, leading to an increase in 2023 and a decrease in 2024 (with respect to the previous years), but this is negligible compared to the emissions estimated in the base year.

The Pb emissions in B_Industry in 2024 show an increase of 3.5% (with and without the Canary Islands) when compared to year 2023.

### 2.1.9. Cadmium (Cd)

In 2024, 6.0 t of cadmium were emitted in Spain (5.3 t excluding emissions from the Canary Islands).

Cd emissions in 2024 decreased by -79.1% when compared to 1990 (-81.0% without Canary Islands) and slightly increased by 0.3% when compared to the previous year (0.8% without Canary Islands).

The major GNFR aggregated sector contributing to Cd emissions was B_Industry, accounting for 51.3% of total Cd emissions (58.0% without Canary Islands), with Iron and steel process emissions (2C1) accounting for 19.7% of the estimated total (22.4% without Canary Islands).

C_OtherStationaryComb was the next largest contributing activity, representing 17.9% of total Cd emissions in 2024 (20.1%, when not considering the Canary Islands emissions).

Public Power generation (A_PublicPower) represented 14.0% of total Cd emissions in 2024 (while only 3.5% when not including the emissions from the Canary Islands, due to the different fuel mix used for electricity generation in the islands).

J_Waste accounted for 5.2% of total Cd emissions in 2024 (5.8%, when not considering the Canary Islands emissions).

**Table 2.1.9 Cd emissions by sector (t)**

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 | Share 2024 | 2024 vs 1990 | 2024 vs 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **A_PublicPower** | 2.1 | 3.5 | 1.8 | 1.5 | 1.3 | 0.9 | 0.9 | 0.8 | 14.0% | -60.4% | -6.6% |
| **B_Industry** | 17.6 | 5.8 | 3.3 | 3.0 | 3.1 | 2.7 | 3.1 | 3.1 | 51.3% | -82.5% | -0.9% |
| **C_OtherStationaryComb** | 1.2 | 1.2 | 1.4 | 1.5 | 1.1 | 1.1 | 1.1 | 1.1 | 17.9% | -9.6% | 0.7% |
| **D_Fugitive** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1% | -49.6% | -1.8% |
| **E_Solvents** | 0.1 | 0.6 | 0.4 | 0.4 | 0.4 | 0.3 | 0.2 | 0.3 | 4.9% | 171.7% | 18.2% |
| **F_RoadTransport** | 0.1 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 5.1% | 104.9% | 3.2% |
| **G_Shipping** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2% | -36.5% | 1.1% |
| **H_Aviation** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | 202.4% | 8.9% |
| **I_Offroad** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5% | -11.7% | 0.6% |
| **J_Waste** | 0.6 | 0.5 | 0.4 | 0.4 | 0.4 | 0.5 | 0.3 | 0.3 | 5.2% | -52.1% | -0.4% |
| **K_AgriLivestock** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | - | - |
| **L_AgriOther** | 6.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.8% | -99.3% | 889.1% |
| **CLRTAP Total (national territory)** | **28.7** | **11.9** | **7.7** | **7.1** | **6.6** | **5.8** | **6.0** | **6.0** | **100.0%** | **-79.1%** | **0.3%** |
| | | | | | | | | | | | |
| ***NECD Total (without Canary Islands)*** | *27.7* | *10.4* | *6.4* | *6.0* | *5.6* | *5.0* | *5.2* | *5.3* | *87.7%* | *-81.0%* | *0.8%* |

Detailed emission data of the Spanish Inventory are available from the MITECO-SEI website WebTable.

### 2.1.9.1. Trend assessment

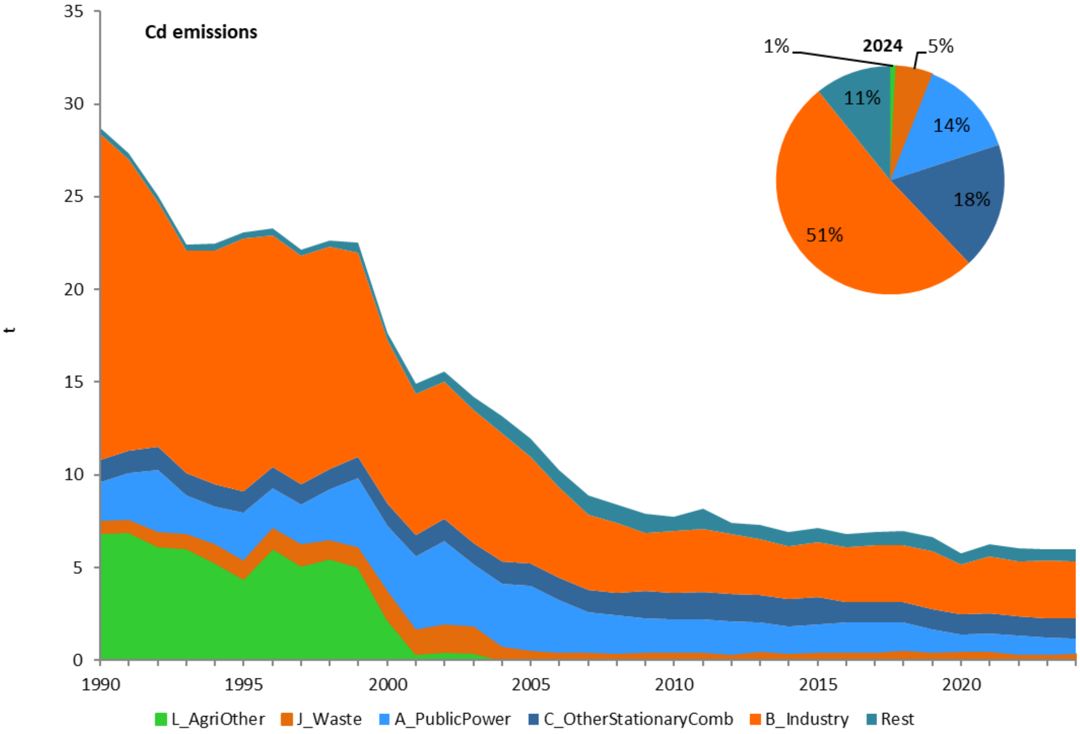



**Figure 2.1.14 Evolution of Cd emissions by category and distribution in year 2024, national territory**

The trend of Cd emissions is basically ruled by the decrease of emissions from B_Industry (-82.5% of reduction along the time series, -82.6% without Canary Islands), and particularly in 1A2f category (Stationary combustion in manufacturing industries and construction: Non-metallic minerals). Emissions in this sub-activity have been reduced by -99.1% (both with and without Canary Islands), due to the introduction of abatement techniques and the decline of coal consumption.

A drastic reduction (-99.3%, the same with and without Canary Islands) is also observed in L_AgriOther group, in which the responsible activity is Field burning (3F). Due to the implemented legal restrictions of this practice by the conditionality of CAP (Common Agricultural Policy) payments and forest fire preventive legislation, after 2003 this practice only occurs after authorization for phytosanitary reasons, and this is why minor amounts can result in large interannual variations. This sector is the main responsible of the increase in emissions when comparing 2024 with 2023 years.

### 2.1.10. Mercury (Hg)

In 2024, a total of 3.1 t of mercury (Hg) were emitted in Spain (2.4 t excluding the Canary Islands).

This means a decrease of -73.6% in mercury emissions in 2024 when compared to 1990 (-77.6% without emissions from the Canary Islands), and a decrease of -2.5% (-2.4% without Canary Islands) when compared to 2023.

These are the GNFR aggregated sectors most contributing to Hg emissions:

- Industrial activities (B_Industry) are the major contributors to Hg emissions in 2024, accounting for 50.0% of total Hg emissions (63.9% without Canary Islands), with Iron and steel production (2C1) accounting for 23.1% of the total of emissions (29.5% without Canary Islands) and Zinc production (2C6) stands for 10.1% of the total (12.9% without Canary Islands). 1A2f category (Combustion in Non-metallic minerals industries, but also including process emissions from cement production, that are not reported under 2A1) accounted for 11.4% of the total of the inventory (14.6% without Canary Islands).
- A_PublicPower accounted for 25.3% of the total of the Hg inventoried in 2024 in Spain (this being 6.1% if excluding the Canary Islands, due to the different fuel mix used for electricity generation in the islands).
- J_Waste represented a 10.4% of the total 2024 mercury emissions (12.7% without the Canary Islands).

**Table 2.1.10 Hg emissions by sector (t)**

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 | Share 2024 | 2024 vs 1990 | 2024 vs 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **A_PublicPower** | 4.3 | 4.9 | 2.4 | 2.7 | 1.6 | 1.1 | 0.9 | 0.8 | 25.3% | -81.7% | -13.5% |
| **B_Industry** | 4.7 | 3.0 | 2.3 | 2.0 | 1.7 | 1.5 | 1.5 | 1.5 | 50.0% | -67.3% | 2.9% |
| **C_OtherStationaryComb** | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 3.3% | -42.2% | -11.1% |
| **D_Fugitive** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5% | -49.8% | -1.6% |
| **E_Solvents** | 0.2 | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 3.7% | -48.2% | 1.1% |
| **F_RoadTransport** | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.1 | 0.2 | 0.2 | 5.5% | 50.7% | 2.7% |
| **G_Shipping** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.8% | -47.5% | 7.6% |
| **H_Aviation** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1% | 202.5% | 8.9% |
| **I_Offroad** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2% | -72.4% | -2.9% |
| **J_Waste** | 0.8 | 0.2 | 0.1 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 10.4% | -57.4% | -0.6% |
| **K_AgriLivestock** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | - | - |
| **L_AgriOther** | 1.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3% | -99.4% | 889.1% |
| **CLRTAP Total (national territory)** | **11.6** | **8.7** | **5.5** | **5.5** | **4.1** | **3.4** | **3.2** | **3.1** | **100.0%** | **-73.6%** | **-2.5%** |
| ***NECD Total (without Canary Islands)*** | *10.7* | *7.3* | *4.2* | *4.4* | *3.1* | *2.6* | *2.5* | *2.4* | *78.1%* | *-77.6%* | *-2.4%* |

Detailed emission data of the Spanish Inventory are available from the MITECO-SEI website WebTable.

### 2.1.10.1. Trend assessment

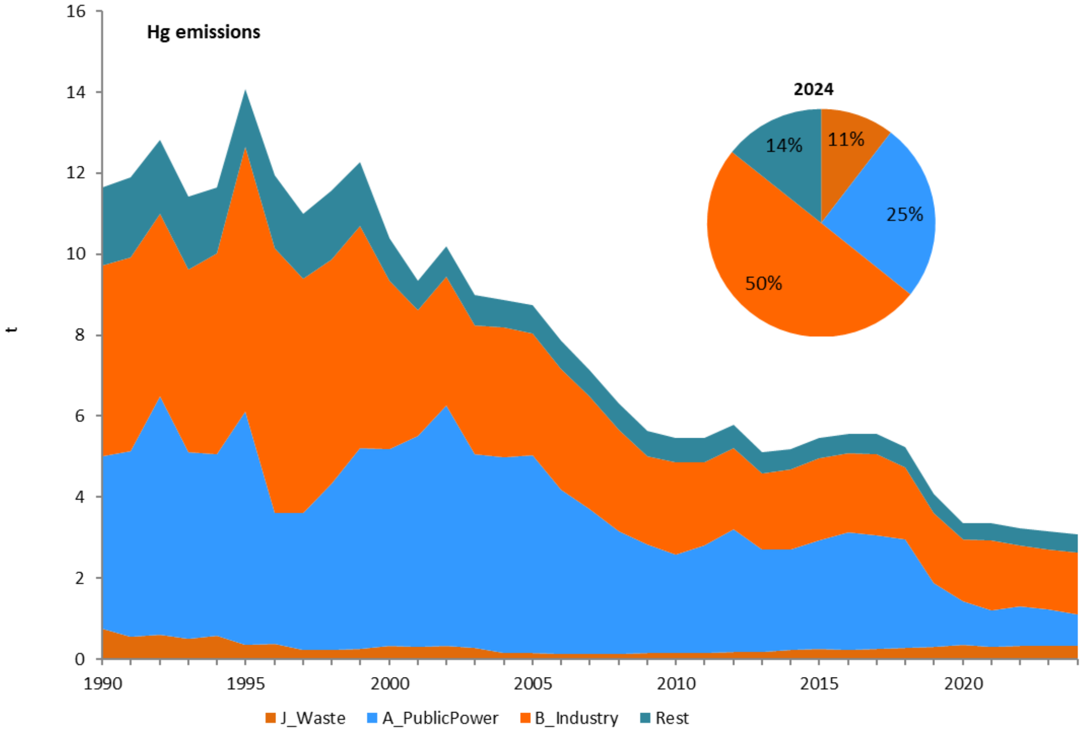



**Figure 2.1.15 Evolution of Hg emissions by category and distribution in year 2024, national territory**

The trend of mercury emissions in Spain is mainly led by the decrease of emissions from A_PublicPower (-81.7% decrease for the national total, -95.6% without Canary Islands) and B_Industry (-67.3%, the same with and without Canary Islands), when comparing 2024 with 1990 emissions. The reduction in the public electricity production sector has been caused by the shift from coal power plants to combined cycle gas plants and the implementation of abatement techniques in thermal power plants. With respect to industry, the Chlorine production using mercury technologies (2B10a), which accounted for 16.2% of total Hg emissions in 1990, halted its emissions in 2018 pursuant the Implementing Decision 2013/732/EU adopted under the Directive 2010/75/EU on industrial emissions, which prohibits the use of mercury as a cathode in the chlor-alkali industry. Additionally, Stationary Combustion in Non-metallic mineral industries (1A2f), which accounted for 12.8% of total Hg emissions in 1990, reduced its emissions by -76.5% in 2024, with respect to 1990.

## 2.1.11. Dioxins and Furans (PCDD/PCDF)

In 2024, 170.9 g I-TEQ (International Toxic Equivalents) of polychlorinated dibenzo-*p*-dioxins and dibenzofurans (PCDD/PCDF, dioxins and furans) were emitted in Spain (168.4 g I-TEQ, if excluding emissions from the Canary Islands).

Such dioxins and furans emissions in 2024 represent a decrease of -65,1% (-65,2% without Canary Islands) when compared to 1990, and an increase of 0.9%, compared to 2023 emissions (the same figure without the Canary Islands).

The major GNFR aggregated sector contributing to PCDD/PCDF emissions was Industries (B_Industry), which accounted for 40.2% of PCDD/PCDF total emissions (40.7% without the

Canary Islands), with Iron and steel production (2C1) accounting for 28.6% of the total dioxins/furans emissions in 2024 (10.6% without the Canary Islands).

J_Waste contributed with a 34.2% (33.9% without the Canary Islands) of the total emissions of the Spanish inventory in 2024, in which Open burning of pruning residues (5C2) accounted for 24.3% (the same percentage with and without the Canary Islands).

Small Stationary Combustion (C_OtherStationaryComb) was the next-largest contributing activity, accounting for 18.0% of the total of emissions in 2024 (17.9% without the Canary Islands), originated from the stationary combustion of biomass.

**Table 2.1.11 PCDD/PCDF emissions by sector (g i-TEQ)**

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 | Share 2024 | 2024 vs 1990 | 2024 vs 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **A_PublicPower** | 133.9 | 4.6 | 1.5 | 3.6 | 2.0 | 1.6 | 1.6 | 1.3 | 0.8% | -99.0% | -18.3% |
| **B_Industry** | 88.2 | 88.6 | 83.8 | 87.1 | 77.0 | 59.8 | 65.9 | 68.6 | 40.2% | -22.2% | 4.2% |
| **C_OtherStationaryComb** | 61.6 | 58.3 | 66.2 | 62.8 | 41.6 | 40.4 | 31.8 | 30.7 | 18.0% | -50.1% | -3.5% |
| **D_Fugitive** | 7.4 | 8.2 | 6.2 | 4.7 | 3.4 | 1.6 | 3.8 | 3.7 | 2.2% | -50.0% | -1.1% |
| **E_Solvents** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | 171.7% | 18.2% |
| **F_RoadTransport** | 5.3 | 19.1 | 19.4 | 13.8 | 11.6 | 8.6 | 7.6 | 7.6 | 4.5% | 43.5% | 0.1% |
| **G_Shipping** | 0.3 | 0.2 | 0.2 | 0.1 | 0.3 | 0.2 | 0.3 | 0.2 | 0.1% | -29.0% | -1.9% |
| **H_Aviation** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | - | - |
| **I_Offroad** | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0% | -67.5% | -3.4% |
| **J_Waste** | 186.5 | 73.6 | 69.5 | 72.0 | 70.8 | 78.8 | 58.4 | 58.5 | 34.2% | -68.6% | 0.2% |
| **K_AgriLivestock** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | - | - |
| **L_AgriOther** | 5.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | -99.5% | 889.1% |
| **CLRTAP Total (national territory)** | **489.3** | **252.8** | **246.8** | **244.1** | **206.7** | **191.1** | **169.5** | **170.9** | **100.0%** | **-65.1%** | **0.9%** |
| | | | | | | | | | | | |
| ***NECD Total (without Canary Islands)*** | *483.6* | *248.9* | *243.3* | *240.9* | *203.7* | *188.4* | *166.9* | *168.4* | *98.5%* | *-65.2%* | *0.9%* |

Detailed emission data of the Spanish Inventory are available from the MITECO-SEI website WebTable.

### 2.1.11.1. Trend assessment

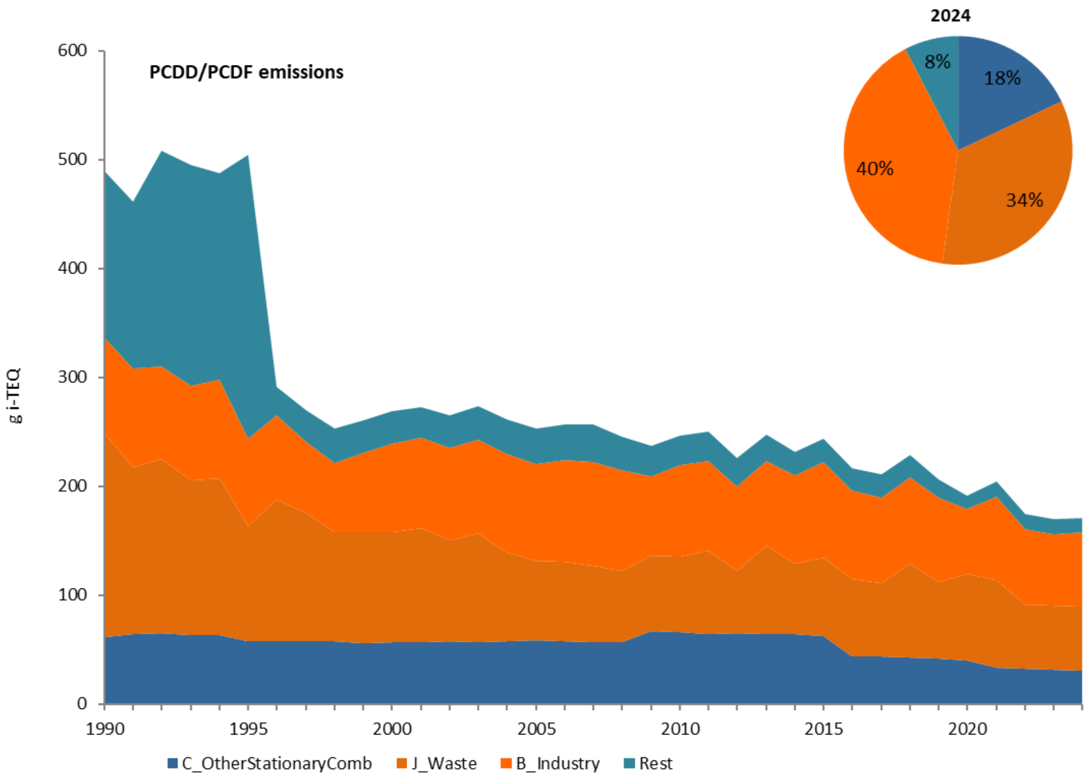



**Figure 2.1.16 Evolution of PCDD/PCDF emissions by category and distribution in year 2024, national territory**

Along the studied time series, the trend of PCDD/PCDF emissions reflects the reduction of PCDD/PCDF emissions since 1990 in the activities A_PublicPower (1A1a category, with a -99.0% decrease, or -95.6% without the Canary Islands, linked to the stringent emission levels set by legislation in this sector) and J_Waste, with a -68.6% decrease in 2024 with respect to year 1990 (-59.2% without the Canary Islands). The latter is explained by the decrease of emissions from incineration of municipal waste (5C1a) and clinical waste incineration (5C1biii), due to the compliance of waste incineration facilities to the limit emission levels set by legislation, and in later years to the introduction of energy recovery technologies, that result in these activities being reported under A_PublicPower. The remaining activities in J_Waste contributing to dioxins and furans emissions are the open burning of pruning residues (5C2).

## 2.1.12. Polycyclic Aromatic Hydrocarbons (PAHs)

In 2024, 33.8 t of polycyclic aromatic hydrocarbons (1-4 total PAHs: sum of benzo(*a*)pyrene, benzo(*b*)fluoranthene, benzo(*k*)fluoranthene, and indeno(*1,2,3-cd*)pyrene) were emitted in Spain (33.4 t excluding the Canary Islands).

The total PAHs emissions in 2024 decreased by -70.3% when compared to 1990 (-70.4% without the Canary Islands), and increased by 1.8%, when compared to 2023 (1.9% without Canary Islands).

The major GNFR aggregated sectors contributing to PAHs emissions in 2024 were the small combustion in C_OtherStationaryComb, representing a 45.5% of the total of emissions (45.3%

without the Canary Islands), and Industries (B_Industry) which accounted for 44.6% (44.9% without the Canary Islands) of the total inventoried PAHs emissions.

**Table 2.1.12 PAHs emissions by sector (t)**

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 | Share 2024 | 2024 vs 1990 | 2024 vs 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **A_PublicPower** | 0.0 | 0.1 | 0.1 | 0.8 | 0.9 | 1.0 | 0.7 | 0.8 | 2.5% | 1674% | 14.4% |
| **B_Industry** | 20.0 | 23.9 | 21.1 | 21.2 | 16.9 | 13.0 | 14.2 | 15.1 | 44.6% | -24.9% | 5.8% |
| **C_OtherStationaryComb** | 38.6 | 34.5 | 36.8 | 33.3 | 22.2 | 21.2 | 15.9 | 15.4 | 45.5% | -60.1% | -3.0% |
| **D_Fugitive** | 1.3 | 1.5 | 1.1 | 0.8 | 0.6 | 0.3 | 0.7 | 0.7 | 1.9% | -50.0% | -1.1% |
| **E_Solvents** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | 107.0% | 17.2% |
| **F_RoadTransport** | 1.1 | 1.6 | 1.3 | 1.2 | 1.2 | 1.0 | 1.2 | 1.2 | 3.5% | 7.7% | 2.3% |
| **G_Shipping** | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1% | -32.3% | -0.6% |
| **H_Aviation** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | 175.1% | 3.3% |
| **I_Offroad** | 0.3 | 0.4 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.9% | 6.3% | 0.5% |
| **J_Waste** | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 | 0.2 | 0.2 | 0.5% | -3.9% | 0.0% |
| **K_AgriLivestock** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | - | - |
| **L_AgriOther** | 52.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.4% | -99.7% | 889.1% |
| **CLRTAP Total (national territory)** | **113.7** | **62.2** | **61.1** | **57.7** | **42.5** | **37.1** | **33.2** | **33.8** | **100.0%** | **-70.3%** | **1.8%** |
| | | | | | | | | | | | |
| ***NECD Total (without Canary Islands)*** | *112.9* | *61.5* | *60.3* | *57.0* | *41.9* | *36.6* | *32.8* | *33.4* | *98.9%* | *-70.4%* | *1.9%* |

Detailed emission data of the Spanish Inventory are available from the MITECO-SEI website WebTable.

### 2.1.12.1. Trend assessment

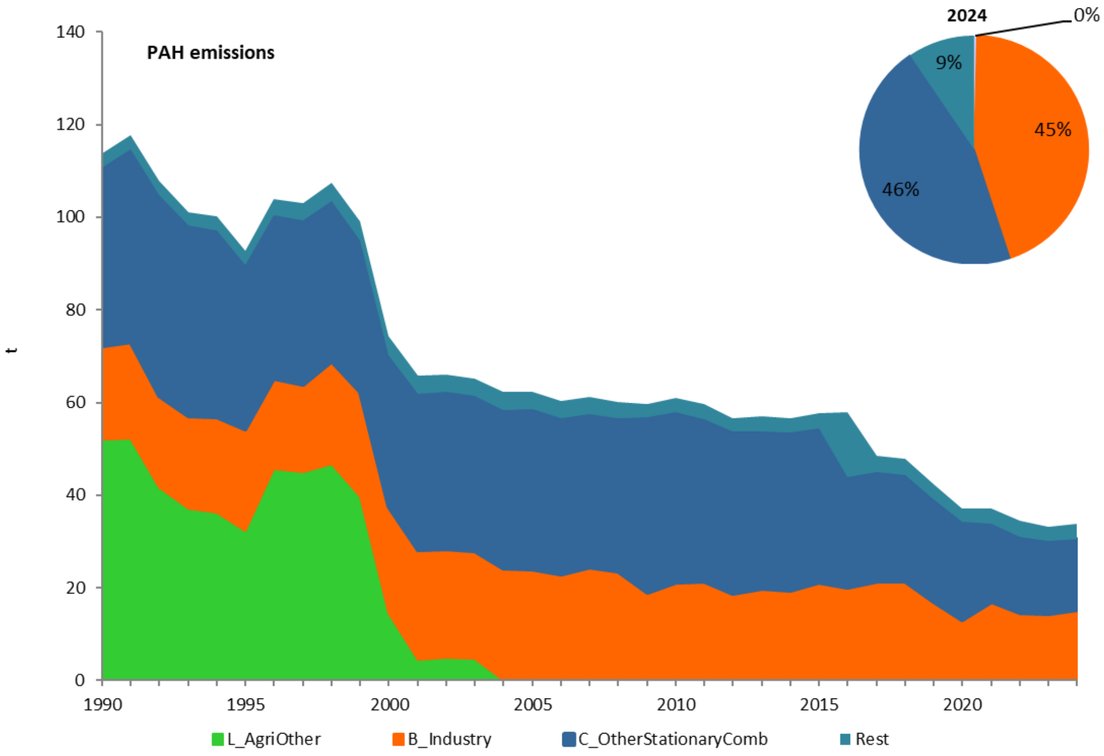



**Figure 2.1.17 Evolution of PAHs emissions by category and distribution in year 2024, national territory**

The trend for total PAHs emissions between 1990 and 2024 (decrease of -70.3%, -70.4% without the Canary Islands) is essentially ruled by the behaviour of emissions from L_AgriOther sector, that experiences a sharp decrease as from 2000, due to the abandonment of the practice of field burning (3F), restricted by conditionality of CAP payments and forest fire prevention legislation.

In the Small Stationary Combustion (C_OtherStationaryComb) category, there is a decrease of -60.1% in PAH emissions in 2024 when compared to 1990 (-60.2% without the Canary Islands), in which predominates the declining use of coal over the increasing use of biomass (PAH emission factors for combustion of coal in small and uncontrolled combustion devices are higher than those of biomass).

B_Industry sectors show a decrease of -24.9% (-25.0% without the Canary Islands) in PAH emissions between 1990 and 2024, owing to the decreasing use of coal as a fuel.

Although not relevant in the total amounts, the A_PublicPower sector shows a noticeable increase in PAH emissions, due to the use of biomass, which was almost residual at the beginning of the time series.

In L_AgriOther group, the 3F activity (Field burning), as from 2003 only occurs after authorization for phytosanitary reasons, so minor amounts differences can result in large interannual variations. B_Industry is the main responsible of the increase in emissions when comparing year 2024 with 2023.

### 2.1.13. Benzo(*a*)pyrene (BaP)

In 2024, 6.8 t of benzo(*a*)pyrene (BaP) were emitted in Spain (6.7 t excluding the Canary Islands).

The total BaP emissions in 2024 decreased by -79.2% when compared to 1990 (-79.4% without the Canary Islands), and decreased by -2.4%, when compared to 2023 (-2.3% without Canary Islands).

The major GNFR aggregated sectors contributing to BaP emissions in 2024 were the small combustion in C_OtherStationaryComb, representing a 77.1% of the total of emissions (the same figure without the Canary Islands), and Industries (B_Industry) which accounted for 10.9% (the same without the Canary Islands) of the total inventoried BaP emissions.

**Table 2.1.13 BaP emissions by sector (t)**

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 | Share 2024 | 2024 vs 1990 | 2024 vs 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **A_PublicPower** | 0.0 | 0.0 | 0.0 | 0.2 | 0.3 | 0.3 | 0.2 | 0.3 | 3.7% | 14938% | 12.4% |
| **B_Industry** | 2.3 | 2.2 | 1.8 | 1.6 | 0.8 | 0.6 | 0.8 | 0.7 | 10.9% | -68.2% | -6.3% |
| **C_OtherStationaryComb** | 13.8 | 12.2 | 13.0 | 11.7 | 7.7 | 7.4 | 5.4 | 5.3 | 77.1% | -61.9% | -3.1% |
| **D_Fugitive** | 0.4 | 0.4 | 0.3 | 0.3 | 0.2 | 0.1 | 0.2 | 0.2 | 2.9% | -50.0% | -1.1% |
| **E_Solvents** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1% | 112.8% | 17.3% |
| **F_RoadTransport** | 0.2 | 0.3 | 0.3 | 0.2 | 0.3 | 0.2 | 0.2 | 0.2 | 3.5% | 20.0% | 2.1% |
| **G_Shipping** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | -33.7% | -0.1% |
| **H_Aviation** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | 155.5% | 3.5% |
| **I_Offroad** | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 1.1% | 10.2% | 0.6% |
| **J_Waste** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3% | -3.9% | 0.0% |
| **K_AgriLivestock** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | - | - |
| **L_AgriOther** | 16.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3% | -99.9% | 889.1% |
| **CLRTAP Total (national territory)** | **32.9** | **15.4** | **15.6** | **14.1** | **9.4** | **8.6** | **7.0** | **6.8** | **100.0%** | **-79.2%** | **-2.4%** |
| *NECD Total (without Canary Islands)* | *32.7* | *15.1* | *15.3* | *13.8* | *9.2* | *8.5* | *6.9* | *6.7* | *98.3%* | *-79.4%* | *-2.3%* |

Detailed emission data of the Spanish Inventory are available from the MITECO-SEI website WebTable.

#### 2.1.13.1. Trend assessment

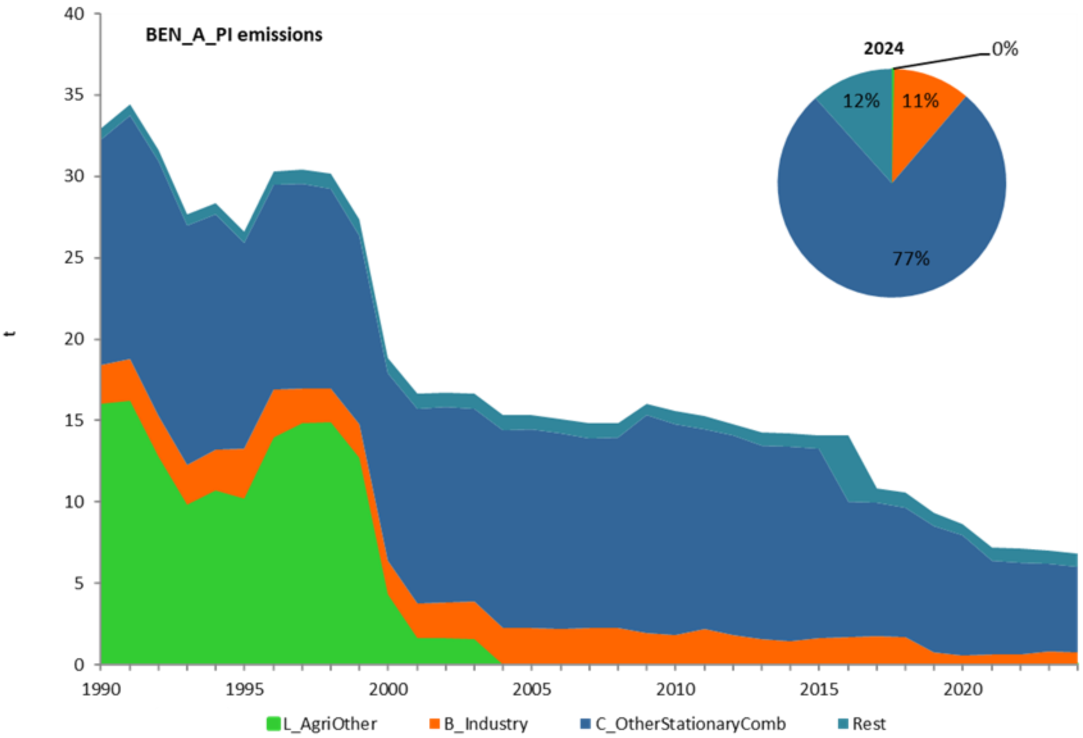



**Figure 2.1.18 Evolution of BaP emissions by category and distribution in year 2024, national territory**

The trend of BaP emissions between 1990 and 2024 (as it is for total PAHs) is mainly ruled by the emissions from L_AgriOther sector, that experiences a sharp decrease as from 2000, due to the abandonment of the practice of field burning (3F), restricted by conditionality of CAP payments and forest fire prevention legislation (in 2024, this GNFR only accounted for 0.3% of BaP emissions).

In the Small Stationary Combustion (C_OtherStationaryComb) category, there is a decrease of -61.9% in BaP emissions in 2024 when compared to 1990 (-62.0% without the Canary Islands), in which predominates the declining use of coal over the increasing use of biomass.

B_Industry sectors also show a decrease of -68.2% (-68.7% without the Canary Islands) in BaP emissions between 1990 and 2024, owing to the strong decrease in the use of coal as a fuel.

Although not relevant in the total amounts, the A_PublicPower sector shows a noticeable increase in BaP emissions, due to the use of biomass, which was almost residual at the beginning of the time series.

In L_AgriOthe p, the 3F activity (Field burning), as from 2003 only occurs after authorization for phytosanitary reasons, so minor amounts differences can result in large interannual variations.

### 2.1.14. Hexachlorobenzene (HCB)

In 2024, 2.0 kg of HCB were emitted in Spain (1.9 kg without Canary Islands).

The total HCB emissions in 2024 decreased by -96.6% when compared to 1990 (-96.7% without the Canary Islands), and increased by 11.3%, when compared to 2024 (11.5% without Canary Islands).

The major GNFR aggregated sectors contributing to HCB emissions in 2024 were B_Industry which accounted for 37.1% (37.8% without the Canary Islands) of the total inventoried emissions, A_PublicPower with 26.4% (27.2% without the Canary Islands), small combustion in C_OtherStationaryComb, representing a 21.4% of the total of emissions (21.6% without the Canary Islands) and then J_Waste with 7.0% of the total of HCB emissions (7.1% without the Canary Islands).

L_AgriOther, which used to be the main contributor to HCB emissions, in 2024 accounted for a 2.3% of the total (2.4% without the Canary Islands).

**Table 2.1.14 HCB emissions by sector (kg)**

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 | Share 2024 | 2024 vs 1990 | 2024 vs 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **A_PublicPower** | 0.7 | 0.4 | 0.2 | 0.3 | 0.8 | 1.0 | 0.3 | 0.5 | 26.4% | -29.8% | 59.9% |
| **B_Industry** | 0.7 | 0.8 | 0.7 | 0.7 | 0.7 | 0.6 | 0.7 | 0.7 | 37.1% | 10.7% | 0.1% |
| **C_OtherStationaryComb** | 0.5 | 0.5 | 0.6 | 0.6 | 0.4 | 0.4 | 0.4 | 0.4 | 21.4% | -7.7% | 0.6% |
| **D_Fugitive** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | - | - |
| **E_Solvents** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | - | - |
| **F_RoadTransport** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | - | - |
| **G_Shipping** | 0.2 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 4.9% | -38.1% | 1.9% |
| **H_Aviation** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | - | - |
| **I_Offroad** | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.9% | -74.0% | 0.3% |
| **J_Waste** | 2.0 | 0.3 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 7.0% | -93.1% | -0.4% |
| **K_AgriLivestock** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | - | - |
| **L_AgriOther** | 53.7 | 2.5 | 10.6 | 8.6 | 11.1 | 6.7 | 0.0 | 0.0 | 2.3% | -99.9% | 0.0% |
| **CLRTAP Total (national territory)** | **57.8** | **4.5** | **12.2** | **10.3** | **13.3** | **9.0** | **1.8** | **2.0** | **100.0%** | **-96.6%** | **11.3%** |
| | | | | | | | | | | | |
| ***NECD Total (without Canary Islands)*** | *57.5* | *4.5* | *12.2* | *10.2* | *13.2* | *8.9* | *1.7* | *1.9* | *97.2%* | *-96.7%* | *11.5%* |

Detailed emission data of the Spanish Inventory are available from the MITECO-SEI website WebTable.

### 2.1.14.1. Trend assessment

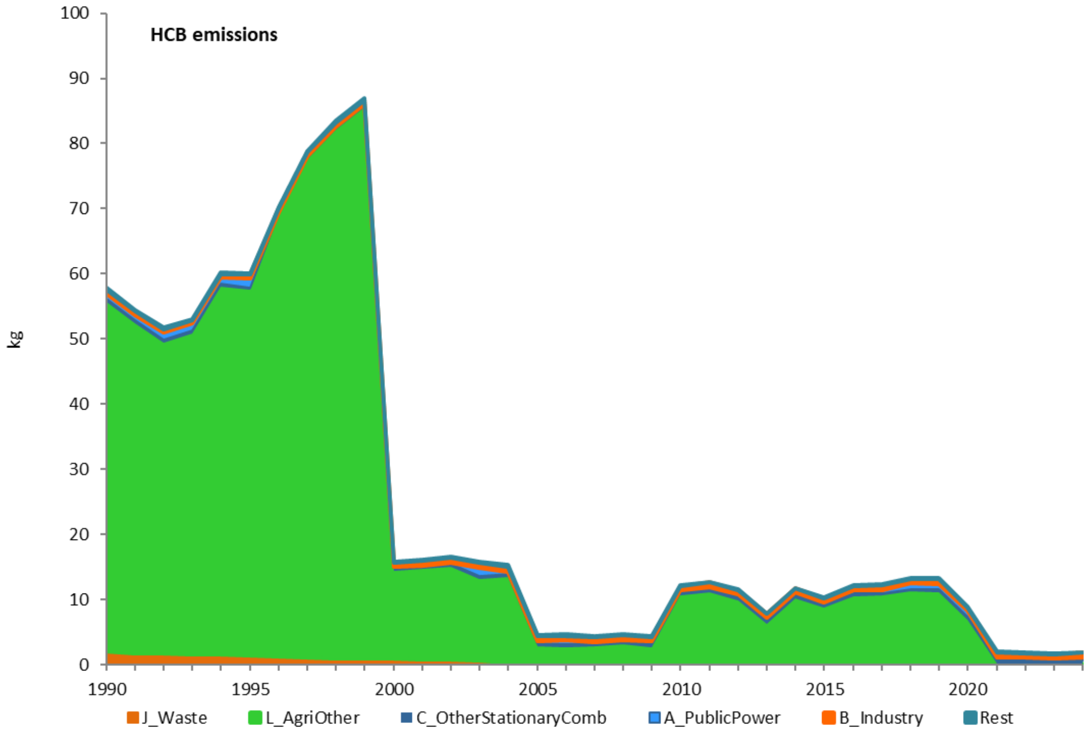



**Figure 2.1.19 Evolution of HCB emissions by category and distribution in year 2024, national territory**

The trend of HCB emissions between 1990 and 2024 (decrease of -96.6% and -96.7% without the Canary Islands emissions) is essentially ruled by the behaviour of emissions from L_AgriOther sector, due to the stricter HCB content in the pesticides applied to soil (category 3Df) imposed by EU normative.

## 2.1.15. Polychlorinated biphenyls (PCBs)

In 2024 , 92.4 kg of polychlorinated biphenyls (PCBs) were emitted in Spain (89.8 kg, when excluding the Canary Islands).

The PCBs emissions in 2024 decreased by -95.9% when compared to 1990 (the same figure without the Canary Islands), and slightly decreased by -0.3%, when compared to 2023 (same figure with and without the Canary Islands).

As can be seen in the table below, the paramount GNFR aggregated sector contributing to PCBs emissions is Industries (B_Industry) which accounted for 97.3% of total PCBs emissions in 2024 (97.4% without the Canary Islands).

**Table 2.1.15 PCBs emissions by sector (kg)**

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 | Share 2024 | 2024 vs 1990 | 2024 vs 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **A_PublicPower** | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.1% | -74.7% | -26.4% |
| **B_Industry** | 2235.4 | 1587.9 | 845.0 | 601.6 | 499.7 | 451.5 | 89.9 | 89.9 | 97.3% | -96.0% | 0.1% |
| **C_OtherStationaryComb** | 2.9 | 2.1 | 1.8 | 0.9 | 1.0 | 0.9 | 0.6 | 0.3 | 0.3% | -89.8% | -48.7% |
| **D_Fugitive** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | - | - |

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 | Share 2024 | 2024 vs 1990 | 2024 vs 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **E_Solvents** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | - | - |
| **F_RoadTransport** | 1.4 | 4.0 | 4.0 | 2.8 | 2.4 | 1.8 | 1.5 | 1.6 | 1.7% | 8.8% | 0.2% |
| **G_Shipping** | 0.3 | 0.1 | 0.1 | 0.1 | 0.4 | 0.2 | 0.3 | 0.2 | 0.3% | -14.1% | -5.9% |
| **H_Aviation** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | - | - |
| **I_Offroad** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | -71.4% | 0.4% |
| **J_Waste** | 0.5 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.4% | -35.4% | -0.2% |
| **K_AgriLivestock** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | - | - |
| **L_AgriOther** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0% | - | - |
| **CLRTAP Total (national territory)** | **2240.8** | **1594.3** | **851.2** | **605.8** | **503.8** | **454.8** | **92.6** | **92.4** | **100.0%** | **-95.9%** | **-0.3%** |
| | | | | | | | | | | | |
| ***NECD Total (without Canary Islands)*** | *2185.2* | *1544.0* | *824.1* | *586.7* | *487.6* | *440.2* | *90.0* | *89.8* | *97.2%* | *-95.9%* | *-0.3%* |

Detailed emission data of the Spanish Inventory are available from the MITECO-SEI website WebTable.

### 2.1.15.1. Trend assessment

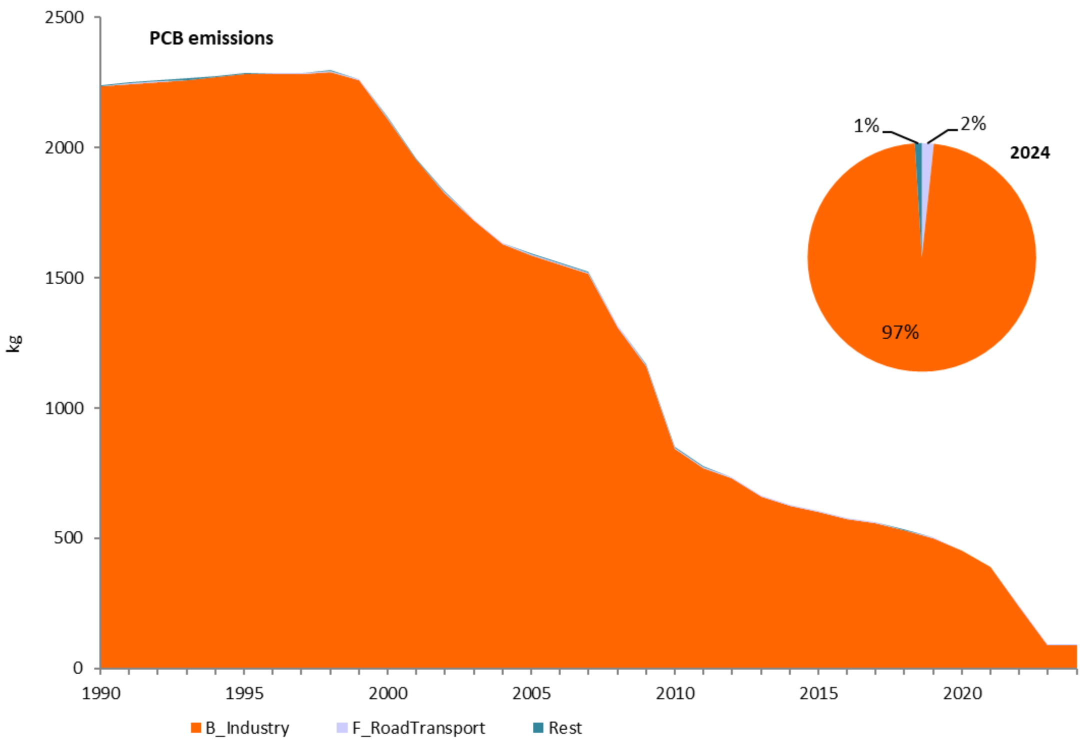



**Figure 2.1.20 Evolution of PCBs emissions by category and distribution in year 2024, national territory**

The trend of global PCBs emissions between 1990 and 2024 (decrease of -95.9%, the same with and without the emissions from the Canary Islands) is essentially ruled by the behaviour of emissions from B_Industry sector, namely by the 2K category (use of POPs in electrical equipment), which decreased its emissions by -97.3% between 1990 and 2024 (-96.0% without the Canary Islands), due to the enforcement of Directive 96/59/EC on the disposal of polychlorinated biphenyls and polychlorinated terphenyls (PCB/PCT) and Regulation (EC) 850/2004 on Persistent Organic Pollutants.

## 2.2. Analysis by activity category

The latest estimates of the emissions by major NFR activity category, as well as the trends in these emissions along the studied time series (1990-2024) are analysed and discussed in this section.

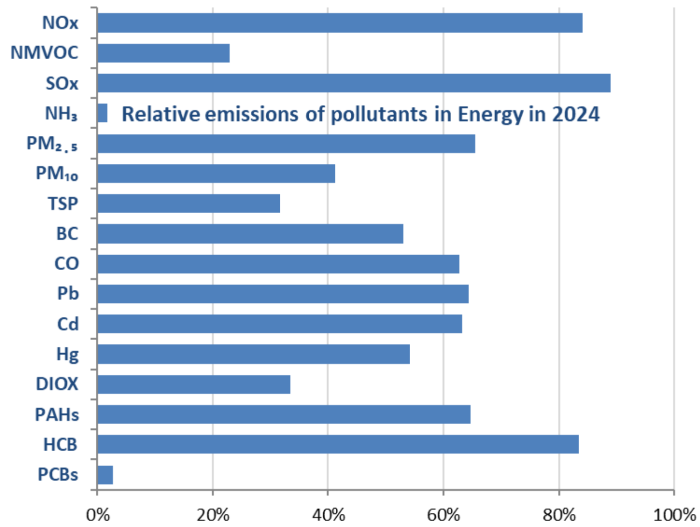
The considered activity categories are:

- Energy (NFR 1A, 1B)
- Industrial Processes and Product Use, IPPU (NFR 2)
- Agriculture (NFR 3)
- Waste (NFR 5)

Each of these activity categories is covered in detail in the following chapters.

### 2.2.1. Energy (NFR 1)

Energy emissions stand out for their relative weight with respect of the total of the Inventory for most pollutants, especially with respect to NOx, $SO_2$, $PM_{2.5}$, HCB, PAHs, CO and priority heavy metals.




| Emissions 2024 | | INV Total | ENER | % |
|---|---|---|---|---|
| NOx | kt | 592.4 | 498.3 | 84% |
| NMVOC | kt | 513.3 | 117.6 | 23% |
| $SO_2$ | kt | 100.7 | 89.5 | 89% |
| $NH_3$ | kt | 446.9 | 8.1 | 2% |
| $PM_{2.5}$ | kt | 91.5 | 60.0 | 66% |
| $PM_{10}$ | kt | 164.7 | 68.0 | 41% |
| TSP | kt | 252.6 | 80.1 | 32% |
| BC | kt | 24.2 | 12.8 | 53% |
| CO | kt | 943.3 | 592.3 | 63% |
| Pb | t | 114.3 | 73.5 | 64% |
| Cd | t | 6.0 | 3.8 | 63% |
| Hg | t | 3.2 | 1.7 | 54% |
| PCCD/F | g | 169.5 | 56.8 | 34% |
| PAHs | t | 33.2 | 21.5 | 65% |
| HCB | kg | 1.8 | 1.5 | 84% |
| PCBs | kg | 92.6 | 2.6 | 3% |

**Figure 2.2.1 Relative emissions of pollutants (Energy vs. national total) in 2024**

Along the last decades, the Inventory shows drastic emission reductions in the energy sector, with most of the pollutants showing reductions higher than 40% in 2024 compared to 1990 levels (year 2000 in case of Particulate Matter). Only $NH_3$ showed increases in this sector.

| | Emission 2024/base year | |
|---|---|---|
| | INV Total | ENER |
| NOx | -56% | -59% |
| NMVOC | -51% | -75% |
| $SO_2$ | -95% | -96% |
| $NH_3$ | -16% | 148% |
| $PM_{2.5}$ | -48% | -48% |
| $PM_{10}$ | -45% | -51% |
| TSP | -45% | -52% |
| BC | -46% | -55% |
| CO | -77% | -79% |
| Pb | -97% | -98% |
| Cd | -79% | -81% |
| Hg | -73% | -73% |
| PCDD/F | -65% | -74% |
| PAHs | -71% | -52% |
| HCB | -97% | -25% |
| PCBs | -96% | -70% |

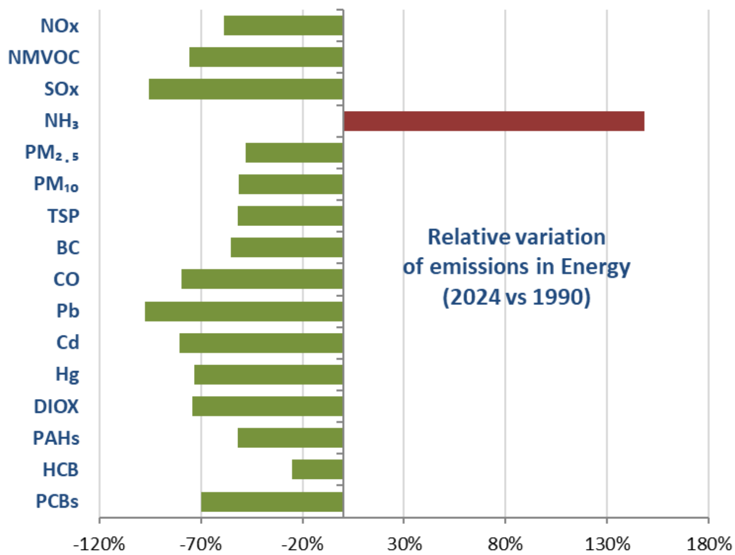
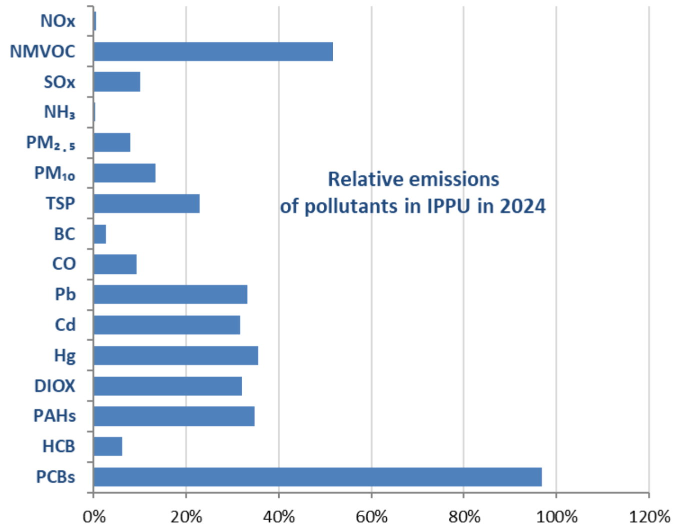



**Figure 2.2.2 Relative variation of emissions in Energy (2024 vs. base year, national total)**

## 2.2.2. Industrial Processes and Product Use: IPPU (NFR 2)

With a wide variety of industrial activities, installations, plants and uses of products in Spain, IPPU sector contributed by 90% of the total PCBs emissions in 2024 and contributed to 52% of the total NMVOC emissions in Spain (national total). To a lesser extent, IPPU activities also had a high share in Heavy Metals, dioxins/furans and PAH emissions.




| Emissions 2024 | | INV Total | IPPU | % |
|---|---|---|---|---|
| NOx | kt | 592.4 | 3.2 | 1% |
| NMVOC | kt | 513.3 | 265.7 | 52% |
| $SO_2$ | kt | 100.7 | 10.2 | 10% |
| $NH_3$ | kt | 446.9 | 1.3 | 0% |
| $PM_{2.5}$ | kt | 91.5 | 7.3 | 8% |
| $PM_{10}$ | kt | 164.7 | 22.1 | 13% |
| TSP | kt | 252.6 | 57.9 | 23% |
| BC | kt | 24.2 | 0.6 | 3% |
| CO | kt | 943.3 | 87.5 | 9% |
| Pb | t | 114.3 | 37.9 | 33% |
| Cd | t | 6.0 | 1.9 | 32% |
| Hg | t | 3.2 | 1.1 | 36% |
| PCCD/F | g | 169.5 | 54.3 | 32% |
| PAHs | t | 33.2 | 11.6 | 35% |
| HCB | kg | 1.8 | 0.1 | 6% |
| PCBs | kg | 92.6 | 89.7 | 97% |

**Figure 2.2.3 Relative emissions of pollutants (IPPU vs. national total) in 2024**

Significant reduction in pollutant emissions has taken place between 1990 and 2024 in the IPPU sector (base year: 2000 in case of Particulate Matter). Emissions reductions of PCBs, NOx and Hg are particularly significant. On the contrary, emissions of Black Carbon and Cd have increased in relative terms, since 1990/2000.

| | Emission 2024/base year | |
|---|---|---|
| | INV Total | IPPU |
| NOx | -56% | -70% |
| NMVOC | -51% | -34% |
| $SO_2$ | -95% | -44% |
| $NH_3$ | -16% | -59% |
| $PM_{2.5}$ | -48% | -30% |
| $PM_{10}$ | -45% | -56% |
| TSP | -45% | -62% |
| BC | -46% | 65% |
| CO | -77% | -52% |
| Pb | -97% | -29% |
| Cd | -79% | 14% |
| Hg | -73% | -64% |
| PCDD/F | -65% | -30% |
| PAHs | -71% | -32% |
| HCB | -97% | 0% |
| PCBs | -96% | -96% |

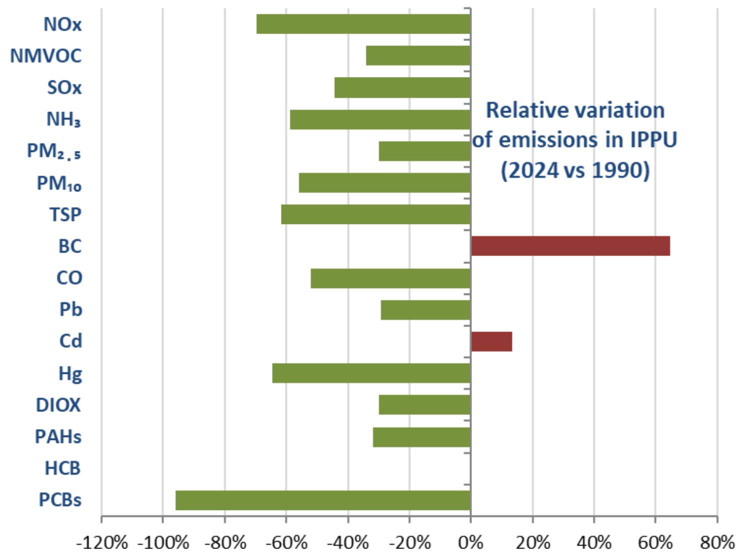
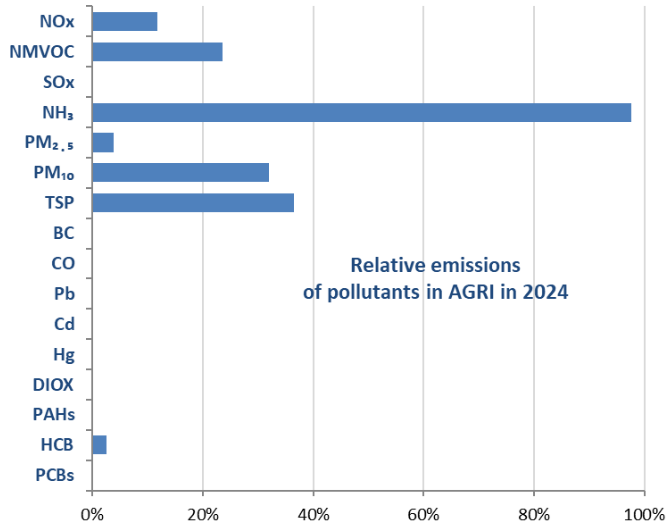



**Figure 2.2.4 Relative variation of emissions in IPPU (2024 vs. base year, national total)**

### 2.2.3. Agriculture (NFR 3)

Agriculture accounts in 2024 for 98% of $NH_3$ emissions, for 24% of NMVOC emissions and for 37% of TSP in Spain (national total).




| Emissions 2024 | | INV Total | AGRI | % |
|---|---|---|---|---|
| NOx | kt | 592.4 | 69.8 | 12% |
| NMVOC | kt | 513.3 | 121.3 | 24% |
| $SO_2$ | kt | 100.7 | 0.0 | 0% |
| $NH_3$ | kt | 446.9 | 436.0 | 98% |
| $PM_{2.5}$ | kt | 91.5 | 3.6 | 4% |
| $PM_{10}$ | kt | 164.7 | 52.7 | 32% |
| TSP | kt | 252.6 | 92.2 | 37% |
| BC | kt | 24.2 | 0.0 | 0% |
| CO | kt | 943.3 | 0.4 | 0% |
| Pb | t | 114.3 | 0.0 | 0% |
| Cd | t | 6.0 | 0.0 | 0% |
| Hg | t | 3.2 | 0.0 | 0% |
| PCCD/F | g | 169.5 | 0.0 | 0% |
| PAHs | t | 33.2 | 0.0 | 0% |
| HCB | kg | 1.8 | 0.0 | 3% |
| PCBs | kg | 92.6 | 0.0 | 0% |

**Figure 2.2.5 Relative emissions of pollutants (Agriculture vs. national total) in 2024**

When comparing 2024 to 1990 (2000 in case of Particulate Matter), every pollutant experienced decreases. The strong decrease observed in $SO_2$, CO, BC, Heavy Metals, PAHs and dioxins (PCDD/PCDF) emissions is caused by the abandonment of the practice of field burning (3F), restricted by forest fire prevention legislation and conditionality of CAP payments.

| | Emission 2024/base year | |
|---|---|---|
| | Total | AGRI |
| NOx | -56% | -33% |
| NMVOC | -51% | -19% |
| $SO_2$ | -95% | -100% |
| $NH_3$ | -16% | -17% |
| $PM_{2.5}$ | -48% | -86% |
| $PM_{10}$ | -45% | -35% |
| TSP | -45% | -17% |
| BC | -46% | -100% |
| CO | -77% | -100% |
| Pb | -97% | -100% |
| Cd | -79% | -100% |
| Hg | -73% | -100% |
| PCDD/F | -65% | -100% |
| PAHs | -71% | -100% |
| HCB | -97% | - |
| PCBs | -96% | - |

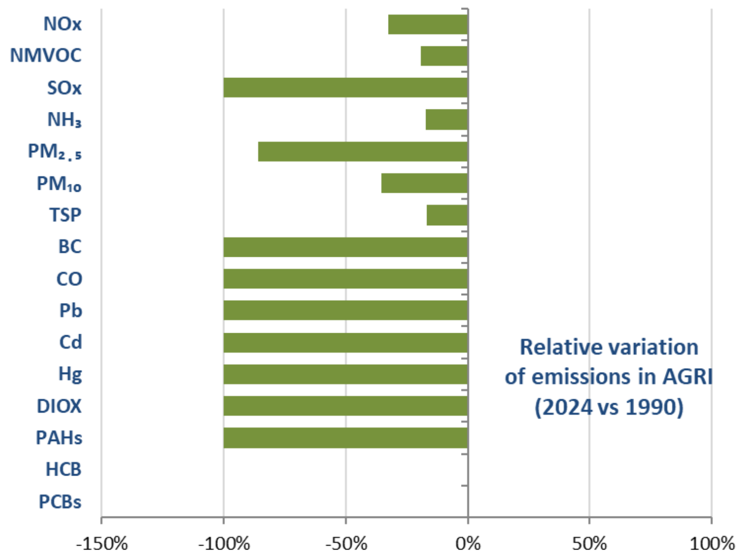
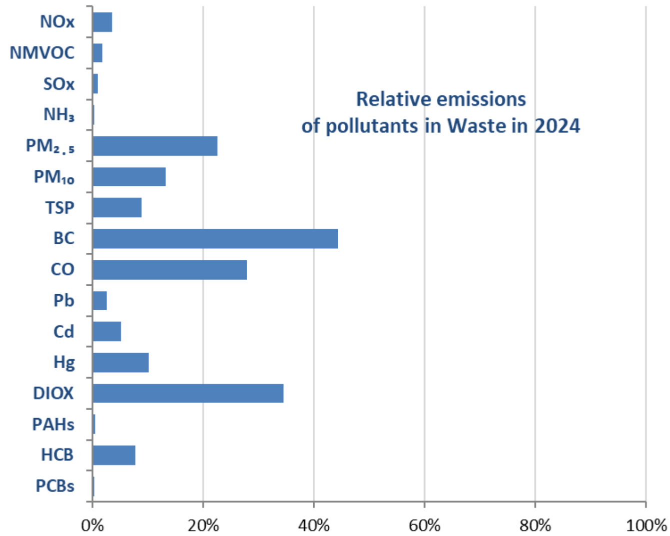



**Figure 2.2.6 Relative variation of emissions in Agriculture (2024 vs. base year, national total)**

## 2.2.4. Waste (NFR 5)

The Waste sector contribution to the total emissions in Spain in 2024 is relatively low for the main pollutants, except for Black Carbon, dioxins and furans, CO, and $PM_{2.5}$.




| Emissions 2024 | | INV Total | WASTE | % |
|---|---|---|---|---|
| NOx | kt | 592.4 | 21.1 | 4% |
| NMVOC | kt | 513.3 | 8.7 | 2% |
| $SO_2$ | kt | 100.7 | 1.0 | 1% |
| $NH_3$ | kt | 446.9 | 1.5 | 0% |
| $PM_{2.5}$ | kt | 91.5 | 20.7 | 23% |
| $PM_{10}$ | kt | 164.7 | 21.9 | 13% |
| TSP | kt | 252.6 | 22.3 | 9% |
| BC | kt | 24.2 | 10.7 | 44% |
| CO | kt | 943.3 | 263.0 | 28% |
| Pb | t | 114.3 | 2.9 | 3% |
| Cd | t | 6.0 | 0.3 | 5% |
| Hg | t | 3.2 | 0.3 | 10% |
| PCCD/F | g | 169.5 | 58.4 | 34% |
| PAHs | t | 33.2 | 0.2 | 0% |
| HCB | kg | 1.8 | 0.1 | 8% |
| PCBs | kg | 92.6 | 0.3 | 0% |

**Figure 2.2.7 Relative emissions of pollutants (Waste vs. national total) in 2024**

Since 1990 (2000 in case of Particulate Matter), $NH_3$, emissions have increased in this sector. The rest of pollutants show reductions in emissions.

| | Emission 2024/base year | |
|---|---|---|
| | Total | WASTE |
| NOx | -56% | -6% |
| NMVOC | -51% | -13% |
| $SO_2$ | -95% | -28% |
| $NH_3$ | -16% | 245% |
| $PM_{2.5}$ | -48% | -20% |
| $PM_{10}$ | -45% | -20% |
| TSP | -45% | -20% |
| BC | -46% | -20% |
| CO | -77% | -6% |
| Pb | -97% | -27% |
| Cd | -79% | -52% |
| Hg | -73% | -57% |
| PCDD/F | -65% | -69% |
| PAHs | -71% | -4% |
| HCB | -97% | -93% |
| PCBs | -96% | -35% |

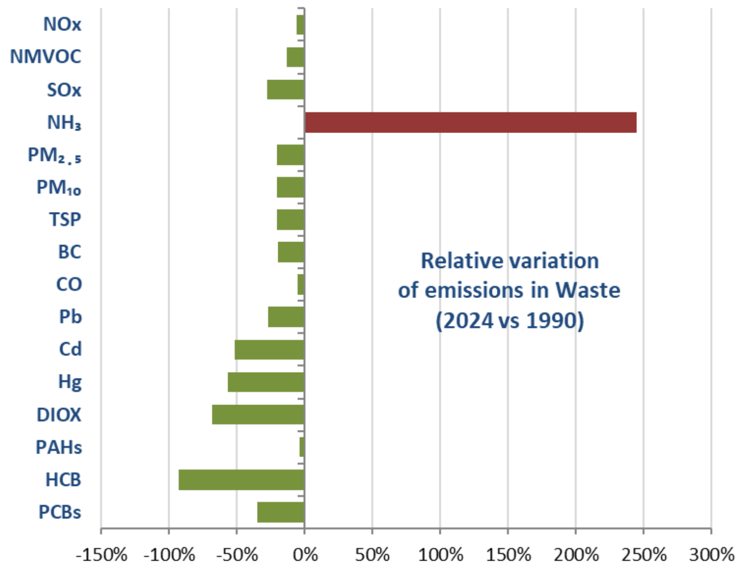



**Figure 2.2.8 Relative variation of emissions in Waste (2024 vs. base year, national total)**

# 3. ENERGY (NFR 1)

# CONTENTS

## FIGURES

## TABLES

# 3. ENERGY (NFR 1)

Chapter updated in March, 2026.

## Sector Energy at a glance

Energy emissions stand out for their relative weight for almost every pollutant covered by the Spanish Inventory. As shown in Figure 3.1.1 (all the figures related to the national territory, Canary Islands included), in many cases Energy sector is responsible for more than 40% of the pollutants emissions in the Inventory. In general, Energy emissions have decreased since 1990 (since 2000 for $PM_{2.5}$ and BC) for most of the inventoried pollutants by more than 50%.

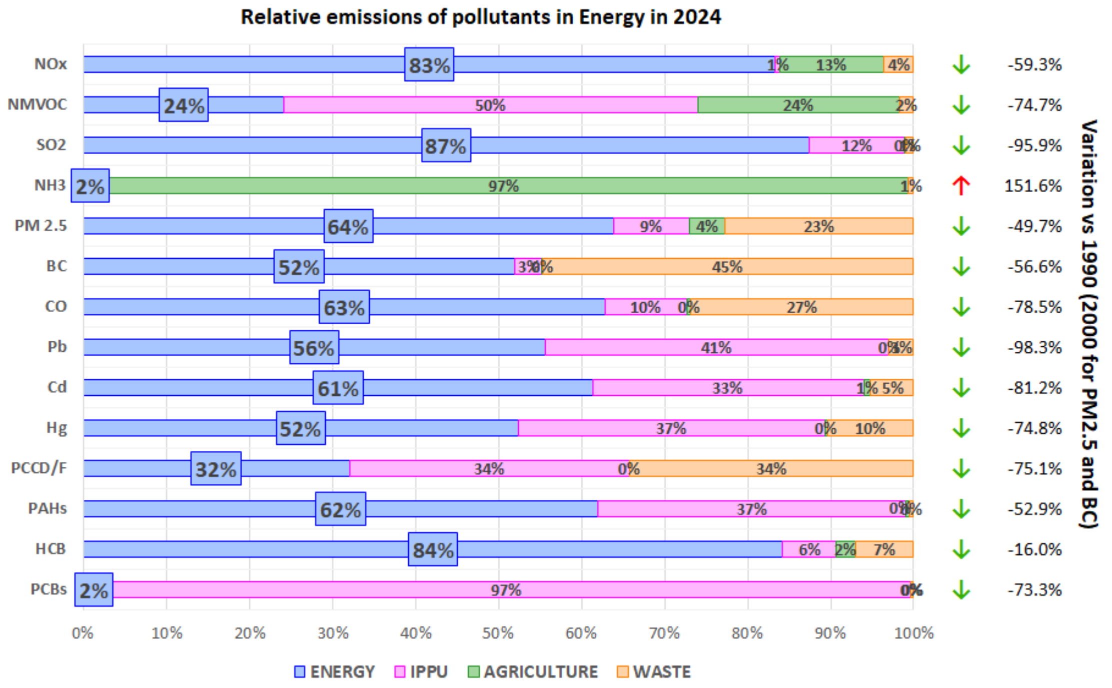



**Figure 3.1.1 Relative emissions in Energy in 2024 and its relative variation (2024 vs. 1990), national territory**

In 2024, the Energy sector in Spain involved, among others, the activity of 61 large thermal power plants (50 plants without Canary Islands), 13 incineration plants with energy recovery, 9 refineries, 1 integrated steel plant with coke production, 2 plants of coke production, more than 800 installations covered by the EU ETS, 200 industrial installations registered within the PRTR, more than 2.60 million flights, more than 36 million vehicles and almost 27 million households (see Table 3.2.1).

Energy activities in 2024 produced 87% of the total emissions of $SO_2$ (85% without Canary Islands), 84% of HCB emissions (also 84% without Canary Islands) and 83% of NOx emissions (80% without Canary Islands). On the other hand, its contribution to PCB and ammonia emissions was minor (around 2%, the same without Canary Islands).

Along the last two decades, emission reduction measures have had a drastic effect on most of the pollutants with reductions higher than 50% in 2024 compared to 1990 levels (98% in Pb and almost 96% in $SO_2$, as without Canary Islands). The relative increase in $NH_3$ emissions is indicative of the growing weight of the use of biomass in energy production and the road transport activity.

## 3.1. Sector overview

The following table shows, per each NFR category, the pollutants coverage, methodology approach (Method) and consideration as key category (KC).

**Table 3.1.1 Coverage of NFR category in 2024**

| NFR Code | NFR category | Pollutants | | | | Method | KC |
|---|---|---|---|---|---|---|---|
| | | Covered | Exceptions | | | | |
| | | | IE | NA | NE | | |
| **1A1a** | Public electricity and heat production | All | – | – | – | T1/T2 | ✓ |
| **1A1b** | Petroleum refining | All | – | HCB, PCBs | $NH_3$ | T1/T2/T3 | ✓ |
| **1A1c** | Manufacture of solid fuels and other energy industries | All | – | – | – | T1/T2 | |
| **1A2a** | Stationary combustion in manufacturing industries and construction: Iron and steel | All | – | – | – | T1/T2/T3 | ✓ |
| **1A2b** | Stationary combustion in manufacturing industries and construction: Non-ferrous metals | All | – | PCBs | – | T1/T2/T3 | ✓ |
| **1A2c** | Stationary combustion in manufacturing industries and constructions: Chemicals | All | – | – | – | T1/T2/T3 | ✓ |
| **1A2d** | Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print | All | – | – | – | T1/T2/T3 | ✓ |
| **1A2e** | Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco | All | – | – | – | T1/T2/T3 | ✓ |
| **1A2f** | Stationary combustion in manufacturing industries and construction: Non-metallic minerals | All | – | – | – | T1/T2/T3 | ✓ |
| **1A2gvii** | Mobile Combustion in manufacturing industries and construction | All | – | HCB, PCBs | Pb, Hg, As, PCDD/PCDF | T1/T2 | ✓ |
| **1A2gviii** | Stationary combustion in manufacturing industries and construction: Other | All | – | – | – | T1/T2/T3 | ✓ |
| **1A3ai(i)** | International aviation LTO (civil) | All | – | HCB, PCBs | $NH_3$, PCDD/PCDF | T1/T3 | ✓ |
| **1A3aii(i)** | Domestic aviation LTO (civil) | All | – | HCB, PCBs | $NH_3$, PCDD/PCDF | T1/T3 | ✓ |
| **1A3bi** | Road transport: Passenger cars | All | – | HCB | – | T2/T3 | ✓ |
| **1A3bii** | Road transport: Light duty vehicles | All | – | HCB | – | T2/T3 | ✓ |
| **1A3biii** | Road transport: Heavy duty vehicles and buses | All | – | HCB | – | T2/T3 | ✓ |
| **1A3biv** | Road transport: Mopeds & motorcycles | All | – | HCB | – | T2/T3 | ✓ |
| **1A3bv** | Road transport: Gasoline evaporation | NMVOC | – | Rest of pollutants | – | T3 | ✓ |

| NFR | NFR category | Pollutants | | | | Method | KC |
|---|---|---|---|---|---|---|---|
| **1A3bvi** | Road transport: Automobile tyre and brake wear | All | – | NOx, NMVOC, $SO_2$, $NH_3$, CO, PCDD/PCDF, HCB, PCBs | Hg, IcP | T1/T2 | |
| **1A3bvii** | Road transport: Automobile road abrasion | All | – | NOx, NMVOC, $SO_2$, $NH_3$, CO, PCDD/PCDF, HCB, PCBs | Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, BaP, BbF, BkF, IcP | T1/T2 | |
| **1A3c** | Railways | All | – | HCB, PCBs | Pb, Hg, As | T1 | |
| **1A3di(ii)** | International inland waterways | NO | | | | | ✓ |
| **1A3dii** | National navigation (shipping) | All | – | – | $NH_3$ | T1/T2 | |
| **1A3ei** | Pipeline transport | All | – | $NH_3$ | – | T1/T2 | |
| **1A3eii** | Other | NO | | | | | |
| **1A4ai** | Commercial/institutional: Stationary | All | – | – | - | T1/T2 | ✓ |
| **1A4aii** | Commercial/institutional: Mobile | All | – | HCB, PCBs | Hg, As, PCDD/PCDF | T1 | |
| **1A4bi** | Residential: Stationary | All | – | – | – | T1/T2 | |
| **1A4bii** | Residential: Household and gardening (mobile) | IE (under 1A4bi) | | | | | |
| **1A4ci** | Agriculture/Forestry/Fishing: Stationary | All | – | – | $NH_3$ | T1/T2 | ✓ |
| **1A4cii** | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | All | – | HCB, PCBs | Pb, Hg, As, PCDD/PCDF | T1/T2 | |
| **1A4ciii** | Agriculture/Forestry/Fishing: National fishing | All | – | – | $NH_3$ | T1/T2 | |
| **1A5a** | Other stationary (including military) | IE (under 1A4) | | | | | |
| **1A5b** | Other mobile (military) | All | – | – | – | T1/T2/T3 | |
| **1B1a** | Coal mining and handling | All | – | NOx, $SO_2$, $NH_3$, CO, PCDD/PCDF, PAHs, HCB, HCH | NMVOC, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, BC | T2 | |
| **1B1b** | Solid fuel transformation | All | – | HCB, PCBs | – | T1/T2 | ✓ |
| **1B1c** | Other fugitive emissions from solid fuels | NO | | | | | |
| **1B2ai** | Fugitive emissions oil: Exploration, production, transport | NMVOC | – | NOx, CO, $NH_3$, TSP, $PM_{10}$, $PM_{2.5}$, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, PCBs, PAHs, HCB | $SO_2$, PCDD/PCDF | T2 | |
| **1B2aiv** | Fugitive emissions oil: Refining /storage | All | – | PAHs, HCB, PCBs | – | T1/T2/T3 | |
| **1B2av** | Distribution of oil products | NMVOC | – | NOx, CO, $NH_3$, TSP, $PM_{10}$, $PM_{2.5}$, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, PCBs, PAHs, HCB | $SO_2$, PCDD/PCDF | T2 | |

| NFR | NFR category | Pollutants | | | | Method | KC |
|---|---|---|---|---|---|---|---|
| **1B2b** | Fugitive emissions from natural gas (exploration, production, processing, transmission, storage, distribution and other) | NMVOC | – | NOx, CO, $NH_3$, TSP, $PM_{10}$, $PM_{2.5}$, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, PCBs, PAHs, HCB | $SO_2$, PCDD/PCDF | T2 | |
| **1B2c** | Venting and flaring (oil, gas, combined oil and gas) | All | – | HCB, PCBs | $NH_3$, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, PCDD/PCDF, PAHs | T1/T2/T3 | ✓ |
| **1B2d** | Other fugitive emissions from energy production | NO | | | | | |

IE: included elsewhere; NA: not applicable NE: not estimated; NO: not occurring.

To a large extent, the emissions of $SO_2$, NOx and PM (sometimes CO, NMVOC) are estimated using data from continuous emission monitoring systems (CEMS), especially in large combustion plants (LCPs) belonging to NFR categories 1A1 and 1A2.

According to Spain's Orden PRA/321/2017 referred to Large Combustion Plants (LCPs) that require continuous measurements, Annex II, Section A, paragraph 7, the concentration validated values must include the subtraction of the specific confidence interval depending on the pollutant, and are to be used solely to assess the compliance with emission limit values. However, paragraph 6 of Annex II sets the criteria to determine time average emission values. The calculation must be performed in accordance with UNE/EN standards (transposition of CEN standards in Spain). No subtraction of the confidence interval is required in this case and, therefore, the Spanish Inventory considers that no underestimation is taking place when including emissions reported by operators using CEMS data and assuming that every operator complies with the current legislation in force.

More information on emission estimations, processes and abatement techniques are available in Introductory factsheet A General description of combustion processes that generate emissions, Introductory factsheet B General description of emission reduction techniques and Introductory factsheet C Methodologies for estimating combustion emissions.

## 3.2. Sector analysis

Main features of the Energy sector in Spain in 2024 are listed in the following table for reference. These main features consider the entire national territory, including the Canary Islands, which are not under the EMEP grid.

For further information on methodology applied to non-key categories, links to the methodology factsheets published in MITECO-SEI website are included below. For key categories, links to the available factsheets have been included in the corresponding methodology section.

**Table 3.2.1 Sector analysis**

| NFR Code | NFR category | Main features (2024) | Main sources of activity data |
|---|---|---|---|
| **1A1a** | Public electricity and heat production | - 61 large thermoelectric power plants (40 combined cycles, 5 coal-fired power plants and 16 diesel/gas turbine stations).<br>- 42,753 GWh/year of electricity produced in thermal | IQ from main power generation plants (LPS), MITECO (small |

| NFR Code | NFR category | Main features (2024) | Main sources of activity data |
|---|---|---|---|
| | | power plants.<br>- 14 Incineration plants with energy production (1 out of order).<br>- 17 significant district heating networks (>10 MWt).<br>- 241 kt of biogas for energy recovery use.<br>- 367,590 TJ in fossil fuels consumption. | power plants and solar thermal plants).<br>National census of DH plants from IDAE-MITECO. |
| **1A1b** | Petroleum refining | - 9 Refineries.<br>- 67.9·$10^6$ tonnes of crude oil processed.<br>- 180,732 TJ in fossil fuels consumption. | IQ from refineries. |
| **1A1c** | Manufacture of solid fuels and other energy industries (Methodology factsheet: Combustion in other energy industries) | - 1 integrated steel plant with coke production.<br>- 2 plants of coke production.<br>- 12,119 TJ in fossil fuels consumption. | IQ from large plants, MITECO (other energy industries). |
| **1A2** | Stationary combustion in manufacturing industries and construction | - More than 60 industrial activities, including:<br>· Cement production: 32 facilities (16,855 kt of clinker manufactured).<br>· Lime production: 17 facilities (1,922 kt produced).<br>· Glass production: more than 25 facilities (4,126 kt of glass).<br>· Steel production: 27 facilities (11,269 kt)<br>- 616,382 TJ in fossil fuels consumption. | IQ<br>Entrepreneurial associations. |
| **1A3a** | Transport: aviation (Methodology factsheet: Aviation) | - 50 airports<br>- 0.82·$10^6$ domestic flights<br>- 96.99·$10^6$ passengers in domestic flights<br>- 2.60·$10^6$ total flights<br>- 309.60·$10^6$ total passengers | National Statistics from Air Navigation Agency (AENA) and MITMS. |
| **1A3b** | Transport: road (Methodology factsheets: Road transport: combustion, evaporative emissions, tyre and brake wear and road abrasion emissions) | - 165,705 km not urban road network<br>- 25.5·$10^6$ passenger cars (56% diesel/44% gasoline)<br>- 4.24·$10^6$ light duty, heavy duty vehicles and buses (92% diesel/8% gasoline)<br>- 262,223·$10^6$ vehicles x km not urban pattern | National statistics from Traffic Department and MITMS. |
| **1A3c** | Transport: railways (Methodology factsheet: Railways) | - 15,652 km railway network of them 66.9% electrified. | National statistics from MITMS. |
| **1A3d** | Transport: navigation (Methodology factsheet: Navigation) | - 56 national ports.<br>- 40.85·$10^6$ domestic passengers<br>- 104.36·$10^6$ tonnes domestic freights | National statistics from MITMS. |
| **1A3e** | Pipeline transport (Methodology factsheet: Pipeline transport) | - More than 12,000 km of high-pressure gas pipelines.<br>- More than 4,000 km of oil pipelines. | ENAGÁS, Exolum. |
| **1A4** | Commercial/Institutional Residential Agriculture, forestry and fishing | - 27.00·$10^6$ households.<br>- 1.88·$10^6$ tonnes of diesel oil for agricultural machinery.<br>- 8,190 fishing ships. | MITMS, MITECO, MAPA. |
| **1B** | Fugitives | - 250.996 GW/h Gas produced.<br>- 1,239,935.63 t of coke produced.<br>- 1,817,649,411 6,063,456 GJ Transport/distribution of petroleum products (PCI). | MITECO, SEDIGÁS, ENAGÁS, IQ (coke plants). |

### 3.2.1. Key categories

Identified key categories within the Energy sector in 2024, according to the information provided in section 1.5 of the IIR and Annex 1, are listed in the following table.

**Table 3.2.2 Assignation of KC**

| NFR | NFR Category | NOx | NMVOC | $SO_2$ | $NH_3$ | $PM_{2.5}$ | $PM_{10}$ | TSP | BC | CO | Pb | Cd | Hg | PCDD/ PCDF | PAHs | HCB | PCBs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1A1a** | Public electricity and heat production | L-T | L-T | L-T | - | L-T | L-T | L-T | - | L | - | L-T | L-T | T | L | L | - |
| **1A1b** | Petroleum refining | L-T | - | T | - | - | - | - | - | - | - | L | - | - | - | - | - |
| **1A2** | Manufacturing Industries and Construction | L-T | L | L-T | - | L-T | L-T | L-T | L-T | L-T | L | L-T | L-T | L | L | L | - |
| **1A3a** | Aviation LTO (civil) | L | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **1A3b** | Road transport | L-T | L-T | T | T | L-T | L-T | L-T | L-T | L-T | L-T | L | L | L | L | - | - |
| **1A3d** | Navigation | L-T | - | L | - | L | L | - | - | - | - | - | - | - | - | L | - |
| **1A4a + 1A4b** | Commercial / institutional / residential | L | L-T | L | - | L-T | L-T | L-T | L-T | L-T | L | L | L | L-T | L-T | L | - |
| **1A4c** | Agriculture / Forestry / Fishing | L-T | - | L | - | L-T | T | T | L-T | L | - | - | - | - | - | - | - |
| **1B** | Fugitive Emissions from Fuels | - | L-T | L-T | - | - | - | - | - | - | - | - | - | - | - | - | - |

L: level; T: trend

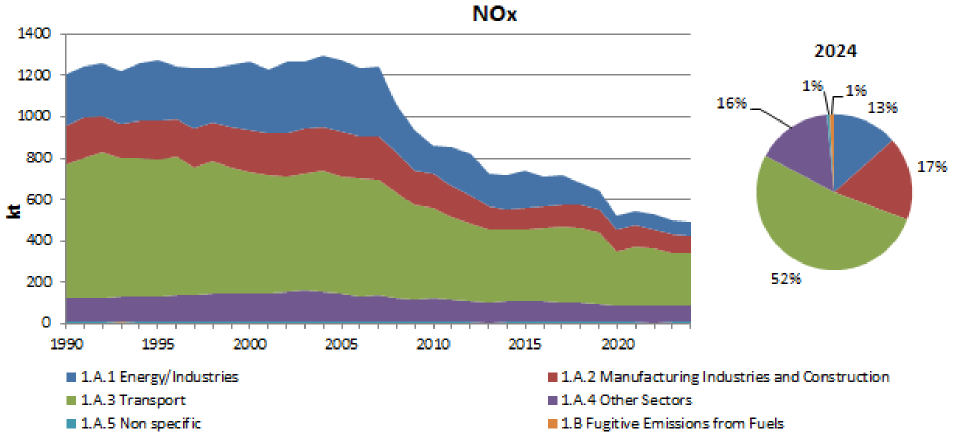
### 3.2.2. Analysis by pollutant

Charts of the time series by pollutants and NFR categories are shown next. Each pollutant is represented independently, broken down by main NFR categories within the sector. Additionally, a pie chart showing weight distribution of the main categories for year 2024 is included.

Explanation boxes are included beside the graphs, providing specific details on the pollutant emissions in year 2024 and main drivers and trends during the time series. Emissions data without the Canary Islands —as their territory is not under the EMEP grid— are shown in parentheses.

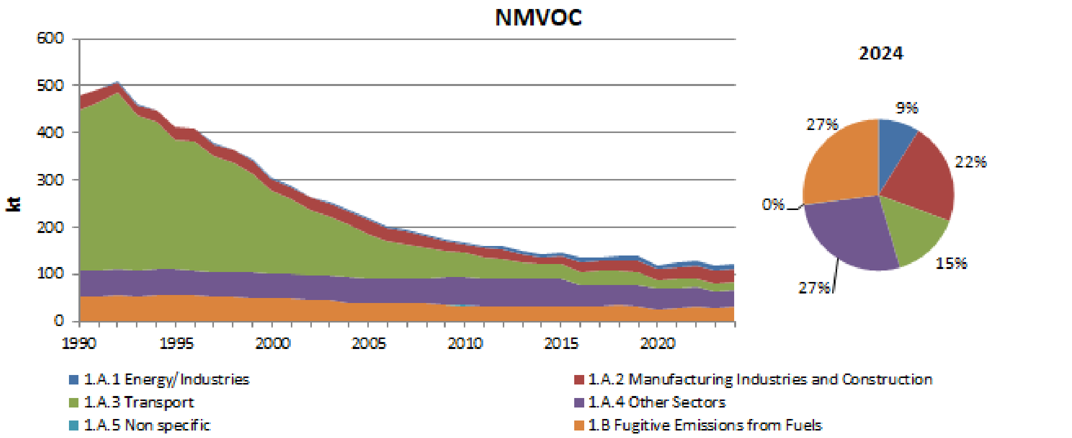
Detailed emission data of the Spanish Inventory are available from the MITECO-SEI website WebTable.

## Main Pollutants



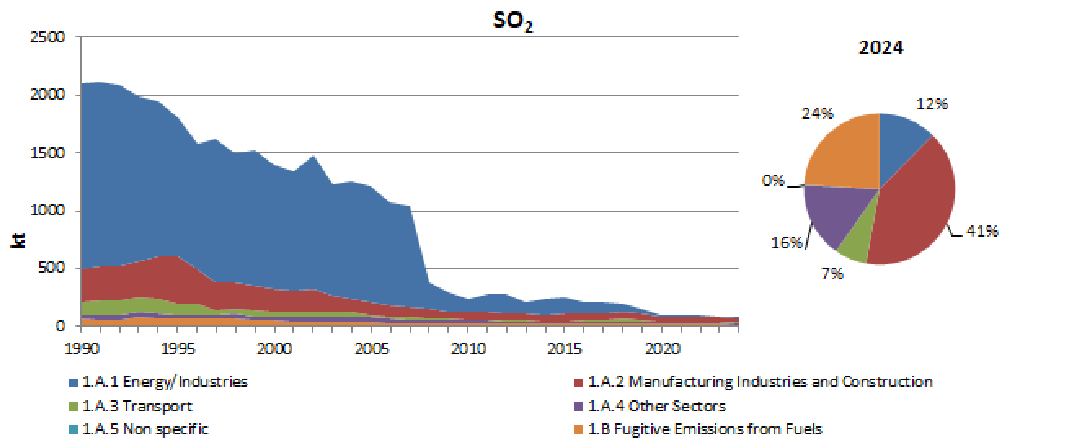

| | | |
|---|---|---|
| ***NOx*** | 490.37 kt emitted in 2024 (435.30 kt without Canary Islands)<br>83.3% of the total NOx emissions of the Inventory in 2024 (80.3% without Canary Islands) | |
| | 1990-2007 | Stability |
| | 2007-2010 | Significant decline in 2008-2010 driven by:<br>(i) Technological advances (EURO technologies) adopted in vehicle fleets (1A3b).<br>(ii) Growth in combined-cycle power stations (1A1a), with lower NOx emission ratios.<br>(iii) Dissemination of NOx abatement and energy efficiency measures in coal-fired power stations (1A1a) and in other industrial combustion sectors (1A2). |
| | 2010-2024 | Minor growth in 2011 and 2012 in the activity of coal-fired power stations and general downward trend due to the increase in renewables in electricity production (1A1a) and the change in the energy mix dominated by the decrease of coal using. Continuous decline of emissions from heavy duty vehicles (1A3biii). Sharp drop in 2020 as a consequence of COVID-19 pandemic, and recovery in 2021. |

**Figure 3.2.1 Evolution of NOx by category and distribution in year 2024, national territory**



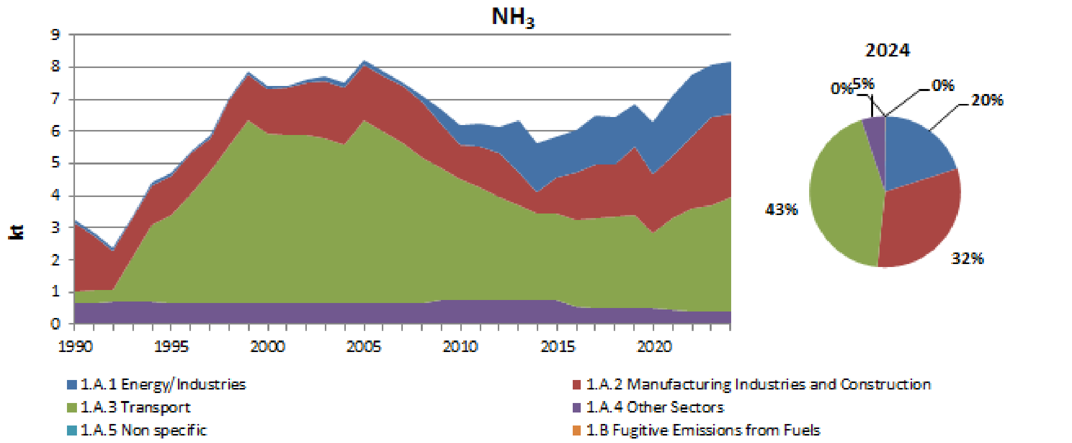

| | | |
|---|---|---|
| ***NMVOC*** | 121.25 kt emitted in 2024 (117.75 kt without Canary Islands)<br>24.2% of the total NMVOC emissions of the Inventory in 2024 (22.9% without Canary Islands) | |
| | 1990-1992 | Growing trend. |
| | 1992-2024 | Decrease in emissions from Transport activities (1A3) as result of successive introduction of EURO technologies and increase in the use of diesel instead of petrol. Emissions increase since 2010 in power generation sector (1A1a), mainly due to the growing activity of industrial waste incineration and biomass power plants. General drop in 2020 due to pandemic. |

**Figure 3.2.2 Evolution of NMVOC by category and distribution in year 2024, national territory**




| | | |
|---|---|---|
| ***$SO_2$*** | 85.09 kt emitted in 2024 (77.93 kt without Canary Islands)<br>87.4% of the total $SO_2$ emissions of the Inventory in 2024 (84.6% without Canary Islands) | |
| | 1990-2008 | Downward trend. |
| | 2008-2010 | Significant decreasing pattern driven by:<br>(i) The change in the structure of the electricity sector (1A1a) with the installation of combined cycle power stations and the smaller influence of coal.<br>(ii) The closure of the last brown coal mine in 2008 and stop in using this fuel in power generation; consumption of fuels with lower sulphur content, together with new limiting regulations.<br>(iii) The introduction of secondary desulphurization techniques. |
| | 2010-2024 | Slight downward trend with a steeper decline in 2019 and 2020, driven by the decrease in consumption of coal in electricity generation (1A1a). |

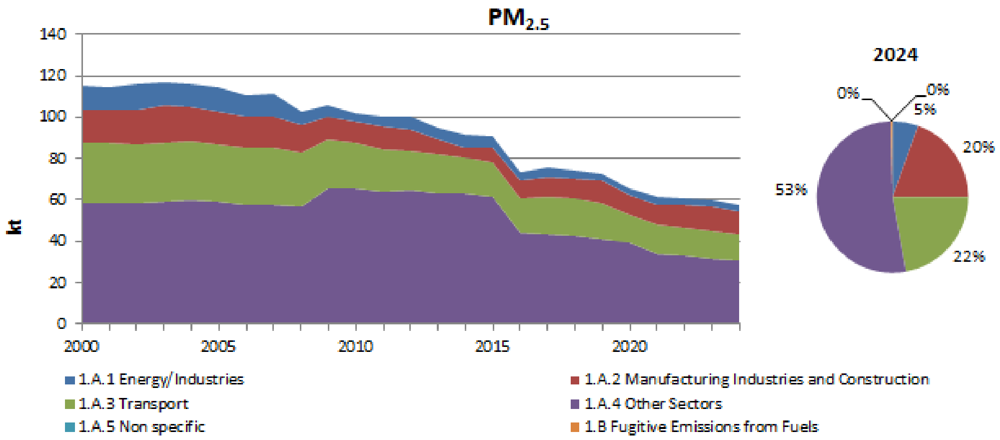
**Figure 3.2.3 Evolution of $SO_2$ by category and distribution in year 2024, national territory**




<table>
<tr><td rowspan="4">NH<sub>3</sub></td><td colspan="2">8.16 kt emitted in 2024 (7.86 kt without Canary Islands)<br>1.8% of the total $NH_3$ emissions of the Inventory in 2024 (1.7% without Canary Islands)</td></tr>
<tr><td>1990-1992</td><td>Decrease in emissions from category 1A2.</td></tr>
<tr><td>1992-1999</td><td>A continue growth in the emissions is observed in road transport (1A3), due to the successive introduction of catalytic technologies EURO I and EURO II.</td></tr>
<tr><td>1999-2024</td><td>Emissions decrease in road transport (1A3) as technologies EURO III and later are entering into force. Since 2010 a noticeable increase is seen in power generation (1A1a), mainly due to proliferation of biomass burning plants. Drop in 2020 (driven by 1A3) due to pandemic, and recovery in 2021 onwards.</td></tr>
</table>

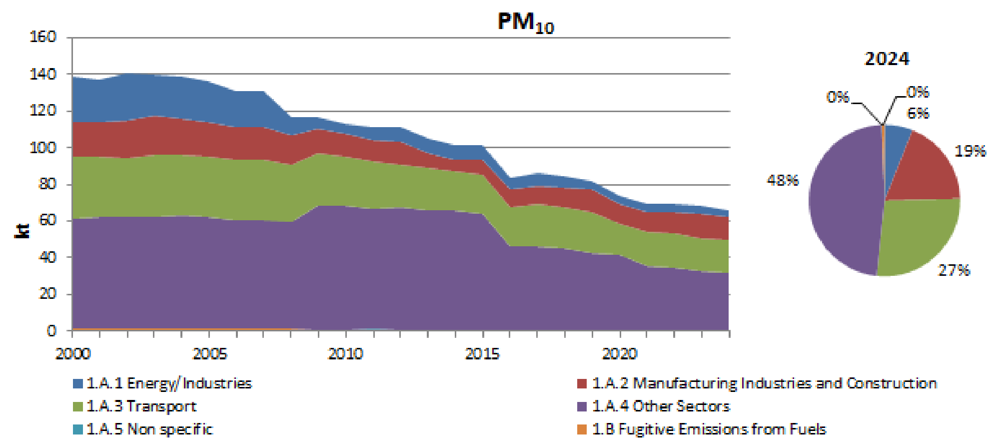
**Figure 3.2.4 Evolution of $NH_3$ by category and distribution in year 2024, national territory**

## Particulate Matter



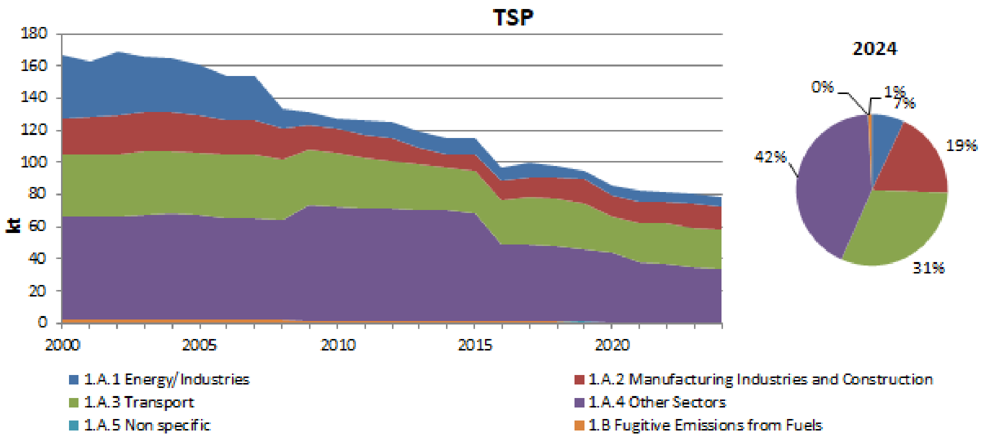

| | | |
|---|---|---|
| ***$PM_{2.5}$*** | 58.01 kt emitted in 2024 (55.89 kt without Canary Islands)<br>63.8% of the total $PM_{2.5}$ emissions of the Inventory in 2024 (53.6% without Canary Islands) | |
| | 2000-2007 | Moderate decline. |
| | 2007-2015 | Increase of the slope, motivated by:<br>(i) Decrease of journeys in road transport together with the fall in national navigation (1A3).<br>(ii) Variation of the fuel mix in power generation (1A1): increase of natural gas consumption, notable drop of coal in 2008-2010 (last brown coal mine closed in 2008) and decrease in certain oil-derived products (such as residual oil).<br>(iii) Introduction of abatement techniques in certain industries (such as the cement industry).<br>(iv) Increase of emissions from Other Sectors (1A4) in 2009, linked to the promotion of biomass consumption in RCI sectors in Spain. |
| | 2015-2024 | Drops in 2016, due to reduction in biomass consumption under category 1A4, and in 2020, as a consequence of COVID-19 pandemic on transport activity (1A3). |

**Figure 3.2.5 Evolution of $PM_{2.5}$ by category and distribution in year 2024, national territory**



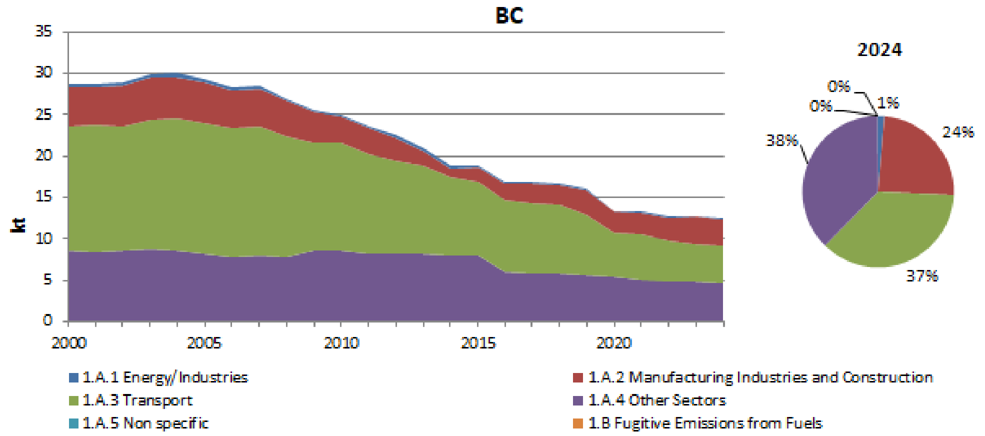

| | | |
|---|---|---|
| ***$PM_{10}$*** | 66.04 kt emitted in 2024 (63.42 kt without Canary Islands)<br>40.1% of the total $PM_{10}$ emissions of the Inventory in 2024 (35.1% without Canary Islands) | |
| | 2000-2024 | The trends are very similar to those already described for $PM_{2.5}$. |

**Figure 3.2.6 Evolution of $PM_{10}$ by category and distribution in year 2024, national territory**




| | | |
|---|---|---|
| ***TSP*** | 78.24 kt emitted in 2024 (75.14 kt without Canary Islands)<br>30.8% of the total TSP emissions of the Inventory in 2024 (27.0% without Canary Islands) | |
| | 2000-2024 | Evolution very similar to that already described for $PM_{2.5}$. |

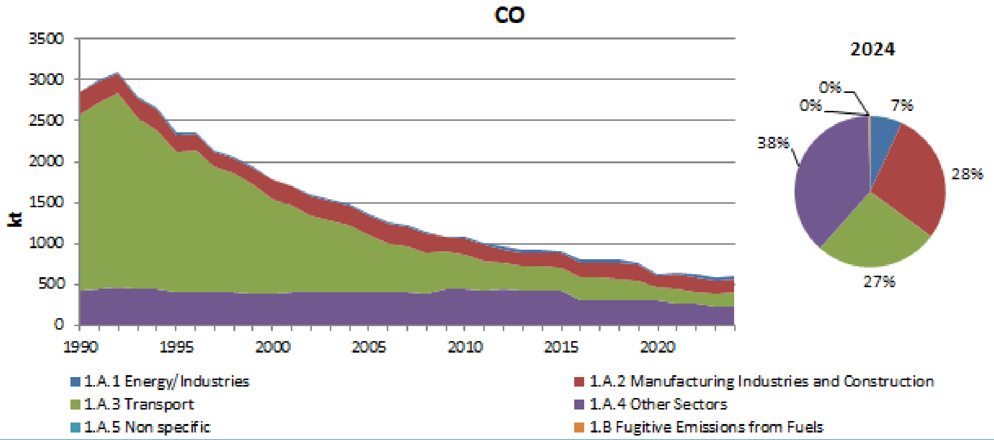
**Figure 3.2.7 Evolution of TSP by category and distribution in year 2024, national territory**




| | | |
|---|---|---|
| ***BC*** | 12.47 kt emitted in 2024 (12.16 kt without Canary Islands)<br>52.0% of the total BC emissions of the Inventory in 2024 (48.8% without Canary Islands) | |
| | 2000-2007 | Stability. |
| | 2007-2015 | Downward trend, mainly motivated by reduction in Transport (1A3) and Manufacturing Industries and Construction (1A2). Increase of emissions from Other Sectors (1A4) in 2009, linked to biomass consumption. |
| | 2015-2024 | Drops in 2016, due to reduction in biomass consumption under category 1A4, and in 2020, as a consequence of COVID-19 pandemic on transport activity (1A3). |

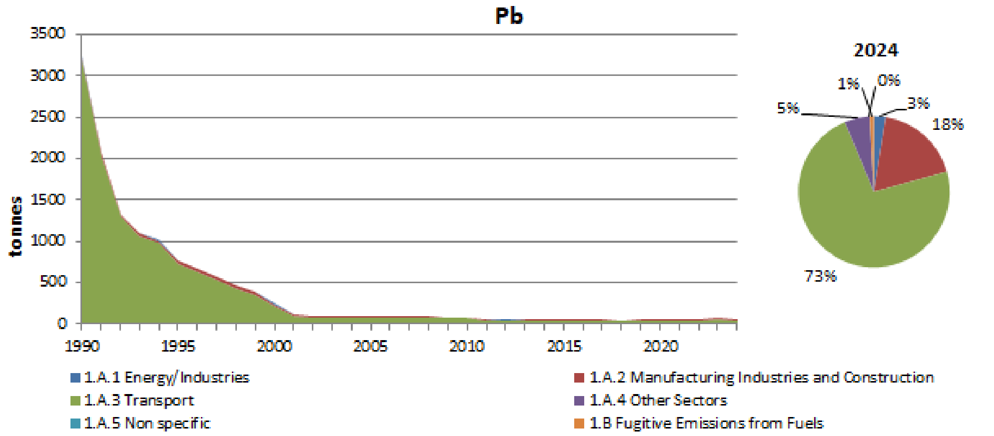
**Figure 3.2.8 Evolution of BC by category and distribution in year 2024, national territory**

## CO and Priority Heavy Metals



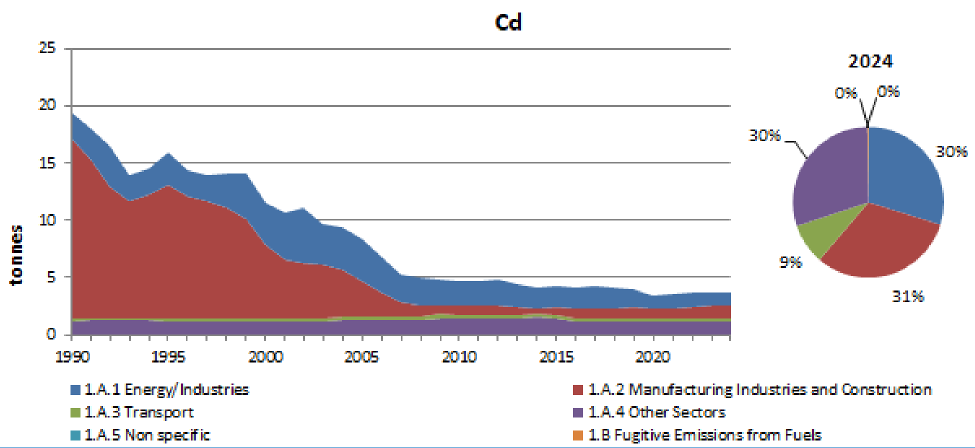

| | | |
|---|---|---|
| ***CO*** | 614.47 kt emitted in 2024 (597.41 kt without Canary Islands)<br>62.8% of the total CO emissions of the Inventory in 2024 (48.7% without Canary Islands) | |
| | 1990-1992 | Upward trend. |
| | 1992-2015 | Downward pattern, determined by the reduction in transport emission levels (1A3):<br>(i) The new vehicles fleets have been equipped with engine technologies and more effective abatement techniques designed to reduce CO (EURO technologies).<br>(ii) The structure of vehicle fleets by fuel type reveals a decrease in the contribution of petrol driven vehicles to the total fleet in favour of diesel vehicles.<br>In 2009, increase from categories 1A4 and 1A1a, linked to biomass consumption. |
| | 2015-2024 | Drops in 2016, due to reduction in biomass consumption under category 1A4, and in 2020, as a consequence of COVID-19 pandemic on transport activity (1A3). |

**Figure 3.2.9 Evolution of CO by category and distribution in year 2024, national territory**



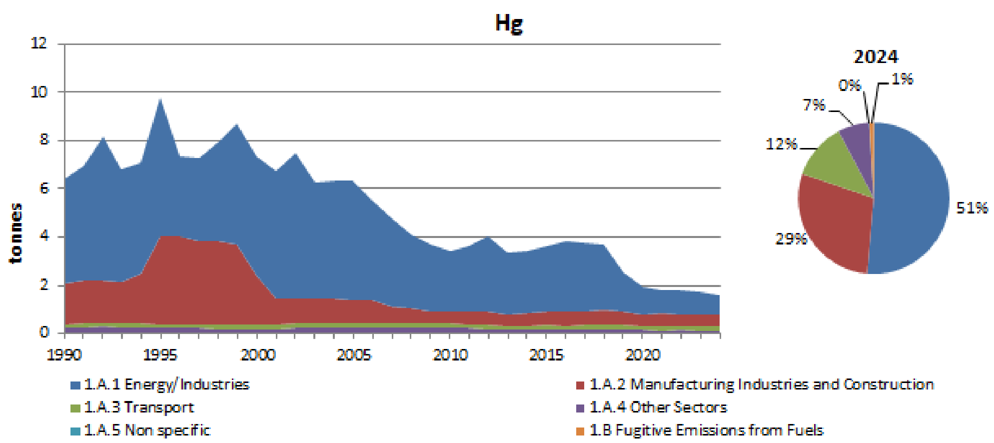

| | | |
|---|---|---|
| ***Pb*** | 53.51 tonnes emitted in 2024 (49.83 tonnes without Canary Islands)<br>55.6% of the total Pb emissions of the Inventory in 2024 (54.0% without Canary Islands) | |
| | 1990-2001 | Strong decrease as a consequence of the progressive decline and disappearance of leaded petrol consumption in road transport:<br>(i) 1990-1992: continued reduction in the maximum lead content allowed in petrol.<br>(ii) Starting in 1993: new petrol-driven vehicles use unleaded fuels (EURO technologies); at the same time, the number of diesel vehicles increases, whereas petrol-driven vehicles have been decreasing continuously. |
| | 2001-2024 | Stability: from 2001 onwards, sales of leaded petrol are prohibited. |

**Figure 3.2.10 Evolution of Pb by category and distribution in year 2024, national territory**




| | | |
|---|---|---|
| ***Cd*** | 3.67 tonnes emitted in 2024 (2.96 tonnes without Canary Islands)<br>61.3% of the total Cd emissions of the Inventory in 2024 (56.4% without Canary Islands) | |
| | 1990-2008 | Energy sector is a significant emission source within the Inventory through the whole period despite the decline in its relative contribution. This decrease is due to the change in the mix of fuels used, mainly in Manufacturing Industries and Construction (1A2) —lower coal and residual oil consumption— but also in power plants (1A1a); efficient TSP abatement techniques have a direct impact on the reduction of heavy metals emissions. As recommended in NECD review 2025, it should be noted that reduction of pollutant Cd is associated with evolution of emission controls on cement facilities as well. |
| | 2008-2024 | Stability with a drop in 2020 mainly linked to the fall in coal consumption for electricity generation (1A1a). |

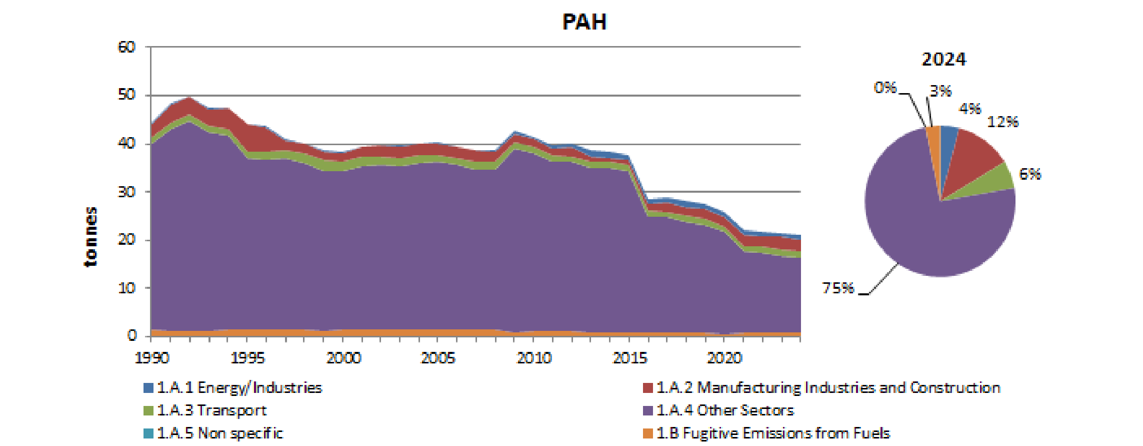
**Figure 3.2.11 Evolution of Cd by category and distribution in year 2024, national territory**




| | | |
|---|---|---|
| ***Hg*** | 1.61 tonnes emitted in 2024 (0.96 tonnes without Canary Islands)<br>52.4% of the total Hg emissions of the Inventory in 2024 (39.9% without Canary Islands) | |
| | 1990-2005 | Energy industries (1A1), as well as the cement industry (1A2f) and non-specific combustion in industries, are the main Hg emitters. The irregular profile of the 1A1 series is linked to the evolution of emissions in Energy industries, subject to annual variations in the use of hydraulic generation vs. combustion of residual oil or coal. |
| | 2005-2010 | Energy sector is a significant emission source within the inventory through the whole period despite the decline in its relative contribution. This decrease is due to the change in the mix of fuels used in power plants (1A1a) and refineries (1A1b) —increased consumption of natural gas—, and in Manufacturing Industries and Construction (1A2) —lower coal and residual oil consumption—. Efficient TSP abatement techniques also imply a reduction on heavy metals emissions. |
| | 2010-2018 | Slight upward trend due to the increment in coal consumption in 1A1 category. |
| | 2018-2024 | Strong decline by activity reduction in coal-fired power plants (1A1a sub-category). |

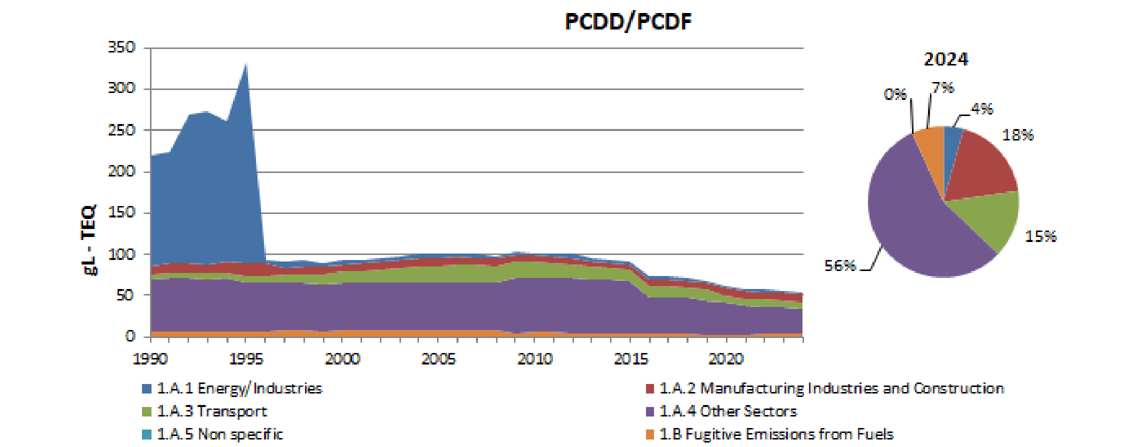
**Figure 3.2.12 Evolution of Hg by category and distribution in year 2024, national territory**

## POPs



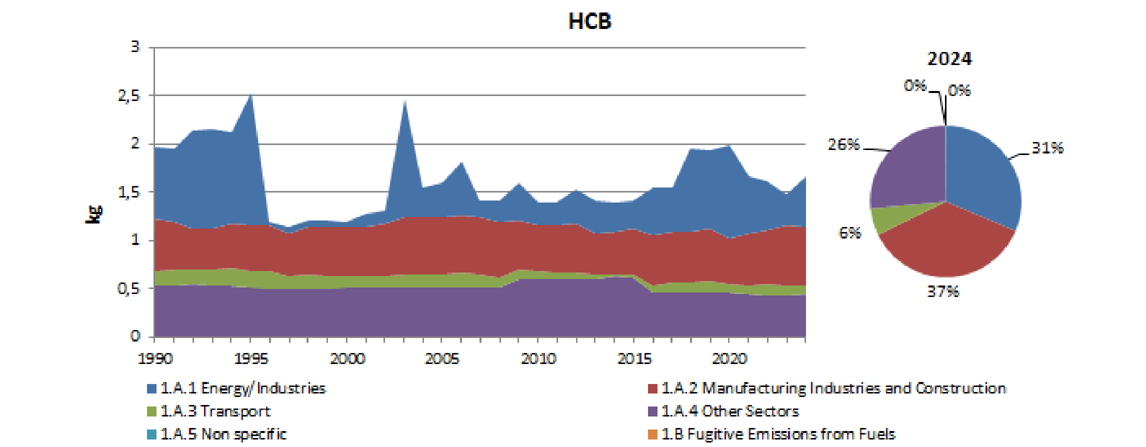

| | | |
|---|---|---|
| ***PAHs*** | 20.93 tonnes emitted in 2024 (20.56 tonnes without Canary Islands)<br>61.9% of the total PAHs emissions of the Inventory in 2024 (61.5% without Canary Islands) | |
| | 1990-1992 | Upward trend due to the growth in coal consumption within Residential sector (1A4bi). |
| | 1993-1999 | Significant reduction of emissions in Manufacturing Industries and Construction, 1A2. |
| | 2000-2015 | Slight upward trend until year 2008. Emissions in Energy/Industries (1A1) increase their share since 2009 as indicative of the increase of wood wastes burned at biomass power plants. In RCI sectors (1A4) the decline in the use of coal is counterbalanced by an increase in the use of biomass in small combustion devices. |
| | 2015-2024 | Strong drop in 2016, due to reduction in biomass consumption under category 1A4, within the overall downward trend that continues in 2024. |

**Figure 3.2.13 Evolution of PAHs by category and distribution in year 2024, national territory**



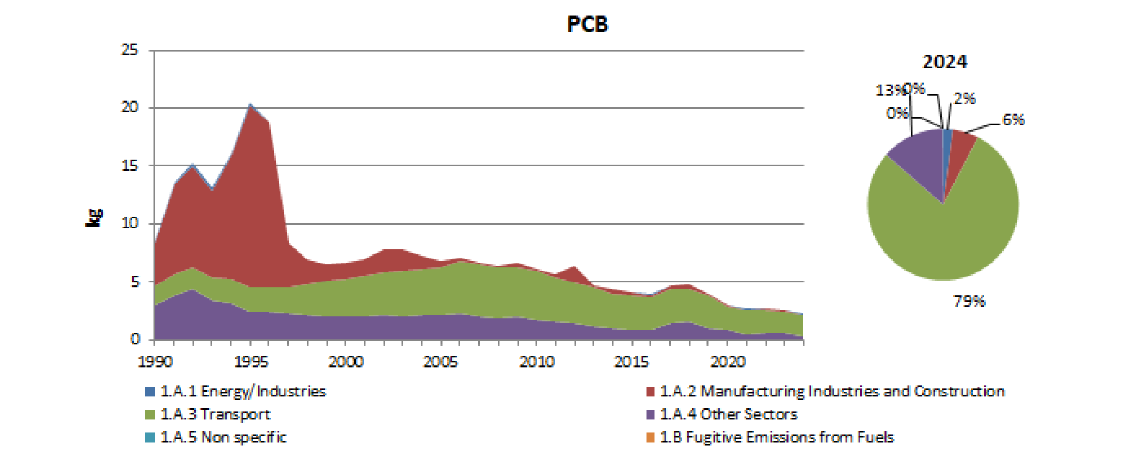

| | | |
|---|---|---|
| ***PCDD/ PCDF*** | 54.78 g I - TEQ emitted in 2024 (53.65 g I – TEQ without Canary Islands)<br>32.0% of the total PCDD/PCDF emissions of the Inventory in 2024 (31.9% without Canary Islands) | |
| | 1990-1995 | Upward trend. Emissions linked to MSW incineration plants with energy recovery. |
| | 1996 | Sudden drop due to new legislative requirements affecting MSW incineration plants with energy recovery. |
| | 1997-2024 | Stability. Slight decline in the steel production activities in 2009.<br>Slight upward trend since 2009, mainly driven by Other Sectors (1A4), with a further fall in emissions in 2016 linked to reduction in biomass consumption. |

**Figure 3.2.14 Evolution of PCDD/PCDF by category and distribution in year 2024, national territory**




| | | |
|---|---|---|
| ***HCB*** | 1.66 kg emitted in 2024 (1.61 kg without Canary Islands)<br>84.2% of the total HCB emissions of the Inventory in 2024 (83.9% without Canary Islands) | |
| | 1990-1995 | Upward trend. Emissions linked to MSW incineration plants with energy recovery. |
| | 1996 | Sudden drop due to abatement techniques in MSW incineration plants with energy recovery. |
| | 1997-2024 | New MSW incineration plants implement energy recovery from 2002 onwards (2003 emissions peak based on measurements carried out by the plants).<br>Slight upward trend in Other Sectors (1A4) since 2009; further fall in emissions in 2016 linked to reduction in biomass consumption. |

**Figure 3.2.15 Evolution of HCB by category and distribution in year 2024, national territory**




| | | |
|---|---|---|
| ***PCBs*** | 2.27 kg emitted in 2024 (2.13 kg without Canary Islands)<br>2.5% of the total PCB emissions of the Inventory in 2024 (2.4% without Canary Islands) | |
| | 1990-1997 | The main contribution is from Manufacturing Industries and Construction, especially Stationary combustion: Non-metallic minerals (1A2f), followed by Other Sectors, basically by Residential: Stationary (1A4bi). |
| | 1997-2024 | Sudden drop in 1997 due to a change in fuels consumption in Manufacturing Industries and Construction: in 1997, the consumption of coal in Non-ferrous metals (1A2b) reduced over 72%. Transport (1A3) results to be the main contributor. General downward trend with a slight increase in 2017-2018 in Other Sectors (1A4 category). |

**Figure 3.2.16 Evolution of PCBs by category and distribution in year 2024, national territory**

### 3.2.3. Condensable component of $PM_{10}$ and $PM_{2.5}$

As detailed in Annex V, indication of whether the emission estimates and emission factors for $PM_{10}$ and $PM_{2.5}$ in the Energy sector include or exclude the condensable component can be found in the table below:

**Table 3.2.3 Condensable component of $PM_{10}$ and $PM_{2.5}$ in Energy sector**

| NFR | Source/sector name | PM emissions: the condensable component is | | EF reference and comments |
|---|---|---|---|---|
| | | included | excluded | |
| **1A1a** | Public electricity and heat production | | X | LPS: continuous stack measurements of TSP (mainly opacimeters, calibrated by gravimetry and isokinetic sampling); $PM_{2.5}$ and $PM_{10}$ fractions based in CEPMEIP (2000), from TSP data. Area sources: default EF from CEPMEIP Database (2000). |
| **1A1b** | Petroleum refining | | X | Varying degrees of complexity; in majority emission factors represent filterable PM emissions. |
| **1A1c** | Manufacture of solid fuels and other energy industries | | X | LPS (coke plants): country specific TSP and $PM_{10}$ EF; $PM_{2.5}$ fraction based on EEA/EMEP Guidebook (2019) Area sources: mainly default EF from CEPMEIP Database (2000), but also from EEA/EMEP Guidebook (2019) where most of the EF used represents only filterable PM emissions. |
| **1A2a** | Stationary combustion in manufacturing industries and construction: Iron and steel | Mostly excluded but unclear | | Varying degrees of complexity: in majority emissions factors represent filterable PM emissions, but it may not be clear whether only the filterable part or the total part is represented (EMEP/EEA Guidebook (2019); TSP (mainly opacimeters, calibrated by gravimetry and isokinetic sampling); $PM_{2.5}$ and $PM_{10}$ fractions based in CEPMEIP (2000), from TSP data. Periodic measurements (between one time a week and once a year). |
| **1A2b** | Stationary combustion in manufacturing industries and construction: Non-ferrous Metals | Mostly excluded but unclear | | Varying degrees of complexity: in majority emissions factors represent filterable PM emissions, but it may not be clear whether only the filterable part or the total part is represented (EMEP/EEA Guidebook (2019); TSP (mainly opacimeters, calibrated by gravimetry and isokinetic sampling); $PM_{2.5}$ and $PM_{10}$ fractions based in CEPMEIP (2000), from TSP data. Periodic measurements (between one time a month and once a year). |
| **1A2c** | Stationary combustion in manufacturing industries and construction: Chemicals | Mostly excluded but unclear | | Varying degrees of complexity: in majority emissions factors represent filterable PM emissions, but it may not be clear whether only the filterable part or the total part is represented (EMEP/EEA Guidebook (2019). |

| NFR | Source/sector name | PM emissions: the condensable component is | | EF reference and comments |
|---|---|---|---|---|
| **1A2d** | Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print | Mostly excluded but unclear | | Varying degrees of complexity: in majority emissions factors represent filterable PM emissions, but it may not be clear whether only the filterable part or the total part is represented (EMEP/EEA Guidebook (2019). Periodic measurements (between once a month and more than once a year). |
| **1A2e** | Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco | Mostly excluded but unclear | | Varying degrees of complexity: in majority emissions factors represent filterable PM emissions, but it may not be clear whether only the filterable part or the total part is represented (EMEP/EEA Guidebook (2019). |
| **1A2f** | Stationary combustion in manufacturing industries and construction: Non-metallic minerals | Mostly excluded but unclear | | Varying degrees of complexity; in majority emission factors represent filterable PM emissions (EMEP/EEA Guidebook (2019), OFICEMEN). |
| **1A2gvii** | Mobile combustion in manufacturing industries and construction | X | | EF from EEA/EMEP Guidebook (2023). |
| **1A2gviii** | Stationary combustion in manufacturing industries and construction: Other | | X | $PM_{2.5}$ and $PM_{10}$ fractions based in CEPMEIP (2000), from TSP data. Periodic measurements (between once a week and once a year). |
| **1A3ai(i)** | International aviation LTO (civil) | X | | EF from FEIS model (EUROCONTROL). |
| **1A3aii(i)** | Domestic aviation LTO (civil) | X | | |
| **1A3bi** | Road transport: Passenger cars | X | | EF from EEA/EMEP Guidebook (2019): The measurement procedure regulated for vehicle exhaust PM mass characterisation requires that samples are taken at a temperature lower than 52°C. At this temperature, PM contains a large fraction of condensable species. Hence, PM mass emission factors in this sector are considered to include both filterable and condensable material. |
| **1A3bii** | Road transport: Light duty vehicles | X | | |
| **1A3biii** | Road transport: Heavy duty vehicles and buses | X | | |
| **1A3biv** | Road transport: Mopeds & motorcycles | X | | |
| **1A3bv** | Road transport: Gasoline evaporation | NA | | |
| **1A3bvi** | Road transport: Automobile tyre and brake wear | X | | EF from EEA/EMEP Guidebook (2019). |
| **1A3bvii** | Road transport: Automobile road abrasion | X | | EF from EEA/EMEP Guidebook (2019). |
| **1A3c** | Railways | X | | Default T1 EF from EEA/EMEP Guidebook (2023). |
| **1A3di(ii)** | International inland waterways | NO | | |
| **1A3dii** | National navigation (shipping) | X | | EF from EEA/EMEP Guidebook (2023). |
| **1A3ei** | Pipeline transport | | X | Default EF from CEPMEIP Database (2000). |
| **1A3eii** | Other | NO | | |
| **1A4ai** | Commercial/Institutional: Stationary | Depending on category and fuel | | EF from EEA/EMEP Guidebook (2023), Chapter 1A4, Small combustion. <u>Boilers – solid and liquid fuels</u>: It is unclear whether PM emissions include or not the condensable component. |

| NFR | Source/sector name | PM emissions: the condensable component is | | EF reference and comments |
|---|---|---|---|---|
| | | | | Boilers – gaseous fuels: Condensable component excluded.<br>Boilers – solid biomass: Condensable component included.<br>Turbines – all fuels: It is unclear whether PM emissions include or not the condensable component.<br>Stationary engines – all fuels: It is unclear whether PM emissions include or not the condensable component. |
| **1A4aii** | Commercial/Institutional: Mobile | X | | Default EF from EEA/EMEP Guidebook (2023), Chapter 1A4 Non-road mobile machinery, table 3-1. |
| **1A4bi** | Residential: Stationary | Depending on category and fuel | | EF from EEA/EMEP Guidebook (2023), Chapter 1A4, Small combustion.<br>Boilers – solid fuels: Condensable component excluded. With the exception of petroleum coke, for which it unclear whether PM emissions include or not the condensable component.<br>Boilers – gas oil: Condensable component excluded.<br>Boilers – rest of liquid fuels: It is unclear whether PM emissions include or not the condensable component.<br>Boilers – gaseous fuels: It is unclear whether PM emissions include or not the condensable component.<br>All appliances – biomass: Condensable component included. |
| **1A4bii** | Residential: Household and gardening (mobile) | IE | | |
| **1A4ci** | Agriculture/Forestry/Fishing: Stationary | Depending on category and fuel | | EF from EEA/EMEP Guidebook (2023), Chapter 1A4, Small combustion.<br>Boilers – solid and liquid fuels: It is unclear whether PM emissions include or not the condensable component.<br>Boilers – gaseous fuels: Condensable component excluded.<br>Boilers – biomass: Condensable component included.<br>Stationary engines – all fuels:<br>It is unclear whether PM emissions include or not the condensable component. |
| **1A4cii** | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | X | | EF from EEA/EMEP Guidebook (2023). |
| **1A4ciii** | Agriculture/Forestry/Fishing: National fishing | X | | EF from EEA/EMEP Guidebook (2023). |
| **1A5a** | Other stationary (including military) | IE | | |
| **1A5b** | Other, Mobile (including military) | X | | Aggregated methodology from 1A3a, 1A3b, 1A3dii (see categories above). |
| **1B1a** | Fugitive emission from solid fuels: Coal mining and handling | No information available | | EF from EEA/EMEP Guidebook (2019). |
| **1B1b** | Fugitive emission from solid fuels: Solid fuel transformation | No information available | | EF from EEA/EMEP Guidebook (2019). |

| NFR | Source/sector name | PM emissions: the condensable component is | EF reference and comments |
|---|---|---|---|
| **1B1c** | Other fugitive emissions from solid fuels | NO | |
| **1B2ai** | Fugitive emissions oil: Exploration, production, transport | NA | |
| **1B2aiv** | Fugitive emissions oil: Refining and storage | No information available | EMEP/EEA Guidebook (2019). Continuous measurements. |
| **1B2av** | Distribution of oil products | NA | |
| **1B2b** | Fugitive emissions from natural gas (exploration, production, processing, transmission, storage, distribution and other) | NA | |
| **1B2c** | Venting and flaring (oil, gas, combined oil and gas) | No information available | Continuous measurements. |
| **1B2d** | Other fugitive emissions from energy production | NO | |

## 3.3. Major changes

In the present edition, the Spanish Inventory has made several major changes that are summarized in the table below.

Those referred to the recommendations made by the TERT in the 2025 NECD review[1] (pursuant to Directive (EU) 2016/2284), have been marked with an asterisk (*).

**Table 3.3.1 Major changes in the Energy sector in Inventory edition 2026**

| NFR Category | Activities included | Pollutant | Type of change |
|---|---|---|---|
| Public electricity and heat production (**1A1a**) | - District heating networks (1A1aiii) | All | Activity data update |
| | - Biogas facilities, managed landfills and wastewater handling plants | All | Activity data update |
| Manufacture of solid fuels and other energy industries (**1A1c**) | - Coke ovens (1A1ci) | PM | Emissions data update |
| | - Other energy industries (1A1cii, 1A1ciii) | All (except $NH_3$, PCBs) | Fuel balance recalculation |
| Manufacturing industries and construction (**1A2**) | - All | All | Fuel balance recalculation for consistency with international energy statistics. |
| (*) Road transport (**1A3b**) | - Combustion | PAH | EF update |
| Commercial/Institutional sector (**1A4a**) | - Stationary | All | Activity data update |
| Residential sector (**1A4b**) | - Stationary | All | Activity data update |
| Agriculture, forestry and fishing sector (**1A4ci**) | - Stationary | All | Activity data update |

[1] Final Review Report available in: https://environment.ec.europa.eu/topics/air/reducing-emissions-air-pollutants/emissions-inventories_en

| NFR Category | Activities included | Pollutant | Type of change |
|---|---|---|---|
| Agriculture, forestry and fishing sector (**1A4cii**) | - Mobile machinery (agriculture, forestry) | All | Activity data update |
| Agriculture, forestry and fishing sector (**1A4ciii**) | - Mobile machinery (fishing) | All | Activity data update |
| (*) Fugitive emissions from solid fuel transformation (**1B1b**) | - Coke ovens | PAH, DIOX, HM | New estimation |

## 3.4. Key categories analysis

Within this sector, the following categories have been identified as key (Table 3.2.2 for reference).

A. Public electricity and heat production - 1A1a
B. Petroleum refining - 1A1b
C. Manufacturing industries and construction - 1A2
D. Air traffic at airports - 1A3a
E. Road transport - 1A3b
F. National navigation - 1A3d
G. Combustion in other sectors - 1A4
H. Fugitive emissions from fuels - 1B

Activity data sources, methodologies and a general assessment for each category are provided.

## A. Public electricity and heat production (1A1a)

This category includes Public service heat and power generation plants (NFR 1A1a) and it constitutes one of the main contributors to the pollutants emissions in the Inventory as a whole. It is considered a key category for:

- NOx, NMVOC, $SO_2$, $PM_{2.5}$, $PM_{10}$, TSP, Cd and Hg for level and trend reasons;
- CO, PAHs and HCB for level reasons;
- PCDD/PCDF for trend reasons.

The dominant types of installations in the power plants are gas turbines (mostly combined cycles) and boilers, and among the latter, those with power ratings over 300 MWt. Facilities using stationary engines are particularly significant within the extra-peninsular electrical system. The presence of district heating networks in Spain is not very significant, although this activity has been experiencing an important growth in relative terms, during the recent years.

In the current edition of the Inventory, some significant changes in activity data have been performed under 1A1a category:

- Activity data update in fuel consumption in district heating plants (sub-category 1A1aiii), year 2023;
- New activity data from six biomethanization plants and data updates for others, years 2012-2023;
- Correction of maximum efficiency on biogas capture in managed landfills, years 2012-2023;
- Referred to biogas from industrial wastewater handling, changes are made in the activity data of industries within category 5D2; in the anaerobic treatment of the brewing industry, a 100% recovery of methane is no longer assumed; wastewater generation for fish processing plants has been updated according to the 2019 Refinement, years 1990-2023 (in all cases);
- Corrections on quantity of wastewater collected and non-collected and on quantity of biogas burnt in domestic wastewater handling plants, years 2013-2023.

Descriptions of these changes are shown in section 3.6 (Recalculations) and in Chapter 8 (Recalculations and planned improvements).

### A.1. Activity variables

The following table summarises the main activities considered within this category, as well as the main activity data and their corresponding sources of information.

### Table 3.4.1 Summary of activity variables, data and information sources for category 1A1a

| Activities included | Activity data | Source of information |
|---|---|---|
| Public service heat and power generation plants | - Fuel consumption.<br>- Fuel characteristics: LHV, contents in carbon, sulphur, ash, etc.<br>- Type of installation and thermal power installed.<br>- Other parameters required for the application of emission estimation algorithms. | - 1990-1993: OFICO-MINER.<br>- 1994-2024: IQ to thermal power stations (Large Point Sources).<br>- 1990-2024: information on fuel consumption and location of small power plants (Area Sources) provided by MITECO.<br>- 2009-2024: information on fuel consumption and location of solar thermal plants (Area Sources) provided by OECC-MITECO and CNMC.<br>- 1990-2012: information on district heating (Area Sources) from FEMP / ADHAC.<br>- 2013-2024: national census of district heating plants provided by IDAE-MITECO. |
| Municipal and industrial waste incineration plants with heat or electricity production | - Quantities of waste burnt.<br>- Composition of the waste.<br>- Other parameters required for the application of emission estimation algorithms. | - IQ to incineration plants. |
| Combustion in managed landfills with biogas capture | - Amounts of biogas burnt.<br>- Other parameters required for the application of emission estimation algorithms. | - 1990-2008: IQ.<br>- 2009-2024: information provided by national focal point (Subdirectorate General of Circular Economy at MITECO).<br>- 2009-2024: IQ to non-municipal facilities. |
| Combustion in biogas facilities | - Amounts of biogas burnt. | - SGEC (MITECO).<br>- IQ. |
| Combustion in domestic / industrial wastewater handling plants with biogas capture | - Amounts of biogas burnt. | - Domestic: data from CEDEX, OECC and CNV.<br>- Industrial: IQ to refinery and paper pulp manufacturing plants; data from MAPA and INE (brewing industry); data from IPI and INE (fish processing plants); estimations based on data from OECC-MITECO. |

## A.2. Methodology

### Table 3.4.2 Summary of methodologies applied in category 1A1a

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| ***Boilers***<br><br>(Methodology factsheet: Public electricity production)<br>(Methodology factsheet: District heating) | | | |
| $SO_2$ | T2 | Direct emissions measurement.<br>Stoichiometric balance.<br>EMEP/EEA Guidebook (2019) Part B, Chapter 1.A.1.a.<br>Chapter 1.A.4. | Data provided by installations via IQ.<br>In absence of direct measurements.<br>In absence of data: default EF.<br>Tables 3-4, 3-5, 3-9 to 3-16.<br>Tables 3-10, 3-25, 3-27 and 3-45. |
| NOx | T2 | Direct emissions measurement.<br>EMEP/EEA Guidebook (2019) Part B, Chapter 1.A.1.a.<br>Chapter 1.A.4. | Data provided by installations via IQ.<br>In absence of data: default EF.<br>Tables 3-4, 3-5, 3-9 to 3-16.<br>Tables 3-10, 3-25, 3-27 and 3-45. |

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| $PM_{2.5}$, $PM_{10}$, TSP<br><br>BC | T1/T2<br><br>T1 | Mixed methodology based on direct emissions measurement and default EF from CEPMEIP.<br><br>EMEP/EEA Guidebook (2019) Part B, Chapter 1.A.1.a. | Data (TSP) provided by installations via questionnaire; distribution of $PM_{2.5}$ and $PM_{10}$ fractions based on CEPMEIP Database.<br>In absence of data: CEPMEIP default EF.<br>Default EF: % of the $PM_{2.5}$.<br>Tables 3-3, 3-6, 3-9 to 3-16. |
| Cd, Hg, Pb | T1/T2 | For coals: CS (country specific) EF from a national study.<br>EMEP/CORINAIR Guidebook (2007) Part B, Chapter 111.<br>EMEP/EEA Guidebook (2019) Part B, Chapter 1.A.4. | EF obtained from publication: "*Heavy metal emissions in ENDESA's Coal Power Stations*".<br>For other fuels or data absence: default EF Table 31, DBB.<br>Area Sources - district heating: default EF. Tables 3-25, 3-27 and 3-45. |
| PCDD/PCDF | T1 | OSPARCOM-HELCOM-UNECE (1995).<br><br>EMEP/EEA Guidebook (2019) Part B, Chapter 1.A.4. | EF for maximum abatement techniques. Table 4.5.1.<br>Area Sources - district heating: default EF. Tables 3-9, 3-25, 3-27 and 3-45. |
| PAHs | T1 | EMEP/EEA Guidebook (2019) Part B, Chapter 1.A.1.a.<br>Chapter 1.A.4. | Default EF.<br>Tables 3-4 to 3-6 and 3-9 to 3-16.<br>Tables 3-8 to 3-10, 3-25, 3-27 and 3-45. |
| PCBs | T1 | EMEP/EEA Guidebook (2019) Part B, Chapter 1.A.1.a.<br>Chapter 1.A.4. | Default EF.<br>Tables 3-4 to 3-6 and 3-9 to 3-16.<br>Table 3-18 and 3-45. |
| NMVOC | T1/T2 | Direct emissions measurement.<br>EMEP/EEA Guidebook (2019) Part B, Chapter 1.A.1.a.<br>Chapter 1.A.4. | Data provided by installations via IQ.<br>In absence of data: default EF<br>Tables 3-4, 3-5, 3-9 to 3-16.<br>Tables 3-10, 3-25, 3-27 and 3-45. |
| CO | T1/T2 | Direct emissions measurement.<br>EMEP/EEA Guidebook (2019) Part B, Chapter 1.A.1.a<br>Chapter 1.A.4. | Data provided by installations via IQ.<br>In absence of data: default EF.<br>Tables 3-4, 3-5, 3-9 to 3-16.<br>Tables 3-10, 3-25, 3-27 and 3-45. |
| $NH_3$ | T1/T2 | Direct emissions measurement.<br>EMEP/EEA Guidebook (2019) Part B, Chapter 1.A.4. | LPS: data provided by installations via IQ.<br>Area Sources: default EF.<br>Tables 3-10 and 3-45. |
| ***Gas turbines and stationary engines***<br><br>(Methodology factsheet: Public electricity production) | | | |
| $SO_2$ | T2 | Direct emissions measurement.<br>Stoichiometric balance.<br>EMEP/EEA Guidebook (2019) Part B, Chapter 1.A.1.a. | Data provided by installations via IQ.<br>In absence of direct measurements.<br>In absence of data: default EF.<br>Tables 3-5, 3-17 to 3-20. |
| NOx | T2 | Direct emissions measurement.<br>EMEP/EEA Guidebook (2019) Part B, Chapter 1.A.1.a. | Data provided by installations via IQ.<br>In absence of data: default EF.<br>Tables 3-5, 3-17 to 3-20. |
| $PM_{2.5}$, $PM_{10}$, TSP<br><br>BC | T1/T2<br><br>T1 | Mixed methodology based on direct emissions measurement and default EF from CEPMEIP.<br>EMEP/EEA Guidebook (2019) Part B, Chapter 1.A.1.a. | Data (TSP) provided by installations via questionnaire; distribution of $PM_{2.5}$ and $PM_{10}$ fractions based on CEPMEIP Database.<br>In absence of data: CEPMEIP default EF.<br>Default EF: % of the $PM_{2.5}$.<br>Tables 3-5, 3-17 to 3-20. |
| Cd, Hg, Pb | T1 | EMEP/CORINAIR Guidebook (2007) Part B, Chapter 111. | Default EF.<br>Table 31, DBB. |
| PAHs | T1 | EMEP/EEA Guidebook (2019) Part B, Chapter 1.A.1.a.<br>Chapter 1.A.4. | Default EF.<br>Tables 3-5, 3-6 and 3-17 to 3-20.<br>Tables 3-9, 3-28, 3-31. |
| PCBs | T1 | EMEP/EEA Guidebook (2013) Part B, Chapter 1.A.1.a. | Default EF.<br>Table 3-19. |

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| NMVOC | T1/T2 | Direct emissions measurement.<br>EMEP/EEA Guidebook (2019) Part B, Chapter 1.A.1.a. | Data provided by installations via IQ.<br>In absence of data: default EF.<br>Tables 3-5, 3-17 to 3-20. |
| CO | T1/T2 | Direct emissions measurement.<br>EMEP/EEA Guidebook (2019) Part B, Chapter 1.A.1.a. | Data provided by installations via IQ.<br>In absence of data: default EF.<br>Tables 3-5, 3-17 to 3-20. |
| ***MSW incineration plants (with energy recovery)***<br><br>(Methodology factsheet: MSW incineration power plants) | | | |
| Main Pollutants, PM, BC, Heavy Metals, PCDD/PCDF, PAHs, HCB, PCBs | T1/T2 | Direct emissions measurement.<br>EMEP/EEA Guidebook (2019) Part B, Chapter 5.C.1.a. | Emission data and abatement techniques provided by installations via IQ.<br>In absence of data: default EF by tonne of waste table 3-2 (1990-1995, it was assumed only “Particle Abatement” as control techniques) and table 3-1 (1996-2015, it is considered as a minimum “Particle Abatement + acid gas abatement”). |
| ***Industrial waste incineration plants (with energy recovery)***<br><br>(Methodology factsheet: IW incineration power plants) | | | |
| Main Pollutants, PM, BC, HM, PCDD/PCDF, PAHs, HCB | T1 | EMEP/EEA Guidebook (2019) Part B, Chapters 5.C.1.bi, 5.C.1.bii, 5.C.1.biv. | Default EF by tonne of waste.<br>Table 3-1. |
| ***Combustion in managed landfills with biogas capture; Combustion in biogas facilities; Combustion in domestic / industrial wastewater handling plants with biogas capture***<br><br>(Methodology factsheet: Managed landfills)<br>(Methodology factsheet: Biomethanization)<br>(Methodology factsheet: Domestic wastewater handling)<br>(Methodology factsheet: Industrial wastewater handling) | | | |
| NOx, CO, PM | T1 | US EPA AP-42 - 5th Edition (1998) Chapter 2.4. | Default EF.<br>Table 2.4-4. |

## A.3. Assessment

According to data from Red Eléctrica[2], the Spanish national electricity system operator, the demand for electricity in Spain during 2024 grew by 0.9% compared to 2023, after two years of decline. The balance of cross-border electricity exchanges resulted in an export value for the third consecutive year, mostly due to the growing export nature of the Portugal-Spain interconnection. However, the net exports represent a reduction of -27.0% in 2024.

In 2024, Spain experienced a decrease in electricity generation for the second consecutive year (-0.5% compared to 2023). This follows two consecutive years of growth, with a 3.5% increase in 2021 and a 5.9% increase in 2022. In this context, electricity generation in the peninsular system (around 95% of total national) was reduced by -0.5% in 2024. The most significant variations with respect to the previous year were recorded by hydroelectric power generation and solar photovoltaic, which rose by 35.5% and 18.8%, respectively, while electricity generation from coal decreased by -24.4% and combined cycle by -27.0%. Generation in the non-peninsular systems fell by -0.7% compared to year 2023. The electricity produced by the

[2] The Spanish Electricity System 2024 Report

Balearic Islands system decreased for the second consecutive year (-3.0% with respect to 2023). On the other hand, electricity generation in the Canary Islands increased for the fourth consecutive year in 2024, with a growth of 0.5% over the previous year, Ceuta saw a 0.2% increase after five years of declines, and Melilla experienced a 0.5% rise for the second consecutive year.

Red Eléctrica’s 2024 annual report states that non-renewable generation in the Spanish electricity system decreased by -11.9% compared to the previous year, registering a 43.2% share in the national generation structure. In the mainland system it was -12.8% lower than in 2023, only reaching a share of 41.0% in 2024. This decrease in non-renewable energy generation is mainly due to lower electricity generation from coal and combined cycle power plants. In the Balearic Islands, non-renewable generation dropped by -6.5% in 2024 due to a decrease in electricity generation from coal, gas turbine and combined cycle power plants. In the Canary Islands, generation from fossil fuel power plants decreased by -1.4%, due to a lower output from diesel engines, gas turbines and steam turbines, even though combined cycle power plants recorded the highest electricity generation rate ever.

Renewable production in the Spanish electricity system increased by 10.3% in 2024 compared to the previous year, registering a share in the national mix of 56.8%, a new all-time high and the majority share for the second time in history (51.2% in 2023). This year was defined by significant contributions from hydroelectric energy and particularly solar photovoltaic energy, which reached record highs in both electricity generation and share of the national energy mix.

Regarding the Spanish Inventory, category 1A1a reflects the evolution of the emitting non-renewable generation in the Spanish electricity system, as well as the influence of the economic downturn in Spain since 2007. Thus, fuel consumption recorded under category 1A1a decreased by -14.0% in 2024 compared to 2023 (-15.9% without Canary Islands), mostly due to the noticeable drop in the consumption of natural gas, the current main fuel used in electricity generation (-21.5%, the same without Canary Islands, where only liquid fuels are used for power production), and also of coals (-18.1%, equal without Canary Islands), which in 2024 were well below biomass in terms of consumption. These figures represent the lowest historical fuel consumption value ever recorded within category 1A1a (see Table 3.4.3).

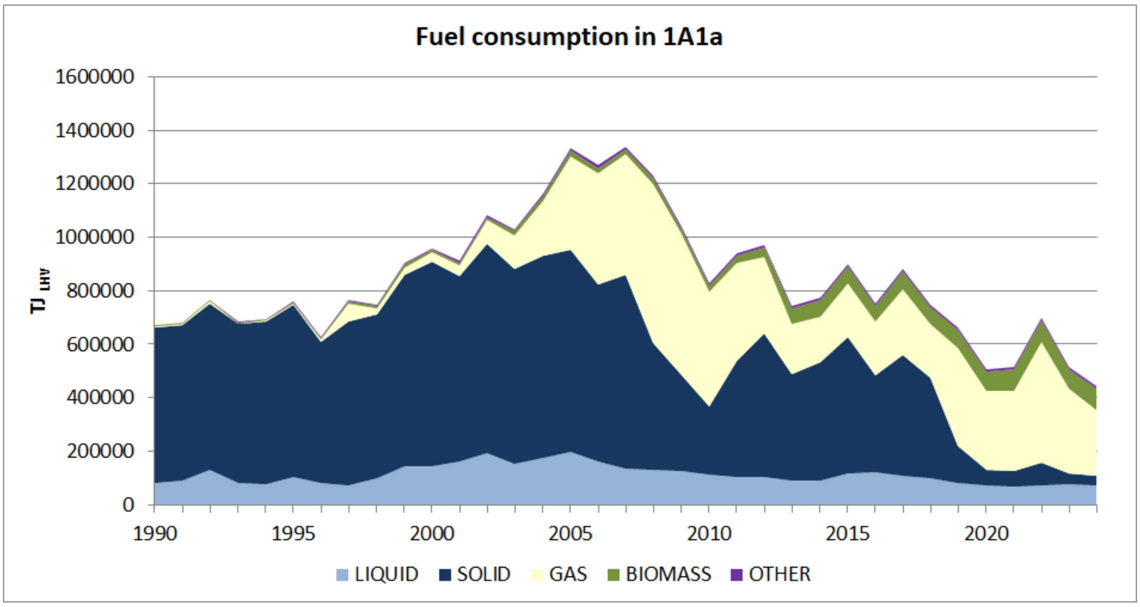



**Figure 3.4.1 Evolution of fuel consumption in category 1A1a (national territory)**

Regarding the whole time series (Figure 3.4.1), even though solid fuels have historically been the predominant type of fuel used for electricity generation, its use has clearly decreased in favour of natural gas, due to the cessation of coal mining in Spain -year 2018- and the progressive closure of coal-fired power plants. However, consumption of solids suffered a rebound in 2022. The high price of gas, whose rise has accelerated after the outbreak of the war in Ukraine, intensified the use of coal to produce electricity in most European Union countries during that year. In 2023 and 2024 the contribution of coals in the energy mix becomes almost testimonial within the national electricity system.

Among liquid fuels, as the following table shows, the main consumption corresponds to residual oil, with an increasing contribution of gas oil. As of 2006, there was a significant decrease in the consumption of residual oil, as a result of the cessation of activity of several thermal plants. In the years 2015 and 2016, there was a remarkable increase in petroleum coke burned at coal-fired thermal plants, although this trend changed in 2017 until reaching zero consumption in 2021. The rise in gas oil consumption in 2022, as a result of the high production achieved in the extra-peninsular electricity system, breaks with the downward trend in liquid fuels in recent years. In addition, in recent years gas oil is gradually replacing residual oil in some power plants in the Canary Islands.

The only IGCC plant in Spain was closed at the end of 2015, so 'Gas works gas' is no longer used in electricity generation.

Regarding gaseous fuels, the entry into operation of the Maghreb gas pipeline in 1996 was an important milestone, connecting Spain with the natural gas fields of Algeria and beginning the widespread use of this fuel throughout the country, and for electricity generation in particular. The increase in natural gas consumption is remarkable since 2002 owing to new combined cycle power stations. 2011 onwards there is a general decline in the use of natural gas, which changes dramatically in 2019. In 2022, growth in natural gas consumption accelerates, mainly motivated by the increase in combined cycle production, required for exportation of electricity that year. However, consumption levels decrease again in 2023 and 2024.

**Table 3.4.3 Fuel consumption in category 1A1a (Amounts in $TJ_{LHV}$), national territory**

| TYPE | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|
| ***LIQUID*** | ***79,773*** | ***196,391*** | ***112,188*** | ***115,148*** | ***83,307*** | ***70,090*** | ***75,051*** | ***73,286*** |
| **GAS OIL** | 6,948 | 43,525 | 44,544 | 36,701 | 34,846 | 35,123 | 43,994 | 43,209 |
| **LPG** | - | - | - | 0 | 0 | 0 | 0 | 0 |
| **OTHER LIQUID FUELS** | - | 59 | 37 | 17 | - | - | - | - |
| **PETROLEUM COKE** | - | 26,081 | 363 | 26,774 | 797 | 471 | - | - |
| **RESIDUAL OIL** | 72,825 | 126,726 | 67,244 | 51,657 | 47,665 | 34,496 | 31,057 | 30,077 |
| ***SOLID*** | ***581,240*** | ***755,577*** | ***254,251*** | ***510,772*** | ***135,441*** | ***60,330*** | ***42,509*** | ***34,822*** |
| **BLAST FURNACE GAS** | 4,784 | 9,922 | 7,672 | 11,374 | 10,350 | 6,406 | 8,098 | 9,234 |
| **BROWN COAL/LIGNITE** | 114,539 | 61,976 | - | - | - | - | - | - |
| **BROWN COAL BRIQ.** | 5,860 | - | - | - | - | - | - | - |
| **COKE OVEN GAS** | 944 | 2,410 | 530 | - | - | - | - | - |
| **GAS WORKS GAS** | - | 6,466 | 8,179 | 6,135 | - | - | - | - |
| **STEAM COAL** | 401,951 | 625,694 | 224,266 | 460,453 | 114,510 | 51,500 | 34,393 | 25,337 |
| **SUB-BITUMINOUS COAL** | 53,162 | 49,109 | 13,604 | 32,809 | 10,580 | 2,424 | 18 | 250 |
| ***GAS*** | ***7,450*** | ***351,556*** | ***430,686*** | ***203,329*** | ***366,733*** | ***292,911*** | ***315,609*** | ***247,861*** |
| **NATURAL GAS** | 7,450 | 351,556 | 430,686 | 203,329 | 366,733 | 292,911 | 315,609 | 247,861 |

| TYPE | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|
| *BIOMASS* | *3,278* | *18,649* | *23,646* | *59,716* | *66,679* | *71,764* | *72,708* | *76,373* |
| AGRICULTURAL WASTES | - | 1,080 | 2,777 | 9,373 | 13,460 | 16,586 | 13,377 | 19,212 |
| BIOGAS | 1,453 | 3,570 | 4,650 | 6,825 | 6,482 | 6,716 | 7,245 | 7,433 |
| BIOMASS FROM MSW | 1,818 | 9,021 | 10,045 | 12,834 | 12,048 | 9,985 | 11,474 | 12,715 |
| BIOMASS FROM IW | - | 101 | 124 | 7,905 | 7,872 | 7,197 | 7,422 | 7,743 |
| GAS FROM WASTE TIPS | 6 | 4,427 | 4,985 | 4,213 | 5,312 | 4,355 | 4,474 | 4,469 |
| WOOD WASTES | - | 451 | 1,065 | 18,566 | 21,506 | 26,924 | 28,716 | 24,801 |
| *OTHER FOSSIL* | *1,285* | *9,467* | *9,240* | *11,149* | *10,565* | *9,833* | *10,598* | *11,622* |
| FOSSIL FROM IW | - | 490 | 495 | 943 | 669 | 615 | 630 | 637 |
| FOSSIL FROM MSW | 1,285 | 6,598 | 7,406 | 9,441 | 8,866 | 8,238 | 9,463 | 10,493 |
| WASTE GAS | - | 2,379 | 1,339 | 766 | 1,029 | 980 | 506 | 491 |
| TOTAL | 673,025 | 1,331,640 | 830,011 | 900,113 | 662,724 | 504,928 | 516,475 | 443,963 |

For consistency with the Spanish Greenhouse Gas Inventory, in the present edition of the Inventory the biomass fraction of waste treated at incineration plants has been differentiated from the fossil fraction, throughout the entire time series. Thus, the biomass fractions of waste (both municipal and industrial) are now included within biomass consumption, while the fossil fractions are included into the 'Other fossil' fuel type.

The general trend of biomass consumption would be linked to the actions developed by the Administration for the promotion of biomass in different productive sectors, such as the Renewable Energy Plan (PER) 2005-2010 and its subsequent regulatory developments. Historically, the main fuel corresponds to biomass fraction of MSW followed by biogas from landfills and biomethanization plants. In 2013, the consumption of wood wastes together with agricultural wastes begins to gain relevance and continues its growth until 2022. This is explained by the proliferation of biomass power plants in recent years in Spain. In year 2012, the consumption of biomass from industrial waste increased significantly due to the operation of a new IW incineration plant in southern Spain. In 2023 biomass consumption decreases, with the decline being more pronounced in the case of agricultural wastes, but it will grow again in 2024.

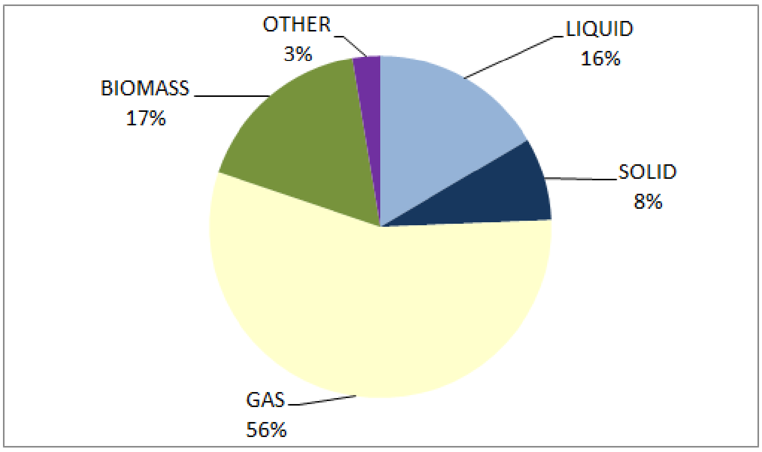



**Figure 3.4.2 Distribution of fuel consumption in category 1A1a (2024), national territory**

Finally, regarding the fuels included in 'Other fossil', the general trend was upward until year 2015, when consumption levels stabilized. Fossil fraction of MSW is the main fuel, but although its trend continues to be one of slight growth, partly due to the operation of a new

MSW incineration plant in northern Spain since 2021, this is being offset by a gradual decrease in waste gas consumption, especially from 2020 onwards.

## B. Petroleum refining (1A1b)

This NFR category 1A1b includes refineries performing many different processes. It is considered a key category for Cd for level and trend reasons, for NOx for level reasons and for $SO_2$ for trend reasons.

In Spain, there are nine[3] refineries with very diverse processes, ages, capacities and configurations.


**Figure 3.4.3 Distribution of refineries in Spain**

### B.1. Activity variables

The following table summarises the main activities considered within this category as well as the main activity data and their corresponding sources of information.

**Table 3.4.4 Summary of activity variables, data and information sources for category 1A1b**

| Activities included | Activity data | Source of information |
|---|---|---|
| Combustion processes in Refineries<br>• Boilers, gas turbines, stationary engines.<br>• Contactless processing furnaces: distillation, catalytic reforming, hydrotreatment, catalytic cracking, alkylation, hydrocracking* | **Fuel Consumption**<br>- Fuel characteristics: LHV, contents in carbon, sulphur, ash, etc. | - IQ sent to each of the nine existing refineries |

* Regarding the emissions of pollutants, consideration is given exclusively to those coming from the combustion carried out in the furnaces; the emissions that these furnaces might generate through non-combustion processes taking place inside them are included within category 1B2aiv. Additionally, the emissions from waste gas flaring are included in category 1B2c2i.

[3] The Santa Cruz de Tenerife (Canary Islands) refinery halted its production in the summer of 2014, and in June 2018 announced its decommissioning. While the process is ongoing, the plant maintains some activity that generates emissions.

## B.2. Methodology

### Table 3.4.5 Summary of methodologies applied in category 1A1b

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| ***Boilers, gas turbines, stationary engines and process furnaces***<br><br>(Methodology factsheets: Combustion in oil refining plants) | | | |
| $SO_2$ | T3/T2 | IQ | Direct emissions measurements, when available via IQ.<br>Mass balance when measurements were not available. |
| NOx | T3/T2/T1 | IQ<br>EMEP/EEA Guidebook (2023), Chapter 1.A.1 | Direct emissions measurements, when available via IQ.<br>Default EF, tables 3-4, 3-5, 3-6, 3-17, 3-18, 4-2, 4-4, 4-5 and 4-6. |
| NMVOC | T1/T2 | EMEP/EEA Guidebook (2023), Chapter 1.A.1. | Default EF, tables 3-4, 3-5, 3-6, 3-17, 3-18,<br>4-2, 4-4, 4-5 and 4-6. |
| $PM_{2.5}$, $PM_{10}$, TSP, BC | T1/T2 | IQ<br><br><br>EMEP/EEA Guidebook (2023), Chapter 1.A.1. | Direct emissions measurements, when available via IQ. With TSP measurement (generally) an in absence of $PM_{10}$ and $PM_{2.5}$ CEPMEIP Database default emission factors.<br>Default EF, tables 3-4, 3-5, 3-6, 3-17, 3-18, 4-2, 4-4, 4-5 and 4-6. |
| Cd, Pb, Hg, As, Cr, Cu, Ni, Se, Zn | T1/T2 | EMEP/EEA Guidebook (2023), Chapter 1.A.1. | Default EF, tables 3-4, 3-5, 3-6, 3-17, 3-18, 4-2, 4-4, 4-5 and 4-6. |
| PCDD/PCDF | T1/T2 | EMEP/EEA Guidebook (2023), Chapter 1.A.1. | Default EF, Tables 3-4, 3-5, 3-6, 4-4. |

## B.3. Assessment

While liquid fuels are the most used within category 1A1b Petroleum refining, there is a change in the relative share of liquid fuels between residual oil and refinery gas, particularly in the last years of the Inventory period. Thus, residual oil shows a downward trend from 2004 on, going from representing 49% of the consumption of liquid fuels in 1990 to 0.5% in 2024, and refinery gas shows an upward trend since 2010. Regarding the whole time series, this fuel varies from a 51% share of liquid fuels in 1990 to represent 98% in 2024.

The increase observed in natural gas consumption throughout the Inventory period is remarkable, as a consequence of the progressive installation of cogeneration units (gas turbines) in oil refinery plants.

Following the recommendation made by TERT (ES-1A1b-2025-0001), the trend of Cd is justified by the evolution of the energy mix consumed in the series. As already mentioned, the relative share of the used fuels has changed, resulting in a residual oil decrease, in favour of refinery gas and natural gas (see Table 3.4.6). The Tier 2 emission factors used for Cd (not changed in EMEP/EEA Guidebook 2023 with respect to the 2019 edition) are: 1.2 mg/GJ for residual oil (Table 4-6), 2.19 mg/GJ for refinery gas (Table 4.4) and 0.00025 mg/GJ for natural gas (Table 4-8). The higher EF for refinery gas and the big difference in order of magnitude between the EF for natural gas and for the other fuels results in Cd emissions to be relatively similar between 2005 and 2024 (residual oil decline is counteracted by increase in refinery gas emissions). In contrast, for example, the EFs for PM2.5 in those Tables are: 9 g/GJ for residual oil, 0.89 g/GJ for refinery gas and 0.14 g/GJ for natural gas, thus mainly reflecting the deep decrease in the use of residual oil.

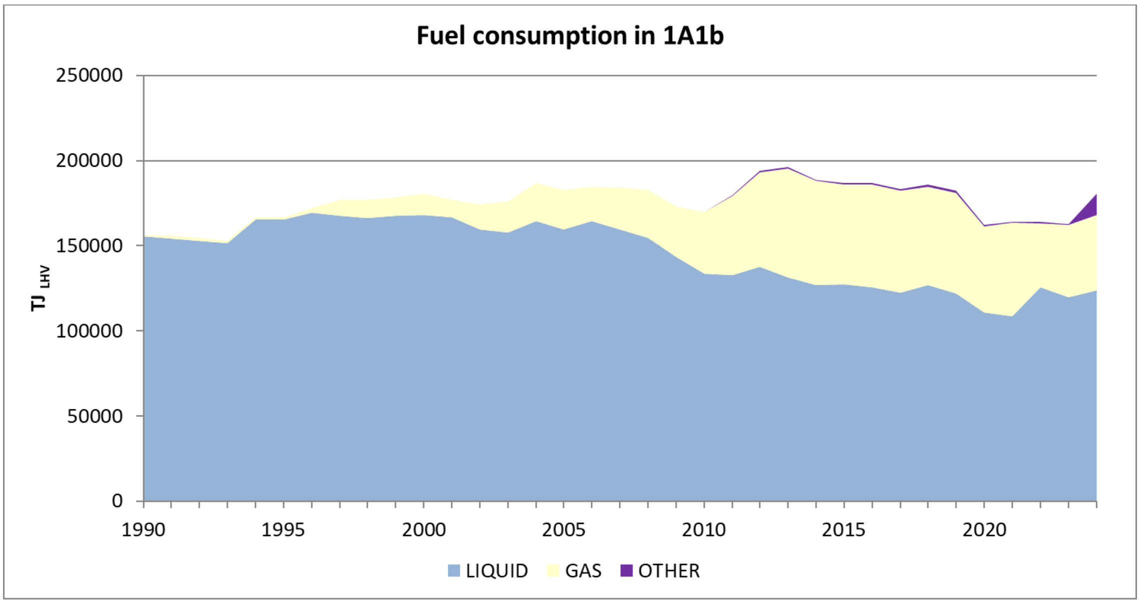



Figure 3.4.4 Evolution of fuel consumption in category 1A1b (national territory)

Table 3.4.6 Fuel consumption (Amounts in $TJ_{LHV}$), national territory

| TYPE | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|
| ***LIQUID*** | ***155,430*** | ***159,566*** | ***133,622*** | ***127,311*** | ***122,221*** | ***110,831*** | ***119,664*** | ***123,727*** |
| **GAS OIL** | 369 | 1,981 | 620 | 41 | 219 | 284 | 326 | 323 |
| **KEROSENE** | - | 22 | 2 | - | - | - | - | - |
| **LPG** | - | 172 | 143 | 115 | 121 | 4 | 1,020 | 198 |
| **NAPHTA** | 195 | - | - | - | - | - | - | - |
| **OTHER PETROLEUM PRODUCTS** | - | 1,390 | 884 | 1,461 | 1,845 | 1,714 | 957 | 1,336 |
| **REFINERY GAS** | 79,397 | 82,134 | 83,811 | 118,066 | 118,762 | 107,862 | 115,952 | 121,100 |
| **RESIDUAL OIL** | 75,469 | 73,867 | 48,164 | 7,627 | 1,275 | 968 | 1,409 | 770 |
| ***GAS*** | ***820*** | ***23,259*** | ***36,188*** | ***58,653*** | ***59,046*** | ***50,460*** | ***42,717*** | ***44,475*** |
| **NATURAL GAS** | 820 | 23,259 | 36,188 | 58,653 | 59,046 | 50,460 | 42,717 | 44,475 |
| ***OTHER*** | *-* | *-* | ***46*** | ***883*** | ***960*** | ***1,009*** | ***476*** | ***12,530*** |
| **WASTE GAS** | - | - | 46 | 883 | 960 | 1,009 | 476 | 12,530 |
| **TOTAL** | ***156,249*** | ***182,824*** | ***169,856*** | ***186,847*** | ***182,227*** | ***162,300*** | ***162,857*** | ***180,732*** |

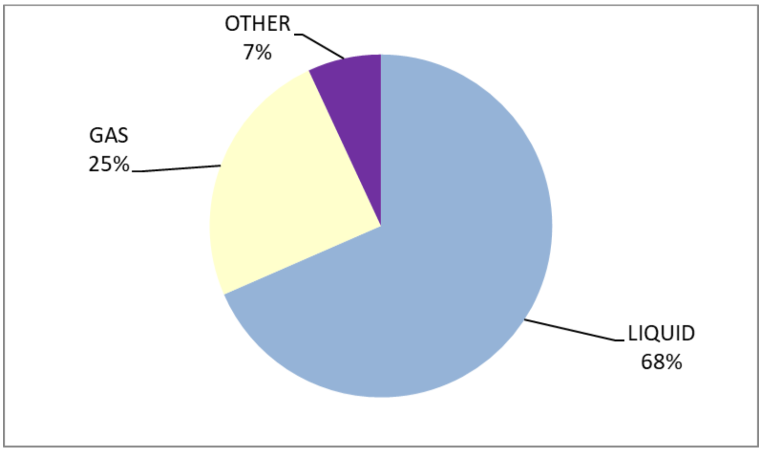



**Figure 3.4.5 Distribution of fuel consumption in category 1A1b (2024), national territory**

Except for natural gas, the fuels used at the refineries are produced onsite. Therefore, their physical and chemical characteristics vary from one plant to another and even from one year to another in the same refinery. The characteristics (ranges) for the fuels used throughout the period of the Inventory are included in the following table.

**Table 3.4.7 Fuel characteristics**

| FUEL | % SULPHUR | % CARBON | LHV | |
|---|---|---|---|---|
| | | | kcal/kg | GJ/t |
| GAS/DIESEL OIL | 0 – 0.872 | 82.70 – 87.47 | 9,542 – 10,548 | 39.76 – 43.95 |
| INDUSTRIAL WASTE | 0 – 6.8 | 0.07 – 74.05 | 60 – 16,344 | 0.25 – 68.9 |
| LPG | 0 – 0.03 | 73.30 – 81.85 | 10,548 – 11,347 | 43.95 – 46.58 |
| NAPHTA | 0 | 81.36 | 10,723 – 11,352 | 44.68 – 47.3 |
| NATURAL GAS | 0 – 0.12 | 69.32 – 78.50 | 10,728 – 12,550 | 44.7 – 52.29 |
| OTHER (*) | - | - | - | - |
| OTHER KEROSENE | 0.035 – 0.3 | 84.80 – 86.48 | 10,270 – 10,632 | 42.79 – 44.3 |
| REFINERY GAS | 0 – 5.7 | 0 – 87.77 | 7,152 – 14,124 | 29.8 – 58.85 |
| RESIDUAL OIL | 0 – 4.49 | 82.91 – 90.35 | 9,326 – 10,109 | 38.86 – 42.12 |

(*) No characteristics are given in the table for “Other” in view of the wide range of variation in the specifications of this gas and because no information is available regarding its characteristics in some refineries

## C. Combustion in industry (1A2)

This category encompasses a set of activities related to fuel combustion (including cogeneration) in different industries. According to EMEP/EEA Guidebook, emissions from autoproducers (public or private undertakings that generate electricity/heat wholly or partly for their own use, as an activity that supports their primary activity) should be assigned to the sector where they were generated and not under 1A1a.

Depending on the device used and the type of process, the Spanish Inventory data compilation is performed differentiating the following four groups:

1. Non-specific stationary industrial combustion: this group includes the emissions from non-specific industrial combustion in boilers, gas turbines and stationary engines whose purpose is the production of electricity and/or the generation of heat. Within the boilers, the Spanish Inventory compiles the emissions differentiating the ranges of rated thermal input capacity (combustion plants: RTI ≥300 MWt; combustion plants: 300 MWt > RTI ≥ 50 MWt; combustion plants: RTI <50 MWt).
2. Industrial combustion in furnaces without contact: this group includes the emissions from furnaces in which neither the flames nor the combustion gases come into contact with the products that are processed. Within this group, the Inventory compiles the emissions from blast furnaces, plaster furnaces and other type of processes.
3. Industrial combustion in furnaces with contact: this group includes the emissions from furnaces in which the flames and/or the combustion gases come into contact with the products that are processed.
4. Industrial mobile machinery: includes emissions of exhaust gases from vehicles and mobile machinery operating in open spaces, essentially in mining, construction and public works.

Besides emissions from combustion of fuels (NFR category 1A2, SNAP group 03), the Spanish Inventory reports the process emissions of each industrial process in NFR category 2, SNAP group 04).

The combustion in industry is a key category for its contribution to the level and the trend of the emissions of NOx, $SO_2$, $PM_{2.5}$, $PM_{10}$, TSP, BC, CO, Cd and Hg; and for its contribution to the level of NMVOC, Pb, PAHs, DIOX and HCB emissions.

Spanish Inventory compiles more than 60 combinations of activities and fuels from more than 70 different sources (both area and large point sources) included in industrial combustion. For this reason, all the particularities of every activity/pollutant are not fully detailed in the following tables. The main characteristics of the activity variables and the methodology are explained in the following sections.

## C.1. Activity variables

### Table 3.4.8 Summary of activity variables, data and information sources for category 1A2

| Activities included | Activity data | Source of information |
|---|---|---|
| Combustion in industry (**1A2**) | Fuel consumption and LHV by category. | AQs: Energy balance from international questionnaires elaborated by DGPCE (MITECO). |
| Stationary combustion in manufacturing industries and construction: Iron and steel (**1A2a**) | Fuel consumption by process.<br>Fuel characteristics: LHV, contents in carbon, sulphur, ash, etc. | IQ from the two existing integrated iron and steel plants.<br>For non-integrated iron and steel sector, the Inventory uses data from:<br>- MINER for 1990-1993,<br>- UNESID for 1994-2024<br>- FEAF. |
| Stationary combustion in manufacturing industries and construction: Nonferrous metals (**1A2b**) | Fuel consumption by process.<br>Fuel characteristics: LHV, contents in carbon, sulphur, ash, etc. | - Primary Aluminium: IQ from the production plants of electrolytic aluminium (1990-2022). Cessation of production in 2023. Resumption of production in 2024<br>- Primary copper: IQ from the only existing plant.<br>- Primary zinc: IQ from the only existing plant.<br>For industries listed below an estimate of fuel consumption is made based on energy requirements (GJ/tonne produced) obtained from the IPCC non-ferrous metal industry BREF.<br>Information on production has been obtained from the following sources:<br>- Primary lead: MINER.<br>- Secondary lead: IQ from five plants, UNIPLOM and MITYC.<br>- Secondary Aluminium: SGIBP-MINER, ASERAL, MITYC and INE data.<br>- Secondary Zinc: SGIBP-MINER and U.S. Geological Survey Mineral Yearbook (2014).<br>- Secondary copper: SGIBP-MINER, MITYC, UNICOBRE and U.S. Geological Survey Mineral Yearbook (2014). |
| Stationary combustion in manufacturing industries and construction: Chemicals (**1A2c**) | Fuel consumption by process. | IQ from production plants.<br>Inventory Energy Balance |
| Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print (**1A2d**) | Fuel consumption by process.<br>Fuel characteristics: LHV, contents in carbon, sulphur, ash, etc. | IQ from 8 production plants.<br>ASPAPEL |
| Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco (**1A2e**) | Fuel consumption and LHV by category. | IQ from 5 sugar plants.<br>Inventory Energy Balance |
| Stationary combustion in manufacturing industries and construction: Non-metallic minerals (**1A2f**) | Fuel consumption by process.<br>Fuel characteristics: LHV, contents in carbon, sulphur, ash, etc. | Cement: OFICEMEN.<br>Asphalt concrete plants: “Asphalt in figures”, EAPA.<br>Lime: ANCADE.<br>Glass: Vidrio España, ANFFEC.<br>Brick and tiles: HISPALYT.<br>Fine ceramics: ASCER.<br>IQ from 2 magnesite plants |
| Mobile Combustion in manufacturing industries and construction (**1A2gvii**) | Fuel consumption of machinery(*)<br>Fuel characteristics: LHV, Contents in carbon, sulphur, etc. | - 1990-1992: “Ministry of Public Works’ Statistical Yearbook”: Survey of Juncture in the construction sector. |

| Activities included | Activity data | Source of information |
|---|---|---|
| | (*) The fuel distribution by machinery type of the period 1993-1996 it is based on an expert's judgment on specialized sectorial documentation. Remaining years: fuel distribution is extrapolated based in 1996 data. | - 1993-1996: expert's judgments on specialized sectorial documentation, about: machinery fleet and activity parameters.<br>- 1996-2011: INE: Gross fixed capital formation (GFCF) in the construction sector<br>- 2012 onwards: National consumption of IEA and Eurostat international questionnaires |
| Stationary combustion in manufacturing industries and construction: Other (**1A2gviii**) | Fuel consumption by process | Others (includes various industries: car and transport material factories among others). |

In those cases where the information on fuel consumptions registered by the Inventory does not fully cover the whole sector, information is completed with the official energy statistics, through the Inventory Energy Balance.

The information coming from direct sources in 1A2 represents 53% of the entire information for the last year reported. The remaining data (47%) come from the national energy statistics, provided by the Spanish Ministry for the Ecological Transition and Demographic Challenge (MITECO). Therefore, the contribution of energy statistics to 1A2 emission estimates is quite significant.[4]

## C.2. Methodology

The methodological approach for all industrial combustion activities is similar. The following table summarizes the general approach followed for estimating all activities as well as the methodology for activities with different approaches within this 1A2 category.

### Table 3.4.9 Summary of methodologies applied in category 1A2

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| General approach | T1/T2 | IQ | Within the IQ, the plants provide measured emissions, specific emission factors or default emission factors. |
| | | Entrepreneurial associations. | The collaboration of the Inventory with associations of reference in different sectors derives in certain cases in national specific emission factors. |
| | | EMEP/EEA Guidebook (2019) & EMEP/CORINAIR Guidebooks.<br>CEPMEIP.<br>PARCOM-ATMOS etc. | In the cases that the Inventory cannot obtain national specific information, default information would be used according to the best available default technology-specific factors. |
| ***Non-specific industrial combustion***<br><br>(Methodology factsheet: Non - specific industrial stationary combustion) | | | |
| NOx, NMVOC, CO, $SO_2$, $NH_3$, PM, CO, HM, PCDD/PCDF, | T3/T2/T1 | EMEP/EEA Guidebook (2016) & EMEP/CORINAIR Guidebooks. | |

[4] See Appendix 3.1: Inventory energy balance (IEB).

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| PAHs, HCB, PCBs | | | |
| ***Iron and steel (1A2a)***<br><br>(Methodology factsheets: Sintering plants (combustion); Blast furnace cowpers; Combustion in other furnaces without contact; Iron and steel reheating furnaces) | | | |
| NOx, NMVOC, $SO_2$, PM, CO, HM, PCDD/PCDF, PAHs, HCB, PCBs | T3/T2/ T1 | IQ.<br>EMEP/EEA Guidebook (2019) Chapter 1.A.1, 1.A.2, 1.A.4.<br>EMEP/CORINAIR Guidebooks Chapters B333.<br>CEPMEIP.<br>PARCOM-ATMOS. | Information from IQ from integrated steel plants has been obtained for several pollutants and years. As this information is not homogeneous and sustained over the years, the Spanish Inventory completes the information from measurements with the best available emission factors. |
| ***Non-Ferrous Metals (1A2b)***<br><br>(Methodology factsheets: Combustion in other furnaces without contact; Non ferrous metal production (combustion)) | | | |
| NOx, NMVOC, $SO_2$, PM, CO, HM, PCDD/PCDF, PAHs, HCB, PCBs | T2/T1 | IQ.<br>EMEP/EEA Guidebook (2019) Chapters 1A1, 1A2 and 1A4.<br>CEPMEIP. | Mass balance ($SO_2$).<br>EF |
| ***Chemicals (1A2c)*** | | | |
| NOx, NMVOC, $SO_2$, $NH_3$, PM, CO, HM, PCDD/PCDF, PAHs, HCB, PCBs | T3/ T2 | IQ.<br>EMEP/EEA Guidebook (2019) Chapter 1.A.2. | Information from IQ.<br>EF |
| ***Pulp, Paper and Print (1A2d)*** | | | |
| NOx, NMVOC, $SO_2$, $NH_3$, PM, CO, HM, PCDD/PCDF, PAHs, HCB, PCBs | T2/T1 | IQ<br>EMEP/EEA Guidebook (2019) Chapter 1A1, 1A2.<br>EMEP/CORINAIR Guidebooks Chapters B111, B321.<br>OSPARCOM-HELCOM-UNECE (1995).<br>CEPMEIP. | Mass balance ($SO_2$).<br>EF |
| ***Food Processing, Beverages and Tobacco (1A2e)*** | | | |
| NOx, NMVOC, $SO_2$, $NH_3$, PM, CO, HM, PCDD/PCDF, PAHs, HCB, PCBs | T2 | EMEP/EEA Guidebook (2019) Chapter 1.A.2. | EF |
| ***Cement (under 1A2f)*** | | | |
| $NO_X$, NMVOC, $SO_2$, $NH_3$, PM, HM, PCDD/PCDF, PCBs | T2 | OFICEMEN | EF<br>OFICEMEN 1990-2005: OFICEMEN estimated the expected evolution of the incorporation of reduction technologies, as well as their impact on the emissions of the pollutants considered.<br>OFICEMEN 2005: OFICEMEN provided EFs as an average of the values measured within the Environmental |

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| | | | Benchmarking programme for 2003. Afterwards, OFICEMEN provided representative EFs based on measurement programs developed during the years 2007-2011, 2009-2013, 2011-2015, 2014-2018, 2016-2020, 2018-2022. |
| ***Non-metallic Minerals (except Cement) (1A2f)*** | | | |
| NOx, NMVOC, $SO_2$, $NH_3$, PM, CO, HM, PCDD/PCDF, PAHs, HCB, PCBs | T2 | EMEP/EEA Guidebook 2019 Chapter 1.A.2. | EF |
| ***Other (1A2gvii) Mobile Combustion in manufacturing industries and construction*** (Methodology factsheet: Mobile machinery) | | | |
| NOx, NMVOC, $SO_2$, $NH_3$, PM, HM (except Pb, Hg, As), PAHs | T2/T1 | EMEP/EEA Guidebook (2023) Chapter 1.A.4 | EF |
| ***Other (1A2gviii) Other:*** | | | |
| NOx, NMVOC, $SO_2$, $NH_3$ , PM, CO, HM, PCDD/PCDF, PAHs, HCB, PCBs | T2 | EMEP/CORINAIR Guidebooks Chapters B111, B112. EMEP/EEA Guidebook (2019) Chapter 1.A.2. OSPARCOM-HELCOM-UNECE (1995). CEPMEIP. | EF |

## C.3. Assessment

The consumption of liquid and gaseous fuels in 1A2 shows opposite trends along the Inventory period. While liquid fuels show a downward trend (in 1990 they accounted for 45% of the total consumption and 13% in 2024), gaseous fuels increased their participation from 25% in 1990 to 60% in 2024. Biomass fuels show a steady trend throughout the period.

The most representative fuels for 2024 besides natural gas (60%) are wood wastes (13%), petroleum coke (7%), black liquor (4%) and diesel oil (4%).

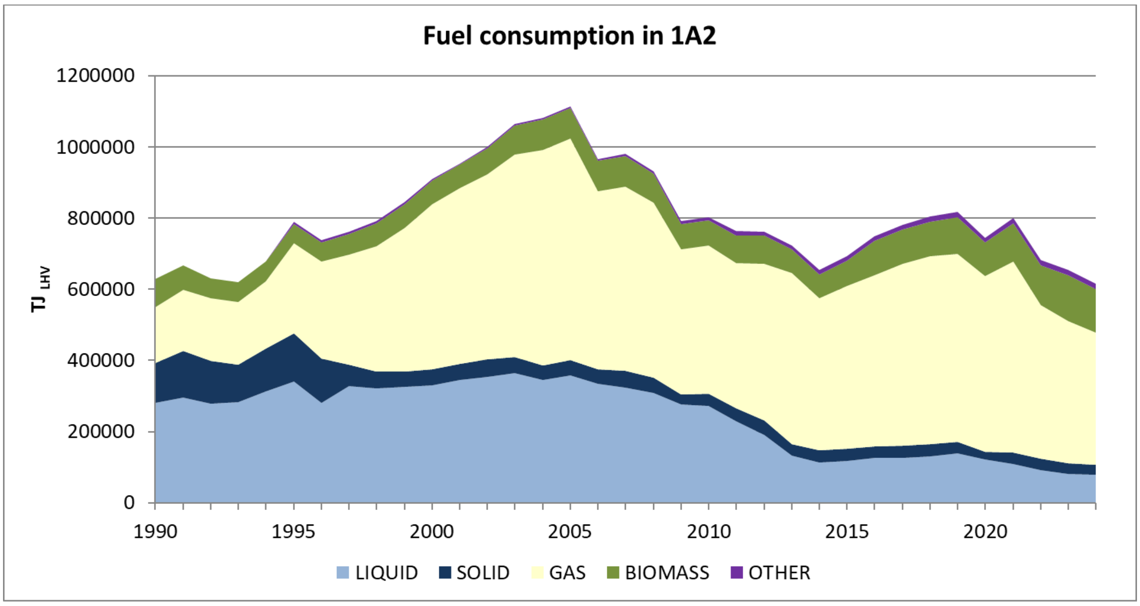



**Figure 3.4.6 Evolution of fuel consumption in category 1A2 (national territory)**

**Table 3.4.10 Fuel consumption (Amounts in $TJ_{LHV}$), national territory**

| TYPE | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|
| ***LIQUID*** | ***281,623*** | ***359,006*** | ***272,452*** | ***117,096*** | ***139,579*** | ***121,337*** | ***82,293*** | ***79,130*** |
| BITUMEN | - | - | 34 | 42 | 127 | 10 | - | - |
| CRUDE OIL | - | - | - | 181 | - | - | - | - |
| DIESEL OIL ROAD TRANSPORT | 52,003 | 58,544 | 45,260 | 22,498 | 31,635 | 26,981 | 22,433 | 23,210 |
| GAS OIL | 429 | 41,964 | 46,804 | 2,449 | 17,071 | 20,381 | 1,095 | 845 |
| LPG | 9,933 | 10,970 | 3,317 | 594 | 593 | 590 | 2,041 | 542 |
| OTHER LIQUID FUELS | - | - | 788 | 709 | 1,628 | 1,662 | 415 | 777 |
| PETROLEUM COKE | 57,124 | 135,527 | 126,949 | 55,596 | 57,915 | 48,036 | 44,025 | 43,353 |
| REFINERY AND PETROCHEM, GAS | 1,344 | - | - | - | - | - | - | - |
| RESIDUAL OIL | 160,790 | 112,002 | 49,301 | 35,027 | 30,609 | 23,678 | 12,285 | 10,402 |
| ***SOLID*** | **110,162** | **41,011** | **33,566** | **35,119** | **32,312** | **23,148** | **28,792** | **28,590** |
| BLAST FURNACE GAS | 16,501 | 8,189 | 6,963 | 8,501 | 8,739 | 6,892 | 6,563 | 7,777 |
| COKE OVEN COKE | 16,288 | 9,280 | 7,402 | 6,712 | 6,434 | 4,849 | 5,341 | 6,027 |
| COKE OVEN GAS | 15,057 | 7,690 | 6,634 | 3,883 | 2,632 | 1,063 | 5,502 | 4,746 |
| GAS WORKS GAS | 81 | - | - | - | - | - | - | - |
| STEAM COAL | 60,830 | 14,460 | 11,068 | 14,574 | 13,485 | 9,596 | 10,395 | 9,415 |
| STEEL PLANT FURNACE GAS | 732 | 1,393 | 1,359 | 1,329 | 1,022 | 748 | 991 | 625 |
| SUB-BITUMINOUS COAL | 673 | - | 140 | 118 | - | - | - | - |
| ***BIOMASS*** | **78,856** | **84,589** | **69,823** | **72,071** | **103,318** | **94,657** | **127,869** | **123,034** |
| AGRICULTURAL WASTES | - | 18 | 17 | 329 | 584 | 688 | 981 | 1,351 |
| ANIMAL MEAL | - | 1,033 | 835 | 1,165 | 1,408 | 1,271 | 1,284 | 1,207 |
| BIOGAS | 363 | 490 | 891 | 1,044 | 1,473 | 1,353 | 1,676 | 2,010 |
| BLACK LIQUOR | 18,217 | 32,106 | 30,897 | 31,613 | 21,425 | 21,070 | 24,652 | 25,110 |
| CELLULOSE | - | - | 25 | - | - | - | - | - |
| SEWAGE SLUDGE | - | 315 | 823 | 399 | 257 | 324 | 220 | 222 |
| WOOD WASTES | 60,276 | 50,627 | 36,334 | 37,523 | 66,349 | 58,597 | 84,191 | 77,840 |

| TYPE | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|
| BIOMASS INDUSTRIAL WASTE | - | - | - | - | 11,822 | 11,354 | 14,864 | 15,185 |
| ***GAS*** | **157,084** | **624,432** | **417,243** | **456,850** | **528,183** | **493,156** | **400,186** | **370,193** |
| NATURAL GAS | 157,084 | 624,432 | 417,243 | 456,850 | 528,183 | 493,156 | 400,186 | 370,193 |
| ***OTHER*** | **853** | **5,310** | **9,383** | **11,807** | **13,624** | **13,124** | **15,200** | **15,436** |
| INDUSTRIAL WASTES | 853 | 2,015 | 7,171 | 4,510 | 6,988 | 6,320 | 5,502 | 5,048 |
| OTHER LIQUID WASTES | - | 1,284 | 474 | 1,011 | 123 | 148 | - | 3 |
| REFUSE DERIVED FUELS | - | - | 438 | 5,682 | 5,986 | 6,123 | 9,103 | 9,805 |
| WASTE GAS | - | 921 | - | - | - | - | - | - |
| WASTE SOLVENTS | - | 1,089 | 1,299 | 605 | 527 | 533 | 595 | 579 |
| ***TOTAL*** | **628,578** | **1,114,349** | **802,468** | **692,942** | **817,016** | **745,422** | **654,341** | **616,382** |

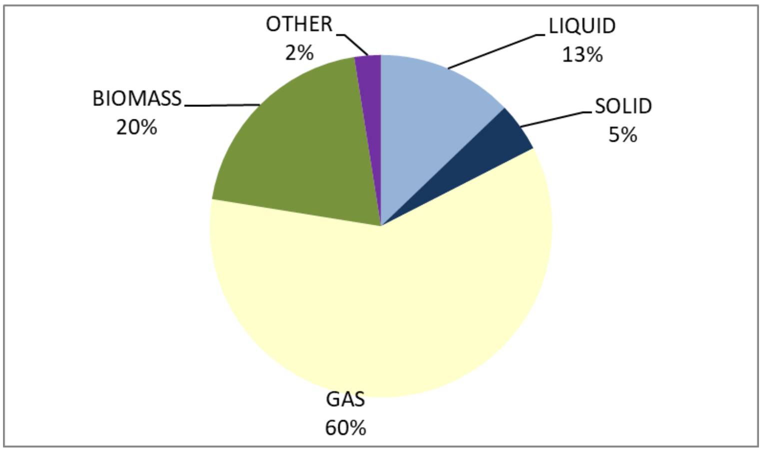



**Figure 3.4.7 Distribution of fuel consumption in category 1A2 (2024), national territory**

## D. Air traffic at airports (1A3a)

Two types of air traffic (segments) may be distinguished based on country of origin and destination for flights, regardless of air carrier nationality; thus, domestic traffic is defined as all airplane traffic between two Spanish airports, and international traffic includes all flights whose origin or final destination is a foreign airport[5].

This category includes activities related to the combustion of fuel by aircraft near the airport that take place below a height of 3,000 ft (914.4 m): landing and take-off cycles, LTO, from both national and international flights.

Cruise stage –national and international- is reported as "Memo item" in the NFR reporting tables for informative purposes.

Aviation (1A3a) is a key category for its contribution to the level of the emissions of NOx.

### D.1. Activity variables

**Table 3.4.11 Summary of activity variables, data and information sources for category 1A3a**

| Activities included | Activity data | Source of information |
|---|---|---|
| Civil air traffic | Spanish Civil Airports landing and take-off cycles (LTO): Number of LTO cycles by segment flight, departure and arrival airport, and by aircraft type. | 2005-2024: EUROCONTROL ("European Organisation for the Safety of Air Navigation").<br>Remaining years: Statistical adjustment based on airports data from Directorate General for Civil Aviation (DGAC) at the Ministry of Transport and Sustainable Mobility. |
| | Domestic and international air traffic (kerosene consumption). | 2005-2024: EUROCONTROL ("European Organisation for the Safety of Air Navigation").<br>Remaining years: Statistical adjustment based on jet fuel sales from National energy statistics elaborated by MITECO (AQ-AOS) and sent to IEA and EUROSTAT. |
| | Air traffic of piston engine aircraft (aviation gasoline consumption). | 2005-2024: EUROCONTROL ("European Organisation for the Safety of Air Navigation") data adjusted to total aviation gasoline consumption sales from National energy statistics elaborated by MITECO (AQ-AOS) and sent to IEA and EUROSTAT.<br>Remaining years: Statistical adjustment based on aviation gasoline sales from National energy statistics elaborated by MITECO (AQ-AOS) and sent to IEA and EUROSTAT. |

### D.2. Methodology

**Table 3.4.12 Summary of methodologies applied in category 1A3a**

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| ***Jet and Turboprop aircraft***<br><br>(Methodology factsheet: Air traffic) | | | |

[5] In the case of international aviation, flights from or to the Canary Islands are not included in the data reported to Directive (EU) 2016/2284.

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| NOx, NMVOC, $SO_2$, PM, CO | T3, T1 | EUROCONTROL European Aviation Fuel Burn and Emissions Inventory System. Tier 1 methodology for time series 1990 – 2004. | EF:<br>- FEIS model from EUROCONTROL.<br>- Statistical adjustment based on emissions for each departure and arrival airport. |
| As, Cd, Cr, Cu, Hg, Ni, Pb, Se, Zn | T1 | EMEP/EEA Guidebook (2023) Chapter 1A3a. | EF:<br>- Annex 2: Additional comments on emission factors: "general emission factors for the stationary combustion of kerosene and the combustion of gasoline in cars may be applied".<br>- Kerosene: EMEP/EEA (2023) 1A1. Table 3-20 |
| PAHs | T3, T1 | EUROCONTROL European Aviation Fuel Burn and Emissions Inventory System. Tier 1 methodology for time series 1990 – 2004. | EF:<br>- FEIS model from EUROCONTROL.<br>- Statistical adjustment based on emissions for each departure and arrival airport.<br>- Speciation of PAHs is based on general emission factors for small stationary combustion of kerosene from EMEP/EEA (2023) 1A4. Table 3-9. |
| BC | T1 | EMEP/EEA Guidebook (2023) Chapter 1A3a. | EF:<br>- Table A3.2: % of $PM_{2.5}$. |
| ***Piston engine aircraft***<br><br>(Methodology factsheet: Air traffic) | | | |
| NOx, NMVOC, $SO_2$, PM, CO | T3, T1 | EUROCONTROL European Aviation Fuel Burn and Emissions Inventory System. Tier 1 methodology for time series 1990 – 2004. | EF:<br>- FEIS model from EUROCONTROL.<br>- Statistical adjustment based on emissions for each departure and arrival airport. |
| As, Cd, Cr, Cu, Hg, Ni, Se, Zn | T1 | EMEP/EEA Guidebook (2023) Chapter 1A3a. | EF:<br>- Annex 2: Additional comments on emission factors: "general emission factors for the stationary combustion of kerosene and the combustion of gasoline in cars may be applied".<br>- Avgas: EMEP/EEA (2023) 1A3b. Table 3-90. |
| PAHs | T3, T1 | EUROCONTROL European Aviation Fuel Burn and Emissions Inventory System. Tier 1 methodology for time series 1990 – 2004. | EF:<br>- FEIS model from EUROCONTROL.<br>- Statistical adjustment based on emissions for each departure and arrival airport.<br>- Speciation of PAHs is based on general emission factors for gasoline in cars from EMEP/EEA (2023) 1A3b. Table 3-87. |
| Pb | T1 | EMEP/EEA Guidebook (2023) Chapter 1A3a. | EF:<br>- Annex 2: Additional comments on emission factors.<br>- EF calculated from the Pb content in Avgas applied to the Avgas density. |
| BC | T1 | EMEP/EEA Guidebook (2023) Chapter 1A3a. | EF:<br>- Table A3.2: % of $PM_{2.5}$. |

EUROCONTROL has developed a Fuel Burn and Emissions Inventory System (FEIS) that produces estimates of the total mass of jet fuel (for aircraft powered by turbojet, turbofan or turboprop engines) burnt by all the aircraft that, during a year, made relevant flights that departed from, arrived at —or both—, an airport (or aerodrome) that is located in a relevant part of the territory of one of the 27 EU Member States. The total masses of certain gaseous species and types of PM that were emitted by the burning of this jet fuel are also estimated.

The system developed by EUROCONTROL concerns the aircraft movement information of any flight that has a part of its trajectory within the EUROCONTROL zone of coverage; it concerns only Instrumental Flight Rules flights (no Visual Flight Rules flights), and all flights operated as military or special operations are excluded.

Because information about trajectory followed by an aircraft when it is below 3,000 feet is not usually available, the calculation used in the FEIS procedure is considered as a mix of Tier 3A and Tier 3B according to EMEP/EEA Guidebook (2023):

- Cruise stage (Advanced Emissions Model): Tier 3B calculation on a “flight segment by flight segment” basis, using as the main source the EUROCONTROL’s PRISME database, which contains the corrected flight plan for each trajectory of a flight with at least a part inside EUROCONTROL airspace. For aircraft movements partly or completely outside of the EUROCONTROL zone of coverage, trajectories are completed or generated from commercial aircraft schedule databases.
- LTO stages (below 3,000 feet): a Tier 3A calculation is performed with the assumption that the LTO stages are described by an ICAO LTO cycle (default ICAO taxi-in and taxi-out times) which are replaced by more accurate values if available (EUROCONTROL’s Central Office for Delay Analysis —CODA—produces specific airport taxi times from an annual list of average measured taxi times for a large number of European airports).

### D.3. Assessment

The following data are expressed in terms of national territory totals. Fuel consumption in 1A3a has experienced a sustained increment throughout the Inventory period as a direct consequence of the growth in air traffic, in continuous expansion. It is worth mentioning the decline starting in 2007 due to the economic downturn, which turns into an increase in 2014. This general trend is smoother in domestic aviation where pre-crisis consumption figures have not yet recovered, while it is noteworthy the marked rise in international consumption, which maintained an average growth close to 7% for the period 2015-2019 (over 7% without Canary Islands). However, both trends dropped drastically in 2020 due to COVID-19 pandemic mobility restrictions. In 2024, pre-COVID-19 levels have been surpassed in domestic air traffic, with an increase of 6.2% compared to 2019 (6.9% without Canary Islands). The same situation occurs with international traffic, which has increased 3% in 2024 compared to 2019 (2.3% without Canary Islands).

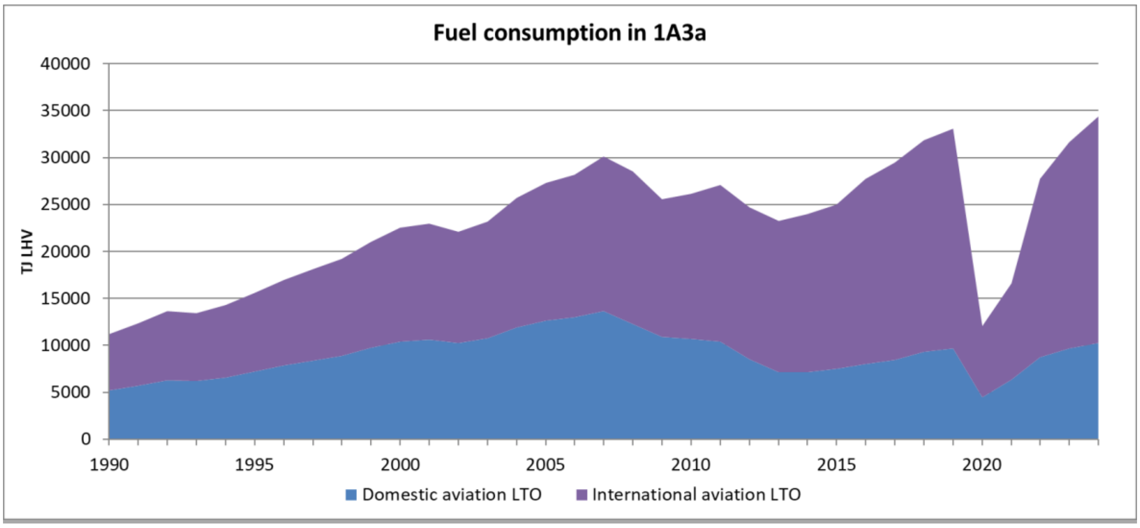



**Figure 3.4.8 Evolution of fuel consumption in 1A3a (national territory)**

## E. Road Transport (1A3b)

This category encompasses pollutant emissions from traffic of road vehicles whose main purpose is the transportation of passengers or freight. Self-propelled vehicles that are classified and used as industrial or agricultural-forestry machinery are included in categories 1A2 and 1A4.

The emissions of road transport are estimated with an own emission calculation tool based in software COPERT 5.5.1 and according to the guidelines of EMEP/EEA 2019 Guidebook (October 2021). In the 2023 Inventory Edition, emission factors were updated following the recommendation made by the ERT in the Spanish Stage 3 centralised Review Report (2022) of the UNECE LRTAP Convention[6]. In regard to the recommendation ES-1A3b-2025-0001 made by the TERT in the Final Review Report 2025 (Review of National Air Pollutant Emission Inventory Data 2025 under Directive (EU) 2016/2284)[7] of updating the methodology to be compliant with the EMEP/EEA 2023 Guidebook and COPERT 5.8, the update is planned and in process, but it has not been possible to accomplish it in the present Inventory Edition.

In the present Inventory Edition, total mileage and its breakdown has been updated for 2023, as well as gasoline consumption for 2022 and 2023, and diesel consumption for 2023. Vehicle fleet data of 2024 has been replicated with 2023 information due to the absence of any further information for this year. In addition, following the recommendation ES-1A3bi-2025-0001 made by the TERT in the Final Review Report 2025 (Review of National Air Pollutant Emission Inventory Data 2025 under Directive (EU) 2016/2284), total PAH emission factors and its species of diesel passenger cars and light commercial vehicles have been reviewed and modified for the whole series, using only Direct Injection diesel emission factors since Euro 3 vehicles, in place of the average of Direct and Indirect Injection emission factors.

Road transport is one of the main contributors to the emissions in the whole Spanish inventory, therefore is a key category for its contribution to the level and trend of the emissions of NOx, NMVOC, Particulate Matter, Black Carbon, CO and Pb. Additionally, is a key category for its contribution to the trend of the emissions of $SO_2$ and $NH_3$, and to the level of the emissions of Cd, Hg, PCDD/PCDF and PAHs.

### E.1. Activity variables

**Table 3.4.13 Summary of activity variables, data and information sources for category 1A3b**

| Activities included | Activity data | Source of information |
|---|---|---|
| Road transport | **Fuel consumption** | - AQs: National energy balances elaborated by MITECO, and sent to IEA and EUROSTAT.<br>- “Oil-derived Product Consumption Statistics” by the Sub-Directorate-General for Hydrocarbons at MITECO. |

[6] Stage 3 Review Report available in: https://www.ceip.at/status-of-reporting-and-review-results/2022-submission

[7] Final Report available at: https://environment.ec.europa.eu/topics/air/reducing-emissions-air-pollutants/emissions-inventories_en#review-of-national-emission-inventories

| Activities included | Activity data | Source of information |
|---|---|---|
| | **Vehicle fleets**<br>Number of registered vehicles classified by type:<br>- Vehicle category,<br>- Fuel type,<br>- Engine capacity or maximum authorised mass,<br>- Year of registration | - 2007-2023: Statistics elaborated by the DGT (Spanish Traffic Department) of the Ministry of Interior.<br>Remaining years: Estimation based on "Anuario Estadístico General" ("General Statistical Yearbook") published by the DGT (Spanish Traffic Department) of the Ministry of Home Affairs. In order to ensure consistency between the two data sets, the available disaggregated information of vehicle type by year of registration (from 1900 to 2006) of year 2007 was used to extrapolate trends and complete the missing information of the older statistics, which is classified in wider groups. Thus, the same detail level was achieved for all years inventoried. This explanation has been included following the recommendation made by the ERT in the Spanish Stage 3 centralised Review Report (2022) of the UNECE LRTAP Convention[8]. |
| | **Distances travelled**<br>- Journeys including the National Road Network (Red de Carreteras del Estado), Regional Community networks and Provincial networks, broken down by vehicle category and driving patterns (interurban and rural routes).<br>- Distances travelled in urban driving pattern. | - Statistics from General Directorate for Roads (Ministry of Transport and Sustainable Mobility).<br>- Study of annual distances travelled by vehicles subject of Technical Inspection of Vehicles (ITV) in 2017 and 2021-2023 (DGT of Ministry of Home Affairs) |
| | **Distribution of vehicle journeys**<br>- Distribution of the journeys for each vehicle category into driving patterns (interurban, rural and urban routes), depending on the fuel type, cylinder capacity, max. authorised mass and year of registration, prepared by the inventory team based on the referred information. | - Statistics from General Directorate for Roads (Ministry of Transport and Sustainable Mobility).<br>- Studies of road sampling carried out in the city of Madrid during the years 2008/2009, 2013, 2017 and 2022 (General Directorate of Sustainability and Environmental Control of Madrid City Council)<br>- "Standing Survey of Road Freight" EPTMC, prepared by DGC (Subdirectorate-General for Statistics and Surveys at the Directorate-General for Economic Programming, of the Ministry of Transport and Sustainable Mobility). |

[8] Stage 3 Review Report available in: https://www.ceip.at/status-of-reporting-and-review-results/2022-submission

## E.2. Methodology

### Table 3.4.14 Summary of methodologies applied in category 1A3b

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| ***Passenger cars (1A3bi), Light commercial vehicles (1A3bii), Heavy duty vehicles (1A3biii) and motorcycles (1A3biv)***<br><br>(Methodology factsheet: Road transport: combustion) | | | |
| $SO_2$, HM | T1, T3 | EMEP/EEA Guidebook 2019 (October 2021). Chapter 1.A.3.b.i, 1.A.3.b.ii, 1.A.3.b.iii, 1.A.3.b.iv | EF:<br>- Emissions dependent on fuel consumption and HM content, assuming that all the sulphur and heavy metals content into fuel are emitted to the atmosphere.<br>- Lubricants*: HM emissions are dependent on lubricant consumption |
| CO, NOx, NMVOC, PM[9] | T3 | EMEP/EEA Guidebook 2019 (October 2021). Chapter 1.A.3.b.i, 1.A.3.b.ii, 1.A.3.b.iii, 1.A.3.b.iv | EF:<br>- Specific for each vehicle category, fuel and engine size.<br>- Two types of emissions considered:<br>- hot emissions (speed dependent) in three different driving patterns (see table 3.4.15 below).<br>- additional cold emissions during transient thermal engine operation, related to meteorological conditions. |
| $NH_3$ | T3 | EMEP/EEA Guidebook 2019 (October 2021). Chapter 1.A.3.b.i, 1.A.3.b.ii, 1.A.3.b.iii, 1.A.3.b.iv | EF:<br>- Related to vehicle mileage and fuel sulphur content. |
| PAHs, POPs, PCDD/PCDF, PCBs | T3 | EMEP/EEA Guidebook 2019 (October 2021). Chapter 1.A.3.b.i, 1.A.3.b.ii, 1.A.3.b.iii, 1.A.3.b.iv | EF:<br>- Values provided for all vehicle categories. |
| BC | T3 | EMEP/EEA Guidebook 2019 (October 2021). Chapter 1.A.3.b.i, 1.A.3.b.ii, 1.A.3.b.iii, 1.A.3.b.iv | EF:<br>- % of $PM_{2.5}$ |
| ***Evaporative emissions (1A3bv)***<br><br>(Methodology factsheet: Road transport: evaporative emissions) | | | |
| NMVOC | T3 | EMEP/EEA Guidebook 2019. Chapter 1.A.3.b.v | EF:<br>- Emission factors depending on the temperature profile and the driving and parking pattern over the day, for uncontrolled and canister equipped vehicles. |
| ***Tyre and brake wear (1A3bvi) and road abrasion (1A3bvii)***<br><br>(Methodology factsheet: Road transport: tyre and brake wear and road abrasion emissions) | | | |
| PM, HM, PAHs | T2 | EMEP/EEA Guidebook 2019. Chapter 1.A.3.b.vi, 1.A.3.b.vii | EF:<br>- Emissions dependent on travelled distances (1.A.3.b.vi, 1.A.3.b.vii) and speed (1.A.3.b.vi)<br>- EF given in section 1.A.3.b.vi/vii. |
| BC | T1 | EMEP/EEA Guidebook 2019. Chapter 1.A.3.b.vi, 1.A.3.b.vii | EF:<br>- % of PST |

The following table describes in more detail the parameters used in the methodology.

[9] Regarding Particulate Matter, it is assumed that all of the emission is concentrated in $PM_{2.5}$

**Table 3.4.15 Methodological issues**

| Parameter | Description | Explanation |
|---|---|---|
| Vehicle classification | European regulations introducing common requirements for emissions from motor vehicles (EURO standards). | Those regulations have been considered taking into account the year of registration of the vehicles as an indicator of the vehicles' environmental characteristics, thus allowing the creation of a correspondence between the age of the fleet and the categories defined in EMEP/EEA Guidebook 2019. |
| Driving patterns | Three driving patterns defined by EMEP/EEA Guidebook 2019:<br>- *highway driving (I)*,<br>- *rural driving (R)*, and<br>- *urban driving (U)*. | A distinction has been made between vehicle categories before determining average speeds, taking into account the different characteristics of the vehicles. |
| Running fleet | Distribution of the total distance travelled for each vehicle type: category, fuel type, segment (engine capacity or max. authorised mass) and EURO standards by driving pattern. | The distribution of the running fleet has been estimated by the inventory team based on road sampling studies carried out in the city of Madrid in years 2008/2009, 2013, 2017 and 2022 (General Directorate of Sustainability and Environmental Control of Madrid City Council) and the fleet characterization of each year, ensuring the temporal coherence along the inventory period.<br>In the case of highway and rural driving patterns, the distribution of heavy duty trucks is estimated based on EPTMC surveys ("Standing Survey of Road Freight") prepared by DGC. |
| Other variables and parameters information | - Fuel Characteristics according to measured values, reported under the fuel quality Directive 98/70/EC.<br>- Average length of journey: the value of 12 km has been assumed in accordance with EMEP/EEA Guidebook (2019).<br>- Monthly minimum and maximum average temperatures (°C). (AEMET (State Meteorological Agency) of MITECO) | The estimation method includes parameters that qualify or constrain emission factors. |

Following the recommendation ES-1A3bi-2025-0002 made by the TERT in the Final Review Report 2025 (Review of National Air Pollutant Emission Inventory Data 2025 under Directive (EU) 2016/2284)[10], the graph of Pb content evolution of petrol has been included. Pb content of petrol is yearly provided by the measured values reported under the fuel quality Directive 98/70/CE.

[10] Final Report available at: https://environment.ec.europa.eu/topics/air/reducing-emissions-air-pollutants/emissions-inventories_en#review-of-national-emission-inventories

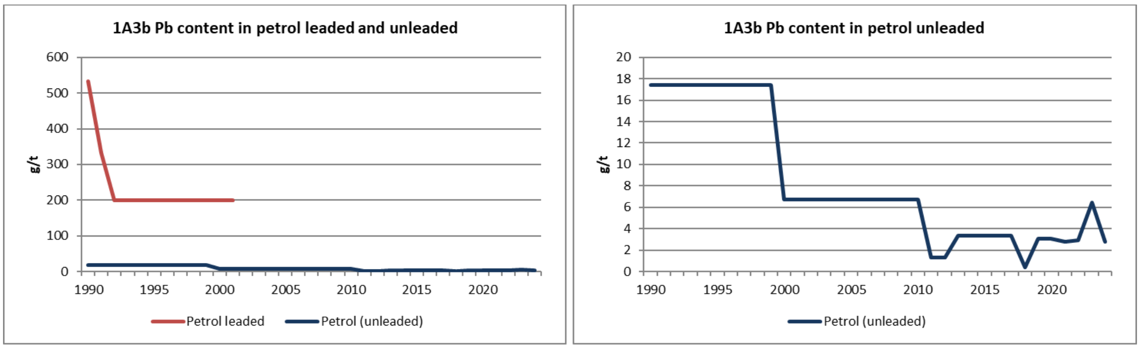
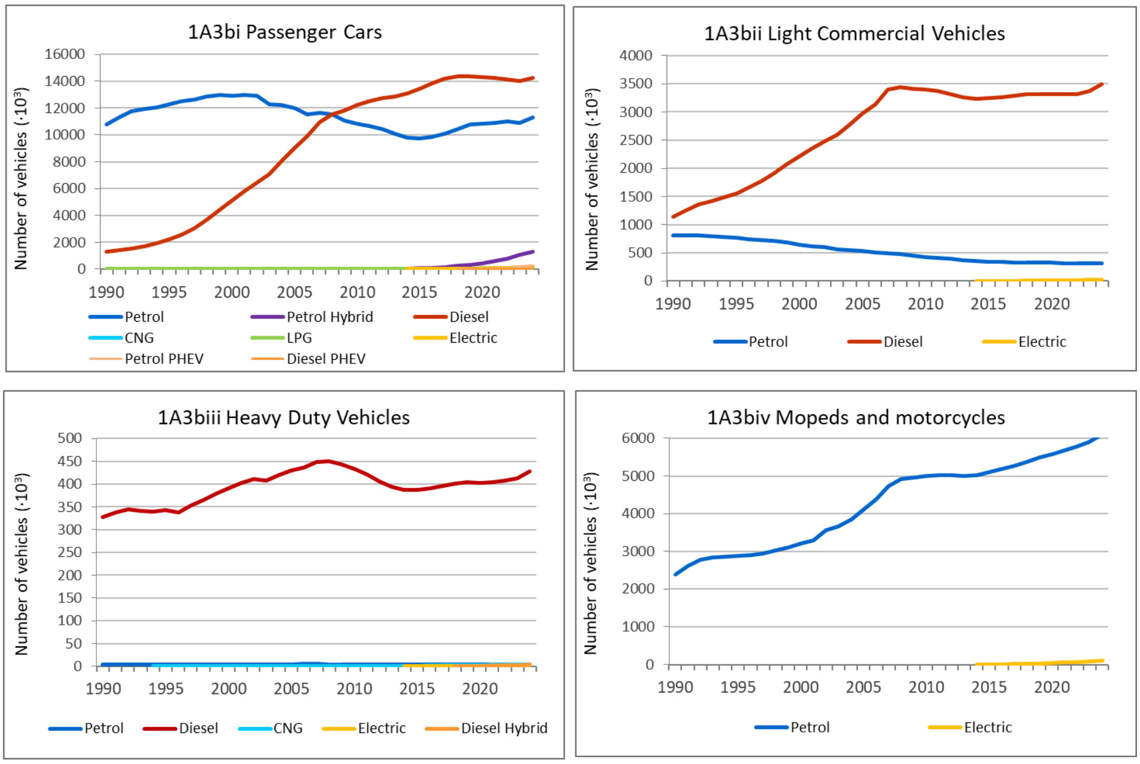



**Figure 3.4.9 1A3b Pb contend evolution in leaded and unleaded petrol**

## E.3. Assessment

All of the following data are expressed in terms of national territory totals. The registered vehicle fleet in Spain has experienced notable growth over the years since 1990, doubling its number. Following the recommendation made by the ERT in the Spanish Stage 3 centralised Review Report (2022) of the UNECE LRTAP Convention[11], the trends in the fleet composition by fuel and Euro Standard by type of vehicle were included, which can be observed in the following figures.

The distances travelled under the three driving patterns considered (interurban, rural and urban routes) have also experienced a similar increase, resulting in an increase of 117% (113% without Canary Islands) in 2024 compared to 1990, although the effect of the COVID-19 pandemic on transport activity has slowed down the rising trend.




[11] Stage 3 Review Report available in: https://www.ceip.at/status-of-reporting-and-review-results/2022-submission

**Figure 3.4.9 1A3b Fleet evolution by fuel (national territory)**

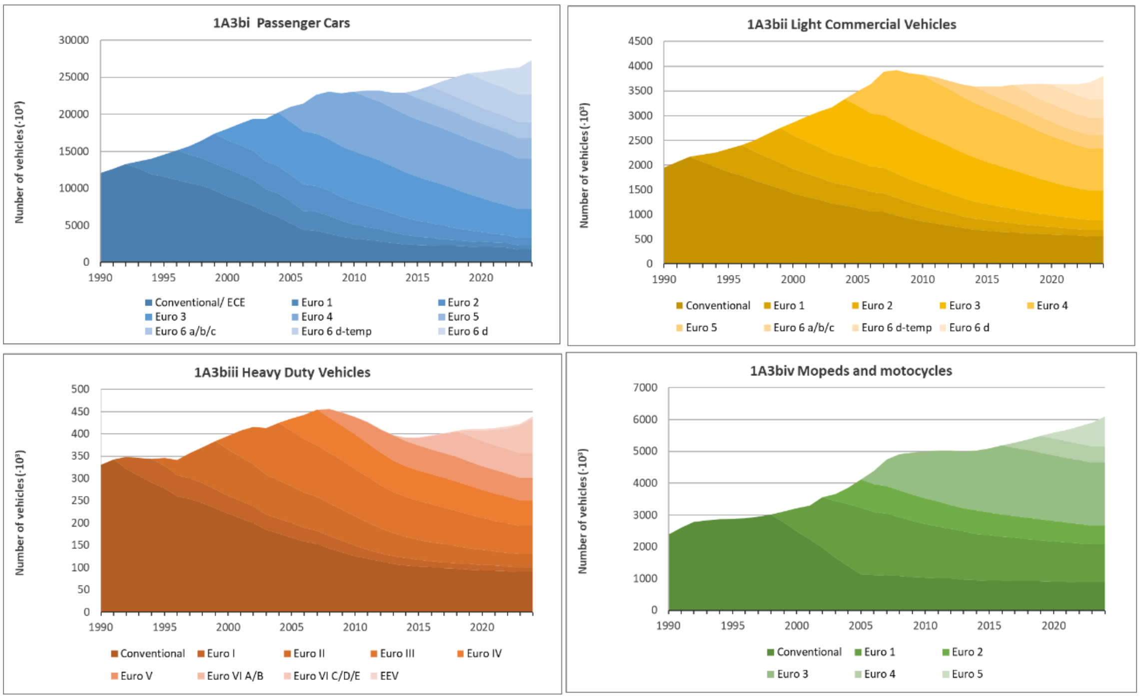



**Figure 3.4.10 1A3b Fleet evolution by Euro Standard (national territory)**

Figures below illustrate the time-based index (taking 1990 as base 100, and year 2000 for $PM_{2.5}$) of the emissions of main pollutants in road transport category (1A3b), and priority heavy metals emissions evolution.

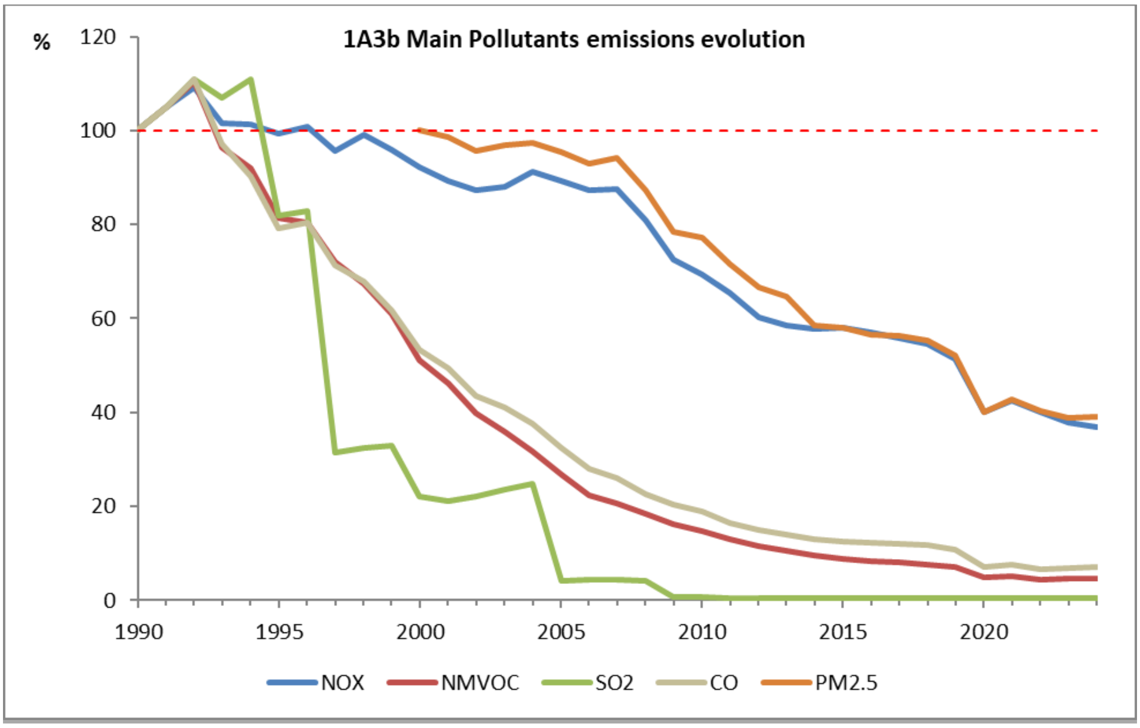



**Figure 3.4.11 1A3b Main Pollutants emissions evolution in percentage (1990 base 100), national territory**

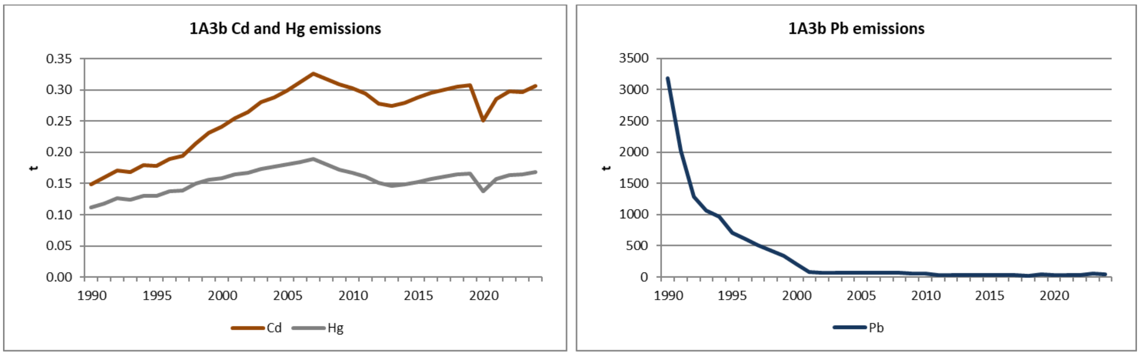



**Figure 3.4.12 1A3b Priority heavy metal emissions evolution (national territory)**

The main contributor to NOx and $SO_2$ emissions is Passenger cars category (1A3bi) followed by Heavy duty vehicles and buses category (1A3biii). Regarding NMVOC, major contributors are Passenger cars category (1A3bi) and mopeds and motorcycles category (1A3biv). For the rest of pollutants, the main contributor is unquestionably, Passenger cars category. This category has experienced the most noticeable increase over the whole series both in vehicle fleet and in mileage for the three driving patterns. Despite this increase in activity, most pollutants have experienced strong decreases due to the enforcement of more stringent emission regulations.

EURO regulations entered into force in 1991 for the first time with the aim of limiting as much as possible the negative impact of road vehicles on the environment. These requirements are particularly focused on nitrogen oxides and Particulate Matter, but also show effects on other pollutants such as carbon monoxide (CO) and non-methane volatile organic compounds (NMVOC). Different emission limits have been established for each category of pollutants and for the different types of vehicles. Successive EURO regulations have been approved and their influence on the affected pollutant emissions is noticeable in the figures above.

Regarding heavy metals emissions, the graphs above reflect how road transport emissions of cadmium and mercury follow a similar trend to the pattern of fuel consumption in 1A3b category. On the other hand, Pb emissions suffer a drastic fall from the beginning of the series to reach negligible values since the prohibition of leaded gasoline in 2002.

The Inventory covers pollutant emissions coming from all kinds of fuels, all vehicle categories and the three different driving patterns (highway, rural and urban routes). The road transport NOx emissions in 2024 in Spain can be split in the following manner:

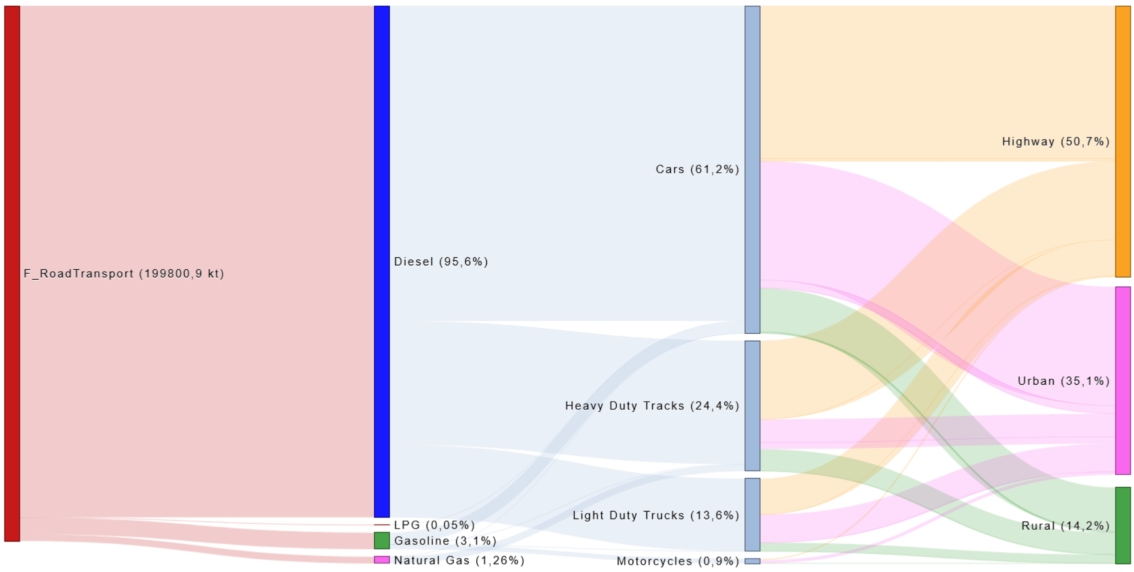



**Figure 3.4.13 Road transport NOx emissions split in 2024 (tonnes), national territory**

The figure above clearly shows that most of the Road transport NOx emissions come from diesel passenger cars (1A3bi) in both urban and highway patterns. In highway pattern, as mentioned above, traffic of heavy duty vehicles (1A3biii) also has an important weight.

As far as fuel consumption is concerned, this activity data has experienced a general growth along the Inventory period. After 2007, consumption has decreased according to the economic downturn in Spain. New sustained growth can be observed from 2012 onwards, until the sharp drop suffered in 2020 because of the COVID-19 pandemic. However, since 2020 fuel consumption experimented an increasing trend until 2024, increasing 2.2% (2.3% without Canary Islands) compared to 2023.

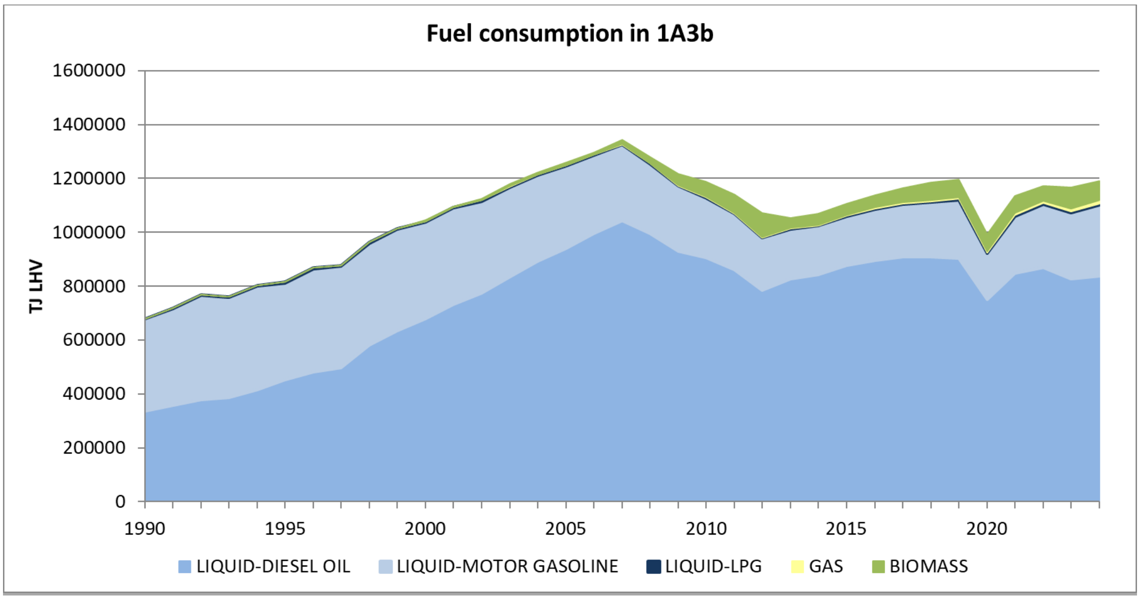



**Figure 3.4.14 Evolution of fuel consumption in 1A3b (national territory)**

**Table 3.4.16 Fuel consumption (Amounts in $TJ_{LHV}$), national territory**

| TYPE | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|
| ***LIQUID*** | **689,228** | **1,261,355** | **1,136,986** | **1,067,808** | **1,131,142** | **929,725** | **1,082,852** | **1,114,216** |
| **MOTOR GASOLINE** | 342,690 | 305,463 | 223,570 | 182,444 | 216,128 | 171,395 | 244,219 | 263,386 |
| **GAS/DIESEL OIL** | 335,296 | 941,046 | 904,507 | 876,675 | 903,748 | 748,788 | 826,315 | 837,950 |
| **LPG** | 1,195 | 2,069 | 874 | 1,977 | 3,954 | 3,035 | 5,199 | 5,661 |
| ***OTHER*** | - | **321** | **2,662** | **1,267** | **2,775** | **2,220** | **2,470** | **2,146** |
| **FOSSIL PART BIODIESEL** | - | 321 | 2,662 | 1,267 | 2,775 | 2,220 | 2,470 | 2,146 |
| ***GAS*** | - | **972** | **2,572** | **3,673** | **6,643** | **7,110** | **11,812** | **12,842** |
| **NATURAL GAS** | - | 972 | 2,572 | 3,673 | 6,643 | 7,110 | 11,812 | 12,842 |
| ***BIOMASS*** | - | **10,260** | **55,410** | **40,743** | **65,779** | **61,080** | **78,095** | **71,581** |
| **LIQUID BIOMASS** | - | 10,260 | 55,410 | 40,743 | 65,779 | 61,080 | 78,095 | 71,581 |
| **TOTAL** | **679,182** | **1,260,130** | **1,189,595** | **1,106,778** | **1,199,027** | **993,627** | **1,168,110** | **1,193,566** |

By type of fuel, the relative distribution of diesel fuel versus gasoline maintains a very similar ratio since 2013, but it is noteworthy the slight increase of the gasoline share in recent years. In 2024, petrol consumption increased 7.8% (8.3% without Canary Islands), whereas diesel increased only 1.4% (1.5% without Canary Islands) compared to 2023.

"Liquid biomass" includes bioethanol and the biogenic part of FAME that are marketed after mixture with petrol and diesel, respectively, and HVO that is marketed separately. Their consumptions grow significantly until 2012 and, after a pronounced decrease in 2013, similar consumptions are observed in 2014 and 2015 with a significant 12.8% (13.7% without Canary Islands) increase in 2016 consumption that almost doubles in 2018. Since 2019, the trend changed, experiencing a slight decrease until 2022, in part aggravated by the drop of fossil fuels during the COVID-19 pandemic. In 2023 biomass consumption increased 45.6% (45.7% without Canary Islands) with respect to 2022, whereas in 2024 decreased -8.3% (-8.2% without Canary Islands) with respect to 2023. For consistency with the Spanish greenhouse gases inventory, the fossil part of FAME (that comes from fossil methanol) is shown separately in the table under "Other".

# F. National navigation (1A3d)

This category includes domestic maritime traffic, thus voyages between domestic ports, despite the vessel´s nationality or flag.

National navigation (1A3d) is a key category for its contribution to the level and the trend of the emissions of NOx, and to the level of the emissions of $SO_2$, $PM_{2.5}$, $PM_{10}$, and HCB.

International navigation is reported as "Memo item" in the NFR reporting tables for informative purposes.

In 2025 Inventory edition, as a result of recommendation ES-1A3dii-2024-0001 made by the TERT in the Final Review Report 2024 (Review of National Air Pollutant Emission Inventory Data 2024 under Directive (EU) 2016/2284)[12], the methodology of NOx emission estimations was revised and corrected for the whole series.

Since 2020, lower sulphur content has been applied to fuel oil consumption, according to the application of the International Maritime Organization (IMO) stricter limits for marine fuels used in territorial seas and exclusive economic zones (Directive 2016/802 amending Directive 2012/33/EU and Council Directive 1999/32/EC as regards the sulphur content of marine fuels). It is also worth mentioning that $NH_3$ emissions are not estimated since updated EMEP Guidelines do not provide $NH_3$ EF for maritime transport.

## F.1. Activity variables

### Table 3.4.17 Summary of activity variables, data and information sources for category 1A3d

| Activities included | Activity data | Source of information |
|---|---|---|
| National navigation | - Fuel consumption series. | Oil international questionnaires (AQ-AOS), elaborated by MITECO and sent to IEA and EUROSTAT. |
| | - Number and gross tonnage of vessels in the main ports by type of vessel. | "Anuario de Puertos del Estado" ("National Ports Yearbook") published by National Port Authorities of the Ministry of Transport and Sustainable Mobility |

## F.2. Methodology

### Table 3.4.18 Summary of methodologies applied in category 1A3d

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| ***National navigation***<br><br>(Methodology factsheet: Navigation) | | | |
| $SO_2$ | T1 | EMEP/EEA Guidebook (2023) Chapter 1A3d. | EF:<br>- Derived from mass balance based on the sulphur content in marine fuels, established by international regulations. |
| HM, PCDD/PCDF, HCB, PCBs | T1 | EMEP/EEA Guidebook (2023) Chapter 1A3d. | EF:<br>- Default value from tables 3-1, 3-2. |

[12] Final Review Report available in: https://environment.ec.europa.eu/topics/air/reducing-emissions-air-pollutants/emissions-inventories_en#review-of-national-emission-inventories

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| NMVOC, CO, BC | T1/T2 | EMEP/EEA Guidebook (2023) Chapter 1A3d. | EF:<br>- T1: Default value from tables 3-1, 3-2 (turbines).<br>- T2: Tables 3-5, 3-6 and 3-7 (diesel motors). |
| NOx | T2 | EMEP/EEA Guidebook (2023) Chapter 1A3d. | EF turbines: Table 3-5<br>EF diesel engines: Based on the information of Tables 3-6 and 3-7, NOx EF of each fuel and engine type is annually estimated, considering the technology regulation of the engine (TIER NOx levels). The progressive inclusion of modern engines in the vessel fleet is assumed as an annual replacement rate of 4%. |
| TSP, $PM_{10}$, $PM_{2.5}$ | T2 | EMEP/EEA Guidebook (2023) Chapter 1A3d. | EF:<br>-Tables 3-5, 3-6 and 3-7. |
| PAHs | T1 | EMEP/EEA Guidebook (2023) Chapter 1A3d. | EF<br>- Default value from tables 3-1, 3-2. |

## F.3. Assessment

The following data are shown in terms of national territory totals. Fuel consumption throughout the Inventory period shows a decreasing trend since 2006 with a minimum in 2014.

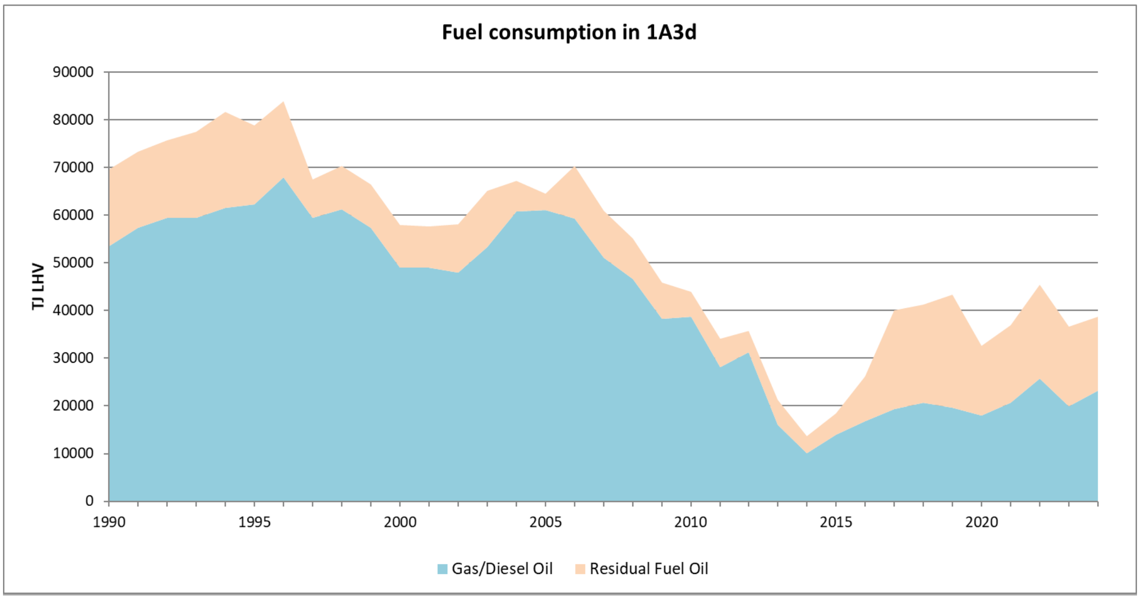



**Figure 3.4.15 Evolution of fuel consumption in 1A3d (national territory)**

Drastic descent in fuel supply to domestic navigation activities is likely due to a combination of sector development, activity evolution during the economic downturn in Spain and market and geographical factors. Nonetheless, since 2014 there has been a change in the trend with a sustained upturn in maritime fuel consumption (see figure above), which grows progressively, starting from an increase of 35% in 2015 compared to 2014 (39% without Canary Islands) and reaching an increase of 53% in 2017 compared to 2016 (56% without Canary Islands). In 2020, fuel consumption suffered a decrease of 25% due to the COVID-19 pandemic (34% without Canary Islands). However, in 2022, fuel consumption recovered pre-COVID-19 levels, reaching an increase of 23% with regard to 2021, although in the last couple of years, the trend descended back to 2021 figures.

Drastic rise in fuel oil supply to domestic navigation activities is again likely due to a combination of factors. On one hand, new market strategies for one of the main operators in the sector have been observed. On the other hand, new technology introduced in residual fuel oil ships, created to adapt the engines to the legislation regarding sulphur content in marine fuels could also be playing a role. The modification of the International Maritime Organization to the MARPOL 78/78 Convention established, as of 2015, lower limits of sulphur content in fuels consumed by ships travelling through Emission Control Areas (ECA). The European Union has gone beyond the IMO, applying since 2020 stricter limits to the waters of its exclusive economic zone (Directive 2016/802 amending Directive 2012/33/EU and Council Directive 1999/32/EC as regards the sulphur content of marine fuels). As an alternative, a new technology is being deployed consisting of installation of scrubber equipment in the residual fuel oil vessels, cleaning the combustion gases before going out into the atmosphere. The installation of scrubbers thus could be directly related to the increase in residual fuel oil consumption.

## G. Combustion in other sectors (1A4)

This category includes the following subcategories:

- Combustion in stationary and mobile equipment in commercial and institutional activities (1A4a).
- Combustion in stationary and mobile equipment in residential activities (1A4b).
- Combustion in stationary and machinery used in agriculture, forestry and fishing activities (1A4c).

It is worth mentioning that subcategory 1A4bii Mobile equipment in residential activities (Household and Gardening) is not reported separately, but included in 1A4bi, since separate activity data is not available. This clarification is provided in this report following the recommendation ES-1A4bii-2025-0001 made by the TERT in the Final Review Report 2025 (Review of National Air Pollutant Emission Inventory Data 2025 under Directive 2016/2284)[13].

The following subcategories have consideration of key category:

- 1A4a (Commercial/Institutional sector) and 1A4b (Residential sector), for its contribution to the level and the trend of the emissions of NMVOC, Particulate Matter, Black Carbon, CO, PCDD/PCDF and PAHs; and for its contribution to the level of the emissions of NOx, $SO_2$, Pb, Cd, Hg and HCBs.
- 1A4c (Agriculture, forestry and fishing sector) for its contribution to the level and the trend of the emissions of NOx, $PM_{2.5}$ and BC; for its contribution to the level of the emissions of SO2 and CO; and for its contribution to the trend of the emissions of $PM_{10}$ and TSP.

In the present Inventory edition, the historical series of gasoil consumption of agricultural machinery (1A4cii) has been reestimated, following the methodology described in EMEP/EEA Guidebook (2023) Chapter 1A4, based in Gross Value Added (GVA) trend of agriculture. Additionally, irrigation engines (included in subcategory 1A4ci) gasoil consumption estimates have been improved with more detailed and annually updated data of irrigated surfaces. Both of these changes in the methodology led to significant recalculations in diesel consumption for the whole series.

As a novelty, charcoal consumption has been registered for 1A4ai subcategory for the first time in the series, in accordance with the publication of International questionnaires elaborated by MITECO and sent to IEA and EUROSTAT.

Additionally, some fuel consumption values have been modified due to the update of different sources, such as cogeneration data, district heating data, or International questionnaires elaborated by MITECO and sent to IEA and EUROSTAT. Among these, it is specially noticeable the increment of biomass consumption in 1A4ai subcategory from 2021 onwards, which will be further addressed in the Assessment section.

The complete description of the recalculations can be found in section 3.6 Recalculations.

[13] Final Report available at: https://environment.ec.europa.eu/topics/air/reducing-emissions-air-pollutants/emissions-inventories_en#review-of-national-emission-inventories

## G.1. Activity variables

Since the 2023 Inventory edition, following the recommendation made in the Spanish Stage 3 CLRTAP Review Report (2022)[14], estimates of residential combustion emissions take into account disaggregation of total biomass consumption according to different existing fuels and appliances. Following the recommendation ES-1A4bi-2025-0001 made by the TERT in the Final Review Report 2025 (Review of National Air Pollutant Emission Inventory Data 2025 under Directive (EU) 2016/2284)[15], a more detailed description of the methodology applied for residential combustion is included, along with the rest of subcategories under 1A4 category.

**Table 3.4.19 Summary of activity variables, data and information sources for category 1A4**

| Activities included | Fuel type | Activity data | Source of information |
|---|---|---|---|
| **Commercial/Institutional sector (1A4a)** | All fuels (except wood pellets) | - Final energy fuel use. | - International questionnaires elaborated by MITECO and sent to IEA and EUROSTAT. |
| | Wood pellets | - Fuel consumption for wood pellets. [1] | - Spanish association for energy recovery of biomass (AVEBIOM). |
| | Liquid fuels (residual fuel oil, gasoil, LPG)<br>Gaseous fuels (natural gas)<br>Biomass (landfill gas, wood and wood wastes[2]) | - Annual electricity production, broken down by energy demand sectors, generation mode (autoproduction vs. co-generation) and fuel type. | - Questionnaires from MITECO and IDAE. |
| **Residential sector (1A4b)** | All fuels (except wood pellets) | - Final energy fuel use. | - International questionnaires elaborated by MITECO and sent to IEA and EUROSTAT. |
| | Gasoil, natural gas, wood and wood wastes | - Annual electricity production, broken down by energy demand sectors, generation mode (co-generation) and fuel type. | - Questionnaires from MITECO and IDAE. |
| | Wood pellets | - Fuel consumption for wood pellets. [1] | - Spanish association for energy recovery of biomass (AVEBIOM). |
| | | - Split between technology appliances (from 2010 onwards).[3] | - Study of biomass heating technologies in Spain (IDAE, 2016) |
| | - All solid biomass fuels (except wood pellets and charcoal) [2,4] | - Split among technology appliances (for years 1990-2009). | - EMEP/EEA Guidebook 2023, Chapter 1A4, tables 3-36 to 3-38 (Appliance type split according IIASA GAINS model) |

[14] Stage 3 Review Report available at: https://www.ceip.at/status-of-reporting-and-review-results/2022-submission

[15] Final Report available at: https://environment.ec.europa.eu/topics/air/reducing-emissions-air-pollutants/emissions-inventories_en#review-of-national-emission-inventories

| Activities included | Fuel type | Activity data | Source of information |
|---|---|---|---|
| | | - Broken down of technology appliances, distinguishing by biomass type (from 2010 onwards).[5] | - Study of biomass heating technologies in Spain (IDAE, 2016)<br>- TIMES model data from 2015 to 2024<br>- EMEP/EEA Guidebook 2023, Chapter 1A4, tables 3-36 to 3-38 (Appliance type split according IIASA GAINS model) |
| **Stationary combustion in the agricultural sector (1A4ci)** | All fuels | - Assigned amounts of fossil fuels; with the exception of diesel, which is estimated proportionality to the value of mobile agricultural machinery. | - AQs: Energy balance from International questionnaires elaborated by MITECO and sent to IEA and EUROSTAT. |
| | Diesel (irrigation engines) | - Fuel consumption for agricultural irrigation engines, based on published:<br>· diesel consumption ratios per hectare of irrigation<br>· irrigation surface area | - "Energy Saving and Efficiency Strategy – E4" for the agricultural sector.<br>- ESYRCE[16] (Crop Yield and Cultivated Areas Survey) Report on irrigation in Spain.<br>- "Water usage in agricultural sector Survey", elaborated by INE (2000-2018).[17] |
| | Natural gas, LPG (aquaculture activities) | - Fuel consumption for stationary fishing activities | - International questionnaires elaborated by MITECO and sent to IEA and EUROSTAT. |
| **Agricultural machinery (1A4cii)** | Diesel | - Power installed in active vehicles by type of machinery. | - Directorate-General for Agricultural Production and Markets at MAPA. |
| | | - Socio-economic data relating to agriculture: GVA (Gross Value Added) for agriculture. | - "Economic Accounts for Agriculture", prepared by MAPA. |
| **Forestry machinery (1A4cii)** | Diesel, Motor gasoline | - Socio-economic data relating to forestry: reforested surface area, volume of wood harvested, etc. | - "Forestry Statistical Yearbook" prepared by MITECO. |
| | | - Additional activity variables (length of prepared forest trails, surface area of firewalls…); characteristics of machinery by class of operation. | - Expert judgement. |
| **Sea fishing (1A4ciii)** | Diesel | - Values for parameters referring to specific fuel consumption per fishing ground calculated from sailing days per year and fishing vessels population. | - "Marine Fishing Economic Survey" elaborated by MAPA. |

[1] Wood pellets' consumption from AVEBIOM is subtracted from total biomass consumption described in International Questionnaires to calculate wood and wood wastes consumption, avoiding double accounting.

[2] Including wood logs.

[16] https://www.mapa.gob.es/es/estadistica/temas/estadisticas-agrarias/agricultura/esyrce/

[17] https://www.ine.es/dynt3/inebase/index.htm?path=/t26/p067/p03/serie

[3] Pellets' technology appliance between single house boilers and stoves is directly taken from national statistics information (IDAE), which include a register of biomass heating installations per province in Spain.

[4] All biomass consumption for years 1990-2009 accounts as wood and similar wood wastes (mainly wood logs).

[5] Firstly, the split between biomass appliance in boilers, stoves and kitchen stoves is made with TIMES-SINERGIA model data consumption (2015-2023) of MITECO. Boilers are further split between community boilers and single house boilers with IIASA GAINS model information. In the specific case of open fireplaces, appliance ratio of total consumption is taken from IIASA GAINS model, with an annual reduction of consumption from 2017 onwards, estimated with the complementary information of TIMES-SINERGIA model data. Except for automatic single house boilers, all of the aforementioned appliances are considered to only combust wood and similar wood wastes (mainly wood logs). Finally, automatic single house boilers, stoves and closed fireplaces appliances are split by fuel type (nut shells, olive pits, sawdust and wood shavings, wood chips, wood and similar wood wastes) taking into account the power data distribution of the aforementioned study of IDAE.

## G.2. Methodology

### Table 3.4.20 Summary of methodologies applied in category 1A4

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| ***Commercial/Institutional sector (1A4a): Combustion plants <50 MW (Boilers)***<br><br>(Methodology factsheet: Other stationary combustion) | | | |
| NOx, NMVOC, CO, $SO_2$, $NH_3$[18], PM, PCBs, HCB, PCDD/PCDF | T1/T2 | EMEP/EEA Guidebook (2023) Chapter 1A4. | EF:<br>- Tables 3-8, 3-9, 3-21, 3-25, 3-27, 3-44 and 3-46. |
| BC | T2 | EMEP/EEA Guidebook (2023) Chapter 1A4. | EF:<br>- Tables 3-21, 3-25, 3-27, 3-44 and 3-46, % of $PM_{2.5}$. |
| HM, PAHs | T1 | EMEP/EEA Guidebook (2023) Chapter 1A4. | EF:<br>- Tables 3-21, 3-25 and 3-46. |
| ***Commercial/Institutional sector (1A4a): Stationary gas turbines***<br><br>(Methodology factsheet: Other stationary combustion) | | | |
| NOx, NMVOC, CO, $SO_2$, PM, PCDD/PCDF | T2 | EMEP/EEA Guidebook (2023) Chapter 1A4. | EF:<br>- Tables 3-28 and 3-29. |
| BC | T2 | EMEP/EEA Guidebook (2023) Chapter 1A4. | EF:<br>- Tables 3-28, 3-29, % of $PM_{2.5}$. |
| Rest of pollutants | T1 | EMEP/EEA Guidebook (2023) Chapter 1A4. | EF:<br>- Tables 3-9, 3-28 and 3-29. |
| ***Commercial/Institutional sector (1A4a): Stationary engines***<br><br>(Methodology factsheet: Other stationary combustion) | | | |
| NOx, NMVOC, CO, $SO_2$, PM, PCBs, HCB, PCDD/PCDF | T2 | EMEP/EEA Guidebook (2023) Chapter 1A4. | EF:<br>- Tables 3-30 and 3-31. |
| BC | T2 | EMEP/EEA Guidebook (2023) Chapter 1A4. | EF:<br>- Tables 3-30 and 3-31, % of $PM_{2.5}$. |
| Rest of pollutants | T2 | EMEP/EEA Guidebook (2023) Chapter 1A4. | EF:<br>- Tables 3-30 and 3-31. |

[18] Estimates of $NH_3$ emissions from biomass included in 1A4a and 1A4c categories, based on the EFs from EMEP/EEA 2019 Guidebook, following recommendations ES1A4a-2022-0001 and ES1A4c-2022-0001 from the Final Report of the 2022 Review of National Air Pollutant Emission Inventory under Directive (EU) 2016/228).

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| ***Commercial/Institutional sector (1A4a): Mobile machinery*** | | | |
| NOx, NMVOC, CO, $SO_2$, PM, BC, $NH_3$, HM, PAHs | T1 | EMEP/EEA Guidebook (2023) Chapter 1A4. | EF:<br>- Table 3-1. |
| ***Residential sector (1A4b): Combustion plants <50 MW (Boilers)***<br><br>(Methodology factsheet: Other stationary combustion) | | | |
| NOx, NMVOC, CO, $SO_2$, PM, BC, PCBs, HCB, PCDD/PCDF, $NH_3$, HM, PAHs | T1/T2 | EMEP/EEA Guidebook (2023) Chapter 1A4. | EF:<br>- Tables 3-4, 3-5, 3-6, 3-15, 3-16, 3-18, 3-42, 3-43 and 3-44. |
| ***Residential sector (1A4b): Residential -Other equipment (stoves, fireplaces, cooking,...)*** | | | |
| NOx, NMVOC, CO, $SO_2$, PM, BC, PCBs, HCB, PCDD/PCDF, $NH_3$, HM, PAHs | T2 | EMEP/EEA Guidebook (2023) Chapter 1A4. | EF:<br>- Tables 3-39, 3-40, 3-41, 3-42 and 3-44 |
| ***Residential sector (1A4b): Combustion plants <50 MW (Medium Boilers)*** | | | |
| NOx, NMVOC, CO, $SO_2$, PM, BC, PCBs, HCB, PCDD/PCDF, $NH_3$, HM, PAHs | T1/T2 | EMEP/EEA Guidebook (2023) Chapter 1A4. | EF:<br>- Tables 3-47 and 3-48 |
| ***Stationary machinery in agriculture, forestry and fishing activities (1A4ci): Combustion plants <50 MW (Boilers)***<br><br>(Methodology factsheet: Other stationary combustion) | | | |
| NOx, NMVOC, CO, $SO_2$, PM, BC, PCBs, HCB, PCDD/PCDF, HM, PAHs | T1/T2 | EMEP/EEA Guidebook (2023) Chapter 1A4. | EF:<br>- Tables 3-7, 3-10, 3-21, 3-25, 3-27 and 3-46. |
| ***Stationary machinery in agriculture, forestry and fishing activities (1A4ci): Stationary engines***<br><br>(Methodology factsheet: Other stationary combustion) | | | |
| NOx, NMVOC, CO, $SO_2$, PM, BC, PCBs, HCB, PCDD/PCDF, HM, PAHs | T1/T2 | EMEP/EEA Guidebook (2023) Chapter 1A4. | EF:<br>- Tables 3-9 and 3-31. |
| ***Mobile machinery in agriculture and forestry activities (1A4cii)***<br><br>(Methodology factsheet: Mobile machinery) | | | |

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| NOx, NMVOC, CO, $SO_2$, $NH_3$, PM, BC | T2 | EMEP/EEA Guidebook (2023) Chapter 1A4. | EF:<br>- Annual emission factors according to annual fleet structure (1.A.4 Non-road mobile machinery Annex: distribution by age and technology). |
| Rest of pollutants | T1 | EMEP/EEA Guidebook (2023) Chapter 1A4. | EF:<br>Table 3-1. |
| ***Mobile machinery in fishing activities (1A4ciii)***<br><br>(Methodology factsheet: Fishing activities) | | | |
| $SO_2$ | T1 | EMEP/EEA Guidebook (2023, update Dec 2021) Chapter 1A3d. | EF:<br>- Derived from mass balance based on the sulphur content in marine fuels, established by international regulations. |
| HM, PCDD/PCDF, HCB, PCBs | T1 | EMEP/EEA Guidebook (2023) Chapter 1A3d. | EF:<br>- Default value from table 3-2. |
| NMVOC, CO, TSP, $PM_{10}$, BC | T1/T2 | EMEP/EEA Guidebook (2023) Chapter 1A3d. | EF:<br>- Default value from table 3-2 |
| NOx, $PM_{2.5}$ | T2 | EMEP/EEA Guidebook (2023) Chapter 1A3d. | EF:<br>-Tables 3-5, 3-6 and 3-7. |
| PAHs | T1 | EMEP/EEA Guidebook (2023) Chapter 1A3d. | EF:<br>- Default value from table 3-2. |

* Summary tables of emission factors for 1A4, mobile sources, have been included in the methodology factsheet for Mobile machinery.

## G.3. Assessment

The following data are shown in terms of national territory totals. Within 1A4 category, the Residential sector (1A4b) is still the main driver in the evolution of fuel consumption, due to its high relative weight within the entire category, being 49% of the total fuel consumption in 1A4 for 2024 (also 49% without Canary Islands).

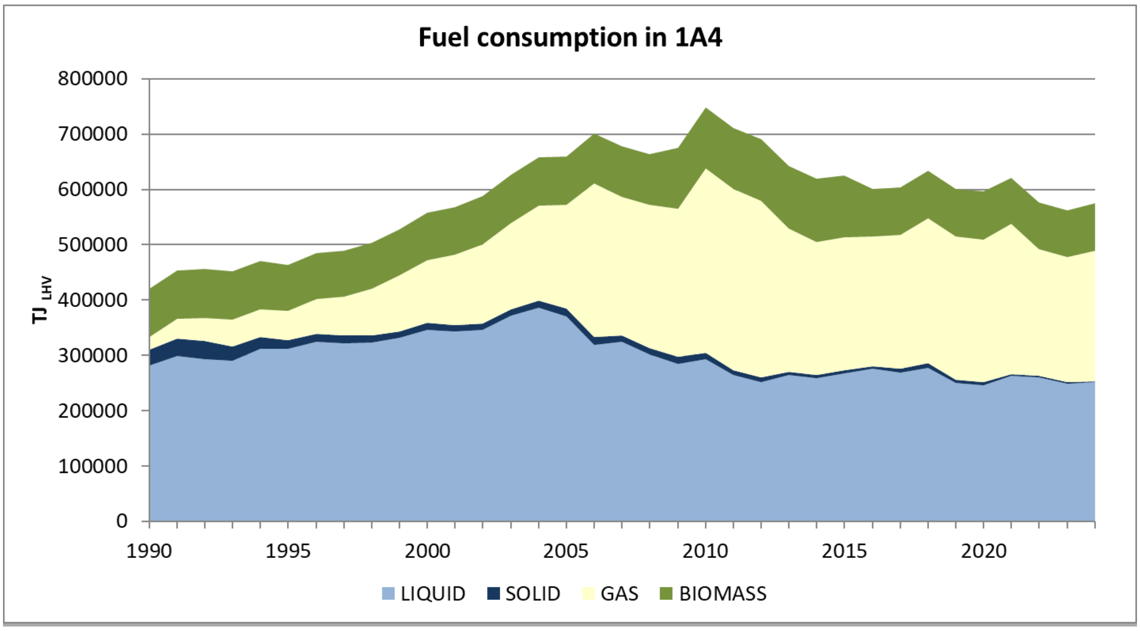



**Figure 3.4.16 Evolution of fuel consumption in 1A4 category (national territory)**

Figure 3.4.16 shows the trend of fuel consumption under 1A4, showing the effect of the economic downturn in Spain, that is intertwined with meteorological inputs. Despite their loss of relative importance, liquid fuels continue to be the predominant type of fuel burned under 1A4, most of it consumed in Agriculture, forestry and fishing sector. This consumption remains almost constant for recent years. Gaseous fuels follow liquid fuels in importance, even though natural gas consumption decreased significantly after 2021, with 2024 showing again a growing tendency (5% in 2024 compared to 2023, also 5% without Canary Islands). Consumption of solid fuels is minor and constantly decreases throughout the period to become negligible since 2015.

Finally, biomass consumption maintains a small but steady growth along the Inventory period, increasing its representativeness due to promotion measures developed by the Spanish administration.

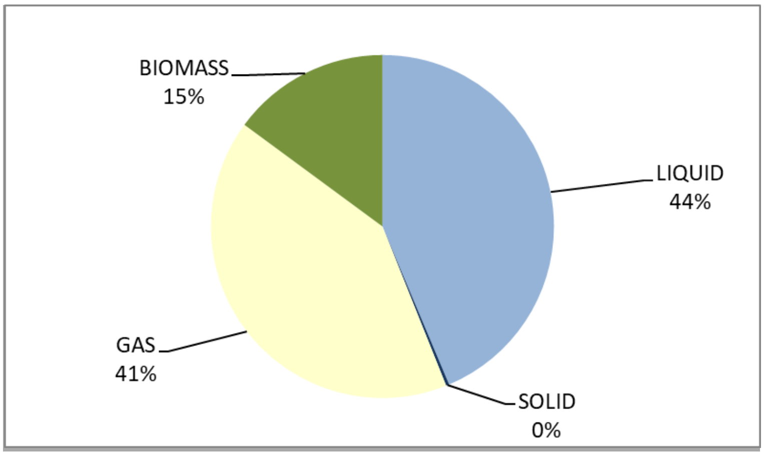



**Figure 3.4.17 Distribution of fuel consumption 1A4 (2024), national territory**

Following figures show the evolution of fuel consumption in the various subcategories that constitute the category Combustion in other sectors (1A4).

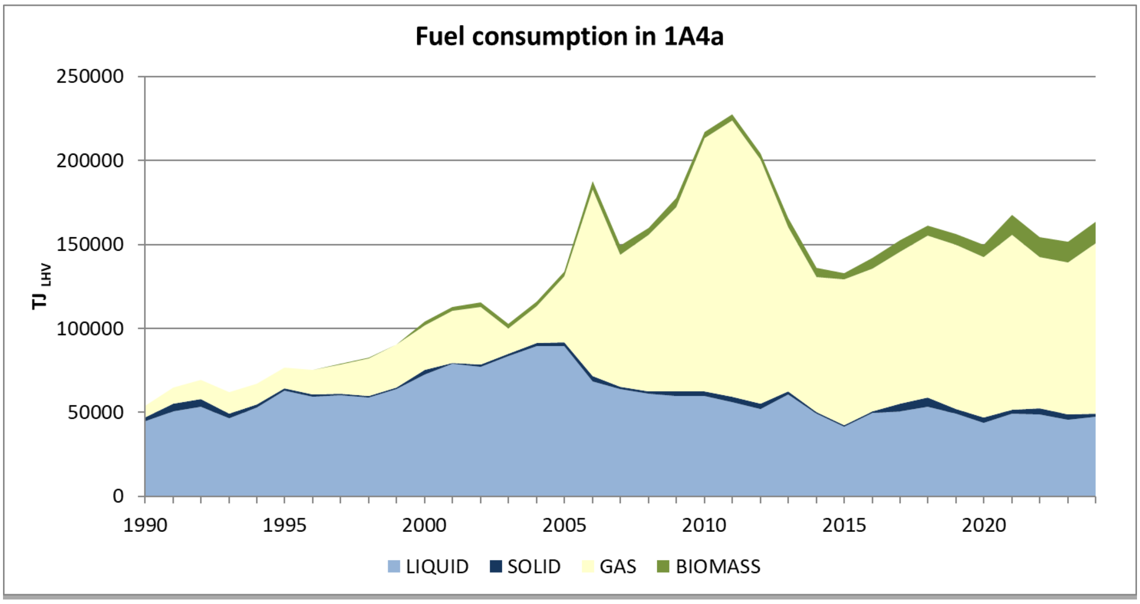



**Figure 3.4.18 Evolution of fuel consumption in Commercial and Institutional sector (1A4a), national territory**

The evolution of natural gas consumption in Commercial and Institutional sector (1A4a) shows more pronounced peaks and valleys than its observed evolution in the whole category 1A4, due to the already mentioned meteorological inputs, affecting mainly the natural gas consumption. However, from 2015 onwards, natural gas consumption seems to be more stable, showing a slightly increasing trend except for a small drop in 2020, defined as one of the warmest years in Spain since records exists[19]. This fact, together with the decrease and even cessation of activity of many institutions and businesses during the lockdown due to the COVID-19 pandemic crisis, clearly explains this decline which recovers its growing trend in 2021. In the following years the trend dropped again, being 2022 even a warmer year than 2020 according to the registers[20]. Recently, 2024's trend rose up again to 2021 levels.

Moreover, biomass consumption has noticeable increased the recent years, being 2024 values 83% higher than 2020 figures. As mentioned, charcoal consumption has been registered in 1A4ai subcategory for the first time (for years 2021-2024).

Regarding liquid fuels, estimates of mobile combustion in commercial and institutional sector (1A4aii subcategory) represent 1.5% of total liquid consumption in 1A4a category in 2024 (1.5% without Canary Islands).

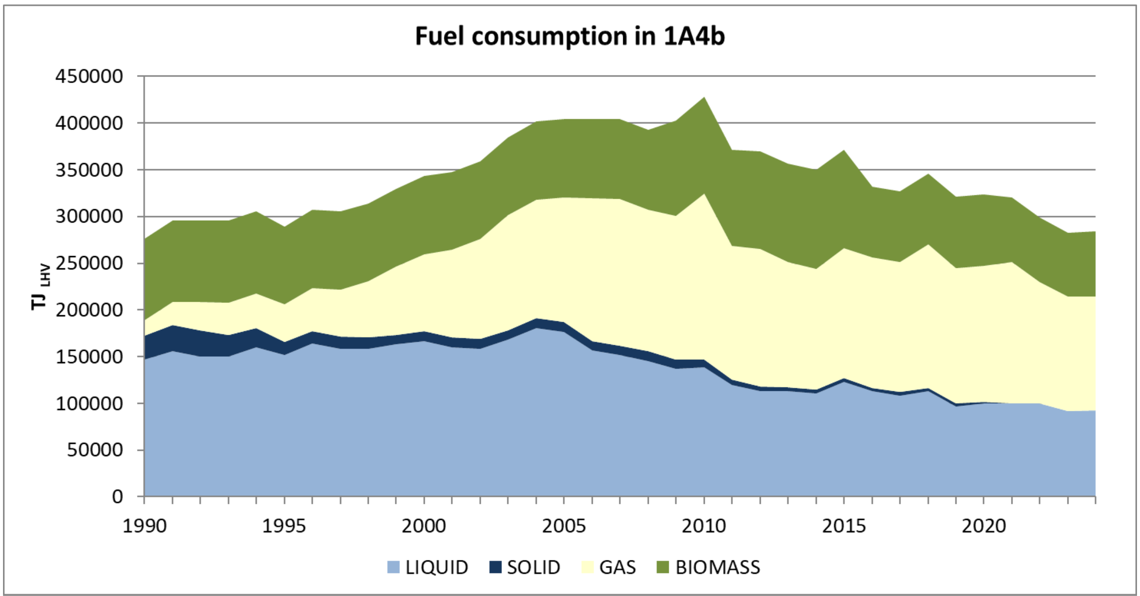



**Figure 3.4.19 Evolution of fuel consumption in Residential Sector (1A4b), national territory**

The general trend in the residential sector (1A4b) reflects the population increase and the effect of the economic downturn, with yearly variations due to meteorological factors. Natural gas consumption increased noticeably until the early 2000s and it remained virtually steady for the period 2019-2021. However, natural gas levels have continued to decrease each year since then, reaching in 2024 the lowest natural gas consumption since 2003 (being 2024

[19] The climate summary report of 2020 is available at: http://www.aemet.es/documentos/es/datos_abiertos/Estadisticas/Vigilancia_Clima/resumenclima_2020.pdf

[20] The climate summary report of 2022 is available at: https://www.aemet.es/documentos/es/serviciosclimaticos/vigilancia_clima/resumenes_climat/anuales/res_anual_clim_2022.pdf

consumption 20% lower than 2021 figures, also -20% without Canary Islands). The more recent years have been warmer, resulting in a lower consumption[21].

Distribution of biomass, liquid and gaseous fuels maintains relatively similar proportions during the recent years. Regarding solid fuels, there has not been consumption registered in 2023 and 2024.

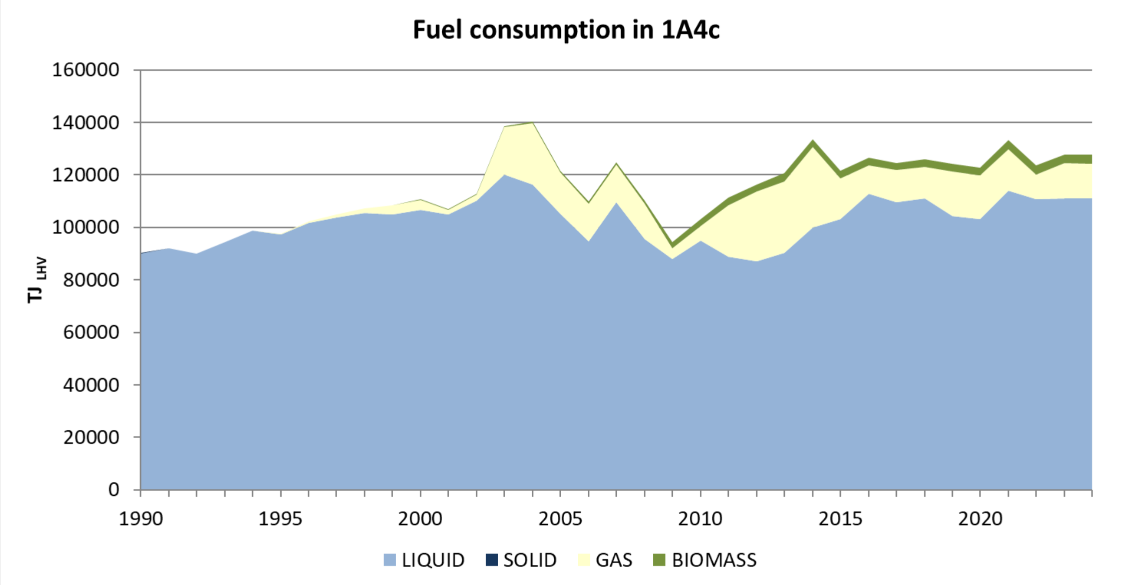



**Figure 3.4.20 Evolution of fuel consumption in Agriculture, forestry and fishing sector (1A4c), national territory**

Gasoil continues to be the most consumed fuel in the Agriculture, forestry and fishing sector (1A4c category, see figure above), remaining almost constant since 2014.

The following tables include detailed information on fuel consumption in 1A4 subcategories.

**Table 3.4.21 Fuel consumption (Amounts in $TJ_{LHV}$), national territory**

### 1A4a Commercial / institutional sector

| TYPE | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|
| *LIQUID* | *44,894* | *89,663* | *59,564* | *41,453* | *49,210* | *43,892* | *45,554* | *47,462* |
| GAS OIL | 26,735 | 70,893 | 47,866 | 32,476 | 39,793 | 36,124 | 32,482 | 35,912 |
| LPG | 7,389 | 9,180 | 8,016 | 7,389 | 7,344 | 4,612 | 10,216 | 10,312 |
| MOTOR GASOLINE | - | - | - | 463 | 1,390 | 1,348 | 683 | 743 |
| PETROLEUM COKE | 163 | 163 | 130 | - | - | - | - | - |
| RESIDUAL OIL | 10,608 | 9,427 | 3,552 | 1,125 | 683 | 1,808 | 2,173 | 495 |
| *SOLID* | *2,128* | *2,150* | *2,804* | *898* | *2,711* | *3,123* | *3,305* | *1,692* |
| COKE OVEN COKE | - | - | - | 282 | 2,256 | 2,820 | 2,820 | 1,692 |
| GAS WORKS GAS | 1,234 | 633 | 1,287 | 9 | - | - | - | - |
| STEAM COAL | 880 | 1,517 | 1,517 | 607 | 455 | 303 | 485 | - |

[21] The climate summary report of 2024 is available at: https://www.aemet.es/documentos/es/serviciosclimaticos/vigilancia_clima/resumenes_climat/anuales/res_anual_clim_2024.pdf

| TYPE | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|
| SUB-BITUMINOUS COAL | 13 | - | - | - | - | - | - | - |
| *GAS* | ***6,878*** | ***39,326*** | ***150,845*** | ***86,687*** | ***97,788*** | ***95,586*** | ***90,537*** | ***101,568*** |
| NATURAL GAS | 6,878 | 39,326 | 150,845 | 86,687 | 97,788 | 95,586 | 90,537 | 101,568 |
| *BIOMASS* | | ***2,720*** | ***3,714*** | ***4,008*** | ***6,726*** | ***7,057*** | ***12,330*** | ***12,928*** |
| BIOGAS | - | 576 | 1,200 | 765 | 2,653 | 2,638 | 3,385 | 3,889 |
| CHARCOAL | - | - | - | - | - | - | 106 | 106 |
| WOOD PELLETS | - | - | - | 1,861 | 2,826 | 3,052 | 3,447 | 3,447 |
| WOOD AND WOOD WASTES (*) | - | 2,144 | 2,514 | 1,382 | 1,247 | 1,368 | 5,392 | 5,486 |
| TOTAL | **53,899** | **133,858** | **216,927** | **133,046** | **156,435** | **149,659** | **151,726** | **163,651** |

## 1A4b Residential sector

| TYPE | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|
| *LIQUID* | ***146,554*** | ***176,377*** | ***138,416*** | ***122,801*** | ***97,031*** | ***99,626*** | ***91,869*** | ***92,500*** |
| GAS OIL | 53,424 | 105,940 | 77,193 | 79,483 | 61,141 | 66,144 | 57,785 | 59,501 |
| LPG | 92,202 | 68,513 | 56,512 | 42,675 | 35,690 | 33,361 | 34,085 | 32,999 |
| PETROLEUM COKE | 325 | 195 | 130 | - | - | - | - | - |
| RESIDUAL OIL | 603 | 1,728 | 4,581 | 643 | 201 | 121 | - | - |
| *SOLID* | ***25,850*** | ***11,150*** | ***8,317*** | ***4,248*** | ***3,186*** | ***2,276*** | - | - |
| GAS WORKS GAS | 10,600 | 1,138 | 126 | - | - | - | - | - |
| PATENT FUELS | 152 | - | - | - | - | - | - | - |
| STEAM COAL | 14,563 | 10,012 | 8,192 | 4,248 | 3,186 | 2,276 | - | - |
| SUB-BITUMINOUS COAL | 536 | - | - | - | - | - | - | - |
| *GAS* | ***16,572*** | ***132,483*** | ***178,090*** | ***138,896*** | ***144,348*** | ***145,066*** | ***122,039*** | ***122,032*** |
| NATURAL GAS | 16,572 | 132,483 | 178,090 | 138,896 | 144,348 | 145,066 | 122,039 | 122,032 |
| *BIOMASS* | ***86,826*** | ***84,608*** | ***102,984*** | ***105,057*** | ***76,270*** | ***76,431*** | ***68,775*** | ***69,246*** |
| CHARCOAL | - | - | 1,130 | 1,130 | 461 | 461 | 606 | 606 |
| NUT SHELL | - | - | 484 | 469 | 317 | 315 | 264 | 266 |
| OLIVE PITS | - | - | 1,742 | 1,690 | 1,140 | 1,136 | 952 | 960 |
| SAWDUST AND WOOD SHAVINGS | - | - | 296 | 287 | 194 | 193 | 162 | 163 |
| WOOD CHIPS | - | - | 433 | 420 | 283 | 282 | 236 | 238 |
| WOOD PELLETS | - | - | 224 | 5,372 | 9,290 | 9,715 | 12,648 | 12,648 |
| WOOD AND WOOD WASTES (*) | 86,826 | 84,608 | 98,675 | 95,689 | 64,586 | 64,329 | 53,907 | 54,364 |
| TOTAL | **275,802** | **404,617** | **427,808** | **371,002** | **320,835** | **323,399** | **282,684** | **283,779** |

## 1A4c Agriculture, forestry and fishing sector

| TYPE | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|
| *LIQUID* | ***89,923*** | ***105,079*** | ***94,867*** | ***103,125*** | ***104,287*** | ***103,112*** | ***111,168*** | ***111,027*** |
| GAS OIL | 86,790 | 101,671 | 92,429 | 100,778 | 101,465 | 100,663 | 108,284 | 108,263 |
| KEROSENE | 1,296 | - | - | - | - | - | 5 | 3 |
| LPG | 985 | 2,552 | 1,702 | 1,881 | 2,373 | 2,194 | 2,548 | 2,485 |
| MOTOR GASOLINE | 249 | 213 | 54 | 225 | 247 | 214 | 227 | 227 |
| RESIDUAL OIL | 603 | 643 | 683 | 241 | 201 | 40 | 105 | 48 |
| *SOLID* | ***375*** | - | - | - | - | - | - | - |

| TYPE | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|
| **SUB-BITUMINOUS COAL** | 375 | - | - | - | - | - | - | - |
| ***GAS*** | ***112*** | ***15,886*** | ***5,752*** | ***15,560*** | ***16,912*** | ***16,778*** | ***13,270*** | ***13,069*** |
| **NATURAL GAS** | 112 | 15,886 | 5,752 | 15,560 | 16,912 | 16,778 | 13,270 | 13,069 |
| ***BIOMASS*** | - | ***640*** | ***2,658*** | ***2,921*** | ***2,982*** | ***2,984*** | ***3,355*** | ***3,493*** |
| **BIOGAS** | - | 3 | 190 | 58 | 145 | 150 | 167 | 194 |
| **WOOD AND WOOD WASTES (*)** | - | 637 | 2,468 | 2,863 | 2,837 | 2,834 | 3,188 | 3,299 |
| **TOTAL** | **90,409** | **121,606** | **103,277** | **121,606** | **124,181** | **122,874** | **127,794** | **127,588** |

(*) Including wood logs.

## H. Fugitive emissions from fuels (1B)

This category includes emissions generated during prospection, extraction, storage, transportation, processing or disposal of fossil fuels (coal, oil, oil-derived fuels or natural gas) where there is no energy recovery from the fuel. Thus, activities such as flaring of petroleum or natural gas are included here, but not combustion activities intended for the provision of energy in those processes.

This category is considered a key category for $SO_2$ and NMVOC for level and trend reasons.

**Table 3.4.22 Contents of 1B**

| 1B | Includes |
|---|---|
| Solid fuel (**1B1**) | **Coal mining and handling (1B1a)**: dust emissions associated with production and storage processes in coal mines. |
| | **Solid fuel transformation (1B1b)**: Fugitive emissions of residual raw gases and powdery materials generated during the opening of doors of coke ovens and coke cooling. Production of solid semi-coke is not included as this activity does not occur in Spain. |
| Oil and natural gas and other emissions from energy production (**1B2**) | **Oil – Exploration, production, transport (1B2ai)**: Evaporative emissions of volatile organic compound (NMVOC) losses during operation in prospection and production platforms and marine terminals, including crude oil supply to refineries. |
| | **Fugitive emissions oil – Refining/storage (1B2aiv)**: fugitive emissions associated with activities in refining plants (excluding those generated by combustion processes for energy purposes): separation, conversion, treating and blending of oil derived products: sulphur recovery, storage and handling of intermediate and final products, vacuum distillation, coke calcination, fluid catalytic cracking (FCC), and catalytic reforming units. |
| | **Distribution of oil products (1B2av)**: emissions from hydrocarbons in the distribution network of petroleum derived products outside. |
| | **Natural gas (1B2b)**: hydrocarbon losses during the different stages of the operation in prospection, production and supply process: production in extractive facilities (marine or inland platforms), first treatment, loading, transportation and distribution. |
| | **Venting and flaring (1B2c)**: intentional gas losses that, for safety reasons, take place at refining plants or natural gas supply systems, by means of direct gas venting or flaring. |

### H.1. Activity variables

The following table summarises the main activities considered within this category, as well as the main activity data and their corresponding sources of information.

**Table 3.4.23 Summary of activity variables, data and information sources for category 1B**

| Activities included | Activity data | Source of information |
|---|---|---|
| Coal, natural gas and oil extraction activities (Coal 1B1a, natural gas **1B2b**, oil **1B2ai**) | **Internal production (gross) of different primary fuels** (coal, crude oil and natural gas). | - National statistics on coal production, hydrocarbon prospection and production. MITECO.<br>- National statistics on hydrocarbon production. MITECO (CORES)<br>- Data reported through Regulation (EU) 2024/1787 on the reduction of methane emissions in the energy sector |
| Opening and extinction of coke oven furnaces (**1B1b**) | **Production of metallurgical coke in coke oven furnaces.** | - For integrated steel plants: IQ.<br>- For offsite coke production facilities (Area source level):<br>· Historically: IEA and EUROSTAT or in national statistics from MITECO ("Statistics on Coking Paste Manufacture, Coke Ovens and Blast Furnace Gas").<br>· 2008-2024: Individualized information at plant level (IQ). |

| Activities included | Activity data | Source of information |
|---|---|---|
| Loading-unloading operations of tank vessels and crude oil storage in marine terminals (**1B2ai**) | **The acquisition (imports) of crude oil by refineries**. | - "Energy Statistics of OECD countries", IEA.<br>- National Energy Statistics by MITECO (AQ-AOS). |
| Refining activities (**1B2aiv**, **1B2c**) | **Processed crude oil** acts as a proxy variable.<br>**Process feed**.<br>**Storage of products**. | - IQ from refineries. |
| Gasoline and biofuels distribution (**1B2av**) | **Exported petrol** | - IQ from refineries. |
| | **Imported petrol** | - IQ from refineries. |
| | **Amount of gasoline dispatched from the refinery supply stations to the national logistics circuit**. | - IQ from refineries. |
| | **Flows of gasoline at the refineries**. | - IQ from refineries. |
| | **Flows of gasoline at the national logistics circuit**. | - IQ from Exolum. |
| | **Gasoline consumption** | - National statistics on hydrocarbon production. MITECO (CORES) |
| | **Temperatures in summer and winter**. | - State Meteorological Agency (AEMET). |
| | **Data on biofuels production**. | - Annual data (from 2006 to 2021) via IQ from major sector entity ("Refining association, Association of Renewable Energy Producers, storage facilities and logistic operators' managers"). |
| | **Means of transport, loading techniques and technologies for reducing evaporative emissions**. | - Evolution of the national logistics circuit of gasoline. |
| Natural gas transport (**1B2b**, **1B2c**) | **Emissions leaked, vented or amounts incinerated in natural gas transport facilities** | IQ (ENAGAS and gas transportation companies) with information on:<br>- Natural gas losses in regulation plants, transport network, compression stations, underground storage and regulation stations and measures.<br>- Amount of gas vented in regulation plants, transport network, compression stations and underground storage.<br>- Burned quantities in regulation plants and underground storage.<br>Data reported through Regulation (EU) 2024/1787 on the reduction of methane emissions in the energy sector |
| Natural gas distribution system facilities (**1B2b**) | **Natural gas losses**. | IQ SEDIGAS (Spanish Gas Association from gas distribution companies) with information on:<br>- Kg $CH_4$ losses in distribution networks. |
| Exploration-drilling (**1B2c**) | **Production of crude oil and gas**. | - National statistics on hydrocarbon production. (CORES).<br>- Data reported through Regulation (EU) 2024/1787 on the reduction of methane emissions in the energy sector |

## H.2. Methodology

### Table 3.4.24 Summary of methodologies applied in category 1B

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| ***Fugitive emissions from fuel (1B)*** | | | |
| In general | T2/T3 | EMEP/EEA Guidebook (2019) Chapters 1B2ai,1B2b, 1B2aiv, 1B2av and 1B2c. | Default EF. |
| | T1 | 2019 Refinement to the 2006 IPPC Volume 2 Chaper4 | |
| PM, BC | T1/T2 | CEPMEIP Database. EMEP/EEA Guidebook (2019). | Default EF. |
| ***Coal mining and handling (1B1a)*** (Methodology factsheet: Fugitive emissions in coal mining) | | | |
| TSP, $PM_{2.5}$, $PM_{10}$ | T2 | EMEP/EEA Guidebook (2019) Chapter 1B1a. | Table 3-2. |
| ***Solid fuel transformation (1B1b)*** (Methodology factsheet: Coke oven (door leakage and extinction)) | | | |
| Main Pollutants | T2 | EMEP/EEA Guidebook (2019) Chapter 1B1b. | Default EF: Tables 3.2/3.3/3.5 (considering wet coal charging, door leak and coke pushing operations). |
| CO | T2 | EMEP/EEA Guidebook (2019) Chapter 1B1b. | Default EF: Tables 3.2/3.3/3.5 (considering wet coal charging, door leak and quenching operations). |
| TSP, $PM_{2.5}$, $PM_{10}$ | T2 | EMEP/EEA Guidebook (2019) Chapter 1B1b. | Default EF: Tables 3.2/3.3/3.4/3.5/3.6 (considering wet coal charging, door leak, off-take leaks, quenching and coke pushing operations). |
| HAP, DIOX, HM | T1 | EMEP/EEA Guidebook (2023) Chapter 1B1b. | Default EF: Table 3.1 |
| ***Oil – Exploration, production, transport (1B2ai)*** (Methodology factsheets: Oil-In Shore exploration, production, transport, Oil-Off Shore exploration, production, transport and Natural gas distribution networks) | | | |
| NMVOC | T1 | 2019 Refinement to the 2006 IPPC Volume 2 Chaper4 | Production Table 4.2.4 |
| | T2 | EMEP/EEA Guidebook (2019) Chapter 1B2ai. | Production Table 3-3<br>Transport Table 3-3 and table 3-16.<br>Data reported to Regulation (EU) 2024/1787 |
| ***Fugitive emissions from natural gas (1B2b)*** (Methodology factsheets: Natural gas-In shore exploration, production, transport and Natural gas-Off shore exploration, production, transport) | | | |
| NMVOC | T1 | 2019 Refinement to the 2006 IPPC Volume 2 Chaper4 | Exploration Table 2.4.4F<br>Production and Gathering Table 2.4.2G<br>Processing Table 2.4.2H |
| | T3 | Direct emissions measurement. | Data on measured/estimated gas emissions furnished by facilities within the network via individualised questionnaire, data provided by transport or supply companies/association together with annual gas characteristics, or reported to Regulation (EU) 2024/1787 |
| ***Fugitive emissions from oil – refining/ storage (1B2aiv)*** (Methodology factsheet: Fugitive emissions from processes in the refining industry) | | | |

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| NOx | T2 | Mixed methodology based on direct emissions measurements or estimates. EMEP/EEA Guidebook (2023) Chapter 1B2aiv. | FCC regeneration and Sulphur recovery. Table 3-2. |
| NMVOC | T2 | EMEP/EEA Guidebook (2023) Chapter 1B2aiv. | Table 3-2, 3-7. Storage and handling (Inventory team judgement). |
| $SO_2$ | T2/ T3 | Mixed methodology based on direct emissions measurements or estimates (mass balance). | Coking calcination, FCC regeneration, sulphur recovery and catalytic reforming units. |
| $NH_3$, PM, BC, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, PAHs | T2 | EMEP/EEA Guidebook (2023) Chapter 1B2aiv. | Table 3-2, 3-7. |
| CO | T2 | Country specific factors based on direct emissions. EMEP/EEA Guidebook (2023) Chapter 1B2aiv. | FCC regeneration. Catalytic reforming units Table 3-3. |
| PCDD/PCDF | T2 | EMEP/EEA Guidebook (2023) Chapter 1B2aiv. | Catalytic reforming units Table 3-3. |
| ***Distribution of oil products (1B2av)*** | | | |
| NMVOC | T1 | 2019 Refinement to the 2006 IPPC Volume 2 Chaper4 | Table 4.2.4D |
| | T2 | EMEP/EEA Guidebook (2019) Chapter 1B2av. | Table 3-2, 3-3, 3-4, 3-5, 3-6, 3-8, 3-9. Directive 2009/126/EC. |
| ***Venting and flaring (1B2c)*** (Methodology factsheets: Oil-In Shore exploration, production, transport, Oil-Off Shore exploration, production, transport, Natural gas-In shore exploration, production, transport, Natural gas-Off shore exploration, production, transport and Flaring in oil refining plants) | | | |
| NOx, NMVOC, CO, $SO_2$ | T1/ T2 | EMEP/EEA Guidebook (2019) Chapter 1B2c. | Flaring Table 3-1, 3-2. Venting Table 3-8. |
| NMVOC | T1 | 2019 Refinement to the 2006 IPPC Volume 2 Chaper4 | Flaring Table 4.2.4, 2.4.4F and 2.4.4H. Venting Table 4.2.4, 2.4.4F, 2.4.4G and 2.4.4H. |
| | | EMEP/EEA Guidebook (2019) Chapter 1B2ai. | Flaring Table 3-3. Venting Table 3-3. Data reported to Regulation (EU) 2024/1787 |
| PM, BC | T3/ T1 | Mixed methodology based on direct emissions measurements or estimates (EMEP/EEA Guidebook (2019) Chapter 1A1). | IQ from refineries table 4-7. |

## H.3. Assessment

This category stands out as a moderate emitting source in the Inventory for certain pollutants (particularly, NMVOC and $SO_2$). The contribution of the remaining main pollutants, namely NOx, $NH_3$, CO, Particulate Matter is marginal.

Activity data and NMVOC emission factors available for 1B2ai (Oil exploration/production and transport) are shown below.

**Table 3.4.25 Activity data of 1B2ai (national territory)**

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|
| **Production ($10^3$ $m^3$)** | 901 | 188 | 138 | 263 | 46 | 31 | 2 | 0 |
| **Transport ($10^3$ $m^3$)** | 72,881 | 84,428 | 73,119 | 86,318 | 89,282 | 73,561 | 76,866 | 78,941 |

Production figures cover offshore and onshore oil extraction in Spain. Transport figures refer to oil transport in pipelines and oil pumping at maritime terminals.

**Table 3.4.26 NMVOC emission factors from EMEP/EEA Guidebook (2019) 1B2ai**

| | EF | Unit | Table |
|---|---|---|---|
| **Production** | 0.10 (onshore) | Kg /Mg oil | 3-3 |
| | 0.40 (offshore) | Kg /Mg oil | 3-4 |
| **Transport** | 0.27(Marine terminals) | Kg/Mg | 3-16 |
| | 0.10(Crude oil transport) | Kg /Mg oil | 3-3 |

As can be seen in the following figure, emissions from oil transport are much higher than emissions from oil production.

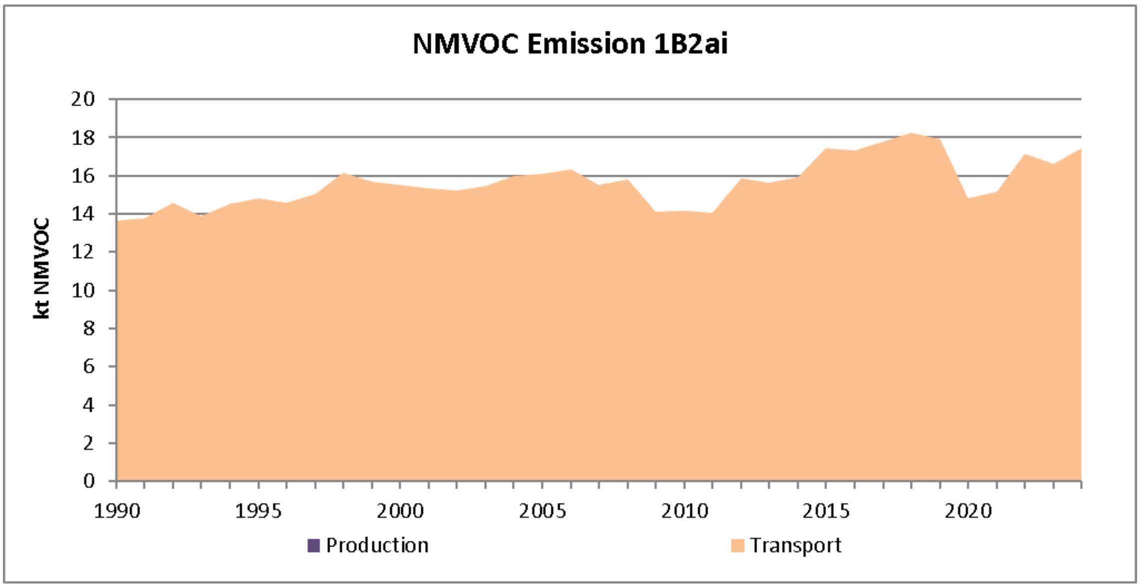



**Figure 3.4.21 Evolution of NMVOC emissions in category 1B2ai (national territory)**

The $SO_2$ implied emission factor for 1B2aiv (Fugitive emissions from oil refining and storage) is displayed in the figure below.

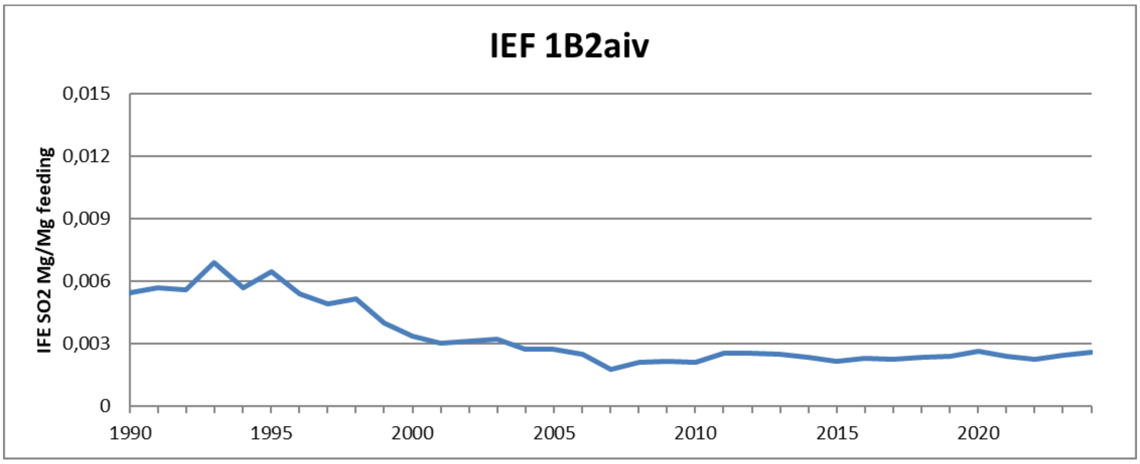



**Figure 3.4.22 Evolution of $SO_2$ Implied emission factor in category 1B2aiv**

The category 1B2aiv includes different processes in petroleum industries as petroleum products processing, fluid catalytic cracking, sulphur recovery plants, catalytic reforming unit and storage and handling of petroleum products in refineries. Every process has different emission factors and, in some cases, emissions are estimated based on direct measurements.

Therefore, it is not feasible to show the whole amount of data associated. The $SO_2$ implied emission factor trend shown is mainly linked to the activity of sulphur recovery, followed by the fluid catalytic cracking process.

Finally, NMVOC emissions from Coal mining and handling activities are considered as negligible (see Annex 6 - Expert Judgement).

## 3.5. Memo items

The United Nations Economic Commission for Europe (UNECE) Convention on Long-Range Transboundary Air Pollution (CLRTAP) excludes the cruising phases (both domestic and international segments) in air traffic category, and the international maritime traffic. These categories and their figures are not included in the totals of the Spanish Inventory, but are reported as “Memo items” in the NFR reporting tables for informative purposes.

Estimation of emissions in air traffic is analogous to what has been previously described in the present chapter, in the item “D. Air traffic at airports”. This correspondence can be seen below:

**Table 3.5.1 Air traffic: Inventory items / Memo Items**

| AIR TRAFFIC | LTO | Cruise |
|---|---|---|
| **International aviation** | 1A3ai(i): Inventory | 1A3ai(ii): Memo item |
| **Domestic aviation** | 1A3aii(i): Inventory | 1A3aii(ii): Memo item |

Total fuel consumption in the cruise phase of aviation follows a similar trend as the one described in item “D. Air traffic at airports” for LTO phase, as shown below.

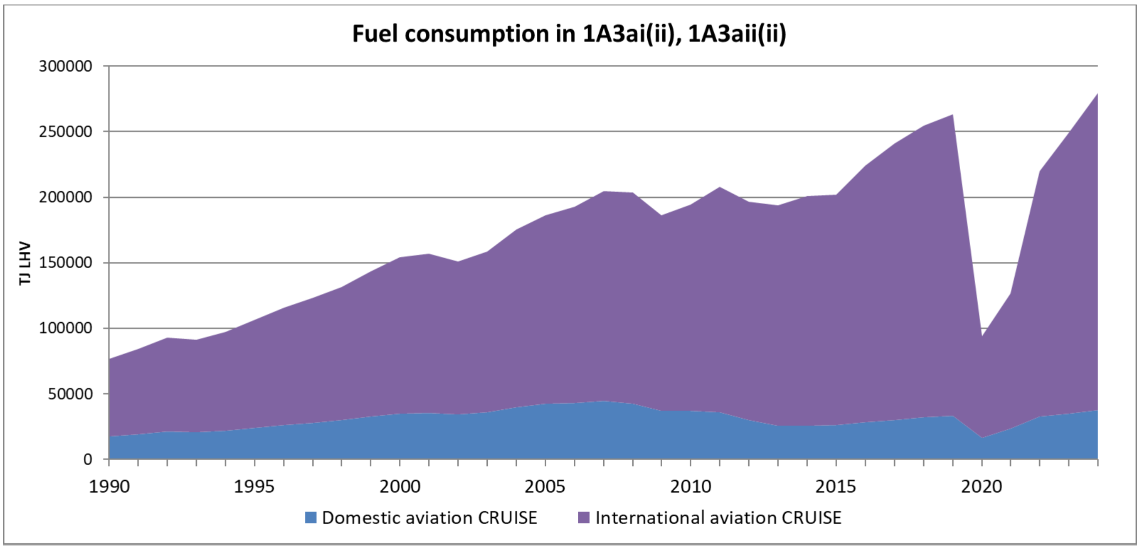



**Figure 3.5.1 Evolution of fuel consumption in aviation cruise phase (1A3ai(i), 1A3aii(ii)), national territory**

Regarding international maritime navigation, the methodology is analogous to what is described in item "F. National navigation" of this chapter.

**Table 3.5.2 Maritime traffic: Inventory items / Memo Items**

| MARITIME TRAFFIC | |
|---|---|
| **International navigation** | 1A3di(i): Memo item |
| **National navigation (shipping)** | 1A3dii: Inventory |

Following the recommendation ES-1A3di(i)-2024-0001 made by the TERT in the Final Review Report 2024 (Review of National Air Pollutant Emission Inventory Data 2023 under Directive (EU) 2016/2284)[22], further information on international navigation activity data is included below.

All of the following data are shown in terms of national territory totals. International navigation differs with national navigation primarily in the share of fuel oil consumption, which contributes to 77% to the total fuel consumption in international navigation in 2024, whereas in national navigation it has a contribution of 40% (both percentages are the same as without Canary Islands). As a consequence, higher $SO_2$ implied emission factors are observed in international navigation, especially in 2005, where fuel oil shares reaches its maximum, contributing to 88% out of total fuel consumption (the same as without Canary Islands).

[22] Final Review Report available in: https://environment.ec.europa.eu/topics/air/reducing-emissions-air-pollutants/emissions-inventories_en#review-of-national-emission-inventories

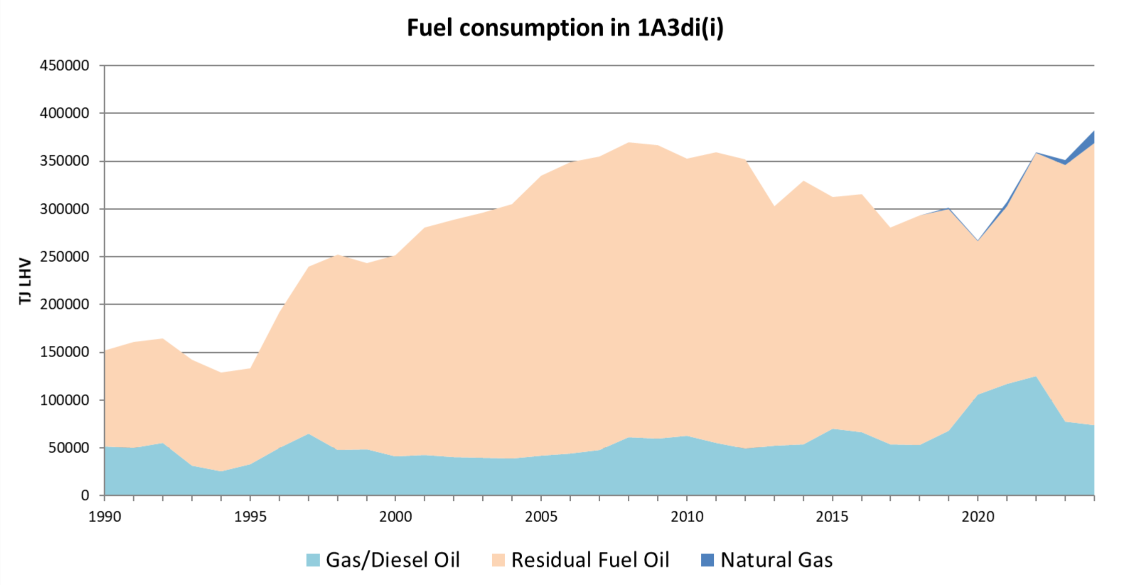



**Figure 3.5.2 Evolution of fuel consumption in international navigation (1A3di(i)), national territory**

## 3.6. Recalculations

In the current edition of the Spanish Inventory, there have been several recalculations within the Energy sector due to different reasons such as methodological improvements —including updates of emission factors to EMEP/EEA Guidebook (2023)—, availability of new data, improvements in the calculations and correction of found errors. All of the recalculations are expressed in terms of national territory totals.

The most relevant recalculations performed in Energy are shown in the following table.

**Table 3.6.1 Recalculation by pollutants – Energy**

| Pollutants affected | Recalculation |
|---|---|
| ***1A1a Public electricity and heat production*** | |
| District heating plants:<br>- All pollutants | Activity data update in year 2023. |
| Biogas facilities:<br>- All pollutants | Activity data from six new biomethanization plants and data updates from others (2012-2023). |
| Domestic wastewater handling plants:<br>- All pollutants | Correction on quantity of wastewater collected and non-collected; corrections in biogas burnt in motors and boilers (2013-2023). |
| Industrial wastewater handling plants:<br>- All pollutants | Changes in activity data within the whole category 5D2; brewing industry: 100% recovery of methane no longer assumed; fish processing plants: updating to 2019 Refinement on wastewater generation (1990-2023); TOW removed as sludge no longer applied, years 1990-1995. |
| Managed landfills:<br>- All pollutants | Correction of the assumption of maximum efficiency 70% of biogas captured (2012-2023). |
| ***1A1c Manufacture of solid fuels and other energy industries*** | |
| Coke ovens:<br>- All pollutants<br>- PM | Activity data update in year 2013.<br>Update of emission data from the source for the year 2023. |

| Pollutants affected | Recalculation |
|---|---|
| All categories (except coke plants):<br>- All pollutants (except $NH_3$ and PCBs) | Fuel balance recalculation for consistency with international energy statistics, years 2006-2023. |
| ***1A2 Combustion in manufacturing industries and construction*** | |
| All categories:<br>- All pollutants | Fuel balance recalculation for consistency with international energy statistics. |
| ***1A2a Combustion in manufacturing industries and construction: Iron and steel*** | |
| NMVOC, NOx, CO, PM, BC, Hg | Activity Data update for years 2003 and 2018 and emission data update for years 2019-2023 |
| ***1A2b Combustion in manufacturing industries and construction: Non ferreous metals*** | |
| NOx, $SO_2$ | Activity Data update for years 2017-2023 |
| ***1A2c Combustion in manufacturing industries and construction: Chemicals*** | |
| - All pollutants | Update of fuel consumption values due to the consistency with energy statistics: wood and other wood wastes (2021-2023), natural gas (2004-2023) and diesel (1995-2022). |
| ***1A2d Combustion in manufacturing industries and construction: Pulp, Paper and Print*** | |
| - All pollutants | Update of fuel consumption values due to the consistency with energy statistics: wood and other wood wastes (2022, 2023), natural gas (2023) and diesel (1995-2023). |
| ***1A2e Combustion in manufacturing industries and construction: Food processing, beverages and tobacco*** | |
| - All pollutants | Update of fuel consumption values due to the consistency with energy statistics: wood and other wood wastes (2021-2023), natural gas (2023), diesel (1995-2023) and residual fuel oil (2022, 2023). |
| Sugar production:<br>- All pollutants | Correction in diesel and residual fuel oil consumption by a sugar plant (2016-2023). |
| ***1A2f Stationary Combustion in Manufacturing Industries and Construction: Non metallic minerals*** | |
| - All pollutants | Update of fuel consumption values due to the consistency with energy statistics: wood and other wood wastes (2021-2023), natural gas (2023) and diesel (1995-2022). |
| ***1A2gvii Mobile combustion in Manufacturing Industries and Construction*** | |
| - All pollutants | Update of 2023 provincial distribution. |
| ***1A2gviii Stationary combustion in manufacturing industries and construction: Other*** | |
| - All pollutants | Update of fuel consumption values due to the consistency with energy statistics: wood and other wood wastes (2021-2023), natural gas (2023) and diesel (1995-2022) and residual fuel oil (2022, 2023). |
| ***1A3b Road transport*** | |
| - All pollutants | Update of activity data of 2023 (total mileage). Update of gasoline consumption of 2022 and 2023. Update of diesel consumption of 2023. |
| - PAH | Update of emission factors of diesel passenger cars and light commercial vehicles (recalculations for the whole period). |
| ***1A3c Railways*** | |
| - All pollutants | Minor correction of 2023 provincial distribution. |
| ***1A4ai Stationary combustion in commercial and institutional activities*** | |
| - All pollutants | Update of fuel consumption values due to the update of data sources: wood and other wood wastes (2021-2023), landfill gas (2021-2023), diesel (2023) and natural gas (2023).<br>New charcoal consumption registered in this category from 2021 onwards.<br>Elimination of other bituminous coal consumption for year 2021, following the information reported in data source. |

| Pollutants affected | Recalculation |
|---|---|
| ***1A4bi Stationary combustion in residential activities*** | |
| - All pollutants | Update of fuel consumption values due to the update of data sources: wood and other wood wastes (2021-2023), charcoal (2021-2023) and natural gas (2023). |
| ***1A4ci Stationary combustion in agriculture, forestry and fishing activities*** | |
| - All pollutants | Update of diesel consumption for the whole series, in line with new methodological improvements.<br>Update of wood and other wood wastes and landfill gas consumption (2021-2023) due to the update of data source.<br>Correction in natural gas consumption for 2019-2023.<br>Provincial distribution of all fuels updated for the whole series. |
| ***1A4cii Mobile machinery in agriculture and forestry activities*** | |
| - All pollutants | Agricultural activity data updated due to new methodology estimates (1990-2023).<br>Update of forestry activity data and provincial distribution (2022, 2023). |
| ***1A4ciii Mobile machinery in fishing activities*** | |
| - All pollutants | Correction of fuel consumption of 2019, 2020 and 2021.<br>Update of 2023 fuel consumption and provincial distribution. |
| ***1A5b Military transport*** | |
| - All pollutants | Militar and multilateral road traffic: minor emission updates due to civil road transport updates.<br>Multilateral road traffic, maritime and aviation traffic: inclusion of 2023 consumption. |
| - PAHs | Military and multilateral road transport: update of PAH diesel EF in line with civil road EF changes, for the whole series. |
| ***1B1b Fugitive emissions from solid fuels: Opening and extinction of coke oven furnaces*** | |
| - PAHs, HM, DIOX | New estimation of these pollutants as suggested by the TERT in the 2025 NECD review. |
| ***1B2av Fugitive emissions oil: Distribution of oil*** | |
| - NMVOC | Methodological change in coherence with 2019 Refinement of the IPCC Guidebook. |

### 1A1a Public electricity and heat production. Main Pollutants and CO emissions

The changes in activity data performed in the present edition have very slightly affected 1A1a estimations, as is shown in the following figures.

The most significant recalculations are a consequence of the correction of maximum efficiency on biogas capture in managed landfills (following the ESR review question ES-5A-2025-0003, see Chapter 6 – Waste) as well as of updating the base information on biomethanization plants, for the period 2012-2023.

There are minor recalculations for the entire time series referred to changes in activity data from industrial wastewater handling plants, as recommended by the ESR review question ES-5D-2025-0002, and due to updating to 2019 Refinement to the 2006 IPCC Guidelines (on wastewater generation in fish processing plants), as detailed in Chapter 6.

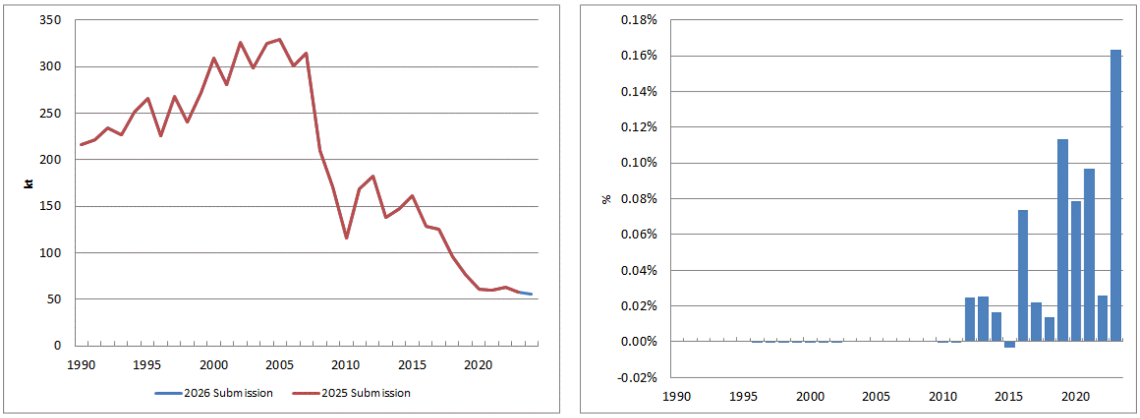



**Figure 3.6.1 Evolution of the difference in 1A1a NOx emissions (national territory)**

Differences in NMVOC, $SO_2$ and $NH_3$ emissions are related to update of fuel combustion in DH plants in 2023 (the latter, directly linked to biomass combustion).

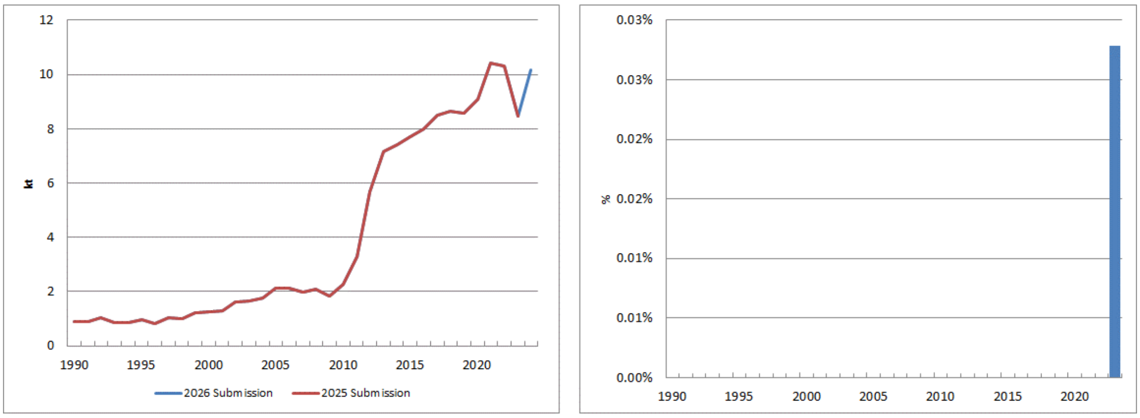



**Figure 3.6.2 Evolution of the difference in 1A1a NMVOC emissions (national territory)**

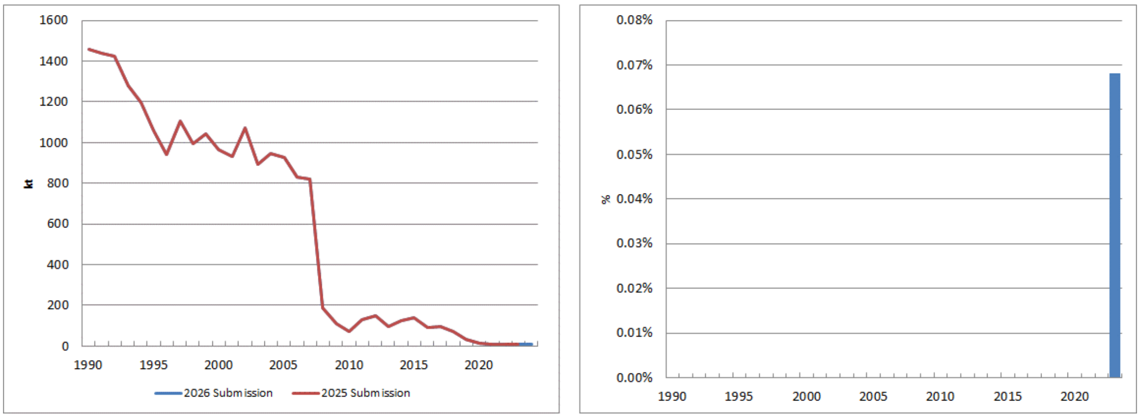



**Figure 3.6.3 Evolution of the difference in 1A1a $SO_2$ emissions (national territory)**

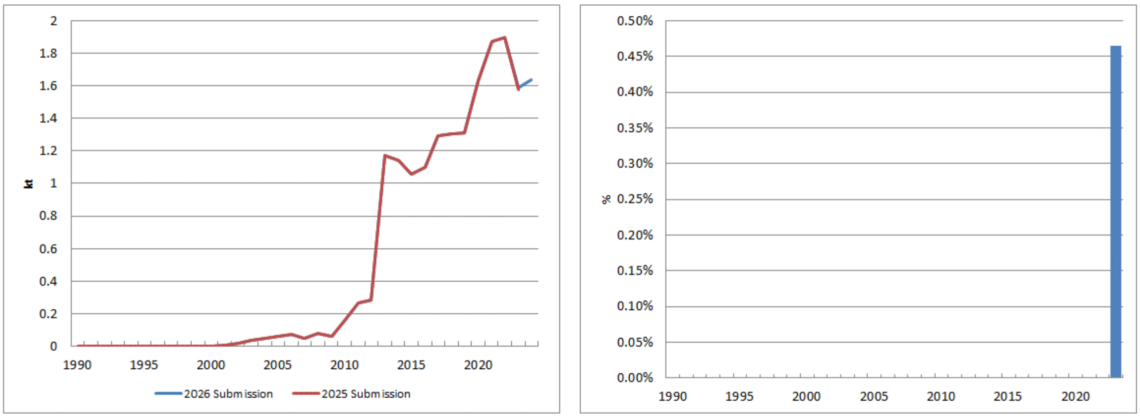



**Figure 3.6.4 Evolution of the difference in 1A1a $NH_3$ emissions (national territory)**

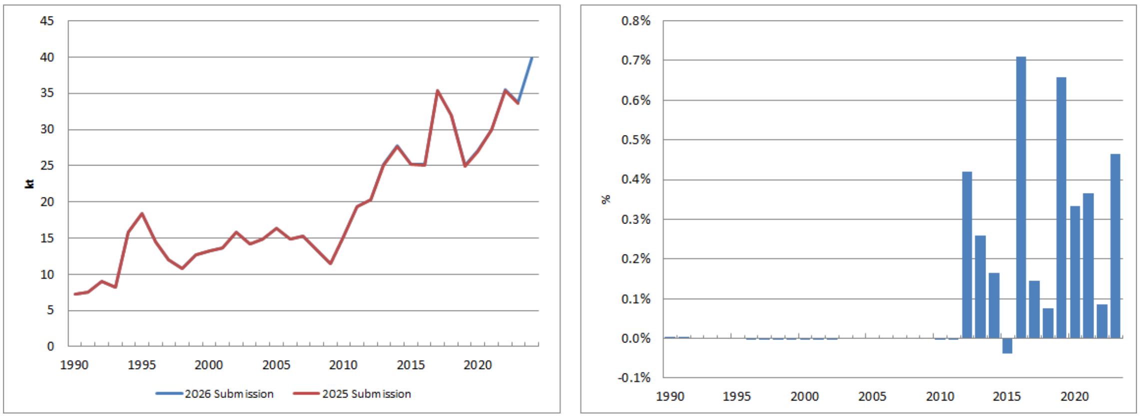



**Figure 3.6.5 Evolution of the difference in 1A1a CO emissions (national territory)**

## 1A1a Public electricity and heat production. Particulate Matter, Heavy Metals and POPs emissions

The main recalculations are a consequence of the correction of maximum efficiency on biogas capture in managed landfills as well as of updating the base information on biomethanization plants, for the period 2012-2023.

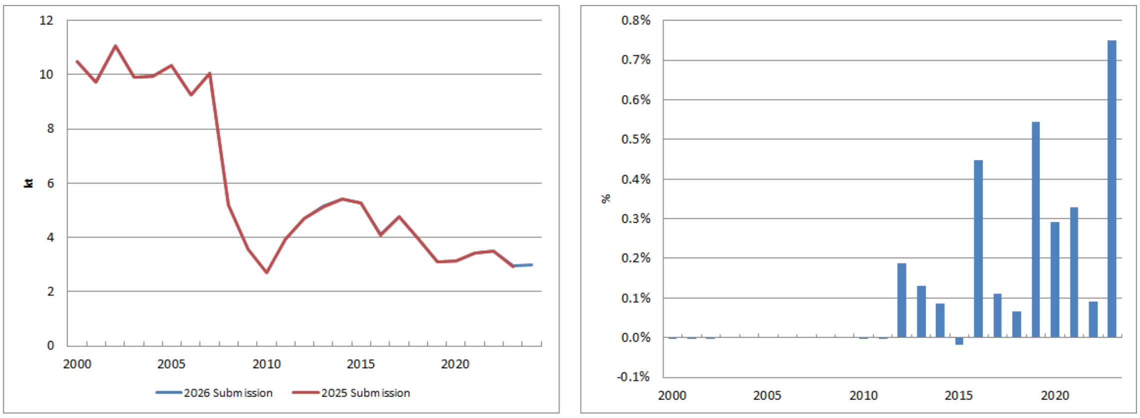



**Figure 3.6.6 Evolution of the difference in 1A1a $PM_{2.5}$ emissions (national territory)**

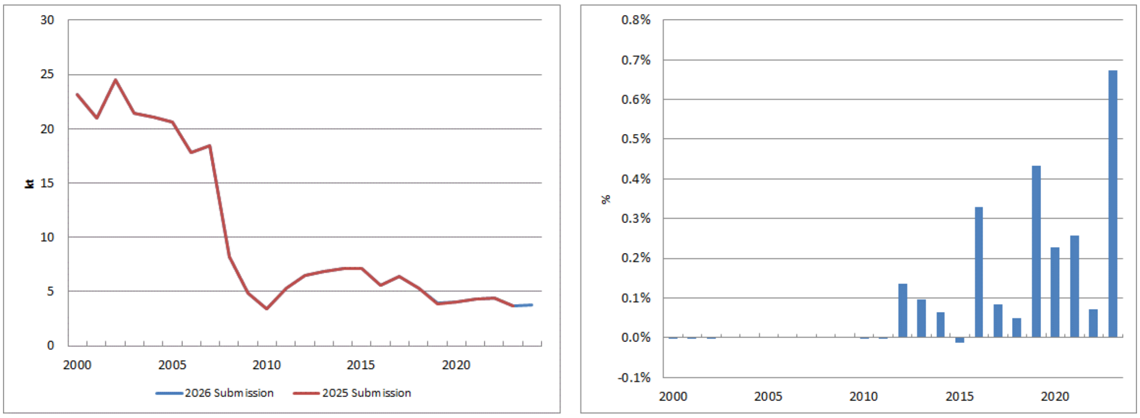



**Figure 3.6.7 Evolution of the difference in 1A1a $PM_{10}$ emissions (national territory)**

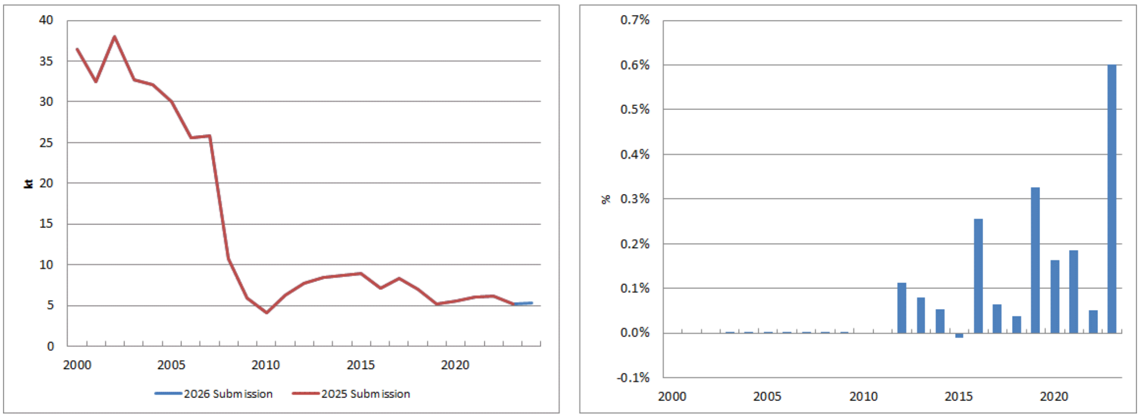



**Figure 3.6.8 Evolution of the difference in 1A1a TSP emissions (national territory)**

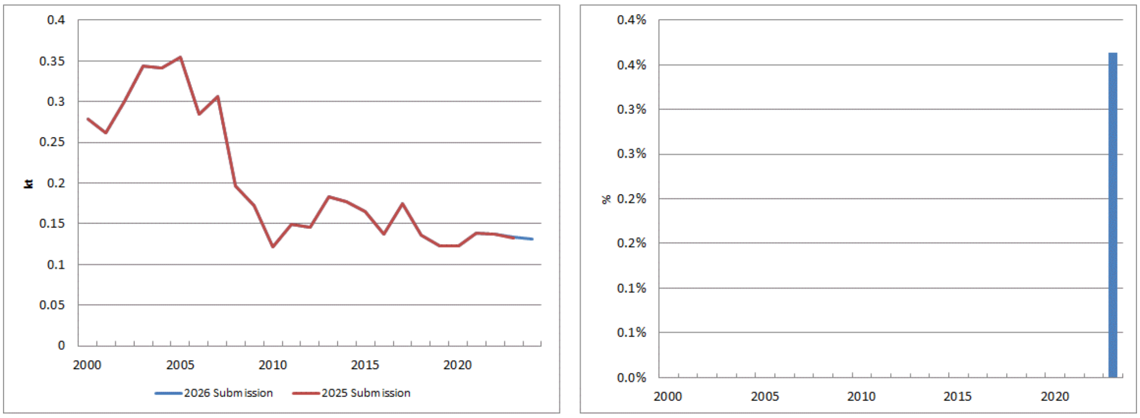



**Figure 3.6.9 Evolution of the difference in 1A1a BC emissions (national territory)**

The recalculations related to the year 2023 are mostly consequence of updating the activity data from district heating activity.

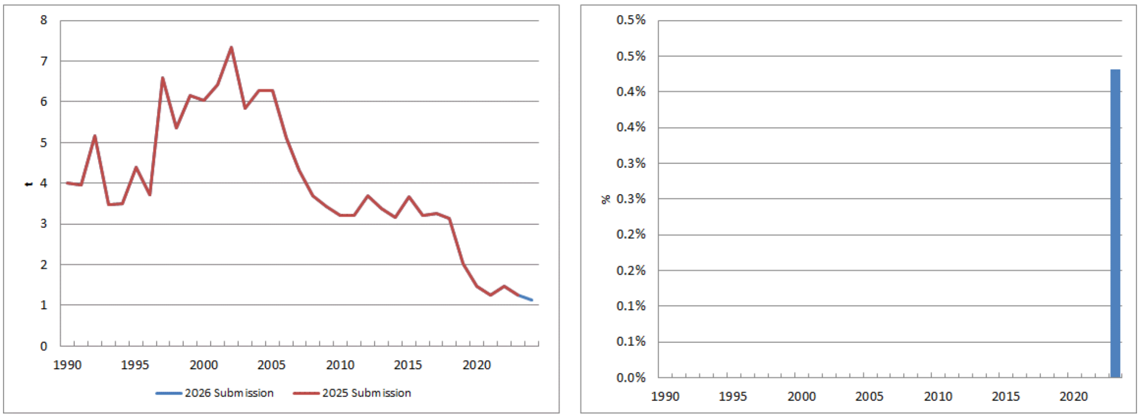



Figure 3.6.10 Evolution of the difference in 1A1a Pb emissions (national territory)

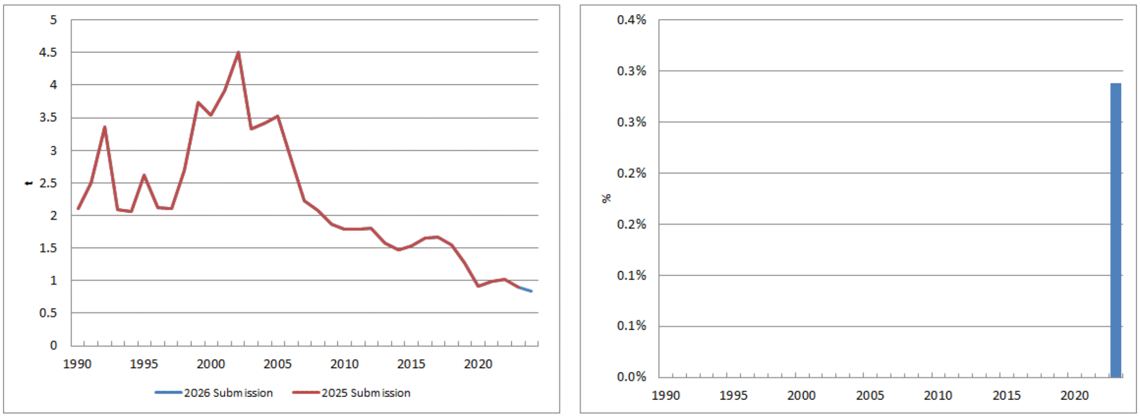



Figure 3.6.11 Evolution of the difference in 1A1a Cd emissions (national territory)

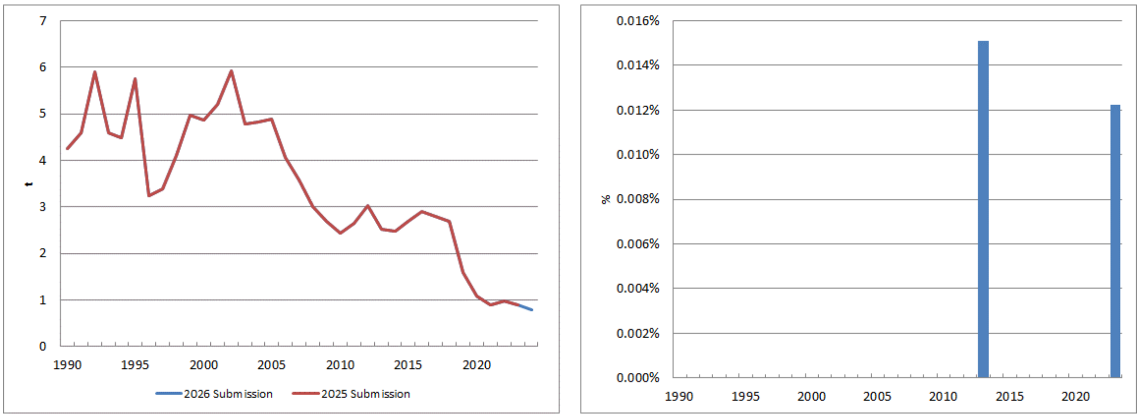



Figure 3.6.12 Evolution of the difference in 1A1a Hg emissions (national territory)

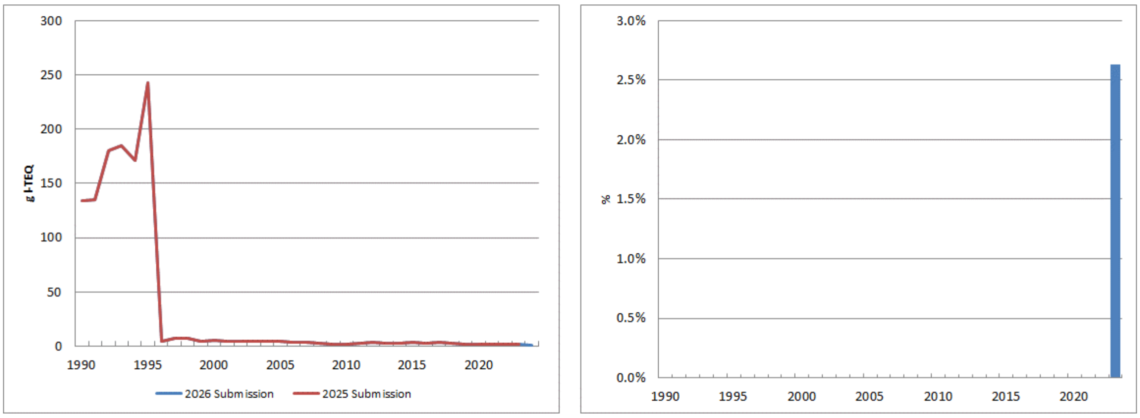



**Figure 3.6.13 Evolution of the difference in 1A1a PCDD/PCDF emissions (national territory)**

### PAHs emissions under 1A1a Public electricity and heat production

Emissions of PAHs totals under 1A1a were updated to EMEP/EEA Guidebook (2019) for both Large Point Sources (LPS) and small power plants (Area Sources) in previous editions of the Inventory, for all type of fuels used in power generation plants and incineration plants.

The changes in activity rates performed in the present edition (mainly corrections within district heating activity in year 2023, with higher proportion of biomass plants) have affected PAHs emissions, as is shown in the following picture.

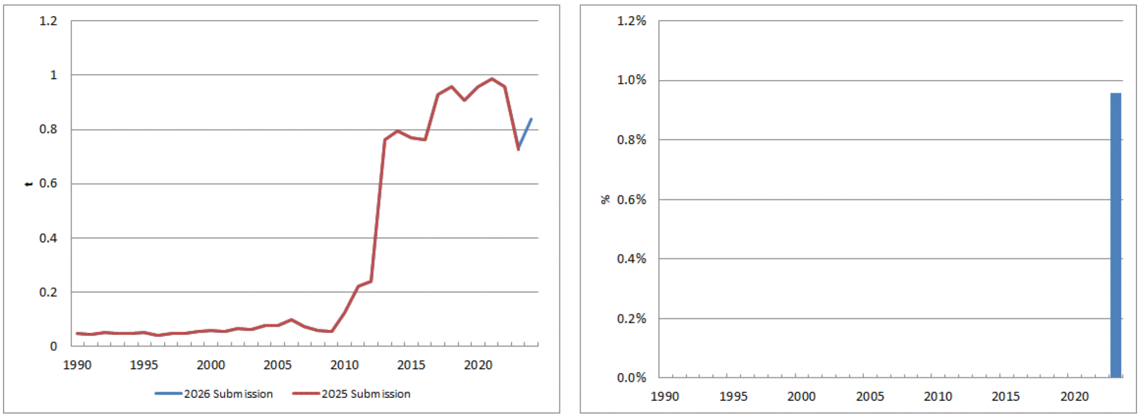



**Figure 3.6.14 Evolution of the difference in 1A1a PAHs emissions (national territory)**

The main driver in PAHs emissions at the beginning of the Inventory period is the amount of MSW burned at incineration plants with energy recovery: Tier 2 EF in Table 3-2 (EMEP/EEA 2019 GB, Chapter 5.C.1.a) are used. From 1996 onwards, information regarding abatement techniques in MSW incineration plants became available: Tier 1 EFs in Table 3-1 are used. After this, as from 2009 a significant rise in agricultural and wood wastes consumption at biomass plants implies an increase in PAHs emissions. Small power plants (mainly biomass power plants but also DH networks) have multiplied in recent years in Spain (e.g. 8 biomass power plants registered in the Inventory in 2011 vs. 32 plants in 2022 or 29 in 2024) that means a significant increase of wood wastes burned in boilers, which have a direct correlation with PAHs emissions. In year 2023, the amount of solid biomass used for electricity and heat production decreased considerably, even though it grew again in 2024, which is reflected in the emissions associated with this kind of fuels.

### 1A1c Manufacture of solid fuels and other energy industries.

Changes related to the recalculation of the fuel balance, for consistency with international energy statistics, are registered within 1A1c category (years 2006-2023).

In addition, in coke oven furnaces:

- Activity data has been updated for the year 2013.
- Update of PM emission data from the source for the year 2023.

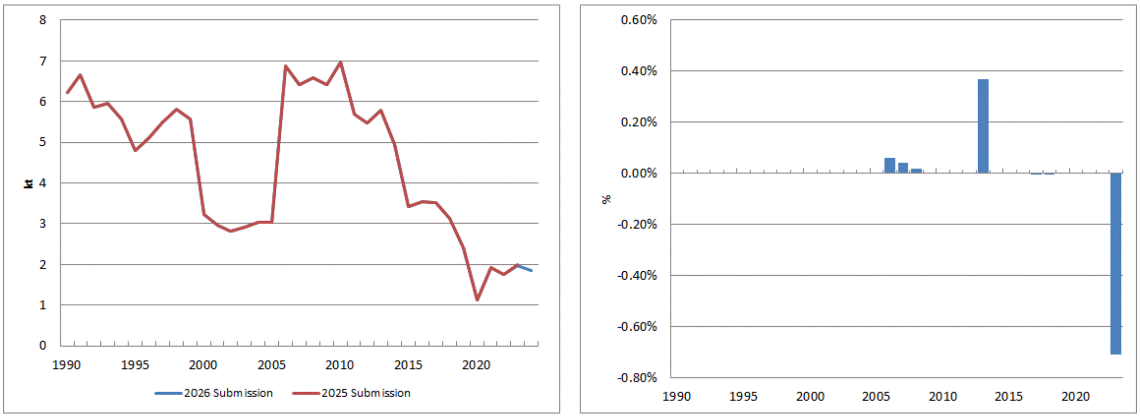



**Figure 3.6.15 Evolution of the difference in 1A1c NOx emissions (national territory)**

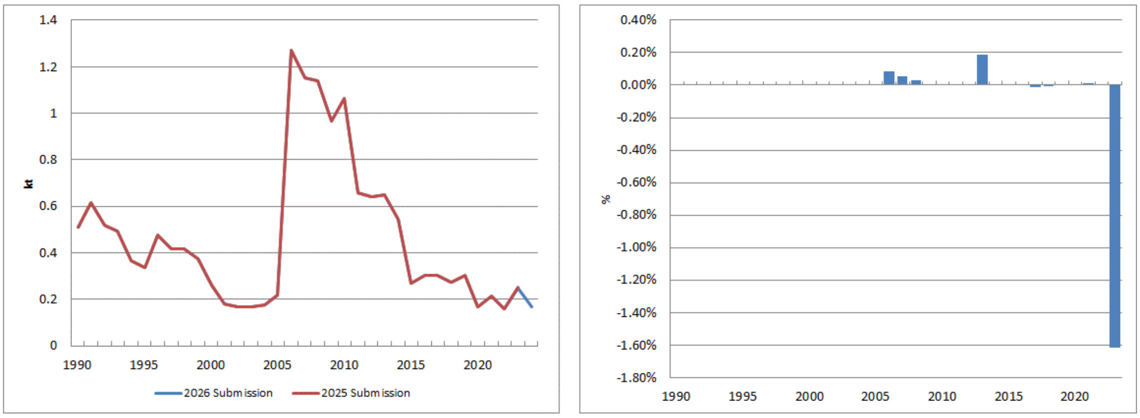



**Figure 3.6.16 Evolution of the difference in 1A1c NMVOC emissions (national territory)**

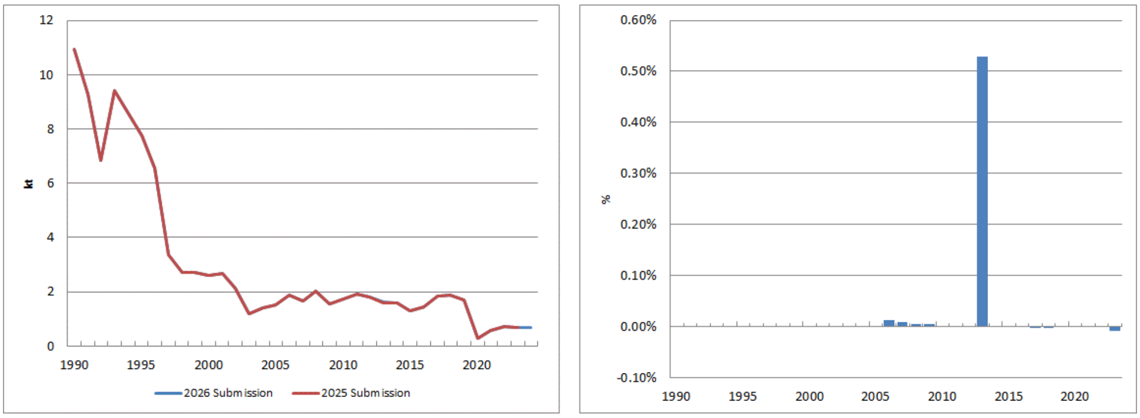



**Figure 3.6.17 Evolution of the difference in 1A1c $SO_2$ emissions (national territory)**

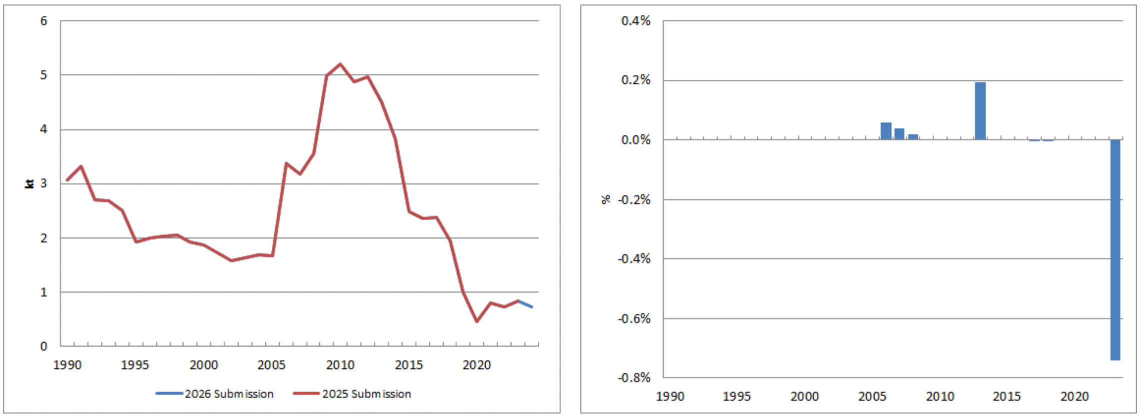



**Figure 3.6.18 Evolution of the difference in 1A1c CO emissions (national territory)**

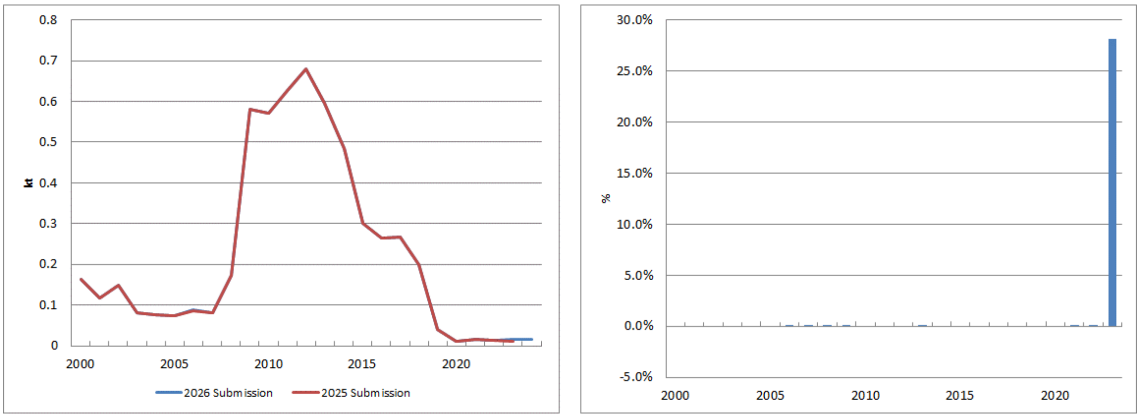



**Figure 3.6.19 Evolution of the difference in 1A1c $PM_{2.5}$ emissions (national territory)**

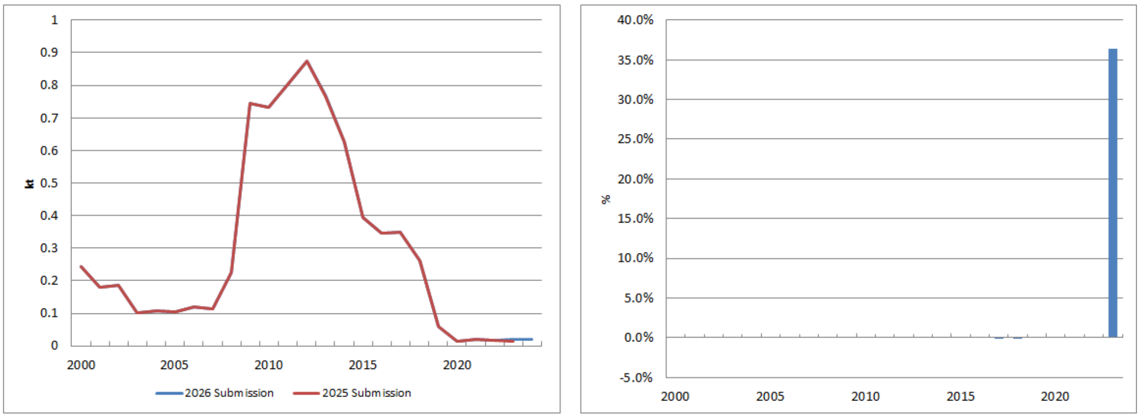



**Figure 3.6.20 Evolution of the difference in 1A1c $PM_{10}$ emissions (national territory)**

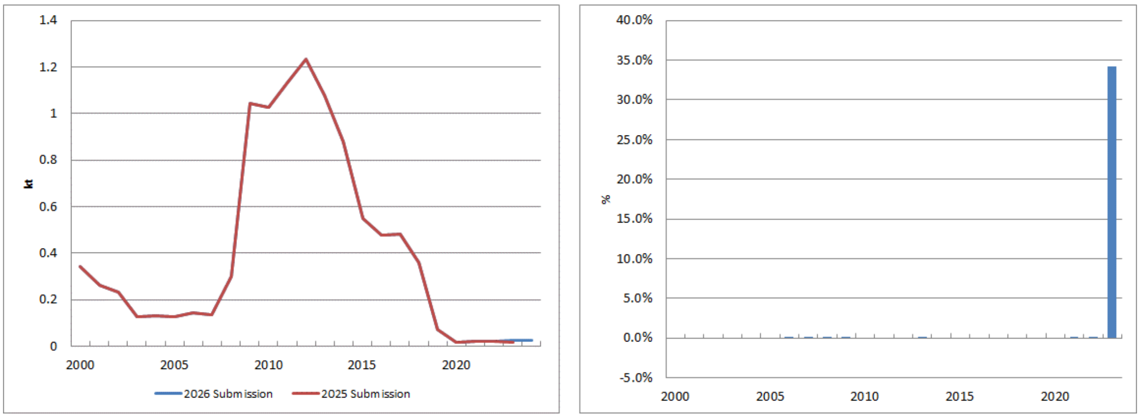



**Figure 3.6.21 Evolution of the difference in 1A1c TSP emissions (national territory)**

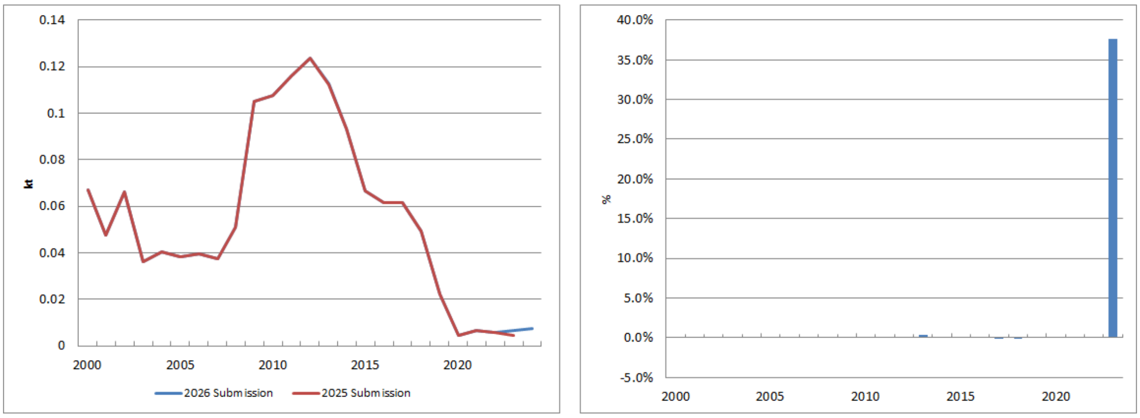



**Figure 3.6.22 Evolution of the difference in 1A1c BC emissions (national territory)**

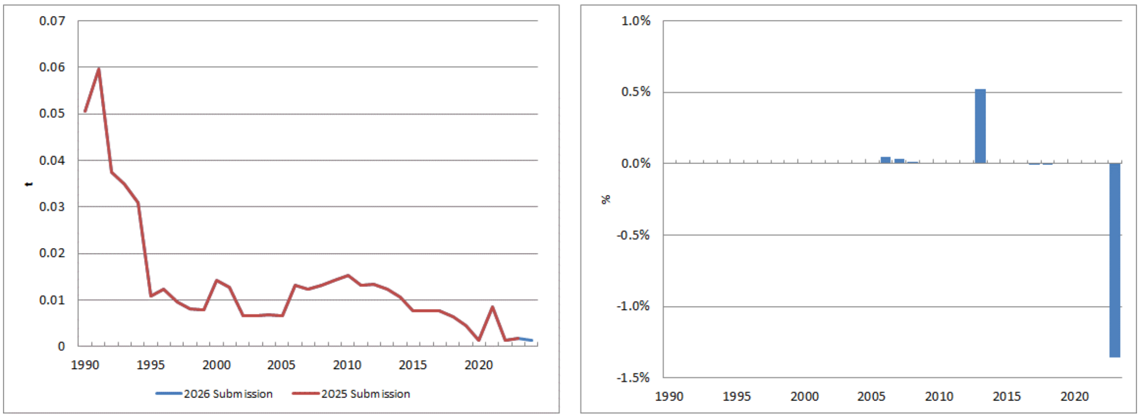



**Figure 3.6.23 Evolution of the difference in 1A1c Hg emissions (national territory)**

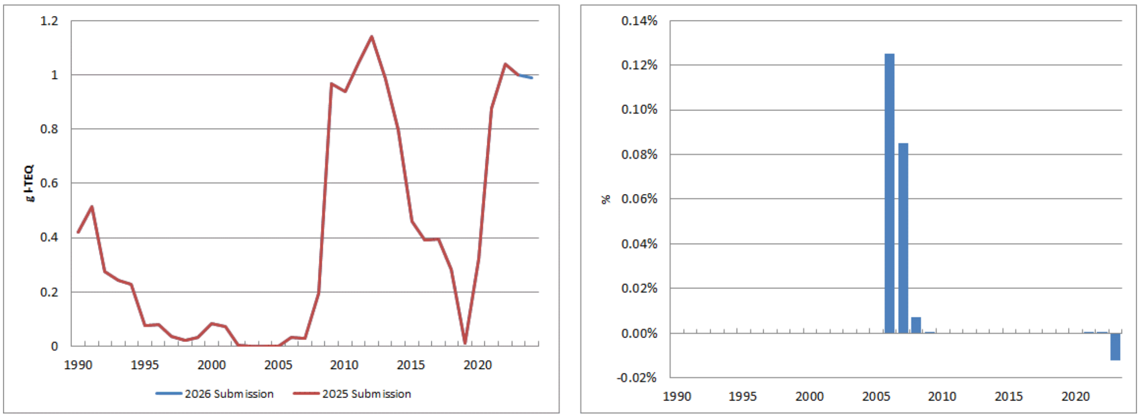



**Figure 3.6.24 Evolution of the difference in 1A1c PCDD/PCDF emissions (national territory)**

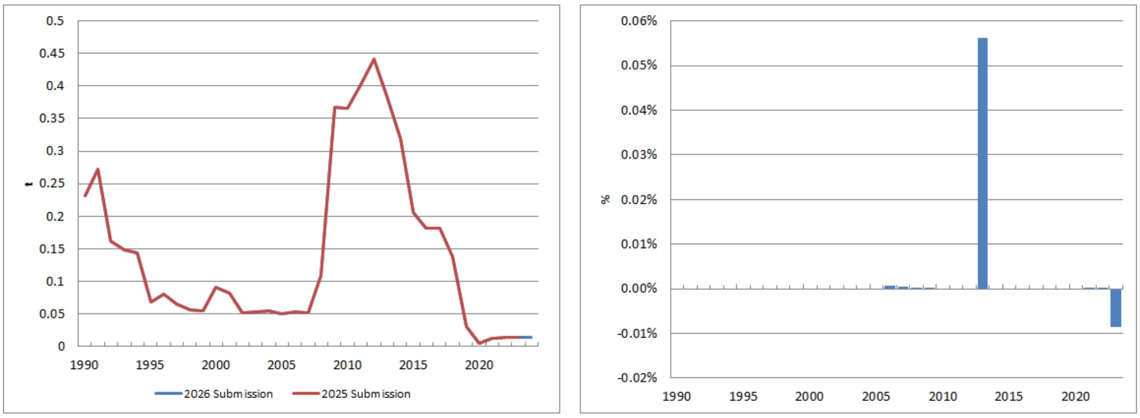



**Figure 3.6.25 Evolution of the difference in 1A1c PAH emissions (national territory)**

### 1A2 Stationary combustion in manufacturing industries and construction

Recalculations caused by the update of the fuel balance for consistency with international energy statistics, have an impact on all subcategories and pollutants. This effect is added to the ones specified in Table 3.6.1 for each subcategory.

In this edition, most of the total recalculation on 1A2 is minor for most of the pollutants, so it has been deemed appropriate to include only the more relevant ones.

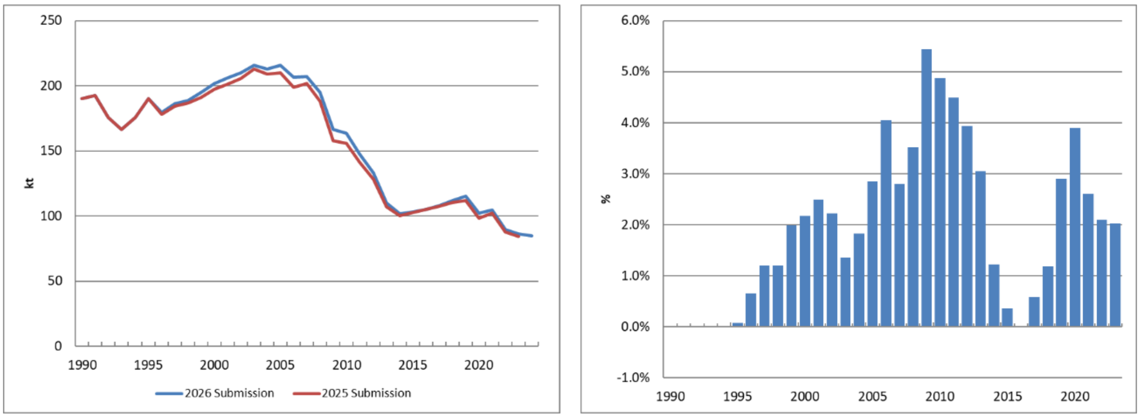



Figure 3.6.26 Evolution of the difference in 1A2 NOx emissions (national territory)

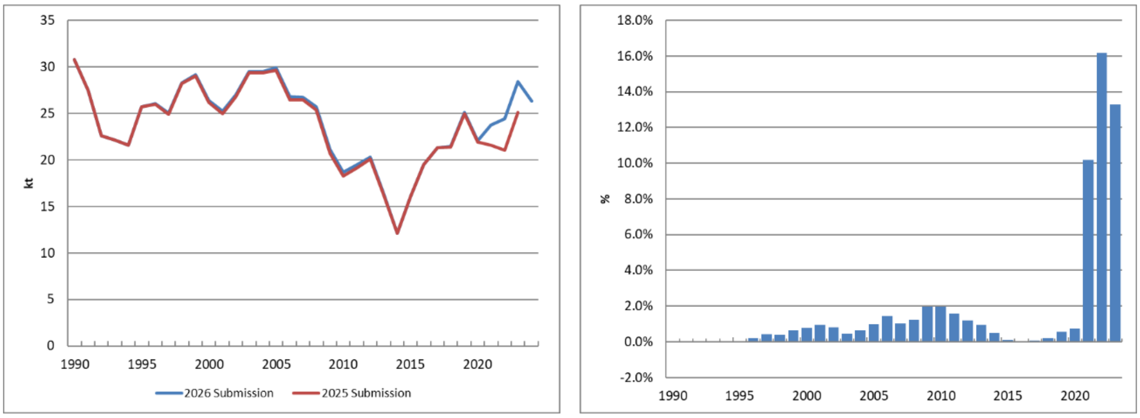



Figure 3.6.27 Evolution of the difference in 1A2 NMVOC emissions (national territory)

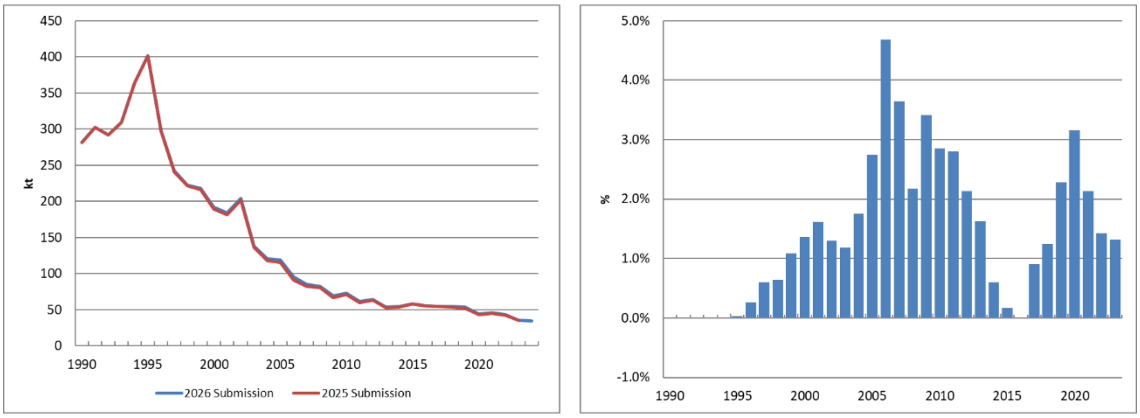



Figure 3.6.28 Evolution of the difference in 1A2 $SO_2$ emissions (national territory)

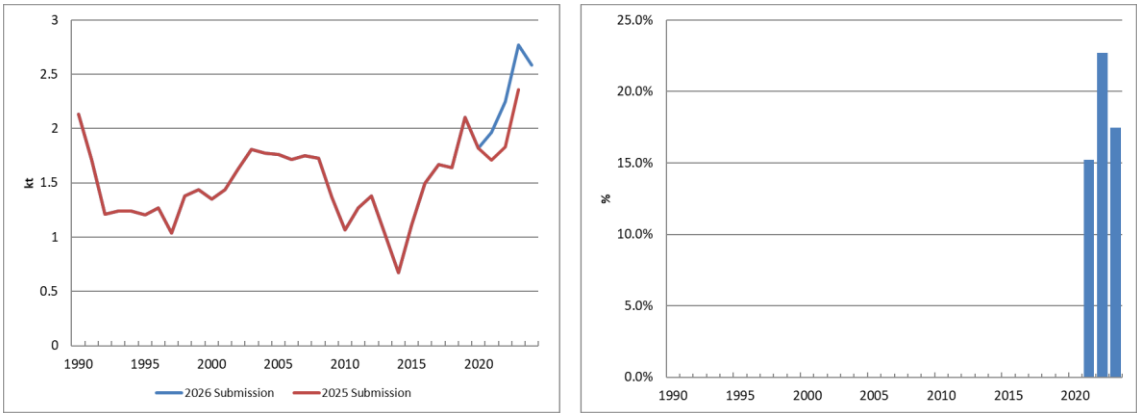



**Figure 3.6.29 Evolution of the difference in 1A2 $NH_3$ emissions (national territory)**

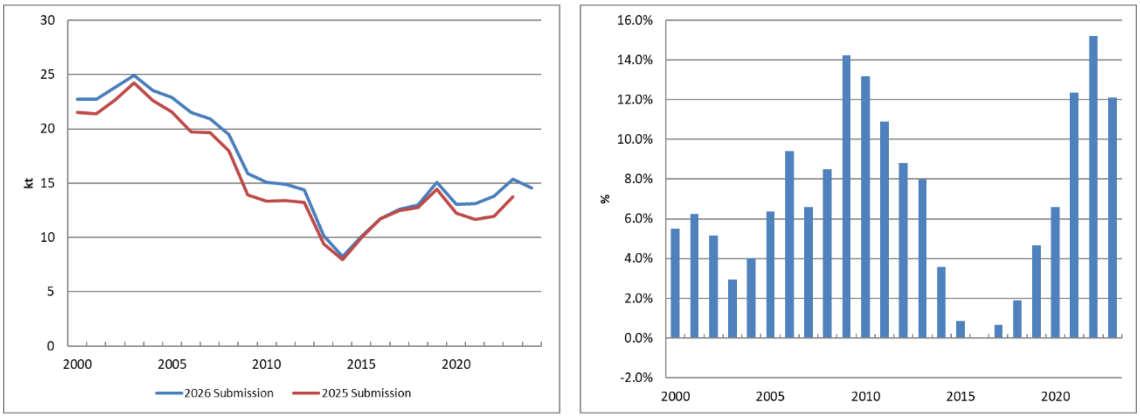



**Figure 3.6.30 Evolution of the difference in 1A2 TSP emissions (national territory)**

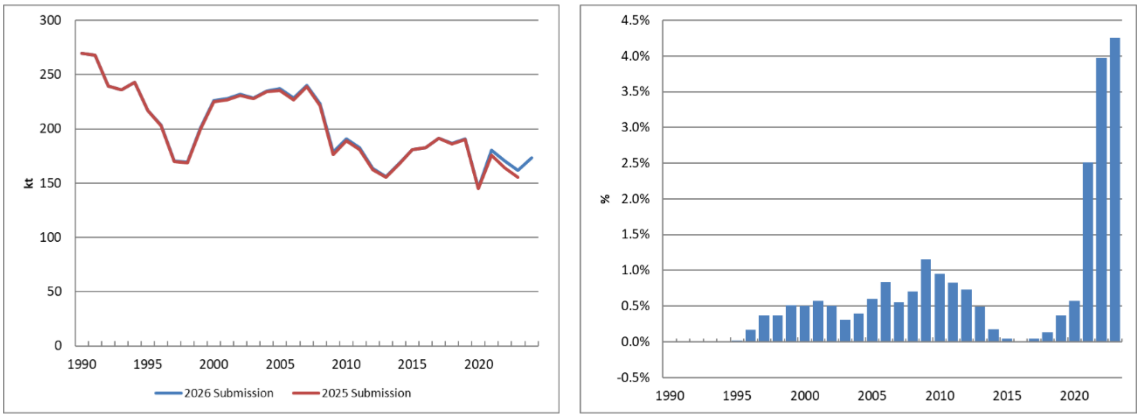



**Figure 3.6.31 Evolution of the difference in 1A2 CO emissions (national territory)**

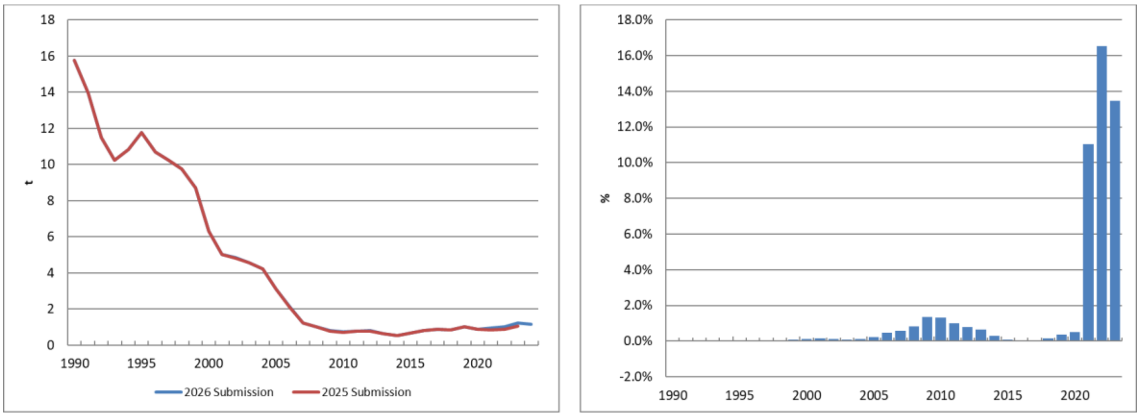



**Figure 3.6.32 Evolution of the difference in 1A2 Cd emissions (national territory)**

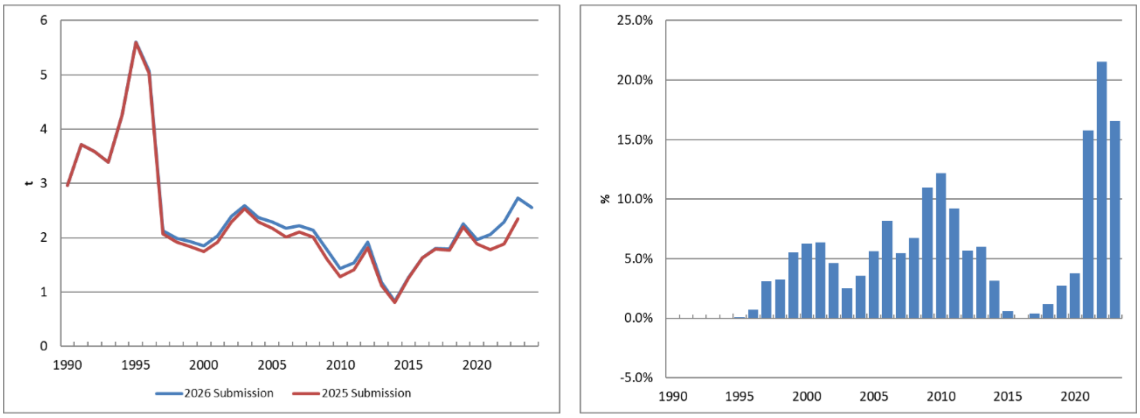



**Figure 3.6.33 Evolution of the difference in 1A2 PAHs emissions (national territory)**

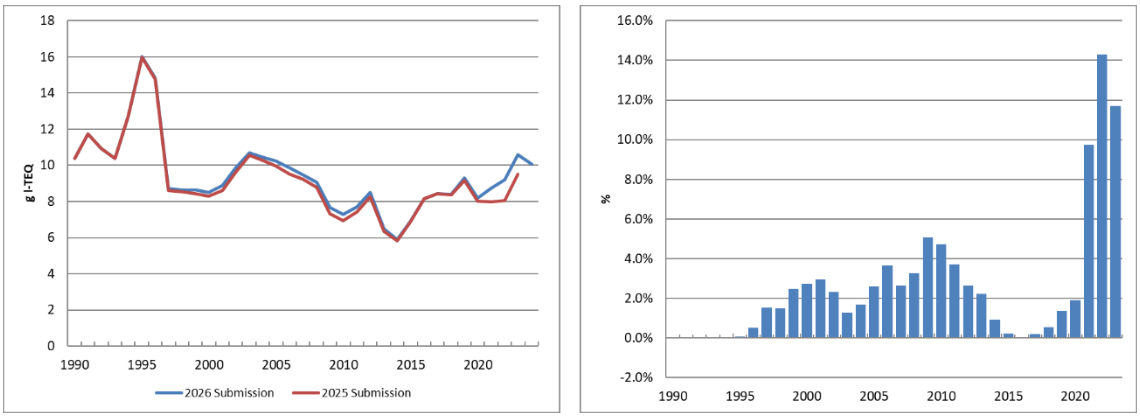



**Figure 3.6.34 Evolution of the difference in 1A2 PCDD/PCDF emissions (national territory)**

### 1A3b Road transport

Recalculations made in road transport are caused by the following variations: inclusion of total mileage data from General Directorate for Roads of 2023 and data of total annual distances travelled by vehicles subject of Technical Inspection of Vehicles of 2023; update of gasoline consumption of 2022 and 2023, and diesel consumption of 2023.

Additionally, recalculations were done in total PAH combustion emission factors and its species of diesel passenger cars and light commercial vehicles, which have been reviewed and modified for the whole series, using only Direct Injection diesel emission factors since Euro 3 vehicles, in place of the average of Direct and Indirect Injection emission factors.

Recalculations of main pollutants, particulate matter, BC, PAH, PCDD/PCDF and priority heavy metals are shown below, although recalculations affect all pollutants.

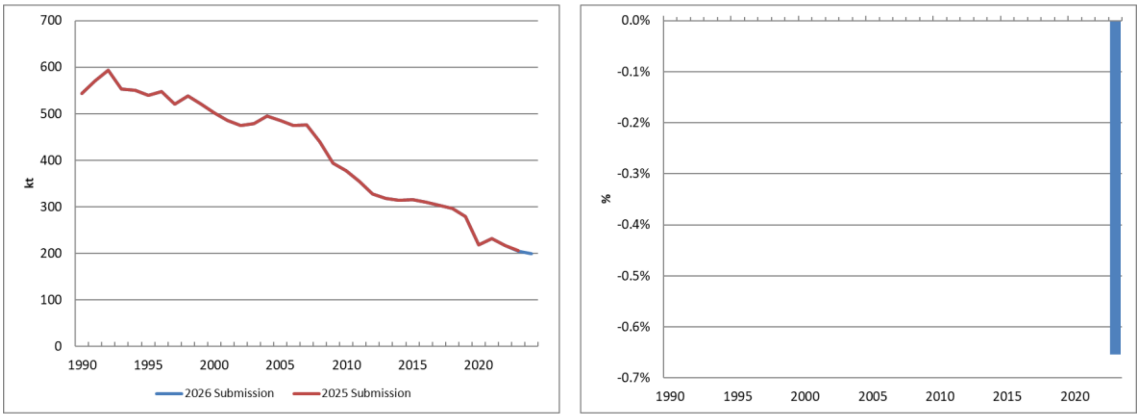



**Figure 3.6.35 Evolution of the difference in 1A3b NOx emissions (national territory)**

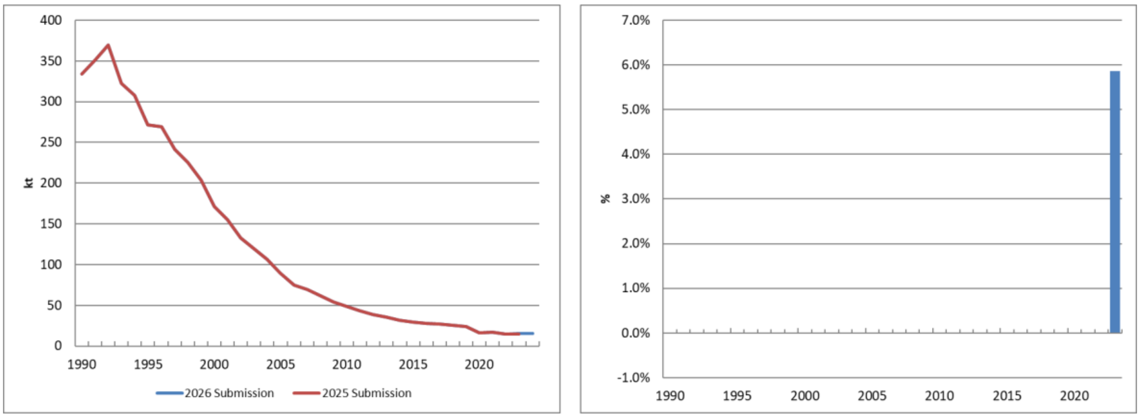



**Figure 3.6.36 Evolution of the difference in 1A3b NMVOC emissions (national territory)**

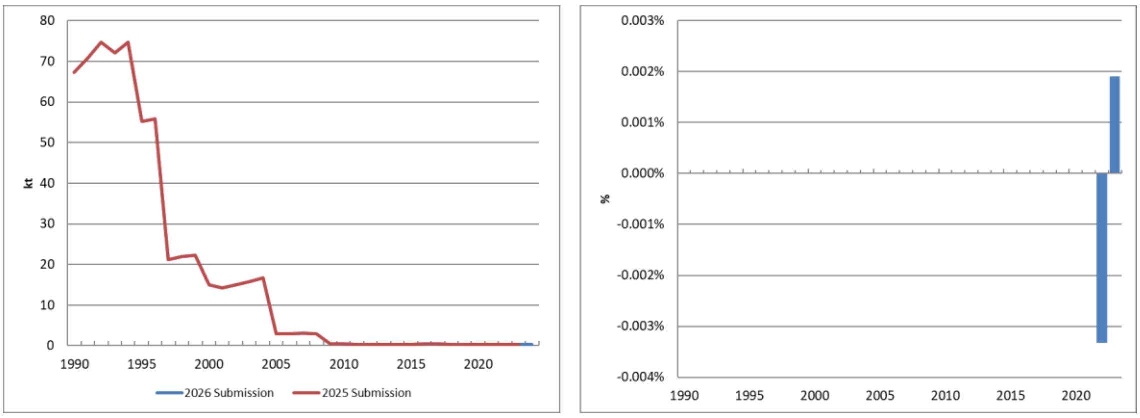



**Figure 3.6.37 Evolution of the difference in 1A3b $SO_2$ emissions (national territory)**

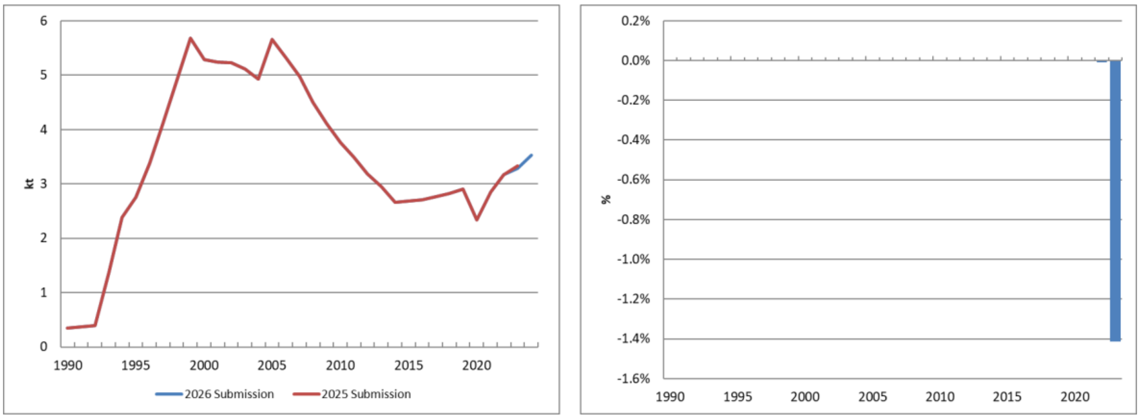



Figure 3.6.38 Evolution of the difference in 1A3b $NH_3$ emissions (national territory)

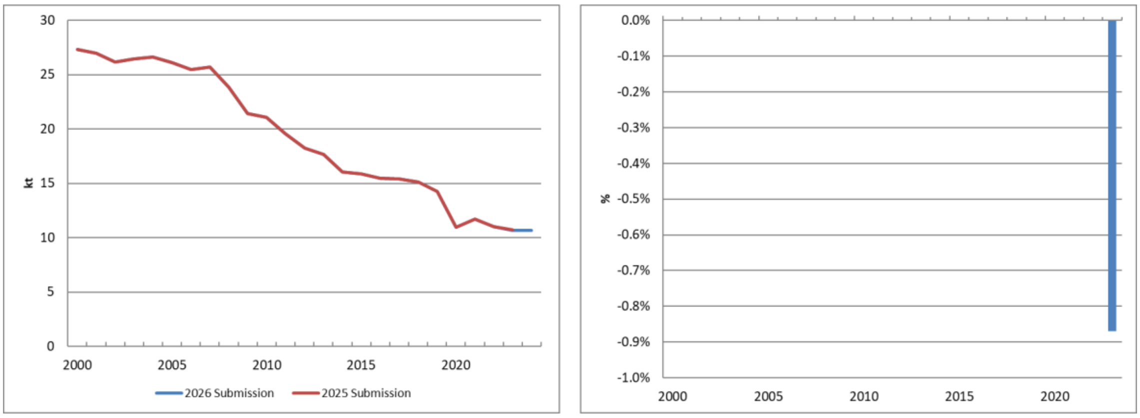



Figure 3.6.39 Evolution of the difference in 1A3b $PM_{2.5}$ emissions (national territory)

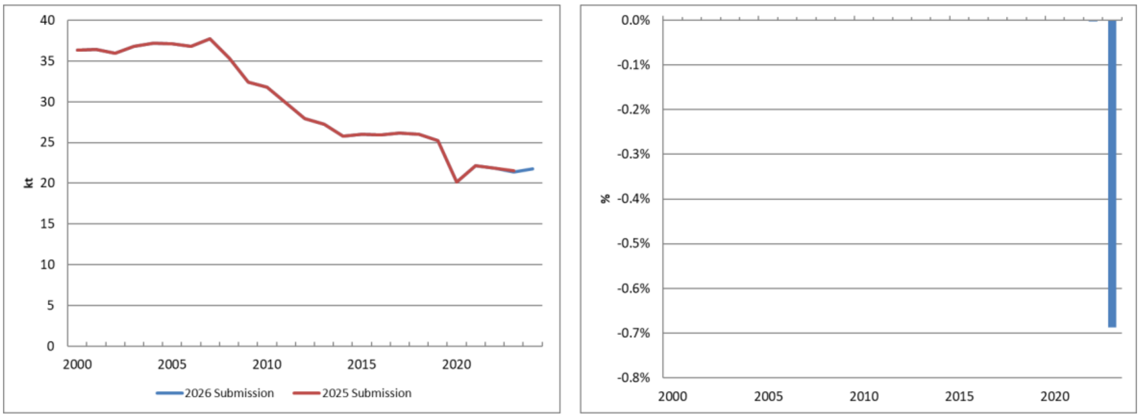



Figure 3.6.40 Evolution of the difference in 1A3b TSP emissions (national territory)

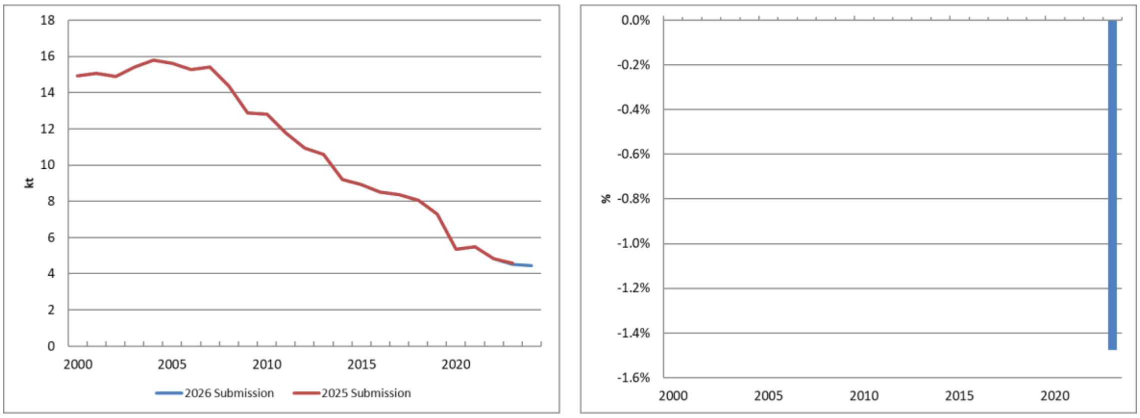



**Figure 3.6.41 Evolution of the difference in 1A3b BC emissions (national territory)**

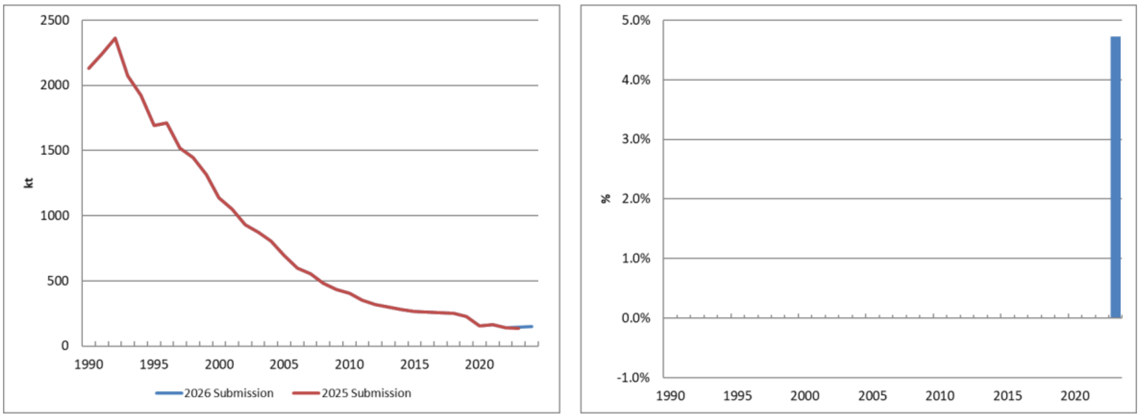



**Figure 3.6.42 Evolution of the difference in 1A3b CO emissions (national territory)**

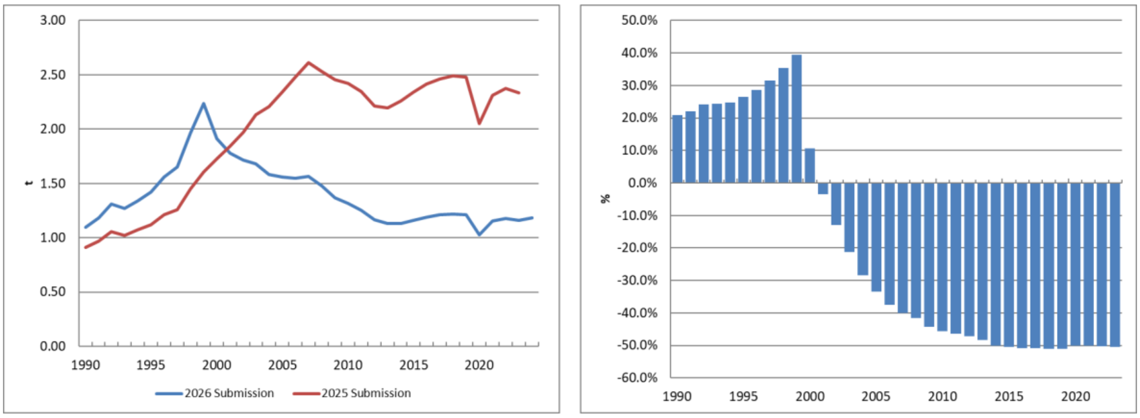



**Figure 3.6.43 Evolution of the difference in 1A3b PAH emissions (national territory)**

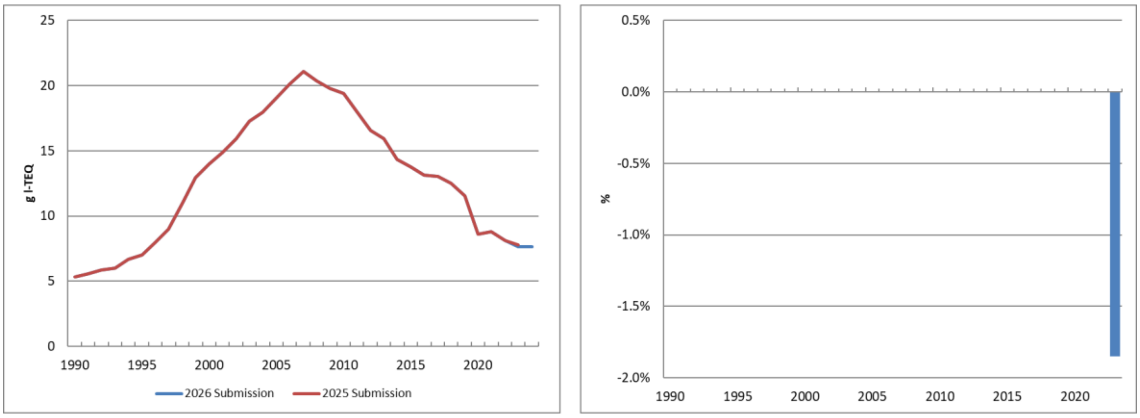



**Figure 3.6.44 Evolution of the difference in 1A3b PCDD/PCDF emissions (national territory)**

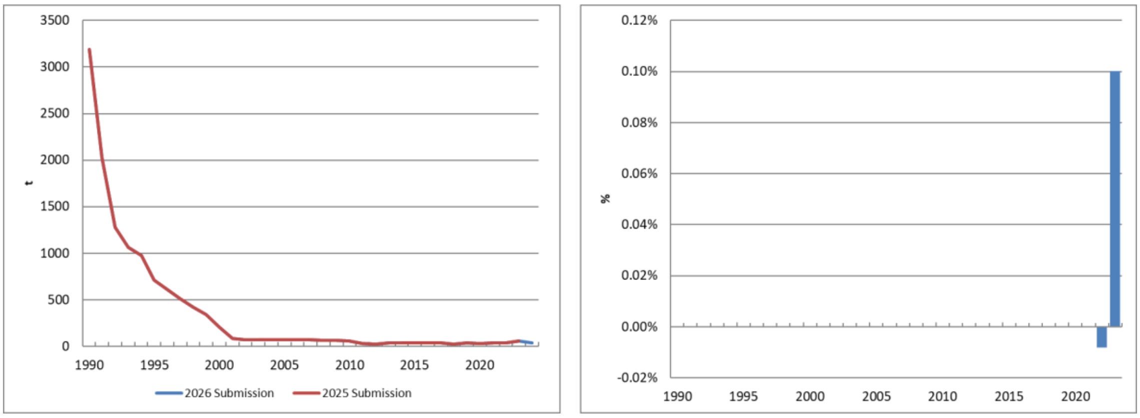



**Figure 3.6.45 Evolution of the difference in 1A3b Pb emissions (national territory)**

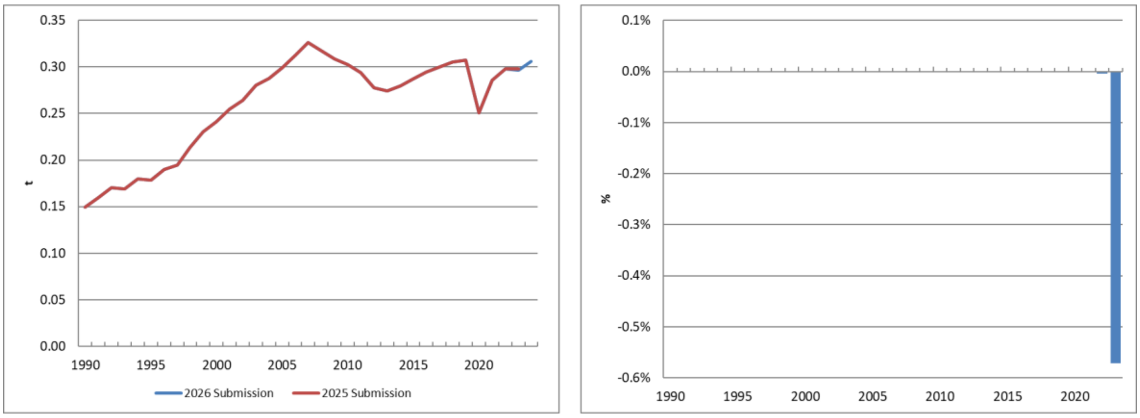



**Figure 3.6.46 Evolution of the difference in 1A3b Cd emissions (national territory)**

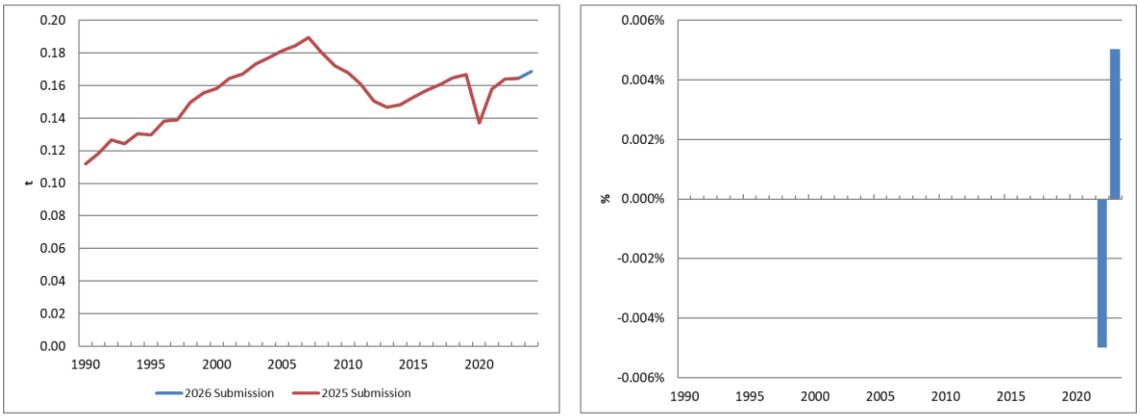



**Figure 3.6.47 Evolution of the difference in 1A3b Hg emissions (national territory)**

### 1A4ai Stationary combustion in commercial and institutional sector

Recalculations and changes in all pollutant trends are due to a mix of recalculations for the whole sector.

Firstly, the most significant recalculations are due to the update of wood and other wood wastes fuel consumption for years 2021-2023, following the data reported in international questionnaires elaborated by MITECO and sent to AIE and EUROSTAT. Besides this, landfill gas for years 2021-2023 and natural gas consumption for 2023 have also been updated. Additionally, in accordance with international questionnaires, other bituminous coal consumption for year 2021 has been eliminated and charcoal consumption has been registered in this subcategory (from 2021 onwards) for the first time.

Regarding cogeneration data reported in international questionnaires sent to AIE and EUROSTAT, diesel consumption has been updated for year 2023.

Finally, due to the publication of district heating data for 2023, natural gas consumption and wood and other wood wastes consumption have been updated for that year.

The following graphs show the trend of the main pollutants affected, particulate matter and priority heavy metals.

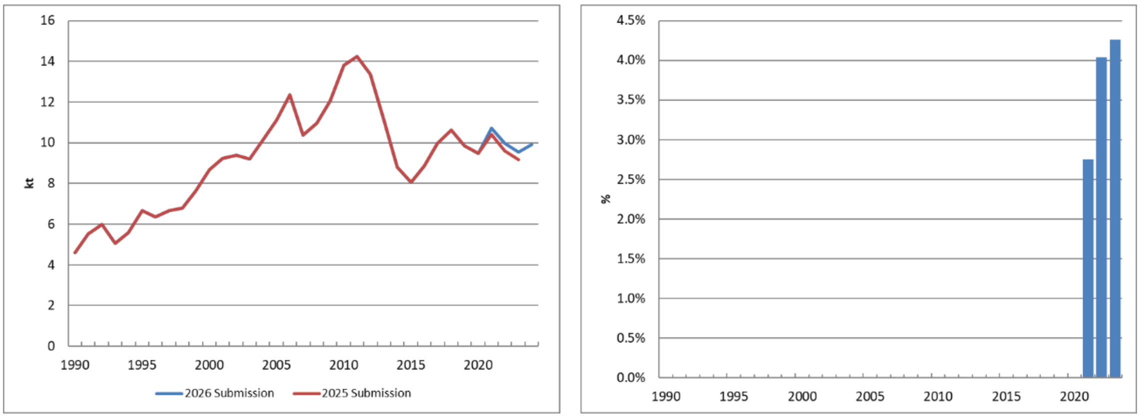



**Figure 3.6.48 Evolution of the difference in 1A4ai NOx emissions (national territory)**

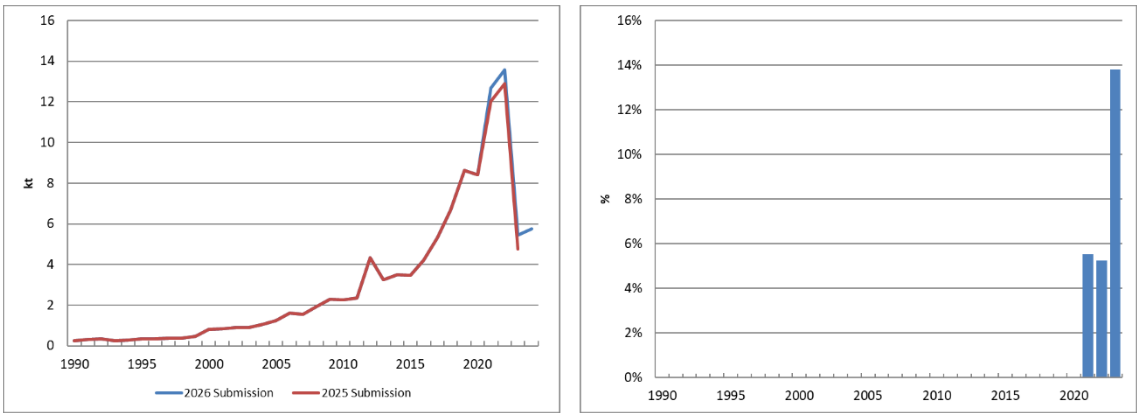



**Figure 3.6.49 Evolution of the difference in 1A4ai NMVOC emissions (national territory)**

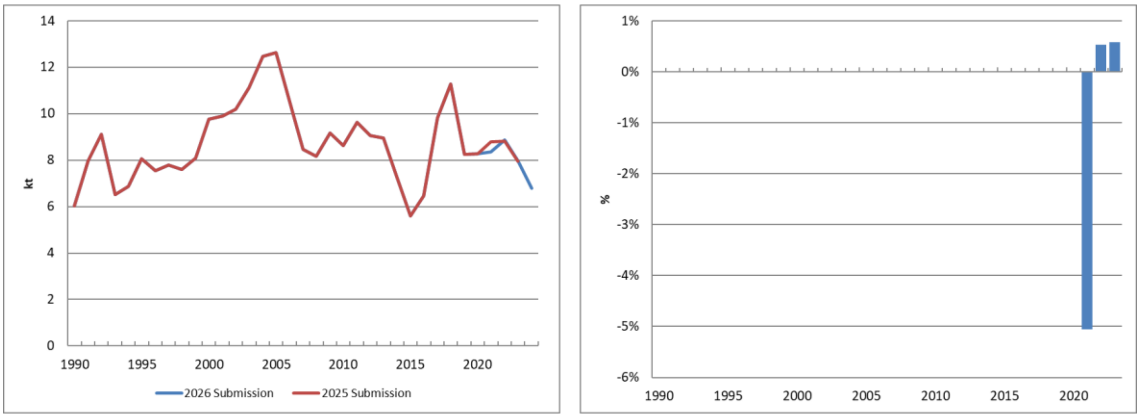



**Figure 3.6.50 Evolution of the difference in 1A4ai $SO_2$ emissions (national territory)**

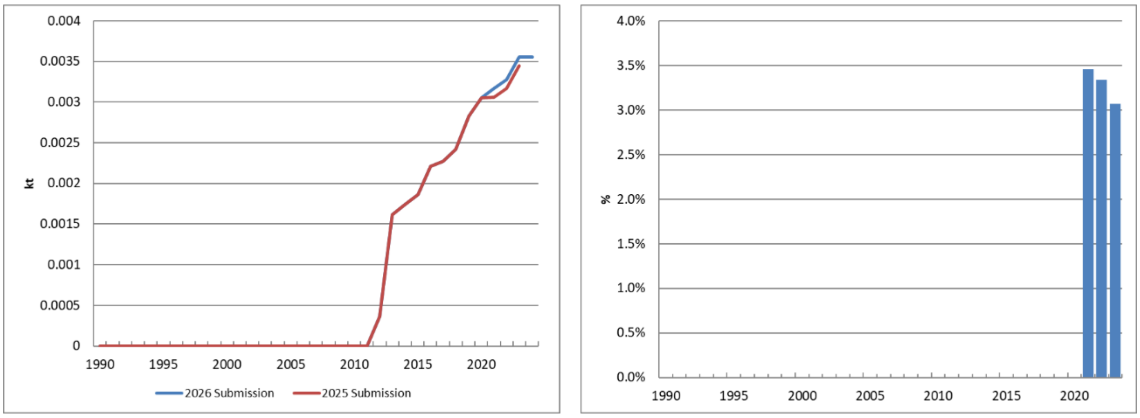



**Figure 3.6.51 Evolution of the difference in 1A4ai $NH_3$ emissions (national territory)**

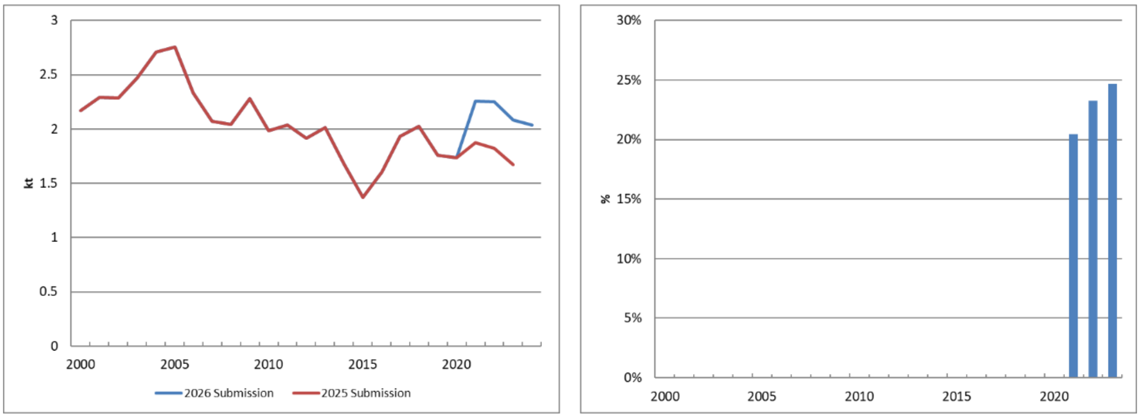



Figure 3.6.52 Evolution of the difference in 1A4ai $PM_{2.5}$ emissions (national territory)

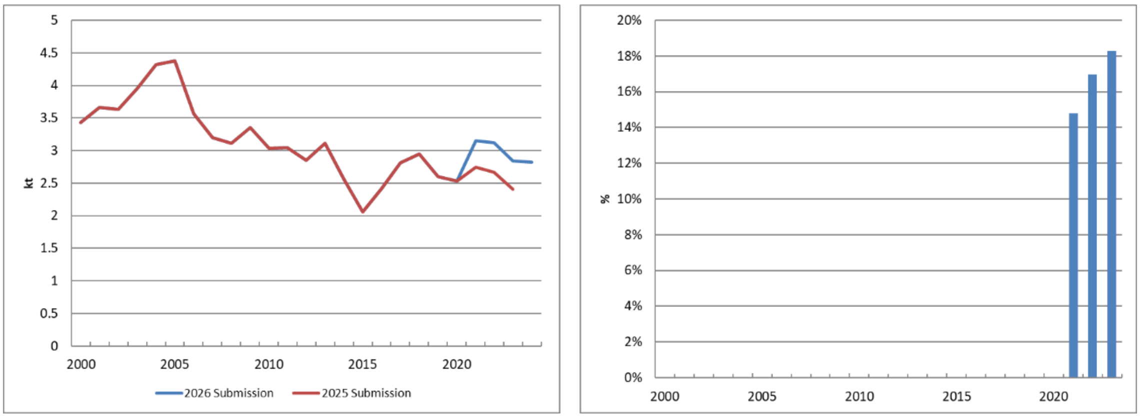



Figure 3.6.53 Evolution of the difference in 1A4ai TSP emissions (national territory)

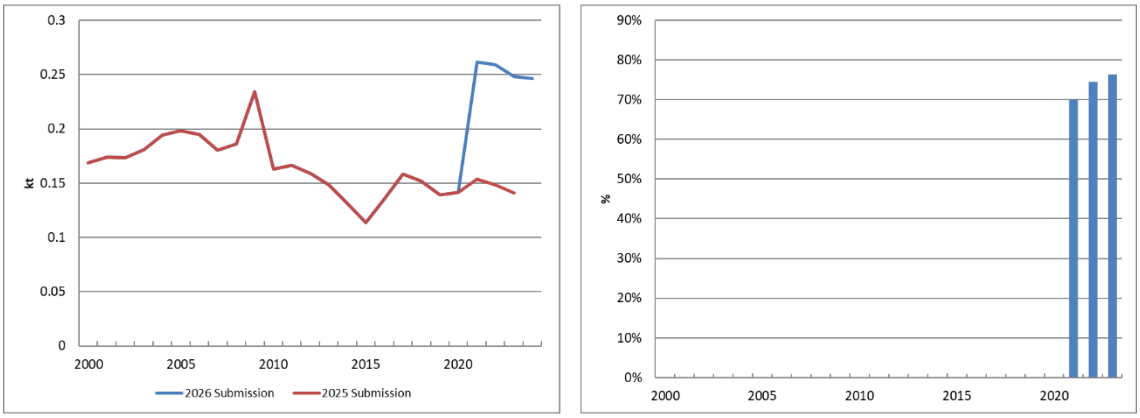



Figure 3.6.54 Evolution of the difference in 1A4ai BC emissions (national territory)

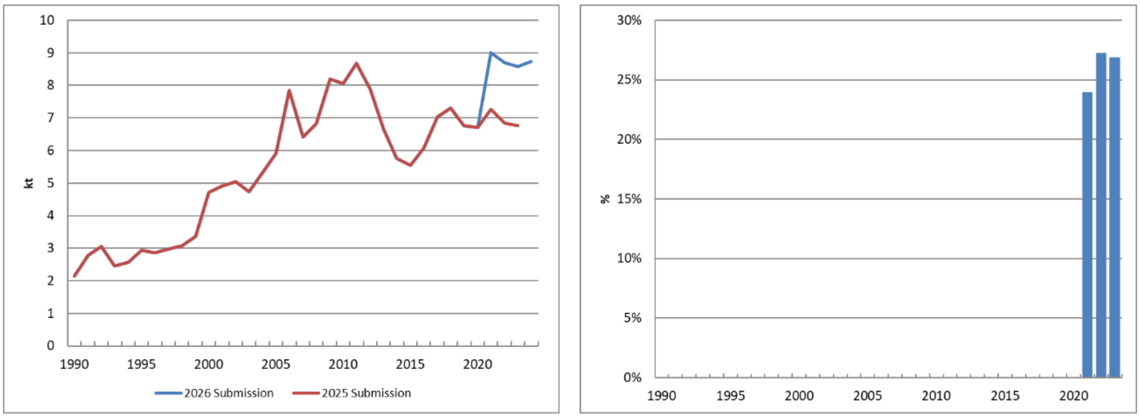



**Figure 3.6.55 Evolution of the difference in 1A4ai CO emissions (national territory)**

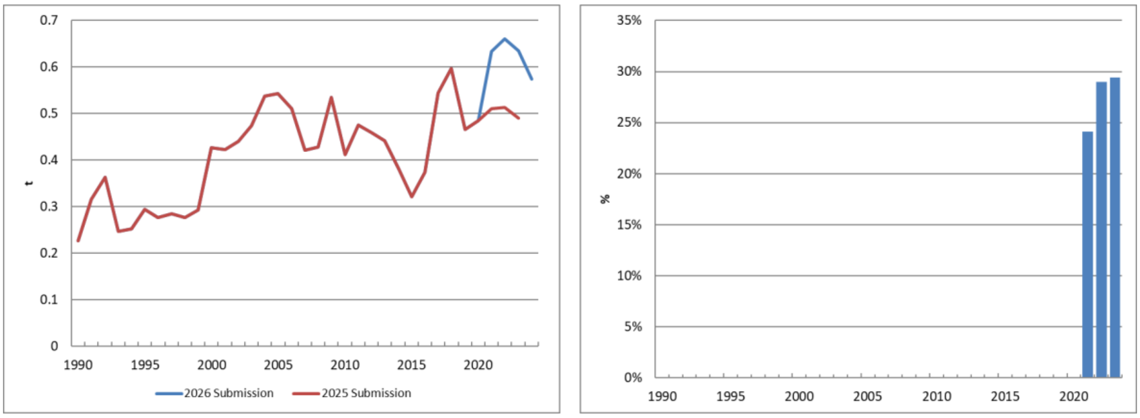



**Figure 3.6.56 Evolution of the difference in 1A4ai PAH emissions (national territory)**

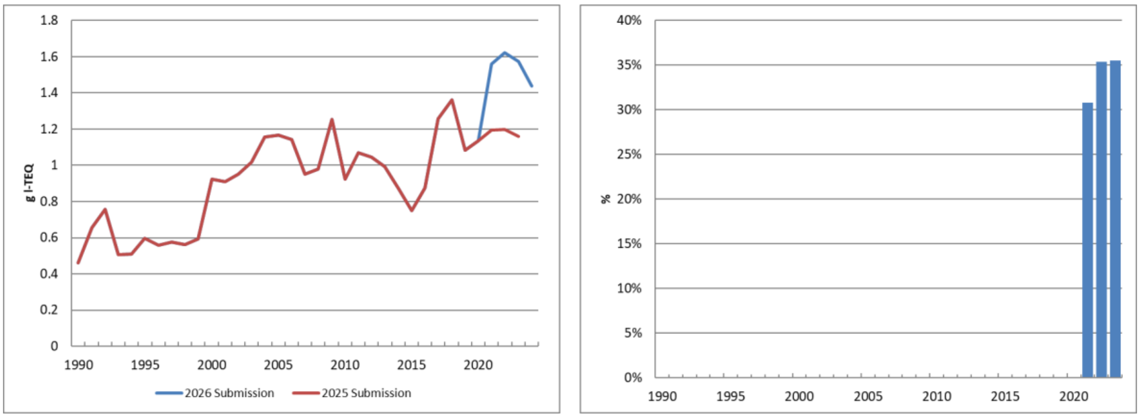



**Figure 3.6.57 Evolution of the difference in 1A4ai PCDD/PCDF emissions (national territory)**

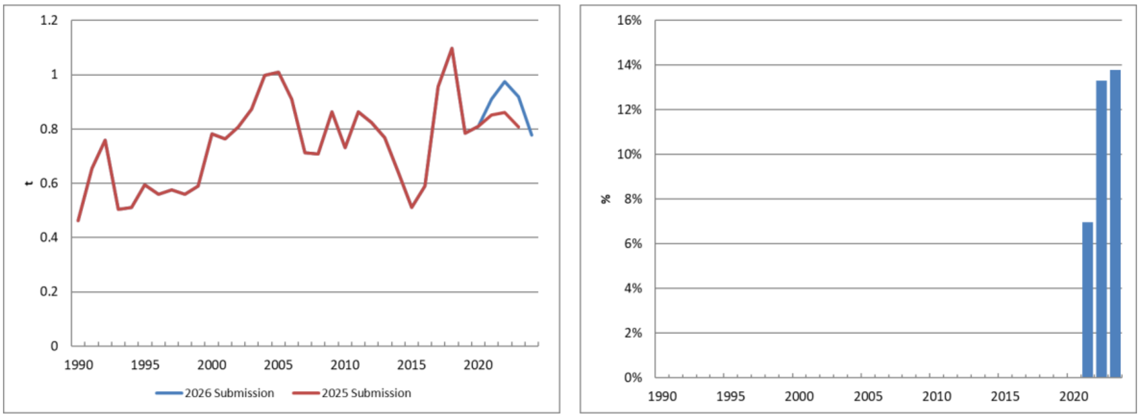



**Figure 3.6.58 Evolution of the difference in 1A4ai Pb emissions (national territory)**

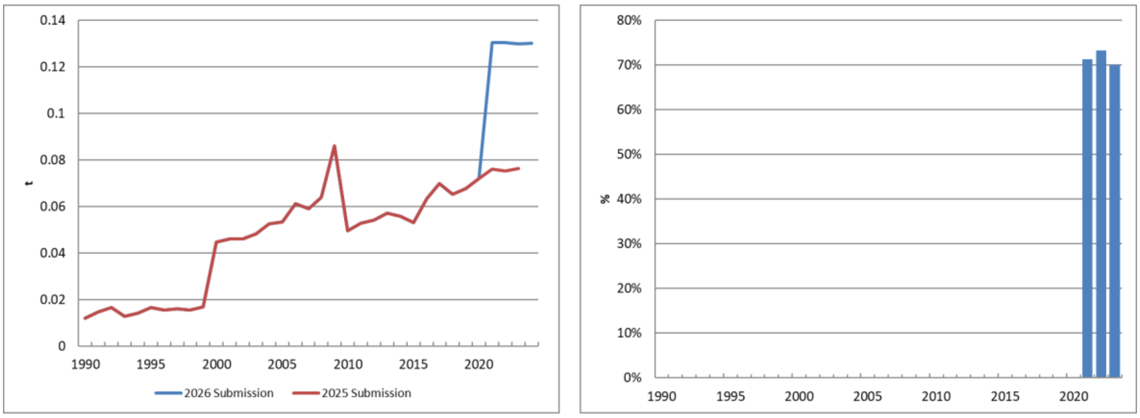



**Figure 3.6.59 Evolution of the difference in 1A4ai Cd emissions (national territory)**

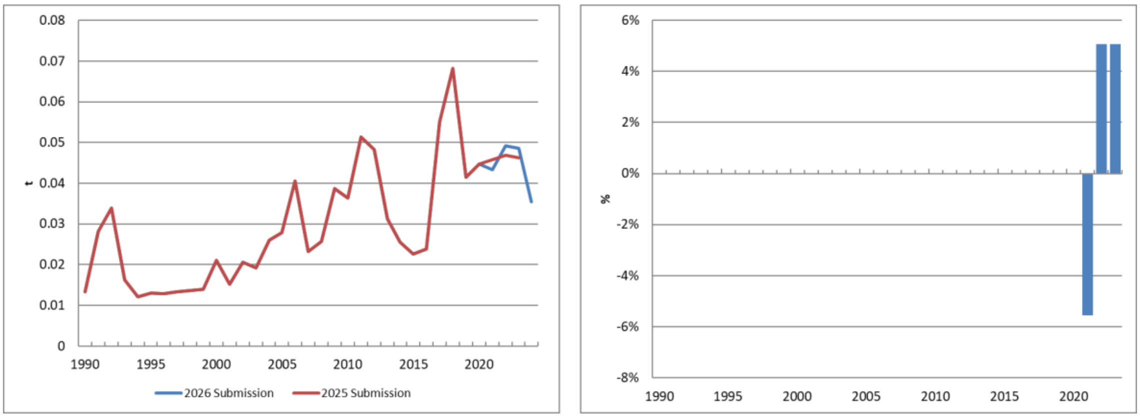



**Figure 3.6.60 Evolution of the difference in 1A4ai Hg emissions (national territory)**

### 1A4bi Combustion in stationary equipment in residential sector

Recalculations in this subcategory are due to the update of activity data sources. Thus, charcoal consumption and wood and other wood wastes consumption for years 2021-2023 have been updated in accordance with international questionnaires sent to AIE and EUROSTAT. Likewise, natural gas consumption and wood and other wood wastes consumption have been updated for 2023 due to the update of district heating data.

The following graphs show the trend of the main pollutants affected, particulate matter, BC, PCDD/PCDF and priority heavy metals.

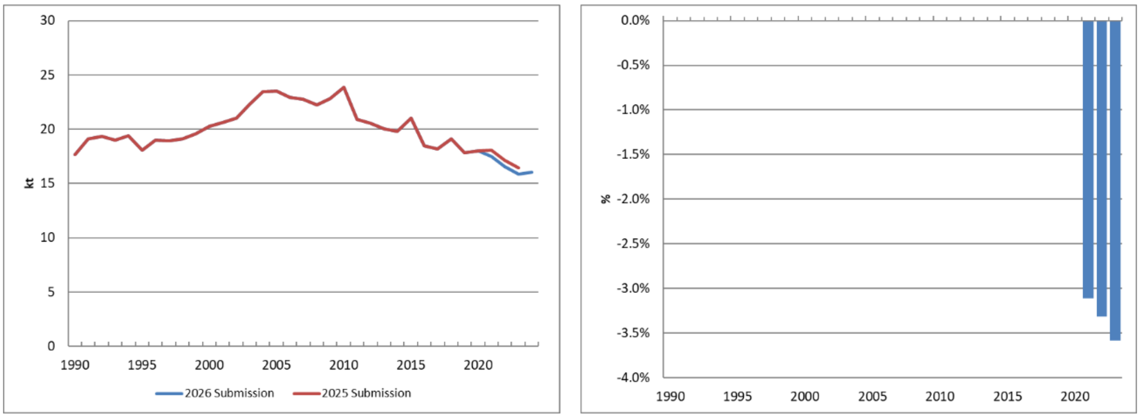



**Figure 3.6.61 Evolution of the difference in 1A4bi NOx emissions (national territory)**

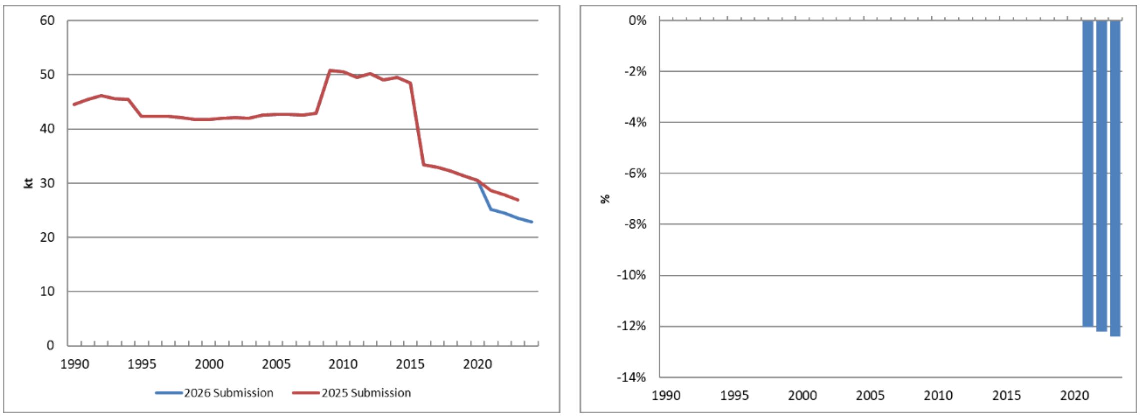



**Figure 3.6.62 Evolution of the difference in 1A4bi NMVOC emissions (national territory)**

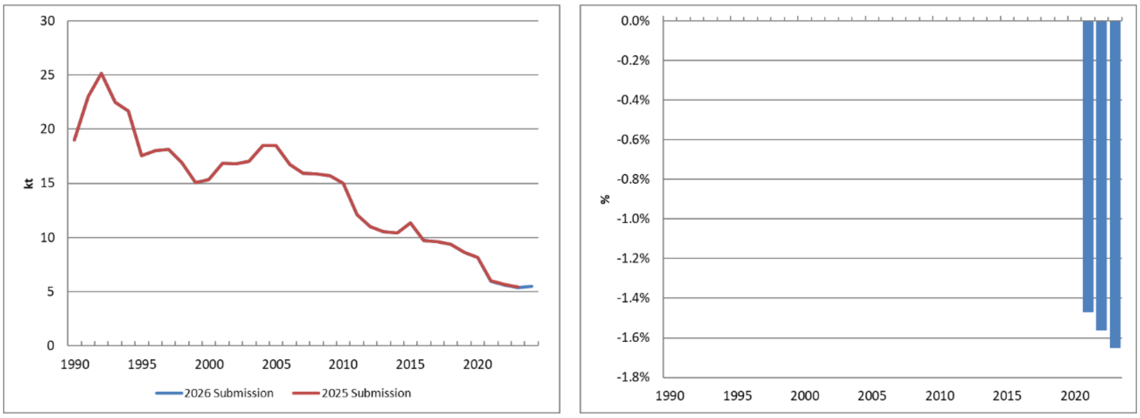



**Figure 3.6.63 Evolution of the difference in 1A4bi $SO_2$ emissions (national territory)**

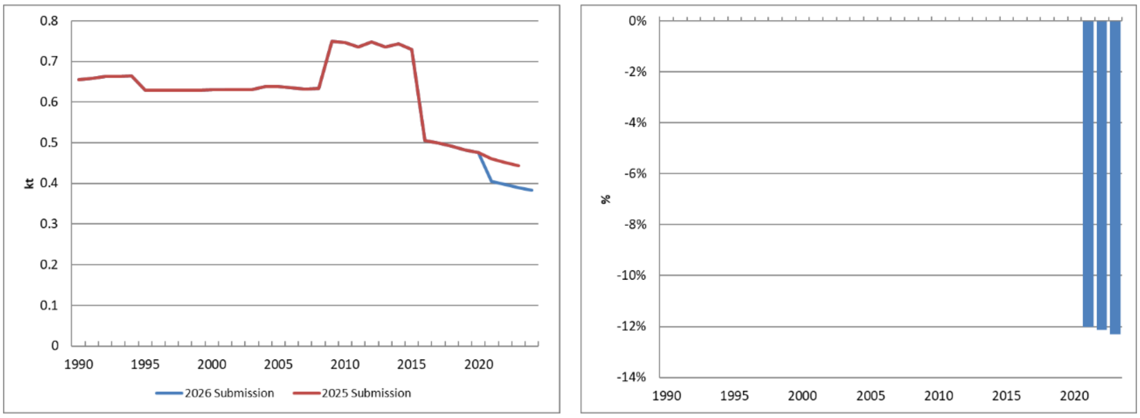



**Figure 3.6.64 Evolution of the difference in 1A4bi $NH_3$ emissions (national territory)**

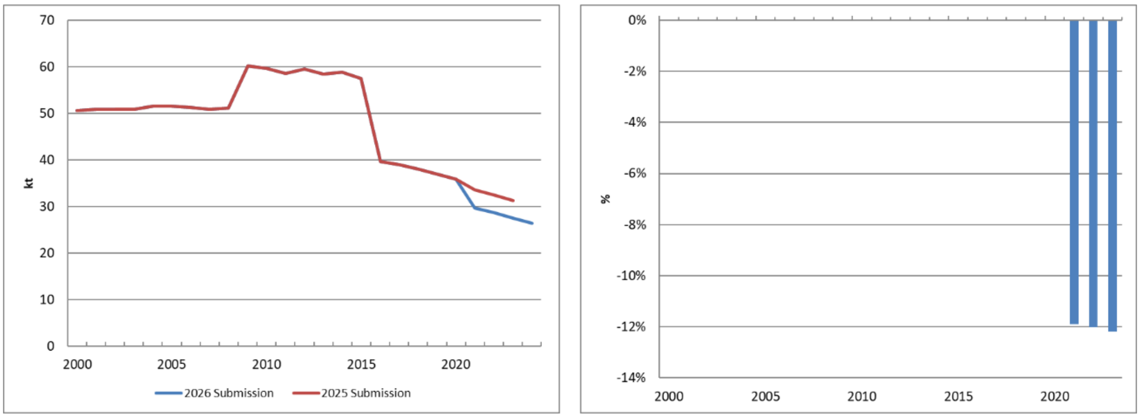



**Figure 3.6.65 Evolution of the difference in 1A4bi $PM_{2.5}$ emissions (national territory)**

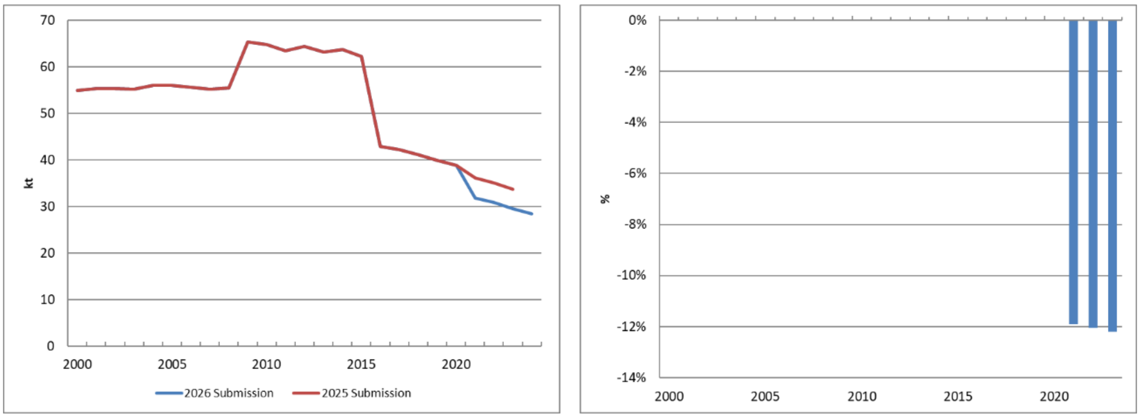



**Figure 3.6.66 Evolution of the difference in 1A4bi TSP emissions (national territory)**

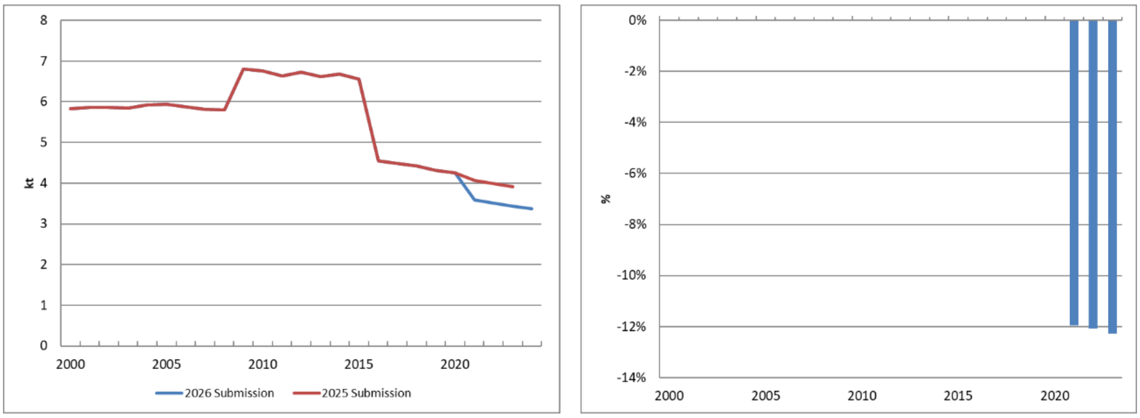



**Figure 3.6.67 Evolution of the difference in 1A4bi BC emissions (national territory)**

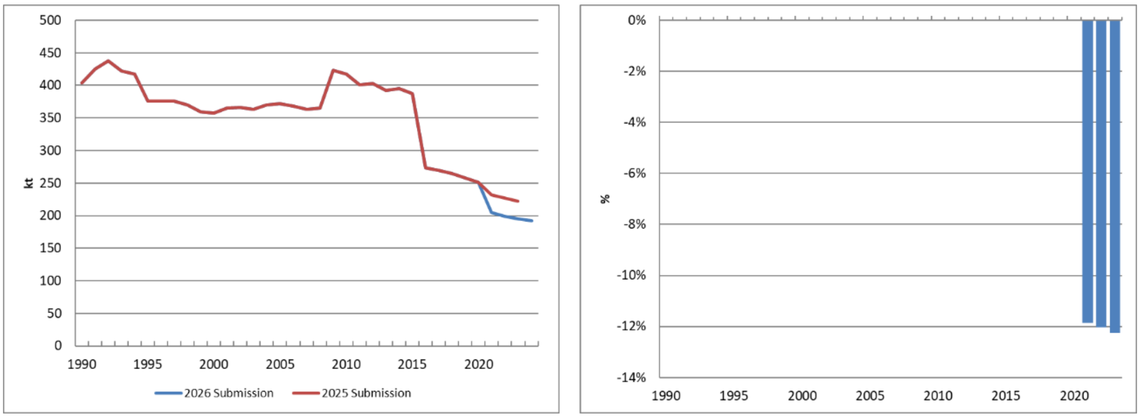



**Figure 3.6.68 Evolution of the difference in 1A4bi CO emissions (national territory)**

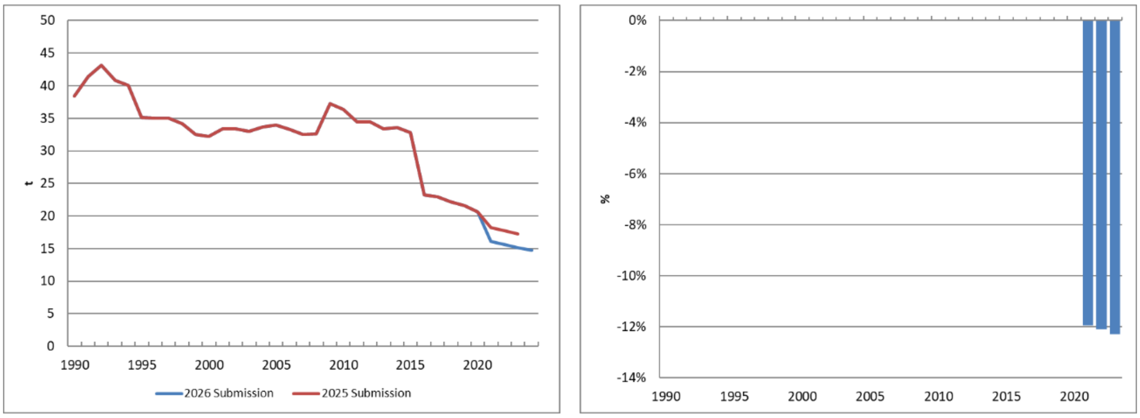



**Figure 3.6.69 Evolution of the difference in 1A4bi PAH emissions (national territory)**

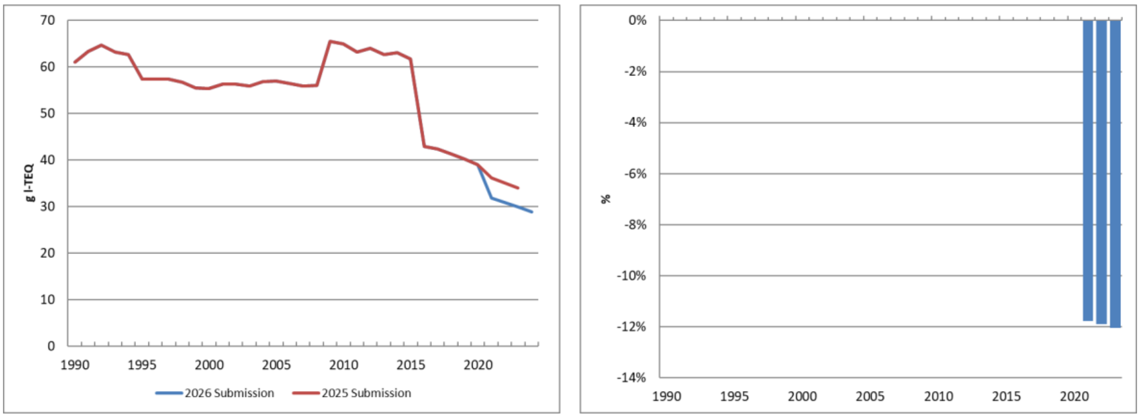



**Figure 3.6.70 Evolution of the difference in 1A4bi PCDD/PCDF emissions (national territory)**

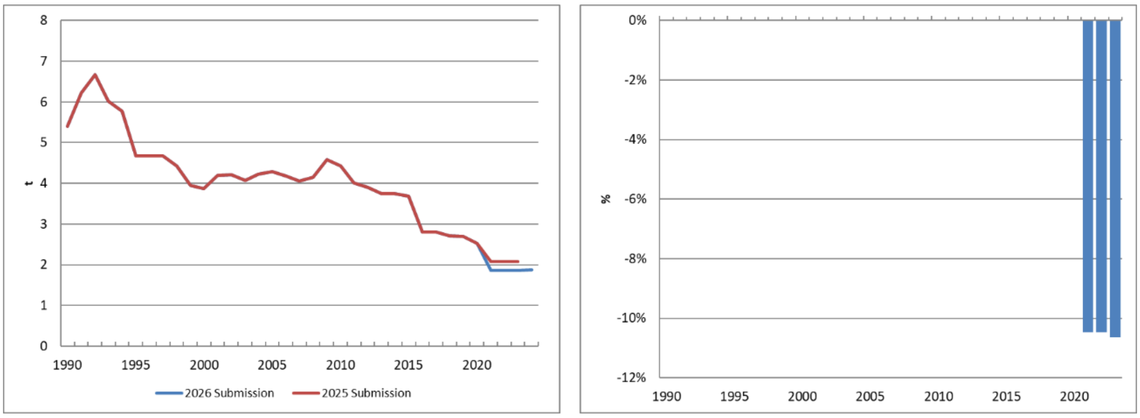



**Figure 3.6.71 Evolution of the difference in 1A4bi Pb emissions (national territory)**

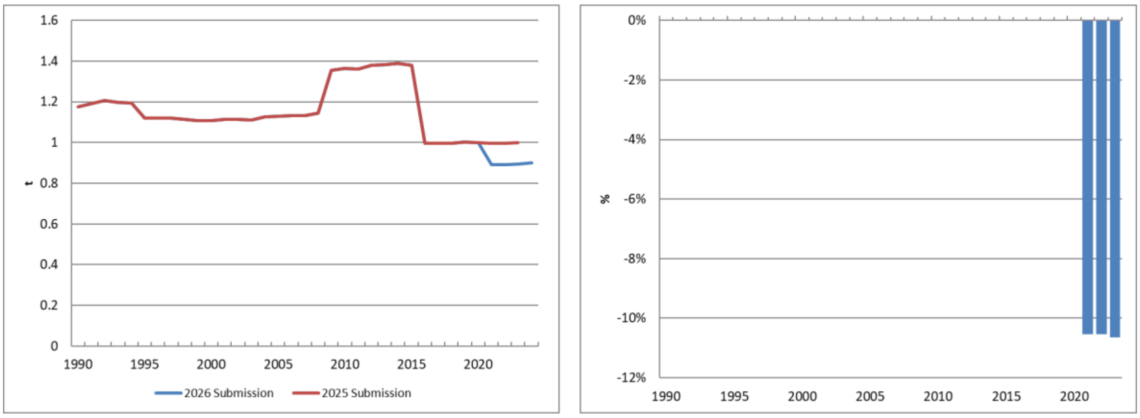



**Figure 3.6.72 Evolution of the difference in 1A4bi Cd emissions (national territory)**

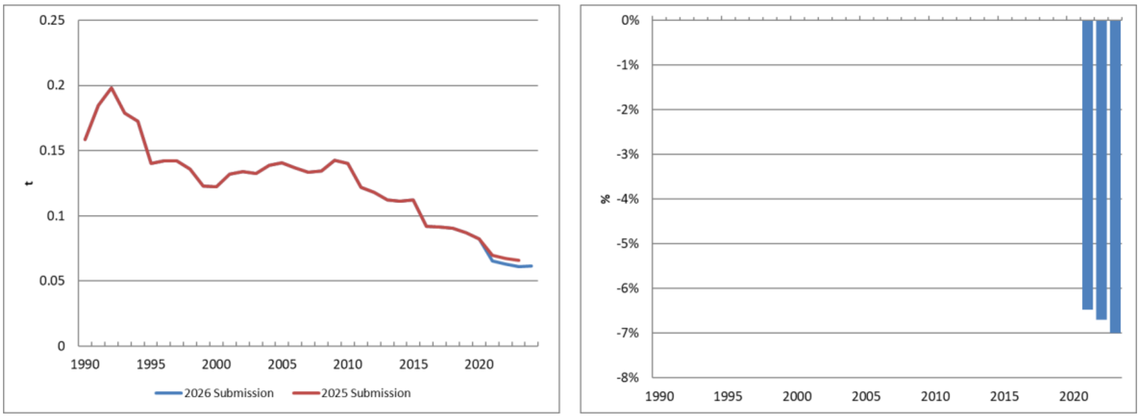



**Figure 3.6.73 Evolution of the difference in 1A4bi Hg emissions (national territory)**

### 1A4ci Stationary combustion in agricultural, forestry and fishing sector

While recalculations and changes in all pollutant trends are due to a mix of recalculations for the whole sector, the update of diesel consumption in agricultural stationary engines in line with agricultural machinery new estimations (1990-2023) contributed the most to the recalculations. Besides this, diesel consumption of irrigation engines was updated for years 1998-2023 due to the improvement of the methodology estimates with up-to-date data on irrigation systems and surface areas. Its provincial distribution has also been updated as a consequence, affecting national totals without Canary Islands.

Recalculations in wood and other wood wastes consumption and landfill gas consumption for years 2021-2023 are due to the update of international questionnaires elaborated by MITECO and sent to AIE and EUROSTAT.

Regarding natural gas, recalculations are due to changes in fuel consumption allocations of aquacultural activities and other boilers (2019-2023), since a correction in LHV/HHV ratio was performed.

Finally, provincial distribution of all fuels except irrigation engine’s diesel has been updated with annual data on GVA (Agrarian Gross Value Added) for years 1990-2023, affecting national total without Canary Islands.

The graphs with the recalculation of the main pollutants affected, particulate matter, BC, PAH, PCDD/PCDF, and priority heavy metals emissions are shown below. Notice that $NH_3$ emissions are not estimated in this category, in accordance with EMEP 2023 Guidebook.

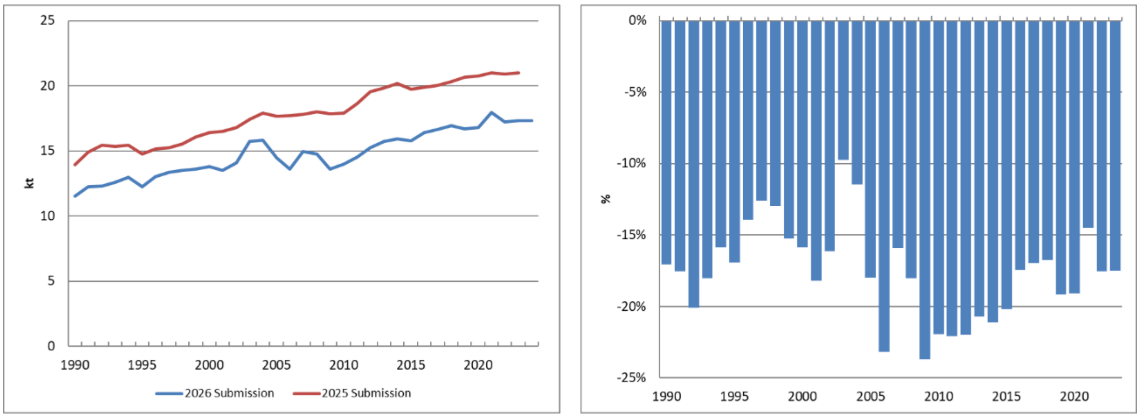



**Figure 3.6.74 Evolution of the difference in 1A4ci NOx emissions (national territory)**

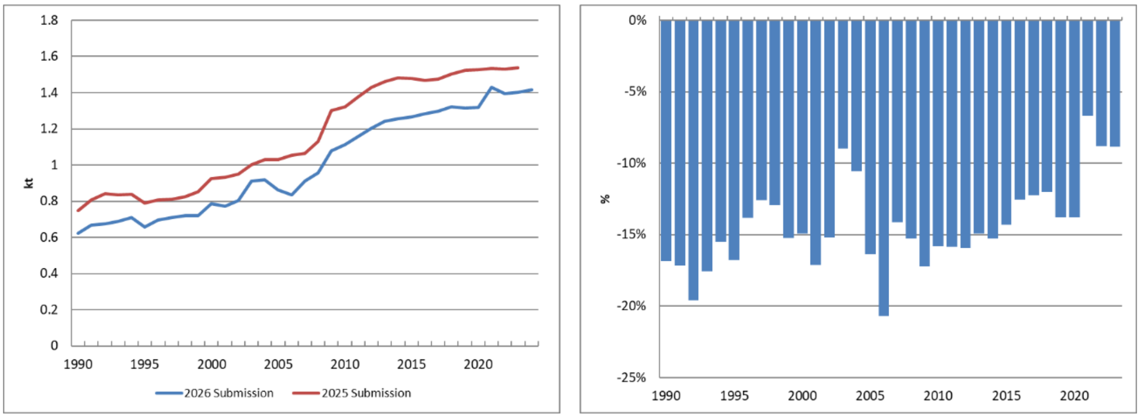



**Figure 3.6.75 Evolution of the difference in 1A4ci NMVOC emissions (national territory)**

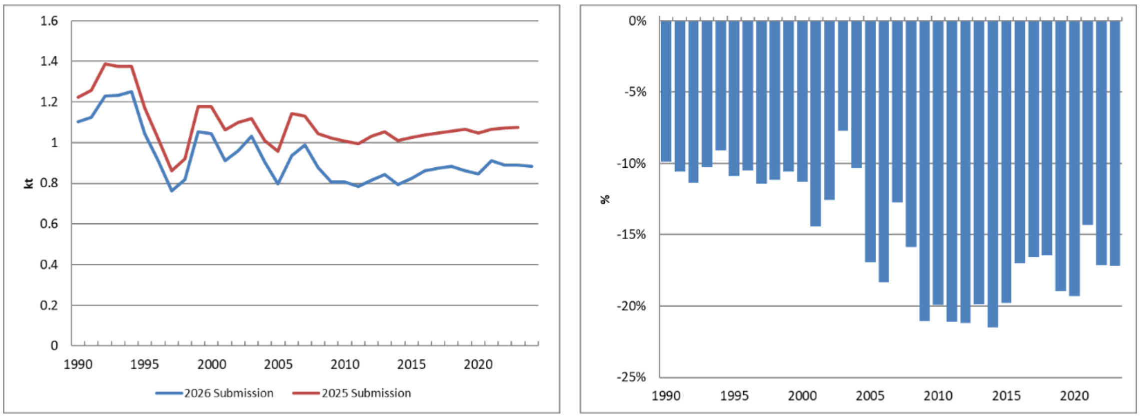



**Figure 3.6.76 Evolution of the difference in 1A4ci $SO_2$ emissions (national territory)**

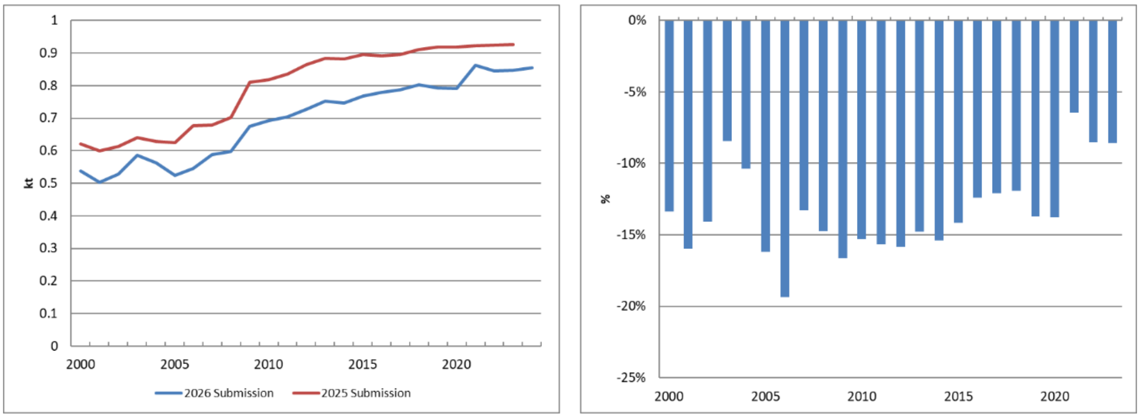



**Figure 3.6.77 Evolution of the difference in 1A4ci $PM_{2.5}$ emissions (national territory)**

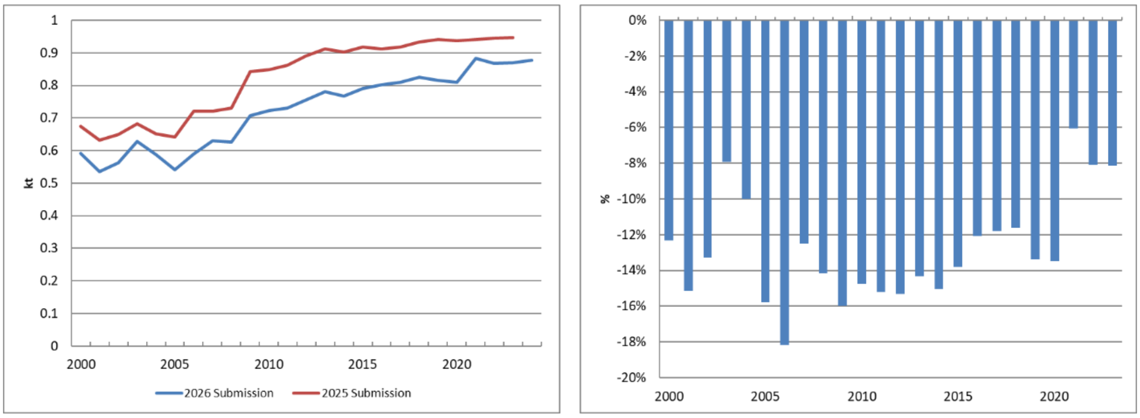



**Figure 3.6.78 Evolution of the difference in 1A4ci TSP emissions (national territory)**

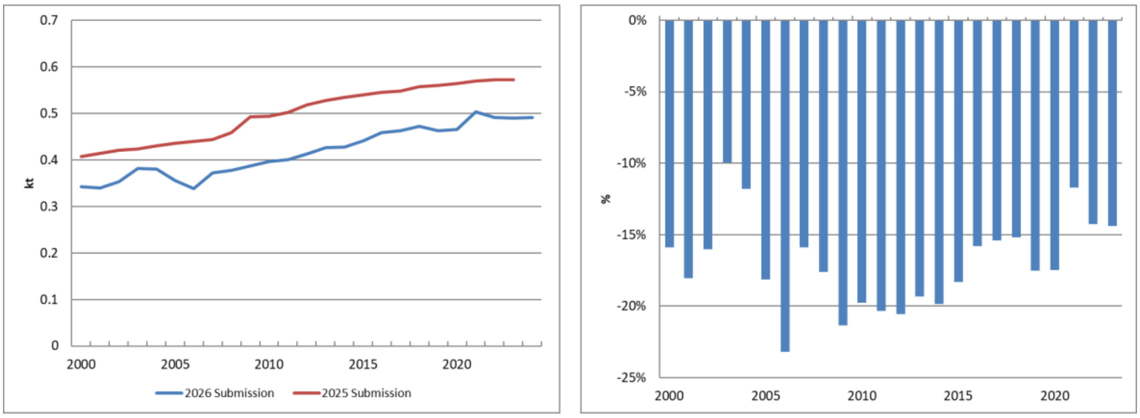



**Figure 3.6.79 Evolution of the difference in 1A4ci BC emissions (national territory)**

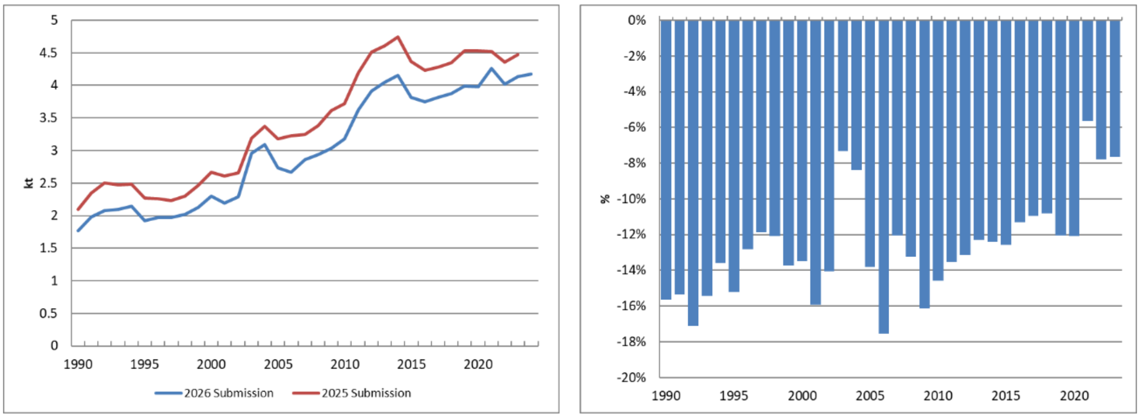



**Figure 3.6.80 Evolution of the difference in 1A4ci CO emissions (national territory)**

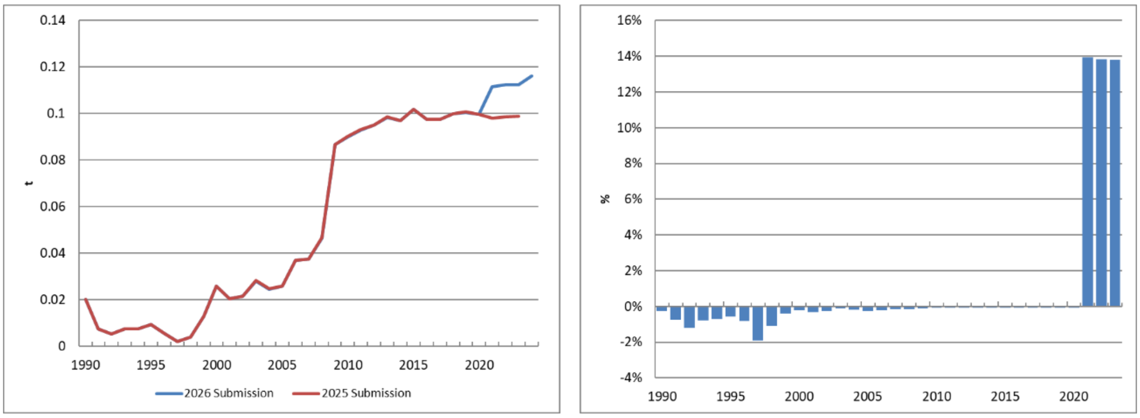



**Figure 3.6.81 Evolution of the difference in 1A4ci PAH emissions (national territory)**

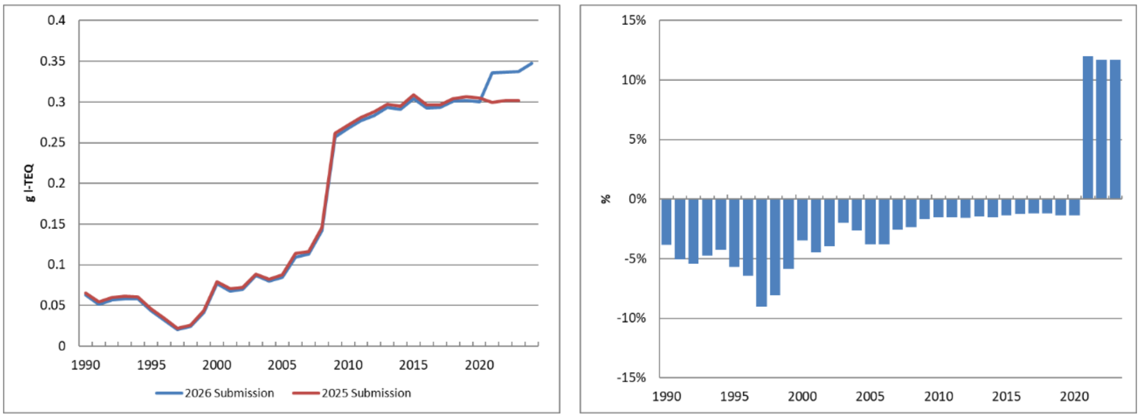



**Figure 3.6.82 Evolution of the difference in 1A4ci PCDD/PCDF emissions (national territory)**

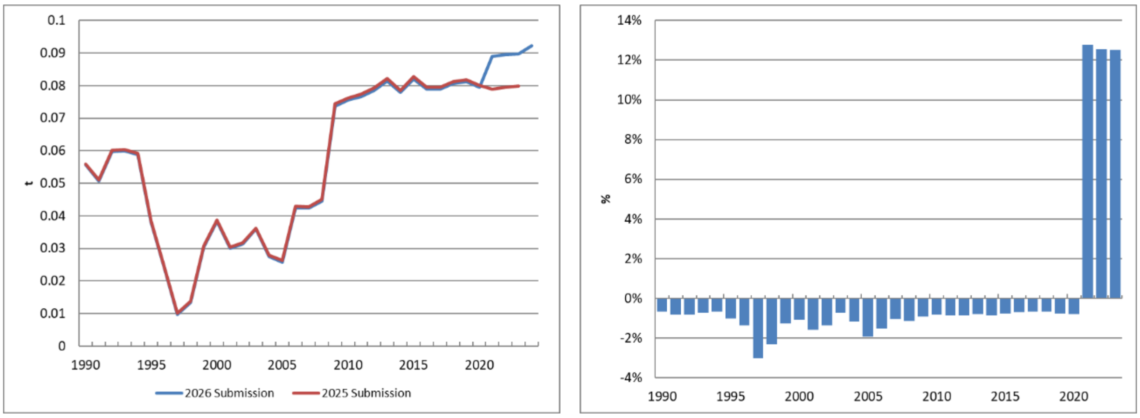



**Figure 3.6.83 Evolution of the difference in 1A4ci Pb emissions (national territory)**

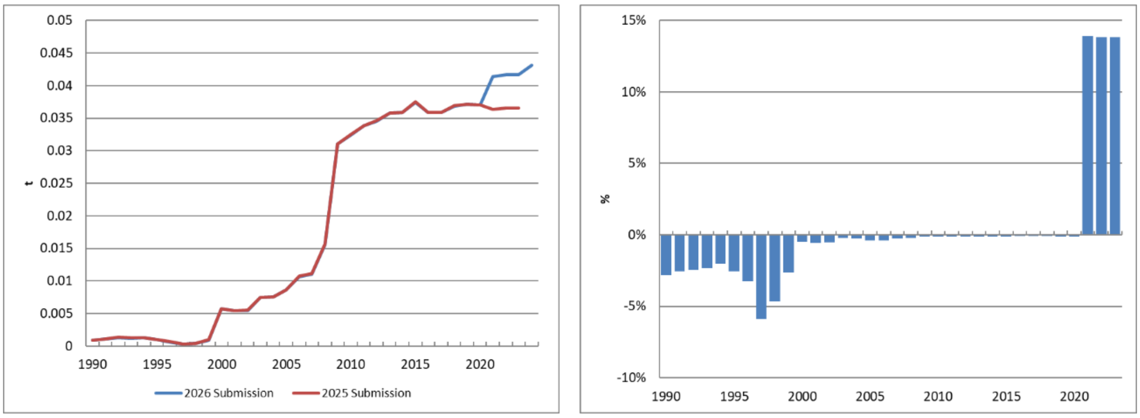



**Figure 3.6.84 Evolution of the difference in 1A4ci Cd emissions (national territory)**

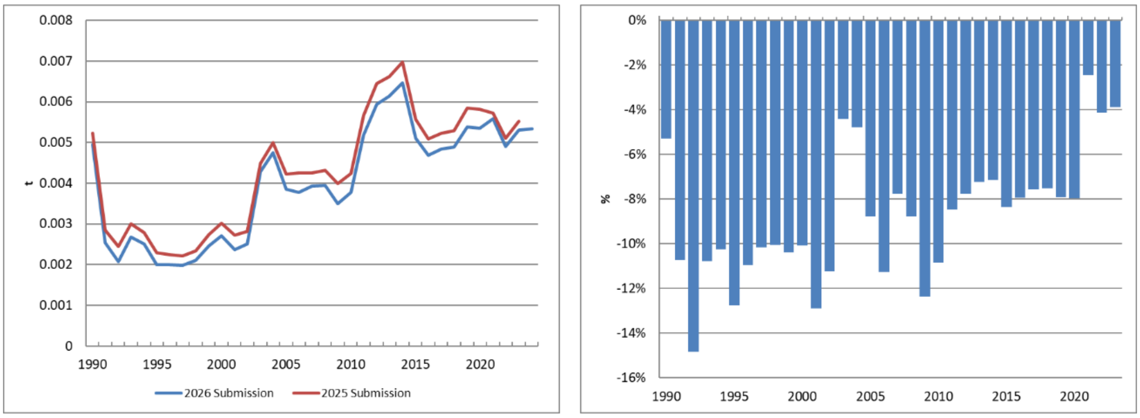



**Figure 3.6.85 Evolution of the difference in 1A4ci Hg emissions (national territory)**

### 1A4cii Mobile machinery in agriculture and forestry

Recalculations for the whole series are due to the improvement of agriculture machinery fuel consumption estimation, now based in GVA (Agrarian Gross Value Added) methodology described in EMEP/EEA 2023 Guidebook. Additionally, forestry machinery fuel consumption and provincial distribution has been updated for years 2022 and 2023, in accordance with new data available from Forestry Statistical Yearbook.

The following graphs show the recalculation of main pollutants, particulate matter, BC, PAH and Cd, although recalculations affect all pollutants. Notice that PCB, HCB, PCDD/PCDF, Pb and Hg emissions are not estimated in this category, in accordance with EMEP 2023 Guidebook.

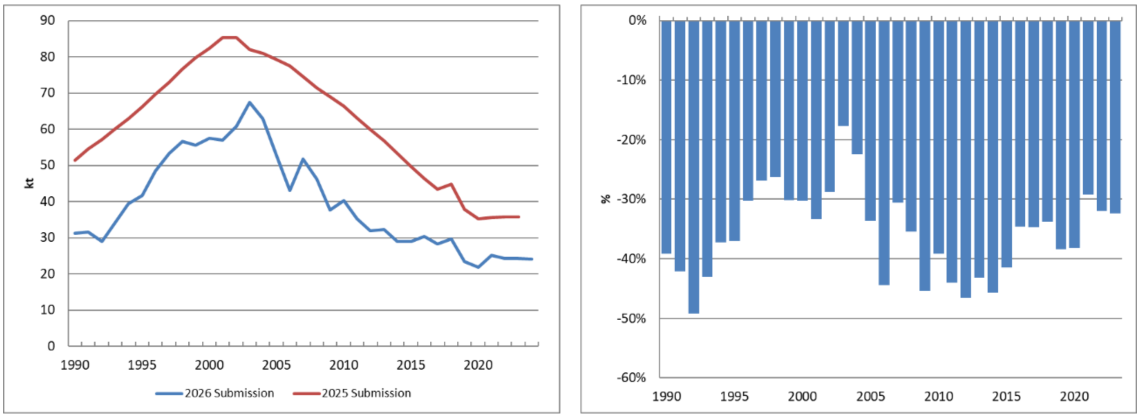



**Figure 3.6.86 Evolution of the difference in 1A4cii NOx emissions (national territory)**

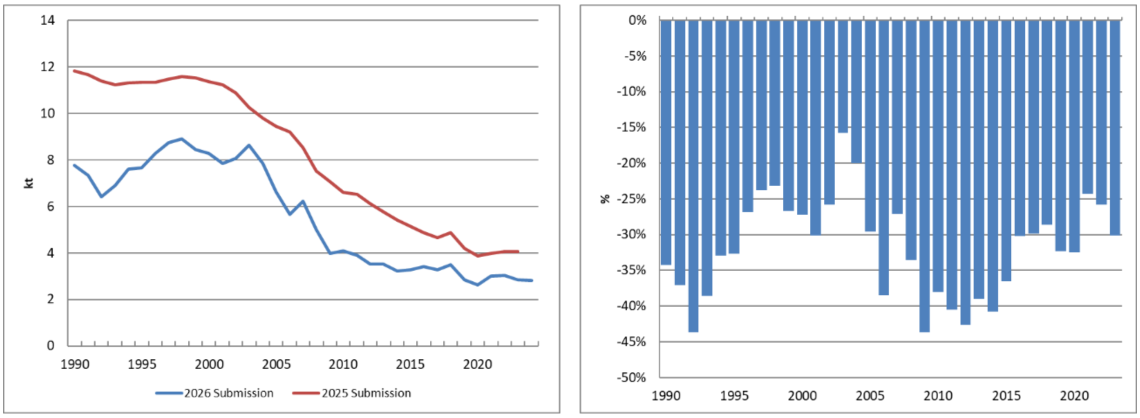



**Figure 3.6.87 Evolution of the difference in 1A4cii NMVOC emissions (national territory)**

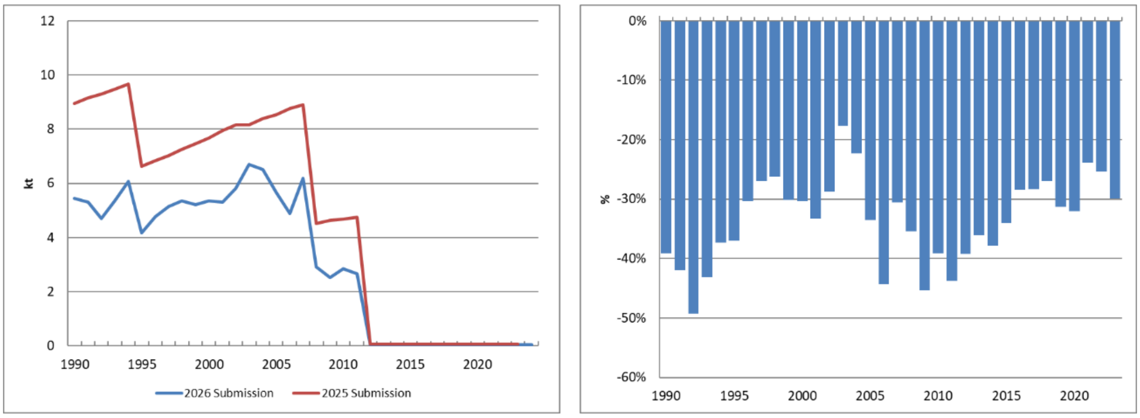



**Figure 3.6.88 Evolution of the difference in 1A4cii $SO_2$ emissions (national territory)**

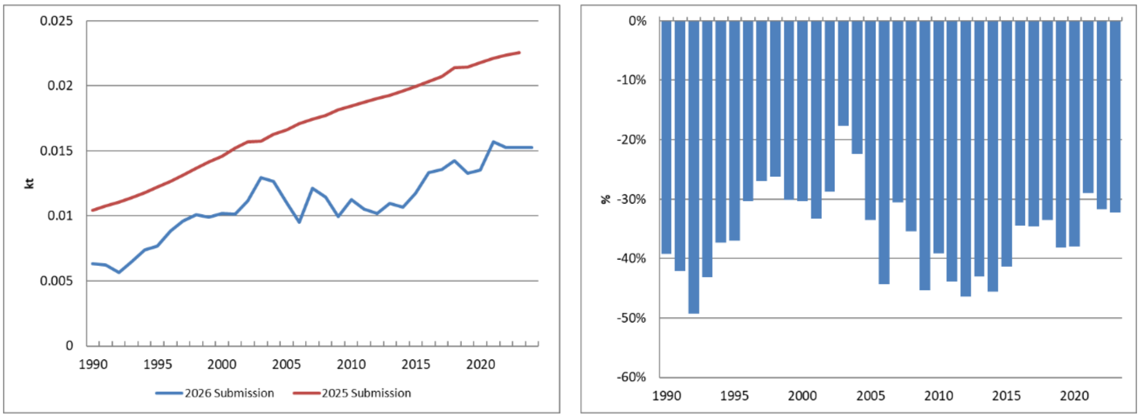



**Figure 3.6.89 Evolution of the difference in 1A4cii $NH_3$ emissions (national territory)**

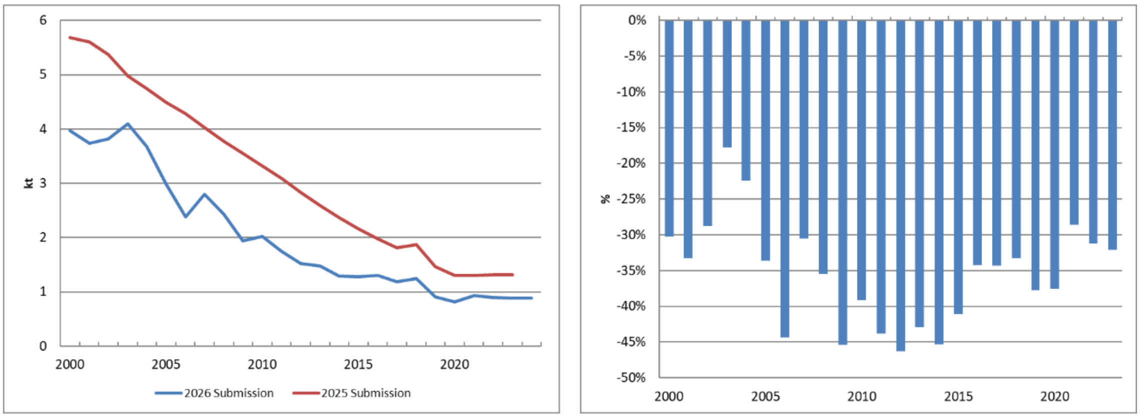



**Figure 3.6.90 Evolution of the difference in 1A4cii $PM_{2.5}$ emissions (national territory)**

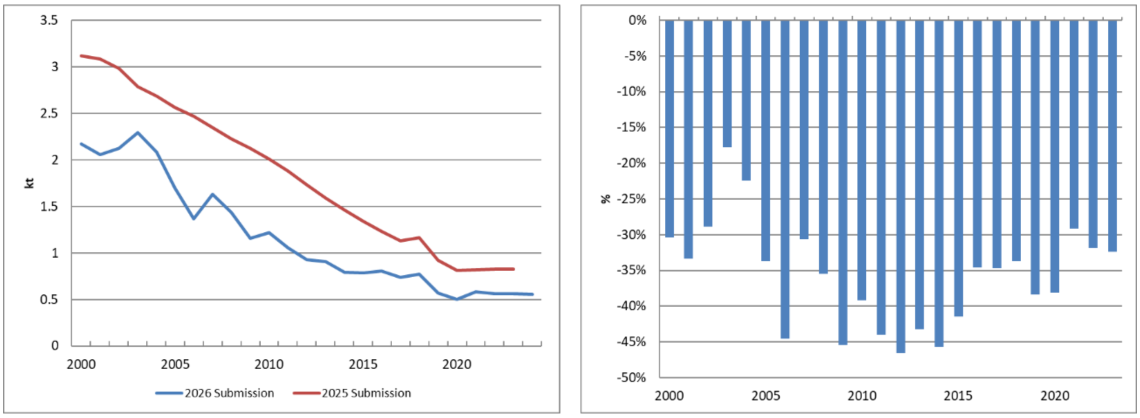



**Figure 3.6.91 Evolution of the difference in 1A4cii BC emissions (national territory)**

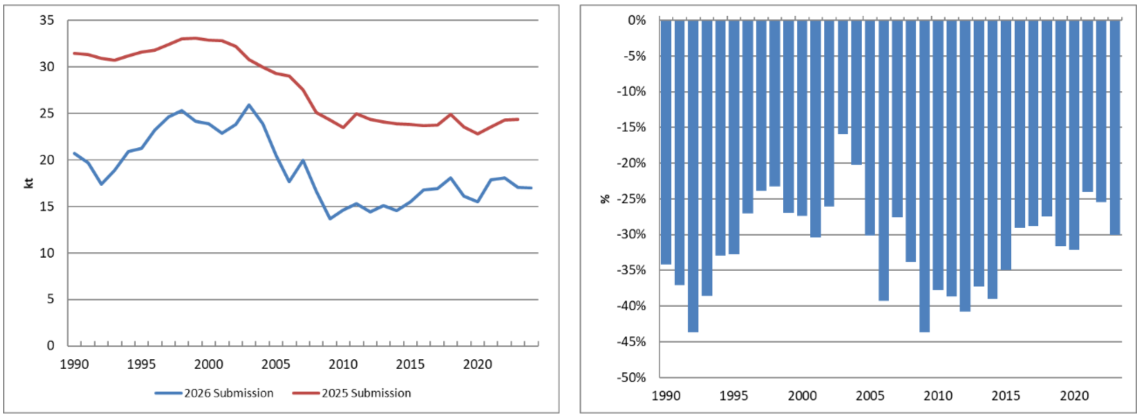



**Figure 3.6.92 Evolution of the difference in 1A4cii CO emissions (national territory)**

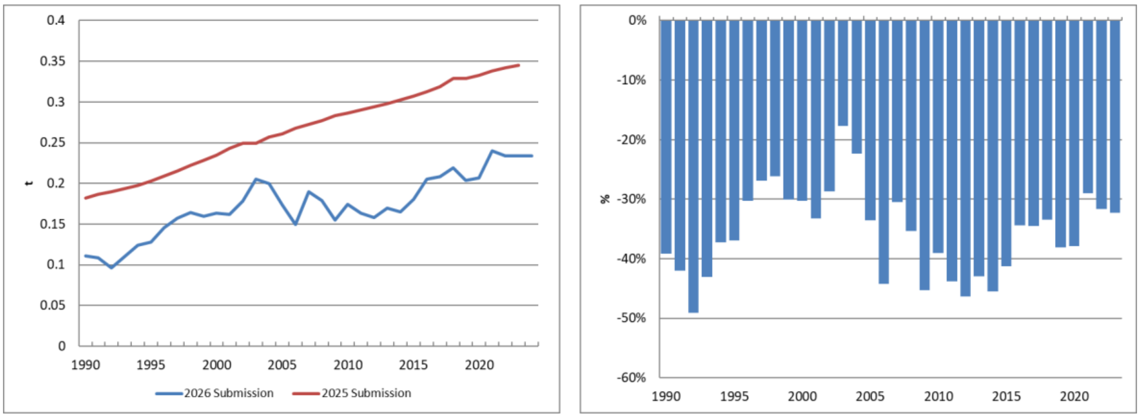



**Figure 3.6.93 Evolution of the difference in 1A4cii PAH emissions (national territory)**

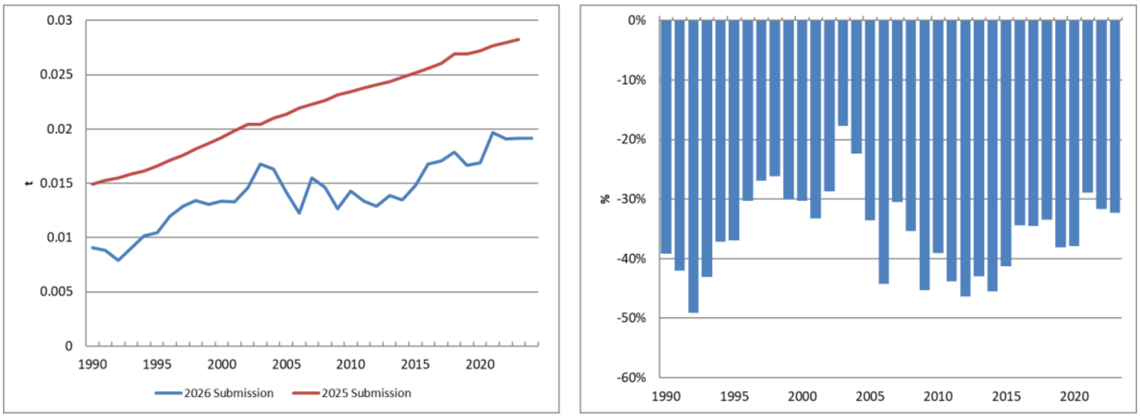



**Figure 3.6.94 Evolution of the difference in 1A4cii Cd emissions (national territory)**

### 1A4ciii National fishing activities

Regarding national fishing activities (1A4ciii), recalculations are due to the correction of fuel consumption of 2019, 2020, 2021 and the update of 2023 activity data in accordance with the newest publication of Sea Fishing Economic Survey. Apart from this, provincial distribution of 2023 has been updated, affecting national totals without Canary Islands.

The following graphs show the recalculation of main pollutants, particulate matter, BC, PCB, HCB, PCDD/PCDF, PAH and priority heavy metals emissions, although recalculations affect all pollutants. Notice that $NH_3$ emissions are not estimated in this category, in accordance with EMEP 2023 Guidebook.

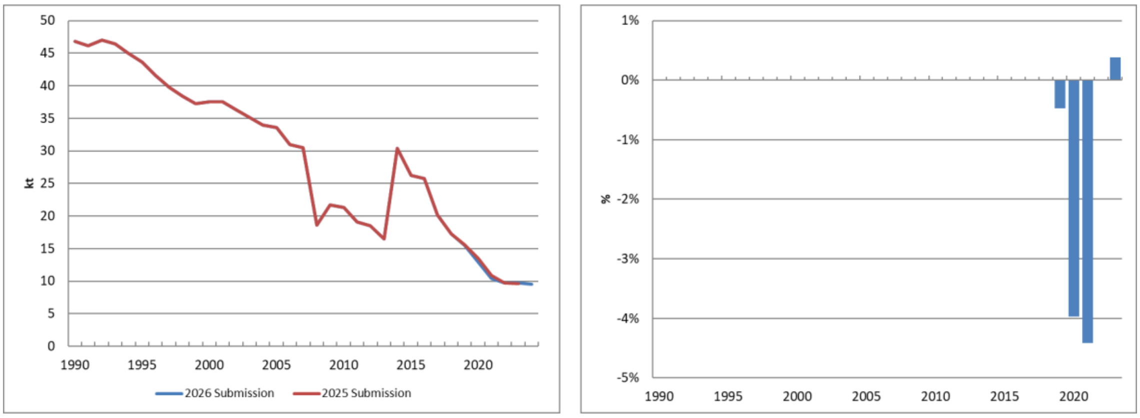



**Figure 3.6.95 Evolution of the difference in 1A4ciii NOx emissions (national territory)**

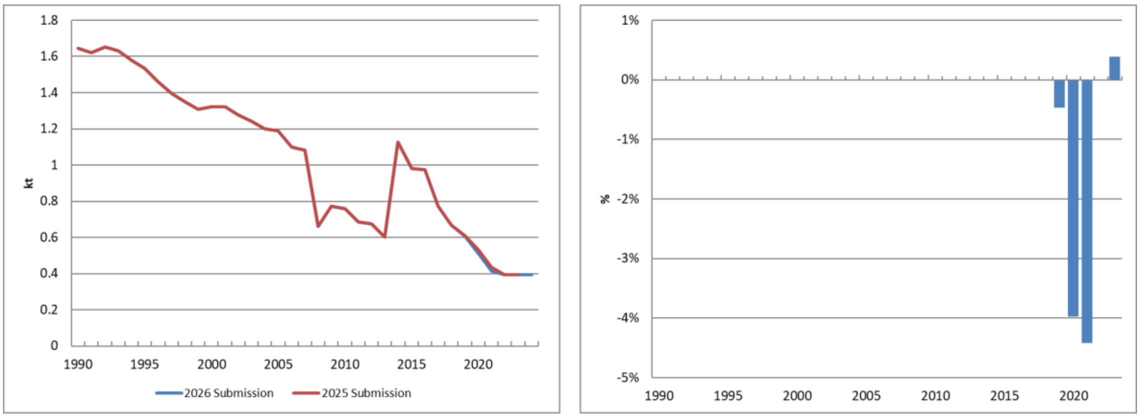



**Figure 3.6.96 Evolution of the difference in 1A4ciii NMVOC emissions (national territory)**

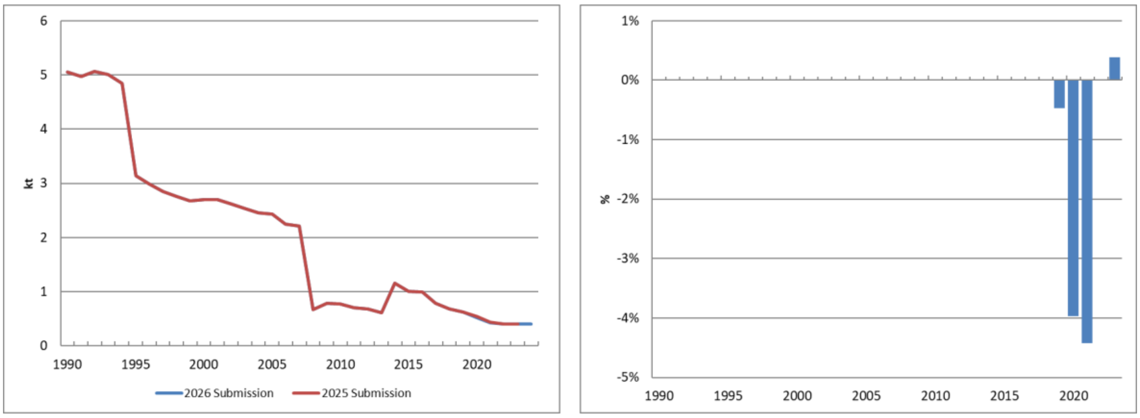



**Figure 3.6.97 Evolution of the difference in 1A4ciii $SO_2$ emissions (national territory)**

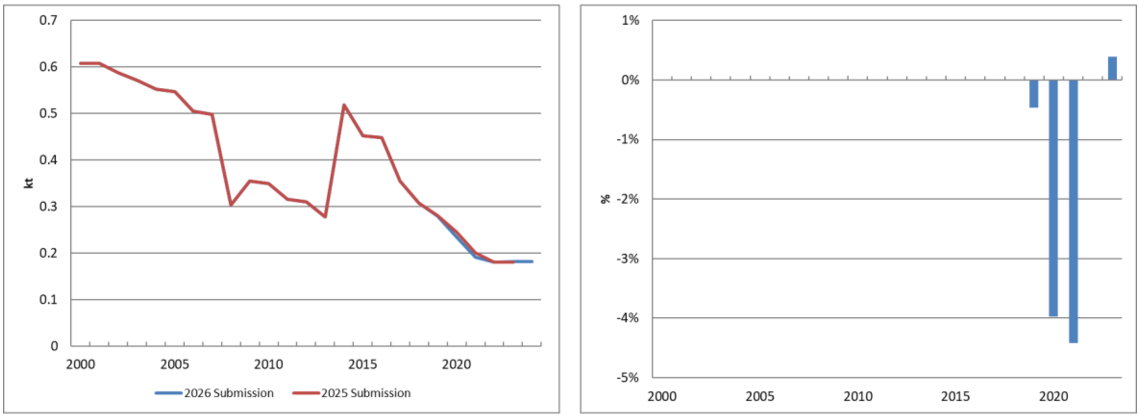



Figure 3.6.98 Evolution of the difference in 1A4ciii $PM_{2.5}$ emissions (national territory)

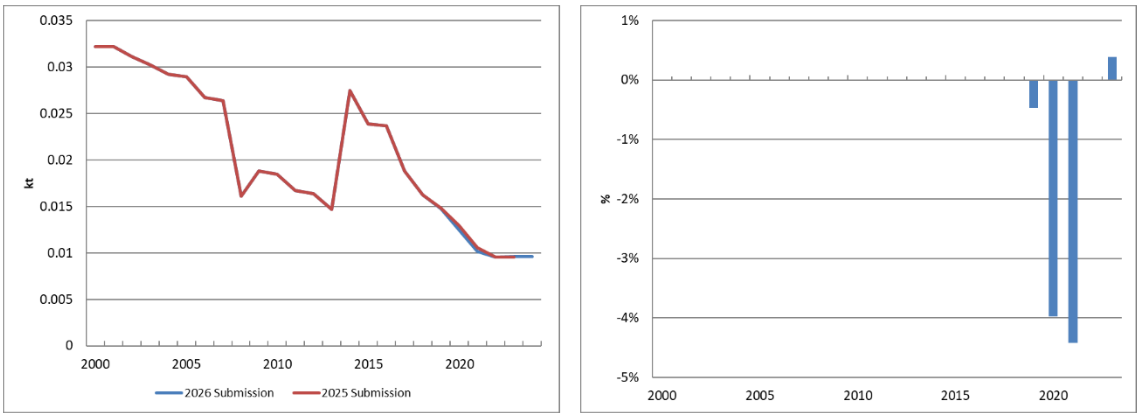



Figure 3.6.99 Evolution of the difference in 1A4ciii BC emissions (national territory)

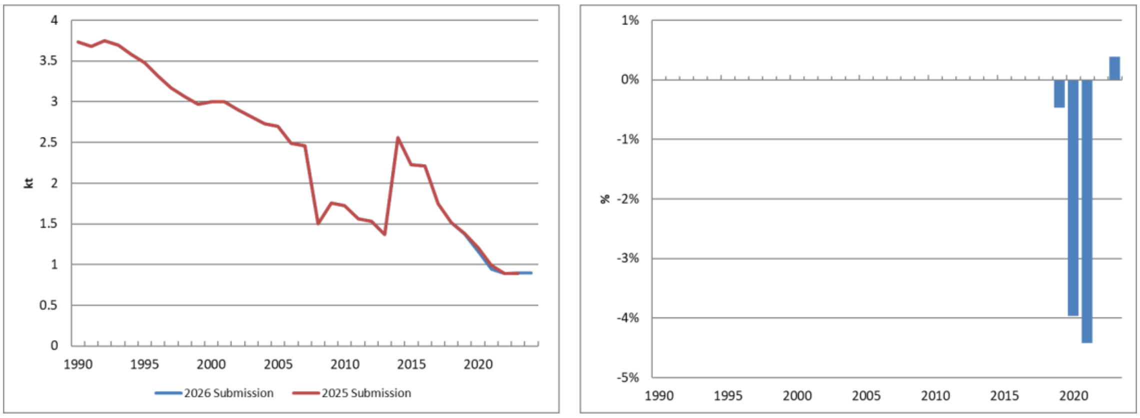



Figure 3.6.100 Evolution of the difference in 1A4ciii CO emissions (national territory)

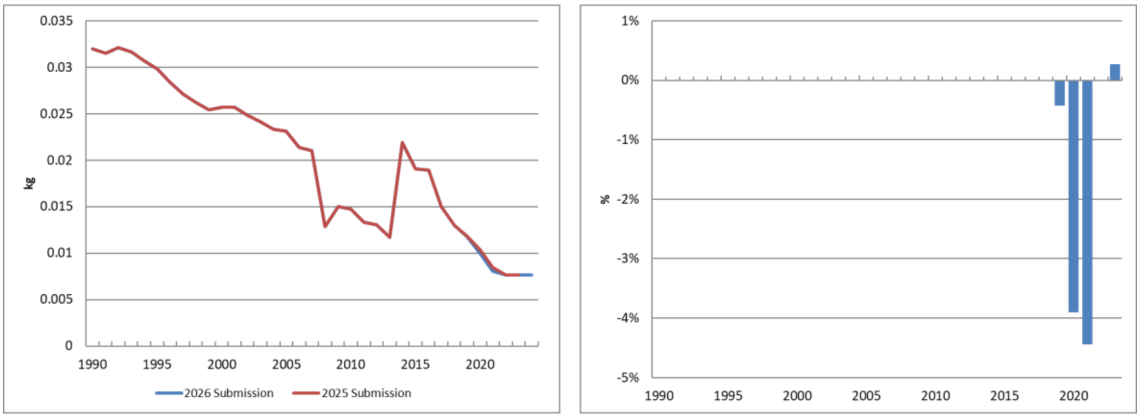



**Figure 3.6.101 Evolution of the difference in 1A4ciii PCB emissions (national territory)**

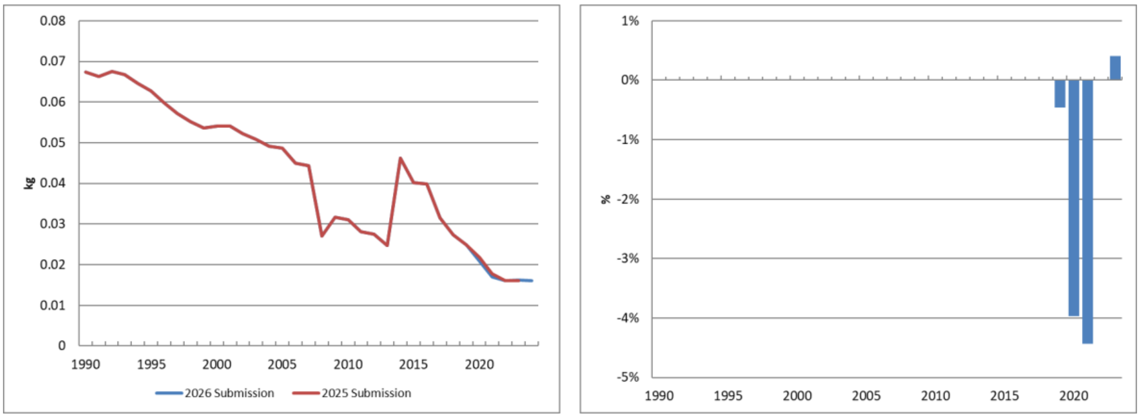



**Figure 3.6.102 Evolution of the difference in 1A4ciii HCB emissions (national territory)**

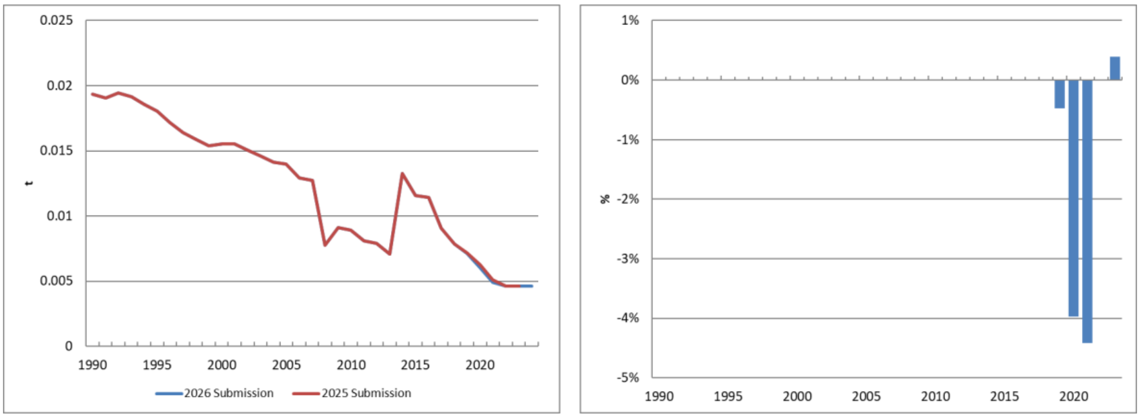



**Figure 3.6.103 Evolution of the difference in 1A4ciii PAH emissions (national territory)**

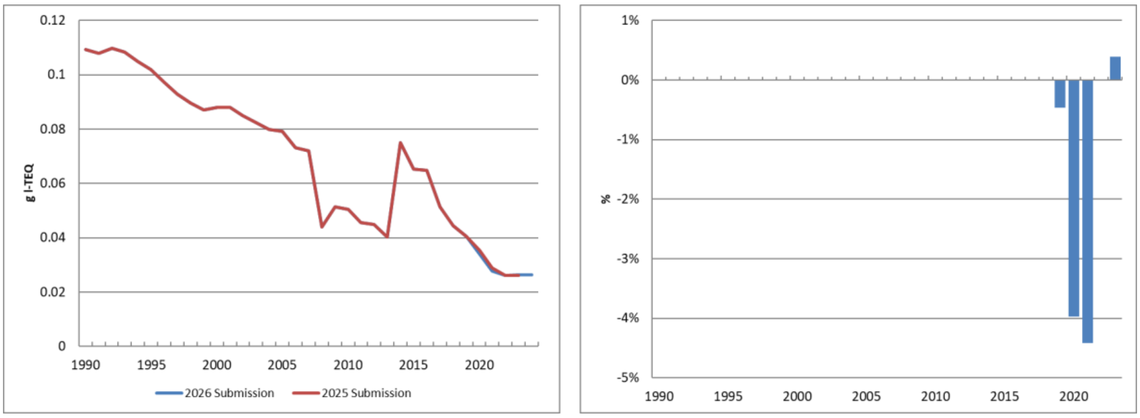



**Figure 3.6.104 Evolution of the difference in 1A4ciii PCDD/PCDF emissions (national territory)**

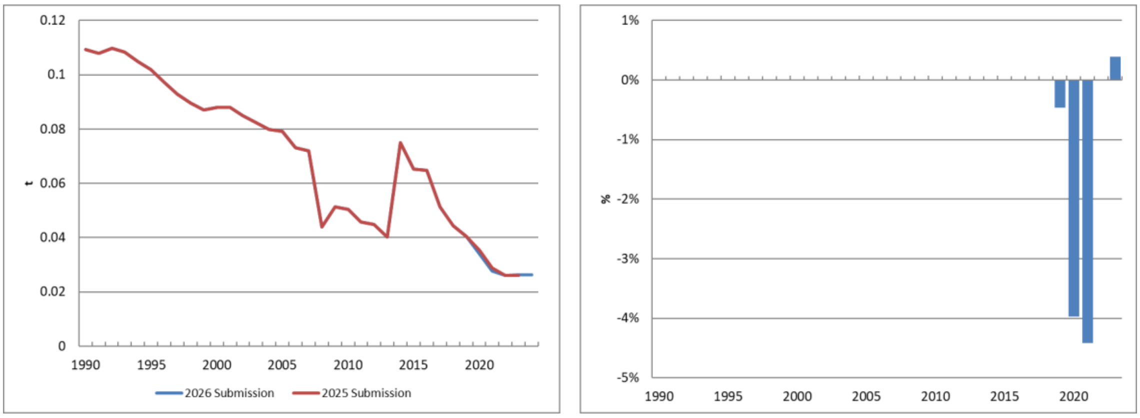



**Figure 3.6.105 Evolution of the difference in 1A4ciii Pb emissions (national territory)**

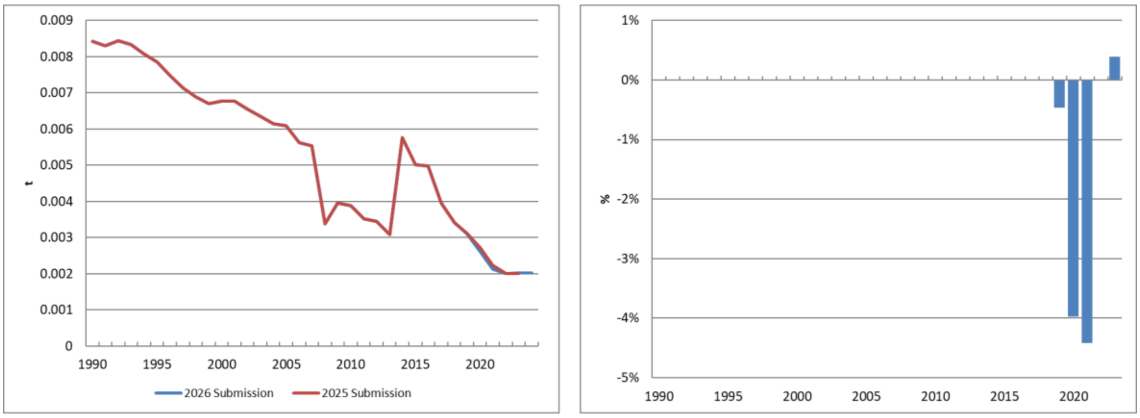



**Figure 3.6.106 Evolution of the difference in 1A4ciii Cd emissions (national territory)**

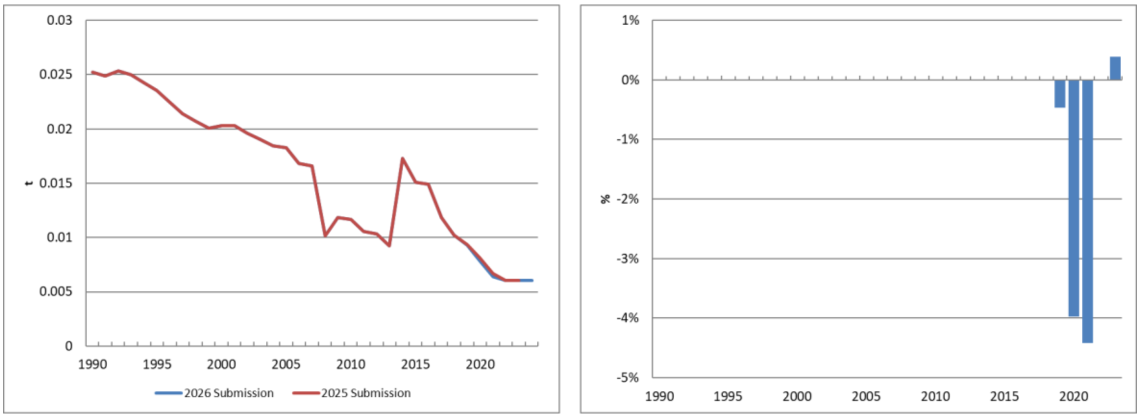



**Figure 3.6.107 Evolution of the difference in 1A4ciii Hg emissions (national territory)**

### 1B1b Fugitive emissions from solid fuels: Solid fuel transformation

The recalculation is due to the new estimation of PAH, DIOX and HM according to the suggestion made by the TERT in the 2025 NECD review.

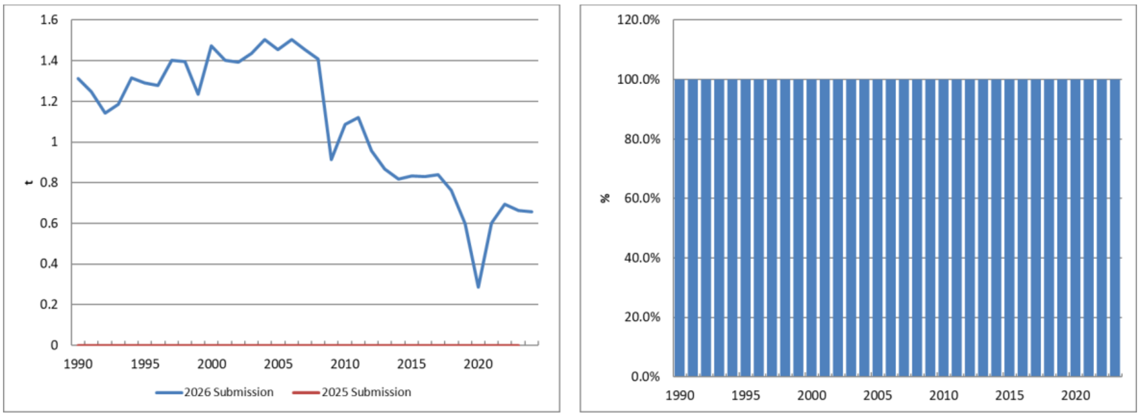



**Figure 3.6.108 Evolution of the difference in 1B1b PAH emissions (national territory)**

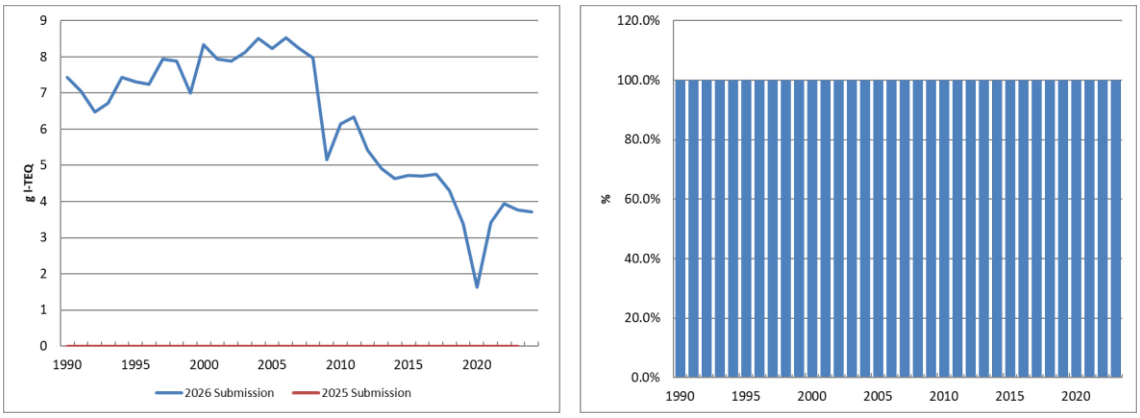



**Figure 3.6.109 Evolution of the difference in 1B1b DIOX emissions (national territory)**

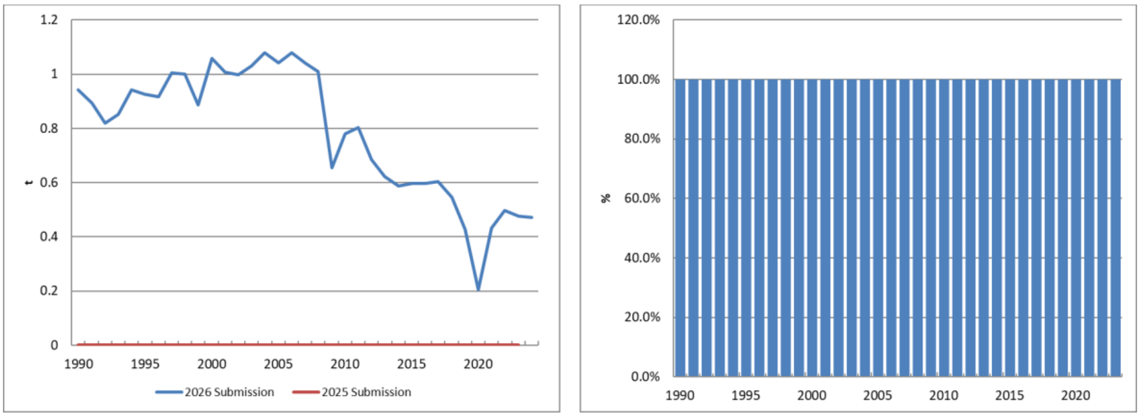



**Figure 3.6.110 Evolution of the difference in 1B1b Pb emissions (national territory)**

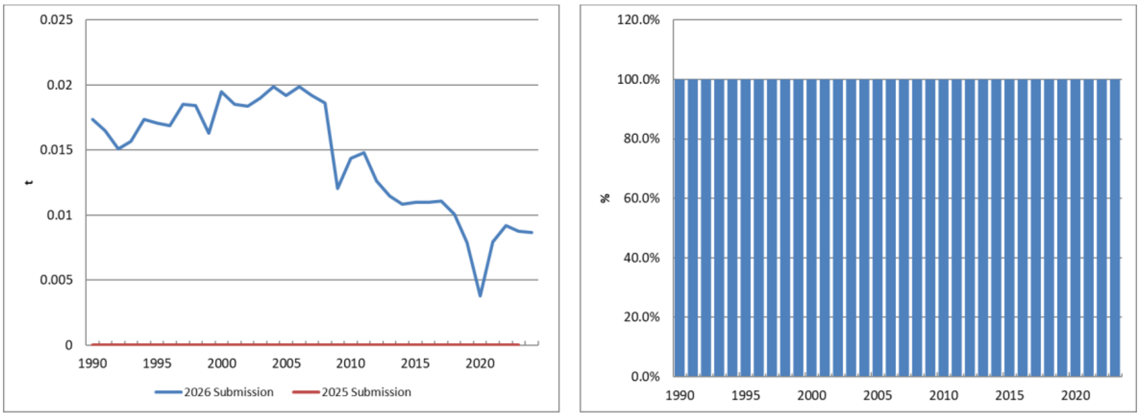



**Figure 3.6.111 Evolution of the difference in 1B1b Cd emissions (national territory)**

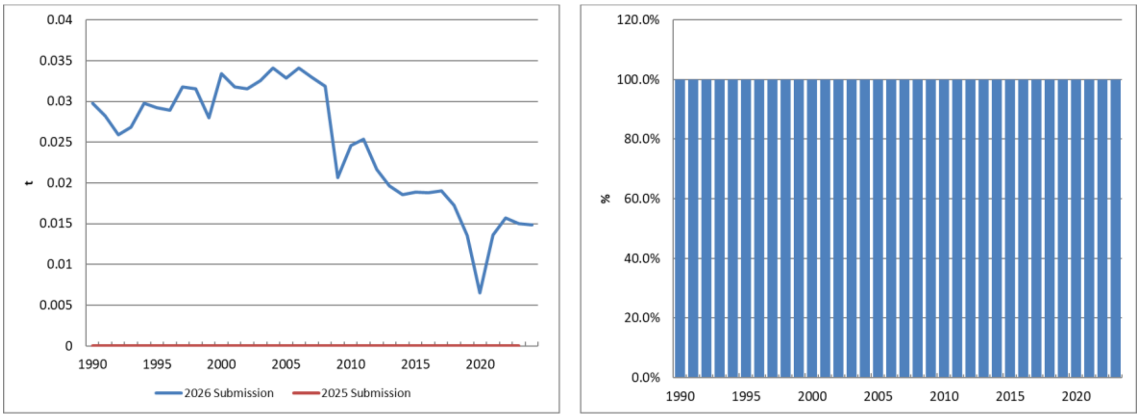



**Figure 3.6.112 Evolution of the difference in 1B1b Hg emissions (national territory)**

### 1B2av Fugitive emissions oil: Distribution of oil. NMVOC emissions

The recalculation is due to an update of the information by the source.

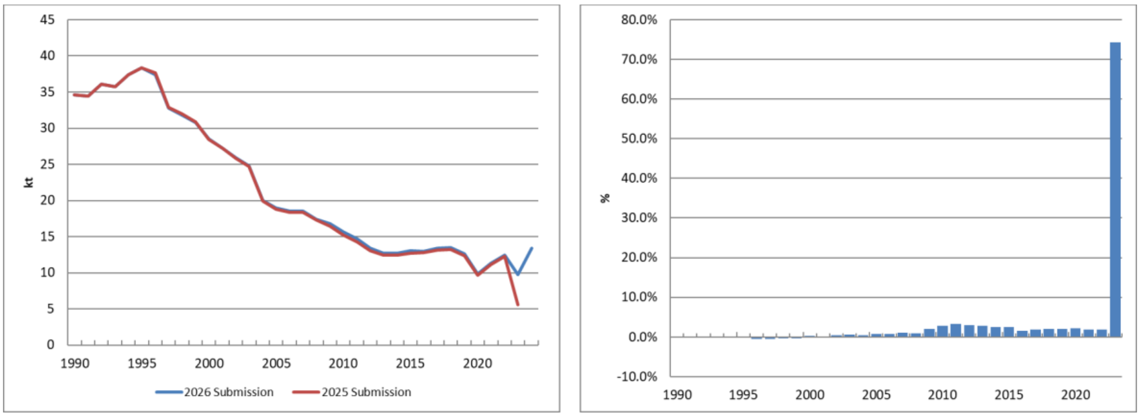



**Figure 3.6.113 Evolution of the difference in 1B2av NMVOC emissions (national territory)**

## 3.7. Sector improvements

The review of the methodology for the elaboration of the fuel balance will continue, in collaboration with the relevant departments of the Secretary of State for Energy at MITECO. The collaboration with the IDAE-MITECO continues in the sense of providing specific information for the balance.

Improvements are progressively addressed in order to achieve full implementation of EMEP/EEA Guidebook (2023).

### 1A1a Public electricity and heat production

Review, update and standardise the emission factors.

### 1A1c Manufacture of solid fuels and other energy industries

Review, update and standardise the emission factors.

The process of collaboration with the General Subdirectorate of Energy Planning and Monitoring of MITECO will continue, in order to improve the information provided by this source and its correct adaptation to the Inventory.

### 1A2 Manufacturing industries and construction (combustion)

Review, update and standardise the emission factors.

### 1A3a Air traffic at airports

Continue alignment with the methodology established by EUROCONTROL, applying all the new improvements proposed.

### 1A3b Road transport

Work will continue in road transport methodology with the aim to be aligned with the improvements proposed in EMEP/EEA 2023 Guidebook and COPERT versions, paying special attention to the emission estimation of alternative modes of propulsion and new Euro Standards.

Carry on with the process of continuous improvement of activity variable data (vehicle fleet, mileage and driving patterns distribution) when more accurate information would be available.

### 1A3c Railways

Continue with the collaboration with the focal point on railways, National Network of Spanish Railways (RENFE), with the aim of improving background information on fuel consumption broken down by type of machinery.

### 1A3d National navigation

Carry on the search of more detailed data of vessel movements and characteristics in order to improve the existing methodology.

### 1A3ei Pipeline transport

Review, update and standardise the emission factors.

### 1A4ai Commercial/Institutional: Stationary

Continue alignment with activity data source of information in order to update the whole fuel consumption series for stationary combustion sectors.

Continue the search of reliable data concerning biomass consumption and its breakdown in stationary combustion.

# Appendix 3.1: Inventory Energy Balance (IEB)

This appendix complements the information in Chapter 3 - Energy of this report by providing background detail on how fuel consumption data is obtained by the Inventory and its full consistency with the National energy statistics elaborated by the Ministry for the Ecological Transition and Demographic Challenge (MITECO) and sent to IEA and EUROSTAT.

Two sources of fuel consumption are used by the Inventory. In some sectors, information provided directly from the affected facilities or entrepreneurial sectors is considered as 'registered information' and those data prevails over statistics or any other source. This information includes the individualized questionnaires from different agents in the private sector and some public sources in those sectors where complete and direct information is available. On the other side, all the registered information, once processed, is completed with the official energy statistics, so as to the total fuel consumption in the Spanish Inventory is tallied with the national fuel balance (EUROSTAT). This is because, in some cases, the registered information by the Inventory does not achieve a full coverage of the sector.

Following this methodology, fuel consumption is finally adjusted for categories 1A1 and 1A2. The result of this fuel balance (average of the entire time series) is summarized in the figure below: the inner circle shows the percentage of information provided by the adjustment of the balance and the 'registered information' for category 1A1; the second circle refers to category 1A2; the third one corresponds to 1A1+1A2 categories and, finally, the outer circle represents the complete Inventory.

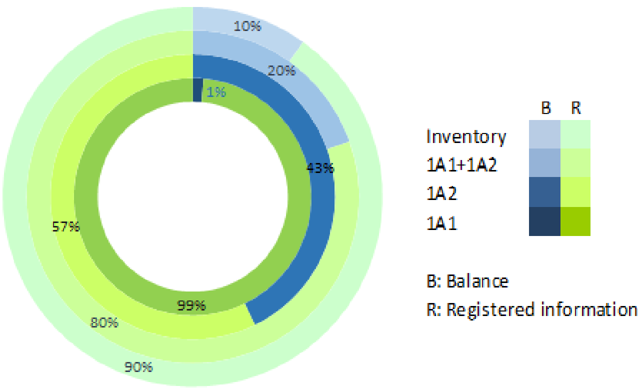



**Figure 3.7.1 Percentage of fuel consumption provided by IEB and registered information for categories (national territory)**

This IEB involves a complex process that aims at ensuring full consistency between the fuel use considered by the Inventory and the total consumption figures from the national energy statistics. The Inventory Energy Balance is performed with the national total consumption of fuels, that includes the whole Spanish territory (including the Canary Islands), and the results are then down-scaled to the EMEP domain, that does not include the Canary Islands.

The IEB always respect the consumptions pre-allocated by the Spanish Inventory as 'registered information' and guarantees that the consumption finally assigned to each sector and type of use must be equal or higher than the information registered by the Inventory, while intending to minimize, for every fuel type, the differences with official energy statistics. As an example, next two first figures with the partial balances for natural gas in 1A1 and 1A2 categories show the way in which some categories are tallied over the figures from the statistics, while others are tallied under the statistics.

The third figure contains the categories affected by the adjustment (1A1 and 1A2) plus fugitive emissions in Energy sector (1B) given that this sector includes non-energy emissions that international statistics consider. Finally, the total national consumption of natural gas from the official energy statistics constitutes the upper limit for the adjustment of the whole Energy sector, as can be seen in the fourth figure that shows how the sectoral differences are compensated so that global fuel consumption in the Spanish Inventory is tallied with the national fuel balance (EUROSTAT).

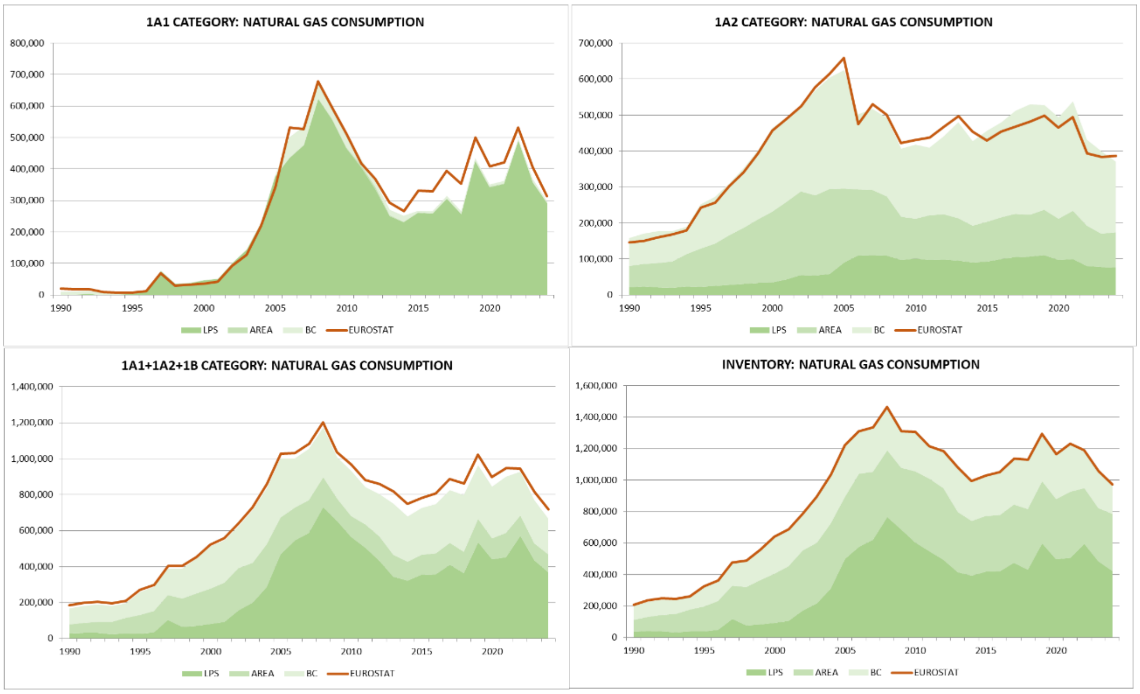



**Figure 3.7.2 Adjustment of natural gas consumption (TJ) as registered by the Inventory and national statistics (national territory)**

For a better interpretation of the graphs, the meaning of the legend is specified below:

- EUROSTAT: national energy statistics from MITECO;
- LPS: information provided by plants to the Inventory;
- AREA: information provided by entrepreneurial associations to the Inventory;
- BC: amount to be allocated to each sector, ensuring that global fuel consumption is tallied with EUROSTAT.

The registered information by the Inventory includes the sum of LPS + AREA while total consumption considered by the Inventory includes the fuel consumption in each category (sum of LPS + AREA + BC).

# 4. IPPU (NFR 2)

# CONTENTS

## FIGURES

## TABLES

# 4. IPPU (NFR 2)

Chapter updated in March, 2026.

## Sector IPPU at a glance

With a wide variety of industrial activities, facilities, plants and product uses, the IPPU sector accounts for a big share of the emissions of the Spanish Inventory for many pollutants. As shown in Figure 4.1.1 (all the figures related to the national territory, Canary Islands included), IPPU sector is the main responsible or has a big share in the emissions of PCBs, NMVOC, heavy metals, and PAHs. The emissions of the rest of the pollutants are not so significant (negligible in the case of NOx, BC, and $NH_3$).

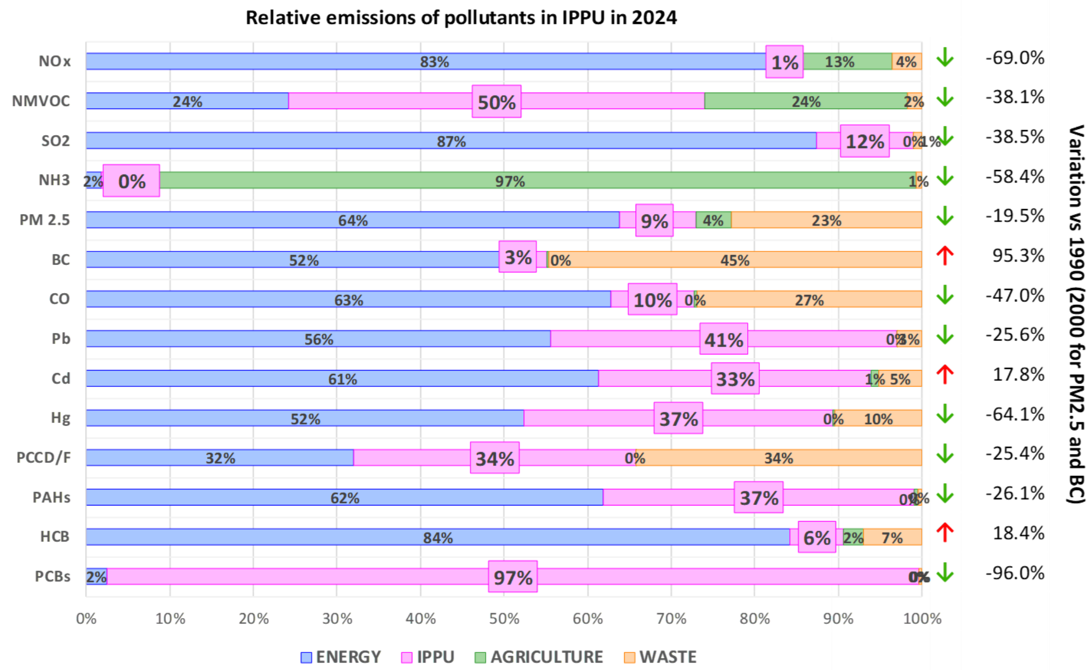



**Figure 4.1.1 Relative emissions in IPPU in 2024 and its relative variation (2024 vs. 1990), national territory**

In 2024, the IPPU sector in Spain involved the activity of 27 iron and steel plants, 5 ferroalloys production plants, 10 vehicle factories, 8 paper pulp plants, several glass and lime production facilities, a big amount and variety of food and beverages industries, as well as the production of organic and inorganic chemicals, and all the related activities and use of products from these and other industries (see Table 4.2.1).

IPPU activities in 2024 are responsible of 97% or the total emissions of PCBs (93,9% without Canary Islands), 50% of NMVOC emissions (46% without Canary Islands), 37% of Hg emissions (44% without Canary Islands), 37% of PAHs emissions (37% without Canary Islands), 41% of Pb emissions (40% without Canary Islands) and 33% of Cd emissions (35% without Canary Islands).

IPPU emissions have decreased since 1990 (2000 for particulate matter) for most of pollutants, due to the applied emission reduction measures. PCBs emissions show a reduction of -96.0% (-96.0% without Canary Islands), while $NO_X$ and mercury have reductions of -69.0% (-69.0% without Canary Islands) and -64.1% (-64.2% without Canary Islands), respectively. Other pollutants, such as BC and HCB show increases in percentage, with a special mention to the rise in BC in the IPPU sector (+95.3%, +93.1% without Canary Islands) due to the increase in tobacco consumption over the analysed period.

## 4.1. Sector overview

Main issues regarding air pollutants' emissions reported for this sector are shown in the following table, in particular, NFR categories and pollutants coverage, methodology approach (method) and consideration as key categories (KC).

**Table 4.1.1 Coverage of NFR category in 2024**

| NFR Code | NFR category | Pollutants | | | | Method | KC |
|---|---|---|---|---|---|---|---|
| | | Covered | Exceptions | | | | |
| | | | IE | NA | NE | | |
| **2A1** | Cement production | – | Rest of pollutants | PCBs | - | – | |
| **2A2** | Lime production | $PM_{2.5}$, $PM_{10}$, TSP, BC | – | Rest of pollutants | NOx, CO, NMVOC, $SO_2$, Pb, Cd, Hg | T2 | |
| **2A3** | Glass production | Rest of pollutants | – | PCBs | NOx, $SO_2$, CO, PCDD/PCDF, PAHs, HCB | T2 | |
| **2A5a** | Quarrying and mining of minerals other than coal | $PM_{2.5}$, $PM_{10}$, TSP | – | Rest of pollutants | – | T2 | ✓ |
| **2A5b** | Construction and demolition | $PM_{2.5}$, $PM_{10}$, TSP | – | Rest of pollutants | – | T1 | |
| **2A5c** | Storage, handling and transport of mineral products | $PM_{2.5}$, $PM_{10}$, TSP | – | Rest of pollutants | – | T2 | |
| **2A6** | Other mineral products: Batteries manufacturing | Pb | – | Rest of pollutants | – | T1 | |
| **2B1** | Ammonia production | – | NOx | Rest of pollutants (*) | $PM_{2.5}$ | – | |
| **2B2** | Nitric acid production | NOx, $NH_3$ | – | Rest of pollutants | $PM_{2.5}$ | T2/T3 | |
| **2B3** | Adipic acid production | NO | | | | | |
| **2B5** | Carbide production | $PM_{2.5}$, $PM_{10}$, TSP, BC, CO | | $NH_3$, PCBs | Rest of pollutants | T2 | |
| **2B6** | Titanium dioxide production | NOx, $SO_2$, $PM_{2.5}$, $PM_{10}$, TSP, BC | – | – | Rest of pollutants | T2 | |
| **2B7** | Soda ash production | $NH_3$, $PM_{2.5}$, $PM_{10}$, TSP, BC, CO | – | Rest of pollutants | – | T3 | ✓ |
| **2B10a** | Other chemical industry: Processes in organic and inorganic chemical industry except adipic acid | NOx, NMVOC, $SO_2$, $NH_3$, $PM_{2.5}$, $PM_{10}$, TSP, BC, CO | – | – | Rest of pollutants | T2/T3 | |
| **2B10b** | Storage, handling and transport of chemical products | – | NMVOC, $PM_{2.5}$, $PM_{10}$, TSP | Rest of pollutants | – | – | |

| NFR Code | NFR category | Pollutants | | | | Method | KC |
|---|---|---|---|---|---|---|---|
| | | Covered | Exceptions | | | | |
| | | | IE | NA | NE | | |
| **2C1** | Iron and steel production | Rest of pollutants | | BaP, BbF, BkF, IcP | $NH_3$ | T2/T3 | |
| **2C2** | Ferroalloys production | $PM_{2.5}$, $PM_{10}$, TSP, BC, Pb, Cd, As, Cr, Cu, Ni, Zn, | | HCB, PCBs | NOx, NMVOC, $SO_2$, CO, $NH_3$, Hg, Se, PCDD/PCDF, PAHs, BaP, BbF, BkF, IcP | T1 | |
| **2C3** | Aluminium production | Rest of pollutants | – | PCBs | NMVOC, $NH_3$, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, HCB | T2/T3 | |
| **2C4** | Magnesium production | NO | | | | | |
| **2C5** | Lead production | $SO_2$, $PM_{2.5}$, $PM_{10}$, TSP, Pb, Cd, As, Zn, PCDD/PCDF, PCBs | | | Rest of pollutants | T2 | ✓ |
| **2C6** | Zinc production | $SO_2$, $PM_{2.5}$, $PM_{10}$, TSP, Pb, Cd, Hg, As, Zn, PCDD/PCDF, PCBs | | | Rest of pollutants | T2 | |
| **2C7a** | Copper production | $SO_2$, $PM_{2.5}$, $PM_{10}$, TSP, BC, Pb, Cd, Hg, As, Cr, Cu, Ni, Zn, PCDD/PCDF, PCBs | | | Rest of pollutants | T2 | |
| **2C7b** | Nickel production | NO | | | | | |
| **2C7c** | Silicon production | TSP, $SO_2$ | – | NMVOC | Rest of pollutants | T1 | |
| **2C7d** | Storage, handling and transport of metal products | – | $PM_{2.5}$, $PM_{10}$, TSP | Rest of pollutants | – | – | |
| **2D3a** | Domestic solvent use including fungicides | NMVOC, Hg | – | Rest of pollutants | $PM_{2.5}$ | T2 | |
| **2D3b** | Road paving with asphalt | NMVOC, $PM_{2.5}$, $PM_{10}$, TSP, BC | | Rest of pollutants | NOx, $SO_2$, CO, PCDD/PCDF, PAHs, HCB | T2 | |
| **2D3c** | Asphalt roofing | NMVOC, $PM_{2.5}$, $PM_{10}$, TSP, BC, CO | – | Rest of pollutants | NOx, Pb, Cd, Hg, PCDD/PCDF, PAHs, HCB | T1 | ✓ |
| **2D3d** | Coating applications | NMVOC | – | Rest of pollutants | - | T2 | |
| **2D3e** | Degreasing | NMVOC | – | Rest of pollutants | $PM_{2.5}$ | T2 | |

| NFR Code | NFR category | Pollutants | | | | Method | KC |
|---|---|---|---|---|---|---|---|
| | | Covered | Exceptions | | | | |
| | | | IE | NA | NE | | |
| **2D3f** | Dry cleaning | NMVOC | – | Rest of pollutants | $PM_{2.5}$ | T2 | |
| **2D3g** | Chemical products | NMVOC | – | – | Rest of Pollutants (**) | T1/T2 | |
| **2D3h** | Printing | NMVOC | – | Rest of pollutants | $PM_{2.5}$, BC | T2 | |
| **2D3i** | Other solvent use | NMVOC, BaP, BbF, BkF, IcP, PAH | – | PCBs | Rest of pollutants | T1/T2 | |
| **2G** | Other product use: Other use of solvents and related activities | Rest of pollutants | – | – | Se, HCB, PCBs | T2 | |
| **2H1** | Pulp and paper industry | NOx, NMVOC, $SO_2$, $PM_{2.5}$, $PM_{10}$, TSP, BC, CO | | Heavy Metals, PCBs, PCDD/PCDF | $NH_3$, PAHs, HCB | T2/T3 | |
| **2H2** | Food and beverages industry | NMVOC | – | Rest of pollutants | $PM_{2.5}$, $PM_{10}$, TSP, BC | T1 | |
| **2H3** | Other industrial processes | NO | | | | | |
| **2I** | Wood processing | TSP | – | Rest of pollutants | NOx, NMVOC, $SO_2$, $NH_3$, $PM_{2.5}$, $PM_{10}$, BC, CO, As, Cu | T1 | ✓ |
| **2J** | Production of POPs | – | – | Rest of pollutants | NOx, NMVOC, $SO_2$, $NH_3$, CO, HCB, PCBs | – | |
| **2K** | Consumption of POPs and Heavy Metals | PCB | – | Rest of pollutants | Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, HCB | T3 | |
| **2L** | Other production, consumption, storage, transportation or handling of bulk products: $NH_3$ consumption in refrigeration | $NH_3$ | – | Rest of pollutants | – | T2 | |

IE: included elsewhere; NA: not applicable; NE: not estimated; NO: not occurring.

(*) Regarding ammonia production, the emissions of CO, $NH_3$ and NMVOC are reported with the notation key 'NA' (not applicable) due to specific plant information for the ammonia process, as they state that the processes that only use natural gas, as both feedstock and fuel, do not emit CO, $NH_3$ nor NMVOC

(**) TSP, Cd, As, Cr, Ni, Se, PAHs Notation Key: NE following the recommendations made by the TERT in the 2024 CLRTAP review

As a general rule, notation keys NE and NA are reported following the EMEP/EEA Guidebook (2019) according to the tables indicated within each chapter in the table summary of methodologies applied.

As for notation keys IE please refer to section 1.8.2.2.

## 4.2. Sector analysis

Main features of the Industrial Processes and Products Use Sector in Spain in 2024 are listed in the following table for reference.

These main features consider the whole national territory, including the Canary Islands, which are not under the EMEP grid.

**Table 4.2.1 Sector analysis**

| NFR Code | NFR category | Main features (2024) | Main sources of activity data |
|---|---|---|---|
| **2A2** | Lime production | - 17 facilities<br>- 1,922 kt produced | - ANCADE (National Association of Manufacturers of Limes and Derivatives of Spain)<br>- EU ETS data<br>- IQ |
| **2A3** | Glass production | - More than 25 facilities<br>- 4,126 kt of glass | - IQ<br>- ANFFECC (Association of companies of Spanish ceramic frits, glazes and ceramic pigments producers) |
| **2A5a** | Quarrying and mining of minerals other than coal | - 187,388 Mt of material quarried | - SGPEM (MITECO) |
| **2A5b** | Construction and demolition | - 26,435,224 $m^2$ of road constructed and floor space constructed/demolished | - INE<br>- Ministry of Public Works |
| **2A5c** | Storage, handling and transport of mineral products | - 48.34 Mt Port traffic: mineral products handled | - Spanish State ports website |
| **2A6** | Other mineral products: Batteries manufacturing | - 7 facilities<br>- 15,900,000 units of lead batteries manufactured | - MINCOTUR |
| **2B1** | Ammonia production | - 3 facilities | - IQ |
| **2B2** | Nitric acid production | - 3 facilities | - IQ |
| **2B5** | Carbide production | - Silicon and calcium carbide production | - IQ |
| **2B6** | Titanium dioxide production | - 1 facility | - FEIQUE |
| **2B7** | Soda ash production | - 1 facility | - SOLVAY |
| **2B10a** | Other chemical industry: Processes in organic and inorganic chemical industry except adipic acid | - 9 subsectors of inorganic production included<br>- 19 subsectors of organic production included | - IQ<br>- FEIQUE |
| **2C1** | Iron and steel production | - 2 integrated iron and steel plants<br>- 25 Non-integrated iron and steel plants<br>- 11,697 kt manufactured | - IQ<br>- UNESID |
| **2C2** | Ferroalloys production | - 5 production plants<br>- Production of ferrosilicon, ferromanganese and silicomanganese | - IQ |
| **2C3** | Aluminium production | - Primary production:<br>  - Type of processes: central prebaked<br>  - 1 facility<br>- Secondary production | - IQ<br>- SGIBP-MINER<br>- Aseral (Spanish Association of Aluminium Refiners)<br>- INE |

| NFR Code | NFR category | Main features (2024) | Main sources of activity data |
|---|---|---|---|
| **2C5** | Lead production | - Primary and secondary lead production<br>- 229 kt produced | - IQ<br>- Spanish Industry Report 1992 (MINER)<br>- UNIPLOM<br>- MITYC<br>- “World Mineral Production” publication |
| **2C6** | Zinc production | - Primary and secondary zinc production | - IQ<br>- SGIBP<br>- U.S. Geological Survey Mineral Yearbook (2014) |
| **2C7a** | Copper production | - Primary and secondary copper production | - IQ<br>- SGIBP<br>- UNICOBRE<br>- U.S. Geological Survey Mineral Yearbook (2014) |
| **2D3a** | Domestic solvent use including fungicides | - Estimations based on population data. 2024 Spain Population = 48,619,695 (46,211,777 without Canary Islands) | - INE<br>- ESIG, European Solvents Industry Group |
| **2D3b** | Road paving with asphalt | Two types of bituminous mixes compiled:<br>- Hot bituminous mixtures<br>- Cutback asphalt | - EAPA |
| **2D3c** | Asphalt roofing | - 171,377 tonnes of roofing material produced (163,485 without Canary Islands) | - INE |
| **2D3d** | Coating applications | - 9 categories of emissions with information on solvent content in the product<br>- 400.55 kt paint applied (382.10 without Canary Islands)<br>- Information on solvent used in manufacturing of automobiles from IQ | - ASEFAPI<br>- Automobile industry |
| **2D3e** | Degreasing | - Information on solvent used in manufacturing of automobiles from IQ<br>- 121,784 t of washing preparations and cleaning preparations, with or without soap, not packaged for retail sale (PRODCOM 20413270) (120,180 without Canary Islands) | - Automobile industry<br>- EUROSTAT |
| **2D3f** | Dry cleaning | - Estimations of solvent consumption based on actual consumption in installations<br>- 231 t of solvents consumed (221 without Canary Islands) | - VOC consumption and emissions from installations under Royal Decree/117/2003 |
| **2D3g** | Chemical products | - 11 compilation categories (activities within SNAP subgroup 06.03) | - INE<br>- COFACO |
| **2D3h** | Printing | - 51.5 kt of inks estimated (paste inks, black new inks, publication inks, varnishes and sundries and other inks) (50.0 kt without Canary Islands) | - ASEFAPI<br>- CITEPA |
| **2D3i** | Other solvent use | - Heterogeneous group including 7 different activities (see Solvent use section for details) | - Statistical sources<br>- AFOEX<br>- ANEO<br>- VOC consumption and emissions from installations under RD/117/2003 |

| NFR Code | NFR category | Main features (2024) | Main sources of activity data |
|---|---|---|---|
| **2G** | Other product use | - Heterogeneous group including 4 different activities (see "Other" section for details) | - EUROSTAT<br>- Spanish producers of anaesthesia |
| **2H1** | Pulp and paper industry | - 8 production plants<br>- 1,626 kt of pulp manufactured | - ASPAPEL<br>- IQ |
| **2H2** | Food and beverages industry | - 1,833,198 tonnes of bread manufactured<br>- 571,849 tonnes of biscuits manufactured<br>- 168,342 tonnes of coffee manufactured<br>- 412,158 tonnes of sugar<br>- 20,262,643 hl of white wine produced<br>- 18,644,080 hl of red wine produced<br>- 40,328,630 hl of beer<br>- 80,076 hl of whisky<br>- 808,170 hl of brandy<br>- 813,974 hl of other spirits | - INE |
| **2I** | Wood processing | - 3,220 kt of wood board products | - FAOSTAT |
| **2K** | Consumption of POPs and Heavy Metals | - 1,152 t of remaining dielectric fluid (1,111 t without Canary Islands) | - SGEC |
| **2L** | Other production, consumption, storage, transportation or handling of bulk products: $NH_3$ Consumption in refrigeration | - 1,205 tonnes of $NH_3$ consumed in refrigeration (1,145 t without Canary Islands) | - Spanish producers of ammonia for refrigeration use |

## 4.2.1. Key categories

Identified Key Categories within the IPPU sector, according to the information provided in section 1.5 of the IIR and Annex 1 are listed in the following table.

### Table 4.2.2 Assignation of KC

| NFR | NFR Category | NOx | NMVOC | $SO_2$ | $NH_3$ | $PM_{2.5}$ | $PM_{10}$ | TSP | BC | CO | Pb | Cd | Hg | PCDD /PCDF | PAHs | HCB | PCBs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | |
| 2A | Mineral products | – | – | – | – | L-T | L-T | L-T | – | – | L | L | – | – | – | – | – |
| 2B | Chemical Industry | – | L | L | T | L | L | L | – | – | – | – | T | – | – | – | – |
| 2C | Metal production | – | – | L | – | – | – | – | – | L | L | L | L | L-T | L-T | L | L |
| 2D | Solvents and other product use | – | L-T | – | – | – | – | – | – | – | – | – | L | – | – | – | – |
| 2G+ 2H+ 2I+ 2J+ 2K+ 2L | Other industrial processes and product use | – | L | L | – | L-T | L-T | L | – | – | – | L | – | – | – | – | L-T |

L: level; T: trend

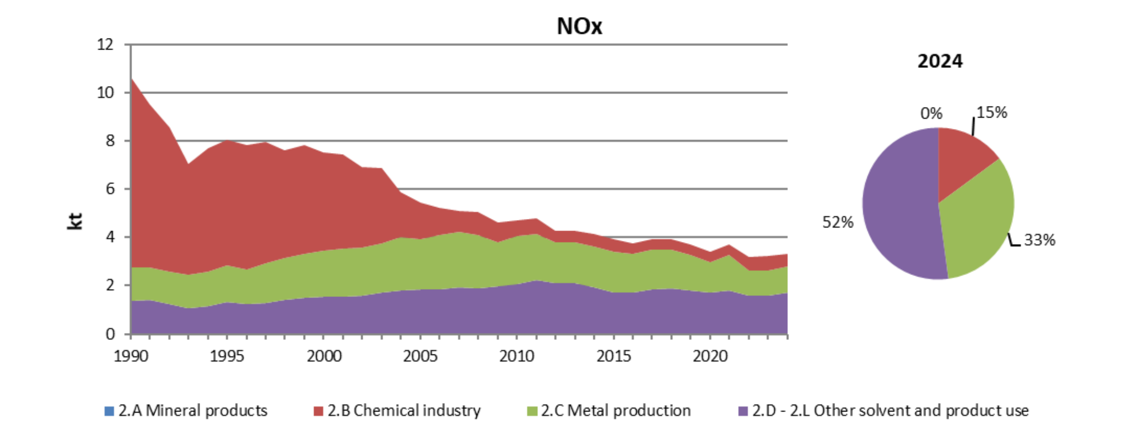
## 4.2.2. Analysis by pollutant

Charts of the time series by pollutants and NFR categories are shown next. Each pollutant is represented independently, broken down by main NFR categories within the sector. Additionally, a pie chart showing the weight distribution of the main categories for year 2024 is included.

Explanation boxes are included next to the graphs, providing specific details on the pollutant emissions in year 2024 and main drivers and trends during the time series. Emissions data without the Canary Islands are shown in parentheses.

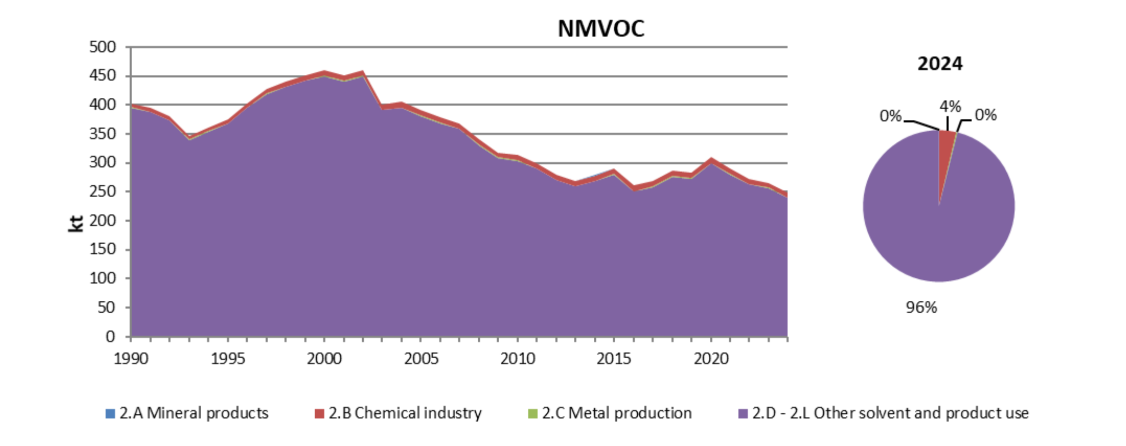
Detailed emission data of the Spanish Inventory are available from the MITECO-SEI website WebTable.

## Main Pollutants



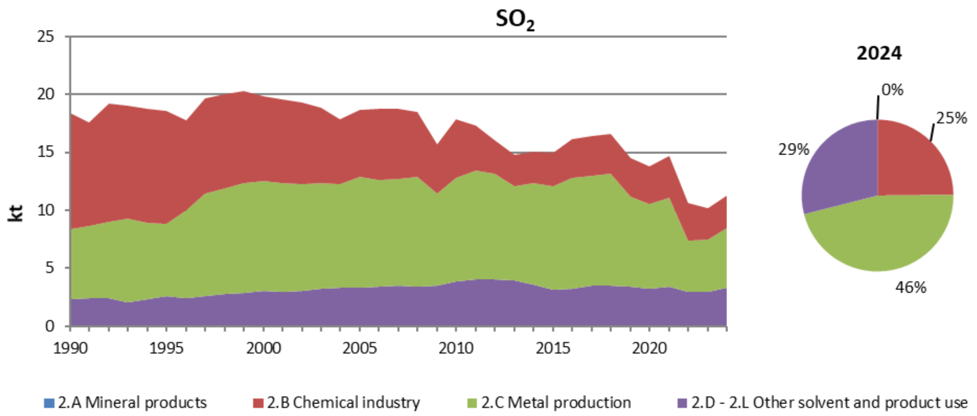

| | | |
|---|---|---|
| ***NOx*** | 3.31 kt emitted in 2024 (3.30 kt without Canary Islands).<br>0.6% of the total NOx emissions of the Inventory in 2024 (0.6% without Canary Islands). | |
| | 1990-1993 | Reduction in the production of nitric acid and introduction of NOx abatement techniques. |
| | 1994-2024 | Trend remains steady till 2001 when a downward tendency begins, led by the chemical industry in general, with steeper declines in 2004, 2009, 2012 and 2016, due to the combined action of nitric acid production (2B2), other chemical industry (2B10a), and iron and steel production (2C1). 2021 shows a slight recovery to 2019 levels led by iron and steel (2C1) while in 2022 a decrease in aluminium production (2C3), with no production in 2023, before recovering slightly in 2024. |

**Figure 4.2.1 Evolution of NOx emissions by category and distribution in year 2024 (national territory)**



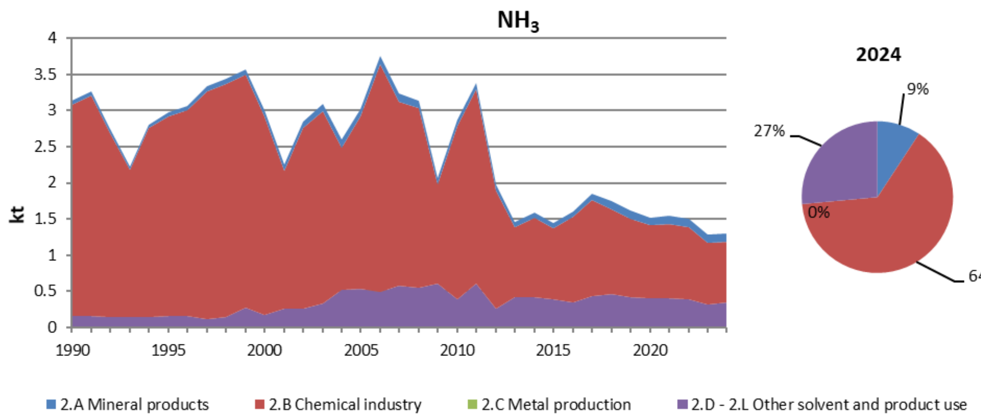

| | | |
|---|---|---|
| ***NMVOC*** | 249.44 kt emitted in 2024 (242.46 kt without Canary Islands).<br>49.8% of the total NMVOC emissions of the Inventory in 2024 (49.6% without Canary Islands). | |
| | 1990-1993 | General descent mainly due to the decreasing consumption of certain products (Paint application, 2D3d) and in category Chemical products (2D3g). |
| | 1994-2007 | Upward trend attributable to the increase in solvent consumption, category 2D3. |
| | 2008-2013 | Progressive decrease owing to the effect of the reduction in the solvent content in painting products, the progressive penetration of abatement techniques and the economic downturn in Spain that led to less consumption. |
| | 2014-2024 | Slight increase due to an upturn in the 2D3g (Chemical products) and 2D3a (Domestic solvent use including fungicides) categories. The latter peaks in 2020 due to the use of hand sanitizers and other solvent-containing products related to the COVID-19 pandemic. In 2021 and subsequent years the trend declines. |

**Figure 4.2.2 Evolution of NMVOC emissions by category and distribution in year 2024 (national territory)**




| | | |
|---|---|---|
| ***$SO_2$*** | 11.28 kt emitted in 2024 (11.28 kt without Canary Islands).<br>11.6% of the total $SO_2$ emissions of the Inventory in 2024 (12.5% without Canary Islands). | |
| | 1990-2014 | Steady fall with stages marked in 1991, 1996, 2004 and 2009 where more pronounced drops arise due to economic and industrial slowdowns in Spain that affected chemical industry (mainly Sulphuric acid production, 2B10a). |
| | 2015-2024 | Slight increase, sharper in 2016, due to an upturn of the production of sulphuric acid (2B10a) and aluminium (2C3). Since 2019, a drop in aluminium production (2C3) can be observed as a consequence of the closure of two plants. 2021 shows a recovery in metal production (2C) while in 2022 it decreases again due to a temporary cessation of activity in aluminium production (2C3). In 2024, a slight increase is observed led by the rise in silicon production. |

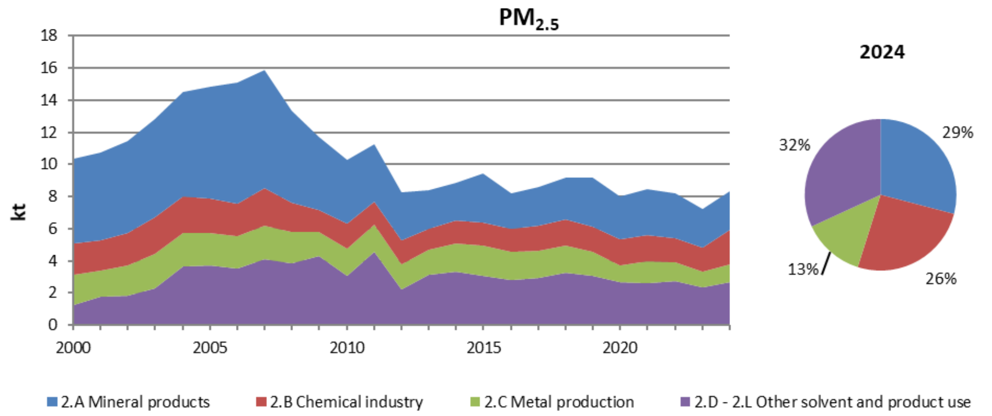
**Figure 4.2.3 Evolution of $SO_2$ emissions by category and distribution in year 2024 (national territory)**




| | | |
|---|---|---|
| ***$NH_3$*** | 1.30 kt emitted in 2024 (1.29 kt without Canary Islands).<br>0.3% of the total $NH_3$ emissions of the Inventory in 2024 (0.3% without Canary Islands). | |
| | 1990-2024 | Trend fluctuates widely over time driven by the NPK fertilisers production (under 2B10a) until 2012 when soda ash production and use (2B7) takes over leadership. Increasing contribution to emissions in recent years from tobacco combustion under other product use (2G) and refrigeration products (2L). |

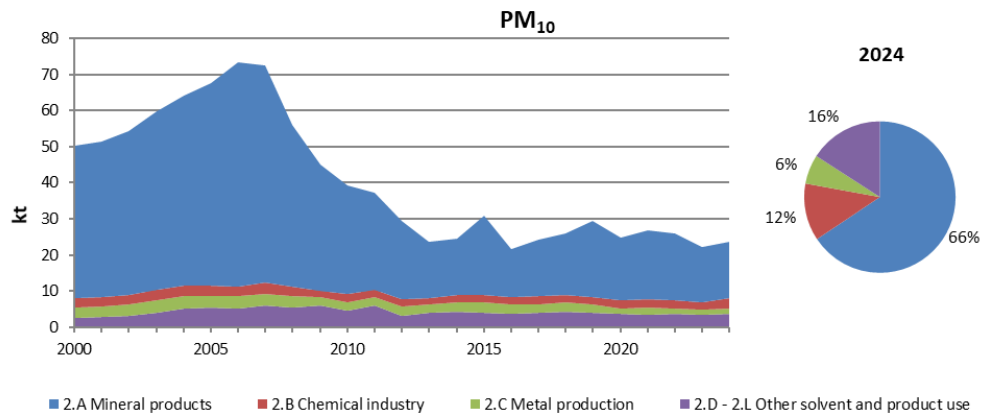
**Figure 4.2.4 Evolution of $NH_3$ emissions by category and distribution in year 2024 (national territory)**

## Particulate Matter



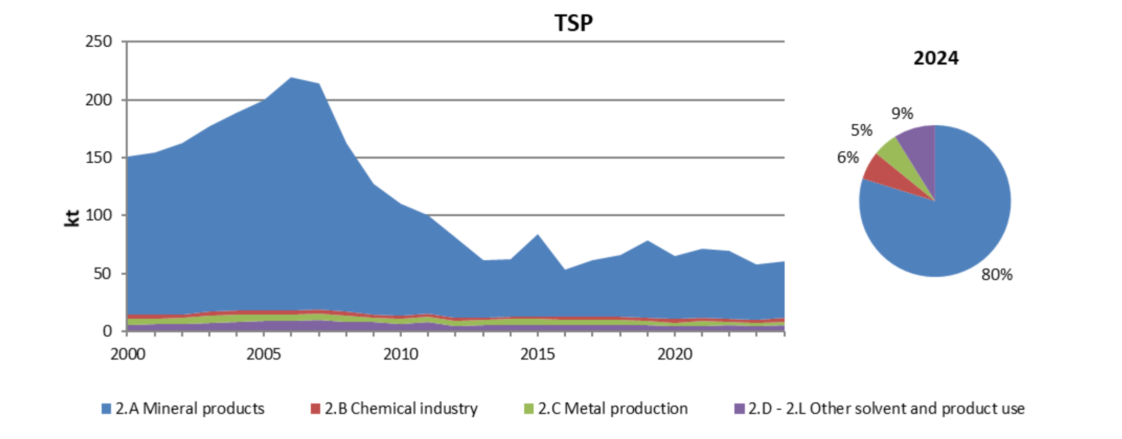

| | | |
|---|---|---|
| ***$PM_{2.5}$*** | 8.31 kt emitted in 2024 (8.18 kt without Canary Islands).<br>9.1% of the total $PM_{2.5}$ emissions of the Inventory in 2024 (9.3% without Canary Islands). | |
| | 2000-2007 | Growing trend led by effect of quarrying and mining of minerals other than coal (2A5a). |
| | 2008-2012 | Decline of the trend due to the reduction of activity under 2A5a, mostly caused by the decrease of the construction activities in Spain, combined with a decrease in the production of NPK fertilisers under other chemical industries (2B10a). Peak in 2011 due to a rise in tobacco consumption. |
| | 2013-2024 | Trend levelled off over the period with a slight rise due to tobacco consumption (2G). Since 2021, a recovery to 2019 levels can be observed. |

**Figure 4.2.5 Evolution of $PM_{2.5}$ emissions by category and distribution in year 2024 (national territory)**



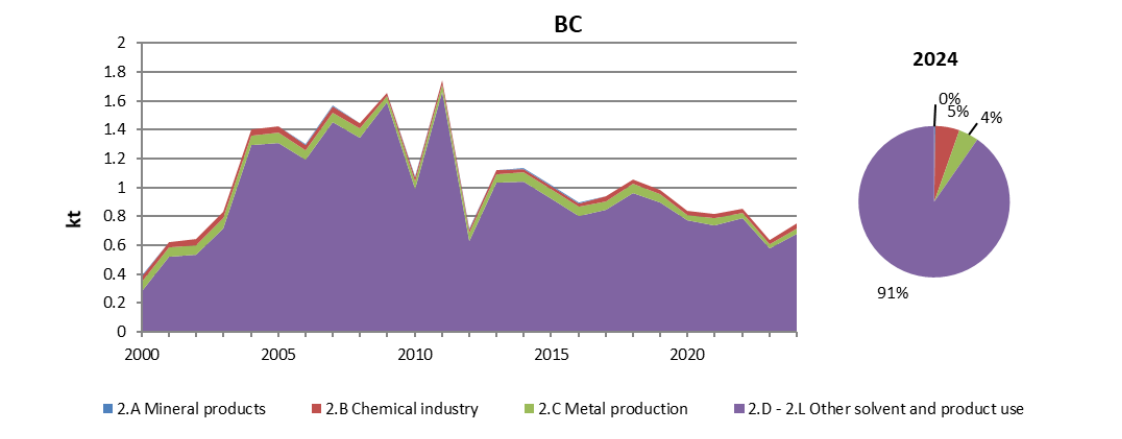

| | | |
|---|---|---|
| ***$PM_{10}$*** | 23.64 kt emitted in 2024 (23.17 kt without Canary Islands).<br>14.4% of the total $PM_{10}$ emissions of the Inventory in 2024 (14.4% without Canary Islands). | |
| | 2000-2006 | Growing trend mainly led by 2A5a and 2A5b source categories in the mineral products sector. |
| | 2007-2013 | Decline of the construction activities in Spain narrowly linked to the aforementioned mineral products sector. 2011 reaches a peak in the category road construction (2A5b). |
| | 2014-2024 | Stable trend led by the contribution of the quarrying and mining of minerals (2A5a). 2015 and 2019 present peaks because of increases in road construction (2A5b). |

**Figure 4.2.6 Evolution of $PM_{10}$ emissions by category and distribution in year 2024 (national territory)**




| | | |
|---|---|---|
| **TSP** | 60.66 kt emitted in 2024 (59.35 kt without Canary Islands).<br>23.9% of the total TSP emissions of the Inventory in 2024 (23.9% without Canary Islands). | |
| | 2000-2006 | Trend grows steadily driven by 2A5a and 2A5b source categories in the mineral products sector. |
| | 2007-2012 | Decline of the construction activities in Spain narrowly linked to the aforementioned mineral products sector. 2011 reaches a peak in the category road construction (2A5b). |
| | 2013-2024 | Trend levels off with slight fluctuations due to a steady contribution from both mineral products sectors, 2A5a and 2A5b. 2015 and 2019 present peaks because of increases in road construction (2A5b). |

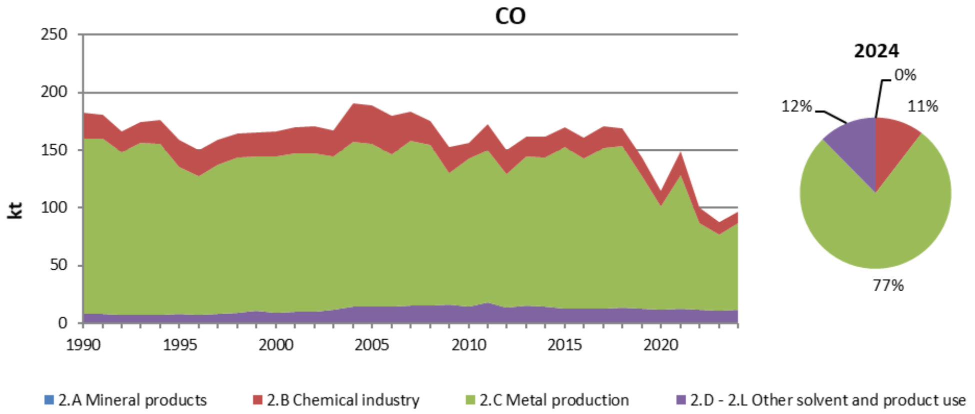
**Figure 4.2.7 Evolution of TSP emissions by category and distribution in year 2024 (national territory)**




| | | |
|---|---|---|
| **BC** | 0.75 kt emitted in 2024 (0.72 kt without Canary Islands).<br>3.1% of the total BC emissions of the Inventory in 2024 (3.1% without Canary Islands). | |
| | 2000-2024 | Unsteady trend led by the tobacco consumption under other product use s (2G). |

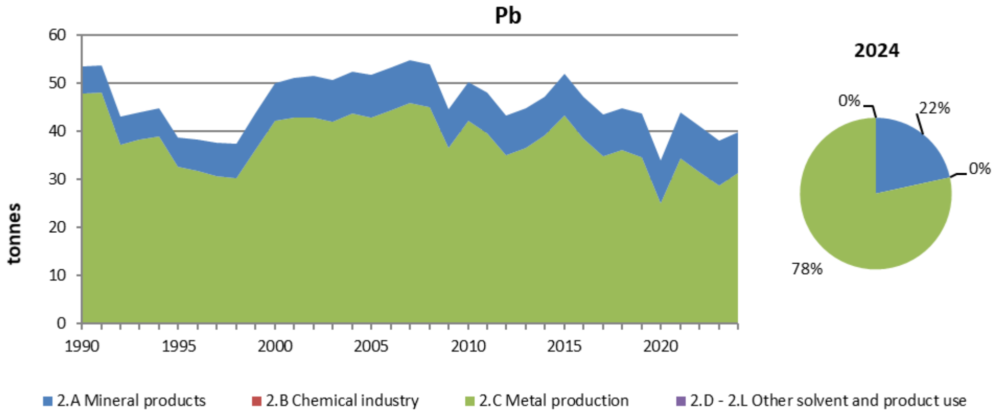
**Figure 4.2.8 Evolution of BC emissions by category and distribution in year 2024 (national territory)**

## CO and Priority Heavy Metals



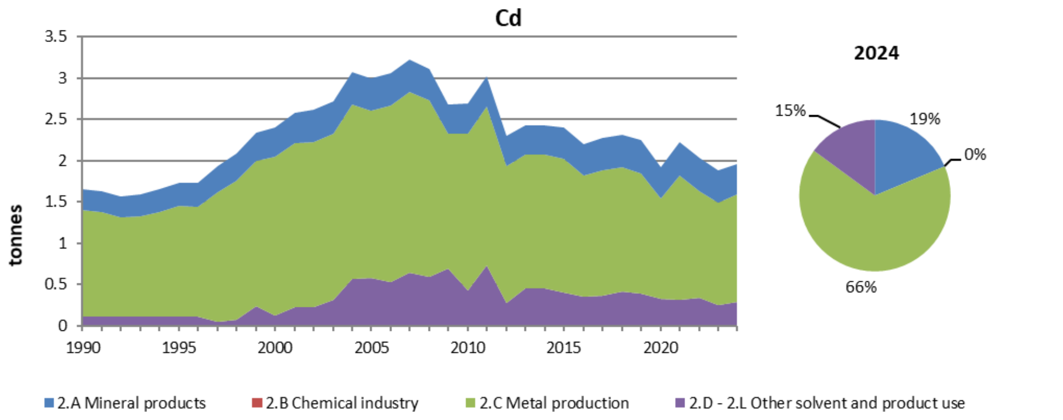

| | | |
|---|---|---|
| ***CO*** | 96.67 kt emitted in 2024 (96.54 kt without Canary Islands).<br>9.9% of the total CO emissions of the Inventory in 2024 (10.1% without Canary Islands). | |
| | 1990-2024 | The trend fluctuates over time, driven mainly by iron and steel production (2C1). 2021 shows a recovery but from 2022 onwards the trend reduces due to cessation of activity in aluminium production (2C3) combined with a reduction in iron and steel production (2C1). In 2024, a slight recovery is noticeable. |

**Figure 4.2.9 Evolution of CO emissions by category and distribution in year 2024 (national territory)**



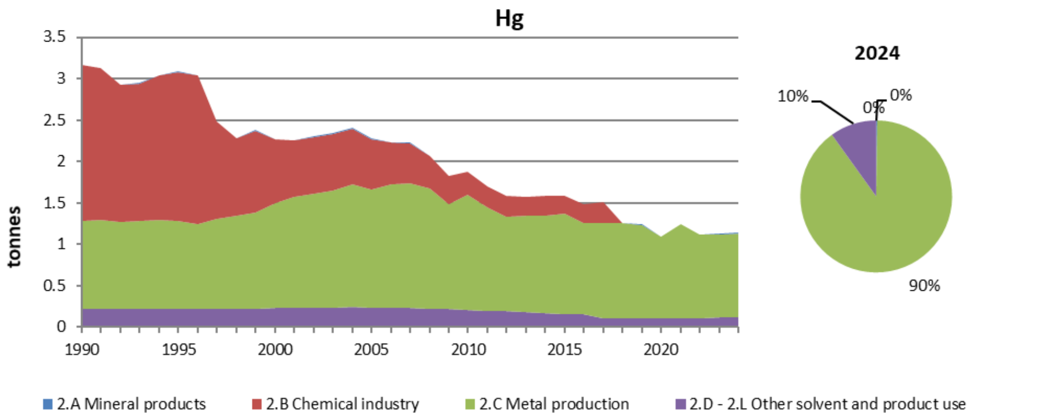

| | | |
|---|---|---|
| ***Pb*** | 39.83 tonnes emitted in 2024 (39.68 tonnes without Canary Islands).<br>41.4% of the total Pb emissions of the Inventory in 2024 (43.0% without Canary Islands). | |
| | 1990-1998 | Downward trend led by iron and steel sector (2C1), sharper in 1995 due to a drop in sinter production as a result of the closure of one integrated iron and steel plant. |
| | 1999-2008 | Rising trend due to the iron and steel sector (2C1). |
| | 2009-2024 | Overall decreasing trend with fluctuations due to both production of steel in electric furnaces (2C1a) and sinter (2C1d). |

**Figure 4.2.10 Evolution of Pb emissions by category and distribution in year 2024 (national territory)**




| | | |
|---|---|---|
| ***Cd*** | 1.95 tonnes emitted in 2024 (1.94 tonnes without Canary Islands).<br>32.7% of the total Cd emissions of the Inventory in 2024 (36.9% without Canary Islands). | |
| | 1990-2008 | Growing trend over the period largely due to metal production, basically, to iron and steel production (2C1). |
| | 2009-2024 | Steady downward trend with fluctuations due to production of steel in electric furnaces (2C1) and tobacco consumption (2G). |

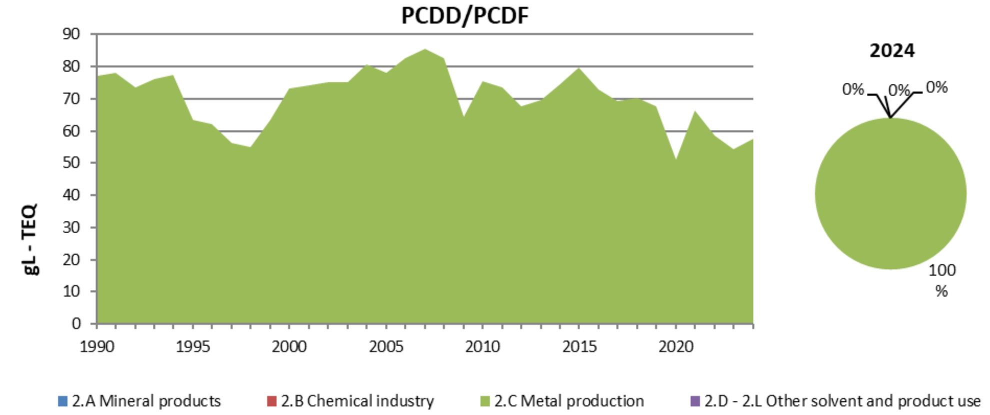
**Figure 4.2.11 Evolution of Cd emissions by category and distribution in year 2024 (national territory)**




| | | |
|---|---|---|
| ***Hg*** | 1.14 tonnes emitted in 2024 (1.13 tonnes without Canary Islands).<br>36.9% of the total Hg emissions of the Inventory in 2024 (47.0% without Canary Islands). | |
| | 1990-1996 | Levelled off trend with slight fluctuations driven by the chemical industry, basically, chlorine manufacturing (2B10a). |
| | 1997-2024 | Decreasing trend due to technological improvements implemented in the chemical industry (Chlorine production, category 2B10a). Since 2018 no Hg emissions have been produced within this sector, as chlorine production with mercury process is no longer allowed, which results in the metal production leading the emissions. |

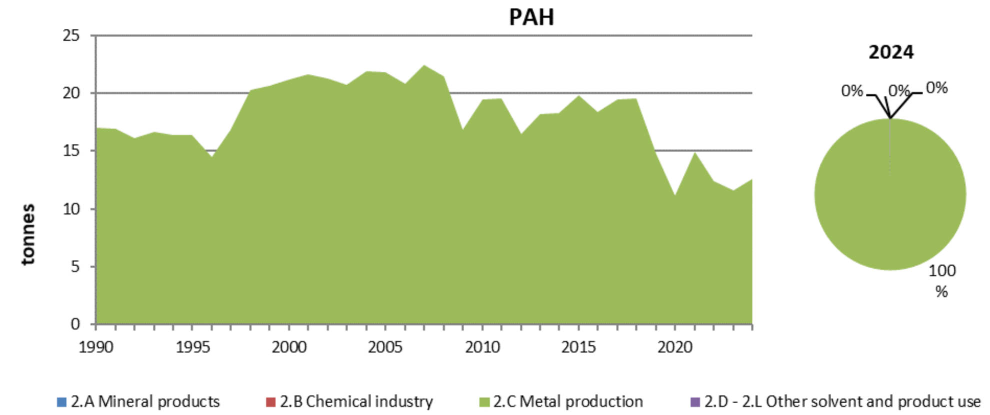
**Figure 4.2.12 Evolution of Hg emissions by category and distribution in year 2024 (national territory)**

## POPs



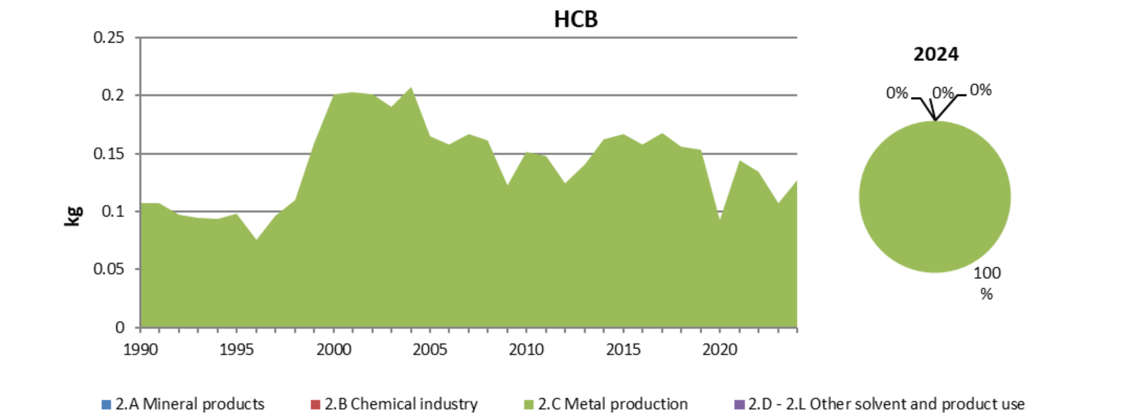

| | | |
|---|---|---|
| ***PCDD/PCDF*** | 57.58 g I-TEQ emitted in 2024 (57.58 g I-TEQ without Canary Islands).<br>33.7% of the total PCDD/PCDF emissions of the Inventory in 2024 (34.2% without Canary Islands). | |
| | 1990-1998 | Downward trend led by sinter production (2C1). |
| | 1999-2007 | Trend increases steadily driven by production of steel in electric furnaces (2C1). |
| | 2008-2024 | Fluctuations over the period with a downward trend driven mainly by the production of sinter and steel in electric furnaces (2C1) followed by the aluminium production (2C3). 2015 peak is due to a rise in sinter production (2C1). |

**Figure 4.2.13 Evolution of PCDD/PCDF emissions by category and distribution in year 2024 (national territory)**



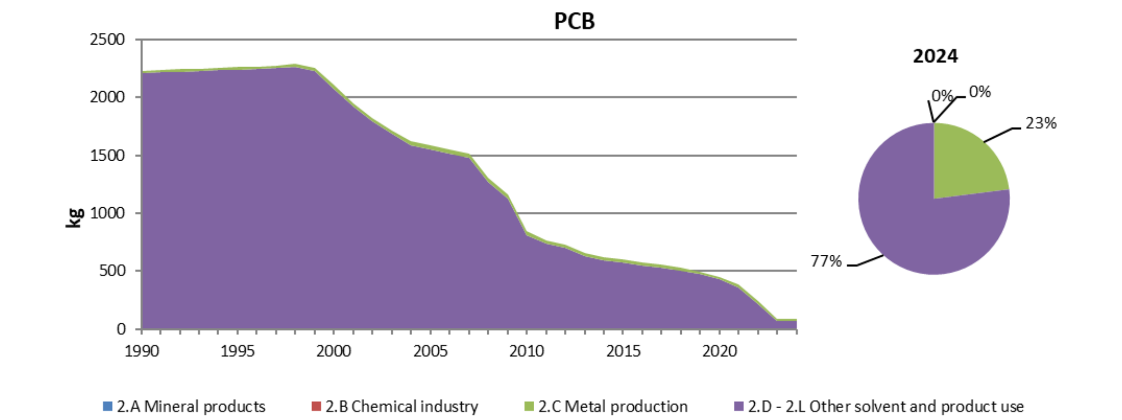

| | | |
|---|---|---|
| ***PAHs*** | 12.57 tonnes emitted in 2024 (12.57 tonnes without Canary Islands).<br>37.2% of the total PAHs emissions of the Inventory in 2024 (37.6% without Canary Islands). | |
| | 1990-2008 | Upward trend with fluctuations, being both the production of pig iron and steel in electric furnaces and the main drivers (category 2C1). |
| | 2009 | Decrease due to a lower activity in the aforementioned drivers. |
| | 2010-2018 | Recovery of activity levels in the involved sectors, with a slight decrease in 2012 and 2016 caused by a reduction in production in pig iron as well as in steel in electric furnaces (2C1). |
| | 2019-2024 | Downward trend due to the closure of several aluminium production plants (2C3) during the period. 2020 presents a steeper decline caused by COVID-19 pandemic. |

**Figure 4.2.14 Evolution of PAHs emissions by category and distribution in year 2024 (national territory)**




| | | |
|---|---|---|
| ***HCB*** | 0.13 kg emitted in 2024 (0.13 kg without Canary Islands).<br>6.4% of the total HCB emissions of the Inventory in 2024 (6.6% without Canary Islands). | |
| | 1990-2024 | Emissions trend from the manufacture of sinter (2C1). 2020 decline caused by COVID-19 pandemic. |

**Figure 4.2.15 Evolution of HCB emissions by category and distribution in year 2024 (national territory)**




| | | |
|---|---|---|
| ***PCB*** | 89.79 kg emitted in 2024 (87.35 kg without Canary Islands).<br>97.2% of the total PCBs emissions of the Inventory in 2024 (97.3% without Canary Islands). | |
| | 1990-1999 | Stable trend. |
| | 2000-2024 | Downward trend correlated with the evolution of the electrical equipment manufactured or contaminated with PCBs that have been destroyed (2K). |

**Figure 4.2.16 Evolution of PCBs emissions by category and distribution in year 2024 (national territory)**

### 4.2.3. Condensable component of $PM_{10}$ and $PM_{2.5}$

As detailed in Annex V, indication of whether the emission estimates and emission factors for $PM_{10}$ and $PM_{2.5}$ in the IPPU sector include or exclude the condensable component can be found in the table below:

**Table 4.2.3 Particulate matter emission factors per source category and information on condensable component**

| NFR | Source/sector name | | PM emissions: the condensable component is | | EF reference and comments |
|---|---|---|---|---|---|
| | | | Included | excluded | |
| **2A1** | Cement production | | IE | | |
| **2A2** | Lime production | | No information available | | EMEP/EEA Guidebook (2019) |
| **2A3** | Glass production | | No information available | | EMEP/EEA Guidebook (2019) |
| **2A5a** | Quarrying and mining of minerals other than coal | | No information available | | “Proxy solution” from “Best practice report of NECD Emissions inventory review 2023” |
| **2A5b** | Construction and demolition | | No information available | | EMEP/EEA Guidebook (2019) |
| **2A5c** | Storage, handling and transport of mineral products | | No information available | | EMEP/EEA Guidebook (2019) |
| **2A6** | Other mineral products: Batteries manufacturing | | NA | | |
| **2B1** | Ammonia production | | NE | | |
| **2B2** | Nitric acid production | | NE | | |
| **2B3** | Adipic acid production | | NO | | |
| **2B5** | Carbide production | | No information available | | EMEP/EEA Guidebook (2019) |
| **2B6** | Titanium dioxide production | | No information available | | EMEP/EEA Guidebook (2019) |
| **2B7** | Soda ash production | | No information available | | EMEP/EEA Guidebook (2019) |
| **2B10a** | Other chemical industry: Processes in organic and inorganic chemical industry except adipic acid | | No information available | | EMEP/EEA Guidebook (2019) |
| **2B10b** | Storage, handling and transport of chemical products | | IE | | |
| **2C1** | Iron and steel production | Integrated iron and steel plants | No information available | | Stack measurements of TSP and $PM_{10}$; $PM_{2.5}$ fractions based in CEPMEIP (2000) or EMEP/EEA GB 2019, from TSP data |
| | | Non Integrated iron and steel plants | | X | EMEP/EEA Guidebook (2019) |
| **2C2** | Ferroalloys production | | | X | EMEP/EEA Guidebook (2019) |
| **2C3** | Aluminium production | Primary production | No information available | | Stack measurements of TSP; $PM_{2.5}$ and $PM_{10}$ fractions based in CEPMEIP (2000), from TSP data |
| | | Secondary production | | X | EMEP/EEA Guidebook (2019) |
| **2C4** | Magnesium production | | NO | | |
| **2C5** | Lead production | | | X | EMEP/EEA Guidebook (2019) |

| NFR | Source/sector name | PM emissions: the condensable component is | | EF reference and comments |
|---|---|---|---|---|
| | | Included | excluded | |
| **2C6** | Zinc production | | X | EMEP/EEA Guidebook (2019) |
| **2C7a** | Copper production | | X | EMEP/EEA Guidebook (2019) |
| **2C7b** | Nickel production | NO | | |
| **2C7c** | Other metal production (Silicon) | NA | | |
| **2C7d** | Storage, handling and transport of metal products | NE | | |
| **2D3a** | Domestic solvent use including fungicides | NE | | |
| **2D3b** | Road paving with asphalt | X | | EMEP/EEA Guidebook (2019) |
| **2D3c** | Asphalt roofing | No information available | | EMEP/EEA Guidebook (2019) |
| **2D3d** | Coating applications | NA | | |
| **2D3e** | Degreasing | NE | | |
| **2D3f** | Dry cleaning | NE | | |
| **2D3g** | Chemical products | NE | | |
| **2D3h** | Printing | NE | | |
| **2D3i** | Other solvent use | NE | | |
| **2G** | Other product use: Other use of solvents and related activities | No information available | | EMEP/EEA Guidebook (2019) |
| **2H1** | Pulp and paper industry | No information available | | EMEP/EEA Guidebook (2019) |
| **2H2** | Food and beverages industry | NE | | |
| **2H3** | Other industrial processes | NO | | |
| **2I** | Wood processing | NE | | |
| **2J** | Production of POPs | NA | | |
| **2K** | Consumption of POPs and heavy metals (e.g. electrical and scientific equipment) | NA | | |
| **2L** | Other production, consumption, storage, transportation or handling of bulk products: $NH_3$ consumption in refrigeration | NA | | |

## 4.3. Major changes

The table below summarizes the major changes performed in the IPPU sector in the current Inventory edition. Those referred to the recommendations made by the TERT in the 2025 NECD review[1] (pursuant to Directive (EU) 2016/2284), have been marked with an asterisk (*).

Further details of new estimations and recalculations can be found in sections 4.4 (Key categories analysis) and 4.5 (Recalculations).

[1] Final Review Report available in: https://environment.ec.europa.eu/topics/air/reducing-emissions-air-pollutants/emissions-inventories_en

**Table 4.3.1 Major changes in the IPPU sector in Inventory edition 2026**

| NFR Category | Activities included | Pollutant | Type of change |
|---|---|---|---|
| (*) Food and beverages industry **(2H2)** | - Food and beverages industry | NMVOC | Detailed information about the increase in NMVOC emissions in 2022. |

## 4.4. Key categories analysis

Within this sector, the following categories have been identified as key (see table Assignation of KC for reference):

A. Mineral Industry - 2A

B. Chemical Industry - 2B

C. Metal production - 2C

D. Solvent use - 2D

E. Other industrial processes and product use – 2G+2H+2I+2J+2K+2L

Activity data sources, methodologies and a general assessment for each category are provided.

## A. Mineral industry (2A)

Mineral industry is a key category for its contribution to the level and the trend of the emissions of $PM_{2.5}$, $PM_{10}$, and TSP, as well as for its contribution to the level of the emission of Pb and Cd.

Emissions of Particulate Matter in this sector are mainly due to activities 2A5a (Quarrying and mining of minerals other than coal) followed by 2A5b (Construction and demolition) and 2A3 (glass production). As for the heavy metals emissions (Pb and Cd), are largely due to glass production activity (2A3). Emissions from 2A1 (Cement production) are included in 1A2f (see section 4.1).

### A.1. Activity variables

**Table 4.4.1 Summary of activity variables, data and information sources for category 2A**

| Activities included | Activity data | Source of information |
|---|---|---|
| Lime production (**2A2**) | - Production of lime. | - 1990-2024: IQ.<br>- 1990-2024: EU ETS DATA.<br>- 1990-2024: ANCADE. |
| Glass production (**2A3**) | - Production of glass. | - 1990-2024: IQ.<br>- 1990-2024: ANFFECC. |
| Quarrying and mining of minerals other than coal (**2A5a**) | - Production of construction aggregates. | - 1991-2024: "Estadística minera de España (Spanish Mining statistic)". SGPEM (MITECO).<br>- 1990: subrogated data from the most recent year available. |
| Construction and demolition (**2A5b**) | - Municipal construction authorizations (square metres authorized for housing construction or demolition) | - 1990–2000: Ministry of Public Works<br>- 2000-2024: INE. |
| | - Square metres of road construction | - 2000-2024: Ministry of Transport and Sustainable Mobility (MITMS) |
| Storage, handling and transport of mineral products (**2A5c**) | Tonnes of material handled:<br>- Cement and clinker.<br>- Construction materials.<br>- Other non metallic minerals. | - 2002-2024: Spanish State ports website. |
| Other mineral products – Batteries manufacturing (**2A6**) | - Number of batteries produced.<br>- Amount of metal used per battery. | - 1993-1996: MITYC.<br>- 2005-2007: MITYC.<br>- 1997-2004: lineal interpolation.<br>- 1990-1992: subrogated data (1993).<br>- 2008-2024: subrogated data (2007).<br>- 1990-2024: EPA. AP-42. |

### A.2. Methodology

**Table 4.4.2 Summary of methodologies applied in category 2A**

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| ***Lime production (2A2)*** | | | |
| $PM_{2.5}$, $PM_{10}$, TSP, BC | T2 | EMEP/EEA Guidebook (2019). Chapter 2A2. | EF:<br>- Table 3.3: default Tier 2 emission factors by tonne of lime. |

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| ***Glass production (2A3)***<br><br>(Methodological factsheets: Glass manufacturing) | | | |
| NMVOC, $NH_3$, $PM_{2.5}$, $PM_{10}$, TSP, BC, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn | T2 | EMEP/EEA Guidebook (2019). Chapter 2A3.<br>US EPA AP-42. Chapter 11.14 Frit Manufacturing. | EF (emission factors by tonne of glass):<br>- Stone glass: CS, except for BC Table 3.5 (default T2).<br>- Wool glass: Table 3.5 (default T2).<br>- Container glass: Table 3.3 (default T2).<br>- Flat glass: Table 3.2 (default T2).<br>- Other glasses: for BC table 3.6 and 3.7. Rest of pollutants: Table 14-1, 14-2 (default US EPA). |
| ***Quarrying and mining of minerals other than coal (2A5a)*** | | | |
| PM | T2 | "Proxy solution" from "Best practice report of NECD Emissions inventory review 2023" | EF:<br>- "Best practice report of NECD Emissions inventory review 2023" |
| ***Construction and demolition (2A5b)*** | | | |
| PM | T1 | EMEP/EEA Guidebook (2019). Chapter 2A5b. | EF:<br>- Tables: 3.2, 3.4: default Tier 1 emission factors. |
| ***Storage, handling and transport of mineral products (2A5c)*** | | | |
| PM | T2 | EMEP/EEA Guidebook (2019). Chapter 2A5c. | EF:<br>- Table 3.4: default Tier 2 emission factors by tonnes of mineral products handled. |
| ***Other mineral products – Batteries manufacturing (2A6)*** | | | |
| Cd, Pb | T1 | PARCOM – ATMOS (1992). Section 2.9.6. | EF:<br>- Emissions factor by tonne of metal used in the manufacturing of batteries.<br>- For Ni-Cd batteries, the lowest value of EF has been chosen assuming abatement techniques installed in factories. |

## A.3. Assessment

Activities 2A5a and 2A5b are narrowly related to each other and both linked to the construction sector. The production of aggregates (2A5a) grows along with the surface to be constructed. As shown in the next figure, from 2000 to 2006, the production of aggregates suffered a steep rise as did the authorized surface for construction. In 2007, just in the prelude of the Spanish economic downturn, activity variables start a sharp fall until 2010, when trend softens, recovering a light increase from 2014 onwards.

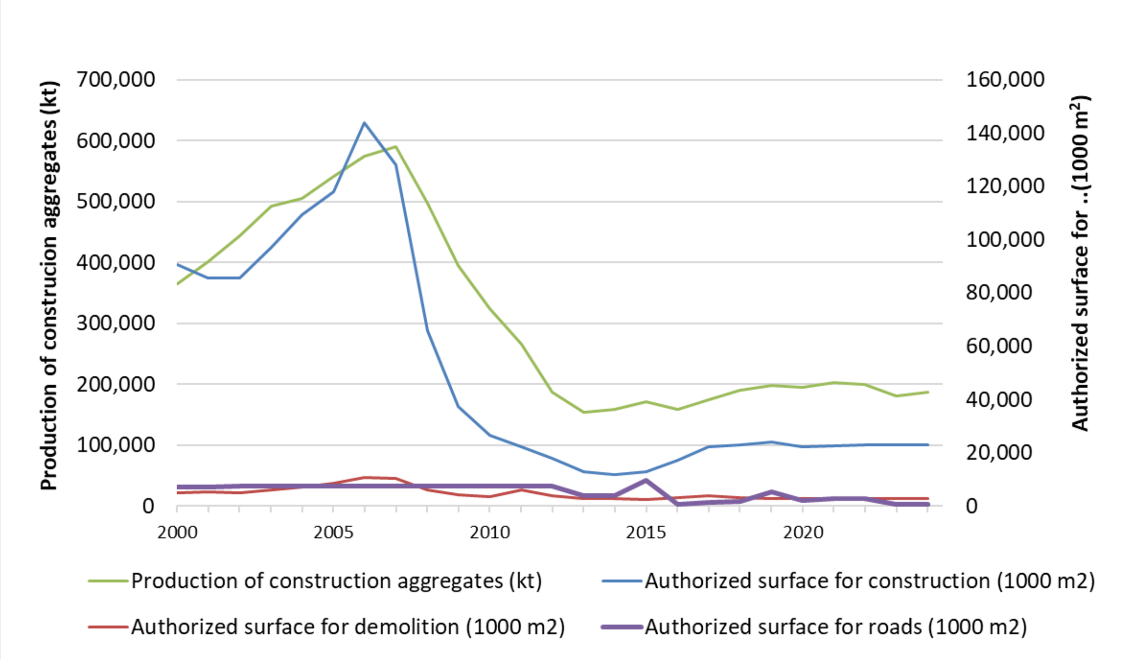



**Figure 4.4.1 Evolution of activity data in 2A5a and 2A5b (national territory)**

Following the recommendation ES-2A5a-2023-001 made by the TERT in the 2023 NECD review[2] (pursuant to Directive (EU) 2016/2284), Spain tried to gather more accurate information from the national quarrying associations and noticed the complexity of getting all the highly detailed parameters requested in the Tier 2 methodology of EMEP/EEA Guidebook, which could be more appropriately labelled as a Tier 3. Finally, the Tier 2 "proxy solution" included in the "Best practice report of the NECD emissions inventory review 2023" has been implemented.

According to the update of this recommendation made by the TERT in the 2024 NECD review[3], the emission factors and production data are presented below.

**Table 4.4.3 2A5a Emission factors extracted from the "Best practice report of the NECD emissions inventory review 2023"**

| EMISSION FACTORS (t/Mt) | | | |
|---|---|---|---|
| **Pollutants** | **Crushed rock** | **Sand and gravel** | **Recycled aggregate** |
| **TSP** | 223 | 35 | 31 |
| **$PM_{10}$** | 68 | 11 | 13 |
| **$PM_{2.5}$** | 8 | 2 | 3 |

[2] Final Review Report available in: https://environment.ec.europa.eu/topics/air/reducing-emissions-air-pollutants/emissions-inventories_en

[3] Final Review Report available in: https://environment.ec.europa.eu/topics/air/reducing-emissions-air-pollutants/emissions-inventories_en

**Table 4.4.4 2A5a Activity data extracted from the "Spanish Mining Statistics" (national territory)**

| Activity data (t) | | | |
|---|---|---|---|
| | Crushed rock | Sand and gravel | Recycled aggregate |
| **2000** | 247,698,975 | 108,606,000 | 9,136,025 |
| **2005** | 366,666,450 | 161,532,000 | 13,543,550 |
| **2010** | 225,817,750 | 89,390,000 | 8,082,250 |
| **2015** | 121,233,064 | 46,264,000 | 4,294,797 |
| **2019** | 137,082,200 | 56,194,000 | 4,955,800 |
| **2020** | 133,642,650 | 57,003,000 | 4,888,350 |
| **2021** | 142,009,925 | 56,191,000 | 5,082,075 |
| **2022** | 136,946,950 | 57,392,000 | 4,983,050 |
| **2023** | 122,996,525 | 53,380,000 | 4,522,475 |
| **2024** | 124,948,300 | 57,755,000 | 4,684,700 |

Emissions from activity 2A3 are driven by the fluctuations of productivity inherent to the glass sector.

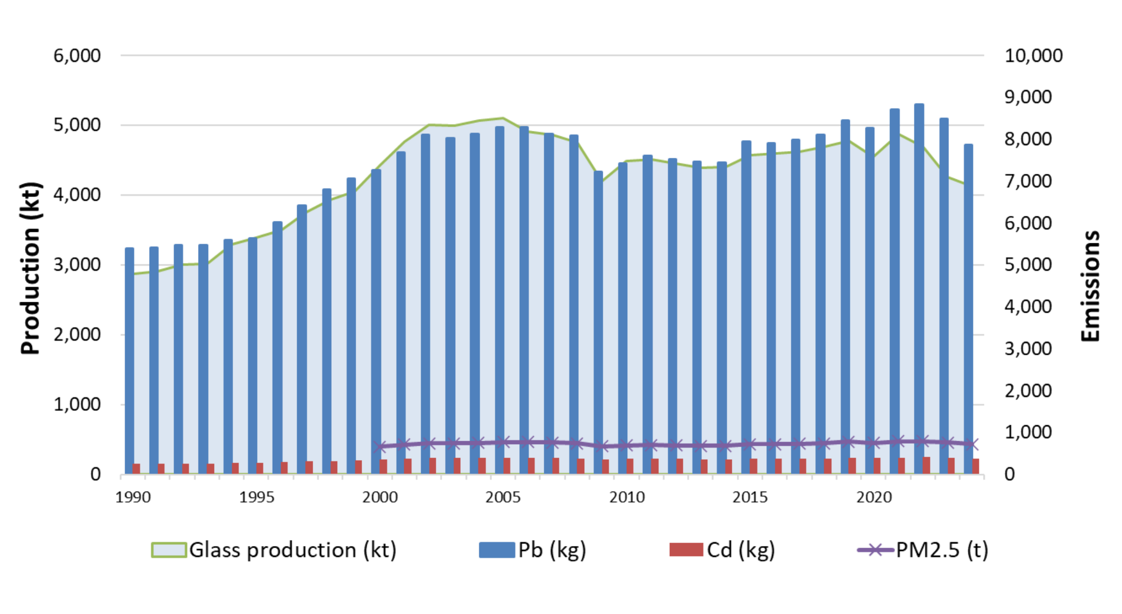



**Figure 4.4.2 Evolution of activity data vs Pb, Cd and $PM_{2.5}$ emissions in 2A3 (national territory)**

## B. Chemical industry (2B)

The chemical industry is a key category for its contribution to the level of the emissions of NMVOC, $SO_2$, TSP, $PM_{2.5}$ $PM_{10}$ and to the trend of $NH_3$ and Hg.

### B.1. Activity variables

#### Table 4.4.5 Summary of activity variables, data and information sources for category 2B

| Activities included | Activity data | Source of information |
|---|---|---|
| Nitric acid (**2B2**) | - Nitric acid production by type of process (low pressure, medium pressure and high pressure). | - 1990: IQ from the production plants.<br>- 1991-2000: Ministry of Industry and FEIQUE.<br>- 2001-2007: IQ from the production plants and FEIQUE.<br>- 2008-2024: IQ from the production plants. |
| Carbide production (**2B5**) | - Production of silicon and calcium carbide. | - 1990–2024: IQ from the production plants for the production of silicon carbide.<br>- 1990-2002: publication “The chemical industry in Spain” for calcium carbide.<br>- 2003-2004: publication “Chemistry engineering yearbook” for calcium carbide.<br>- 2005-2024: IQ from the production plants for the production of calcium carbide. |
| Titanium dioxide production (**2B6**) | - Production of titanium dioxide. | - 1990-2002: publication “The chemical industry in Spain”.<br>- 2003-2007: MINCOTUR.<br>- 2008-2024: FEIQUE. |
| Soda ash production (**2B7**) | - Production of soda ash. | - 1990-2024: IQ from the production plant. |
| Manufacture of sulphuric acid (**2B10a**) | - Sulphuric acid production. | - 1990-2000: IQ from the production plants and Ministry of Industry.<br>- 2001-2024: IQ from the production plants and FEIQUE. |
| Ammonium sulphate (**2B10a**) | - Ammonium sulphate production | - 1990-2002: publication “The chemical industry in Spain”.<br>- 2003-2007: DG of Industry (MITYC)<br>- 2008-2024: INE’s Industrial Survey |
| Ammonium nitrate (**2B10a**) | - Ammonium nitrate production | - 1990-2000: Sub-Directorate General for Basic and Processing Industries at the Ministry of Industry and Energy.<br>- 2001-2002: publication “The chemical industry in Spain”; IQ from the production plants.<br>- 2003-2007: DG of Industry (MITYC); IQ from the production plants<br>- 2008-2024: IQ from the production plants. |
| Ammonium phosphate (**2B10a**) | - Ammonium phosphate production | - 1900: IQ from the production plants.<br>- 1991-2001: publication “The chemical industry in Spain”.<br>2001-2013: IQ from the production plants; FEIQUE. |
| NPK fertilisers (**2B10a**) | - NPK fertilisers production | - 1990-2000: publication “The chemical industry in Spain”.<br>- 2001-2002: publication “The chemical industry in Spain”; IQ from the production plants. |

| Activities included | Activity data | Source of information |
|---|---|---|
| | | - 2003-2007: DG of Industry (MITYC); IQ from the production plants.<br>- 2008-2024: INE's Industrial Survey; IQ from the production plants. |
| Urea (**2B10a**) | - Urea production | - 1990-2024: IQ from the production plants. |
| Carbon black (**2B10a**) | - Production of carbon black. | - 1990-2024: IQ from the plant. |
| Production of chlorine (**2B10a**) | - Data on production capacity with mercury cells. | - 1990–1997: Chemical Engineering Annual Report.<br>- 1998-2004: ANE.<br>- 2005–2012: IQ from the production plants.<br>- 2013-2017: MITECO (Data from the Spanish Chlor-Alkali industry reported under OSPAR Convention). |
| Phosphate fertilisers (**2B10a**) | - Phosphate fertilisers production | - 1990-2005: Chemical Engineering Annual Report; publication "The chemical industry in Spain".<br>- 2006-2024: INE's Industrial Survey. |
| Ethylene (**2B10a**) | - Ethylene production | - 1990-2002: publication "The chemical industry in Spain".<br>- 2003-2024: IQ from the production plants and FEIQUE. |
| Propylene (**2B10a**) | - Propylene production | - 1990-2002: publication "The chemical industry in Spain"; Sub-Directorate General for Basic and Processing Industries at the Ministry of Industry and Energy; FEIQUE; National Encyclopaedia of Oil, Petrochemistry and Gas, OILGAS.<br>- 2002-2024: FEIQUE; IQ from production plants. |
| Vinylchloride (**2B10a**) | - Vinyl chloride production | - 1990-2002: publication "The chemical industry in Spain".<br>- 2003-2008: FEIQUE.<br>- 2009-2024: FEIQUE; IQ from production plant. |
| Polyethylene low density (**2B10a**) | - Polyethylene low density production | - 1990-2002: publication "The chemical industry in Spain".<br>- 2003: publication "The plastics in Spain" (ANAIP)<br>- 2004-2005: ANAIP<br>- 2006-2024: FEIQUE; IQ from production plant. |
| Polyethylene high density (**2B10a**) | - Polyethylene high density production | - 1990-2002: publication "The chemical industry in Spain".<br>- 2003: publication "The plastics in Spain" (ANAIP)<br>- 2004-2005: ANAIP<br>- 2006-2024: FEIQUE; IQ from production plant. |
| Polyvinylchloride (**2B10a**) | - Polyvinylchloride production | - 1990-2024: FEIQUE; IQ from production plant. |
| Polypropylene (**2B10a**) | - Polypropylene production | - 1990-2002: publication "The chemical industry in Spain".<br>- 2003: publication "The plastics in Spain" (ANAIP)<br>- 2004-2005: ANAIP<br>- 2006-2024: FEIQUE; IQ from production plant. |

| Activities included | Activity data | Source of information |
|---|---|---|
| Styrene (**2B10a**) | - Styrene production | - 1990-2002: publication "The chemical industry in Spain".<br>- 2003-2007: National producer.<br>- 2008-2024: IQ from production plant. |
| Polystyrene (**2B10a**) | - Polystyrene production | - 1990-2002: publication "The chemical industry in Spain".<br>- 2003: publication "The plastics in Spain" (ANAIP).<br>- 2004-2005: ANAIP.<br>- 2006-2019: FEIQUE; IQ from production plant. |
| Styrene butadiene (**2B10a**) | - Styrene butadiene production | - 1990-2002: publication "The chemical industry in Spain".<br>- 2003-2006: FEIQUE.<br>- 2007-2024: IQ from production plants. |
| Styrene-butadiene latex (**2B10a**) | - Styrene-butadiene latex production | - 1990-2002: publication "The chemical industry in Spain".<br>- 2003-2005: Chemical Engineering Yearbook.<br>- 2006-2024: subrogated data (2005). |
| Styrene-butadiene rubber (SBR) (**2B10a**) | - Styrene-butadiene rubber (SBR) production | - 1990-2002: publication "The chemical industry in Spain".<br>- 2003-2024: IQ from production plant. |
| Acrylonitrile butadiene styrene (ABS) resins (**2B10a**) | - Acrylonitrile butadiene styrene (ABS) resins production | - 1990-2002: publication "The chemical industry in Spain".<br>- 2003: publication "The plastics in Spain" (ANAIP).<br>- 2004-2005: ANAIP.<br>- 2006-2024: FEIQUE. |
| Ethylene oxide (**2B10a**) | - Ethylene oxide production | - 1990-2002: publication "The chemical industry in Spain".<br>- 2003-2024: FEIQUE. |
| Formaldehyde (**2B10a**) | - Formaldehyde production | - 1990-2002: publication "The chemical industry in Spain".<br>- 2003-2024: FEIQUE. |
| Ethylbenzene (**2B10a**) | - Ethylbenzene production | - 1990-1995: Chemical Engineering Yearbook.<br>- 1996-2012: FEIQUE<br>- 2013-2024: IQ from production plant. |
| Phthalic anhydride (**2B10a**) | - Phthalic anhydride production | - 1990-1996: publication "The chemical industry in Spain".<br>- 1997-2017: FEIQUE<br>- 2018-2024: IQ from production plant. |
| Acrylonitrile (**2B10a**) | - Acrylonitrile production | - 1990-2002: publication "The chemical industry in Spain".<br>- 2003-2005: FEIQUE.<br>- 2006-2009: IQ from production plant. |

## B.2. Methodology

### Table 4.4.6 Summary of methodologies applied in category 2B

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| ***Nitric acid production (2B2)***<br><br>(Methodological factsheet: Nitric acid production) | | | |
| NOx | T3/T2 | - EMEP/EEA Guidebook (2019). Chapter 2B. | EF:<br>- For those plants that provide measured emissions, whenever the information was not available, an implicit emission factor has been applied, estimated either from 1990 data or from 2008 data, depending on the plant's activity period.<br>- Default emission factors were used when no information from plants was available. Tables 3.9 – 3.12. |
| $NH_3$ | T3/T2 | - Country specific emission factors<br>- EMEP/CORINAIR Guidebook (2007). Chapter B-442. | Emission measurements and information on abatement techniques since 2001 for certain plants. Default emission factors were used when no information from plants was available. Table 2. |
| ***Carbide production (2B5)*** | | | |
| CO<br><br>$PM_{2.5}$, $PM_{10}$, TSP, BC | T1<br><br>T2 | - Emission factor used by Norway.<br><br>- EMEP/EEA Guidebook (2019). Chapter 2B. | EF:<br>- Provided in a technical communication of the CORINAIR group.<br>EF:<br>- Table 3.18.<br>- Table 3.1. |
| ***Titanium dioxide production (2B6)*** | | | |
| NOx, $SO_2$, TSP<br><br>$PM_{2.5}$, $PM_{10}$, BC | T2 | - EMEP/EEA Guidebook (2019). Chapter 2B. | EF:<br>- Table 3.20 (sulphate process).<br>- Table 3.1. |
| ***Soda ash production (2B7)*** | | | |
| $NH_3$, TSP, CO<br><br>$PM_{2.5}$, $PM_{10}$, BC | T3 | - Country specific Emission Factors.<br>- EMEP/EEA Guidebook (2019). Chapter 2B. | EF:<br>- Information provided by plant.<br><br>- Table 3.1. |
| ***Manufacture of sulphuric acid (2B10a)*** | | | |
| $SO_2$ | T3 | - Country specific Emission Factors, for each manufacturing process. | EF:<br>- Implied emission factor for each plant based on measured emissions. It is applied whenever emissions are not available.<br>Emissions (three different methods):<br>- Measured emissions since 2001 for most of the plants.<br>- Measured emissions declared to the PRTR.<br>- Measured emissions declared on environmental statements. |
| ***Ammonium sulphate (2B10a)***<br><br>(Methodological factsheets: Production of NPK fertilisers, ammonium nitrate, ammonium sulphate, ammonium phosphate and urea) | | | |
| TSP<br><br>$PM_{10}$, $PM_{2.5}$, BC | T2 | - EMEP/EEA Guidebook (2019). Chapter 2B.<br><br>- EMEP/EEA Guidebook (2019). Chapter 2B. | EF:<br>- Table 3.26.<br>- Abatement efficiencies Table 6.62.<br>- Table 3.1. |

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| ***Ammonium nitrate (2B10a)***<br><br>(Methodological factsheets: Production of NPK fertilisers, ammonium nitrate, ammonium sulphate, ammonium phosphate and urea) | | | |
| $NH_3$, TSP, $PM_{10}$, $PM_{2.5}$, BC | T3 | - Country specific Emission Factors. | EF:<br>- 1990-2000, implied emission factors based on plant measurements.<br>Emissions measurements provided by plant from 2001 onwards. |
| ***Ammonium phosphate (2B10a)***<br><br>(Methodological factsheets: Production of NPK fertilisers, ammonium nitrate, ammonium sulphate, ammonium phosphate and urea) | | | |
| $NH_3$, TSP, $PM_{10}$, $PM_{2.5}$, BC | T3 | - Country specific Emission Factors. | EF:<br>- 1990-2001, implied emission factors based on plant measurements.<br>Emissions measurements provided by plant for the years 2002, 2004, 2007, 2009, 2011 and 2013. |
| ***NPK fertilisers (2B10a)***<br><br>(Methodological factsheets: Production of NPK fertilisers, ammonium nitrate, ammonium sulphate, ammonium phosphate and urea) | | | |
| $NH_3$, TSP, $PM_{10}$, $PM_{2.5}$, BC | T3 | - Country specific Emission Factors. | EF:<br>- 1990-2000, implied emission factors based on plant measurements over the period 2001-2010.<br>Emissions measurements provided by plant from 2001 onwards. |
| ***Urea (2B10a)***<br><br>(Methodological factsheets: Production of NPK fertilisers, ammonium nitrate, ammonium sulphate, ammonium phosphate and urea) | | | |
| $NH_3$, TSP, $PM_{10}$, $PM_{2.5}$, BC | T3 | - Country specific Emission Factors. | EF:<br>- 1990-2000, implied emission factors based on plant measurements over the period 2001-2009.<br>Emissions measurements provided by plant from 2001 onwards. |
| ***Carbon black production (2B10a)*** | | | |
| NOx, $SO_2$, $PM_{2.5}$, $PM_{10}$, TSP, BC | T3 | - Country specific Emission Factors. | EF:<br>- 1990-2006, implied emission factor based on plant measurements.<br>Emissions measurements provided by plant from 2007 onwards. |
| NMVOC, CO | T2 | - EMEP/EEA Guidebook (2019). Chapter 2B. | EF:<br>- Table 3.30. |
| ***Chlorine production (2B10a)*** | | | |
| Hg | T2 | - 1990-1997: PARCOM - ATMOS.<br>- 1998-2004: OSPAR Commission report "Mercury Losses from the Chlor-Alkali Industry 2004").<br>- 2005-2011: IQ from the 7 existent production plants framed in the Voluntary Agreement for the environmental protection and control of emissions of the Spanish Chlor-alkali industry. | EF:<br>- 1990-1997: emission factors by production capacity with mercury cells from PARCOM - ATMOS.<br>- 1998-2017: emission factors by production capacity provided by each of the production plants using mercury cells for the different sources of information described before. |

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| | | - 2012 ANE (Electrochemical National Association).<br>- 2013-2017: MITECO (Emission factors from the Spanish Chlor-Alkali industry reported under OSPAR Convention). | |
| ***Phosphate fertilisers (2B10a)*** | | | |
| TSP, $PM_{10}$, $PM_{2.5}$<br>BC | T2 | - EMEP/EEA Guidebook (2019). Chapter 2B | EF:<br>- Table 3.35<br>- Table 3.1 |
| ***Ethylene (2B10a)*** | | | |
| NMVOC | T2 | - EMEP/EEA Guidebook (2019). Chapter 2B | EF:<br>- Table 3.36 |
| ***Propylene (2B10a)*** | | | |
| NMVOC | T2 | - EMEP/EEA Guidebook (2019). Chapter 2B | EF:<br>- Table 3.36 |
| ***Vinyl chloride (2B10a)*** | | | |
| NMVOC | T2 | - EMEP/EEA Guidebook (2019). Chapter 2B | EF:<br>- Table 3.37 |
| ***Polyethylene low density (2B10a)***<br><br>(Methodological factsheets: Production of polymers) | | | |
| NMVOC, TSP<br><br>$PM_{2.5}$, $PM_{10}$, BC | T2 | - EMEP/EEA Guidebook (2019). Chapter 2B. | EF:<br>- Table 3.39<br>- Table 3.1. |
| ***Polyethylene high density (2B10a)***<br><br>(Methodological factsheets: Production of polymers) | | | |
| NMVOC, TSP<br><br>$PM_{2.5}$, $PM_{10}$, BC | T2 | - EMEP/EEA Guidebook (2019). Chapter 2B. | EF:<br>- Table 3.40<br>- Table 3.1. |
| ***Polyvinylchloride (2B10a)***<br><br>(Methodological factsheets: Production of polymers) | | | |
| NMVOC, TSP,<br>$PM_{2.5}$, $PM_{10}$<br><br>BC | T2 | - EMEP/EEA Guidebook (2019). Chapter 2B. | EF:<br>- Table 3.41<br>- Table 3.42<br>- Table 3.1. |
| ***Polypropylene (2B10a)***<br><br>(Methodological factsheets: Production of polymers) | | | |
| NMVOC, TSP<br><br>$PM_{2.5}$, $PM_{10}$, BC | T2 | - EMEP/EEA Guidebook (2019). Chapter 2B. | EF:<br>- Table 3.43.<br>- Table 3.1. |
| ***Styrene (2B10a)*** | | | |
| NMVOC | T2 | - EMEP/EEA Guidebook (2019). Chapter 2B. | EF:<br>- Table 3.44. |
| ***Polystyrene (2B10a)***<br><br>(Methodological factsheets: Production of polymers) | | | |
| NMVOC, TSP<br><br>$PM_{2.5}$, $PM_{10}$, BC | T2 | - EMEP/EEA Guidebook (2019). Chapter 2B. | EF:<br>- Table 3.45.<br>- Table 3.1 |

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| ***Styrene butadiene (2B10a)***<br><br>(Methodological factsheets: Production of polymers) | | | |
| NMVOC | T2 | EMEP/EEA Guidebook (2019). Chapter 2B. | EF:<br>- Table 3.48. |
| ***Styrene-butadiene latex (2B10a)***<br><br>(Methodological factsheets: Production of polymers) | | | |
| NMVOC | T2 | - EMEP/EEA Guidebook (2019). Chapter 2B. | EF:<br>- Table 3.49. |
| ***Styrene-butadiene rubber (SBR) (2B10a)***<br><br>(Methodological factsheets: Production of polymers) | | | |
| NMVOC | T2 | - EMEP/EEA Guidebook (2019). Chapter 2B. | EF:<br>- Table 3.50. |
| ***Acrylonitrile butadiene styrene (ABS) resins (2B10a)***<br><br>(Methodological factsheets: Production of polymers) | | | |
| NMVOC | T2 | - EMEP/EEA Guidebook (2019). Chapter 2B. | EF:<br>- Table 3.51. |
| ***Ethylene oxide (2B10a)*** | | | |
| NMVOC | T2 | - BAT Reference Document for the Production of LVOC (2017). Chapter 7. | EF:<br>- Table 7.4. |
| ***Formaldehyde (2B10a)*** | | | |
| NMVOC, CO, TSP<br><br>$PM_{2.5}$, $PM_{10}$, BC | T2 | - EMEP/EEA Guidebook (2019). Chapter 2B. | EF:<br>- Table 3.55.<br>- Table 3.1 |
| ***Ethylbencene (2B10a)*** | | | |
| NMVOC | T2 | - EMEP/EEA Guidebook (2019). Chapter 2B. | EF:<br>- Table 3.56. |
| ***Phthalic anhydride (2B10a)*** | | | |
| NMVOC | T2 | - EMEP/EEA Guidebook (2019). Chapter 2B. | EF:<br>- Table 3.57. |
| ***Acrylonitrile (2B10a)*** | | | |
| NMVOC | T2 | - EMEP/EEA Guidebook (2019). Chapter 2B. | EF:<br>- Table 3.59. |

## B.3. Assessment

This category includes processes for both organic and inorganic chemical industries, though in the light of the total share of emissions in the category, the most representative is the subcategory 2B10a, which is the one responsible for the key category status.

The following table shows in red the activities included under subcategory 2B10a (Chemical industry: other) that account for more than 15% of the emissions of each pollutant in 2024 within 2B10a. In blue are highlighted those pollutants for which the category is key.

### Table 4.4.7 Main drivers for activity and pollutant in subcategory 2B10a for 2024

| Industry | Activity | NOx | NMVOC | $SO_2$ | $NH_3$ | $PM_{2.5}$ | $PM_{10}$ | TSP | BC | CO |
|---|---|---|---|---|---|---|---|---|---|---|
| **Inorganic chemical industry** | Sulphuric acid | – | – | X | – | – | – | – | – | – |
| | Ammonium sulphate | – | – | – | – | X | X | X | X | – |
| | Ammonium nitrate | – | – | – | X | – | – | – | – | – |
| | Ammonium phosphate | – | – | – | – | – | – | – | – | – |
| | NPK fertilisers | – | – | – | X | – | – | – | – | – |
| | Urea | – | – | – | X | – | – | – | – | – |
| | Carbon black production | X | – | X | – | – | – | – | – | X |
| | Chlorine production | – | – | – | – | – | – | – | – | – |
| | Phosphate fertilizers | – | – | – | – | – | – | – | – | – |
| **Organic chemical industry** | Ethylene | – | – | – | – | – | – | – | – | – |
| | Propylene | – | – | – | – | – | – | – | – | – |
| | Vinylchloride | – | – | – | – | – | – | – | – | – |
| | Polyethylene low density | – | X | – | – | – | – | – | – | – |
| | Polyethylene high density | – | – | – | – | – | – | – | – | – |
| | Polyvinylchloride | – | – | – | – | – | – | – | – | – |
| | Polypropylene | – | X | – | – | X | X | X | X | – |
| | Styrene | – | – | – | – | – | – | – | – | – |
| | Polystyrene | – | – | – | – | – | – | – | – | – |
| | Styrene butadiene | – | – | – | – | – | – | – | – | – |
| | Styrene-butadiene latex | – | – | – | – | – | – | – | – | – |
| | Styrene-butadiene rubber (SBR) | – | – | – | – | – | – | – | – | – |
| | Acrylonitrile butadiene styrene (ABS) resins | – | – | – | – | – | – | – | – | – |
| | Ethylene oxide | – | – | – | – | – | – | – | – | – |
| | Formaldehyde | – | – | – | – | – | – | – | – | – |
| | Ethylbenzene | – | – | – | – | – | – | – | – | – |
| | Phthalic anhydride | – | – | – | – | – | – | – | – | – |
| | Acrylonitrile | – | – | – | – | – | – | – | – | – |

The following figure illustrates the evolution of the five most significant activity variables, taking the data from 1990 as base year.

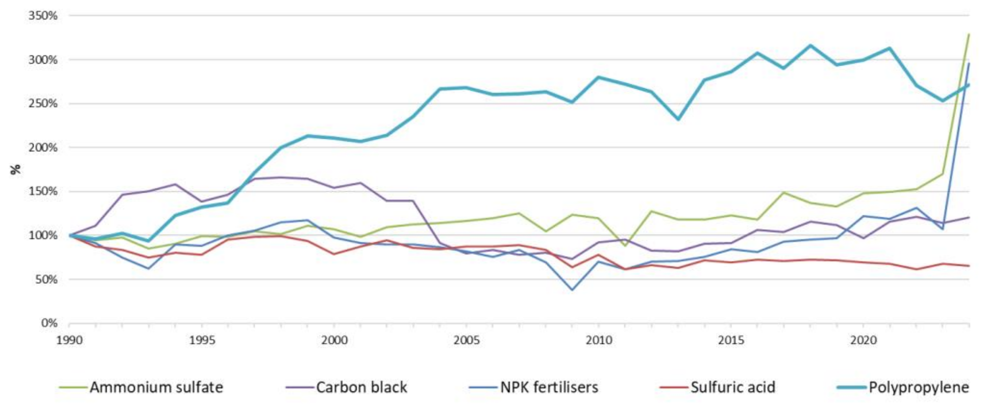



**Figure 4.4.3 Evolution index of production (base year 1990) for main activities under 2B10a (national territory)**

The chart shows an increase in 2024 production for ammonium sulphate and NPK fertilizers (data provided by INE's Industrial Survey).

It is important to note that, from 2018 onwards, within chlor-alkali industry in Spain, no mercury cell facilities operate, pursuant the Best Available Technique (BAT) conclusions applicable to chlor-alkali (Implementing Decision 2013/732/EU adopted under the Directive 2010/75/EU on industrial emissions) which states that the mercury-cell process is not BAT, so that mercury-cell technique cannot be used after 11 December 2017. Therefore, no Hg emissions are reported since.

In 2020, the production of polystyrene in Spain was suspended.

# C. Metal Production (2C)

The Metal Production industry is a key category for its contribution to the level and the trend of the emissions of PAHs and PCDD/PCDF. It is also a key category for its contribution to the level of the emissions of $SO_2$, CO, Pb, Cd, Hg, PCBs and HCB.

In the following pages further details are given regarding activities which are main drivers within this sector:

- The sinter production
- The pig iron production (blast furnace charging and pig iron tapping)
- The steel production (both basic oxygen and electric furnaces)
- The steel rolling (both hot and cold processes)
- The manufacturing of ferroalloys
- The aluminium production (both primary and secondary)
- The lead production (both primary and secondary)
- The zinc production (both primary and secondary)
- The copper production (both primary and secondary)
- The silicon production

## C.1. Activity variables

### Table 4.4.8 Summary of activity variables, data and information sources for category 2C

| Activities included | Activity data | Source of information |
|---|---|---|
| Sinter production (**2C1**) | - Sinter production from integrated iron and steel plants (information individually treated as large point sources). | - 1990-2024: IQ. |
| Pig iron production (**2C1**) | - Pig iron production by plant. | - 1990-2024: IQ. |
| Steel production-Basic oxygen furnaces (**2C1**) | - Steel production from integrated iron and steel plants (information individually treated as large point sources). | - 1990-2024: IQ from the two existent integrated iron and steel plants. |
| Steel production-Electric furnaces (**2C1**) | - Steel production from non-integrated iron and steel sector (information individually treated as large point sources). | - 1990-1993: Data from MINETAD.<br>- 1994-2024: Data from UNESID. |
| Steel rolling (**2C1**) | - Amounts of steel submitted to the processes of hot and cold lamination. Information from integrated and non-integrated iron and steel plants, individually treated as large point sources. | - 1990-2024: IQ from the two existent integrated iron and steel plants.<br>- For non-integrated iron and steel sector, the Inventory uses data from:<br>• MINETAD for 1990-1993.<br>• UNESID for 1994-2024. |
| Ferroalloys production (**2C2**) | - Production by type of ferroalloy.<br>- Carbon content of the inputs and outputs of the process. | - 1990-2024: IQ from the five existing production plants. |

| Activities included | Activity data | Source of information |
|---|---|---|
| Aluminium production (**2C3**) | - Primary production by type of process (prebaked anodes: side worked, central worked or Söderberg anodes). | Primary aluminium:<br>1990–2019: IQ from three existing production plants of electrolytic aluminium.<br>2020-2024: IQ from the only remaining production plant of electrolytic aluminium. |
| | - Secondary production. | Secondary aluminium:<br>- 1990: Employer´s association.<br>- 1991-1994: SGIBP-MINER.<br>- 1995-2009: ASERAL.<br>- 2010-2024: National institute of Statistics industry product survey. |
| Lead production (**2C5**) | - Primary production. | Primary lead:<br>- 1990-1991: "Spanish Industry Report 1992". |
| | - Secondary production. | - 1990-2014: Data from UNIPLOM, MITYC and "World Mineral Production" publication.<br>2015-2024: IQ from five existing production plants of secondary lead. |
| Zinc production (**2C6**) | - Primary production. | - 1990-2008: IQ from the existing plants and data from SGIBP.<br>- 2009-2024: IQ from the only existing plant. |
| | - Secondary production. | - 1990-2024: IQ from one of the plants and data from U.S. Geological Survey Mineral Yearbook (2014). |
| Copper production (**2C7a**) | - Primary production. | - 1990-2024: IQ from the only existing plant. |
| | - Secondary production. | - 1990-2024: Data from SGIBP, UNICOBRE and U.S. Geological Survey Mineral Yearbook (2014). |
| Silicon production (**2C7c**) | - Silicon production | - 1990–2024: IQ from the only existing plant. |

## C.2. Methodology

### Table 4.4.9 Summary of methodologies applied in category 2C

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| ***Steel production-Sinter production (2C1)***<br><br>(Methodology factsheet: Sinter production) | | | |
| NMVOC | T2 | - 1990–2002: EMEP/EEA Guidebook (2019) Chapter 2C1.<br>- 2003: Measurements of emissions from the only existing plant.<br>- 2004–2024: Derived from the measurements of 2003. | EF:<br>- EMEP/EEA Guidebook (2019) Chapter 2C1. Table 3.2.<br>- National derived emission factors using 2003 data. |
| HM (Heavy Metals) | T2/ T3 | - 1990–2002: Derived from the measurements of 2003 in one of the plants/ EMEP/EEA Guidebook (2019) Chapter 2C1 for the other two plants.<br>- 2003: Measurements of emissions from the only existing plant.<br>- 2004–2024: Derived from the measurements of 2003. | EF:<br>- EMEP/EEA Guidebook (2019) Chapter 2C1. Table 3.2.<br>- National derived emission factors using 2003 data. |
| TSP/$PM_{10}$ | T2/ T3 | - 1990–1997: EMEP/EEA Guidebook (2019) Chapter 2C1 for two plants.<br>- 2000-2002: Derived from the measurements of 2003 in the only existing plant.<br>- 2003: Measurements of emissions from the only production plant. | EF:<br>- EMEP/EEA Guidebook (2019) Chapter 2C1. Table 3.2.<br>- National derived emission factors using 2003 data. |

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| | | - 2004-2024: Derived from the measurements of 2003. | |
| $PM_{2.5}$ | T2 | - 1990-1997: EMEP/EEA Guidebook (2019) Chapter 2C1 for two plants.<br>- 2000-2024: CEPMEIP database for particles. | EF:<br>- EMEP/EEA Guidebook (2019) Chapter 2C1. Table 3.2.<br>- CEPMEIP data has been used to calculate the ratio between $PM_{2.5}$ and $PM_{10}$ emissions |
| BC | T2 | - EMEP/EEA Guidebook (2019) Chapter 2C1. | EF:<br>- Table 3.2. |
| PCBs | T2 | - EMEP/EEA Guidebook (2019) Chapter 2C1. | EF:<br>- Table 3.2. |
| PCDD/PCDF | T2/ T3 | - 1990-2002: Derived from the measurements of 2003 in one of the plants/ EMEP/EEA Guidebook (2019) Chapter 2C1. Table 3.2 for two plants.<br>- 2003: Measurements of emissions from the only existing plant.<br>- 2004-2024: Derived from the measurements of 2003. | - National derived emission factors using 2003 data.<br>- EMEP/EEA Guidebook (2019) Chapter 2C1. Table 3.2 |
| PAHs | T3 | - 1990-2002: Derived from the measurements of 2003 in one of the plants.<br>- 2003: Measurements of emissions from the only existing plant.<br>- 2004-2024: Derived from the measurements of 2003. | - National derived emission factors using 2003 data. |
| ***Steel production-Pig iron production (2C1)***<br><br>(Methodology factsheet: Pig iron production) | | | |
| $SO_2$ | T3 | - 1990-2002: Derived from the measurements of 2003.<br>- 2003: Measurements of emissions from the only existing plant.<br>- 2004-2024: Derived from the measurements of 2003. | EF:<br>- National derived emission factors using 2003 data. |
| TSP, $PM_{10}$, $PM_{2.5}$, BC | T3 | - 2000-2002: Derived from the measurements of 2003.<br>- 2003: Measurements of emissions of $PM_{10}$ and TSP from the only existing plant.<br>- 2004-2024: Derived from the measurements of 2003. | EF:<br>- National derived emission factors for $PM_{10}$ and TSP using 2003 data. |
| HM | T3 | - 1990-2002: Derived from the measurements of 2003.<br>- 2003: Measurements of emissions from the only existing plant.<br>- 2004-2024: Derived from the measurements of 2003. | EF:<br>- National derived emission factors using 2003 data. |
| PAHs | T2 | - EMEP/EEA Guidebook (2019) Chapter 2C1. | EF:<br>- Table 3.11. |
| ***Steel production-Basic oxygen furnaces (2C1)***<br><br>(Methodology factsheet: Basic oxygen furnaces in steel plants) | | | |
| NOx, NMVOC | T2/ T3 | - 1990-2002: Derived from the measurements of 2003 of one of the production plants.<br>- 2003: Measurements of emissions from one of the existing plants.<br>- 2004-2024: Derived from the measurements of 2003 of one of the existing plants. | EF:<br>- National derived emission factors using 2003 data from one of the existing plants. |

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| $SO_2$ | T2/ T3 | - 1990-2002: Derived from the measurements of 2003 of one of the existing plants.<br>- 2003-2024: Measurements of emissions of $SO_2$ from one of the existing plants/ Derived from the measurements of 2003 for the other plants. | EF:<br>- National derived emission factors using 2003 data from one of the existing plants. |
| TSP, $PM_{10}$ | T2/ T3 | - 1990-2002: Derived from the measurements of 2003.<br>- 2003: Measurements of emissions from both existing plants.<br>- 2004-2024: Derived from the measurements of 2003. | EF:<br>- National derived emission factors using data from 2003. |
| $PM_{2.5}$, BC | T2 | - CEPMEIP database for particles. | EF:<br>CEPMEIP data has been used to calculate the ratio between:<br>- $PM_{2.5}$ and $PM_{10}$ emissions.<br>- BC and $PM_{2.5}$ emissions. |
| CO | T3 | - 1990-2002: Derived from the measurements of 2003.<br>- 2003: Measurements of emissions from one of the existing plants.<br>- 2004-2024: Derived from the measurements of 2003. | EF:<br>- National derived emission factors using data from 2003. |
| HM | T2 | - 1990-2002: Derived from the measurements of 2003.<br>- 2003: Measurements of emissions from both existing plants.<br>- 2004-2024: Derived from the measurements of 2003. | EF:<br>- National derived emission factors using data from 2003. |
| PAHs | T3 | - 1990-2002: Derived from the measurements of 2003.<br>- 2003: Measurements of emissions from one of the existing plants.<br>- 2004-2024: Derived from the measurements of 2003. | EF:<br>- National derived emission factors using data from 2003. |
| ***Steel production-Electric furnaces (2C1)***<br><br>(Methodology factsheet: Electric arc furnaces) | | | |
| MP, PM, BC, CO, HM, PCDD/PCDF, PAHs, PCBs | T2 | - EMEP/EEA Guidebook (2019) Chapter 2C1. | EF:<br>- Table 3.19. |
| ***Steel production-Steel rolling (2C1)***<br><br>(Methodology factsheet: Rolling mills) | | | |
| ***Hot rolling mills*** | | | |
| NMVOC | T2 | - EMEP/EEA Guidebook (2019) Chapter 2C1. | EF:<br>- Tables 3.22. |
| TSP | T2 | Integrated iron and steel plants:<br>- 1990-2002: Derived from the measurements of 2003.<br>- 2003: Measurements of emissions.<br>- 2004-2024: Derived from the measurements of 2003.<br>Non-integrated iron and steel plants:<br>- EMEP/EEA Guidebook (2019) Chapter 2C1. | EF:<br>- National derived emission factors using data from 2003.<br><br><br><br><br>- Table 3.22. |

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| $PM_{10}$, $PM_{2.5}$ | T2 | Integrated iron and steel plants:<br>- 1990-2002: Derived from the measurements of 2003.<br>- 2003: Measurements of emissions.<br>- 2004-2024: Derived from the measurements of 2003.<br>Non-integrated iron and steel plants:<br>- EMEP/EEA Guidebook (2019) Chapter 2C1. | EF:<br>- National derived emission factors using data from 2003.<br>Table 3.1 has been used to calculate the ratio between:<br>- $PM_{10}$ and TSP emissions.<br>- $PM_{2.5}$ and $PM_{10}$ emissions. |
| HM | T3 | - 1990-2002: Derived from the measurements of 2003.<br>- 2003: Measurements of emissions from one of the existing plants.<br>- 2004-2024: Derived from the measurements of 2003. | EF:<br>- National derived emission factors using data from 2003. |
| ***Cold rolling mills*** | | | |
| TSP | T2 | - EMEP/EEA Guidebook (2019) Chapter 2C1. | EF:<br>- Table 3.21. |
| $PM_{10}$, $PM_{2.5}$ | T2 | - EMEP/EEA Guidebook (2019) Chapter 2C1. | Table 3.1 has been used to calculate the ratio between:<br>- $PM_{10}$ and TSP emissions.<br>- $PM_{2.5}$ and $PM_{10}$ emissions. |
| ***Ferroalloys production (2C2)***<br><br>(Methodology factsheet: Ferroalloys production) | | | |
| PM, BC | T1 | - EMEP/EEA Guidebook (2019) Chapter 2C2. | EF:<br>Table 3.1. |
| HM | T1 | - "Experiences with the Heavy Metals Inventory in Slovakia". | - Best available default emission factors. |
| ***Aluminium production (2C3)***<br><br>(Methodology factsheet: Aluminium production) | | | |
| ***Primary production*** | | | |
| NOx, $SO_2$, PM, BC, CO, PAHs | T2/ T3 | - Measurements provided by each production plant.<br><br>- EMEP/EEA Guidebook (2019) Chapter 2C3. | EF:<br>- For $SO_2$ and PM: national emission factors derived from the data provided by the production plants. When no information was available, the implicit emission factor of the closest year for which information was available was applied.<br>- The remaining pollutants have been estimated by default emission factors: Tables 3.2, 3.3. |
| ***Secondary production*** | | | |
| PM, BC, PCDD/PCDF | T2/ T3 | - EMEP/EEA Guidebook (2019) Chapter 2C3. | EF:<br>- Table 3.4. |
| ***Lead production (2C5)***<br><br>(Methodology factsheet: Lead production) | | | |
| ***Primary production*** | | | |
| PM, As, Cd, Hg, Pb, Zn, PCDD/PCDF, PCBs | T2 | - EMEP/EEA Guidebook (2019) Chapter 2C5. | EF:<br>- Tables 3.2. |

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| ***Secondary production*** | | | |
| $SO_2$, PM, As, Cd, Pb, Zn, PCDD/PCDF, PCBs | T2 | - EMEP/EEA Guidebook (2019) Chapter 2C5. | EF:<br>- Tables 3.5. |
| ***Zinc production (2C6)***<br><br>(Methodology factsheet: Zinc production) | | | |
| ***Primary production*** | | | |
| $SO_2$, PM, Cd, Hg, Pb, Zn, PCDD/PCDF, PCBs | T2 | - EMEP/EEA Guidebook (2019) Chapter 2C6. | EF:<br>- Tables 3.3. |
| ***Secondary production*** | | | |
| $SO_2$, PM, As, Cd, Hg, Pb, Zn, PCDD/PCDF, PCBs | T2 | - EMEP/EEA Guidebook (2019) Chapter 2C6. | EF:<br>- Tables 3.5. |
| ***Copper production (2C7a)***<br><br>(Methodology factsheet: Copper production) | | | |
| ***Primary production*** | | | |
| $SO_2$, PM, As, Cd, Cu, Hg, Ni, Pb, Zn | T2/ T3 | - 1990-2008: Derived from measurements in the period 2009-2011<br><br>- 2009-2024: Measurements provided by the plant. | EF:<br>- National derived emission factors using data from 2009-2011. |
| BC, Cr, PCDD/PCDF | T2 | - EMEP/EEA Guidebook (2019) Chapter 2C7a. | EF:<br>Tables 3.2. |
| ***Secondary production*** | | | |
| $SO_2$, PM, BC, As, Cd, Cu, Ni, Pb, PCDD/PCDF, PCBs | T2 | - EMEP/EEA Guidebook (2019) Chapter 2C7a. | EF:<br>- Tables 3.3. |
| ***Silicon production (2C7c)*** | | | |
| $SO_2$, TSP | T1 | - EMEP/EEA Guidebook (2019) Chapter 2C7c. | EF:<br>Tables 3.1. |

## C.3. Assessment

The following figure illustrates the evolution of the most important activity variables (production) included within NFR category 2C1.


**Figure 4.4.4 Evolution index of activity variables of subcategory 2C1 (1990=100) (national territory)**

Both pig iron casting and sinter process, while suffering important variations over the time series, show a close relationship, with the only exception in 1997 when the closure of the sinter production line in one of the two existing integrated iron and steel plants led to a rough decrease of sinter production. In 2020, a sharp drop in production caused by the COVID-19 pandemic is noticeable: pig iron production fell by 26.5% and sinter production by 39.4%. In 2021, production shows a recovery back to pre-pandemic levels but, from 2022 onwards, there is a further decline in pig iron and sinter production, both falling by 25%, as a result of the decrease in steel production. In 2024, a slight increase is observed.

Steel production, that includes both basic oxygen and electric arc furnaces, has also undergone important variations throughout the time series, where it is worth highlighting a significant decrease since 2008, corresponding to the economic and industrial slowdowns in Spain. In 2020, because of COVID-19, there is a significant further drop by 18.8%, which reverses in 2021 when production returns to pre-pandemic values. Since 2022, a new decrease in production can be observed as a consequence of the energy crisis in Europe. However, in 2024, the trend begins to show a slight increase.

Regarding the non-ferrous metallurgical industry (2C3, 2C5, 2C6 and 2C7a), the next figure shows the trend of its production.

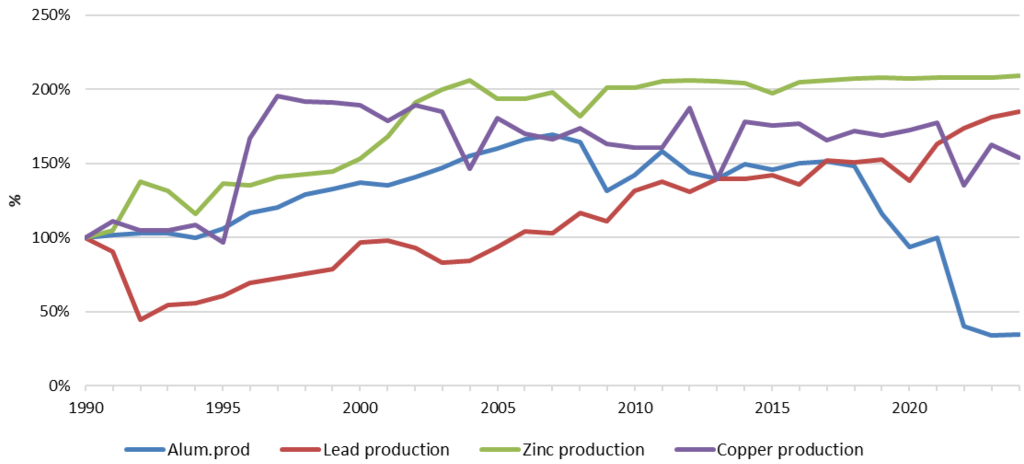



**Figure 4.4.5 Evolution index of activity variables of subcategory 2C3, 2C5, 2C6 and 2C7a (1990=100) (national territory)**

It can be seen that aluminium production shows a progressive increase until 2007, when the trend is reversed due to the economic and industrial slowdowns in Spain, that becomes drastic from 2019 onwards (- 22%), when the closure of two of the primary aluminium production plants takes place. In 2022, there is again a sharp drop in production (-60%) due to a temporary suspension of the only remaining primary aluminium plant in operation, which ceases production in 2023. In 2024, however, it returns to small-scale production.

As for zinc and lead production, both present a similar trend, showing a gradual growth over time, with the exception that lead drastically decreased its production in 1992, when primary production was completely abandoned. It is also noticeable the upturn in lead production since 2021, after suffering a decrease in 2020 caused by the COVID-19 pandemic.

Finally, in terms of the evolution of copper, a strong increase has been observed since 1995, for which primary production is responsible. Since then, great variations have been observed throughout the Inventory period.

## D. Solvent use (2D)

Solvent use sector is a key category for its contribution to the level and the trend of the emissions of NMVOC and for its contribution to the level of Hg. It represents 39.4% of the total of Non-Methane Volatile Organic Compounds Inventory emissions in 2024 (39.3% without Canary Islands).

There have been no methodological changes in this section in this edition.

As recommended by the TERT in the 2025 NECD review[4], Spanish Inventory includes further information on Hg estimates methodology into 2D3a category.

### D.1. Activity variables

**Table 4.4.10 Summary of activity variables, data and information sources for category 2D**

| Activities included | Activity data | Source of information |
|---|---|---|
| Domestic solvents use including fungicides (**2D3a**) | - Spanish population | - 1990-2024: INE.<br>- 2015-2024: ESIG. |
| Road paving with asphalt (**2D3b**) | - Consumption of hot bituminous mixtures and cutback asphalt. | - 2001, 2006-2024: "Asphalt in figures". EAPA.<br>- 1990-2005: estimation by interpolation based on information from ASEFMA.<br>- 1990-2024: ratio cutback asphalt/ Cold Bituminous mixtures estimated based on ASEFMA information. |
| Asphalt roofing (**2D3c**) | - Bitumen products in roll. | - 1990-2024: INE. |
| Paint application in construction and buildings (deco-paint)<br>Other industrial paint application (**2D3d**) | - Annual paint consumption disaggregated by sector of consumption, VOC content, density, water quantity and evolution of these characteristics by type of paint and share between water-based vs. solvent-based paint. | - 1990-2024: ASEFAPI.<br>- 1990, 2000 and 2010: European Council of the Paint, Printing Ink and Artists Colours Industry (CEPE).<br>- 2005, 2009: % VOC from a Spanish producer of industrial and anticorrosive coatings. |
| Paint application in automobiles (**2D3d**) | - Annual paint consumption for the whole sector disaggregated by subsector of consumption. | - 1990-1996: ASEFAPI.<br>- From 1997 this information is complemented by ten IQ provided by automobile manufacturers. |
| Metal degreasing (**2D3e**) | - Consumption of washing and cleaning preparations, excluding those for use as soap, surface-active preparations<br>- Solvents consumed for metal degreasing in the production processes of automobiles. | - 1990-1995: "Gross Domestic Product". INE<br>- 1995-2024: PRODCOM Statistics and Industrial Product Survey. Eurostat and INE<br>- From 1997 this information is complemented by ten IQ provided by automobile manufacturers. |
| Dry cleaning (**2D3f**) | - Solvents consumed in the installations. | - Official data in compliance with Royal Decree 117/2003-transposition of the VOC solvents emissions directive. |
| Chemical products (**2D3g**) | - Polyester processed in Spain. | - 1990-2008: "Gross Domestic Product". INE<br>- 2008-2024: INE (Industrial Product Survey). |
| | - Polyvinylchloride processed. | - 1990-2002: INE (Industrial Product Survey).<br>- 2002-2005: ANAIP.<br>- 2006-2011: National Encyclopaedia of Oil, Petrochemistry and Gas, OILGAS. |

[4] Final Review Report available in: https://www.ceip.at/status-of-reporting-and-review-results

| Activities included | Activity data | Source of information |
|---|---|---|
| | | - 2003-2024: FEIQUE.<br>- 2012-2024: Catalan Statistical Institute. |
| | - Polyurethane foam processed. | - 1990-2005: ANAIP.<br>- 2005-2024: PRODCOM Statistics. |
| | - Polystyrene foams. | - 1990-2024: ANAPE. |
| | - Rubber manufactured. | - 1990-2024: COFACO. |
| | - Solvents used in the pharmaceutical sector. | - 1990-2006: Extrapolation based on annual variation of number of pharmaceutical sector employees.<br>- 2007-2024: Official data in compliance with Royal Decree 117/2003 transposition of the VOC solvents emissions directive. |
| | - Paints, inks and glues manufactured. | - 1990-2024: INE (Industrial survey of companies).<br>- 2007-2023: Official data in compliance with Royal Decree 117/2003 transposition of the VOC solvents emissions directive. |
| | - Leather tanning. | - 1990-2006: Extrapolation based on previous data of tanned leather ($m^2$) from the Spanish tanner council and other publications.<br>- 2007-2024: Official data in compliance with Royal Decree 117/2003- transposition of the VOC solvents emissions directive. |
| Printing industry (**2D3h**) | - Sales of the different types of inks (paste inks, black new inks, gravure publication inks, other liquid inks, other printing inks and varnishes and sundries). | - 1990-2024: ASEFAPI<br>- 1990, 2000, 2010, 2019 percentage of distribution of ink uses between the different printing techniques. CITEPA (France). |
| Other solvent use (**2D3i**) | - Glass wool and mineral wool enduction. | - 1990-1996: MINETAD statistics.<br>- 1997-2024: IQs from manufacturing plants. |
| | - Solvents consumed in sunflower, rapeseed, soy and olive-pomace oil production.<br>- Amount of oil produced. | - 1990-2024: AFOEX.<br>- 1990-2024: ANEO and AICA. |
| | - Creosote and organic solvents used in the treatment of wood. | - 1990-1998: AITIM.<br>- 1999-2024: ANEPROMA. |
| | - Number of vehicles manufactured. | - IQ from vehicles manufacturing plants. |
| | - Glues application | - 1990-2024: INE (Industrial survey of companies). |

## D.2. Methodology

### Table 4.4.11 Summary of methodologies applied in category 2D

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| ***Domestic solvent use including fungicides (2D3a)***<br><br>(Methodological factsheets of a part of the category: Domestic solvent use; Mercury emission from lamps) | | | |
| NMVOC, Hg | T2a | Inventory Team expert judgment and EMEP/EEA Guidebook. Chapter 2D3a. | EF (expressed by habitant):<br>NMVOC<br>- 2013 and 2015-2022: Country-specific emission factor based on data provided by ESIG. Ethanol is included and 30% of data corresponding to the coating applications have been included, following, Section 3.2.3 and Annex I of EMEP/EEA 2023.<br>- 2006-2012 and 2014: Weighting between years with data estimated by ESIG. |

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| | | | - 1990-2005: Average of EFs from years 2013 and 2015-2019<br>- AD used is the population from Spain (excluding Canary Islands). This is the reason why It is represented as NA in NECD Annex I tables. It is not possible to relate it with activity units in the NFR tables (kt of solvents used).<br>Hg<br>- 1990-2004: EMEP/EEA 2016, Table 3.6<br>- 2005-2024: Country specific factor from AMBILAMP, assuming that 35-44% of lamp waste is collected and treated with the most stringent conditions. The Hg contained in non-collected lamps is assumed to be emitted to the atmosphere and is reported in 2D3a. |
| ***Road paving with asphalt (2D3b)***<br><br>(Methodological factsheets of a part of the category: Road paving with asphalt) | | | |
| $PM_{2.5}$, $PM_{10}$, TSP, BC, NMVOC | T2 | EMEP/EEA Guidebook (2019). Chapter 2D3b. | EF:<br>- Tables 3.2, 3.3 and 3.4.<br>Abatement:<br>- Tables 3.5, 3.6. |
| ***Asphalt roofing (2D3c)***<br><br>(Methodological factsheets of a part of the category: Manufacture of asphalt roofing for waterproofing) | | | |
| $PM_{2.5}$, $PM_{10}$, TSP, BC, NMVOC | T1 | EMEP/EEA Guidebook (2019). Chapter 2D3c. | EF:<br>- Table 3.1. |
| ***Paint application in construction and buildings (deco-paint). Other industrial paint application (2D3d)***<br><br>(Methodological factsheets of a part of the category: Paint application in car manufacturing; Paint application in construction and buildings (deco-paint), Paint application in coil coating; Paint application in shipbuilding; Paint application in car repairing; and Paint application in wood) | | | |
| NMVOC | T2 | Inventory Team expert judgment and EMEP/EEA Guidebook (2019). Chapter 2D3d. | EF:<br>- Estimation made by the Inventory team based on default values progressively reduced along the time series according to threshold VOC concentrations established by the Royal Decree 227/2006, information from CEPE on distribution of the consumption by type of paint and VOC contents for each type, share between water-based vs. solvent-based paint and degree of penetration of abatement techniques assumed for every year. The percentage of ecolabel volatile content between 2010 and 2020 has been incorporated to the EF.<br>- Tables 3.8, 3.9 and 3.15.<br>Abatement:<br>- Tables 3.20. |
| ***Paint application in the manufacture of automobiles (2D3d)*** | | | |
| NMVOC | T2 | Solvent balance from 12 IQ. | Emissions:<br>- Emission calculated by a solvent balance (solvent consumed – solvent recovery). |
| ***Metal degreasing (2D3e)***<br><br>(Methodological factsheets of a part of the category: Solvent use in metal degreasing) | | | |
| NMVOC | T2 | - Inventory Team expert judgment.<br>- From 1997 IQ to automobiles manufacturers. | EF:<br>Threshold VOC concentrations established by the Royal Decree 227/2006.<br>AD:<br>- PRODCOM data. |

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| ***Dry cleaning (2D3f)***<br><br>(Methodological factsheets of a part of the category: Dry cleaning) | | | |
| NMVOC | T2 | Inventory Team expert judgment. | Official data in compliance with Royal Decree 117/2003-transposition of the VOC solvents emissions directive. |
| ***Chemical products (2D3g)***<br><br>(Methodological factsheets of a part of the category: Use of solvents in the manufacture or treatment of chemical products; Solvents use in pharmaceutical products manufacturing; and Solvents use in leather tanning) | | | |
| ***Chemical products (2D3g) Polyester processing*** | | | |
| NMVOC | T1 | EMEP/EEA Guidebook (2019). Chapter 2D3g. | EF:<br>- Table 3-1. |
| ***Chemical products (2D3g) Polyvinylchloride processing*** | | | |
| NMVOC | T1 | EMEP/EEA Guidebook (2019). Chapter 2D3g. | EF:<br>- Table 3-1. |
| ***Chemical products (2D3g) Polyurethane foam processing*** | | | |
| NMVOC | T2 | EMEP/EEA Guidebook (2019). Chapter 2D3g. | EF:<br>- Table 3-3. |
| ***Chemical products (2D3g) Rubber processing*** | | | |
| NMVOC | T2 | EMEP/EEA Guidebook (2019). Chapter 2D3g. | EF:<br>- Tables 3-5 and 3-6.<br>Abatement:<br>- Table 3-21 from 1999 and 2003 onwards, VOC solvents Directive and Royal Decree 117/2003 dates of entry into force (Process optimization and new processes). |
| ***Chemical products (2D3g) Pharmaceutical products manufacturing*** | | | |
| NMVOC | T2 | Inventory Team expert judgment. | Official data in compliance with Royal Decree 117/2003-transposition of the VOC solvents emissions directive. |
| ***Chemical products (2D3g) Paints, inks and glues manufacturing*** | | | |
| NMVOC | T2 | EMEP/EEA Guidebook (2019). Chapter 2D3g. | EF:<br>- Table 3-11.<br>Abatement:<br>- Table 3-20 from 2003 onwards, Royal Decree 117/2003 dates of entry into force (Use of good practices).<br>- Abatement techniques applied to paint manufactures (Table 3-20) from 2007 onwards, Royal Decree 227/2006 dates of entry into force and reduction evidence based on Royal Decree 117/2003-transposition of the VOC solvents emissions directive data collection (Improved production mix). |
| ***Chemical products (2D3g) Leather tanning*** | | | |
| NMVOC | T2 | Inventory Team expert judgment. | Official data in compliance with Royal Decree 117/2003-transposition of the VOC solvents emissions directive. |
| ***Chemical products (2D3h) Printing industry***<br><br>(Methodological factsheets of a part of the category: Solvent use in printing industry) | | | |
| NMVOC | T2 | - ASEFAPI.<br>- EMEP/EEA Guidebook (2019). Chapter 2D3g. | EF:<br>- EMEP/EEA Guidebook (2019) Tables 3-2, to 3-6 from 1990 to 2002. Onwards, EF based on threshold VOC concentrations established by the Royal Decree 117/2003-transposition of the VOC solvents emissions directive. |

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| ***Other solvents use (2D3i) Glass wool and mineral wool enduction***<br><br>(Methodological factsheets of a part of the category: Solvents use in glass and mineral wool enduction) | | | |
| NMVOC | T2 | EMEP/EEA Guidebook (2019). Chapter 2D3i, 2G. | EF:<br>- Tables 3-2 and Table 3-3. |
| ***Other solvents use (2D3i) Fat, edible and non-edible oil extraction***<br><br>(Methodological factsheets of a part of the category: Extraction of fats and oils) | | | |
| NMVOC | T2 | Country specific emission factors based on solvents consumed and tonnes of seeds treated. | EF expressed in kg NMVOC/tonnes of seeds. For chemical extraction of olive-pomace oil, EF 2003 onwards based on threshold VOC concentrations established by the Royal Decree 117/2003-transposition of the VOC solvents emissions directive and its data collection. |
| ***Other solvents use (2D3i) Preservation of wood*** | | | |
| NMVOC, BaP, BbF, BkF, IcP, PAH | T2 | Inventory Team expert judgment and EMEP/EEA Guidebook (2019). Chapter 2D3i, 2G. | EF:<br>- Estimation made by the Inventory team using data from ANEPROMA. |
| ***Other solvents use (2D3i) Underseal treatment and conservation of vehicles*** | | | |
| NMVOC | T2 | Mass balance. | - Mass balance based on solvents consumed in IQs from vehicles manufacturing plants. |
| ***Application of glues and adhesives (2D3i)*** | | | |
| NMVOC | T2 | EMEP/EEA Guidebook (2019). Chapter 2D3i. | EF:<br>- Estimation made by the Inventory team based on default values (Table 3-11) which are progressively reduced along the time series according to threshold VOC concentrations established by the Royal Decree 227/2006 and the degree of penetration of abatement techniques assumed for every year. |

### D.3. Assessment

As can be seen in the following graph and in the emissions data, a significant decrease in NMVOC emissions can be seen since 2003. This decrease is due to the application of Royal Decree 117/2003, which is a transposition of Council Directive 1999/13/EC of 11 March 1999 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations. The reduction in emissions has been gradual because the law applied a transitional period of application of this regulation. The peak in emissions in 2020 within subcategory 2D3a corresponds to an unusual surge in the use of hydroalcoholic gel due to the COVID-19 pandemic.

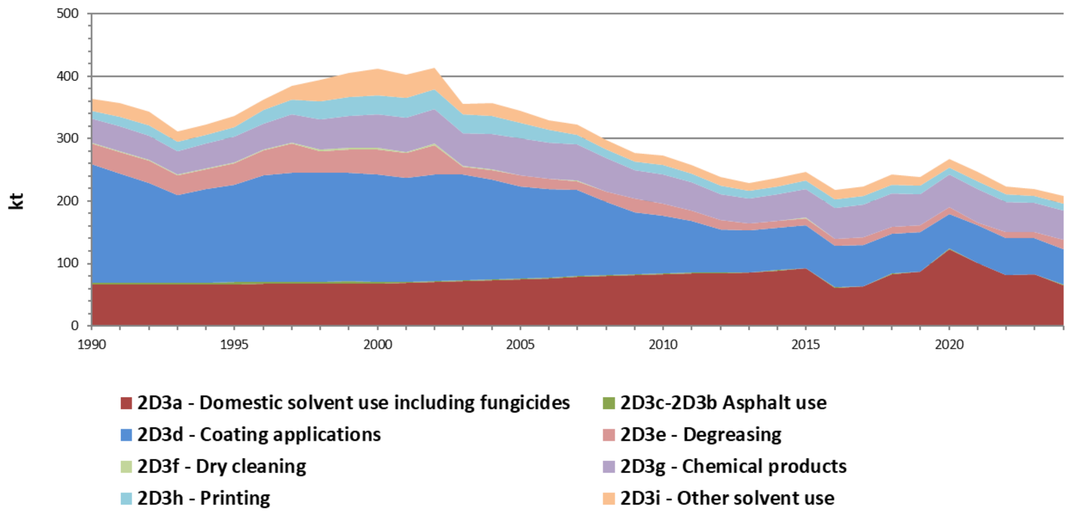



**Figure 4.4.6 Distribution of NMVOC emissions in subcategories 2D (national territory)**

In the last years, the 2D3a subcategory continues to be the main contributor to NMVOC emissions estimates.

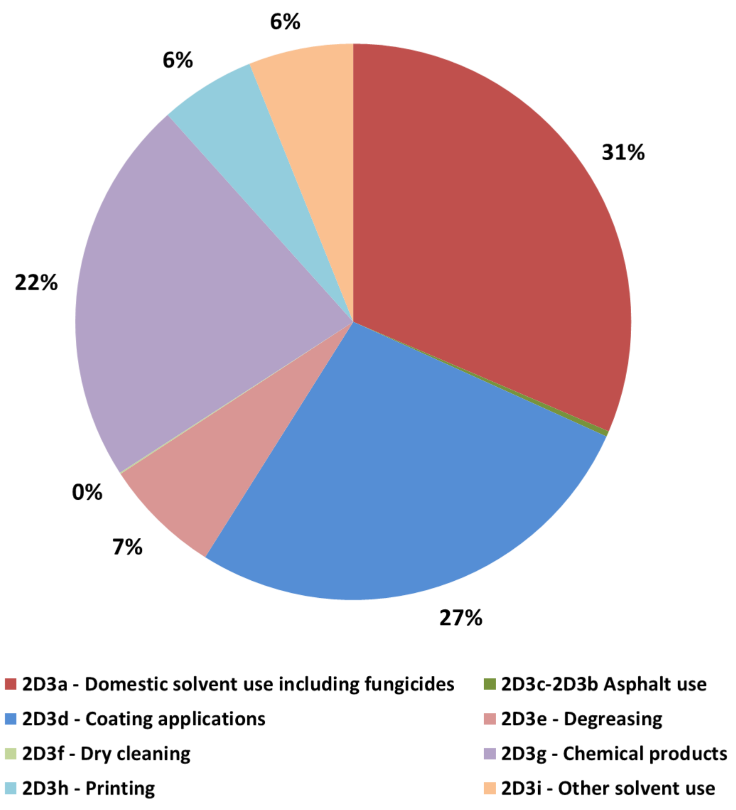



**Figure 4.4.7 Distribution of NMVOC emissions in 2D for the year 2024 (national territory)**

Regarding the estimated Hg emissions within subcategory 2D3a and following NECD guidelines, it should be noted that the 2016 EMEP/EEA Guidebook, in its corresponding chapter, provided a Tier 2 Hg emission factor of 5.6 mg/person coming from fluorescent tubes. The Spanish Inventory commissioned a study by AMBILAMP (the main Collective System of Extended Producer Responsibility for lighting equipment in Spain) to reflect the effect into the mercury emissions. The results of the study showed that the mercury emissions to the atmosphere coming from lighting equipment in Spain had a downward trend, being 3.24 mg/person in 2016 and 2.32 mg/person in 2017. Since AMBILAMP's activity began in 2005, the EF from the 2016 EMEP/EEA Guidebook was used for years 1990-2004, in 2005-2016 a linear interpolation between that EF and the AMBILAMP calculated EF for 2016 (3.24 mg/person), and from 2017 onwards the EF of 2.32 mg/person is used. Below is a graph showing the evolution of Hg emissions throughout the series.

## E. Other industrial processes and product use (2G+2H+2I+2J+2K+2L)

This group of NFR categories is significant for its emissions of $PM_{2.5}$, $PM_{10}$ and PCB, being key category for its contribution to the level and the trend of these pollutants. It is as well key category for its contribution to the level of NMVOC, $SO_2$, TSP and Cd emissions. The main activities encompassed within this category are:

- Tobacco consumption
- Fireworks
- Manufacturing of paper pulp and paperboard.
- Processes in the food and beverage industry (bread, biscuits, sugar, coffee roasting, wine, and spirits).
- Consumption of POPs and heavy metals

### E.1. Activity variables

**Table 4.4.12 Summary of activity variables, data and information sources for category 2G+2H+2I+2J+2K+2L**

| Activities included | Activity data | Source of information |
|---|---|---|
| Tobacco (**2G**) | - Total tobacco consumption. | - Eurostat data. |
| Fireworks (**2G**) | - Fireworks used in Spain. | - Eurostat data. |
| Chipboard (**2H1**) | - Chipboard production. | - 1991-1996: Sub-Directorate General for Basic and processing Industries at the Ministry of Industry and Energy.<br>- Rest of years in the time series: ASPAPEL. |
| Paper pulp production (**2H1**) | - Paper pulp production by type of process (kraft process, acid sulphite process, neutral sulphite and semi-chemical process). | - IQ from 8 production plants.<br>- 2021: cease production of acid sulphite process |
| Manufacture of bread and other food products (**2H2**) | - Production of bread, biscuits, sugar and coffee roasting. | Bread, Biscuits<br>- 1990-1994: Overlap technique following the trend published in “La Alimentación en España” (MITECO).<br>- 1995-2024: INE’s Industrial Survey.<br>Coffee roasting:<br>- 1990-2024: INE’s Industrial Survey.<br>Sugar:<br>- 1990-2009: INE’s Industrial Survey.<br>- 2010-2024: IQ from production plants. |
| Manufacture of wine, beer and spirits (**2H2**) | - Production of wine (white, red and rose), beer and spirits (whisky, brandy, others). | - 1990-1994: Overlap technique following the trend published in Statistical Yearbook of MITEC or “La Alimentación en España” (MITECO).<br>- 1995-2024: INE’s Industrial Survey. |
| Wood processing (**2I**) | - Wood-board processed products. | - FAOSTAT.<br>- Data provided by sector facilities. |
| Consumption of POPs and heavy metals (**2K**) | - Electrical equipment manufactured or contaminated with PCBs that have been destroyed | - 1990-1997: Spanish Population (INE)<br>- 1998-2024: Data of electrical equipment with PCBs and amount of dielectric fluid, and amounts yearly decontaminated or disposed of, provided by SGEC pursuant to Royal Decree 1378/1999. |

| Activities included | Activity data | Source of information |
|---|---|---|
| Refrigeration products (**2L**) | - Tonnes of $NH_3$ used in refrigerating industry. | - Data provided by sector facilities. |

## E.2. Methodology

### Table 4.4.13 Summary of methodologies applied in category 2G+2H+2I+2J+2K+2L

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| ***Tobacco (2G)***<br><br>(Methodological factsheets of a part of the category: Tobacco combustion) | | | |
| NOx, NMVOC, $NH_3$, PM, BC, CO, Cd, Cu, Ni, Zn, PCDD/PCDF, PAHs | T2 | - EMEP/EEA Guidebook (2019). Chapter 2.D3.i. | EF:<br>- Table 3.15. |
| ***Fireworks (2G)***<br><br>(Methodological factsheets of a part of the category: Use of pyrotechnical products) | | | |
| NOx, $SO_2$, PM, BC, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Zn | T2 | - EMEP/EEA Guidebook (2019). Chapter 2.D3.i. | EF:<br>- Table 3.14. |
| **Chipboard (2H1)** | | | |
| NMVOC | T2 | - EMEP/EEA Guidebook (2019). Chapter 2H1. | EF:<br>- Table 3.4. |
| **Paper pulp production (2H1)** | | | |
| NOx, NMVOC, $SO_2$, CO, PM | T2 | - EMEP/EEA Guidebook (2019). Chapter 2H1. | EF:<br>- Table 3.2, 3.3. |
| **Manufacture of bread and other food products (2H2)** | | | |
| NMVOC | T2 | - EMEP/EEA Guidebook (2019). Chapter 2H2. | EF:<br>- Table 3.11, 3.18, 3.20, 3.23**.** |
| **Manufacture of wine, beer and spirits (2H2)** | | | |
| NMVOC | T2 | - EMEP/EEA Guidebook (2019). Chapter 2H2. | EF:<br>- Table 3.25, 3.26, 3.27, 3.29, 3.31, 3.32. |
| **Wood processing (2I)** | | | |
| TSP | T2 | - EMEP/EEA Guidebook (2019). Chapter 2I. | - Emission factors derived from information on measurements provided by the production plants for 2016 (lineal extrapolation for the rest of the years). |
| **Consumption of POPs and heavy metals (2K)** | | | |
| PCB | T3 | - EMEP/EEA Guidebook (2019). Chapter 2K. | EF:<br>- Table 3.4 |
| ***Other production, consumption, storage, transportation or handling of bulk products (2L)***<br><br>(Methodological factsheets of a part of the category: Use of products different from halogenated hydrocarbons for refrigeration) | | | |
| $NH_3$ | T2 | - Inventory Team expert judgment. | - Emission factors derived from Central purchasing and services of refrigeration (ASOFRIO) based on measurements provided by the production plants. |

## E.3. Assessment

The main driver for NMVOC emissions is the category Food and beverage industry (2H2), as illustrated in the following figure. This subcategory is a mixture of many activities with different emissions factors, so the fluctuations in emissions are conditioned by changes in the share of each product in the total production.

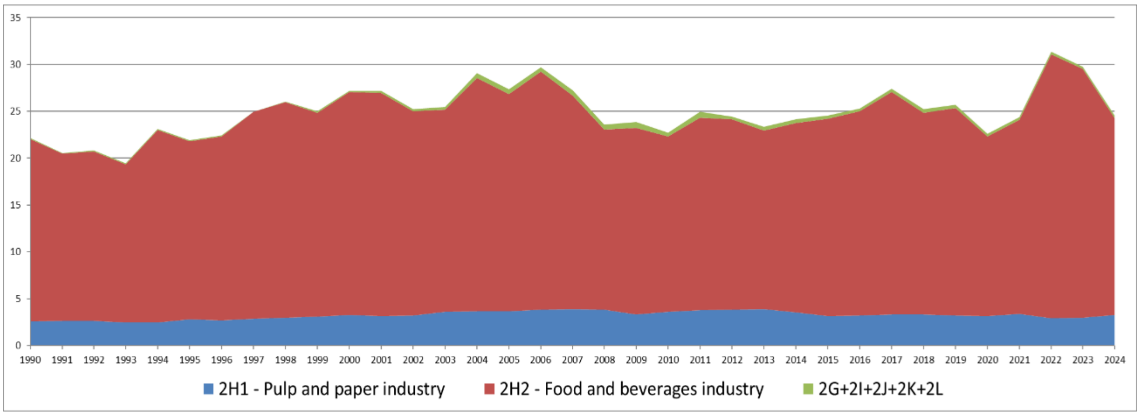



**Figure 4.4.8 NMVOC emissions in categories 2H1, 2H2 and 2G+2I+2J+2K+2L (national territory)**

In 2022, an increase in NMVOC emissions is observed within the 2H2 category, coming from the source of the data: INE's Industrial Survey, as per Regulation (EU) 2019/2152 of 27 November 2019 and Commission Implementing Regulation (EU) 2020/1197 of 30 July 2020. Following the recommendation ES-2H2-2025-0001 made by the TERT in the 2025 NECD review[5] (pursuant to Directive (EU) 2016/2284), it should be explained that the increase in NMVOC emissions is due to the 20,5% rise in total food sales in 2022.

As recommended in NECD review as well, it should be noted that lead emissions within this subcategory are due to fireworks activity. These emissions saw a very marked decrease in the 2020-2021 period due to COVID-19 pandemic restrictions.

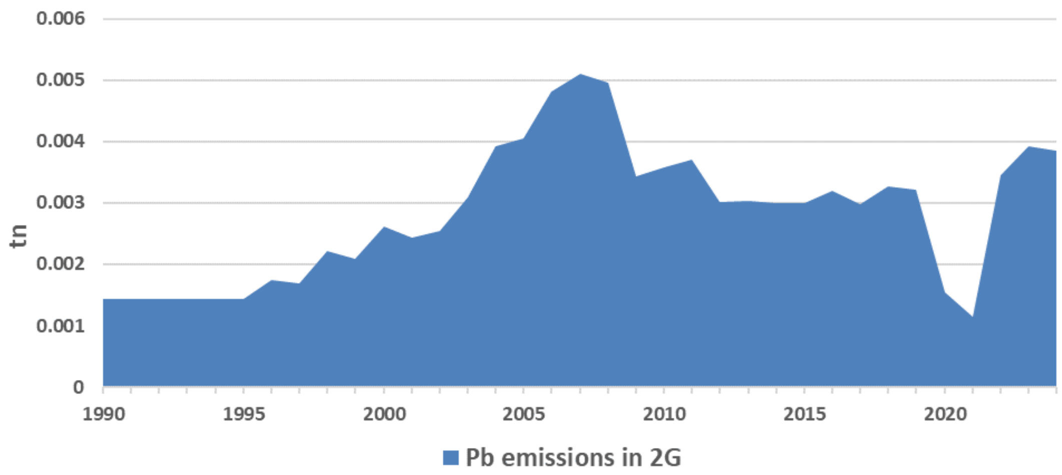



**Figure 4.4.9 Pb emissions in category 2G (national territory)**

[5] Final Review Report available in: https://environment.ec.europa.eu/topics/air/reducing-emissions-air-pollutants/emissions-inventories_en

Some recalculations have taken place caused by updated data by providers for categories: 2H2, 2G and 2K.

## 4.5. Recalculations

The next table shows the main recalculations carried out in this Inventory edition, specifying pollutants affected and the reason for recalculation.

**Table 4.5.1 Recalculation by pollutants - IPPU**

| Pollutants affected | Recalculation |
|---|---|
| ***2A2 Lime production*** | |
| $PM_{10}$, $PM_{2.5}$, TSP, BC | Recalculations due to the update of lime production in calcium carbide manufacturing in 2023 |
| ***2B5 Carbide production*** | |
| $PM_{10}$, $PM_{2.5}$, TSP, BC | Recalculations due to the update of calcium carbide production in 2023 |
| ***2C1 Iron and steel production*** | |
| $PM_{10}$, $PM_{2.5}$, TSP | Update of 2023 emission data from the source |
| ***2C7a Copper production*** | |
| $PM_{10}$, $PM_{2.5}$, TSP, BC, Pb, Cd, As, Cu, Ni, PCDD/DF, PCB | Update of 2022-2023 AD |
| ***2D3a Domestic solvent use*** | |
| NMVOC | Recalculations due to 2023 updating of ESIG data |
| ***2D3d Coating application*** | |
| NMVOC | New estimates due to EF updating to 2023 data provided by ASEFAPI |
| ***2H2 Manufacture of bread and other food products*** | |
| NMVOC | Update of 2022-2023 AD from national Statistics |
| **2G *Tobacco consumption*** | |
| NMVOC, NOx, $NH_3$, CO, Cd, Cu, Zn, Ni, $PM_{2.5}$, $PM_{10}$, TSP, BC, PCDD/DF | Recalculations due to activity data update from national Statistics. |
| ***2G Fire works*** | |
| TSP | Recalculations due to EF updating |
| **2I Wood processing** | |
| TSP | Update of 2022-2023 AD |
| **2K Consumption of POPs and heavy metals** | |
| PCB | Recalculations due to AD updating |

As described above, major differences found between 2025 and 2024 editions for sector NFR 2 affect a wide range of pollutants. Next figures show recalculations in absolute values and in relative terms respectively for categories where either recalculation have been carried out for methodological reasons or have a significant weight within IPPU sector. Impacts of these changes have already been explained in this Chapter.

### 2A2 Lime production. $PM_{2.5}$, $PM_{10}$, TSP, BC

New estimates caused by an activity data update for 2023 in some of the processes included within this category (see table 4.5.1 for more detail).

Due to the low impact on emissions (0.1% of variation being the highest), it has not been considered necessary to show any graph.

### 2B5 Carbide production. $PM_{2.5}$, $PM_{10}$, TSP, BC

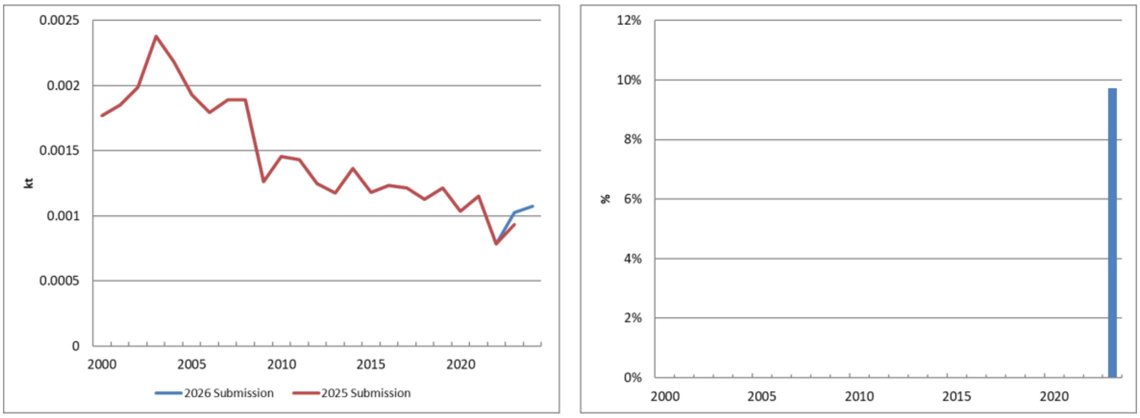



**Figure 4.5.1 Evolution of the difference in 2B5 $PM_{2.5}$ emissions (national territory)**

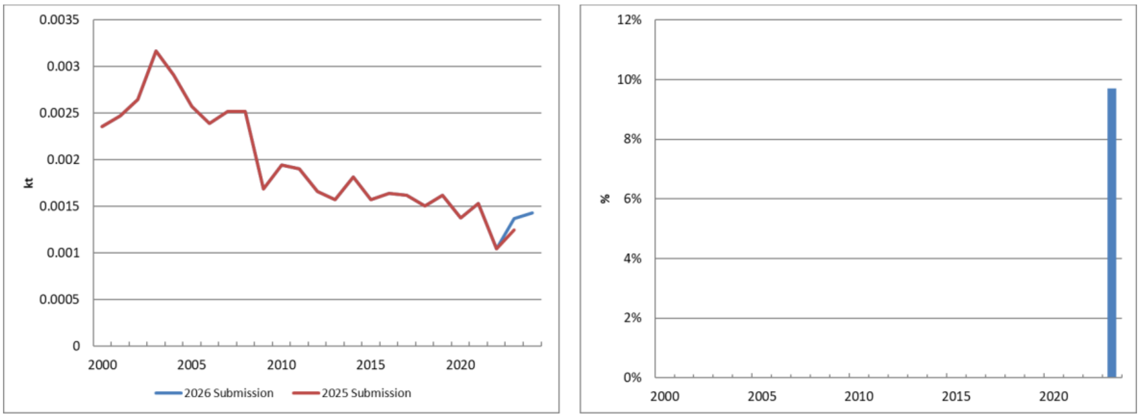



**Figure 4.5.2 Evolution of the difference in 2B5 $PM_{10}$ emissions (national territory)**

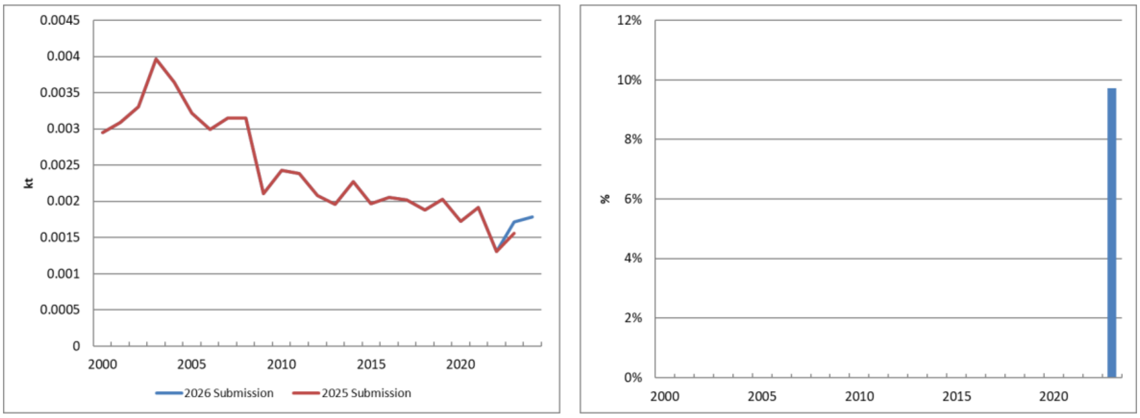



**Figure 4.5.3 Evolution of the difference in 2B5 TSP emissions (national territory)**

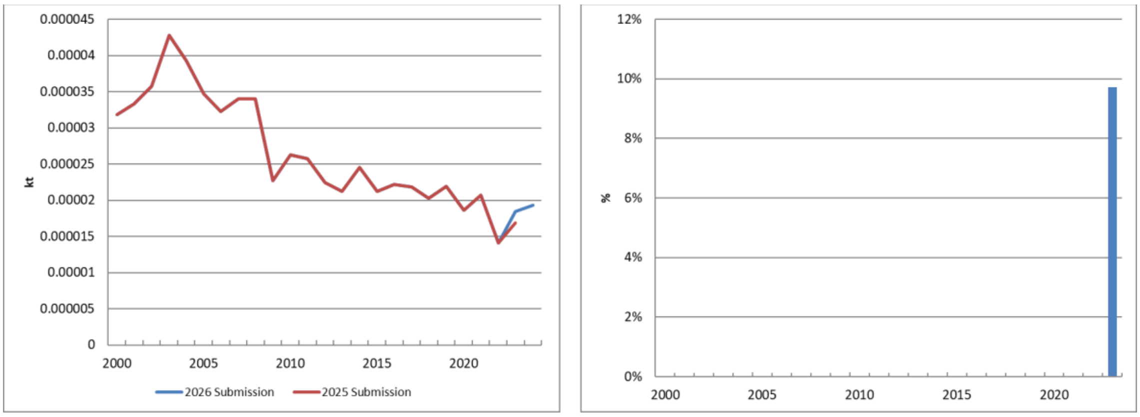



**Figure 4.5.4 Evolution of the difference in 2B5 BC emissions (national territory)**

### 2C1 Iron and steel production. $PM_{2.5}$, $PM_{10}$, TSP

Minor recalculations due to an update of emission data from the source for 2023 in steel production.
Due to the low impact on emissions (1.4% of variation being the highest), it has not been considered necessary to show any graph.

### 2C7a Copper production. PM, Pb, Cd, As, Cu, Ni, PCDD/DF, PCB

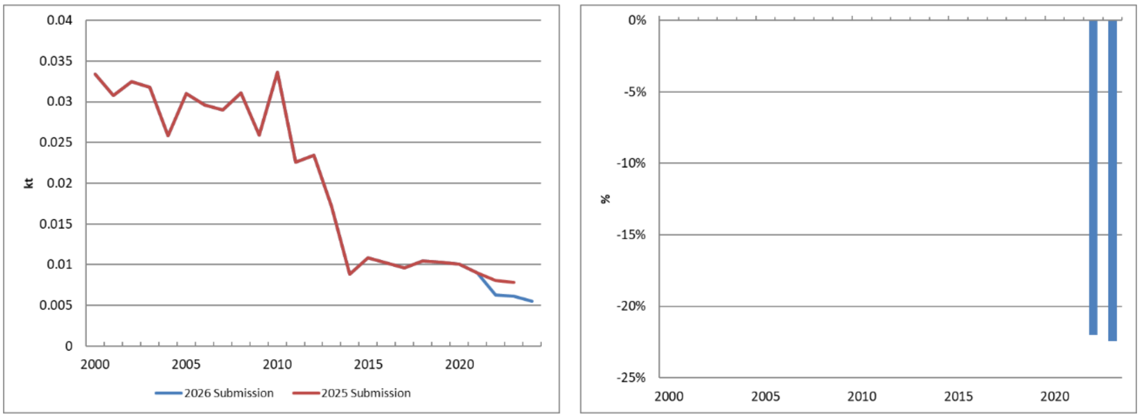



**Figure 4.5.5 Evolution of the difference in 2C7a $PM_{2.5}$ emissions (national territory)**

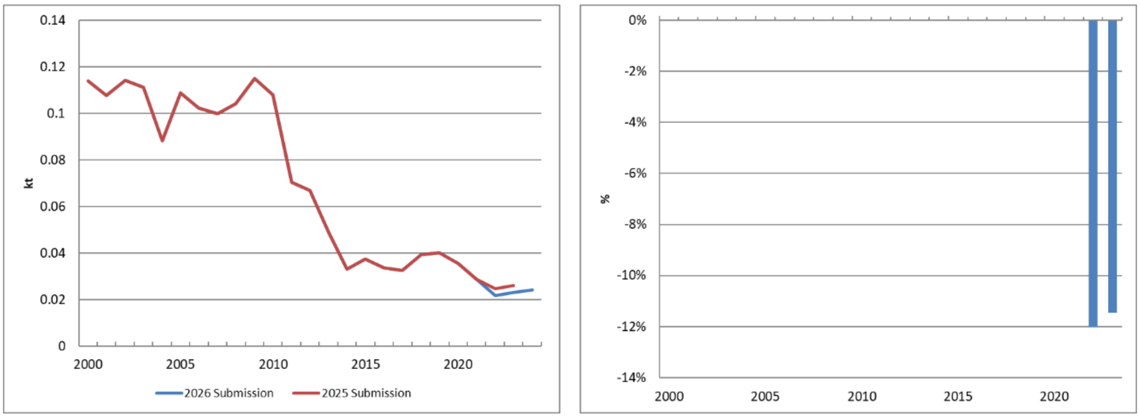



**Figure 4.5.6 Evolution of the difference in 2C7a TSP emissions (national territory)**

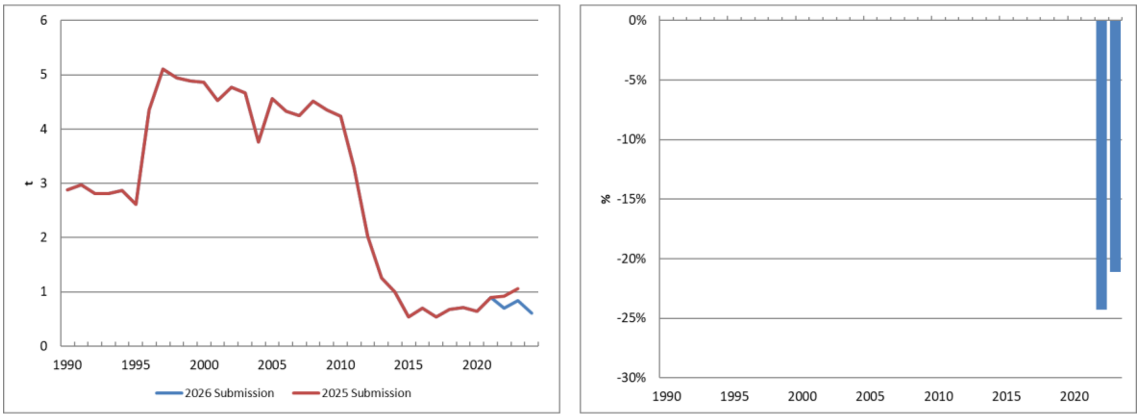



**Figure 4.5.7 Evolution of the difference in 2C7a Pb emissions (national territory)**

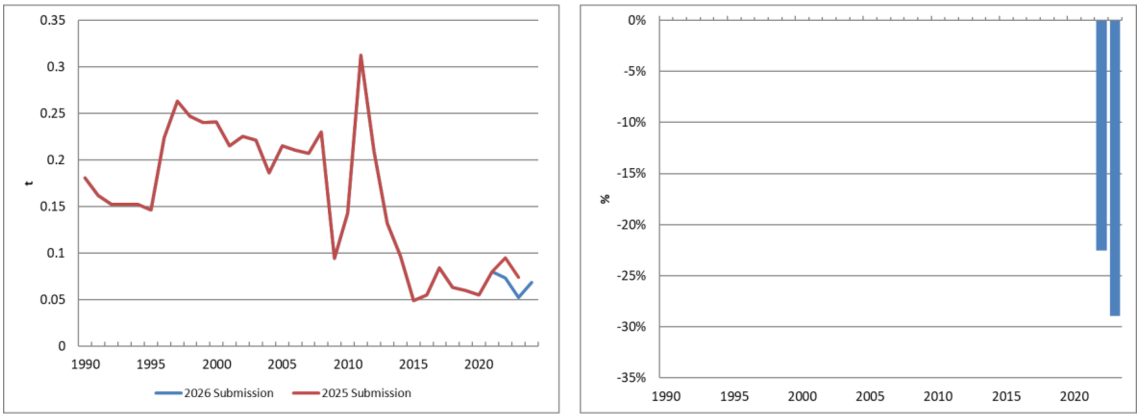



**Figure 4.5.8 Evolution of the difference in 2C7a Cd emissions (national territory)**

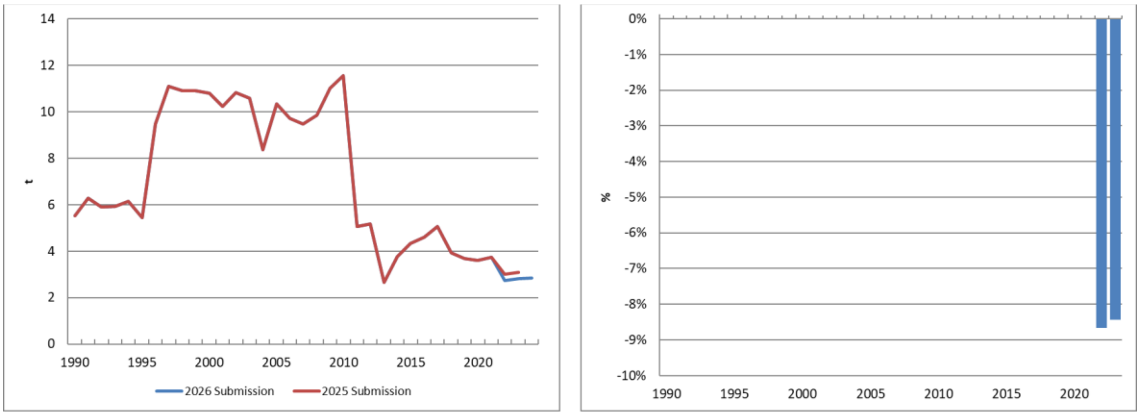



**Figure 4.5.9 Evolution of the difference in 2C7a Cu emissions (national territory)**

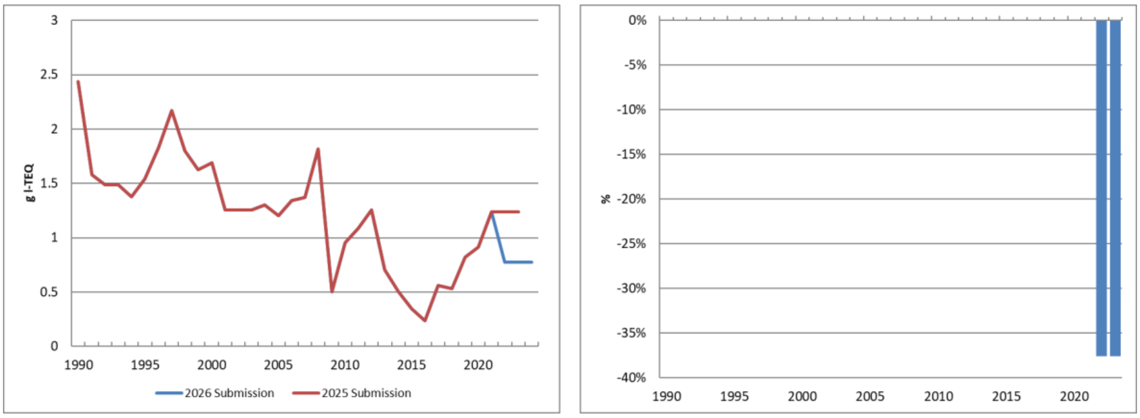



**Figure 4.5.10 Evolution of the difference in 2C7a PCDD/DF emissions (national territory)**

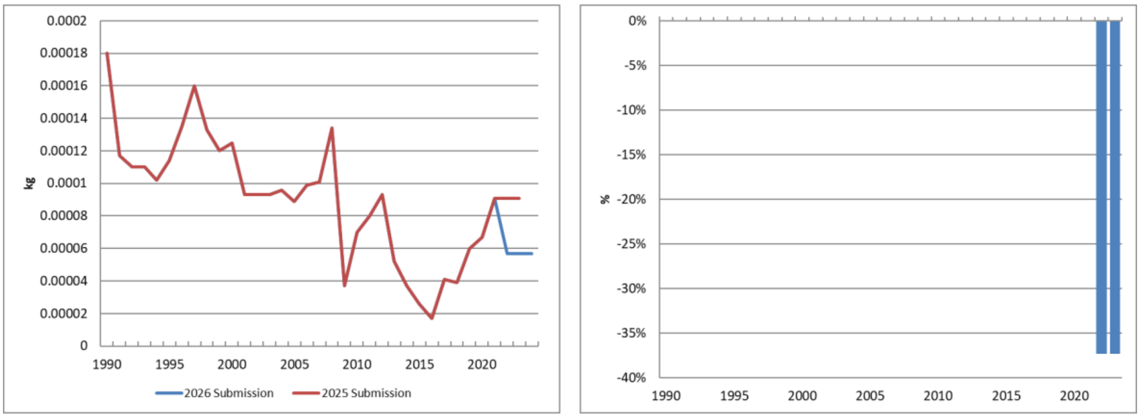



**Figure 4.5.11 Evolution of the difference in 2C7a PCB emissions (national territory)**

### 2D3a Domestic solvent use. NMVOC

Data from the European Solvents Industry Group (ESIG) has been updated for the domestic use in Spain. This has implied a change in the emission factor for 2023.

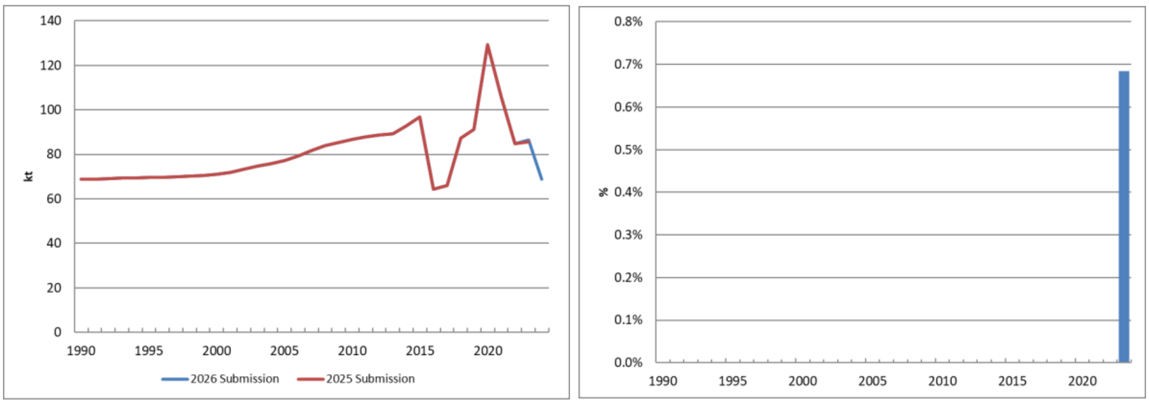



**Figure 4.5.12 Evolution of the difference in 2D3a NMVOC emissions (national territory)**

### 2D3b Road paving with asphalt. NMVOC, $PM_{2.5}$, $PM_{10}$, TSP, BC

This recalculation occurs regularly every year because there is a one-year lag in the focal point data. Therefore, the data from the previous year must be replicated in each edition and corrected in the following edition.

### 2D3d Coating application. NMVOC

The focal point for paint consumption information has made a correction to the variable for domestic paint use. Likewise, the recalculation of the automotive paint data from LPS 0011 is included.:

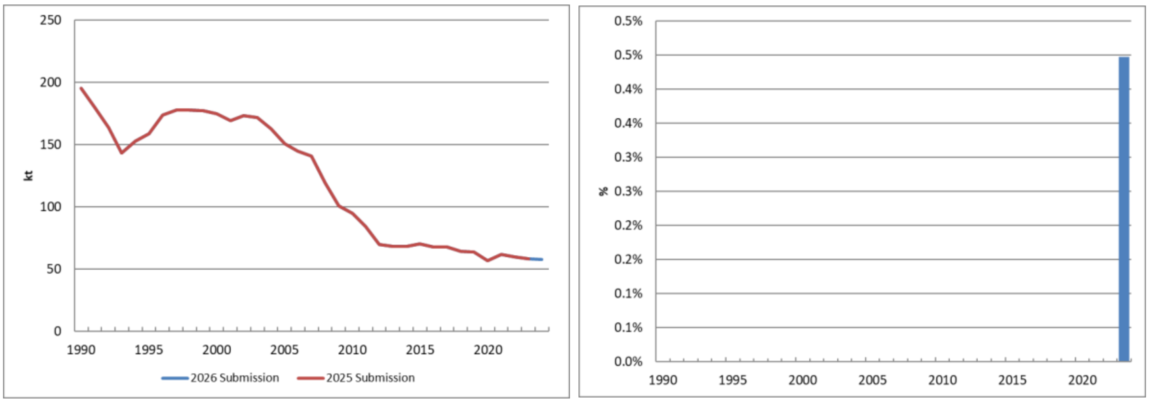



**Figure 4.5.13 Evolution of the difference in 2D3d NMVOC emissions (national territory)**

### 2G Other product use. NOx, NMVOC, $NH_3$, CO, $PM_{2.5}$, $PM_{10}$, TSP, BC, PAH, PCDD/DF, Cd, Cu, Ni, Zn

Recalculation of estimates due to the adjustment of the TSP emission factor in fireworks activity so that the values are consistent with $PM_{10}$ and $PM_{2,5}$ values and correction of the tobacco consumption activity variable by the Eurostat information focal point. Only the NOx recalculation graph is shown since all pollutants have been re-estimated by the same percentage.

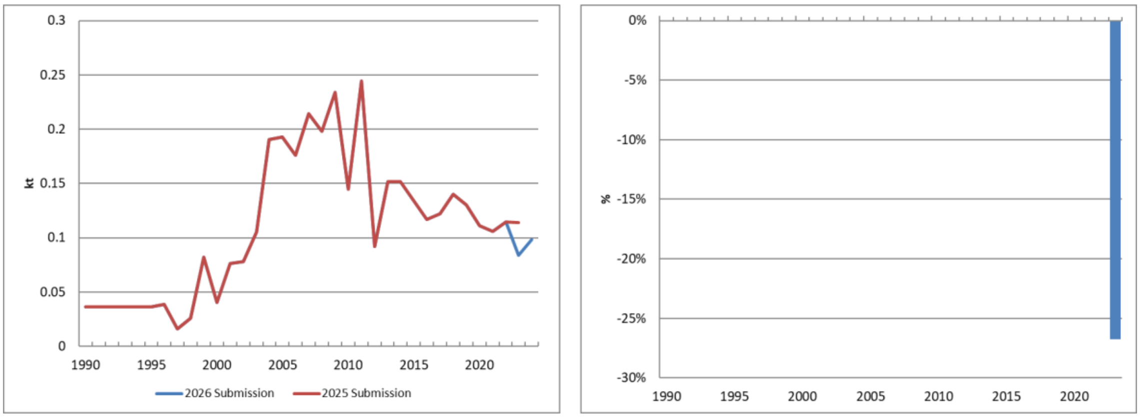



**Figure 4.5.14 Evolution of the difference in 2G $NO_x$ emissions (national territory)**

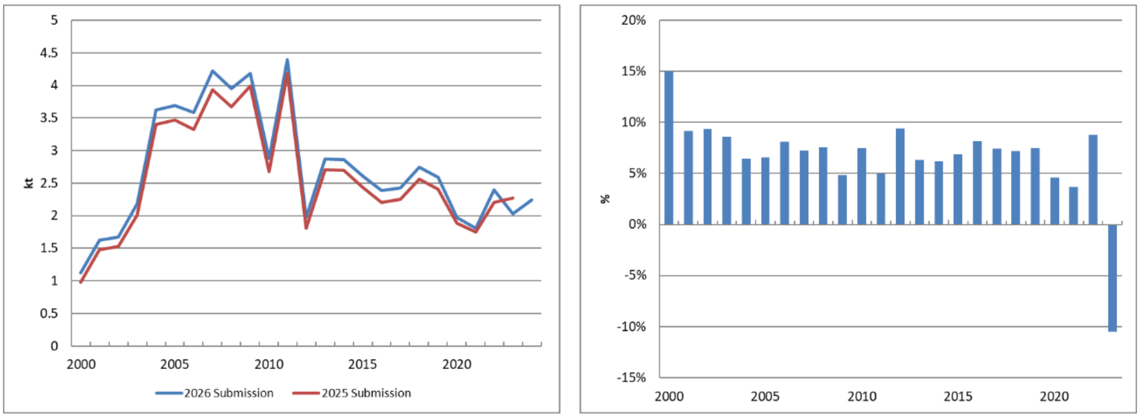



Figure 4.5.15 Evolution of the difference in 2G TSP emissions (national territory)

### 2H2 Manufacture of bread and other food products. NMVOC

Recalculations for 2022 and 2023 caused by an activity data update from national Statistics.

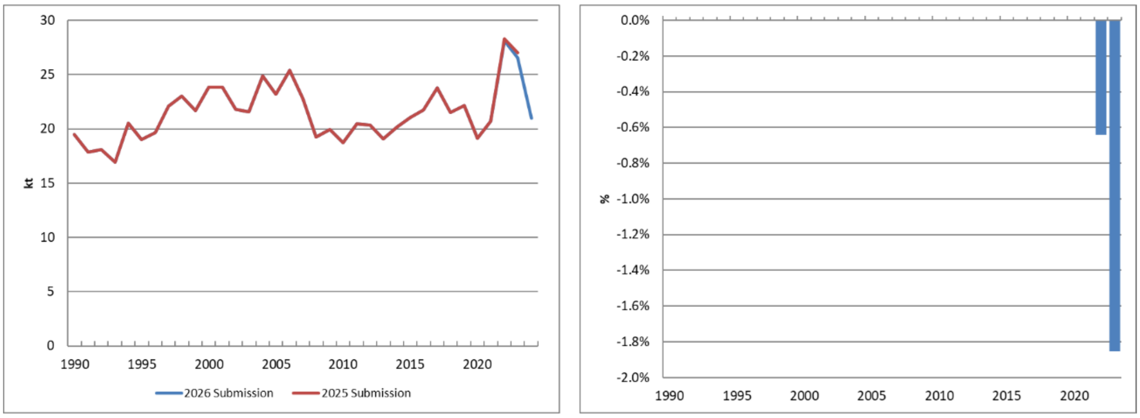



Figure 4.5.16 Evolution of the difference in 2H2 NMVOC emissions (national territory)

### 2K Consumption of POPs and Heavy Metals PCB

Recalculations due to dielectric fluid activity data update from the information focal point.

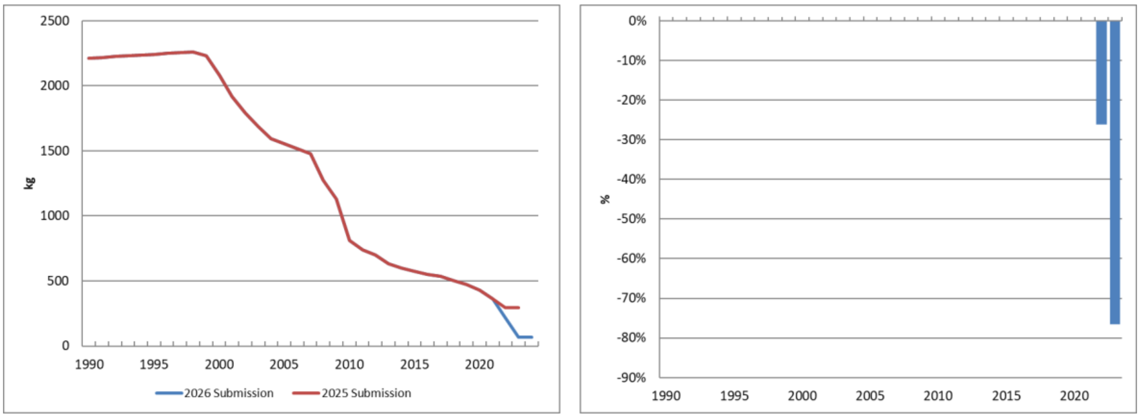



Figure 4.5.17 Evolution of the difference in 2K PCB emissions (national territory)

## 4.6. Sector improvements

Following the Inventory's Improvement Plan, methodologies will be assessed in future editions according to the guidance provided by 2023 EMEP/EEA Guidebook.

# 5. AGRICULTURE (NFR 3)

# CONTENTS

## FIGURES

## TABLES

# 5. AGRICULTURE (NFR 3)

Chapter updated in March, 2026.

## Sector Agriculture at a glance

Agriculture sector mainly accounts for 97% of $NH_3$, 24% of NMVOC and 13% of NOx inventoried emissions as expected due to the magnitude of the primary sector in Spain. Also, agriculture activities in 2024 produced 2% of the total emissions of HCB, linked to HCB impurities in pesticides use (activity 3Df) and 4% of $PM_{2.5}$ emissions.

In 2024, this sector involved 6.98 millions of cattle and equine animals heads breeding (6.95 without Canary Islands), 15.84 millions of small livestock (sheep and goats) (15.56 without Canary Islands), 33.45 millions of swine (33.41 without Canary Islands), 163.83 millions of poultry (162.12 without Canary Islands), 4.51 millions of rabbits (4.50 without Canary Islands), 17.11 million of hectares of crops susceptible to emit pollutants (17.06 without Canary Islands) and 1.82 millions of tonnes of N inorganic and organic fertilizers applied to soils (1.81 without Canary Islands); data without the Canary Islands are provided in parentheses, since their territory is not under the EMEP grid.

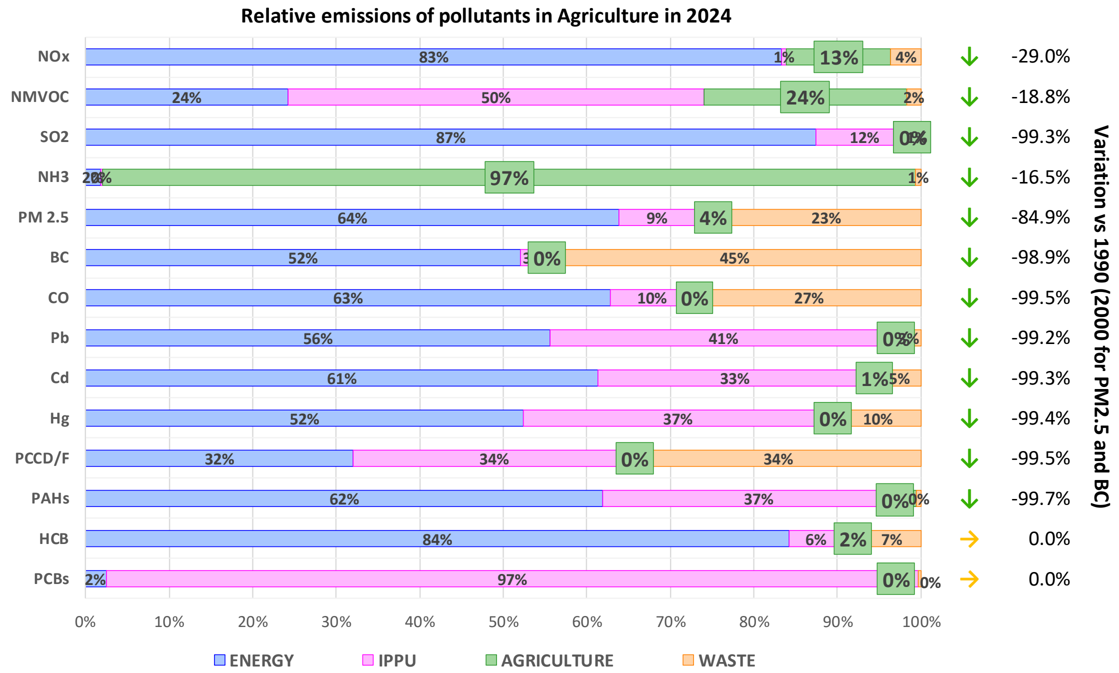



**Figure 5.1.1 Relative emissions in Agriculture in 2024 and its relative variation (2024 vs. 1990) (national territory)**

When comparing 2024 to 1990 results (2000 in case of Particulate Matter), most of the emissions trends show a clear reduction along the time series (around -85 to -99%) directly linked to the progressive abandonment of burning agricultural residues on field. Only the emissions of the predominant pollutants: $NH_3$, NOx and NMVOC register smaller downward trends since 1990, due to evolution of livestock and fertilization and the great importance of the agricultural sector in the country.

## 5.1. Sector overview

Main issues regarding air pollutant emissions reported for this sector are shown in the following table, in particular, NFR categories and pollutants coverage, methodology approach (Method) and consideration as key categories (KC).

**Table 5.1.1 Coverage of NFR category in 2024**

| NFR Code | NFR category | Pollutants | | | | Method | KC |
|---|---|---|---|---|---|---|---|
| | | Covered | Exceptions | | | | |
| | | | IE | NA | NE | | |
| **3B1a** | Dairy cattle | NOx, NMVOC, $NH_3$, $PM_{2.5}$, $PM_{10}$, TSP | – | Rest of pollutants | – | T1/T2 | |
| **3B1b** | Non-dairy cattle | NOx, NMVOC, $NH_3$, $PM_{2.5}$, $PM_{10}$, TSP | – | Rest of pollutants | – | T1/T2 | |
| **3B2** | Sheep | NOx, NMVOC, $NH_3$, $PM_{2.5}$, $PM_{10}$, TSP | – | Rest of pollutants | – | T1/T2 | |
| **3B3** | Swine | NOx, NMVOC, $NH_3$, $PM_{2.5}$, $PM_{10}$, TSP | – | Rest of pollutants | – | T1/T3 | |
| **3B4a** | Buffalo | NO | | | | | |
| **3B4d** | Goats | NOx, NMVOC, $NH_3$, $PM_{2.5}$, $PM_{10}$, TSP | – | Rest of pollutants | – | T1/T2 | |
| **3B4e** | Horses | NOx, NMVOC, $NH_3$, $PM_{2.5}$, $PM_{10}$, TSP | – | Rest of pollutants | – | T1/T2 | ✓ |
| **3B4f** | Mules and asses | NOx, NMVOC, $NH_3$, $PM_{2.5}$, $PM_{10}$, TSP | – | Rest of pollutants | – | T1/T2 | |
| **3B4gi** | Laying hens | NOx, NMVOC, $NH_3$, $PM_{2.5}$, $PM_{10}$, TSP | – | Rest of pollutants | – | T1/T2/T3 | |
| **3B4gii** | Broilers | NOx, NMVOC, $NH_3$, $PM_{2.5}$, $PM_{10}$, TSP | – | Rest of pollutants | – | T1/T2/T3 | |
| **3B4giii** | Turkeys | NOx, NMVOC, $NH_3$, $PM_{2.5}$, $PM_{10}$, TSP | – | Rest of pollutants | – | T1/T2 | |
| **3B4giv** | Other poultry | NOx, NMVOC, $NH_3$, $PM_{2.5}$, $PM_{10}$, TSP | – | Rest of pollutants | – | T1/T2 | |
| **3B4h** | Other animals-Rabbits | NOx, NMVOC, $NH_3$, $PM_{2.5}$, $PM_{10}$, TSP | – | Rest of pollutants | – | T1/T2 | |
| **3Da1** | Inorganic N-fertilizers (also includes urea application) | NOx, $NH_3$ | – | Rest of pollutants | – | T1/T2 | |
| **3Da2a** | Animal manure applied to soils | NOx, $NH_3$ | – | Rest of pollutants | – | T1/T2/T3 | |
| **3Da2b** | Sewage sludge applied to soils | NOx, $NH_3$ | – | Rest of pollutants | – | T1 | |
| **3Da2c** | Other organic fertilizers applied to soils (including compost) | NOx, $NH_3$ | – | Rest of pollutants | – | T1 | ✓ |
| **3Da3** | Urine, dung deposited by grazing animals | NOx, $NH_3$ | – | Rest of pollutants | – | T1/T2 | |
| **3Da4** | Crop residues applied to soils | $NH_3$ | – | Rest of pollutants | – | T1 | |
| **3Db** | Indirect emissions from managed soils | NA | | | | | |

| NFR Code | NFR category | Pollutants | | | | Method | KC |
|---|---|---|---|---|---|---|---|
| | | Covered | Exceptions | | | | |
| | | | IE | NA | NE | | |
| **3Dc** | Farm-level agricultural operations including storage, handling, transport of agricultural products | $PM_{2.5}$, $PM_{10}$, TSP | – | Rest of pollutants | – | T2 | |
| **3Dd** | Off-farm storage, handling, transport of bulk agricultural products | NA | | | | | |
| **3De** | Cultivated crops | NMVOC | – | Rest of pollutants | $NH_3$ | T2 | |
| **3Df** | Use of pesticides | HCB | – | Rest of pollutants | – | T1 | |
| **3F** | Field burning of agricultural residues | NOx, NMVOC, $SO_2$, $NH_3$, $PM_{2.5}$, $PM_{10}$, TSP, BC, CO, HM, PAHs, PCDD/PCDF | – | Rest of pollutants | – | T2 | ✓ |

IE: included elsewhere; NA: not applicable; NE: not estimated; NO: not occurring.

## 5.2. Sector analysis

Main features of Agriculture sector in Spain in 2024 are listed in the following table for reference (data without the Canary Islands are provided in parentheses, since their territory is not under the EMEP grid).

**Table 5.2.1 Sector analysis**

| NFR Code | NFR category | Main features (2024) | Main sources of activity data |
|---|---|---|---|
| **3B1** | Cattle | - 6.28 million (M) of cow heads (6.26 without Canary Islands). | - Zootechnical document[1]<br>- Livestock Surveys[2] |
| **3B2** | Sheep | - 13.48 M of sheep heads (13.44 without Canary Islands). | - Zootechnical document[1].<br>- Livestock Surveys[2]. |
| **3B3** | Swine | - 33.45 M of swine heads (33.41 without Canary Islands). | - Zootechnical document[1].<br>- Livestock Surveys[2]. |
| **3B4d** | Goats | - 2.36 M of goat heads (2.12 without Canary Islands). | - Zootechnical document[1].<br>- Livestock Surveys[2]. |
| **3B4e**<br>**3B4f** | Equidae | - 0.70 M of equidae heads (0.69 without Canary Islands). | - Zootechnical document[1].<br>- REGA[3] (Livestock Farm Registry).<br>- RIIA[3] (Animal Individual Identification Registry). |
| **3B4g** | Poultry | - 163.83 M of poultry (162.12 without Canary Islands). | - Zootechnical document[1].<br>- MAPA's Statistical Yearbook[4].<br>- REGA[3] (Livestock Farms Registry). |
| **3B4h** | Other animals-Rabbits | - 4.51 M of rabbits (4.50 without Canary Islands). | - MAPA's Statistical Yearbook[4]. |

[1] See Table 5.4.3.

[2] Livestock Surveys (May and November): https://www.mapa.gob.es/es/estadistica/temas/estadisticas-agrarias/ganaderia/encuestas-ganaderas/

[3] https://www.mapa.gob.es/es/ganaderia/temas/trazabilidad-animal/sitran/

[4] Ministry for Agriculture, Fisheries and Food Statistical Yearbook: https://www.mapa.gob.es/es/estadistica/temas/publicaciones/anuario-de-estadistica/default.aspx

| NFR Code | NFR category | Main features (2024) | Main sources of activity data |
|---|---|---|---|
| **3Da1** | Inorganic N-fertilizers (also includes urea application) | - 0.87 M tonnes of N inorganic fertilizers applied to soil.<br>(0.87 without Canary Islands). | - MAPA's Statistical Yearbook[4].<br>- Husbandry Surveys.<br>- Nitrogen and Phosphorous Balance in Spanish Agriculture (BNPAE) Yearbook.<br>- Zootechnical document[1].<br>- National Sewage Register (MITECO).<br>- SG Circular Economy information (MITECO). |
| **3Da2a** | Animal manure applied to soils | - 0.45 M tonnes of N manure applied to soil<br>(0.45 without Canary Islands). | |
| **3Da2b** | Sewage sludge applied to soils | - 0.02 M tonnes of N from sewage sludge applied to soil. | |
| **3Da2c** | Other organic fertilizers applied to soils (compost) | - 0.02 M tonnes of N from compost applied to soil. | |
| **3Da3** | Urine and dung deposited by grazing animals | - 0.30 M tonnes of N manure by grazing animals applied to soil.<br>(0.30 without Canary Islands). | |
| **3Da4** | Crop residues applied to soils | - 0.14 M tonnes of N crop residues applied to soil*<br>(0.14 without Canary Islands). | |
| **3Dc** | Farm-level agricultural operations | - 17.11 M hectares of arable crops*<br>(17.06 without Canary Islands). | - MAPA's Statistical Yearbook.<br>- Nitrogen and Phosphorous Balance in Spanish Agriculture (BNPAE) Yearbook. |
| **3De** | Cultivated crops | - 10.63 M hectares of wheat, rye, rape and grass (susceptible to emit NMVOC) *<br>(10.48 without Canary Islands). | - MAPA's Statistical Yearbook. |
| **3Df** | Use of pesticides | - 18.45 tonnes of active substances with HCB impurities. | - MAPA (Ministry for Agriculture, Fisheries and Food). |
| **3F** | Field burning of agricultural residues | - 57.76 kilotonnes of dry matter burnt<br>(57.76 without Canary Islands). | - MAPA (Ministry for Agriculture, Fisheries and Food). Statistical Yearbook and others.<br>- Nitrogen and Phosphorous Balance in Spanish Agriculture (BNPAE) Yearbook. |

* Data of areas of agricultural soils are provided by MAPA's Statistics Yearbook to BNPAE technical team with two-year lag compared with inventory report. In these cases, the Inventory replicates the x-2 year values published in the Yearbook, into x-1 year, the last year inventoried. This edition has updated the values of 2023 according to the yearbook and has replicated them into 2024.

## 5.2.1. Key categories

Identified key categories within the Agriculture sector, according to the information provided in the corresponding section/annex of the IIR, are listed in the following table.

**Table 5.2.2 Assignation of KC**

| NFR | NFR Category | NOx | NMVOC | $SO_2$ | $NH_3$ | $PM_{2.5}$ | $PM_{10}$ | TSP | BC | CO | Pb | Cd | Hg | PCDD /PCDF | PAHs | HCB | PCBs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3B | Manure management | – | L-T | – | L-T | L | L | L-T | – | – | – | – | – | – | – | – | – |
| 3D | Crop production and agricultural soils | L | L-T | – | L-T | L | L-T | L-T | – | – | – | – | – | – | – | T | – |
| 3F | Field burning of agricultural residues | T | T | – | T | T | T | T | T | T | – | T | T | T | T | – | – |

L: level T: trend

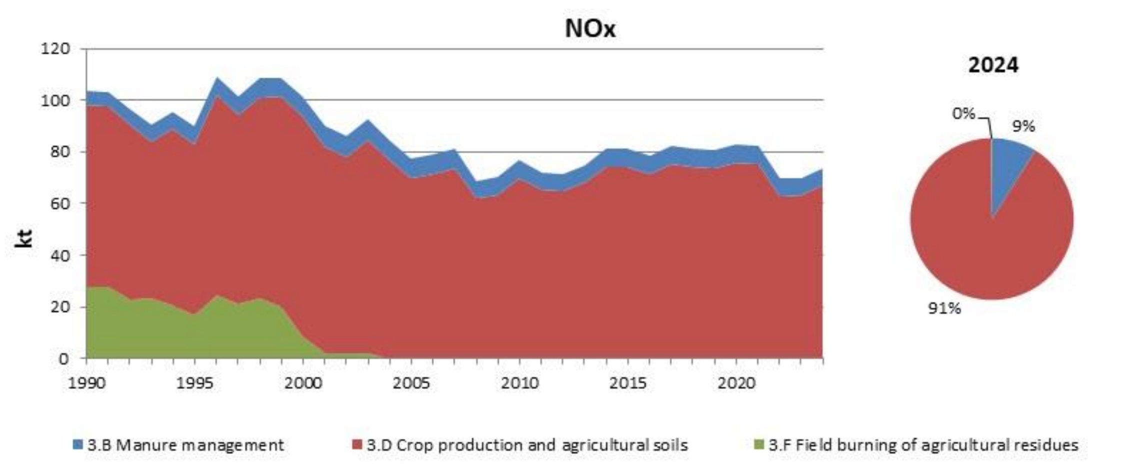
### 5.2.2. Analysis by pollutant

Featured below are the charts of the time series by pollutants and NFR categories. Each pollutant is represented independently, broken down by main NFR categories within the sector. Additionally, a pie chart showing the weight distribution of the main categories for the year 2024 is included.

Explanation boxes below the graphs provide specific details on the pollutant emissions for the year 2024 (national territory (NT)), as well as main drivers and its trends during the time series (data without the Canary Islands are provided in parentheses, since their territory is not under the EMEP grid).

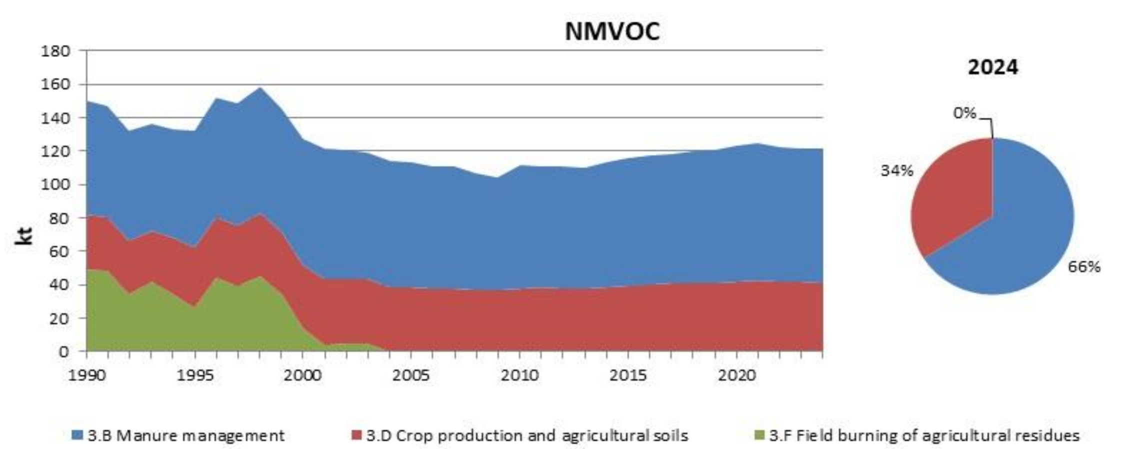
Detailed emission data of the Spanish Inventory are available from the MITECO-SEI website WebTable.

## Main Pollutants (national territory (NT))



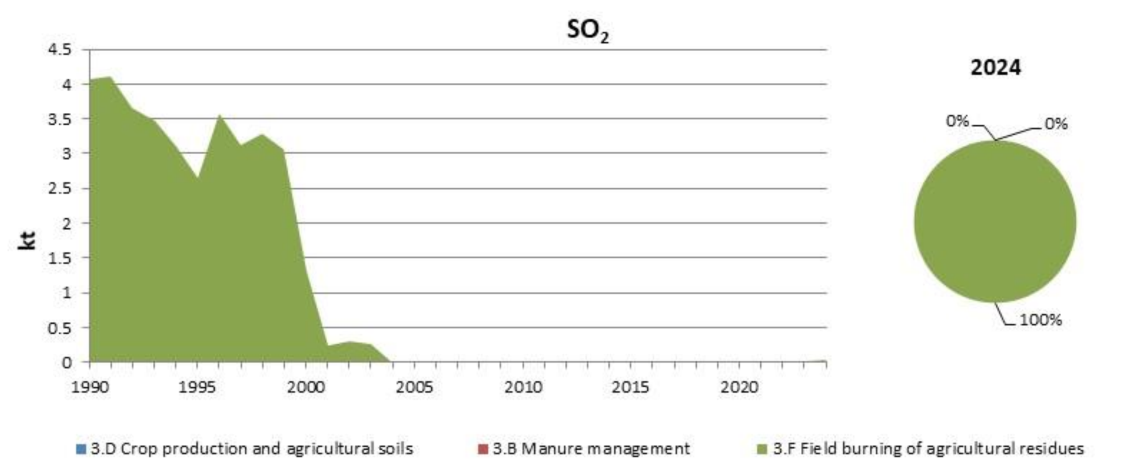

| | | |
|---|---|---|
| ***NOx*** | 73.70 kt emitted in 2024 (73.30 kt without Canary Islands)<br>12.52% of the total NOx emissions of the Inventory in 2024 (13.82% without Canary Islands) | |
| | 1990-1999 | The emission fall from 1990 to 1993 is due to the economic recession of the early 1990s, 1993 worst year considered. From then on, $NO_X$ emissions regained base level until 1999. |
| | 2000-2024 | NOx emissions due to field of agricultural residues burning (3F) in Spain dropped drastically after year 2000: being restricted by the conditionality of CAP (Common Agricultural Policy) payments and forest fire prevention legislation, this practice is, from then on, only allowed in limited cases under authorization by public authorities. Emissions fluctuate irregularly coupled to the trade and use of fertilizers (3D). Manure management emissions (3B) evolve in correlation with livestock heads, with a sharp drop between 2021 and 2022. |

**Figure 5.2.1 Evolution of NOx by category and distribution in year 2024 (national territory (NT))**



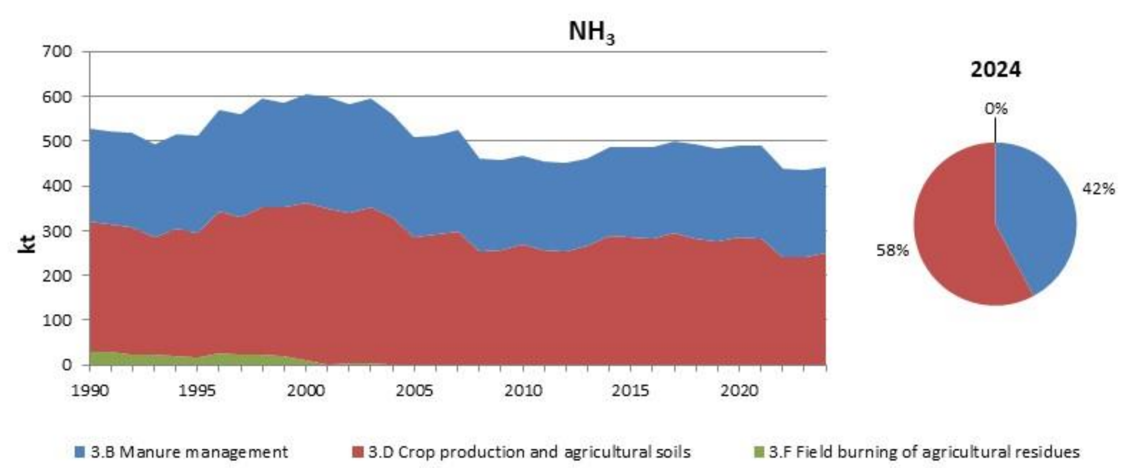

| | | |
|---|---|---|
| ***NMVOC*** | 121.57 kt emitted in 2024 (120.60 kt without Canary Islands)<br>24.27% of the total NMVOC emissions of the Inventory in 2024 (24.67% without Canary Islands) | |
| | 1990-2024 | Within the Agriculture sector, around two thirds of the emissions of this pollutant are due to category 3B (Manure management), being the rest produced by Crop production and agricultural soils (3D). Showing a slight increasing trend, there is only one period of clear decline between 2000 and 2008. From 2000 on, the drop in category 3F is due to restriction by public authorities who have limited the situations to benefit from a field burning authorization. |

**Figure 5.2.2 Evolution of NMVOC by category and distribution in year 2024 (NT)**




| | | |
|---|---|---|
| ***$SO_2$*** | 0.03 kt emitted in 2024 (0.03 kt without Canary Islands)<br>0.03% of the total $SO_2$ emissions of the Inventory in 2024 (0.03% without Canary Islands) | |
| | 1990-2000 | In the Agriculture sector, $SO_2$ emissions exclusively come from category 3F. From the base year until 1999, the activity keep remains quite constant, with the exception of a gap in 1995 due to lower agricultural productivity. |
| | 2001-2024 | Drastic drop in 3F category is due to restriction by public authorities who have limited the situations to benefit from a field burning authorization. |

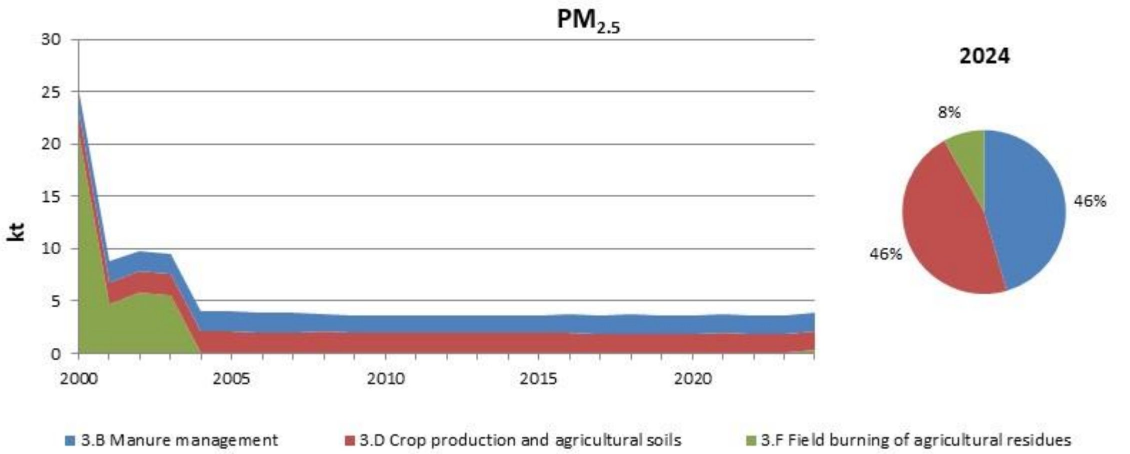
**Figure 5.2.3 Evolution of $SO_2$ by category and distribution in year 2024 (NT)**




| | | |
|---|---|---|
| ***$NH_3$*** | 440.70 kt emitted in 2024 (438.06 kt without Canary Islands)<br>97.26% of the total $NH_3$ emissions of the Inventory in 2024 (97.33% without Canary Islands) | |
| | 1990-1994 | Ammonia emissions decrease from 1990 to 1994. Economic crisis in early 1990s and a marked drought period affected fertilizers trade and crop production (3D). |
| | 1995-2003 | Emissions rise in agreement with both drivers, livestock effectives and nitrogen amount applied to soils as fertilizer. The $NH_3$ emissions of open field burning of crops follow the tendency explained in previous boxes. 3F emissions dropped drastically from 2000 onwards as a result of abandonment of this practice restricted by forest fire preventive legislation and conditionality of Common Agricultural Policy payments. |
| | 2004-2024 | Decrease from 2004 to 2011, possibly related to another drought period followed by a economic crisis that flattened the sector. From 2013 on, recovery is noticeably, with a slight increase in recent years despite the increase in livestock population, because from 2005 onwards, Spanish inventory considers abatement measures implemented in 3B and 3D. Emissions increase in 2024 vs. 2023, mainly due to the increased use of urea. |

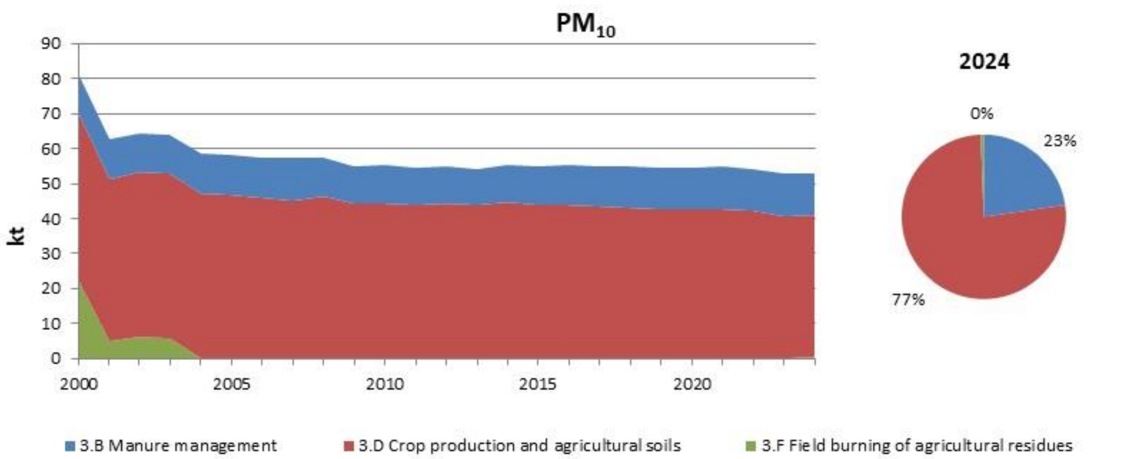
**Figure 5.2.4 Evolution of $NH_3$ by category and distribution in year 2024 (NT)**

## Particulate Matter



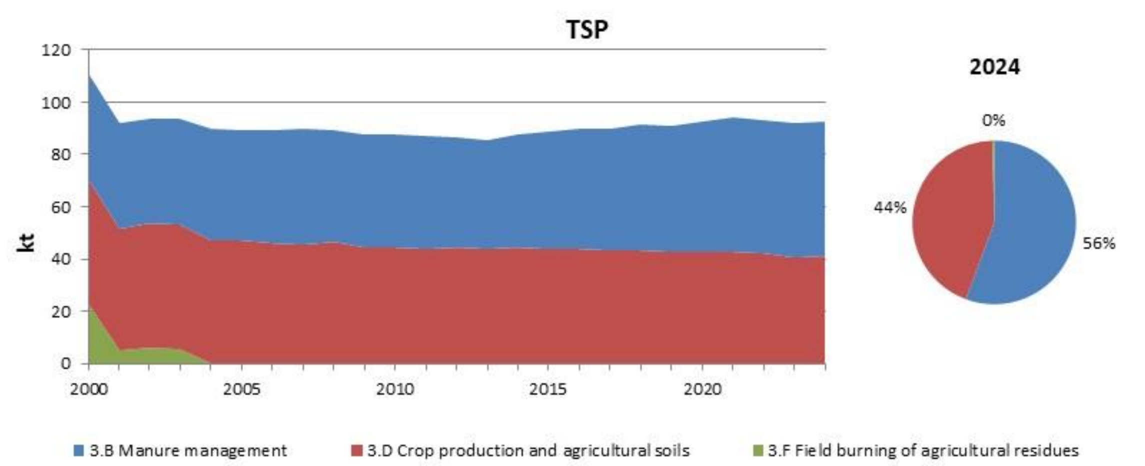

| | | |
|---|---|---|
| ***$PM_{2.5}$*** | 3.84 kt emitted in 2024 (3.82 kt without Canary Islands)<br>4.23% of the total $PM_{2.5}$ emissions of the Inventory in 2024 (4.33% without Canary Islands) | |
| | 2000-2003 | Remarkable decrease in the first year of the series is due to category 3F. In the frame of forest fire preventive legislation and conditionality of Common Agricultural Policy payments, public authorities ruled field burning of crop residues in a restricted way allowing it only in limited cases. After 2003 only crop residues are burnt in open field with authorization for phytosanitary reasons. |
| | 2004-2024 | From 2004 onwards, emissions evolve with the fluctuations of livestock heads and crop surface. |

**Figure 5.2.5 Evolution of $PM_{2.5}$ by category and distribution in year 2024 (NT)**



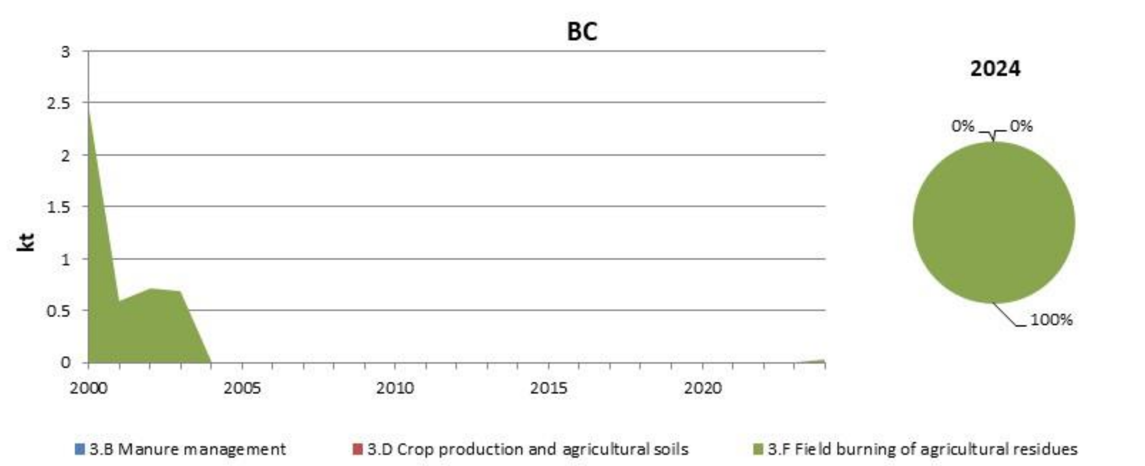

| | | |
|---|---|---|
| ***$PM_{10}$*** | 53.05 kt emitted in 2024 (52.88 kt without Canary Islands)<br>32.23% of the total $PM_{10}$ emissions of the Inventory in 2024 (32.86% without Canary Islands) | |
| | 2000-2003 | 3F emissions dropped drastically as a result of abandonment of this practice restricted by forest fire preventive legislation and conditionality of Common Agricultural Policy payments. After 2003 only crop residues are burnt in open field with authorization for phytosanitary reasons. |
| | 2004-2024 | From 2004 onwards, emissions evolve with the fluctuations of livestock heads and crop surface. |

**Figure 5.2.6 Evolution of $PM_{10}$ by category and distribution in year 2024 (NT)**




| | | |
|---|---|---|
| ***TSP*** | 92.45 kt emitted in 2024 (92.01 kt without Canary Islands)<br>36.45% of the total TSP emissions of the Inventory in 2024 (37.05% without Canary Islands) | |
| | 2000-2003 | 3F emissions dropped drastically as a result of abandonment of this practice restricted by forest fire preventive legislation and conditionality of Common Agricultural Policy payments. After 2003 only crop residues are burnt in open field with authorization for phytosanitary reasons. |
| | 2004-2024 | From 2004 onwards, emissions evolve with the fluctuations of livestock heads and crop surface. |

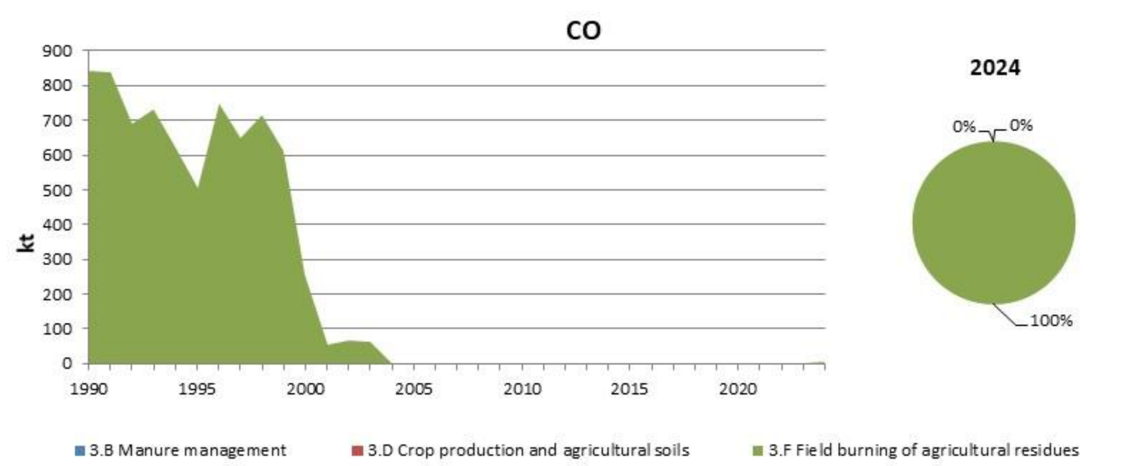
**Figure 5.2.7 Evolution of TSP by category and distribution in year 2024 (NT)**




| | | |
|---|---|---|
| ***BC*** | 0.03 kt emitted in 2024 (0.03 kt without Canary Islands)<br>0.13% of the total BC emissions of the Inventory in 2024 (0.13% without Canary Islands) | |
| | 2000-2003 | BC emissions exclusively come from category 3F whose fall in 2001 is explained in previous boxes. In this case, effects on relative emissions are remarkable because of the lack of any other contributor. |
| | 2004-2024 | From 2004 onwards, BC emissions present slight variations in absolute terms, in line with the remaining of burning of residues from crops in open field with authorization for phytosanitary reasons. |

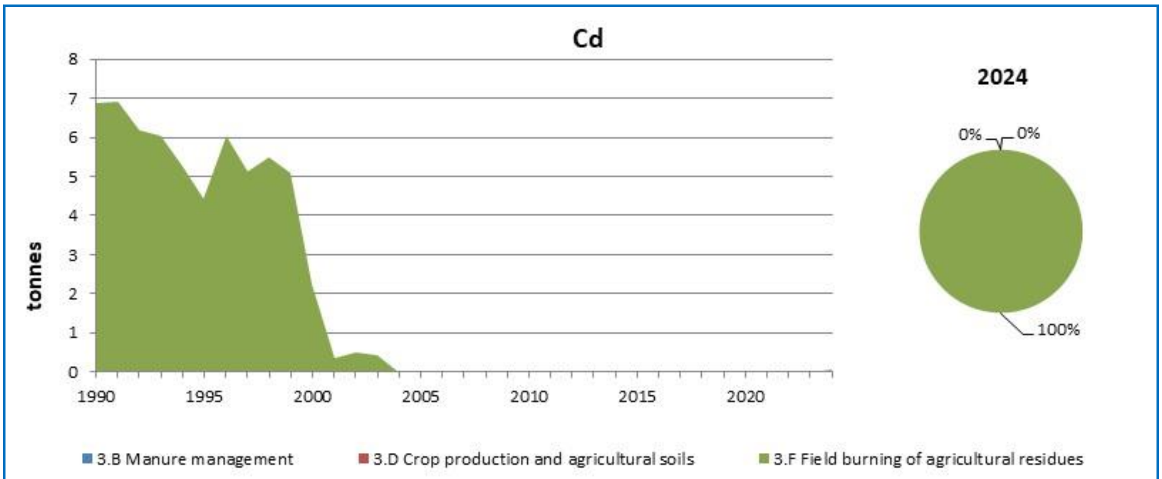
**Figure 5.2.8 Evolution of BC by category and distribution in year 2024 (NT)**

## CO and Priority Heavy Metals



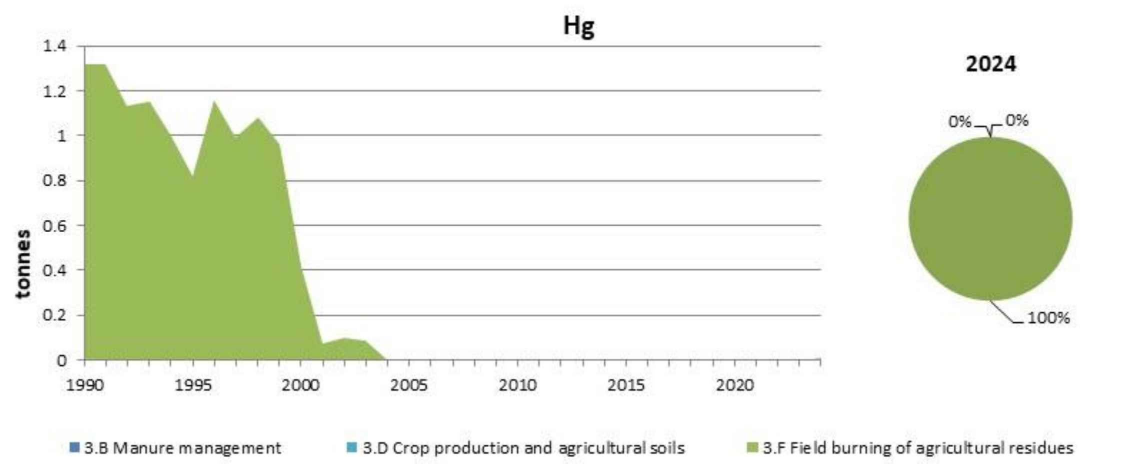

| | | |
|---|---|---|
| ***CO*** | 3.85 kt emitted in 2024 (3.85 kt without Canary Islands)<br>0.39% of the total CO emissions of the Inventory in 2024 (0.40% without Canary Islands) | |
| | 1990-2003 | CO emissions exclusively come from category 3F whose fall in 2000-2003 is due to restriction by public authorities who have limited the situations to benefit from a field burning authorization. From 1990 until 1999, the activity evolves with the agricultural productivity. |
| | 2004-2024 | From 2004 onwards, CO emissions present slight variations in absolute terms, in line with the remaining of burning of residues from crops in open field with authorization for phytosanitary reasons. |

**Figure 5.2.9 Evolution of CO by category and distribution in year 2024 (NT)**



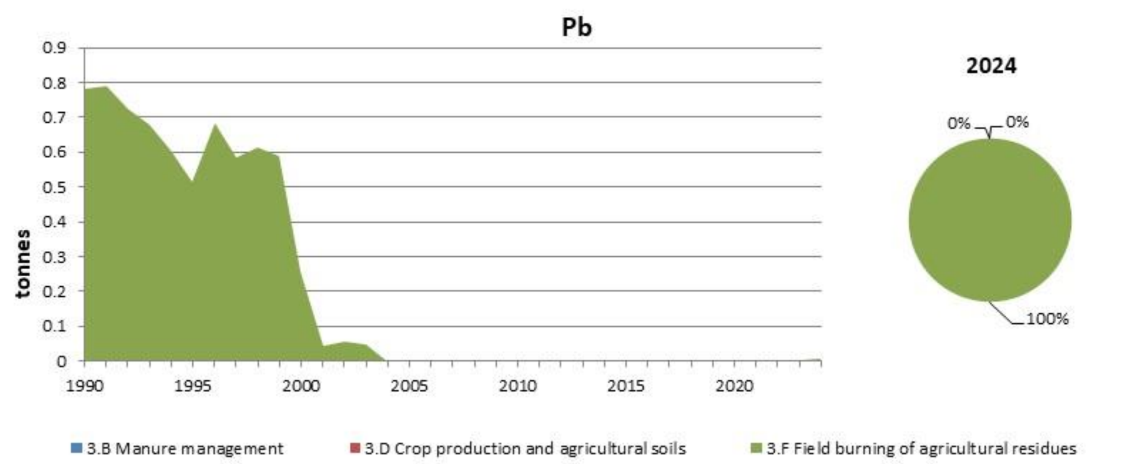

| | | |
|---|---|---|
| ***Cd*** | 0.05 t emitted in 2024 (0.05 t without Canary Islands)<br>0.83% of the total Cd emissions of the Inventory in 2024 (0.95% without Canary Islands) | |
| | 1990-2003 | Cd emissions exclusively come from category 3F whose fall in 2000-2003 is explained in the previous boxes. From 1990 until 1999, the activity evolves with the agricultural productivity. |
| | 2004-2024 | From 2004 onwards, Cd emissions present slight variations in absolute terms, in line with the remaining of burning of residues from crops in open field with authorization for phytosanitary reasons. |

**Figure 5.2.10 Evolution of Cd by category and distribution in year 2024 (NT)**




| | | |
|---|---|---|
| ***Hg*** | 0.008 t emitted in 2024 (0.008 t without Canary Islands)<br>0.26% of the total Hg emissions of the Inventory in 2024 (0.33% without Canary Islands) | |
| | 1990-2003 | Hg emissions exclusively come from category 3F whose fall in 2000-2003 is explained in the previous boxes. From 1990 until 1999, the activity evolves with the agricultural productivity. |
| | 2004-2024 | From 2004 onwards, Hg emissions present slight variations in absolute terms, in line with the remaining of burning of residues from crops in open field with authorization for phytosanitary reasons. |

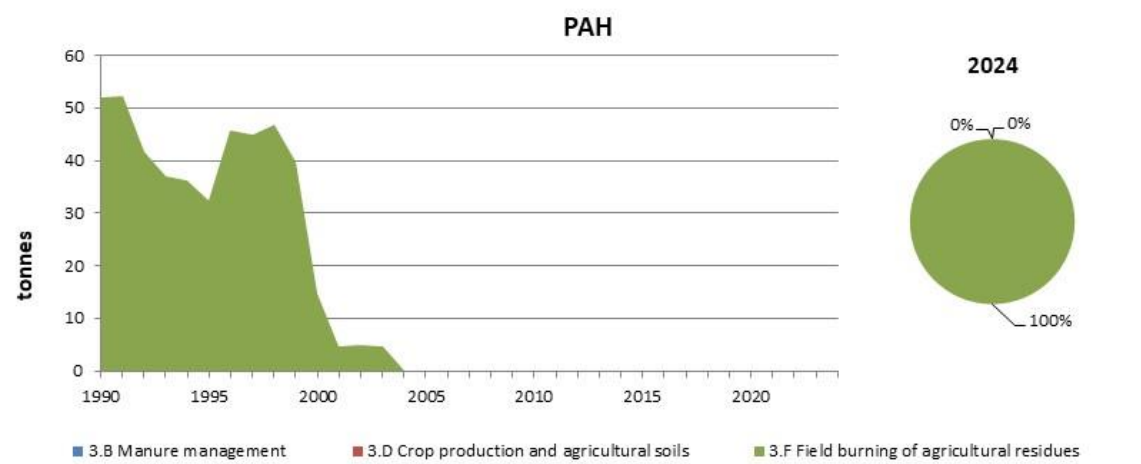
**Figure 5.2.11 Evolution of Hg by category and distribution in year 2024 (NT)**




| | | |
|---|---|---|
| ***Pb*** | 0.006 t emitted in 2023 (0.006 t without Canary Islands)<br>0.01% of the total Pb emissions of the Inventory in 2023 (0.01% without Canary Islands) | |
| | 1990-2003 | Pb emissions exclusively come from category 3F whose fall in 2000-2003 is explained in the previous boxes. From 1990 until 1999, the activity evolves with the agricultural productivity. |
| | 2004-2024 | From 2004 onwards, Pb emissions present slight variations in absolute terms, in line with the remaining of burning of residues from crops in open field with authorization for phytosanitary reasons. |

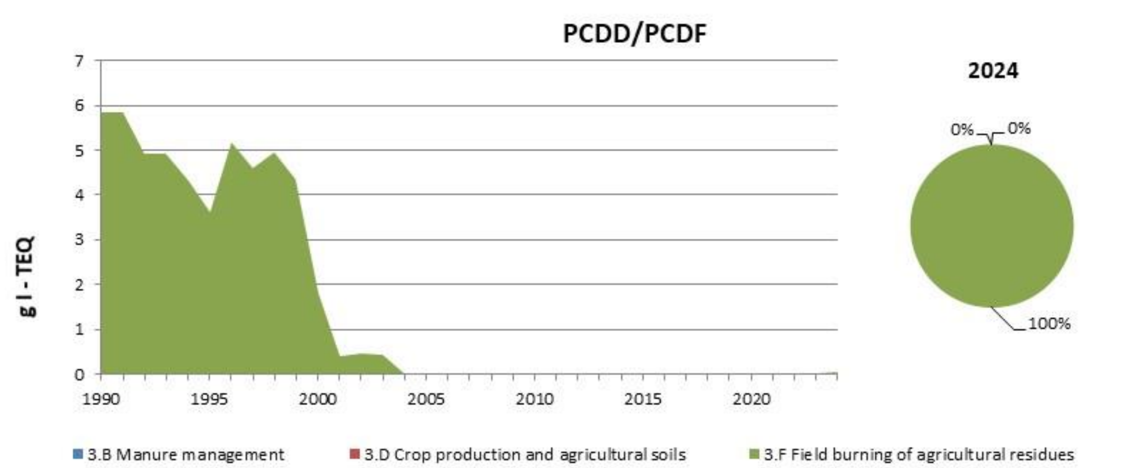
**Figure 5.2.12 Evolution of Pb by category and distribution in year 2024 (NT)**

## POPs



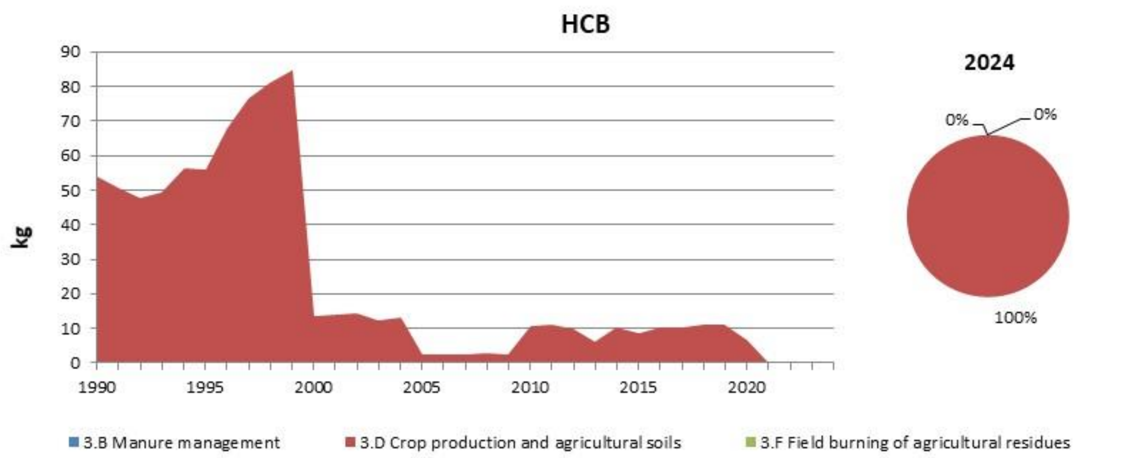

| | | |
|---|---|---|
| ***PAH*** | 0.13 tonnes emitted in 2024 (0.13 tonnes without Canary Islands)<br>0.38% of the total PAH emissions of the Inventory in 2024 (0.39% without Canary Islands) | |
| | 1990-2003 | PAH emissions exclusively come from category 3F whose fall in 2000-2003 is explained in the previous boxes. From 1990 until 1999, the activity evolves with the agricultural productivity. |
| | 2004-2024 | From 2004 onwards, PAH emissions present slight variations in absolute terms, in line with the remaining of burning of residues from crops in open field with authorization for phytosanitary reasons. |

**Figure 5.2.13 Evolution of PAH by category and distribution in year 2024 (NT)**




| | | |
|---|---|---|
| ***PCDD/F*** | 0.029 g I-TEQ emitted in 2024 (0.029 g I-TEQ without Canary Islands)<br>0.02% of the total PCDD/PCDF emissions of the Inventory in 2024 (0.02% without Canary Islands) | |
| | 1990-2003 | PCDD/PCDF emissions exclusively come from category 3F whose fall in 2000-2003 is explained in the previous boxes. From 1990 until 1999, the activity evolves with the agricultural productivity. |
| | 2004-2024 | From 2004 onwards, PCDD/PCDF emissions present slight variations in absolute terms, in line with the remaining of burning of residues from crops in open field with authorization for phytosanitary reasons. |

**Figure 5.2.14 Evolution of PCDD/PCDF by category and distribution in year 2024 (NT)**




| | | |
|---|---|---|
| ***HCB*** | 0.046 kg emitted in 2024 (0.046 kg without Canary Islands)<br>2.34% of the total HCB emissions of the Inventory in 2024 (2.40% without Canary Islands) | |
| | 1990-2024 | HCB emissions exclusively come from category 3Df (use of pesticides), whose fall in 1999-2001 is due to prohibition use of lindane and change in HCB-concentration (impurity factor) for chlorothalonil. The prohibition use of simazine was applied in 2005 and clopyralid began to use in 2007. The prohibition use of chlorothalonil has been applied in 2020. Currently, the only active substance with HCB impurities used is clopyralid. |

**Figure 5.2.15 Evolution of HCB by category and distribution in year 2024 (NT)**

## 5.2.3. Condensable component of $PM_{10}$ and $PM_{2.5}$

As detailed in Annex V, indication of whether the emission estimates and emission factors for $PM_{10}$ and $PM_{2.5}$ in the Agriculture sector include or exclude the condensable component can be found in the table below:

**Table 5.2.3 Information on condensable component of PM**

| NFR | Source/sector name | PM emissions: the condensable component is | | EF reference and comments |
|---|---|---|---|---|
| | | included | excluded | |
| **3B1a** | Dairy Cattle | No information available | | EF from EEA/EMEP Guidebook (2023) |
| **3B1b** | Non-Dairy Cattle | No information available | | EF from EEA/EMEP Guidebook (2023) |
| **3B2** | Sheep | No information available | | EF from EEA/EMEP Guidebook (2023) |
| **3B3** | Swine | No information available | | EF from EEA/EMEP Guidebook (2023) |
| **3B4d** | Goats | No information available | | EF from EEA/EMEP Guidebook (2023) |
| **3B4e** | Horses | No information available | | EF from EEA/EMEP Guidebook (2023) |
| **3B4f** | Mules and Asses | No information available | | EF from EEA/EMEP Guidebook (2023) |
| **3B4gi** | Laying Hens | No information available | | EF from EEA/EMEP Guidebook (2023) |
| **3B4gii** | Broilers | No information available | | EF from EEA/EMEP Guidebook (2023) |
| **3B4giii** | Turkeys | No information available | | EF from EEA/EMEP Guidebook (2023) |
| **3B4giv** | Other Poultry | No information available | | EF from EEA/EMEP Guidebook (2023) |
| **3B4h** | Other animals-Rabbits | No information available | | EF from EEA/EMEP Guidebook (2023) |
| **3Dc** | Farm-level agricultural operations including storage, handling and transport of agricultural products | | X | EF from EEA/EMEP Guidebook (2023) |

| NFR | Source/sector name | PM emissions: the condensable component is | | EF reference and comments |
|---|---|---|---|---|
| | | included | excluded | |
| **3F** | Field burning of agricultural residues | No information available | | EF from EEA/EMEP Guidebook (2023) |

## 5.3. Major changes

The chapter on agriculture was thoroughly reviewed in the 2017 edition of the inventory to adapt it to EMEP/EEA Guidebook (2016). Subsequent editions of the inventory have been adapted to the new requirements EMEP/EEA Gb 2019 and EMEP/EEA Gb 2023.

The table below summarizes the major changes performed in the Agriculture sector in the current Inventory edition (Ed. 2026) (see table 5.5.1).

**Table 5.3.1 Major changes in Agriculture sector in Inventory edition 2026**

| NFR Category | Activities included | Pollutant | Type of change |
|---|---|---|---|
| **3B3** (Swine) | - Manure management / Swine. | $NO_X$, $NH_3$, NMVOC | Recalculation and updating values of the VA (Variable Activity). |
| **3B4e** (Horses), **3B4f** (Mules and asses) | - Manure management / Horses, Mules and asses. | $NO_X$, $NH_3$, NMVOC, $PM_{2.5}$, $PM_{10}$, TSP | Recalculation and updating values of the VA. |
| **3B4gi** (Laying hens), **3B4gii** (Broilers) | - Manure management / Laying hens, Broilers. | $NO_X$, $NH_3$, NMVOC | Recalculation and updating values of the VA. |
| **3B4h** (Rabbits) | - Manure management / Rabbits. | $NO_X$, $NH_3$, NMVOC, $PM_{2.5}$, $PM_{10}$, TSP | Updating values of the VA. |
| **3Da1** (Inorganic N-fertilizers) | - Inorganic N-fertilizers (also includes urea application). | $NH_3$ | Recalculation. |
| **3Da2a** (Animal manure applied to soils) | - Animal manure applied to soils. | $NO_X$, $NH_3$, NMVOC | Recalculation and updating values of the VA. |
| **3Da2b, 3Da2c** (Sewage sludge and compost applied to soils) | - Sewage sludge and compost applied to soils. | $NO_X$, $NH_3$ | Updating values of the VA. |
| **3Da3** (Urine and dung deposited by grazing animals) | - Urine and dung deposited by grazing animals. | $NO_X$, $NH_3$, NMVOC | Updating values of the VA. |
| **3Da4** (Crop residues applied to soils) | - Crop residues applied to soils. | $NH_3$ | Updating values of the VA. |
| **3Dc** (Farm-level agricultural operations) | - Farm-level agricultural operations including storage, handling and transport of agricultural products. | $PM_{2.5}$, $PM_{10}$, TSP | Updating values of the VA. |
| **3De** (Cultivated crops) | - Cultivated crops. | NMVOC | Updating values of the VA. |
| **3F** (Field burning of agricultural residues) | - Field burning of agricultural residues. | $NO_X$, NMVOC, $SO_2$, $NH_3$, $PM_{2.5}$, $PM_{10}$, TSP, BC, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, PCDD/PCDF, PAHs | Updating values of the VA. |

## 5.4. Key categories analysis

Within this sector, the following categories have been identified as key (check table 5.2.2 for reference):

A. Manure management - 3B

B. Crop production and agricultural soils - 3D

C. Field burning of agricultural residues - 3F

Activity data sources, methodologies and a general assessment for each category are provided in the following paragraphs.

## A. Manure management (3B)

Category 3B "Manure management" is considered as a key category for its contribution to the level of $PM_{2.5}$ and $PM_{10}$ emissions and for its contribution to the level and the trend of emissions of the following pollutants NMVOC, $NH_3$ and TSP.

### A.1. Activity variables

Activity variables mainly consist of livestock census and its derived variable "Annual Average Population", per species and homogeneous categories in terms of emissions. Data from new zootechnical documents, updated REGA and Husbandry and slaughterhouse surveys, performed under European Regulation No. 1165/2008, are compiled by the Statistical Office (MAPA). Results are available in the official web of the Ministry of Agriculture, Fishing and Food.

**Table 5.4.1 Summary of activity variables, data and information sources for category 3B (Manure management)**

| Activities included | Activity data | Source of information |
|---|---|---|
| Manure management /<br>- Dairy cattle (3B1a)<br>- Non-dairy cattle (3B1b)<br>- Sheep (3B2)<br>- Swine (3B3)<br>- Goats (3B4d) | - Annual census and provincial distribution. | - Zootechnical document[5]<br>- Official Husbandry Surveys[6]<br>- MAPA's Statistic Yearbook[7] |
| Manure management /<br>- Horses (3B4e)<br>- Mules and asses (3B4f) | - Annual census and provincial distribution. | - Zootechnical document[7]<br>- REGA[8] (General Registry of Livestock Farming).<br>- RIIA (Registry of Individual Animal Identification). |
| Manure management /<br>- Laying hens (3B4gi)<br>- Broilers (3B4gii)<br>- Turkeys (3B4giii)<br>- Other poultry (3B4giv) | - Monthly sacrificed livestock heads in national territory.<br>- Annual census and provincial distribution. | - Zootechnical document[7]<br>- MAPA's Statistic Yearbook[9]<br>- REGA (General Registry of Livestock Farming)[10] |
| Manure management /<br>- Rabbits (3B4h) | - Annual sacrificed livestock.<br>- Annual census and provincial distribution. | - MAPA's Statistic Yearbook[9] |

### A.2. Methodology

The following table summarises the methodologies applied in this chapter. Methodology level and sources are provided for reference.

**Table 5.4.2 Summary of methodologies applied in category 3B (Manure management)**

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| ***Cattle (3B1a-3B1b)*** | | | |
| NOx | T2 | - Country specific methodology. | - Total and ammoniacal N-excreted and pasture distribution. |

[5] See Table 5.4.3.

[6] Official statistical information from husbandry can be consulted at: https://www.mapa.gob.es/es/estadistica/temas/estadisticas-agrarias/ganaderia/default.aspx

[7] https://www.mapa.gob.es/es/estadistica/temas/publicaciones/anuario-de-estadistica/default.aspx

[8] https://www.mapa.gob.es/es/ganaderia/temas/trazabilidad-animal/sitran/

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| | | | - Manure management system from 2010 onwards, with progressive implementation since 1990(***). |
| | | - IPCC 2019 Refinement Guidebook. | - Manure management system averages (Table 10A.6) from 1990 to 2009, with progressive dis-implementation between 1991 and 2009. |
| | | - EMEP/EEA Guidebook (2023). | - EF (3.B Manure management-section 3.4 —Tier 2 technology specific approach - Table 3.10) (N-mass balance).<br>- Detailed methodological factsheets (MITECO)(*). |
| NMVOC | T2 | - Country specific methodology. | - Feed intake, silage feeding and pasture distribution.<br>- Manure management system from 2010 onwards, with progressive implementation since 1990(***). |
| | | - IPCC 2019 Refinement Guidebook. | - Manure management system averages (Table 10A.6) from 1990 to 2009, with progressive dis-implementation between 1991 and 2009. |
| | | - EMEP/EEA Guidebook (2023). | - NMVOC EF (3.B Manure management-Table 3.11).<br>- $NH_3$ emissions (3.B Manure management).<br>- Fraction of silage store.<br>- Detailed methodological factsheets (MITECO)(*). |
| $NH_3$ | T2 | - Country specific methodology. | - Total and ammoniacal N-excreted and pasture distribution.<br>- Manure management system from 2010 onwards, with progressive implementation since 1990(***).<br>- BATs from 2010 MAPA surveys(***), with progressive implementation since 2003. |
| | | - IPCC 2019 Refinement Guidebook. | - Manure management system averages (Table 10A.6) from 1990 to 2009, with progressive dis-implementation between 1991 and 2009. |
| | | - EMEP/EEA Guidebook (2023). | - EF (3.B Manure management- section 3.4 – Tier 2 technology specific approach, Table 3.9) (N-mass balance).-specific approach, Table 3.9) (N-mass balance).<br>- Detailed methodological factsheets (MITECO)(*). |
| $PM_{2.5}$, $PM_{10}$, TSP | T1 | - Country specific methodology. | - Housing period. |
| | | - EMEP/EEA Guidebook (2023). | - EF (3.B Manure management-Table 3.5). |
| ***Sheep (3B2)*** | | | |
| NOx | T2 | - Country specific methodology. | - Total and ammoniacal N-excreted.<br>- Manure management system and pasture distribution. |
| | | - EMEP/EEA Guidebook (2023). | - EF (3.B Manure management- section 3.4 – Tier 2 technology specific approach, Table 3.10) (N-mass balance).-specific approach, Table 3.10) (N-mass balance).<br>- Detailed methodological factsheets (MITECO)(*). |
| NMVOC | T2 | - Country specific methodology. | - VS excreted, silage feeding, pasture distribution and manure management system. |
| | | - EMEP/EEA Guidebook (2023). | - NMVOC EF (3.B Manure management-Table 3.12).<br>- $NH_3$ emissions (3.B Manure management).<br>- Fraction of silage store.<br>- Detailed methodological factsheets (MITECO)(*). |
| $NH_3$ | T2 | - Country specific methodology. | - Total and ammoniacal N-excreted.<br>- Manure management system and pasture distribution. |
| | | - EMEP/EEA Guidebook (2023). | - EF (3.B Manure management- section 3.4 – Tier 2 technology specific approach, Table 3.9) (N-mass balance).-specific approach, Table 3.9) (N-mass balance).<br>- Detailed methodological factsheets (MITECO)(*). |
| $PM_{2.5}$, $PM_{10}$, TSP | T1 | - Country specific methodology. | - Housing period. |
| | | - EMEP/EEA Guidebook (2023). | - EF (3.B Manure management-Table 3.5). |

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| ***Swine (3B3)*** | | | |
| NOx | T3 | - Country specific methodology. | - Total and ammoniacal N-excreted (zootechnical document (1990-2021) and ECOGAN(**) (2022, 2023 and 2024) for white swine and only zootechnical document for Iberian swine.<br>- Manure management system from 2015 onwards, with progressive implementation since 1990.<br>- Pasture distribution for Iberian swine. |
| | | - IPCC 2019 Refinement Guidebook. | - Manure management system averages (Table 10A.7), with progressive dis-implementation between 1991 and 2014. |
| | | - EMEP/EEA Guidebook (2023). | - EF (3.B Manure management- section 3.4 – Tier 2 technology specific approach, Table 3.10) (N-mass balance).-specific approach, Table 3.10) (N-mass balance).<br>- Detailed methodological factsheets (MITECO)(*). |
| NMVOC | T3 | - Country specific methodology. | - VS excreted, silage feeding, pasture distribution and manure management system from 2015 onwards. |
| | | - IPCC 2019 Refinement Guidebook. | - Manure management system averages (Table 10A.7), with progressive dis-implementation between 1991 and 2014. |
| | | - EMEP/EEA Guidebook (2023). | - NMVOC EF (3.B Manure management-Table 3.12).<br>- $NH_3$ emissions (3.B Manure management).<br>- Fraction of silage store.<br>- Detailed methodological factsheets (MITECO)(*). |
| $NH_3$ | T3 | - Country specific methodology. | - Total and ammoniacal N-excreted (zootechnical document (1990-2021) and ECOGAN(**) (2022, 2023 and 2024) for white swine and only zootechnical document for Iberian swine.<br>- Manure management system from 2015 onwards, with progressive implementation since 1990.<br>- Pasture distribution for Iberian swine.<br>- BATs from 2015 surveys, with progressive implementation since 2003 and progressive dis-implementation between 2015 and 2020; BATs from ECOGAN(**) data from 2022, 2023 and 2024, with progressive implementation of 2022 data since 2015. |
| | | - IPCC 2019 Refinement Guidebook. | - Manure management system averages (Table 10A.7), with progressive dis-implementation between 1991 and 2014. |
| | | - EMEP/EEA Guidebook (2023). | - EF (3.B Manure management- section 3.4 – Tier 2 technology specific approach, Table 3.9) (N-mass balance).-specific approach, Table 3.9) (N-mass balance).<br>- Detailed methodological factsheets (MITECO)(*). |
| $PM_{2.5}$, $PM_{10}$, TSP | T1 | - Country specific methodology. | - Housing period. |
| | | - EMEP/EEA Guidebook (2023). | - EF (3.B Manure management-Table 3.5). |
| ***Goats (3B4d)*** | | | |
| NOx | T2 | - Country specific methodology. | - Total and ammoniacal N-excreted.<br>- Manure management system and pasture distribution. |
| | | - EMEP/EEA Guidebook (2023). | - EF (3.B Manure management- section 3.4 - Tier 2 technology specific approach, Table 3.10) (N-mass balance).-specific approach, Table 3.10) (N-mass balance).<br>- Detailed methodological factsheets (MITECO)(*). |
| NMVOC | T2 | - Country specific methodology. | - VS excreted, silage feeding, pasture distribution and manure management system. |
| | | - EMEP/EEA Guidebook (2023). | - NMVOC EF (3.B Manure management-Table 3.12).<br>- $NH_3$ emissions (3.B Manure management).<br>- Fraction of silage store.<br>- Detailed methodological factsheets (MITECO)(*). |
| $NH_3$ | T2 | - Country specific methodology. | - Total and ammoniacal N-excreted. |

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| | | | - Manure management system and pasture distribution. |
| | | - EMEP/EEA Guidebook (2023). | - EF (3.B Manure management- section 3.4 – Tier 2 technology specific approach, Table 3.9) (N-mass balance).-specific approach, Table 3.9) (N-mass balance).<br>- Detailed methodological factsheets (MITECO)(*). |
| $PM_{2.5}$, $PM_{10}$, TSP | T1 | - Country specific methodology. | - Housing period. |
| | | - EMEP/EEA Guidebook (2023). | - EF (3.B Manure management-Table 3.5). |
| ***Horses (3B4e), Mules and Assess (3B4f)*** | | | |
| NOx | T2 | - Country specific methodology. | - Total and ammoniacal N-excreted.<br>- Manure management system and pasture distribution. |
| | | - EMEP/EEA Guidebook (2023). | - EF (3.B Manure management- section 3.4 - Tier 2 technology specific approach, Table 3.10) (N-mass balance).-specific approach, Table 3.10) (N-mass balance).<br>- Detailed methodological factsheets (MITECO)(*). |
| NMVOC | T2 | - Country specific methodology. | - VS excreted, silage feeding, pasture distribution and manure management system. |
| | | - EMEP/EEA Guidebook (2023). | - NMVOC EF (3.B Manure management-Table 3.12).<br>- $NH_3$ emissions (3.B Manure management).<br>- Fraction of silage store.<br>- Detailed methodological factsheets (MITECO)(*). |
| $NH_3$ | T2 | - Country specific methodology. | - Total and ammoniacal N-excreted.<br>- Manure management system and pasture distribution. |
| | | - EMEP/EEA Guidebook (2023). | - EF (3.B Manure management- section 3.4 – Tier 2 technology specific approach, Table 3.9) (N-mass balance).-specific approach, Table 3.9) (N-mass balance).<br>- Detailed methodological factsheets (MITECO)(*). |
| $PM_{2.5}$, $PM_{10}$, TSP | T1 | - Country specific methodology. | - Housing period. |
| | | - EMEP/EEA Guidebook (2023). | - EF (3.B Manure management-Table 3.5). |
| ***Laying hens (3B4gi)*** | | | |
| NOx | T2 | - Country specific methodology. | - Total and ammoniacal N-excreted (zootechnical document (1990-2022) and ECOGAN(**) (2023 and 2024).<br>- Manure management system(***). |
| | | - EMEP/EEA Guidebook (2023). | - EF (3.B Manure management- section 3.4 - Tier 2 technology specific approach, Table 3.10) (N-mass balance).-specific approach, Table 3.10) (N-mass balance).<br>- Detailed methodological factsheets (MITECO)(*). |
| NMVOC | T2 | - Country specific methodology. | - VS excreted.<br>- Manure management system(***). |
| | | - EMEP/EEA Guidebook (2023). | - NMVOC EF (3.B Manure management-Table 3.12).<br>- $NH_3$ emissions (3.B Manure management).<br>- Detailed methodological factsheets (MITECO)(*). |
| $NH_3$ | T3 | - Country specific methodology. | - Total and ammoniacal N-excreted (zootechnical document (1990-2022) and ECOGAN(**) (2023 and 2024).<br>- Manure management system(***).<br>- BATs from 2010 MAPA surveys(***), with progressive implementation since 2003 and progressive dis-implementation between 2015 and 2022; BATs from ECOGAN(**) data from 2023 and 2024, with progressive implementation of the 2023 data since 2015. |
| | | - EMEP/EEA Guidebook (2023). | - EF (3.B Manure management- section 3.4 - Tier 2 technology specific approach, Table 3.9) (N-mass balance).-specific approach, Table 3.9) (N-mass balance).<br>- Detailed methodological factsheets (MITECO)(*). |
| $PM_{2.5}$, $PM_{10}$, TSP | T1 | - Country specific methodology. | - Housing period. |
| | | - EMEP/EEA Guidebook (2023). | - EF (3.B Manure management-Table 3.5). |

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| ***Broilers (3B4gii)*** | | | |
| NOx | T2 | - Country specific methodology. | - Total and ammoniacal N-excreted (zootechnical document (1990-2022) and ECOGAN(**) (2023 and 2024).<br>- Manure management system. |
| | | - EMEP/EEA Guidebook (2023). | - EF (3.B Manure management- section 3.4 - Tier 2 technology specific approach, Table 3.10) (N-mass balance).-specific approach, Table 3.10) (N-mass balance).<br>- Detailed methodological factsheets (MITECO)(*). |
| NMVOC | T2 | - Country specific methodology. | - VS excreted and manure management system. |
| | | - EMEP/EEA Guidebook (2023). | - NMVOC EF (3.B Manure management-Table 3.12).<br>- $NH_3$ emissions (3.B Manure management).<br>- Detailed methodological factsheets (MITECO)(*). |
| $NH_3$ | T3 | - Country specific methodology. | - Total and ammoniacal N-excreted (zootechnical document (1990-2022) and ECOGAN(**) (2023 and 2024).<br>- Manure management system.<br>- BATs from ECOGAN(**) data from 2023 and 2024, with progressive implementation of the 2023 data since 2015. |
| | | - EMEP/EEA Guidebook (2023). | - EF (3.B Manure management- section 3.4 – Tier 2 technology specific approach, Table 3.9) (N-mass balance).-specific approach, Table 3.9) (N-mass balance).<br>- Detailed methodological factsheets (MITECO)(*). |
| $PM_{2.5}$, $PM_{10}$, TSP | T1 | - Country specific methodology. | - Housing period. |
| | | - EMEP/EEA Guidebook (2023). | - EF (3.B Manure management-Table 3.5). |
| ***Turkeys (3B4giii), Ducks and other poultry (3B4giv)*** | | | |
| NOx | T2 | - Country specific methodology. | - Total and ammoniacal N-excreted.<br>- Manure management system. |
| | | - EMEP/EEA Guidebook (2023). | - EF (3.B Manure management- section 3.4 - Tier 2 technology specific approach, Table 3.10) (N-mass balance).-specific approach, Table 3.10) (N-mass balance).<br>- Detailed methodological factsheets (MITECO)(*). |
| NMVOC | T2 | - Country specific methodology. | - VS excreted and manure management system. |
| | | - EMEP/EEA Guidebook (2023). | - NMVOC EF (3.B Manure management-Table 3.12).<br>- $NH_3$ emissions (3.B Manure management).<br>- Detailed methodological factsheets (MITECO)(*). |
| $NH_3$ | T2 | - Country specific methodology. | - Total and ammoniacal N-excreted.<br>- Manure management system. |
| | | - EMEP/EEA Guidebook (2023). | - EF (3.B Manure management- section 3.4 – Tier 2 technology specific approach, Table 3.9) (N-mass balance).-specific approach, Table 3.9) (N-mass balance).<br>- Detailed methodological factsheets (MITECO)(*). |
| $PM_{2.5}$, $PM_{10}$, TSP | T1 | - Country specific methodology. | - Housing period. |
| | | - EMEP/EEA Guidebook (2023). | - EF (3.B Manure management-Table 3.5). |
| ***Rabbits (3B4h)*** | | | |
| NOx | T1/ T2 | - IPCC Reference Manual 2019 Refinement. | - N excreted.<br>- Manure management system averages (Table 10A.9). |
| | | - Country specific methodology. | - Manure management system. |
| | | - EMEP/EEA Guidebook (2023). | - EF and TAN (3.B Manure management- section 3.4 - Tier 2 technology specific approach, Table 3.9) (N-mass balance).-specific approach, Table 3.9) (N-mass balance). |
| NMVOC | T1/ T2 | - IPCC Reference Manual 2019 Refinement. | - VS excreted (Table 10.15).<br>- Manure management system averages (Table 10A.9). |
| | | - Country specific methodology. | - Manure management system. |
| | | - EMEP/EEA Guidebook (2023). | - NMVOC EF (3.B Manure management-Table 3.12).<br>- $NH_3$ emissions (3.B Manure management). |

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| $NH_3$ | T1/ T2 | - IPCC Reference Manual 2019 Refinement. | - N excreted.<br>- Manure management system averages (Table 10A.9). |
| | | - Country specific methodology. | - Manure management system. |
| | | - EMEP/EEA Guidebook (2023). | - EF and TAN (3.B Manure management- section 3.4 - Tier 2 technology specific approach, Table 3.9) (N-mass balance).-specific approach, Table 3.9) (N-mass balance). |
| $PM_{2.5}$, $PM_{10}$, TSP | T1 | - Country specific methodology. | - Housing period. |
| | | - EMEP/EEA Guidebook (2023). | - EF (3.B Manure management-Table 3.5). |

(*) https://www.miteco.gob.es/es/calidad-y-evaluacion-ambiental/temas/sistema-espanol-de-inventario-sei-/metodologias-estimacion-emisiones.html
Methodological factsheets: 3B-NH3 and NOx, 3B-NMVOC, 3B-PM
(**) https://www.mapa.gob.es/es/ganaderia/temas/ganaderia-y-medio-ambiente/calculo-emisiones/default.aspx
(***) MAPA surveys and descriptive studies.
https://www.mapa.gob.es/es/ganaderia/publicaciones/Bovino%20cebo_tcm30-105325.pdf
https://www.mapa.gob.es/es/ganaderia/publicaciones/Bovino%20leche_tcm30-105326.pdf
https://www.mapa.gob.es/es/ganaderia/publicaciones/AVES%20DE%20PUESTA_tcm30-105324.pdf

The following table summarises the country specific zootechnical information provided by the collection of documents "Bases Zootécnicas para el cálculo del balance alimentario de nitrógeno y de fósforo"[9] whose parameters are applied in emission calculations.

### Table 5.4.3 Country specific technical information and zootechnical documents

| Animal | Zootechnical document – Country specific technical information |
|---|---|
| **Dairy cattle** | Document completed and published.<br>"Bases zootécnicas para el cálculo del balance alimentario de nitrógeno y fósforo en bovino." |
| **Non-dairy cattle** | Document completed and published.<br>"Bases zootécnicas para el cálculo del balance alimentario de nitrógeno y fósforo en bovino." |
| **Sheep** | Document completed and published.<br>"Bases zootécnicas para el cálculo del balance alimentario de nitrógeno y fósforo en ovino." |
| **White swine** | Document completed and published.<br>"Bases zootécnicas para el cálculo del balance alimentario de nitrógeno y fósforo en porcino blanco." |
| **Iberian swine** | Document completed and published.<br>"Bases zootécnicas para el cálculo del balance alimentario de nitrógeno y fósforo en porcino ibérico." |
| **Goats** | Document completed and published.<br>"Bases zootécnicas para el cálculo del balance alimentario de nitrógeno y fósforo en caprino." |
| **Horses** | Document completed and published.<br>"Bases zootécnicas para el cálculo del balance alimentario de nitrógeno y fósforo en équidos." |
| **Mules and asses** | Document completed and published.<br>"Bases zootécnicas para el cálculo del balance alimentario de nitrógeno y fósforo en équidos." |
| **Laying hens** | Document completed and published.<br>"Bases zootécnicas para el cálculo del balance alimentario de nitrógeno y fósforo en aves de puesta." |
| **Broilers** | Document completed and published.<br>"Bases zootécnicas para el cálculo del balance alimentario de nitrógeno y fósforo en aves de carne." |
| **Turkeys, ducks and other poultry** | Document completed. Publication planned for the 2nd semester of 2026.<br>"Bases zootécnicas para el cálculo del balance alimentario de nitrógeno y fósforo en pavos y patos." |

[9] https://www.mapa.gob.es/es/ganaderia/temas/ganaderia-y-medio-ambiente/balance-de-nitrogeno-e-inventario-de-emisiones-de-gases/default.aspx

| Animal | Zootechnical document – Country specific technical information |
|---|---|
| **Rabbits** | MAPA information (Ministry for Agriculture, Fisheries and Food)[10]. |

## A.3. Assessment

From the base year, population of swine, horses, mules-asses, non-dairy cattle, and poultry have increased in number of heads, while dairy cattle, sheep-goats and rabbits steadily decrease.

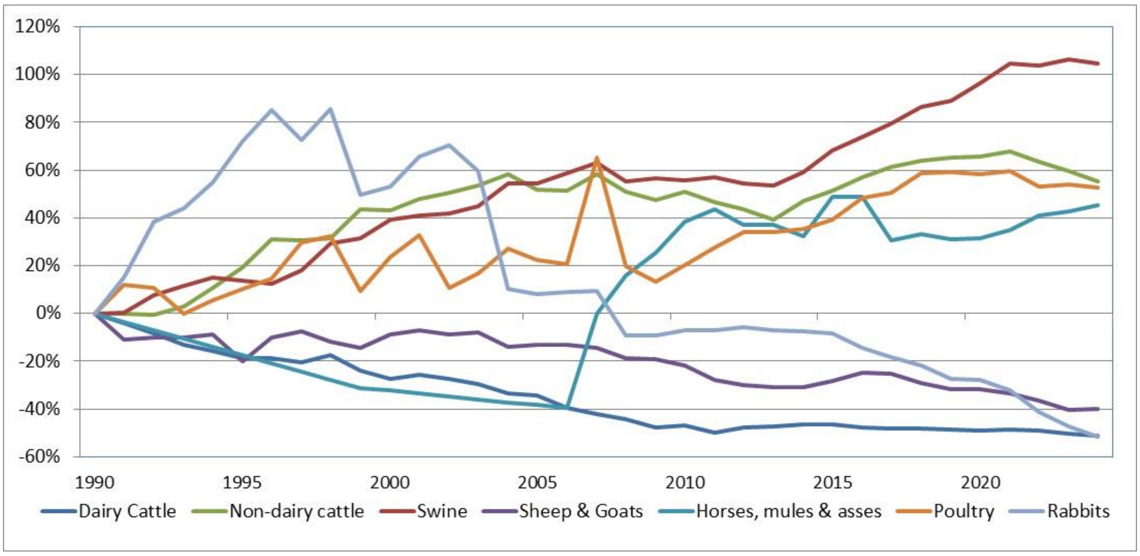



**Figure 5.4.1 Variation in animal number from 1990 (%) (national territory)**

In the following table, the values of livestock numbers, N excretion rates, TAN fraction and use of the different Manure Management Systems (MMS) by animal (cattle and swine subcategories included) for the time series are provided[11].

Disaggregated values have been included for swine subcategories (Iberian and white)[12].

**Table 5.4.4 Values of livestock numbers, N excretion rates and use of MMS by animal (national territory)**

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|
| **Dairy Cattle (3B1a)** | | | | | | | | |
| **Population (1000s)** | **1,587.8** | **1,045.1** | **841.4** | **848.7** | **814.1** | **810.5** | **789.9** | **778.7** |
| **N excr (kg/head/year)** | 86.4 | 101.6 | 112.9 | 118.2 | 118.5 | 125.6 | 125.6 | 125.7 |
| **TAN (Fraction)** | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| **Total N excr (ton/year)** | **137,170.4** | **106,230.0** | **94,989.6** | **100,345.2** | **96,484.3** | **101,813.7** | **99,194.3** | **97,889.7** |
| ***N excretion per MMS*** | | | | | | | | |
| **Anaerobic lagoon** | 0,0 | 5,115.0 | 6,098.3 | 6,442.2 | 6,194.3 | 6,536.4 | 6,368.3 | 6,284.5 |
| **Liquid system** | 79,707.0 | 48,126.4 | 38,979.9 | 41,177.6 | 39,593.3 | 41,780.2 | 40,705.3 | 40,170.0 |
| **Daily spread** | 3,707.7 | 717.8 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 |
| **Solid storage and dry lot** | 53,755.7 | 44,239.1 | 40,335.6 | 42,609.8 | 40,970.3 | 43,233.3 | 42,121.0 | 41,567.1 |
| **Pasture** | - | - | - | - | - | - | - | - |
| **Digesters** | - | - | - | - | - | - | - | - |

[10] https://www.mapa.gob.es/es/ganaderia/temas/produccion-y-mercados-ganaderos/sectores-ganaderos/

[11] Recommendation made by the ERT in the 2019 NECD Final Review Report.

[12] Recommendation made by the ERT in the 2020 NECD Final Review Report.

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|
| **Pit storage** | 0,0 | 1,659.0 | 1,977.9 | 2,089.4 | 2,009.0 | 2,120.0 | 2,065.4 | 2,038.3 |
| **Deep bedding** | 0,0 | 6,372.7 | 7,597.9 | 8,026.3 | 7,717.5 | 8,143.7 | 7,934.2 | 7,829.9 |
| **Other** | - | - | - | - | - | - | - | - |
| **Non-Dairy Cattle (3B1b)** | | | | | | | | |
| **Population (1000s)** | **3,538.4** | **5,378.5** | **5,336.4** | **5,359.8** | **5,847.1** | **5,865.4** | **5,640.2** | **5,498.0** |
| **N excr (kg/head/year)** | 57.1 | 58.9 | 57.2 | 56.9 | 56.8 | 56.8 | 56.7 | 56.8 |
| **TAN (Fraction)** | 0.6 | 0.7 | 0.6 | 0.7 | 0.7 | 0.7 | 0.7 | 0.6 |
| **Total N excr (ton/year)** | **201,870.4** | **317,021.7** | **305,318.0** | **304,970.9** | **331,846.9** | **333,145.1** | **319,694.9** | **312,152.5** |
| ***N excretion per MMS*** | | | | | | | | |
| **Anaerobic lagoon** | - | - | - | - | - | - | - | - |
| **Liquid system** | 37,020.8 | 14,526.5 | 1,728.0 | 1,810.1 | 2,010.6 | 1,873.1 | 1,785.0 | 1,711.4 |
| **Daily spread** | 6,730.7 | 2,346.5 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 |
| **Solid storage and dry lot** | 43,751.5 | 85,247.5 | 74,661.8 | 78,209.7 | 86,875.1 | 80,933.8 | 77,125.5 | 73,944.6 |
| **Pasture** | 114,367.4 | 194,996.4 | 207,696.2 | 202,710.1 | 218,256.1 | 227,322.6 | 218,851.9 | 215,468.5 |
| **Digesters** | - | - | - | - | - | - | - | - |
| **Pit storage** | 0,0 | 1,500.9 | 1,600.9 | 1,677.0 | 1,862.8 | 1,735.4 | 1,653.8 | 1,585.6 |
| **Deep bedding** | 0,0 | 18,403.8 | 19,631.0 | 20,563.9 | 22,842.3 | 21,280.2 | 20,278.8 | 19,442.5 |
| **Other** | - | - | - | - | - | - | - | - |
| **Sheep (3B2)** | | | | | | | | |
| **Population (1000s)** | **24,037.0** | **22,749.5** | **18,551.6** | **16,026.4** | **15,478.6** | **15,439.2** | **13,596.6** | **13,476.0** |
| **N excr (kg/head/year)** | 4.3 | 5.1 | 5.6 | 5.4 | 5.3 | 5.4 | 5.4 | 5.5 |
| **TAN (Fraction)** | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |
| **Total N excr (ton/year)** | **102,610.5** | **115,858.7** | **103,954.0** | **86,772.4** | **82,612.1** | **82,781.8** | **73,219.6** | **73,541.1** |
| ***N excretion per MMS*** | | | | | | | | |
| **Anaerobic lagoon** | - | - | - | - | - | - | - | - |
| **Liquid system** | - | - | - | - | - | - | - | - |
| **Daily spread** | - | - | - | - | - | - | - | - |
| **Solid storage and dry lot** | 13,002.4 | 12,915.8 | 14,191.2 | 12,527.5 | 11,274.7 | 11,269.8 | 9,643.7 | 9,673.7 |
| **Pasture** | 71,988.7 | 85,440.8 | 70,532.5 | 57,269.2 | 56,059.2 | 56,240.4 | 50,507.8 | 50,758.7 |
| **Digesters** | - | - | - | - | - | - | - | - |
| **Pit storage** | - | - | - | - | - | - | - | - |
| **Deep bedding** | 17,619.4 | 17,502.0 | 19,230.2 | 16,975.8 | 15,278.2 | 15,271.6 | 13,068.1 | 13,108.7 |
| **Other** | - | - | - | - | - | - | - | - |
| **Goats (3B4d)** | | | | | | | | |
| **Population (1000s)** | **3,663.3** | **2,904.7** | **2,903.8** | **2,801.1** | **2,659.1** | **2,651.1** | **2,293.5** | **2,361.0** |
| **N excr (kg/head/year)** | 9.3 | 9.5 | 9.7 | 9.0 | 9.3 | 9.4 | 9.5 | 9.5 |
| **TAN (Fraction)** | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| **Total N excr (ton/year)** | **34,204.5** | **27,725.6** | **28,174.4** | **25,343.8** | **24,733.0** | **24,898.8** | **21,787.3** | **22,536.9** |
| ***N excretion per MMS*** | | | | | | | | |
| **Anaerobic lagoon** | - | - | - | - | - | - | - | - |
| **Liquid system** | - | - | - | - | - | - | - | - |
| **Daily spread** | - | - | - | - | - | - | - | - |
| **Solid storage and dry lot** | 2,862.4 | 5,582.3 | 7,419.9 | 5,997.7 | 6,904.9 | 7,264.2 | 6,362.6 | 6,513.1 |
| **Pasture** | 27,463.4 | 14,578.7 | 10,699.8 | 11,218.8 | 8,471.3 | 7,791.0 | 6,802.9 | 7,198.0 |
| **Digesters** | - | - | - | - | - | - | - | - |
| **Pit storage** | - | - | - | - | - | - | - | - |
| **Deep bedding** | 3,878.8 | 7,564.5 | 10,054.6 | 8,127.3 | 9,356.7 | 9,843.6 | 8,621.9 | 8,825.8 |
| **Other** | - | - | - | - | - | - | - | - |
| **Iberian&White Swine (Sows) (3B3)** | | | | | | | | |
| **Population (1000s)** | **1,993.3** | **2,675.5** | **2,611.6** | **2,463.5** | **2,584.5** | **2,625.2** | **2,771.2** | **2,700.4** |
| **N excr (kg/head/year)** | 19.1 | 18.7 | 18.4 | 18.5 | 17.2 | 16.4 | 17.9 | 16.8 |
| **TAN (Fraction)** | 0.689 | 0.748 | 0.734 | 0.731 | 0.706 | 0.695 | 0.694 | 0.695 |
| **Total N excr (ton/year)** | **38,137.7** | **49,994.6** | **47,945.6** | **45,685.8** | **44,427.5** | **43,127.3** | **49,605.8** | **45,321.0** |

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|
| ***N excretion per MMS*** | | | | | | | | |
| **Anaerobic lagoon** | 2,185.0 | 1,091.1 | 718.1 | 217.1 | 257.8 | 201.8 | 205.4 | 194.3 |
| **Liquid system** | 18,572.1 | 15,555.2 | 13,704.4 | 11,035.5 | 10,861.7 | 10,350.1 | 11,865.0 | 10,863.7 |
| **Daily spread** | 364.2 | 561.5 | 579.1 | 591.7 | 567.1 | 555.6 | 645.9 | 589.3 |
| **Solid storage and dry lot** | 5,462.4 | 3,790.8 | 3,081.7 | 2,098.3 | 2,112.0 | 1,966.0 | 2,226.2 | 2,045.0 |
| **Pasture** | 1,721.7 | 4,690.0 | 3,159.3 | 2,386.6 | 2,693.2 | 2,480.2 | 2,489.7 | 2,305.9 |
| **Digesters** | 0,0 | 263.1 | 318.3 | 384.9 | 363.2 | 361.7 | 423.8 | 385.8 |
| **Pit storage** | 9,832.3 | 23,110.0 | 25,255.7 | 27,606.7 | 26,284.8 | 25,929.4 | 30,246.7 | 27,568.7 |
| **Deep bedding** | 0,0 | 932.9 | 1,128.9 | 1,365.0 | 1,287.9 | 1,282.6 | 1,503.0 | 1,368.3 |
| **Other** | - | - | - | - | - | - | - | - |
| **Iberian&White Swine (Finishing/fattening pigs) (3B3)** | | | | | | | | |
| **Population (1000s)** | **14,346.8** | **22,568.6** | **22,809.9** | **24,999.0** | **28,270.3** | **29,460.3** | **30,971.1** | **30,747.6** |
| **N excr (kg/head/year)** | 11.0 | 9.0 | 7.9 | 7.9 | 7.9 | 7.6 | 7.1 | 7.3 |
| **TAN (Fraction)** | 0.719 | 0.730 | 0.722 | 0.709 | 0.695 | 0.685 | 0.685 | 0.685 |
| **Total N excr (ton/year)** | **157,912.9** | **203,095.2** | **180,299.0** | **197,324.5** | **223,792.1** | **224,345.8** | **218,710.2** | **223,847.9** |
| ***N excretion per MMS*** | | | | | | | | |
| **Anaerobic lagoon** | 9,080.2 | 4,402.5 | 2,884.3 | 1,175.0 | 1,583.5 | 1,505.7 | 1,455.8 | 1,491.1 |
| **Liquid system** | 77,182.0 | 62,738.4 | 53,726.9 | 48,808.2 | 55,921.0 | 55,913.2 | 54,491.4 | 55,783.0 |
| **Daily spread** | 1,513.4 | 2,264.1 | 2,246.5 | 2,542.5 | 2,830.7 | 2,857.2 | 2,788.6 | 2,854.4 |
| **Solid storage and dry lot** | 21,187.2 | 14,557.6 | 11,674.1 | 9,312.3 | 10,881.7 | 10,810.8 | 10,525.5 | 10,775.7 |
| **Pasture** | 6,575.7 | 20,406.1 | 6,103.1 | 10,121.5 | 14,060.9 | 13,090.0 | 12,593.5 | 12,862.5 |
| **Digesters** | 0,0 | 1,060.3 | 1,223.4 | 1,625.9 | 1,778.4 | 1,805.8 | 1,764.0 | 1,805.5 |
| **Pit storage** | 42,374.4 | 93,905.7 | 98,102.1 | 117,972.9 | 130,429.1 | 131,959.3 | 128,835.7 | 131,872.8 |
| **Deep bedding** | 0,0 | 3,760.4 | 4,338.7 | 5,766.1 | 6,306.9 | 6,403.9 | 6,255.8 | 6,403.0 |
| **Other** | - | - | - | - | - | - | - | - |
| ***Iberian Swine (Sows) (partial 3B3)*** | | | | | | | | |
| **Population (1000s)** | **93.6** | **245.2** | **367.9** | **316.6** | **372.7** | **333.6** | **344.5** | **339.6** |
| **N excr (kg/head/year)** | 20.2 | 19.6 | 18.8 | 19.0 | 18.8 | 17.5 | 17.2 | 16.3 |
| **TAN (Fraction)** | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.7 | 0.7 | 0.7 |
| **Total N excr (ton/year)** | **1,887.2** | **4,795.1** | **6,922.8** | **6,005.2** | **6,989.1** | **5,843.2** | **5,912.5** | **5,543.8** |
| ***N excretion per MMS*** | | | | | | | | |
| **Anaerobic lagoon** | 9.9 | 6.3 | 225.8 | 217.1 | 257.8 | 201.8 | 205.4 | 194.3 |
| **Liquid system** | 84.4 | 53.6 | 1,919.4 | 1,845.5 | 2,190.9 | 1,715.1 | 1,745.7 | 1,651.3 |
| **Daily spread** | 1.7 | 1.1 | 37.6 | 36.2 | 43.0 | 33.6 | 34.2 | 32.4 |
| **Solid storage and dry lot** | 24.8 | 15.8 | 564.5 | 542.8 | 644.4 | 504.4 | 513.4 | 485.7 |
| **Pasture** | 1,721.7 | 4,690.0 | 3,159.3 | 2,386.6 | 2,693.2 | 2,480.2 | 2,489.7 | 2,305.9 |
| **Digesters** | - | - | - | - | - | - | - | - |
| **Pit storage** | 44.7 | 28.4 | 1,016.2 | 977.0 | 1,159.9 | 908.0 | 924.2 | 874.2 |
| **Deep bedding** | - | - | - | - | - | - | - | - |
| **Other** | - | - | - | - | - | - | - | - |
| ***Iberian Swine (Finishing/fattening pigs) (partial 3B3)*** | | | | | | | | |
| **Population (1000s)** | **621.3** | **1,897.8** | **2,039.3** | **2,293.6** | **2,973.7** | **2,963.8** | **2,892.5** | **2,889.9** |
| **N excr (kg/head/year)** | 12.1 | 11.0 | 11.1 | 13.0 | 13.6 | 12.9 | 12.7 | 13.1 |
| **TAN (Fraction)** | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.7 | 0.7 | 0.7 |
| **Total N excr (ton/year)** | **7,513.2** | **20,904.9** | **22,643.7** | **29,704.7** | **40,452.0** | **38,184.6** | **36,856.2** | **37,714.2** |
| ***N excretion per MMS*** | | | | | | | | |
| **Anaerobic lagoon** | 56.3 | 29.9 | 992.4 | 1,175.0 | 1,583.5 | 1,505.7 | 1,455.8 | 1,491.1 |
| **Liquid system** | 478.1 | 254.4 | 8,435.7 | 9,987.4 | 13,459.5 | 12,798.2 | 12,374.0 | 12,674.4 |
| **Daily spread** | 9.4 | 5.0 | 165.4 | 195.8 | 263.9 | 250.9 | 242.6 | 248.5 |
| **Solid storage and dry lot** | 131.3 | 69.8 | 2,315.7 | 2,741.6 | 3,694.8 | 3,513.2 | 3,396.8 | 3,479.2 |
| **Pasture** | 6,575.7 | 20,406.1 | 6,103.1 | 10,121.5 | 14,060.9 | 13,090.0 | 12,593.5 | 12,862.5 |
| **Digesters** | - | - | - | - | - | - | - | - |

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|
| **Pit storage** | 262.5 | 139.7 | 4,631.4 | 5,483.3 | 7,389.5 | 7,026.5 | 6,793.6 | 6,958.5 |
| **Deep bedding** | - | - | - | - | - | - | - | - |
| **Other** | - | - | - | - | - | - | - | - |
| ***White Swine (Sows) (partial 3B3)*** | | | | | | | | |
| **Population (1000s)** | **1,899.7** | **2,430.2** | **2,243.7** | **2,146.9** | **2,211.8** | **2,291.5** | **2,426.7** | **2,360.8** |
| **N excr (kg/head/year)** | 19.1 | 18.6 | 18.3 | 18.5 | 16.9 | 16.3 | 18.0 | 16.8 |
| **TAN (Fraction)** | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| **Total N excr (ton/year)** | **36,250.5** | **45,199.5** | **41,022.8** | **39,680.6** | **37,438.4** | **37,284.1** | **43,693.3** | **39,777.2** |
| ***N excretion per MMS*** | | | | | | | | |
| **Anaerobic lagoon** | 2,175.0 | 1,084.8 | 492.3 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 |
| **Liquid system** | 18,487.8 | 15,501.6 | 11,785.0 | 9,190.0 | 8,670.7 | 8,635.0 | 10,119.4 | 9,212.4 |
| **Daily spread** | 362.5 | 560.5 | 541.5 | 555.5 | 524.1 | 522.0 | 611.7 | 556.9 |
| **Solid storage and dry lot** | 5,437.6 | 3,775.1 | 2,517.2 | 1,555.5 | 1,467.6 | 1,461.5 | 1,712.8 | 1,559.3 |
| **Pasture** | - | - | - | - | - | - | - | - |
| **Digesters** | 0,0 | 263.1 | 318.3 | 384.9 | 363.2 | 361.7 | 423.8 | 385.8 |
| **Pit storage** | 9,787.6 | 23,081.6 | 24,239.5 | 26,629.6 | 25,124.9 | 25,021.4 | 29,322.6 | 26,694.5 |
| **Deep bedding** | 0,0 | 932.9 | 1,128.9 | 1,365.0 | 1,287.9 | 1,282.6 | 1,503.0 | 1,368.3 |
| **Other** | - | - | - | - | - | - | - | - |
| ***White Swine (Finishing/fattening pigs) (partial 3B3)*** | | | | | | | | |
| **Population (1000s)** | **13,725.5** | **20,670.8** | **20,770.6** | **22,705.4** | **25,296.6** | **26,496.5** | **28,078.6** | **27,857.7** |
| **N excr (kg/head/year)** | 11.0 | 8.8 | 7.6 | 7.4 | 7.2 | 7.0 | 6.5 | 6.7 |
| **TAN (Fraction)** | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| **Total N excr (ton/year)** | **150,399.7** | **182,190.2** | **157,655.3** | **167,619.8** | **183,340.1** | **186,161.2** | **181,853.9** | **186,133.7** |
| ***N excretion per MMS*** | | | | | | | | |
| **Anaerobic lagoon** | 9,024.0 | 4,372.6 | 1,891.9 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 |
| **Liquid system** | 76,703.8 | 62,484.0 | 45,291.2 | 38,820.7 | 42,461.6 | 43,114.9 | 42,117.4 | 43,108.6 |
| **Daily spread** | 1,504.0 | 2,259.2 | 2,081.1 | 2,346.7 | 2,566.8 | 2,606.3 | 2,546.0 | 2,605.9 |
| **Solid storage and dry lot** | 21,056.0 | 14,487.8 | 9,358.4 | 6,570.7 | 7,186.9 | 7,297.5 | 7,128.7 | 7,296.4 |
| **Pasture** | - | - | - | - | - | - | - | - |
| **Digesters** | 0,0 | 1,060.3 | 1,223.4 | 1,625.9 | 1,778.4 | 1,805.8 | 1,764.0 | 1,805.5 |
| **Pit storage** | 42,111.9 | 93,766.0 | 93,470.7 | 112,489.7 | 123,039.6 | 124,932.8 | 122,042.2 | 124,914.3 |
| **Deep bedding** | 0,0 | 3,760.4 | 4,338.7 | 5,766.1 | 6,306.9 | 6,403.9 | 6,255.8 | 6,403.0 |
| **Other** | - | - | - | - | - | - | - | - |
| **Horses (3B4e)** | | | | | | | | |
| **Population (1000s)** | **244.9** | **268.5** | **626.9** | **653.5** | **574.7** | **577.9** | **628.4** | **626.4** |
| **N excr (kg/head/year)** | 54.1 | 54.7 | 54.1 | 52.5 | 53.7 | 53.9 | 54.7 | 55.2 |
| **TAN (Fraction)** | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| **Total N excr (ton/year)** | **13,244.3** | **14,695.5** | **33,921.7** | **34,332.9** | **30,888.2** | **31,166.1** | **34,353.8** | **34,588.9** |
| ***N excretion per MMS*** | | | | | | | | |
| **Anaerobic lagoon** | - | - | - | - | - | - | - | - |
| **Liquid system** | - | - | - | - | - | - | - | - |
| **Daily spread** | - | - | - | - | - | - | - | - |
| **Solid storage and dry lot** | 4,735.6 | 5,458.3 | 10,881.8 | 11,337.6 | 12,060.6 | 12,193.0 | 13,340.7 | 17,411.9 |
| **Pasture** | 7,803.8 | 8,424.7 | 21,420.3 | 21,308.5 | 17,033.2 | 17,159.0 | 19,028.7 | 14,587.1 |
| **Digesters** | - | - | - | - | - | - | - | - |
| **Pit storage** | - | - | - | - | - | - | - | - |
| **Deep bedding** | 704.9 | 812.5 | 1,619.6 | 1,686.8 | 1,794.4 | 1,814.1 | 1,984.4 | 2,589.8 |
| **Other** | - | - | - | - | - | - | - | - |
| **Mules and Asses (3B4f)** | | | | | | | | |
| **Population (1000s)** | **203.1** | **27.7** | **42.8** | **61.5** | **55.8** | **55.4** | **57.9** | **71.1** |
| **N excr (kg/head/year)** | 34.7 | 31.4 | 31.2 | 33.9 | 34.3 | 34.3 | 33.9 | 34.9 |
| **TAN (Fraction)** | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.3 |
| **Total N excr (ton/year)** | **7,052.4** | **870.0** | **1,337.9** | **2,087.2** | **1,917.3** | **1,899.2** | **1,958.5** | **2,482.5** |

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|
| ***N excretion per MMS*** | | | | | | | | |
| **Anaerobic lagoon** | - | - | - | - | - | - | - | - |
| **Liquid system** | - | - | - | - | - | - | - | - |
| **Daily spread** | - | - | - | - | - | - | - | - |
| **Solid storage and dry lot** | 2,873.2 | 275.3 | 357.4 | 750.7 | 740.1 | 724.4 | 694.8 | 997.6 |
| **Pasture** | 3,749.8 | 553.6 | 927.1 | 1,224.3 | 1,066.6 | 1,066.5 | 1,159.8 | 1,335.8 |
| **Digesters** | - | - | - | - | - | - | - | - |
| **Pit storage** | - | - | - | - | - | - | - | - |
| **Deep bedding** | 429.3 | 41.1 | 53.4 | 112.2 | 110.6 | 108.2 | 103.8 | 149.1 |
| **Other** | - | - | - | - | - | - | - | - |
| **Poultry (Laying hens) (3B4gi)** | | | | | | | | |
| **Population (1000s)** | **49,170.7** | **51,141.1** | **51,108.8** | **47,835.3** | **47,692.3** | **50,334.8** | **50,529.7** | **50,746.6** |
| **N excr (kg/head/year)** | 0.7 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |
| **TAN (Fraction)** | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| **Total N excr (ton/year)** | **33,006.6** | **32,981.5** | **31,515.8** | **28,789.4** | **28,986.7** | **31,649.8** | **31,117.1** | **29,478.8** |
| ***N excretion per MMS*** | | | | | | | | |
| **Anaerobic lagoon** | - | - | - | - | - | - | - | - |
| **Liquid system** | 1,515.0 | 1,513.8 | 1,446.6 | 1,321.4 | 1,330.5 | 1,452.7 | 1,428.3 | 1,353.1 |
| **Daily spread** | - | - | - | - | - | - | - | - |
| **Solid storage and dry lot** | - | - | - | - | - | - | - | - |
| **Pasture** | - | - | - | - | - | - | - | - |
| **Digesters** | - | - | - | - | - | - | - | - |
| **Pit storage** | 1,515.0 | 1,513.8 | 1,446.6 | 1,321.4 | 1,330.5 | 1,452.7 | 1,428.3 | 1,353.1 |
| **Deep bedding** | - | - | - | - | - | - | - | - |
| **Other (poultry manure)** | 29,976.6 | 29,953.8 | 28,622.6 | 26,146.6 | 26,325.7 | 28,744.4 | 28,260.5 | 26,772.6 |
| **Poultry (Broilers) (3B4gii)** | | | | | | | | |
| **Population (1000s)** | **65,321.5** | **76,591.7** | **75,920.1** | **79,307.9** | **89,272.3** | **84,397.9** | **86,108.6** | **93,512.1** |
| **N excr (kg/head/year)** | 0.8 | 0.7 | 0.7 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |
| **TAN (Fraction)** | 0.8 | 0.8 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| **Total N excr (ton/year)** | **50,064.1** | **51,763.9** | **49,751.5** | **49,530.5** | **55,753.6** | **54,131.2** | **52,733.8** | **56,357.5** |
| ***N excretion per MMS*** | | | | | | | | |
| **Anaerobic lagoon** | - | - | - | - | - | - | - | - |

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|
| Liquid system | - | - | - | - | - | - | - | - |
| Daily spread | - | - | - | - | - | - | - | - |
| Solid storage and dry lot | - | - | - | - | - | - | - | - |
| Pasture | - | - | - | - | - | - | - | - |
| Digesters | - | - | - | - | - | - | - | - |
| Pit storage | - | - | - | - | - | - | - | - |
| Deep bedding | - | - | - | - | - | - | - | - |
| Other (poultry manure) | 50,064.1 | 51,763.9 | 49,751.5 | 49,530.5 | 55,753.6 | 54,131.2 | 52,733.8 | 56,357.5 |
| **Poultry (Turkeys) (3B4giii)** | | | | | | | | |
| **Population (1000s)** | **3,562.7** | **4,633.9** | **5,797.0** | **8,333.9** | **10,390.3** | **10,364.5** | **9,804.4** | **9,584.0** |
| **N excr (kg/head/year)** | 1.5 | 1.2 | 1.5 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| **TAN (Fraction)** | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| **Total N excr (ton/year)** | **5,171.2** | **5,576.1** | **8,511.2** | **10,999.3** | **13,713.3** | **12,967.5** | **12,266.7** | **11,990.9** |
| ***N excretion per MMS*** | | | | | | | | |
| Anaerobic lagoon | - | - | - | - | - | - | - | - |
| Liquid system | - | - | - | - | - | - | - | - |
| Daily spread | - | - | - | - | - | - | - | - |
| Solid storage and dry lot | - | - | - | - | - | - | - | - |
| Pasture | - | - | - | - | - | - | - | - |
| Digesters | - | - | - | - | - | - | - | - |
| Pit storage | - | - | - | - | - | - | - | - |
| Deep bedding | - | - | - | - | - | - | - | - |
| Other (poultry manure) | 5,171.2 | 5,576.1 | 8,511.2 | 10,999.3 | 13,713.3 | 12,967.5 | 12,266.7 | 11,990.9 |
| **Poultry (Other poultry (ducks and other)) (3B4giv)** | | | | | | | | |
| **Population (1000s)** | **15,933.9** | **19,964.4** | **13,878.4** | **11,704.3** | **10,581.6** | **10,642.9** | **10,830.7** | **9,988.9** |
| **N excr (kg/head/year)** | 1.4 | 1.2 | 1.5 | 1.3 | 1.3 | 1.2 | 1.2 | 1.2 |
| **TAN (Fraction)** | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| **Total N excr (ton/year)** | **23,022.1** | **23,946.2** | **20,224.6** | **15,353.2** | **13,861.6** | **13,249.7** | **13,463.8** | **12,402.6** |
| ***N excretion per MMS*** | | | | | | | | |
| Anaerobic lagoon | - | - | - | - | - | - | - | - |
| Liquid system | - | - | - | - | - | - | - | - |
| Daily spread | - | - | - | - | - | - | - | - |
| Solid storage and dry lot | - | - | - | - | - | - | - | - |
| Pasture | - | - | - | - | - | - | - | - |
| Digesters | - | - | - | - | - | - | - | - |
| Pit storage | - | - | - | - | - | - | - | - |
| Deep bedding | - | - | - | - | - | - | - | - |
| Other (poultry manure) | 23,022.1 | 23,946.2 | 20,224.6 | 15,353.2 | 13,861.6 | 13,249.7 | 13,463.8 | 12,402.6 |
| **Rabbits (3B4gh)** | | | | | | | | |
| **Population (1000s)** | **9,294.4** | **10,033.1** | **8,650.0** | **8,526.3** | **6,739.1** | **6,692.6** | **4,907.7** | **4,512.0** |
| **N excr (kg/head/year)** | 8.1 | 8.1 | 8.1 | 8.1 | 8.1 | 8.1 | 8.1 | 8.1 |
| **TAN (Fraction)** | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |
| **Total N excr (ton/year)** | **75,284.3** | **81,268.0** | **70,065.2** | **69,062.8** | **54,586.9** | **54,210.4** | **39,752.6** | **36,547.1** |
| ***N excretion per MMS*** | | | | | | | | |
| Anaerobic lagoon | - | - | - | - | - | - | - | - |
| Liquid system | - | - | - | - | - | - | - | - |
| Daily spread | - | - | - | - | - | - | - | - |
| Solid storage and dry lot | 75,284.3 | 81,268.0 | 70,065.2 | 69,062.8 | 54,586.9 | 54,210.4 | 39,752.6 | 36,547.1 |
| Pasture | - | - | - | - | - | - | - | - |
| Digesters | - | - | - | - | - | - | - | - |
| Pit storage | - | - | - | - | - | - | - | - |
| Deep bedding | - | - | - | - | - | - | - | - |
| Other | - | - | - | - | - | - | - | - |

Distribution pattern of manure management for dairy cattle, non-dairy cattle and laying hens were estimated based on descriptive studies[13] (MARM, 2010) produced by the Ministry of Agriculture, Fisheries and Food (MAPA) and national producer's associations for cattle and laying hens.

Regarding $N_{excreted}$ and TAN values[14], calculated using specific methodology, TAN is calculated as the ratio between $N_{urine}$ with respect to $N_{excreted}$ total. $N_{urine}$ is the difference between $N_{excreted}$ total and $N_{feces}$. On the other hand, $N_{excreted}$ is calculated as the difference between $N_{ingested}$ and $N_{retained}$, where $N_{ingested}$ is obtained from the protein of the ration and its nitrogen fraction, while $N_{retained}$ is calculated with a series of equations in which, among other parameters, fraction of protein retained and the average gain of daily weight are used. Finally, $N_{feces}$ is calculated from the protein ingested and its digestibility.

In zootechnical documents published by the Ministry of Agriculture, Fisheries and Food (MAPA), values of zootechnical coefficients necessary to calculate zootechnical coefficients are obtained for each animal and, specifically, for each census category, province and 5-year periods (see table 5.4.3).

The changes in zootechnical variables for swine category between 2004 and 2006 are due to the combination of animal diets and relevant legislative changes in 2005, which led to a drastic change in the use of raw materials used in animal feeding, with significantly lower methane emissions rates. This trend has been maintained in the subsequent period. The same situation occurs with cattle, where certain effects of changes in feeding and advances in technology in the sector with strong impulses in certain years generate changes in certain zootechnical coefficients, such as between 2009 and 2010. Full details of the criteria and formulas used can be found in the zootechnical reports (see table 5.4.3).

Furthermore, significant changes occurred in animal feeding as from 2005 for white swine. Specifically, the use of growth-promoting antibiotics in animal feeding was banned altogether, resulting in a radical change in feeding conditions. Raw materials with lowest digestibility were removed and trends were modified, mainly carbohydrates (products difficult to digest as cassava were eliminated from diets and replaced by cereals). In terms of protein intake, the soybean 47 replaced the soybean 44 in a systematic way, seeking a higher digestibility and quality protein supply. Also, affordable synthetic amino acids and digestive enzymes were systematically introduced. In addition, during the same year, the regulation on additives used in animal feeding was published, forcing the withdrawal of products that were being used to date, in order to facilitate the digestion of other diet components. White swine breeding is particularly intensive and homogeneous.

On the other hand, it is important to note regarding Iberian swine that its breeding in Spain has been developing an intensification process since 2005, which manifests a clear decrease in grazing system in contrast to an increase in manure management systems with storage, typical of intensive facilities, such as slurry storage or pit storage under the animal.

[13] https://www.mapa.gob.es/es/ganaderia/publicaciones/Bovino%20cebo_tcm30-105325.pdf
https://www.mapa.gob.es/es/ganaderia/publicaciones/Bovino%20leche_tcm30-105326.pdf
https://www.mapa.gob.es/es/ganaderia/publicaciones/AVES%20DE%20PUESTA_tcm30-105324.pdf

[14] Recommendation made by the ERT in the 2023 CLRTAP S3 Review.

Nitrogen excreted values for white swine from 2022, 2023 and 2024 are obtained from ECOGAN[15] (computerized system), which is a new calculation application based on the methodology explained in the zootechnical document for this animal[16], but in which certain input parameters, such as the configuration of the rations, the way of feeding the animals or BATs used, are entered by the farmers themselves through registration. The annual results are presented in a report that can be consulted on the MAPA website[17].

All along the time series, 3B ammonia emissions evolve in parallel with the variable of activity, livestock population, except for animals for which information on abatement measures is available. From 2004 onwards, Spanish inventory has taken into account abatement measures implemented for manure management in swine farms. BATs penetration rate applied have been estimated through surveys performed during 2015-2016 for white swine (results are not published but they are available in case of need) and the other hand with data from ECOGAN register for white and Iberian swine for the years 2022, 2023 and 2024. For this overlap, BATs from 2015 surveys, with progressive implementation since 2003 and progressive dis-implementation between 2015 and 2021, have been implemented join with BATs from ECOGAN data from 2022, with progressive implementation since 2015.

ECOGAN has only recently begun to operate, so the population universe includes only a fraction of the censused population of these animals and this universe is expanding every year as this registry is implemented; although for this reason, and as a precautionary criterion, the ECOGAN BAT data is reduced proportionally to this fraction.

Similarly, BATs penetration rates have been implemented based on ECOGAN data from 2022, 2023 and 2024 for Iberian pigs, with progressive implementation of the 2022 data since 2015.

On the other hand, BATs from ECOGAN data from 2023, with progressive implementation since 2015, have been implemented for laying hens and broilers. In this case, 2023 has been the first year of operation of ECOGAN, as well as its annual BATs report, so, as has happened with white pigs, the population universe accommodates only a fraction of the census population of these animals and this universe is expanding every year; although for this reason, and as a precautionary criterion, ECOGAN BATs data have been proportionally reduced to this fraction too.

**Table 5.4.5 Reduction of 3B ammonia emissions for swine (ECOGAN 2022, 2023 and 2024) (national territory)**

| | | Building(*) | Storage(*) |
|---|---|---|---|
| **2022** | White swine (sows) | 12% | 24% |
| | White swine (fattening) | 14% | 24% |
| | Iberian swine (sows) | 7% | 12% |
| | Iberian swine (fattening) | 7% | 12% |

15 ECOGAN - National electronic support that facilitates the calculation, monitoring and notification of the emissions of each farm, as well as the notification to the General Registry of BATs available in the web of the Ministry of Agriculture, Fisheries and Food (MAPA). It is currently available for swine, the rest of livestock species will be incorporated as the corresponding management regulations are implemented. https://www.mapa.gob.es/es/ganaderia/temas/ganaderia-y-medio-ambiente/calculo-emisiones/default.aspx

16 Zootechnical documents - https://www.mapa.gob.es/es/ganaderia/temas/ganaderia-y-medio-ambiente/balance-de-nitrogeno-e-inventario-de-emisiones-de-gases/default.aspx

17 Swine BATs reports - https://www.mapa.gob.es/es/ganaderia/temas/ganaderia-y-medio-ambiente/calculo-emisiones/ecogan_sector_porcino

| | | Building(*) | Storage(*) |
|---|---|---|---|
| | Laying hens | - | - |
| | Broilers | - | - |
| 2023 | White swine (sows) | 13% | 27% |
| | White swine (fattening) | 15% | 25% |
| | Iberian swine (sows) | 8% | 13% |
| | Iberian swine (fattening) | 7% | 12% |
| | Laying hens | 26% | 2% |
| | Broilers | 34% | 4% |
| 2024 | White swine (sows) | 13% | 30% |
| | White swine (fattening) | 20% | 26% |
| | Iberian swine (sows) | 8% | 15% |
| | Iberian swine (fattening) | 10% | 11% |
| | Laying hens | 30% | 3% |
| | Broilers | 40% | 4% |

(*) Precautionary criterion data

Next graphics show the progression of the two main drivers linked to ammonia emissions in category 3B where can see a difference between a non-dairy cattle category for whose 3B BATs there are not yet available ECOGAN data and swine category for which BATs are considered[18].

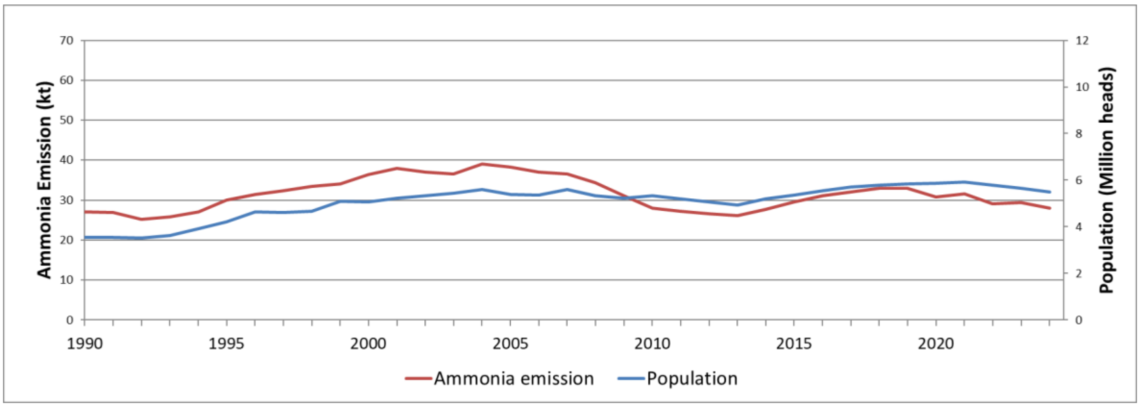



**Figure 5.4.2 Variation of $NH_3$ emissions for Non-Dairy Cattle (3B1b) (national territory)**

[18] Feeding and feed formulation strategies, BATs for reducing ammonia emissions in housing and in the storage of manure/slurry.

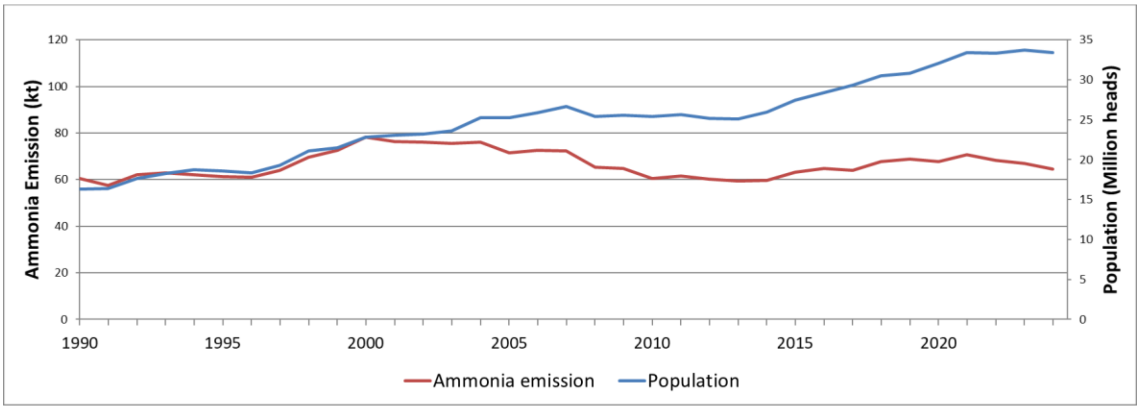



**Figure 5.4.3 Variation of $NH_3$ emissions for Swine (White swine & Iberian swine) (3B3) (national territory)**

In addition, it should be mentioned that for dairy-cattle, milk yield per capita has increased while there is a decrease in the populations of this livestock species and milk production is maintained and, consequently, although the Nex (excreted nitrogen) and TAN (total ammoniacal nitrogen) per head increases (table 5.4.4), a reduction in the emission rate per quantity of milk obtained is achieved. This is due to the increase in the production efficiency of animals, as a result of genetic selection and improvement of feeding composition and farm management, as can be seen in the following graphics.

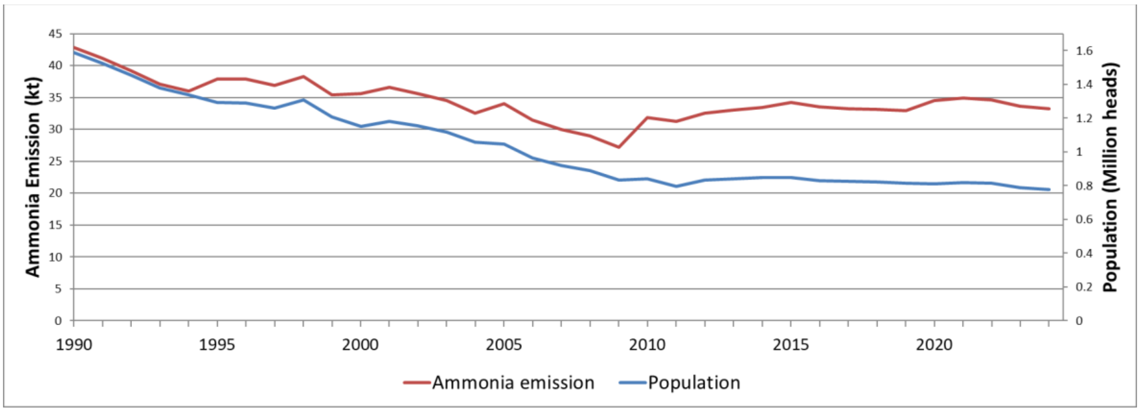



**Figure 5.4.4 Ammonia emission vs population for Dairy Cattle (3B1a) (national territory)**

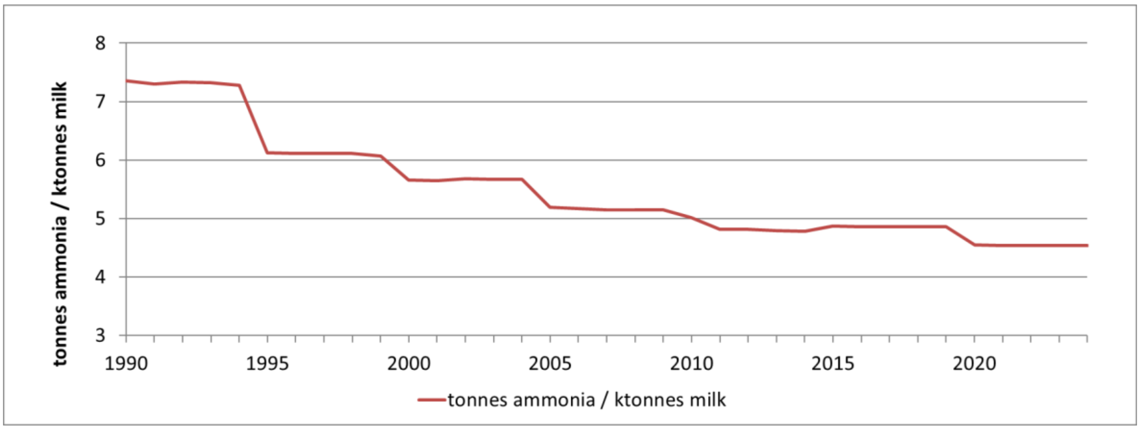



**Figure 5.4.5 Emission rate per quantity of milk obtained for Dairy Cattle (national territory)**

Emissions of nitrogen compounds by manure management and soil N-fertilization activities in 2024 are shown in a Sankey diagram (see figure 5.4.10).

Relative contributions to ammonia emissions due to manure management by animal category in 2024 are shown in the following chart.

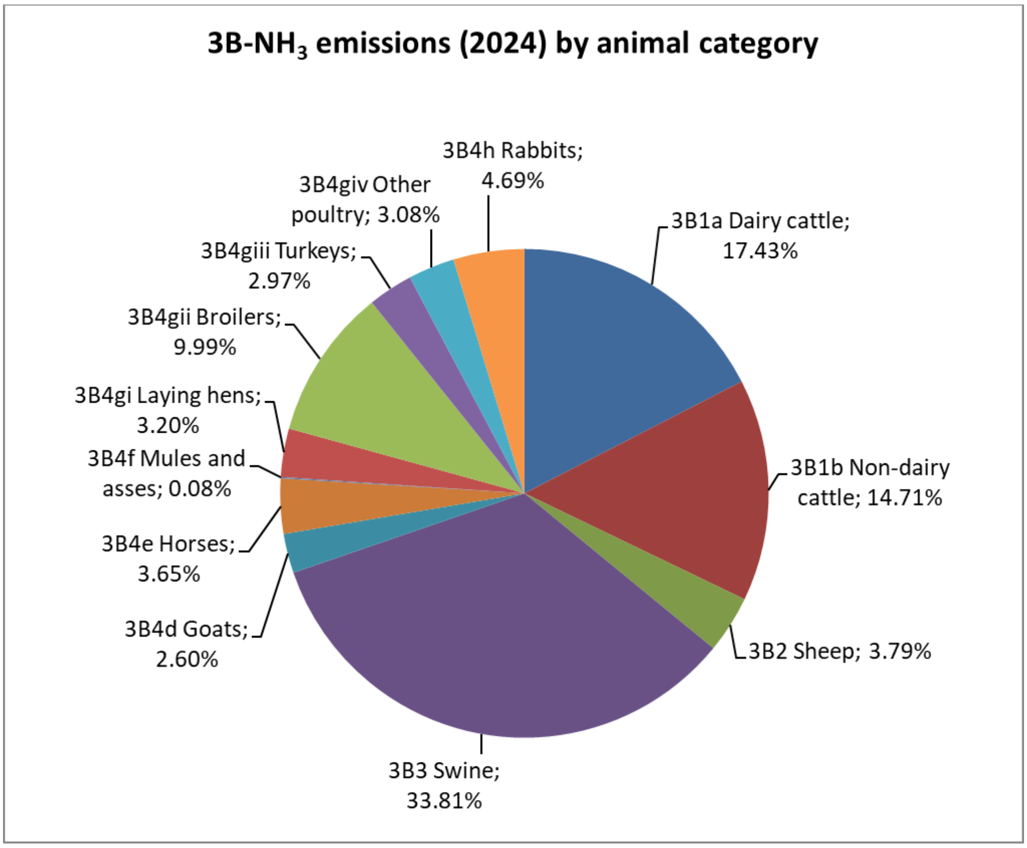



**Figure 5.4.6 3B-$NH_3$ emissions (2024) by animal category (national territory)**

On the other hand, in the following table and chart, values of housing days by animal for the time series are provided[19]. These data are used to calculate NMVOC, $PM_{2.5}$, $PM_{10}$ and TSP emissions.

**Table 5.4.6 Housing days by animal (national territory)**

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|
| **Dairy cattle** | 365 | 365 | 365 | 365 | 365 | 365 | 365 | 365 |
| **Non-dairy cattle** | 156 | 129 | 117 | 122 | 125 | 122 | 120 | 118 |
| **Sheep** | 99 | 81 | 96 | 105 | 102 | 101 | 99 | 99 |
| **Goats** | 93 | 174 | 221 | 199 | 238 | 249 | 249 | 246 |
| **Iberian swine (sows)** | 37 | 8 | 212 | 222 | 226 | 225 | 227 | 228 |
| **Iberian swine (fattening)** | 40 | 9 | 270 | 238 | 234 | 234 | 235 | 234 |
| **White swine (sows)** | 365 | 365 | 365 | 365 | 365 | 365 | 365 | 365 |

[19] Recommendation made by the ERT in the 2019 and 2022 NECD Final Review Report.

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|
| **White swine (fattening)** | 365 | 365 | 365 | 365 | 365 | 365 | 365 | 365 |
| **Poultry (Laying hens)** | 365 | 365 | 365 | 365 | 365 | 365 | 365 | 365 |
| **Poultry (Broilers)** | 365 | 365 | 365 | 365 | 365 | 365 | 365 | 365 |
| **Poultry (Turkeys)** | 365 | 365 | 365 | 365 | 365 | 365 | 365 | 365 |
| **Poultry (other poultry)** | 365 | 365 | 365 | 365 | 365 | 365 | 365 | 365 |
| **Horses** | 136 | 142 | 120 | 124 | 150 | 150 | 149 | 203 |
| **Mules** | 220 | 216 | 182 | 211 | 226 | 225 | 221 | 297 |
| **Asses** | 62 | 67 | 52 | 65 | 75 | 73 | 67 | 45 |
| **Rabbits** | 365 | 365 | 365 | 365 | 365 | 365 | 365 | 365 |

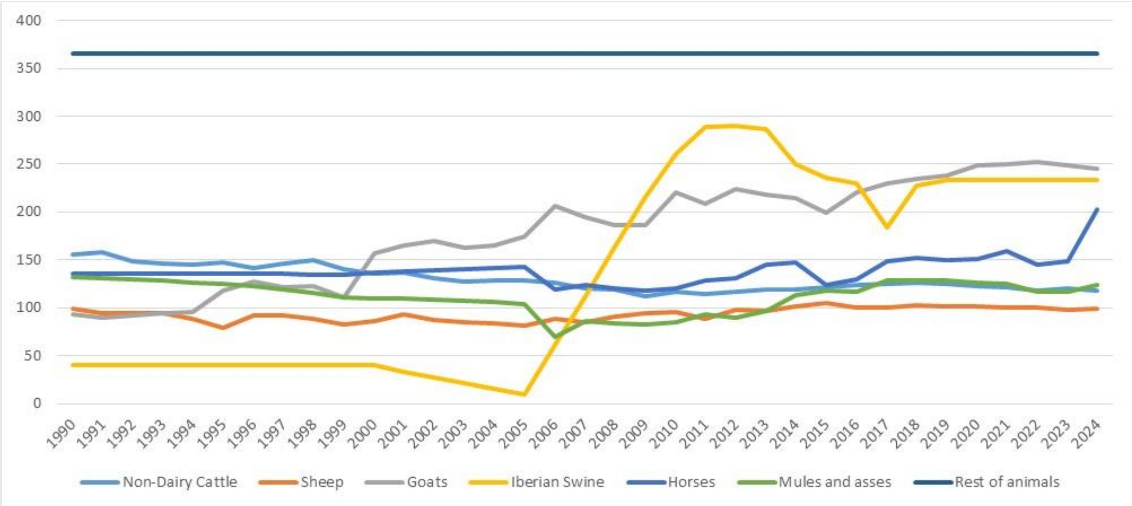



**Figure 5.4.7 Evolution of housing days by animal (national territory)**

Further, in the following tables, values of gross energy intake, excreted VS (volatile solids), and fraction of silage feeding by animal for the time series are provided[20]. These data are used to calculate NMVOC.

**Table 5.4.7 Gross energy intake (MJ/head/day) by animal (national territory)**

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|
| **Dairy cattle** | 198.70 | 251.32 | 278.02 | 293.26 | 293.78 | 316.64 | 316.66 | 316.96 |
| **Non-dairy cattle** | 148.76 | 146.96 | 148.87 | 146.39 | 145.68 | 148.00 | 149.00 | 149.82 |

**Table 5.4.8 Excreted VS (kg/head/day) by animal (national territory)**

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|
| **Sheep** | 0.32 | 0.38 | 0.40 | 0.38 | 0.38 | 0.38 | 0.39 | 0.39 |
| **Goats** | 0.43 | 0.42 | 0.40 | 0.39 | 0.37 | 0.37 | 0.37 | 0.38 |
| **Iberian swine (sows)** | 0.60 | 0.55 | 0.49 | 0.49 | 0.49 | 0.47 | 0.46 | 0.43 |
| **Iberian swine (fattening)** | 0.31 | 0.27 | 0.25 | 0.29 | 0.30 | 0.31 | 0.31 | 0.31 |
| **White swine (sows)** | 0.73 | 0.72 | 0.71 | 0.73 | 0.79 | 0.79 | 0.77 | 0.76 |

20 Recommendation made by the ERT in the 2019 NECD Final Review Report.

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|
| **White swine (fattening)** | 0.41 | 0.36 | 0.32 | 0.32 | 0.33 | 0.33 | 0.32 | 0.32 |
| **Poultry (Laying hens)** | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.02 |
| **Poultry (Broilers)** | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| **Poultry (Turkeys)** | 0.03 | 0.03 | 0.04 | 0.04 | 0.04 | 0.03 | 0.03 | 0.03 |
| **Poultry (ducks and other poultry)** | 0.03 | 0.03 | 0.04 | 0.04 | 0.04 | 0.03 | 0.03 | 0.03 |
| **Horses** | 2.78 | 2.82 | 2.72 | 2.73 | 2.78 | 2.78 | 2.81 | 2.83 |
| **Mules and Asses** | 2.63 | 2.48 | 2.37 | 2.62 | 2.69 | 2.68 | 2.64 | 2.93 |
| **Rabbits** | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |

The following table shows the fraction of feeding during housing that is silage, out of the maximum proportion of silage possible in the feed composition[21].

### Table 5.4.9 Fraction of silage feeding by animal (national territory)

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|
| **Dairy cattle** | 0.6155 | 0.6018 | 0.7729 | 0.7851 | 0.7835 | 0.7836 | 0.7842 | 0.7837 |
| **Non-dairy cattle** | 0.1322 | 0.1042 | 0.0949 | 0.0839 | 0.0754 | 0.0741 | 0.0729 | 0.0842 |
| **Sheep** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Goats** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Swine** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Horses, Mules and Asses** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

[21] Recommendation made by the ERT in the 2023 NECD Final Review Report.

## B. Crop production and agricultural soils (3D)

Category 3D "Crop Production and Agricultural Soils" is considered as a key category for its contribution to the level of NOx and $PM_{2.5}$ emissions, for its contribution to the trend of HCB emissions and for its contribution to the level and the trend of emissions of the following pollutants $NH_3$, NMVOC, $PM_{10}$ and TSP.

### B.1. Activity Variables

**Table 5.4.10 Summary of activity variables, data and information sources for category 3D (Crop production and agricultural soils)**

| Activities included | Activity data | Source of information |
|---|---|---|
| Inorganic N-fertilizers (includes urea application) (**3Da1**) | - Fertilizer sales (by N-fertilizer type at a national level).<br>- N-fertilizer applied to cultivated areas is disaggregated by N-fertilizer type, crop species and irrigation system at a provincial level (region). | - MAPA´s Statistic Yearbook.<br>- ESYRCE[22] (Crop Yield and Cultivated Areas Survey) Report on irrigation in Spain.<br>- Nitrogen and Phosphorous Balance in Spanish Agriculture Book (BNPAE), several years[23]. |
| Animal manure applied to soils (**3Da2a**) | - Amount of N excreted from manure by animal species, by productive category, by breeding system at a provincial level.<br>- % of N excreted aimed at fertilization. | - Documentation cited in category 3B to estimate N excreted by livestock. |
| Sewage sludge applied to soils (**3Da2b**) | - Sewage sludge applied to soils as fertilizer. | - 1990-1992- Interpolation between data of 1989 provided by "The Environment in Spain" (MOPT, 1991) and data of 1993 provided by "Study on treatment and final disposal of urban wastewater sewage sludge" (CADIC, S.A., 1993).<br>- 1993-1996-Interpolation between the MOPT study and the first available year from "National Sewage Register" (MITECO).<br>- 1997-2023. "National Sewage Register" (MITECO).<br>- 2024. 2023 "National Sewage Register" data is replicated due to lack of consolidated information from this year on. |
| | - Nitrogen contained in sludge. | - Nitrogen contained in sludge (0.04 (kg N /kg sludge residues) Sludge composition provided by "National Sewage Register" (MITECO). "Caracterización de los lodos de depuradoras generados en España" MAPAMA 2009. Pag. 29. |
| | - Provincial distribution of sludge application to soils. | - Provincial proportion of national total sludge application to soil is provided by BNPAE. |
| Other organic fertilizers applied to soils (including compost) (**3Da2c**) | - Amount of organic waste converted into compost.<br>- Nitrogen contained in compost produced. | - 1990-2023 - Information of composting facilities and waste amount entering the composting process, provided by the SG Circular Economy.<br>- 2024. 2023 data is replicated due to lack of consolidated information from this year on. |
| Urine and dung deposited by grazing animals (**3Da3**) | - Amount of N excreted from grazing. | - Documentation cited in category 3B to estimate N excreted by livestock (3B Manure Management). |

[22] https://www.mapa.gob.es/es/estadistica/temas/estadisticas-agrarias/agricultura/esyrce/

[23] BNPAE results are annually submitted to EUROSTAT Nitrogen Balance database.

| Activities included | Activity data | Source of information |
|---|---|---|
| Farm-level agricultural operations (**3Dc**) | - Cultivated surface. | - MAPA´s Statistic Yearbook.<br>- BNPAE. |
| Cultivated crops (**3De**) | - Cultivated Surface of wheat, rye, rape and grass (susceptible to emit NMVOC). | - MAPA´s Statistic Yearbook.<br>- BNPAE. |
| Use of pesticides (**3Df**) | - Amount of active substances with HCB impurities. | - MAPA (Ministry for Agriculture, Fisheries and Food). |

## B.2. Methodology

The following table summarises the methodologies applied in this chapter. Methodology level and sources are provided for reference.

### Table 5.4.11 Summary of methodologies applied in category 3D (Crop production and agricultural soils)

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| ***Inorganic N-fertilizers (3Da1)*** | | | |
| $NH_3$ | T2 | - EMEP/EEA Guidebook (2023). | - EF (3D Crop production and agricultural soils- Table 3-2).<br>- Reduction Factors applied according to "Options for ammonia mitigation. Guidance from the UNECE Task Force on Reactive Nitrogen" (Chapter 8: Fertilizer application)[24].<br>- Methodology factsheets(*): 3Da1 |
| NOx | T1 | - EMEP/EEA Guidebook (2023). | - EF (3D Crop production and agricultural soils- Table 3-1).<br>- Methodology factsheets(*)[25]: 3Da1 |
| ***Animal manure applied to soils (3Da2a)*** | | | |
| $NH_3$ | T2/ T3 | - EMEP/EEA Guidebook (2023). | - N-mass balance methodology (3B Manure management section 3.4 - Tier 2 technology-specific approach, Table 3.9).<br>- EF (3B Manure management- section 3.4 - Tier 2 technology specific approach, Table 3.9).<br>- Reduction Factors applied according to "Options for ammonia mitigation. Guidance from the UNECE Task Force on Reactive Nitrogen" (Chapter 7: Manure application techniques).<br>- BATs from 2010 MAPA surveys(***) for cattle, with progressive implementation since 2003. BATs from 2010 and 2015 surveys, with progressive implementation between 2003 and 2010 and progressive dis-implementation between 2015 and 2021 for laying hens and swine along with BATs from ECOGAN(**) data of 2022-2024 (for swine) and 2023-2024 (for laying hens and broilers), with progressive implementation since 2015.<br>- Methodology factsheets(*): $NH_3$ 3Da2a/3Da3 |
| NOx | T1 | - EMEP/EEA Guidebook (2023). | - N-mass balance methodology (3B Manure management section 3.4 - Technology-specific approach, Table 3.9).<br>- EF (3D Crop production and agricultural soils- section 3.3.2, Table 3.1). |
| NMVOC | T2 | - EMEP/EEA Guidebook (2023). | - Algorithm for NMVOC emissions (3.B Manure management).<br>- EF (3.B Manure management-Tables 3.11 and 3.12).<br>- Relations of $NH_3$ emissions.<br>- Methodology factsheets(*): NMVOC 3B/3Da2a/3Da3 |
| ***Sewage sludge applied to soils (3Da2b)*** | | | |
| $NH_3$ | T1 | - EMEP/EEA Guidebook (2023). | - EF (3D Crop production and agricultural soils- section 3.3.2, Table 3.1). |

[24] "Options for ammonia mitigation. Guidance from the UNECE Task Force on Reactive Nitrogen", 2014.

[25] Recommendation made by the ERT in the 2019 NECD Review Final Review Report.

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| NOx | T1 | - EMEP/EEA Guidebook (2023). | - EF (3D Crop production and agricultural soils- section 3.3.2, Table 3.1). |
| ***Other organic fertilizers applied to soils (including compost) (3Da2c)*** | | | |
| $NH_3$ | T1 | - EMEP/EEA Guidebook (2023). | - EF (3D Crop production and agricultural soils- section 3.3.2, Table 3.1). |
| NOx | T1 | - EMEP/EEA Guidebook (2023). | - EF (3D Crop production and agricultural soils- section 3.3.2, Table 3.1). |
| ***Urine and dung deposited by grazing animals (3Da3)*** | | | |
| $NH_3$ | T2 | - EMEP/EEA Guidebook (2023). | - N-mass balance methodology (3B Manure management section 3.4 - Tier 2 technology-specific approach, Table 3.9).<br>- EF (3B Manure management- section 3.4 - Tier 2 technology-specific approach, Table 3.9).<br>- Methodology factsheets(*): $NH_3$ 3Da2a/3Da3 |
| NOx | T1 | - EMEP/EEA Guidebook (2023). | - N-mass balance methodology (3B Manure management section 3.4 - Technology-specific approach, Table 3.9).<br>- EF (3D Crop production and agricultural soils- section 3.3.2, Table 3.1). |
| NMVOC | T2 | - EMEP/EEA Guidebook (2023). | - Algorithm for NMVOC emissions (3.B Manure management).<br>- EF (3.B Manure management-Tables 3.11 and 3.12).<br>- Methodology factsheets(*): NMVOC 3B/3Da2a/3Da3 |
| ***Crop residues applied to soils (3Da4)*** | | | |
| $NH_3$ | T1 | - EMEP/EEA Guidebook (2023). | - EF (3D Crop production and agricultural soils, Table 3.1).<br>- Methodology factsheets(*): 3Da4 |
| ***Farm-level agricultural operations (3Dc)*** | | | |
| $PM_{2.5}$, $PM_{10}$, TSP | T2 | - EMEP/EEA Guidebook (2023). | - EF (3D Crop production and agricultural soils, Tables 3.6-3.9).<br>- Methodology factsheets(*): 3Dc |
| ***Cultivated crops (3De)*** | | | |
| NMVOC | T2 | - EMEP/EEA Guidebook (2023). | - EF (3D Crop production and agricultural soils, Table 3.4).<br>- Methodology factsheets(*): 3De |
| ***Use of pesticides (3Df)*** | | | |
| HCB | T1 | - EMEP/EEA Guidebook (2023). | - Impurity factor (3Df, 3I Agriculture other including use of pesticides) Section 7.4. |

(*) Detailed methodological factsheets (MITECO)[26]

For the particular case of 3Da1 Inorganic N-fertilizers, to calculate nitrogen emissions ($NH_3$, NOx) from inorganic fertilized crops, the Spanish Inventory Team has proceeded the following way:

- The share of each type of commercialized fertilizer provided by MAPA for the total national territory (this data is not available at a more disaggregated level) has been allocated to the inorganic N-fertilizers amount applied to soils by crop and province estimated by the BNPAE (Nitrogen and Phosphorous Balance in Spanish Agriculture, that assumes equivalence between nitrogen needs according to annual yields and nitrogen uptake by crop, presuming enough nitrogen availability).
- The "Informe sobre regadíos en España" (Spanish Irrigation Report) run by ESYRCE provides irrigation type and extension by main crops and Autonomous Communities. The Inventory crosses this information with the above paragraph results for estimation of implementation level of possible BATs for ammonia mitigation.

[26] https://www.miteco.gob.es/es/calidad-y-evaluacion-ambiental/temas/sistema-espanol-de-inventario-sei-/metodologias-estimacion-emisiones.html

- Once the amount of nitrogen from every fertilizer type applied (per year, crop and province) has been calculated, it is then multiplied by the appropriate emission factor taking into account the pH-soil characterization of every province in Spain (see table 5.4.13).
- Information about performance of Good Agricultural Practices of fertilizer application has been collected from a survey, whose results are published by the MAPA´s Statistic Yearbook. When the implemented extent of those practices has been determined, a reduction factor is assigned according to "Options for ammonia mitigation. Guidance from the UNECE Task Force on Reactive Nitrogen"[27]. If a range of reduction was available, the interval average was chosen (see table 5.4.14).

## B.3. Assessment

The chart below shows the time series evolution of N-fertilizers applied to soils.

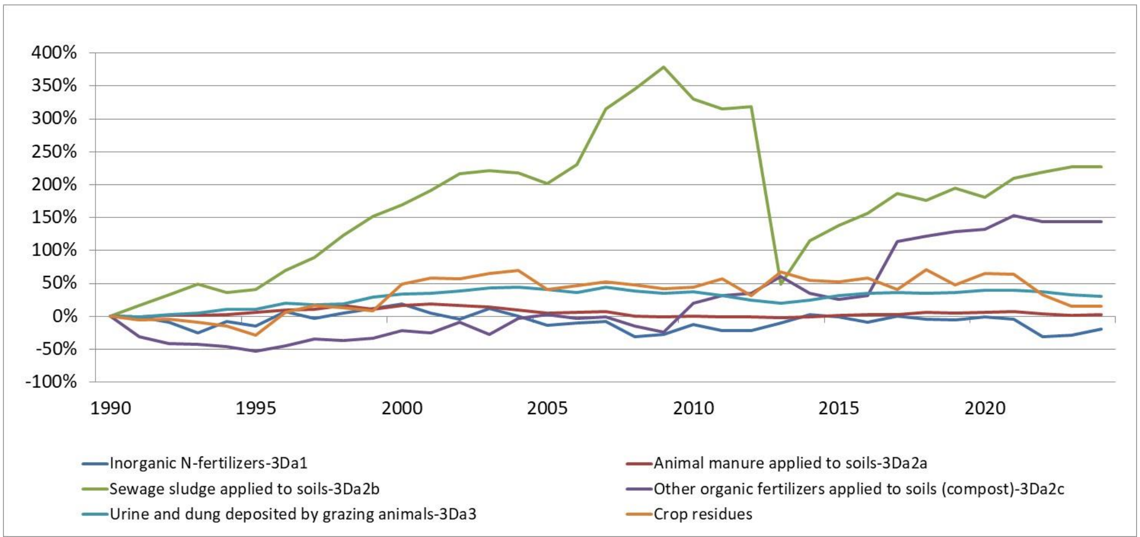



**Figure 5.4.8 Variation ratio of N applied by fertilizers with respect to 1990 (national territory)**

In relative terms, sewage sludge suffers a strong increase with respect to the base year, until 2012. From 2013 a significant decrease is observed following the entry into force of the Spanish Ministerial Order AAA/1072/2013, of 7 June, on the use of sewage sludge in the agriculture sector. Next graph shows the progression from 1990 and the impact of each subcategory on total N applied.

[27] "Options for ammonia mitigation. Guidance from the UNECE Task Force on Reactive Nitrogen", 2014.

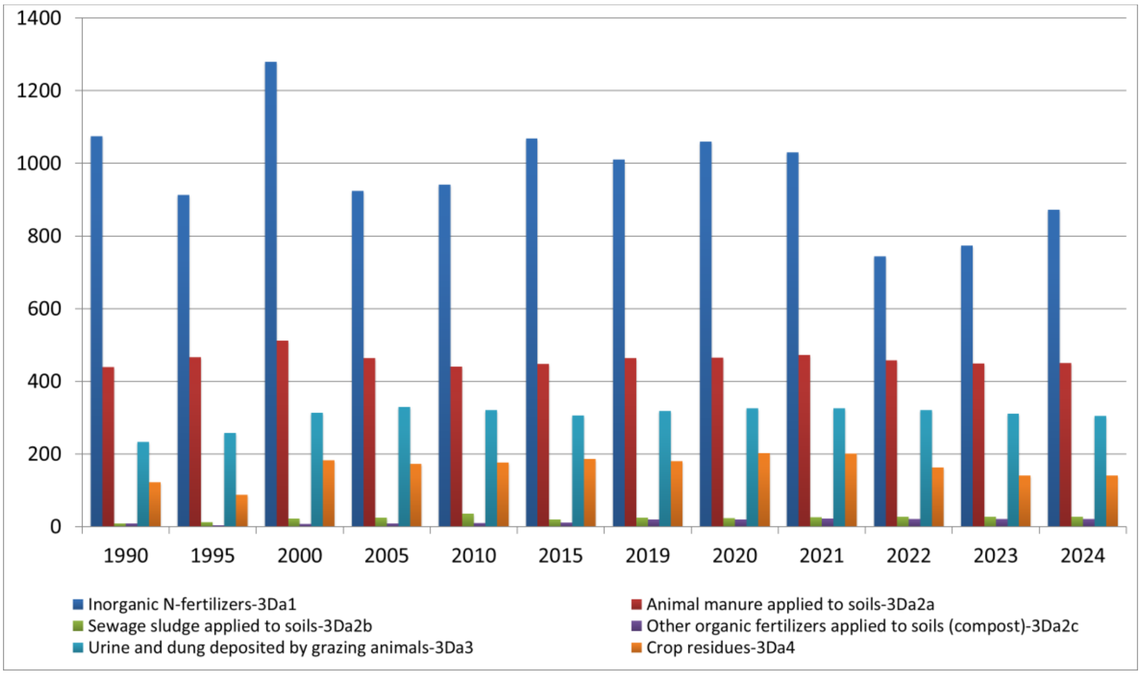



**Figure 5.4.9 N applied by source (kt/year) (national territory)**

In the following table, the values of N applied to soil for the time series are provided in kt/year.

**Table 5.4.12 N applied to soil by 3D category (kt/year) (national territory)**

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|
| **3Da1** | 1,074.17 | 923.76 | 940.98 | 1,068.10 | 1,010.58 | 1,059.30 | 773.01 | 871.89 |
| **3Da2a** | 439.57 | 463.38 | 440.56 | 447.66 | 463.70 | 464.82 | 448.44 | 450.53 |
| **3Da2b** | 8.32 | 25.14 | 35.83 | 19.80 | 24.52 | 23.34 | 27.22 | 27.22 |
| **3Da2c** | 8.51 | 8.78 | 10.22 | 10.71 | 19.47 | 19.73 | 20.72 | 20.72 |
| **3Da3** | 233.67 | 329.09 | 320.54 | 306.24 | 317.64 | 325.15 | 311.43 | 304.52 |
| **3Da4** | 122.50 | 172.53 | 176.94 | 186.19 | 180.60 | 202.73 | 141.09 | 141.09 |
| **Total** | **1,886.74** | **1,922.68** | **1,925.07** | **2,038.70** | **2,016.51** | **2,095.07** | **1,721.91** | **1,815.97** |

An approximate Sankey diagram of the nitrogen flows along the different agriculture sectors and pools (N-fertilization and manure management) and the corresponding emissions of nitrogen compounds in 2024 is shown in the following Sankey diagram.

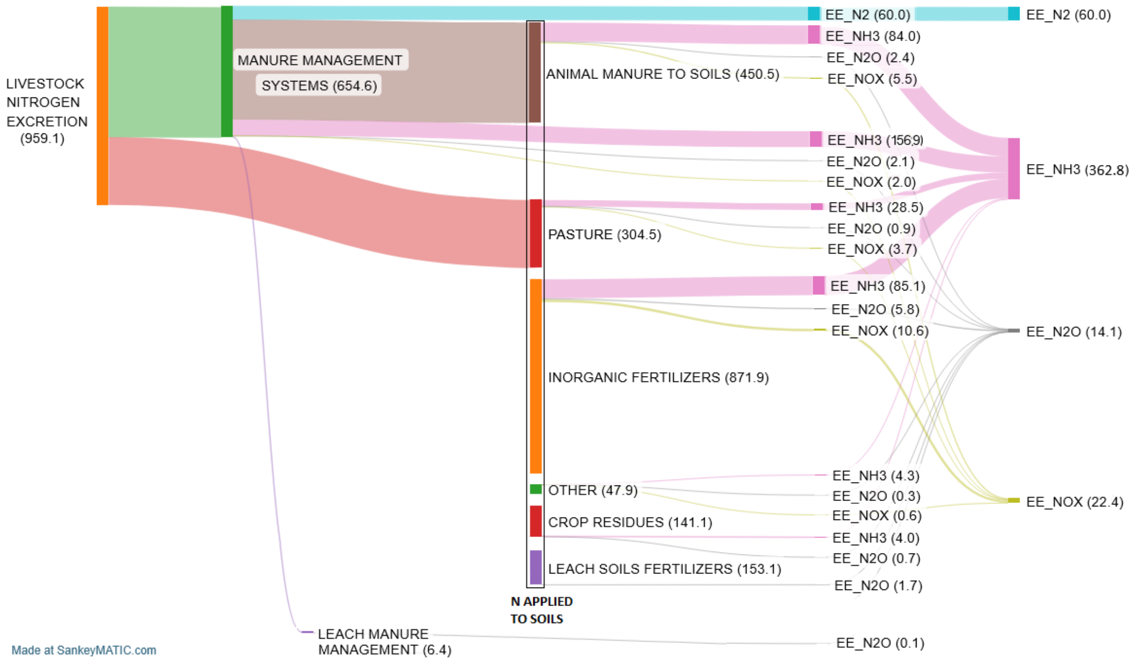



**Figure 5.4.10 Emissions of nitrogen compounds by agricultural N-fertilization activity and manure management in 2024 (kt N) (national territory)**

The following pie chart displays the main relative contributions within category 3D in 2024 for $NH_3$ emissions.

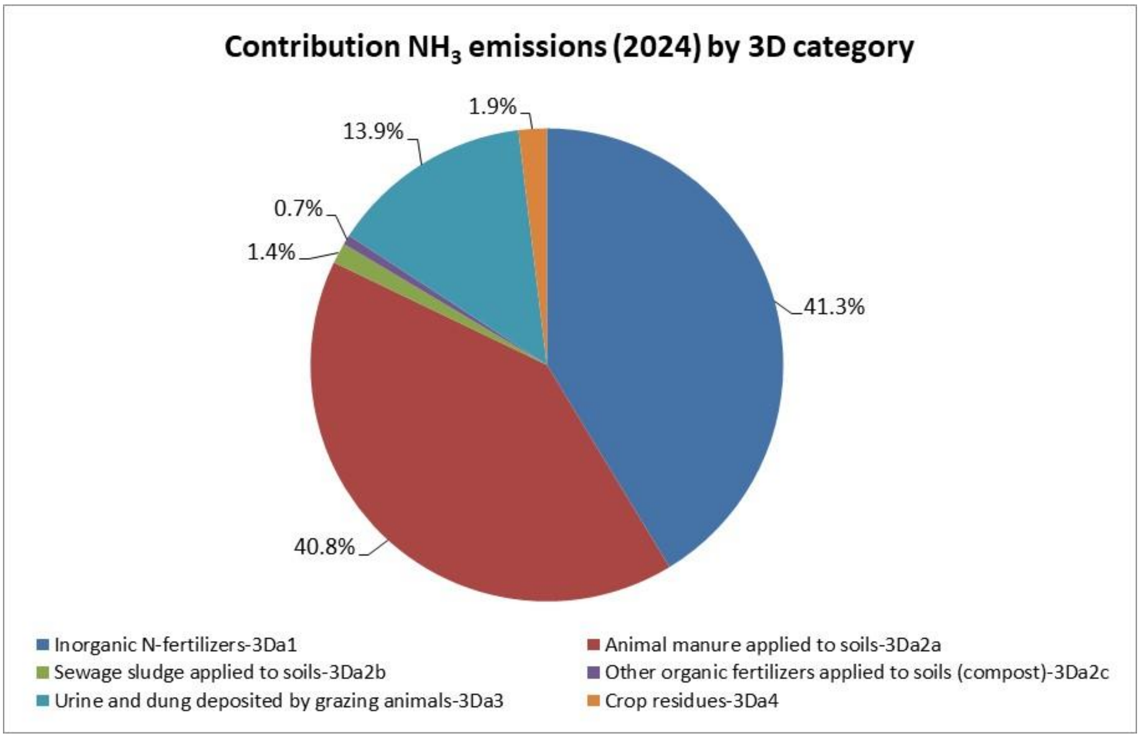



**Figure 5.4.11 Contribution of $NH_3$ emissions (2024) by N applied to soil (national territory)**

Regarding 3Da1 category (Inorganic N-fertilizers), values of N applied to soil by type N-fertilizer and climate-pH provincial, as well as description of applied BATs are provided.[28]

### Table 5.4.13 N applied to soil by type N-fertilizer and climate-pH provincial (t/year) in 2024 (national territory)

| Climate-pH provincial | | 1. Ammonium sulphate (AS) | 2. Ammonium nitrosulphate (ANS) | 3. Calcium ammonium nitrate (CAN) | 4. Ammonium nitrate (AN) | 5. Urea | 6. Calcium nitrate (CN) |
|---|---|---|---|---|---|---|---|
| N applied in cool provinces (*) | Normal pH | 9,220.36 | 4,243.95 | 14,389.99 | 3,618.34 | 32,747.50 | 1,482.89 |
| | High pH | 24,262.75 | 11,167.65 | 37,866.27 | 9,521.40 | 86,172.81 | 3,902.13 |
| N applied in temperate provinces (*) | Normal pH | 4,922.58 | 2,265.77 | 7,682.56 | 1,931.76 | 17,483.30 | 791.69 |
| | High pH | 37,387.03 | 17,208.49 | 58,349.01 | 14,671.75 | 132,785.67 | 6,012.89 |
| TOTAL | | **75,792.72** | **34,885.86** | **118,287.83** | **29,743.25** | **269,189.28** | **12,189.61** |

| Climate-pH provincial | | 7. Chile nitrate | 8. Anhydrous ammonia (AH) | 9. Nitrogen solutions | 10. NK, NPK, NP mixtures | 11. Other straight N compounds | TOTAL |
|---|---|---|---|---|---|---|---|
| N applied in cool provinces (*) | Normal pH | 0.0 | 117.01 | 8,179.03 | 28,270.13 | 3,797.70 | **106,066.91** |
| | High pH | 0.0 | 307.91 | 21,522.56 | 74,390.92 | 9,993.39 | **279,107.79** |
| N applied in temperate provinces (*) | Normal pH | 0.0 | 62.47 | 4,366.64 | 15,092.91 | 2,027.52 | **56,627.21** |
| | High pH | 0.0 | 474.47 | 33,164.62 | 114,630.69 | 15,399.04 | **430,083.66** |
| TOTAL | | **0.0** | **961.87** | **67,232.85** | **232,384.65** | **31,217.65** | **871,885.57** |

(*) EFs for category 3Da1 are not differentiated by temperature type in EMEP/EEA 2023 guide (they were differentiated in the EMEP/EEA 2019 guide).

### Table 5.4.14 Description of applied BATs in 3Da1 (Inorganic N-fertilizers (includes urea application))

| BAT id | Abatement measure | Fertilizer | Crops | Dry land/Irrigation | Regions (provinces) | Reduction (fraction) | Source |
|---|---|---|---|---|---|---|---|
| 1 | Irrigation with at least 5 mm water immediately following fertilizer application | All | All | Fertilization-Irrigation | All | 0.55 (0.4-0.7) | (*) |
| 2 | Incorporation of fertilizer into the soil | Ammonium sulphate | All crops | All | Castilla y León provinces | 0.65 (0.5-0.8) | (*) |
| 3 | Incorporation of fertilizer into the soil | Urea | Cereals and beans | All | Castilla y León provinces | 0.65 (0.5-0.8) | (*) |
| 4 | Close-slot injection | Urea | Rice | Irrigation land | Cataluña provinces | 0.8 | (*) |
| 5 | Close-slot injection | Urea | Rice | Irrigation land | Valencia provinces | 0.8 | (*) |

[28] Recommendation made by the ERT in the 2019 NECD Review Final Review Report.

| BAT id | Abatement measure | Fertilizer | Crops | Dry land/Irrigation | Regions (provinces) | Reduction (fraction) | Source |
|---|---|---|---|---|---|---|---|
| 6 | Incorporation of fertilizer into the soil | Ammonium nitrosulphate, Calcium ammonium nitrate, Urea, Nitrogen solutions, NK,NPK,NP mixtures, Other straight N compounds | Rice | Irrigation land | Andalucía provinces | 0.65 (0.5-0.8) | (*) |
| 7 | Incorporation of fertilizer into the soil | Ammonium nitrate, Nitrogen solutions, Other straight N compounds | Rice | Irrigation land | Aragón provinces | 0.65 (0.5-0.8) | (*) |
| 8 | Incorporation of fertilizer into the soil | Ammonium nitrosulphate, Calcium ammonium nitrate, Ammonium nitrate, Urea | Rice | Irrigation land | Navarra province | 0.65 (0.5-0.8) | (*) |
| 9 | Incorporation of fertilizer into the soil | Calcium ammonium nitrate | Vineyard | All | Extremadura provinces | 0.65 (0.5-0.8) | (*) |
| 10 | Incorporation of fertilizer into the soil | Urea | Olive grove | Dry land | Extremadura provinces | 0.65 (0.5-0.8) | (*) |

(*) “Options for ammonia mitigation. Guidance from the UNECE Task Force on Reactive Nitrogen”, 2014.

In the following table, values of $NH_3$ emissions due to Inorganic N-fertilizers application (3Da1) by type N-fertilizer for the time series are provided in tonnes/year.

**Table 5.4.15 Values of $NH_3$ emissions (tonnes) by type N-fertilizer (Inorganic N-fertilizers application (3Da1 category)) (national territory)**

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|
| **Ammonium sulphate (AS)** | 17,374 | 9,719 | 8,697 | 10,633 | 8,048 | 8,885 | 9,967 | 10,698 |
| **Ammonium nitrosulphate (ANS)** | 2,174 | 1,098 | 1,722 | 2,481 | 2,358 | 2,605 | 2,570 | 2,758 |
| **Calcium ammonium nitrate (CAN)** | 9,714 | 9,847 | 8,943 | 8,176 | 7,871 | 6,836 | 4,453 | 4,780 |
| **Ammonium nitrate (AN)** | 5,709 | 2,091 | 1,794 | 1,548 | 1,866 | 1,620 | 1,121 | 1,203 |
| **Urea** | 54,108 | 37,204 | 48,097 | 49,763 | 44,224 | 53,420 | 39,081 | 45,057 |
| **Calcium nitrate (CN)** | 56 | 117 | 104 | 113 | 92 | 150 | 88 | 95 |
| **Chile nitrate** | 30 | 12 | 36 | | | | | |
| **Anhydrous ammonia (AH)** | 380 | 68 | 42 | 26 | 30 | 16 | 16 | 17 |
| **Nitrogen solutions** | 7,163 | 9,220 | 7,652 | 13,208 | 12,009 | 13,232 | 7,972 | 8,557 |
| **NK, NPK, NP mixtures** | 35,870 | 28,375 | 23,335 | 26,852 | 31,737 | 32,188 | 21,441 | 25,614 |
| **Other straight N compounds** | | 2,967 | 3,649 | 9,818 | 4,689 | 4,388 | 4,219 | 4,528 |
| **TOTAL** | **132,579** | **100,717** | **104,070** | **122,617** | **112,925** | **123,339** | **90,927** | **103,308** |

Regarding 3Da2a category (Animal manure applied to soils), reduction of ammonia emissions was applied to swine, cattle, laying hens and broilers according to UNECE Task Force on Reactive Nitrogen Guidance of “Options for Ammonia Mitigation”). BATs implemented in farms were identified and assigned a reduction factor according to the JRC document what was applied to the default emission factor according to equation 61, pg. 35 of EMEP/EEA Guidebook (2023). A summary is provided in the following table[29] (5.4.16).

BATs penetration rate used during application manure to soils were estimated based on descriptive studies[30] (MARM, 2010) produced by the Ministry of Agriculture, Fisheries and Food (MAPA) and national producers associations for cattle and laying hens, with progressive implementation between 2003 and 2010 and constant values from 2010 onwards.

For white swine, BATs penetration rate used during application manure to soils were estimated based on surveys for this livestock performed during 2015-2016 (results are not published but they are available in case of need) and lately with data from ECOGAN[31] register for white and Iberian swine, available since 2022. For this overlap, BATs from 2015 surveys, with progressive implementation since 2003 and progressive dis-implementation between 2015 and 2021, have been implemented jointly with BATs[32] from ECOGAN data from 2022, 2023 and 2024, with progressive implementation of the 2022 data since 2015 (2023-2024 (for laying hens and broilers), with progressive implementation since 2015). See Table 5.4.11.

ECOGAN has only recently begun to operate, so the population universe includes only a fraction of the censused population of these animals and this universe is expanding every year as this registry is implemented; although for this reason, and as a precautionary criterion, the ECOGAN BAT data is reduced proportionally to this fraction.

**Table 5.4.16 BAT implementation and reduction of ammonia emissions during manure application to soils in 2024**

| Animal | | BAT | Implement (fraction) (*) | Reduction (fraction) (**) |
|---|---|---|---|---|
| **Dairy cattle** | Slurry | Soil incorp by ploughing <4 h after applic, slurry | 0.077 | 0.700 |
| | | Soil incorp by ploughing 4 - 12 h after applic, slurry | 0.100 | 0.550 |
| | | Soil incorp by ploughing 12 - 24 h after applic, slurry | 0.092 | 0.300 |
| | | Soil incorp by ploughing >24 h after applic, slurry | 0.231 | 0.300 |
| | solid | Soil incorp by ploughing <4 h after applic, solid | 0.000 | 0.600 |
| | | Soil incorp by ploughing 4 - 12 h after applic, solid | 0.061 | 0.550 |
| | | Soil incorp by ploughing 12 - 24 h after applic, solid | 0.412 | 0.500 |
| | | Soil incorp by ploughing >24 h after applic, solid | 0.295 | 0.300 |
| **Non-dairy cattle** | slurry | Soil incorp by ploughing <4 h after applic, slurry | 0.000 | 0.700 |
| | | Soil incorp by ploughing 4 - 12 h after applic, slurry | 0.020 | 0.550 |
| | | Soil incorp by ploughing 12 - 24 h after applic, slurry | 0.071 | 0.300 |
| | | Soil incorp by ploughing >24 h after applic, slurry | 0.353 | 0.300 |

[29] Recommendation made by the ERT in the 2019 NECD. Final Review Report.

[30] https://www.mapa.gob.es/es/ganaderia/publicaciones/Bovino%20cebo_tcm30-105325.pdf
https://www.mapa.gob.es/es/ganaderia/publicaciones/Bovino%20leche_tcm30-105326.pdf
https://www.mapa.gob.es/es/ganaderia/publicaciones/AVES%20DE%20PUESTA_tcm30-105324.pdf

[31] ECOGAN - National electronic support that facilitates the calculation, monitoring and notification of the emissions of each farm, as well as the notification to the General Registry of BATs available in the web of the Ministry of Agriculture, Fisheries and Food (MAPA). It is currently available for swine; the rest of livestock species will be incorporated as the corresponding management regulations are implemented.
https://www.mapa.gob.es/es/ganaderia/temas/ganaderia-y-medio-ambiente/calculo-emisiones/default.aspx

[32] BATs reports - Swine - Laying hens - Broilers

| Animal | | BAT | Implement (fraction) (*) | Reduction (fraction) (**) |
|---|---|---|---|---|
| | solid | Soil incorp by ploughing <4 h after applic, solid | 0.000 | 0.600 |
| | | Soil incorp by ploughing 4 - 12 h after applic, solid | 0.036 | 0.550 |
| | | Soil incorp by ploughing 12 - 24 h after applic, solid | 0.387 | 0.500 |
| | | Soil incorp by ploughing >24 h after applic, solid | 0.293 | 0.300 |
| **Laying hens** | - | Soil incorp by ploughing <4 h after applic | 0.014 | 0.600 |
| | | Soil incorp by ploughing 4 - 12 h after applic | 0.003 | 0.550 |
| | | Soil incorp by ploughing 12 - 24 h after applic | 0.044 | 0.500 |
| | | Soil incorp by ploughing >24 h after applic | 0.052 | 0.300 |
| **Broilers** | - | Soil incorp by ploughing <4 h after applic | 0.010 | 0.600 |
| | | Soil incorp by ploughing 4 - 12 h after applic | 0.013 | 0.550 |
| | | Soil incorp by ploughing 12 - 24 h after applic | 0.054 | 0.500 |
| | | Soil incorp by ploughing >24 h after applic | 0.045 | 0.300 |
| **White swine (fattening)(*)** | slurry | Acidification | 0.002 | 0.600 |
| | | Dilution slurry | 0.003 | 0.300 |
| | | Band spreading slurry | 0.488 | 0.325 |
| | | Superficial injection | 0.033 | 0.700 |
| | | Deep injection | 0.064 | 0.900 |
| | | Soil incorp by ploughing <4 h after applic, slurry | 0.074 | 0.700 |
| | | Soil incorp by ploughing 4 - 12 h after applic, slurry | 0.044 | 0.550 |
| | | Soil incorp by ploughing 12 - 24 h after applic, slurry | 0.260 | 0.300 |
| | | Soil incorp by ploughing >24 h after applic, slurry | 0.104 | 0.300 |
| | solid | Soil incorp by ploughing <4 h after applic, solid | 0.074 | 0.600 |
| | | Soil incorp by ploughing 4 - 12 h after applic, solid | 0.044 | 0.550 |
| | | Soil incorp by ploughing 12 - 24 h after applic, solid | 0.260 | 0.500 |
| | | Soil incorp by ploughing >24 h after applic, solid | 0.104 | 0.300 |
| **White swine (sows)(*)** | slurry | Acidification | 0.001 | 0.600 |
| | | Dilution slurry | 0.007 | 0.300 |
| | | Band spreading slurry | 0.576 | 0.325 |
| | | Superficial injection | 0.045 | 0.700 |
| | | Deep injection | 0.080 | 0.900 |
| | | Soil incorp by ploughing <4 h after applic, slurry | 0.130 | 0.700 |
| | | Soil incorp by ploughing 4 - 12 h after applic, slurry | 0.058 | 0.550 |
| | | Soil incorp by ploughing 12 - 24 h after applic, slurry | 0.297 | 0.300 |
| | | Soil incorp by ploughing >24 h after applic, slurry | 0.103 | 0.300 |
| | solid | Soil incorp by ploughing <4 h after applic, solid | 0.130 | 0.600 |
| | | Soil incorp by ploughing 4 - 12 h after applic, solid | 0.058 | 0.550 |
| | | Soil incorp by ploughing 12 - 24 h after applic, solid | 0.297 | 0.500 |
| | | Soil incorp by ploughing >24 h after applic, solid | 0.103 | 0.300 |
| **Iberian swine (fattening)(*)** | slurry | Acidification | 0.005 | 0.600 |
| | | Dilution slurry | 0.010 | 0.300 |
| | | Band spreading slurry | 0.188 | 0.325 |
| | | Superficial injection | 0.011 | 0.700 |

| Animal | | BAT | Implement (fraction) (*) | Reduction (fraction) (**) |
|---|---|---|---|---|
| | | Deep injection | 0.063 | 0.900 |
| | | Soil incorp by ploughing <4 h after applic, slurry | 0.080 | 0.700 |
| | | Soil incorp by ploughing 4 - 12 h after applic, slurry | 0.014 | 0.550 |
| | | Soil incorp by ploughing 12 - 24 h after applic, slurry | 0.128 | 0.300 |
| | | Soil incorp by ploughing >24 h after applic, slurry | 0.052 | 0.300 |
| | solid | Soil incorp by ploughing <4 h after applic, solid | 0.080 | 0.600 |
| | | Soil incorp by ploughing 4 - 12 h after applic, solid | 0.014 | 0.550 |
| | | Soil incorp by ploughing 12 - 24 h after applic, solid | 0.128 | 0.500 |
| | | Soil incorp by ploughing >24 h after applic, solid | 0.052 | 0.300 |
| **Iberian swine (sows)(*)** | slurry | Acidification | 0.004 | 0.600 |
| | | Dilution slurry | 0.021 | 0.300 |
| | | Band spreading slurry | 0.303 | 0.325 |
| | | Superficial injection | 0.032 | 0.700 |
| | | Deep injection | 0.029 | 0.900 |
| | | Soil incorp by ploughing <4 h after applic, slurry | 0.125 | 0.700 |
| | | Soil incorp by ploughing 4 - 12 h after applic, slurry | 0.020 | 0.550 |
| | | Soil incorp by ploughing 12 - 24 h after applic, slurry | 0.170 | 0.300 |
| | | Soil incorp by ploughing >24 h after applic, slurry | 0.054 | 0.300 |
| | solid | Soil incorp by ploughing <4 h after applic, solid | 0.125 | 0.600 |
| | | Soil incorp by ploughing 4 - 12 h after applic, solid | 0.020 | 0.550 |
| | | Soil incorp by ploughing 12 - 24 h after applic, solid | 0.170 | 0.500 |
| | | Soil incorp by ploughing >24 h after applic, solid | 0.054 | 0.300 |

(*) Precautionary criterion data for implementation

(**) "Options for ammonia mitigation. Guidance from the UNECE Task Force on Reactive Nitrogen", 2014.

In the following tables, values of $NH_3$ emissions by animal under 3Da2a category (animal manure applied to soils) and 3Da3 category (urine and dung deposited by grazing animals) for the time series are provided in tonnes/year. Ammonia emissions increased in this category by 13.6 % in 2024 with respect to 2023, mainly because of the registered increase in the use of urea and of NK-NPK-NP fertilizing mixtures.

### Table 5.4.17 Values of $NH_3$ emissions (tonnes) by animal under 3Da2a category (national territory)

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|
| Dairy Cattle | 30,313 | 21,578 | 16,501 | 17,687 | 17,020 | 17,881 | 17,416 | 17,191 |
| Non-Dairy Cattle | 20,135 | 22,231 | 11,948 | 12,620 | 14,044 | 13,086 | 12,491 | 11,929 |
| Sheep | 3,684 | 4,254 | 4,637 | 4,086 | 3,673 | 3,679 | 3,142 | 3,112 |
| Goats | 1,212 | 2,244 | 2,981 | 2,466 | 2,836 | 2,987 | 2,606 | 2,665 |
| Iberian Swine (Sows) | 24 | 16 | 558 | 517 | 562 | 408 | 401 | 377 |
| Iberian Swine (Finishing/fattening pigs) | 217 | 108 | 3,489 | 3,911 | 4,635 | 4,136 | 3,838 | 4,397 |
| White Swine (Sows) | 5,185 | 7,061 | 6,416 | 5,989 | 4,682 | 4,444 | 4,804 | 3,740 |
| White Swine (Finishing/fattening pigs) | 32,602 | 40,957 | 34,980 | 35,701 | 33,597 | 32,653 | 29,732 | 29,121 |
| Poultry (Laying hens) | 7,334 | 6,619 | 4,778 | 4,577 | 5,553 | 6,235 | 6,981 | 6,651 |
| Poultry (Broilers) | 5,410 | 5,595 | 5,192 | 5,205 | 6,063 | 5,912 | 5,898 | 6,343 |
| Turkeys | 752 | 799 | 1,247 | 1,590 | 1,983 | 1,891 | 1,789 | 1,749 |
| Poultry (Other poultry) | 3,346 | 3,433 | 2,962 | 2,220 | 2,004 | 1,932 | 1,963 | 1,808 |
| Rabbits | 20,883 | 22,543 | 19,436 | 19,158 | 15,142 | 15,038 | 11,027 | 10,138 |
| Horses | 776 | 895 | 1,799 | 1,846 | 1,963 | 1,987 | 2,189 | 2,817 |
| Mules | 148 | 11 | 16 | 34 | 33 | 32 | 31 | 41 |
| Asses | 4 | 1 | 1 | 2 | 2 | 2 | 2 | 5 |
| TOTAL | 132,024 | 138,346 | 116,942 | 117,609 | 113,792 | 112,303 | 104,309 | 102,082 |

### Table 5.4.18 Values of $NH_3$ emissions (tonnes) by animal under 3Da3 category (national territory)

| | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|
| Dairy Cattle | - | - | - | - | - | - | - | - |
| Non-Dairy Cattle | 11,568 | 20,498 | 21,778 | 21,451 | 23,239 | 24,117 | 23,001 | 22,499 |
| Sheep | 4,242 | 5,120 | 4,220 | 3,454 | 3,400 | 3,408 | 3,054 | 3,075 |
| Goats | 1,984 | 1,032 | 750 | 793 | 597 | 550 | 479 | 506 |
| Iberian Swine (Sows) | 493 | 1,348 | 920 | 685 | 771 | 701 | 704 | 654 |
| Iberian Swine (Finishing/fattening pigs) | 1,945 | 6,035 | 1,806 | 3,003 | 4,171 | 3,769 | 3,621 | 3,705 |
| White Swine (Sows) | - | - | - | - | - | - | - | - |
| White Swine (Finishing/fattening pigs) | - | - | - | - | - | - | - | - |
| Poultry (Laying hens) | - | - | - | - | - | - | - | - |
| Poultry (Broilers) | - | - | - | - | - | - | - | - |
| Turkeys | - | - | - | - | - | - | - | - |
| Poultry (Other poultry) | - | - | - | - | - | - | - | - |
| Rabbits | - | - | - | - | - | - | - | - |
| Horses | 2,156 | 2,326 | 5,935 | 5,888 | 4,708 | 4,743 | 5,259 | 4,036 |
| Mules | 251 | 20 | 39 | 65 | 53 | 52 | 52 | 23 |
| Asses | 372 | 67 | 115 | 136 | 118 | 119 | 134 | 161 |
| TOTAL | 23,010 | 36,445 | 35,563 | 35,475 | 37,057 | 37,458 | 36,304 | 34,660 |

## C. Field burning of agricultural residues (3F)

Category 3F "Field burning of agricultural residues" is considered as a key category for its contribution to the trend of the following pollutants: NOx, NMVOC, $NH_3$, $PM_{2.5}$, $PM_{10}$, TSP, BC, CO, Hg, Cd, PCDD/PCDF and PAHs.

The practice of on-field burning of agricultural residues after annual crop harvesting has been soundly settled in Spanish agriculture before being excluded by the Good Agricultural Practice framework. From then on, it has been progressively restricted by forest fire preventive legislation and conditionality of CAP (Common Agricultural Policy) payments.

Currently, crop residues are only burned on the field for sanitary reasons. Residues of woody crop pruning, such as olive or vineyards, are conveyed out of the crop field and burnt as waste in separated areas. For this reason, the emissions derived from burning of the pruning residues are not included in category 3F but in NFR 5.C.2 category (Open burning of waste).

As mentioned, as from 2000, the forest fire prevention legislation (see next table[33]) has strongly/completely restricted the burnings in the field, which also include forest residues. Before that date, and due to the climatic characteristics of most of the Spanish territory and the extreme risk of burning wood in a forest, it is considered that this practice was not common either. Below is a compilation of the national regulations applicable in Spain regarding the burning of agricultural residues, which is complemented by regional and local regulations adopted over the years in this matter.

**Table 5.4.19 Forest fire prevention legislation**

| Legislation |
| --- |
| Real Decreto 4/2001, de 12 de enero, por el que se establece un régimen de ayudas a la utilización de métodos de producción agraria compatibles con el medio ambiente. |
| Real Decreto 1322/2002, de 13 de diciembre, sobre requisitos agroambientales en relación con las ayudas directas en el marco de la política agraria común (Initial regulations). |
| Real Decreto 1049/2022, de 27 de diciembre, por el que se establecen las normas para la aplicación de la condicionalidad reforzada y de la condicionalidad social que deben cumplir las personas beneficiarias de las ayudas en el marco de la Política Agrícola Común que reciban pagos directos, determinados pagos anuales de desarrollo rural y del Programa de Opciones Específicas por la Lejanía y la Insularidad (POSEI). |
| Ley 43/2003, de 21 de noviembre, de Montes. |

### C.1. Activity variables

**Table 5.4.20 Summary of activity variables, data and information sources for category 3F**

| Activities included | Activity data | Source of information |
| --- | --- | --- |
| Field burning of agricultural residues (**3F**) | - Crop surface and crop yield. | - MAPA´s Statistic Yearbook.<br>- Nitrogen and Phosphorous Balance in Spanish Agriculture Book (BNPAE). |
| | - Annual N-amount of burnt crop residue and burnt fraction by crop (1990-2005). | - Nitrogen and Phosphorous Balance in Spanish Agriculture Book (BNPAE). |
| | - Burnt surface by phytosanitary | - Data for field burning of cropland by phytosanitary reasons obtained from the different competent authorities in this matter. |

[33] Recommendation made by the ERT in the 2022 NECD Final Review Report for 5C2 category.

| Activities included | Activity data | Source of information |
|---|---|---|
| | reasons (2005 onwards) | |
| | - Nitrogen fraction by crop. | - Nitrogen fraction by crop (several authors); Ref. Man. & Good Pract. Guide IPCC; Martínez, X.; Roselló, J. and Domínguez, A. (2006); Harvest index. (2006); Krider J.N. et al.; Villalobos, F.J. *et al*. (2002); Wheeler, R.M. (2003); Energy Andalucia Agency (1999); Senovilla, L. and Antolín, G. (2005); La Cal, J.A. (2007). |

## C.2. Methodology

The following table summarises the methodologies applied in this chapter. Methodology level and sources are provided for reference.

### Table 5.4.21 Summary of methodologies applied in category 3F

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| ***Field burning of agricultural residues (3F)*** | | | |
| NOx, NMVOC, $SO_2$, $NH_3$, $PM_{2.5}$, $PM_{10}$, TSP, BC, CO, HM, PCDD/PCDF, PAHs | T2 | - EMEP/EEA Guidebook (2023). | - 3F Field burning of agricultural residues - section 3.3 – Methodological fundamentals.<br>- EF default value (3.F Field burning of agricultural residues - Tables 3.3, 3.4, 3.5 y 3.6).<br>- Calculation of PAH emissions has been carried out by pollutants: benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene. |

## C.3. Assessment

The emissions of Field burning of agricultural residues (3F) in 2024 are -99.5% lower than in 1990 due to progressive abandonment of this practice as explained above. The chart below shows the time series evolution of dry matter burnt.

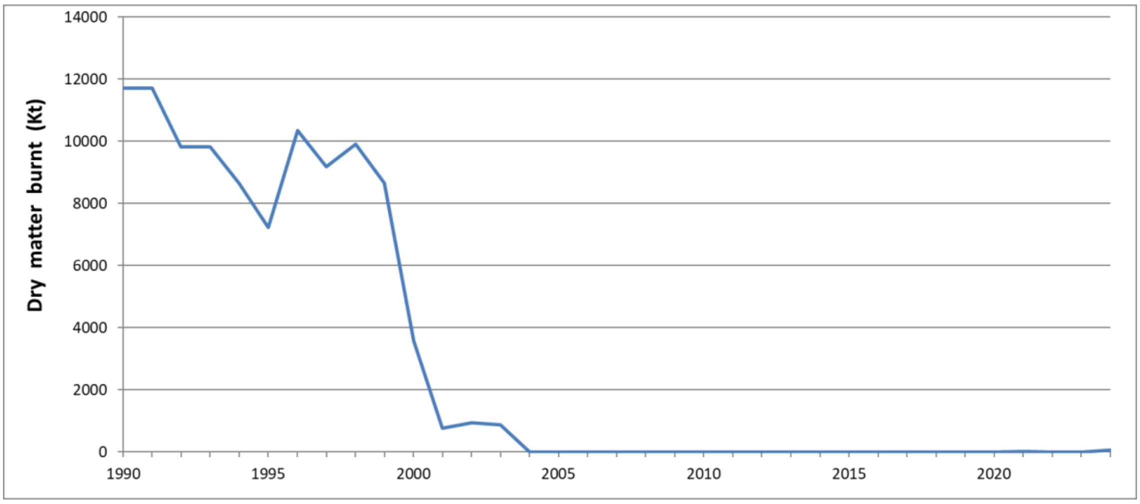



Figure 5.4.12 Dry matter burnt (national territory)

This activity has been a common practice in Spain until the early 2000s. It generates emission of polluting gases without energy yield and can elicit other negative consequences such as risk of fires and erosion. For this reason, the practice has been limited to a few authorised situations within different law frameworks and the proportion of crops burnt has been significantly reduced, and subsequently the emissions derived from them. The evolution can be seen in the following tables.

**Table 5.4.22 Dry matter burnt evolution (kt)* (national territory)**

| 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|
| **11,711.5** | 11,714.9 | 9,811.6 | 9,812.2 | 8,656.1 | 7,226.9 | 10,350.3 | 9,184.4 | 9,914.3 |

| 1999 | 2000 | 2001 | 2002 | 2003 | 2004-2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|
| **8,664.2** | 3,589.5 | 775.3 | 938.3 | 883.9 | 0.0 | 12.3 | 0.0 | 5.8 | 57.8 |

(*) Since 2004, only crop residues are burned for sanitary reasons.

## 5.5. Recalculations

The changes have been incorporated and summarized in the following table.

**Table 5.5.1 Recalculation by pollutants**

| Pollutants affected | Recalculation |
|---|---|
| ***3B Manure management (3B1a, 3B1b, 3B2, 3B3, 3B4d, 3B4e, 3B4f, 3B4gi, 3B4gii, 3Bgiii, 3B4giv and 3B4h)*** | |
| ***3B1a (Dairy Cattle)*** | |
| | No recalculation in this edition. |
| ***3B1b (Non-Dairy Cattle)*** | |
| | No recalculation in this edition. |
| ***3B2 (Sheep)*** | |
| | No recalculation in this edition. |
| ***3B3 (Swine)*** | |
| NOx, $NH_3$ | Recalculation that affects to white and Iberian swine due to updating implementation rate of $NH_3$ BATs from ECOGAN, that has been revised with weighted implementation adjustment to the data of the populations of the Agricultural Statistics Yearbook over the time series, including the BAT-3 affecting to the nitrogen excreted. In addition, the manure management average systems for white and Iberian pigs in 1990 have been updated to the values in the new Table 10A.7 of the IPCC 2019 Refinement guide. |
| NMVOC | Recalculation that affects NMVOC emissions of 3B3 categories corresponding to white and Iberian swine due to the availability of $NH_3$ BATs. The calculation methodology used in the EMEP/EEA 2023 Guidebook has been updated. This guide uses, among other parameters, the $NH_3$ emissions ratio and advises monitoring the effect of $NH_3$ reductions through BATs to avoid distorting NMVOC emissions, the NMVOC emissions calculation methodology has been updated to ensure that $NH_3$ BATs do not affect the calculations. |
| ***3B4d (Goats)*** | |
| | No recalculation in this edition. |
| ***3B4e (Horses)*** | |
| NOx, $NH_3$, NMVOC, $PM_{2.5}$, $PM_{10}$, TSP | Redistribution of housing/grazing in equids (horses, mules, and asses) has produced a recalculation across the entire time series that affects the NFR categories 3B4e and 3B4f. |
| ***3B4f (Mules and Asses)*** | |
| NOx, $NH_3$, NMVOC, $PM_{2.5}$, $PM_{10}$, TSP | Redistribution of housing/grazing in equids (horses, mules, and asses) has produced a recalculation across the entire time series that affects the NFR categories 3B4e and 3B4f. |
| ***3B4gi (Laying hens)*** | |
| NOx, $NH_3$ | Recalculation affecting laying hens due that the implementation rate of $NH_3$ BATs from ECOGAN has been updated with weighted implementation adjustment to the populations of the zootechnical document, in progressive form over the time series, and |

| Pollutants affected | Recalculation |
|---|---|
| | including BAT-3 that affect to the nitrogen excreted. This update was also used to correct a very minor error in the laying hen data across the entire time series. |
| NMVOC | Recalculation that affects NMVOC emissions due to the availability of $NH_3$ BATs. The calculation methodology used in the EMEP/EEA 2023 Guidebook has been updated. This guide uses, among other parameters, the $NH_3$ emissions ratio and advises monitoring the effect of $NH_3$ reductions through BATs to avoid distorting NMVOC emissions, the NMVOC emissions calculation methodology has been updated to ensure that $NH_3$ BATs do not affect the calculations. |
| ***3B4gii (Broilers)*** | |
| NOx, $NH_3$ | Recalculation affecting broilers due that the implementation rate of $NH_3$ BATs from ECOGAN has been updated with weighted implementation adjustment to the data of the zootechnical document, in progressive form over the time series, and including BAT-3 that affect to the nitrogen excreted. |
| NMVOC | Recalculation that affects NMVOC emissions due to the availability of $NH_3$ BATs. The calculation methodology used in the EMEP/EEA 2023 Guidebook has been updated. This guide uses, among other parameters, the $NH_3$ emissions ratio and advises monitoring the effect of $NH_3$ reductions through BATs to avoid distorting NMVOC emissions, the NMVOC emissions calculation methodology has been updated to ensure that $NH_3$ BATs do not affect the calculations. |
| ***3B4giii (Turkeys)*** | |
| | No recalculation in this edition. |
| ***3B4giv (Other poultry)*** | |
| | No recalculation in this edition. |
| ***3B4h (Rabbits)*** | |
| NOx, NMVOC, $NH_3$, $PM_{2.5}$, $PM_{10}$, TSP | Recalculation due to update for population of rabbits. Due to new information in the 2022 Agricultural Statistics Yearbook, rabbit population data is now available that can be compared with the populations calculated for the entire series based on slaughter carcasses, which until now was the only population information available. Thus, an adjustment to the population of 2022 has been made, resulting in a -0.30% decrease that has been extrapolated to the entire series. Therefore, emissions also decrease by -0.30% across the entire series. |
| ***3D Crop production and agricultural soils (3Da1, 3Da2a, 3Da2b, 3Da2c, 3Da3, 3Da4, 3Dc, 3De and 3Df)*** | |
| ***3Da1 (Inorganic N-fertilizers (also includes urea application))*** | |
| $NH_3$ | Recalculation that affects categories related to mineral fertilization due to minor alterations in the values from the BNPAE (Nitrogen and Phosphorus Balance of Spanish Agriculture) across the entire annual series is due to the implementation of emission recalculations during the last inventory edition, as well as revisions to the data in some animal husbandry documents that were incorporated into the nitrogen balance for the following year. This resulted in regional changes in fertilizer distribution, whose emissions are affected by the pH of the regions. Change in the area of forage crops has been affected too; for these crops, the sum of the harvested area and the area grazed and harvested, along with their associated yields, has been considered as the harvested crop area for calculating production. These changes produce minimal variations in emissions due to slight changes in the quantities and provincial distributions of nitrogen applied as mineral fertilizer. These very small variations could be slightly more pronounced in ammonia ($NH_3$) because their calculation is affected by the provincial distribution with varying pH, that influence their final values. |
| ***3Da2a (Animal manure applied to soils)*** | |
| NOx, $NH_3$, NMVOC | Recalculation due to variations in population or zootechnical parameters as nitrogen excreted, grazing animal distribution data, ratios of BATs implementation throughout the time series, etc., owing to animals with recalculations cited from 3B categories, whose effect produces cascading consequences on 3Da2a category. |
| NMVOC | Recalculation that affects NMVOC emissions due to the availability of NH3 BATs. The calculation methodology used in the EMEP/EEA 2023 Guidebook has been updated. This guide uses, among other parameters, the $NH_3$ emissions ratio and advises monitoring the effect of $NH_3$ reductions through BATs to avoid distorting NMVOC emissions, the |

| Pollutants affected | Recalculation |
|---|---|
| | NMVOC emissions calculation methodology has been updated to ensure that $NH_3$ BATs do not affect the calculations. |
| ***3Da2b (Sewage sludge applied to soils)*** | |
| NOx, $NH_3$ | Recalculation due to sewage sludge amount applied to soils are provided by source ("National Sewage Register" (MITECO)) with a slight delay. In these cases, the Inventory replicates the x-3 year values published, into x-2 year, the last year inventoried. This 2026 Edition has updated the values of 2023 according to values published and has replicated them into 2024. |
| ***3Da2c (Other organic fertilizers applied to soils (including compost))*** | |
| NOx, $NH_3$ | Recalculation due to compost amount applied to soils are provided by source with a slight delay. In these cases, the Inventory replicates the x-3 year values published, into x-2 year, the last year inventoried. This 2026 Edition has updated the values of 2023 according to values published and has replicated them into 2024. |
| ***3Da3 (Urine and dung deposited by grazing animals)*** | |
| NOx, $NH_3$, NMVOC | Recalculation due to slight variations in grazing animal distribution data throughout the time series for equids. |
| NMVOC | Recalculation that affects NMVOC emissions due to the availability of $NH_3$ BATs. The calculation methodology used in the EMEP/EEA 2023 Guide has been updated. This guide uses, among other parameters, the $NH_3$ emissions ratio and advises monitoring the effect of $NH_3$ reductions through BATs to avoid distorting NMVOC emissions, the NMVOC emissions calculation methodology has been updated to ensure that $NH_3$ BATs do not affect the calculations. |
| ***3Da4 (Crop residues applied to soils)*** | |
| $NH_3$ | Recalculation due to data of areas of agricultural soils are provided by MAPA`s Statistics Yearbook to BNPAE technical team with two-year lag compared with inventory report. In these cases, the Inventory replicates the x-3 year values published in the Yearbook, into x-2 year, the last year inventoried. This 2026 Edition has updated the values of 2023 according to the yearbook and has replicated them into 2024. |
| ***3Dc (Farm-level agricultural operations including storage, handling and transport of agricultural products)*** | |
| $PM_{2.5}$, $PM_{10}$, TSP | Recalculation due to data of areas of agricultural soils are provided by MAPA`s Statistics Yearbook to BNPAE technical team with two-year lag compared with inventory report. In these cases, the Inventory replicates the x-3 year values published in the Yearbook, into x-2 year, the last year inventoried. This 2026 Edition has updated the values of 2023 according to the yearbook and has replicated them into 2024. |
| ***3De (Cultivated crops)*** | |
| NMVOC | Recalculation due to data of areas of agricultural soils are provided by MAPA`s Statistics Yearbook to BNPAE technical team with two-year lag compared with inventory report. In these cases, the Inventory replicates the x-3 year values published in the Yearbook, into x-2 year, the last year inventoried. This 2026 Edition has updated the values of 2023 according to the yearbook and has replicated them into 2024. |
| ***3Df (Use of pesticides)*** | |
| | No recalculation in this edition. |
| ***3F (Field burning of agricultural residues)*** | |
| NOx, NMVOC, $SO_2$, $NH_3$, $PM_{2.5}$, $PM_{10}$, TSP, BC, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, PCDD/PCDF, PAHs | Recalculation due to correction of the data of variable of activity for phytosanitary burning received in 2021 and 2023, because some of the data were referred to woody crops and not herbaceous crops, which are those that correspond to category 3F. The recalculation has been equivalent for all pollutants. |

The following figures display the evolution as a result of the most representative recalculations. The line chart shows emissions (kt) in absolute terms, while the bar chart displays the relative difference between emission values before and after recalculations.

### 3B Manure management (3B1a, 3B1b, 3B2, 3B3, 3B4d, 3B4e, 3B4f, 3B4gi, 3B4gii, 3Bgiii, 3B4giv and 3B4h)

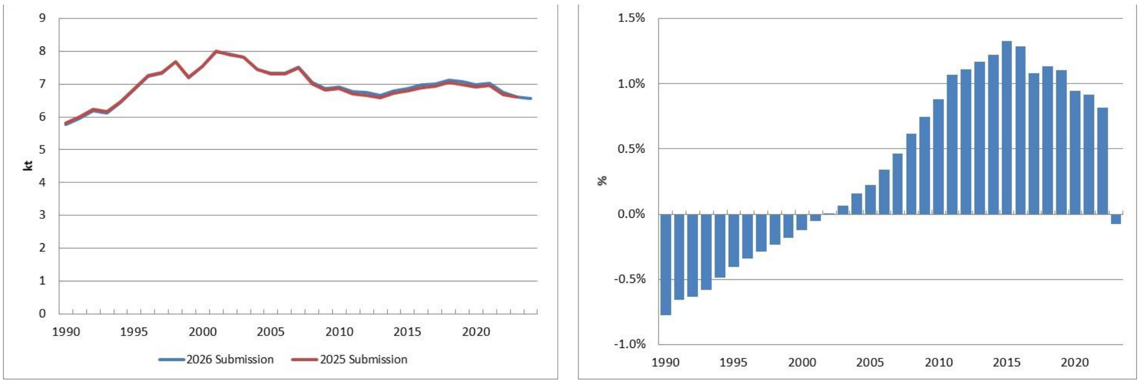



Figure 5.5.1 Evolution of the difference in 3B $NO_X$ emissions (national territory)

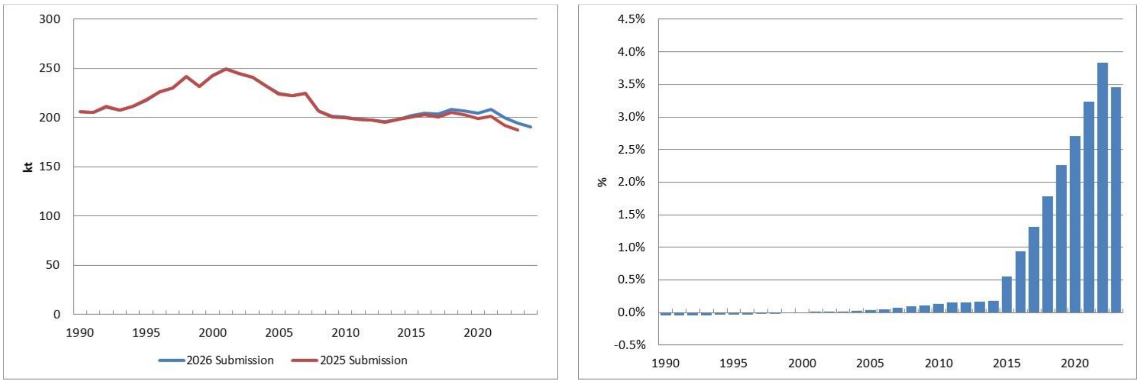



Figure 5.5.2 Evolution of the difference in 3B $NH_3$ emissions (national territory)

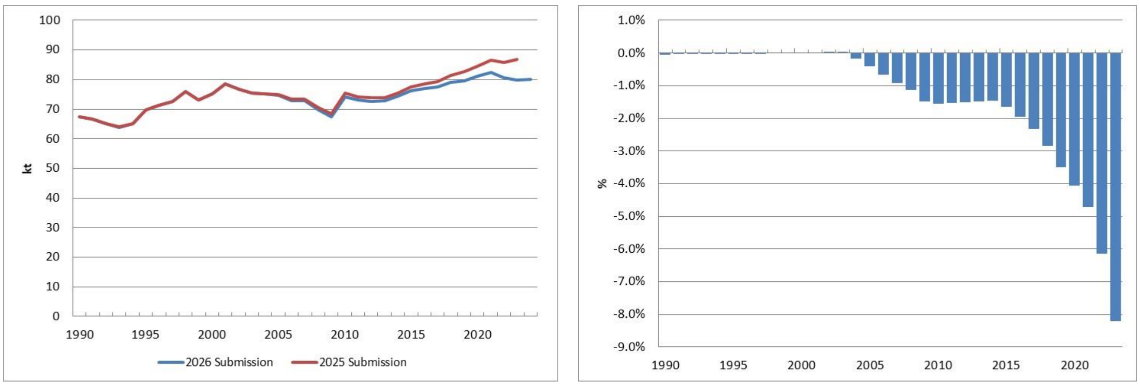



Figure 5.5.3 Evolution of the difference in 3B NMVOC emissions (national territory)

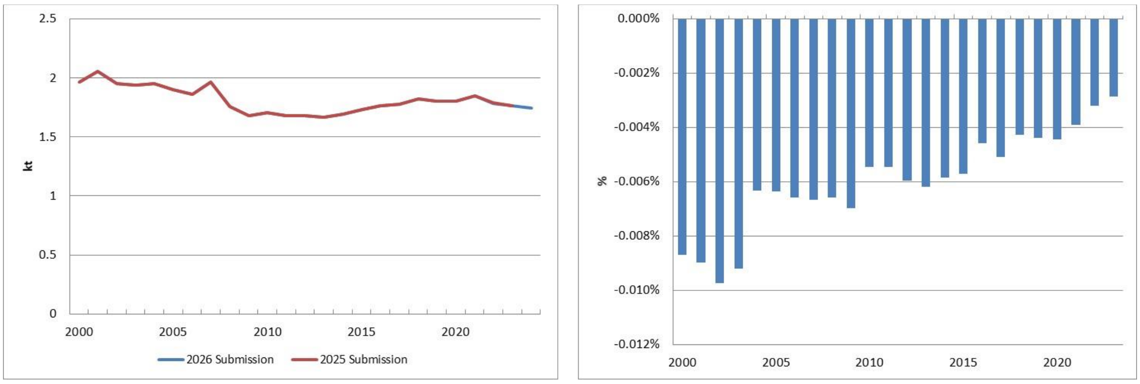



**Figure 5.5.4 Evolution of the difference in 3B $PM_{2.5}$ emissions (national territory)**

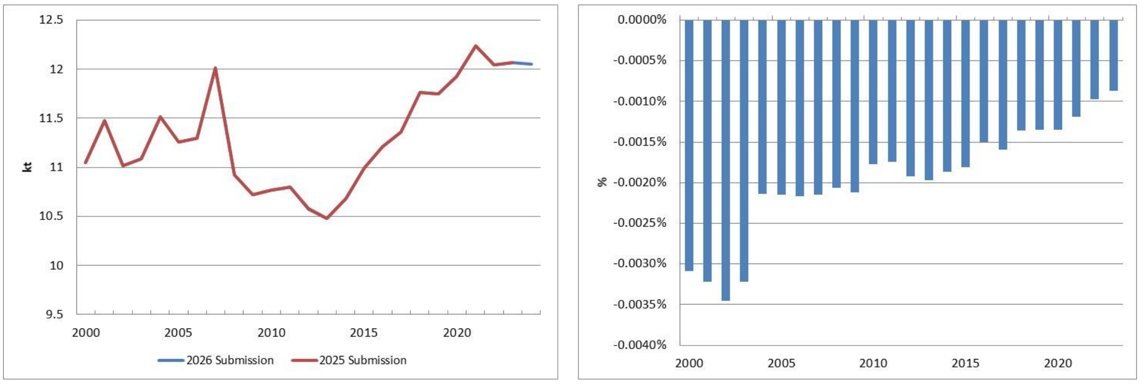



**Figure 5.5.5 Evolution of the difference in 3B $PM_{10}$ emissions (national territory)**

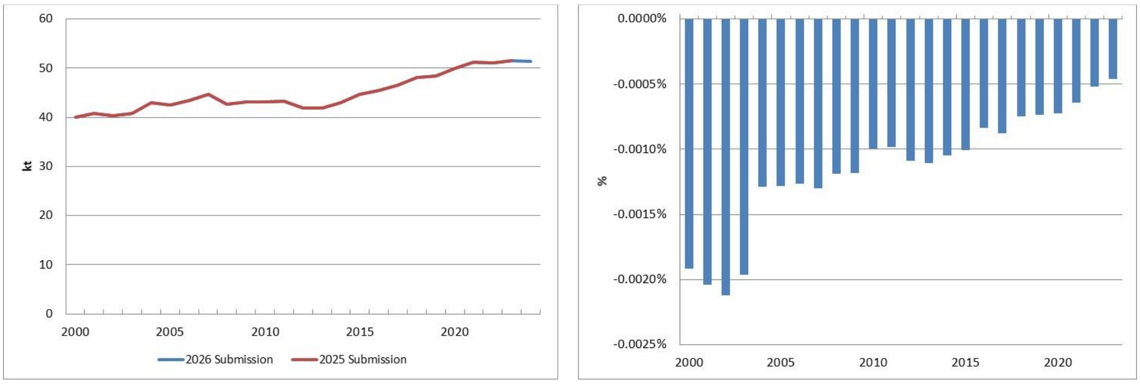



**Figure 5.5.6 Evolution of the difference in 3B TSP emissions (national territory)**

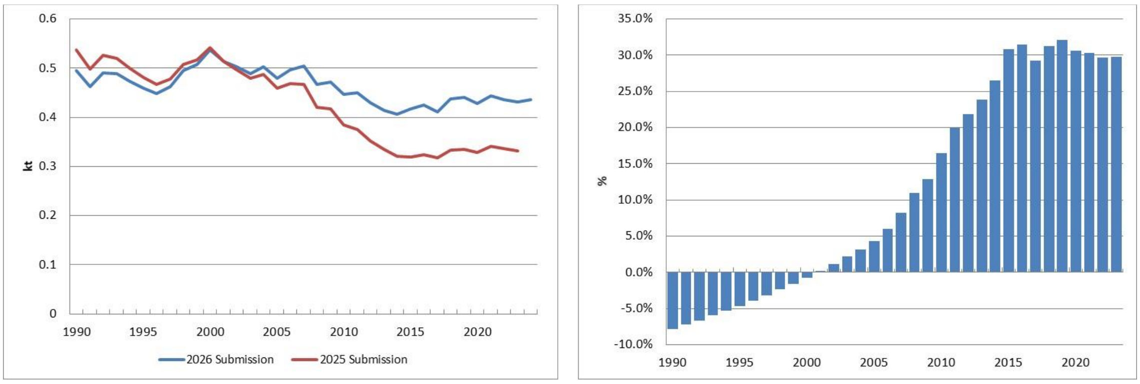



**Figure 5.5.7 Evolution of the difference in 3B3 (Swine) $NO_X$ emissions (national territory)**

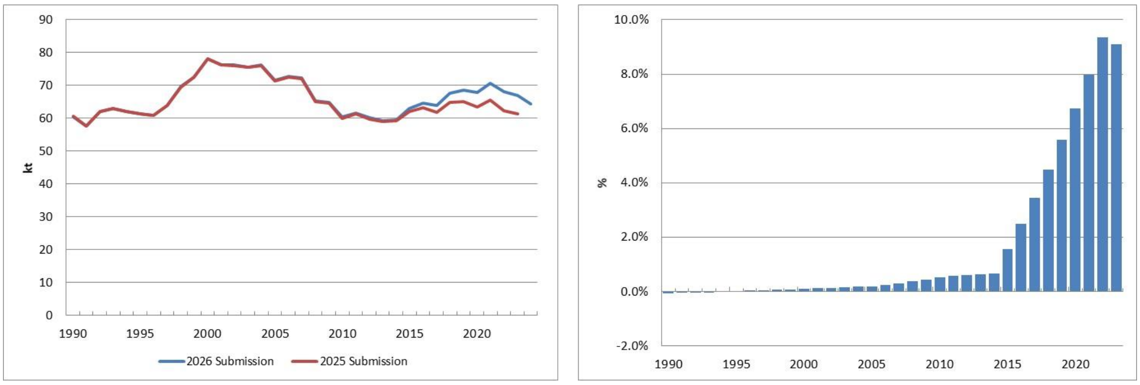



**Figure 5.5.8 Evolution of the difference in 3B3 (Swine) $NH_3$ emissions (national territory)**

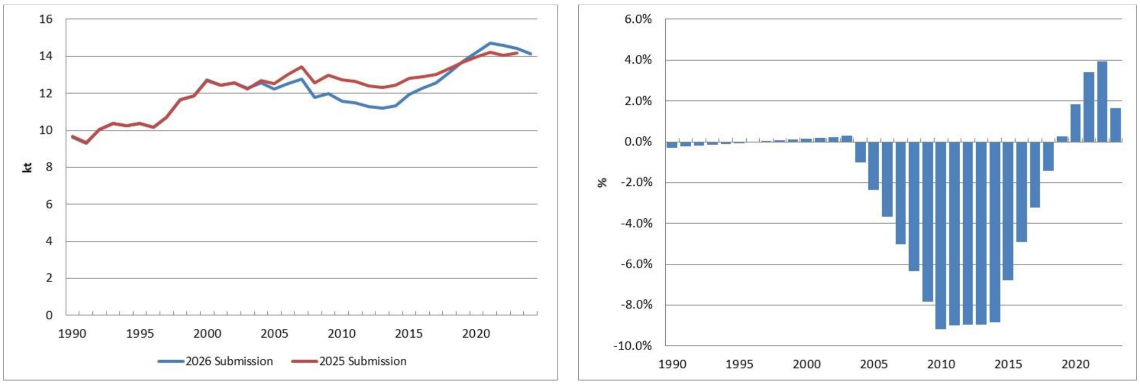



**Figure 5.5.9 Evolution of the difference in 3B3 (Swine) NMVOC emissions (national territory)**

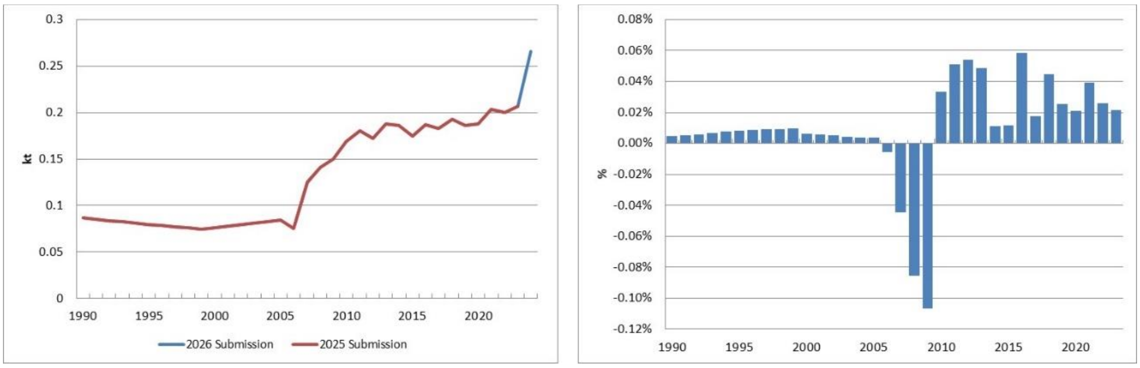



**Figure 5.5.10 Evolution of the difference in 3B4e and 3B4f (Horses, Mules and asses) $NO_X$ emissions (national territory)**

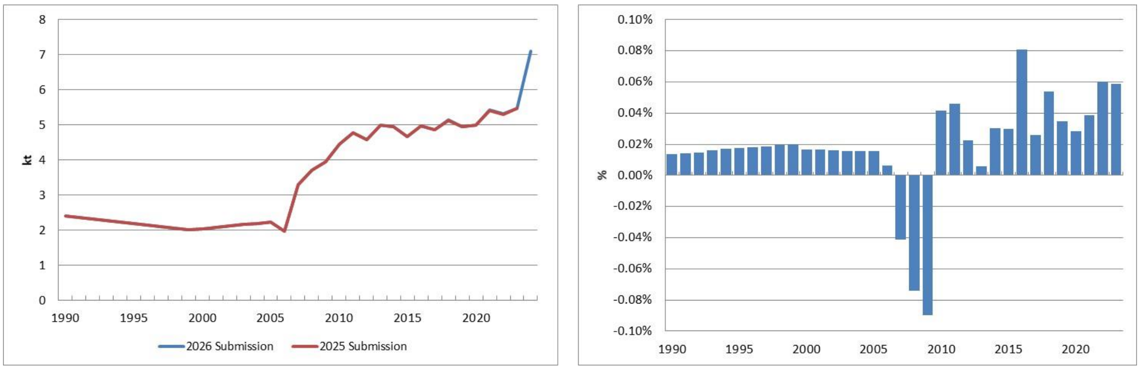



**Figure 5.5.11 Evolution of the difference in 3B4e and 3B4f (Horses, Mules and asses) $NH_3$ emissions (national territory)**

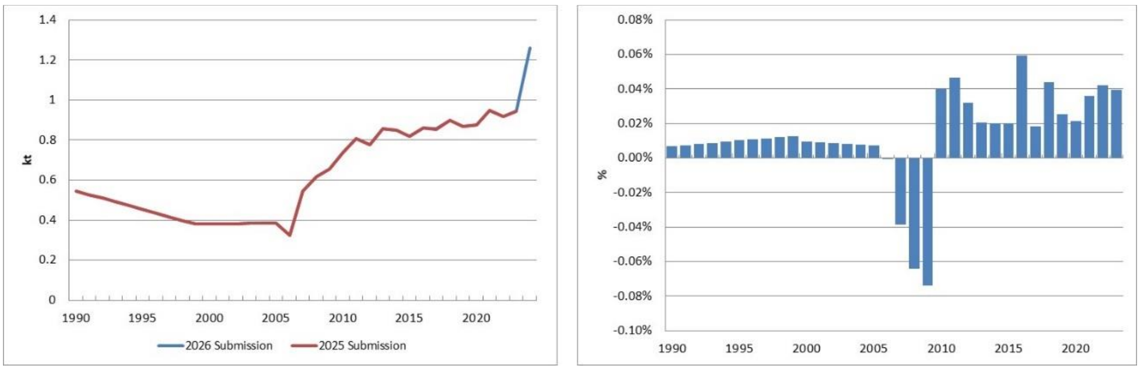



**Figure 5.5.12 Evolution of the difference in 3B4e and 3B4f (Horses, Mules and asses) NMVOC emissions (national territory)**

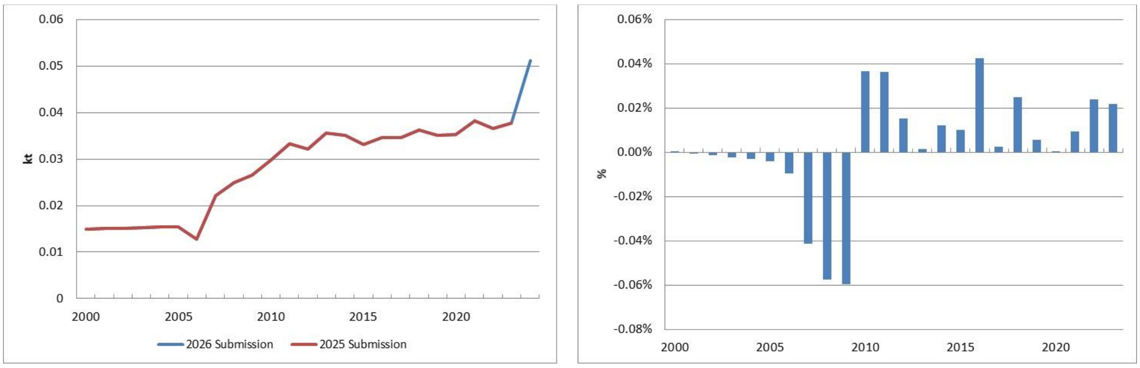



**Figure 5.5.13 Evolution of the difference in 3B4e and 3B4f (Horses, Mules and asses) $PM_{2.5}$ emissions (national territory)**

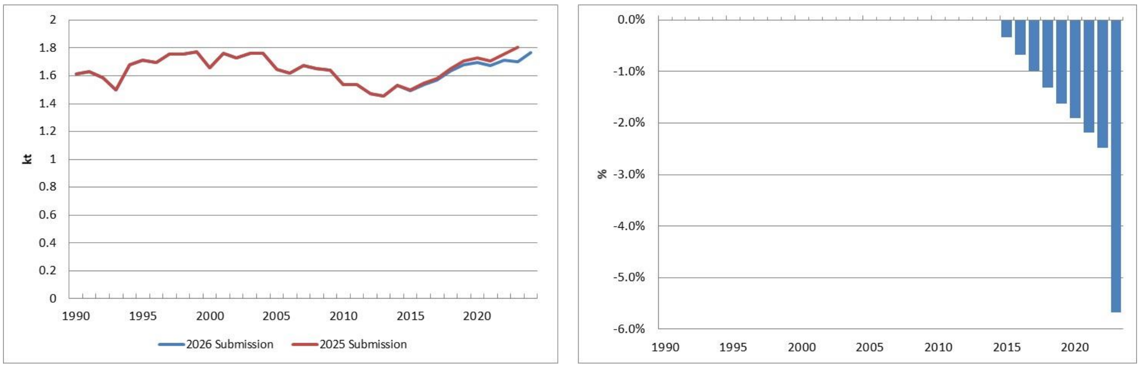



**Figure 5.5.14 Evolution of the difference in 3B4gi and 3B4gii (Laying hens and broilers) $NO_X$ emissions (national territory)**

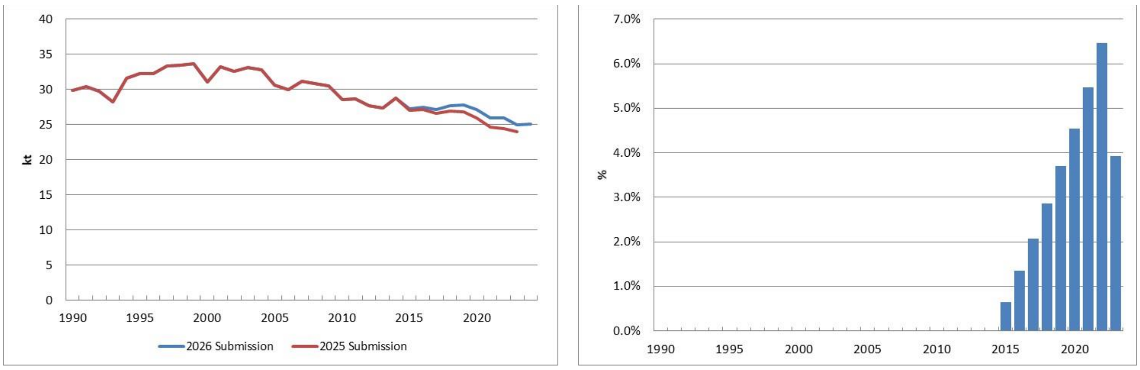



**Figure 5.5.15 Evolution of the difference in 3B4gi and 3B4gii (Laying hens and broilers) $NH_3$ emissions (national territory)**

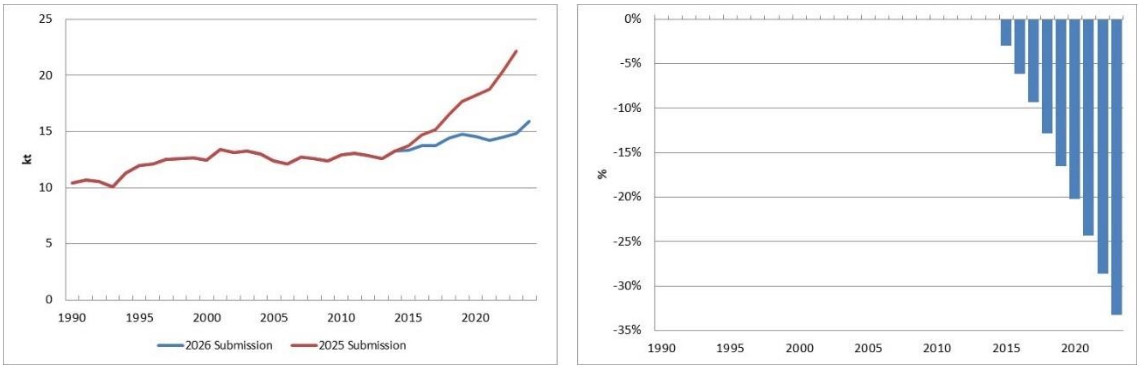



**Figure 5.5.16 Evolution of the difference in 3B4gi and 3B4gii (Laying hens and broilers) NMVOC emissions (national territory)**

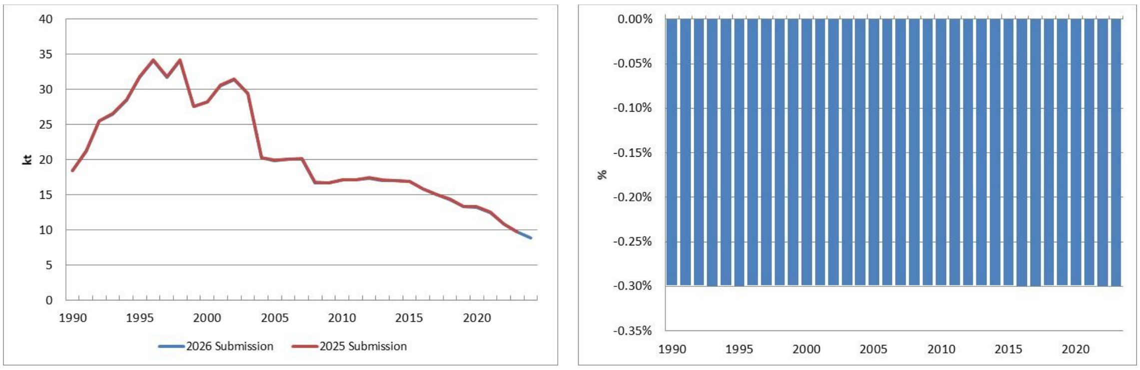



**Figure 5.5.17 Evolution of the difference in 3B4h (Rabbits) $NH_3$ emissions (national territory)**

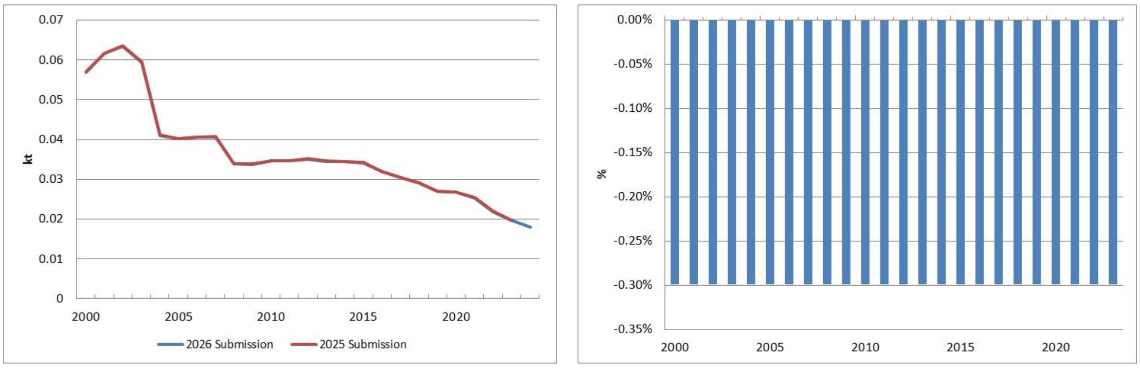



**Figure 5.5.18 Evolution of the difference in 3B4h (Rabbits) $PM_{2.5}$ emissions (national territory)**

### 3D Crop production and agricultural soils (3Da1, 3Da2a, 3Da2b, 3Da2c, 3Da3, 3Dc, 3De and 3Df)

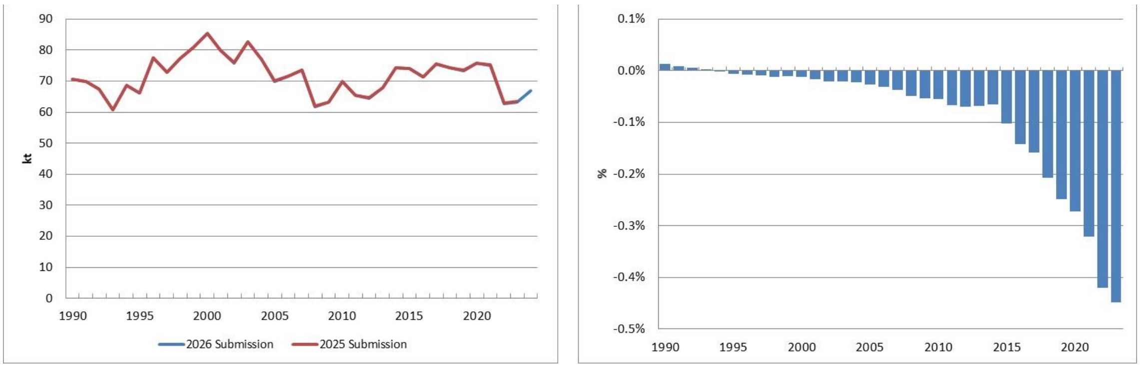



**Figure 5.5.19 Evolution of the difference in 3D $NO_X$ emissions (national territory)**

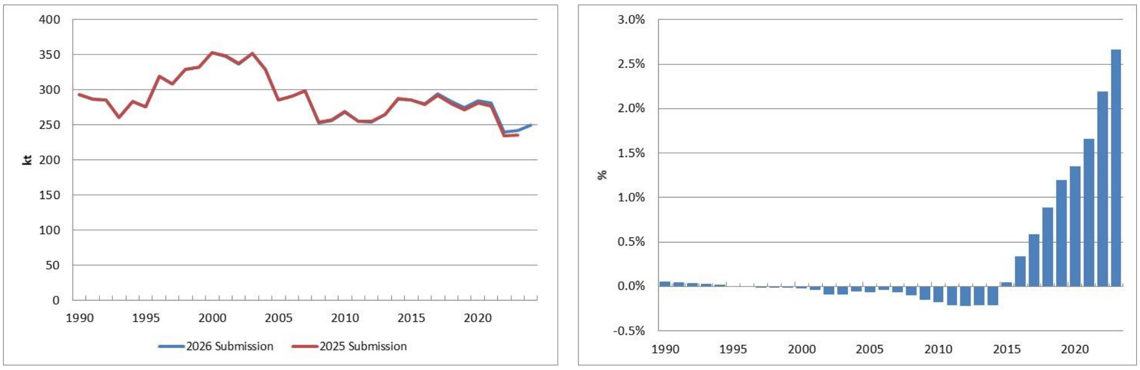



**Figure 5.5.20 Evolution of the difference in 3D $NH_3$ emissions (national territory)**

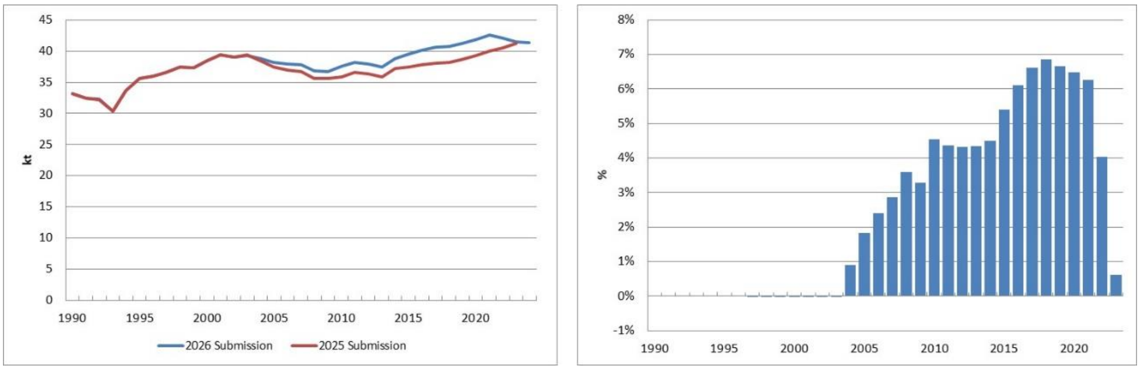



**Figure 5.5.21 Evolution of the difference in 3D NMVOC emissions (national territory)**

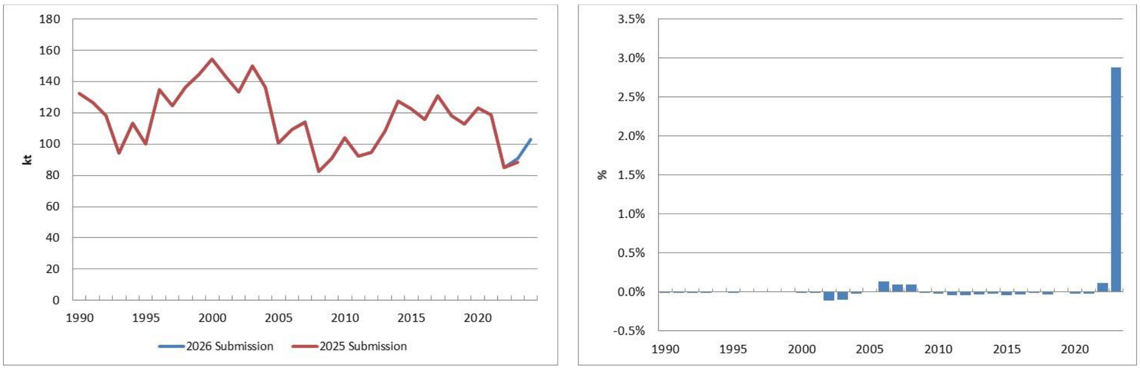



**Figure 5.5.22 Evolution of the difference in 3Da1 (Inorganic n-fertilizers) $NH_3$ emissions (national territory)**

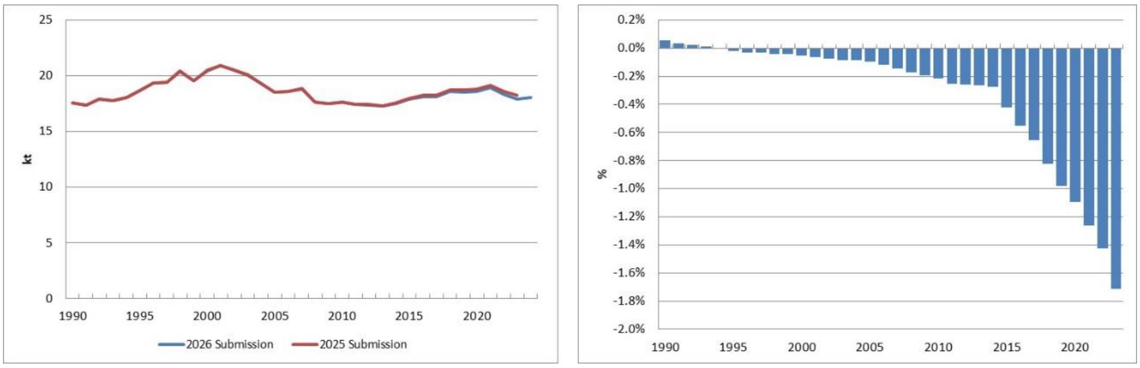



**Figure 5.5.23 Evolution of the difference in 3Da2a (Animal manure applied to soils) $NO_X$ emissions (national territory)**

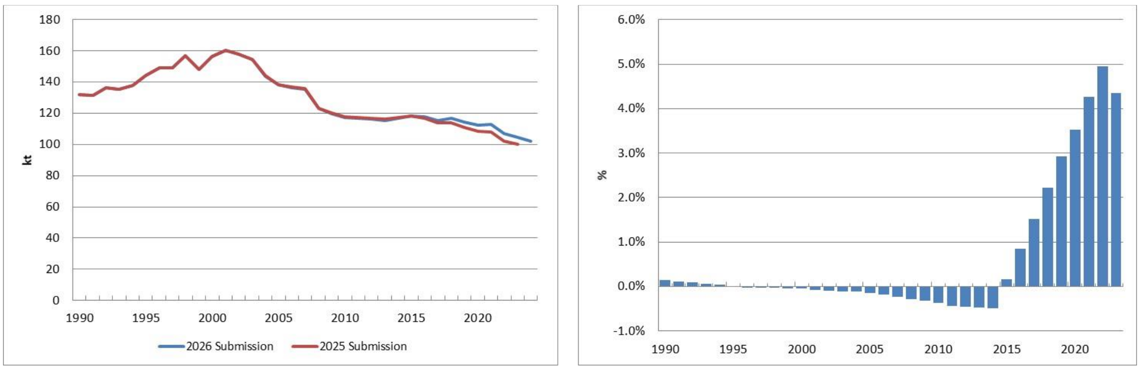



**Figure 5.5.24 Evolution of the difference in 3Da2a (Animal manure applied to soils) $NH_3$ emissions (national territory)**

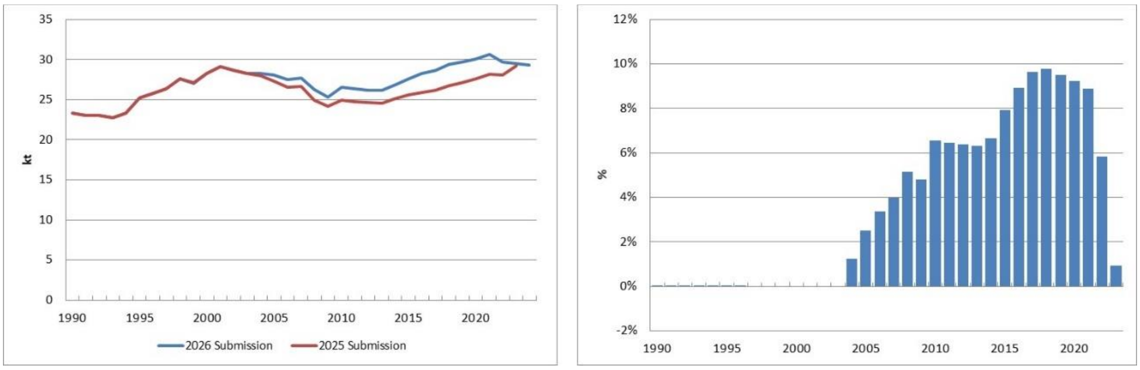



**Figure 5.5.25 Evolution of the difference in 3Da2a (Animal manure applied to soils) NMVOC emissions (national territory)**

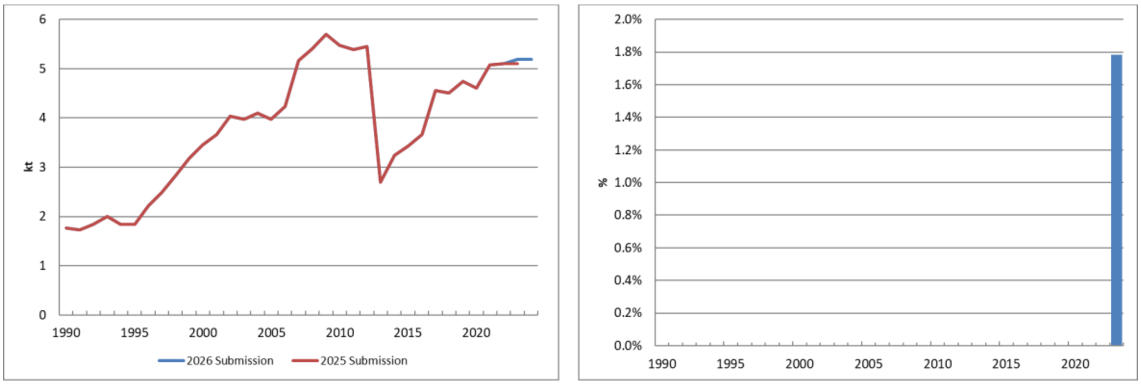



**Figure 5.5.26 Evolution of the difference in 3Da2b and 3Da2c (Sewage sludge applied to soils and Other organic fertilisers applied to soils (including compost) $NH_3$ emissions (national territory)**

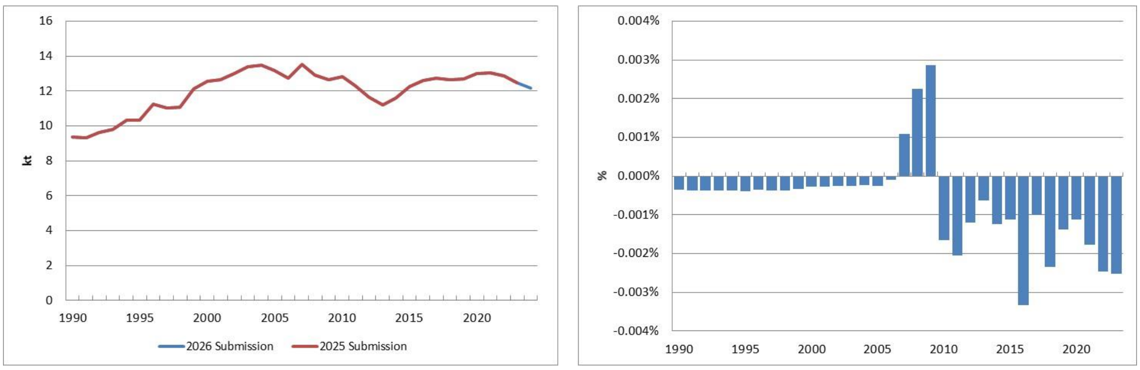



**Figure 5.5.27 Evolution of the difference in 3Da3 (Urine and dung deposited by grazing animals) $NO_X$ emissions (national territory)**

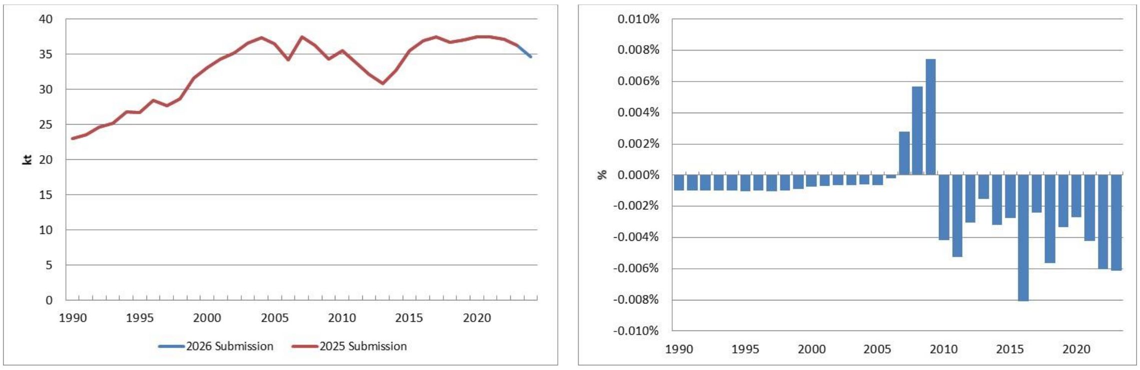



**Figure 5.5.28 Evolution of the difference in 3Da3 (Urine and dung deposited by grazing animals) $NH_3$ emissions (national territory)**

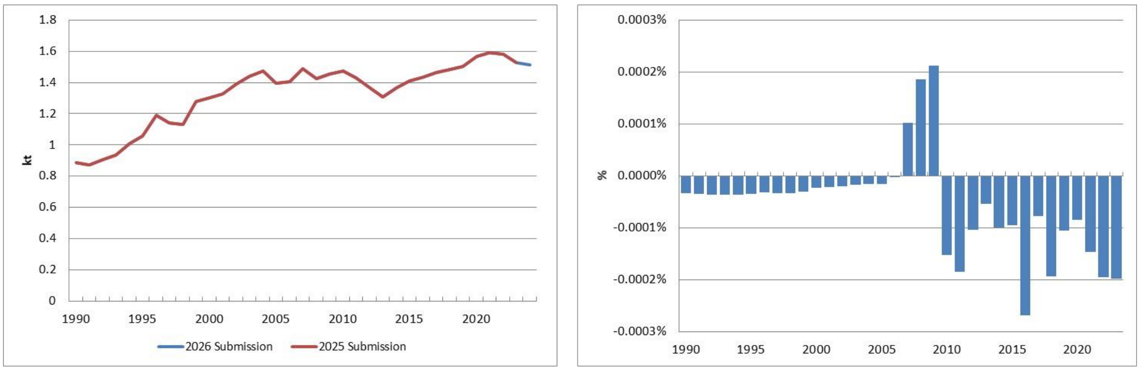



**Figure 5.5.29 Evolution of the difference in 3Da3 (Urine and dung deposited by grazing animals) NMVOC emissions (national territory)**

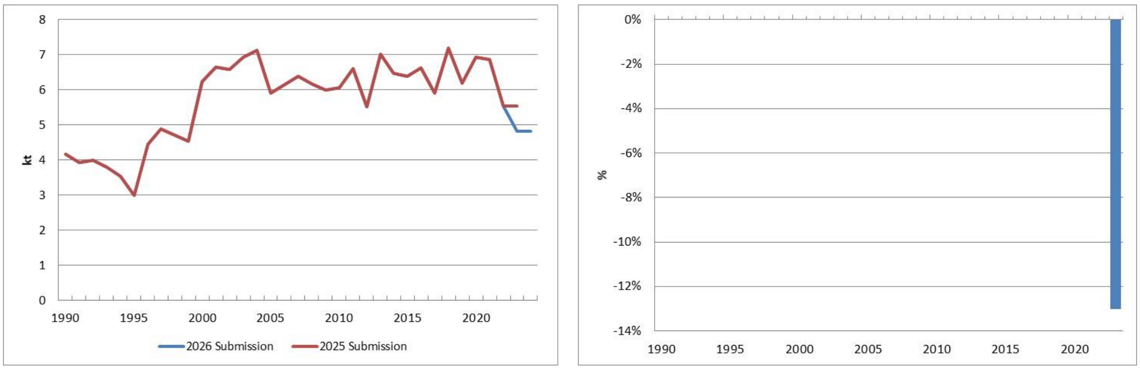



**Figure 5.5.30 Evolution of the difference in 3Da4 (Crop residues applied to soils) $NH_3$ emissions (national territory)**

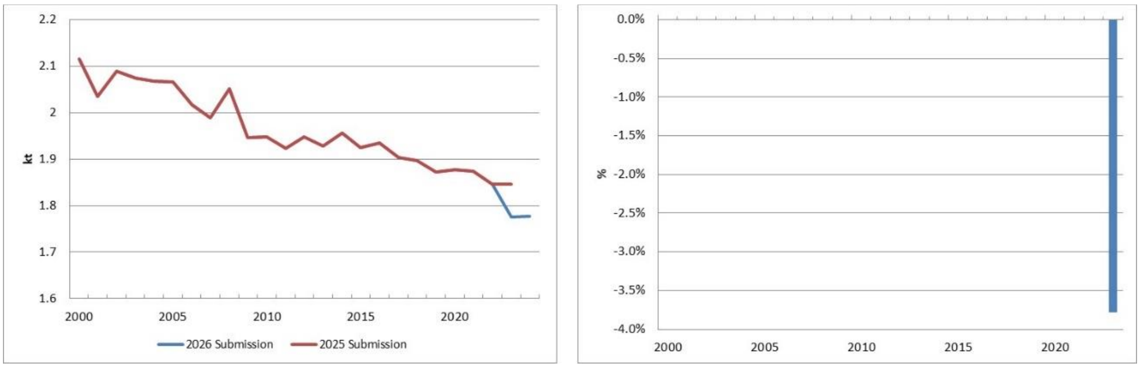



**Figure 5.5.31 Evolution of the difference in 3Dc (Farm-level agricultural operations including storage, handling and transport of agricultural products) (unique PM category of 3D) $PM_{2.5}$ emissions (national territory)**

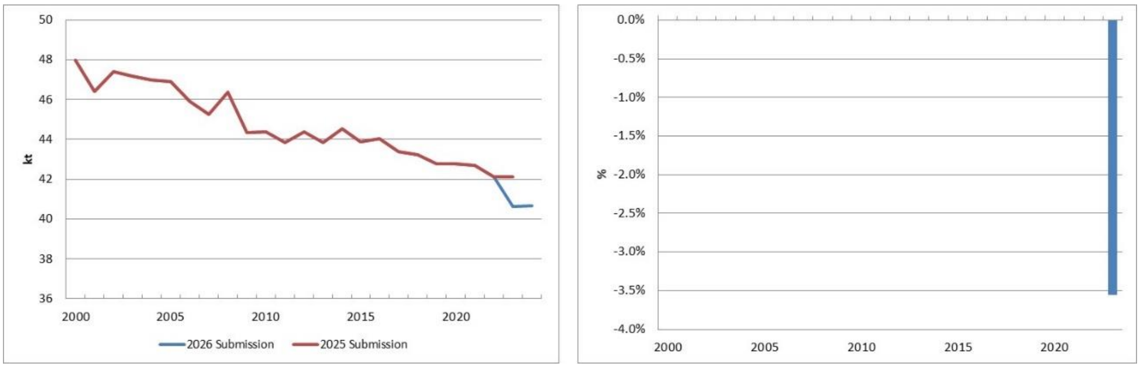



**Figure 5.5.32 Evolution of the difference in 3Dc (Farm-level agricultural operations including storage, handling and transport of agricultural products) (unique PM category of 3D) $PM_{10}$ emissions (national territory)**

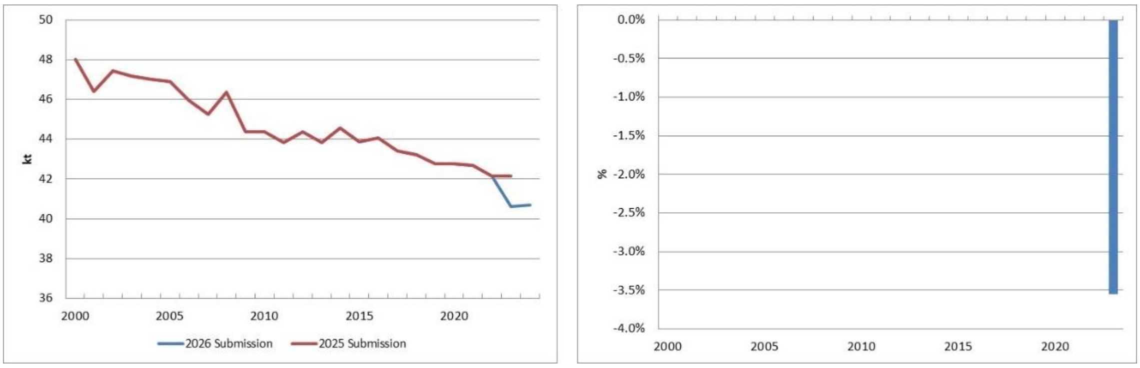



**Figure 5.5.33 Evolution of the difference in 3Dc (Farm-level agricultural operations including storage, handling and transport of agricultural p roducts) (unique PM category of 3D) TSP emissions (national territory)**

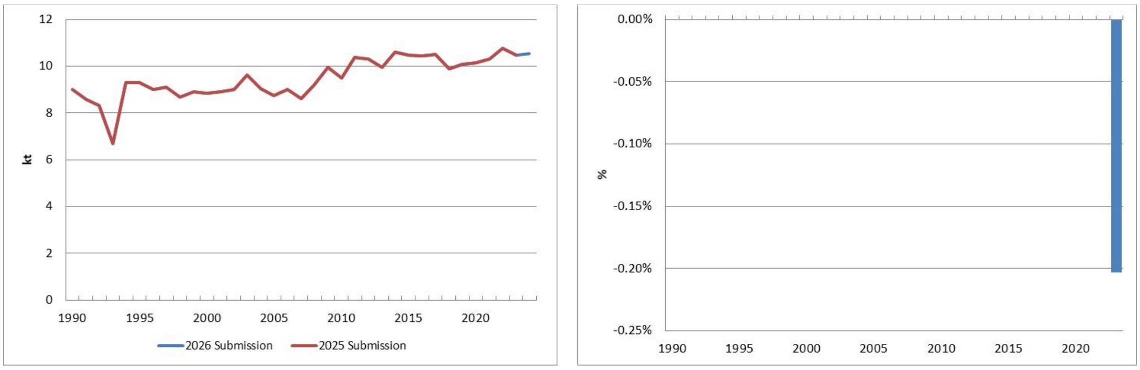



**Figure 5.5.34 Evolution of the difference in 3De NMVOC emissions (cultivated crops) (national territory)**

## 3F Field burning of agricultural residues

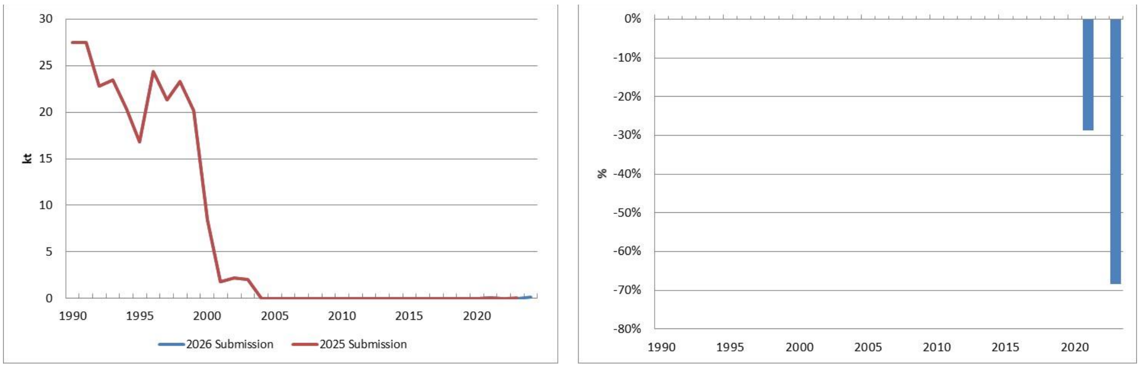



**Figure 5.5.35 Evolution of the difference in 3F $NO_X$ emissions (national territory)**

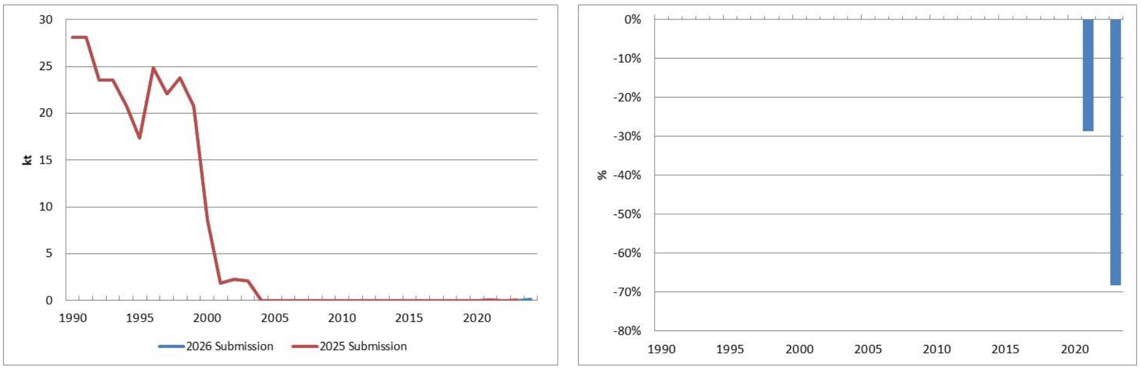



**Figure 5.5.36 Evolution of the difference in 3F $NH_3$ emissions (national territory)**

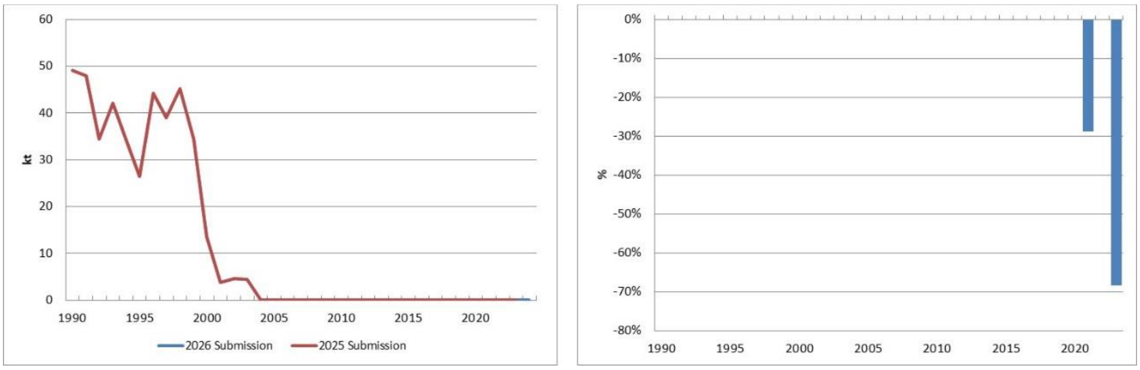



**Figure 5.5.37 Evolution of the difference in 3F NMVOC emissions (national territory)**

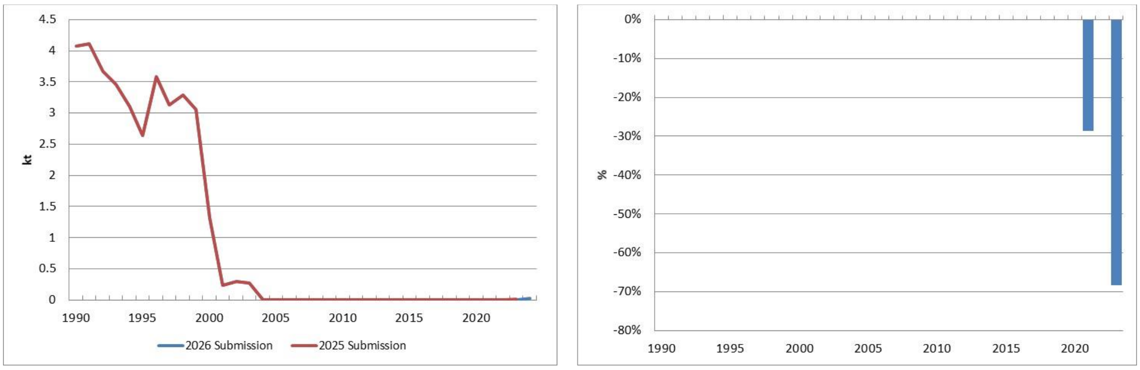



**Figure 5.5.38 Evolution of the difference in 3F $SO_2$ emissions (national territory)**

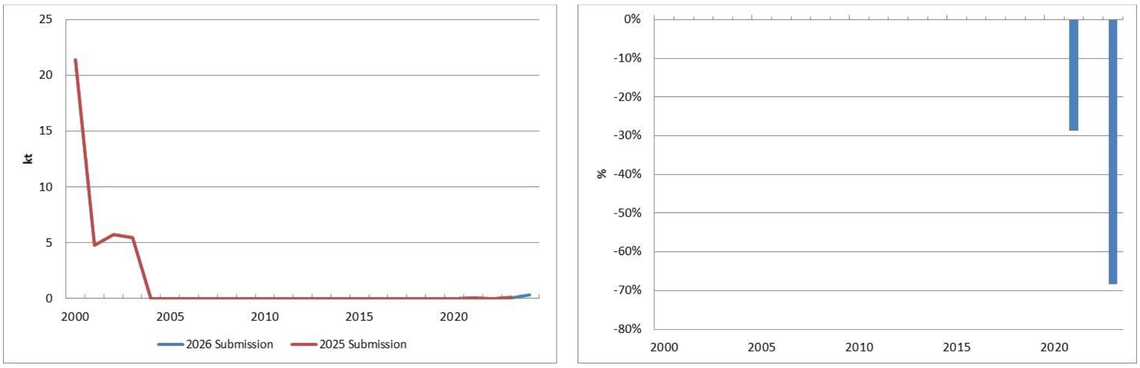



**Figure 5.5.39 Evolution of the difference in 3F $PM_{2.5}$ emissions (% equivalent to the rest of the PM) (national territory)**

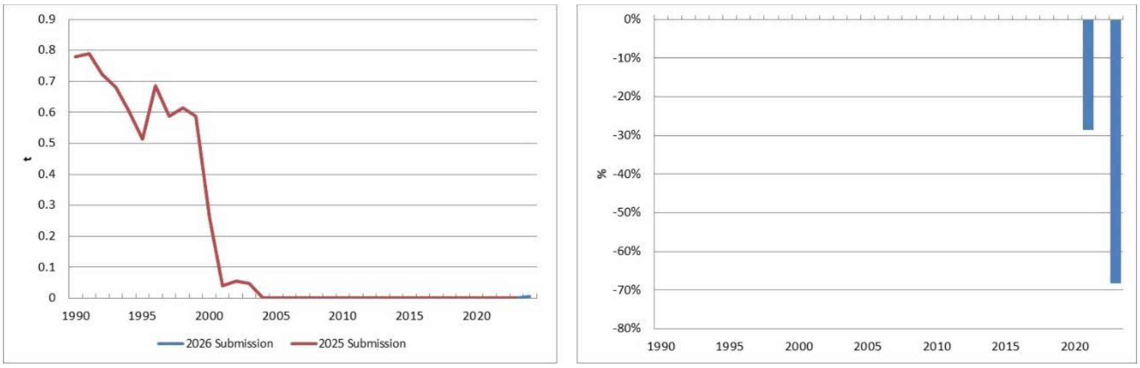
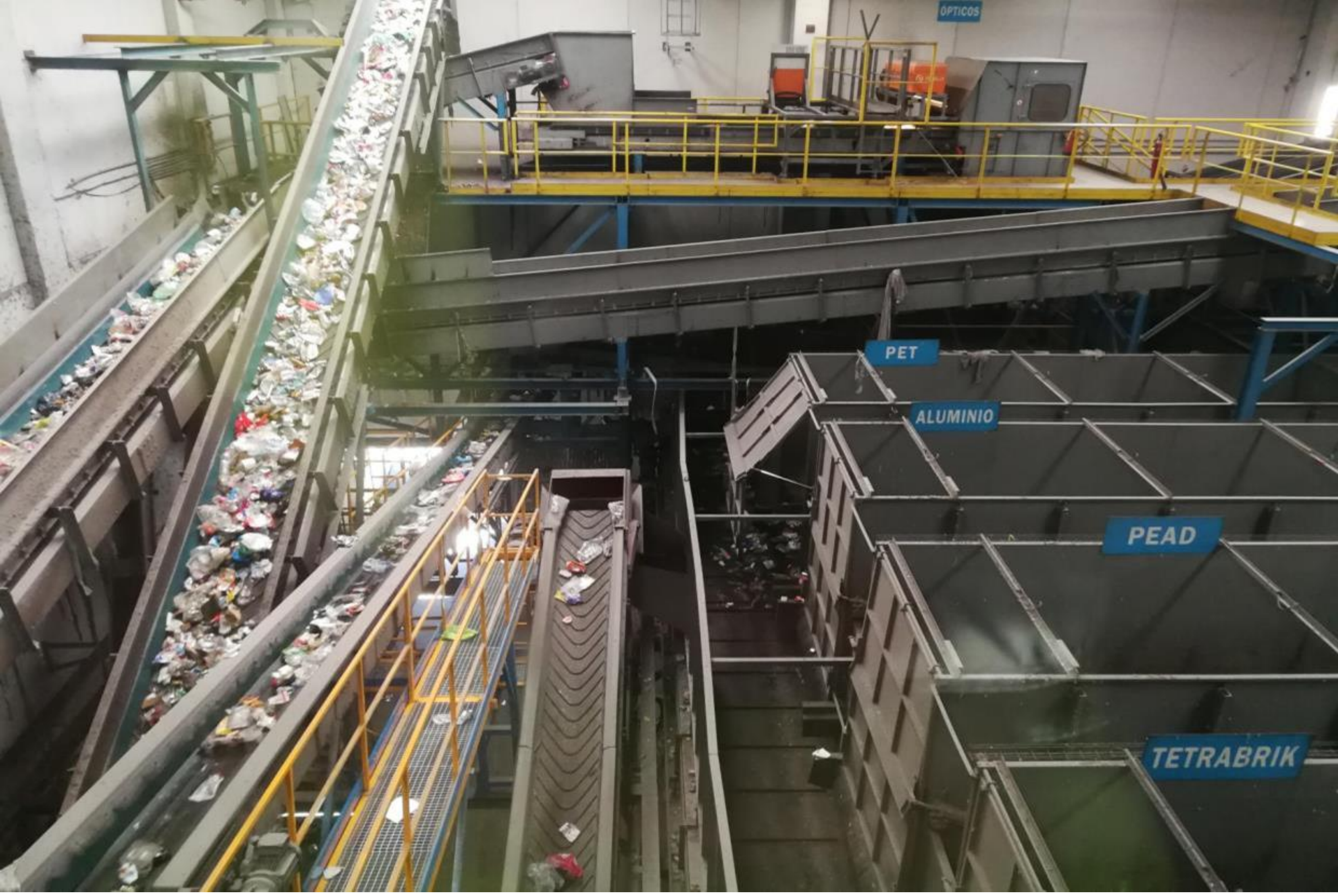



**Figure 5.5.40 Evolution of the difference in 3F Pb emissions (% equivalent to the rest of the pollutants) (national territory)**

## 5.6. Sector improvements

Areas of improvement intended to be accomplished, include:

- Incorporate into inventory the information supplied by new reviews of zootechnical documents are being completed.
- Continue with the research together with the team of experts in charge of preparing and reviewing the zootechnical documents on the methodology for estimating the zootechnical coefficients in relation to changes marked in these coefficients for different reasons in some years of the time series, such as changes in diet or legislation of use of antibiotics or due to other reasons.
- Incorporate into inventory the information supplied by technical sources about country-specific Manure Management Systems (MMSs), zootechnical coefficients and Best Available Techniques (BATs), if available, from ECOGAN, new legislation, surveys or others.




# 6. WASTE (NFR 5)

# CONTENTS

## FIGURES

## TABLES

# 6. WASTE (NFR 5)

Chapter updated in March, 2026.

## Sector Waste at a glance

The emissions of air pollutants from the Waste sector in 2024 compared to the global inventory emissions in Spain are represented in the following figure (Figure 6.1.1), where BC and PCDD/F emissions stand out, accounting for 44.69% and 34.25% of the total, respectively (44.95% and 33.94% without Canary Islands). Similarly, other contaminants as CO and $PM_{2.5}$ have a great weight in the total emissions inventoried in Spain in 2024 as well (26.90% and 22.78%, respectively; 27.06% and 23.05% without Canary Islands). All these emissions are linked mainly to a particular activity, Open burning of waste (5C2), which in 2024 corresponds to open burning of agricultural residues.

The emissions of air pollutants from the Waste sector have been reduced when compared to 1990 (2000 for $PM_{2.5}$ and BC). Such significant decreases happen for all contaminants except for $NH_3$.

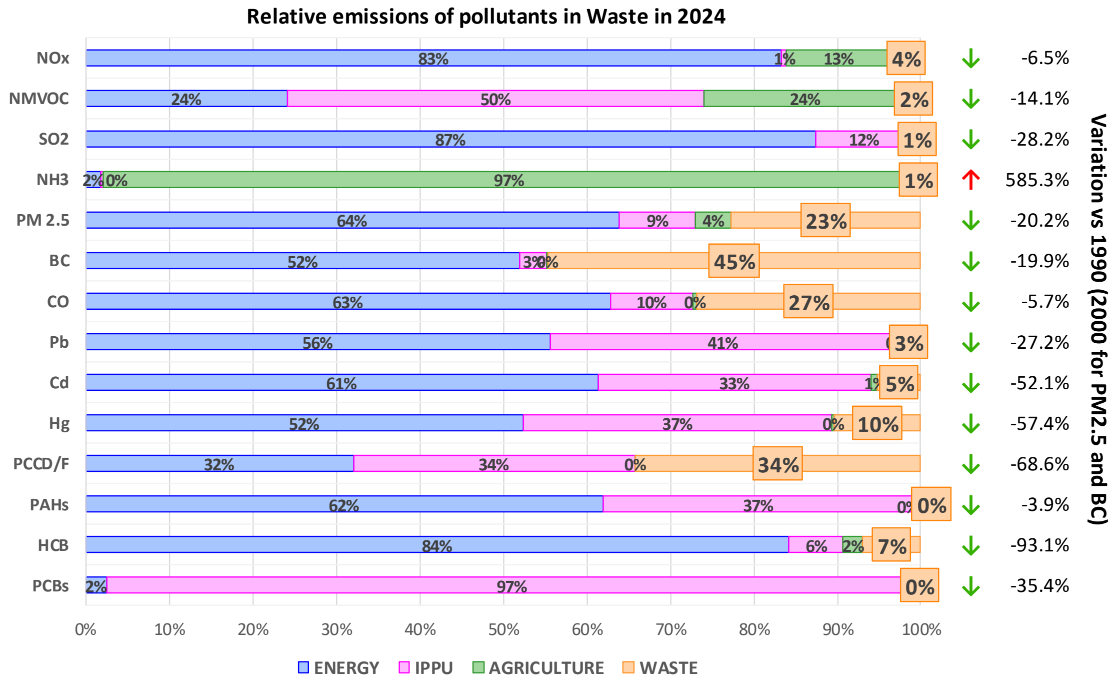



**Figure 6.1.1 Relative emissions in Waste in 2024 and its relative variation (2024 vs. 1990) (national territory)**

Waste sector activities in Spain comprises the emissions of waste management in 136 landfills, 232 composting plants, 86 biomethanization facilities and more than 2,000 wastewater treatment plants across the country. Despite this large variety of activities covered, for most pollutants, the emissions are mainly related to incineration/burning/flaring activities, with the Open burning of waste (5C2) being the principal key category for the sector and dominating most of the annual emissions and emissions trends.

During all the time series, 5C2 emissions present variations in absolute terms, in line with the annual crop production and its subsequent burning of agricultural wastes. In this sense, for 2024, emissions levels for most of the pollutants show a downwards trend driven by the relative lower activity of Open burning of waste in comparison with 1990. Regarding to pollutants linked to burning of other residues, as Cd, Pb or PCDD/F, they also show a clear decrease of emissions in 2024 due to reduced activity in Sewage sludge incineration (5C1biv). Finally, $NH_3$ emissions are directly related to Compost production (5B1) and Anaerobic digestion (5B2), which presents a rising trend.

## 6.1. Sector overview

The table below shows, per each Waste NFR category, the pollutants coverage, methodology approach (Method) and consideration as key category (KC).

**Table 6.1.1 Coverage of NFR category in 2024**

| NFR code | NFR category | Pollutants | | | | Method | KC |
|---|---|---|---|---|---|---|---|
| | | Covered | Exceptions | | | | |
| | | | IE | NA | NE | | |
| **5A** | Solid waste disposal on land | NOx, NMVOC, PM, CO | – | Rest of pollutants | $NH_3$, Hg | T2 | – |
| **5B1** | Biological treatment of waste<br>- Composting | $NH_3$ | – | Rest of pollutants | NOx, NMVOC, $SO_2$, PM, BC, CO | T2 | – |
| **5B2** | Biological treatment of waste<br>- Anaerobic digestion at biogas facilities | NOx, $NH_3$, PM, CO | – | As, Cu, Ni, Se | Rest of pollutants | T1 | – |
| **5C1a** | Municipal waste incineration | NO (since 2003, or 2004 when considering the Canary Islands, reported in 1A1a)[1] | | | | | – |
| **5C1bi** | Industrial waste incineration | IE (reported in 1A1a) | | | | | |
| **5C1bii** | Hazardous waste incineration | NO | | | | | |
| **5C1biii** | Clinical waste incineration | IE (since 2006, reported in 1A1a) | | | | | |
| **5C1biv** | Sewage sludge incineration | All | – | | $NH_3$ | T2 | ✓ |
| **5C1bv** | Cremation | All | – | $NH_3$ | BC | T1 | – |
| **5C1bvi** | Other waste incineration (please specify in the IIR) | NO | | | | | – |
| **5C2** | Open burning of waste | All | – | PCB | $NH_3$, Hg, Ni, HCB, Indeno (1,2,3-cd) pyrene | T2 | ✓ |
| **5D1** | Domestic wastewater handling | NOx, NMVOC, PM, CO | – | Rest of pollutants | $NH_3$, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, BC | T2 | – |
| **5D2** | Industrial wastewater handling | NOx, NMVOC, PM, CO | – | Rest of pollutants | $NH_3$, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, BC | T1 | |

[1] Recommendation ES-5C1a-2025-0001 made by the TERT in NECD the Final Review Report (Review of National Air Pollutant Emission Inventory Data 2025 under Directive (EU) 2016/2284). Final Review Report available at: https://environment.ec.europa.eu/topics/air/reducing-emissions-air-pollutants/emissions-inventories_en#review-of-national-emission-inventories

| NFR code | NFR category | Pollutants | | | | Method | KC |
|---|---|---|---|---|---|---|---|
| | | Covered | Exceptions | | | | |
| | | | IE | NA | NE | | |
| **5E** | Other waste | All | – | Rest of pollutants | NOx, CO | T2 | ✓ |

IE: included elsewhere; NA: not applicable; NE: not estimated; NO: not occurring.

## 6.2. Sector analysis

The following table covers the detailed source categories for Waste in Spain in 2024. These main features reference to national total values and between parenthesis the value without Canary Islands.

For further information on methodology applied to non-key categories, links to the methodology factsheets published in MITECO-SEI website are included in the following table. For key categories, links to the available methodology factsheets have been included in the corresponding methodology section.

### Table 6.2.1 Sector analysis

| NFR Code | NFR category | Main features (2024) | Main sources of activity data |
|---|---|---|---|
| **5A** | Solid waste disposal on land<br><br>(Methodology factsheets:<br>Deposit of solid waste in managed landfills<br>Deposit of solid waste in unmanaged landfills) | - 136 active landfills with waste disposal covered, 91 of them with biogas capture (128 active landfills without Canary Islands, 86 of them with biogas capture).<br>- 9,146.81 kt of waste deposited in landfills (8,112.82 kt without Canary Islands). | - SGR (MITECO). |
| **5B1** | Biological treatment of waste: Composting<br><br>(Methodology factsheet:<br>Compost production) | - 232 composting plants covered (224 without Canary Islands).<br>- 4,475 kt of waste entering the composting process (4,233 kt without Canary Islands). | - SGR (MITECO). |
| **5B2** | Biological treatment of waste: Anaerobic digestion at biogas facilities<br><br>(Methodology factsheet:<br>Biological treatment of solid waste (biomethanization)) | - 86 biomethanization facilities covered (84 without Canary Islands): 4 of them mainly treating slurry, and the rest of facilities treating the organic fraction of municipal solid waste (MSW) and/or sludge. | - IQ.<br>- SGR (MITECO). |
| **5C1biv** | Sewage sludge incineration<br><br>(Methodology factsheet:<br>Sewage sludge incineration) | - 57.2 kt of sludge incinerated (7% of the total sludge produced). | - IQ.<br>- National Sludge Registry (RNL (MITECO)). |

| NFR Code | NFR category | Main features (2024) | Main sources of activity data |
|---|---|---|---|
| **5C1bv** | Cremation<br><br>(Methodology factsheet: Cremation) | - 207,149 corpses incinerated (201,003 without Canary Islands) which represents the final destiny of 47.8% of deaths. | - 1990-2009: European Federation of Funeral Services.<br>- 2010-2014: Estimation based on data provided by the main entrepreneurial association for the period 1990-2009 and data of deaths from INE.<br>- 2015-2024: PANASEF. |
| **5C2** | Open burning of waste<br><br>(Methodology factsheet: Controlled burning of agricultural residues) | - 2,910.4 kt of agricultural residues burned (dry matter). | -Statistical Yearbook[2] (MAPA).<br>- Nitrogen and Phosphorus Balance in Spanish Agriculture (BNPAE) Yearbook. |
| **5D1** | Domestic wastewater handling<br><br>(Methodology factsheet: Domestic wastewater handling) | - 75.4 kt of biogas produced and recovered in domestic wastewater plants from anaerobic treatment of sludge (73.4 kt without Canary Islands).<br>- 9.1% of biogas burned in flares. | - "Uses of biogas produced in urban wastewater treatment plants in Spain" by CEDEX.<br>- Indicators on wastewater from the Spanish Statistical Office (INE).<br>- Data from OECC and MITECO.<br>- Data from CNV (Censo Nacional de Vertidos). |
| **5D2** | Industrial wastewater handling<br><br>(Methodology factsheet: Industrial wastewater handling) | - 9.4 kt of biogas recovered from industrial wastewater treatment plants (9.0 kt without Canary Islands).<br>- 42% of $CH_4$ burned in flares. | - Estimation based on data from OECC, MITECO and INE. |
| **5E** | Other waste: Sludge spreading, accidental fires<br><br>(Methodology factsheets: Sludge spreading, Accidental fires) | - 0.79 kt of sludge dried by spreading (0.77 kt without Canary Islands) which represents the 0.1% of total sludge produced in domestic wastewater plants.<br>- Accidental fires:<br>· 3,203 detached houses fires (3,056 without Canary Islands).<br>· 3,184 semi-detached houses fires (3,037 without Canary Islands).<br>· 12,125 flat fires (11,567 without Canary Islands).<br>· 9,800 industrial fires (9,349 without Canary Islands).<br>· 22,958 cars fires (21,901 without Canary Islands). | - National Sludge Registry (RNL (MITECO)).<br>- CEDEX.<br>- Madrid Council Government Area of Security and Community Services. General Directorate of Emergencies.<br>- MAPFRE Foundation and Professional Association of Firemen Technicians.<br>- Distribution of population by degree of urbanisation, dwelling type and income group (Eurostat).<br>- Fleet vehicle (DGT). |

## 6.2.1. Key categories

According to the information provided in section 1.5 of this IIR and the Annex 1, the identified Key Categories within the Waste sector are summarised in the following table.

[2] Cultivated areas data and crop yields for BNPAE calculates are provided by MAPA's Statistics Yearbook with two-year lag. In these cases, the Inventory replicates the x-2 year values published in the Yearbook, into x-1 year, the last year inventoried. This edition has updated the values of 2023 according to the yearbook, and has replicated them into 2024.

**Table 6.2.2 Assignation of KC**

| NFR | NFR Category | NOx | NMVOC | $SO_2$ | $NH_3$ | $PM_{2.5}$ | $PM_{10}$ | TSP | BC | CO | Pb | Cd | Hg | PCDD/ PCDF | PAHs | HCB | PCBs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **5B** | Biological treatment of solid waste | - | - | - | T | - | - | - | - | - | - | - | - | - | - | - | - |
| **5C** | Incineration | L | - | - | - | L-T | L-T | L-T | L-T | L | L | L | L-T | L-T | - | L | - |
| **5E** | Other waste | - | - | - | - | - | - | - | - | - | - | - | - | L | - | - | - |

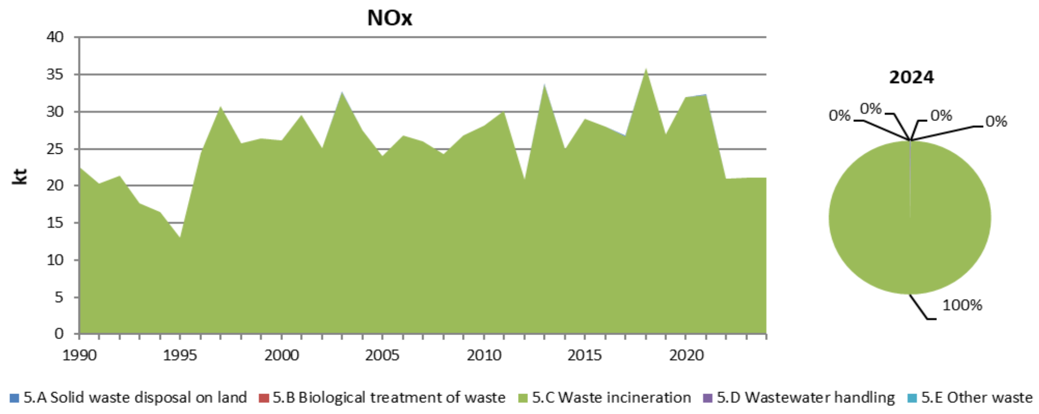
L: level; T: trend

## 6.2.2. Analysis by pollutant

Featured below are the charts of the time series by pollutants and NFR categories. Each pollutant is represented independently, broken down by main NFR categories within the sector. Additionally, a pie chart showing the weight distribution of the main categories for the year 2024 is included.

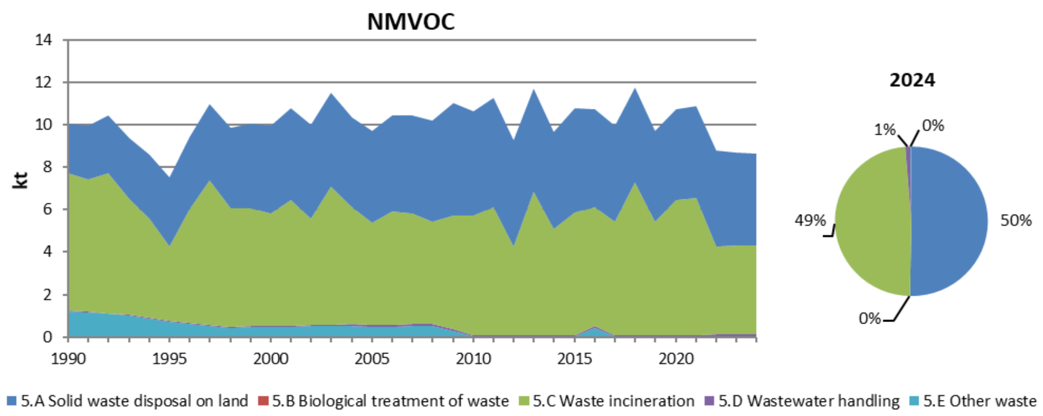
Explanation boxes below the graphs provide specific details on the pollutant emissions for the year 2024 (national territory), as well as main drivers and its trends during the time series (data without the Canary Islands are provided in parentheses, since their territory is not under the EMEP grid). Detailed emission data of the Spanish Inventory are available from the MITECO-SEI website WebTable.

## Main Pollutants



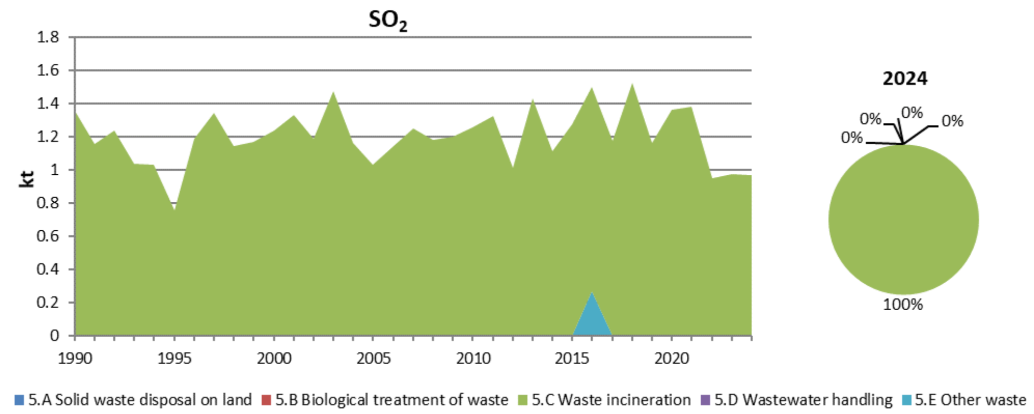

| | | |
|---|---|---|
| ***NOx*** | 21.09 kt emitted in 2024 (20.75 kt without Canary Islands)<br>3.58% of the total NOx emissions of the Inventory in 2024 (3.91% without Canary Islands) | |
| | 1990-2024 | NOx emissions from the Open burning of waste (5C2) show variations in absolute terms, in line with the annual crop production and the subsequent burning of agricultural residues.<br>Emissions are also influenced, to a lesser extent, by the municipal waste incineration without energy recovery (5C1a), Clinical waste incineration without energy recovery (5C1biii) and Cremation (5C1bv). |

**Figure 6.2.1 Evolution of NOx by category and distribution in year 2024 (national territory, NT)**



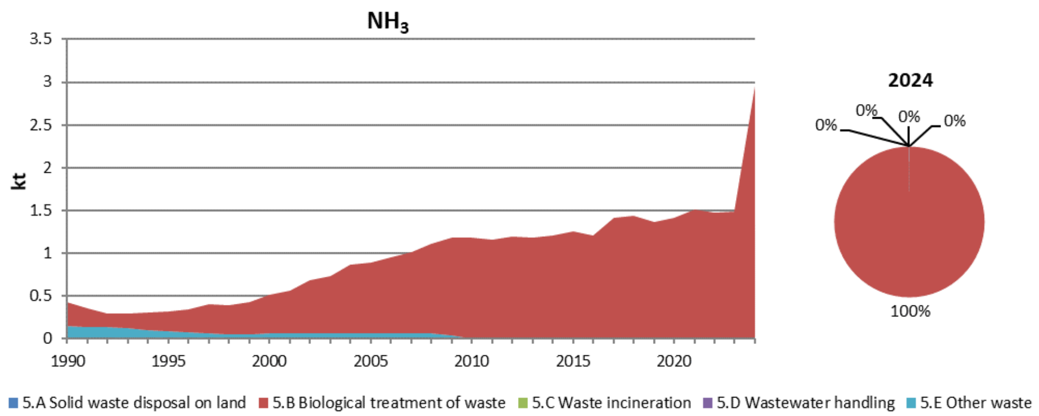

| | | |
|---|---|---|
| ***NMVOC*** | 8.65 kt emitted in 2024 (8.14 kt without Canary Islands)<br>1.73% of the total NMVOC emissions of the Inventory in 2024 (1.67% without Canary Islands) | |
| | 1990-2024 | Main source of NMVOC emissions is linked to Open burning of waste (NFR 5C2); and Solid waste disposal on land (NFR 5A). These emissions show variations in absolute terms, in line with annual waste production and its subsequent burning or disposal.<br>Emissions related to Other waste (5E) correspond to the Sludge spreading series (no longer relevant since 2010). The uptick in 2016 is due to an accidental tire fire event reported under Other waste (5E) for that specific year.<br>Emissions are also influenced, to a lesser extent, by the municipal waste incineration without energy recovery (5C1a), Clinical waste incineration without energy recovery (5C1biii), Cremation (5C1bv). |

**Figure 6.2.2 Evolution of NMVOC by category and distribution in year 2024 (NT)**




| | | |
|---|---|---|
| ***$SO_2$*** | 0.97 kt emitted in 2024 (0.96 kt without Canary Islands)<br>1.00% of the total $SO_2$ emissions of the Inventory in 2024 (1.06% without Canary Islands) | |
| | 1990-2024 | $SO_2$ emissions from the Open burning of waste (5C2) show variations in absolute terms, in line with the annual crop production and the subsequent burning of agricultural waste.<br>Emissions are also influenced, to a lesser extent, by the municipal waste incineration without energy recovery (5C1a), Clinical waste incineration without energy recovery (5C1biii) and Cremation (5C1bv).<br>The uptick in 2016 is due to an accidental tire fire event reported under Other waste (5E) for that specific year. |

**Figure 6.2.3 Evolution of $SO_2$ by category and distribution in year 2024 (NT)**



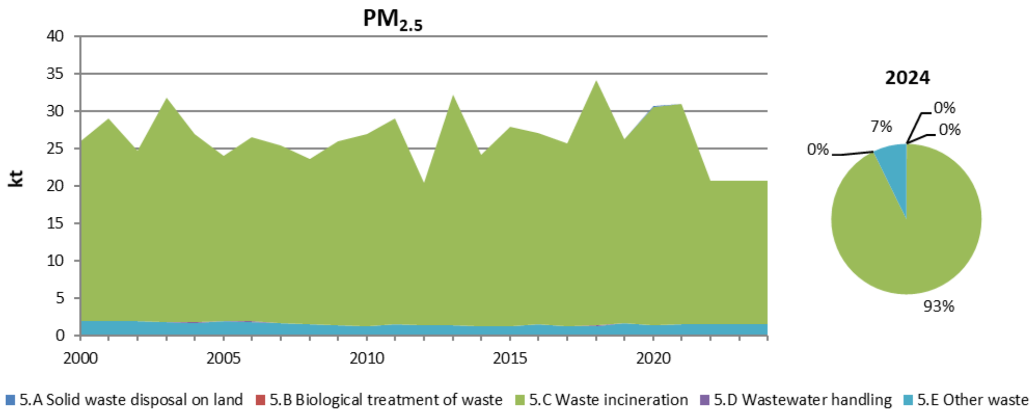

| | | |
|---|---|---|
| ***$NH_3$*** | 2.95 kt emitted in 2024 (2.87 kt without Canary Islands)<br>0.65% of the total $NH_3$ emissions of the Inventory in 2024 (0.64% without Canary Islands) | |
| | 1990-2024 | Ammonia emissions are directly related with Biological treatment of solid waste activity (5B, Composting and Anaerobic digestion at biogas facilities), which increases gradually throughout the time series. The high amount of slurry and sludge entering the digesters of the biomethanization plants in the last reported year (2024) generated a peak in $NH_3$ emissions.<br>Emissions related to Other waste (5E) corresponds to the series of Sludge spreading which are no longer relevant since 2010. |

**Figure 6.2.4 Evolution of $NH_3$ by category and distribution in year 2024 (NT)**

## Particulate Matter

For the entire time series, the emission factors used for particulate matter (PM) emitted during biogas burning in flares within categories 5A, 5B2 and 5D come from AP 42, Fifth Edition, Volume I, Chapter 2: Solid Waste Disposal, table 2.4-4 (for flares, IC engines, boilers and gas turbines) where it is stated the following footnote: "(b) No data on PM size distributions were available, however for other gas-fired combustion sources, most of the particulate matter is less than 2.5 microns in diameter. Hence, this emission factor can be used to provide estimates of $PM_{10}$ or $PM_{2.5}$ emissions [...]". The Spanish Inventory Team thus assumes the same emission factors for both $PM_{2.5}$ and $PM_{10}$[3].

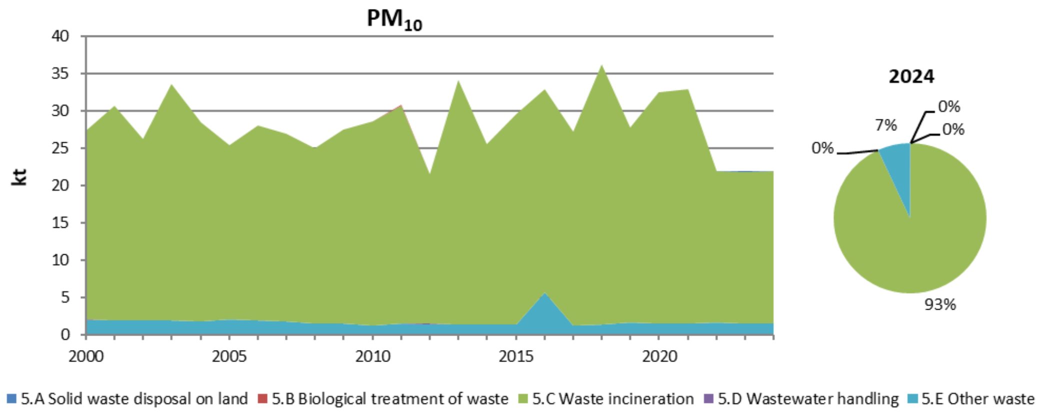
Combustion of biogas with energy recovery is included under the energy sector (1A1a).




| | | |
|---|---|---|
| ***PM2.5*** | 20.70 kt emitted in 2024 (20.33 kt without Canary Islands)<br>22.78% of the total $PM_{2.5}$ emissions of the Inventory in 2024 (23.05% without Canary Islands) | |
| | 2000-2024 | $PM_{2.5}$ emissions within the Waste sector are dominated by Open burning of waste (5C2). These emissions show variations in absolute terms, in line with the cessation of the open burning of unmanaged landfills from 2000 onwards, and the annual crop production and the subsequent burning of agricultural waste.<br>Emissions under Other waste (5E) correspond to the Accidental fires series. |

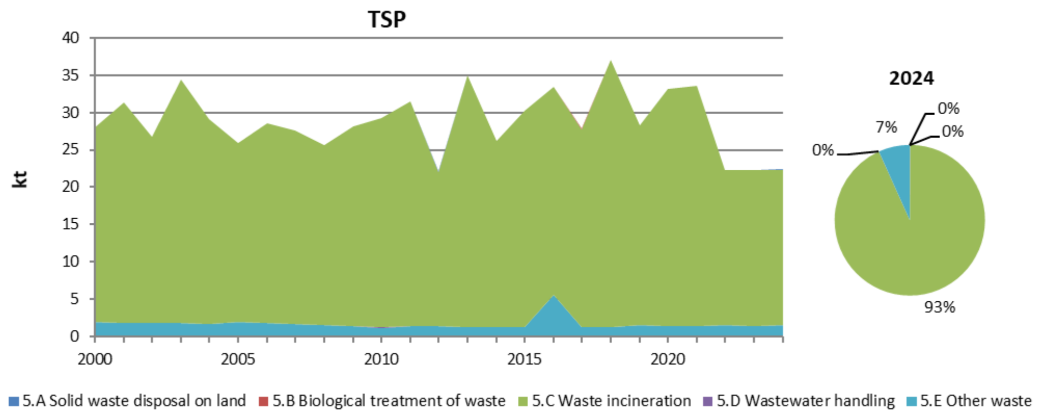
**Figure 6.2.5 Evolution of $PM_{2.5}$ by category and distribution in year 2024 (NT)**

[3] Recommendations ES-5B2-2023-0001, ES-5D1-2023-0001, ES 5D2-2023-0001 and ES-5D1-2019-0001/ES-5D2-2019-0001 made by the TERT in the Final Review Reports (Review of National Air Pollutant Emission Inventory Data 2019 and 2023 under Directive (EU) 2016/2284). Final Review Report available at:
https://environment.ec.europa.eu/topics/air/reducing-emissions-air-pollutants/emissions-inventories_en#review-of-national-emission-inventories



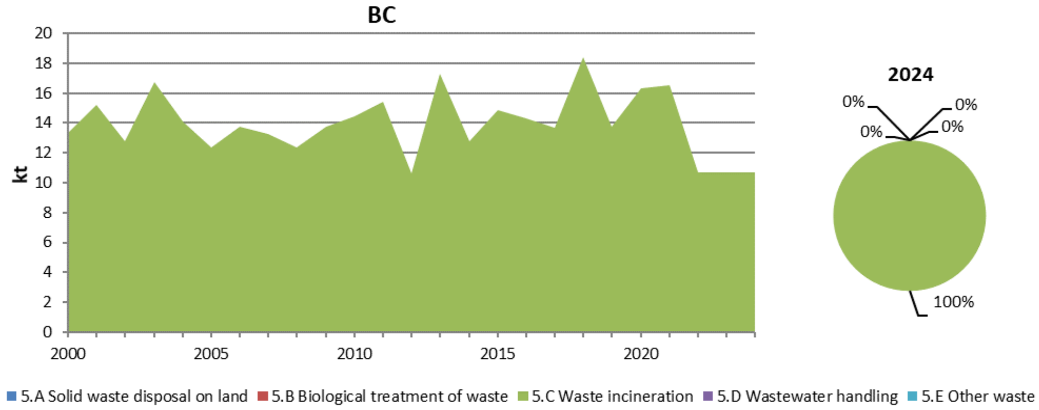

| | | |
|---|---|---|
| ***$PM_{10}$*** | 21.88 kt emitted in 2024 (21.48 kt without Canary Islands)<br>13.29% of the total $PM_{10}$ emissions of the Inventory in 2024 (13.35% without Canary Islands) | |
| | 2000-2024 | $PM_{10}$ emissions within the Waste sector are dominated by Open burning of agricultural waste (5C2). These emissions show variations in absolute terms, in line with the cessation of the open burning of unmanaged landfills from 2000 onwards, and the annual crop production and the subsequent burning of agricultural waste.<br>Emissions under Other waste (5E) correspond to the Accidental fires series. The uptick in 2016 is due to an accidental tire fire event reported under this category for that specific year. |

**Figure 6.2.6 Evolution of $PM_{10}$ by category and distribution in year 2024 (NT)**




| | | |
|---|---|---|
| ***TSP*** | 22.36 kt emitted in 2024 (21.96 kt without Canary Islands)<br>8.82% of the total TSP emissions of the Inventory in 2024 (8.84% without Canary Islands) | |
| | 2000-2024 | TSP emissions within the Waste sector are dominated by Open burning of agricultural waste (5C2). These emissions show variations in absolute terms, in line with the cessation of the open burning of unmanaged landfills from 2000 onwards, and the annual crop production and the subsequent burning of agricultural waste.<br>Emissions under Other waste (5E) correspond to the Accidental fires series. The uptick in 2016 is due to an accidental tire fire event reported under this category for that specific year. |

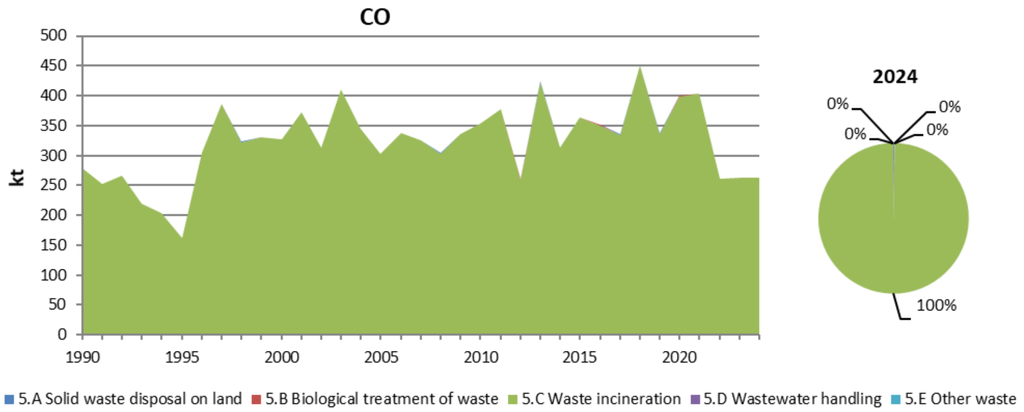
**Figure 6.2.7 Evolution of TSP by category and distribution in year 2024 (NT)**




| | | |
|---|---|---|
| ***BC*** | 10.71 kt emitted in 2024 (10.54 kt without Canary Islands)<br>44.69% of the total BC emissions of the Inventory in 2024 (44.95% without Canary Islands) | |
| | 2000-2024 | BC emissions within the Waste sector are dominated by Open burning of waste (5C2). These emissions show variations in absolute terms, in line with annual crop production and the subsequent burning of agricultural waste. |

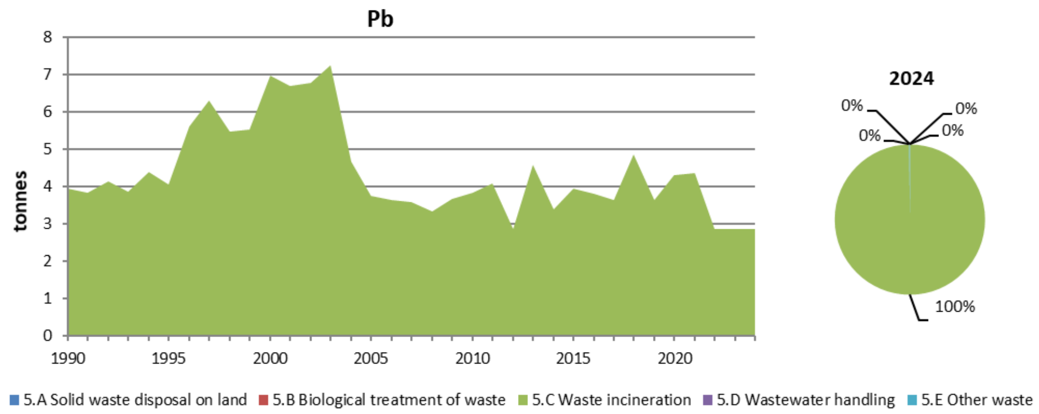
**Figure 6.2.8 Evolution of BC by category and distribution in year 2024 (NT)**

## CO and Priority Heavy Metals



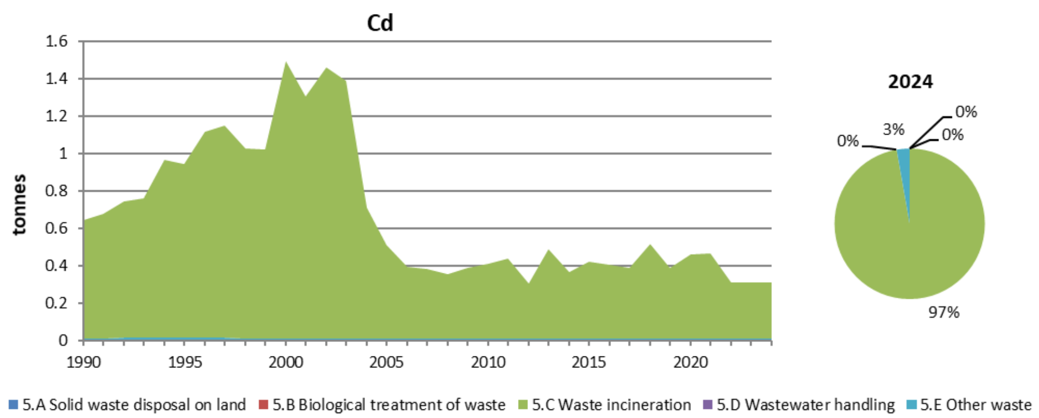

| | | |
|---|---|---|
| ***CO*** | 263.06 kt emitted in 2024 (258.82kt without Canary Islands)<br>26.90% of the total CO emissions of the Inventory in 2024 (27.06% without Canary Islands) | |
| | 1990-2024 | CO emissions within the Waste sector are dominated by Open burning of waste (5C2). These emissions show variations in absolute terms, in line with annual crop production and the subsequent burning of agricultural waste. |

**Figure 6.2.9 Evolution of CO by category and distribution in year 2024 (NT)**



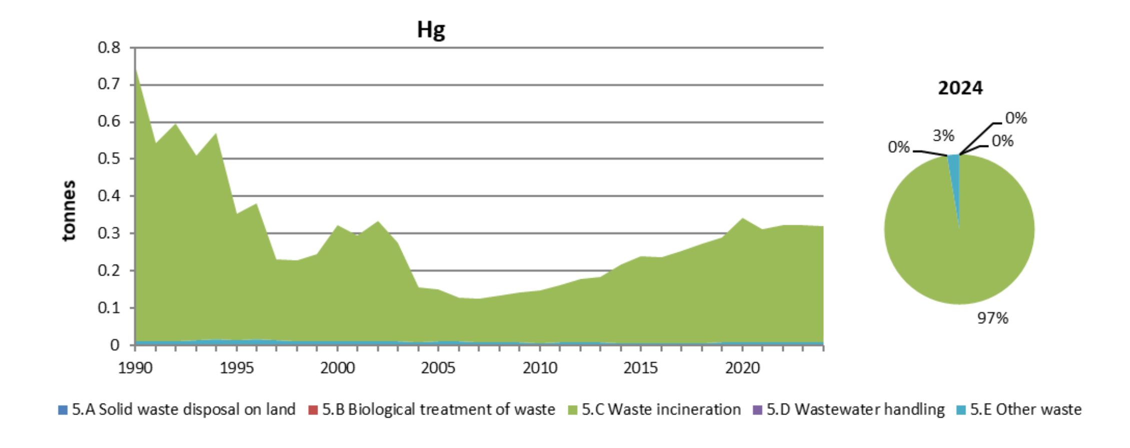

| | | |
|---|---|---|
| ***Pb*** | 2.87 tonnes emitted in 2024 (2.83 tonnes without Canary Islands)<br>2.99% of the total Pb emissions of the Inventory in 2024 (3.06% without Canary Islands) | |
| | 1990-2002 | Upward trend driven by increasing sludge incineration combined with an uncontrolled, unabated emission factor for Sewage sludge incineration (5C1biv). |
| | 2003-2024 | Sewage sludge incineration estimates consider abatement, due to the implementation of the Waste Incineration Directive.<br>Emissions from the Open burning of waste (5C2) show variations in absolute terms, in line with annual crop production and the subsequent burning of agricultural residues.<br>Emissions are also influenced, to a lesser extent, by the municipal waste incineration without energy recovery (5C1a), Clinical waste incineration without energy recovery (5C1biii) and Cremation (5C1bv). |

**Figure 6.2.10 Evolution of Pb by category and distribution in year 2024 (NT)**




| | | |
|---|---|---|
| ***Cd*** | 0.31 tonnes emitted in 2024 (0.30 tonnes without Canary Islands)<br>5.15% of the total Cd emissions of the Inventory in 2024 (5.78% without Canary Islands) | |
| | 1990-2002 | Upward trend driven by increasing sludge incineration combined with an uncontrolled, unabated emission factor for Sewage sludge incineration (5C1biv). |
| | 2003-2024 | Sewage sludge incineration estimates consider abatement, due to the implementation of the Waste Incineration Directive.<br>Emissions from the Open burning of waste (5C2) show variations in absolute terms, in line with annual crop production and the subsequent burning of agricultural residues.<br>Emissions are also influenced, to a lesser extent, by the municipal waste incineration without energy recovery (5C1a), Clinical waste incineration without energy recovery (5C1biii) and Cremation (5C1bv). Other waste (5E) emissions correspond to the series of Accidental fires. |

**Figure 6.2.11 Evolution of Cd by category and distribution in year 2024 (NT)**




| | | |
|---|---|---|
| *Hg* | 0.32 tonnes emitted in 2024 (0.31 tonnes without Canary Islands)<br>10.42% of the total Hg emissions of the Inventory in 2024 (12.73% without Canary Islands) | |
| | 1990-2024 | Downward trend due to the decrease of municipal waste incineration without energy recovery (5C1a), the introduction of municipal waste incineration plants with energy recovery (reported under 1A1a) in 2003 and the progressive reduction of Clinical waste incineration without energy recovery (5C1biii) in 2005.<br>The trend slightly grows since 2006 due to emissions from Cremation of human corpses (5C1bv).<br>Other waste (5E) corresponds to the series of Accidental fires for the entire time series. |

**Figure 6.2.12 Evolution of Hg by category and distribution in year 2024 (NT)**

## POPs

Emissions of POPs are mainly generated in categories 5C (Incineration) and 5E (Other waste). Therefore, a unique figure with the pollutants is shown.

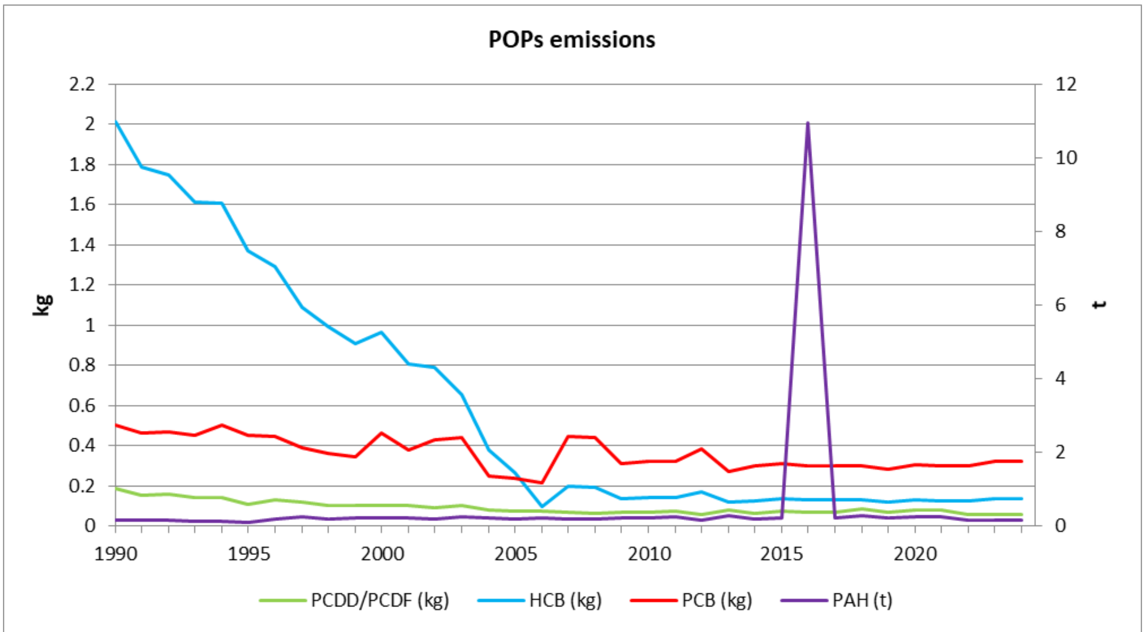



**Figure 6.2.13 Evolution of POPs emissions in 5C and 5E (NT)**

| | | |
|---|---|---|
| ***PCDD/ PCDF*** | 0.06 kg I-TEQ emitted in 2024 (0.06 kg I-TEQ without Canary Islands)<br>34.25% of the total PCDD/PCDF emissions of the Inventory in 2024 (33.94% without Canary Islands) | |
| | 1990-2005 | The trend of the first years is explained by the progressive ending of the Clinical waste incineration without energy recovery (5C1biii) in 2005 combined with the ending of municipal waste incineration without energy recovery (5C1a) in 2003 because of the introduction of Municipal waste incineration plants with energy recovery (reported under 1A1a). |
| | 2006-2024 | Steady trend with fluctuations linked to the annual crop production and Open burning of waste (5C2) and Accidental fires (5E). It is also influenced, to a lesser extent, by the amount of Sewage sludge incinerated (5C1biv) and the number of cremations (5C1bv). |

| | | |
|---|---|---|
| ***HCB*** | 0.14 kg emitted in 2024 (0.14 kg without Canary Islands)<br>7.00% of the total HCB emissions of the Inventory in 2024 (7.13% without Canary Islands) | |
| | 1990-2005 | The trend of the first years is explained by the progressive ending of the Clinical waste incineration without energy recovery (5C1biii) in 2005 combined with the ending of municipal waste incineration without energy recovery (5C1a) in 2003 because of the introduction of Municipal waste incineration plants with energy recovery (reported under 1A1a). |
| | 2006-2024 | Steady trend due to the amount of Sewage sludge incineration (5C1biv) and Cremations (5C1bv). |

| | | |
|---|---|---|
| ***PCBs*** | 0.32 kg emitted in 2023 (0.32 kg without Canary Islands)<br>0.35% of the total PCBs emissions of the Inventory in 2024 (0.36% without Canary Islands) | |
| | 1990-2005 | The trend of the first years is explained by the progressive ending of the Clinical waste incineration without energy recovery (5C1biii) in 2005 combined with the ending of municipal waste incineration without energy recovery (5C1a) in 2003 because of the introduction of Municipal waste incineration plants with energy recovery (reported under 1A1a). |
| | 2006-2024 | Steady trend due to the amount of Sewage sludge incineration (5C1biv) and Cremations (5C1bv). |

| | | |
|---|---|---|
| ***PAHs*** | 0.17 tonnes emitted in 2024 (0.16 tonnes without Canary Islands)<br>0.49% of the total PAHs emissions of the Inventory in 2024 (0.49% without Canary Islands) | |
| | 1990-2005 | The trend of the first years is explained by the progressive ending of the Clinical waste incineration without energy recovery (5C1biii) in 2005 combined with the ending of municipal waste incineration without energy recovery (5C1a) in 2003 because of the introduction of Municipal waste incineration plants with energy recovery (reported under 1A1a). |
| | 2006-2024 | PAHs emissions within the Waste sector are dominated by the open burning of waste (5C2). They are also influenced, to a lesser extent, by the amount of Sewage sludge incinerated (5C1biv) and the number of cremations (5C1bv). In 2016, there is an uptick due to an accidental tire fire event reported under Other waste (5E). |

### 6.2.3. Condensable component of $PM_{10}$ and $PM_{2.5}$

As detailed in Annex V, indication of whether the emission estimates and emission factors for $PM_{10}$ and $PM_{2.5}$ in the Waste sector include or exclude the condensable component can be found in the table below:

**Table 6.2.3 Information on condensable component of PM**

| NFR | Source/sector name | PM emissions: the condensable component is | | EF reference and comments |
|---|---|---|---|---|
| | | Included | Excluded | |
| **5A** | Solid waste disposal on land | No information in the EMEP/EEA GB 2023. | | EMEP/EEA GB 2023. |
| **5B1** | Biological treatment of waste - Composting | NE | | |
| **5B2** | Biological treatment of waste - Anaerobic digestion at biogas facilities | No information in the EMEP/EEA GB 2023. | | No information in the EMEP/EEA GB 2023. |
| **5C1a** | Municipal waste incineration | NO[4] | | In 2003 only occurred in Canary Islands and since 2004, included in 1A1a. |
| **5C1bi** | Industrial waste incineration | IE | | Included in 1A1a. |
| **5C1bii** | Hazardous waste incineration | NO | | |
| **5C1biii** | Clinical waste incineration | IE | | Included in 1A1a. |
| **5C1biv** | Sewage sludge incineration | | X | US EPA AP-42 Section 2.4 Chapter 2.2. |
| **5C1bv** | Cremation | No information in the EMEP/EEA GB 2023. | | EMEP/EEA GB 2023. |
| **5C1bvi** | Other waste incineration | NO | | |
| **5C2** | Open burning of waste | No information in the EMEP/EEA GB 2023. | | EMEP/EEA GB 2023. |
| **5D1** | Domestic wastewater handling | No information in the EMEP/EEA GB 2023. | | EMEP/EEA GB 2023. |
| **5D2** | Industrial wastewater handling | No information in the EMEP/EEA GB 2023. | | EMEP/EEA GB 2023. |
| **5E** | Other waste | No information in the EMEP/EEA GB 2023. | | EMEP/EEA GB 2023. |

## 6.3. Major changes

The main changes performed in the Waste sector were due to recalculations in 5A (Solid waste disposal on land) and 5C2 activity (Open burning of waste).
Further details of these and other recalculations can be found in section 6.5 (Recalculations).

## 6.4. Key categories analysis

Within this sector, the following categories have been identified as key (table 6.2.2 for reference):

A. Biological treatment of solid waste – 5B.

B. Incineration – 5C.

[4] Recommendation ES-5C1a-2025-0001 made by the TERT in NECD the Final Review Report (Review of National Air Pollutant Emission Inventory Data 2025 under Directive (EU) 2016/2284). Final Review Report available at: https://environment.ec.europa.eu/topics/air/reducing-emissions-air-pollutants/emissions-inventories_en#review-of-national-emission-inventories

C. Wastewater handling – 5D[5].

D. Other waste – 5E.

Activity data sources, methodologies and a general assessment for each category are provided.

[5] Although 5D is not a Key Category identified in Table 6.2.2, it is included in this section due to a recommendation of the 2025 NECD review asking for explanations of the elimination of latrines' estimations.

# A. Biological treatment of solid waste (5B)

Category 5B is considered as key category for its contribution to the Trend of emissions of $NH_3$ (Table 6.2.2).

This source category includes emissions estimates for the following activities:

– Biological treatment of waste: composting (5B1).

– Biological treatment of waste: anaerobic digestion at biogas facilities (5B2).

Emissions from combustion of biogas with energy recovery in biomethanisation plants are reported under the Energy sector (1A1a), whereas the flaring of biogas from those plants is considered within NFR category 5B2 in this chapter.

In this sense, emissions reported under this category 5B are mainly due to the flaring of biogas in 5B2. Considering waste biological treatment activities themselves, category 5B only accounts for one of the pollutants covered in this report: $NH_3$.

## A.1. Activity variables

### Table 6.4.1 Summary of activity variables, data, and information sources for category 5B

| Activities included | Activity data | Source of information |
|---|---|---|
| Biological treatment of waste: Composting (**5B1**) | - Amount of waste entering the composting process.<br>- Compost produced. | - SGR (MITECO). |
| Biological treatment of waste: Anaerobic digestion at biogas facilities (**5B2**) | - Amount of waste treated by anaerobic digestion at biogas plants.<br>- Biogas produced.<br>- Share of biogas/$CH_4$ burned into different devices (flares, engines or boilers). | - 2002-2024: IQ from anaerobic digestion at biogas facilities and SGR (MITECO). |

## A.2. Methodology

### Table 6.4.2 Summary of methodologies applied in category 5B

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| ***Biological treatment of solid waste: Composting (5B1)***<br><br>(Methodology factsheets: **Compost production**) | | | |
| $NH_3$ | T2 | EMEP/EEA Guidebook (2023). Chapter 5B1. | EF |
| ***Biological treatment of solid waste: Anaerobic digestion at biogas facilities (5B2)***<br><br>(Methodology factsheets: **Biological treatment of solid waste (biomethanization)**) | | | |
| $NH_3$ | T1 | EMEP/EEA Guidebook (2023). Chapter 5B2. | EF<br>- Table 3-1. |

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| NOx, $PM_{2.5}$, $PM_{10}$, TSP, CO | T1 | US EPA AP-42. 5ª Ed. (1998). Chapter 2.4, table 2.4-4 | PM emissions are related to the burning in flares of a part of the biogas produced in anaerobic digestion plants, and as the 2023 EMEP/EEA Guidebook does not provide default emission factors, emission factors from US EPA AP-42. 5th Ed. (1998), chapter 2.4, table 2.4-4, have been used, which provides the same emission factor for $PM_{10}$ and $PM_{2.5}$.[6] |

## A.3. Assessment

Emissions of $NH_3$ in 5B are led by the activity Composting (5B1). As shown in the figure below, the irregular behaviour of the activity data stems from fluctuations in waste treatment for composting; however, the overall trend is currently on the rise.

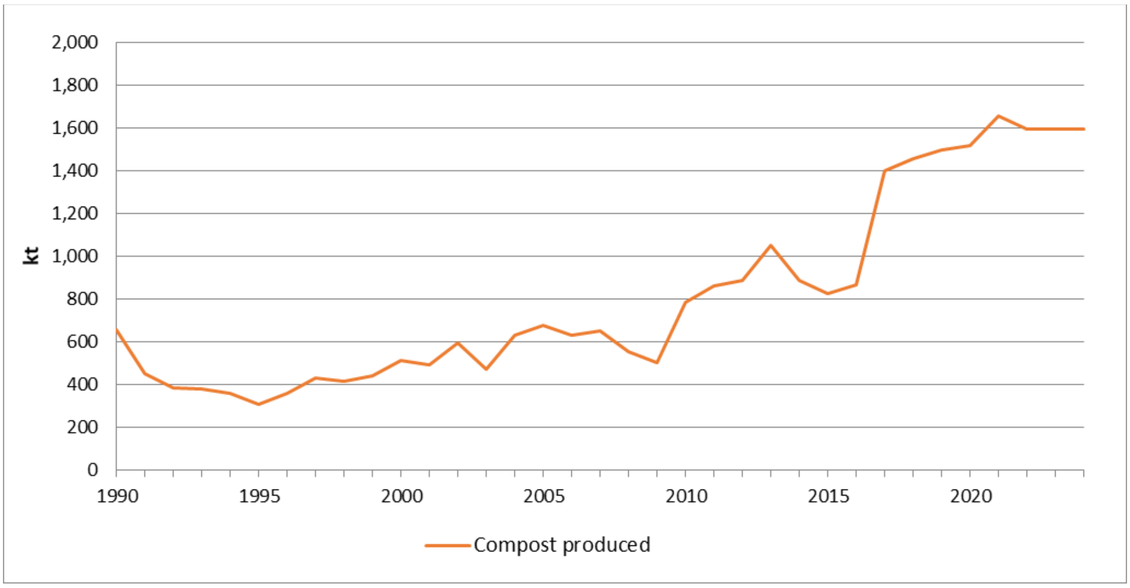



**Figure 6.4.1 Evolution of activity variable in category Composting (5B1) (NT)**

In the following table the amount of treated waste by type in activity Anaerobic digestion at biogas facilities (5B2) for the entire time series is provided. Higher amount of livestock slurry and sewage sludge subject to biomethanization in the last reporting year (2024, data coming from a new plant) generated a peak in $NH_3$ emissions, as can be seen in Figure 6.2.4.

[6] Final Review Report (ES-5D1-2019-0001/ES-5D2-2019-0001 (Table 3).

**Table 6.4.3 Amount of waste treated by type in activity 5B2 (NT)**

| Year | Municipal Solid Waste (RSW) (kt) | Sludge (kt) | Slurry (kt) |
|---|---|---|---|
| **2002** | 17.53 | 0 | 0 |
| **2003** | 41.81 | 0 | 0 |
| **2004** | 69.11 | 0 | 0 |
| **2005** | 68.95 | 0 | 0 |
| **2006** | 52.68 | 0 | 0 |
| **2007** | 75.12 | 0 | 993.00 |
| **2008** | 142.35 | 0 | 1,605.00 |
| **2009** | 348.16 | 23,342.12 | 5,253.45 |
| **2010** | 323.92 | 21,595.56 | 13,256.72 |
| **2011** | 503.81 | 26,679.97 | 26,224.99 |
| **2012** | 760.68 | 48,312.96 | 36,439.55 |
| **2013** | 1,374.65 | 35,413.41 | 38,967.86 |
| **2014** | 1,613.50 | 68,404.17 | 59,972.91 |
| **2015** | 1,514.11 | 133,542.95 | 44,711.99 |
| **2016** | 1,014.41 | 142,438.14 | 88,954.59 |
| **2017** | 918.82 | 254,677.69 | 101,989.56 |
| **2018** | 1,069.39 | 231,216.61 | 46,049.92 |
| **2019** | 1,047.41 | 151,119.05 | 71,641.77 |
| **2020** | 1,255.53 | 150,215.31 | 66,783.73 |
| **2021** | 1,060.55 | 148,239.32 | 84,063.23 |
| **2022** | 1,195.61 | 149,514.22 | 84,304.76 |
| **2023** | 1,239.52 | 155,963.87 | 89,863.55 |
| **2024** | 1,651.91 | 1,413,931.21 | 266,990.74 |

## B. Incineration (5C)

Category 5C is considered as key category for its contribution to the Level and the Trend of emissions of the following pollutants: $PM_{2.5}$, $PM_{10}$, TSP, BC, Hg and PCDD/PCDF. In addition, it also contributes to the Level of emissions of NOx, CO, Pb, Cd and HCB (Table 6.2.2).

This source category includes emissions estimates for the following activities:

- Municipal waste incineration (5C1a) without energy recovery[7].
- Clinical waste incineration without energy recovery (5C1biii).
- Sewage sludge incineration without energy recovery (5C1biv).
- Cremation (5C1bv).
- Burning of unmanaged waste dumps and agricultural waste within the activity Open burning of waste (5C2).

Emissions from industrial and hazardous waste incineration do not account for this category since they have always taken place with energy recovery. Therefore, their corresponding emissions are allocated under the energy category 1A1a.

### B.1. Activity variables

**Table 6.4.4 Summary of activity variables, data, and information sources for category 5C**

| Activities included | Activity data | Source of information |
|---|---|---|
| Municipal waste incineration (**5C1a**) | - Amount and composition of waste incinerated.<br>- Energy produced.<br>- Emissions and abatement techniques implemented.<br>- Other parameters concerning the incineration process (LHV, incineration units, stacks, etc.). | - 1990-2003: publication “Medio Ambiente en España” (Environment in Spain) and IQ.<br>Since 2004 no incineration of MSW takes place without energy recovery, so no activity variable is reported under 5C1a. Emissions from energy recovery are reported within the Energy category (1A1a). |
| Clinical waste incineration (**5C1biii**) | - Number of hospital beds.<br>- Clinical waste generation parameter per bed and day. | - 1990-1994: INE. “Statistics Yearbook of Spain” (INE).<br>- 1995-1998: statistic interpolation.<br>- “Study on generation and management of clinical wastes in Spain, 1995” (Institute for the Sustainability of Resources, MITECO).<br>- 1999-2005: statistics from the Health Information Institute.<br>Since 2006 no incineration without energy recovery takes place. Emissions are reported under the Energy category (1A1a). |

[7] According to the information available, all incineration facilities have undertaken incineration with energy recovery since 2004.

| Activities included | Activity data | Source of information |
|---|---|---|
| Sewage sludge incineration (**5C1biv**) | - Amount and percentage of sludge incinerated at a regional level (area sources).<br>- Volume of water treated at industrial wastewater handling plants in refinery and paper pulp manufacturing plants (LPS). | AREA SOURCES:<br><br>- 1989: publication “Medio Ambiente en España, 1991” (The Environment in Spain, 1991) MOPT.<br>- 1993: “Study on treatment and final disposal of urban wastewater sewage sludge” (MOPTMA).<br>- 1990-1992 and 1994-1996: estimated by interpolation.<br>- 1997-2024: National Sewage Register RNL (MITECO) (Data from 2023 replicated in 2024).<br><br>LARGE POINT SOURCES (LPS):<br><br>- 1990-1993: Refinery plants: statistical extrapolation based on the volume of water treated at industrial wastewater treatment plants.<br>- 1994-1997: Refinery plants: IQ.<br>- 1997-2024: Paper pulp manufacturing plants: IQ. |
| Cremation (**5C1bv**) | - Number of deaths per year.<br>- Number of corpses incinerated in crematoriums per year. | - 1990-2009: data provided by the main entrepreneurial association.<br>- 2010-2024: estimation based on the death statistics available from the INE and a cremation percentage provided by "The National Funeral Services Association" (PANASEF). |
| Open burning of waste: burning of unmanaged landfills (**5C2**) | - Rate of burned unmanaged landfills. | - 1990-2000: SGR (MITECO). |
| Open burning of waste: burning of agricultural waste **(5C2)** | - Crop surface and crop yield.<br>- Burnt fraction by crop.<br>- Annual N-amount of burnt crop residue.<br>- Nitrogen fraction by crop.<br>- Dry matter fraction. | - 1990-2023 (2024): Statistical Yearbook (MAPA).<br>- 1990-2023 (2024): Nitrogen and Phosphorous Balance in Spanish Agriculture Book (BNyPAE).<br>- 1990-2024: Nitrogen fraction by crop: Bilanzdija, N., Voca, N., Kricka, T., Matin, A., & Jurisic, V. (2012). “Energy potential of fruit tree pruned biomass in Croatia”. Spanish Journal of Agricultural Research, 10(2), 292-298; Tortosa, G. “Material para compostar: Residuos de algodón” https://www.compostandociencia.com/2014/12/residuos-de-algodon/<br>- 1990-2024: “Dry matter fraction”. Francesc Giró, Compostarc, 2007.Forest fire prevention legislation[8] |

[8] See chapter 5.4 of the IIR.

## B.2. Methodology

### Table 6.4.5 Summary of methodologies applied in category 5C

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| ***Municipal waste incineration (5C1a)***<br><br>**(Methodology factsheet: Municipal waste incineration)** | | | |
| **LARGE POINT SOURCES (LPS):**<br><br>NOx, NMVOC, $SO_2$, $PM_{2.5}$, $PM_{10}$, TSP, BC, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, PCDD/PCDF, PAHs, HCB, PCB, PCP | T1/T2 | IQ from incineration plants treated as a point source of pollution. EMEP/EEA Guidebook (2023). Chapter 5C1a. | EE:<br>- Measured emissions, emissions estimates and abatement techniques applied provided by incineration plants.<br><br>EF:<br>- Emission factors by tonne of waste.<br>- Table 3-2, Abatement techniques applied (table 3-3): 1990-1996 for these years it was assumed only "Particle Abatement" as control techniques.<br>- Table 3-1: 1996-2003 for this period, it is considered as a minimum the control techniques of "Particle Abatement + acid gas abatement". |
| **AREA SOURCES:**<br><br>NOx, NMVOC, $SO_2$, $PM_{2.5}$, $PM_{10}$, TSP, BC, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, PCDD/PCDF, PAHs, HCB, PCB, PCP | T1 | EMEP/EEA Guidebook (2023) Chapter 5C1a. | EF<br>- Emission factors by tonne of waste.<br>- Table 3-2, Abatement techniques applied (table 3-3): 1990-1995 for these years it was assumed only "Particle Abatement" as control techniques.<br>- Table 3-1: 1996-2003 for this period it is considered as a minimum the control techniques of "Particle Abatement + acid gas abatement". |
| ***Clinical waste incineration (5C1biii)***<br><br>**(Methodology factsheet: Clinical waste incineration)** | | | |
| NOx, NMVOC, $SO_2$, TSP, BC, CO, Cd, Hg, As, Cr, Cu, Ni, PCDD/PCDF, PAHs, HCB, PCB, PCP | T2 | EMEP/EEA Guidebook (2019) Chapter 5C1biii. | EF<br>- Emission factors by tonne of waste.<br>- Table 3-2, Abatement techniques applied (table 3-3). |
| ***Sewage sludge incineration (5C1biv)***<br><br>**(Methodology factsheet: Sewage sludge incineration)** | | | |
| NOx, NMVOC, $SO_2$, $PM_{2.5}$, $PM_{10}$, TSP, BC, CO, Pb, Cd, Hg, As, Cr, Cu, Zn, Ni, Se, PCDD/PCDF, PAHs, HCB, PCB | T2 | EMEP/EEA Guidebook (2023) Chapter 5C1bi, 5C1bii, 5C1biv. | EF:<br>- Emission factors by tonne of waste.<br>- Tables 3-1 and 3-2[9].<br>- Abatement efficiencies Table 3-4 (NMVOC, $SO_2$ and PM). |

[9] Recommendations ES-5C1biv-2025-0001 and ES-5C1biv-2025-0002 made by the TERT in NECD the Final Review Report (Review of National Air Pollutant Emission Inventory Data 2025 under Directive (EU) 2016/2284). Final Review Report available at:
https://environment.ec.europa.eu/topics/air/reducing-emissions-air-pollutants/emissions-inventories_en#review-of-national-emission-inventories

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| ***Cremation (5C1bv)***<br><br>**(Methodology factsheet: Cremation)** | | | |
| NOx, NMVOC, $SO_2$, $PM_{2.5}$, $PM_{10}$, TSP, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, PCDD/PCDF, PAHs, HCB, PCB | T1 | EMEP/EEA Guidebook (2023) Chapter 5C1bv. | EF<br>- Emission factors by cremation.<br>- Table 3-1.<br>- CO emissions are included in 1A4 category to avoid double counting, as they are not related to the incinerated bodies but to the auxiliary combustion of fuels associated[10]. |
| ***Open burning of waste: burning of agricultural waste (5C2)***<br><br>**(Methodology factsheet: Open burning of waste: burning of agricultural waste)** | | | |
| NOx, NMVOC, $SO_2$, $PM_{2.5}$, $PM_{10}$, TSP, BC, CO, Pb, Cd, As, Cr, Cu, Se, Zn, PCDD/PCDF, PAHs | T2 | EMEP/EEA Guidebook (2023) Chapter 5C2. | EF<br>- Emission factors by tonne of waste (except PAH (by dry matter)).<br>- Table 3-3 (orchard crops) (except PCDD/PCDF (Table 3-1 (T1))). |
| ***Open burning of waste: burning of unmanaged landfills (municipal solid waste (1990-2000)) (5C2)***<br><br>**(Methodology factsheet: Open burning of waste: Solid waste deposit in unmanaged landfills** | | | |
| NOx, NMVOC, $SO_2$, $PM_{2.5}$, $PM_{10}$, TSP, CO | T1 | US EPA AP-42. 5th Ed. (1998) Chapter 2.5. Table 2.5-1, and UK Inventory (only for NMVOC). | - EF (Default).<br>- 1990-2000 (from 2000 onwards, this activity was prohibited). |

## B.3. Assessment

Emissions in 5C are dominated by the Open burning of waste category (5C2). As shown in the figure below, the irregular behaviour of the activity data is due to the cessation of the open burning of unmanaged landfills from 2000 onwards, and to the fluctuations in the production of crops that generate waste subsequently disposed of through open burning (mainly pruning residues from woody crops, but also cut flowers and cotton waste).

[10] Recommendation ES-5C1bv-2021-0001 made by the TERT in NECD the Final Review Report 2021 (Review of National Air Pollutant Emission Inventory Data 2021 under Directive (EU) 2016/2284). Final Review Report available at:
https://environment.ec.europa.eu/topics/air/reducing-emissions-air-pollutants/emissions-inventories_en#review-of-national-emission-inventories

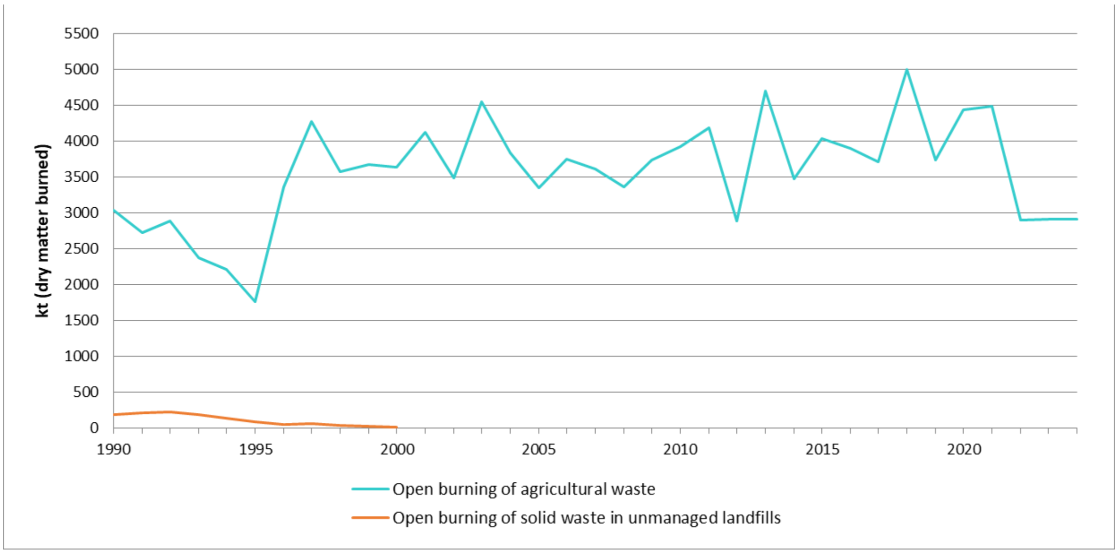



**Figure 6.4.2 Evolution of activity variable in category Open burning of waste (5C2) (NT)**

The quantity of sewage sludge incinerated without energy recovery (5C1biv) shows a stable trend during the latter part of the time series (see figure below). In the remaining categories, activity data decreases until it disappears entirely due to its reallocation to the Energy sector (1A1a); since 2004, no incineration of Municipal Solid Waste (5C1a) has occurred without energy recovery. The same applies to the Clinical waste incineration (5Cbiii) since 2006.

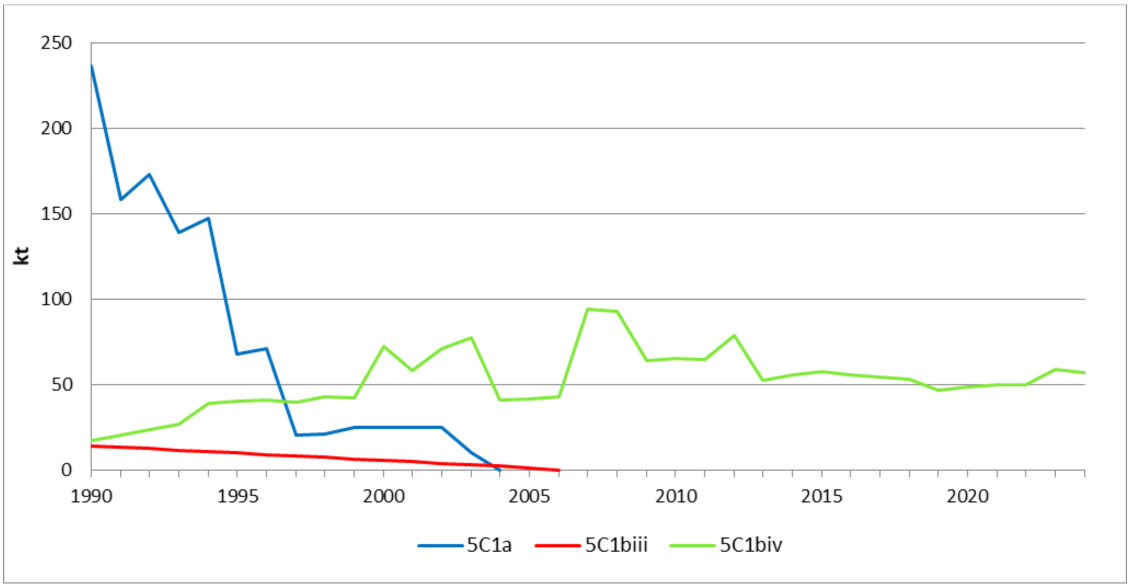



**Figure 6.4.3 Evolution of activity variables in category Waste incineration (5C1) without Cremations (5C1bv) (NT)**

Finally, Cremation activity (5C1bv) shows an upward trend (see figure below), particularly in 2020, which saw a significant spike due to the scourge of the COVID-19 pandemic in Spain. However, there was a decrease in the number of cremations in 2021, primarily driven by a decline in mortality as the pandemic stabilized. From 2022 onwards, the figures aligned with pre-pandemic trends, reflecting a decrease in total mortality.

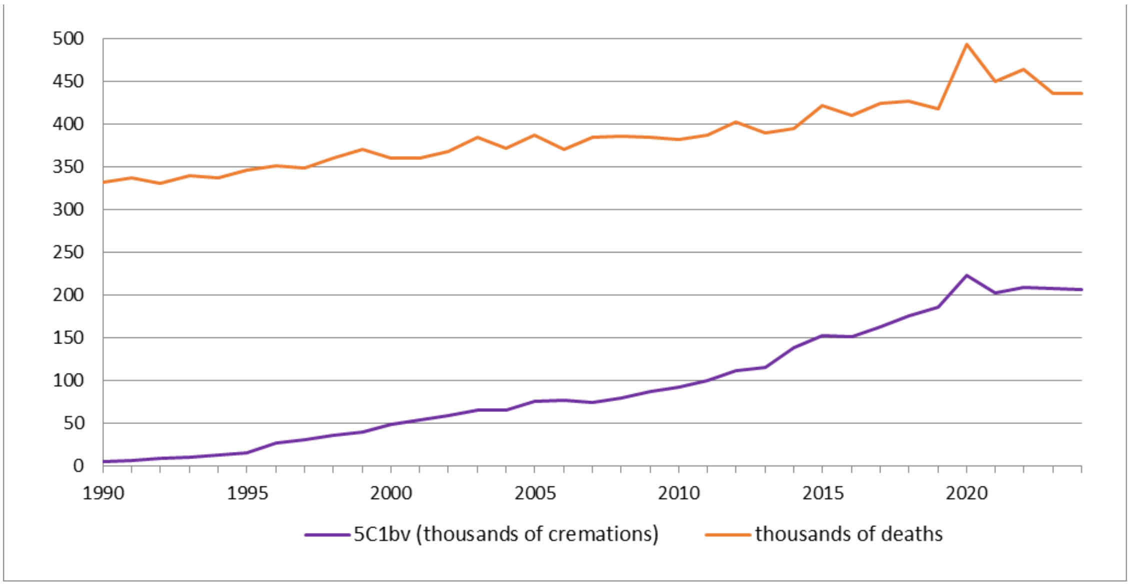



**Figure 6.4.4 Evolution of activity variable in category Cremation (5C1bv) (NT)**

In the following table the amount of matter burned by type in category 5C2 for the time series is provided[11].

**Table 6.4.6 Amount of matter burned by type in category 5C2 (NT)**

| Year | Activity data for "Open burning of waste: burning of unmanaged landfills (municipal solid waste (1990-2000)) (5C2)" (Waste burned in tonnes) | Activity data for "Open burning of waste: burning of agricultural waste (5C2)" (Amount of dry matter burned in tonnes) | Activity data for "Open burning of waste: burning of agricultural waste (5C2)" (Waste burned in tonnes) |
|---|---|---|---|
| 1990 | 279,971 | 3,029,974 | 4,328,530 |
| 2005 | - | 3,351,426 | 4,787,746 |
| 2010 | - | 3,916,200 | 5,594,566 |
| 2015 | - | 4,037,746 | 5,768,203 |
| 2019 | - | 3,733,276 | 5,333,246 |
| 2020 | - | 4,434,379 | 6,334,821 |
| 2023 | - | 2,910,421 | 4,157,740 |
| 2024 | - | 2,910,421 | 4,157,740 |

[11] Recommendation made by the TERT in NECD the Final Review Report 2021 (Review of National Air Pollutant Emission Inventory Data 2021 under Directive (EU) 2016/2284). Final Review Report available at: https://environment.ec.europa.eu/topics/air/reducing-emissions-air-pollutants/emissions-inventories_en#review-of-national-emission-inventories

## C. Wastewater handling (5D)

Following the removal of the activity Other wastewater handling: Latrines (5D3), category 5D is no longer a key category (Table 6.2.2). Nevertheless, in order to maintain the transparency of the present report, the description of this category has been retained.

This source category includes emissions estimates for the following activities:

– Domestic wastewater handling (5D1).

– Industrial wastewater handling (5D2).

Emissions from combustion of biogas with energy recovery in wastewater treatment plants are reported under the Energy sector (1A1a) and flaring of biogas from anaerobic sludge treatment at wastewater treatment facilities is considered within NFR category 5D. When sludge from wastewater treatment is transferred to an anaerobic facility which is co-digesting sludge with solid municipal or other waste, emissions are reported within NFR 5B2, biological treatment of solid waste.

In this sense, emissions reported under this category 5D are mainly due to flaring of biogas. Considering wastewater treatment activities themselves, category 5D only accounts for NMVOC emissions.

### C.1. Activity variables

#### Table 6.4.7 Summary of activity variables, data, and information sources for category 5D

| Activities included | Activity data | Source of information |
|---|---|---|
| Domestic wastewater handling (**5D1**) | - Amount of biogas produced in sludge anaerobic digesters from wastewater treatment plants.<br>- Share of biogas/$CH_4$ burned into different devices (flares, engines or boilers). | - "Uses of biogas produced in urban wastewater treatment plants in Spain". CEDEX.<br>- Spanish Climate Change Office data (OECC) |
| Industrial wastewater handling (**5D2**) | - Volume of wastewater treated in refinery and paper pulp manufacturing plants.<br>- Share of biogas/$CH_4$ burned into different devices (flares, engines or boilers).<br>- Industrial production, wastewater discharge rate, volume of discharge, organic load of water discharged. | - 1990-2024: IQ from refinery and paper pulp manufacturing plants.<br>- Final project: "Comparative analysis of biogas energy utilization technologies in wastewater treatment plants", 2016, OECC.<br>- "Studies on regulation of wastewater discharges". MITECO.<br>- IPCC 2019 GL. Table 6.9, Ch. 6, Vol. 5.<br>- INE. |

### C.2. Methodology

#### Table 6.4.8 Summary of methodologies applied in category 5D

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| ***Domestic wastewater handling (5D1)***<br>***Industrial wastewater handling (5D2)***<br><br>(Methodology factsheets: Domestic wastewater handling, Industrial wastewater handling) | | | |

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| NOx, CO, $PM_{2.5}$, $PM_{10}$, TSP | T1 | US EPA AP-42. 5th Edition (1998), Chapter 2.4. Table 2.4-4. | PM emissions are related to the burning in flares of a part of the biogas produced in wastewater treatment plants, and as the 2023 EMEP/EEA Guidebook does not provide default emission factors, emission factors from US EPA AP-42. 5th Ed. (1998), chapter 2.4, table 2.4-4, have been used, which provides the same emission factor for $PM_{10}$ and $PM_{2.5}$.[12] |
| NMVOC | T1 | EMEP/EEA Guidebook (2023). Chapter 5D. | EF<br>- Emission factors by $m^3$ wastewater handled.<br>- Table 3-1. |

## C.3. Assessment

In the 2025 Inventory edition, following the recommendation ES-5D1-2025-0002 made by the TERT in the Final Review Report 2025 (Review of National Air Pollutant Emission Inventory Data 2025 under Directive (EU) 2016/2284)[13], states that the following information regarding the removal of the activity Other wastewater handling: Latrines (5D3) must be re-included in the present report.

In the recommendation ES-5D3-2023-0001, Spain stated that the use of latrines was an assumption for the population not connected to wastewater treatment plants (EUROSTAT) as the Spanish Inventory Team had no source of information on the technologies used, as reporting is not mandatory for populations smaller than 2,000 equivalent inhabitants. Nevertheless, Spain committed to do further research in the matter with national focal points. Subsequent investigations revealed several sources of information that led Spain to conclude that the assumption of latrine utilization for the population not connected was incorrect and did never occur during the reporting time period for the following reasons:

- Law 29/1985 of august 2 on Water. Prohibits direct or indirect discharges that contaminate waters, accumulation of solid waste, and actions causing degradation to the water's physical or biological environment. It considers as discharges those made directly or indirectly into watercourses, regardless of their nature, as well as those carried out in the subsoil or on the ground, ponds, or excavations, by evacuation, injection, or deposition.

- According to Directive 91/271/EEC (in 1991), the National Sanitation and Purification Plan (1995-2005) establishes the obligation to have collector systems for populations larger than 15,000 inhabitants, starting in 2000; and for agglomerations between 2,000 and 15,000 inhabitants, starting in 2005. In Article 4, stats Member States shall ensure that urban wastewater entering collector systems undergoes, before discharge, secondary treatment or an equivalent process.

- From the CEDEX study "Asistencia técnica, investigación y desarrollo tecnológico en material de tratamiento y control de calidad de las aguas. Situación actual de la depuración de las aguas residuals en pequeñas poblaciones" (December 2008) different tables appear identifying technologies used by small populations (<2,000 inhabitants),

[12] Final Review Report (ES-5D1-2019-0001/ES-5D2-2019-0001 (Table 3).

[13] Final Review Report available at:
https://environment.ec.europa.eu/topics/air/reducing-emissions-air-pollutants/emissions-inventories_en#review-of-national-emission-inventories

such as septic tanks, Imhoff tanks and infiltration systems, where latrines do not appear at any time. These populations are those not connected by collectors to WWTP but have adequate treatment before discharge (septic tanks, biodiscs, static bacterial beds...).

- Finally, data from the National Discharge Centre (CNV) is also available, with records since 2005, where the concept of latrine does not appear either. Among these data are all types of agglomerations including those <250 inhabitants. There is even a section on discharges "without associated equivalent inhabitants," where the type of treatment is septic tank with start date of discharge since 1976.

Therefore, as a brief summary based on the data sources presented earlier, we have verifiable data that there are no latrines in use during the inventoried period.

# D. Other waste (5E)

Category 5E is considered as key category in 2024 for its contribution to the Level of emissions of PCDD/PCDF (Table 6.2.2).

This source category includes emissions estimates from the following activities:

- Sludge spreading.
- Accidental car fire.
- Accidental detached house.
- Accidental semi-detached house.
- Accidental flat fire.
- Accidental industrial fire.

On May 13th, 2016, a fire accidentally broke out in a tire dump located between the municipalities of Seseña (Castilla-La Mancha) and Valdemoro (Community of Madrid). This unprecedented, single-year event lasted for more than a week and resulted in the emission of several pollutants, mainly Particulate Matter, PCDD/PCDF and PAHs.

## D.1. Activity variables

### Table 6.4.9 Summary of activity variables, data, and information sources for category 5E

| Activities included | Activity data | Source of information |
|---|---|---|
| Sludge spreading. | - Total amount of sludge generated in EDARs. | - National Sludge Registry (RNL (MITECO)).<br>- Estimation of the production and treatment of sewage sludge from wastewater treatment plants, prepared by the Centre for Studies and Experimentation of Public Works (CEDEX). |
| Accidental fires:<br>- Accidental car fire.<br>- Accidental detached house fire.<br>- Accidental semi-detached house fire.<br>- Accidental flat fire.<br>- Accidental industrial fire. | - Number of fires of the different categories. | - Government Area of Security and Community Services. General Directorate of Emergencies. City of Madrid.<br>- MAPFRE foundation and Professional Association of Bombers Technicians.<br>- Distribution of population by degree of urbanisation, dwelling type and income group (Eurostat).<br>- Fleet vehicle (DGT). |
| Accidental fires:<br>- Accidental fire at a tire landfill (2016). | - Total amount (tonnes) of tires burned. | - Department of Agriculture, Environment and Rural Development. Castilla-La Mancha.<br>- Department of Agriculture, Environment and Rural Development. Community of Madrid. |

## D.2. Methodology

### Table 6.4.10 Summary of methodologies applied in category 5E

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| ***Sludge spreading (5E)***<br><br>**(Methodology factsheet: Sludge spreading)** | | | |

| Pollutants | Tier | Methodology applied | Observations |
|---|---|---|---|
| $NH_3$ | T2 | EMEP/EEA Guidebook (2023) Chapter 5E. | EF<br>- Emission factors by g/kg $NH_3$ in the sludge.<br>- Table 3-1. |
| NMVOC | T2 | EMEP/EEA Guidebook (2023) Chapter 5E. | EF<br>- NMVOC. Report on Complementary Information in the Frame of the Assistance Provided for CORINAIR 90 Inventory. Pg. 14. |
| ***Accidental fires (cars, detached and semi-detached houses, industrial, flats) (5E)***<br><br>**(Methodology factsheets: Accidental fires)** | | | |
| $PM_{2.5}$, $PM_{10}$, TSP, Pb, Cd, Hg, As, Cr, Cu, PCDD/PCDF | T2 | EMEP/EEA Guidebook (2023). Chapter 5E. | EF<br>- Emission factors by kg/fire; g/fire and mg/fire.<br>- Table 3-2; 3-3; 3-4; 3-5; 3-6. |
| ***Accidental fires (accidental fire at a tire landfill) (5E)***<br><br>**(Methodology factsheets: Accidental fires)** | | | |
| NMVOC, $PM_{2.5}$, $PM_{10}$, TSP, BC, PAH, $SO_2$, Pb, As, Cr, Cu, Se, Ni, Zn | T2 | EMEP/EEA Guidebook (2023) Chapter 5E. | EF<br>- NMVOCs, $PM_{10}$, TSP, PAHs. EPA. U.S. Air emission from scrap tire combustion. (October 1997).<br>- As, Cr, Cu, Pb, Ni, Se, Zn. AP-42, Vol. I, Chapter 2.5: Open burning (October 1992). Table 2. 5-2.<br>- $PM_{2.5}$, $SO_2$. "Uncontrolled combustion of shredded tires in a landfill, Part I: Characterization of gaseous and particulate emissions". University of Iowa.<br>- BC. 3.5% of $PM_{2.5}$ (Olmez *et al*. (1988))[14]. |

## D.3. Assessment

Considering 5E activity data in detail, Sludge spreading activity shows a downward trend until 2010, because this activity is a minor treatment in Spain nowadays. On the contrary, Accidental fires show an irregular behaviour, especially Industrial fire with an important decrease since 1996. Car fires show an increase between 2000 and 2003, reaching a new peak in 2024.

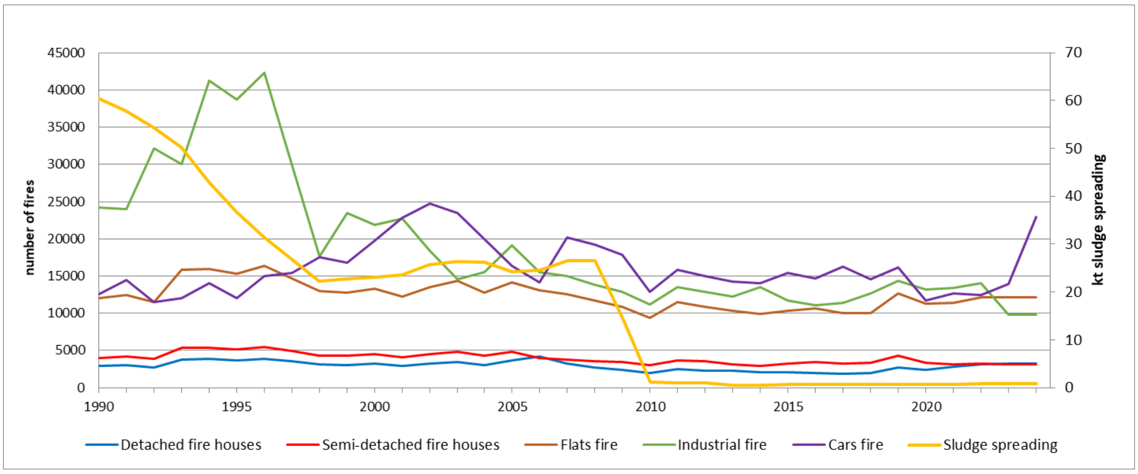



**Figure 6.4.5 Evolution of activity variables in category 5E (NT)**

[14] Recommendation ES-5E-2021-0001 made by the TERT in NECD the Final Review Report 2021 (Review of National Air Pollutant Emission Inventory Data 2021 under Directive (EU) 2016/2284).
Final Review Report available at:
https://environment.ec.europa.eu/topics/air/reducing-emissions-air-pollutants/emissions-inventories_en#review-of-national-emission-inventories

Regarding the emissions of pollutants under 5E, PAHs emissions in 2016 are linked to the above-mentioned accidental tire fire and, therefore, can be considered as a singularity in the time series emissions.

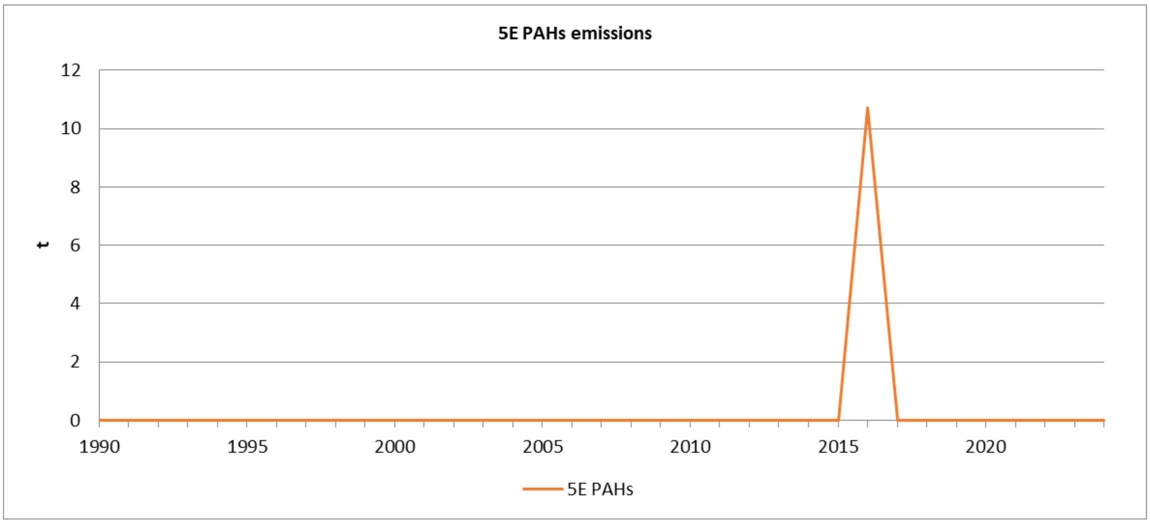



**Figure 6.4.6 Evolution of PAHs (NT)**

PCDD/PCDF emissions are exclusively related to the Accidental fires. As displayed in the figure below, these emissions show a downward trend, except for occasional years in which they experience slight increases. The irregular trend is directly attributed to fluctuations in the number of fires.

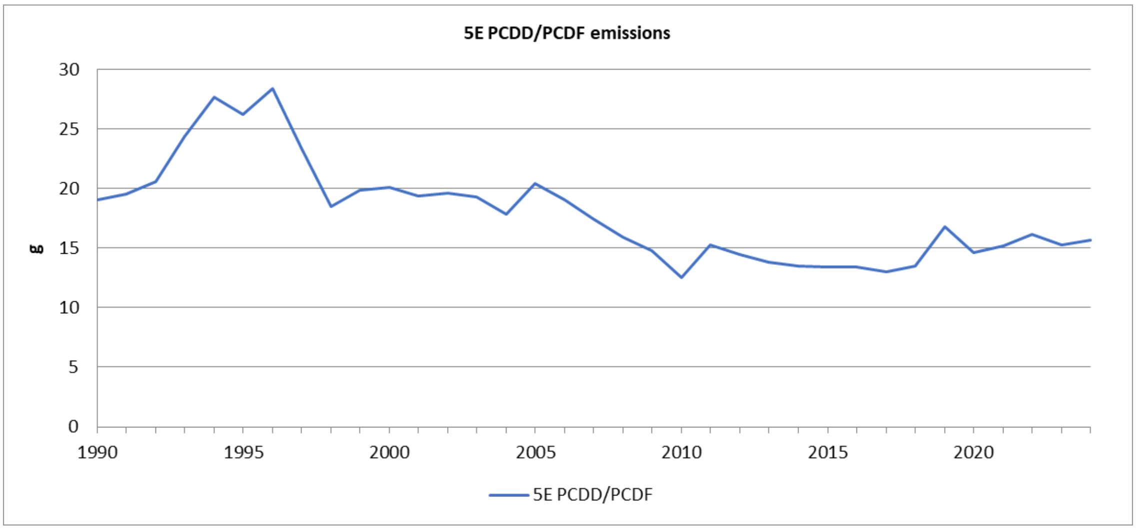



**Figure 6.4.7 Evolution of PCDD/PCDF (NT)**

The following figure shows the trend for Particulate Matter emissions. The uptick in 2016 is due to the accidental tire fire in Seseña.

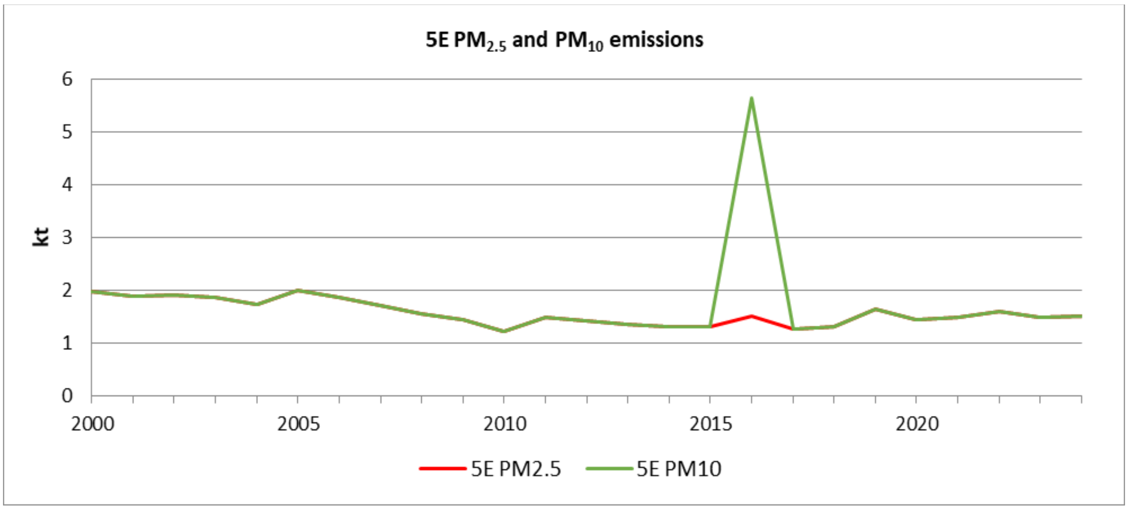



Figure 6.4.8 Evolution of PM emissions in 5E (NT)

## 6.5. Recalculations

The following table shows a brief view of the recalculations in the Waste sector:

Table 6.5.1 Recalculation by pollutants – Waste

| Pollutants affected | Recalculations |
|---|---|
| ***5A- Solid waste disposal on land*** | |
| **CO, NOx, $PM_{2.5}$, $PM_{10}$, TSP** | Recalculation for the period 2012-2023 due to the correction of the 70% maximum efficiency assumption for captured biogas, following the ESR recommendation (ES-5A-2025-0003).<br>These updates have led to the recalculation of methane and other pollutant emissions of the ulterior biogas combustion (1A1a). |
| **NMVOC** | Recalculation for the entire time series due to the adoption of updated parameters from the 2019 Refinement (DOC of sludge, DOCf and Ox). |
| ***5B-Biological treatment of solid waste*** | |
| **Anaerobic digestion at biogas facilities**<br><br>**$NH_3$, CO, NOx, $PM_{2.5}$, $PM_{10}$, TSP** | The amount of waste treated since 2012 has been updated. Additionally, six new biogas plants have been added to the database (some including data since 2022).<br>These updates have led to the recalculation of methane and other pollutant emissions of the ulterior biogas combustion (1A1a). |
| ***5C1biv-Sewage sludge incineration*** | |
| **NOx, CO, NMVOC, PCB, HCB, PCDD/PCDF, PAHs, $SO_2$, Pb, $PM_{10}$, $PM_{2.5}$, TSP, Cd, Hg, As, BC, Cr, Cu, Ni, Se, Zn** | Recalculation of the activity data for 2023 due to an update of the information provided by the focal point (Registro Nacional de Lodos (RNL)).<br>Additionally, emission factors for specific pollutants have been corrected following the NECD recommendations (ES-5C1biv-2025-0001 and ES-5C1biv-2025-0002), affecting respectively: PCDD/F, and mostly Cd, Hg and Pb (in 1990-2002 uncontrolled emission factors without abatement are applied, and from 2006 onwards, the complete implementation of the Waste Incineration Directive is considered, with a linear evolution of the EFs between 2002 and 2006). |
| ***5C1bv-Cremation*** | |
| **NOx, NMVOC, $SO_2$, $PM_{2.5}$, $PM_{10}$, TSP, PCB, HCB, PCDD/PCDF, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, PAHs** | Recalculation in 2023 due to new information provided by the focal point regarding the number of deaths (INE) and the cremation percentage (PANASEF). |

| Pollutants affected | Recalculations |
|---|---|
| ***5C2-Open burning of waste*** | |
| **Burning of agricultural waste**<br><br>**NOx, NMVOC, $SO_2$, $PM_{2.5}$, $PM_{10}$, TSP, BC, CO, Pb, Cd, As, Cr, Cu, Se, Zn, PAHs, PCDD/PCDF** | Recalculation affecting all air pollutants because the nitrogen/dry matter conversion ratios of open-burned pruning residues from woody crops and cotton have been updated, leading to a reduction in the activity variable of burned residues throughout the time series. These data have been contrasted with the Ministry for Agriculture, Fisheries and Food, whose TECO network gathers information of the agricultural production systems in Spain, coming from real exploitations.<br>Furthermore, cultivated areas data and crop yields for BNPAE calculates are provided by MAPA's Statistics Yearbook with two-year lag. In these cases, the Inventory replicates the x-2 year values published in the Yearbook, into x-1 year, the last year inventoried. This edition has updated the values of 2023 according to the yearbook, and has replicated them into 2024. |
| ***5D-Wastewater handling*** | |
| **Domestic wastewater handling**<br><br>**CO, NOx, $PM_{2.5}$, $PM_{10}$, TSP** | The quantity of collected and non-collected wastewater has been corrected starting from 2013. Additionally, errors regarding the amount of biogas combusted in engines and boilers have been rectified.<br>These updates have led to the recalculation of methane and other pollutant emissions of the ulterior biogas combustion (1A1a). |
| **Industrial wastewater handling**<br><br>**CO, NOx, $PM_{2.5}$, $PM_{10}$, TSP, NMVOC** | Recalculation of the activity data for the entire time series (1990-2024), due to the change in the data source. Previously, the Industrial Production Index (IPI) was used, whereas the current data is now based on actual production figures. Additionally, a 100% methane recovery rate is no longer assumed for the brewing industry; instead, a 95% recovery rate is applied. Furthermore, for fish processing plants the wastewater generation parameter (W) has been updated to the 2019 Refinement value. Finally, TOW removed as sludge is no longer applied for the period 1990-1995. All recalculations follow the ESR recommendation (ES-5D-2025-0002).<br>These updates have led to the recalculation of methane and other pollutant emissions of the ulterior biogas combustion (1A1a). |
| ***5E-Other waste*** | |
| **Sludge spreading**<br><br>**$NH_3$, NMVOC** | Recalculation of activity data for 2023, which has been replicated for 2024, due to updated information provided by the focal point (Registro Nacional de Lodos (RNL)). |
| **Accidental fires (Car, detached and semi-detached houses, industrial and flats)**<br><br>**$PM_{2.5}$, $PM_{10}$, TSP, PCDD/PCDF, As, Cd, Cr, Cu, Hg, Pb** | Recalculation in 2023 due to updated vehicle fleet data from the focal point (Ayuntamiento de Madrid) and of the number of fires in buildings (living place fires and industrial fires) from the focal point (MAPFRE). |

Next figures show the evolution as a result of the recalculations implemented in the current Inventory edition explained before. The line chart shows emissions (kt) in absolute terms in the last submissions, while the bar chart displays those recalculations in relative terms (%, the average percentage of recalculation in the time series 1990-2023 is represented with the orange dotted line).

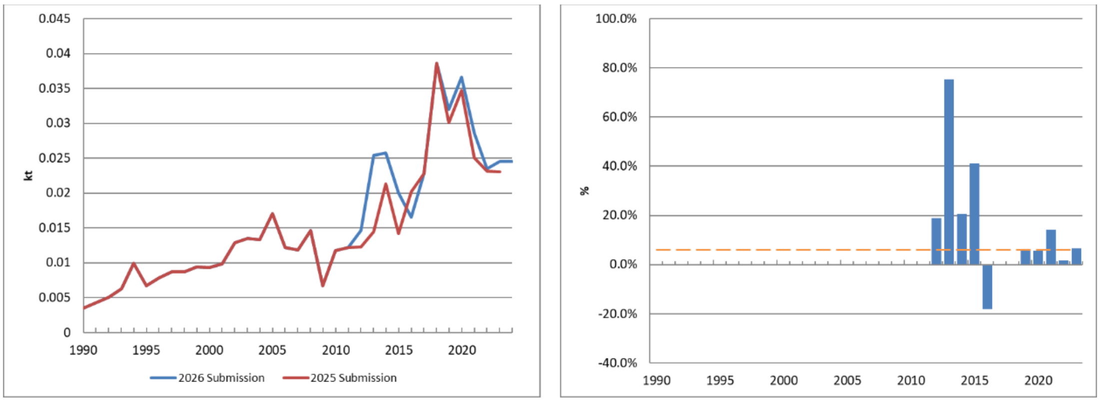



**Figure 6.5.1 Evolution of the difference in 5A NOx emissions (national territory)**

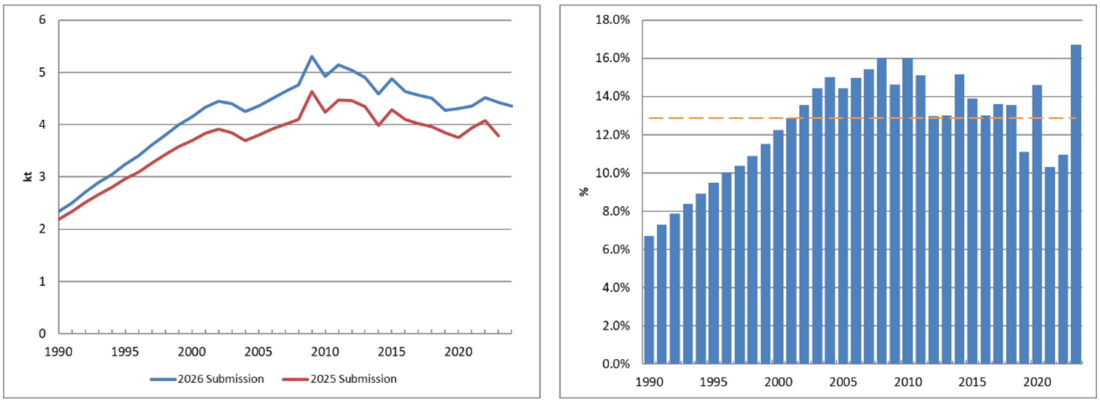



**Figure 6.5.2 Evolution of the difference in 5A NMVOC emissions (national territory)**

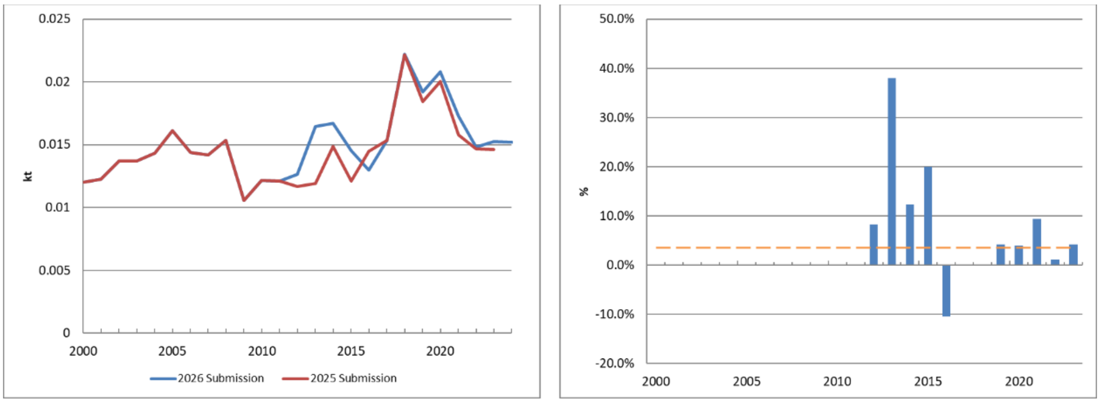



**Figure 6.5.3 Evolution of the difference in 5A TSP emissions (national territory)**

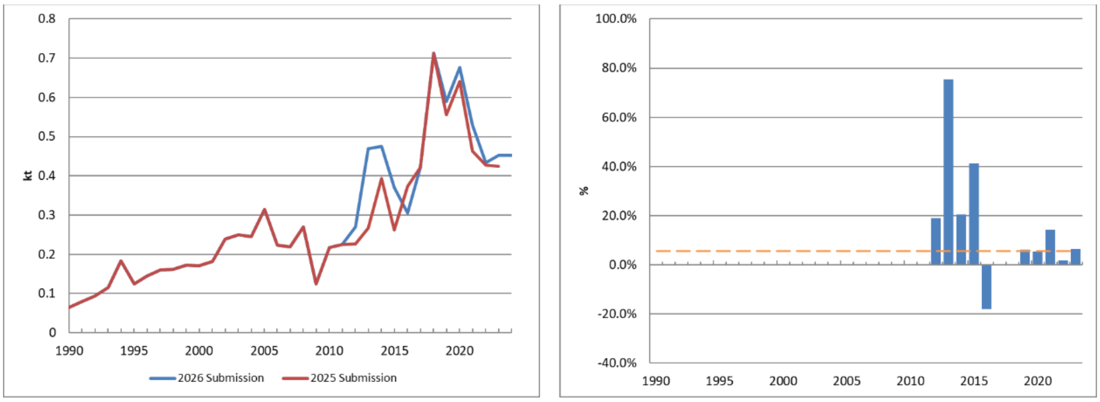



**Figure 6.5.4 Evolution of the difference in 5A CO emissions (national territory)**

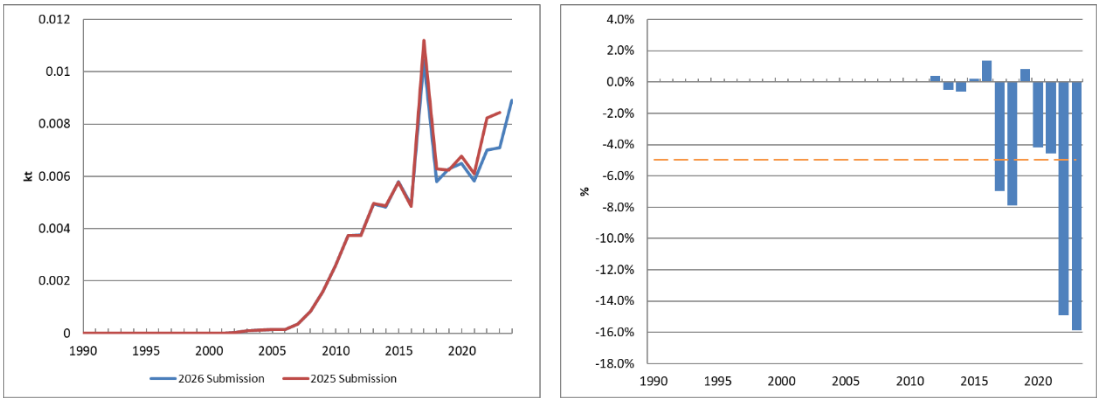



**Figure 6.5.5 Evolution of the difference in 5B2 NOx emissions (national territory)**

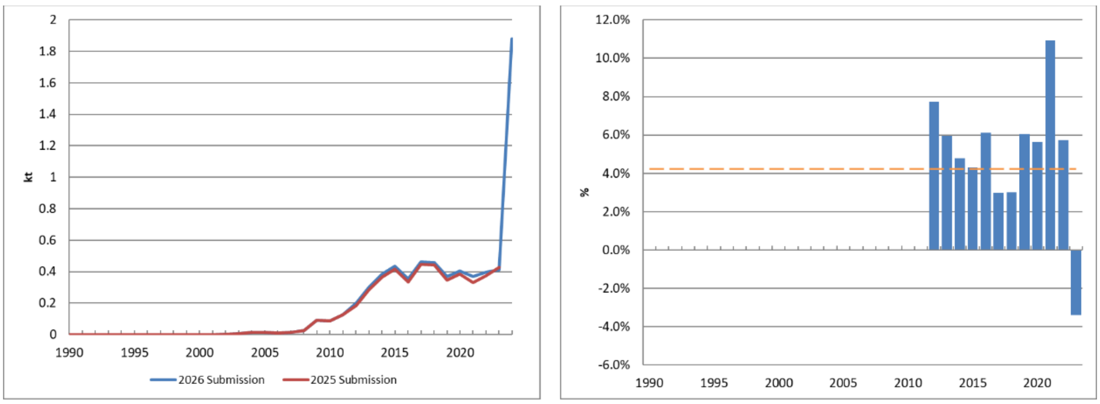



**Figure 6.5.6 Evolution of the difference in 5B2 $NH_3$ emissions (national territory)**

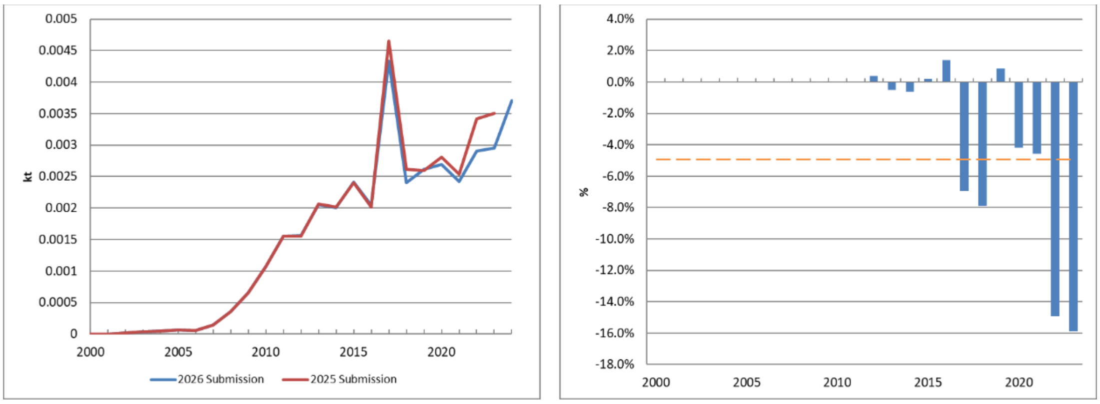



**Figure 6.5.7 Evolution of the difference in 5B2 TSP emissions (national territory)**

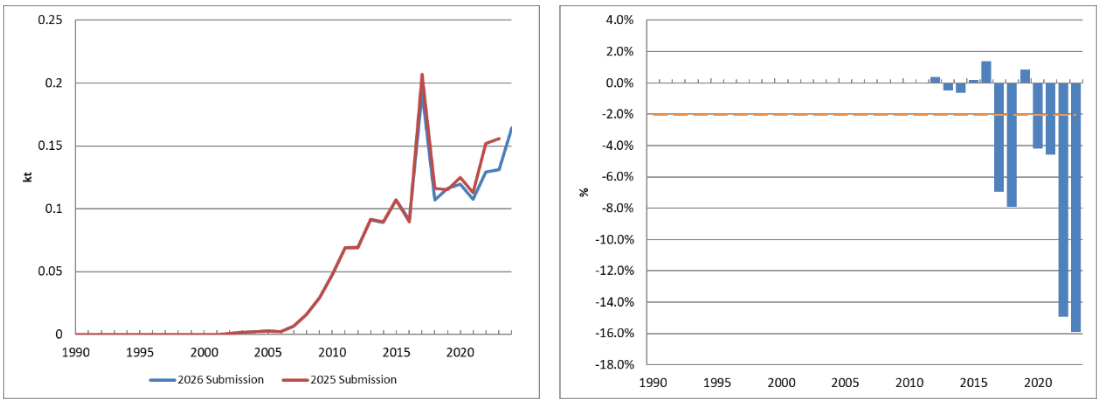



**Figure 6.5.8 Evolution of the difference in 5B2 CO emissions (national territory)**

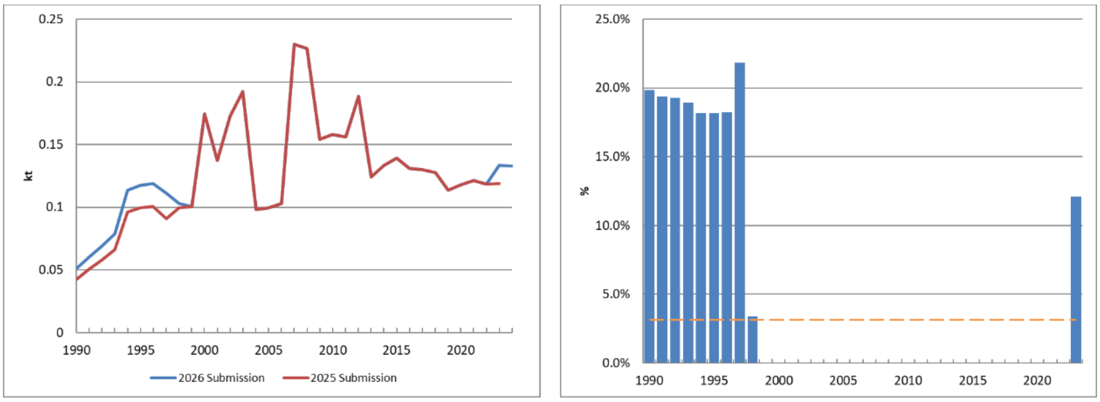



**Figure 6.5.9 Evolution of the difference in 5C1biv NOx emissions (national territory)**

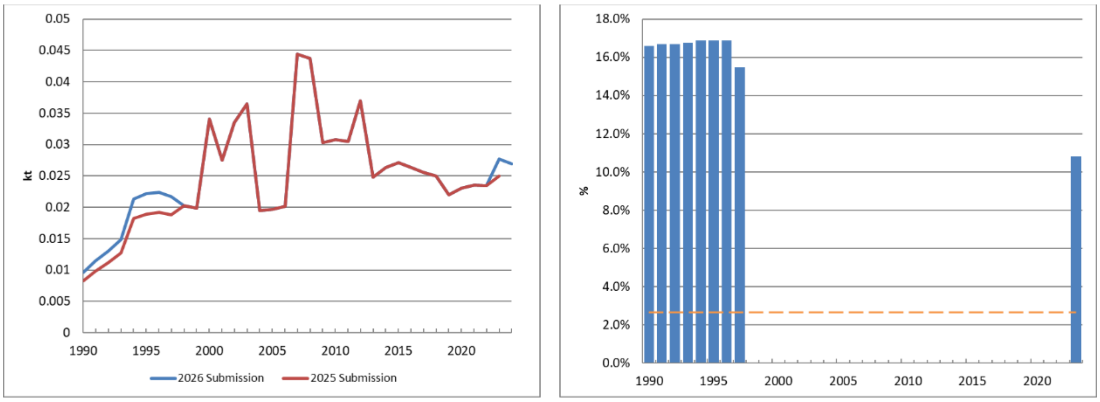



**Figure 6.5.10 Evolution of the difference in 5C1biv NMVOC emissions (national territory)**

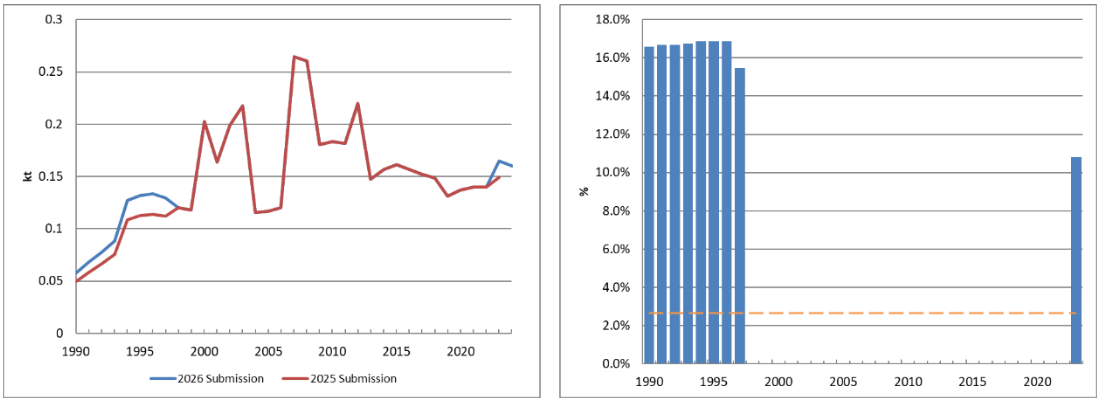



**Figure 6.5.11 Evolution of the difference in 5C1biv $SO_2$ emissions (national territory)**

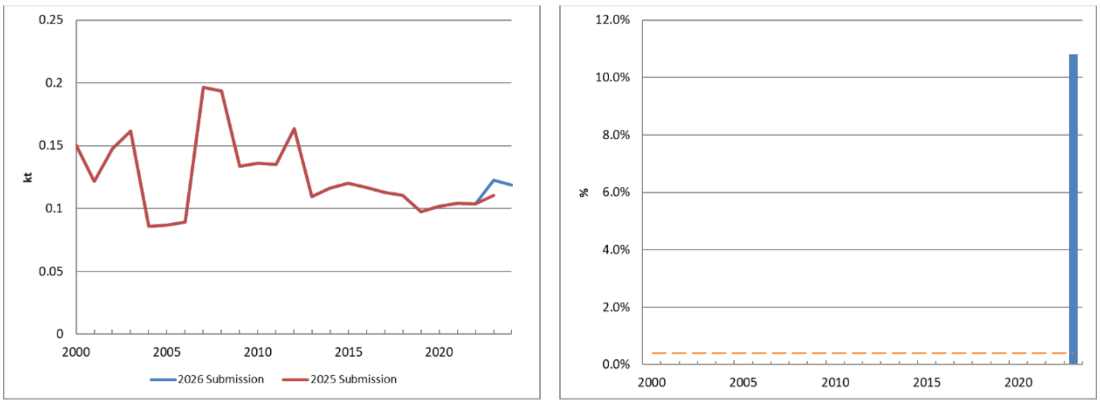



**Figure 6.5.12 Evolution of the difference in 5C1biv TSP emissions (national territory)**

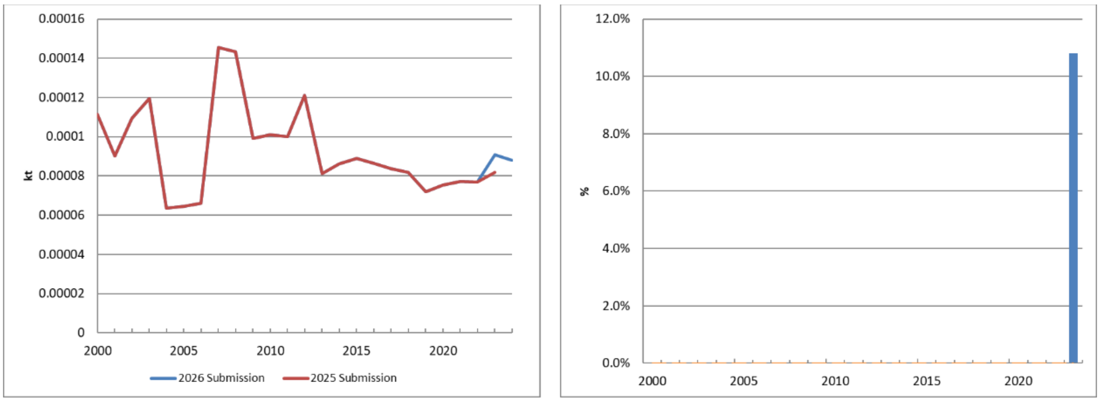



**Figure 6.5.13 Evolution of the difference in 5C1biv BC emissions (national territory)**

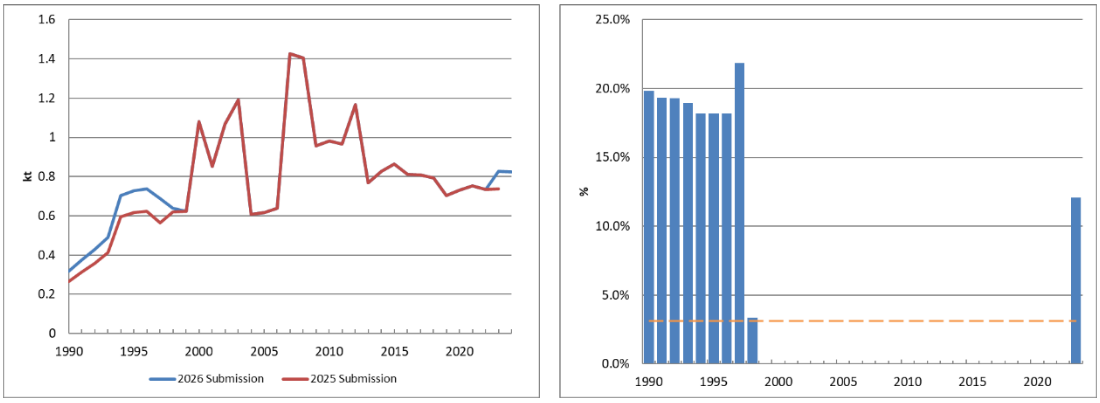



**Figure 6.5.14 Evolution of the difference in 5C1biv CO emissions (national territory)**

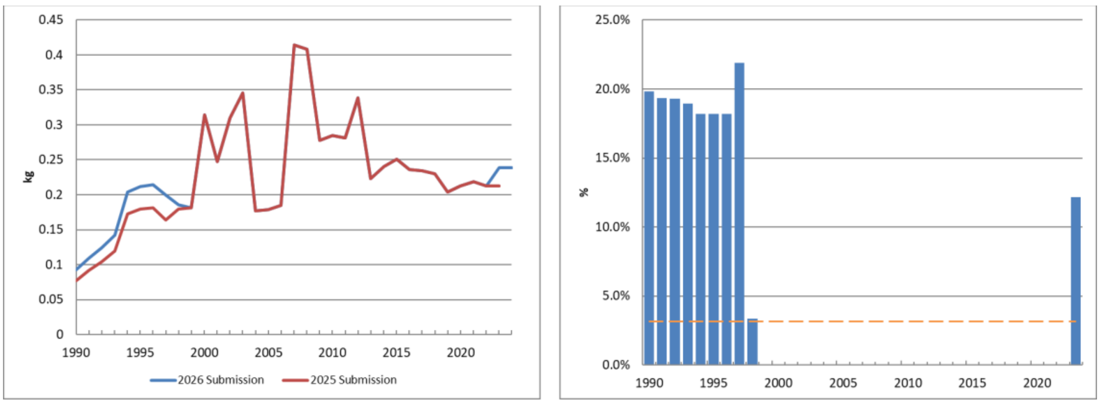



**Figure 6.5.15 Evolution of the difference in 5C1biv PCB emissions (national territory)**

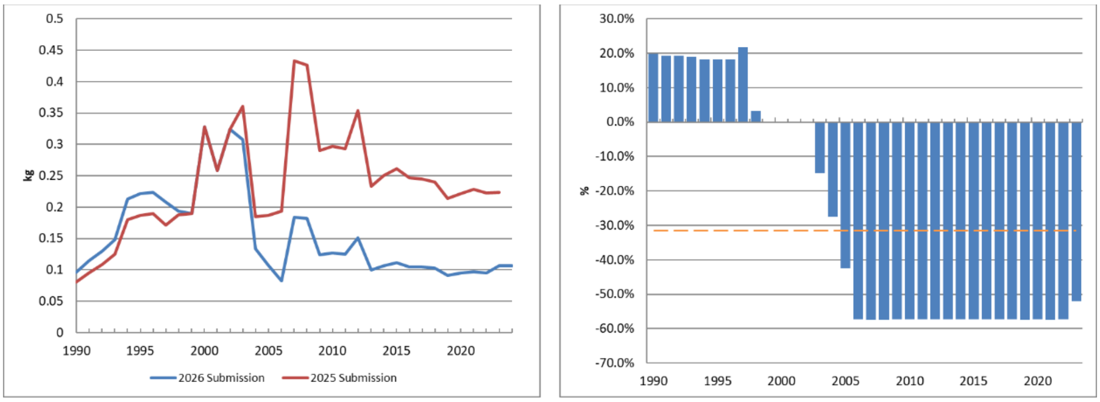



Figure 6.5.16 Evolution of the difference in 5C1biv HCB emissions (national territory)

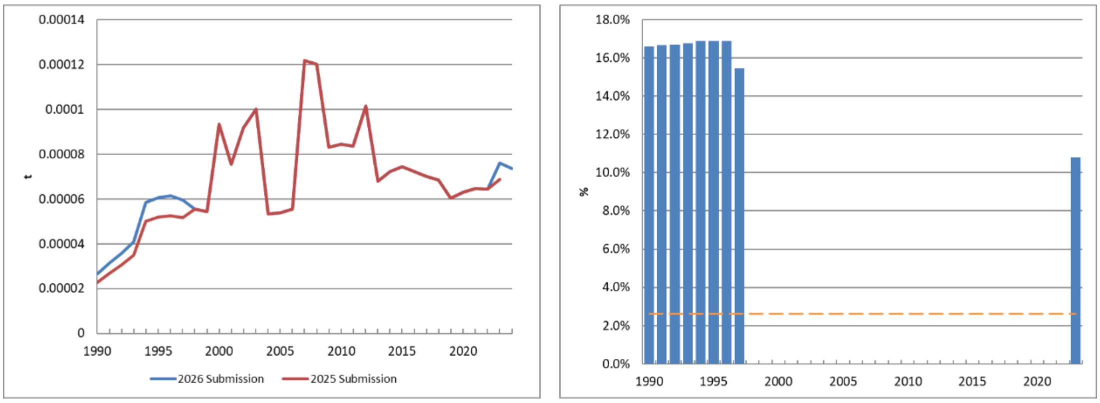



Figure 6.5.17 Evolution of the difference in 5C1biv PAH emissions (national territory)

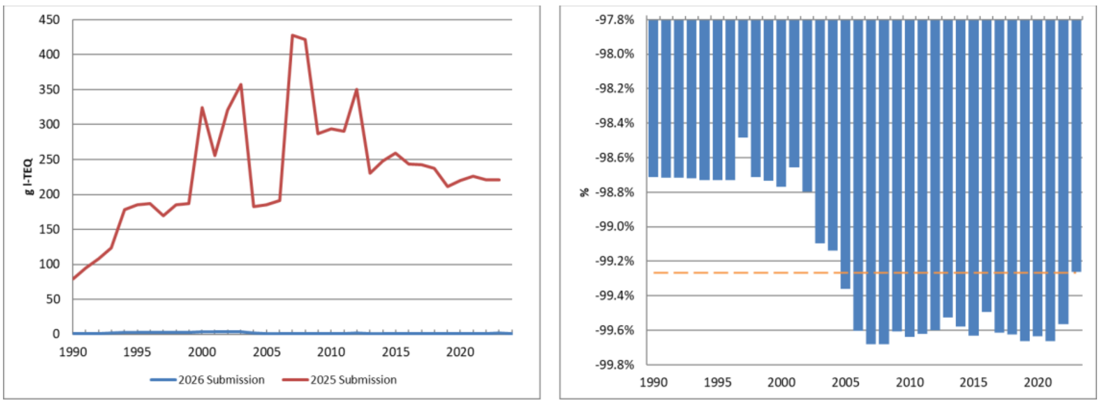



Figure 6.5.18 Evolution of the difference in 5C1biv PCDD/PCDF emissions (national territory)

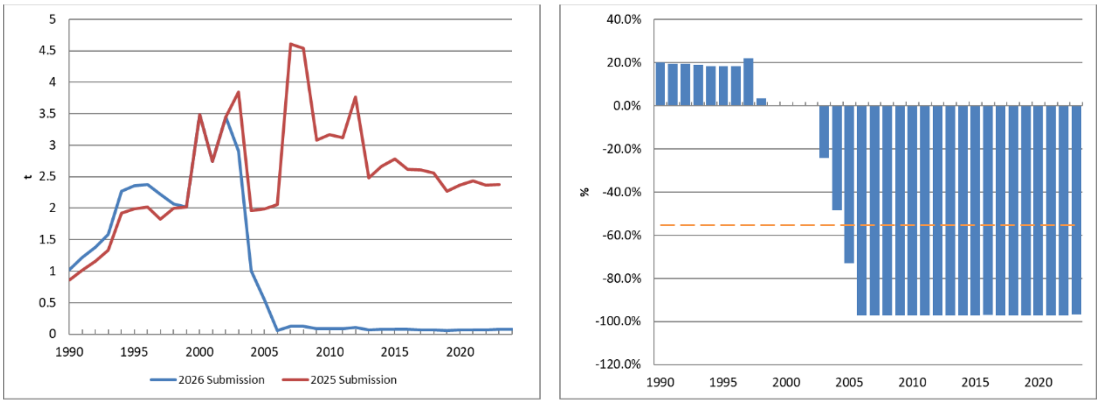



Figure 6.5.19 Evolution of the difference in 5C1biv Pb emissions (national territory)

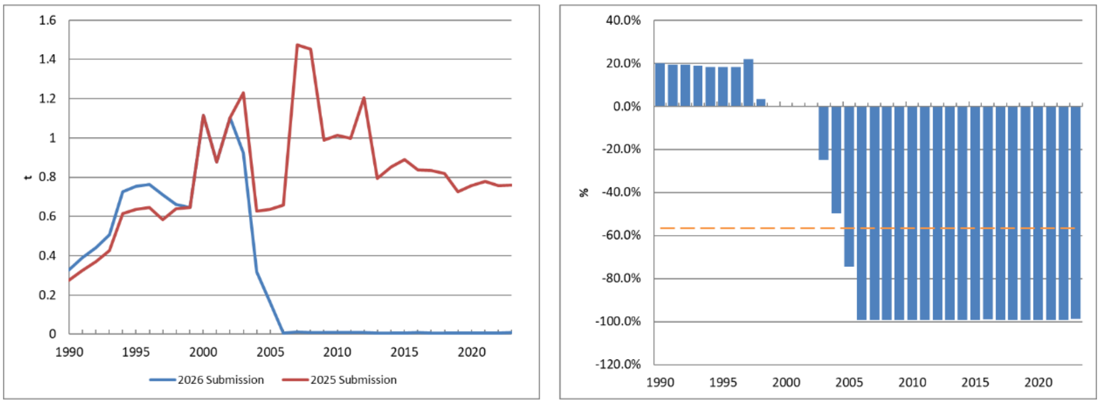



Figure 6.5.20 Evolution of the difference in 5C1biv Cd emissions (national territory)

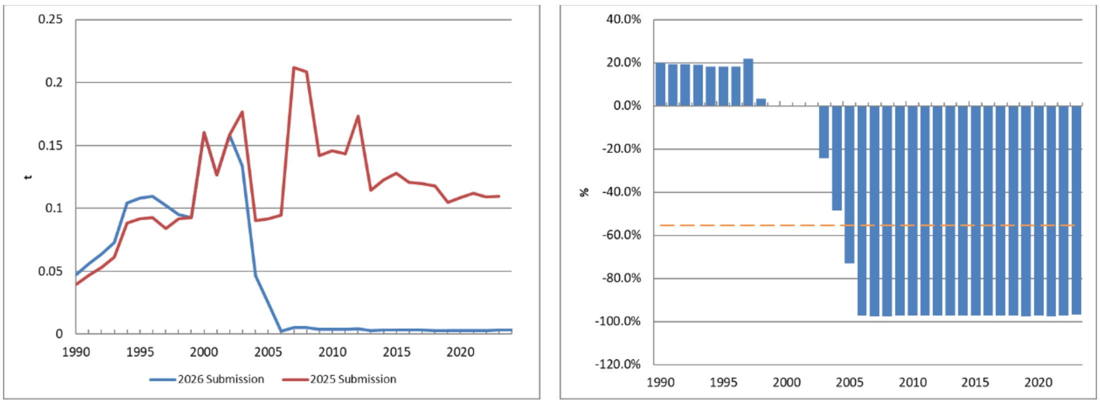



Figure 6.5.21 Evolution of the difference in 5C1biv Hg emissions (national territory)

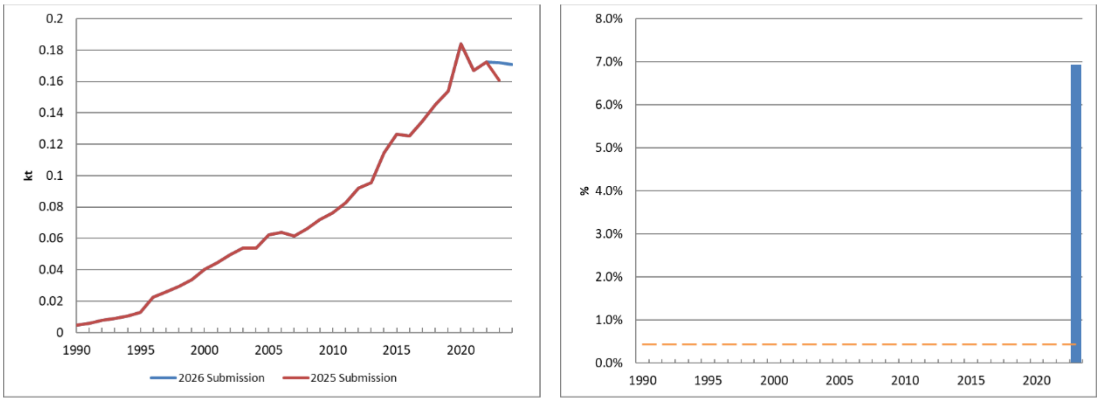



**Figure 6.5.22 Evolution of the difference in 5C1bv NOx emissions (national territory)**

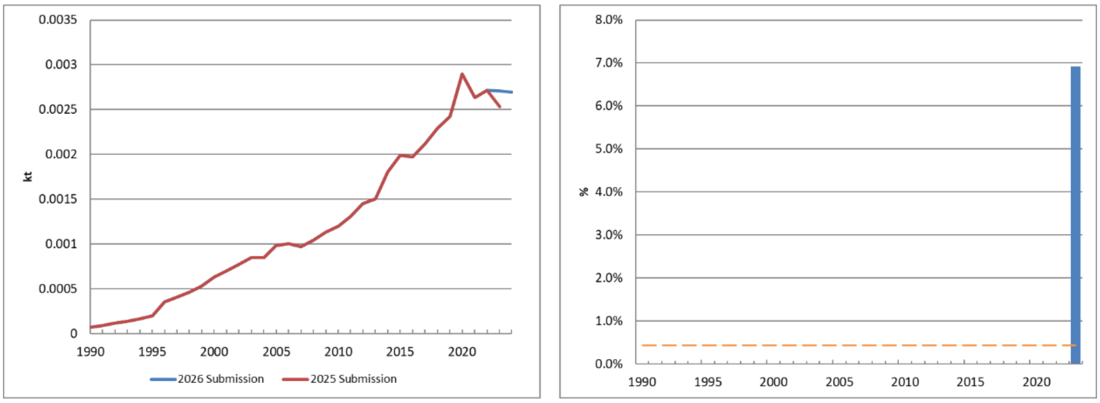



**Figure 6.5.23 Evolution of the difference in 5C1bv NMVOC emissions (national territory)**

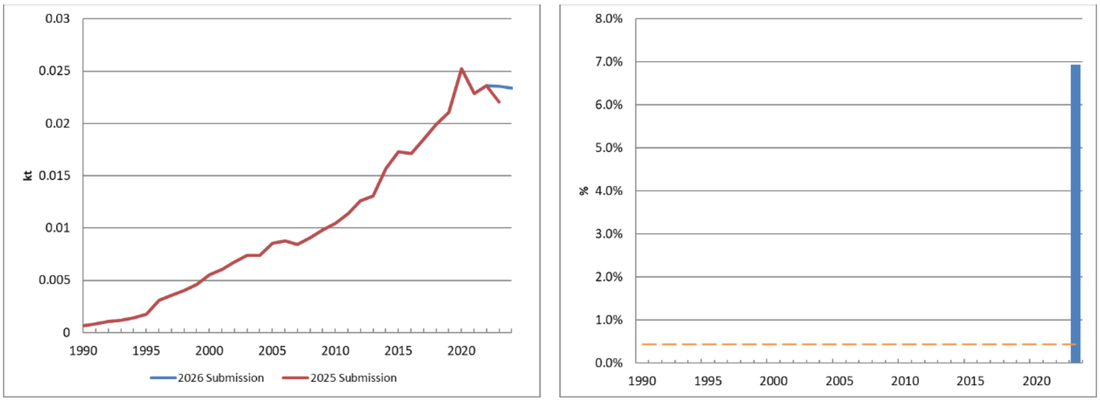



**Figure 6.5.24 Evolution of the difference in 5C1bv $SO_2$ emissions (national territory)**

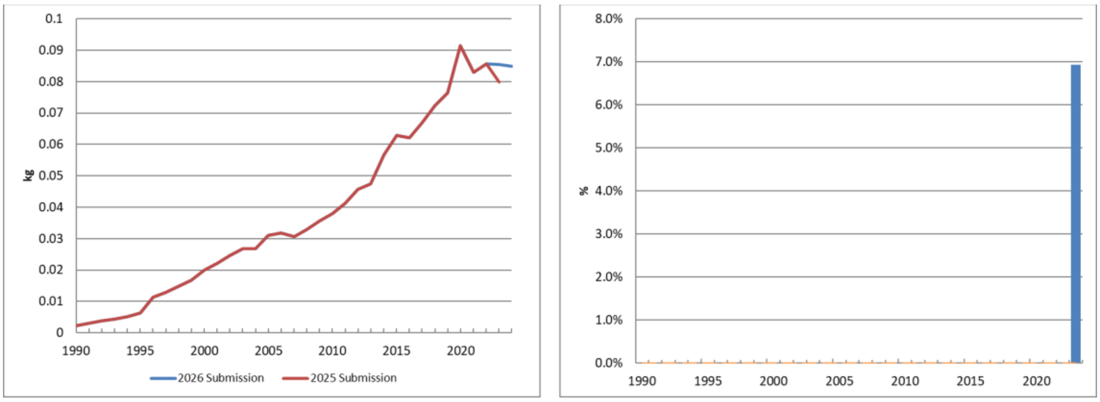



Figure 6.5.25 Evolution of the difference in 5C1bv PCB emissions (national territory)

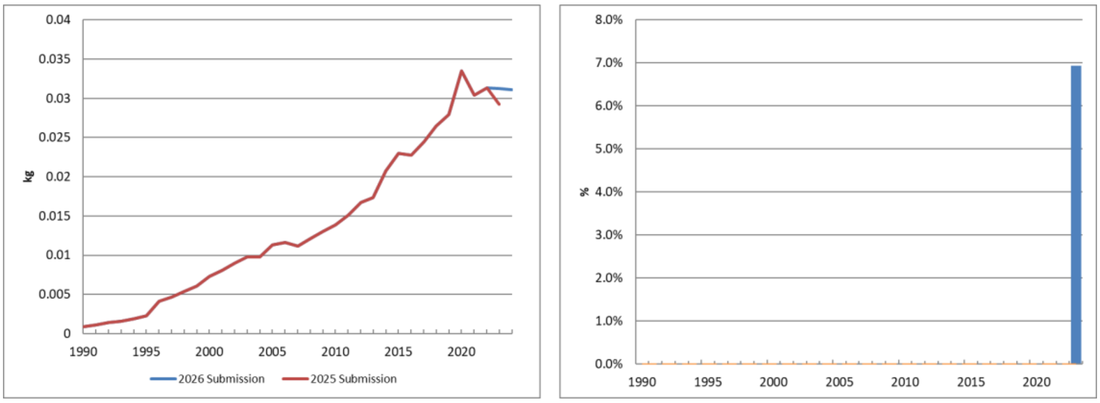



Figure 6.5.26 Evolution of the difference in 5C1bv HCB emissions (national territory)

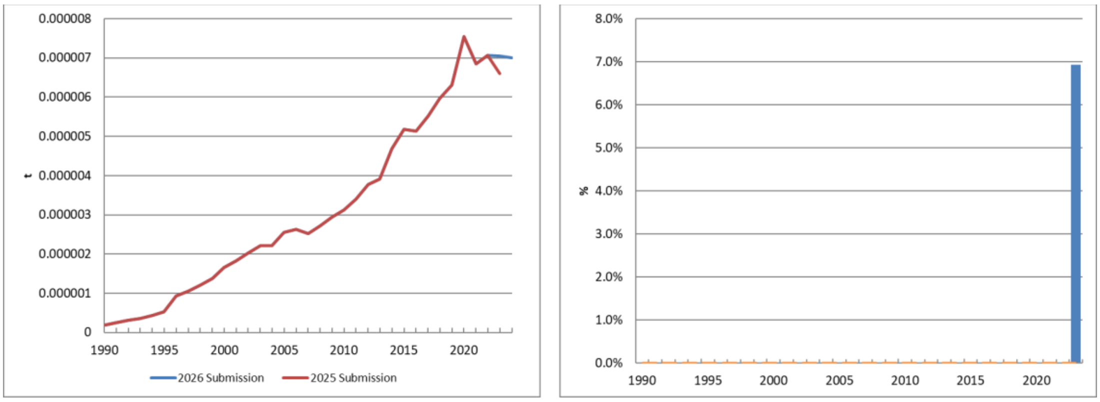



Figure 6.5.27 Evolution of the difference in 5C1bv PAH emissions (national territory)

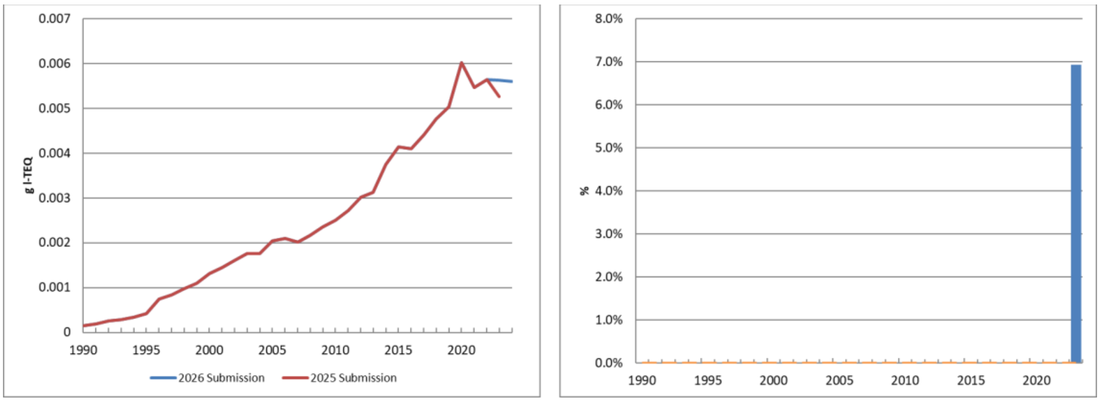



**Figure 6.5.28 Evolution of the difference in 5C1bv PCDD/PCDF emissions (national territory)**

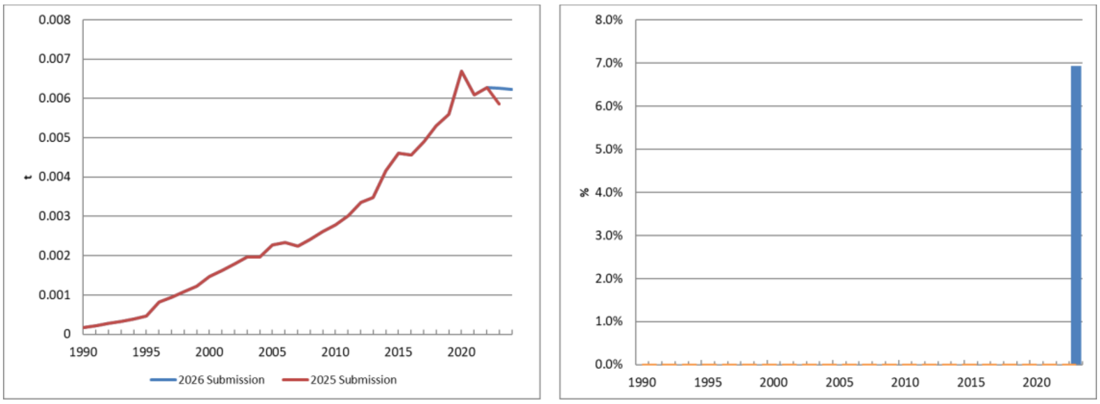



**Figure 6.5.29 Evolution of the difference in 5C1bv Pb emissions (national territory)**

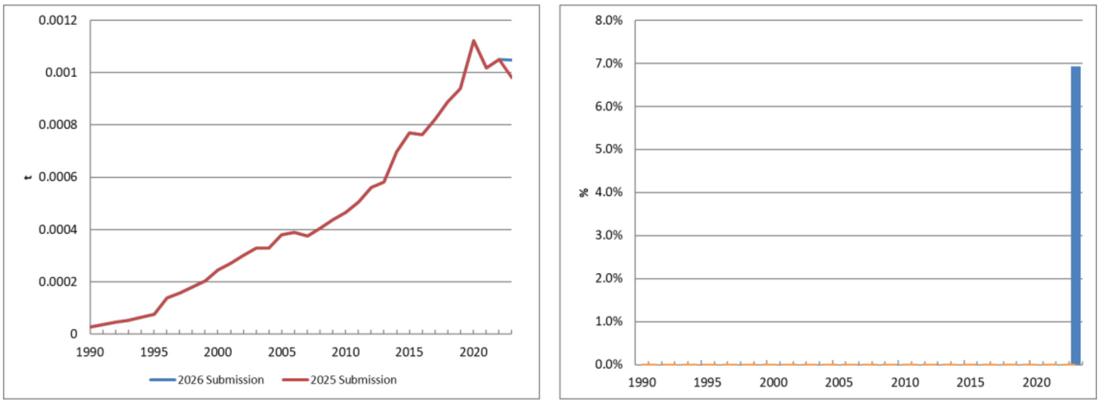



**Figure 6.5.30 Evolution of the difference in 5C1bv Cd emissions (national territory)**

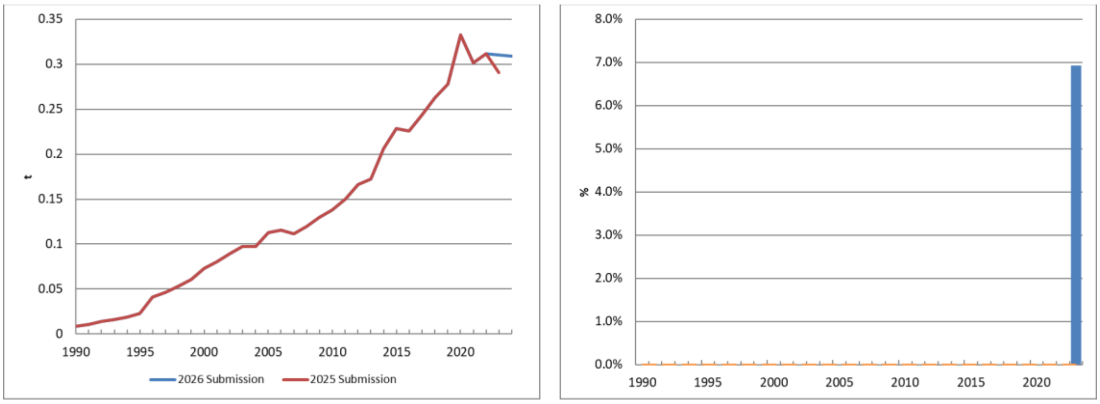



Figure 6.5.31 Evolution of the difference in 5C1bv Hg emissions (national territory)

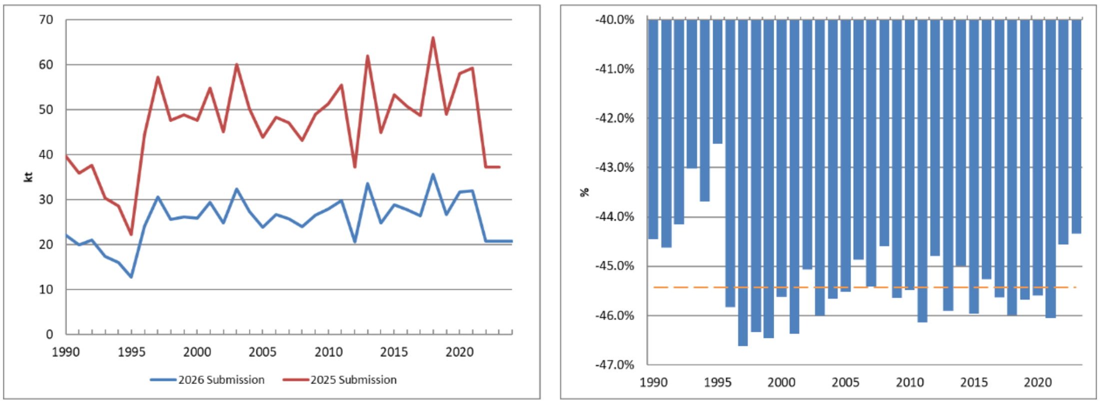



Figure 6.5.32 Evolution of the difference in 5C2 NOx emissions (national territory)

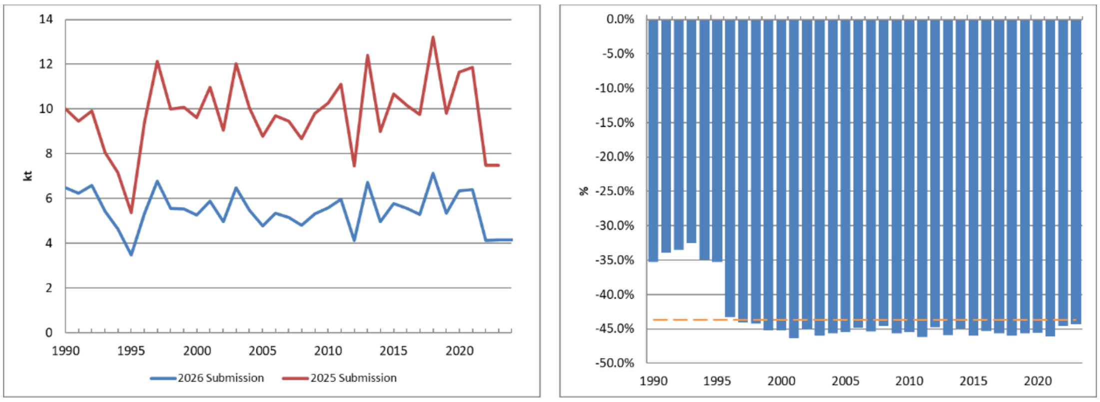



Figure 6.5.33 Evolution of the difference in 5C2 NMVOC emissions (national territory)

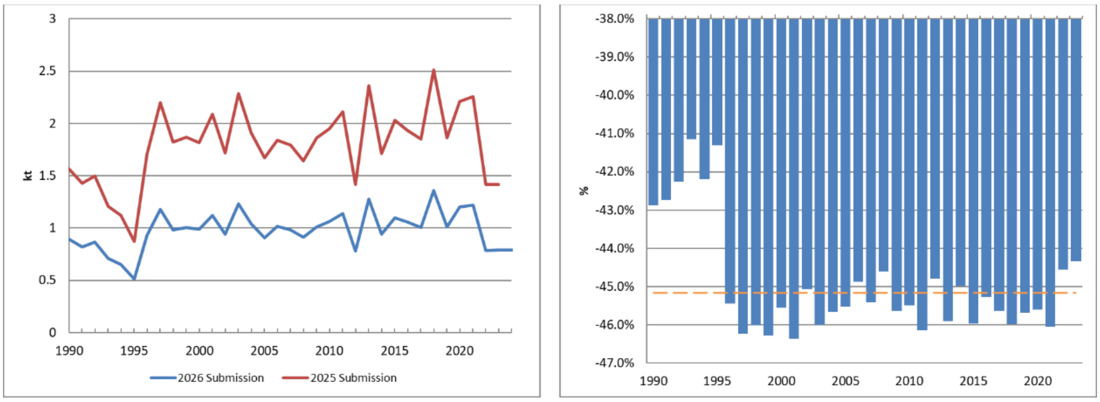



**Figure 6.5.34 Evolution of the difference in 5C2 $SO_2$ emissions (national territory)**

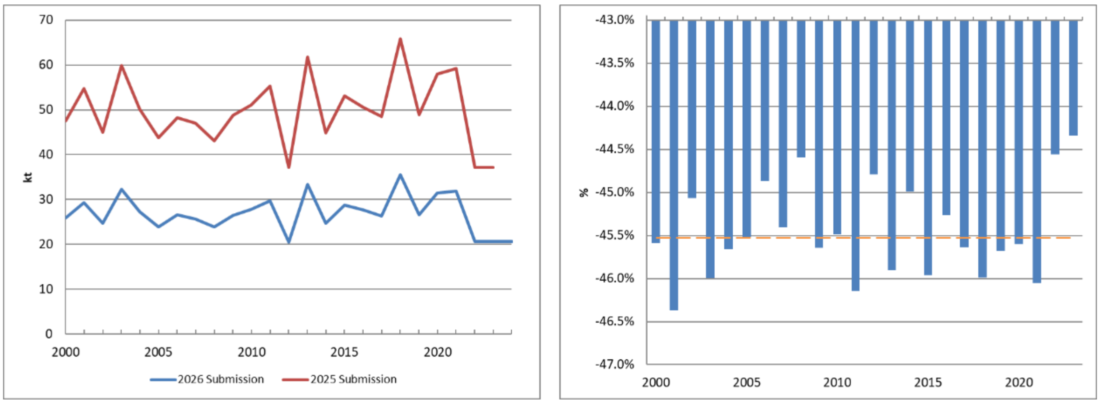



**Figure 6.5.35 Evolution of the difference in 5C2 TSP emissions (national territory)**

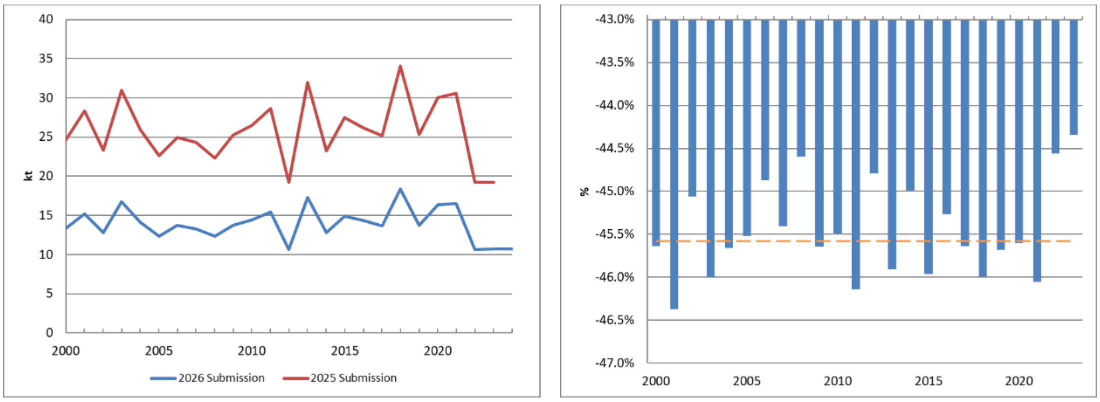



**Figure 6.5.36 Evolution of the difference in 5C2 BC emissions (national territory)**

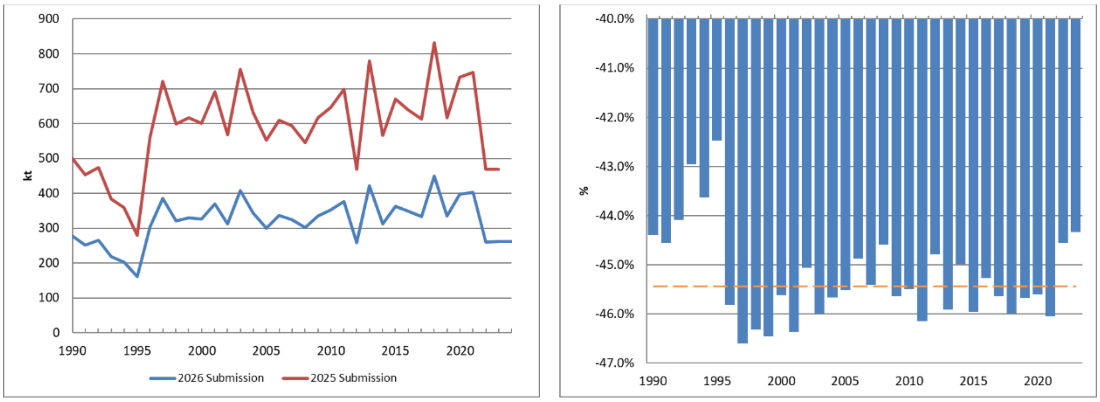



**Figure 6.5.37 Evolution of the difference in 5C2 CO emissions (national territory)**

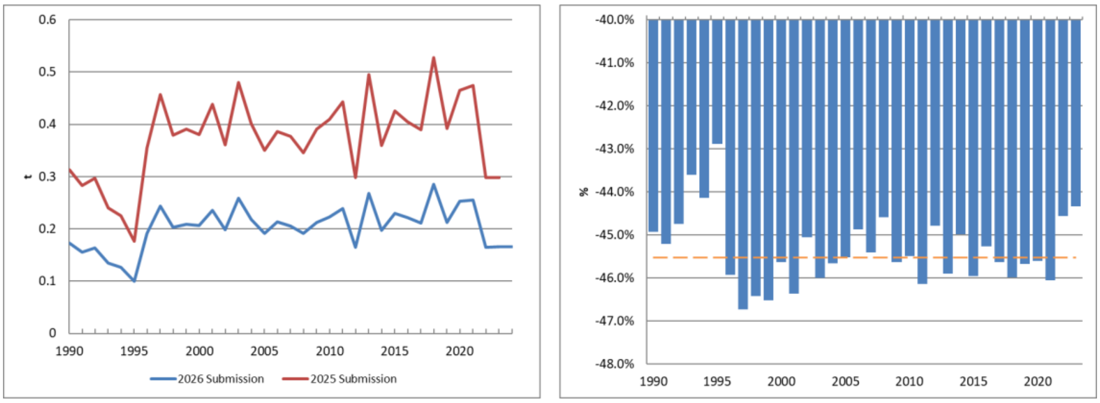



**Figure 6.5.38 Evolution of the difference in 5C2 PAH emissions (national territory)**

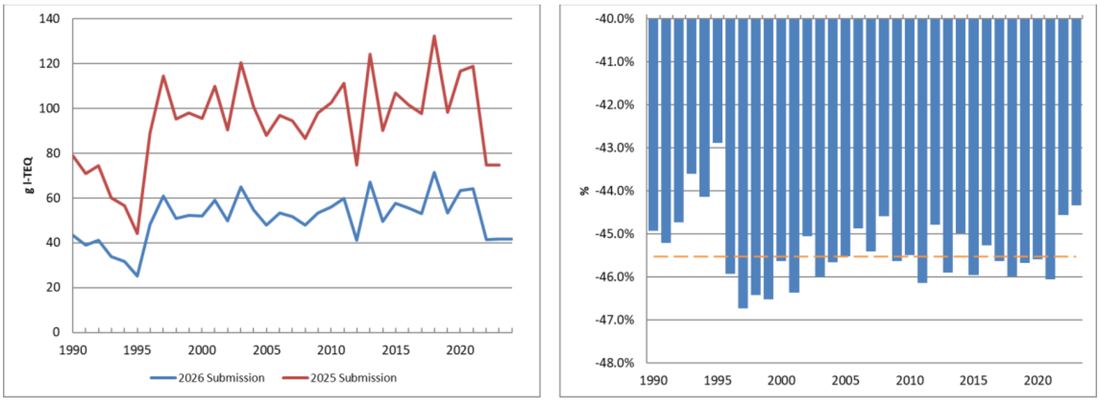



**Figure 6.5.39 Evolution of the difference in 5C2 PCDD/PCDF emissions (national territory)**

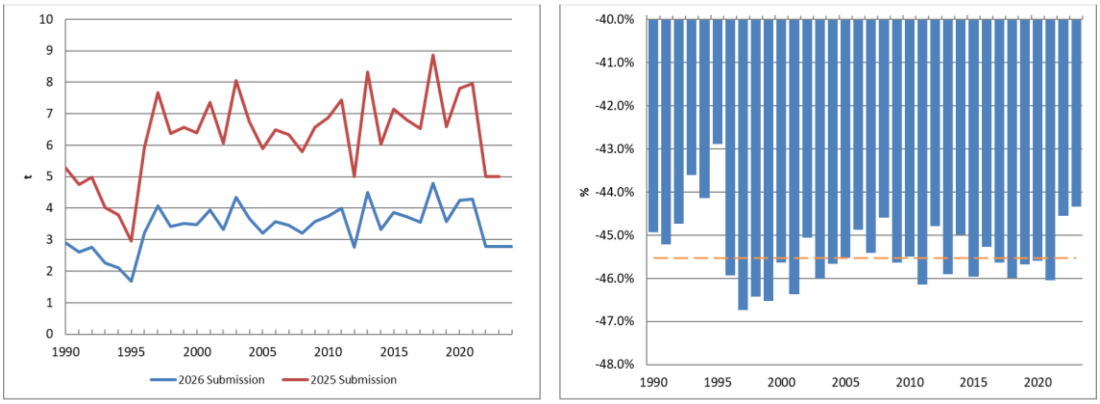



Figure 6.5.40 Evolution of the difference in 5C2 Pb emissions (national territory)

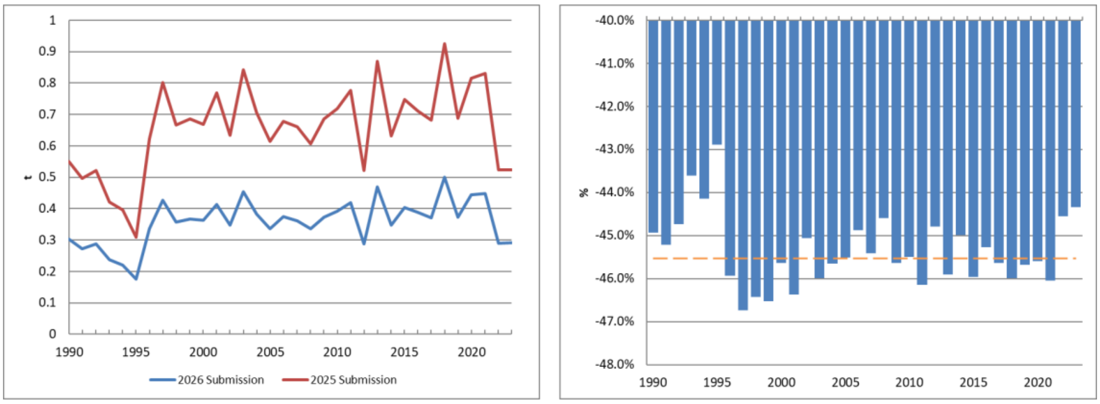



Figure 6.5.41 Evolution of the difference in 5C2 Cd emissions (national territory)

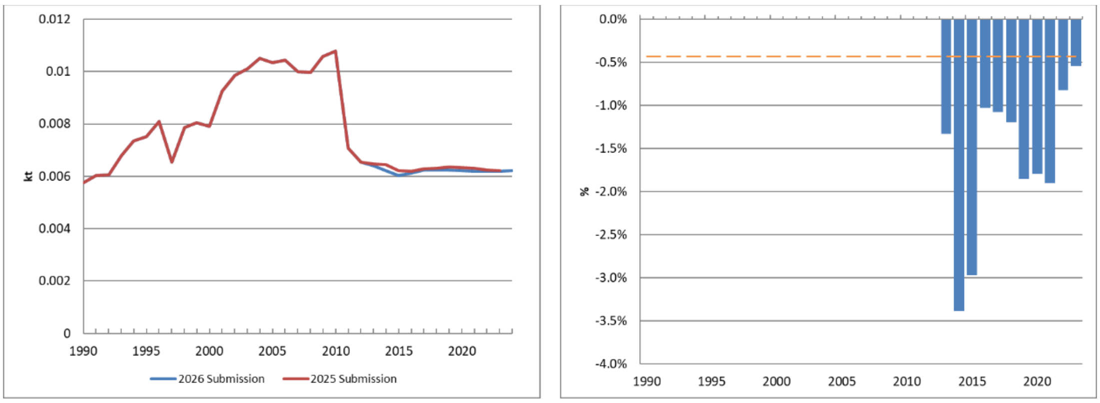



Figure 6.5.42 Evolution of the difference in 5D1 NOx emissions (national territory)

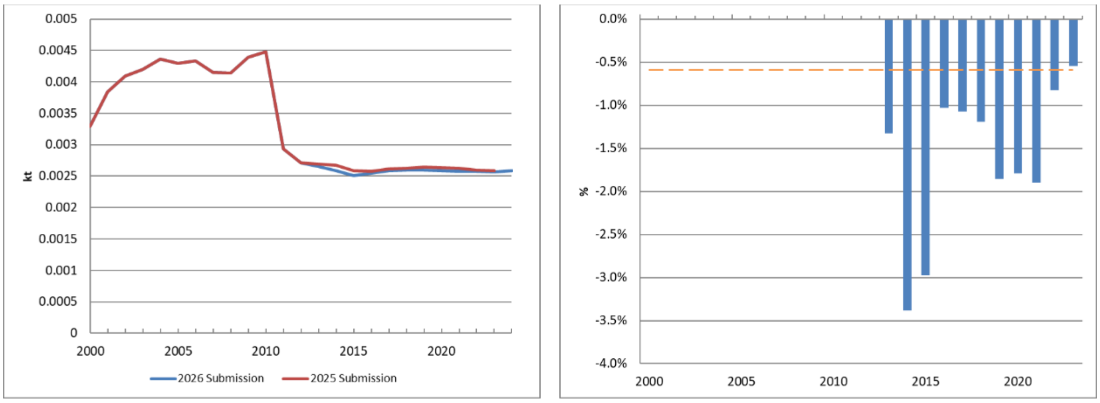



**Figure 6.5.43 Evolution of the difference in 5D1 TSP emissions (national territory)**

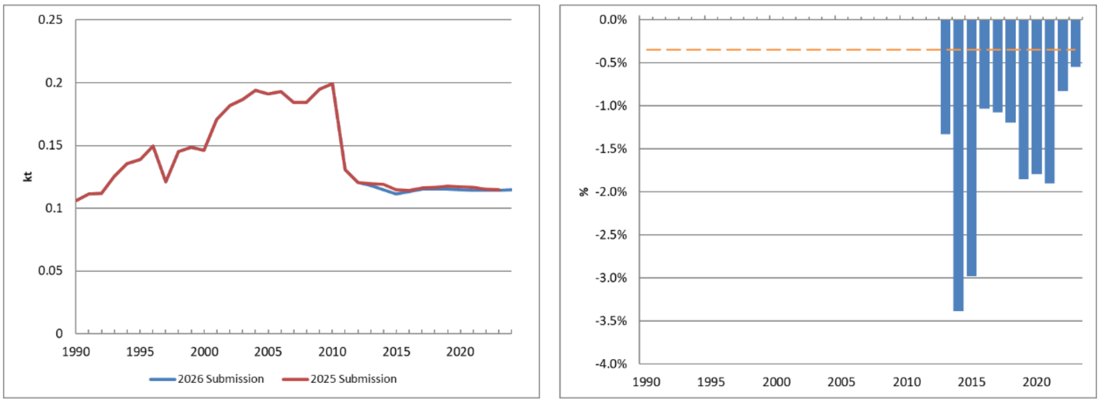



**Figure 6.5.44 Evolution of the difference in 5D1 CO emissions (national territory)**

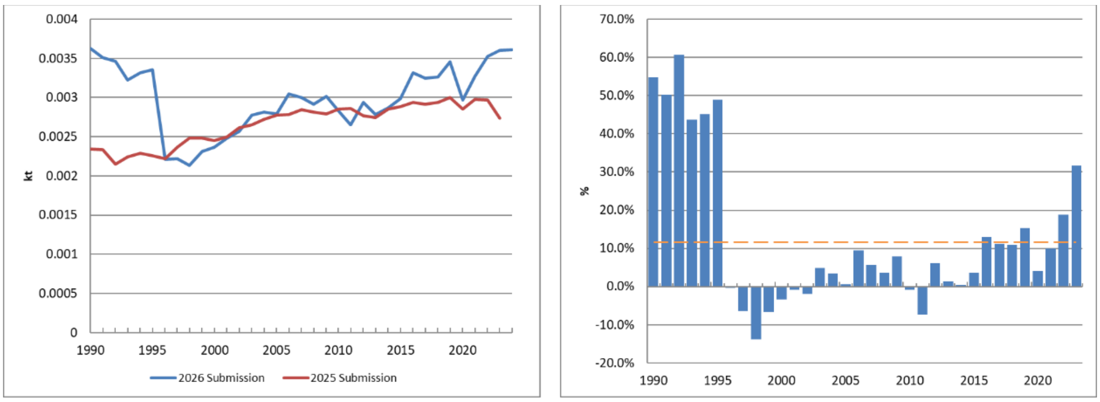



**Figure 6.5.45 Evolution of the difference in 5D2 NOx emissions (national territory)**

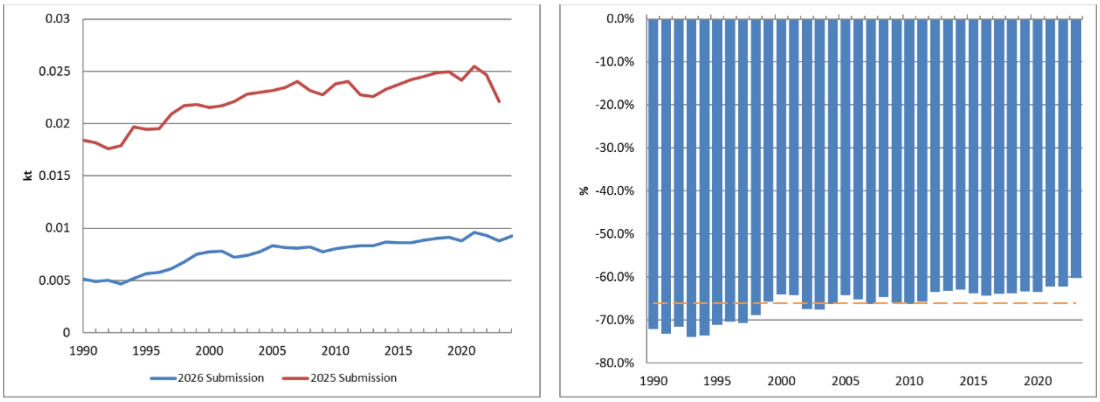



**Figure 6.5.46 Evolution of the difference in 5D2 NMVOC emissions (national territory)**

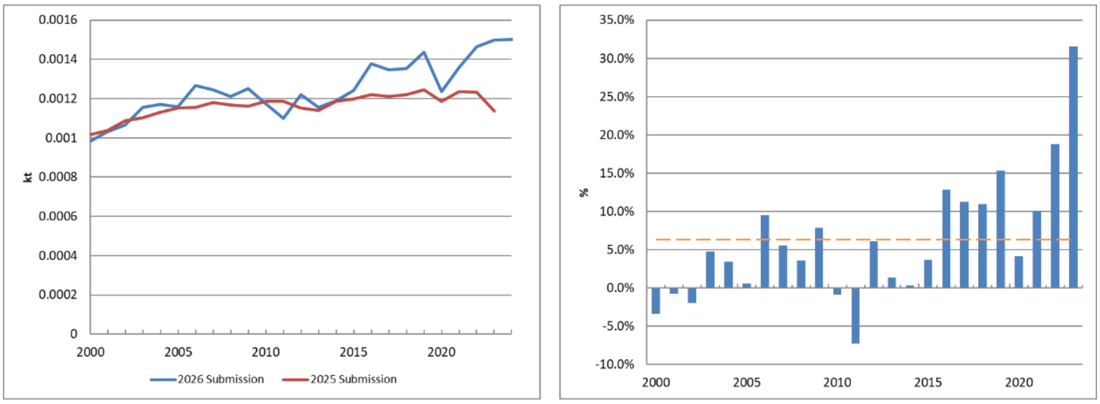



**Figure 6.5.47 Evolution of the difference in 5D2 TSP emissions (national territory)**

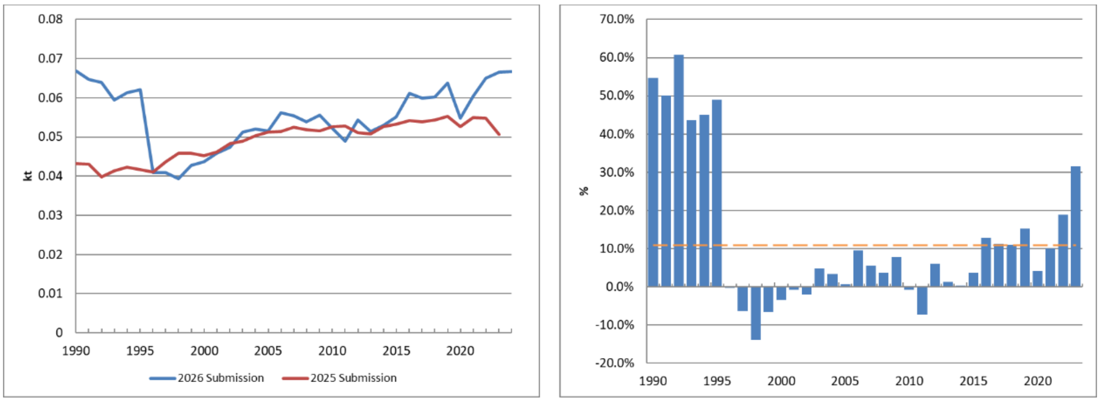



**Figure 6.5.48 Evolution of the difference in 5D2 CO emissions (national territory)**

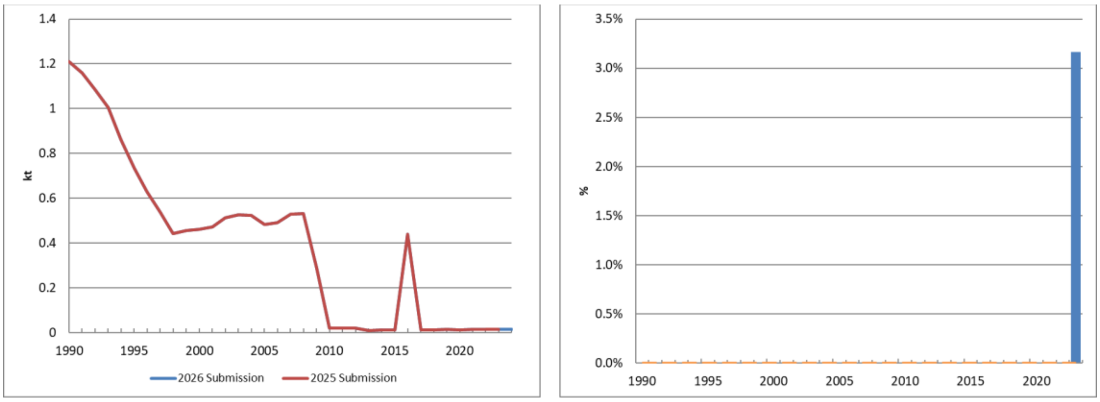



**Figure 6.5.49 Evolution of the difference in 5E NMVOC emissions (national territory)**

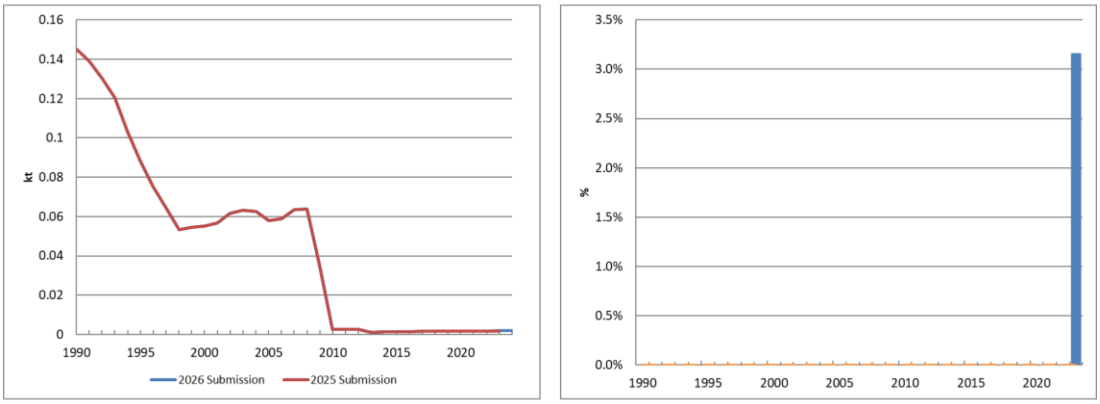



**Figure 6.5.50 Evolution of the difference in 5E $NH_3$ emissions (national territory)**

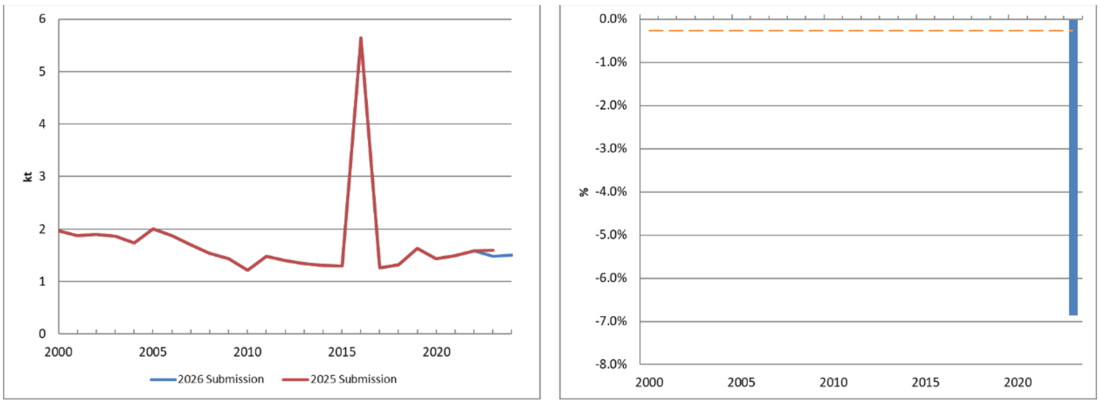



**Figure 6.5.51 Evolution of the difference in 5E TSP emissions (national territory)**

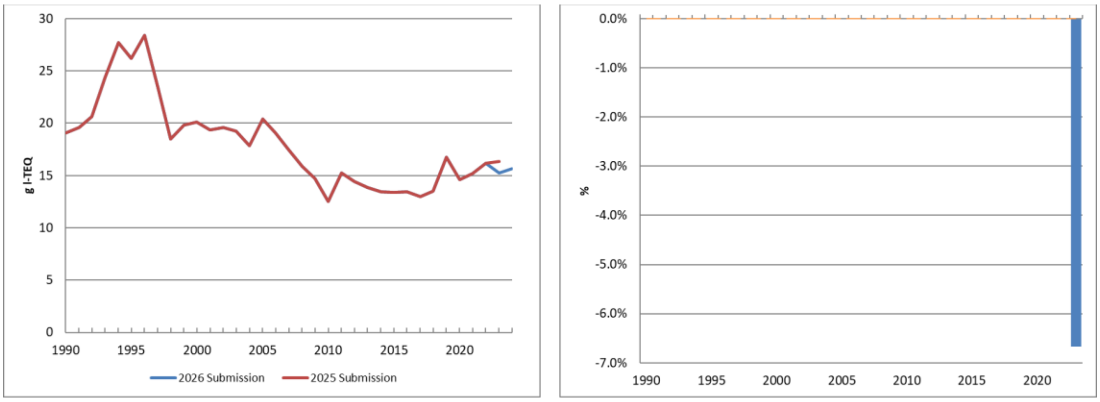



**Figure 6.5.52 Evolution of the difference in 5E PCDD/PCDF emissions (national territory)**

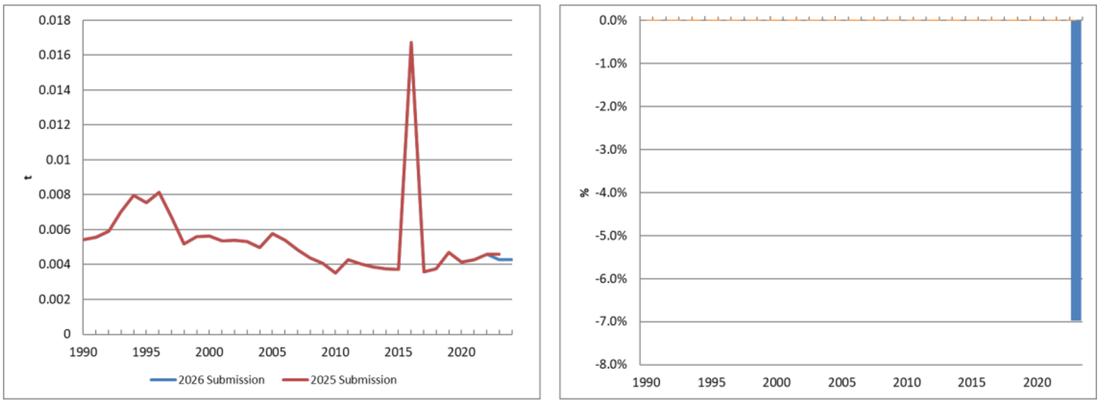
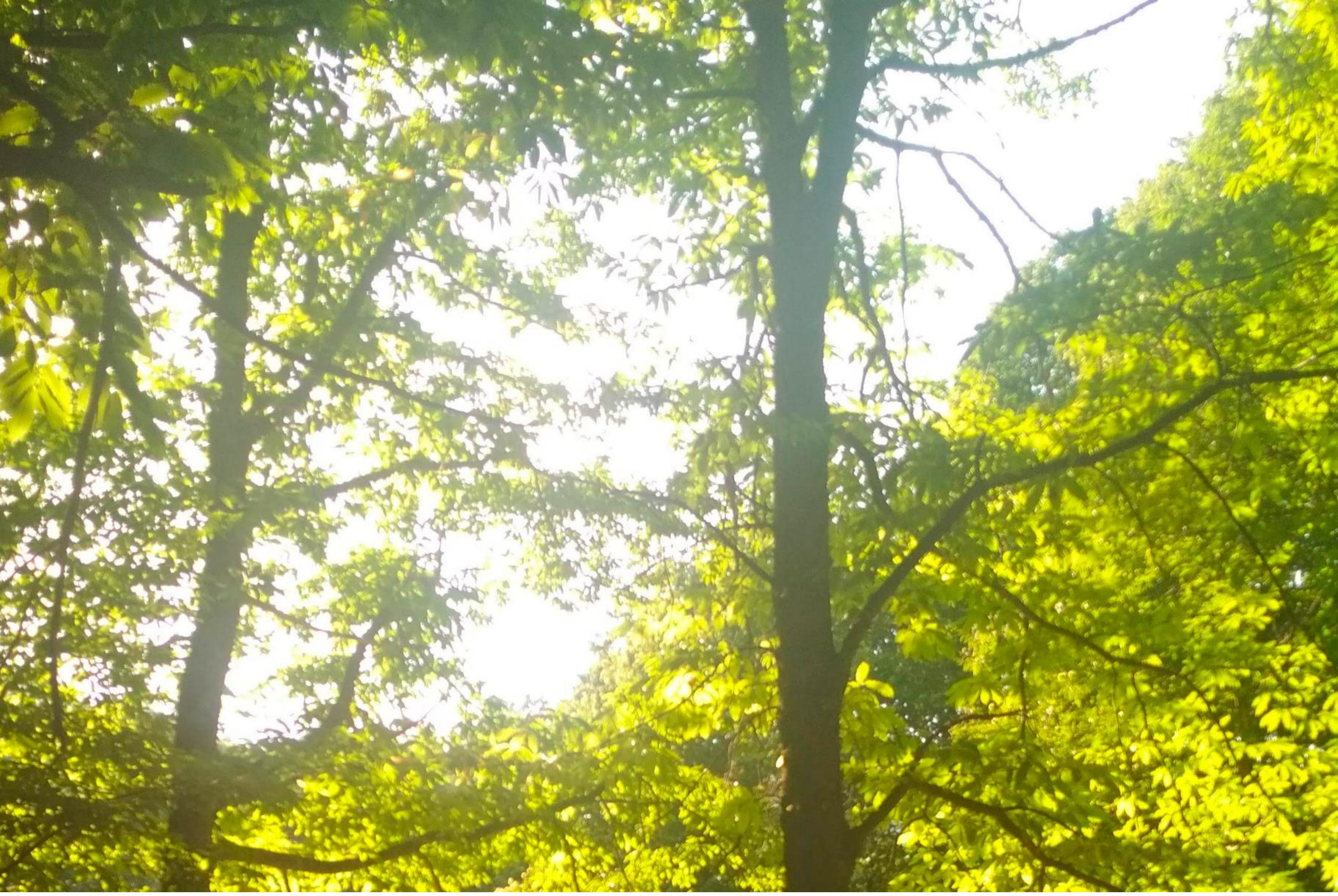



**Figure 6.5.53 Evolution of the difference in 5E Pb emissions (national territory)**

## 6.6. Sector improvements

The collaboration with the main focal points: Sub-directorate General of Circular Economy at the Ministry for the Ecological Transition and Demographic Challenge (SGR-MITECO), Spanish Climate Change Office (OECC), National Census for Sewage Disposal (CNV) and National Sludge Registry (RNL) will continue.



# 7. NATURAL EMISSIONS (NFR 11)

# CONTENTS

## FIGURES



## TABLES

# 7. NATURAL EMISSIONS (NFR 11)

Chapter updated in March, 2026.

Natural emissions are reported on a *pro memoria* basis in the EMEP template for emission data and are not included in the national totals emissions. Information is provided in the Inventory Report for reference.

## 7.1. Sector overview

Main issues regarding gas emissions reported for this sector are shown in the following table, in particular, NFR categories and pollutants coverage, methodology approach (Method) and selection as key categories (KC).

**Table 7.1.1 Coverage of NFR category for reported year 2024**

| NFR Code | NFR category | Pollutants | | | | Method | KC |
|---|---|---|---|---|---|---|---|
| | | Covered | Exceptions | | | | |
| | | | IE | NA | NE | | |
| **11A** | Volcanoes | – | – | All | – | – | – |
| **11B** | Forest fires | NOx, $SO_2$, $NH_3$, NMVOC, CO, $PM_{2.5}$, $PM_{10}$, TSP and BC | – | PCBs | Rest of pollutants | T2 | – |
| **11C** | Other natural emissions | – | – | All | – | – | – |

IE: included elsewhere; NA: not applicable; and NE: not estimated.

## 7.2. Sector analysis

Main features of the Natural Sector in Spain (national territory) in 2024 are listed in the following table for reference.

**Table 7.2.1 Sector analysis (national territory)**

| NFR Code | NFR category | Main features | Main sources of activity data |
|---|---|---|---|
| **11A** | Volcanoes | – | – |
| **11B** | Forest fires(**) | Number of forest fires per year(*): 9,670 (2014-2023 average)[1]<br>Area (hectares) of forest affected per year: 103,918.00 (2014-2023 average) | MITECO |
| **11C** | Other natural emissions | – | – |

(*) 2024 official data on forest fires are not yet available, emission data has been calculated as an average of the last decade available data (2014-2023[2]).

(**) Data include the Canary Islands.

[1] Source: Information for the period 2014-2023 included in the publication "Los Incendios Forestales en España. 1 enero - 31 diciembre 2024. Avance Informativo" ("Forest fires in Spain: 1st January - 31th December 2024. Preliminary report").

[2] 2019, 2020, 2021, 2022 and 2023 official data are provisional.

### 7.2.1. Key categories

This sector has not been included in the key categories analysis because is reported on a *pro memoria* basis.

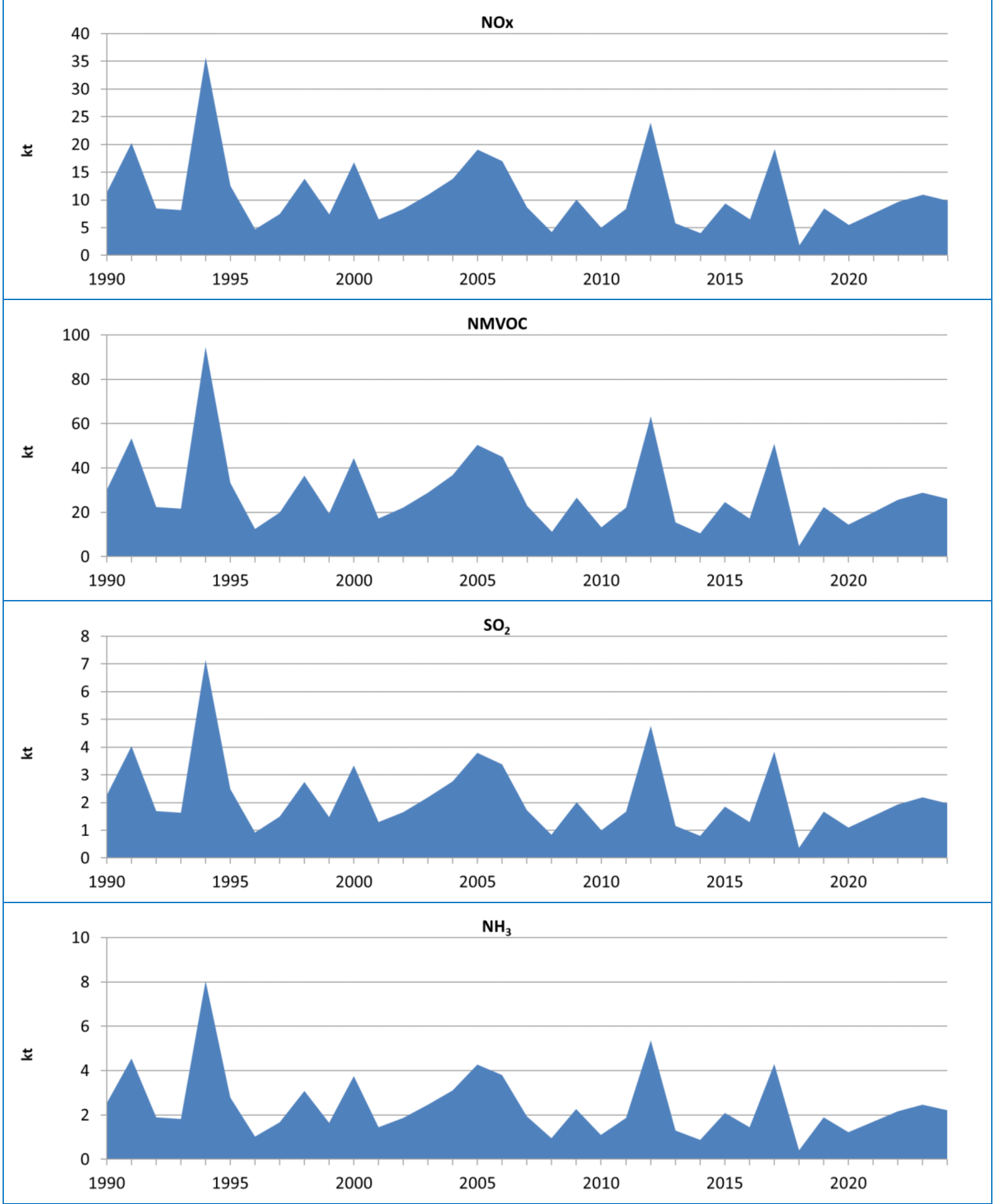
### 7.2.2. Analysis by pollutant

Charts of the time series by pollutants and NFR categories are shown next. Each pollutant is represented independently.

Explanation boxes are included beside the graphs, providing specific details on the pollutant emissions in year 2024 and main drivers and trends during the time series. Emissions from the Canary Islands are considered, although their territory is not under the EMEP grid.

Detailed emission data of the Spanish Inventory are available from the MITECO-SEI website WebTable.

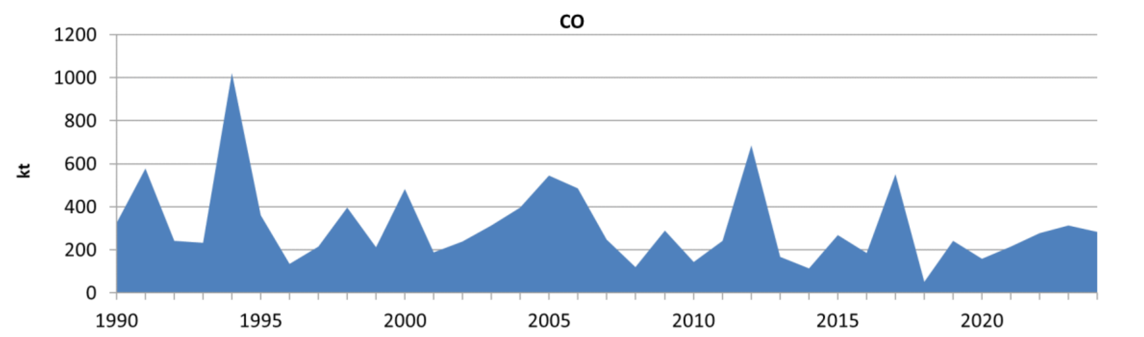
## Main Pollutants




| | | |
|---|---|---|
| ***NOx*** | 9.90 kt emitted in 2024 (9.39 without Canary Islands). | |
| ***NMVOC*** | 26.21 kt emitted in 2024 (24.88 without Canary Islands). | |
| ***$SO_2$*** | 1.97 kt emitted in 2024 (1.87 without Canary Islands). | |
| ***$NH_3$*** | 2.22 kt emitted in 2024 (2.11 without Canary Islands). | |
| | 1990-2024 | Continuous series of peaks and troughs due to the randomness of forest fires, highlighting the peaks corresponding to the years 1991, 1994, 2000, 2004-2006, 2012, 2015 and 2017. This trend depends, to a large extent, on such effects as annual rainfall, summer temperatures, terrain, biomass content in the area affected, etc. |

**Figure 7.2.1 Evolution of main pollutants emissions (national territory)**

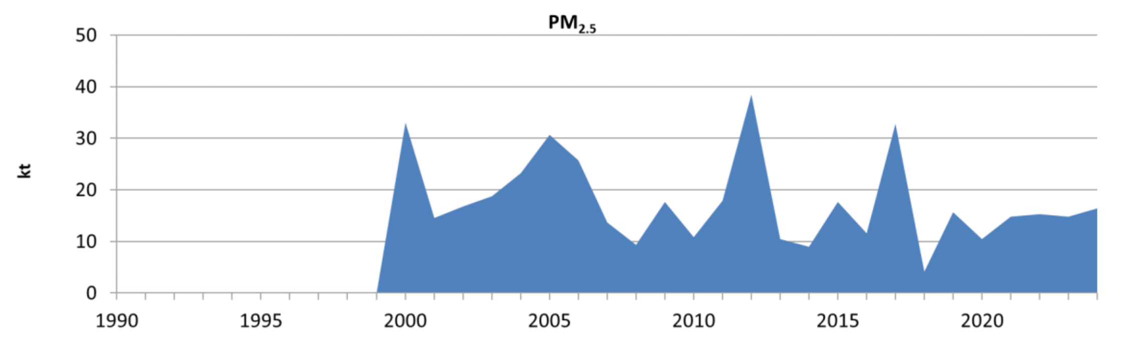
## CO and Priority Heavy Metals

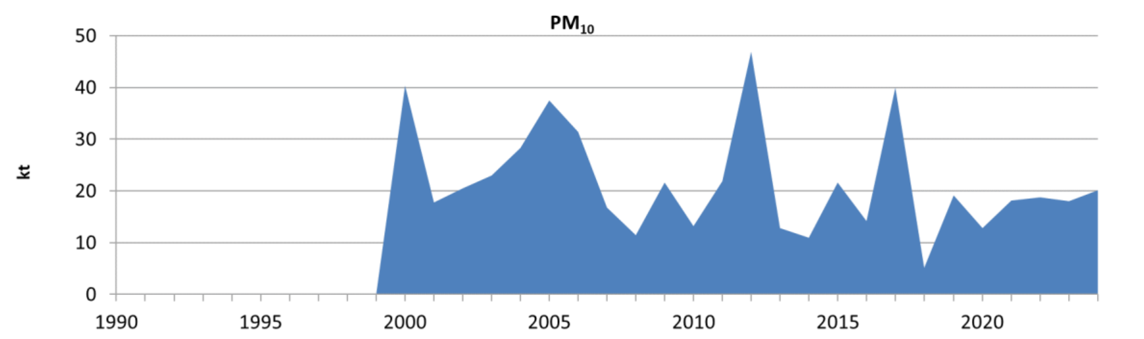


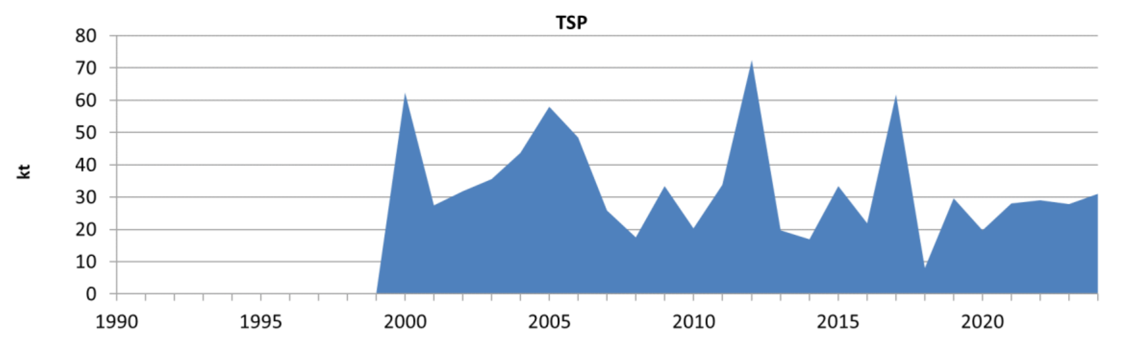

| | | |
|---|---|---|
| ***CO*** | 283.88 kt emitted in 2024 (269.51 without Canary Islands) | |
| | 1990-2024 | See main pollutants analysis of the trend in the series above. |

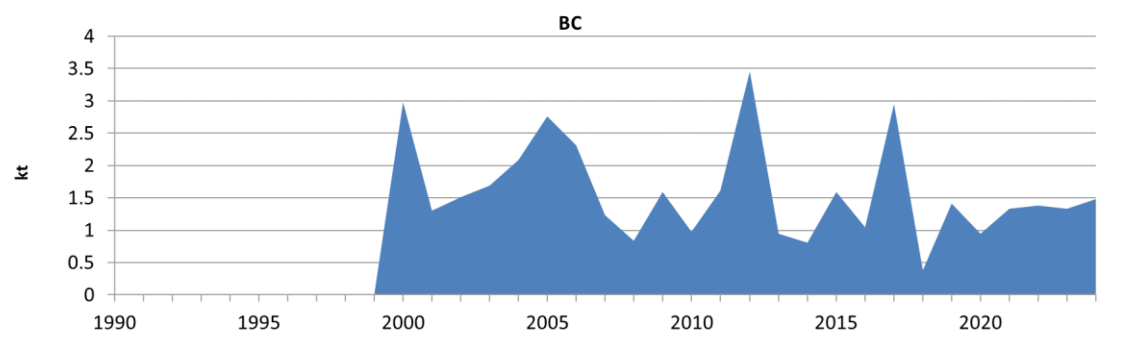
**Figure 7.2.2 Evolution of CO emissions (national territory)**

## Particulate Matter






| | | |
|---|---|---|
| ***$PM_{2.5}$*** | 16.47 kt emitted in 2024 (15.99 without Canary Islands). | |
| ***$PM_{10}$*** | 20.13 kt emitted in 2024 (19.54 without Canary Islands). | |
| ***TSP*** | 31.11 kt emitted in 2024 (30.21 without Canary Islands). | |
| ***BC*** | 1.48 kt emitted in 2024 (1.44 without Canary Islands). | |
| | 2000-2024 | See main pollutants analysis of the trend in the series above. |

**Figure 7.2.3 Evolution of PMs emissions (national territory)**

## 7.3. Major changes

No major changes have been implemented in this sector in the current edition of the Inventory. The data of the activity variables for the years 2017, 2018 and 2023 have been corrected, but the source considers that the data for the years of the 2019-2023 period are still provisional.

## 7.4. Activity analysis

### 7.4.1. Forest Fires (11B)

This category considers the immediate emissions caused by forest fires occurred in Spain (national territory). It does not include delayed emissions attributable in origin to the fires, such as those caused by the biodegradation of unburnt biomass biologically affected by the fires (fire waste).

Forest fires are associated with emissions of NOx, NMVOC, $SO_2$, $NH_3$, CO, $PM_{2.5}$, $PM_{10}$, TSP and BC. This section examines the emissions from burning biomass in forest fires.

### Activity variables

The following table shows the activity variables considered within this category and their corresponding sources of information.

**Table 7.4.1 Contents of category 11B Forest fires**

| Activities included | Activity data | Source of information |
|---|---|---|
| Forest fires | - Surface area affected (hectare).<br>- Biomass factor per hectare for broad-leaved or coniferous species (cubic metre per hectare).<br>- Carbon density (grams per cubic centimetre) for broad-leaved or coniferous species.<br>- Ratios between the components of the total biomass in the species affected.<br>- Annual amount of burnt shrubland and grass-steppe biomass. | - Directorate-General of Biodiversity, Forests and Desertification.<br>- Methodology and factors extracted from Rodríguez Murillo (1994).<br>- 2006 IPCC Guidelines (Table 2.4 - Chapter 2.4 - Vol 4). |

Since 2024 official data on surface area affected by forest fires are not yet available, the activity data for year 2024 has been calculated as an average of the last decade available data (2014-2023[3]).

## Methodology

The methodology employed to estimate the emissions of NOx, NMVOC, $SO_2$, $NH_3$, CO, $PM_{2.5}$, $PM_{10}$, TSP and BC from the burning of biomass in forest land caused by forest fires by anthropic causes is based by obtaining:

- the surface area affected by anthropic causes;
- the prior biomass existing in the tree-covered areas affected by forests fires; and
- the burnt biomass in shrublands and grass/steppe and other temperate forest.

### Calculation of the prior biomass existing in the tree-covered areas affected by forest fires

In tree-covered areas, it is possible to distinguish the following biomass components liable to be affected by fire, its distribution and ratios of fraction burnt:

**Table 7.4.2 Biomass components, distribution and fraction burnt**

| | |
|---|---|
| **Components** | Total biomass (T) T = M + B + U + PL |
| | Above-ground biomass:<br>- Merchantable fraction (M)<br>- Rest of the above-ground biomass (B) |
| | Underground biomass (U) |
| | Residual biomass in the soil (PL) |
| **Distribution**[4] | T = 2.7 M |
| | U = 0.25 (M + B) |
| | PL = 0.1 (M + B + U) |
| **Fraction burnt** | 20% of the carbon forming part of the above-ground biomass[5] |
| | 60% of the carbon forming part of the biomass in soil litter[6] |

[3] 2019, 2020, 2021, 2022 and 2023 official data are provisional.

[4] Equations used in the scenarios mentioned in the article by Rodríguez Murillo (1994).

[5] In line with Seiler and Crutzen (1980).

[6] Inventory working group assumption.

The parameters applied in the calculation methodology are listed in the following table:

### Table 7.4.3 Parameters of the emissions model for forest fires

| Parameters | Species | |
|---|---|---|
| | Coniferous | Broad-leaved |
| Volumes of biomass by surface area | 43 $m^3$/ha | 73 $m^3$/ha |
| Density of dry wood | 0.504 g/$cm^3$ | 0.703 g/$cm^3$ |
| Density of C in dry wood | 0.227 g/$cm^3$ | 0.316 g/$cm^3$ |

Source: Rodríguez Murillo (1994).

### Calculation of the burnt biomass in shrublands and grass/steppe.

For shrublands and grass/steppe, the amount of biomass burnt is estimated by multiplying the area burnt by default values for the amount of fuel actually burnt provided by the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (the product $M_B \times C_f$, Table 2.4, Chapter 2, Volume 4). Those default values are listed in the following table:

### Table 7.4.4 Fuel biomass consumption values for fires (tonnes dry matter $ha^{-1}$)

| Vegetation type | Subcategory | Value |
|---|---|---|
| **Shrublands** | Shrubland (general) | 26.7 |
| **All savanna grasslands (mid/late dry season burns)** | | 10.0 |
| **All “other” temperate forests** | | 50.4 |

### Emission factors

Tier 2 emission factors for source category 11.B forest fires of the EMEP/EEA guidebook 2023 (temperate forest (table 3-5), Mediterranean forest (table 3-6), shrubland (table 3-7) and grass/steppe (table 3-8)) have been used.

The emission factors for the NOx, NMVOC, $SO_2$, $NH_3$, CO, $PM_{2.5}$, $PM_{10}$, TSP and BC are calculated with values extracted of the source of reference indicated in the last column of the following table. In this table, type of activity variable and its units are displayed.

### Table 7.4.5 Sources of reference for the emission factors, type of activity variable and units

| Pollutants | Type of VA Units | Tier | Source of reference |
|---|---|---|---|
| **NOx** | kg/ha area burned | T2 | EFs in tables 3-5, 3-6, 3-7 and 3-8 of chapter 11.B of the EMEP/EEA guidebook (2023). |
| **NMVOC** | | | |
| **$SO_2$** | | | |
| **$NH_3$** | | | |
| **CO** | | | |
| **$PM_{2.5}$** | g/kg wood burned | T2 | EFs in tables 3-5, 3-6, 3-7 and 3-8 of chapter 11.B of the EMEP/EEA guidebook (2023). |
| **$PM_{10}$** | | | |
| **TSP** | | | |
| **BC** | | | |

## Evolution assessment

Within the 1990-2024 period, in Spain there were significant forest fires in years 1991, 1994, 2000, 2005, 2012 and 2017 as shown in the next table and figure.

**Table 7.4.6 Activity variable: Surface area affected (amounts in ha) and burnt biomass (amount in tonnes) (national territory)(*)**

| | | 1990 | 2005 | 2010 | 2015 | 2019 | 2020 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|
| **Surface area affected by anthropic causes (ha)** | Coniferous species | 26,752 | 39,998 | 5,464 | 13,843 | 12,065 | 4,835 | 29,688 | 18,605 |
| | Broad-leaved species | 10,565 | 19,868 | 3,458 | 9,969 | 10,966 | 11,336 | 10,551 | 12,177 |
| | Shrublands | 47,725 | 87,716 | 37,466 | 54,387 | 45,847 | 26,507 | 37,942 | 45,811 |
| | Grass/steppe | 11,189 | 11,011 | 4,927 | 9,923 | 9,380 | 10,506 | 2,756 | 8,390 |
| | **Total** | **96,231** | **158,593** | **51,315** | **88,122** | **78,258** | **53,184** | **80,937** | **84,983** |
| **Burnt biomass by anthropic causes (tonnes)** | Coniferous species | 295,122 | 441,248 | 60,277 | 152,708 | 133,092 | 53,333 | 327,511 | 205,245 |
| | Broad-leaved species | 275,441 | 517,980 | 90,166 | 259,912 | 285,901 | 295,536 | 275,080 | 317,453 |
| | Shrublands | 1274,253 | 2,342,012 | 1,000,355 | 1,452,130 | 1,224,122 | 707,736 | 1,013,049 | 1,223,155 |
| | Grass/steppe | 111,889 | 110,108 | 49,271 | 99,234 | 93,799 | 105,059 | 27,564 | 83,897 |
| | **Total** | **1,956,705** | **3,411,348** | **1,200,069** | **1,963,984** | **1,736,914** | **1,161,664** | **1,643,204** | **1,829,750** |

(*) Data include the Canary Islands.

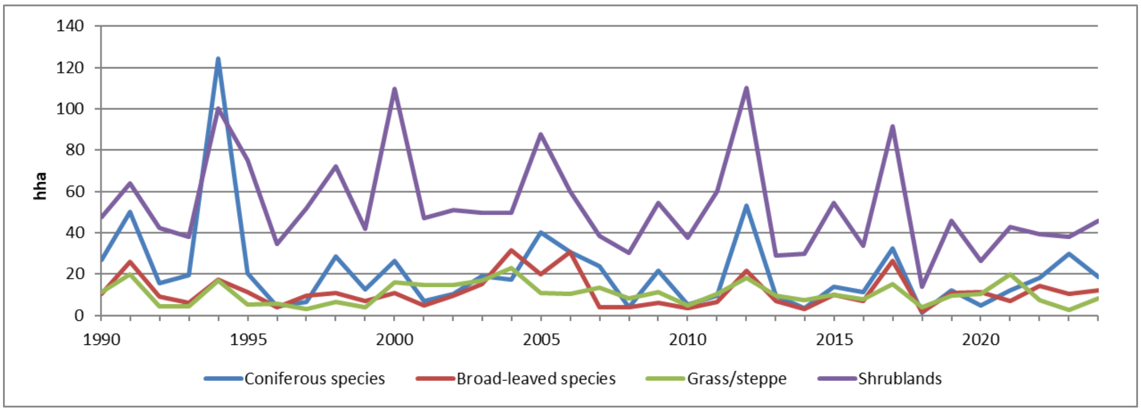



**Figure 7.4.1 Evolution of surface area affected by anthropic causes (national territory)**

# 8. RECALCULATIONS AND PLANNED IMPROVEMENTS

# CONTENTS

## TABLES

# 8. RECALCULATIONS AND PLANNED IMPROVEMENTS

Chapter updated in March, 2026.

This chapter summarises the impact on the emissions totals of the recalculations performed in this Inventory edition, using an analysis by pollutant. Furthermore, the largest changes (in absolute value) for each pollutant are highlighted including the main reasons for the changes observed. Sector-specific recalculations are described within each of the relevant chapters. These chapters should be referred to for details of recalculations and methodology changes.

## 8.1. Overview

Throughout the Spanish Inventory, emission estimates are updated annually across the fulltime series in response to new research and revisions to data sources, as well as error corrections and methodology changes or as a result of the implementation of reviews' recommendations. Main features regarding revised estimates are presented below:

In this edition of the Inventory, 63 categories[1] (61% of the total accounting for the National Total) have been recalculated in the time series 1990-2023. Among them, for one category, recalculations involved new estimations for one or more pollutants[2] for which no estimations had been provided in the last edition. For details on completeness and use of notation keys, please refer to section 1.8.

As a summary, the relative impact of recalculations in the National Totals of Emissions in the last edition of the Inventory, for each pollutant and for pivot years, is shown in the following tables.

**Table 8.1.1 Relative impact of recalculations in the National Totals of Emissions**

| Year | NOx | NMVOC | $SO_2$ | $NH_3$ | $PM_{2.5}$ | $PM_{10}$ | TSP | BC | CO |
|---|---|---|---|---|---|---|---|---|---|
| **1990** | -2.9% | -0.7% | -0.2% | 0.0% | NA | NA | NA | NA | -5.3% |
| **2005** | -3.1% | -0.8% | 0.0% | 0.0% | -10.9% | -6.5% | -4.0% | -20.5% | -12.2% |
| **2010** | -4.5% | -0.9% | -0.3% | 0.0% | -13.2% | -8.8% | -6.0% | -24.0% | -15.9% |
| **2015** | -5.4% | -0.9% | -0.4% | 0.3% | -15.1% | -10.3% | -7.3% | -27.6% | -18.0% |
| **2020** | -6.0% | -1.2% | 0.1% | 1.9% | -18.5% | -12.3% | -8.6% | -31.5% | -22.9% |
| **2021** | -5.5% | -1.4% | -0.7% | 2.3% | -21.1% | -13.8% | -9.7% | -32.1% | -23.5% |
| **2022** | -4.6% | -1.3% | -0.2% | 2.9% | -15.9% | -9.8% | -6.6% | -26.7% | -19.2% |
| **2023** | -5.1% | -0.9% | -0.4% | 3.0% | -16.8% | -11.2% | -7.7% | -27.3% | -19.6% |
| **1990-2023** | -3.9% | -0.9% | -0.2% | 0.3% | -14.0% | -9.2% | -6.3% | -25.0% | -13.1% |

[1] Only categories and pollutants with more than a ±0.00001% variation have been accounted for as a real recalculation. Minor variations could be found under this threshold due to rounding effects in the calculation process or minor error corrections performed.

[2] New estimations have been performed in this inventory edition following NECD review recommendation ES-1B1b-2025-0001.

| Year | Pb | Cd | Hg | As | Cr | Cu | Ni | Se | Zn | PCDD/ PCDF | PAHs | HCB | PCBs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1990** | 0.0% | -0.6% | 0.3% | -0.9% | 1.4% | -1.5% | 0.1% | -0.9% | -18.9% | -17.9% | 1.1% | 0.0% | 0.0% |
| **2005** | -1.8% | -5.8% | -0.4% | -1.0% | 2.4% | -1.1% | 2.3% | -0.9% | -19.0% | -46.0% | 0.9% | -1.7% | 0.0% |
| **2010** | -3.7% | -14.5% | -2.0% | -2.0% | 3.1% | -1.5% | 4.5% | -1.6% | -21.5% | -57.5% | -0.3% | -1.4% | 0.0% |
| **2015** | -4.7% | -14.7% | -1.9% | -2.8% | 0.7% | -1.9% | 0.5% | -1.7% | -22.7% | -55.3% | -1.1% | -1.4% | 0.0% |
| **2020** | -6.2% | -16.2% | -2.9% | -5.0% | 1.2% | -2.2% | 4.4% | -2.4% | -25.8% | -58.6% | -2.6% | -1.4% | 0.0% |
| **2021** | -5.3% | -15.1% | -2.9% | -5.1% | 1.3% | -1.7% | 2.3% | -2.2% | -25.1% | -57.8% | -6.7% | -5.5% | 0.0% |
| **2022** | -4.0% | -13.0% | -2.6% | -3.5% | 1.7% | -1.7% | 0.8% | -1.2% | -18.4% | -59.1% | -6.3% | -4.5% | -24.2% |
| **2023** | -3.4% | -14.5% | -2.2% | -3.0% | 1.8% | -1.6% | 0.1% | -1.3% | -18.0% | -59.9% | -6.6% | -4.2% | -70.9% |
| **1990-2023** | -2.6% | -8.2% | -1.0% | -1.8% | 1.8% | -1.4% | 1.8% | -1.3% | -20.6% | -48.7% | -0.1% | -1.3% | -0.7% |

Reasons for the main recalculations are shown in the following table.

### Table 8.1.2 Most contributing categories to the recalculations in 2023

| Recalculation | NFR | Description | Explanation |
|---|---|---|---|
| 1 | 5C2 | Open burning of waste | Recalculation affecting all pollutants because the nitrogen/dry matter conversion ratios of open-burned pruning residues from woody crops have been updated, leading to a reduction in the activity variable of burned residues throughout the time series. |
| 2 | 5C1biv | Sewage sludge incineration | Recalculation of the activity data for 2023 due to an update of the information provided by the focal point (Registro Nacional de Lodos (RNL)).<br>Additionally, emission factors for specific pollutants have been corrected following the NECD recommendations (ES-5C1biv-2025-0001 and ES-5C1biv-2025-0002). |
| 3 | 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | Recalculations for the whole series (1990-2023) are due to the improvement of agriculture machinery fuel consumption estimation, now based in GVA (Agrarian Gross Value Added) methodology described in EMEP/EEA 2023 Guidebook. |
| 4 | 1B1b | Fugitive emission from solid fuels: Solid fuel transformation | New estimation of these pollutants as suggested by the TERT in the 2025 NECD review. |
| 5 | 3Da2a | Animal manure applied to soils | Recalculation due to variations in population or zootechnical parameters as nitrogen excreted, grazing animal distribution data, ratios of BATs implementation throughout the time series, etc., owing to animals with recalculations cited from 3B categories, whose effect produces cascading consequences on 3Da2a category. |
| 6 | 3B3 | Manure management - Swine | Recalculation that affects white and iberian swine due to updating implementation rate of $NH_3$ BATs from ECOGAN, that has been revised with weighted implementation adjustment to the data of the populations of the Agricultural Statistics Yearbook over the time series, including the BAT-3 affecting to the nitrogen excreted. |
| 7 | 3B4gii | Manure management - Broilers | Recalculation affecting broilers due that the implementation rate of $NH_3$ BATs from ECOGAN has been updated with weighted implementation adjustment to the data of the zootechnical document, in progressive form over the time series, and including BAT-3 that affect to the nitrogen excreted. |
| 8 | 1A2b | Stationary combustion in manufacturing industries and construction: Non-ferrous metals | Activity Data update for years 2017-2023 |

In the next table the relative weight of the most contributing categories to the recalculations in 2023 is shown (CL: contribution level. as a percentage of the recalculation over the total variation observed in absolute value). In terms of impact on each pollutant category 5C2 registers the biggest values of CL in more cases with 98% of Zn recalculation. Other categories only have impact on one or a few pollutants but are main contributors to their recalculations (see categories 5C1biv and 1A4cii with 100% of PCBs and 61% Cu recalculations).

**Table 8.1.3 CL by category and pollutant for the most contributing categories to the overall recalculation (in the time series 1990-2023)**

| NFR | NOx | NMVOC | $SO_2$ | $NH_3$ | $PM_{2.5}$ | $PM_{10}$ | TSP | BC | CO | Pb | Cd | Hg | As | Cr | Cu | Ni | Se | Zn | PCDD/PCDF | PAHs | HCB | PCBs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5C2 | 43% | 40% | 20% | 0% | 89% | 89% | 88% | 93% | 95% | 53% | 35% | 0% | 78% | 6% | 27% | 0% | 74% | 97% | 15% | 8% | 0% | 0% |
| 5C1biv | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 28% | 58% | 70% | 3% | 3% | 3% | 0% | 0% | 0% | 82% | 0% | 88% | 0% |
| 1A4cii | 44% | 24% | 43% | 0% | 5% | 4% | 4% | 5% | 3% | 0% | 1% | 0% | 0% | 5% | 60% | 2% | 5% | 1% | 0% | 4% | 0% | 0% |
| 1B1b | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 15% | 2% | 25% | 12% | 47% | 5% | 9% | 20% | 1% | 2% | 50% | 0% | 0% |
| 3Da2a | 0% | 9% | 0% | 30% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| 3B3 | 0% | 3% | 0% | 49% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| 3B4gii | 0% | 8% | 0% | 8% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| 1A2b | 0% | 0% | 3% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 1% | 0% | 3% | 0% | 0% | 0% | 0% | 0% | 0% |

In the next section an analysis by pollutant is performed. Information is structured in a table containing the recalculation values for the reported year 2023 and for the time series 1990-2023. Furthermore, the top four most recalculated categories are presented including an explanation for each revised estimate as well as the value and its contribution level. For each pollutant figures showing the evolution of the differences between editions are included being the average percentage of recalculation in the time series 1990-2023 represented with an orange dotted line.

## 8.2. Analysis by pollutant

### 8.2.1. NOx

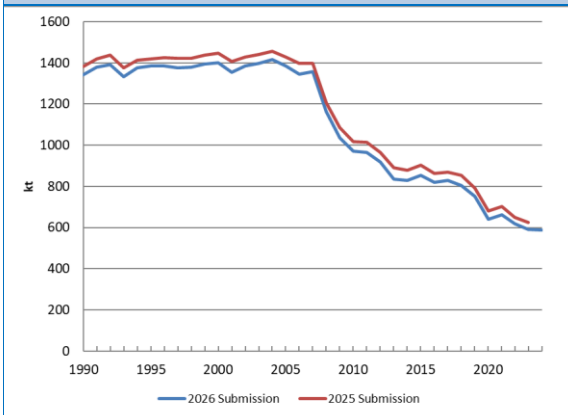
**Table 8.2.1 Summary of recalculations for NOx**

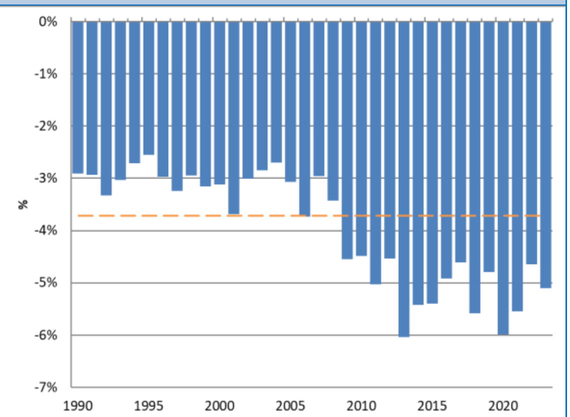
| TOTAL NUMBER OF REVISED CATEGORIES |
|---|
| 41 out of 61 estimated (67%) for reported year 2023 |

| IMPACT OF REVISED ESTIMATES | |
|---|---|
| Reported year 2023 | Time series 1990-2023 (average) |
| -31.9 kt (-5.1%) | -43.2 kt/year (-3.7%) |

| TOP MOST RECALCULATED CATEGORIES FOR REPORTED YEAR 2023 | | | | | |
|---|---|---|---|---|---|
| Order | NFR | Category name | Difference | | Explanation |
| | | | kt | CL | |
| 1 | 5C2 | Open burning of waste | -16.5 | 41% | See Recalculation 1 in Table 8.1.2 |
| 2 | 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | -11.6 | 29% | See Recalculation 3 in Table 8.1.2 |
| 3 | 1A4ci | Agriculture/Forestry/Fishing: Stationary | -3.7 | 9% | Several recalculations for the whole sector, amongst which the update of diesel consumption in agricultural stationary engines in line with agricultural machinery new estimations (1990-2023) contributed the most. |
| 4 | 1A2gviii | Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR) | -0.1 | 0% | Update of fuel consumption values due to the consistency with energy statistics: wood and other wood wastes (2021-2023), natural gas (2023) and diesel (1995-2022) and residual fuel oil (2022, 2023). |

**Evolution of the difference**




| TOP MOST RECALCULATED CATEGORIES FOR TIME SERIES 1990-2023 | | | | | |
|---|---|---|---|---|---|
| Order | NFR | Category name | Difference | | Explanation |
| | | | kt/year | CL | |
| 1 | 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | -21.8 | 44% | See 2 in table above. |
| 2 | 5C2 | Open burning of waste | -21.3 | 43% | See 1 in table above. |
| 3 | 1A4ci | Agriculture/Forestry/Fishing: Stationary | -3.2 | 6% | See 3 in table above. |
| 4 | 1A2gviii | Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR) | 1.3 | 3% | See 4 in table above. |

## 8.2.2. NMVOC

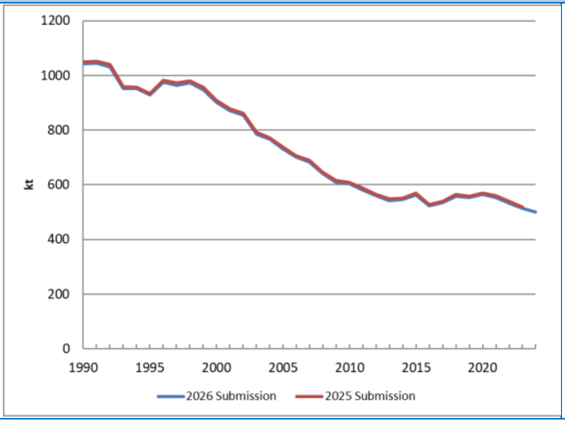
**Table 8.2.2 Summary of recalculations for NMVOC**

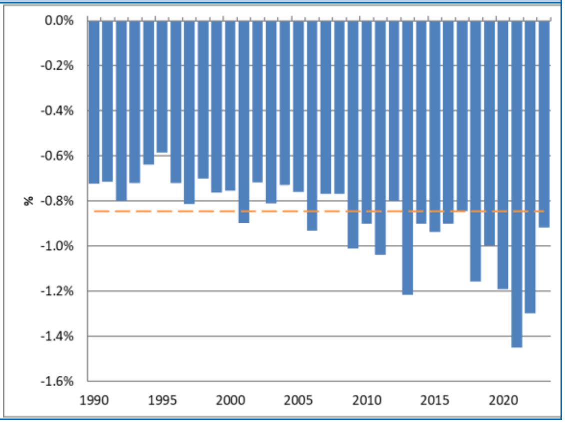
| TOTAL NUMBER OF REVISED CATEGORIES |
|---|
| 47 out of 72 estimated (65%) for reported year 2023 |

| IMPACT OF REVISED ESTIMATES | |
|---|---|
| Reported year 2023 | Time series 1990-2023 (average) |
| -4.8 kt (-0.9%) | -6.3 kt/year (-0.8%) |

| TOP MOST RECALCULATED CATEGORIES FOR REPORTED YEAR 2023 | | | | | |
|---|---|---|---|---|---|
| Order | NFR | Category name | Difference | | Explanation |
| | | | kt | CL | |
| 1 | 3B4gii | Manure management - Broilers | -7,1 | 26% | See Recalculation 7 in Table 8.1.2 |
| 2 | 1B2av | Distribution of oil products | 4,2 | 15% | Methodological change in coherence with 2019 Refinement of the IPCC Guidebook. |
| 3 | 5C2 | Open burning of waste | -3,3 | 12% | See Recalculation 1 in Table 8.1.2 |
| 4 | 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | -1,2 | 4% | See Recalculation 3 in Table 8.1.2 |

**Evolution of the difference**




| TOP MOST RECALCULATED CATEGORIES FOR TIME SERIES 1990-2023 | | | | | |
|---|---|---|---|---|---|
| Order | NFR | Category name | Difference | | Explanation |
| | | | kt/year | CL | |
| 1 | 5C2 | Open burning of waste | -4.3 | 40% | See 3 in table above. |
| 2 | 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | -2.6 | 24% | See 4 in table above. |
| 3 | 3Da2a | Animal manure applied to soils | 1.0 | 9% | See Recalculation 5 in Table 8.1.2 |
| 4 | 3B4gii | Manure management - Broilers | -0.8 | 8% | See 1 in table above. |

## 8.2.3. $SO_2$

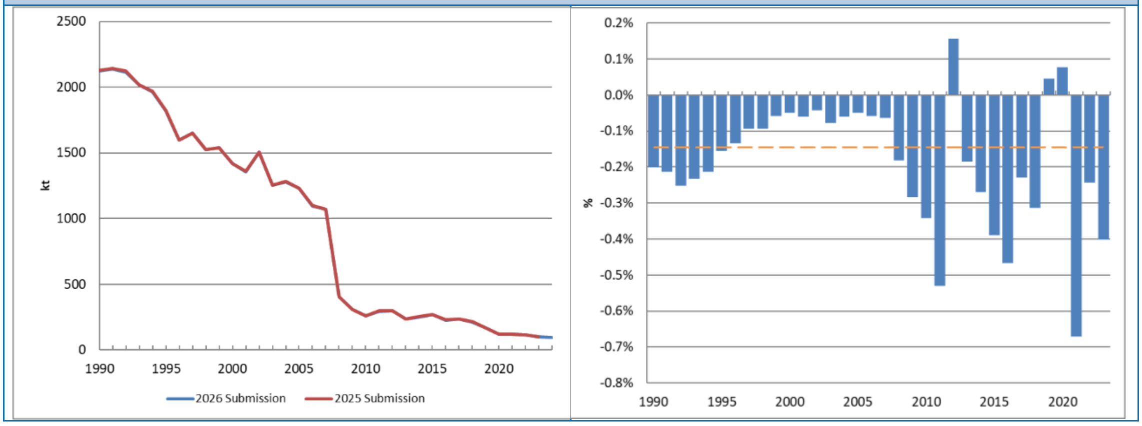
**Table 8.2.3 Summary of recalculations for $SO_2$**

| TOTAL NUMBER OF REVISED CATEGORIES |
|---|
| 25 out of 43 estimated (58%) for reported year 2023 |

| IMPACT OF REVISED ESTIMATES | |
|---|---|
| **Reported year 2023** | **Time series 1990-2023 (average)** |
| -0.4 kt (-0.4%) | -1.4 kt/year (-0.1%) |

| TOP MOST RECALCULATED CATEGORIES FOR REPORTED YEAR 2023 | | | | | |
|---|---|---|---|---|---|
| Order | NFR | Category name | Difference | | Explanation |
| | | | kt | CL | |
| 1 | 5C2 | Open burning of waste | -0.6 | 40% | See Recalculation 1 in Table 8.1.2 |
| 2 | 1A2b | Stationary combustion in manufacturing industries and construction: Non-ferrous metals | 0.4 | 23% | See Recalculation 8 in Table 8.1.2 |
| 3 | 1A2gviii | Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR) | 0.0 | 3% | Update of fuel consumption values due to the consistency with energy statistics: wood and other wood wastes (2021-2023), natural gas (2023) and diesel (1995-2022) and residual fuel oil (2022, 2023). |
| 4 | 1A4ci | Agriculture/Forestry/Fishing: Stationary | -0.2 | 12% | While recalculations and changes in all pollutant trends are due to a mix of recalculations for the whole sector, the update of diesel consumption in agricultural stationary engines in line with agricultural machinery new estimations (1990-2023) contributed the most to the recalculations. |

**Evolution of the difference**




| TOP MOST RECALCULATED CATEGORIES FOR TIME SERIES 1990-2023 | | | | | |
|---|---|---|---|---|---|
| **Order** | **NFR** | **Category name** | **Difference** | | **Explanation** |
| | | | **kt/year** | **CL** | |
| 1 | 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | -1.7 | 43% | See Recalculation 3 in Table 8.1.2 |
| 2 | 5C2 | Open burning of waste | -0.8 | 20% | See 1 in table above. |
| 3 | 1A2gviii | Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR) | 0.6 | 14% | See 3 in table above. |
| 4 | 1A2e | Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco | 0.3 | 7% | Update of fuel consumption values due to the consistency with energy statistics: wood and other wood wastes (2021-2023), natural gas (2023), diesel (1995-2023) and residual fuel oil (2022, 2023). |

## 8.2.4. $NH_3$

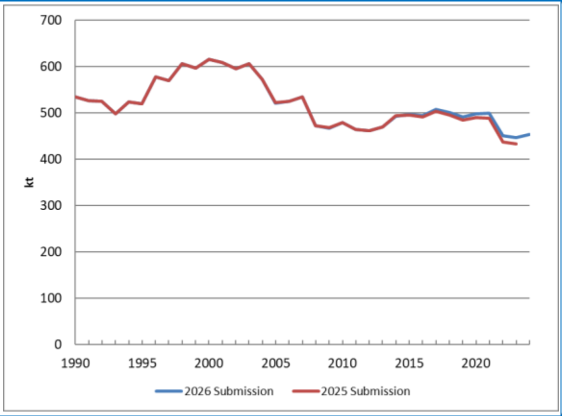
### Table 8.2.4 Summary of recalculations for $NH_3$

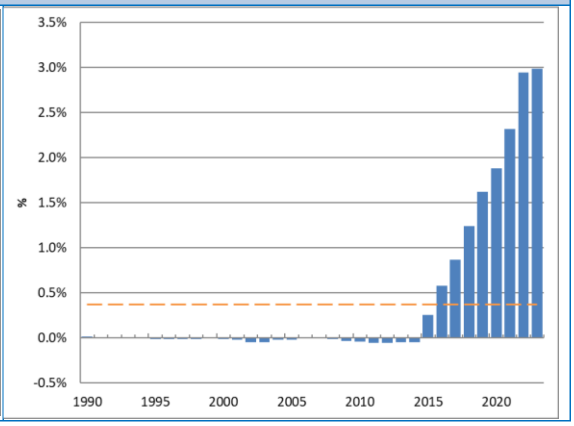
| TOTAL NUMBER OF REVISED CATEGORIES |
|---|
| 32 out of 48 estimated (67%) for reported year 2023 |

| IMPACT OF REVISED ESTIMATES | |
|---|---|
| **Reported year 2023** | **Time series 1990-2023 (average)** |
| 13.0 kt (3.0%) | 1.9 kt/year (0.4%) |

| TOP MOST RECALCULATED CATEGORIES FOR REPORTED YEAR 2023 | | | | | |
|---|---|---|---|---|---|
| **Order** | **NFR** | **Category name** | **Difference** | | **Explanation** |
| | | | **kt** | **CL** | |
| 1 | 3B3 | Manure management - Swine | 5.6 | 43% | See Recalculation 6 in Table 8.1.2 |
| 2 | 3Da2a | Animal manure applied to soils | 4.4 | 33% | See Recalculation 5 in Table 8.1.2 |
| 3 | 3B4gii | Manure management - Broilers | 0.6 | 5% | See Recalculation 7 in Table 8.1.2 |
| 4 | 3B4gi | Manure management - Laying hens | 0.4 | 3% | Recalculation affecting laying hens due that the implementation rate of $NH_3$ BATs from ECOGAN has been updated with weighted implementation adjustment to the populations of the zootechnical document, in progressive form over the time series, and including BAT-3 that affect to the nitrogen excreted. This update was also used to correct a very minor error in the laying hen data across the entire time series. |

**Evolution of the difference**




| TOP MOST RECALCULATED CATEGORIES FOR TIME SERIES 1990-2023 | | | | | |
|---|---|---|---|---|---|
| **Order** | **NFR** | **Category name** | **Difference** | | **Explanation** |
| | | | **kt/year** | **CL** | |
| 1 | 3B3 | Manure management - Swine | 1.1 | 49% | See 1 in table above. |
| 2 | 3Da2a | Animal manure applied to soils | 0.7 | 30% | See 2 in table above. |
| 3 | 3B4gii | Manure management - Broilers | 0.2 | 8% | See 3 in table above. |

| TOP MOST RECALCULATED CATEGORIES FOR TIME SERIES 1990-2023 | | | | | |
|---|---|---|---|---|---|
| Order | NFR | Category name | Difference | | Explanation |
| | | | kt/year | CL | |
| 4 | 3Da1 | Inorganic N-fertilizers (includes also urea application) | 0.1 | 3% | Recalculation that affects categories related to mineral fertilization due to minor alterations in the values from the BNPAE (Nitrogen and Phosphorus Balance of Spanish Agriculture) across the entire annual series is due to the implementation of emission recalculations during the last inventory edition, as well as revisions to the data in some animal husbandry documents that were incorporated into the nitrogen balance for the following year. This resulted in regional changes in fertilizer distribution, whose emissions are affected by the pH of the regions. Change in the area of forage crops has affected too; for these crops, the sum of the harvested area and the area grazed and harvested, along with their associated yields, has been considered as the harvested crop area for calculating production. These changes produce minimal variations in emissions due to slight changes in the quantities and provincial distributions of nitrogen applied as mineral fertilizer, slightly more pronounced in ammonia ($NH_3$) emissions. |

## 8.2.5. $PM_{2.5}$

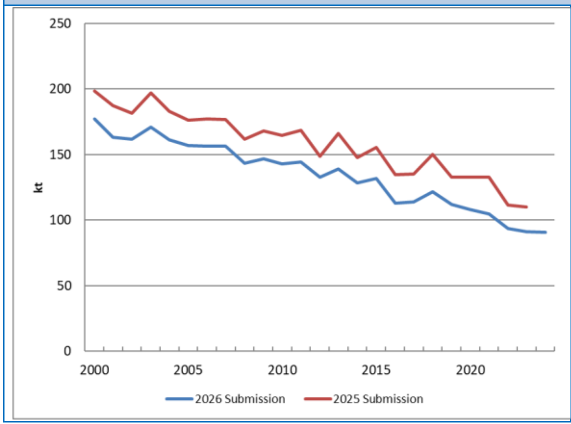
**Table 8.2.5 Summary of recalculations for $PM_{2.5}$**

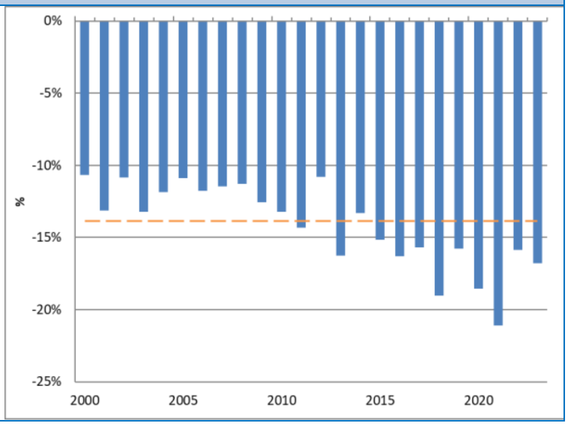
| TOTAL NUMBER OF REVISED CATEGORIES |
|---|
| 44 out of 73 estimated (60%) for reported year 2023 |

| IMPACT OF REVISED ESTIMATES | |
|---|---|
| **Reported year 2023** | **Time series 1990-2023 (average)** |
| -18.4 kt (-16.8%) | -15.5 kt/year (-13.9%) |

| TOP MOST RECALCULATED CATEGORIES FOR REPORTED YEAR 2023 | | | | | |
|---|---|---|---|---|---|
| **Order** | **NFR** | **Category name** | **Difference** | | **Explanation** |
| | | | **kt** | **CL** | |
| 1 | 5C2 | Open burning of waste | -15.3 | 70% | See Recalculation 1 in Table 8.1.2 |
| 2 | 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | -0.4 | 2% | See Recalculation 3 in Table 8.1.2 |
| 3 | 1A2gviii | Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR) | 0.0 | 0% | Update of 2023 provincial distribution. |
| 4 | 1A4ci | Agriculture/Forestry/Fishing: Stationary | -0.1 | 0% | While recalculations and changes in all pollutant trends are due to a mix of recalculations for the whole sector, the update of diesel consumption in agricultural stationary engines in line with agricultural machinery new estimations (1990-2023) contributed the most to the recalculations. |

**Evolution of the difference**




| TOP MOST RECALCULATED CATEGORIES FOR TIME SERIES 1990-2023 | | | | | |
|---|---|---|---|---|---|
| **Order** | **NFR** | **Category name** | **Difference** | | **Explanation** |
| | | | **kt/year** | **CL** | |
| 1 | 5C2 | Open burning of waste | -14.8 | 89% | See 1 in table above. |
| 2 | 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | -008 | 5% | See 2 in table above. |
| 3 | 1A4bi | Residential: Stationary | -0.3 | 2% | Recalculations in this subcategory are due to the update of activity data sources. |
| 4 | 1A2gviii | Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR) | 0.2 | 1% | See 3 in table above. |

## 8.2.6. $PM_{10}$

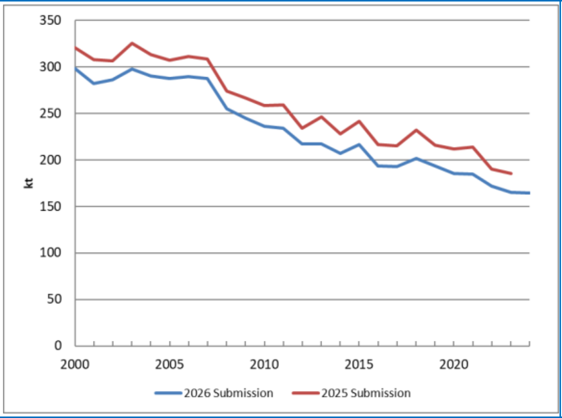
**Table 8.2.6 Summary of recalculations for $PM_{10}$**

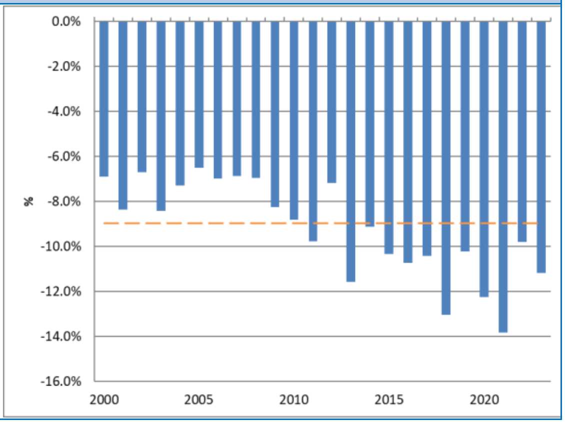
| TOTAL NUMBER OF REVISED CATEGORIES |
|---|
| 44 out of 73 estimated (60%) for reported year 2023 |

| IMPACT OF REVISED ESTIMATES | |
|---|---|
| **Reported year 2023** | **Time series 1990-2023 (average)** |
| -20.7 kt (-11.2%) | -16.3 kt/year (-9.0%) |

| TOP MOST RECALCULATED CATEGORIES FOR REPORTED YEAR 2023 | | | | | |
|---|---|---|---|---|---|
| **Order** | **NFR** | **Category name** | **Difference** | | **Explanation** |
| | | | **kt** | **CL** | |
| 1 | 5C2 | Open burning of waste | -16.2 | 71% | See Recalculation 1 in Table 8.1.2 |
| 2 | 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | -0.4 | 2% | See Recalculation 3 in Table 8.1.2 |
| 3 | 1A2gviii | Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR) | 0.0 | 0% | Update of 2023 provincial distribution. |
| 4 | 1A4ci | Agriculture/Forestry/Fishing: Stationary | -0.1 | 0% | While recalculations and changes in all pollutant trends are due to a mix of recalculations for the whole sector, the update of diesel consumption in agricultural stationary engines in line with agricultural machinery new estimations (1990-2023) contributed the most to the recalculations. |

**Evolution of the difference**




| TOP MOST RECALCULATED CATEGORIES FOR TIME SERIES 1990-2023 | | | | | |
|---|---|---|---|---|---|
| **Order** | **NFR** | **Category name** | **Difference** | | **Explanation** |
| | | | **kt/year** | **CL** | |
| 1 | 5C2 | Open burning of waste | -15.7 | 89% | See 1 in table above. |
| 2 | 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | -0.8 | 4% | See 2 in table above. |
| 3 | 1A4bi | Residential: Stationary | -0.4 | 2% | Recalculations in this subcategory are due to the update of activity data sources. |
| 4 | 1A2gviii | Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR) | 0.2 | 1% | See 3 in table above. |

## 8.2.7. TSP

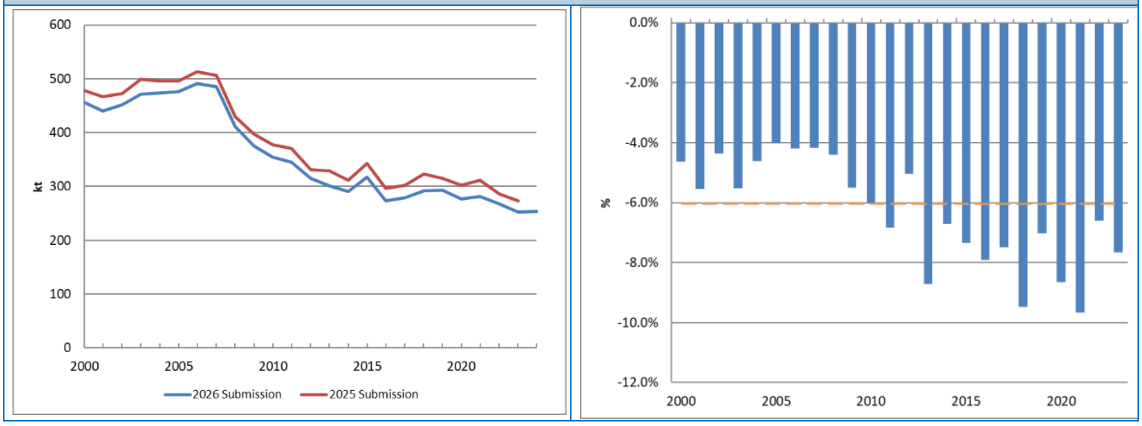
### Table 8.2.7 Summary of recalculations for TSP

| TOTAL NUMBER OF REVISED CATEGORIES |
|---|
| 44 out of 75 estimated (59%) for reported year 2023 |

| IMPACT OF REVISED ESTIMATES | |
|---|---|
| **Reported year 2023** | **Time series 1990-2023 (average)** |
| -21.0 kt (-7.7%) | -16.4 kt/year (-6.0%) |

| TOP MOST RECALCULATED CATEGORIES FOR REPORTED YEAR 2023 | | | | | |
|---|---|---|---|---|---|
| **Order** | **NFR** | **Category name** | **Difference** | | **Explanation** |
| | | | **kt** | **CL** | |
| 1 | 5C2 | Open burning of waste | -16.5 | 69% | See Recalculation 1 in Table 8.1.2 |
| 2 | 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | -0.4 | 2% | See Recalculation 3 in Table 8.1.2 |
| 3 | 1A2gviii | Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR) | 0.0 | 0% | Update of 2023 provincial distribution. |
| 4 | 2G | Other product use (please specify in the IIR) | -0.2 | 1% | Recalculation of estimates due to the adjustment of the TSP emission factor in fireworks activity so that the values are consistent with $PM_{10}$ and $PM_{2,5}$ values and correction of the tobacco consumption activity variable by the Eurostat information focal point. |

**Evolution of the difference**




| TOP MOST RECALCULATED CATEGORIES FOR TIME SERIES 1990-2023 | | | | | |
|---|---|---|---|---|---|
| **Order** | **NFR** | **Category name** | **Difference** | | **Explanation** |
| | | | **kt/year** | **CL** | |
| 1 | 5C2 | Open burning of waste | -16.0 | 88% | See 1 in table above. |
| 2 | 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | -0.8 | 4% | See 2 in table above. |
| 3 | 1A4bi | Residential: Stationary | -0.4 | 2% | Recalculations in this subcategory are due to the update of activity data sources. |
| 4 | 1A2gviii | Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR) | 0.3 | 2% | See 3 in table above. |

## 8.2.8. BC

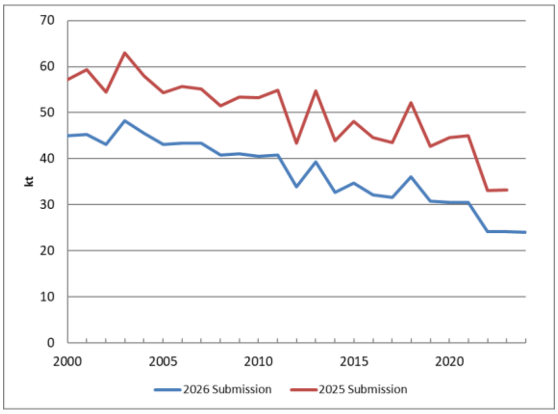
### Table 8.2.8 Summary of recalculations for BC

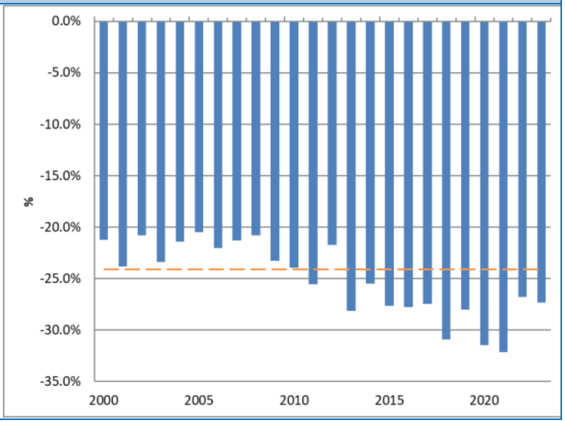
| TOTAL NUMBER OF REVISED CATEGORIES |
| --- |
| 31 out of 48 estimated (65%) for reported year 2023 |

| IMPACT OF REVISED ESTIMATES | |
| --- | --- |
| Reported year 2023 | Time series 1990-2023 (average) |
| -9.1 kt (-27.3%) | -8.8 kt/year (-24.8%) |

| TOP MOST RECALCULATED CATEGORIES FOR REPORTED YEAR 2022 | | | | | |
| --- | --- | --- | --- | --- | --- |
| Order | NFR | Category name | Difference | | Explanation |
| | | | kt | CL | |
| 1 | 5C2 | Open burning of waste | -8.5 | 86% | See Recalculation 1 in Table 8.1.2 |
| 2 | 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | -0.3 | 3% | See Recalculation 3 in Table 8.1.2 |
| 3 | 1A4ci | Agriculture/Forestry/Fishing: Stationary | -0.1 | 1% | While recalculations and changes in all pollutant trends are due to a mix of recalculations for the whole sector, the update of diesel consumption in agricultural stationary engines in line with agricultural machinery new estimations (1990-2023) contributed the most to the recalculations. |
| 4 | 1A2gviii | Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR) | 0.0 | 0% | Update of 2023 provincial distribution. |

**Evolution of the difference**




| TOP MOST RECALCULATED CATEGORIES FOR TIME SERIES 1990-2023 | | | | | |
| --- | --- | --- | --- | --- | --- |
| Order | NFR | Category name | Difference | | Explanation |
| | | | kt/year | CL | |
| 1 | 5C2 | Open burning of waste | -8.3 | 93% | See 1 in table above. |
| 2 | 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | -0.5 | 5% | See 2 in table above. |
| 3 | 1A4ci | Agriculture/Forestry/Fishing: Stationary | -0.1 | 1% | See 3 in table above. |
| 4 | 1A4bi | Residential: Stationary | 0.0 | 0% | Recalculations in this subcategory are due to the update of activity data sources. |

### 8.2.9. CO

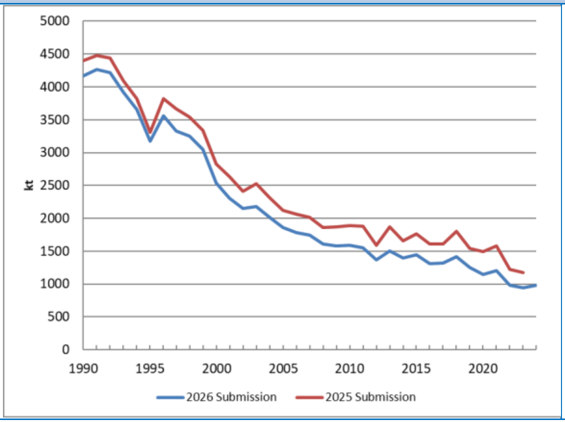
**Table 8.2.9 Summary of recalculations for CO**

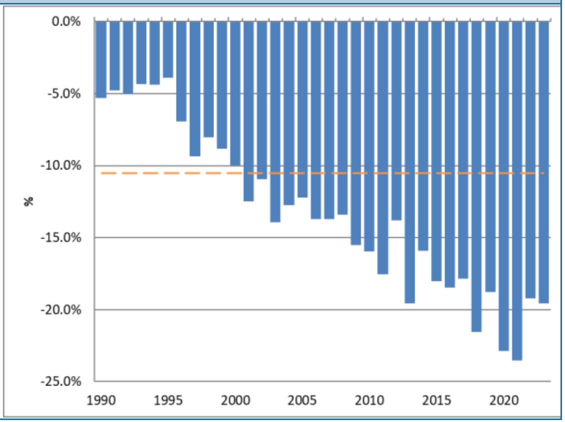
| TOTAL NUMBER OF REVISED CATEGORIES |
|---|
| 29 out of 44 estimated (66%) for reported year 2023 |

| IMPACT OF REVISED ESTIMATES | |
|---|---|
| **Reported year 2023** | **Time series 1990-2023 (average)** |
| -229.7 kt (-19.6%) | -278.0 kt/year (-11.2%) |

| TOP MOST RECALCULATED CATEGORIES FOR REPORTED YEAR 2023 | | | | | |
|---|---|---|---|---|---|
| **Order** | **NFR** | **Category name** | **Difference** | | **Explanation** |
| | | | **kt** | **CL** | |
| 1 | 5C2 | Open burning of waste | -208.3 | 83% | See Recalculation 1 in Table 8.1.2 |
| 2 | 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | -7.3 | 3% | See Recalculation 3 in Table 8.1.2 |
| 3 | 1A4ci | Agriculture/Forestry/Fishing: Stationary | -0.3 | 0% | While recalculations and changes in all pollutant trends are due to a mix of recalculations for the whole sector, the update of diesel consumption in agricultural stationary engines in line with agricultural machinery new estimations (1990-2023) contributed the most to the recalculations. |
| 4 | 1A2gviii | Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR) | -0.1 | 0% | Update of 2023 provincial distribution. |

**Evolution of the difference**




| TOP MOST RECALCULATED CATEGORIES FOR TIME SERIES 1990-2023 | | | | | |
|---|---|---|---|---|---|
| **Order** | **NFR** | **Category name** | **Difference** | | **Explanation** |
| | | | **kt/year** | **CL** | |
| 1 | 5C2 | Open burning of waste | -268.0 | 95% | See 1 in table above. |
| 2 | 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | -8.7 | 3% | See 2 in table above. |
| 3 | 1A4bi | Residential: Stationary | -2.4 | 1% | Recalculations in this subcategory are due to the update of activity data sources. |
| 4 | 1A2e | Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco | 0.5 | 0% | Update of fuel consumption values due to the consistency with energy statistics: wood and other wood wastes (2021-2023), natural gas (2023), diesel (1995-2023) and residual fuel oil (2022, 2023). |

## 8.2.10. Pb

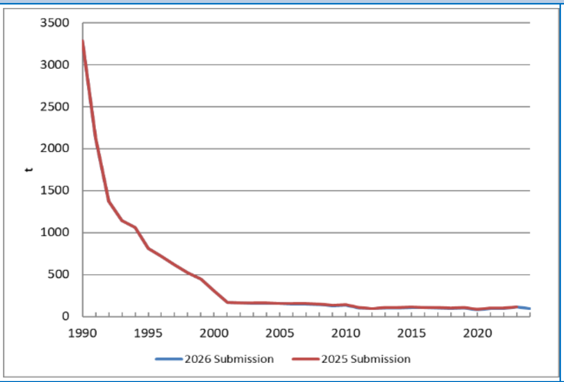
### Table 8.2.10 Summary of recalculations for Pb

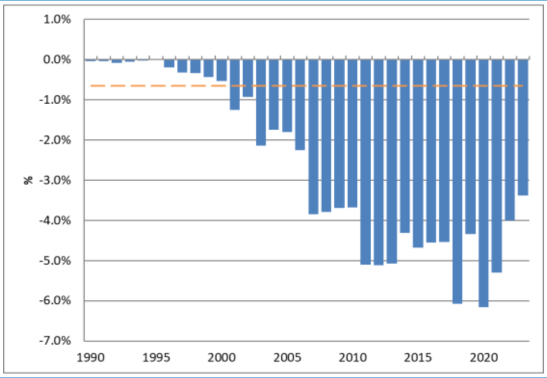
| TOTAL NUMBER OF REVISED CATEGORIES |
|---|
| 26 out of 40 estimated (65%) for reported year 2023 |

| IMPACT OF REVISED ESTIMATES | |
|---|---|
| Reported year 2023 | Time series 1990-2023 (average) |
| -4.0 t (-3.4%) | -3.4 t (-0.8%) |

| TOP MOST RECALCULATED CATEGORIES FOR REPORTED YEAR 2023 | | | | | |
|---|---|---|---|---|---|
| Order | NFR | Category name | Difference | | Explanation |
| | | | t | CL | |
| 1 | 5C2 | Open burning of waste | -2.2 | 37% | See Recalculation 1 in Table 8.1.2 |
| 2 | 5C1biv | Sewage sludge incineration | -2.3 | 39% | See Recalculation 2 in Table 8.1.2 |
| 3 | 1B1b | Fugitive emission from solid fuels: Solid fuel transformation | 0.5 | 8% | See Recalculation 4 in Table 8.1.2 |
| 4 | 1A2gviii | Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR) | 0.0 | 0% | Update of 2023 provincial distribution. |

**Evolution of the difference**




| TOP MOST RECALCULATED CATEGORIES FOR TIME SERIES 1990-2023 | | | | | |
|---|---|---|---|---|---|
| Order | NFR | Category name | Difference | | Explanation |
| | | | t | CL | |
| 1 | 5C2 | Open burning of waste | -2.9 | 53% | See 1 in table above. |
| 2 | 5C1biv | Sewage sludge incineration | -1.5 | 28% | See 2 in table above. |
| 3 | 1B1b | Fugitive emission from solid fuels: Solid fuel transformation | 0.8 | 15% | See 3 in table above. |
| 4 | 1A2gviii | Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR) | 0.1 | 1% | See 4 in table above. |

## 8.2.11. Cd

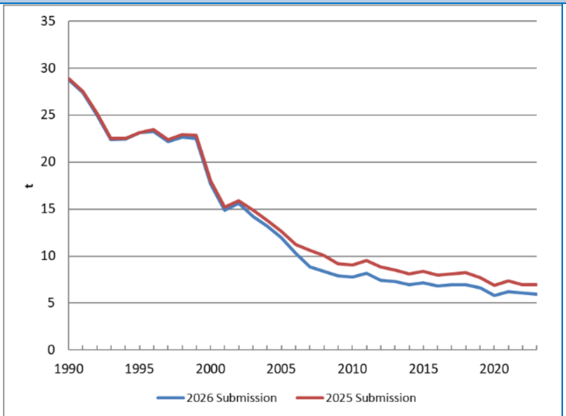
### Table 8.2.11 Summary of recalculations for Cd

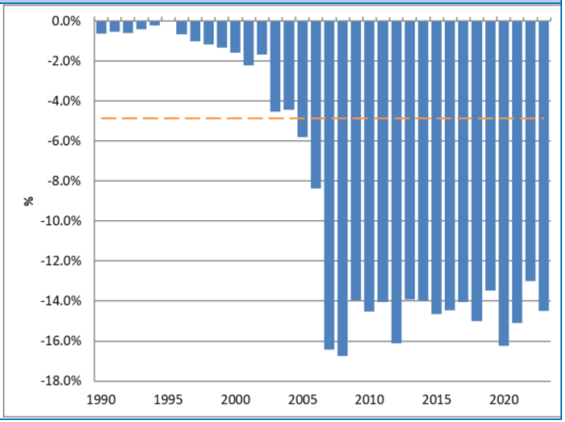
| TOTAL NUMBER OF REVISED CATEGORIES |
|---|
| 29 out of 42 estimated (69%) for reported year 2023 |

| IMPACT OF REVISED ESTIMATES | |
|---|---|
| **Reported year 2023** | **Time series 1990-2023 (average)** |
| -1.0 t (-14.5%) | -0.8 t/year (-5.5%) |

| TOP MOST RECALCULATED CATEGORIES FOR REPORTED YEAR 2023 | | | | | |
|---|---|---|---|---|---|
| **Order** | **NFR** | **Category name** | **Difference** | | **Explanation** |
| | | | **t** | **CL** | |
| 1 | 5C1biv | Sewage sludge incineration | -0.8 | 56% | See Recalculation 2 in Table 8.1.2 |
| 2 | 5C2 | Open burning of waste | -0.2 | 17% | See Recalculation 1 in Table 8.1.2 |
| 3 | 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | 0.0 | 1% | See Recalculation 3 in Table 8.1.2 |
| 4 | 1B1b | Fugitive emission from solid fuels: Solid fuel transformation | 0.0 | 1% | See Recalculation 4 in Table 8.1.2 |

**Evolution of the difference**




| TOP MOST RECALCULATED CATEGORIES FOR TIME SERIES 1990-2023 | | | | | |
|---|---|---|---|---|---|
| **Order** | **NFR** | **Category name** | **Difference** | | **Explanation** |
| | | | **t/year** | **CL** | |
| 1 | 5C1biv | Sewage sludge incineration | -0.5 | 58% | See 1 in table above. |
| 2 | 5C2 | Open burning of waste | -0.3 | 35% | See 2 in table above. |
| 3 | 1B1b | Fugitive emission from solid fuels: Solid fuel transformation | 0.0 | 2% | See 4 in table above. |
| 4 | 1A4bi | Residential: Stationary | 0.0 | 1% | Recalculations in this subcategory are due to the update of activity data sources. |

## 8.2.12. Hg

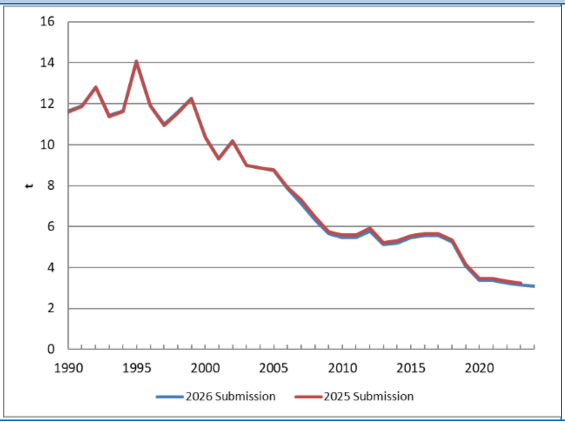
### Table 8.2.12 Summary of recalculations for Hg

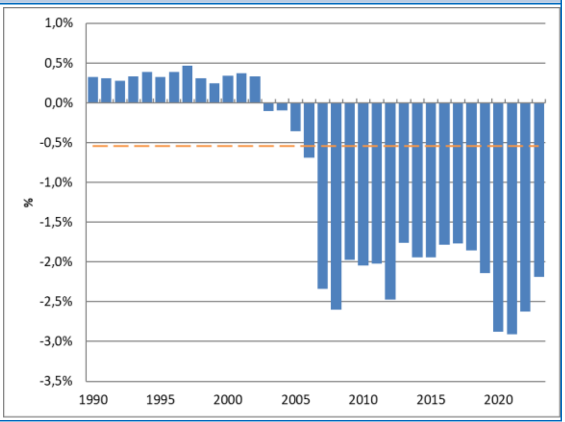
| TOTAL NUMBER OF REVISED CATEGORIES |
|---|
| 24 out of 35 estimated (69%) for reported year 2023 |

| IMPACT OF REVISED ESTIMATES | |
|---|---|
| Reported year 2023 | Time series 1990-2023 (average) |
| -0.1 t (-2.2%) | 0.0 t/year (-0.5%) |

| TOP MOST RECALCULATED CATEGORIES FOR REPORTED YEAR 2023 | | | | | |
|---|---|---|---|---|---|
| Order | NFR | Category name | Difference | | Explanation |
| | | | t | CL | |
| 1 | 5C1biv | Sewage sludge incineration | -0.1 | 77% | See Recalculation 2 in Table 8.1.2 |
| 2 | 1B1b | Fugitive emission from solid fuels: Solid fuel transformation | 0.0 | 11% | See Recalculation 4 in Table 8.1.2 |
| 3 | 1A1b | Petroleum refining | 0.0 | 1% | Updating Emission Factor EMEP/EEA 2023 |
| 4 | 1A2gviii | Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR) | 0.0 | 0% | Update of 2023 provincial distribution. |

**Evolution of the difference**




| TOP MOST RECALCULATED CATEGORIES FOR TIME SERIES 1990-2023 | | | | | |
|---|---|---|---|---|---|
| Order | NFR | Category name | Difference | | Explanation |
| | | | t/year | CL | |
| 1 | 5C1biv | Sewage sludge incineration | -0.1 | 70% | See 1 in table above. |
| 2 | 1B1b | Fugitive emission from solid fuels: Solid fuel transformation | 0.0 | 25% | See 2 in table above. |
| 3 | 1A1b | Petroleum refining | 0.0 | 1% | See 3 in table above. |
| 4 | 1A2gviii | Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR) | 0.0 | 1% | See 4 in table above. |

## 8.2.13. As

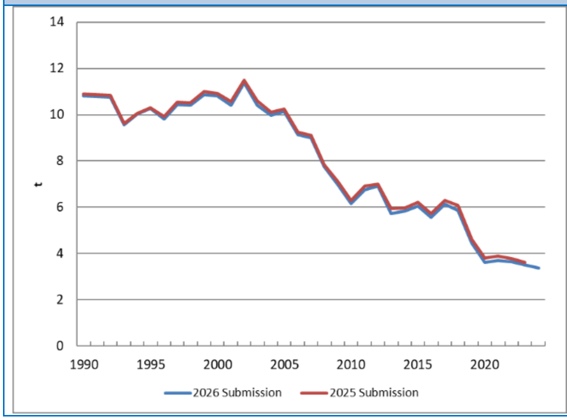
### Table 8.2.13 Summary of recalculations for As

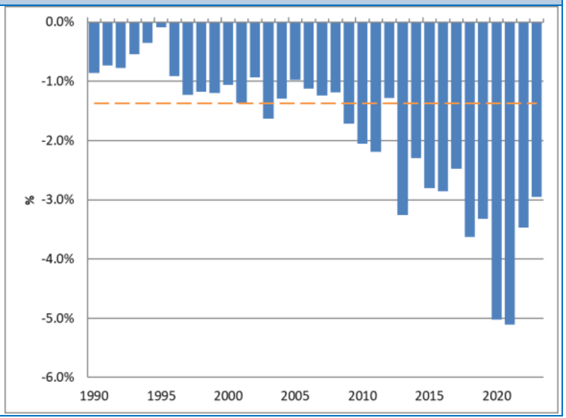
| TOTAL NUMBER OF REVISED CATEGORIES |
|---|
| 26 out of 38 estimated (68%) for reported year 2023 |

| IMPACT OF REVISED ESTIMATES | |
|---|---|
| Reported year 2023 | Time series 1990-2023 (average) |
| -0.1 t (-3.0%) | -0.1 t/year (-1.5%) |

| TOP MOST RECALCULATED CATEGORIES FOR REPORTED YEAR 2023 | | | | | |
|---|---|---|---|---|---|
| Order | NFR | Category name | Difference | | Explanation |
| | | | t | CL | |
| 1 | 5C2 | Open burning of waste | -0.1 | 75% | See Recalculation 1 in Table 8.1.2 |
| 2 | 1B1b | Fugitive emission from solid fuels: Solid fuel transformation | 0.0 | 9% | See Recalculation 4 in Table 8.1.2 |
| 3 | 1A2gviii | Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR) | 0.0 | 0% | Update of 2023 provincial distribution. |
| 4 | 1A2e | Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco | 0.0 | 1% | Update of fuel consumption values due to the consistency with energy statistics: wood and other wood wastes (2021-2023), natural gas (2023), diesel (1995-2023) and residual fuel oil (2022, 2023). |

**Evolution of the difference**




| TOP MOST RECALCULATED CATEGORIES FOR TIME SERIES 1990-2023 | | | | | |
|---|---|---|---|---|---|
| Order | NFR | Category name | Difference | | Explanation |
| | | | t/year | CL | |
| 1 | 5C2 | Open burning of waste | -0.2 | 78% | See 1 in table above. |
| 2 | 1B1b | Fugitive emission from solid fuels: Solid fuel transformation | 0.0 | 12% | See 2 in table above. |
| 3 | 5C1biv | Sewage sludge incineration | 0.0 | 3% | See Recalculation 2 in Table 8.1.2 |
| 4 | 1A2gviii | Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR) | 0.0 | 3% | See 3 in table above. |

## 8.2.14. Cr

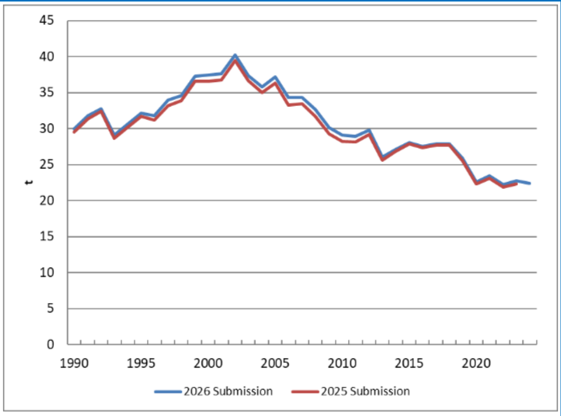
### Table 8.2.14 Summary of recalculations for Cr

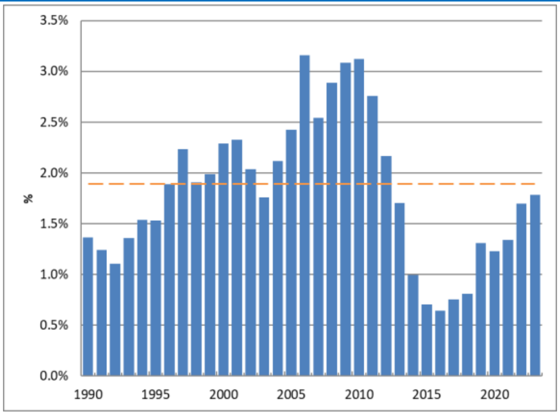
| TOTAL NUMBER OF REVISED CATEGORIES |
|---|
| 27 out of 40 estimated (68%) for reported year 2023 |

| IMPACT OF REVISED ESTIMATES | |
|---|---|
| Reported year 2023 | Time series 1990-2023 (average) |
| 0.4 t (1.8%) | 0.6 t/year (1.9%) |

| TOP MOST RECALCULATED CATEGORIES FOR REPORTED YEAR 2023 | | | | | |
|---|---|---|---|---|---|
| Order | NFR | Category name | Difference | | Explanation |
| | | | t | CL | |
| 1 | 1B1b | Fugitive emission from solid fuels: Solid fuel transformation | 0.2 | 24% | See Recalculation 4 in Table 8.1.2 |
| 2 | 1A2gviii | Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR) | 0.0 | 1% | Update of 2023 provincial distribution. |
| 3 | 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | 0.0 | 5% | See Recalculation 3 in Table 8.1.2 |
| 4 | 1A2e | Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco | 0.1 | 15% | Update of fuel consumption values due to the consistency with energy statistics: wood and other wood wastes (2021-2023), natural gas (2023), diesel (1995-2023) and residual fuel oil (2022, 2023). |

**Evolution of the difference**




| TOP MOST RECALCULATED CATEGORIES FOR TIME SERIES 1990-2023 | | | | | |
|---|---|---|---|---|---|
| Order | NFR | Category name | Difference | | Explanation |
| | | | t/year | CL | |
| 1 | 1B1b | Fugitive emission from solid fuels: Solid fuel transformation | 0.4 | 47% | See 1 in table above. |
| 2 | 1A2gviii | Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR) | 0.1 | 16% | See 2 in table above. |
| 3 | 1A2e | Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco | 0.1 | 9% | See 4 in table above. |
| 4 | 5C2 | Open burning of waste | 0.0 | 6% | See Recalculation 1 in Table 8.1.2 |

## 8.2.15. Cu

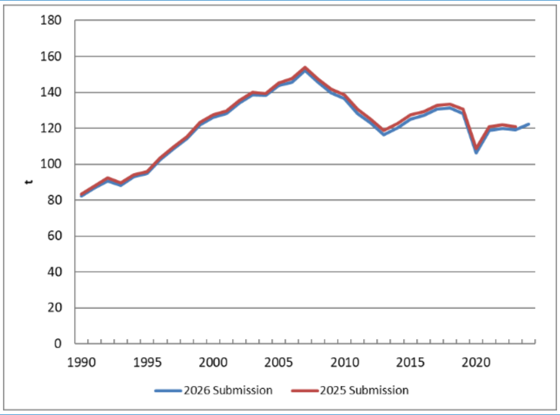
### Table 8.2.15 Summary of recalculations for Cu

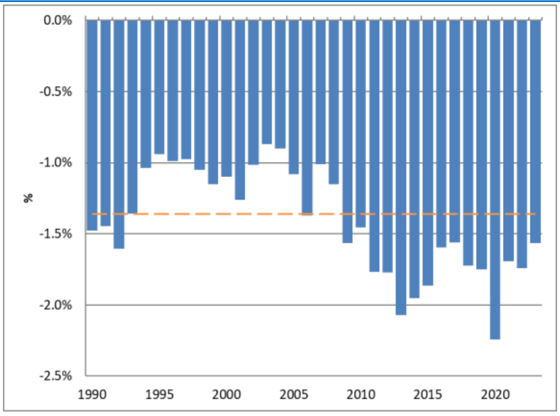
| TOTAL NUMBER OF REVISED CATEGORIES |
|---|
| 30 out of 40 estimated (75%) for reported year 2023 |

| IMPACT OF REVISED ESTIMATES | |
|---|---|
| Reported year 2023 | Time series 1990-2023 (average) |
| -1.9 t (-1.6%) | -1.7 t/year (-1.4%) |

| TOP MOST RECALCULATED CATEGORIES FOR REPORTED YEAR 2023 | | | | | |
|---|---|---|---|---|---|
| Order | NFR | Category name | Difference | | Explanation |
| | | | t | CL | |
| 1 | 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | -1.5 | 63% | See Recalculation 3 in Table 8.1.2 |
| 2 | 5C2 | Open burning of waste | -0.5 | 19% | See Recalculation 1 in Table 8.1.2 |
| 3 | 1B1b | Fugitive emission from solid fuels: Solid fuel transformation | 0.1 | 2% | See Recalculation 4 in Table 8.1.2 |
| 4 | 1A2gviii | Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR) | 0.0 | 0% | Update of 2023 provincial distribution. |

**Evolution of the difference**




| TOP MOST RECALCULATED CATEGORIES FOR TIME SERIES 1990-2023 | | | | | |
|---|---|---|---|---|---|
| Order | NFR | Category name | Difference | | Explanation |
| | | | t/year | CL | |
| 1 | 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | -1.3 | 60% | See 1 in table above. |
| 2 | 5C2 | Open burning of waste | -0.6 | 27% | See 2 in table above. |
| 3 | 1B1b | Fugitive emission from solid fuels: Solid fuel transformation | 0.1 | 5% | See 3 in table above. |
| 4 | 5C1biv | Sewage sludge incineration | 0.1 | 3% | See Recalculation 2 in Table 8.1.2 |

## 8.2.16. Ni

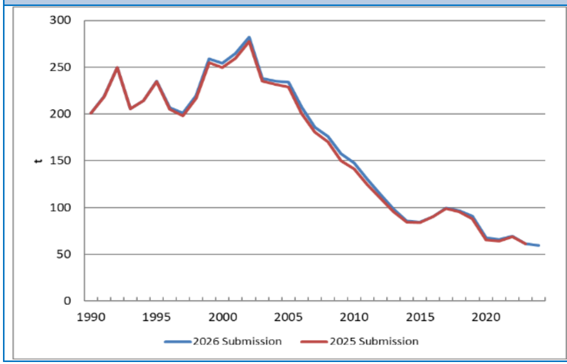
### Table 8.2.16 Summary of recalculations for Ni

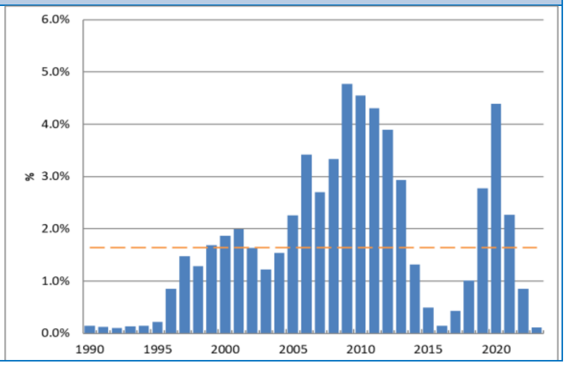
| TOTAL NUMBER OF REVISED CATEGORIES |
|---|
| 27 out of 38 estimated (71%) for reported year 2023 |

| IMPACT OF REVISED ESTIMATES | |
|---|---|
| **Reported year 2023** | **Time series 1990-2023 (average)** |
| 0.1 t (0.1%) | 2.8 t/year (1.7%) |

| TOP MOST RECALCULATED CATEGORIES FOR REPORTED YEAR 2023 | | | | | |
|---|---|---|---|---|---|
| **Order** | **NFR** | **Category name** | **Difference** | | **Explanation** |
| | | | **t** | **CL** | |
| 1 | 1B1b | Fugitive emission from solid fuels: Solid fuel transformation | 0.2 | 34% | See Recalculation 4 in Table 8.1.2 |
| 2 | 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | -0.1 | 14% | Update of fuel consumption values due to the consistency with energy statistics: wood and other wood wastes (2021-2023), natural gas (2023), diesel (1995-2023) and residual fuel oil (2022, 2023). |
| 3 | 1A2gviii | Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR) | 0.0 | 4% | Update of 2023 provincial distribution. |
| 4 | 1A2f | Stationary combustion in manufacturing industries and construction: Non-metallic minerals | 0.0 | 3% | Update of fuel consumption values due to the consistency with energy statistics: wood and other wood wastes (2021-2023), natural gas (2023) and diesel (1995-2022). |

**Evolution of the difference**




| TOP MOST RECALCULATED CATEGORIES FOR TIME SERIES 1990-2023 | | | | | |
|---|---|---|---|---|---|
| **Order** | **NFR** | **Category name** | **Difference** | | **Explanation** |
| | | | **t/year** | **CL** | |
| 1 | 1A2gviii | Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR) | 1.2 | 41% | See 3 in table above. |
| 2 | 1A2e | Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco | 0.6 | 20% | Update of fuel consumption values due to the consistency with energy statistics: wood and other wood wastes (2021-2023), natural gas (2023), diesel (1995-2023) and residual fuel oil (2022, 2023). |
| 3 | 1B1b | Fugitive emission from solid fuels: Solid fuel transformation | 0.3 | 9% | See 1 in table above |
| 4 | 1A2f | Stationary combustion in manufacturing industries and construction: Non-metallic minerals | 0.2 | 9% | See 4 in table above. |

## 8.2.17. Se

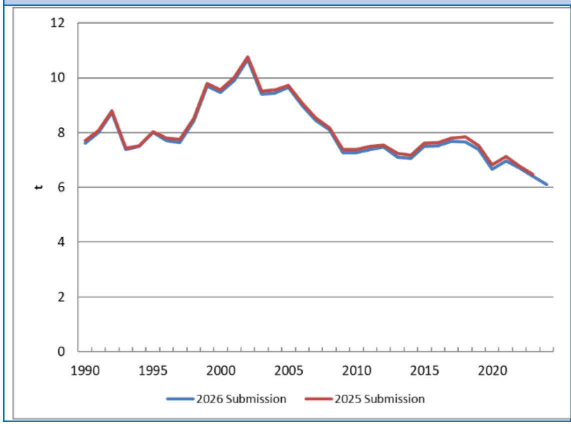
### Table 8.2.17 Summary of recalculations for Se

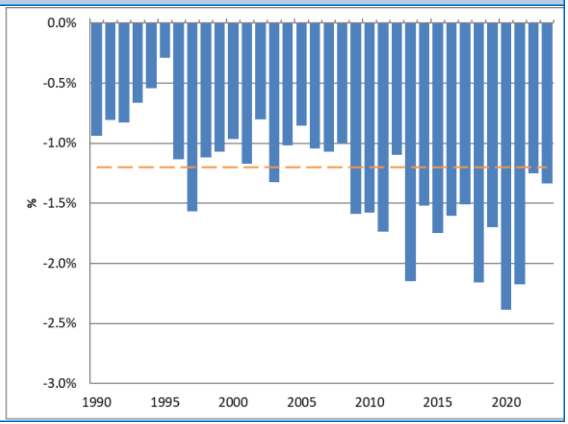
| TOTAL NUMBER OF REVISED CATEGORIES |
|---|
| 26 out of 36 estimated (72%) for reported year 2023 |

| IMPACT OF REVISED ESTIMATES | |
|---|---|
| **Reported year 2023** | **Time series 1990-2023 (average)** |
| -0.1 t (-1.3%) | -0.1 t/year (-1.3%) |

| TOP MOST RECALCULATED CATEGORIES FOR REPORTED YEAR 2023 | | | | | |
|---|---|---|---|---|---|
| **Order** | **NFR** | **Category name** | **Difference** | | **Explanation** |
| | | | **t** | **CL** | |
| 1 | 5C2 | Open burning of waste | -0.1 | 70% | See Recalculation 1 in Table 8.1.2 |
| 2 | 1B1b | Fugitive emission from solid fuels: Solid fuel transformation | 0.0 | 14% | See Recalculation 4 in Table 8.1.2 |
| 3 | 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | 0.0 | 6% | See Recalculation 3 in Table 8.1.2 |
| 4 | 1A4ci | Agriculture/Forestry/Fishing: Stationary | 0.0 | 0% | While recalculations and changes in all pollutant trends are due to a mix of recalculations for the whole sector, the update of diesel consumption in agricultural stationary engines in line with agricultural machinery new estimations (1990-2023) contributed the most to the recalculations. |

**Evolution of the difference**




| TOP MOST RECALCULATED CATEGORIES FOR TIME SERIES 1990-2023 | | | | | |
|---|---|---|---|---|---|
| **Order** | **NFR** | **Category name** | **Difference** | | **Explanation** |
| | | | **t/year** | **CL** | |
| 1 | 5C2 | Open burning of waste | -0.1 | 74% | See 1 in table above. |
| 2 | 1B1b | Fugitive emission from solid fuels: Solid fuel transformation | 0.0 | 20% | See 2 in table above. |
| 3 | 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | 0.0 | 5% | See 3 in table above. |
| 4 | 1A4ci | Agriculture/Forestry/Fishing: Stationary | 0.0 | 0% | See 4 in table above. |

## 8.2.18. Zn

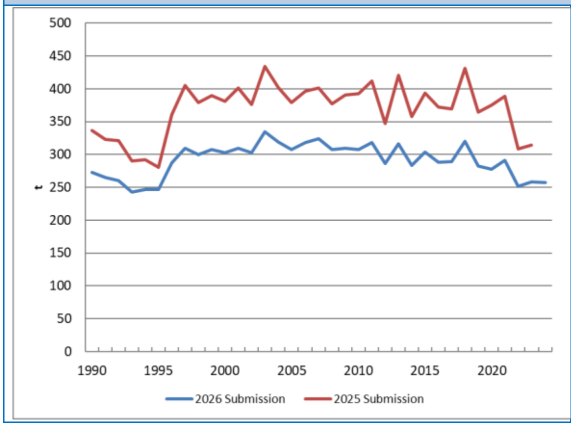
### Table 8.2.18 Summary of recalculations for Zn

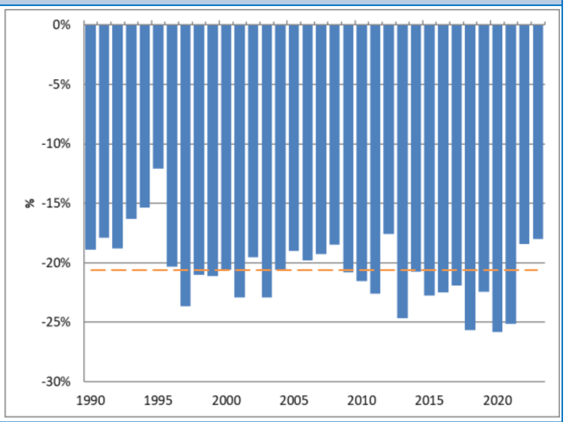
| TOTAL NUMBER OF REVISED CATEGORIES |
|---|
| 28 out of 41 estimated (68%) for reported year 2023 |

| IMPACT OF REVISED ESTIMATES | |
|---|---|
| **Reported year 2023** | **Time series 1990-2023 (average)** |
| -56.7 t (-18.0%) | -76.9 t/year (-20.8%) |

| TOP MOST RECALCULATED CATEGORIES FOR REPORTED YEAR 2023 | | | | | |
|---|---|---|---|---|---|
| **Order** | **NFR** | **Category name** | **Difference** | | **Explanation** |
| | | | **t** | **CL** | |
| 1 | 5C2 | Open burning of waste | -59.8 | 81% | See Recalculation 1 in Table 8.1.2 |
| 2 | 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | -0.9 | 1% | See Recalculation 3 in Table 8.1.2 |
| 3 | 1B1b | Fugitive emission from solid fuels: Solid fuel transformation | 0.3 | 0% | See Recalculation 4 in Table 8.1.2 |
| 4 | 1A4ci | Agriculture/Forestry/Fishing: Stationary | 0.0 | 0% | While recalculations and changes in all pollutant trends are due to a mix of recalculations for the whole sector, the update of diesel consumption in agricultural stationary engines in line with agricultural machinery new estimations (1990-2023) contributed the most to the recalculations. |

**Evolution of the difference**




| TOP MOST RECALCULATED CATEGORIES FOR TIME SERIES 1990-2023 | | | | | |
|---|---|---|---|---|---|
| **Order** | **NFR** | **Category name** | **Difference** | | **Explanation** |
| | | | **t/year** | **CL** | |
| 1 | 5C2 | Open burning of waste | -76.9 | 97% | See 1 in table above. |
| 2 | 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | -0.8 | 1% | See 2 in table above. |
| 3 | 1B1b | Fugitive emission from solid fuels: Solid fuel transformation | 0.5 | 1% | See 3 in table above. |
| 4 | 1A4bi | Residential: Stationary | -0.4 | 0% | Recalculations in this subcategory are due to the update of activity data sources. |

## 8.2.19. PCDD/PCDF

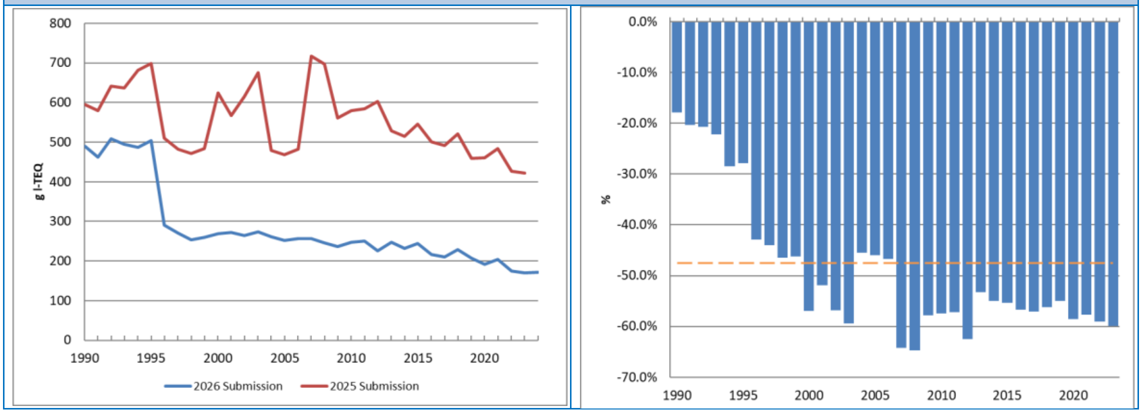
### Table 8.2.19 Summary of recalculations for PCDD/PCDF

| TOTAL NUMBER OF REVISED CATEGORIES |
|---|
| 27 out of 35 estimated (77%) for reported year 2023 |

| IMPACT OF REVISED ESTIMATES | |
|---|---|
| **Reported year 2023** | **Time series 1990-2023 (average)** |
| -253.0 g I-TEQ (-59.9%) | -268.6 g I-TEQ/year (-48.6%) |

| TOP MOST RECALCULATED CATEGORIES FOR REPORTED YEAR 2023 | | | | | |
|---|---|---|---|---|---|
| **Order** | **NFR** | **Category name** | **Difference g I-TEQ** | **Difference CL** | **Explanation** |
| 1 | 5C1biv | Sewage sludge incineration | -219.5 | 83% | See Recalculation 2 in Table 8.1.2 |
| 2 | 5C2 | Open burning of waste | -33.1 | 13% | See Recalculation 1 in Table 8.1.2 |
| 3 | 1B1b | Fugitive emission from solid fuels: Solid fuel transformation | 3.8 | 1% | See Recalculation 4 in Table 8.1.2 |
| 4 | 1A2gviii | Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR) | 0.0 | 0% | Update of 2023 provincial distribution. |

**Evolution of the difference**




| TOP MOST RECALCULATED CATEGORIES FOR TIME SERIES 1990-2023 | | | | | |
|---|---|---|---|---|---|
| **Order** | **NFR** | **Category name** | **Difference g I-TEQ /year** | **Difference CL** | **Explanation** |
| 1 | 5C1biv | Sewage sludge incineration | -232.1 | 82% | See 1 in table above. |
| 2 | 5C2 | Open burning of waste | -42.6 | 15% | See 2 in table above. |
| 3 | 1B1b | Fugitive emission from solid fuels: Solid fuel transformation | 6.3 | 2% | See 3 in table above. |
| 4 | 1A4bi | Residential: Stationary | -0.4 | 0% | Recalculations in this subcategory are due to the update of activity data sources. |

### 8.2.20. PAH

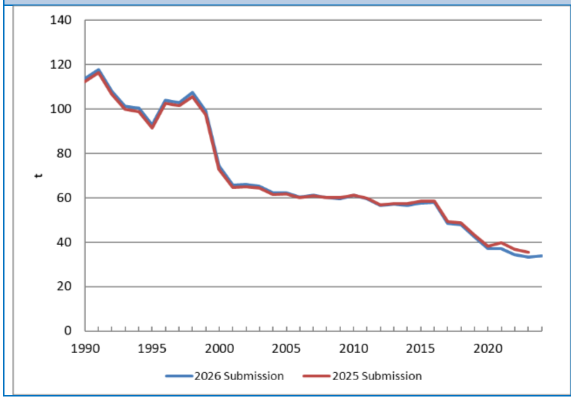
**Table 8.2.20 Summary of recalculations for PAH**

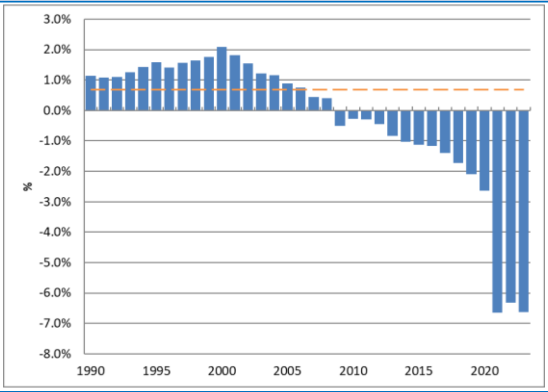
| TOTAL NUMBER OF REVISED CATEGORIES |
|---|
| 27 out of 36 estimated (80%) for reported year 2023 |

| IMPACT OF REVISED ESTIMATES | |
|---|---|
| Reported year 2023 | Time series 1990-2023 (average) |
| -2.4 t (-6.6%) | 0.2 t/year (0.3%) |

| TOP MOST RECALCULATED CATEGORIES FOR REPORTED YEAR 2023 | | | | | |
|---|---|---|---|---|---|
| Order | NFR | Category name | Difference | | Explanation |
| | | | T | CL | |
| 1 | 1A3bi | Road transport: Passenger cars | -1.1 | 22% | Recalculations made in road transport are caused by the following variations: inclusion of total mileage data from General Directorate for Roads of 2023 and data of total annual distances travelled by vehicles subject of Technical Inspection of Vehicles of 2023; update of gasoline consumption of 2022 and 2023, and diesel consumption of 2023. |
| 2 | 1B1b | Fugitive emission from solid fuels: Solid fuel transformation | 0.7 | 14% | See Recalculation 4 in Table 8.1.2 |
| 3 | 5C2 | Open burning of waste | -0.1 | 3% | See Recalculation 1 in Table 8.1.2 |
| 4 | 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | -0.1 | 2% | See Recalculation 3 in Table 8.1.2 |

**Evolution of the difference**




| TOP MOST RECALCULATED CATEGORIES FOR TIME SERIES 1990-2023 | | | | | |
|---|---|---|---|---|---|
| Order | NFR | Category name | Difference | | Explanation |
| | | | t/year | CL | |
| 1 | 1B1b | Fugitive emission from solid fuels: Solid fuel transformation | 1.1 | 50% | See 2 in table above. |
| 2 | 1A3bi | Road transport: Passenger cars | -0.5 | 23% | See 1 in table above. |
| 3 | 1A4bi | Residential: Stationary | -0.2 | 9% | Recalculations in this subcategory are due to the update of activity data sources. |
| 4 | 5C2 | Open burning of waste | -0.2 | 8% | See 3 in table above. |

## 8.2.21. PCB

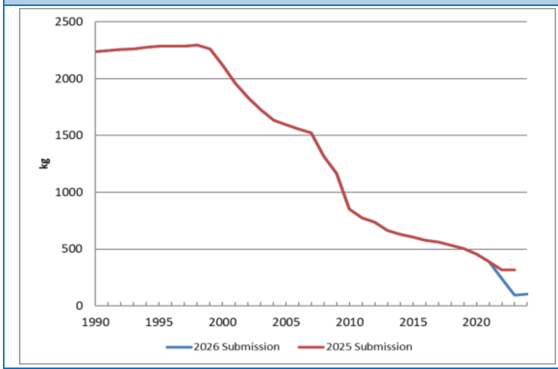
### Table 8.2.21 Summary of recalculations for PCB

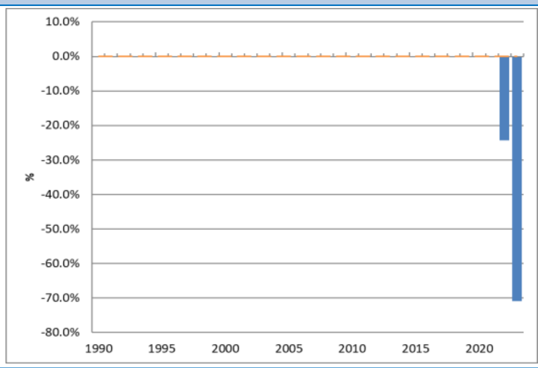
| TOTAL NUMBER OF REVISED CATEGORIES |
|---|
| 18 out of 25 estimated (72%) for reported year 2023 |

| IMPACT OF REVISED ESTIMATES | |
|---|---|
| Reported year 2023 | Time series 1990-2023 (average) |
| -226.0 kg (-70.9%) | -8.9 kg/year (-0.6%) |

| TOP MOST RECALCULATED CATEGORIES FOR REPORTED YEAR 2023 | | | | | |
|---|---|---|---|---|---|
| Order | NFR | Category name | Difference | | Explanation |
| | | | kg | CL | |
| 1 | 2K | Consumption of POPs and heavy metals (e.g. electrical and scientific equipment) | -226.0 | 100% | Recalculations due to dielectric fluid activity data update from the information focal point. |
| 2 | 1A2e | Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco | 0.0 | 0% | Update of fuel consumption values due to the consistency with energy statistics: wood and other wood wastes (2021-2023), natural gas (2023), diesel (1995-2023) and residual fuel oil (2022, 2023). |
| 3 | 1A4bi | Residential: Stationary | 0.0 | 0% | Recalculations in this subcategory are due to the update of activity data sources. |
| 4 | 1A2f | Stationary combustion in manufacturing industries and construction: Non-metallic minerals | 0.0 | 0% | Update of fuel consumption values due to the consistency with energy statistics: wood and other wood wastes (2021-2023), natural gas (2023) and diesel (1995-2022). |

**Evolution of the difference**




| TOP MOST RECALCULATED CATEGORIES FOR TIME SERIES 1990-2023 | | | | | |
|---|---|---|---|---|---|
| Order | NFR | Category name | Difference | | Explanation |
| | | | kg/year | CL | |
| 1 | 2K | Consumption of POPs and heavy metals (e.g. electrical and scientific equipment) | -8.9 | 100% | See 1 in table above. |
| 2 | 5C1biv | Sewage sludge incineration | 0.0 | 0% | See Recalculation 2 in Table 8.1.2 |
| 3 | 1A4ai | Commercial/institutional: Stationary | 0.0 | 0% | Recalculations and changes in all pollutant trends are due to a mix of recalculations for the whole sector. Firstly, the most significant recalculations are due to the update of wood and other wood wastes fuel consumption for years 2021-2023, following the data reported in international questionnaires elaborated by MITECO and sent to AIE and EUROSTAT. |
| 4 | 1A3bi | Road transport: Passenger cars | 0.0 | 0% | Recalculations made in road transport are caused by the following variations: inclusion of total mileage data from General Directorate for Roads of 2023 and data of total annual distances travelled by vehicles subject of Technical Inspection of Vehicles of 2023; update of gasoline consumption of 2022 and 2023, and diesel consumption of 2023. |

## 8.3. Summary of categories/pollutants recalculated in the reported period 1990-2023

A summary of the categories and pollutants that have been recalculated in the time series 1990-2023 are presented below. R stands for "Recalculated", and N means "New estimation". In order to reduce the length of this document, only categories with revised estimates are presented below.

**Table 8.3.1 Summary of categories and pollutants with revised estimates in the time series 1990-2023**

| NFR Code | NOx | NMVOC | SOx | $NH_3$ | $PM_{2.5}$ | $PM_{10}$ | TSP | BC | CO | Pb | Cd | Hg | As | Cr | Cu | Ni | Se | Zn | DIOX | B(a)P | B(b)F | B(k)F | IP | Total 1-4 PAH | HCB | PCBs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1A1a | R | R | - | R | R | R | R | R | R | R | R | R | - | R | R | - | R | R | R | R | R | R | R | R | R | R |
| 1A1b | R | - | R | - | R | R | R | R | R | - | - | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1A1c | R | R | R | - | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | - | - |
| 1A2a | R | R | R | - | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | - |
| 1A2b | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | - |
| 1A2c | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | - |
| 1A2d | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R |
| 1A2e | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R |
| 1A2f | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R |
| 1A2gviii | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R |
| 1A3bi | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | - | R |
| 1A3bii | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | - | R |
| 1A3biii | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | - | R |
| 1A3biv | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | - | R |
| 1A3bv | - | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1A3bvi | - | - | - | - | R | R | R | R | - | R | R | - | R | R | R | R | R | R | - | R | R | R | - | R | - | - |
| 1A3bvii | - | - | - | - | R | R | R | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1A3ei | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | R |
| 1A4ai | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R |

| NFR Code | NOx | NMVOC | SOx | $NH_3$ | $PM_{2.5}$ | $PM_{10}$ | TSP | BC | CO | Pb | Cd | Hg | As | Cr | Cu | Ni | Se | Zn | DIOX | B(a)P | B(b)F | B(k)F | IP | Total 1-4 PAH | HCB | PCBs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1A4bi** | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R |
| **1A4ci** | R | R | R | - | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | - |
| **1A4cii** | R | R | R | R | R | R | R | R | R | - | R | - | - | R | R | R | R | R | - | R | R | R | R | R | - | - |
| **1A4ciii** | R | R | R | - | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R |
| **1A5b** | R | R | - | R | R | R | R | R | R | - | R | R | R | R | R | R | R | R | R | R | R | R | R | R | - | R |
| **1B1b** | - | - | - | - | - | - | - | - | - | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N | - | - |
| **1B2av** | - | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **1B2b** | - | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **1B2c** | - | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **2A2** | - | - | - | - | R | R | R | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **2B10a** | - | - | - | - | R | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **2B5** | - | - | - | - | R | R | R | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **2C1** | - | - | - | - | R | R | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **2C7a** | - | - | R | - | R | R | R | R | - | R | R | - | R | - | R | R | - | - | R | - | - | - | - | - | - | R |
| **2D3a** | - | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **2D3b** | - | R | - | - | R | R | R | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **2D3d** | - | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **2D3i** | - | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **2G** | R | R | - | R | R | R | R | R | R | - | R | - | - | - | R | R | - | R | R | R | R | R | R | R | - | - |
| **2H2** | - | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **2I** | - | - | - | - | - | - | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **2K** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | R |
| **3B3** | R | R | - | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **3B4e** | R | R | - | R | R | R | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **3B4f** | R | R | - | R | R | R | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

| NFR Code | NOx | NMVOC | SOx | $NH_3$ | $PM_{2.5}$ | $PM_{10}$ | TSP | BC | CO | Pb | Cd | Hg | As | Cr | Cu | Ni | Se | Zn | DIOX | B(a)P | B(b)F | B(k)F | IP | Total 1-4 PAH | HCB | PCBs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3B4gi | R | R | - | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3B4gii | R | R | - | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3B4h | R | R | - | R | R | R | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3Da1 | - | - | - | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3Da2a | R | R | - | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3Da2b | R | - | - | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3Da3 | R | R | - | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3Da4 | - | - | - | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3Dc | - | - | - | - | R | R | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3De | - | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3F | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | - | - |
| 5A | R | R | - | - | R | R | R | - | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5B2 | R | - | - | R | R | R | R | - | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5C1biv | R | R | R | - | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R |
| 5C1bv | R | R | R | - | R | R | R | - | - | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R | R |
| 5C2 | R | R | R | - | R | R | R | R | R | R | R | - | R | R | R | - | R | R | R | R | R | R | - | R | - | - |
| 5D1 | R | - | - | - | R | R | R | - | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5D2 | R | R | - | - | R | R | R | - | R | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5E | - | R | - | R | R | R | R | - | - | R | R | R | R | R | R | - | - | - | R | - | - | - | - | - | - | - |

## 8.4. Planned improvements

### 8.4.1. General/Cross-cutting

The following actions can be highlighted for the entire Inventory as planned improvements:

- Harmonization of the Inventory with other registers (EU ETS. E-PRTR. etc.).
- The implementation of the EMEP/EEA GB 2023.

The review of the methodology for the elaboration of the fuel balance will continue. in collaboration with the relevant departments of the Secretary of State for Energy at MITECO. The collaboration with the IDAE-MITECO continues in the sense of providing specific information for the balance.

### 8.4.2. Energy (NFR 1)

#### 1A1a Public electricity and heat production

Review, update and standardise the emission factors.

#### 1A1c Manufacture of solid fuels and other energy industries

Review, update and standardise the emission factors.

The process of collaboration with the General Subdirectorate of Energy Planning and Monitoring of MITECO will continue in order to improve the information provided by this source and its correct adaptation to the Inventory.

#### 1A2 Manufacturing industries and construction (combustion)

Review, update and standardise the emission factors.

#### 1A3a Air traffic at airports

Continue alignment with the methodology established by EUROCONTROL applying all the new improvements proposed.

#### 1A3b Road transport

Work will continue in road transport methodology with the aim to be aligned with the improvements proposed in EMEP/EEA 2023 Guidebook and COPERT versions, paying special attention to the emission estimation of alternative modes of propulsion and new Euro Standards.

Carry on with the process of continuous improvement of activity variable data (vehicle fleet, mileage and driving patterns distribution) when more accurate information would be available.

#### 1A3c Railways

Continue with the collaboration with the focal point on railways, National Network of Spanish Railways (RENFE), with the aim of improving background information on fuel consumption broken down by type of machinery.

#### 1A3d National navigation

Carry on the search of more detailed data of vessel movements and characteristics in order to improve the existing methodology.

#### 1A3ei Pipeline transport

Review update and standardise the emission factors.

#### 1A4ai Commercial/Institutional: Stationary

Continue alignment with activity data source of information in order to update the whole fuel consumption series for stationary combustion sectors.

Continue the search of reliable data concerning biomass consumption and its breakdown in stationary combustion.

### 8.4.3. Agriculture (NFR 3)

Areas of improvement intended to be accomplished include:

-Incorporate into inventory the information supplied by new reviews of zootechnical documents are being completed.

Continue with the research together with the team of experts in charge of preparing and reviewing the zootechnical documents on the methodology for estimating the zootechnical coefficients in relation to changes marked in these coefficients for different reasons in some years of the time series such as changes in diet or legislation of use of antibiotics or due to other reasons.

Incorporate into inventory the information supplied by technical sources about country-specific Manure Management Systems (MMSs) zootechnical coefficients and Best Available Techniques (BATs) if available from ECOGAN new legislation surveys or others.

### 8.4.4. Waste (NFR 5)

The collaboration with the main focal points: Sub-directorate General for Waste at the Ministry for the Ecological Transition and Demographic Challenge (SGEC-MITECO), Spanish Climate Change Office (OECC), National Census for Sewage Disposal (CNV) and National Sludge Registry (RNL) will continue.

# 9. PROJECTIONS

## CONTENTS

## FIGURES



## TABLES

# 9. PROJECTIONS

Chapter updated in March, 2026.

In 2026, no National Emissions Projections have been estimated. This Chapter builts upon the Projections data reported in 2025 (1990 to 2023).

## 9.1. Introduction

Air Pollutant Emissions Projections in Spain are estimated by the Spanish Emissions Inventories and Projections System. Projections are calculated jointly and coherently for the main air pollutants (NOx, $SO_2$, NMVOC, $NH_3$, and $PM_{2.5}$) and greenhouse gases ($CO_2$, $CH_4$, $N_2O$, HFCs, PFCs, $SF_6$ and $CO_2$-eq).

The projections are calculated at national level (whole national territory, including the Canary Islands). However, for coherence with the Spanish National Air Pollution Control Programme (NAPCP) and the National Air Pollutant Inventory required by Directive (EU) 2016/2284, projected emissions from the Canary Islands are not included in the official reporting tables or its associated Report, nor in this Chapter.

These Air Pollutant Emissions Projections respond to the obligations set by Directive (EU) 2016/2284 on the reduction of national emissions of certain atmospheric pollutants[1], and the reporting obligations within the 1999 Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone[2] to the Convention on Long-range Transboundary Air Pollution and are coherent with the updated Spanish National Air Pollution Control Programme (NAPCP 2023-2030)[3] required by Directive (EU) 2016/2284, with the updated Spanish National Energy and Climate Plan (NECP 2023-2030)[4] required by Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action[5], and with the Spanish Decarbonization Long Term Strategy (LTS)[6]. More information about the general methods (models), data sources and assumptions used for estimating projected emissions and activity data can be found at these documents.

[1] 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 (EUR-Lex - 02016L2284-20240206 - ES - EUR-Lex).

[2] Protocol to the 1979 Convention on Long-range Transboundary Air Pollution to Abate Acidification, Eutrophication and Ground-level Ozone. Gothenburg (Sweden), 30 November 1990 (Ch_XXVII_01_hp.pdf).

[3] Updated Spanish National Air Pollution Control Programme (NAPCP 2023-2030) (Programa Nacional de Control de la Contaminación Atmosférica).

[4] Updated Spanish National Energy and Climate Plan (NECP 2023-2030) (Plan Nacional Integrado de Energía y Clima (PNIEC 2023-2030)).

[5] Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action, amending Regulations (EC) No 663/2009 and (EC) No 715/2009 of the European Parliament and of the Council, Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council (EUR-Lex - 02018R1999-20231120 - ES - EUR-Lex).

[6] Spanish Decarbonization Long Term Strategy (LTS) (El Gobierno aprueba la Estrategia de Descarbonización a Largo Plazo, que marca la senda para alcanzar la neutralidad climática a 2050).

## 9.2. Institutional arrangements

### 9.2.1. Legal framework

The National System for the elaboration of Emissions Inventories and Projections is set and ruled by the following legal framework:

- Law 34/2007 on air quality and protection of the atmosphere[7] foresees in its article 27.4 the Spanish Emissions Inventory System (SEI).
- Royal Decrees 818/2018[8] and 91/2025 set the rules of functioning of the Spanish Atmospheric Emissions and Projections Inventory System and designate the General Directorate for Environmental Quality and Assessment as competent authority of the Spanish Emissions and Projections Inventory System.

Within the General Directorate for Environmental Quality and Assessment of the Ministry for Ecological Transition and Demographic Challenge, the Emissions Inventory Unit manages the functioning of the SEI. Additionally, the General Directorate for Environmental Quality and Assessment as National Authority of the SEI awarded in 2017 the society TRAGSATEC a contract for the technical assistance in the management, maintenance and updating of the National Inventory.

### 9.2.2. Cross-cutting issues

Air Pollutant Emissions Projections have been based on the scenario used in the elaboration of the aforementioned updates of the Spanish NECP 2023-2030 and NAPCP 2023-2030, in order to maintain coherence with other international reporting obligations.

In this framework, relevant and concerned departments within the national administration were involved in a deep, intense, and coordinated collaborative process. Experts from all concerned sectors, internal and external, were consulted to build the projected scenarios and define policy options. The TIMES-Sinergia model was used for simulating the energy related scenarios, including fuel consumed by industry and transport.

## 9.3. General description of methodologies and models for estimating projected emissions

Air Pollutant Emissions Projections have been elaborated in a four-step process:

- Step 0: setting the general framework for modelling.
- Step 1: modelling sectors, policies and measures.
- Step 2: estimation of emissions projections.
- Step 3: assessment of objectives, policies and measures.

[7] Law 34/2007, of November 15, on air quality and protection of the atmosphere (BOE-A-2007-19744 Ley 34/2007, de 15 de noviembre, de calidad del aire y protección de la atmósfera.).

[8] Royal Decree 818/2018, of July 6, on measures for the reduction of national emissions of certain atmospheric pollutants (BOE-A-2018-9466 Real Decreto 818/2018, de 6 de julio, sobre medidas para la reducción de las emisiones nacionales de determinados contaminantes atmosféricos.).

Steps 1 to 3 were iteratively run all along the updates of the NECP and the NAPCP.

## 9.3.1. Step 0: setting the general framework for modelling

In order to design future scenarios, in a first step, general macroeconomic assumptions such as GDP, GDP *per capita*, population projections, number of households, elasticity or relationship of energy service demands with main macroeconomic variables have been taken, according to data used to update the Spanish NECP 2023-2030. Additionally, other relevant variables for projections modelling have been established such as carbon prices under the European Emission Trading System pursuant to Directive 2003/87/EC[9], as well as the price of the main energy commodities (coal, gas and oil import prices). These are those recommended by the European Commission for the development of the National Energy and Climate Plans (NECPs).

## 9.3.2. Step 1: modelling sectors, policies and measures

Once the general macroeconomic framework has been set up, activity data for all activity sectors (energy, industry and transport, use of products, agriculture and waste) are modelled for a time horizon until 2030, and policies and measures which are adopted and implemented have been iteratively included in the WeM (With Measures) scenario. Additionally, policies and measures which are adopted, implemented and planned have been included in the WaM (With Additional Measures) scenario.

### Energy, Industry and Transport Sectors

The modelling of the energy system, together with the main industry sectors related to energy consumption, transport, consumption of fuels in residential, commercial and institutional sectors (RCI) and consumption of fuels in Agriculture/Forestry/Fishing has been carried out with the TIMES-Sinergia model.

The TIMES tool (The Integrated MARKAL-EFOM System) was developed by the International Energy Agency, within the framework of the ETSAP program (Energy Technology Systems Analysis Program) for the development of energy and environmental analysis. From the General Directorate of Energy Planification and Coordination (DGPCE), under the Secretariat of Energy of the Spanish Ministry for the Ecological Transition and Demographic Challenge, the necessary work has been done to use TIMES as a prospective and energy analysis tool in the preparation of the Spanish NECP. The new adapted model has received the name of TIMES-Sinergia (Sistema Integrado para el Estudio de la Energía).

TIMES is a bottom-up mathematical model combining two complementary approaches, one technical and the other economic. It is based on the linear optimization of the energy system, looking for a solution under the principle of minimum cost of the energy.

It has a detailed characterization of energy technologies, sectors and demands for energy services. For the different scenarios proposed in the model, TIMES guarantees the demand for energy services through the combination of operational and investment decisions, minimizing

[9] Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a system for greenhouse gas emission allowance trading within the Union and amending Council Directive 96/61/EC (EUR-Lex - 02003L0087-20240301 - ES - EUR-Lex).

the cost of the energy system throughout the analysed horizon, taking into account the projected fuel prices and $CO_2$ prices.

In addition, these Projections expand the parameterizations of the Royal Decree 1042/2017 on the limitation of emissions of NOx, $SO_2$ and $PM_{2.5}$ into the air from Medium Combustion Plants (MCPs)[10], as well as the Euro standards (including the new Regulation (EU) 2027/1257)[11], the performance standards regarding $CO_2$ emissions from new passenger cars and new light commercial vehicles (Regulation (EU) 2023/851)[12], and the performance standards regarding $CO_2$ emissions for new heavy-duty vehicles (Regulation (EU) 2024/1610)[13] into the road transport sector.

### Product Use sector

Besides the manufacturing industry, which is projected within the energy system, this sector includes, basically, the activities linked to the use of fluorinated gases (NFR 2F and 2G) and solvents and lubricants (NFR 2D).

The projection of the variables of activities linked to the use of solvents and lubricants has been linked by elasticity to the GDP and population forecasts, determined in the general macroeconomic context of the Spanish NECP 2023-2030.

Moreover, emissions of fluorinated gases from refrigeration and air conditioning (2F1), foam blowing agents (2F2), fire protection (2F3), aerosols (2F4) and electrical equipment and other product uses (2G) have been projected according to the objectives of the new Regulation (EU) 2024/573 on fluorinated greenhouse gases[14].

[10] Royal Decree 1042/2017, of December 22, on the limitation of emissions of certain pollutants into the air from medium-sized combustion plants, updating Annex IV of Law 34/2007, of November 15, on air quality and the protection of the atmosphere (BOE-A-2017-15368 Real Decreto 1042/2017, de 22 de diciembre, sobre la limitación de las emisiones a la atmósfera de determinados agentes contaminantes procedentes de las instalaciones de combustión medianas y por el que se actualiza el anexo IV de la Ley 34/2007, de 15 de noviembre, de calidad del aire y protección de la atmósfera.).

[11] Regulation (EU) 2024/1257 of the European Parliament and of the Council of 24 April 2024 on type-approval of motor vehicles and engines and of systems, components and separate technical units intended for such vehicles, with respect to their emissions and battery durability (Euro 7), amending Regulation (EU) 2018/858 of the European Parliament and of the Council and repealing Regulations (EC) No 715/2007 and (EC) No 595/2009 of the European Parliament and of the Council, Commission Regulation (EU) No 582/2011, Commission Regulation (EU) 2017/1151, Commission Regulation (EU) 2017/2400 and Commission Implementing Regulation (EU) 2022/1362 (Regulation - 2024/1257 - EN - EUR-Lex).

[12] Regulation (EU) 2023/851 of the European Parliament and of the Council of 19 April 2023 amending Regulation (EU) 2019/631 as regards strengthening the $CO_2$ emission performance standards for new passenger cars and new light commercial vehicles in line with the Union's increased climate ambition (Regulation - 2023/851 - EN - EUR-Lex).

[13] Regulation (EU) 2024/1610 of the European Parliament and of the Council of 14 May 2024 amending Regulation (EU) 2019/1242 as regards strengthening the $CO_2$ emission performance standards for new heavy-duty vehicles and integrating reporting obligations, amending Regulation (EU) 2018/858 and repealing Regulation (EU) 2018/956 (Regulation - EU - 2024/1610 - EN - EUR-Lex).

[14] Regulation (EU) 2024/573 of the European Parliament and of the Council of 7 February 2024 on fluorinated greenhouse gases, amending Directive (EU) 2019/1937 and repealing Regulation (EU) No 517/2014 (Regulation - EU - 2024/573 - EN - EUR-Lex).

## Agriculture sector

Three fundamental sets of data inputs have been considered in the projections: livestock activity data, crops activity data and implementation of Best Available Techniques (BATs).

The evolution forecasts of the livestock numbers by animal type (dairy and non-dairy cattle, sheep, white and Iberian swine, goats, horses, mules and asses, poultry (laying hens, broilers, turkeys), and rabbits) for the projected period have been provided by the Spanish Ministry of Agriculture, Fisheries and Food (MAPA), based on historical data and market forecasts of livestock production. Specifically, reductions in livestock numbers are expected for most animals (dairy cattle, sheep, laying hens and broilers, horses, mules and asses); to be highlighted is the sharp decrease in the number of swine population by 2030. In addition, the MAPA has provided and validated forecasts with destination of livestock manure, distribution of manure management systems and the universe of the national regulation on livestock management.

For each animal type, in addition to the census data, parameters related to enteric fermentation and manure management have been considered in a consistent manner with the National Emissions Inventory. These data are based on the zootechnical documents[15], with specific data for Spain for each animal type, and current data and forecasts on manure management systems. Calculations are carried out in a coordinated manner, consistent with the estimation of emissions derived from the application of manure to the field as organic fertilizer (NFR 3Da2a) or those derived from grazing activities (NFR 3Da3).

Additionally, updated livestock surveys are available for the last years by means of the computerized system ECOGAN[16]. Certain input parameters such as the configuration of the feed rations, the way of feeding the animals or BATs applied in the solid and liquid manure management of intensive pig farms (white and Iberian swine), and poultry farms (laying hens and broilers), are entered by the farmers themselves through registration.

Moreover, the Royal Decree 306/2020, which establishes basic regulations for the management of intensive pig farms, and modifies the basic regulations for the management of extensive pig farms[17], Royal Decree 637/2021, which establishes the basic regulations for the management of poultry farms[18], Royal Decree 1053/2022, which establishes the basic regulations for the management of bovine farms[19], are included into the WeM and WaM scenarios.

For the estimation of the projected emissions derived from crop management (NFR 3C and 3D), the MAPA has provided and validated forecasts of total cultivated surface (including rice fields), total amount of inorganic fertilizers and compost applied to the soil, amount of nitrogen from crop residues in the agricultural soils, and lime applied to the soil as amendment. Within these practices, the current level of implementation of BATs and their foreseeable future evolution

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[15] Zootechnical documents (Balance de nitrógeno e inventario de emisiones de gases).

[16] ECOGAN (ECOGAN: Registro General de MTDs y Cálculo de emisiones).

[17] Royal Decree 306/2020, of February 11, which establishes basic regulations for the management of intensive pig farms, and modifies the basic regulations for the management of extensive pig farms (BOE-A-2020-2110 Real Decreto 306/2020, de 11 de febrero, por el que se establecen normas básicas de ordenación de las granjas porcinas intensivas, y se modifica la normativa básica de ordenación de las explotaciones de ganado porcino extensivo.).

[18] Royal Decree 637/2021, of July 27, which establishes the basic regulations for the management of poultry farms (BOE-A-2021-12609 Real Decreto 637/2021, de 27 de julio, por el que se establecen las normas básicas de ordenación de las granjas avícolas.).

[19] Royal Decree 1053/2022, of December 27, which establishes the basic regulations for the management of bovine farms (BOE-A-2022-23053 Real Decreto 1053/2022, de 27 de diciembre, por el que se establecen normas básicas de ordenación de las granjas bovinas.).

have also been taken into account. The cultivated surface used is consistent with the data inventoried in the last edition of the National Emissions Inventory, as well as the data on the use and application of inorganic fertilizers, consistent with the National Balances for Nitrogen and Phosphorus in the Spanish Agriculture (BNPAE)[20].

Finally, the Royal Decree 840/2024[21], amending Royal Decree 1051/2022, which establishes regulations for sustainable nutrition in agricultural soils[22] and the Common Agricultural Policy Strategic Plan (CAP 2023-2027)[23] are included both into the WeM and WaM scenarios.

#### Waste sector

For the projection of the emissions derived from waste management and treatment, the historically inventoried data has been used as starting data (since 1950 for landfill discharges, and since 1990 for the rest of activities). These data are consistent with the national official series (MITECO Waste General Subdirectorate, and National Statistics Office (INE)) and those published in EUROSTAT.

The forecasts of evolution of the total waste generation (NFR 5A, 5B and 5C), as well as the distribution of management and treatment systems at the national level for both scenarios, have been provided by the competent unit (General Subdirectorate on Waste). Law 7/2022, of April 8, on waste and contaminated soils for a circular economy[24] is incorporated into the WeM and WaM scenarios, reflecting the reduction in weight of the waste generated and the decrease in the deposit of solid waste in managed landfills and the consequent increase in their biological treatment (composting and biomethanation).

Regarding emissions from wastewater treatment (NFR 5D), the projection has been linked to the national population forecast. Additionally, the distribution of sewage sludge management systems projected in the WeM and WaM scenarios has been provided by the General Subdirectorate on Waste based on the objectives of the National Waste Framework Plan (PEMAR) 2023-2035[25].

### 9.3.3. Step 2: estimation of emissions projections

Emissions from the energy sectors, both derived from combustion (NFR 1A, including the NFR categories 1A3 and 1A4) and fugitive emissions (NFR 1B), as well as emissions derived from industrial processes (NFR 2A, 2B and 2C) have been built upon the activity variables projected as a result of the scenarios generated by the TIMES-Sinergia model.

[20] National Balances for Nitrogen and Phosphorus in the Spanish Agriculture (BNPAE) (Productos fertilizantes).

[21] Royal Decree 840/2024, of August 27, amending Royal Decree 1051/2022, of December 27, which establishes regulations for sustainable nutrition in agricultural soils (BOE-A-2024-17371 Real Decreto 840/2024, de 27 de agosto, por el que se modifica el Real Decreto 1051/2022, de 27 de diciembre, por el que se establecen normas para la nutrición sostenible en los suelos agrarios.).

[22] Royal Decree 1051/2022, of December 27, which establishes regulations for sustainable nutrition in agricultural soils (BOE-A-2022-23052 Real Decreto 1051/2022, de 27 de diciembre, por el que se establecen normas para la nutrición sostenible en los suelos agrarios.).

[23] Common Agricultural Policy Strategic Plan 2023-2027 (El Plan Estratégico de la PAC de España).

[24] Law 7/2022, of April 8, on waste and contaminated soils for a circular economy (BOE-A-2022-5809 Ley 7/2022, de 8 de abril, de residuos y suelos contaminados para una economía circular.).

[25] National Waste Framework Plan (PEMAR) 2023-2035 (230705 nuevo PEMAR_IP_Revisado.pdf).

In a complementary manner, emissions from the rest of the non-energy sectors (agriculture, waste, and use of products) have been projected, case by case, according to national forecasts of the main activity variables representative of each sector.

From activity variables, emissions for each pollutant have been estimated, applying calculation methodologies consistent with those implemented in the National Emissions Inventory (EMEP/EEA Air Pollutant Emission Inventory Guidebook 2019 and 2023, and IPCC 2006 Guidelines and its 2019 Refinement). The 2025 edition of the National Emissions Inventory, corresponding to the 1990-2023 series, has been used as a reference for the calculation of projected emissions, in terms of characteristics and average parameters, emission trends and emission factors (direct and implicit).

Estimates of projected emissions have been made jointly and consistently for greenhouse gases ($CO_2$, $CH_4$, $N_2O$ and fluorinated gases), as well as for air pollutant emissions (NOx, $SO_2$, NMVOC, $NH_3$ and $PM_{2.5}$).

Quality control (QC) checks for consistency of the projected and inventoried emission data and for completeness are frequently carried out during the emissions projections elaboration process.

### 9.3.4. Step 3: assessment of objectives, policies and measures

The macroeconomic assumptions and the policies and measures considered in the different projected scenarios have been outlined and defined in a progressive manner according to different approaches and assumptions. The resulting calculations of the emissions, both for greenhouse gases and air pollutants, were evaluated against the objectives set for Spain for the year 2030. In this way, the sectoral forecast models and the calculation system of the projections have been executed in an iterative manner until a set of policies and measures has been defined and considered adequate for compliance with the mitigation objectives and feasible for incorporation into the Spain’s NAPCP 2023-2030 and NECP 2023-2030.

## 9.4. Policies and measures

The main existing (implemented and adopted) and additional (planned) measures and policies (PAMs), which have been taken into account in the construction of the projection scenarios, are those contemplated in the updated NECP 2023-2030 and NAPCP 2023-2030.

Firstly, it is a set of twelve packages or groups of measures (1-12) parameterized differently in the WeM and WaM scenarios. Each one is composed of one or several measures with synergic effects in the affected sectors). Additionally, four additional packages (13-16) have been added, which are composed by PAMs equally parameterized in both scenarios.

A summary of the considered measures can be found below.

## Table 9.4.1 Policies and measures (PAMs) considered in the projected scenarios

| No. | DESCRIPTION | SECTOR |
|---|---|---|
| 1 | **Package of measures for energy mix:**<br>• *Hydrogen Roadmap.*<br>• *Self-Consumption Roadmap.*<br>• *Roadmap for the development of offshore wind and marine energy in Spain.*<br>• *Biogas Roadmap.*<br>• *Energy Storage Strategy.*<br>• *Recovery, Transformation and Resilience Plan.*<br>• *Spanish circular economy strategy.*<br>• *National Energy and Climate Plan 2023-2030.*<br>• *National Air Pollution Control Programme 2023-2030.*<br>• *Royal Decree 1042/2017, of December 22, on the limitation of emissions of certain pollutants into the air from medium-sized combustion plants, updating Annex IV of Law 34/2007, of November 15, on air quality and the protection of the atmosphere.* | **1A1a & 1A1c** |
| 2 | **Package of measures in the industry energy sector:**<br>• *Recovery, Transformation and Resilience Plan.*<br>• *Self-Consumption Roadmap.*<br>• *Spanish circular economy strategy.*<br>• *National Energy and Climate Plan 2023-2030.*<br>• *National Air Pollution Control Programme 2023-2030.*<br>• *Royal Decree 1042/2017, of December 22, on the limitation of emissions of certain pollutants into the air from medium-sized combustion plants, updating Annex IV of Law 34/2007, of November 15, on air quality and the protection of the atmosphere.*<br>• *Commission Implementing Decision (EU) 2016/1032 of 13 June 2016 establishing best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for the non-ferrous metals industries.* | **1A2** |
| 3 | **Mitigation measures in the refining sector:**<br>• *National Energy and Climate Plan 2023-2030.*<br>• *National Air Pollution Control Programme 2023-2030.*<br>• *Hydrogen Roadmap.* | **1A1b** |
| 4 | **Package of measures for the aviation sector:**<br>• *National Energy and Climate Plan 2023-2030.*<br>• *National Air Pollution Control Programme 2023-2030.*<br>• *Regulation (EU) 2023/2405 of the European Parliament and of the Council of 18 October 2023 on ensuring a level playing field for sustainable air transport (ReFuelEU Aviation).* | **1A3a** |

| No. | DESCRIPTION | SECTOR |
|---|---|---|
| 5 | **Package of measures for the road transport sector:**<br>• *Recovery, Transformation and Resilience Plan.*<br>• *National Energy and Climate Plan 2023-2030.*<br>• *National Air Pollution Control Programme 2023-2030.*<br>• *EURO Standards.*<br>• *Regulation (EU) 2024/1610 of the European Parliament and of the Council of 14 May 2024 amending Regulation (EU) 2019/1242 as regards strengthening the $CO_2$ emission performance standards for new heavy-duty vehicles and integrating reporting obligations, amending Regulation (EU) 2018/858 and repealing Regulation (EU) 2018/956.*<br>• *Regulation (EU) 2023/851 of the European Parliament and of the Council of 19 April 2023 amending Regulation (EU) 2019/631 as regards strengthening the $CO_2$ emission performance standards for new passenger cars and new light commercial vehicles in line with the Union's increased climate ambition.* | 1A3b |
| 6 | **Package of measures for the rail transport sector:**<br>• *National Energy and Climate Plan 2023-2030.*<br>• *National Air Pollution Control Programme 2023-2030.*<br>• *Hydrogen Roadmap.*<br>• *Directive 2004/ 26/EC of the European Parliament and of the Council of 21 April 2004 amending Directive 97/68/EC on the approximation of the laws of the Member States relating to measures against the emission of gaseous and particulate pollutants from internal combustion engines to be installed in non-road mobile machinery.* | 1A3c |
| 7 | **Package of measures for the domestic navigation sector:**<br>• *National Energy and Climate Plan 2023-2030.*<br>• *National Air Pollution Control Programme 2023-2030.*<br>• *Regulation (EU) 2023/1805 of the European Parliament and of the Council of 13 September 2023 on the use of renewable and low-carbon fuels in maritime transport, and amending Directive 2009/16/EC.*<br>• *Designation of the Mediterranean Sea, as a whole, as an Emission Control Area for SOx pursuant to MARPOL Annex VI.* | 1A3d |
| 8 | **Package of measures related to the residential, commercial and institutional sector (RCI):**<br>• *Self-Consumption Roadmap.*<br>• *Recovery, Transformation and Resilience Plan.*<br>• *National Energy and Climate Plan 2023-2030.*<br>• *National Air Pollution Control Programme 2023-2030.*<br>• *Royal Decree 1042/2017, of December 22, on the limitation of emissions of certain pollutants into the air from medium-sized combustion plants, updating Annex IV of Law 34/2007, of November 15, on air quality and the protection of the atmosphere.*<br>• *Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products.* | 1A4a<br>&<br>1A4b |

| No. | DESCRIPTION | SECTOR |
|---|---|---|
| 9 | **Package of improvements in practices of fertilization on crops and improvements in manure soil application:**<br>• *National Energy and Climate Plan 2023-2030.*<br>• *National Air Pollution Control Programme 2023-2030.*<br>• *Royal Decree 840/2024, of August 27, amending Royal Decree 1051/2022, of December 27, which establishes regulations for sustainable nutrition in agricultural soils.*<br>• *Royal Decree 1051/2022, of December 27, which establishes regulations for sustainable nutrition in agricultural soils.*<br>• *Royal Decree 1053/2022, of December 27, which establishes the basic regulations for the management of bovine farms.*<br>• *Law 30/2022, of December 23, which regulates the management system of the Common Agricultural Policy and other related matters.*<br>• *Royal Decree 306/2020, of February 11, which establishes basic regulations for the management of intensive pig farms, and modifies the basic regulations for the management of extensive pig farms.* | 3D |
| 10 | **Package of improvements in manure management systems:**<br>• *National Energy and Climate Plan 2023-2030.*<br>• *National Air Pollution Control Programme 2023-2030.*<br>• *Royal Decree 1053/2022, of December 27, which establishes the basic regulations for the management of bovine farms.*<br>• *Royal Decree 637/2021, of July 27, which establishes the basic regulations for the management of poultry farms.*<br>• *Royal Decree 306/2020, of February 11, which establishes basic regulations for the management of intensive pig farms, and modifies the basic regulations for the management of extensive pig farms.* | 3B |
| 11 | **Package of measures in the consumption of fuels in Agriculture/Forestry/Fishing:**<br>• *Proposal of the contracting parties to the Barcelona Convention for the designation of the Mediterranean Sea, as a whole, as an Emission Control Area for SOx pursuant to MARPOL Annex VI.*<br>• *Self-Consumption Roadmap.*<br>• *National Energy and Climate Plan 2023-2030.*<br>• *National Air Pollution Control Programme 2023-2030.*<br>• *Royal Decree 1042/2017, of December 22, on the limitation of emissions of certain pollutants into the air from medium-sized combustion plants, updating Annex IV of Law 34/2007, of November 15, on air quality and the protection of the atmosphere.*<br>• *Directive (EU) 2016/802 of the European Parliament and of the Council of 11 May 2016 relating to a reduction in the sulphur content of certain liquid fuels.*<br>• *Directive 2004/ 26/EC of the European Parliament and of the Council of 21 April 2004 amending Directive 97/68/EC on the approximation of the laws of the Member States relating to measures against the emission of gaseous and particulate pollutants from internal combustion engines to be installed in non-road mobile machinery.* | 1A4c |
| 12 | **NMVOC reduction measures associated with the use of products:**<br>• *Commission Implementing Decision (EU) 2020/2009 of 22 June 2020 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council on industrial emissions, for surface treatment using organic solvents including preservation of wood and wood products with chemicals.* | 2D |

| No. | DESCRIPTION | SECTOR |
|---|---|---|
| 13 | **EU Emissions Trading System (EU ETS), affecting greenhouse gases:**<br>• *Directive (EU) 2023/959 of the European Parliament and of the Council of 10 May 2023 amending Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the Union and Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading system.*<br>• *Regulation (EU) 2023/957 of the European Parliament and of the Council of 10 May 2023 amending Regulation (EU) 2015/757 in order to provide for the inclusion of maritime transport activities in the EU Emissions Trading System and for the monitoring, reporting and verification of emissions of additional greenhouse gases and emissions from additional ship types.*<br>• *Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community.*<br>• *Directive 2008/101/EC of the European Parliament and of the Council of 19 November 2008 amending Directive 2003/87/EC so as to include aviation activities in the scheme for greenhouse gas emission allowance trading within the Community.*<br>• *Law 1/2005, of 9 March, which regulates the greenhouse gas emission trading system.*<br>• *Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC.* | Several |
| 14 | **GHG emissions reductions related to fluorinated gases, affecting greenhouse gases:**<br>• *National Energy and Climate Plan 2023-2030.*<br>• *Regulation (EU) 2024/573 of the European Parliament and of the Council of 7 February 2024 on fluorinated greenhouse gases, amending Directive (EU) 2019/1937 and repealing Regulation (EU) No 517/2014.*<br>• *Law 14/2022, of July 8, amending Law 19/2013, of December 9, on transparency, access to public information and good governance, in order to regulate the statistics of micro, small and medium-sized enterprises (SMEs) in public procurement*<br>• *Royal Decree 115/2017, of February 17, which regulates the marketing and handling of fluorinated gases and equipment based on them, as well as the certification of the professionals who use them and which establishes the technical requirements for facilities that carry out activities that emit fluorinated gases.*<br>• *Law 16/2013, of October 29, which establishes certain measures regarding environmental taxation and adopts other tax and financial measures.* | 2F & 2G |
| 15 | **Package of measures for the waste management sector:**<br>• *National Energy and Climate Plan 2023-2030.*<br>• *National Air Pollution Control Programme 2023-2030.*<br>• *Law 7/2022, of April 8, on waste and contaminated soils for a circular economy.*<br>• *National Waste Framework Plan (PEMAR) 2023-2035.* | 5A, 5B & 5D |
| 16 | **Reduction of field burning of pruning remains:**<br>• *National Energy and Climate Plan 2023-2030.*<br>• *National Air Pollution Control Programme 2023-2030.*<br>• *Law 30/2022, of December 23, which regulates the management system of the Common Agricultural Policy and other related matters.*<br>• *Law 7/2022, of April 8, on waste and contaminated soils for a circular economy.* | 5C |

## 9.5. Projections results

Two scenarios have been considered in the emissions projections, one in which the impact of the currently implemented and adopted policies and regulation is foreseen (scenario with existing measures, WeM) and a second scenario (with additional measures, WaM), including the foreseeable impact on the emissions of the measures and policies implemented, adopted and planned, such as the updated Spanish NECP 2023-2030 and NAPCP 2023-2030, Hydrogen Roadmap, Self-Consumption Roadmap, Roadmap for the development of offshore wind and marine energy in Spain, Biogas Roadmap, Energy Storage Strategy, Recovery, Transformation and Resilience Plan and Spanish circular economy strategy, among others.

### Scenario-with additional measures (WaM)

Emission projections in the WaM scenario, contemplated in the framework of the National Energy and Climate Plan and the National Program for the Control of Atmospheric Pollution, show a clear downward trend on the historical and projected series in the considered pollutants.

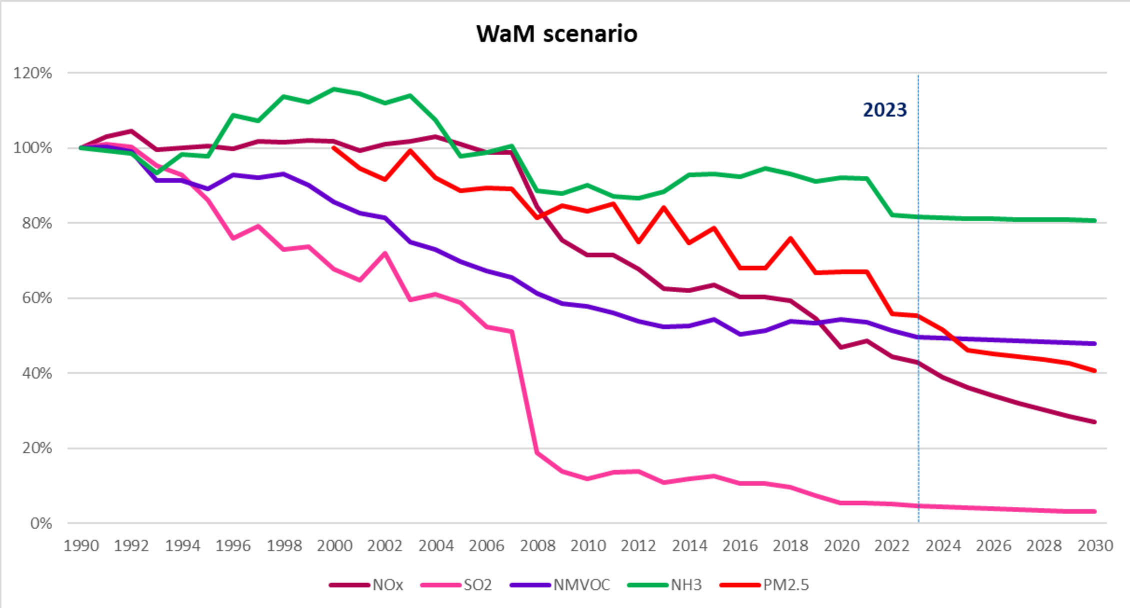



**Figure 9.5.1 Emissions projections evolution for WaM scenario 1990-2030**

### 9.5.1. Projections by pollutant

In the following sections, data results and summarized analysis of the projections for each pollutant are provided.

#### 9.5.1.1. NOx

The emissions in the WeM scenario, in which just the impact of adopted and implemented policies and measures has been considered, will be reduced by -70.8% in 2030 compared to 2005. Additionally, the added effect of planned PAMs in the WaM scenario allows reductions to reach levels of -73.2% in 2030, compared to 2005.

Regarding the principal contributions of the different sectors, the main emissions reductions in the WaM scenario by 2030 compared to 2005 occur in the road transport sector, followed by energy generation and stationary combustion in manufacturing industries.

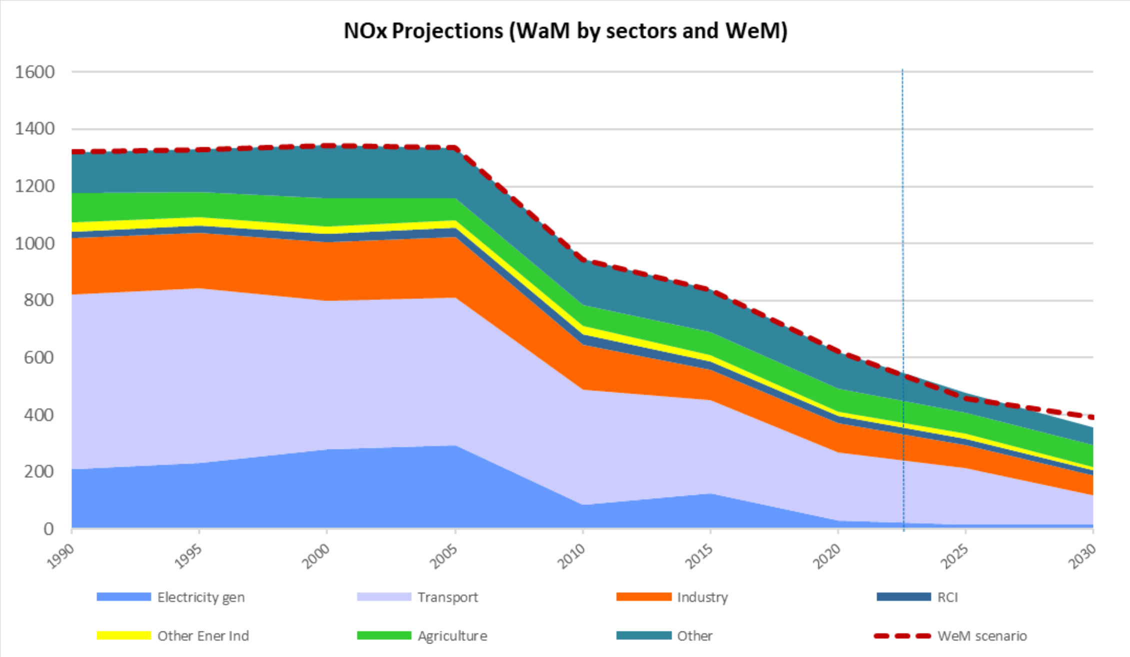



**Figure 9.5.2 NOx emissions and projections by sector (WaM by sector and WeM)**

### Policies and measures in the projected scenarios

The main measures that have been taken into account in the projections include:

i. renewal of the vehicle fleet (electrification and progressive incorporation of new combustion models with more advanced EURO standards, with lower NOx emission ratios), and modal shift (package of measures No. 5 of the list of PAMs);

ii. gradual introduction of energy efficiency measures and abatement of NOx emissions in large and medium-sized combustion plants and industrial installations (package of measures No. 2);

iii. changes in the energy mix, considering a high proportion of renewable energies, and the consequent reduction in generation in thermal power plants and related reductions on refineries (packages of measures No. 1 and No. 3, respectively).

### Reduction commitments compliance

The mitigation measures planned in both WeM and WaM scenarios are sufficient to achieve the emission reduction levels established by Directive (EU) 2016/2284, for the entire projected period, as can be seen in the following graph.

It should be made clear that emissions from activities falling under NFR categories 3B (manure management) and 3D (agricultural soils) are not accounted for the purpose of complying, according to the article 4.3.d) of Directive (EU) 2016/2284.

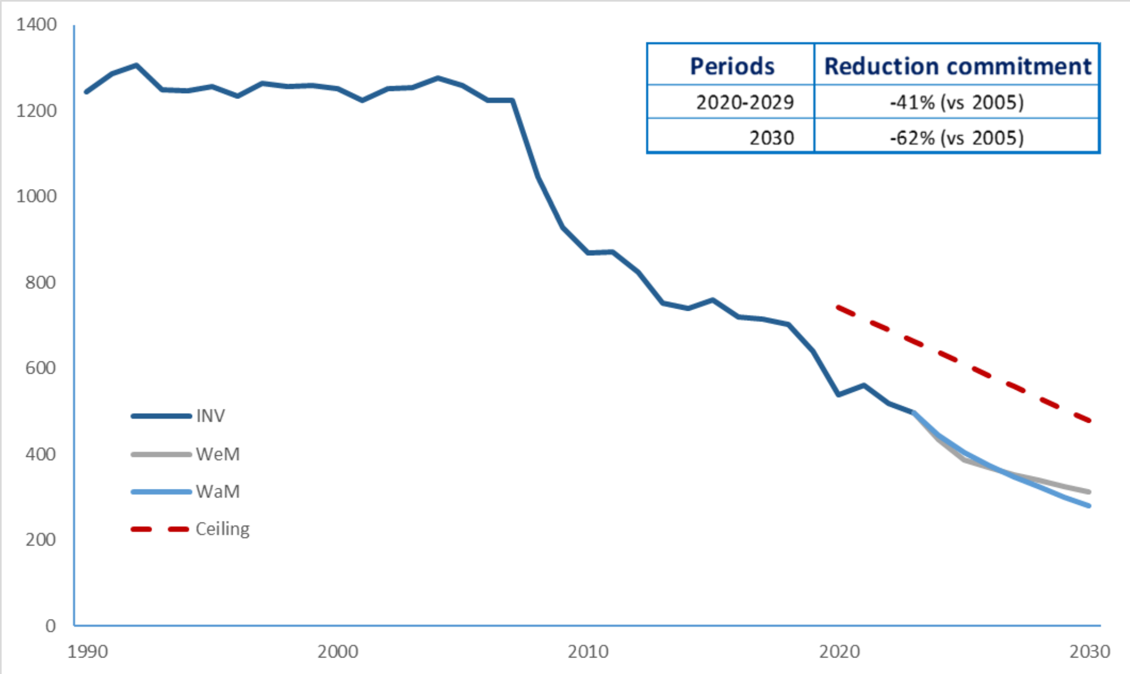



**Figure 9.5.3 Expected compliance for NOx projections**

### 9.5.1.2. $SO_2$

The important $SO_2$ reduction recorded in the inventory period continues in the projected emissions in the WeM scenario, in which just the impact of adopted and implemented policies and measures has been considered. These values will be reduced by -93.9% in 2030 compared to 2005. Additionally, the added effect of planned PAMs in the WaM scenario allows reductions to reach levels of -94.8% in 2030, compared to 2005.

The main decreases in the WaM scenario by 2030 compared to 2005 are associated with the substitution of coal in the energy sectors (mainly power generation) as well as the effect of the planned measures contemplated both in the updated NECP 2023-2030 and NAPCP 2023-2030.

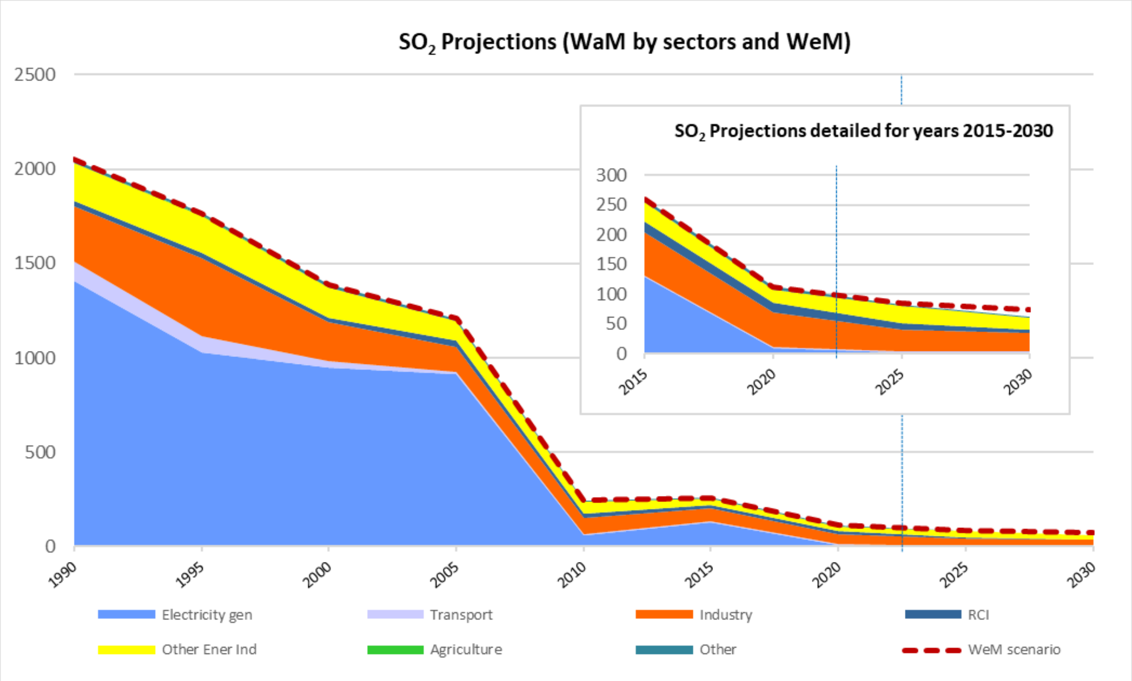



**Figure 9.5.4 $SO_2$ emissions and projections by sector (WaM by sector and WeM), and detail for years 2015-2030**

### Policies and measures in the projected scenarios

Despite the great achievements accomplished to date (such as changes in the electric mix and gradual introduction of measures to reduce $SO_2$ emissions in large and medium-sized combustion plants and industrial facilities, among others) leave little room for further reductions, the main planned PAMs that have been taken into account in the WaM scenario include:

i. NECP 2023-2030 and Hydrogen Roadmap planned measures, which imply a decrease on petroleum refining, producing an indirect $SO_2$ reduction concerning fugitive emissions associated with venting and flaring (related to package of measures No. 3, but accounted for in other measures-diffuse emissions);

ii. NECP 2023-2030 energy efficiency measures regarding combustion in manufacturing industries (package of measures No. 2);

iii. measures in maritime transport, which imply a gradual substitution of heavy fuel oil with marine diesel oil and marine gas oil (package of measures No. 7).

### Reduction commitments compliance

Regarding the compliance of the commitment set in the Directive (EU) 2016/2284 on the reduction of national emissions of certain atmospheric pollutants, as shown in the following graph, the projection of the emissions foresees the compliance with the reduction commitments in the two scenarios, for both time periods (2020-2029: reduction of -67.0% compared to 2005 emissions, and 2030 and onwards: reduction of -88.0% compared to the emissions of the year 2005).

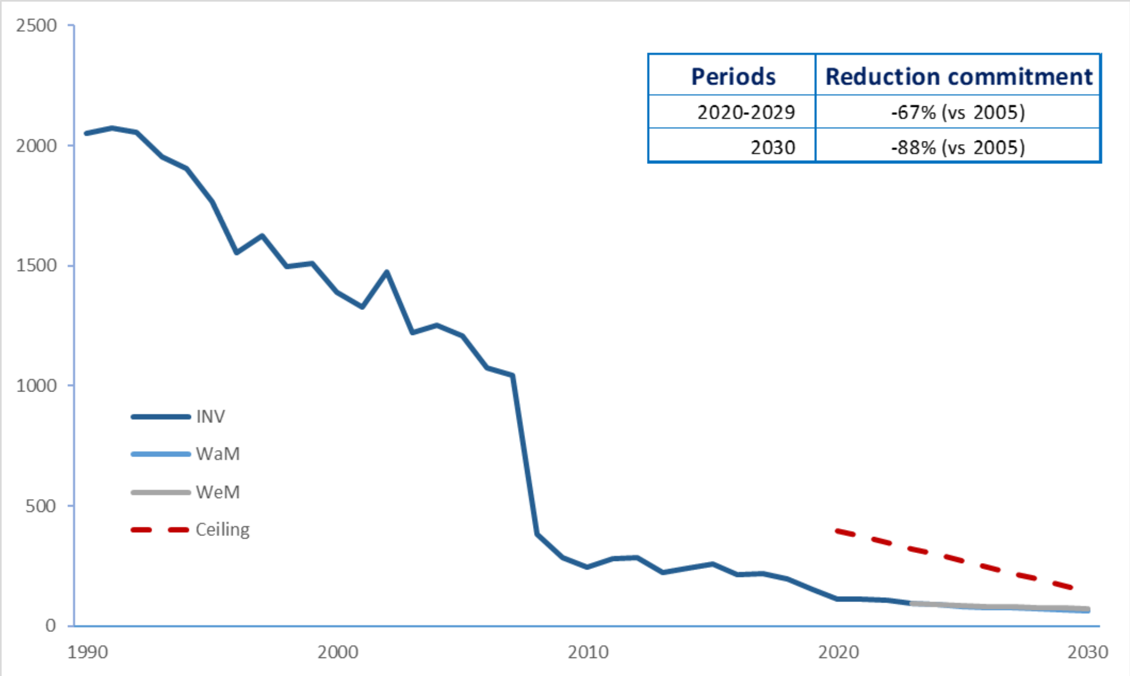



**Figure 9.5.5 Expected compliance for $SO_2$ projections**

### 9.5.1.3. NMVOC

The emissions in the WeM scenario, in which just the impact of adopted and implemented policies and measures has been considered, will be reduced by -28.4% in 2030 compared to 2005. Additionally, the added effect of planned PAMs in the WaM scenario allows reductions to reach levels of -31.5% in 2030, compared to 2005.

Regarding the principal contributions of the different sectors, the main emissions reductions in the WaM scenario by 2030 compared to 2005 occur in the solvent use sector (principally coating applications), in the residential sector (linked to energy efficiency, electrification and progressive replacement of traditional solid biomass by other energy source, such as natural gas and pellets) and in the road transport sector.

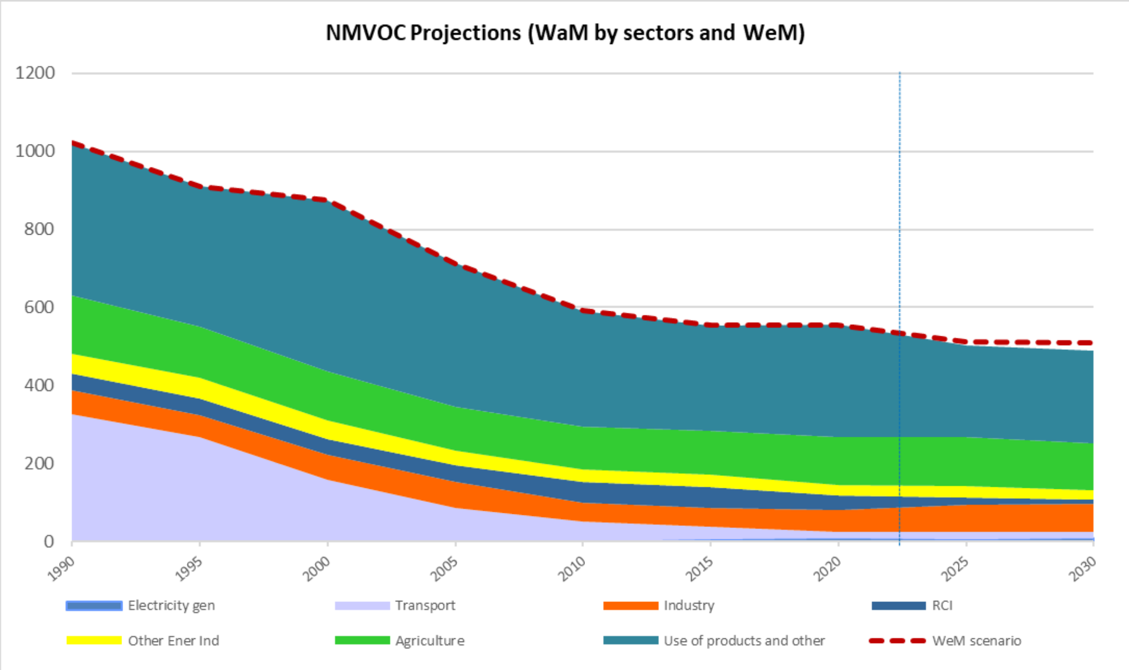



**Figure 9.5.6 NMVOC emissions and projections by sector (WaM by sector and WeM)**

### Policies and measures in the projected scenarios

Important policies and measures focused on NMVOC emission reductions (such as the Commission Implementing Decision (EU) 2020/2009, of 22 June 2020, establishing the best available techniques (BATs) conclusions, under Directive 2010/75/EU, on industrial emissions, Directive 1999/12/EC on the limitation of VOC emissions due to the use of organic solvents in certain activities and installations, and Directive 2004/42/EC, on the limitation of VOC emissions due to the use of organic solvents in certain paints and varnishes, as well as the best available techniques from the related BREFs, and the renewal of the vehicle fleet (substitution of old models by new ones with more advanced EURO standards)) are already adopted or implemented. Therefore, these are equally parameterized in both WeM and WaM scenarios.

Additionally, the main planned PAMs that have been considered in the WaM scenario include:

i. NECP 2023-2030 and Hydrogen Roadmap planned measures, which imply a decrease on petroleum refining, producing an indirect NMVOC reduction concerning fugitive emissions associated with this activity (related to package of measures No. 3, but accounted for in other measures-diffuse emissions);

ii. renewal of the vehicle fleet (electrification and progressive incorporation of new combustion models with more advanced EURO standards, with lower NMVOC emission ratios), and modal shift (package of measures No. 5);

iii. NAPCP 2023-2030 planned measures on product use (package of measures No. 12. Nevertheless, the effect of mitigation policies may be limited on these emissions, mostly linked to domestic consumption factors and related to economic growth.

### Reduction commitments compliance

Regarding the compliance of the reduction commitments set in the Directive (EU) 2016/2284 on the reduction of national emissions of certain atmospheric pollutants, as shown in the following graph, the projection foresees compliance with the reduction commitment of -22.0% in the 2020-2029 period (with respect to 2005 levels) in WaM scenario and up to 2027 in WeM scenario, considering the linear trajectory between 2020 and 2030. Nevertheless, none of both scenarios would lead to compliance in 2030. It will therefore be necessary to carry out a more detailed analysis of the potential measures to be applied, possible new planning instruments and their effect on future editions of the projections.

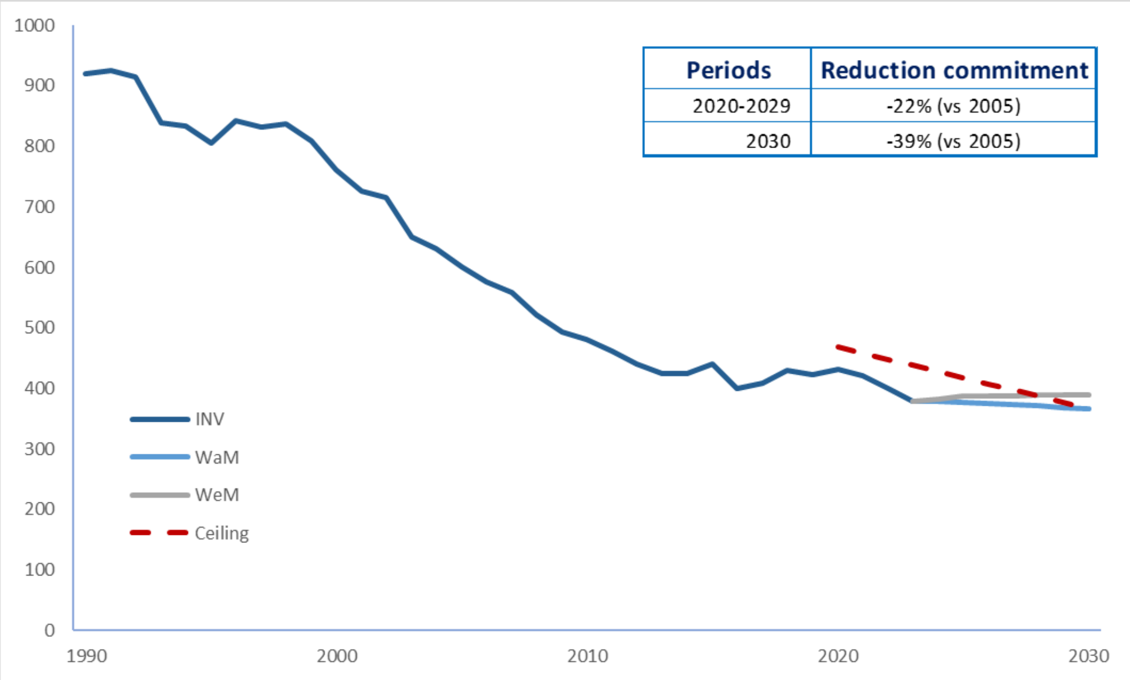



**Figure 9.5.7 Expected compliance for NMVOC projections**

It should be made clear that emissions from activities falling under NFR categories 3B (manure management) and 3D (agricultural soils) are not accounted for the purpose of complying¸ according to the article 4.3.d) of Directive (EU) 2016/2284.

### 9.5.1.4. $NH_3$

The projections of ammonia ($NH_3$) emissions in both scenarios incorporate the effect of the expected reductions in livestock numbers for most animals (dairy cattle, sheep, laying hens and broilers, horses, mules and asses) and specially a sharp decrease in the number of swine population by 2030, provided by the Spanish Ministry of Agriculture, Fisheries and Food.

Additionally, Royal Decree 1053/2022, which establishes the basic regulations for the management of bovine farms, Royal Decree 637/2021, which establishes the basic regulations for the management of poultry farms, Royal Decree 306/2020, which establishes basic regulations for the management of intensive pig farms, and modifies the basic regulations for the management of extensive pig farms, Royal Decree 840/2024, amending Royal Decree 1051/2022, which establishes regulations for sustainable nutrition in agricultural soils and Law 30/2022, which regulates the management system of the Common Agricultural Policy and other related matters are included into the WeM and WaM scenarios.

These measures, which are contemplated in the NAPCP 2023-2030, are aimed at improving manure management, both within the farm and in soil application by means of the implementation of best available techniques present on BREF documents. These measures are also aimed at a sustainable and efficient fertilization of crops with the double effect to reduce the total amount of nitrogen compounds and implement soil management practices, which would reduce the emissions of ammonia in crop production and agricultural soils.

Therefore, emissions of ammonia in the WeM scenario, in which just the impact of adopted and implemented policies and measures has been considered, will be reduced by -17.3% in 2030 compared to 2005. Additionally, the added effect of planned PAMs in the WaM scenario allows reductions to reach levels of -17.6% in 2030, compared to 2005.

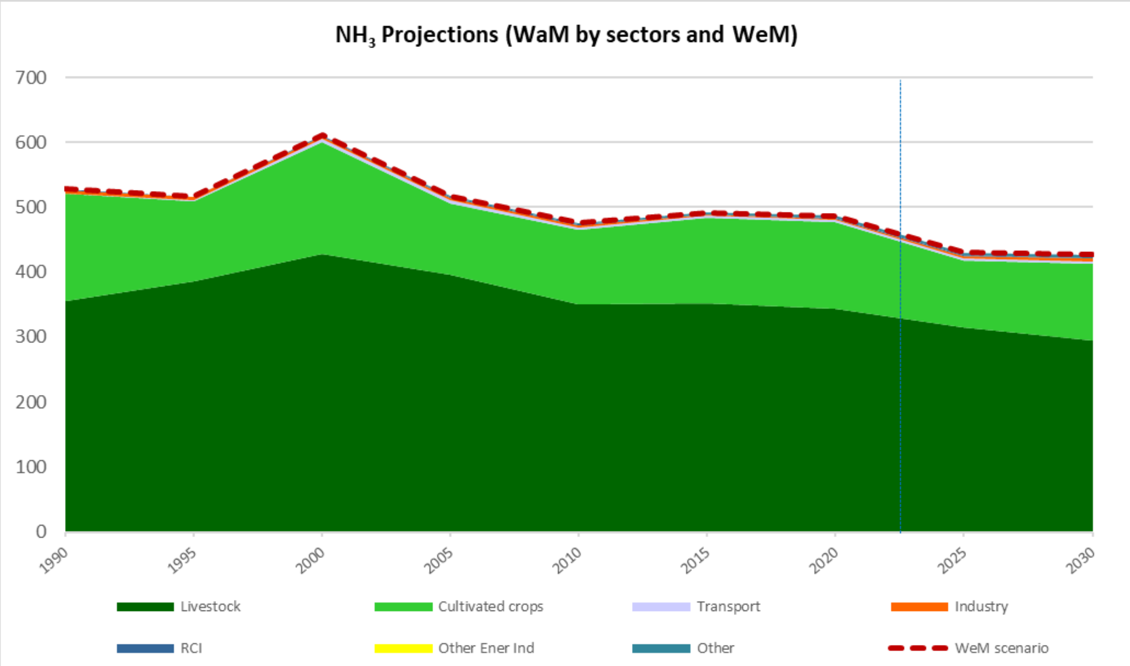



**Figure 9.5.8 $NH_3$ emissions and projections by sector (WaM by sector and WeM)**

### Policies and measures in the projected scenarios

Emissions of ammonia are those which decrease the least throughout the historical and projected series. The main measures with effect on $NH_3$ projections in 2030, both in WeM and WaM scenarios, by means of application of ammonia abatement techniques, are those related to an improving both on manure management (package of measures No. 10 of the PaMs list) and on organic and inorganic fertilizers applied to soils (package of measures No. 9 of the PaMs list). However, given that fertilization practices are very variable depending on weather and because of the effect of some activity data, such as compost applied to soils (growing trend since 1995), a slight increase in emissions from crops is observed with respect to reference year (2005).

### Reduction commitments compliance

Regarding the compliance of the commitment set in the Directive (EU) 2016/2284 on the reduction of national emissions of certain atmospheric pollutants, as shown in the following graph, the projection of the emissions foresees the compliance with the reduction commitments in the two scenarios, for both time periods (2020-2029: reduction of -3.0% compared to 2005 emissions, and 2030 and onwards: reduction of -16.0% compared to the emissions of the year 2005).

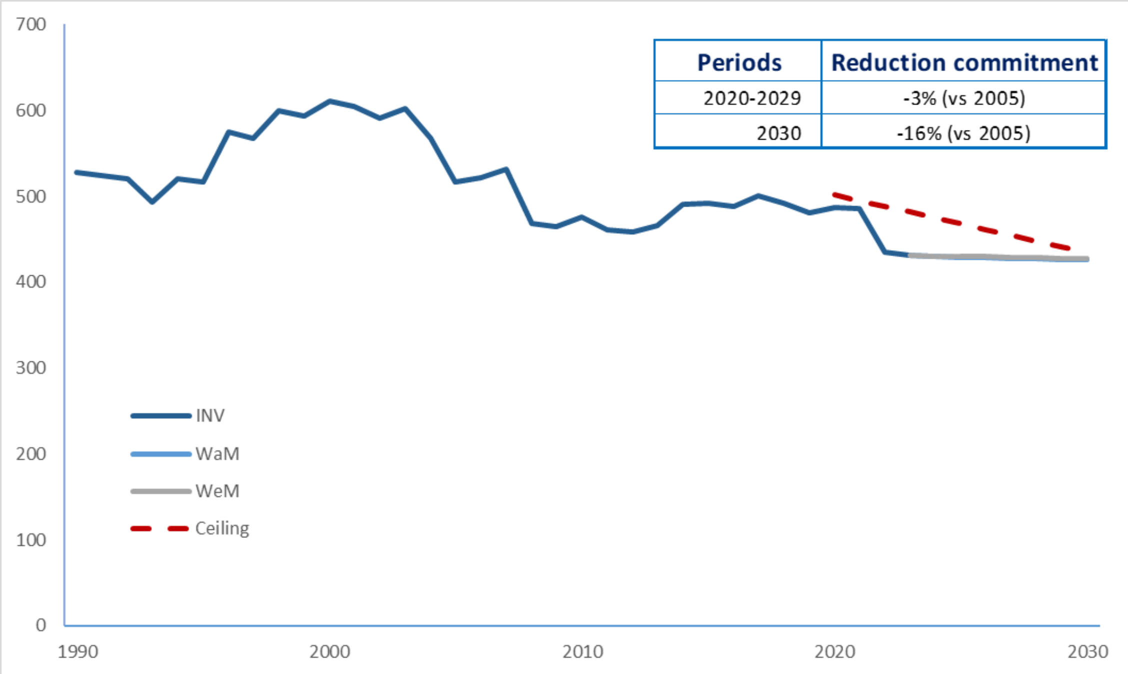



**Figure 9.5.9 Expected compliance for $NH_3$ projections**

### 9.5.1.5. $PM_{2.5}$

The emissions of fine particulate matter emissions ($PM_{2.5}$) in the WeM scenario, in which just the impact of adopted and implemented policies and measures has been considered, will be reduced by -53.2% in 2030 compared to 2005. Additionally, the added effect of planned PAMs in the WaM scenario allows reductions to reach levels of -54.1% in 2030, compared to 2005.

Regarding the principal contributions of the different sectors, the main emission reductions in the WaM scenario by 2030 compared to 2005 are linked to energy efficiency, electrification and progressive replacement of traditional solid biomass by other energy sources in the residential sector, such as natural gas and pellets, emission reduction measures applied in road transport, specially in passenger cars, and energy measures and evolution of the national energy mix, which have produced a significant decrease in emissions from solid fuel combustion.

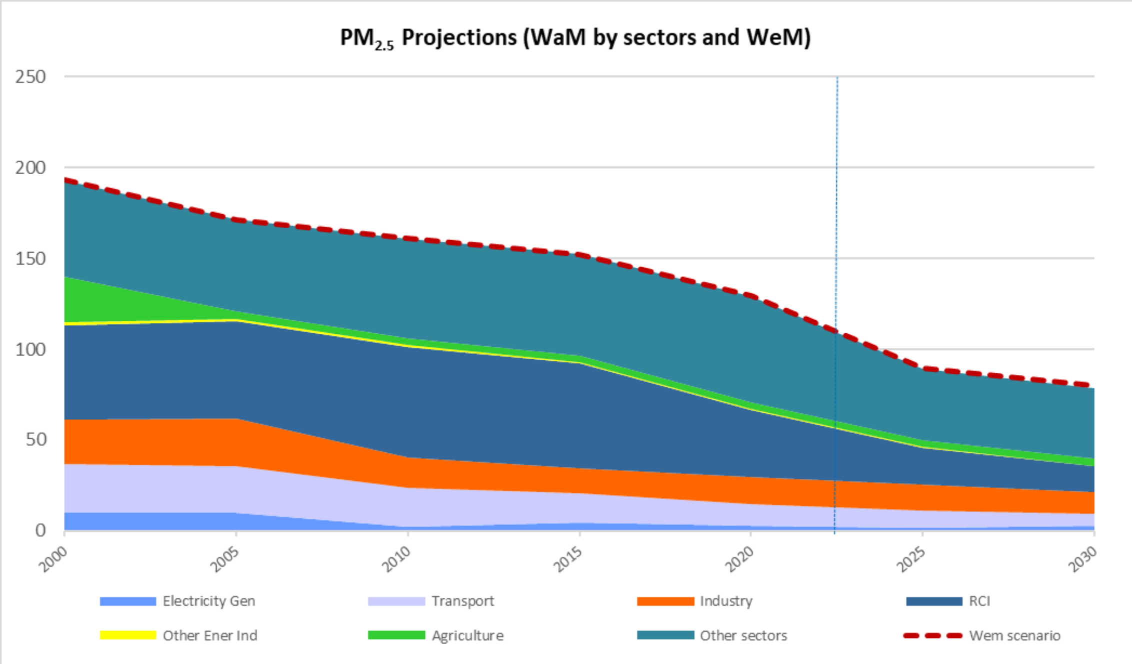



**Figure 9.5.10 $PM_{2.5}$ emissions and projections by sector (WaM by sector and WeM)**

## Policies and measures in the projected scenarios

Important policies and measures focused on $PM_{2.5}$ emission reductions (such as Ecodesign Directive and relative regulations and ecological design requirements applicable to boilers and local heating devices, limitation of emissions into the air from Medium Combustion Plants, emission reduction measures applied in road transport and PAMs focused on the evolution of the national energy mix) are already adopted or implemented. Therefore, these are equally parameterized in both WeM and WaM scenarios.

Additionally, the main planned PAMs that have been considered in the WaM scenario include:

i. modal shift applied in road transport (package of measures No. 5) (reductions mainly from automobile tyre and break wear and road abrasion);

ii. energy efficiency, electrification and progressive replacement of traditional solid biomass by other energy sources in the RCI sector (mainly residential), such as natural gas and pellets (package of measures No. 8);

iii. promotion of solid biomass in the energy mix (package of measures No. 1), which has the side-effect of increasing $PM_{2.5}$ emissions in WaM scenario in comparison with WeM scenario by 2030.

## Reduction commitments compliance

Regarding the compliance of the commitment set in the Directive (EU) 2016/2284 on the reduction of national emissions of certain atmospheric pollutants, as shown in the following graph, the projection of the emissions foresees the compliance with the reduction commitments in the two scenarios, for both time periods (2020-2029: reduction of -15.0% compared to 2005 emissions, and 2030 and onwards: reduction of -50.0% compared to the emissions of the year 2005).

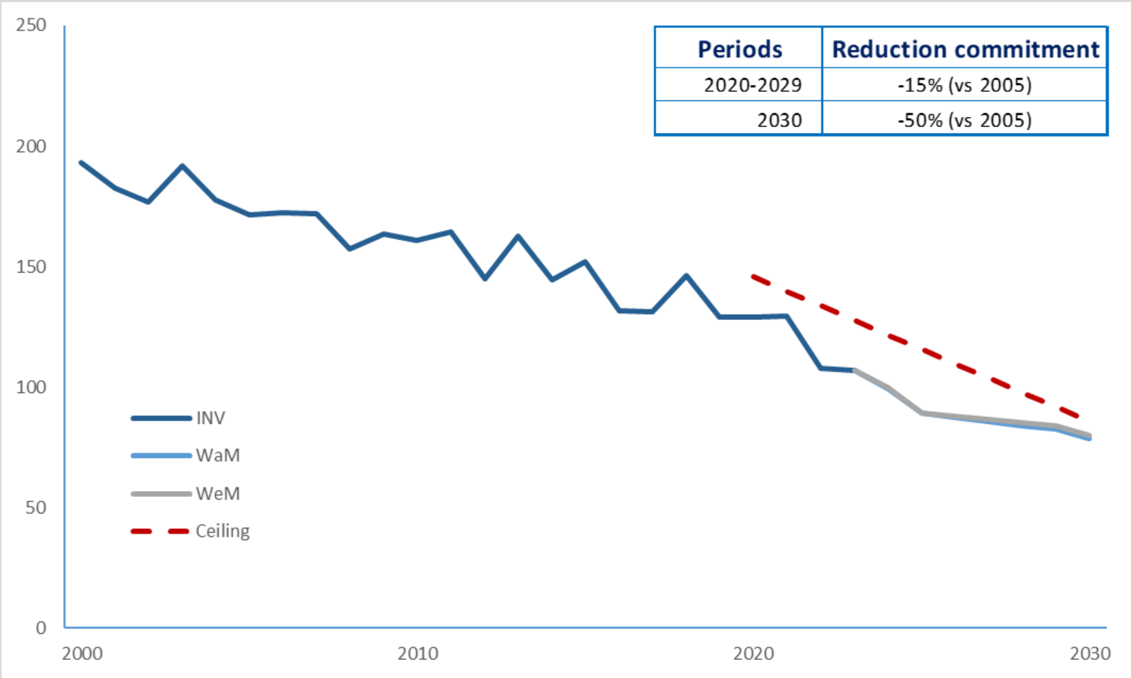



**Figure 9.5.11 Expected compliance for $PM_{2.5}$ projections**

## 9.6. Projections editions comparison

It is provided, for informative purposes, a general comparison of the global results of the projected emission data (2025 edition) against the previous reported projections (edition 2023), both in the WaM scenario.

Firstly, it is important to underline that the projections made on the 2023 edition were based on the 1990-2021 Inventory historical series, whereas these are based on the inventoried period 1990-2023.

Additionally, the energy scenario of the updated NECP 2023-2030, received from the Spanish Secretary of State for Energy, was used to prepare the 2025 Edition, while the 2023 edition included a previous version of this energy scenario.

In summary, the differences on the comparison include modifications among both editions, which are due to: (1) updates in the parameterization of existing policies and measures and the inclusion of new ones; (2) methodological changes and recalculations that modify the historical and projected series, which come from programmed improvements, changes in reference handbooks, corrections resulting from the reviews or correction of detected errors; and (3) changes in fuel consumption projections, mainly due to the unstable international geopolitical context and the consequences of the COVID-19 pandemic.

The following graphs show the comparison between the WeM and WaM projected scenarios of this Edition and the WaM scenario of the 2023 Projections Edition (dotted line).

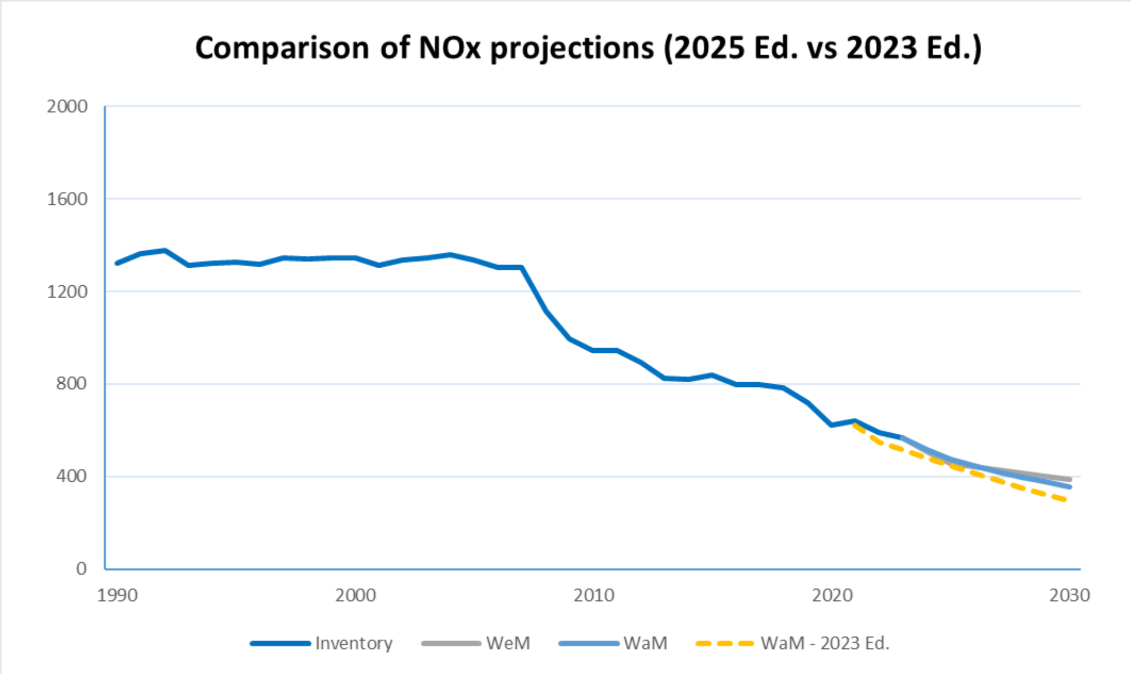



**Figure 9.6.1 Comparison of NOx projections for WaM scenario (2025 Ed. vs 2023 Ed.)**

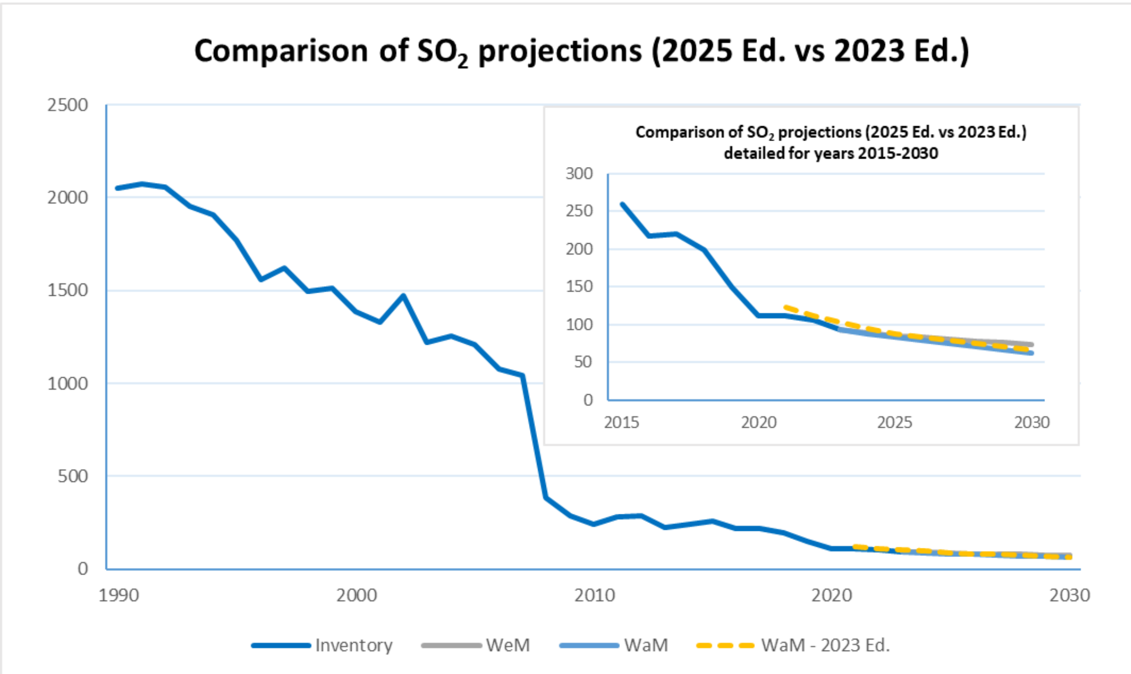



**Figure 9.6.2 Comparison of $SO_2$ projections for WaM scenario (2025 Ed. vs 2023 Ed.)**

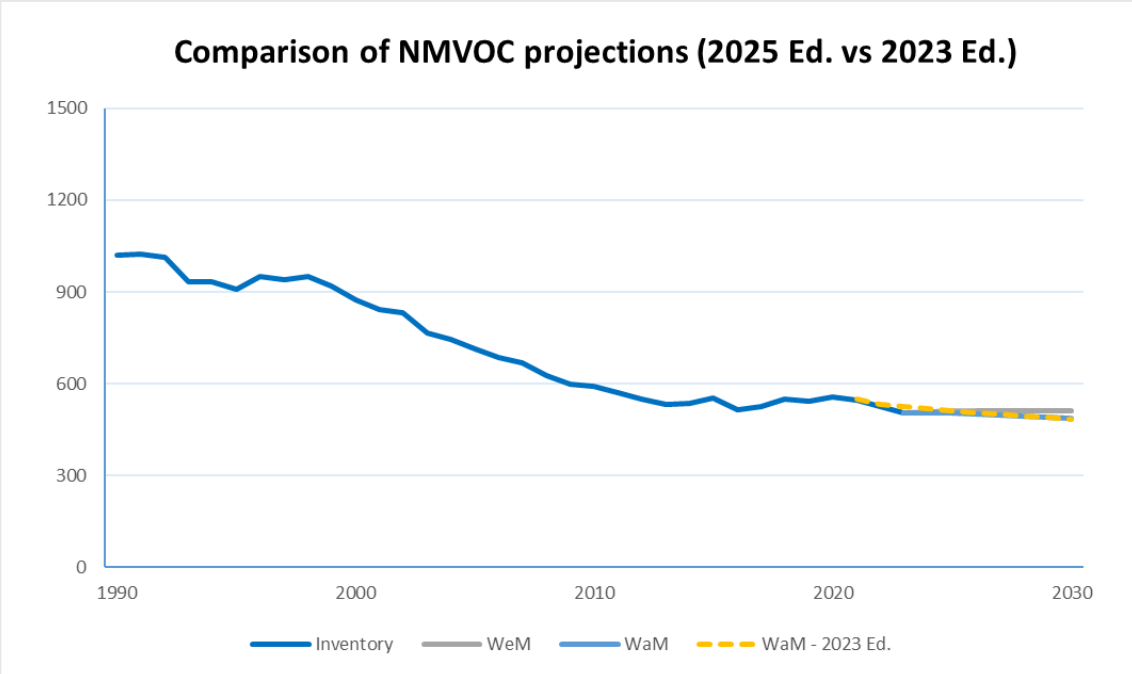



**Figure 9.6.3 Comparison of NMVOC projections for WaM scenario (2025 Ed. vs 2023 Ed.)**

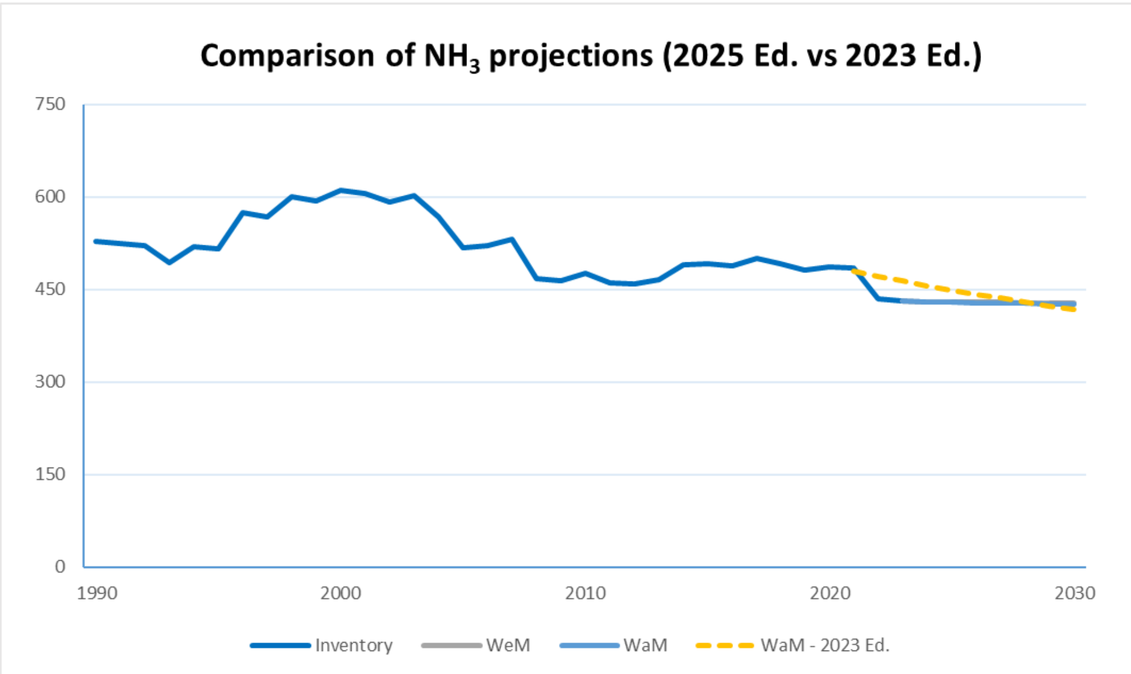



**Figure 9.6.4 Comparison of $NH_3$ projections for WaM scenario (2025 Ed. vs 2023 Ed.)**

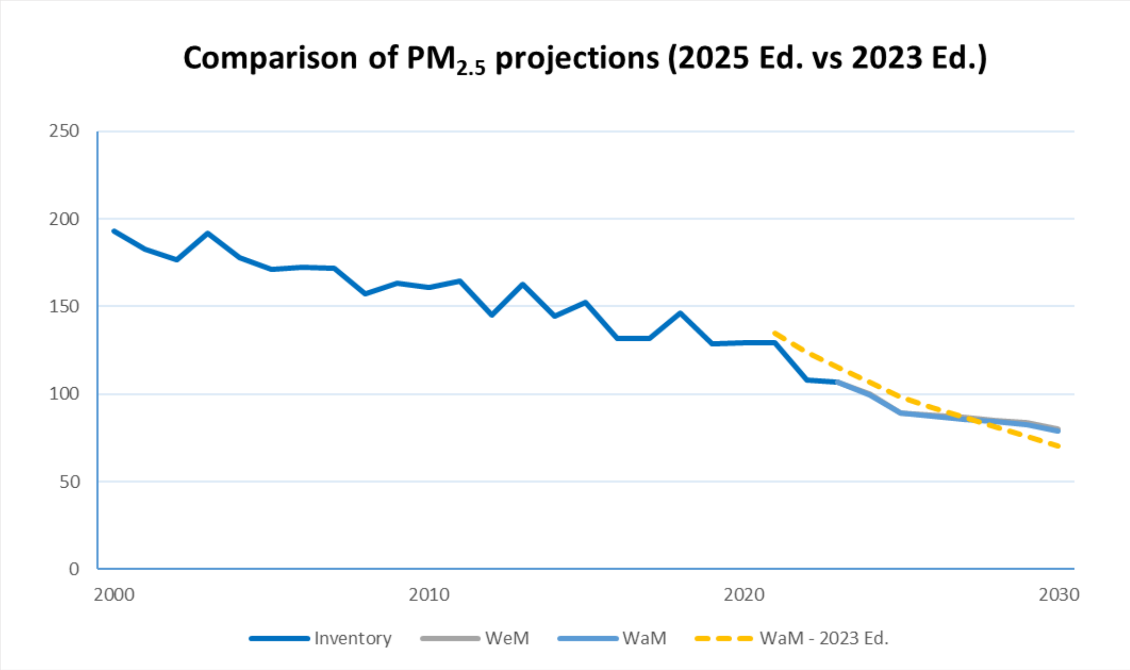



**Figure 9.6.5 Comparison of $PM_{2.5}$ projections for WaM scenario (2025 Ed. vs 2023 Ed.)**

## 9.7. Sensitivity analysis

In the framework of the elaboration of the National Energy and Climate Plan, sensitivity analyses of the different scenarios contemplated have been carried out, in particular with respect to the effect of the fossil fuel price scenarios. For more information, please refer to the Spanish NECP and the final report of emissions projections for the non-energy sectors, with respect to livestock census, Spanish population, and GDP.

# 10. REPORTING OF GRIDDED EMISSIONS AND LPS

# CONTENTS

## FIGURES



## TABLES

# 10. REPORTING OF GRIDDED EMISSIONS AND LPS

## 10.1. Introduction

Chapter updated in March, 2026.

Aggregated sectoral gridded and LPS emissions are to be reported under UNECE Convention on Long-Range Transboundary Air Pollution (CLRTAP) and Directive 2016/2284[1].

This chapter is been written following the criteria of the Recommended Structure for Informative Inventory Report (Annex 2).

## 10.2. Grid and LPS dataset

The pollutants reported as gridded and LPS emissions by the Spanish inventory are the following: $NO_X$, NMVOC, $SO_2$, $NH_3$, $PM_{2.5}$, $PM_{10}$, BC, CO, Pb, Cd, Hg, PCDD/PCDF, PAH, HCB, PCB. For all pollutants, the Inventory reports the complete series from 1990 to 2024, except for particles, that are only reported from the year 2000 onwards.

LPS emissions are also reflected in the gridded data submission, and both the gridded and LPS emissions data are fully consistent with the total NFR emissions data from the inventory.

## 10.3. Changes in gridded emissions

In this edition, 9 intensive livestock farms are been included as geolocated point sources (GeoPS), 8 of them exceeding the threshold values applicable to LPS catalogation. All these facilities are dedicated to pig farming, and are the largest in their sector. The intention is to add gradually more farms in subsequent editions as geolocated point sources, ranked by importance.

Furthermore, in order to more accurately reflect the emissions produced by biomass combustion, a new classification has been introduced within the land use map cataloging system, which defines more precisely the types of residential land (Residential areas, corresponding to code 810 shown in Table 10.4.3 of this chapter). Specifically, this category has been differentiated into two subcategories: strictly urban areas (populations with more than 10,000 inhabitants) and rural areas (populations with less than 10,000 inhabitants).

## 10.4. Grid methodology

### 10.4.1. Summary

The criterion of the Spanish Inventory to consider facilities as LPS are the thresholds set up by the CLRTAP Guidelines. However, the Inventory registers other point sources that do not fall into this criterion, and whose emissions are also geographically assigned, in order to improve the allocation of emissions for the grid report. This completes the spatial distribution of emissions resulting from the Area source distribution based on the land use map that is explained in epigraphs 10.4.2 and 10.4.3.

[1] 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 (http://data.europa.eu/eli/dir/2016/2284/oj).

Below is a summary table with the tier methodological approach for gridding into each of the GNFR sectors, and percentage corresponding to area sources and to facilities whose emissions are geographically assigned ("geoloc") (in 2024, the national Inventory has a total of 735 geolocated point sources, although not all of them correspond to the guideline reporting criteria as LPS.

**Table 10.4.1 GNFR Spatial mapping Tier and 2024 source percentage emission**

| GNFR Sector | Tier | Emission source | NOx | NMVOC | SOx | $NH_3$ | $PM_{2,5}$ |
|---|---|---|---|---|---|---|---|
| **A_Public power** | T2/T3 | Area | 24,0% | 60,1% | 14,1% | 99,5% | 88,6% |
| | | Geoloc | 76,0% | 39,9% | 85,9% | 0,5% | 11,4% |
| **B_Industry** | T2/T3 | Area | 36,1% | 82,4% | 13,3% | 74,2% | 77,4% |
| | | Geoloc | 63,9% | 17,6% | 86,7% | 25,8% | 22,6% |
| **C_OtherStatComb** | T1/T2/T3 | Area | 99,5% | 99,4% | 100,0% | 100,0% | 100,0% |
| | | Geoloc | 0,5% | 0,6% | 0,0% | 0,0% | 0,0% |
| **D_Fugitives** | T2/T3 | Area | 0,0% | 93,5% | 0,0% | 8,2% | 7,5% |
| | | Geoloc | 100,0% | 6,5% | 100,0% | 91,8% | 92,5% |
| **E_Solvents** | T1/T2 | Area | 100,0% | 96,9% | 100,0% | 100,0% | 100,0% |
| | | Geoloc | 0,0% | 3,1% | 0,0% | 0,0% | 0,0% |
| **F_RoadTransport** | T3 | Area | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% |
| | | Geoloc | 0,0% | 0,0% | 0,0% | 0,0% | 0,0% |
| **G_Shipping** | T2 | Area | 100,0% | 100,0% | 100,0% | - | 100,0% |
| | | Geoloc | 0,0% | 0,0% | 0,0% | - | 0,0% |
| **H_Aviation** | T3 | Area | 0,0% | 0,0% | 0,0% | - | 0,0% |
| | | Geoloc | 100,0% | 100,0% | 100,0% | - | 100,0% |
| **I_OffRoad** | T1 | Area | 99,8% | 100,0% | 100,0% | 100,0% | 100,0% |
| | | Geoloc | 0,2% | 0,0% | 0,0% | 0,0% | 0,0% |
| **J_Waste** | T2 | Area | 99,9% | 56,4% | 98,8% | 100,0% | 100,0% |
| | | Geoloc | 0,1% | 43,6% | 1,2% | 0,0% | 0,0% |
| **K_AgriLivestock** | T2 | Area | 100,0% | 99,8% | - | 99,9% | 99,9% |
| | | Geoloc | 0,0% | 0,2% | - | 0,1% | 0,1% |
| **L_AgriOther** | T2 | Area | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% |
| | | Geoloc | 0,0% | 0,0% | 0,0% | 0,0% | 0,0% |
| **TOTAL SOURCE PERCENTAGE** | | **Area** | **82,63%** | **94,31%** | **27,52%** | **99,74%** | 94,87% |
| | | **Geoloc** | **17,37%** | **5,69%** | **72,48%** | **0,26%** | 5,13% |

Every area source estimates in GNFR sectors except Road transport, are distributed according to land use maps elaborated by Spanish Inventory. Land use map elaboration is explained in next section 10.4.2. Road transport estimates distribution are explained in epigraph 10.4.4

## 10.4.2. Land use map

As advanced in the 2021 edition of the IIR, geo-location of emissions has been upgraded through a specific project that is being conducted by the Spanish inventory, with the aim to compile and analyse the available land-use cartography for Spain for 1970-2021 in order to implement IPCC advanced criteria for the whole time series (more information about the LULUCF cartographic project is available in https://www.miteco.gob.es/content/dam/miteco/es/calidad-y-evaluacion-ambiental/temas/sistema-espanol-de-inventario-sei-/metodologias-estimacion-emisiones/4_Intro_Proyecto_Cartografia_LULUCF.pdf). The sources of geographical data used in this analysis have been:

- Historical cartographies of land occupation (coverage and / or use) of Spain:
  - Maps of Crop and Land Use. Ministry of Agriculture, Fisheries and Food. 1980-1990, and 2000-2010 editions.
  - National Forest Map scale 1:50,000 (MFE50), 1996-2007; Change layer in the MFE snapshot, 2009, 2012, 2015, 2018, and 2021. Ministry for the Ecological Transition and the Demographic Challenge.
  - Common Agricultural Policy Geographic Information System (SIGPAC). Ministry of Agriculture, Fisheries and Food. 2009, 2012, 2015, 2018, and 2021.
  - CORINE Land Cover maps. National Geographic Institute. 1990, 2000, 2006, 2018, and 2021 editions.
- Urban Cadastre of Spain. General Directorate of Cadastre, Ministry of Finance and Provincial Council of Álava. 1970-2021.
- Cartography of water masses from the General Directorate of Water (MITECO) and Reference Geographical Information on Hydrography "IGR Hidrografía" from the National Geographic Institute (IGN).
- Road infrastructure of the National Topographic Base (BTN) of the IGN.
- Railway infrastructure of the IGN National Topographic Base (BTN).
- Highways shapefiles with AMD traffic density. (Ministry for Transport and Sustainable Mobility).
- Rocky areas obtained from the analysis carried out by remote sensing from SENTINEL and LANDSAT images.
- Information on peat bogs from the Geological and Mining Institute of Spain (IGME).

The harmonization and standardization of these cartographic data sources, developed for different purposes, has been one of the major challenges in the project development. Similarly, new data provided by the cartography project are being cross-checked with data currently used in the national inventory.

The result of this project will be a land-use cartography (LULUCF maps), with 25x25 m pixel size, for the years 1970, 1990, 2000, 2006, 2009, 2012, 2015, 2018, and 2021.

These maps consider 73 different land uses coded according to three digits number where the first digit responds to general use based on the following scheme:

**Table 10.4.2 Land Use group classification**

| First digit group | Land use category |
|---|---|
| 1 | Forest Land |
| 2 | Grassland |
| 4 | Other land |
| 5 | Wetlands |
| 7 | Cropland |
| 8 | Settlements |

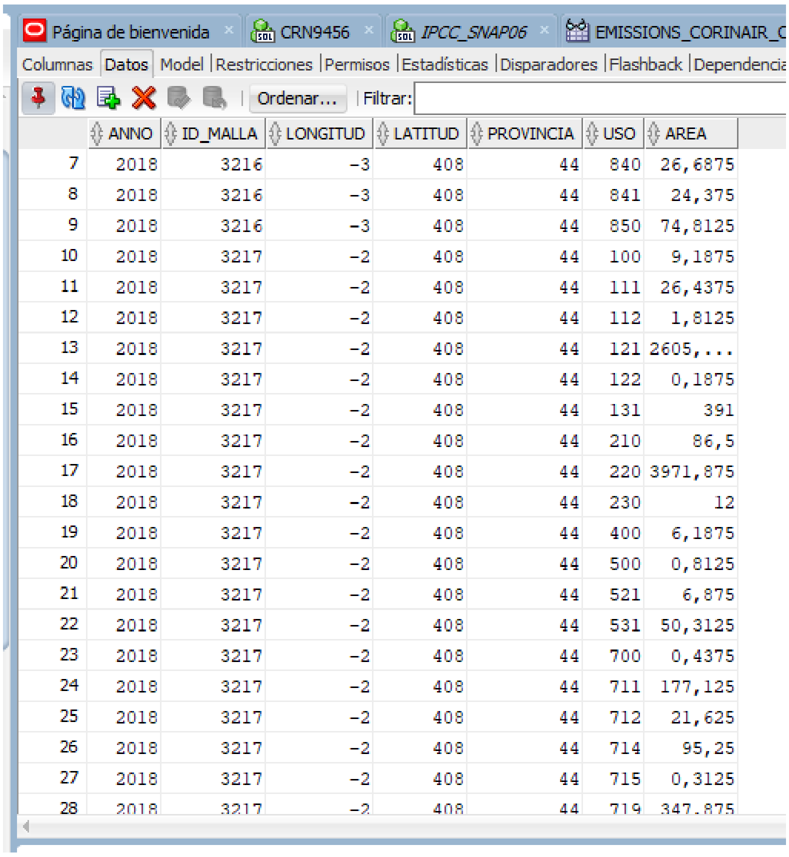
The second and third digit goes deeper into breakdown land uses. As an example, the group 8 disintegration is shown in the following table:

**Table 10.4.3 Group 8 classification**

<table>
<tr><th>Group</th><th colspan="2">Subcategory</th><th>Code</th></tr>
<tr><td rowspan="25">8<br>Settlement</td><td colspan="2">All developed land, including transportation infrastructure and human settlements of any size, unless included in other categories.</td><td>800</td></tr>
<tr><td>Residential units</td><td>Residential area</td><td>810</td></tr>
<tr><td rowspan="5">Industrial or commercial units</td><td>Industrial or commercial area</td><td>820</td></tr>
<tr><td>Industrial area</td><td>821</td></tr>
<tr><td>Commercial area</td><td>822</td></tr>
<tr><td>Wind turbine park</td><td>823</td></tr>
<tr><td>Solar panel park</td><td>824</td></tr>
<tr><td rowspan="4">Port areas and airports</td><td>Port areas and airports</td><td>830</td></tr>
<tr><td>Port areas</td><td>831</td></tr>
<tr><td>Airport</td><td>832</td></tr>
<tr><td>Other</td><td>839</td></tr>
<tr><td rowspan="4">Road and rail transport networks</td><td>Road and rail transport networks</td><td>840</td></tr>
<tr><td>Roads</td><td>841</td></tr>
<tr><td>Railroad tracks</td><td>842</td></tr>
<tr><td>Other</td><td>849</td></tr>
<tr><td>Mineral extraction sites</td><td>Mineral extraction sites</td><td>850</td></tr>
<tr><td>Dump sites</td><td>Dump sites</td><td>860</td></tr>
<tr><td>Construction sites</td><td>Construction sites</td><td>870</td></tr>
<tr><td rowspan="4">Vegetated areas</td><td>Land with vegetative cover, which is not considered within the Forest Land, Cropland or Grassland categories.</td><td>880</td></tr>
<tr><td>Wooded area</td><td>881</td></tr>
<tr><td>Bushy area</td><td>882</td></tr>
<tr><td>Herbaceous area</td><td>883</td></tr>
</table>

## 10.4.3. Land use map and area source emission interaction

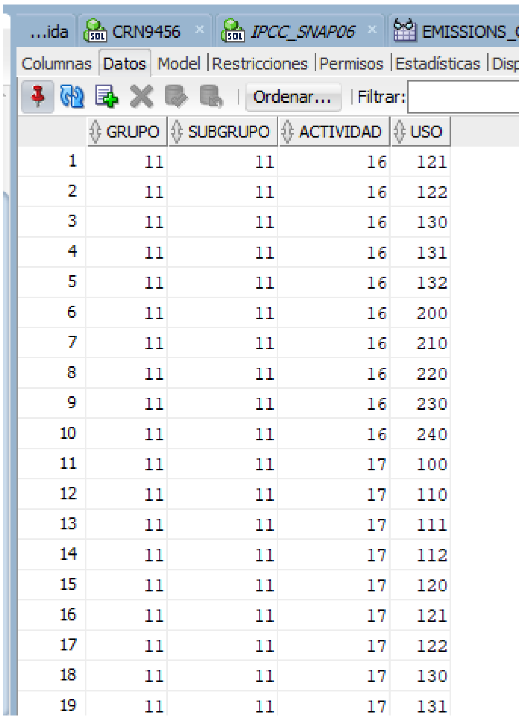
Once the LULUCF cartography has been obtained, it has been intersected with the EMEP grid, as well as with the layer of provinces of Spain (NUT3 level). The result is a georeferenced table with the surface area of each of land use activities considered in the Inventory (Figure 10.4.2).



| | ANNO | ID_MALLA | LONGITUD | LATITUD | PROVINCIA | USO | AREA |
|---|---|---|---|---|---|---|---|
| 7 | 2018 | 3216 | -3 | 408 | 44 | 840 | 26,6875 |
| 8 | 2018 | 3216 | -3 | 408 | 44 | 841 | 24,375 |
| 9 | 2018 | 3216 | -3 | 408 | 44 | 850 | 74,8125 |
| 10 | 2018 | 3217 | -2 | 408 | 44 | 100 | 9,1875 |
| 11 | 2018 | 3217 | -2 | 408 | 44 | 111 | 26,4375 |
| 12 | 2018 | 3217 | -2 | 408 | 44 | 112 | 1,8125 |
| 13 | 2018 | 3217 | -2 | 408 | 44 | 121 | 2605,... |
| 14 | 2018 | 3217 | -2 | 408 | 44 | 122 | 0,1875 |
| 15 | 2018 | 3217 | -2 | 408 | 44 | 131 | 391 |
| 16 | 2018 | 3217 | -2 | 408 | 44 | 210 | 86,5 |
| 17 | 2018 | 3217 | -2 | 408 | 44 | 220 | 3971,875 |
| 18 | 2018 | 3217 | -2 | 408 | 44 | 230 | 12 |
| 19 | 2018 | 3217 | -2 | 408 | 44 | 400 | 6,1875 |
| 20 | 2018 | 3217 | -2 | 408 | 44 | 500 | 0,8125 |
| 21 | 2018 | 3217 | -2 | 408 | 44 | 521 | 6,875 |
| 22 | 2018 | 3217 | -2 | 408 | 44 | 531 | 50,3125 |
| 23 | 2018 | 3217 | -2 | 408 | 44 | 700 | 0,4375 |
| 24 | 2018 | 3217 | -2 | 408 | 44 | 711 | 177,125 |
| 25 | 2018 | 3217 | -2 | 408 | 44 | 712 | 21,625 |
| 26 | 2018 | 3217 | -2 | 408 | 44 | 714 | 95,25 |
| 27 | 2018 | 3217 | -2 | 408 | 44 | 715 | 0,3125 |
| 28 | 2018 | 3217 | -2 | 408 | 44 | 719 | 347,875 |

**Figure 10.4.1 View of land use distribution table for each year, province and EMEP cell**

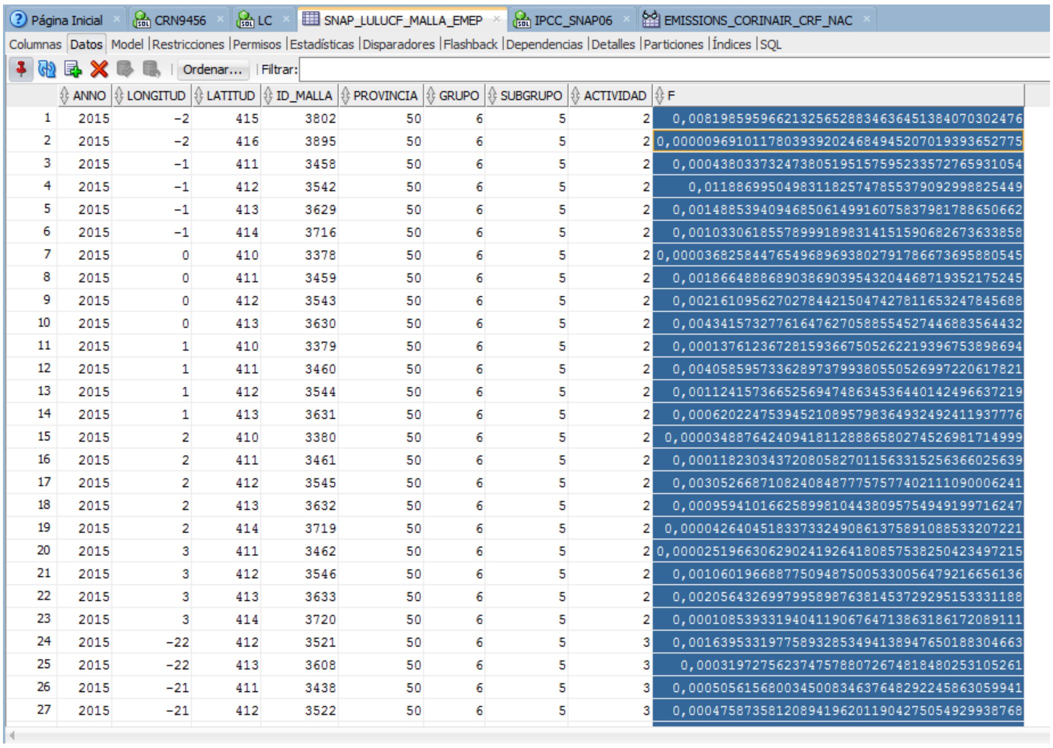
At the same time, a correlation between SNAP activities and the three digit land use codes has been established.



| | GRUPO | SUBGRUPO | ACTIVIDAD | USO |
|---|---|---|---|---|
| 1 | 11 | 11 | 16 | 121 |
| 2 | 11 | 11 | 16 | 122 |
| 3 | 11 | 11 | 16 | 130 |
| 4 | 11 | 11 | 16 | 131 |
| 5 | 11 | 11 | 16 | 132 |
| 6 | 11 | 11 | 16 | 200 |
| 7 | 11 | 11 | 16 | 210 |
| 8 | 11 | 11 | 16 | 220 |
| 9 | 11 | 11 | 16 | 230 |
| 10 | 11 | 11 | 16 | 240 |
| 11 | 11 | 11 | 17 | 100 |
| 12 | 11 | 11 | 17 | 110 |
| 13 | 11 | 11 | 17 | 111 |
| 14 | 11 | 11 | 17 | 112 |
| 15 | 11 | 11 | 17 | 120 |
| 16 | 11 | 11 | 17 | 121 |
| 17 | 11 | 11 | 17 | 122 |
| 18 | 11 | 11 | 17 | 130 |
| 19 | 11 | 11 | 17 | 131 |

**Figure 10.4.2 View of table to correlate SNAP and land use**

With this operation, it has been possible to obtain the percentage distribution of emissions for each SNAP activity and EMEP cell. Below is an image of the resulting table in Oracle software.



Página Inicial | CRN9456 | LC | SNAP_LULUCF_MALLA_EMEP | IPCC_SNAP06 | EMISSIONS_CORINAIR_CRF_NAC

Columnas | Datos | Model | Restricciones | Permisos | Estadísticas | Disparadores | Flashback | Dependencias | Detalles | Particiones | Índices | SQL

Ordenar... | Filtrar:

| | ANNO | LONGITUD | LATITUD | ID_MALLA | PROVINCIA | GRUPO | SUBGRUPO | ACTIVIDAD | F |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2015 | -2 | 415 | 3802 | 50 | 6 | 5 | 2 | 0,0081985959662132565288346364513840703O2476 |
| 2 | 2015 | -2 | 416 | 3895 | 50 | 6 | 5 | 2 | 0,00000969101178039392024684945207019393652775 |
| 3 | 2015 | -1 | 411 | 3458 | 50 | 6 | 5 | 2 | 0,000438033732473805195157595233572765931054 |
| 4 | 2015 | -1 | 412 | 3542 | 50 | 6 | 5 | 2 | 0,0118869950498311825747855379092998825449 |
| 5 | 2015 | -1 | 413 | 3629 | 50 | 6 | 5 | 2 | 0,001488539409468506149916075837981788650662 |
| 6 | 2015 | -1 | 414 | 3716 | 50 | 6 | 5 | 2 | 0,001033061855789991898314151590682673633858 |
| 7 | 2015 | 0 | 410 | 3378 | 50 | 6 | 5 | 2 | 0,00003682584476549689693802791786673695880545 |
| 8 | 2015 | 0 | 411 | 3459 | 50 | 6 | 5 | 2 | 0,001866488868903869039543204468719352175245 |
| 9 | 2015 | 0 | 412 | 3543 | 50 | 6 | 5 | 2 | 0,002161095627027844215047427811653247845688 |
| 10 | 2015 | 0 | 413 | 3630 | 50 | 6 | 5 | 2 | 0,004341573277616476270588554527446883564432 |
| 11 | 2015 | 1 | 410 | 3379 | 50 | 6 | 5 | 2 | 0,000137612367281593667505262219396753898694 |
| 12 | 2015 | 1 | 411 | 3460 | 50 | 6 | 5 | 2 | 0,004058595733628973799380550526997220617821 |
| 13 | 2015 | 1 | 412 | 3544 | 50 | 6 | 5 | 2 | 0,001124157366525694748634536440142496637219 |
| 14 | 2015 | 1 | 413 | 3631 | 50 | 6 | 5 | 2 | 0,000620224753945210895798364932492411937776 |
| 15 | 2015 | 2 | 410 | 3380 | 50 | 6 | 5 | 2 | 0,0000348876424094181128886580274526981714999 |
| 16 | 2015 | 2 | 411 | 3461 | 50 | 6 | 5 | 2 | 0,000118230343720805827011563315256366025639 |
| 17 | 2015 | 2 | 412 | 3545 | 50 | 6 | 5 | 2 | 0,003052668710824084877757577402111090006241 |
| 18 | 2015 | 2 | 413 | 3632 | 50 | 6 | 5 | 2 | 0,000959410166258998104438095754949199716247 |
| 19 | 2015 | 2 | 414 | 3719 | 50 | 6 | 5 | 2 | 0,0000426404518337332490861375891088533207221 |
| 20 | 2015 | 3 | 411 | 3462 | 50 | 6 | 5 | 2 | 0,00002519663062902419264180857538250423497215 |
| 21 | 2015 | 3 | 412 | 3546 | 50 | 6 | 5 | 2 | 0,001060196688775094875005330056479216656136 |
| 22 | 2015 | 3 | 413 | 3633 | 50 | 6 | 5 | 2 | 0,002056432699799589876381453729295153331188 |
| 23 | 2015 | 3 | 414 | 3720 | 50 | 6 | 5 | 2 | 0,000108539331940411906764713863186172089111 |
| 24 | 2015 | -22 | 412 | 3521 | 50 | 6 | 5 | 3 | 0,001639533197758932853494138947650188304663 |
| 25 | 2015 | -22 | 413 | 3608 | 50 | 6 | 5 | 3 | 0,00031972756237475788072674818480253105261 |
| 26 | 2015 | -21 | 411 | 3438 | 50 | 6 | 5 | 3 | 0,000505615680034500834637648292245863059941 |
| 27 | 2015 | -21 | 412 | 3522 | 50 | 6 | 5 | 3 | 0,000475873581208941962011904275054929938768 |

**Figure 10.4.3 View of emissions percentage distribution into EMEP grid**

In this table, F field represents the emission's percentage distribution applied to each EMEP cell, of the emissions of each SNAP activity by province for each of the years of LULUCF maps. Explained in another way, filtering by a year, a province and a SNAP, the sum of field F will be one.

The generation of the gridded emission report for each year within the 1990-2024 series is therefore based on this F distribution using the correspondent LULUCF map and the aggregation of SNAP into NFR codes. It follows that the report for 2024 emissions is based on the 2021 LULUCF map.

As an example, as recommended by the TERT in the 2025 NECD review[2], the grid distribution of emissions from the solvents group is shown. Each of the SNAPs that make up the solvents group has been assigned a land use type, all of them falling within categories 810, 820, 821, and 822, that is, residential, commercial, and industrial land uses (action reflected in Figure 10.4.2). It should be noted that the same SNAP can occur in several land types, as is often the case.

From this allocation, in each year and province, each SNAP belonging to the solvents category and each EMEP cell will be assigned a factor F (an action reflected in Figure 10.4.3). Furthermore, the Inventory distributes emissions at the provincial level according to allocation criteria based on available data. The main criterion is population per province, but in many cases, data on productive activity, number of employees in a defined sector, etc., have been used. It should be noted that each SNAP has its own individualized allocation criterion. The provincial emissions

[2] Final Review Report available in: https://www.ceip.at/status-of-reporting-and-review-results

distributed according to their respective criteria will be redistributed in a second stage at the EMEP cell level according to this F obtained from the land use criterion.

In summary, the grid distribution of area source emissions for any snap is based on two components: the provincial distribution of the total national amount established for each snap, and the SNAP activity per EMEP cell within each province.

#### 10.4.4. Road transport emissions mappping

Road transport emissions are the main contributor to the area source estimates in many pollutants so, the Inventory has made a specific mapping for this activity.

To elaborate this task, the interurban traffic intensities available and provided by the Dirección General de Tráfico (DGT). Also, urban areas with the representation of their population have been taken into account.

This cartography is the result of the fusion of three maps generated for each of the three driving patterns included in the inventory (interurban, rural and urban routes). For the generation of each map, the geographical distribution of the different types of roads and the distribution of urban centers have been taken into account and their respective emissions have been assigned. Subsequently, the emissions per unit of length or area have been estimated for each entity. In the specific case of the emission layer in the interurban driving pattern (highways), the traffic densities have been taken into account for this distribution of emissions per unit length. This operation has been carried out for several years of the series, using cartography as close as possible to the estimation year. Latest traffic and population data taken into analysis are from 2022 and 2023.

Finally, resulting shape files and the EMEP grid has been intersected, thus, it is possible to estimate road transport emissions per cell. The analysis results are incorporated to the gridded emissions report, thus completing emissions accuracy achieved with the geolocated point sources and the LULUCF maps methodology for the rest of activities.

## 10.5. Planned improvements

The aim is to gradually add livestock facilities to the reporting list as GeoPS. To do this, it is necessary to first verify that the data received individually from each facility is reliable and do not distort the overall livestock emissions data by area source.

Furthermore, to improve the spatial distribution of emissions from maritime transport, the aim is to expand the reference EMEP grid to include cells adjacent to the coastline. This will allow these cells to be included in the emission area, since the current concentration of emissions within the port is not considered to accurately reflect the pattern of such diffuse emissions as the transport ones are.

## 10.6. LPS reporting

The Spanish Inventory reports as LPS the point sources that exceed the thresholds established in Table 1 of the Guidelines for Reporting Emissions and Projections Data under the Convention on Long-range Transboundary Air Pollution (https://unece.org/sites/default/files/2025-05/ECE_EB.AIR_156_Add.3%20%28E%29.pdf), in 2024 accounting for 222 facilities. Besides those, the Inventory estimates emissions from other geolocated point sources that do not fall into the emission criteria to be reported as LPS, accounting for 513 additional facilities, with the aim of further improving the spatial distribution of emissions (gridded data).

# 11. ADJUSTMENTS

# CONTENTS

# 11. ADJUSTMENTS

Chapter updated in March, 2026.

## 11.1. Adjustment applications by Spain

Spain has not requested new adjustment applications in 2026 reporting edition.

# ANNEXES

# CONTENTS

# ANNEX 1. KEY CATEGORY ANALYSIS

Chapter updated in March, 2026.

All emissions in this annex take into account the entire national territory. For clarification purposes, key categories are shown in bold.

## A1.1. Analysis by level (2024)

### Main Pollutants

#### NOx

| NFR Code | NFR Category | Emissions (kt) | Level valuation | Accumulated total |
|---|---|---|---|---|
| **1A3b** | **Road transport** | **199.80** | **0.34** | **0.3395** |
| **1A2** | **Manufacturing industries and Construction** | **84.78** | **0.14** | **0.4836** |
| **3D** | **Crop production and agricultural soils** | **66.99** | **0.11** | **0.5974** |
| **1A1a** | **Public electricity and heat production** | **56.14** | **0.10** | **0.6928** |
| **1A4c** | **Agriculture/Forestry/Fishing** | **50.95** | **0.09** | **0.7794** |
| **1A3d** | **National navigation** | **41.39** | **0.07** | **0.8498** |
| **1A4a + 1A4b** | **Commercial/Institutional/Residential** | **25.95** | **0.04** | **0.8939** |
| **5C** | **Incineration** | **21.05** | **0.04** | **0.9296** |
| **1A3a** | **Aviation LTO (civil)** | **11.21** | **0.02** | **0.9487** |
| **1A1b** | **Petroleum refining** | **7.86** | **0.01** | **0.9620** |
| 3B | Manure management | 6.57 | 0.01 | 0.9732 |
| 1A3c + 1A3e + 1A5 | Other transport | 5.76 | 0.01 | 0.9830 |
| 1B | Fugitive emissions from fuels | 4.68 | 0.01 | 0.9909 |
| 1A1c | Manufacture of solid fuels and other energy industries | 1.84 | 0.00 | 0.9941 |
| 2G + 2H + 2I + 2J + 2K + 2L | Other products use and industrial processes | 1.72 | 0.00 | 0.9970 |
| 2C | Metal production | 1.09 | 0.00 | 0.9989 |
| 2B | Chemical industry | 0.49 | 0.00 | 0.9997 |
| 3F | Field burning of agricultural wastes | 0.13 | 0.00 | 0.9999 |
| 5A | Biological treatment of waste: Solid waste disposal on land | 0.02 | 0.00 | 1.0000 |

#### NMVOC

| NFR Code | NFR Category | Emissions (kt) | Level valuation | Accumulated total |
|---|---|---|---|---|
| **2D** | **Solvents use** | **215.07** | **0.43** | **0.4294** |
| **3B** | **Manure management** | **80.19** | **0.16** | **0.5895** |
| **3D** | **Crop production and agricultural soils** | **41.35** | **0.08** | **0.6720** |
| **1B** | **Fugitive emissions from fuels** | **32.82** | **0.07** | **0.7375** |
| **1A4a + 1A4b** | **Commercial/Institutional/Residential** | **28.62** | **0.06** | **0.7947** |
| **1A2** | **Manufacturing industries and Construction** | **26.34** | **0.05** | **0.8473** |
| **2G + 2H + 2I + 2J + 2K + 2L** | **Other products use and industrial processes** | **24.53** | **0.05** | **0.8962** |
| **1A3b** | **Road transport** | **15.21** | **0.03** | **0.9266** |

| NFR Code | NFR Category | Emissions (kt) | Level valuation | Accumulated total |
|---|---|---|---|---|
| **1A1a** | **Public electricity and heat production** | **10.15** | **0.02** | **0.9469** |
| **2B** | **Chemical industry** | **9.11** | **0.02** | **0.9651** |
| 1A4c | Agriculture/Forestry/Fishing | 4.63 | 0.01 | 0.9743 |
| 5A | Biological treatment of waste: Solid waste disposal on land | 4.35 | 0.01 | 0.9830 |
| 5C | Incineration | 4.19 | 0.01 | 0.9913 |
| 1A3d | National navigation | 1.74 | 0.00 | 0.9948 |
| 1A3a | Aviation LTO (civil) | 0.83 | 0.00 | 0.9965 |
| 2C | Metal production | 0.65 | 0.00 | 0.9977 |
| 1A1b | Petroleum refining | 0.42 | 0.00 | 0.9986 |
| 1A3c + 1A3e + 1A5 | Other transport | 0.32 | 0.00 | 0.9992 |
| 1A1c | Manufacture of solid fuels and other energy industries | 0.17 | 0.00 | 0.9996 |
| 5D | Wastewater handling | 0.10 | 0.00 | 0.9998 |
| 2A | Mineral products | 0.08 | 0.00 | 0.9999 |
| 3F | Field burning of agricultural wastes | 0.03 | 0.00 | 1.0000 |

## $SO_2$

| NFR Code | NFR Category | Emissions (kt) | Level valuation | Accumulated total |
|---|---|---|---|---|
| **1A2** | **Manufacturing industries and Construction** | **34.57** | **0.35** | **0.3545** |
| **1B** | **Fugitive emissions from fuels** | **20.49** | **0.21** | **0.5647** |
| **1A4a + 1A4b** | **Commercial/Institutional/Residential** | **12.29** | **0.13** | **0.6908** |
| **1A1a** | **Public electricity and heat production** | **8.70** | **0.09** | **0.7800** |
| **2C** | **Metal production** | **5.21** | **0.05** | **0.8334** |
| **1A3d** | **Nationnal navigation** | **4.87** | **0.05** | **0.8833** |
| **2G + 2H + 2I + 2J + 2K + 2L** | **Other products use and industrial processes** | **3.27** | **0.03** | **0.9168** |
| **2B** | **Chemical industry** | **2.81** | **0.03** | **0.9456** |
| **1A4c** | **Agriculture/Forestry/Fishing** | **1.34** | **0.01** | **0.9593** |
| 1A1b | Petroleum refining | 1.18 | 0.01 | 0.9714 |
| 5C | Incineration | 0.97 | 0.01 | 0.9813 |
| 1A1c | Manufacture of solid fuels and other energy industries | 0.68 | 0.01 | 0.9883 |
| 1A3a | Aviation LTO (civil) | 0.66 | 0.01 | 0.9951 |
| 1A3b | Road transport | 0.34 | 0.00 | 0.9986 |
| 1A3c + 1A3e + 1A5 | Other transport | 0.11 | 0.00 | 0.9997 |
| 3F | Field burning of agricultural wastes | 0.03 | 0.00 | 1.0000 |

### $NH_3$

| NFR Code | NFR Category | Emissions (kt) | Level valuation | Accumulated total |
|---|---|---|---|---|
| **3D** | **Crop production and agricultural soils** | **250.03** | **0.55** | **0.5518** |
| **3B** | **Manure management** | **190.53** | **0.42** | **0.9723** |
| 1A3b | Road transport | 3.53 | 0.01 | 0.9801 |
| 5B | Biological treatment of waste | 2.95 | 0.01 | 0.9866 |
| 1A2 | Manufacturing industries and Construction | 2.58 | 0.01 | 0.9923 |
| 1A1a | Public electricity and heat production | 1.64 | 0.00 | 0.9959 |
| 2B | Chemical industry | 0.84 | 0.00 | 0.9977 |
| 1A4a + 1A4b | Commercial/Institutional/Residential | 0.39 | 0.00 | 0.9986 |
| 2G + 2H + 2I + 2J + 2K + 2L | Other products use and industrial processes | 0.34 | 0.00 | 0.9994 |
| 3F | Field burning of agricultural wastes | 0.14 | 0.00 | 0.9997 |
| 2A | Mineral products | 0.12 | 0.00 | 0.9999 |
| 1A4c | Agriculture/Forestry/Fishing | 0.02 | 0.00 | 1.0000 |

## Particulate Matter

### $PM_{2.5}$

| NFR Code | NFR Category | Emissions (kt) | Level valuation | Accumulated total |
|---|---|---|---|---|
| **1A4a + 1A4b** | **Commercial/Institutional/Residential** | **28.53** | **0.31** | **0.3140** |
| **5C** | **Incineration** | **19.18** | **0.21** | **0.5250** |
| **1A2** | **Manufacturing industries and Construction** | **11.31** | **0.12** | **0.6495** |
| **1A3b** | **Road transport** | **10.69** | **0.12** | **0.7672** |
| **1A1a** | **Public electricity and heat production** | **3.00** | **0.03** | **0.8002** |
| **2G + 2H + 2I + 2J + 2K + 2L** | **Other products use and industrial processes** | **2.60** | **0.03** | **0.8288** |
| **2A** | **Mineral products** | **2.42** | **0.03** | **0.8554** |
| **2B** | **Chemical industry** | **2.14** | **0.02** | **0.8790** |
| **1A3d** | **National navigation** | **2.02** | **0.02** | **0.9013** |
| **1A4c** | **Agriculture/Forestry/Fishing** | **1.92** | **0.02** | **0.9224** |
| **3D** | **Crop production and agricultural soils** | **1.78** | **0.02** | **0.9419** |
| **3B** | **Manure management** | **1.75** | **0.02** | **0.9611** |
| 5E | Other waste | 1.51 | 0.02 | 0.9777 |
| 2C | Metal production | 1.10 | 0.01 | 0.9899 |
| 3F | Field burning of agricultural wastes | 0.31 | 0.00 | 0.9933 |
| 1B | Fugitive emissions from fuels | 0.17 | 0.00 | 0.9952 |
| 1A1b | Petroleum refining | 0.16 | 0.00 | 0.9969 |
| 1A3c + 1A3e + 1A5 | Other transport | 0.11 | 0.00 | 0.9982 |
| 1A3a | Aviation LTO (civil) | 0.08 | 0.00 | 0.9991 |
| 2D | Solvents use | 0.05 | 0.00 | 0.9996 |

| NFR Code | NFR Category | Emissions (kt) | Level valuation | Accumulated total |
|---|---|---|---|---|
| 1A1c | Manufacture of solid fuels and other energy industries | 0.02 | 0.00 | 0.9998 |
| 5A | Biological treatment of waste: Solid waste disposal on land | 0.01 | 0.00 | 0.9999 |
| 5D | Wastewater handling | 0.00 | 0.00 | 1.0000 |

## $PM_{10}$

| NFR Code | NFR Category | Emissions (kt) | Level valuation | Accumulated total |
|---|---|---|---|---|
| **3D** | **Crop production and agricultural soils** | **40.67** | **0.25** | **0.2471** |
| **1A4a + 1A4b** | **Commercial/Institutional/Residential** | **29.55** | **0.18** | **0.4266** |
| **5C** | **Incineration** | **20.35** | **0.12** | **0.5502** |
| **2A** | **Mineral products** | **15.51** | **0.09** | **0.6445** |
| **1A3b** | **Road transport** | **15.35** | **0.09** | **0.7378** |
| **1A2** | **Manufacturing industries and Construction** | **12.26** | **0.07** | **0.8122** |
| **3B** | **Manure management** | **12.05** | **0.07** | **0.8855** |
| **1A1a** | **Public electricity and heat production** | **3.79** | **0.02** | **0.9085** |
| **2G + 2H + 2I + 2J + 2K + 2L** | **Other products use and industrial processes** | **3.13** | **0.02** | **0.9275** |
| **2B** | **Chemical industry** | **2.90** | **0.02** | **0.9451** |
| **1A3d** | **National navigation** | **2.38** | **0.01** | **0.9596** |
| 1A4c | Agriculture/Forestry/Fishing | 1.96 | 0.01 | 0.9715 |
| 5E | Other waste | 1.51 | 0.01 | 0.9806 |
| 2C | Metal production | 1.48 | 0.01 | 0.9896 |
| 2D | Solvents use | 0.62 | 0.00 | 0.9934 |
| 1B | Fugitive emissions from fuels | 0.35 | 0.00 | 0.9955 |
| 3F | Field burning of agricultural wastes | 0.33 | 0.00 | 0.9975 |
| 1A1b | Petroleum refining | 0.17 | 0.00 | 0.9985 |
| 1A3c + 1A3e + 1A5 | Other transport | 0.12 | 0.00 | 0.9993 |
| 1A3a | Aviation LTO (civil) | 0.08 | 0.00 | 0.9997 |
| 1A1c | Manufacture of solid fuels and other energy industries | 0.02 | 0.00 | 0.9999 |
| 5A | Biological treatment of waste: Solid waste disposal on land | 0.01 | 0.00 | 1.0000 |

## TSP

| NFR Code | NFR Category | Emissions (kt) | Level valuation | Accumulated total |
|---|---|---|---|---|
| **3B** | **Manure management** | **51.44** | **0.20** | **0.2028** |
| **2A** | **Mineral products** | **48.40** | **0.19** | **0.3937** |
| **3D** | **Crop production and agricultural soils** | **40.67** | **0.16** | **0.5541** |
| **1A4a + 1A4b** | **Commercial/Institutional/Residential** | **31.27** | **0.12** | **0.6774** |
| **1A3b** | **Road transport** | **21.74** | **0.09** | **0.7631** |
| **5C** | **Incineration** | **20.83** | **0.08** | **0.8452** |
| **1A2** | **Manufacturing industries and Construction** | **14.45** | **0.06** | **0.9022** |

| NFR Code | NFR Category | Emissions (kt) | Level valuation | Accumulated total |
|---|---|---|---|---|
| **1A1a** | **Public electricity and heat production** | **5.27** | **0.02** | **0.9230** |
| **2G + 2H + 2I + 2J + 2K + 2L** | **Other products use and industrial processes** | **4.11** | **0.02** | **0.9392** |
| **2B** | **Chemical industry** | **3.67** | **0.01** | **0.9537** |
| 2C | Metal production | 3.22 | 0.01 | 0.9664 |
| 1A3d | National navigation | 2.38 | 0.01 | 0.9758 |
| 1A4c | Agriculture/Forestry/Fishing | 1.97 | 0.01 | 0.9836 |
| 5E | Other waste | 1.51 | 0.01 | 0.9895 |
| 2D | Solvents use | 1.26 | 0.00 | 0.9945 |
| 1B | Fugitive emissions from fuels | 0.64 | 0.00 | 0.9970 |
| 3F | Field burning of agricultural wastes | 0.34 | 0.00 | 0.9983 |
| 1A1b | Petroleum refining | 0.17 | 0.00 | 0.9990 |
| 1A3c + 1A3e + 1A5 | Other transport | 0.13 | 0.00 | 0.9995 |
| 1A3a | Aviation LTO (civil) | 0.08 | 0.00 | 0.9998 |
| 1A1c | Manufacture of solid fuels and other energy industries | 0.02 | 0.00 | 0.9999 |
| 5A | Biological treatment of waste: Solid waste disposal on land | 0.02 | 0.00 | 1.0000 |

## BC

| NFR Code | NFR Category | Emissions (kt) | Level valuation | Accumulated total |
|---|---|---|---|---|
| **5C** | **Incineration** | **10.71** | **0.45** | **0.4469** |
| **1A3b** | **Road transport** | **4.44** | **0.19** | **0.6322** |
| **1A4a + 1A4b** | **Commercial/Institutional/Residential** | **3.62** | **0.15** | **0.7833** |
| **1A2** | **Manufacturing industries and Construction** | **3.04** | **0.13** | **0.9101** |
| **1A4c** | **Agriculture/Forestry/Fishing** | **1.06** | **0.04** | **0.9542** |
| 2G + 2H + 2I + 2J + 2K + 2L | Other products use and industrial processes | 0.68 | 0.03 | 0.9826 |
| 1A1a | Public electricity and heat production | 0.13 | 0.01 | 0.9880 |
| 1A3c + 1A3e + 1A5 | Other transport | 0.05 | 0.00 | 0.9903 |
| 1A3d | National navigation | 0.05 | 0.00 | 0.9925 |
| 2B | Chemical industry | 0.04 | 0.00 | 0.9942 |
| 1A3a | Aviation LTO (civil) | 0.04 | 0.00 | 0.9958 |
| 2C | Metal production | 0.03 | 0.00 | 0.9971 |
| 3F | Field burning of agricultural wastes | 0.03 | 0.00 | 0.9983 |
| 1A1b | Petroleum refining | 0.03 | 0.00 | 0.9994 |
| 1A1c | Manufacture of solid fuels and other energy industries | 0.01 | 0.00 | 0.9997 |
| 1B | Fugitive emissions from fuels | 0.00 | 0.00 | 0.9998 |
| 2D | Solvents use | 0.00 | 0.00 | 0.9999 |
| 2A | Mineral products | 0.00 | 0.00 | 1.0000 |

## CO and Priority Heavy Metals

### CO

| NFR Code | NFR Category | Emissions (kt) | Level valuation | Accumulated total |
|---|---|---|---|---|
| **5C** | **Incineration** | **262.26** | **0.27** | **0.2681** |
| **1A4a + 1A4b** | **Commercial/Institutional/Residential** | **211.94** | **0.22** | **0.4848** |
| **1A2** | **Manufacturing industries and Construction** | **173.31** | **0.18** | **0.6620** |
| **1A3b** | **Road transport** | **150.93** | **0.15** | **0.8164** |
| **2C** | **Metal production** | **74.65** | **0.08** | **0.8927** |
| **1A1a** | **Public electricity and heat production** | **39.81** | **0.04** | **0.9334** |
| **1A4c** | **Agriculture/Forestry/Fishing** | **22.04** | **0.02** | **0.9559** |
| 2G + 2H + 2I + 2J + 2K + 2L | Other products use and industrial processes | 11.96 | 0.01 | 0.9681 |
| 2B | Chemical industry | 10.06 | 0.01 | 0.9784 |
| 1A3a | Aviation LTO (civil) | 7.31 | 0.01 | 0.9859 |
| 3F | Field burning of agricultural wastes | 3.85 | 0.00 | 0.9898 |
| 1A3d | National navigation | 3.70 | 0.00 | 0.9936 |
| 1B | Fugitive emissions from fuels | 2.04 | 0.00 | 0.9957 |
| 1A1b | Petroleum refining | 1.71 | 0.00 | 0.9975 |
| 1A3c + 1A3e + 1A5 | Other transport | 0.97 | 0.00 | 0.9984 |
| 1A1c | Manufacture of solid fuels and other energy industries | 0.72 | 0.00 | 0.9992 |
| 5A | Biological treatment of waste: Solid waste disposal on land | 0.45 | 0.00 | 0.9996 |
| 5D | Wastewater handling | 0.18 | 0.00 | 0.9998 |
| 5B | Biological treatment of waste | 0.16 | 0.00 | 1.0000 |

### Pb

| NFR Code | NFR Category | Emissions (t) | Level valuation | Accumulated total |
|---|---|---|---|---|
| **1A3b** | **Road transport** | **38.58** | **0.40** | **0.4009** |
| **2C** | **Metal production** | **31.23** | **0.32** | **0.7255** |
| **1A2** | **Manufacturing industries and Construction** | **9.76** | **0.10** | **0.8269** |
| **2A** | **Mineral products** | **8.59** | **0.09** | **0.9162** |
| **5C** | **Incineration** | **2.87** | **0.03** | **0.9460** |
| **1A4a + 1A4b** | **Commercial/Institutional/Residential** | **2.74** | **0.03** | **0.9744** |
| 1A1a | Public electricity and heat production | 1.14 | 0.01 | 0.9862 |
| 1B | Fugitive emissions from fuels | 0.47 | 0.00 | 0.9911 |
| 1A3a | Aviation LTO (civil) | 0.35 | 0.00 | 0.9948 |
| 1A1b | Petroleum refining | 0.19 | 0.00 | 0.9968 |
| 1A3d | National navigation | 0.14 | 0.00 | 0.9983 |
| 1A4c | Agriculture/Forestry/Fishing | 0.12 | 0.00 | 0.9995 |
| 1A3c + 1A3e + 1A5 | Other transport | 0.03 | 0.00 | 0.9998 |

| NFR Code | NFR Category | Emissions (t) | Level valuation | Accumulated total |
|---|---|---|---|---|
| 3F | Field burning of agricultural wastes | 0.01 | 0.00 | 0.9999 |
| 5E | Other waste | 0.00 | 0.00 | 0.9999 |
| 2G + 2H + 2I + 2J + 2K + 2L | Other products use and industrial processes | 0.00 | 0.00 | 1.0000 |

## Cd

| NFR Code | NFR Category | Emissions (t) | Level valuation | Accumulated total |
|---|---|---|---|---|
| **2C** | **Metal production** | **1.30** | **0.22** | **0.2167** |
| **1A2** | **Manufacturing industries and Construction** | **1.16** | **0.19** | **0.4097** |
| **1A4a + 1A4b** | **Commercial/Institutional/Residential** | **1.03** | **0.17** | **0.5818** |
| **1A1a** | **Public electricity and heat production** | **0.84** | **0.14** | **0.7214** |
| **2A** | **Mineral products** | **0.37** | **0.06** | **0.7825** |
| **1A3b** | **Road transport** | **0.31** | **0.05** | **0.8336** |
| **5C** | **Incineration** | **0.30** | **0.05** | **0.8837** |
| **2G + 2H + 2I + 2J + 2K + 2L** | **Other products use and industrial processes** | **0.29** | **0.05** | **0.9325** |
| **1A1b** | **Petroleum refining** | **0.26** | **0.04** | **0.9755** |
| 1A4c | Agriculture/Forestry/Fishing | 0.06 | 0.01 | 0.9862 |
| 3F | Field burning of agricultural wastes | 0.05 | 0.01 | 0.9947 |
| 1A3d | National navigation | 0.01 | 0.00 | 0.9969 |
| 1B | Fugitive emissions from fuels | 0.01 | 0.00 | 0.9983 |
| 5E | Other waste | 0.01 | 0.00 | 0.9998 |
| 1A3c + 1A3e + 1A5 | Other transport | 0.00 | 0.00 | 0.9999 |
| 1A1c | Manufacture of solid fuels and other energy industries | 0.00 | 0.00 | 1.0000 |

## Hg

| NFR Code | NFR Category | Emissions (t) | Level valuation | Accumulated total |
|---|---|---|---|---|
| **2C** | **Metal production** | **1.02** | **0.33** | **0.3318** |
| **1A1a** | **Public electricity and heat production** | **0.78** | **0.25** | **0.5850** |
| **1A2** | **Manufacturing industries and Construction** | **0.46** | **0.15** | **0.7360** |
| **5C** | **Incineration** | **0.31** | **0.10** | **0.8374** |
| **1A3b** | **Road transport** | **0.17** | **0.05** | **0.8922** |
| **2D** | **Solvents use** | **0.11** | **0.04** | **0.9289** |
| **1A4a + 1A4b** | **Commercial/Institutional/Residential** | **0.10** | **0.03** | **0.9604** |
| 1A1b | Petroleum refining | 0.05 | 0.02 | 0.9761 |
| 1A3d | National navigation | 0.02 | 0.01 | 0.9838 |
| 1B | Fugitive emissions from fuels | 0.02 | 0.00 | 0.9887 |
| 1A4c | Agriculture/Forestry/Fishing | 0.01 | 0.00 | 0.9924 |
| 5E | Other waste | 0.01 | 0.00 | 0.9952 |

| NFR Code | NFR Category | Emissions (t) | Level valuation | Accumulated total |
|---|---|---|---|---|
| 3F | Field burning of agricultural wastes | 0.01 | 0.00 | 0.9978 |
| 2A | Mineral products | 0.00 | 0.00 | 0.9986 |
| 1A3a | Aviation LTO (civil) | 0.00 | 0.00 | 0.9992 |
| 1A3c + 1A3e + 1A5 | Other transport | 0.00 | 0.00 | 0.9996 |
| 1A1c | Manufacture of solid fuels and other energy industries | 0.00 | 0.00 | 1.0000 |

## POPs

### PCDD/PCDF

| NFR Code | NFR Category | Emissions (g) | Level valuation | Accumulated total |
|---|---|---|---|---|
| **2C** | **Metal production** | **57.57** | **0.34** | **0.3368** |
| **5C** | **Incineration** | **42.87** | **0.25** | **0.5876** |
| **1A4a + 1A4b** | **Commercial/Institutional/Residential** | **30.35** | **0.18** | **0.7652** |
| **5E** | **Other waste** | **15.67** | **0.09** | **0.8569** |
| **1A2** | **Manufacturing industries and Construction** | **10.06** | **0.06** | **0.9157** |
| **1A3b** | **Road transport** | **7.65** | **0.04** | **0.9605** |
| 1B | Fugitive emissions from fuels | 3.72 | 0.02 | 0.9822 |
| 1A1a | Public electricity and heat production | 1.34 | 0.01 | 0.9901 |
| 1A1c | Manufacture of solid fuels and other energy industries | 0.99 | 0.01 | 0.9959 |
| 1A4c | Agriculture/Forestry/Fishing | 0.37 | 0.00 | 0.9981 |
| 1A3d | National navigation | 0.25 | 0.00 | 0.9995 |
| 3F | Field burning of agricultural wastes | 0.03 | 0.00 | 0.9997 |
| 1A1b | Petroleum refining | 0.02 | 0.00 | 0.9998 |
| 1A3c + 1A3e + 1A5 | Other transport | 0.02 | 0.00 | 1.0000 |

### PAHs

| NFR Code | NFR Category | Emissions (t) | Level valuation | Accumulated total |
|---|---|---|---|---|
| **1A4a + 1A4b** | **Commercial/Institutional/Residential** | **15.28** | **0.45** | **0.4520** |
| **2C** | **Metal production** | **12.56** | **0.37** | **0.8235** |
| **1A2** | **Manufacturing industries and Construction** | **2.56** | **0.08** | **0.8991** |
| **1A3b** | **Road transport** | **1.18** | **0.04** | **0.9341** |
| **1A1a** | **Public electricity and heat production** | **0.84** | **0.02** | **0.9589** |
| 1B | Fugitive emissions from fuels | 0.66 | 0.02 | 0.9783 |
| 1A4c | Agriculture/Forestry/Fishing | 0.35 | 0.01 | 0.9888 |
| 5C | Incineration | 0.17 | 0.00 | 0.9937 |
| 3F | Field burning of agricultural wastes | 0.13 | 0.00 | 0.9977 |
| 1A3d | National navigation | 0.04 | 0.00 | 0.9987 |

| NFR Code | NFR Category | Emissions (t) | Level valuation | Accumulated total |
|---|---|---|---|---|
| 1A1c | Manufacture of solid fuels and other energy industries | 0.01 | 0.00 | 0.9992 |
| 2G + 2H + 2I + 2J + 2K + 2L | Other products use and industrial processes | 0.01 | 0.00 | 0.9995 |
| 1A3c + 1A3e + 1A5 | Other transport | 0.01 | 0.00 | 0.9998 |
| 1A3a | Aviation LTO (civil) | 0.01 | 0.00 | 1.0000 |

## HCB

| NFR Code | NFR Category | Emissions (kg) | Level valuation | Accumulated total |
|---|---|---|---|---|
| **1A2** | **Manufacturing industries and Construction** | **0.60** | **0.31** | **0.3063** |
| **1A1a** | **Public electricity and heat production** | **0.52** | **0.26** | **0.5703** |
| **1A4a + 1A4b** | **Commercial/Institutional/Residential** | **0.40** | **0.20** | **0.7736** |
| **5C** | **Incineration** | **0.14** | **0.07** | **0.8436** |
| **2C** | **Metal production** | **0.13** | **0.06** | **0.9081** |
| **1A3d** | **National navigation** | **0.10** | **0.05** | **0.9568** |
| 3D | Crop production and agricultural soils | 0.05 | 0.02 | 0.9803 |
| 1A4c | Agriculture/Forestry/Fishing | 0.04 | 0.02 | 0.9988 |
| 1A3c + 1A3e + 1A5 | Other transport | 0.00 | 0.00 | 0.9999 |
| 1A1c | Manufacture of solid fuels and other energy industries | 0.00 | 0.00 | 1.0000 |

## PCBs

| NFR Code | NFR Category | Emissions (kg) | Level valuation | Accumulated total |
|---|---|---|---|---|
| **2G + 2H + 2I + 2J + 2K + 2L** | **Other products use and industrial processes** | **69.14** | **0.75** | **0.7483** |
| **2C** | **Metal production** | **20.66** | **0.22** | **0.9719** |
| 1A3b | Road transport | 1.55 | 0.02 | 0.9887 |
| 5C | Incineration | 0.32 | 0.00 | 0.9922 |
| 1A4a + 1A4b | Commercial/Institutional/Residential | 0.29 | 0.00 | 0.9954 |
| 1A3d | National navigation | 0.24 | 0.00 | 0.9979 |
| 1A2 | Manufacturing industries and Construction | 0.13 | 0.00 | 0.9993 |
| 1A1a | Public electricity and heat production | 0.05 | 0.00 | 0.9998 |
| 1A4c | Agriculture/Forestry/Fishing | 0.02 | 0.00 | 1.0000 |

# A1.2. Analysis by trend (2024)

## Main Pollutants

### NOx

| NFR Code | NFR Category | Emissions (kt) 1990 | Emissions (kt) 2024 | Rating trend | Contribution to the trend | Accumulated total |
|---|---|---|---|---|---|---|
| **1A3b** | **Road transport** | **543.54** | **199.80** | **0.46** | **0.44** | **0.4411** |
| **1A1a** | **Public electricity and heat production** | **216.03** | **56.14** | **0.21** | **0.21** | **0.6463** |
| **1A2** | **Manufacturing industries and Construction** | **190.05** | **84.78** | **0.14** | **0.14** | **0.7813** |
| **1A3d** | **National navigation** | **96.19** | **41.39** | **0.07** | **0.07** | **0.8517** |
| **1A4c** | **Agriculture/Forestry/Fishing** | **89.66** | **50.95** | **0.05** | **0.05** | **0.9013** |
| **3F** | **Field burning of agricultural wastes** | **27.50** | **0.13** | **0.04** | **0.04** | **0.9364** |
| **1A1b** | **Petroleum refining** | **20.70** | **7.86** | **0.02** | **0.02** | **0.9529** |
| 1A3a | Aviation LTO (civil) | 3.31 | 11.21 | 0.01 | 0.01 | 0.9631 |
| 2B | Chemical industry | 7.92 | 0.49 | 0.01 | 0.01 | 0.9726 |
| 1A3c + 1A3e + 1A5 | Other transport | 10.63 | 5.76 | 0.01 | 0.01 | 0.9788 |
| 1A1c | Manufacture of solid fuels and other energy industries | 6.23 | 1.84 | 0.01 | 0.01 | 0.9845 |
| 1A4a + 1A4b | Commercial/Institutional/Residential | 22.24 | 25.95 | 0.00 | 0.00 | 0.9892 |
| 3D | Crop production and agricultural soils | 70.57 | 66.99 | 0.00 | 0.00 | 0.9938 |
| 1B | Fugitive emissions from fuels | 6.59 | 4.68 | 0.00 | 0.00 | 0.9963 |
| 5C | Incineration | 22.54 | 21.05 | 0.00 | 0.00 | 0.9982 |
| 3B | Manure management | 5.77 | 6.57 | 0.00 | 0.00 | 0.9992 |
| 2G + 2H + 2I + 2J + 2K + 2L | Other products use and industrial processes | 1.39 | 1.72 | 0.00 | 0.00 | 0.9996 |
| 2C | Metal production | 1.35 | 1.09 | 0.00 | 0.00 | 1.0000 |

### NMVOC

| NFR Code | NFR Category | Emissions (kt) 1990 | Emissions (kt) 2024 | Rating trend | Contribution to the trend | Accumulated total |
|---|---|---|---|---|---|---|
| **1A3b** | **Road transport** | **334.41** | **15.21** | **0.59** | **0.52** | **0.5169** |
| **2D** | **Solvents use** | **373.15** | **215.07** | **0.29** | **0.26** | **0.7729** |
| **3F** | **Field burning of agricultural wastes** | **49.12** | **0.03** | **0.09** | **0.08** | **0.8525** |
| **1B** | **Fugitive emissions from fuels** | **53.12** | **32.82** | **0.04** | **0.03** | **0.8853** |
| **1A4a + 1A4b** | **Commercial/Institutional/Residential** | **44.78** | **28.62** | **0.03** | **0.03** | **0.9115** |
| **3B** | **Manure management** | **67.44** | **80.19** | **0.02** | **0.02** | **0.9321** |
| **1A1a** | **Public electricity and heat production** | **0.88** | **10.15** | **0.02** | **0.02** | **0.9472** |
| **3D** | **Crop production and agricultural soils** | **33.23** | **41.35** | **0.02** | **0.01** | **0.9603** |
| 1A4c | Agriculture/Forestry/Fishing | 10.04 | 4.63 | 0.01 | 0.01 | 0.9691 |
| 1A2 | Manufacturing industries and Construction | 30.77 | 26.34 | 0.01 | 0.01 | 0.9762 |
| 2B | Chemical industry | 6.07 | 9.11 | 0.01 | 0.00 | 0.9812 |
| 2G + 2H + 2I + 2J + 2K + 2L | Other products use and industrial processes | 22.14 | 24.53 | 0.00 | 0.00 | 0.9850 |
| 5C | Incineration | 6.50 | 4.19 | 0.00 | 0.00 | 0.9888 |
| 5A | Biological treatment of waste: Solid waste disposal on land | 2.34 | 4.35 | 0.00 | 0.00 | 0.9920 |

| NFR Code | NFR Category | Emissions (kt) 1990 | Emissions (kt) 2024 | Rating trend | Contribution to the trend | Accumulated total |
|---|---|---|---|---|---|---|
| 1A3d | National navigation | 3.21 | 1.74 | 0.00 | 0.00 | 0.9944 |
| 5E | Other waste | 1.21 | 0.02 | 0.00 | 0.00 | 0.9963 |
| 2C | Metal production | 1.42 | 0.65 | 0.00 | 0.00 | 0.9976 |
| 1A3a | Aviation LTO (civil) | 0.30 | 0.83 | 0.00 | 0.00 | 0.9984 |
| 1A3c + 1A3e + 1A5 | Other transport | 0.77 | 0.32 | 0.00 | 0.00 | 0.9992 |
| 1A1c | Manufacture of solid fuels and other energy industries | 0.51 | 0.17 | 0.00 | 0.00 | 0.9997 |
| 5D | Wastewater handling | 0.02 | 0.10 | 0.00 | 0.00 | 0.9998 |
| 2A | Mineral products | 0.02 | 0.08 | 0.00 | 0.00 | 0.9999 |
| 1A1b | Petroleum refining | 0.38 | 0.42 | 0.00 | 0.00 | 1.0000 |

## $SO_2$

| NFR Code | NFR Category | Emissions (kt) 1990 | Emissions (kt) 2024 | Rating trend | Contribution to the trend | Accumulated total |
|---|---|---|---|---|---|---|
| **1A1a** | **Public electricity and heat production** | **1,459.05** | **8.70** | **0.72** | **0.72** | **0.7151** |
| **1A2** | **Manufacturing industries and Construction** | **281.41** | **34.57** | **0.12** | **0.12** | **0.8368** |
| **1A1b** | **Petroleum refining** | **134.37** | **1.18** | **0.07** | **0.07** | **0.9025** |
| **1A3b** | **Road transport** | **67.35** | **0.34** | **0.03** | **0.03** | **0.9355** |
| **1B** | **Fugitive emissions from fuels** | **64.66** | **20.49** | **0.02** | **0.02** | **0.9573** |
| 1A3d | National navigation | 43.44 | 4.87 | 0.02 | 0.02 | 0.9763 |
| 1A4a + 1A4b | Commercial/Institutional/Residential | 25.04 | 12.29 | 0.01 | 0.01 | 0.9826 |
| 1A4c | Agriculture/Forestry/Fishing | 11.60 | 1.34 | 0.01 | 0.01 | 0.9877 |
| 1A1c | Manufacture of solid fuels and other energy industries | 10.93 | 0.68 | 0.01 | 0.01 | 0.9927 |
| 2B | Chemical industry | 9.95 | 2.81 | 0.00 | 0.00 | 0.9962 |
| 3F | Field burning of agricultural wastes | 4.07 | 0.03 | 0.00 | 0.00 | 0.9982 |
| 1A3c + 1A3e + 1A5 | Other transport | 1.11 | 0.11 | 0.00 | 0.00 | 0.9987 |
| 2G + 2H + 2I + 2J + 2K + 2L | Other products use and industrial processes | 2.35 | 3.27 | 0.00 | 0.00 | 0.9992 |
| 2C | Metal production | 6.05 | 5.21 | 0.00 | 0.00 | 0.9996 |
| 1A3a | Aviation LTO (civil) | 0.22 | 0.66 | 0.00 | 0.00 | 0.9998 |
| 5C | Incineration | 1.36 | 0.97 | 0.00 | 0.00 | 1.0000 |

## $NH_3$

| NFR Code | NFR Category | Emissions (kt) 1990 | Emissions (kt) 2024 | Rating trend | Contribution to the trend | Accumulated total |
|---|---|---|---|---|---|---|
| **3D** | **Crop production and agricultural soils** | **293.55** | **250.03** | **0.53** | **0.44** | **0.4449** |
| **3F** | **Field burning of agricultural wastes** | **28.11** | **0.14** | **0.34** | **0.29** | **0.7309** |
| **3B** | **Manure management** | **206.07** | **190.53** | **0.19** | **0.16** | **0.8898** |
| **1A3b** | **Road transport** | **0.35** | **3.53** | **0.04** | **0.03** | **0.9223** |
| **5B** | **Biological treatment of waste** | **0.29** | **2.95** | **0.03** | **0.03** | **0.9496** |
| **2B** | **Chemical industry** | **2.92** | **0.84** | **0.03** | **0.02** | **0.9708** |
| 1A1a | Public electricity and heat production | 0.00 | 1.64 | 0.02 | 0.02 | 0.9876 |
| 1A2 | Manufacturing industries and Construction | 2.13 | 2.58 | 0.01 | 0.00 | 0.9922 |

| NFR Code | NFR Category | Emissions (kt) 1990 | Emissions (kt) 2024 | Rating trend | Contribution to the trend | Accumulated total |
|---|---|---|---|---|---|---|
| 1A4a + 1A4b | Commercial/Institutional/Residential | 0.66 | 0.39 | 0.00 | 0.00 | 0.9949 |
| 2G + 2H + 2I + 2J + 2K + 2L | Other products use and industrial processes | 0.15 | 0.34 | 0.00 | 0.00 | 0.9969 |
| 5E | Other waste | 0.15 | 0.00 | 0.00 | 0.00 | 0.9984 |
| 1A1c | Manufacture of solid fuels and other energy industries | 0.08 | 0.00 | 0.00 | 0.00 | 0.9992 |
| 2A | Mineral products | 0.06 | 0.12 | 0.00 | 0.00 | 0.9998 |
| 1A4c | Agriculture/Forestry/Fishing | 0.01 | 0.02 | 0.00 | 0.00 | 0.9999 |
| 1B | Fugitive emissions from fuels | 0.02 | 0.01 | 0.00 | 0.00 | 1.0000 |

## Particulate Matter

### $PM_{2.5}$

| NFR Code | NFR Category | Emissions (kt) 2000 | Emissions (kt) 2024 | Rating trend | Contribution to the trend | Accumulated total |
|---|---|---|---|---|---|---|
| **1A4a + 1A4b** | **Commercial/Institutional/Residential** | **52.80** | **28.53** | **0.28** | **0.27** | **0.2699** |
| **3F** | **Field burning of agricultural wastes** | **21.42** | **0.31** | **0.24** | **0.23** | **0.5046** |
| **1A3b** | **Road transport** | **27.35** | **10.69** | **0.19** | **0.19** | **0.6898** |
| **1A1a** | **Public electricity and heat production** | **10.48** | **3.00** | **0.09** | **0.08** | **0.7730** |
| **5C** | **Incineration** | **23.97** | **19.18** | **0.06** | **0.05** | **0.8263** |
| **1A2** | **Manufacturing industries and Construction** | **15.70** | **11.31** | **0.05** | **0.05** | **0.8751** |
| **1A4c** | **Agriculture/Forestry/Fishing** | **5.11** | **1.92** | **0.04** | **0.04** | **0.9107** |
| **2A** | **Mineral products** | **5.22** | **2.42** | **0.03** | **0.03** | **0.9419** |
| **2G + 2H + 2I + 2J + 2K + 2L** | **Other products use and industrial processes** | **1.16** | **2.60** | **0.02** | **0.02** | **0.9579** |
| 1A1b | Petroleum refining | 1.19 | 0.16 | 0.01 | 0.01 | 0.9694 |
| 2C | Metal production | 1.88 | 1.10 | 0.01 | 0.01 | 0.9780 |
| 5E | Other waste | 1.96 | 1.51 | 0.01 | 0.01 | 0.9830 |
| 3D | Crop production and agricultural soils | 2.12 | 1.78 | 0.00 | 0.00 | 0.9868 |
| 1B | Fugitive emissions from fuels | 0.48 | 0.17 | 0.00 | 0.00 | 0.9903 |
| 1A3d | National navigation | 1.80 | 2.02 | 0.00 | 0.00 | 0.9927 |
| 3B | Manure management | 1.96 | 1.75 | 0.00 | 0.00 | 0.9951 |
| 2B | Chemical industry | 1.99 | 2.14 | 0.00 | 0.00 | 0.9968 |
| 1A1c | Manufacture of solid fuels and other energy industries | 0.16 | 0.02 | 0.00 | 0.00 | 0.9985 |
| 1A3c + 1A3e + 1A5 | Other transport | 0.19 | 0.11 | 0.00 | 0.00 | 0.9994 |
| 2D | Solvents use | 0.08 | 0.05 | 0.00 | 0.00 | 0.9997 |
| 1A3a | Aviation LTO (civil) | 0.06 | 0.08 | 0.00 | 0.00 | 0.9999 |
| 5A | Biological treatment of waste: Solid waste disposal on land | 0.00 | 0.01 | 0.00 | 0.00 | 1.0000 |

### $PM_{10}$

| NFR Code | NFR Category | Emissions (kt) 2000 | Emissions (kt) 2024 | Rating trend | Contribution to the trend | Accumulated total |
|---|---|---|---|---|---|---|
| **2A** | **Mineral products** | **42.01** | **15.51** | **0.20** | **0.19** | **0.1890** |
| **1A4a + 1A4b** | **Commercial/Institutional/Residential** | **54.87** | **29.55** | **0.19** | **0.18** | **0.3696** |

| NFR Code | NFR Category | Emissions (kt) 2000 | Emissions (kt) 2024 | Rating trend | Contribution to the trend | Accumulated total |
|---|---|---|---|---|---|---|
| **3F** | **Field burning of agricultural wastes** | **22.45** | **0.33** | **0.17** | **0.16** | **0.5274** |
| **1A1a** | **Public electricity and heat production** | **23.14** | **3.79** | **0.14** | **0.14** | **0.6654** |
| **1A3b** | **Road transport** | **31.20** | **15.35** | **0.12** | **0.11** | **0.7784** |
| **3D** | **Crop production and agricultural soils** | **48.00** | **40.67** | **0.05** | **0.05** | **0.8306** |
| **1A2** | **Manufacturing industries and Construction** | **19.19** | **12.26** | **0.05** | **0.05** | **0.8801** |
| **5C** | **Incineration** | **25.43** | **20.35** | **0.04** | **0.04** | **0.9163** |
| **1A4c** | **Agriculture/Forestry/Fishing** | **5.24** | **1.96** | **0.02** | **0.02** | **0.9398** |
| **2G + 2H + 2I + 2J + 2K + 2L** | **Other products use and industrial processes** | **1.45** | **3.13** | **0.01** | **0.01** | **0.9518** |
| 2C | Metal production | 3.02 | 1.48 | 0.01 | 0.01 | 0.9628 |
| 1A1b | Petroleum refining | 1.67 | 0.17 | 0.01 | 0.01 | 0.9735 |
| 1B | Fugitive emissions from fuels | 1.44 | 0.35 | 0.01 | 0.01 | 0.9813 |
| 3B | Manure management | 11.05 | 12.05 | 0.01 | 0.01 | 0.9884 |
| 5E | Other waste | 1.96 | 1.51 | 0.00 | 0.00 | 0.9917 |
| 2D | Solvents use | 0.98 | 0.62 | 0.00 | 0.00 | 0.9942 |
| 1A3d | National navigation | 2.12 | 2.38 | 0.00 | 0.00 | 0.9961 |
| 1A1c | Manufacture of solid fuels and other energy industries | 0.24 | 0.02 | 0.00 | 0.00 | 0.9977 |
| 2B | Chemical industry | 2.68 | 2.90 | 0.00 | 0.00 | 0.9992 |
| 1A3c + 1A3e + 1A5 | Other transport | 0.21 | 0.12 | 0.00 | 0.00 | 0.9998 |
| 1A3a | Aviation LTO (civil) | 0.06 | 0.08 | 0.00 | 0.00 | 0.9999 |
| 5A | Biological treatment of waste: Solid waste disposal on land | 0.01 | 0.01 | 0.00 | 0.00 | 1.0000 |

## TSP

| NFR Code | NFR Category | Emissions (kt) 2000 | Emissions (kt) 2024 | Rating trend | Contribution to the trend | Accumulated total |
|---|---|---|---|---|---|---|
| **2A** | **Mineral products** | **136.45** | **48.40** | **0.43** | **0.39** | **0.3875** |
| **1A1a** | **Public electricity and heat production** | **36.48** | **5.27** | **0.15** | **0.14** | **0.5248** |
| **1A4a + 1A4b** | **Commercial/Institutional/Residential** | **58.30** | **31.27** | **0.13** | **0.12** | **0.6438** |
| **3F** | **Field burning of agricultural wastes** | **22.81** | **0.34** | **0.11** | **0.10** | **0.7427** |
| **1A3b** | **Road transport** | **36.32** | **21.74** | **0.07** | **0.06** | **0.8069** |
| **3B** | **Manure management** | **40.08** | **51.44** | **0.06** | **0.05** | **0.8569** |
| **1A2** | **Manufacturing industries and Construction** | **22.73** | **14.45** | **0.04** | **0.04** | **0.8933** |
| **3D** | **Crop production and agricultural soils** | **48.00** | **40.67** | **0.04** | **0.03** | **0.9255** |
| **5C** | **Incineration** | **26.04** | **20.83** | **0.03** | **0.02** | **0.9484** |
| **1A4c** | **Agriculture/Forestry/Fishing** | **5.27** | **1.97** | **0.02** | **0.01** | **0.9630** |
| 1B | Fugitive emissions from fuels | 2.71 | 0.64 | 0.01 | 0.01 | 0.9721 |
| 2C | Metal production | 5.22 | 3.22 | 0.01 | 0.01 | 0.9809 |
| 1A1b | Petroleum refining | 2.15 | 0.17 | 0.01 | 0.01 | 0.9896 |
| 2D | Solvents use | 1.95 | 1.26 | 0.00 | 0.00 | 0.9926 |
| 5E | Other waste | 1.96 | 1.51 | 0.00 | 0.00 | 0.9946 |
| 1A1c | Manufacture of solid fuels and other energy industries | 0.34 | 0.02 | 0.00 | 0.00 | 0.9960 |
| 2B | Chemical industry | 3.40 | 3.67 | 0.00 | 0.00 | 0.9972 |
| 1A3d | National navigation | 2.12 | 2.38 | 0.00 | 0.00 | 0.9984 |

| NFR Code | NFR Category | Emissions (kt) 2000 | Emissions (kt) 2024 | Rating trend | Contribution to the trend | Accumulated total |
|---|---|---|---|---|---|---|
| 2G + 2H + 2I + 2J + 2K + 2L | Other products use and industrial processes | 3.85 | 4.11 | 0.00 | 0.00 | 0.9995 |
| 1A3c + 1A3e + 1A5 | Other transport | 0.22 | 0.13 | 0.00 | 0.00 | 0.9999 |
| 1A3a | Aviation LTO (civil) | 0.06 | 0.08 | 0.00 | 0.00 | 1.0000 |

### BC

| NFR Code | NFR Category | Emissions (kt) 2000 | Emissions (kt) 2024 | Rating trend | Contribution to the trend | Accumulated total |
|---|---|---|---|---|---|---|
| **1A3b** | **Road transport** | **14.95** | **4.44** | **0.50** | **0.48** | **0.4799** |
| **5C** | **Incineration** | **13.37** | **10.71** | **0.13** | **0.12** | **0.6012** |
| **3F** | **Field burning of agricultural wastes** | **2.52** | **0.03** | **0.12** | **0.11** | **0.7150** |
| **1A4a + 1A4b** | **Commercial/Institutional/Residential** | **6.00** | **3.62** | **0.11** | **0.11** | **0.8237** |
| **1A2** | **Manufacturing industries and Construction** | **4.64** | **3.04** | **0.08** | **0.07** | **0.8970** |
| **1A4c** | **Agriculture/Forestry/Fishing** | **2.54** | **1.06** | **0.07** | **0.07** | **0.9648** |
| 2G + 2H + 2I + 2J + 2K + 2L | Other products use and industrial processes | 0.28 | 0.68 | 0.02 | 0.02 | 0.9832 |
| 1A1a | Public electricity and heat production | 0.28 | 0.13 | 0.01 | 0.01 | 0.9899 |
| 1A1c | Manufacture of solid fuels and other energy industries | 0.07 | 0.01 | 0.00 | 0.00 | 0.9926 |
| 1A1b | Petroleum refining | 0.08 | 0.03 | 0.00 | 0.00 | 0.9951 |
| 1A3c + 1A3e + 1A5 | Other transport | 0.10 | 0.05 | 0.00 | 0.00 | 0.9974 |
| 2C | Metal production | 0.07 | 0.03 | 0.00 | 0.00 | 0.9989 |
| 1A3d | National navigation | 0.06 | 0.05 | 0.00 | 0.00 | 0.9994 |
| 1A3a | Aviation LTO (civil) | 0.03 | 0.04 | 0.00 | 0.00 | 0.9998 |
| 1B | Fugitive emissions from fuels | 0.00 | 0.00 | 0.00 | 0.00 | 0.9999 |
| 2D | Solvents use | 0.00 | 0.00 | 0.00 | 0.00 | 1.0000 |

## CO and Priority Heavy Metals

### CO

| NFR Code | NFR Category | Emissions (kt) 1990 | Emissions (kt) 2024 | Rating trend | Contribution to the trend | Accumulated total |
|---|---|---|---|---|---|---|
| **1A3b** | **Road transport** | **2,132.39** | **150.93** | **0.62** | **0.61** | **0.6059** |
| **3F** | **Field burning of agricultural wastes** | **842.81** | **3.85** | **0.26** | **0.26** | **0.8625** |
| **1A4a + 1A4b** | **Commercial/Institutional/Residential** | **405.92** | **211.94** | **0.06** | **0.06** | **0.9218** |
| **1A2** | **Manufacturing industries and Construction** | **269.49** | **173.31** | **0.03** | **0.03** | **0.9512** |
| 2C | Metal production | 151.65 | 74.65 | 0.02 | 0.02 | 0.9748 |
| 1A1a | Public electricity and heat production | 7.29 | 39.81 | 0.01 | 0.01 | 0.9847 |
| 5C | Incineration | 278.69 | 262.26 | 0.01 | 0.01 | 0.9897 |
| 2B | Chemical industry | 22.61 | 10.06 | 0.00 | 0.00 | 0.9936 |
| 1A4c | Agriculture/Forestry/Fishing | 26.21 | 22.04 | 0.00 | 0.00 | 0.9948 |
| 1A3a | Aviation LTO (civil) | 3.27 | 7.31 | 0.00 | 0.00 | 0.9961 |
| 2G + 2H + 2I + 2J + 2K + 2L | Other products use and industrial processes | 8.06 | 11.96 | 0.00 | 0.00 | 0.9973 |

| NFR Code | NFR Category | Emissions (kt) 1990 | Emissions (kt) 2024 | Rating trend | Contribution to the trend | Accumulated total |
|---|---|---|---|---|---|---|
| 1A3d | National navigation | 6.70 | 3.70 | 0.00 | 0.00 | 0.9982 |
| 1A1c | Manufacture of solid fuels and other energy industries | 3.07 | 0.72 | 0.00 | 0.00 | 0.9989 |
| 1A3c + 1A3e + 1A5 | Other transport | 2.62 | 0.97 | 0.00 | 0.00 | 0.9994 |
| 1B | Fugitive emissions from fuels | 2.79 | 2.04 | 0.00 | 0.00 | 0.9996 |
| 1A1b | Petroleum refining | 2.34 | 1.71 | 0.00 | 0.00 | 0.9998 |
| 5A | Biological treatment of waste: Solid waste disposal on land | 0.06 | 0.45 | 0.00 | 0.00 | 0.9999 |
| 5B | Biological treatment of waste | 0.00 | 0.16 | 0.00 | 0.00 | 1.0000 |

## Pb

| NFR Code | NFR Category | Emissions (t) 1990 | Emissions (t) 2024 | Rating trend | Contribution to the trend | Accumulated total |
|---|---|---|---|---|---|---|
| **1A3b** | **Road transport** | **3,185.79** | **38.58** | **0.99** | **0.99** | **0.9853** |
| 1A2 | Manufacturing industries and Construction | 26.77 | 9.76 | 0.01 | 0.01 | 0.9906 |
| 2C | Metal production | 47.84 | 31.23 | 0.01 | 0.01 | 0.9958 |
| 1A4a + 1A4b | Commercial/Institutional/Residential | 5.86 | 2.74 | 0.00 | 0.00 | 0.9968 |
| 2A | Mineral products | 5.66 | 8.59 | 0.00 | 0.00 | 0.9977 |
| 1A1a | Public electricity and heat production | 4.00 | 1.14 | 0.00 | 0.00 | 0.9986 |
| 5C | Incineration | 3.94 | 2.87 | 0.00 | 0.00 | 0.9989 |
| 3F | Field burning of agricultural wastes | 0.78 | 0.01 | 0.00 | 0.00 | 0.9992 |
| 1A3c + 1A3e + 1A5 | Other transport | 0.77 | 0.03 | 0.00 | 0.00 | 0.9994 |
| 1A1c | Manufacture of solid fuels and other energy industries | 0.63 | 0.00 | 0.00 | 0.00 | 0.9996 |
| 1B | Fugitive emissions from fuels | 0.94 | 0.47 | 0.00 | 0.00 | 0.9997 |
| 1A3a | Aviation LTO (civil) | 0.76 | 0.35 | 0.00 | 0.00 | 0.9999 |
| 1A1b | Petroleum refining | 0.48 | 0.19 | 0.00 | 0.00 | 1.0000 |

## Cd

| NFR Code | NFR Category | Emissions (t) 1990 | Emissions (t) 2024 | Rating trend | Contribution to the trend | Accumulated total |
|---|---|---|---|---|---|---|
| **1A2** | **Manufacturing industries and Construction** | **15.76** | **1.16** | **0.64** | **0.62** | **0.6157** |
| **3F** | **Field burning of agricultural wastes** | **6.86** | **0.05** | **0.30** | **0.29** | **0.9030** |
| **1A1a** | **Public electricity and heat production** | **2.11** | **0.84** | **0.06** | **0.05** | **0.9567** |
| 5C | Incineration | 0.63 | 0.30 | 0.01 | 0.01 | 0.9708 |
| 2G + 2H + 2I + 2J + 2K + 2L | Other products use and industrial processes | 0.11 | 0.29 | 0.01 | 0.01 | 0.9786 |
| 1A3b | Road transport | 0.15 | 0.31 | 0.01 | 0.01 | 0.9852 |
| 1A4a + 1A4b | Commercial/Institutional/Residential | 1.19 | 1.03 | 0.01 | 0.01 | 0.9918 |
| 2A | Mineral products | 0.26 | 0.37 | 0.00 | 0.00 | 0.9963 |
| 1A4c | Agriculture/Forestry/Fishing | 0.02 | 0.06 | 0.00 | 0.00 | 0.9982 |
| 1A1c | Manufacture of solid fuels and other energy industries | 0.01 | 0.00 | 0.00 | 0.00 | 0.9987 |
| 1B | Fugitive emissions from fuels | 0.02 | 0.01 | 0.00 | 0.00 | 0.9991 |

| NFR Code | NFR Category | Emissions (t) 1990 | Emissions (t) 2024 | Rating trend | Contribution to the trend | Accumulated total |
|---|---|---|---|---|---|---|
| 1A1b | Petroleum refining | 0.27 | 0.26 | 0.00 | 0.00 | 0.9994 |
| 1A3d | National navigation | 0.02 | 0.01 | 0.00 | 0.00 | 0.9997 |
| 2C | Metal production | 1.29 | 1.30 | 0.00 | 0.00 | 0.9999 |
| 5E | Other waste | 0.01 | 0.01 | 0.00 | 0.00 | 1.0000 |

## Hg

| NFR Code | NFR Category | Emissions (t) 1990 | Emissions (t) 2024 | Rating trend | Contribution to the trend | Accumulated total |
|---|---|---|---|---|---|---|
| **1A1a** | **Public electricity and heat production** | **4.25** | **0.78** | **0.41** | **0.40** | **0.4003** |
| **2B** | **Chemical industry** | **1.88** | **0.00** | **0.22** | **0.22** | **0.6170** |
| **3F** | **Field burning of agricultural wastes** | **1.32** | **0.01** | **0.15** | **0.15** | **0.7677** |
| **1A2** | **Manufacturing industries and Construction** | **1.66** | **0.46** | **0.14** | **0.14** | **0.9053** |
| **5C** | **Incineration** | **0.74** | **0.31** | **0.05** | **0.05** | **0.9548** |
| 2D | Solvents use | 0.22 | 0.11 | 0.01 | 0.01 | 0.9669 |
| 1A4a + 1A4b | Commercial/Institutional/Residential | 0.17 | 0.10 | 0.01 | 0.01 | 0.9755 |
| 1A3b | Road transport | 0.11 | 0.17 | 0.01 | 0.01 | 0.9820 |
| 1A1c | Manufacture of solid fuels and other energy industries | 0.05 | 0.00 | 0.01 | 0.01 | 0.9877 |
| 2C | Metal production | 1.06 | 1.02 | 0.00 | 0.00 | 0.9926 |
| 1A3d | National navigation | 0.05 | 0.02 | 0.00 | 0.00 | 0.9951 |
| 1A4c | Agriculture/Forestry/Fishing | 0.03 | 0.01 | 0.00 | 0.00 | 0.9973 |
| 1B | Fugitive emissions from fuels | 0.03 | 0.02 | 0.00 | 0.00 | 0.9990 |
| 1A1b | Petroleum refining | 0.05 | 0.05 | 0.00 | 0.00 | 0.9995 |
| 5E | Other waste | 0.01 | 0.01 | 0.00 | 0.00 | 0.9998 |
| 1A3a | Aviation LTO (civil) | 0.00 | 0.00 | 0.00 | 0.00 | 0.9999 |
| 2A | Mineral products | 0.00 | 0.00 | 0.00 | 0.00 | 1.0000 |

# POPs

## PCDD/PCDF

| NFR Code | NFR Category | Emissions (g) 1990 | Emissions (g) 2024 | Rating trend | Contribution to the trend | Accumulated total |
|---|---|---|---|---|---|---|
| **1A1a** | **Public electricity and heat production** | **133.92** | **1.34** | **0.42** | **0.41** | **0.4085** |
| **5C** | **Incineration** | **167.43** | **42.87** | **0.39** | **0.38** | **0.7923** |
| **1A4a + 1A4b** | **Commercial/Institutional/Residential** | **61.50** | **30.35** | **0.10** | **0.10** | **0.8882** |
| **2C** | **Metal production** | **77.21** | **57.57** | **0.06** | **0.06** | **0.9488** |
| **3F** | **Field burning of agricultural wastes** | **5.86** | **0.03** | **0.02** | **0.02** | **0.9667** |
| 1B | Fugitive emissions from fuels | 7.44 | 3.72 | 0.01 | 0.01 | 0.9782 |
| 5E | Other waste | 19.07 | 15.67 | 0.01 | 0.01 | 0.9886 |
| 1A3b | Road transport | 5.33 | 7.65 | 0.01 | 0.01 | 0.9958 |
| 1A1c | Manufacture of solid fuels and other energy industries | 0.42 | 0.99 | 0.00 | 0.00 | 0.9975 |
| 1A2 | Manufacturing industries and Construction | 10.37 | 10.06 | 0.00 | 0.00 | 0.9985 |

| NFR Code | NFR Category | Emissions (g) 1990 | Emissions (g) 2024 | Rating trend | Contribution to the trend | Accumulated total |
|---|---|---|---|---|---|---|
| 1A4c | Agriculture/Forestry/Fishing | 0.17 | 0.37 | 0.00 | 0.00 | 0.9991 |
| 1A1b | Petroleum refining | 0.19 | 0.02 | 0.00 | 0.00 | 0.9996 |
| 1A3d | National navigation | 0.35 | 0.25 | 0.00 | 0.00 | 0.9999 |
| 1A3c + 1A3e + 1A5 | Other transport | 0.04 | 0.02 | 0.00 | 0.00 | 1.0000 |

## PAHs

| NFR Code | NFR Category | Emissions (t) 1990 | Emissions (t) 2024 | Rating trend | Contribution to the trend | Accumulated total |
|---|---|---|---|---|---|---|
| **3F** | **Field burning of agricultural wastes** | **52.02** | **0.13** | **0.65** | **0.63** | **0.6323** |
| **1A4a + 1A4b** | **Commercial/Institutional/Residential** | **38.61** | **15.28** | **0.29** | **0.28** | **0.9166** |
| **2C** | **Metal production** | **17.00** | **12.56** | **0.06** | **0.05** | **0.9707** |
| 1A1a | Public electricity and heat production | 0.05 | 0.84 | 0.01 | 0.01 | 0.9803 |
| 1B | Fugitive emissions from fuels | 1.31 | 0.66 | 0.01 | 0.01 | 0.9883 |
| 1A2 | Manufacturing industries and Construction | 2.96 | 2.56 | 0.01 | 0.00 | 0.9932 |
| 1A1c | Manufacture of solid fuels and other energy industries | 0.23 | 0.01 | 0.00 | 0.00 | 0.9959 |
| 1A4c | Agriculture/Forestry/Fishing | 0.15 | 0.35 | 0.00 | 0.00 | 0.9984 |
| 1A3b | Road transport | 1.10 | 1.18 | 0.00 | 0.00 | 0.9994 |
| 1A3d | National navigation | 0.05 | 0.04 | 0.00 | 0.00 | 0.9996 |
| 1A3c + 1A3e + 1A5 | Other transport | 0.02 | 0.01 | 0.00 | 0.00 | 0.9997 |
| 2G + 2H + 2I + 2J + 2K + 2L | Other products use and industrial processes | 0.00 | 0.01 | 0.00 | 0.00 | 0.9999 |
| 5C | Incineration | 0.17 | 0.17 | 0.00 | 0.00 | 0.9999 |
| 1A3a | Aviation LTO (civil) | 0.00 | 0.01 | 0.00 | 0.00 | 1.0000 |

## HCB

| NFR Code | NFR Category | Emissions (kg) 1990 | Emissions (kg) 2024 | Rating trend | Contribution to the trend | Accumulated total |
|---|---|---|---|---|---|---|
| **3D** | **Crop production and agricultural soils** | **53.73** | **0.05** | **0.96** | **0.96** | **0.9586** |
| 5C | Incineration | 2.01 | 0.14 | 0.03 | 0.03 | 0.9921 |
| 1A1a | Public electricity and heat production | 0.74 | 0.52 | 0.00 | 0.00 | 0.9960 |
| 1A3d | National navigation | 0.16 | 0.10 | 0.00 | 0.00 | 0.9971 |
| 1A2 | Manufacturing industries and Construction | 0.55 | 0.60 | 0.00 | 0.00 | 0.9980 |
| 1A4a + 1A4b | Commercial/Institutional/Residential | 0.45 | 0.40 | 0.00 | 0.00 | 0.9990 |
| 1A4c | Agriculture/Forestry/Fishing | 0.07 | 0.04 | 0.00 | 0.00 | 0.9996 |
| 2C | Metal production | 0.11 | 0.13 | 0.00 | 0.00 | 0.9999 |
| 1A1c | Manufacture of solid fuels and other energy industries | 0.00 | 0.00 | 0.00 | 0.00 | 1.0000 |

## PCBs

| NFR Code | NFR Category | Emissions (kg) 1990 | Emissions (kg) 2024 | Rating trend | Contribution to the trend | Accumulated total |
|---|---|---|---|---|---|---|
| **2G + 2H + 2I + 2J + 2K + 2L** | **Other products use and industrial processes** | **2,212.74** | **69.14** | **1.00** | **1.00** | **0.9961** |
| 1A2 | Manufacturing industries and Construction | 3.68 | 0.13 | 0.00 | 0.00 | 0.9978 |
| 1A4a + 1A4b | Commercial/Institutional/Residential | 2.75 | 0.29 | 0.00 | 0.00 | 0.9989 |
| 2C | Metal production | 19.00 | 20.66 | 0.00 | 0.00 | 0.9997 |
| 1A4c | Agriculture/Forestry/Fishing | 0.20 | 0.02 | 0.00 | 0.00 | 0.9998 |
| 5C | Incineration | 0.50 | 0.32 | 0.00 | 0.00 | 0.9999 |
| 1A1a | Public electricity and heat production | 0.19 | 0.05 | 0.00 | 0.00 | 0.9999 |
| 1A3b | Road transport | 1.43 | 1.55 | 0.00 | 0.00 | 1.0000 |

# ANNEX 2. COMPLIANCE WITH INVENTORY REVIEWS

Chapter updated in March, 2026.

## A2.1. Compliance with 2025 comprehensive technical review pursuant to the directive (EU) 2016/2284

13 out of 14 recommendations are considered resolved, and 1 is considered addressing; 2 revised estimates are considered resolved; and 1 technical correction is considered resolved.

### [Table 4:] All findings for $NO_X$, NMVOC, $SO_2$, $NH_3$, $PM_{2.5}$ and $PM_{10}$, including those made during the 2025 NECD inventory review and those not implemented from the 2024 NECD inventory review

| Observation | Key Category | NFR, Pollutant(s), Year(s) | Assessment of the implementation of the initial recommendation. Recommendation | Status | Section in IIR |
|---|---|---|---|---|---|
| **ES-1A3b-2025-0001** | Yes | 1A3b Road Transport, $NO_X$, NMVOC, $SO_2$, $NH_3$, $PM_{2.5}$ and $PM_{10}$, 1990-2023 | **Recommendation**<br>For category 1A3b Road Transport, all pollutants, years 1990-2023, the TERT notes that Spain report emission calculations to be based on COPERT 5.5.1 according to the 2019 EMEP/EEA Guidebook. Page 242 of the 2025 IIR includes an upgrade of COPERT version in the section on sector improvements. In response to a question raised during the review, Spain stresses using a self-developed tool in Oracle, following the 2019 EMEP/EEA Guidebook (2021 version), in line with COPERT 5.5.1. Spain indicated that an update of this tool to the 2023 EMEP/EEA Guidebook is planned but that Spain cannot guarantee that the update will be fully implemented in the 2026 submission. The TERT notes that the issue is below the threshold of significance for a technical correction.<br>**The TERT recommends that Spain update the methodology to be compliant with the 2023 EMEP/EEA Guidebook and COPERT 5.8 for the next submission.** | Addressing | Chap. 3 |
| **ES-1A4bi-2025-0001** | Yes | 1A4bi Residential: Stationary, $SO_2$, $NO_X$, NMVOC, $PM_{2.5}$, BaP, PAHs, $PM_{10}$, 2005-2023 | **Recommendation**<br>For category 1A4bi Residential: Stationary, pollutants $SO_2$, $NO_X$, NMVOC, $PM_{2.5}$, BaP, PAHs, $PM_{10}$, years 2005-2023, the TERT notes that there is a lack of transparency regarding how emission estimates have been developed. The IIR (Table 3.4.19) indicates that the emission estimates are developed from electricity generation, final energy fuel use and biomass. Table 3.4.20 of the IIR sets out three groups of methodology for the Residential sector which appear to align with Tier 1/Tier 2 methodologies for liquid, gaseous and biomass fuels, Tier 2 for biomass room heaters and Tier 2 for larger biomass boilers. This does not relate to an over-estimate or under-estimate of emissions. In response to a question raised during the review, Spain provided an overview of the approach for different fuels including biomass fuel types, of activity details | Resolved | Chap. 3 |

| Observation | Key Category | NFR, Pollutant(s), Year(s) | Assessment of the implementation of the initial recommendation. Recommendation | Status | Section in IIR |
|---|---|---|---|---|---|
| | | | and the basis of technology assumptions and allocation of biomass fuels.<br>**The TERT recommends that Spain provide a more detailed description of the methodology applied for residential combustion in the 2026 IIR submission.** | | |
| **ES-1A4bii-2025-0001** | No | 1A4bii Residential: Household and Gardening (Mobile), $NO_x$, NMVOC, $SO_2$, $NH_3$, $PM_{2.5}$ and $PM_{10}$, 1990-2023 | **Recommendation**<br>For category 1A4bii Residential: Household and Gardening (Mobile), all pollutants, years 1990-2023, the TERT clarified the issue with Spain and concludes that splitting up category 1A4bi Residential: Stationary to report 1A4bii Residential: Household and gardening (mobile) separately is not possible due to data unavailability on the disaggregated level. As 1Abii is included in 1Abi there is no issue of underestimation of the emissions.<br>**The TERT recommends that Spain include the explanation for the current aggregated reporting in the 2026 IIR.** | Resolved | Chap. 3 |
| **ES-2H2-2025-0001** | Yes | 2H2 Food and Beverages Industry, NMVOC, 2020-2021 | **Recommendation**<br>For category 2H2 Food and Beverages Industry, pollutant NMVOC, years 2020, 2021, the TERT notes that there is a lack of transparency regarding the trend in emissions, in particular the large increase in emissions in 2023 compared to 2022. In the IIR Spain explains that this is related to changes in activity data without further details. This does not relate to an over-estimate or under- estimate of emissions. In response to a question raised during the review, Spain explained that the total food sales increased by 20.5% in 2022 and provided a link to the official press release that highlighted this.<br>**The TERT recommends that Spain include this information in the IIR for the 2026 submission, and similarly in other cases where relatively large changes in activity data occur.** | Resolved | Chap. 4 |
| **ES-5C1a-2025-0001** | No | 5C1a Municipal Waste Incineration, $NO_x$, NMVOC, $SO_2$, $NH_3$, $PM_{2.5}$ and $PM_{10}$, 2003-2023 | **Recommendation**<br>For category 5C1a Municipal Waste Incineration, all pollutants, years 2003-2023, the TERT noted that the notation key 'NA' (Not Applicable) is reported for 2023 and 'IE' (Implied Emission) is applied since 2004. The TERT would expect the notation key 'NO' (Not Occurring) instead of 'NA' or 'IE' to be reported since 2003. In response to a question raised during the review, Spain confirmed that since 2003 there has been no incineration of municipal solid waste (MSW) without energy recovery except in the Canary Islands in 2023, and that they revise the notation key and apply 'NO' instead, to clearly reflect that no incineration without energy recovery has taken place since 2004.<br>**The TERT recommends that Spain update the notation key to 'NO' in their next submission, starting with 2023, as the Canary Islands are not included in the scope of the NEC Directive.** | Resolved | Chap. 6 |
| **ES-5D1-2025-0002** | No | 5D1 Domestic Wastewater Handling, $NH_3$, 1990-2023 | **Recommendation**<br>For category 5D1 Domestic Wastewater Handling, pollutant $NH_3$, years 1990-2023, the TERT notes that in the NFR tables, there is a lack of transparency regarding the use of the notation key 'NE' (Not Estimated). This does not relate to an over-estimate or under-estimate of emissions. In response to a question raised | Resolved | Chap. 6 |

| Observation | Key Category | NFR, Pollutant(s), Year(s) | Assessment of the implementation of the initial recommendation. Recommendation | Status | Section in IIR |
|---|---|---|---|---|---|
| | | | during the review, Spain provided verifiable data that there are no latrines in use at least since 2005 and that according to Law 29-1985, discharges without treatment that result in water pollution were prohibited. Moreover, Spain indicated that this explanation was removed from the 2025 edition of the IIR. Due to the lack of transparency that the absence of this information can generate, Spain will be re-including the information in the next edition of the IIR.<br>**The TERT recommends that Spain include the information justifying the absence of latrines over the complete time series in the IIR of the 2026 submission.** | | |

## [Table 6:] All findings for heavy metals and POPs, including those made during the 2025 NECD inventory review and those not implemented from the 2021 NECD

| Observation | Key Category | NFR, Pollutant(s), Year(s) | Assessment of the implementation of the initial recommendation. Recommendation | Status | Section in IIR |
|---|---|---|---|---|---|
| **ES-1B1b-2025-0001** | No | 1B1b Fugitive Emission from Solid Fuels: Solid Fuel Transformation, PCDD/F,<br>1990-2008 | **Technical correction**<br>For category 1B1b Fugitive Emission from Solid Fuels: Solid Fuel Transformation, pollutant PAHs, for the period 1990-2008 (and heavy metals and PCDD/F) the TERT notes that the notation key 'NE' (not estimated) is used for category 1B1b when a Tier 1 method is available in the 2023 EMEP/EEA Guidebook. In response to a question raised during the review Spain provided emission estimates using the 2023 EMEP/EEA Guidebook Tier 1 emission factors and applied an assumption regarding abatement efficiency. The TERT did not agree that the Tier 1 default emission factor for PAHs was for unabated operation and developed a draft Technical Correction. Spain explained that it is not in a position to accept the draft technical correction suggested by the TERT for HM and PCDD/F emissions (not greater than the threshold of significance) nor to provide a revised estimate for PAHs. Spain summarised an understanding that the Tier 1 PAH emission factors in Table 3.1 of Chapter 1B1b of the 2023 EMEP/EEA Guidebook represent unabated technology and did not provide a revised estimate. Spain explained that the 2023 EMEP/EEA Guidebook reference “Wenborn et al. (1999)” (page A5 of its Appendix 1) states: “The ‘best’ estimate emission factor for benzo[a]pyrene (0.16 g/t) in this report is taken from the 1998 EMEP/CORINAIR Guidebook (1998 EMEP/CORINAIR) which is described as the draft edition of 1999 EMEP/CORINAIR.' The TERT acknowledges that Table 8.1 of the Coke Ovens section of 1999EMEP/CORINAIR does not provide details of abatement type or abatement efficiency (or fuel type) for the B(a)P emission factor - parameters are labelled “n.a.” which is not defined in Table 8.1 but is defined in other tables of the 'Combustion in Energy and Transformation Industries' Chapter of 1999 EMEP/CORINAIR as 'no data available'. The TERT | Resolved | Chap. 3 |

| Observation | Key Category | NFR, Pollutant(s), Year(s) | Assessment of the implementation of the initial recommendation. Recommendation | Status | Section in IIR |
|---|---|---|---|---|---|
| | | | notes that 1999 EMEP/CORINAIR B(a)P emission factor for coke ovens is presented as a range (0.16-0.6 g/t) and references data sources for coke ovens from Germany and Holland. The TERT acknowledges that the 2023 EMEP/EEA Guidebook default Tier 1 emission factor for B(a)P is clearly old - predating current understanding of Best Available Techniques. The TERT also acknowledges that the speciation profile used to develop default emission factors for other PAHs may be derived from data for an unabated source. However, the TERT does not agree that it is reasonable to assume that abatement techniques are not considered in the Tier 1 B(a)P EF of the 2023 EMEP/EEA Guidebook. The TERT decided to calculate a technical correction for the years 2005 and 2020-2023. The technical correction was not accepted by Spain. The TERT's estimates demonstrate that the issue is above the threshold of significance for B(a)P and PAH. **The TERT recommends that Spain review the methodology applied for category 1B1b Fugitive Emission from Solid Fuels: Solid Fuel Transformation and include a revised estimate in the 2026 submission.** | | |
| **ES-5C1biv-2025-0001** | Yes | 5C1biv Sewage Sludge Incineration, PCDD/F, 1990-2023 | **Revised Estimate** For category 5C1biv Sewage Sludge Incineration, pollutant PCDD/F, all years, the TERT notes that the implied emission factor for PCDD/F is unexpectedly high (e.g. 4155 microg/Mg of sludge), even higher than the EF for an uncontrolled situation presented in Table 3-2 of the 2023 EMEP/EEA Guidebook (50 microg/Mg). In response to a question raised during the review, Spain provided a revised estimate for the complete time series and stated that it will be included in the next submission. The TERT agreed with the revised estimate provided by Spain. **The TERT recommends that Spain include a revised estimate in the 2026 submission.** | Resolved | Chap. 6 |
| **ES-5C1biv-2025-0002** | Yes | 5C1biv Sewage Sludge Incineration, BaP, PAHs, PCBs, HCB, Cd, Hg, Pb, 1990-2023 | **Revised Estimate** For category 5C1biv Sewage Sludge Incineration, pollutants BaP, PAHs, PCBs, HCB, Cd, Hg, Pb, all years, the TERT noted that in NFR tables there is a misestimate due to the application of wrong emission factors and abatement efficiencies over the time series. The TERT also notes that 5C1biv is a key category for Cd, Hg and HCB. In response to a question raised during the review, Spain provided a revised estimate for the complete time series and stated that it will be included in the next submission. Please note that PCDD/F is considered in observation ES-5C1biv-2025-0002. The TERT agreed with the revised estimate provided by Spain. **The TERT recommends that Spain include a revised estimate in the 2026 submission.** | Resolved | Chap. 6 |
| **ES-1A1b-2025-0001** | Yes | 1A1b Petroleum Refining, Cd, 2005-2023 | **Recommendation** For category 1A1b Petroleum Refining, pollutant Cd, years 2005-2023, the TERT noted that there is a lack of transparency regarding why the emissions are relatively similar across the time series compared to other pollutants. This does not relate to an over-estimate or under-estimate of emissions. In response to a question raised during the review, Spain explained that although the emission trend for Cd is inconsistent with the other pollutants, the emission estimates are corroborated by relatively similar emission factors for | Resolved | Chap. 3 |

| Observation | Key Category | NFR, Pollutant(s), Year(s) | Assessment of the implementation of the initial recommendation. Recommendation | Status | Section in IIR |
|---|---|---|---|---|---|
| | | | refinery gas and residual fuel oil and changes in fuel use across the time series.<br>**The TERT recommends that Spain provide information in the IIR for the 2026 submission to explain the trend for Cd and other pollutant emission estimates over the time series.** | | |
| **ES-1A2f-2025-0001** | Yes | 1A2f Stationary Combustion in Manufacturing Industries and Construction: Non-Metallic Minerals, Cd, 2005-2008 | **Recommendation**<br>For category 1A2f Stationary Combustion in Manufacturing Industries and Construction: Non-Metallic Minerals, pollutants, Cd, Pb, Hg, PCBs, years 2005-2008, the TERT notes that there is a lack of transparency regarding why emissions decline rapidly, but a similar decrease in non-gaseous fuels is less pronounced in the same period. This does not relate to an over-estimate or under- estimate of emissions. In response to a question raised during the review, Spain explained that reduction of pollutant Cd is associated with evolution of emission controls on cement facilities. **The TERT recommends that Spain include the missing information in the 2026 IIR (or reference to a separate methodology) so that emission factors and the activity are transparent.** | Resolved | Chap. 3 |
| **ES-1A3bi-2025-0001** | No | 1A3bi Road Transport: Passenger Cars,<br>PAHs,<br>2005 | **Recommendation**<br>For category 1A3bi Road Transport: Passenger Cars, pollutant PAHs, year 2005, the TERT notes that the implied emission factor (IEF) is outside of the 95% confidence interval when compared to the other Member States. Studying the 2025 IIR, the TERT could not find a straightforward explanation for this high IEF. In response to a question raised during the review, Spain explained that the high emission factors are due to the high share of diesel consumption compared to gasoline consumption for this category and the use of an average DI (direct injection)/IDI (indirect injection) emission factor, which does not reflect the trend towards DI. The TERT notes that the issue is below the threshold of significance for a technical correction.<br>**The TERT recommends that Spain update the assumption of DI/IDI in the 2026 submission.** | Resolved | Chap. 3 |
| **ES-1A3bi-2025-0002** | Yes | 1A3bi Road Transport: Passenger Cars,<br>Pb,<br>2023 | **Recommendation**<br>For category 1A3bi Road Transport: Passenger Cars, pollutant Pb, year 2023, the TERT notes that there is a lack of transparency regarding the emission factor used, which results in a high implied emission factor (IEF) outside the 95% confidence interval when compared to other Member States. This does not relate to an over-estimate or under-estimate of emissions. In response to a question raised during the review, Spain explained that the high IEF is caused by the increment in Pb content in gasoline in 2023 with respect to 2022. The Pb content is yearly provided by the Ministry for the Ecological Transition and the Demographical Challenge. Spain also double checked the activity data and emission factor used for the estimates and found no inconsistencies.<br>**The TERT recommends that Spain include a clear description of the source of the Pb content and a graph illustrating the time series variability of the Pb content in the IIR of the 2026 submission.** | Resolved | Chap. 3 |

| Observation | Key Category | NFR, Pollutant(s), Year(s) | Assessment of the implementation of the initial recommendation. Recommendation | Status | Section in IIR |
|---|---|---|---|---|---|
| **ES-2C1-2025-0001** | Yes | 2C1 Iron and Steel Production,<br>PAHs,<br>1990-2023 | **Recommendation**<br>For category 2C1 Iron and Steel Production, pollutants PAHs, years 1990-2023, the TERT notes that there is a lack of transparency regarding the use of specific notation keys for these 4 individual PAHs. This does not relate to an over-estimate or under-estimate of emissions. Spain reports these 4 species as 'IE' (Included Elsewhere) because these are included in the emissions for PAH-4 in the same source category, as explained in Section 1.7.2.2 of the Spanish IIR. In response to a question raised during the review, Spain confirmed this to be the case.<br>**The TERT recommends that Spain reports the emissions for the 4 individual PAH indicator species as 'NA', (Not Applicable) when no emission factor is available in the 2023 EMEP/EEA Guidebook, since the use of 'IE' is only for those cases where emissions are reported in another source category, as outlined by the EMEP Reporting Guidelines paragraph 12(b). The TERT recommends that Spain applies this approach for the next submission.** | Resolved | Chap. 4 |
| **ES-2D3a-2025-0001** | Yes | 2D3a Domestic Solvent Use Including Fungicides,<br>Hg,<br>2004-2023 | **Recommendation**<br>For category 2D3a Domestic Solvent Use Including Fungicides, pollutant Hg, years 2004-2023, the TERT notes that there is a lack of transparency regarding the exact source of Hg emissions from lamps, since most of the hazardous emissions are expected to arise during the end-of-life phase and not during normal use of the lamps. The TERT also notes that the methodology partly relies on an emission factor from an older version of the EMEP/EEA Guidebook, and that it is no longer included in the 2023 EMEP/EEA Guidebook. This does not relate to an over-estimate or under-estimate of emissions. In response to a question raised during the review, Spain provided additional information on how the country specific emission factor has been derived, and that 35-44% of the waste was collected and assumed to be treated with the most stringent conditions, except for a minor percentage that was lost during collection/transport. The Hg contained in non-collected lamps is assumed to be entirely emitted to the atmosphere and is reported in 2D3a since this loss is not considered to be waste treatment but rather the result of the use of the products.<br>**The TERT agrees with the explanation provided by Spain and recommends that Spain document the methodology used and the considerations to report these in category 2D3a Domestic Solvent Use Including Fungicides in the IIR for the 2026 submission.** | Resolved | Chap. 4 |
| **ES-2G-2025-0001** | No | 2G Other Product Use, Pb, 2020-2021 | **Recommendation**<br>For category 2G Other Product Use, pollutant Pb, years 2020, 2021, the TERT notes that there is a lack of transparency regarding an observed dip in emissions in 2020 and 2021. This does not relate to an over-estimate or under-estimate of emissions. In response to a question raised during the review, Spain explained that the decrease in emissions during these two years was due to the Covid-19 pandemic.<br>**The TERT recommends that Spain include this explanation in the IIR for the 2026 submission.** | Resolved | Chap. 4 |

| Observation | Key Category | NFR, Pollutant(s), Year(s) | Assessment of the implementation of the initial recommendation. Recommendation | Status | Section in IIR |
|---|---|---|---|---|---|
| **ES-5C2-2025-0001** | Yes | 5C2 Open Burning of Waste,<br>PCDD/F,<br>1990-2023 | **Recommendation**<br>For category 5C2 Open Burning of Waste, pollutant PCDD/F, years 1990-2023, the TERT notes on page 388, Table 6.1.1 of the IIR 2025 that PCDD/F emissions from category 5C2 are reported as 'NE' (Not Estimated) whereas emission values are expected. This does not relate to an over-estimate or under-estimate of emissions. In response to a question raised during the review, Spain confirmed that the use of the notation key 'NE' in Table 6.1.1 for PCDD/F emissions is incorrect and that the mistake will be fixed in the next IIR (2026 edition).<br>**The TERT recommends that Spain correct Table 6.1.1 of the IIR in the 2026 submission as stated in the answer.** | Resolved | Chap. 6 |

# ANNEX 3. UNCERTAINTY ANALYSIS

Chapter updated in March, 2026. All emissions in this annex take into account the entire national territory.

## A3.1. Uncertainty Analysis NOx

| Sector | | Emissions in 1990 | Emissions in 2024 | Level assess ment | Cumulative total | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Contribution to variance in 2024 | Type A sensitivity | Type B sensitivity | Uncertainty in trend in total emissions due to EF | Uncertainty in trend in total emissions due to AD | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **NFR** | **Name sector** | **Kt** | **kt** | **(%)** | **(%)** | **(%)** | **(%)** | **(%)** | | | | **(%)** | **(%)** | **(%)** |
| 1A3bi | Road transport: Passenger cars | 298.2 | 122.2 | 20.8 | 20.8 | 10.0 | 10.0 | 14.1 | 8.6 | 0.006 | 0.091 | 0.06 | 1.29 | 1.66 |
| 1A1a | Public electricity and heat production | 216.0 | 56.1 | 9.5 | 30.3 | 1.5 | 20.0 | 20.1 | 3.7 | 0.029 | 0.042 | 0.57 | 0.09 | 0.34 |
| 1A3biii | Road transport: Heavy duty vehicles and buses | 207.0 | 48.7 | 8.3 | 38.6 | 10.0 | 10.0 | 14.1 | 1.4 | 0.031 | 0.036 | 0.31 | 0.51 | 0.36 |
| 1A2f | Stationary combustion in manufacturing industries and construction: Non-metallic minerals | 110.9 | 44.7 | 7.6 | 46.2 | 5.3 | 76.0 | 76.2 | 33.5 | 0.003 | 0.033 | 0.22 | 0.25 | 0.11 |
| 1A3dii | National navigation (shipping) | 96.2 | 41.4 | 7.0 | 53.2 | 50.0 | 40.0 | 64.0 | 20.3 | 0.001 | 0.031 | 0.02 | 2.18 | 4.76 |
| 3Da1 | Inorganic N-fertilizers (includes also urea application) | 43.0 | 34.9 | 5.9 | 59.1 | 5.0 | 160.0 | 160.1 | 90.0 | 0.012 | 0.026 | 1.91 | 0.18 | 3.69 |
| 1A3bii | Road transport: Light duty vehicles | 35.8 | 27.2 | 4.6 | 63.8 | 10.0 | 10.0 | 14.1 | 0.4 | 0.009 | 0.020 | 0.09 | 0.29 | 0.09 |
| 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | 31.3 | 24.1 | 4.1 | 67.8 | 15.0 | 40.0 | 42.7 | 3.1 | 0.008 | 0.018 | 0.31 | 0.38 | 0.24 |
| 5C2 | Open burning of waste | 22.0 | 20.7 | 3.5 | 71.4 | 63.0 | 100.0 | 118.2 | 17.4 | 0.008 | 0.015 | 0.83 | 1.38 | 2.58 |
| 3Da2a | Animal manure applied to soils | 17.6 | 18.0 | 3.1 | 74.4 | 70.8 | 160.0 | 175.0 | 28.7 | 0.008 | 0.013 | 1.23 | 1.34 | 3.32 |
| 1A4ci | Agriculture/Forestry/Fishing: Stationary | 11.5 | 17.3 | 2.9 | 77.4 | 15.0 | 40.0 | 42.7 | 1.6 | 0.009 | 0.013 | 0.37 | 0.27 | 0.21 |
| 1A4bi | Residential: Stationary | 17.6 | 16.0 | 2.7 | 80.1 | 20.0 | 40.4 | 45.1 | 1.5 | 0.006 | 0.012 | 0.25 | 0.34 | 0.18 |
| 3Da3 | Urine and dung deposited by grazing animals | 9.3 | 12.2 | 2.1 | 82.2 | 70.8 | 160.0 | 175.0 | 13.1 | 0.006 | 0.009 | 0.96 | 0.91 | 1.75 |
| 1A4ai | Commercial/institutional: Stationary | 4.6 | 9.9 | 1.7 | 83.8 | 5.0 | 35.6 | 35.9 | 0.4 | 0.006 | 0.007 | 0.21 | 0.05 | 0.05 |
| 1A4ciii | Agriculture/Forestry/Fishing: National fishing | 46.8 | 9.6 | 1.6 | 85.5 | 75.0 | 40.0 | 85.0 | 1.9 | 0.008 | 0.007 | 0.33 | 0.76 | 0.68 |
| 1A3ai(i) | International aviation LTO (civil) | 1.9 | 8.0 | 1.4 | 86.8 | 25.0 | 10.0 | 26.9 | 0.1 | 0.005 | 0.006 | 0.05 | 0.21 | 0.05 |
| 1A1b | Petroleum refining | 20.7 | 7.9 | 1.3 | 88.2 | 10.0 | 11.0 | 14.9 | 0.0 | 0.001 | 0.006 | 0.01 | 0.08 | 0.01 |
| 1A2c | Stationary combustion in manufacturing industries and construction: Chemicals | 6.7 | 7.0 | 1.2 | 89.4 | 4.4 | 23.0 | 23.4 | 0.1 | 0.003 | 0.005 | 0.07 | 0.03 | 0.01 |
| 1A2a | Stationary combustion in manufacturing industries and construction: Iron and steel | 10.8 | 6.2 | 1.1 | 90.4 | 3.5 | 1.0 | 3.6 | 0.0 | 0.001 | 0.005 | 0.00 | 0.02 | 0.00 |
| 1A2gvii | Mobile Combustion in manufacturing industries and construction: (please specify in the IIR) | 39.7 | 6.1 | 1.0 | 91.5 | 10.0 | 40.0 | 41.2 | 0.2 | 0.008 | 0.005 | 0.34 | 0.06 | 0.12 |
| 1A2e | Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco | 3.9 | 5.9 | 1.0 | 92.5 | 4.5 | 39.0 | 39.3 | 0.2 | 0.003 | 0.004 | 0.12 | 0.03 | 0.02 |
| 1A2gviii | Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR) | 9.4 | 5.6 | 1.0 | 93.4 | 4.6 | 14.0 | 14.7 | 0.0 | 0.001 | 0.004 | 0.02 | 0.03 | 0.00 |
| 1A2d | Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print | 5.3 | 5.2 | 0.9 | 94.3 | 4.9 | 10.0 | 11.1 | 0.0 | 0.002 | 0.004 | 0.02 | 0.03 | 0.00 |
| 1A2b | Stationary combustion in manufacturing industries and construction: Non-ferrous metals | 3.4 | 4.0 | 0.7 | 95.0 | 4.3 | 48.0 | 48.2 | 0.1 | 0.002 | 0.003 | 0.09 | 0.02 | 0.01 |
| 1B2c | Venting and flaring (oil, gas, combined oil and gas) | 4.0 | 3.3 | 0.6 | 95.5 | 10.0 | 16.6 | 19.4 | 0.0 | 0.001 | 0.002 | 0.02 | 0.04 | 0.00 |
| 1A3aii(i) | Domestic aviation LTO (civil) | 1.4 | 3.2 | 0.5 | 96.1 | 25.0 | 10.0 | 26.9 | 0.0 | 0.002 | 0.002 | 0.02 | 0.08 | 0.01 |
| 1A5b | Other, Mobile (including military, land based and recreational boats) | 3.7 | 3.0 | 0.5 | 96.6 | 28.3 | 20.0 | 34.7 | 0.0 | 0.001 | 0.002 | 0.02 | 0.09 | 0.01 |
| 1A3c | Railways | 6.9 | 2.6 | 0.4 | 97.0 | 2.0 | 77.5 | 77.5 | 0.1 | 0.000 | 0.002 | 0.02 | 0.01 | 0.00 |
| * | Other categories | 56.5 | 17.4 | 3.0 | 100.0 | 100.0 | 100.0 | 141.4 | 17.4 | 0.006 | 0.013 | 0.55 | 1.83 | 3.65 |
| **kt** | | **1,342.2** | **588.5** | | | | | | **243.8** | | | | | **23.9** |
| **Uncertainty** | | | | | | | | | **15.6** | | | | | **4.9** |

# A3.2. Uncertainty Analysis NMVOC

| Sector | | Emissions in 1990 | Emissions in 2024 | Level assess ment | Cumulative total | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Contribution to variance in 2024 | Type A sensitivity | Type B sensitivity | Uncertainty in trend in total emissions due to EF | Uncertainty in trend in total emissions due to AD | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NFR | Name sector | kt | Kt | (%) | (%) | (%) | (%) | (%) | | | | (%) | (%) | (%) |
| 2D3a | Domestic solvent use including fungicides | 68.7 | 68.8 | 13.7 | 13.7 | 2.0 | 67.0 | 67.0 | 84.6 | 0.034 | 0.066 | 2.30 | 0.19 | 5.30 |
| 2D3d | Coating applications | 195.3 | 57.9 | 11.6 | 25.3 | 24.0 | 58.0 | 62.8 | 52.6 | 0.034 | 0.056 | 2.00 | 1.89 | 7.56 |
| 2D3g | Chemical products | 39.6 | 48.2 | 9.6 | 34.9 | 17.0 | 78.0 | 79.8 | 59.1 | 0.028 | 0.046 | 2.18 | 1.11 | 6.01 |
| 3Da2a | Animal manure applied to soils | 23.3 | 29.3 | 5.8 | 40.8 | 50.1 | 300.0 | 304.2 | 316.2 | 0.017 | 0.028 | 5.20 | 1.99 | 31.01 |
| 3B1a | Manure management - Dairy cattle | 28.0 | 27.5 | 5.5 | 46.3 | 50.1 | 300.0 | 304.2 | 279.3 | 0.013 | 0.026 | 4.04 | 1.87 | 19.85 |
| 1A4bi | Residential: Stationary | 44.5 | 22.9 | 4.6 | 50.8 | 20.0 | 293.0 | 293.7 | 179.5 | 0.001 | 0.022 | 0.40 | 0.62 | 0.55 |
| 2H2 | Food and beverages industry | 19.5 | 21.0 | 4.2 | 55.0 | 7.0 | 490.0 | 490.0 | 422.2 | 0.011 | 0.020 | 5.47 | 0.20 | 29.95 |
| 3B1b | Manure management - Non-dairy cattle | 15.0 | 17.7 | 3.5 | 58.5 | 50.1 | 300.0 | 304.2 | 115.6 | 0.010 | 0.017 | 3.02 | 1.20 | 10.59 |
| 1B2ai | Fugitive emissions oil: Exploration, production, transport | 13.7 | 17.4 | 3.5 | 62.0 | 10.0 | 200.0 | 200.2 | 48.6 | 0.010 | 0.017 | 2.08 | 0.24 | 4.40 |
| 2D3e | Degreasing | 33.7 | 14.5 | 2.9 | 64.9 | 40.0 | 100.0 | 107.7 | 9.7 | 0.002 | 0.014 | 0.17 | 0.79 | 0.65 |
| 3B3 | Manure management - Swine | 9.6 | 14.1 | 2.8 | 67.7 | 50.1 | 300.0 | 304.2 | 73.8 | 0.009 | 0.014 | 2.74 | 0.96 | 8.43 |
| 3B4gii | Manure management - Broilers | 8.6 | 13.8 | 2.8 | 70.5 | 50.1 | 300.0 | 304.2 | 70.3 | 0.009 | 0.013 | 2.79 | 0.94 | 8.64 |
| 1B2av | Distribution of oil products | 34.6 | 13.4 | 2.7 | 73.2 | 40.0 | 2.0 | 40.0 | 1.1 | 0.003 | 0.013 | 0.01 | 0.73 | 0.53 |
| 2D3i | Other solvent use (please specify in the IIR) | 19.6 | 13.0 | 2.6 | 75.8 | 10.0 | 60.0 | 60.8 | 2.5 | 0.003 | 0.012 | 0.21 | 0.18 | 0.07 |
| 2D3h | Printing | 12.2 | 11.9 | 2.4 | 78.1 | 40.0 | 125.0 | 131.2 | 9.7 | 0.006 | 0.011 | 0.73 | 0.65 | 0.94 |
| 3De | Cultivated crops | 9.0 | 10.6 | 2.1 | 80.2 | 3.0 | 300.0 | 300.0 | 39.9 | 0.006 | 0.010 | 1.79 | 0.04 | 3.21 |
| 1A1a | Public electricity and heat production | 0.9 | 10.2 | 2.0 | 82.3 | 3.0 | 121.0 | 121.0 | 6.0 | 0.009 | 0.010 | 1.13 | 0.04 | 1.28 |
| 1A2gviii | Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR) | 16.3 | 9.9 | 2.0 | 84.2 | 4.6 | 50.0 | 50.2 | 1.0 | 0.002 | 0.009 | 0.10 | 0.06 | 0.01 |
| 1A2e | Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco | 0.2 | 9.4 | 1.9 | 86.1 | 4.5 | 48.0 | 48.2 | 0.8 | 0.009 | 0.009 | 0.43 | 0.06 | 0.19 |
| 2B10a | Chemical industry: Other (please specify in the IIR) | 6.1 | 9.1 | 1.8 | 87.9 | 10.0 | 75.0 | 75.7 | 1.9 | 0.006 | 0.009 | 0.45 | 0.12 | 0.21 |
| 1A3bi | Road transport: Passenger cars | 198.7 | 7.2 | 1.4 | 89.4 | 10.0 | 12.0 | 15.6 | 0.1 | 0.085 | 0.007 | 1.02 | 0.10 | 1.04 |
| 1A3biv | Road transport: Mopeds & motorcycles | 29.1 | 4.4 | 0.9 | 90.3 | 10.0 | 12.0 | 15.6 | 0.0 | 0.009 | 0.004 | 0.11 | 0.06 | 0.02 |
| 5A | Biological treatment of waste - Solid waste disposal on land | 2.3 | 4.3 | 0.9 | 91.1 | 30.0 | 92.3 | 97.1 | 0.7 | 0.003 | 0.004 | 0.29 | 0.18 | 0.11 |
| 5C2 | Open burning of waste | 6.5 | 4.2 | 0.8 | 91.9 | 63.0 | 200.0 | 209.7 | 3.0 | 0.001 | 0.004 | 0.20 | 0.36 | 0.17 |
| 1A4aii | Commercial/institutional: Mobile | 0.0 | 4.0 | 0.8 | 92.7 | 15.0 | 100.0 | 101.1 | 0.7 | 0.004 | 0.004 | 0.38 | 0.08 | 0.15 |
| 2H1 | Pulp and paper industry | 2.6 | 3.3 | 0.7 | 93.4 | 5.0 | 100.0 | 100.1 | 0.4 | 0.002 | 0.003 | 0.20 | 0.02 | 0.04 |
| 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | 7.8 | 2.8 | 0.6 | 94.0 | 15.0 | 35.9 | 38.9 | 0.0 | 0.001 | 0.003 | 0.03 | 0.06 | 0.00 |
| 1A2f | Stationary combustion in manufacturing industries and construction: Non-metallic minerals | 3.1 | 2.7 | 0.5 | 94.5 | 5.3 | 76.0 | 76.2 | 0.2 | 0.001 | 0.003 | 0.09 | 0.02 | 0.01 |
| 3B4gi | Manure management - Laying hens | 1.8 | 2.1 | 0.4 | 94.9 | 50.1 | 300.0 | 304.2 | 1.6 | 0.001 | 0.002 | 0.35 | 0.14 | 0.15 |
| 1A2d | Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print | 2.0 | 1.9 | 0.4 | 95.3 | 5.0 | 100.0 | 100.1 | 0.1 | 0.001 | 0.002 | 0.09 | 0.01 | 0.01 |
| 1A4ai | Commercial/institutional: Stationary | 0.2 | 1.8 | 0.4 | 95.6 | 5.0 | 36.8 | 37.1 | 0.0 | 0.002 | 0.002 | 0.06 | 0.01 | 0.00 |
| 1A3dii | National navigation (shipping) | 3.2 | 1.7 | 0.3 | 96.0 | 50.0 | 50.0 | 70.7 | 0.1 | 0.000 | 0.002 | 0.01 | 0.12 | 0.01 |
| 1A3bv | Road transport: Gasoline evaporation | 82.5 | 1.7 | 0.3 | 96.3 | 20.0 | 20.0 | 28.3 | 0.0 | 0.036 | 0.002 | 0.73 | 0.05 | 0.53 |
| 1A2c | Stationary combustion in manufacturing industries and construction: Chemicals | 0.3 | 1.7 | 0.3 | 96.7 | 4.4 | 40.0 | 40.2 | 0.0 | 0.001 | 0.002 | 0.06 | 0.01 | 0.00 |
| 3Da3 | Urine and dung deposited by grazing animals | 0.9 | 1.5 | 0.3 | 97.0 | 50.1 | 300.0 | 304.2 | 0.8 | 0.001 | 0.001 | 0.31 | 0.10 | 0.11 |
| * | Other categories | 102.3 | 15.1 | 3.0 | 100.0 | 100.0 | 100.0 | 141.4 | 18.2 | 0.033 | 0.015 | 3.27 | 2.05 | 14.89 |
| kt | | **1,041.8** | **500.9** | | | | | | **1,800.7** | | | | | **156.6** |
| Uncertainty | | | | | | | | | **42.4** | | | | | **12.5** |

## A3.3. Uncertainty Analysis $SO_2$

| Sector | | Emissions in 1990 | Emissions in 2024 | Level assess ment | Cumulative total | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Contribution to variance in 2024 | Type A sensitivity | Type B sensitivity | Uncertainty in trend in total emissions due to EF | Uncertainty in trend in total emissions due to AD | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NFR | Name sector | kt | kt | (%) | (%) | (%) | (%) | (%) | | | | (%) | (%) | (%) |
| 1B2aiv | Fugitive emissions oil: Refining / storage | 40.3 | 17.8 | 18.2 | 18.2 | 10.0 | 2.0 | 10.2 | 3.5 | 0.008 | 0.008 | 0.02 | 0.12 | 0.01 |
| 1A2f | Stationary combustion in manufacturing industries and construction: Non-metallic minerals | 88.2 | 17.8 | 18.2 | 36.5 | 5.3 | 1.0 | 5.4 | 1.0 | 0.006 | 0.008 | 0.01 | 0.06 | 0.00 |
| 1A1a | Public electricity and heat production | 1,459.1 | 8.7 | 8.9 | 45.4 | 1.5 | 20.0 | 20.1 | 3.2 | 0.027 | 0.004 | 0.55 | 0.01 | 0.30 |
| 1A2b | Stationary combustion in manufacturing industries and construction: Non-ferrous metals | 18.5 | 7.3 | 7.5 | 52.9 | 4.3 | 2.0 | 4.7 | 0.1 | 0.003 | 0.003 | 0.01 | 0.02 | 0.00 |
| 1A4ai | Commercial/institutional: Stationary | 6.0 | 6.8 | 6.9 | 59.8 | 5.0 | 40.3 | 40.6 | 7.9 | 0.003 | 0.003 | 0.12 | 0.02 | 0.02 |
| 1A4bi | Residential: Stationary | 19.0 | 5.5 | 5.6 | 65.5 | 20.0 | 40.2 | 44.9 | 6.4 | 0.002 | 0.003 | 0.09 | 0.07 | 0.01 |
| 1A3dii | National navigation (shipping) | 43.4 | 4.9 | 5.0 | 70.5 | 50.0 | 30.0 | 58.3 | 8.5 | 0.001 | 0.002 | 0.04 | 0.16 | 0.03 |
| 1A2c | Stationary combustion in manufacturing industries and construction: Chemicals | 47.7 | 4.5 | 4.6 | 75.1 | 4.4 | 363.0 | 363.0 | 278.7 | 0.001 | 0.002 | 0.39 | 0.01 | 0.15 |
| 1A2a | Stationary combustion in manufacturing industries and construction: Iron and steel | 28.5 | 3.4 | 3.5 | 78.6 | 35.8 | 4.0 | 36.0 | 1.6 | 0.001 | 0.002 | 0.00 | 0.08 | 0.01 |
| 2H1 | Pulp and paper industry | 2.3 | 3.3 | 3.3 | 81.9 | 5.0 | 100.0 | 100.1 | 11.2 | 0.001 | 0.002 | 0.15 | 0.01 | 0.02 |
| 1B2c | Venting and flaring (oil, gas, combined oil and gas) | 24.4 | 2.7 | 2.8 | 84.7 | 10.0 | 18.9 | 21.4 | 0.4 | 0.001 | 0.001 | 0.01 | 0.02 | 0.00 |
| 2B10a | Chemical industry: Other (please specify in the IIR) | 9.7 | 2.6 | 2.7 | 87.4 | 2.0 | 20.0 | 20.1 | 0.3 | 0.001 | 0.001 | 0.02 | 0.00 | 0.00 |
| 2C7a | Copper production | 1.0 | 1.4 | 1.4 | 88.8 | 5.0 | 2.0 | 5.4 | 0.0 | 0.001 | 0.001 | 0.00 | 0.00 | 0.00 |
| 1A1b | Petroleum refining | 134.4 | 1.2 | 1.2 | 90.0 | 10.0 | 2.0 | 10.2 | 0.0 | 0.002 | 0.001 | 0.00 | 0.01 | 0.00 |
| 2C5 | Lead production | 0.3 | 1.1 | 1.2 | 91.2 | 5.0 | 20.0 | 20.6 | 0.1 | 0.001 | 0.001 | 0.01 | 0.00 | 0.00 |
| 2C1 | Iron and steel production | 1.3 | 1.0 | 1.0 | 92.2 | 40.0 | 190.0 | 194.2 | 3.7 | 0.000 | 0.000 | 0.08 | 0.03 | 0.01 |
| 2C7c | Other metal production (please specify in the IIR) | 0.3 | 0.9 | 0.9 | 93.1 | 5.0 | 792.0 | 792.0 | 56.2 | 0.000 | 0.000 | 0.34 | 0.00 | 0.11 |
| 1A4ci | Agriculture/Forestry/Fishing: Stationary | 1.1 | 0.9 | 0.9 | 94.0 | 15.0 | 40.0 | 42.7 | 0.1 | 0.000 | 0.000 | 0.02 | 0.01 | 0.00 |
| 5C2 | Open burning of waste | 0.9 | 0.8 | 0.8 | 94.8 | 63.0 | 200.0 | 209.7 | 2.9 | 0.000 | 0.000 | 0.07 | 0.03 | 0.01 |
| 2C6 | Zinc production | 0.4 | 0.8 | 0.8 | 95.6 | 5.0 | 567.0 | 567.0 | 20.4 | 0.000 | 0.000 | 0.20 | 0.00 | 0.04 |
| 1A2gviii | Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR) | 28.2 | 0.7 | 0.7 | 96.3 | 4.6 | 2.0 | 5.0 | 0.0 | 0.000 | 0.000 | 0.00 | 0.00 | 0.00 |
| 1A1c | Manufacture of solid fuels and other energy industries | 10.9 | 0.7 | 0.7 | 97.0 | 4.6 | 2.0 | 5.0 | 0.0 | 0.000 | 0.000 | 0.00 | 0.00 | 0.00 |
| * | Other categories | 157.1 | 2.9 | 3.0 | 100.0 | 100.0 | 100.0 | 141.4 | 17.6 | 0.002 | 0.001 | 0.20 | 0.19 | 0.08 |
| **Kt** | | **2,123.0** | **97.5** | | | | | | **423.6** | | | | | **0.8** |
| **Uncertainty** | | | | | | | | | **20.6** | | | | | **0.9** |

## A3.4. Uncertainty Analysis $NH_3$

| Sector | | Emissions in 1990 | Emissions in 2024 | Level assess ment | Cumulative total | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Contribution to variance in 2024 | Type A sensitivity | Type B sensitivity | Uncertainty in trend in total emissions due to EF | Uncertainty in trend in total emissions due to AD | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NFR | Name sector | kt | kt | (%) | (%) | (%) | (%) | (%) | | | | (%) | (%) | (%) |
| 3Da1 | Inorganic N-fertilizers (includes also urea application) | 132.6 | 103.3 | 22.8 | 22.8 | 5.0 | 50.0 | 50.2 | 131.2 | 0.017 | 0.193 | 0.85 | 1.37 | 2.59 |
| 3Da2a | Animal manure applied to soils | 132.0 | 102.1 | 22.5 | 45.3 | 70.8 | 50.0 | 86.7 | 381.1 | 0.018 | 0.191 | 0.92 | 19.12 | 366.26 |
| 3B3 | Manure management - Swine | 60.5 | 64.4 | 14.2 | 59.5 | 70.8 | 136.0 | 153.3 | 475.1 | 0.024 | 0.121 | 3.33 | 12.07 | 156.67 |
| 3Da3 | Urine and dung deposited by grazing animals | 23.0 | 34.7 | 7.6 | 67.2 | 70.8 | 136.0 | 153.3 | 137.5 | 0.028 | 0.065 | 3.85 | 6.49 | 57.00 |
| 3B1a | Manure management - Dairy cattle | 42.8 | 33.2 | 7.3 | 74.5 | 70.8 | 136.0 | 153.3 | 126.3 | 0.006 | 0.062 | 0.79 | 6.22 | 39.33 |
| 3B1b | Manure management - Non-dairy cattle | 27.1 | 28.0 | 6.2 | 80.7 | 70.8 | 136.0 | 153.3 | 89.9 | 0.009 | 0.052 | 1.28 | 5.25 | 29.18 |
| 3B4gii | Manure management - Broilers | 20.9 | 19.0 | 4.2 | 84.9 | 70.8 | 136.0 | 153.3 | 41.5 | 0.002 | 0.036 | 0.34 | 3.56 | 12.82 |
| 3B4h | Manure management - Other animals (please specify in IIR) | 18.4 | 8.9 | 2.0 | 86.9 | 70.8 | 136.0 | 153.3 | 9.1 | 0.012 | 0.017 | 1.70 | 1.67 | 5.68 |
| 3B2 | Manure management - Sheep | 9.3 | 7.2 | 1.6 | 88.5 | 70.8 | 136.0 | 153.3 | 6.0 | 0.001 | 0.013 | 0.17 | 1.35 | 1.86 |
| 3B4e | Manure management - Horses | 1.9 | 6.9 | 1.5 | 90.0 | 70.8 | 136.0 | 153.3 | 5.5 | 0.010 | 0.013 | 1.36 | 1.30 | 3.53 |
| 3B4gi | Manure management - Laying hens | 9.0 | 6.1 | 1.3 | 91.3 | 70.8 | 136.0 | 153.3 | 4.3 | 0.003 | 0.011 | 0.39 | 1.14 | 1.46 |
| 3B4giv | Manure management - Other poultry | 10.8 | 5.9 | 1.3 | 92.6 | 70.8 | 136.0 | 153.3 | 3.9 | 0.006 | 0.011 | 0.85 | 1.10 | 1.92 |
| 3B4giii | Manure management - Turkeys | 2.4 | 5.7 | 1.3 | 93.9 | 70.8 | 136.0 | 153.3 | 3.7 | 0.007 | 0.011 | 0.92 | 1.06 | 1.97 |
| 3B4d | Manure management - Goats | 2.3 | 5.0 | 1.1 | 95.0 | 70.8 | 136.0 | 153.3 | 2.8 | 0.006 | 0.009 | 0.77 | 0.93 | 1.46 |
| 3Da4 | Crop residues applied to soils | 4.2 | 4.8 | 1.1 | 96.0 | 35.0 | 50.0 | 61.0 | 0.4 | 0.002 | 0.009 | 0.12 | 0.45 | 0.21 |
| 3Da2b | Sewage sludge applied to soils | 1.1 | 3.5 | 0.8 | 96.8 | 35.0 | 50.0 | 61.0 | 0.2 | 0.005 | 0.007 | 0.25 | 0.33 | 0.17 |
| 1A3bi | Road transport: Passenger cars | 0.3 | 3.1 | 0.7 | 97.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.005 | 0.006 | 0.00 | 0.00 | 0.00 |
| * | Other categories | 35.8 | 11.3 | 2.5 | 100.0 | 100.0 | 100.0 | 141.4 | 12.4 | 0.036 | 0.021 | 3.57 | 2.99 | 21.67 |
| **Kt** | | **534.5** | **453.1** | | | | | | **1,431.0** | | | | | **703.8** |
| **Uncertainty** | | | | | | | | | **37.8** | | | | | **26.5** |

## A3.5. Uncertainty Analysis $PM_{2.5}$

| Sector | | Emissions in 2000 | Emissions in 2024 | Level assess ment | Cumulative total | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Contribution to variance in 2024 | Type A sensitivity | Type B sensitivity | Uncertainty in trend in total emissions due to EF | Uncertainty in trend in total emissions due to AD | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NFR | Name sector | kt | kt | (%) | (%) | (%) | (%) | (%) | | | | (%) | (%) | (%) |
| 1A4bi | Residential: Stationary | 50.6 | 26.4 | 29.1 | 29.1 | 20.0 | 99.7 | 101.7 | 875.4 | 0.003 | 0.149 | 0.25 | 4.22 | 17.88 |
| 5C2 | Open burning of waste | 24.0 | 19.2 | 21.1 | 50.2 | 63.0 | 200.0 | 209.7 | 1,956.4 | 0.039 | 0.108 | 7.75 | 9.64 | 153.05 |
| 1A2gviii | Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR) | 3.7 | 4.3 | 4.7 | 54.9 | 4.6 | 77.5 | 77.6 | 13.6 | 0.014 | 0.024 | 1.05 | 0.16 | 1.12 |
| 1A2e | Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco | 2.1 | 4.0 | 4.4 | 59.4 | 4.5 | 85.5 | 85.6 | 14.4 | 0.017 | 0.023 | 1.43 | 0.14 | 2.06 |
| 1A3bvi | Road transport: Automobile tyre and brake wear | 2.9 | 3.6 | 3.9 | 63.3 | 10.0 | 32.0 | 33.5 | 1.8 | 0.012 | 0.020 | 0.38 | 0.29 | 0.23 |
| 1A3bi | Road transport: Passenger cars | 9.6 | 3.5 | 3.9 | 67.2 | 10.0 | 9.0 | 13.5 | 0.3 | 0.008 | 0.020 | 0.07 | 0.28 | 0.08 |
| 1A1a | Public electricity and heat production | 10.5 | 3.0 | 3.3 | 70.5 | 1.5 | 30.0 | 30.0 | 1.0 | 0.013 | 0.017 | 0.40 | 0.04 | 0.16 |
| 1A3bvii | Road transport: Automobile road abrasion | 1.8 | 2.2 | 2.4 | 72.9 | 10.0 | 25.0 | 26.9 | 0.4 | 0.007 | 0.012 | 0.18 | 0.17 | 0.06 |
| 2B10a | Chemical industry: Other (please specify in the IIR) | 2.0 | 2.1 | 2.3 | 75.2 | 10.0 | 132.0 | 132.4 | 9.7 | 0.006 | 0.012 | 0.84 | 0.17 | 0.73 |
| 1A4ai | Commercial/institutional: Stationary | 2.2 | 2.0 | 2.2 | 77.5 | 5.0 | 33.7 | 34.0 | 0.6 | 0.005 | 0.011 | 0.18 | 0.08 | 0.04 |
| 1A3dii | National navigation (shipping) | 1.8 | 2.0 | 2.2 | 79.7 | 50.0 | 50.0 | 70.7 | 2.5 | 0.006 | 0.011 | 0.31 | 0.81 | 0.75 |
| 3Dc | Farm-level agricultural operations including storage, handling and transport of agricultural products | 2.1 | 1.8 | 2.0 | 81.6 | 3.0 | 400.0 | 400.0 | 61.2 | 0.004 | 0.010 | 1.56 | 0.04 | 2.45 |
| 2G | Other product use (please specify in the IIR) | 0.8 | 1.7 | 1.9 | 83.5 | 2.0 | 13.0 | 13.2 | 0.1 | 0.008 | 0.010 | 0.10 | 0.03 | 0.01 |
| 5E | Other waste (please specify in IIR) | 2.0 | 1.5 | 1.7 | 85.2 | 25.2 | 50.5 | 56.4 | 0.9 | 0.003 | 0.009 | 0.14 | 0.30 | 0.11 |
| 1A2f | Stationary combustion in manufacturing industries and construction: Non-metallic minerals | 2.5 | 1.2 | 1.4 | 86.5 | 5.3 | 39.3 | 39.7 | 0.3 | 0.000 | 0.007 | 0.01 | 0.05 | 0.00 |
| 1A2d | Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print | 2.4 | 1.2 | 1.3 | 87.8 | 4.9 | 77.0 | 77.2 | 1.0 | 0.000 | 0.007 | 0.03 | 0.05 | 0.00 |
| 2A5a | Quarrying and mining of minerals other than coal | 2.2 | 1.1 | 1.2 | 89.1 | 5.0 | 100.0 | 100.1 | 1.5 | 0.000 | 0.006 | 0.01 | 0.05 | 0.00 |
| 2C1 | Iron and steel production | 1.0 | 0.9 | 1.0 | 90.1 | 3.1 | 472.0 | 472.0 | 23.5 | 0.002 | 0.005 | 1.08 | 0.02 | 1.17 |
| 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | 4.0 | 0.9 | 1.0 | 91.1 | 15.0 | 39.3 | 42.1 | 0.2 | 0.007 | 0.005 | 0.26 | 0.11 | 0.08 |
| 2H1 | Pulp and paper industry | 0.4 | 0.9 | 1.0 | 92.0 | 5.0 | 194.0 | 194.1 | 3.5 | 0.004 | 0.005 | 0.74 | 0.03 | 0.55 |
| 1A4ci | Agriculture/Forestry/Fishing: Stationary | 0.5 | 0.9 | 0.9 | 93.0 | 15.0 | 39.8 | 42.6 | 0.2 | 0.003 | 0.005 | 0.13 | 0.10 | 0.03 |
| 1A3biii | Road transport: Heavy duty vehicles and buses | 7.2 | 0.7 | 0.8 | 93.8 | 10.0 | 9.0 | 13.5 | 0.0 | 0.017 | 0.004 | 0.15 | 0.06 | 0.03 |
| 2A3 | Glass production | 0.7 | 0.7 | 0.8 | 94.6 | 5.0 | 120.2 | 120.3 | 0.9 | 0.002 | 0.004 | 0.26 | 0.03 | 0.07 |
| 1A3bii | Road transport: Light duty vehicles | 5.3 | 0.6 | 0.6 | 95.2 | 10.0 | 9.0 | 13.5 | 0.0 | 0.012 | 0.003 | 0.11 | 0.05 | 0.01 |
| 2A5b | Construction and demolition | 2.3 | 0.5 | 0.5 | 95.7 | 5.0 | 563.0 | 563.0 | 8.9 | 0.004 | 0.003 | 2.14 | 0.02 | 4.59 |
| 3B1b | Manure management - Non-dairy cattle | 0.3 | 0.3 | 0.4 | 96.1 | 50.1 | 400.0 | 403.1 | 2.0 | 0.001 | 0.002 | 0.33 | 0.13 | 0.13 |
| 3B1a | Manure management - Dairy cattle | 0.5 | 0.3 | 0.4 | 96.5 | 50.1 | 400.0 | 403.1 | 2.0 | 0.000 | 0.002 | 0.17 | 0.13 | 0.05 |
| 3F | Field burning of agricultural residues | 21.4 | 0.3 | 0.3 | 96.8 | 63.0 | 24.1 | 67.5 | 0.1 | 0.060 | 0.002 | 1.45 | 0.16 | 2.13 |
| 1A2gvii | Mobile Combustion in manufacturing industries and construction: (please specify in the IIR) | 3.4 | 0.3 | 0.3 | 97.1 | 10.0 | 40.0 | 41.2 | 0.0 | 0.008 | 0.002 | 0.34 | 0.02 | 0.11 |
| * | Other categories | 7.1 | 2.6 | 2.9 | 100.0 | 100.0 | 100.0 | 141.4 | 17.0 | 0.006 | 0.015 | 0.56 | 2.11 | 4.78 |
| **Kt** | | **177.1** | **90.9** | | | | | | **2,999.0** | | | | | **192.4** |
| **Uncertainty** | | | | | | | | | **54.8** | | | | | **13.9** |

# A3.6. Uncertainty Analysis BC

| Sector | | Emissions in 2000 | Emissions in 2024 | Level assess ment | Cumulative total | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Contribution to variance in 2024 | Type A sensitivity | Type B sensitivity | Uncertainty in trend in total emissions due to EF | Uncertainty in trend in total emissions due to AD | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NFR | Name sector | kt | kt | (%) | (%) | (%) | (%) | (%) | | | | (%) | (%) | (%) |
| 5C2 | Open burning of waste | 13.4 | 10.7 | 44.7 | 44.7 | 63.0 | 276.0 | 283.1 | 16,009.8 | 0.080 | 0.238 | 21.98 | 21.20 | 932.57 |
| 1A4bi | Residential: Stationary | 5.8 | 3.4 | 14.1 | 58.8 | 20.0 | 87.4 | 89.7 | 159.1 | 0.006 | 0.075 | 0.52 | 2.12 | 4.75 |
| 1A3bi | Road transport: Passenger cars | 7.0 | 3.0 | 12.4 | 71.2 | 10.0 | 40.0 | 41.2 | 26.2 | 0.017 | 0.066 | 0.67 | 0.93 | 1.32 |
| 1A2gviii | Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR) | 0.8 | 1.2 | 5.0 | 76.2 | 4.6 | 32.0 | 32.3 | 2.6 | 0.017 | 0.027 | 0.53 | 0.17 | 0.31 |
| 1A2e | Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco | 0.4 | 1.1 | 4.7 | 80.8 | 4.5 | 39.0 | 39.3 | 3.3 | 0.020 | 0.025 | 0.76 | 0.16 | 0.61 |
| 2G | Other product use (please specify in the IIR) | 0.3 | 0.7 | 2.7 | 83.6 | 2.0 | 65.4 | 65.4 | 3.2 | 0.011 | 0.015 | 0.75 | 0.04 | 0.56 |
| 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | 2.2 | 0.6 | 2.3 | 85.9 | 15.0 | 40.0 | 42.7 | 1.0 | 0.013 | 0.012 | 0.53 | 0.26 | 0.35 |
| 1A4ci | Agriculture/Forestry/Fishing: Stationary | 0.3 | 0.5 | 2.1 | 87.9 | 15.0 | 40.0 | 42.7 | 0.8 | 0.007 | 0.011 | 0.27 | 0.23 | 0.13 |
| 1A3bii | Road transport: Light duty vehicles | 3.4 | 0.5 | 2.0 | 90.0 | 10.0 | 40.0 | 41.2 | 0.7 | 0.029 | 0.011 | 1.18 | 0.15 | 1.41 |
| 1A3biii | Road transport: Heavy duty vehicles and buses | 4.0 | 0.5 | 2.0 | 91.9 | 10.0 | 40.0 | 41.2 | 0.7 | 0.037 | 0.011 | 1.49 | 0.15 | 2.23 |
| 1A3bvi | Road transport: Automobile tyre and brake wear | 0.3 | 0.4 | 1.7 | 93.6 | 10.0 | 50.0 | 51.0 | 0.7 | 0.005 | 0.009 | 0.26 | 0.13 | 0.08 |
| 1A2f | Stationary combustion in manufacturing industries and construction: Non-metallic minerals | 0.6 | 0.4 | 1.5 | 95.1 | 5.3 | 25.2 | 25.8 | 0.1 | 0.000 | 0.008 | 0.01 | 0.06 | 0.00 |
| 1A4ai | Commercial/institutional: Stationary | 0.2 | 0.2 | 1.0 | 96.1 | 5.0 | 94.2 | 94.3 | 0.9 | 0.003 | 0.005 | 0.33 | 0.04 | 0.11 |
| 1A2gvii | Mobile Combustion in manufacturing industries and construction: (please specify in the IIR) | 1.9 | 0.2 | 0.8 | 97.0 | 10.0 | 40.0 | 41.2 | 0.1 | 0.018 | 0.004 | 0.72 | 0.06 | 0.52 |
| * | Other categories | 4.3 | 0.7 | 3.0 | 100.0 | 100.0 | 100.0 | 141.4 | 18.2 | 0.035 | 0.016 | 3.47 | 2.27 | 17.17 |
| **Kt** | | **45.0** | **24.0** | | | | | | **16,227.4** | | | | | **962.1** |
| **Uncertainty** | | | | | | | | | **127.4** | | | | | **31.0** |

# ANNEX 4. INFORMATION ON CONDENSABLE COMPONENT OF PM

Chapter updated in March, 2026.

## A4.1. Information on the condensable component of PM

Within the CLRTAP, the Executive Body, at its thirty-eight session, formally requested that Parties describe their practices for reporting the condensable component of PM in their IIRs, (ECE/EB.AIR/142 para 18.f). The purpose is to provide transparent information that can easily be used by the modellers. To this end, information regarding the inclusion or not of the condensable component of PM in the reported emissions is provided in this annex. An extract of this annex has been included in the relevant sector chapters in order to inform on the matter on a sector basis.

| NFR | Source/sector name | PM emissions: the condensable component is | | EF reference and comments |
|---|---|---|---|---|
| | | included | excluded | |
| 1A1a | Public electricity and heat production | | X | LPS: continuous stack measurements of TSP (mainly opacimeters, calibrated by gravimetry and isokinetic sampling); $PM_{2.5}$ and $PM_{10}$ fractions based in CEPMEIP (2000), from TSP data.<br>Area sources: default EF from CEPMEIP Database (2000). |
| 1A1b | Petroleum refining | | X | Varying degrees of complexity; in majority emission factors represent filterable PM emissions. |
| 1A1c | Manufacture of solid fuels and other energy industries | | X | LPS (coke plants): country-specific TSP and $PM_{10}$ EF; $PM_{2.5}$ fraction based in CEPMEIP.<br>Area sources: mainly default EF from CEPMEIP Database (2000), but also from EEA/EMEP Guidebook (2019) where most of the EF used represents only filterable PM emissions. |
| 1A2a | Stationary combustion in manufacturing industries and construction: Iron and Steel | Mostly excluded but unclear | | Varying degrees of complexity: in majority emissions factors represent filterable PM emissions, but it may not be clear whether only the filterable part or the total part is represented (EMEP/EEA Guidebook (2019); TSP (mainly opacimeters, calibrated by gravimetry and isokinetic sampling); $PM_{2.5}$ and $PM_{10}$ fractions based in CEPMEIP (2000), from TSP data Periodic measurements (between one time a week and once a year). |

| NFR | Source/sector name | PM emissions: the condensable component is | | EF reference and comments |
|---|---|---|---|---|
| | | **included** | **excluded** | |
| 1A2b | Stationary combustion in manufacturing industries and construction: Non-ferrous metals | Mostly excluded but unclear | | Varying degrees of complexity: in majority emissions factors represent filterable PM emissions, but it may not be clear whether only the filterable part or the total part is represented (EMEP/EEA Guidebook (2019); TSP (mainly opacimeters, calibrated by gravimetry and isokinetic sampling); $PM_{2.5}$ and $PM_{10}$ fractions based in CEPMEIP (2000), from TSP data Periodic measurements (between one time a month and once a year). |
| 1A2c | Stationary combustion in manufacturing industries and construction: Chemicals | Mostly excluded but unclear | | Varying degrees of complexity: in majority emissions factors represent filterable PM emissions, but it may not be clear whether only the filterable part or the total part is represented (EMEP/EEA Guidebook (2019). |
| 1A2d | Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print | Mostly excluded but unclear | | Varying degrees of complexity: in majority emissions factors represent filterable PM emissions, but it may not be clear whether only the filterable part or the total part is represented (EMEP/EEA Guidebook (2019), Periodic measurements (between one time a month and more than once a year). |
| 1A2e | Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco | Mostly excluded but unclear | | Varying degrees of complexity: in majority emissions factors represent filterable PM emissions, but it may not be clear whether only the filterable part or the total part is represented (EMEP/EEA Guidebook (2019). |
| 1A2f | Stationary combustion in manufacturing industries and construction: Non-metallic minerals | Mostly excluded but unclear | | Varying degrees of complexity; in majority emission factors represent filterable PM emissions (EMEP/EEA Guidebook (2019), OFICEMEN). |
| 1A2gvii | Mobile combustion in manufacturing industries and construction | X | | EF from EEA/EMEP Guidebook (2023). |
| 1A2gviii | Stationary combustion in manufacturing industries and construction: Other | | X | $PM_{2.5}$ and $PM_{10}$ fractions based in CEPMEIP (2000), from TSP data Periodic measurements (between one time a week and once a year). |
| 1A3ai(i) | International aviation LTO (civil) | X | | EF from FEIS model (EUROCONTROL). |

| NFR | Source/sector name | PM emissions: the condensable component is | | EF reference and comments |
|---|---|---|---|---|
| | | included | excluded | |
| 1A3aii(i) | Domestic aviation LTO (civil) | X | | |
| 1A3bi | Road transport: Passenger cars | X | | EF from EEA/EMEP Guidebook (2019): The measurement procedure regulated for vehicle exhaust PM mass characterisation requires that samples are taken at a temperature lower than 52 °C. At this temperature, PM contains a large fraction of condensable species, Hence, PM mass emission factors in this sector are considered to include both filterable and condensable material. |
| 1A3bii | Road transport: Light duty vehicles | X | | |
| 1A3biii | Road transport: Heavy duty vehicles and buses | X | | |
| 1A3biv | Road transport: Mopeds & motorcycles | X | | |
| 1A3bv | Road transport: Gasoline evaporation | NA | | |
| 1A3bvi | Road transport: Automobile tyre and brake wear | X | | EF from EEA/EMEP Guidebook (2019). |
| 1A3bvii | Road transport: Automobile road abrasion | X | | EF from EEA/EMEP Guidebook (2019). |
| 1A3c | Railways | X | | Default T1 EF from EEA/EMEP Guidebook (2023). |
| 1A3di(ii) | International inland waterways | NO | | |
| 1A3dii | National navigation (shipping) | X | | EF from EEA/EMEP Guidebook (2023). |
| 1A3ei | Pipeline transport | | X | Default EF from CEPMEIP Database (2000). |
| 1A3eii | Other | NO | | |
| 1A4ai | Commercial/Institutional: Stationary | Depending on category and fuel. | | EF from EEA/EMEP Guidebook (2023), Chapter 1A4, Small combustion.<br>Boilers – solid and liquid fuels: It is unclear whether PM emissions include or not the condensable component.<br>Boilers – gaseous fuels: Condensable component excluded.<br>Boilers – solid biomass: Condensable component included.<br>Turbines – all fuels: It is unclear whether PM emissions include or not the condensable component.<br>Stationary engines – all fuels: It is unclear whether PM emissions include or not the condensable component. |
| 1A4aii | Commercial/Institutional: Mobile | X | | Default EF from EEA/EMEP Guidebook (2023), Chapter 1A4, Non-road mobile machinery, table 3-1. |

| NFR | Source/sector name | PM emissions: the condensable component is | | EF reference and comments |
|---|---|---|---|---|
| | | included | excluded | |
| 1A4bi | Residential: Stationary | Depending on category and fuel. | | EF from EEA/EMEP Guidebook (2023), Chapter 1A4, Small combustion.<br>Boilers – solid fuels: Condensable component excluded. With the exception of petroleum coke, for which it is unclear whether PM emissions include or not the condensable component.<br>Boilers – gas oil: Condensable component excluded.<br>Boilers – rest of liquid fuels: It is unclear whether PM emissions include or not the condensable component.<br>Boilers – gaseous fuels: It is unclear whether PM emissions include or not the condensable component.<br>All appliances – biomass: Condensable component included. |
| 1A4bii | Residential: Household and gardening (mobile) | IE | | |
| 1A4ci | Agriculture/Forestry/Fishing: Stationary | Depending on category and fuel. | | EF from EEA/EMEP Guidebook (2023), Chapter 1A4, Small combustion.<br>Boilers – solid and liquid fuels: It is unclear whether PM emissions include or not the condensable component.<br>Boilers – gaseous fuels: Condensable component excluded.<br>Boilers – biomass: Condensable component included.<br>Stationary engines – all fuels: It is unclear whether PM emissions include or not the condensable component. |
| 1A4cii | Agriculture/Forestry/Fishing: Off-road vehicles and other machinery | X | | EF from EEA/EMEP Guidebook (2023). |
| 1A4ciii | Agriculture/Forestry/Fishing: National fishing | X | | EF from EEA/EMEP Guidebook (2023). |
| 1A5a | Other stationary (including military) | IE | | |
| 1A5b | Other, Mobile (including military, land based and recreational boats) | X | | Aggregated methodology from 1A3a, 1A3b, 1A3dii (see categories above). |
| 1B1a | Fugitive emission from solid fuels: Coal mining and handling | No information available. | | EF from EEA/EMEP Guidebook (2019). |
| 1B1b | Fugitive emission from solid fuels: Solid fuel transformation | No information available. | | EF from EEA/EMEP Guidebook (2019). |
| 1B1c | Other fugitive emissions from solid fuels | NO | | |

| NFR | Source/sector name | PM emissions: the condensable component is | | EF reference and comments |
|---|---|---|---|---|
| | | **included** | **excluded** | |
| 1B2ai | Fugitive emissions oil: Exploration, production, transport | NA | | |
| 1B2aiv | Fugitive emissions oil: Refining and storage | No information available. | | EMEP/EEA Guidebook (2019), Continuous measurements. |
| 1B2av | Distribution of oil products | NA | | |
| 1B2b | Fugitive emissions from natural gas (exploration, production, processing, transmission, storage, distribution and other) | NA | | |
| 1B2c | Venting and flaring (oil, gas, combined oil and gas) | No information available. | | Continuous measurements. |
| 1B2d | Other fugitive emissions from energy production | NO | | |
| 2A1 | Cement production | IE | | |
| 2A2 | Lime production | No information available. | | EMEP/EEA GB 2019. |
| 2A3 | Glass production | No information available. | | EMEP/EEA GB 2019. |
| 2A5a | Quarrying and mining of minerals other than coal | No information available. | | "Proxy solution" from "Best practice report of NECD Emissions inventory review 2023". |
| 2A5b | Construction and demolition | No information available. | | EMEP/EEA GB 2019. |
| 2A5c | Storage, handling and transport of mineral products | No information available. | | EMEP/EEA GB 2019. |
| 2A6 | Other mineral products: Batteries manufacturing | NA | | |
| 2B1 | Ammonia production | NE | | |
| 2B2 | Nitric acid production | NE | | |
| 2B3 | Adipic acid production | NO | | |
| 2B5 | Carbide production | No information available. | | EMEP/EEA GB 2019. |
| 2B6 | Titanium dioxide production | No information available. | | EMEP/EEA GB 2019. |
| 2B7 | Soda ash production | No information available. | | EMEP/EEA GB 2019. |
| 2B10a | Other chemical industry: Processes in organic and inorganic chemical industry except adipic acid | No information available. | | EMEP/EEA GB 2019. |
| 2B10b | Storage, handling and transport of chemical products | IE | | |
| 2C1 | Iron and steel production | No information available. | | Stack measurements of TSP and $PM_{10}$; $PM_{2.5}$ fractions based in CEPMEIP (2000) or EMEP/EEA GB 2019, from TSP data. |
| | | | X | EMEP/EEA GB 2019. |
| 2C2 | Ferroalloys production | | X | EMEP/EEA GB 2019. |
| 2C3 | Aluminium production – Primary prod | No information available. | | Stack measurements of TSP; $PM_{2.5}$ and $PM_{10}$ fractions based in CEPMEIP (2000), from TSP data. |
| | Secondary prod | | X | EMEP/EEA GB 2019. |
| 2C4 | Magnesium production | NO | | |
| 2C5 | Lead production | | X | EMEP/EEA GB 2019. |
| 2C6 | Zinc production | | X | EMEP/EEA GB 2019. |

| NFR | Source/sector name | PM emissions: the condensable component is | | EF reference and comments |
|---|---|---|---|---|
| | | included | excluded | |
| 2C7a | Copper production | | X | EMEP/EEA GB 2019. |
| 2C7b | Nickel production | NO | | |
| 2C7c | Other metal production (Silicon) | NA | | |
| 2C7d | Storage, handling and transport of metal products | NE | | |
| 2D3a | Domestic solvent use including fungicides | NE | | |
| 2D3b | Road paving with asphalt | X | | EMEP/EEA GB 2019. |
| 2D3c | Asphalt roofing | No information available. | | EMEP/EEA GB 2019. |
| 2D3d | Coating applications | NA | | |
| 2D3e | Degreasing | NE | | |
| 2D3f | Dry cleaning | NE | | |
| 2D3g | Chemical products | NE | | |
| 2D3h | Printing NE | | | |
| 2D3i | Other solvent use | NE | | |
| 2G | Other product use: Other use of solvents and related activities | No information available. | | EMEP/EEA GB 2019. |
| 2H1 | Pulp and paper industry | No information in the EMEP/EEA GB 2019. | | EMEP/EEA GB 2019. |
| 2H2 | Food and beverages industry | NE | | |
| 2H3 | Other industrial processes | NO | | |
| 2I | Wood processing | NE | | |
| 2J | Production of POPs | NA | | |
| 2K | Consumption of POPs and heavy metals (e.g. electrical and scientific equipment) | NA | | |
| 2L | Other production, consumption, storage, transportation or handling of bulk products: $NH_3$ consumption in refrigeration | NA | | |
| 3B1a | Manure management – Dairy cattle | No information available. | | EF from EEA/EMEP Guidebook (2019). |
| 3B1b | Manure management – Non-dairy cattle | No information available. | | EF from EEA/EMEP Guidebook (2019). |
| 3B2 | Manure management – Sheep | No information available. | | EF from EEA/EMEP Guidebook (2019). |
| 3B3 | Manure management – Swine | No information available. | | EF from EEA/EMEP Guidebook (2019). |
| 3B4a | Manure management – Buffalo | NO | | |
| 3B4d | Manure management – Goats | No information available. | | EF from EEA/EMEP Guidebook (2019). |
| 3B4e | Manure management – Horses | No information available. | | EF from EEA/EMEP Guidebook (2019). |
| 3B4f | Manure management – Mules and asses | No information available. | | EF from EEA/EMEP Guidebook (2019). |
| 3B4gi | Manure management – Laying hens | No information available. | | EF from EEA/EMEP Guidebook (2019). |
| 3B4gii | Manure management – Broilers | No information available. | | EF from EEA/EMEP Guidebook (2019). |
| 3B4giii | Manure management – Turkeys | IE | | |

| NFR | Source/sector name | PM emissions: the condensable component is | | EF reference and comments |
|---|---|---|---|---|
| | | included | excluded | |
| 3B4giv | Manure management – Other poultry | No information available. | | EF from EEA/EMEP Guidebook (2019). |
| 3B4h | Manure management – Other animals- Rabbits | NO | | |
| 3Da1 | Inorganic N-fertilizers (includes also urea application) | NA | | |
| 3Da2a | Animal manure applied to soils | NA | | |
| 3Da2b | Sewage sludge applied to soils | NA | | |
| 3Da2c | Other organic fertilisers applied to soils (including compost) | NA | | |
| 3Da3 | Urine and dung deposited by grazing animals | NA | | |
| 3Da4 | Crop residues applied to soils | NA | | |
| 3Db | Indirect emissions from managed soils | NA | | |
| 3Dc | Farm-level agricultural operations including storage, handling and transport of agricultural products | No information available. | | EF from EEA/EMEP Guidebook (2019). |
| 3Dd | Off-farm storage, handling and transport of bulk agricultural products | NA | | |
| 3De | Cultivated crops | NA | | |
| 3Df | Use of pesticides | NA | | |
| 3F | Field burning of agricultural residues | No information available. | | EF from EEA/EMEP Guidebook (2019). |
| 3I | Agriculture other | NO | | |
| 5A | Biological treatment of waste – Solid waste disposal on land | No information in the EMEP/EEA GB 2019. | | EMEP/EEA GB 2019. |
| 5B1 | Biological treatment of waste – Composting | NE | | |
| 5B2 | Biological treatment of waste – Anaerobic digestion at biogas facilities | No information in the EMEP/EEA GB 2019. | | No information in the EMEP/EEA GB 2019. |
| 5C1a | Municipal waste incineration | IE | | Included in 1A1a. |
| 5C1bi | Industrial waste incineration | IE | | Included in 1A1a. |
| 5C1bii | Hazardous waste incineration | NO | | |
| 5C1biii | Clinical waste incineration | IE | | Included in 1A1a. |
| 5C1biv | Sewage sludge incineration | | X | US EPA AP-42 Section 2.4 Chapter 2.2. |
| 5C1bv | Cremation | No information in the EMEP/EEA GB 2019. | | |
| 5C1bvi | Other waste incineration | NO | | |
| 5C2 | Open burning of waste | No information in the EMEP/EEA GB 2019. | | EMEP/EEA GB 2019. |
| 5D1 | Domestic wastewater handling | No information in the EMEP/EEA GB 2019. | | EMEP/EEA GB 2019. |
| 5D2 | Industrial wastewater handling | No information in the EMEP/EEA GB 2019. | | EMEP/EEA GB 2019. |
| 5E | Other waste | No information in the EMEP/EEA GB 2019. | | EMEP/EEA GB 2019. |
| 6A | Other (included in national total for entire territory) | No information in the EMEP/EEA GB 2019. | | EMEP/EEA GB 2019. |

# ANNEX 5. EXPERT JUDGEMENT

Chapter updated in March, 2026.

## A5.1. Energy

| EXPERT JUDGEMENT | |
|---|---|
| Expert judgment reference number | **INV-ESP-JE/ENER/2015-001** |
| Date | December 10, 2015. |
| Name of the experts | María Pilar Martínez de la Calle.<br>José Luis García-Siñeriz Martínez. |
| Organizations to which the experts belong | Asociación para la Investigación y Desarrollo Industrial de los Recursos Naturales (AITEMIN). |
| Evaluation | Emissions of particles and volatile organic compounds from coal mining in Spain. |
| Basis | Application of the new 2006 IPCC Guidelines in the National Inventory. |
| Results | New series of emission estimates for the period 1990-2014. |
| Identification of external validators | |
| Result of external validation | |
| Approval by the National Inventory Manager | |

Web link to document:

INV-ESP-JE/ENER/2015-001

# GLOSSARY

# GLOSSARY

Chapter updated in March, 2026.

| | |
|---|---|
| ADHAC | Spanish Association of District Heating and Cooling |
| AEMET | State Meteorological Agency |
| AENA | Spanish Airports and Air Navigation |
| AFOEX | National Association of Companies for the Fostering and Extraction of Oleaginous Substances |
| AFOLU | Agriculture, Forestry and Other Land Use |
| AICA | Food Information and Control Agency |
| AITIM | Technical Research Association of the Wood and Cork Industries |
| AMBILAMP | Association for the Recycling of lighting equipment |
| ANAIP | Spanish Association of Plastics Industry |
| ANAPE | Spanish Association for Expanded Polystyrene Producers |
| ANCADE | Spanish National Association of Manufacturers of Lime and Derivatives |
| ANE | National Electrochemical Association |
| ANEO | National Association of Olive Oil Companies |
| ANEPROMA | National Association of Wood Protection Companies |
| ANFFE | National Association of Fertilizer Manufacturers |
| ANFFECC | National Association of Manufacturers of Frits, Enamels and Ceramic Colours |
| ANIACAM | National Association of Cars, Trucks, Buses and Motorbikes Importers |
| AOP | Association of Petroleum Operators |
| APPA | Biocarburantes Association of Generators of Renewable Energy (biofuels section) |
| AQ-AOS | Annual Questionnaire - Annual Oil Questionnaire (Annual Oil Statistics) |
| AQs | Annual Questionnaires |
| ASCER | Spanish Association of Manufacturers of Ceramic Floor Tiles, Wall Tiles, and Paving |
| ASEFAPI | Spanish Association of Manufacturers of Paint and Printing Dyes |
| ASEFMA | Spanish Association of Bituminous Mixture Factories |
| ASERAL | Spanish Association of Aluminium Refiners |
| ASOFRIO | Central purchasing and services of refrigeration |
| ASPAPEL | Association of Spanish Pulp and Paper Manufacturers |
| B(a)P | Benzo(a)pyrene |
| B(b)F | Benzo(b)fluoranthene |
| B(k)F | Benzo(k)fluoranthene |
| BAT | Best available Techniques |
| BBVA | Foundation Bilbao Vizcaya Argentaria Bank |
| BC | Black Carbon |
| BNPAE | Nitrogen and Phosphorous Balance in Agriculture |

| | |
|---|---|
| BREF | Best Available Techniques Reference Document |
| CAP | Common Agricultural Policy |
| CEDEX | Spanish Centre for Public Works Studies and Experimentation |
| CEIP | Centre on Emission Inventories and Projections |
| CEPE | European Council of the Paint, Printing Ink and Artists' Colours Industry |
| CEPMEIP | Co-ordinated European Programme on Particulate Matter Emission Inventories, Projections and Guidance |
| CIEDB | Core Inventory Emissions Database |
| CIEMAT | Research Centre for Energy, Environment and Technology |
| CITEPA | Interprofessional Technical Centre for Studies on Air Pollution-France |
| CLH | Logistics Company of Hydrocarbons |
| CLRTAP or LRTAP | Convention on Long-Range Transboundary Air Pollution |
| CNE | National Energy Commission |
| CNMC | National Commission on Markets and Competition |
| CNV | National Census for Sewage Disposal |
| CODA | Central Office for Delay Analysis (EUROCONTROL) |
| COFACO | National Consortium of Rubber Manufacturers |
| CONCAWE | Division of the European Petroleum Refiners Association |
| COPERT | Computer Programme to calculate Emissions from Road Transport |
| CORES | Corporation for Strategic Oil Reserves |
| CORINAIR | Core Inventory of Air emissions |
| CRF | Common Reporting Format |
| CRT | Common Reporting Tables |
| DG ENV | Directorate-General for environment |
| DGAC | Directorate General for Civil Aviation (Ministry of Transport and Sustainable Mobility – MITMS) |
| DGCEA | Directorate-General for Environmental Quality and Assessment (Ministry for the Ecological Transition and the Demographic Challenge - MITECO) |
| DGPCE | Directorate-General for Energy Planning and Coordination. (Ministry for the Ecological Transition and the Demographic Challenge - MITECO) |
| DGPEM | Directorate-General for Energy Policy and Mines (Ministry for the Ecological Transition and the Demographic Challenge - MITECO) |
| DGT | Directorate General of Traffic (Ministry of Interior) |
| DRDB | Data Request Database |
| EAPA | European Asphalt Pavement Association |
| ECA | Emission Control Areas |
| ECOGAN | General Registry of BATs and Calculation of Livestock Emissions |
| EDARs | Waste Water Treatment Plants |
| EEA | European Environment Agency |
| EF | Emission factor |

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|---|---|
| EMEP | European Monitoring Evaluation Programme of CLRTAP |
| ENAGÁS | Technical Manager of the Spanish gas system |
| ENDESA | National Electricity Company |
| E-PRTR | European Pollutant Release and Transfer Register |
| EPTMC | Continuing Survey of Road Goods Transport |
| ERT | Expert Review Team |
| ESIG | European Solvents Industry Group |
| ESYRCE | Official Survey on Crop Areas and Yields |
| ETSAP | Energy Technology Systems Analysis Program |
| EU | European Union |
| EU-ETS | European Union Emissions Trading System |
| EUROCONTROL | European Organisation for the Safety of Air Navigation |
| EUROSTAT | European Union Statistical Office |
| EXOLUM | (Formerly CLH) Logistics Company of Hydrocarbons |
| FAME | Fatty Acid Methyl Ester |
| FAOSTAT | Statistics Division of the Food and Agriculture Organization of the United Nations |
| FCC | Fluid catalytic cracking |
| FEAF | Spanish Federation of Foundry Associations |
| FEIQUE | Spanish Federation of Chemical Industries |
| FEIS | Fuel Burn and Emissions Inventory System |
| FEMP | Spanish Federation of Municipalities and Provinces |
| GDP | Gross Domestic Product |
| GE | Gross Energy |
| GFCF | Gross fixed capital formation |
| GHG | Greenhouse gases |
| GNFR | Gridded NFR |
| HCB | Hexachlorobenzene |
| HELCOM | Helsinki Commission |
| HFCs | Hydrofluorocarbons |
| HISPALYT | Spanish Association of Manufacturers of Clay Bricks and Tiles |
| HM | Heavy Metals |
| ICAO | International Civil Aviation Organization |
| IDAE | Institute for Energy Saving and Diversification |
| IE | Included Elsewhere |
| IEA | International Energy Agency |
| IEB | Inventory Energy Balance |
| IEF | Implicit Emission Factor |
| IF | Indeno(1,2,3-cd)pyrene |
| IGME | Geological and Mining Institute of Spain |

| | |
|---|---|
| IIASA | International Institute for Applied Systems Analysis |
| IIR | Informative Inventory Report |
| ITV | Technical Inspection of Vehicles |
| IMO | International Maritime Organization |
| INE | National Statistics Institute |
| INM | National Weather Institute |
| IPCC | Intergovernmental Panel for Climate Change |
| IPPU | Industrial Processes and Products Use |
| IPTS | Institute for Prospective Technological Studies |
| IPUR | Industry Association of Rigid Polyurethane |
| IQ | Individualized Questionnaire |
| IQMDB | Inventory quality management database |
| I-TEQ | International Toxic Equivalent |
| KC | Key Categories |
| KP | Kyoto Protocol |
| LCP | Directive Large Combustion Plants Directive |
| LHV | Lower Heating Value |
| LPG | Liquefied Petroleum Gases |
| LPS | Large Point Sources |
| LTO | cycles Landing and Take-off cycles |
| LULUCF | Land Use, Land-Use Change and Forestry |
| MAGRAMA | Ministry of Agriculture, Food and Environment (currently, Ministry for the Ecological Transition and the Demographic challenge - MITECO and the Ministry of Agriculture, Fisheries and Food- MAPA) |
| MAPA | Ministry of Agriculture, Fisheries and Food |
| MAPAMA | Ministry of Agriculture and Fisheries, Food and Environment (currently split into the Ministry for the Ecological Transition and the Demographic challenge -MITECO and the Ministry of Agriculture, Fisheries and Food -MAPA) |
| MAPFRE | Mutuality of the Group of Owners of Rural Estates of Spain |
| MARPOL | Marine Pollution - International Convention for the prevention of pollution from ships |
| MCP | Directive Medium Combustion Plant Directive |
| MDE | Ministry of Defence |
| MFOM | Ministry of Public Works (currently, Ministry of Transport and Sustainable Mobility -MITMS) |
| MINCOTUR | Ministry of Industry, Trade and Tourism |
| MINER | Ministry of Industry and Energy (currently split into the Ministry for the Ecological Transition and the Demographic challenge –MITECO and Ministry of Industry, Trade and Tourism –MINCOTUR) |

| | |
|---|---|
| MINETAD | Ministry of Energy, Tourism and the Digital Agenda (currently, Directorate-General for Energy Policy and Mines, Ministry for the Ecological Transition and the Demographic challenge -MITECO) |
| MINETUR | Ministry of Industry, Energy and Tourism (currently, Directorate-General for Energy Policy and Mines, Ministry for the Ecological Transition and the Demographic challenge -MITECO) |
| MITECO | Ministry for the Ecological Transition and the Demographic Challenge |
| MITMA | Ministry of Transport, Mobility and Urban Agenda (currently, Ministry of Transport and Sustainable Mobility - MITMS) |
| MITMS | Ministry of Transport and Sustainable Mobility |
| MITYC | Ministry of Industry, Tourism and Trade (currently, Ministry of industry, trade and tourism - MINCOTUR) |
| MMR | Monitoring Mechanism Regulation |
| MMS | Manure Management System |
| MOPT | Ministry of Public Works and Transportation (currently, Ministry of Transport and Sustainable Mobility - MITMS) |
| MOPTMA | Ministry of Public Works and Transportation and the Environment (currently, Ministry of Transport and Sustainable Mobility - MITMS and the Ministry for the Ecological Transition and the Demographic challenge -MITECO) |
| MSCBS | Ministry of Health, Consumer Affairs and Social welfare |
| MSW | Municipal Solid Waste |
| NA | Not Applicable |
| NAPCP | National Air Pollution Control Programme |
| NE | Not estimated |
| NECD | National Emissions Ceilings Directive |
| NFR | Nomenclature for Reporting |
| NID | National Inventory Document |
| NIECP | National Integrated Energy and Climate Plan |
| NIR | National Inventory Report |
| NK | Notation Keys |
| NMVOC | Non-methanic Volatile Organic Compounds |
| NO | Not occurring |
| NPK | Nitrogen phosphorus and potassium |
| OECC | Spanish Office for Climate Change |
| OECD | Organisation for Economic Co-operation and Development |
| OFICEMEN | Spanish Association of Cement Manufacturers |
| OFICO | Office for Electricity Compensations |
| OSPAR | Convention for the Protection of the Marine Environment of the North-East Atlantic |
| OSPARCOM | OSPAR Commission |
| PAH | Polycyclic aromatic hydrocarbons |

| | |
|---|---|
| PAMs | Policies and Measures |
| PANASEF | National Funeral Services Association |
| PARCOM-ATMOS | Emission factors manual PARCOM-ATMOS |
| PCBs | Polychlorinated biphenyls |
| PCDD | Dioxins |
| PCDD/F | Dioxins and Furans |
| PCDF | Furans |
| PDCA cycle | Plan–Do–Check–Act cycle |
| PER | Renewable Energy Plan |
| PFC | Perfluorocarbons |
| PM | Particulate Matter |
| PNCCA | National Air Pollution Control Programme |
| POPs | Persistent Organic Pollutants |
| PRTR | Pollutant Release and Transfer Register |
| QA/QC | Quality Assurance/Quality Control |
| RCE | Spain's Road Network |
| RE | Red Eléctrica (formerly REE, operator of the Spanish electricity transport system) |
| RENFE | Red Nacional de los Ferrocarriles Españoles (Spanish National Railways Network) |
| REGA | General Registry of Livestock Farming |
| RIIA | Registry of individual animal identification |
| RMS | Regulating and Metering Stations |
| RNL | National Sludge Registry |
| SEDIGAS | Spanish Gas Association |
| SEI | Spanish National Inventory System |
| SGALSI | Subdirectorate-General for Clean Air and Industrial Sustainability (Ministry for the Ecological Transition and the Demographic challenge -MITECO) |
| SGR | Subdirectorate-General for Waste (Ministry for the Ecological Transition and the Demographic challenge – MITECO) |
| SGIBP | Subdirectorate General of Basic and Process Industries |
| SGPEM | Subdirectorate-General of Energy Politic and Mines |
| SNAP | Selected Nomenclature for sources of Air Pollution |
| SOLVAY | Worldwide Chemical Company |
| TAN | Total Ammonia Nitrogen |
| TERT | Technical Expert Review Team |
| TFEIP | Task Force on Emission Inventories and Projections under the Convention on Long-range Transboundary Air Pollution |
| TSP | Total Suspended Particulate |
| UNECE | United Nations Economic Commission for Europe |
| UNESID | Union of Iron and Steel Companies |

| | |
|---|---|
| UNFCCC | United Nations Framework Convention on Climate Change |
| UNICOBRE | National Union for Copper Industries |
| UNIPLOM | Union of the lead industry |
| US EPA | United States Environmental Protection Agency |
| VOC | Volatile Organic Compounds |
| WaM | With Additional Measures |
| WeM | With Existing Measures |
| WG I | Working Group I – "Annual inventories" under the EU Climate Change Committee (European Commission) |


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# REFERENCES

Chapter updated in March, 2026.

## General


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