UNITED NATIONS

Distr.
GENERAL

CEIP/S3.RR/2022/
28/09/2022

ENGLISH ONLY

Report for the Stage 3 *ad-hoc* review of emission inventories submitted under the UNECE LRTAP Convention:

STAGE 3 REVIEW REPORT

AUSTRIA

CONTENT

INTRODUCTION

The mandate and overall objectives for the emission inventory review process under the LRTAP Convention is given by the UNECE document '*Updated methods and procedures for the technical reviews of air pollutant emission inventories reported under the Convention*'[1] – hereafter referred to as the 'Review guidelines 2018'.

1. Paragraph 7 (c) of the 'Review guidelines 2018' defines that stage 3 reviews may be annual centralized reviews or ad hoc reviews. Paragraph 18 of the 'Review guidelines 2018' further specifies that such ad hoc reviews could, for instance, focus on specific source sectors, specific pollutants such as heavy metals or persistent organic pollutants, gridded and projections data, or on other areas as requested by the Implementation Committee and that where appropriate, ad hoc reviews could be conducted in line with the present Methods and Procedures for the In-depth (Stage 3) review.

2. At its seventh joint session in September 2021 the Steering Body and the Working Group on Effects approved the plan to perform (in 2022) an in-depth review of $PM_{2.5}$ emissions from residential heating and road transport, with a special focus on the topic of '*condensable particulate matter*' and a follow-up review of the implementation of recommendations given as part of the review carried out in 2021. The Parties reviewed in 2021 are Kazakhstan, Liechtenstein, Monaco and Montenegro.

3. Particulate matter can exist as solid or liquid matter (the "filterable" portion) or as gases (the "condensable" portion). Condensable particulate matter is vapour phase at stack conditions, but condenses and/or reacts upon cooling and dilution upon discharge into ambient air to form solid or liquid PM. All condensable PM is assumed to be in the $PM_{2.5}$ size fraction[2]. The inclusion of the condensable component of $PM_{2.5}$ emissions can have a big impact on the emission estimate for certain sources[3].

4. This ad-hoc review, has assessed $PM_{2.5}$ emission estimates with a special focus on the topic of '*condensables*' for the years 2000 to 2020.

5. This report covers the results of the stage 3 centralised review (ad hoc review) 2022 of the UNECE LRTAP Convention of Austria coordinated by the EMEP emission centre CEIP acting as review secretariat. The review took place between April and June 2022 and was performed as desk review with an in person meeting between 30 of May 2022 and 3 June 2022. The following team of nominated experts from the roster of experts performed the review.

---

[1] Decision 2018/1 adopted by EB: *Updated methods and procedures for the technical review of air pollutant emission Inventories reported under the Convention*. ECE/EB.AIR/142/Add.1 https://unece.org/fileadmin/DAM/env/documents/2018/Air/EB/ECE_EB.AIR_142_Add.1-1902937E.pdf

[2] Condensable Particulate Matter Definition | Law Insider

[3] For more technical details please refer to the EMEP/EEA Guidebook (https://www.eea.europa.eu/publications/emep-eea-guidebook-2019) or the report 'How should condensables be included in PM emission inventories reported to EMEP/CLRTAP?' https://emep.int/publ/reports/2020/emep_mscw_technical_report_4_2020.pdf

1A3b Road Transport: Gudrun Stranner, Katrina Young, Magdalena Zimakowska-Laskowska, Martina Toceva and Rebecca Rose

1A4bi Residential: stationary: Aleksandra Nestorovska-Krsteska, André Amaro, Benjamin Cuniasse, Canan Esin Köksal, Damian Zasina, Laureta Dibra, Marion Pinterits, Sam Gorji and Wolfgang Schieder

6. Kristina Saarinen, Jeroen Kuenen and Ben Richmond were the lead reviewers. The review was coordinated by Sabine Schindlbacher (EMEP Centre on Emission Inventories and Projections - CEIP).

7. The review was performed on the basis of CLRTAP emission data officially reported by Austria, due by 15 February 2022 for emission inventories. The Informative Inventory Reports (IIR), reported due 15 March 2022 under the CLRTAP, informed the review.

8. The emission inventory of Austria was received on 15 February 2022 and thus by the deadline of 15 February. The Informative Inventory Report was received on 15 March 2022 and thus by the deadline of 15 March. Austria provided resubmissions of both the emission inventory and the IIR, on 15 March 2022 and 21 April 2022, respectively.

RECOMMENDATIONS FOR IMPROVEMENTS TO THE PARTY

1.A.4.b.i Residential: stationary

9. Austria uses a Tier 2 methodology for calculating $PM_{2.5}$ emissions from '1A4bi – Residential: stationary'.

10. The activity data are taken from the national energy balance provided by Statistik Austria. The ERT notes that the activity data are transparently described in the Informative Inventory Report, distinguished by primary fuel type. In order to improve overall transparency, the ERT suggests that Austria provides the detailed biomass consumption for the time series in the 1A4bi sector between "fuel wood" and "waste wood" in the IIR for the next submission.

11. The activity data for Austria, provided by the census survey on energy use in households (including type of heating) and conducted biannually by Statistics Austria, include collected wood, i.e. wood directly harvested from the forest outside formal market activity. The ERT recommends that the Party adds this information in the IIR for the next submission in order to improve overall transparency.

12. Austria has stratified the total fuel consumption in residential combustion (1A4bi) for each fuel type into different appliance types (22 appliance types are considered) in a consistent and complete manner. The basis for this split over appliance types is documented in the IIR for the entire time series. For biomass consumption in the residential stationary sector (1A4bi), Austria distinguished nine different appliance types: five using fuel wood and four using waste wood. The ERT commends Austria for the high level transparency of its IIR regarding this topic.

13. Austria uses both the EMEP/EEA Guidebook 2016 (without 2017 update) for 9 appliance types and country specific methodologies for 14 appliance types for the compilation of its PM emissions from this category. The ERT recommends Austria to use the 2019 version of the EMEP/EEA Guidebook instead of an earlier version for the next submission.

14. The ERT noted that there was a lack of transparency in the IIR regarding the PM emission factor for the biomass burning appliance type n°14 ("Mixed-fuel wood boilers"). In response to a question raised during the review, the Party explained that the PM emission factor n°14 was derived as a weighted average between emission factors for conventional and new appliances from the two emission factors. The ERT recommends that Austria include this explanation and also the exact reference used for the next submission.

15. The ERT noted that there was a lack of transparency in the IIR regarding the PM emission factor for the biomass burning appliance type n°15 ("Natural-draft wood boilers"). In response to a question raised during the review, the Party explained precisely why and how the PM emission factor was derived (lower limit of the 95% confidence interval from the EMEP/EEA 2016 Guidebook - Table 3-34). The ERT recommends that Austria provide the appropriate explanations for both the exact reference used and the reasoning behind this choice for the next submission.

16. The Party informed the ERT that the measurement standards for the country specific methods that are used in the calculation of emissions from biomass consumption were partly unknown (for four biomass burning appliance types) and

partly based on PM gravimetrical measurements (for biomass burning three appliance types and for the two coal burning appliance types).

17. The Party uses measurements based on the PM gravimetric method but was not able to provide detailed information on the sampling method for each quoted study. The ERT recommends to collect information on the sampling and measurement standards and/or equipment used and include this in the IIR in future submissions. In case different measurements/equipments are used for different types of equipment it is recommended that these are also documented in the IIR.

18. It is most likely that the PM gravimetrical method used in the quoted studies does not include the condensable fraction, however this could not be confirmed with the Party. The Party stated in its IIR that it is not clear if the condensable component of particulate matter (CPM) is included or not for five appliance types consuming biomass.

19. The ERT noted that for the appliance type n°12 ("wood stoves and cooking stoves"), the IIR lists a PM emission factor of 148 g/GJ including condensables and that for similar appliances in Tier 2 (Table 3.40 - conventional stoves burning wood and similar wood waste), the 2019 EMEP/EEA Guidebook suggests to use a PM emission factor including condensables of 800 g/GJ. When asked about this discrepancy during the review, the Party provided precise clarification about the reference from which the inventory emission factor originated. This raised some doubt whether the condensables were actually included or not, and the Party stated that further investigation was needed. The ERT recommends that the Party continues its investigation to determine whether or not fraction is included in this PM emission factor used for biomass burning appliance type n°12. The ERT also recommends Austria to update in its IIR the condensable fraction status declared from "Included" to "Unknown" until the necessary investigation are completed.

20. The measurements used to derive the emission factors do cover the start phase (ignition) and the end (ember) phase of the combustion cycle only for one appliance type consuming biomass (amongst nine appliance types in total) and the emission factor used in the inventory derived from these measurements also includes the start phase (ignition) and end (ember) phase. In response to a question raised during the review, the Party stated that it was unclear if the entire combustion cycle was taken into account in the PM emissions factors for six appliance types (the PM emission factors for the remaining two appliance types consuming biomass are based on the 2016 EMEP/EEA Guidebook). The ERT recommends Austria to include emissions during the start and end phases of the combustion cycle in the emission factors used for inventory compilation for all appliance types, to reflect the actual emission levels occurring during combustion. The ERT also recommends Austria to add in its IIR for each biomass burning appliance type whether it is known if the PM emissions factors take into account the entire combustion cycle in order to improve overall transparency.

21. The measurements used to derive the emission factors for the two coal burning appliance type also cover the entire combustion cycle. In response to a question raised during the review, the Party stated that the emission factors used in the inventory derived from these measurements include the start phase (ignition) and end (ember) phase as well. The ERT recommends Austria to add in its IIR for each coal burning

appliance type whether it is known if the PM emissions factors take into account the entire combustion cycle in order to improve overall transparency.

22. In response to a question raised during the review, the Party explained that only for one of the 7 biomass burning appliances for which country specific emission factors are used, the user impact is taken into account. The user impact refers to non-ideal burning conditions related to the user, i.e. the use of wet/unclean wood or poor management of air circulation in the appliance. In this particular case, for appliance type n° 20 a 42%/58% ratio between partial and full load is assumed. Austria also stated that for the other biomass or coal emission factors it is unclear if the user impact is taken into account. The ERT found the information included in the IIR not to be sufficiently transparent regarding this matter. While the user impact is not yet completely included in the inventory, the ERT recommends the Party to :

- Collect data on national circumstances (e.g. through studies or expert judgement/data collection by chimney sweepers) and to incorporate the information in the inventory throughout the entire time series for the next submissions.

- Add in its IIR for each appliance type whether it is known if the PM emissions factors take into account the "user impact" (and to what extent) in order to improve overall transparency for the next submission.

23. The emission factors partially include the condensable component of $PM_{2.5}$ emissions (Table 1). The ERT recommends the Party to further investigate for each biomass and coal PM emission factor whether or not condensables are included.

Table 1: Inclusion of condensables per fuel typ

Fuel Type	Includes the condensable component of $PM_{2.5}$ emissions
Biomass	Partially (depending on the appliance type considered)
Coal	Unknown
Liquid	Excluded or unknown depending on the appliance type
Gaseous	Excluded or unknown depending on the appliance type

24. The ERT notes that the time series is consistent.

25. The $PM_{2.5}$ emissions from small combustion are spatially distributed using proxy data based on an energy demand model for space heating and based on the Austrian register of buildings and dwellings.

26. Austria does not list specific planned improvements for future submissions in their 2022 IIR but states it will implement when possible recommendations from the different reviews.

1.A.3.b.i-iv Road transport exhaust emissions

27. Austria´s PM transport sector emissions are calculated using a national model NEMO (Network Emission Model) version 5.0.2 which uses emissions factors from HBEFA version 4.1. The IIR provides details of the main features of the model. The IIR describes the calculation of transport emissions transparently.

28. The activity data is taken from official national statistics from the Ministry of Transport, from the periodical inspection database, from traffic counting stations and toll data.

29. The $PM_{2.5}$ emissions from road transport exhaust do include the condensable component of $PM_{2.5}$ emissions. Considering the measuring protocol within the HBEFA group (measuring procedure and the max. temperature of 52°C), it can be assumed that the country specific emission factors taken from HBEFA include the condensable component of PM2.5 emissions.

30. The ERT notes that the method is documented transparently in the IIR.

31. The time series is consistent.

32. Austria lists the following planned improvements for their submission in 2023 in their 2022 IIR

- Update of emission factors according to HBEFA version V4.2

- Update of specific yearly mileage of passenger cars for the years 2019, 2020, 2021 according to data of the annual inspection of traffic and operational safety through section 57a of the 1967 Motor Traffic Act (KFG)

The ERT commends Austria for its improvement plans and recommends implementing them as scheduled.

33. In addition the ERT recommends implementing the following:

- In response to a question raised during the review, Austria provided details of how national fleet data is allocated to vehicle layers in NEMO. The ERT recommends Austria to provide summary information on vehicle fleet and the NEMO categories in future IIR submissions.

- In response to a question raised during the review, Austria provided details of average speeds modelled in HBEFA for Austria for each vehicle type for urban, rural and motorways. The ERT recommends that Austria provide summary information on average speeds used and their source in future IIR submissions.

REVISED ESTIMATES AND TECHNICAL CORRECTIONS CONSIDERED AND/OR CALCULATED BY ERT

34. In the Appendix of the 'EMEP/UNECE Review Guidelines 2018[4]' it is stated that if the ERT considers that when emissions are significantly under- or overestimated, then during the review, the Party is invited to submit "Revised Estimates" that address the issue raised. Should the Party decline to do this, or should it not be possible to agree on the quantification of the Revised Estimates, then the ERT may calculate a "Technical Correction" in the absence of an updated emission estimate being provided by the Party itself. The threshold for significance for a technical

[4] https://www.ceip.at/fileadmin/inhalte/ceip/3_review/advance_version_ece_eb.air_142_add.1.pdf

correction for the in-depth review in 2022 was set at 2% of the national total, i.e. findings identified which result in an over- or under-estimate of emissions of more than 2% of the national total can result in a Technical Correction. The methods for calculating the Technical Corrections are set up in the “Review Guidelines 2018” and use the EMEP/EEA Emission “Inventory Guidebook” as a reference for methods and emission factors.

35. Austria did not provide any revised estimates and the ERT did not calculate technical corrections for Austria.

LIST OF MATERIALS PROVIDED TO ERT

1. Austria IIR 2022
2. AT_2022_NFR_ANNEX_I_2019.xlsx

LIST OF ADDITIONAL MATERIALS PROVIDED BY THE COUNTRY DURING THE REVIEW

3. Responses to questions raised by the ERT during this review
4. Attachment_Energy_Question6_AT_1A4bi_Fuel_Consumption_Detail.xlsx
5. Attachment_Transport_Question2_Average speeds IOAOAB_V2.xlsx
6. Attachment_Energy_Question1to3_EMEP GB 2016 Small Combustion (prior 2017 revision).pdf