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

STAGE 3 REVIEW REPORT

SERBIA

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 Serbia 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 Serbia, 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 Serbia was received on 14 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. Serbia provided resubmissions of the emission inventory on 15 March and 13 April 2022, respectively, and a resubmission of the IIR on 13 April 2022.

RECOMMENDATIONS FOR IMPROVEMENTS TO THE PARTY

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

9. Serbia uses a Tier 1 methodology for calculating PM emissions from '1A4bi – Residential: stationary'. As '1A4bi – Residential: stationary' is a key category, the ERT recommends Serbia to use at least a Tier 2 method for calculating emissions from '1A4bi – Residential: stationary' in line with Reporting Guidelines' paragraph [214]

10. The activity data is taken from official statistics (Statistical Office of Serbia). The ERT notes that the activity data is described transparently in the informative Inventory Report. The consumption of biomass forms the majority of the fuel used for 1A4bi.

11. The activity data for Serbia do not include collected wood, i.e. wood directly harvested from the forest outside formal market activity. The ERT recommends Serbia to account for the emissions associated with the combustion of collected wood in 1A4bi in the future submissions.

12. Serbia has not stratified the total fuel consumption for each fuel type into different appliance types e.g. boilers, stoves, since a Tier 1 approach is used for all fuels.

13. Serbia uses the EMEP/EEA Guidebook 2019 for the compilation of its emissions from this category.

14. It is not clear if the emission factors include the condensable component of $PM_{2.5}$ emissions (Table 1), except for biomass where condensables are included.

Table 1: Inclusion of condensables per fuel type

Fuel Type	Includes the condensable component of $PM_{2.5}$ emissions
Biomass	Yes
Hard coal and brown coal	Unclear (EMEP/EEA Guidebook 2019)
Gaseous fuel	Unclear (EMEP/EEA Guidebook 2019)
Other liquid fuel	Unclear (EMEP/EEA Guidebook 2019)

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

16. The $PM_{2.5}$ emissions from small combustion are spatially distributed using population density as the proxy.

17. Serbia has not listed any planned improvements for future submissions in their 2022 IIR.

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

18. Serbia´s PM transport sector emissions are calculated using COPERT version 5.5 for the period 2016 to 2020 and COPERT 5.2 for the previous years. All emission factors in COPERT are based on the Tier 3 methodology in the 2019 EMEP/EEA Guidebook. The IIR

[4] Reporting Guidelines paragraph 21: "For sources that are determined to be key categories in accordance with the EMEP/EEA Guidebook methodologies, Parties should make every effort to use a Tier 2 or higher (detailed) methodology, including country-specific information."

provides details of the main features of the model and describes the calculation of transport emissions transparently.

19. The activity data are taken from official statistics of all registered vehicles in the territory obtained from the Ministry of Internal Affairs of the Republic of Serbia, Traffic Police from 1990 to 2020.

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

21. The ERT notes that the method is not documented transparently in the IIR. The IIR does not describe how the vehicle fleet is derived or presents data showing trends in the vehicle fleet composition by vehicle and fuel type or show the age distribution of the fleet. Furthermore, the IIR does not provide details of the source of data and methodology used to distribute vehicle activity between urban, rural and highway road classes. The ERT recommends Serbia to include all these elements in the next submission of the IIR.

22. The time series is not consistent. Serbia recalculated road transport emissions with a change of the methodology for the period 2016 to 2020 only. Emissions for previous years were not recalculated. The impact of the recalculation is a step change increase in $PM_{2.5}$ exhaust emissions (sectors 1A3bi-iv) of greater than 100% between 2015 and 2016. Trends for the recalculated period 2016 to 2020 are consistent. The ERT recommends Serbia to recalculate the full time series with a consistent methodology in the next submission.

23. Serbia does not list any planned improvements for PM emissions from road transport for future submissions in their 2022 IIR.

24. The ERT recommends implementing the following:

- The ERT recommends that Serbia include a statement in the road transport chapter of the IIR confirming that the condensable component of $PM_{2.5}$ is included in emission estimates.

- Serbia did not submit activity data in Annex 1 of their inventory submission. In response to a question raised during the review Serbia explained that the National Energy Balance of Serbia provides activity data only for road transport as a total and not for different vehicle classes. The ERT notes that the EMEP/EEA Inventory Guidebook and COPERT provide vehicle type and technology specific energy consumption factors to facilitate energy balance calculations that will allow the total energy balance to be disaggregated by vehicle type. The ERT recommends that Serbia uses this methodology to provide energy consumption for road transport sectors 1A3bi-iv in its next submission.

- The ERT recommends Serbia to report emissions of TSP and BC for ‘1A3b – Road Transport’ in its next submission.

The ERT encourages implementing the following:

- The ERT encourages Serbia to follow the recommended structure of the IIR detailed in Annex II of the 2014 Guidelines for Estimating and Reporting Emission Data, which includes an appendix with a table summarising the use of PM emission factors that include/exclude the condensable component, where available.

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

25. In the Appendix of the 'EMEP/UNECE Review Guidelines 2018[5]' 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.

26. The ERT calculated one (1) technical correction. Serbia did not accept this technical correction. The ERT recommends Serbia to consider the Technical Correction in their next inventory submission and to collect the necessary information to improve this estimate in the next years. Details of the Technical Correction presented in Table 2 are included in ANNEX I TECHNICAL CORRECTIONS AND REVISED ESTIMATES.

Table 2 Summary of revised estimates and technical corrections identified by ERT for country

Number	NFR category (	Pollutant	Year	RE/TC quantified (yes/no)	Contribution to national total (%)
TC1-RS-2020-1A4bi	1A4bi	$PM_{2.5}$	2020	Yes	2.0%

[5] 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. Serbia IIR 2022

2. National sector emissions: Main pollutants, particulate matter, heavy metals and persistent organic pollutants, 1990-2020, NFR Ver 2.xlsx

3. National sector emissions: Main pollutants, particulate matter, heavy metals and persistent organic pollutants, 1990-2020, NFR Ver 3.xlsx

LIST OF ADDITIONAL MATERIALS PROVIDED BY THE COUNTRY DURING THE REVIEW

4. Responses to questions raised by the ERT during this review

ANNEX I TECHNICAL CORRECTIONS AND REVISED ESTIMATES

27. The ERT calculated one potential technical correction. Detailed related information is provided separately in the Excel file:

- TC1-RS-2020-1A4bi.xlsx

Table 1: Technical corrections calculated by the ERT

Technical Correction for $PM_{2.5}$ emissions in 1A4bi Residential: stationary			
Year	Original estimate (kt)	Revised Estimate received from MS (kt)	Difference between original estimate and Revised Estimate (kt)
2005	31.118	30.937	0.181
2010	33.606	32.790	0.816
2015	28.862	28.142	0.720
2016	30.903	30.161	0.742
2017	28.716	28.033	0.683
2018	29.527	28.812	0.715
2019	30.494	29.754	0.740
2020	46.174	45.021	1.153

Table 2: Effect of the Technical Corrections and Revised Estimates on the National Total and National Total for compliance

Year	National Total (kt)[6]	National Total for Compliance (kt)[7]	Sum of Revised Estimates and Technical Corrections (kt)	National Total including Revised Estimates and Technical Corrections (kt)	National Total for Compliance including Revised Estimates and Technical Corrections (kt)
2005	39.711	39.711	0.181	39.892	39.892
2010	42.579	42.579	0.816	43.395	43.395
2015	37.855	37.855	0.720	38.575	38.575
2016	43.334	43.334	0.742	44.076	44.076
2017	40.939	40.939	0.683	41.622	41.622
2018	41.280	41.280	0.715	41.995	41.995
2019	42.224	42.224	0.740	42.964	42.964
2020	57.983	57.983	1.153	59.136	59.136

[6] Line 141 in Annex I to the reporting guidelines (NFR table)
[7] Line 152 in Annex I to the reporting guidelines (NFR table)