

**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

SLOVAKIA

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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 fraction². The inclusion of the condensable component of PM_{2.5} emissions can have a big impact on the emission estimate for certain sources³.

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 Slovakia 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.

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

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

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 Slovakia, 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 Slovakia 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. Slovakia provided a resubmission of the emission inventory by 15 March 2022.

RECOMMENDATIONS FOR IMPROVEMENTS TO THE PARTY

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

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

10. The activity data is taken from NEIS (National Energy Information System) database and the national energy balance which was revised by the support of a project with EUROSTAT, where statistical data and time series were corrected based on an improved methodology. Thereafter cooperation with the Statistical Office of the Slovak Republic was continued which resulted in a second statistical survey for improving the estimates of energy consumption in households. The ERT notes that the activity data is described in the Informative Inventory Report in a transparent manner.

11. The activity data for Slovakia include collected wood, i.e. wood directly harvested from the forest outside formal market activity.

12. Slovakia has stratified the total fuel consumption for each fuel type into different appliance types e.g. boilers, stoves, in a consistent and complete manner. The basis for this split over appliance types is documented in the IIR.

13. Slovakia uses a country specific methodology for the compilation of its emissions from this category for biomass combustion.

14. The Party informed the ERT that the country specific methods used in the calculation of emissions are based on emission measurements, and the emission factors are derived from these measurements.

15. The Party uses measurements taken from results of dedicated measurements taken at low and nominal heat ratings. These data are provided in cooperation with the air quality modellers' team (Air Quality Department, SHMÚ) throughout their active participation in the project named "LIFE Integrated Project: Implementation of Air Quality Plan for Małopolska Region – Małopolska in a healthy atmosphere". Emission factors are determined for biomass burning in over-fire boilers, under-fire boilers, gasification boilers and automatic boilers. Biomass emission factors of air pollutants for fireplaces, stoves, masonry/built-in tile stoves (Tables 3-14 and 3-17) modern masonry/built-in tile stoves and pellets stoves (Table 3-25) are obtained from the EMEP/EEA GB 2019 Tier 2 methodology. Slovakia did not provide detailed information on the sampling and measurements. The ERT recommends to include in the IIR, information on the measurement standards and/or equipment used; in case different measurements/equipment are used for different types of equipment, also to include documentation of these.

16. The measurements include the condensable component of particulate matter (CPM).

17. The measurements used to derive the emission factors do not cover the start phase (ignition) and the end (ember) phase of the combustion cycle. The corresponding emission factors used in the inventory derived from these measurements therefore also exclude the start phase (ignition) and end (ember) phase. The ERT recommends Slovakia to include emissions during the start and end phases of the combustion cycle in the emission factors used for inventory compilation, to reflect the actual emission levels occurring during combustion, when new measurements are planned.

18. The Party 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 ERT found the information included in the IIR not to be transparent. While the user impact is not yet 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 chimneysweepers) and to incorporate the information in the inventory for the next submissions.

19. The emission factors include the condensable component of PM_{2.5} emissions for biomass fuels, whereas for other fuels it is not known if condensables are included (Table 1).

Table 1: Inclusion of condensables per fuel type

Fuel Type	Includes the condensable component of PM_{2.5} emissions
Biomass	Yes
Coal	Unknown (EMEP/EEA Guidebook 2019)
Liquid	Unknown (EMEP/EEA Guidebook 2019)
Gaseous	Unknown (EMEP/EEA Guidebook 2019)

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

21. The PM_{2.5} emissions from small combustion are spatially distributed using proxy data (as CORINE landcover - inhabited areas, information from census 2011; a type of fuel for households, data from National Emission Information System-NEIS).

22. Slovakia lists the following planned improvements for future submissions in their 2022 IIR:

- Slovakia planned to improve the methodology and completeness of reporting in the next submission of gridded data, with a focus on the key source categories.

The ERT commends Slovakia for their improvement plans and recommends implementing them as soon as possible.

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

23. Slovakia PM road transport sector emissions are calculated using COPERT 5.5. All emission factors in COPERT are based on the Tier 3 methodology in the 2019 EMEP/EEA Guidebook. The IIR provides details of the main features of the model. The IIR describes the calculation of transport emissions transparently.

24. The activity data is derived from odometer data from Transport Directorate (TID) combined with vehicle fleet data from the Police. Activity was distributed between urban, rural and highways based on the Traffic Census of Slovakia conducted every 5 years (latest 2015).

25. The PM_{2.5} emissions from road transport exhaust include the condensable component of PM_{2.5} emissions.

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

27. The time series is consistent.

28. Slovakia lists the following planned improvements for future submissions in their 2022 IIR

- An improvement to the uncertainty analysis for the transport sector

The ERT commends Slovakia for their improvement plans and recommends implementing them as soon as possible.

29. In addition the ERT recommends implementing the following:

- In response to a question raised during the review, Slovakia provided details of vehicle speed assumptions used in modelling and the source of speed data. The ERT recommends Slovakia to provide the speed assumptions in the IIR in its next submission.

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

30. 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 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.

31. Slovakia did not provide any revised estimates and the ERT did not calculate technical corrections for Slovakia.

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

LIST OF MATERIALS PROVIDED TO ERT

1. Slovakia IIR 2022
2. Annex_I_SK_2022_Submission_v2.0.xlsx

LIST OF ADDITIONAL MATERIALS PROVIDED BY THE COUNTRY DURING THE REVIEW

3. Responses to questions raised by the ERT during this review
4. Summary of traffic speed data used in road transport emissions model provided in response to question raised by the ERT during the review, Speed_CLRTAP_Q.xlsx