umweltbundesamt
ENVIRONMENT AGENCY AUSTRIA

AUSTRIA'S INFORMATIVE INVENTORY REPORT (IIR) 2023

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

SUMMARY – ACCESSIBLE FORMAT
REP-0855

VIENNA 2023

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 information covered refers to the following accreditation scope of the IBE: EMEP 2019 (akkreditierung-austria.gv.at/overview)

EXECUTIVE SUMMARY

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

ES.1.2 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) 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 2021 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 $PM_{2.5}$. New emission reduction obligations will apply to anthropogenic emissions of these pollutants and, for the first time, 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 new 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 2021, emissions were reduced by 85% 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. The economic crisis in 2009 caused a decrease in emissions, followed by an increase due to the recovery of the economy. From 2020 to 2021, SO_2 emissions rose by 4.4% (+0.5 kt), mainly because in the iron and steel industry (1.A.2.a), which accounts for the largest share of SO_2 emissions (43%), the emissions rose by 7.0% (+0.3 kt) as a result of increased production of pig iron and steel. Compared to the previous year, SO_2 emissions also increased significantly in the residential

(1.A.4.b.1) and commercial/institutional heating sector (1.A.4.a.1) due to higher consumption of heating oil, coal and firewood (cooler weather compared to 2020). In the oil refinery sector (1.A.1.b) a rise of SO_2 emissions could also be observed.

In 1990, national total NO_x emissions amounted to 219 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 2021, NO_x emissions amounted to 123 kt and were about 44% lower than in 1990. From 2020 to 2021 emissions decreased by 1.5%. One of the reasons for this is the renewal of the fleet with low-emission vehicles in passenger car and truck traffic (1.A.3.b), which reduces the level of emissions despite an increase in mileage. Higher use of heating oil, coal and firewood from stationary combustion of commercial/institutional (1.A.4.a.1) and households (1.A.4.b.1) led to an increase in NO_x emissions due to the cooler weather compared to the previous year.

In 1990, national total NMVOC emissions amounted to 334 kt. Emissions have decreased steadily since then and in the year 2021 emissions were reduced by 67% to 111 kt compared to 1990 From 2020 to 2021, NMVOC emissions increased by 0.3 kt (+ 0.3%). 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 (3.4%) of Austria's total NMVOC emissions. Reductions in the solvent sector (2.D.3) have been achieved due to the Solvent Ordinance and the VOC Installation Ordinance.

In 1990, national total NH_3 emissions amounted to 69 kt; emissions have decreased over the period from 1990 to 2021. In 2021, emissions were 4.9% under 1990 levels and amounted to 66 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 2020, total NH_3 emissions increased by 0.3 kt (+0.5%). The main reasons for this light short-term increase is the slightly larger number of cattle (dairy cows: +0.3%; other cattle: +1.0%, cattle in total +0.8%).

In 1990, national total CO emissions amounted to 1 249 kt. Emissions considerably decreased from 1990 to 2021. In 2021, emissions were 58% below 1990 levels and amounted to 523 kt. This reduction was mainly due to decreasing emissions from road transport (catalytic converters). The emissions increased between 2020 and 2021 by 10%, mainly in the categories *1.A.2.a Iron and Steel* and *1.A.4.b.i Residential*.

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 2021: TSP emissions decreased by 26%, PM_{10} emissions were about 35% below the level of 1990, and $PM_{2.5}$ emissions dropped by about 49%. 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 2020 and 2021 TSP, PM_{10} and $PM_{2.5}$ emissions increased by 5.0% (TSP) and 4.5% (PM_{10} and $PM_{2.5}$).

Heavy Metals

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

The overall Cd emissions reduction of 48% from 1990 to 2021 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 increase compared to the previous year 2020 was mainly due to higher emissions from residential heating *(1.A.4.b.i Residential)*.

The overall reduction of Hg of about 59% for the period 1990 to 2021 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 new data from the steel industry, Hg emissions from 1990-2005 had to be revised upwards, due to abatement measures emissions dropped from 2006 onwards. Between 2020 and 2021 emissions decreased by 2.7% because of falling emissions from NFR *2.C.1 Iron and Steel Production.*

The overall reduction trend of Pb emissions was minus 95% for the period 1990 to 2021, which is 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 an increase of 5.3% mainly because of increased mileage from *Road Transportation (Automobile tyre and break wear)* and *1.A.4.b.i Residential*.

Persistent Organic Pollutants (POPs)

Emissions of all POPs decreased remarkably from 1990 to 2021 (HCB -81%, PAH -61%, PCDD/F -70% and PCBs -92%), 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 2021 PCDD/F emissions increased by 9.8% compared to the previous year 2020, HCB and PAH emissions rose by 11% in the same time. The increase of HCB emissions was mainly due to rising emissions from sectors *1.A.4.b Residential, 2.C.1 Iron and Steel Production and 2.C.3 Aluminium Production*. The increase of PCDD/F emissions was due to higher emissions from sectors *1.A.4.b Residential and 2.C.3 Aluminium Production*. PAH emissions rose because of higher emissions from *1.A.4.b Residential.* Emissions from *Iron and steel* and *aluminium production* followed production numbers, and in the residential sector increasing emissions were due the higher heating demand because of the the colder weather.

In 2021 PCB emissions decreased by 4.5% compared to the previous year 2020 due to lower hard coal consumption in *1.A.2.d Pulp, Paper and Print*.

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 44 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 2021.

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	14 times (Cd, Pb, Hg, PAH, DIOX, HCB, 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, 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.3.b.3 – R.T., Heavy duty vehicles	6 times (SO_2, NO_x, 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. The revisions in the sector *1.A.2.a Manufacturing Industries* of NMVOC emissions for 2020 are due to an error correction.

For 1990 to 2020, 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).

Activity data (gasoline) and NMVOC emissions from *1.B.2.a.v Distribution of oil products* were revised for the years 2010 to 2020 due to the change of the calculation by one data supplier. Furthermore, NMVOC emissions from NFR *1.B.2.b Natural Gas* had to be revised over the whole time series due to the correction of a calculation error and the use of updated data on the composition of natural gas. Additionally the NMVOC emission from gas extraction 2020 was corrected by the Austrian association of oil industry.

In NFR sector ***1.A.3 Transport***, a statistical evaluation of the specific annual mileage for the years 2018, 2019 and 2020 was carried out for passenger cars, light duty vehicles, buses and 2-wheelers. The revision of this data resulted in a shift between inland vehicle kilometres and mileage of ve-

hicles in the category fuel export. Furthermore, an update of hot emission factors and characteristic motor curves for EURO 6 passenger cars and EURO VI HDV trucks, the adaptation of the fleet data to HBEFA V4.2 and an update of aging factors for cars and HDV was undertaken.

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 and on the other hand as a result of methodological improvements (change of emission factors, implementation of measurement data, error corrections). Furthermore, new emission sources were considered - process specific $PM_{2.5}$ emissions from glass production and NMVOC emissions from sugar and animal feed production.

The main reason for revised emissions in NFR sector ***3 Agriculture*** was the consideration of updated activity data: updated livestock data of poultry and deer, new values for the protein content and fat content of milk as well as updated figures on biogas plants became available. Additionally, the continued reduced use of tied systems in cattle farming was taken into account for the first time. Following a recommendation of the NEC Review 2022, emissions from the burning of residual wood from vinicultures on open fields have been reallocated to the Waste sector.

In NFR sector ***5 Waste***, revisions of activity data were carried out in categories *Solid waste disposal on land (5.A.1)*, *Biological treatment of waste (5.B)* and *Other waste (5.E)*. NMVOC emissions from onsite industrial wastewater handling are reported in this years' submission for the first time, resulting in higher emissions for the complete time series from category *Wastewater handling (5.D)*.

For more detailed information see Chapter 7 – 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 349. 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* (United Nations, 2022). The recommendations for Austria are presented in Table 350.

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 2022 (EC, 2022) and the National Air Pollution Projections Review 2021 (EC, 2021b) for Austria are summarized and commented in Table 351 and Table 352.

Recalculations and improvements are summarized in Chapter 7 – 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 12.3).
- 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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