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

2023

THE NETHERLANDS

FINAL REPORT

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INTRODUCTION

1. 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'.

2. 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.

3. At its eighth joint session in September 2022, the Steering Body and the Working Group on Effects approved the plan that the in-depth review in 2023 focuses on emissions from agriculture with a special emphasis on ammonia, NMVOC and NO_x emissions including gridded data. While the focus was set on NH₃, NMVOC and NO_x emissions, also all other pollutants covered by LRTAP Convention and its protocols (i.e. SO₂, NO_x, NMVOC, NH₃, plus PM₁₀ PM_{2.5}, BC, priority HMs and POP_S) have been checked for the time series years 1990 – 2021 to the extent possible. For these other pollutants especially completeness of reporting was assessed.

4. This report covers the results of the Stage 3 Review (ad hoc review) 2023 of the Netherlands' air emission inventory submitted under the UNECE LRTAP Convention. The review was coordinated by the EMEP Centre on Emission Inventories and Projections (CEIP) acting as Review Secretariat. The review took place between April and June 2023 and was performed as a desk review between 31 March to 5 May 2023 and an in-person meeting between 22 of May 2023 and 26 May 2023 (centralized review). The following team of nominated experts from the Roster of Experts performed the review.

Agriculture experts:

Ms. Armine ARTENYAN (Republic of Armenia)

Ms. Ajla BASOVIC (Montenegro)

Ms. Aleksandra NESTOROVSKA-KRSTESKA (North Macedonia)

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
http://www.unece.org/fileadmin/DAM/env/documents/2002/eb/air/EB%20Decisions/Decision_2018_1.pdf

Mr. Lasha AKHALAIA (Georgia)

Mr. Hakam AL-HANBALI (Sweden)

Ms. Susana LOPEZ-APARICIO (EU/ETC(EEA))

Ms. Simone MAYER (Austria)

Ms. Andjelka RADOSAVLJEVIC (Serbia)

Ms. Kristina Tonhauzer (Slovakia)

Mr. Tim VAN DER ZEE (Netherlands)

Experts for gridded emission data:

Ms. Christine BRENDLE (Austria)

Mr. Christopher EVANGELIDES (United Kingdom)

Mr. Christian MIELKE (Germany)

5. Mr. Ben RICHMOND (United Kingdom), Ms. Rikke ALBREKTSEN (Denmark), Mr. Etienne MATHIAS (France), Ms. Kristina SAARINEN (Finland) were the lead reviewers. The review was coordinated by Ms. Sabine Schindlbacher and Mr. Bernhard Ullrich (EMEP Centre on Emission Inventories and Projections - CEIP).

6. The review was performed on the basis of CLRTAP emission data officially reported by the Netherlands, due by 15 February 2023. The Informative Inventory Reports (IIR), reported due by 15 March 2023 under the CLRTAP, informed the review.

7. The EMEP/EEA Guidebook 2019² was used as a base for the review.

8. The emission inventory of the Netherlands was received on 15 February 2023 and thus by the deadline of 15 February. The Informative Inventory Report was received on 15 March 2023 and thus by the deadline of 15 March. The Netherlands provided a resubmission of the emission inventory on 27 March 2023. This resubmission has been considered for the review.

² EMEP/EEA: EMEP/EEA air pollutant emission inventory guidebook 2019, EEA Report No. 13/2019 European Environment Agency, Copenhagen. Available at: <https://www.eea.europa.eu/publications/emep-eea-guidebook-2019> EU 2019

PART A: GENERAL RECOMMENDATIONS FOR THE CHAPTER AGRICULTURE

9. The ERT recognises the level of effort undertaken by the Netherlands in providing an inventory including a significant level of detail.

The IIR describes the methods used for the sector agriculture transparently. The ERT considers the agriculture part of the inventory submission to be of very good quality in terms of completeness and of very good quality in terms of accuracy, comparability and consistency.

To improve the overall quality of the agriculture air emission inventory the ERT recommends the Netherlands to:

- Ensure that the agriculture emission inventory is complete for all relevant air pollutants.
- Ensure that also emissions of NH₃ from sewage sludge applied to soils are included in 3Da2b.
- Ensure that the time series is consistent and transparent by providing a detailed description on the dips and jumps of the emission data in the time series.
- Ensure that the explanations on allocations for PM emissions in categories 3D are complete by providing a detailed list of subsources included in subcategories and the references used source by source.
- Assess the possibility to include PM emissions from 3Da2a (Animal manure applied to soils), 3Da2b (Sewage sludge applied to soils), 3Da2c (Other organic fertilizers applied to soils) whenever resources are available and scientific literature sufficient.
- Assess the possibility to include emissions from wildfires even though reporting is optional.
- Keep delivering emission inventories and the related technical information at the same high-quality level as the 2023 submission.

PART B: SPECIFIC RECOMMENDATIONS FOR THE SECTOR AGRICULTURE

10. Table 1 provides the findings from the 2023 CLRTAP Stage 3 Review including those not implemented from previous CLTRAP Stage 3 Reviews. While the focus was set on NH₃, NMVOC and NO_x emissions, also all other pollutants covered by the LRTAP Convention and its protocols (i.e. SO₂, NO_x, NMVOC, NH₃, plus PM₁₀ PM_{2.5}, BC, priority HMs and POPs) have been checked for the years 1990 – 2021 to the extent possible, especially regarding the completeness of reporting. The implementation of the recommendations will be followed up in a future CLRTAP inventory review.

Table 1: Findings from the CLRTAP Stage 3 Review 2023 for the Sector Agriculture³

ID	Pollutants	NFR category	Key Category	Tier level	Type	TAC ₁ C ₂ C ₃
NL-2023-3D-1	NH ₃ , NO _x	3D	Indeterminate	Indeterminate	R	TC ₃
<p>Observation The ERT noted that the Netherlands reported “NE” for NH₃ emission from sewage sludge applied to soils (3Da2b) while NH₃ emissions are expected for sewage sludge application. The Netherlands acknowledged that a mistake was made in the allocation of emissions from the database, the NH₃ emissions from the application of sewage sludge applied to soils has been attributed to Animal manure applied to soils (3Da2a) instead of 3Da2b and provided a full timeseries of the NH₃ emissions from sewage sludge applied to soils. They indicate that the allocation of the NH₃ emissions will be corrected in next submission.</p> <p>Recommendation The ERT recommends the Party to correct the allocation of the NH₃ emissions from sewage sludge applied to soils (3Da2b) in next submission.</p>						
ID	Pollutants	NFR category	Key Category	Tier level	Type	TAC ₁ C ₂ C ₃
NL-2023-3D-2	PM	3D	No	Indeterminate	R	TC ₃
<p>Observation The ERT noted that the Netherlands reported “NE” and not "NA" for PM emissions from the following categories 3Da2a: Animal manure applied to soils, 3Da2b: Sewage sludge applied to soils, 3Da2c: Other organic fertilizers applied to soils (including compost), 3Da3: Urine and</p>						

³ Note: There are four possible types of findings: R: Recommendation, TC: Technical Correction, PTC: Potential Technical Correction; RE : Revised Estimate

The findings have been assigned to one or more of the following criteria: TACCC T (Transparency), A (Accuracy), C₁ (Completeness), C₂ (Comparability), C₃ (Consistency) for definitions of these criteria see EMEP/EEA Guidebook 2019

dung deposited by grazing animals, and 3Da4: Crop residues applied to soils, although the EEA EMEP Guidebook 2019 does not give emission factors for these categories. The ERT asked the Party whether there were plans to calculate emission of PM from these sources. The Party indicated during the review that "NE" is used instead of "NA" because it is known that there are PM emission from the application of manure and provided a link to a published article <https://www.sciencedirect.com/science/article/pii/S0160412019339765> but does not indicate that there were plans to include these emissions.

Recommendation

The ERT acknowledges the existence of PM emissions after application of organic materials and thus recommends to keep "NE" for the categories 3Da2a (Animal manure applied to soils), 3Da2b (Sewage sludge applied to soils) and 3Da2c (Other organic fertilizers applied to soils). Yet, the ERT also recommends the Netherlands to report "NA" for PM from categories 3Da3 (Urine and dung deposited by grazing animals) and 3Da4 (Crop residues applied to soils) for which PM emissions are not expected.

ID	Pollutants	NFR category	Key Category	Tier level	Type	TAC ₁ C ₂ C ₃
NL-2023-3B-1	NH ₃ , NMVOC	3B	Yes	Yes	R	T

Observation

The ERT noted that there is a jump of NH₃ emission from 3B4gii (Broilers) in 2002 and a dip of NH₃ emission from category 3B4gi (Laying hens) in 2003 and asked the Netherlands to give an explanation. The Party replied that in 2002 the number of broilers peaked at 50.562.545. in 2003 the number of broilers decreased to 36.371.492 due to avian influenza. The number of farms keeping broilers also decreased in 2003 to 582 (812 in 2002). In the following years the number of farms decreased even further. For observed dip in 2003, the Party added that 2002 was a year with a high incidence of avian influenza, leading to the culling of 30 million animals.

<https://opendata.cbs.nl/#/CBS/nl/dataset/80782ned/table?defaultview&dl=63F25>

Recommendation

The ERT recommends that the Netherlands add such information of the emission trends in order to enhance the transparency of the inventory in next submission.

PART C: SPECIFIC RECOMMENDATIONS FOR THE GRIDDED EMISSION DATA FOR THE SECTOR AGRICULTURE

For the 2023 Review of the gridded emission data the focus was set on NH₃, NMVOC, NO_x and PM_{2.5} emissions.

11. The methods used by the Netherlands to grid sectoral emissions are described transparently in the IIR.

12. The description includes data sources that have been used for spatial distribution.

13. Gridded emissions reported for GNFR K_AgriLivestock and L_AgriOther are consistent with the corresponding NFR categories reported in Annex I.

14. Table 2 provides the findings of the ERT related to the gridded data. For the Netherlands, no recommendations were provided by the ERT for this review.

Table 2: Findings from the CLRTAP stage 3 review 2023 for gridded emissions from the sector agriculture⁴

ID	Pollutants	GNFR category	TAC ₁ C ₂ C ₃
No recommendation			

⁴ The findings have been assigned to one or more of the following criteria: TACCC T (Transparency), A (Accuracy), C₁ (Completeness), C₂ (Comparability), C₃ (Consistency) for definitions of these criteria see EMEP/EEA Guidebook 2019

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

15. In the Appendix of the 'EMEP/UNECE Review Guidelines 2018'⁵ it is stated that if the ERT considers that emissions are significantly under- or overestimated, the Party is during the review 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 a Revised Estimate i.e. the ERT does not accept a Revised Estimate provided by the Party, the ERT may calculate a 'Technical Correction'. The threshold for significance for a Technical Correction for the in-depth review in 2023 was set at 2% of the national total, i.e. a finding that has been identified to result in an over- or under-estimate of emissions of more than 2% of the national total. The methods for calculating Technical Corrections are set up in the 'EMEP/UNECE Review Guidelines 2018' and use the EMEP/EEA Emission 'Inventory Guidebook' as a reference for methods and emission factors.

16. The ERT did not calculate any Technical Corrections and the Netherlands did not provide any Revised Estimates.

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. The Netherlands Annex I reporting template
2. The Netherlands Stage 2 S&A report
3. The Netherlands Stage 1 report 2023
4. The Netherlands IIR 2023
5. Repdab-Report
6. Extended checks

LIST OF ADDITIONAL MATERIALS PROVIDED BY THE COUNTRY DURING THE REVIEW

1. Responses to the question raised by ERT during the review.
2. Material received from the Party during the Review
 - A full timeseries of the NH₃ emissions from sewage sludge applied to soils: <https://data-preview.emissieregistratie.nl/s/tXvbSEBKV>
 - Information regarding agriculture; crops, animals and land use by farm type on a national scale.
<https://opendata.cbs.nl/#/CBS/nl/dataset/80782ned/table?defaultview&dl=63F25>
 - Functional relationship of particulate matter (PM) emissions, animal species, and moisture content during manure application, Environmental International, volume 143, 2020.
<https://www.sciencedirect.com/science/article/pii/S0160412019339765>

ANNEX I TECHNICAL CORRECTIONS AND REVISED ESTIMATES

The ERT did not calculate any Technical Corrections and the Netherlands did not provide any Revised Estimates.

ABBREVIATIONS

This list includes abbreviations commonly used in the Review Reports

AD	Activity data
BaP	Benzo[a]pyrene
BC	Black Carbon
C	Confidential
Cd	Cadmium
CEIP	Centre on Emission Inventories and Projections
CLRTAP	Convention on Long-range Transboundary Air Pollution – ‘the Air Convention’
CO	Carbon Monoxide
E-PRTR	European Pollutant Release and Transfer Register
EEA	European Environment Agency
EF	Emission factor
EMEP	The co-operative programme for monitoring and evaluation of the long-range transmission of air pollutants in Europe (unofficially ‘European Monitoring and Evaluation Programme’ = EMEP)
ERC	Emission Reduction Commitment
ERT	Expert Review Team
GHG	Greenhouse gas
GIS	Geo Information System
GNFR	NFR Aggregation for Gridding and LPS
HCB	Hexachlorobenzene
Hg	Mercury
HM	Heavy metals
IEF	Implied emission factor
kt	Kilotonnes
LPS	Large Point Sources
NA	Not applicable
NE	Not Estimated
NECD	National Emission reduction Commitments Directive
NFR	Nomenclature for reporting
NH ₃	Ammonia
NMVOG	Non-methane volatile organic compounds
NO	Not Occuring
NO _x	Nitrogen oxides
NR	Not relevant/Not Reported
PAHs	Polycyclic aromatic hydrocarbons
Pb	Lead
PCB	Polychlorinated biphenyls
PCDD/F	Polychlorinated dibenzo-p-dioxins and dibenzofurans
PM ₁₀	Fine particulate matter: particles with an aerodynamic diameter equal to or less than 10 micrometres (µm)

PM _{2.5}	Fine particulate matter: particles with an aerodynamic diameter equal to or less than 2.5 micrometres (µm)
POPs	Persistent organic pollutants
PTC	Potential technical correction
RE	Revised estimate
SO ₂	Sulphur dioxide
SO _x	Sulphur oxides
TC	Technical correction
TSP	Total suspended particulates

LIST OF REFERENCES AND SUPPORTING DOCUMENTS

1. Annex I emission reporting template. Available at <https://www.ceip.at/reporting-instructions>
2. ECE/EB.AIR/111/Add.1: Decision 2012/3: Adjustments under the Gothenburg Protocol to emission reduction commitments or to inventories for the purposes of comparing total national emissions with them
https://unece.org/DAM/env/documents/2013/air/ECE_EB.AIR_111_Add.1_ENG_DE_CISION_3.pdf
3. ECE/EB.AIR/113/Add.1: Decision 2012/12: Guidance for adjustments under the 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone to emission reduction commitments or to inventories for the purposes of comparing total national emissions with them
https://unece.org/DAM/env/documents/2012/EB/Decision_2012_12.pdf
4. ECE/EB.AIR/125: 2014 Reporting Guidelines for Estimating and Reporting Emission Data under CLRTAP
https://unece.org/fileadmin/DAM/env/documents/2013/air/eb/ece.eb.air.125_E_ODS.pdf
5. ECE/EB.AIR/127/Add.1: Decision 2014/1: Improving the guidance for adjustments under the 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone to emission reduction commitments or to inventories for the purposes of comparing total national emissions with them
https://unece.org/DAM/env/documents/2014/AIR/EB/Decision_2014_1.pdf
6. ECE/EB.AIR/130: Technical Guidance for Parties Making Adjustment Applications and for the Expert Review of Adjustment Applications, 14 April 2015
https://unece.org/DAM/env/documents/2014/AIR/EB/ECE_EB_AIR_130_ENG.pdf
7. [ECE/EB.AIR/142/Add.1: Decision 2018/1: Updated methods and procedures for the technical reviews of air pollutant emission inventories reported under the Convention](https://www.ceip.at/fileadmin/inhalte/ceip/00_pdf_other/2019/decision_2018_1_advance_version_ece_eb.air_142_add.1.pdf)
https://www.ceip.at/fileadmin/inhalte/ceip/00_pdf_other/2019/decision_2018_1_advance_version_ece_eb.air_142_add.1.pdf
8. EMEP/EEA: EMEP/EEA air pollutant emission inventory guidebook 2016, EEA Report No. 21/2016 European Environment Agency, Copenhagen. Available at: <http://www.eea.europa.eu/publications/emep-eea-guidebook-2016>
9. EMEP/EEA: EMEP/EEA air pollutant emission inventory guidebook 2019, EEA Report No. 13/2019 European Environment Agency, Copenhagen. Available at: <https://www.eea.europa.eu/publications/emep-eea-guidebook-2019>
10. TFEIP (2022): "Inventory adjustments in the context of emission reduction commitments (ERC)" available at: https://www.ceip.at/fileadmin/inhalte/ceip/00_pdf_other/2022/technical_guidance_for_erc_adjustments_issue1.1.pdf