umweltbundesamt
ENVIRONMENT AGENCY AUSTRIA

AUSTRIA'S INFORMATIVE INVENTORY REPORT (IIR) 2025

Submission under the UNECE Convention on Long-range Transboundary Air Pollution and Directive (EU) 2016/2284 on the reduction of national emissions of certain atmospheric pollutants

REPORT
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Since 23 December 2005 the Umweltbundesamt has been accredited as Inspection Body for emission inventories, Type A (ID No. 0241), in accordance with EN ISO/IEC 17020 and the Austrian Accreditation Law (AkkG), by decree of Accreditation Austria (first decree, No. BMWA-92.715/0036-I/12/2005, issued by Accreditation Austria / Federal Ministry of Economics and Labour on 19 January 2006).

The accreditation scope of the IBE is listed on: akkreditierung-austria.gv.at/overview. The specific underlying standard for the results presented in this report is outlined in Chapter 1.6.

EXECUTIVE SUMMARY

ES.1 REPORTING OBLIGATIONS UNDER UNECE/LRTAP AND DIRECTIVE (EU) 2016/2284 (NEC DIRECTIVE)

Austria's Informative Inventory Report (IIR) and the complete set of NFR tables (the latter are submitted in digital format only) represent Austria's official submission under the United Nations Economic Commission for Europe (UNECE) Convention on Long-rage Transboundary Air Pollution (LRTAP) and under Directive (EU) 2016/2284 (NEC Directive). The Umweltbundesamt in its role as single national entity regarding emission inventories compiles Austria's annual delivery, and the Austrian Federal Ministry of 'Climate Action, Environment, Energy, Mobility, Innovation and Technology' (BMK) – since 1st April 2025 named as 'Federal Ministry of Agriculture and Forestry, Climate and Environmental Protection, Regions and Water Management (BMLUK) – submits it officially to the Executive Secretary of UNECE as well as to the European Commission.

As a party to the UNECE/LRTAP Convention and according to the reporting obligations of the NEC Directive Austria is required to annually report data on emissions of air pollutants covered in the Convention and its Protocols:

- main pollutants: nitrogen oxides (NO_x), non-methane volatile organic compounds (NMVOC), sulphur oxides (SO_x), ammonia (NH_3) and carbon monoxide (CO);
- particulate matter (PM): primary PM (fine particulate matter ($PM_{2.5}$) and coarse particulate matter (PM_{10})[1];
- priority heavy metals (HMs): lead (Pb), cadmium (Cd) and mercury (Hg);
- persistent organic pollutants (POPs): polychlorinated dibenzodioxins/dibenzofurans (PCDD/Fs), polycyclic aromatic hydrocarbons (PAHs), hexachlorobenzene (HCB) and polychlorinated biphenyls (PCBs).

In order to fulfil these reporting requirements, Austria compiles an Air Emission Inventory ("Österreichische Luftschadstoff-Inventur – OLI"), which is updated annually. The IIR contains information on Austria's inventories of air pollutants for all years from 1990 to 2023 for the main pollutants, for POPs and HMs and for the years 1990, 1995 and from 2000 onwards for PM. In accordance with the NEC Directive (EU) 2016/2284, Table A (*Annual emission reporting requirements*) and Table C (*Reporting requirements on emissions and projections*), Austria does not report emissions of BC (notation key NR is used).

From submission 2020 onwards, Austria reports all pollutants in the NFR19 reporting format from 1990 to the latest inventory year. Emissions of the years before 1990 were last updated and published in submission 2014.[2]

[1] According to the CLRTAP Reporting GL the reporting of total suspended particules (TSPs) is not mandatory, but reported by Austria.

[2] Austria´s submission 2014 under the Convention on Long-range Transboundary Air Pollution covering the years 1980–2012: https://cdr.eionet.europa.eu/at/un/CLRTAP_AT/envuvyara/

In addition, the report includes both detailed descriptions of methods, data sources and uncertainties and information on quality assurance and quality control (QA/QC) activities as well as analyses of emission trends.

The emission data presented in this report were compiled according to the 2023 Reporting Guidelines that were adopted by the Executive Body for the UNECE/LRTAP Convention at its 42nd session.

The Austrian inventory is complete with regard to reported gases, reported years and reported emissions from all sources, and also complete in terms of geographic coverage.

ES.2 DIFFERENCES WITH OTHER REPORTING OBLIGATIONS

NEC Directive (EU) 2016/2284 sets out national emission reduction commitments for the pollutants SO_2, NO_x, VOC, NH_3 and $PM_{2.5}$. Emission reduction obligations will apply to anthropogenic emissions of these pollutants and also particulate matter ($PM_{2.5}$) covering the years from 2020 to 2029 and from 2030 onwards. While the target comparison for the years 2010 to 2019 was based on emissions without exports of fuels, Austria's total emissions calculated on the basis of the volume of fuel sold will now be taken into account for the current target period, as the emission reduction commitments from 2020 onwards have been derived from projections based on the amount of fuel sold.

The annual greenhouse gas reporting under the UNFCCC also requires the reporting of indirect GHGs (NO_x, CO, NMVOC) and SO_2 emissions based on *fuel sold*. In contrast to UNFCCC requirements, emissions from aviation under the NEC Directive and the LRTAP Convention include domestic LTO and cruise. Furthermore, international navigation of inland waterways is covered under NEC and CLRTAP.

ES.3 OVERVIEW OF EMISSION TRENDS

Main Pollutants

In 1990, national total SO_2 emissions amounted to 74 kt. Since then emissions have decreased quite steadily. In the year 2023, emissions were reduced by 86% compared to 1990 and amounted to 11 kt. This decline is mainly caused by a reduction of the sulphur content in mineral oil products and fuels (according to the Austrian Fuel Ordinance), the installation of desulphurisation units in plants (according to the Clean Air Act for boilers) and an increased use of low-sulphur fuels like natural gas. From 2022 to 2023, SO_2 emissions decreased by 0.2 kt (-1.5 %). This reduction was largely influenced by the decrease in emissions from oil refining (*1.A.1.b*) due to improvements in the 'SNOx' plant (a combined flue gas de-sulphurisation and flue gas de-nitrification system). The reduced use of biomass in the wood processing industries within sector *Other Stationary Combustion in Manufacturing Industries and Construction* (*1.A.2.g.viii*) led to a further decrease of emissions. In the case of households (*1.A.4.b.1*), the reduction in the use of coal and biomass resulted in decreasing emissions in 2023 compared to the previous year as well.

This decline was partly offset by higher process emissions from integrated steel plants (*1.A.2.a*).

In 1990, national total NO_x emissions amounted to 216 kt. After an all-time high of emissions between 2003 and 2005 emissions are decreasing continuously. This is mainly due to reduced emissions from heavy trucks, especially because of improvements in the after treatment technology. In 2023, NO_x emissions amounted to 109 kt and were about 50% lower than in 1990. From 2022 to 2023 emissions decreased by 5.4%. *Road transportation* (*1.A.3.b*) decreased by 2.9 kt due to a mix of reduced total fuel consumption, a continuously increasing share of the latest exhaust emissions standards and slightly increasing shares in total mileage with electric vehicles. NO_x emissions from the combustion of non-metallic minerals (*1.A.2.f*), particularly from cement and brick manufacturing industries, also fell between 2022 and 2023 due to lower production volumes. In Other sectors (*1.A.4*, predominantly households) the NO_x-emissions from fuel combustion fell by 7.1 % due to the lower use of oil and gas.

In 1990, national total NMVOC emissions amounted to 338 kt. Emissions have decreased steadily since then and in the year 2023 emissions were reduced by 69% compared to 1990 to 104 kt. From 2022 to 2023, NMVOC emissions decreased by 2.0 kt (-1.9%). The largest reductions since 1990 have been achieved in the road transport sector due to an increased use of catalytic converters and diesel cars. Currently the road transport sector (*1.A.3.b*) accounts only for a small share (3.5 %) of Austria's total NMVOC emissions. Reductions in the solvent sector (*2.D.3*) have been achieved due to the EU Solvents Directive and the national VOC Installation Act. From 2022 to 2023, NMVOC emissions decreased by 1.9%, mainly due to reductions in the solvent sector, agriculture and households sector. The reasons for this are the declining consumption of disinfectants in the household sector for solvents, decreasing animal populations (especially cattle) in agriculture and the lower use of biomass as a result of the milder weather in the household sector.

In 1990, national total NH_3 emissions amounted to 90 kt; emissions have decreased over the period from 1990 to 2023. In 2023, emissions were 18% under 1990 levels and amounted to 74 kt. NH_3 in Austria is almost exclusively emitted in the agricultural sector. The lower NH_3 emissions can be explained by decreasing cattle numbers, more efficient feeding and an increased application of low emission spreading techniques (e.g. band spreading, trailing shoe, rapid incorporation of manure). Compared to the previous year 2022, total emissions decreased by 1.8 kt (-2.4%). The main reason for this reduction were falling ammonia emissions from the application of manure on agricultural soils as a result of lower animal numbers and the increased use of low-nitrogen application techniques in Austria.

In 1990, national total CO emissions amounted to 1 249 kt. Emissions decreased considerably from 1990 to 2023. In 2023, emissions were 63% below 1990 levels and amounted to 466 kt. This reduction was mainly due to decreasing emissions from road transport (catalytic converters) and to a lesser extent also from residential heating (phasing out of coal-fired heating systems). The emissions decreased between 2022 and 2023 by 3.5%, mainly in the categories *1.A.2.a Iron and Steel* because of lower production and *1.A.4.b.i Residential: stationary* as a consequence of the mild weather as well as changes in energy prices and the associated reduced use of biomass.

Particulate Matter

Particulate matter emissions in Austria mainly arise from 1.*A Fuel Combustion Activities* (*1.A.3 Road transport, 1.A.4 Other sectors* – residential heating), *2 Industrial Processes and Product Use* and *3 Agriculture*.

Particulate matter (PM) emissions show a decreasing trend over the period 1990 to 2023: TSP emissions decreased by 31%, PM_{10} emissions were about 40% below the level of 1990, and $PM_{2.5}$ emissions dropped by about 53%. In the transport sector PM emissions show a general decrease since several years as a result of improved technology. In the NFR sectors *1.A.4 Other* and *2 Industrial Processes*, PM emissions also fell since 1990. Between 2022 and 2023 TSP, PM_{10} and $PM_{2.5}$ emissions decreased by 4.1% (TSP), 4.0% (PM_{10}) and 3.9% ($PM_{2.5}$). The short-term decrease of PM emissions (in particular for TSP and PM_{10}) was largely influenced by sector *2.A.5 Mining, construction/demolition and handling of products* as a consequence of a significant decrease in construction activities. In sector residential heating *1.A.4.b* the PM emission levels have also decreased in 2023 compared to the previous year (in particular for $PM_{2.5}$) the mild weather as well as changes in energy prices and the associated reduced use of biomass.

Heavy Metals

Emissions of all three priority heavy metals (Cd, Pb and Hg) have decreased since 1990.

The overall Cd emissions reduction of 50% from 1990 to 2023 is mainly due to a decline in the industrial processes and energy sector, which is due to reduced use of heavy fuel oil and lower process emissions from iron and steel production. The decrease in 2023 (-4,5 %) compared to the previous year was also largely due to lower emissions from *2.C.1 Iron and Steel Production*.

Hg emissions were declining by about 64% in the period 1990 to 2023, which was due to decreasing emissions from cement industries and the industrial processes sector as well as due to reduced use of coal for residential heating and public electricity and heat production. Several bans in different industrial sub-sectors led to the sharp fall of total Hg emission in Austria, where the largest reduction was achieved in the early 90ies. Due to abatement measures emissions dropped from 2006 onwards. Between 2022 and 2023 emissions decreased by 10.2 % because of falling emissions from NFR *2.C.1 Iron and steel Production* due to lower cement clinker production (*1.A.2.f non-metallic minerals)*.

The overall reduction trend of Pb emissions was minus 94% for the period 1990 to 2023, which was mainly a result of the ban of lead in gasoline. However, abatement techniques and product substitutions also contributed to the emission reduction. Compared to the previous year total Pb emissions show a decrease of 1.6% mainly due to a decline in the use of biomass in *1.A.1.a Public Electricity and Heat Production* and wood processing industries (*1.A.2.g.8 Other Stationary Combustion in Manufacturing Industries and Construction),* but also *1.A.4.b.i Residential: stationary* and *2.C.1 Iron and Steel Production*.

Persistent Organic Pollutants (POPs)

Emissions of all POPs decreased remarkably from 1990 to 2023 (HCB -88%, PAH -71%, PCDD/F -75% and PCBs -93%), where the highest achievement was made until 1994. The significant increase of HCB emissions in the years 2012, 2013 and 2014 was due to unintentional releases of HCB by an Austrian cement plant.

In 2023 PCDD/F emissions decreased by 5.7% compared to the previous year, HCB emissions declined by 4.1% and PAH emissions by 7.4% in the same time. These reductions were mainly due to lower emissions from sector *1.A.4.b Residential* as a result of the lower heating demand because of the warmer weather.

In 2023, PCB emissions decreased by 12% compared to the previous year 2022 due to lower hard coal consumption in *1.A 2.d Pulp, Paper and Print* and *1.A.2.c Chemicals* as well as lower cement clinker production (*1.A.2.f Non-metallic Minerals*).

The most important source of PAH, PCDD/F and HCB emissions in Austria is residential heating. In the 1980s industry and waste incineration were still important sources regarding POP emissions. Due to legal regulations concerning air quality emissions from industry and waste incineration decreased remarkably from 1990 to 1993. For PCB emissions the most important source category is *2.C Metal Production*.

ES.4 KEY CATEGORIES

To determine key categories, a trend and a level assessment have been carried out, which resulted in 41 identified key categories. It shows that the residential sector has been identified as the most important key category: all air pollutants except for NH_3 are found key in either the trend or the level assessment. In the following table the top 5 ranked key categories are listed.

Table 1: Most relevant key categories in Austria for air emissions 2023.

Name of key category	No of occurrences as key category
1.A.4.b.1 – Residential: stationary	26 times (SO_2, NO_x, NMVOC, CO, Cd, Pb, Hg, PAH, DIOX, HCB, PCB, TSP, PM_{10}, $PM_{2.5}$)
2.C.1 – Iron and Steel Production	12 times (Cd, Pb, Hg, PAH, DIOX, PCB, TSP, PM_{10}, $PM_{2.5}$)
1.A.1.a – Public Electricity and Heat Production	11 times (SO_2, NO_x, Cd, Pb, Hg, DIOX, HCB, PM_{10}, $PM_{2.5}$)
1.A.3.b.1 – R.T., Passenger cars	10 times (NO_x, NMVOC, CO, Pb, TSP, PM_{10}, $PM_{2.5}$)
1.A.2.d – Pulp, Paper and Print	8 times (SO_2 , NOX , Cd , Hg , TSP , PM_{10} , $PM_{2.5}$)

ES.5 MAIN DIFFERENCES IN THE INVENTORY SINCE THE LAST SUBMISSION

As a result of the continuous improvement process of Austria's Annual Air Emission Inventory, emissions for some sources have been recalculated, e.g. on the basis of updated activity data or revised methodologies. Thus emission data for the whole time series submitted this year differ from the data reported previously.

In NFR sector ***1 Energy***, changes are mainly due to revisions of the energy balance. Furthermore, the natural gas consumption of gas supply companies was moved from sector *1.A.1.c* to sector *1.A.2.g* since the year 2011, as the offset quantity had previously been deducted from this sector, which improved consistency with the energy balance at the sector level. The NH_3 emission factor for municipal solid waste (NFR *1.A.1.a*) was revised by implementing the EMEP/EEA 2023 Guidebook Tier 1 factor. In sector *1.A.2.g.7* Off-road Industry the stock of non-road mobile machinery (NRMM)

in construction and industry from 2016 onwards was updated according to the production index by the federal statistics office 'Statistik Austria'.

For 1990 to 2022, minor changes in air pollutant emissions of categories Commercial/Institutional *(1.A.4.a)* and Residential *(1.A.4.b)* occur because of updated heating stock data and newly allocated shares of combustion technologies per energy carrier (updated energy demand model for space heating). Furthermore, NH_3 and $PM_{2.5}$ EF were were revised following the Tier 2 methodology of the EMEP/EEA Guidebook 2023.

Coal consumption activity data in *1.B.1.a. Storage of solid fuels* was revised. Emissions of NMVOC from *1.B.2.b Natural gas* were revised over the whole time series due to the consideration of new study results on fugitive emissions from gas transmission, storage and distribution in Austria based on a survey among Austrian gas companies.

In NFR sector ***1.A.3 Transport***, the natural gas and liquefied petroleum gas consumption has been revised for 2021 and 2022 according to the energy balance. Additionally, the real-world consumption correction factors have been updated in the NEMO emissions calculation model for passenger cars. Methodological improvements have been carried out by revising the assumptions of specific mileage for inland/domestic road transport activity. For *1.A.5 Military* the kerosene consumption of military air traffic was updated using actual data for the years 2016, 2017 and 2018 as reported by the Austrian Ministry of Defense.

In NFR sector ***2 Industrial Processes and Product Use*** several recalculations have been carried out on the one hand due to revisions of activity data (e.g. lime and copper production, domestic solvent use, road paving and asphalt roofing) and on the other hand as a result of methodological improvements (e.g. reallocation in *2.B.10*; reassessment of emissions from Solvent Use).

One of the main reasons for revised emissions in NFR sector ***3 Agriculture*** was the implementation of new data on livestock feeding, management systems and practices as well as application techniques for 2023 according to a comprehensive survey. These data were used as the basis for the calculation of Austria's emission inventory in submission 2025 resulting in revisions in all animal related emission sources. Additionally, methodological improvements have been carried out for the ammonia calculations. The total ammoniacal nitrogen (TAN) values for liquid and solid manure of cattle and swine were revised according to the latest science. Furthermore, there have been recalculations carried out for GHG emissions by applying the 2019 Refinement with an effect on air pollutants as well. New emission sources (emissions from rabbits, NH_3 from crop residues) have also been included.

In NFR sector ***5 Waste***, minor revisions of NH_3 have been carried out for subcategory *5.B.2 anaerobic digestion* at biogas facilities, which are due to updates of activity and nutrition data in the agriculture sector.

In NFR sector **6 Other**, NH_3 emissions from pets (cats and dogs) are reported for the first time in the current submission.

For more detailed information see Chapter 8 – Recalculations and Improvements.

ES.6 IMPROVEMENT PROCESS

The Austrian Air Emission Inventory is subject to a continuous improvement programme resulting in annual recalculations (see Chapter ES.5 above). Furthermore, the regularly conducted reviews under the LRTAP Convention and the NEC Directive trigger improvements.

The last CLRTAP Stage 3 ("In-depth") review of the Austrian Inventory took place in 2017 (United Nations, 2017). The findings for Austria are summarized and commented in Table 353. In 2022, an In-depth review of all Parties (so called ad-hoc Review) took place with a special focus on the condensable component of PM for sectors Residential heating and Transport. The recommendations for Austria are presented in Table 354. In 2023, the ad-hoc Review focused on Agriculture (emission inventories and gridded data). The recommendations for Austria are presented in Table 355. In 2024, the ad-hoc Review concentrated on sector IPPU. The recommendations for Austria are presented in Table 356.

In addition to the CLRTAP Review, from 2017 onwards the national emission inventory data is also checked by the European Commission as set out in Article 10 of Directive 2016/2284. The inventories are checked annually in order to verify the transparency, accuracy, consistency, comparability and completeness of information submitted and to identify possible inconsistencies with the requirements set out under international law, in particular under the LRTAP Convention. Synergies are maximised with the 'Stage 3' reviews conducted by the LRTAP Convention. The findings under the NEC Review 2024 (European Commission, 2024) and the National Air Pollution Projections Review 2023 (European Commission, 2023) for Austria are summarized and commented in Table 357 and Table 358.

Recalculations and improvements are summarized in Chapter 8 – Recalculations and Improvements and described in detail in the sector-specific chapters of this report.

ES.7 CONDENSABLE COMPONENT OF PM_{10} AND $PM_{2.5}$

The Parties to the LRTAP Convention have been formally requested by the Executive Body at its thirty-eight session to provide information on the reporting of the condensable component of particulate matter (PM) in their Informative Inventory Reports. The purpose is the provision of transparent information for the modellers. As a consequence, Annex II (Recommended structure for the Informative Inventory Report (IIR)) of the CLRTAP Reporting GL has been updated accordingly. Austria included the following information in its IIR from 2019 on:

- appendix including a table summarising whether PM_{10} and $PM_{2.5}$ emission factors for each source sector include or exclude the condensable component (and references for their emission factors) (see chapter 13.3).
- indication in the methodology sections whether PM_{10} and $PM_{2.5}$ emission estimates include or exclude the condensable component (please refer to the methodological chapters 3-6).

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