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 Ministry of Sustainability and Tourism (BMNT) 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 under 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 2016 for the main pollutants, for POPs and HMs and for the years 1990, 1995 and from 2000 onwards for PM.

From submission 2015 onwards, Austria reports all pollutants in the NFR14 reporting format from 1990 to the latest inventory year. Emissions of the years before 1990 were last updated and published in submission 2014.[2]

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 revised 2014 Reporting Guidelines (ECE/EB.AIR.125) that were approved by the Executive Body for the UNECE/LRTAP Convention at its 36th 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.

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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: http://www.ceip.at/ms/ceip_home1/ceip_home/status_reporting/2014_submissions/

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 $PM_{2.5}$. Austria uses the national emission totals calculated on the basis of *fuel used* (thus excluding emissions from fuel exports in the vehicle tank) for compliance assessment under the NEC Directive.

The annual greenhouse gas reporting under the UNFCCC and the Kyoto Protocoll 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 2016, emissions were reduced by 81% compared to 1990 and amounted to 14 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. Due to the economic crisis in 2009 emissions decreased, followed by an increase due to the recovery of the economy. From 2015 to 2016 emissions declined by 5.6%. This was mainly caused by the decommissioning of a large coal boiler (*1.A.1.a*) as well as by reductions in emissions from oil refineries (*1.A.1.b*), and from iron and steel (*1.A.2.a*) and non-metallic minerals (*1.A.2.f*) industries.

In 1990, national total NO_x emissions amounted to 220 kt. After an all-time high of emissions between 2003 and 2005 emissions are decreasing continuously. This is mainly due to lower emissions from heavy duty vehicles influenced by declined fuel sales, fleet renewal and well-functioning NO_x exhaust after treatment systems. In 2016, NO_x emissions amounted to 154 kt and were about 30% lower than in 1990. From 2015 to 2016 emissions decreased by 3.1%, again mainly due to decreasing emissions of road transportation, in particular from heavy duty vehicles. In 2016 49% of the total nitrogen oxides emissions originate from road transport (including fuel exports). Austria is a landlocked country and fuel prices vary significantly between neighbouring countries. So Austria has experienced a considerable amount of 'fuel export' and the share of NO_x emissions caused by fuel sold in Austria but used abroad is notable. Emissions for 2016 based on fuel used amount to 140 kt and are about 15 kt lower than based on fuel sold; the decrease between 1990 and 2016 is also slightly stronger.

In 1990, national total NMVOC emissions amounted to 303 kt. Emissions have decreased steadily since then and in the year 2016 emissions had been reduced by 55% to 138 kt compared to 1990. The largest reductions were achieved in the road transport sector due to an increased use of catalytic converters in petrol cars. Reductions in the solvent sector were due to several regulations (Solvent Ordinance, Cogeneration Act, VOC Emissions Ordinance). From 2015 to 2016 emissions slightly decreased by 0.1%.

In 1990, national total NH_3 emissions amounted to 66.1 kt; emissions have been relatively stable over the period from 1990 to 2016. In 2016, emissions were 2.6% above 1990 levels and amounted to 67.9 kt. NH_3 in Austria is almost exclusively emitted in the agricultural sector. The slight increase in NH_3 emissions in spite of a decrease in the number of cattle can be explained

by an increase in loose-housing systems (to ensure animal welfare and according to EU law) and an increase of high-capacity dairy cows. Additionally, there has been an increase in the use of urea as nitrogen fertiliser (a cheap but less efficient fertiliser). Compared to the previous year, emissions in 2016 slightly rose by 1.0%, mainly caused by the increased use of mineral fertilisers applied on agricultural soils, especially the use of urea.

In 1990, national total CO emissions amounted to 1 191 kt. Emissions considerably decreased from 1990 to 2016. In 2016, emissions were 53% below 1990 levels and amounted to 565 kt. This reduction was mainly due to decreasing emissions from road transport (catalytic converters). The emissions decreased slightly between 2015 and 2016 by 0.6%, mainly due to sectors road transportation and non-metallic minerals (cement kilns).

Particulate Matter

Particulate matter emissions in Austria mainly arise from industrial processes, road transport, agriculture and small heating installations.

Particulate matter (PM) emissions show a decreasing trend over the period 1990 to 2016: TSP emissions decreased by 17%, PM_{10} emissions were about 24% below the level of 1990, and $PM_{2.5}$ emissions dropped by about 33%. Between 2015 and 2016 PM emissions decreased slightly by 0.3% (TSP), 0.8% (PM_{10}) and 1.7% ($PM_{2.5}$) mainly because of reductions in the energy and transport sectors (lower biomass consumption in 1.*A.1.a Public Electricity and Heat Production;* lower waste consumption in *1.A.2.c Chemicals*; *1.A.3.b Road Transportation*). Apart from industry and road transport, private households and the agricultural sector (soil cultivation and harvesting) are the main contributors to PM emissions. Where for TSP the most important sources are transport and industrial processes, small heating installations have the highest share in $PM_{2.5}$ emissions.

Heavy Metals

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

The overall Cd emissions reduction of 28% from 1990 to 2016 is mainly due to a decline in the industrial processes and energy sector, which is due to lower use of heavy fuel oil and lower emissions from iron and steel production. Emissions in 2016 remained quite stable (-0.1%) compared to the previous year.

The overall reduction of Hg of about 56% for the period 1990 to 2016 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. Several bans in different industrial sub-sectors and in the agriculture sector are behind these developments in Austria. Between 2015 and 2016 emissions decreased by 5.6% mainly because of decreasing emissions from cement production and a decrease in coal and biomass consumption from power plants.

The overall reduction trend of Pb emissions was minus 93% for the period 1990 to 2016, which is mainly a result of the ban of lead in gasoline. However, abatement techniques and product substitutions also contributed to the emission reduction.

Persistent Organic Pollutants (POPs)

Emissions of all POPs decreased remarkably from 1990 to 2016 (HCB, PAH, PCDD/F and PCBs by about 27 to 65%), where the highest achievement was made until 1995. 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 2016 PCB emissions decreased by 2.8% compared to the previous year 2015. This decrease is dependent on production activities in iron and steel production.

PCDD/F emissions remained at the same level in 2016 compared to the previous year 2015, whereas PAH and HCB emissions rose slightly by 0.8%, respectively. The light increase is mainly due to higher emissions from the residential sector (*1.A.4.b*) as a result of the colder winter and the higher biomass consumption.

The most important source for PAH, PCDD/F and HCB emissions in Austria is residential heating. In the 80s 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. PCB emissions are almost exclusively emitted in NFR sector *2 Industrial Processes and Product Use* (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 and PCB 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 2016.

Name of key category	No of occurrences as key category
1.A.4.b.1 – Residential: stationary	22 times (SO_2, NO_x, NMVOC, CO, Cd, Pb, Hg, PAH, DIOX, HCB, TSP, PM_{10}, $PM_{2.5}$)
2.C.1 – Iron and Steel Production	15 times (Cd, Pb, Hg, DIOX, HCB, PCB, TSP, PM_{10}, $PM_{2.5}$)
1.A.3.b.1 R.T., Passenger cars	12 times (NO_x, NMVOC, CO, Pb, TSP, PM_{10}, $PM_{2.5}$)
1.A.2.g.8 Other Stationary Combustion in Manufacturing Industries and Construction	17 times (SO_2, NO_x, Cd, Pb, DIOX, HCB, TSP, PM_{10}, $PM_{2.5}$)
1.A.2.a Iron and Steel	4 times (SO_2, CO)

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. In previous versions of the balance, category *1.A.4.a* was used as a 'residual' sector for the amount of fuels which could not be attributed to sectors by default. For the years 2012 onwards a new systematic approach has been applied for gasoil, residual fuel oil, LPG, natural gas, wood pellets and briquettes. These are now listed under final energy consumption in the subcategories *1.A.2 Manufacturing Industries* and *1.A.4 Other sectors*. However, these changes did not affect the total final consumption data for these fuels but lead to shifts between *1.A.2* and *1.A.4* subcategories. Further main changes for energy consumption and CO_2 emissions for the years 2003 to 2015 include the shift of natural gas for the years 2011−2015 between 'final energy consumption', 'other energy industries' and 'transformation input to power plants', a major revision for 'other fuels', as well as minor changes for solid and liquid fuels. According to recommendations of the NEC Review 2017 SO_2 emissions from natural gas combustion were estimated for the first time.

In NFR sector *1.A.3 Transport*, an update of the aviation emission model for calculating emissions of 2016 has been performed including the EMEP/EEA 2016 emission factors. Flight movement data and the calculation of distances between airports have been improved. In road transport several improvements have been implemented, such as the update of NO_x emission factors for diesel passenger cars in the model NEMO according to the latest HBEFA Version V3.3, a refined calibration of specific CO_2 emissions from newly registered PCs and LDVs for all years and an increase in the specific yearly mileage for diesel PC from 2010 onwards. Further revisions comprise improved calculations of $PM_{2.5}$ emissions, e.g. the application of the Tier 2 methodology for mopeds and motorcycles.

In NFR sector *2 Industrial Processes and Product Use* recalculations have been carried out due to updated activity data for one cast iron facility in 2015 (*2.C.1 Iron and Steel Production*). On the other hand the revisions were due to methodological changes, like the application of new emission factors from the EMEP/EEA Guidebook 2016 for tobacco smoking and fireworks (*2.G Other product use*) and the correction of double counting for sector *2.H Other Production*.

For NFR sector *3 Agriculture* recalculations have been carried out due to change of activity data (milk yield data for dairy cows, detailed raw material and energy balance, amount of urea and land use data). According to recommendations of the NEC Review 2017, NMVOC emissions from source category *3.B Manure Management* were reported for the first time. Revisions due to methodological changes comprise the modification of NMVOC calculations from *3.D.e Cultivated Crops* and PM calculations from *3.D.c Farm-level agricultural operations.*

In NFR sector *5 Waste*, revisions were due to change of activity data as in the NEC Review 2017 for source category *5.D Wastewater Treatment and Discharge* it was recommended to exclude activity data from individual septic tanks and take into account only wastewater handled in centralised wastewater treatment plants. Further recalculations have been carried out because PM emissions, heavy metals and PCDD/F emissions from car fires and building fires (*5.E Other waste)* were reported for the first time in the current submission.

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 next Stage 3 review is currently not scheduled, but will be within the next five years.

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.