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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**

NORWAY

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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*<sup>(1)</sup> – 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<sub>2.5</sub> 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<sub>2.5</sub> size fraction<sup>2</sup>. The inclusion of the condensable component of PM<sub>2.5</sub> emissions can have a big impact on the emission estimate for certain sources<sup>3</sup>.

4. This ad-hoc review, has assessed PM<sub>2.5</sub> 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 Norway 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

<sup>&</sup>lt;sup>1</sup> 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

<sup>&</sup>lt;sup>2</sup> Condensable Particulate Matter Definition | Law Insider

<sup>&</sup>lt;sup>3</sup> For more technical details please refer to the EMEP/EEA Guidebook (https://www.eea.europa.eu/publications/emep-eeaguidebook-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 Norway, 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 Norway was received on 11 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. Norway provided resubmissions of the emission inventory by 8 March and 15 March 2022.

# **RECOMMENDATIONS FOR IMPROVEMENTS TO THE PARTY**

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

9. Norway uses a Tier 3 methodology for calculating  $PM_{2.5}$  emissions from '1A4bi – Residential: stationary'.

10. The activity data is based on a combination of sources:

• Statistics Norway's Travel and Holiday Survey for use of wood in households for the years 2005-2011, which included questions relating to wood burning, combined with the amount of wood burned;

• the annual survey on consumer expenditure (Statistics IIR 2020 99 Norway) for the years before 2005 and for 2012;

• for the years after 2012, the data is again based on Statistics Norway's Travel and Holiday Survey.

Additionally it is assumed that all combustion of wood in private households takes place in small ovens. The ERT notes that the activity data is not described sufficiently transparent in the Informative Inventory Report. The ERT recommends Norway to document in more detail the references of the specific studies and statistics in the next IIR submission.

11. The activity data for Norway include collected wood, i.e. wood directly harvested from the forest outside formal market activity, as is stated in the Norwegian IIR.

12. Norway 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 however not sufficiently documented in the IIR. The ERT recommends the documentation to be included in the next submission.

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

14. The Party uses country specific methods for the calculation of emissions and the derivation of the EFs which Norway stated in response of the review question. These are also included in the links provided in the IIR.

15. The Party uses national measurements based on a specific studies carried out in Norway for which references are provided in the IIR, however no detailed information on the sampling and measurements is given. The ERT recommends the descriptions to be included in the IIR, including information on the measurement standards and/or equipment. In case different measurements/equipments are used for different types of equipment it is recommended that these be also documented in the IIR.

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

17. Based on the information provided in the IIR, the ERT is unsure whether emissions occurring during the start phase (ignition) and the end (ember) phase of the combustion cycle are taken into account in the measurements. The ERT recommends Norway 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, and to confirm the inclusion of these in the next submissions of IIR.

18. It is not clear to the ERT whether the Party takes or 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 to not sufficiently transparent on this aspect. The ERT recommends the Party to clearly document in the IIR for each of the emission factors used whether "user impact" is included or not. In case it is not included, the ERT recommends Norway 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 for the next submissions.

19. The emission factors include the condensable component of  $PM_{2.5}$  emissions (Table 1).

Fuel Type	Includes the condensable component of PM <sub>2.5</sub> emissions
Biomass (wood waste, wood pellet, wood	Yes
briquette)	
Solid fuels (coal, coke, petrol coke, charcoal)	Unknown (Country specific case)
Liquid fuels	Unknown (Country specific case)
Gaseous	Unknown (Country specific case)

#### Table 1: Inclusion of condensables per fuel type

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

21. The PM<sub>2.5</sub> emissions from small combustion are spatially distributed using proxy data. Emissions are allocated to grid cells when figures for the activity used to calculate emissions are available directly at geographical level i.e. fuel combustion in manufacturing industries and emissions from animals. When the activity at the geographical level is unknown, the national emissions are allocated indirectly using surrogate statistical data.

22. Norway lists the following planned improvement for future submission in their 2022 IIR

• For the next reporting, the Norwegian Environment Agency plans to reduce the uncertainty in the methodologies used to allocate emissions on the grid.

The ERT commends Norway for this improvement plan and recommends implementing this as scheduled.

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

23. Norway's PM transport sector emissions are calculated using the HBEFA model version 4.1. 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 taken primarily from official registers and public statistics from Statistics Norway, the Norwegian Directorate of Public Roads and the Institute of Transport Economics. Mileage data pre-2005 is taken from surveys by Statistics Norway or the Institute of Transport Economics. Load data and transformation data is taken from surveys by Statistics Norway or the Institute of Transport Economics.

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

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

27. The time series is consistent.

28. Norway lists no specific planned improvements in their 2022 IIR for PM emissions from sectors 1A3bi-iv.

29. The ERT recommends implementing the following:

• In response to a question raised during the review, Norway agreed to investigate the emission factors of HEBFA regarding whether the condensable component of PM<sub>2.5</sub> is included in sectors 1A3bi-iv, in contrast to the statement in the IIR. The ERT recommends that Norway include a statement in the road transport chapter of the IIR confirming whether the condensable component of PM<sub>2.5</sub> is included in emissions estimates or not.

And the ERT encourages to implement the following:

• In response to a question raised during the review, Norway explained that research is ongoing to estimate mileage of foreign lorries in Norway, which is expected to be finalised in 2022. The ERT encourages Norway to use the results to analyse the discrepancy between calculated fuel consumption in HBEFA and sold quantities of fuel and describe the findings in the next IIR submission.

• The ERT encourages Norway 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

30. In the Appendix of the 'EMEP/UNECE Review Guidelines 2018<sup>4</sup>' 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. Norway did not provide any revised estimates and the ERT did not calculate technical corrections for Norway.

<sup>&</sup>lt;sup>4</sup> <u>https://www.ceip.at/fileadmin/inhalte/ceip/3\_review/advance\_version\_ece\_eb.air\_142\_add.1.pdf</u>

### LIST OF MATERIALS PROVIDED TO ERT

- 1. Norway IIR 2022
- 2. Annex\_I\_Emissions\_Norway\_mal\_2022\_v2.xlsx

# LIST OF ADDITIONAL MATERIALS PROVIDED BY THE COUNTRY DURING THE REVIEW

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