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

2023

Ukraine

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 Ukraine's 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 ALBREKTSSEN (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 Ukraine, 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 Ukraine was received on 14 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. Ukraine provided resubmissions of the emission inventory on 15 March. The 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 Ukraine in providing an inventory including a significant level of detail.

The IIR does not describe the methods used for the sector agriculture transparently enough. The ERT considers the agriculture part of the inventory submission to be of adequate quality in terms of completeness and of adequate quality in terms of accuracy, comparability and consistency.

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

- provide a detailed description of applied methodologies, data sources, choice of emission factors and activity data for all categories in the IIR. When using a Tier 3 method it is good practice to provide a detailed description of the method.
- ensure that the agriculture emission inventory is complete, and ensure that also emissions of the following pollutants are included; NH₃ from animal manure applied to soils – 3Da2a. (NO_x emissions from this source are included)
- ensure the time series are consistent
- ensure that activity data is included in the NFR tables

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 POP_s) 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
UA-2023-3B-1	All	3B - 3D	Yes	Tier 1	R	TC ₁
<p>Observation The ERT noticed that no activity data (NRF 3B and 3D) is provided in the Annex I neither as tables in the IIR. However, in the IIR there are methodologies described for all livestock categories, and the IIR refers to the State Statistics Service as data source for the number of livestock animals and crop production.</p> <p>Encouragement The ERT encourages Ukraine to include activity data in the NFR tables as well as in the IIR in future submissions to enhance the quality of the report and to contribute to transparency.</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

ID	Pollutants	NFR category	Key Category	Tier level	Type	TAC ₁ C ₂ C ₃
UA-2023-3B-2	All	3B, 3D	Yes	Tier 1	R	TA

Observation

The ERT noticed that the IIR presents "Dynamics of the total volume of emissions" for each category with linear regression lines. To the ERTs understanding when evaluating the information provided in the Annex I, the total volume of emissions represents the annual sum up of all pollutants.

Recommendation

The ERT recommends to include the time series per individual pollutant and not as the sum up of all of them. Moreover, the ERT encourages to remove the linear regression lines, as in some cases there are unclear interannual variations. For instance, in figure 5.7.2 (3B4D – Manure management – goats) shows an increasing trends from 1990 to 2002, followed by a strong decrease towards 2008, and the time series finishes with a decreasing trend from 2013 to 2021. These type of interannual variations should be analyzed in the future for the different categories to enhance the quality of the IIR.

ID	Pollutants	NFR category	Key Category	Tier level	Type	TAC ₁ C ₂ C ₃
UA-2023-3B-3	All	3B4h, 3De, 3Df	No	Tier 3	R	TA

Observation

The ERT noticed that emissions from 3B4h (Manure management - Other animals) and from 3De (Cultivated crops) are estimated based on Tier 3 methodology. According to the EMEP/EEA Guidebook, there is no restriction in the form of Tier 3 emission modelling and the use of facility data provided. It can supply estimates that can be demonstrated to be more accurate than Tier 2. The ERT noticed a lack of detailed description in the IIR concerning the Tier 3 method used for 3B4h and 3De. Similarly, Ukraine reports Tier 3 behind the emission estimates from 3Df (Use of pesticides), on the contrary the EMEP/EEA Guidebook states that neither Tier 2 nor Tier 3 are available for emissions from

the use of pesticides. Based on feedback from Ukraine to clarify the methodologies, it is needed to contact the statistical service, which may take a considerable amount of time, especially during a state of war.

Recommendation

The ERT recommends Ukraine to clarify the methodology behind emissions from 3B4h, 3De and 3Df with the enterprises and provide additional information in future submissions.

ID	Pollutants	NFR category	Key Category	Tier level	Type	TAC ₁ C ₂ C ₃
UA-2023-3D-1	All	3De, 3Df	No	Tier 3	R	TC ₃

Observation

The ERT noticed that Ukraine reports NO_x, NMVOC, SO_x, NH₃, PM_{2.5}, PM₁₀, CO, Pb, Cd (3De), As (3Df), Cr, Cu (3Df), Ni, Zn (3Df), total POP (3Df) emissions from cultivated crops (3De) and use of pesticides (3Df). According to the EMEP/EEA GB, only NMVOC emissions arise from 3De, and only HCB arises from 3Df. To the ERTs question, Ukraine responded that agricultural enterprises provide data on their emissions according to the Tier 3 method to the State Statistics Service of Ukraine in the form of State Statistical Observation No. 2-TP (air) (annual) "Report on Emissions of Pollutants and Greenhouse Gases into Atmospheric Air from Stationary Emission Sources". The methodologies used by enterprises to calculate emissions may differ from those of the EMEP/EEA GB. To clarify the methodologies, it is necessary to contact the statistical service, which may take a considerable amount of time, especially during a state of war.

Recommendation

The ERT recommends Ukraine to clarify the methodology of NFR categories 3De and 3Df with the enterprises when possible and provide additional information in future submissions.

ID	Pollutants	NFR category	Key Category	Tier level	Type	TAC ₁ C ₂ C ₃
UA-2023-3D-2	NH ₃	3Da2a	-	-	R	TC ₁

Observation

The ERT noticed that NH₃ emissions from 3Da2a (Animal manure applied to soils) are not reported in the Annex I, neither in the IIR, although methodology is available in the EMEP/EEA Guidebook.

Recommendation

The ERT recommends Ukraine to continue improving their emission reporting by including NH₃ emissions from NFR category 3Da2a in order to complete emission reporting in future submissions.

ID	Pollutants	NFR category	Key Category	Tier level	Type	TAC ₁ C ₂ C ₃
UA-2023-3D-3	All	3Da2a, 3Dc	-	Tier 1 – Tier 3	R	TC ₃

Observation

The ERT noticed that methods to estimate emissions changed over time for the categories 3Da2a (IIR, Table 5.16.3) and 3Dc (IIR, 5.21.3). While from 1990 to 2020 a Tier 3 method was used, in 2020 and 2021 a Tier 1 is used. The lack of consistency may explain the discrepancies observed in the time series of emissions.

Recommendation

The ERT recommends Ukraine to address the consistency issues for NFR categories 3Da2a and 3Dc, and to include explanations of the time series in its IIR in future submissions.

ID	Pollutants	NFR category	Key Category	Tier level	Type	TAC ₁ C ₂ C ₃
UA-2023-3F-1	All	3F	No	-	R	T

Observation

The ERT noticed, that Ukraine reports emissions from 3F Field burning in the Annex I as "not occurring" (NO) (Annex I _ version 2 submitted), however no information is provided in the IIR.

Recommendation

The ERT recommends Ukraine to include additional information that supports the choice of the notation key "Not Occurring" (NO) in future submissions. For instance, a reference to the national/international legislation, and if possible also the year when this legislation entered into force.

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

No gridded emission data was reported.

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

11. In the Appendix of the 'EMEP/UNECE Review Guidelines 2018'⁴ 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 underestimate 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.

12. The ERT did not calculate any Technical Corrections and Ukraine did not provide any Revised Estimates.

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. Ukraine Annex I reporting template (version 2.0)
2. Ukraine Stage 2 S&A report
3. Ukraine Stage 1 report 2023
4. Ukraine 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
 - No additional information was provided by the Party either before or during the review

ANNEX I TECHNICAL CORRECTIONS AND REVISED ESTIMATES

13. The ERT did not calculate any Technical Corrections and Ukraine 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