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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

UKRAINE

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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 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 Ukraine 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 Ukraine, 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 Ukraine was received on 14 February 2022 and thus by the deadline of 15 February. The Informative Inventory Report was received on 14 March 2022 and thus by the deadline of 15 March.

RECOMMENDATIONS FOR IMPROVEMENTS TO THE PARTY

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

9. Ukraine uses a Tier 1 methodology for calculating PM_{2.5} emissions from '1A4bi – Residential: stationary'. As category 1A4bi is a key category of PM_{2.5} emissions for Ukraine, the ERT recommends the Ukraine to use a least a Tier 2 method for calculating PM_{2.5} emissions from this category, in line with Reporting Guidelines' paragraph 21⁴.

10. The activity data are taken from the energy balance of Ukraine for 2020.

11. The ERT was unable to conclude whether collected wood, i.e. wood directly harvested from the forest outside formal market activity, is included or not in the activity data. The ERT recommends that Ukraine include information on whether collected wood is included in the inventory, in the next IIR submission. If not, the ERT recommends Ukraine to carry out studies to collect this information in order to complete the activity data.

12. Ukraine has not stratified the total fuel consumption for each fuel type into different appliance types, such as boilers and stoves. The ERT recommends that the Ukraine carry out studies to collect this country-specific information and use it to move to the Tier 2 methodology. The ERT also notes that Tables 3.36-3.38 in the Guidebook provide default percentages for the appliance type split for the years 2000, 2005 and 2010 to be used with the Tier 2 method, if country-specific data is not available.

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

14. The emission factors for wood include the condensable component of PM_{2.5} emissions. (Table 1)

Table 1: Inclusion of condensables per fuel type

Fuel Type	Includes the condensable component of PM _{2.5} emissions
Biomass	Yes
Coal	Unclear (Guidebook 2019 – Tier 1)
Liquid	Unclear (Guidebook 2019 – Tier 1)
Gaseous	Unclear (Guidebook 2019 – Tier 1)

15. The ERT was unable to conclude whether the time series is consistent, as the Ukraine only reported data for the year 2020 in the NFR 2022 submission. The ERT recommends the Ukraine to include the whole time series calculated with consistent methods in the next submission.

16. At the date of the CLRTAP review, the Ukraine have not disaggregated emissions in the EMEP grid. However, according to the IIR 2022 it is planned to implement an EMEP pilot

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."

project and to estimate emissions in the new EMEP grid resolution (0.1° x 0.1°) in 2021-2023. The ERT recommends the Party to implement the improvement whenever possible.

17. The Ukraine lists the following planned improvements for their submission in 2023 in their 2022 IIR:

- Assure the verification of all source data for T3 and to report these data utilising T3 method for most of the categories.

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

18. Ukraine's transport sector emissions are calculated using a combination of Tier 1 and Tier 2 methodologies for disaggregating the fleet data and Tier 2 default emission factors (reference to 2019 EMEP/EEA Guidebook is missing).

19. The activity data is taken from the total fuel sales provided by State Statistic Service of Ukraine. This information is documented transparently in the IIR. However, it seems that no other sources of activity data are being used in the emission calculation.

20. Ukraine uses emission factors from the 2019 EMEP/EEA Guidebook. Thus the inventory includes the condensable component of PM_{2.5} emissions, because Tier 2 emission factors were determined using the Tier 3 methodology in the 2019 EMEP/EEA Guidebook. The ERT recommends the Party to include this information in the transport sector chapter of the IIR.

21. The ERT notes that the method is documented on a very general level in the IIR. The ERT recommends the Ukraine to document the calculation on a more detailed level.

22. The time series is consistent.

23. Ukraine lists the following planned improvements for future submissions in their 2022 IIR:

- Implementation of COPERT version 5

The ERT commends the Ukraine for their improvement plan and encourages to implement it whenever possible.

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

24. 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.

25. The ERT calculated one technical correction that was sent to Ukraine. Ukraine did not provide comments on whether they agree or disagree with the technical correction and sent no revised estimates that were accepted by the ERT. The ERT recommends the Ukraine to consider the Technical Correction in their next inventory submission. Details of the Technical Corrections and Revised Estimates presented in Table 5 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 (s)	Pollutants	Year(s)	RE/TC quantified (yes/no)	Contribution to national total of PM _{2.5} (%)
RE1_TC1-UA-2022-1A4bi	1A4bi	PM2.5 (PM10, TSP)	2005	Yes	1.8%
RE1_TC1-UA-2022-1A4bi	1A4bi	PM2.5 (PM10, TSP)	2020	Yes	-17.1%

The calculation file also provide PM₁₀ and TSP emissions and cover the years 2005 and 2015-2020.

⁵ 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. Ukraine's Stage 2 S&A report
2. Ukraine's Stage 1 report 2022
3. Ukraine's IIR 2022
4. NFR tables reported by Ukraine in 2022

LIST OF ADDITIONAL MATERIAL PROVIDED BY THE COUNTRY DURING THE REVIEW

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

ANNEX I TECHNICAL CORRECTIONS AND REVISED ESTIMATES

26. Text to be up-dated in the second draft of the report

- PTC1_RE1-UA_1A4bi_2022.xlsx

Table 1: Potential Technical Correction (heading to be up-dated in the second draft of the report)

Revised estimate 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	27.71	29.97	2.26 (1)
2010	0.11	20.18	20.07 (2)
2015	0.10	19.97	19.87 (3)
2016	0.12	25.19	25.07 (4)
2017	0.12	26.51	26.39 (5)
2018	0.12	28.41	28.29 (6)
2019	64.09	28.83	-35.26 (7)
2020	61.97	28.55	-33.42 (8)

(1) Original estimate taken from Ukraine 2007 submission

(2) Original estimate taken from Ukraine 2012 submission

(3) Original estimate taken from Ukraine 2017 submission

(4) Original estimate taken from Ukraine 2020 submission

(5) Original estimate taken from Ukraine 2020 submission

(6) Original estimate taken from Ukraine 2020 submission

(7) Original estimate taken from Ukraine 2021 submission

(8) Original estimate taken from Ukraine 2022 submission

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

Year	National Total (kt) ⁶ for PM _{2.5}	National Total for Compliance (kt) ⁷ for PM _{2.5}	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	125.239	125.239	2.26	127.494	127.494
2010	40.707	40.707	20.07	60.775	60.775
2015	37.677	37.677	19.87	57.547	57.547
2016	41.803	41.803	25.07	66.878	66.878
2017	53.774	53.774	26.39	80.165	80.165
2018	48.397	48.397	28.29	76.683	76.683
2019	187.30	187.30	-35.26	152.934	152.934
2020	195.38	195.38	-33.42	162.954	162.954

⁶ Line 141 in Annex I to the reporting guidelines (NFR table)

⁷ Line 152 in Annex I to the reporting guidelines (NFR table)