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

GERMANY

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 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 Germany 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

Ad hoc review - condensables

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 and Jeroen Kuenen 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 Germany 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 Germany was received on 8 February 2022 and thus by the deadline of 15 February. The Informative Inventory Report was published online by 22 April 2022 and thus after the deadline of 15 March.

RECOMMENDATIONS FOR IMPROVEMENTS TO THE PARTY

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

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

10. The activity data is taken from official statistics (Energy Balance for the Federal Republic of Germany prepared by the Working Group on Energy Balances (AGEB); AGEB, 2021: National energy balance and Satellite balance for renewable energy: *https://ag-energiebilanzen.de/en/data-and-facts/energy-balance-2000-to-2019/). The ERT notes that the activity data is not described transparently enough in the Informative Inventory Report and recommends the Party to document the description in more detail, including information from the chimney sweeps statistic, in the next IIR submission.

11. The activity data for Germany includes collected wood, i.e. wood directly harvested from the forest outside formal market activity. The Party describes in its IIR, that in the framework of the 'Rohstoffmonitoring Holz'[4] data for both - firewood purchased via commercial sellers and wood gathered in forests - was collected.

12. Germany has stratified the total fuel consumption for each fuel type into different appliance types e.g. boilers, stoves, in a consistent and complete manner. During the review, the Party clarified that the information on appliance types is available from the chimney sweeps statistic. Combining the chimney sweeps statistic with energy consumption data from the wood monitoring study ('Rohstoffmonitoring Holz'[4]) results in appliance- and age-class specific fuel data. Numbers of degree days and price indexes for conventional fuels is not used in the inventory but only in the regression model residential buildings for interim years, not for technical allocation. The basis for this split over appliance types is not sufficiently documented in the IIR. The ERT recommends Germany to provide a complete and clear documentation on these in the next IIR submission.

13. Germany uses a country specific methodology in the calculation of emissions based on the studies 'Efficient provision of current emissions data for purposes of air quality control' Struschka 2008[5]) and the updated study 'Ermittlung und Aktualisierung von Emissionsfaktoren für das nationale Emissionsinventar bezüglich kleiner und mittlerer Feuerungsanlagen der Haushalte und Kleinverbraucher' (Tebert, 2016; unpublished).

14. The emission factors used in the inventory are based on national measurements, which are described in the underlying study 'Efficient provision of current emissions data for purposes of air quality control' (Struschka 2008[6]). The ERT recommends Germany to include information on the measurement standards and equipment used in the IIR.

15. The measurements exclude the condensable component of particulate matter (CPM). The Party responded that there are no plans to include the condensable compounds.

[4] https://www.fnr.de/fileadmin/allgemein/pdf/broschueren/Handout_Rohstoffmonitoring_Holz_Web_neu.pdf
[5] https://www.umweltbundesamt.de/sites/default/files/medien/publikation/short/k3677.pdf
[6] https://www.umweltbundesamt.de/sites/default/files/medien/publikation/short/k3677.pdf

16. The measurements used to derive the emission factors also cover the start phase (ignition) and the end (ember) phase of the combustion cycle.

17. The German inventory does not take into account user induced impacts that affect emission levels from those during “normal combustion” (the so-called user impact, which covers e.g. the use of wet/unclean wood or poor management of air circulation in the appliance). The Party clarified during the review that the moisture content is not considered because of the specific German legal requirement. The amount of treated wood (painted or impregnated wood) is given from the statistic. The illegal use of treated wood cannot be taken into account, due to the lack of reliable data. According to German legislation the combustion of waste or paper is not allowed. It’s not possible to quantify the (illegally used) amount of waste. The ERT found the information included in the IIR to be partially transparent and recommend the Party to include the information provided during the review on their approach to the so-called user impact in the next IIR submission.

18. The emission factors do not 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 type

Fuel Type	**Includes the condensable component of $PM_{2.5}$ emissions**
Hard Coal	No
Hard Coal Coke	No
Hard Coal Briquettes	No
Lignite Briquettes	No
Natural Wood	No
Light Fuel Oil	No
Natural Gas	No

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

20. The $PM_{2.5}$ emissions from small combustion are spatially distributed using proxy data (e.g. population density, land use classes, etc.). During the review Germany explained, that for this source group, distribution parameters are mainly based on statistical data at district level. The spatial distribution of emissions from small combustion appliances of households was carried out via a more complex distribution function since the national emissions are differentiated into the four sub-categories of oil, gas, wood and other solid fuel combustion plants. Then the emissions per energy source are distributed using different distribution parameters to the district respectively community levels. Within the districts (for wood firing within the communities) emissions are again distributed over the relevant CLC classes to the level of the area sources.

21. Planned improvements subcategory 1A4bi are not listed in Germany’s IIR 2022.

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

22. Germany calculates particle emissions from the transport sector using TREMOD model (“Transport Emission Estimation Model” v6.02). All emission factors in TREMOD are based on the Tier 3 methodology in the Handbook Emission Factors

for Road Transport (HBEFA, version 4.1). The IIR provides details of the main features of the model as well as the calculation of transport emissions transparently.

23. The fuel consumption is provided by Working Group on Energy Balances (AGEB) and correspond to the Energy Balance data (GEB (2021): Working Group on Energy Balances (Arbeitsgemeinschaft Energiebilanzen (Hrsg.), AGEB): Energiebilanz für die Bundesrepublik Deutschland; URL: https://ag-energiebilanzen.de/7-0-Bilanzen-1990-2019.html, Köln & Berlin, 2021.). The activity data for vehicles category is generated within TREMOD (Knörr et al. (2020a): Knörr, W., Heidt, C., Gores, S., & Bergk, F.: ifeu Institute for Energy and Environmental Research (Institut für Energie- und Umweltforschung Heidelberg gGmbH, ifeu): Fortschreibung des Daten- und Rechenmodells: Energieverbrauch und Schadstoffemissionen des motorisierten Verkehrs in Deutschland 1960-2035, sowie TREMOD, im Auftrag des Umweltbundesamtes, Heidelberg & Berlin, 2020.)

24. The $PM_{2.5}$ emissions from road transport exhaust gases 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 $PM_{2.5}$ emissions.

25. The ERT notes that the method is not documented transparently in the IIR and recommends Germany to include further information on the age distribution of the vehicle fleet and more information about the traffic condition (average speed per road class and mileage share per road class) in the next IIR submission.

26. The time series is consistent.

27. No specific planned improvements are listed in Germany's 2022 IIR submission for particle emissions from sectors 1A3bi-iv.

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

28. In the Appendix of the 'EMEP/UNECE Review Guidelines 2018[7]' 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 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.

29. Germany did not provide any revised estimates and the ERT did not calculate any technical corrections.

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

LIST OF MATERIAL PROVIDED TO ERT

1. Germany Stage 2 S&A report
2. Germany Stage 1 report 2022
3. Germany IIR 2022
4. NFR tables 2022 submitted by Germany

LIST OF ADDITIONAL MATERIAL PROVIDED BY THE COUNTRY DURING THE REVIEW

5. Responses to preliminary question raised prior to the review
6. Response to questions raised during the review: