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

**2023**

**Armenia**

**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<sub>x</sub> emissions including gridded data. While the focus was set on NH<sub>3</sub>, NMVOC and NO<sub>x</sub> emissions, also all other pollutants covered by LRTAP Convention and its protocols (i.e. SO<sub>2</sub>, NO<sub>x</sub>, NMVOC, NH<sub>3</sub>, plus PM<sub>10</sub> PM<sub>2.5</sub>, BC, priority HMs and POP<sub>s</sub>) 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 Armenia'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)

Mr. Lasha AKHALAIA (Georgia)

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<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  
[http://www.unece.org/fileadmin/DAM/env/documents/2002/eb/air/EB%20Decisions/Decision\\_2018\\_1.pdf](http://www.unece.org/fileadmin/DAM/env/documents/2002/eb/air/EB%20Decisions/Decision_2018_1.pdf)

Mr. Hakam AL-HANBALI (Sweden)

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

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 basis of CLRTAP emission data officially reported by Armenia, due by 15 February 2023. The Informative Inventory Report (IIR), reported due by 15 March 2023 under the CLRTAP, informed the review.

7. The EMEP/EEA Guidebook 2019<sup>2</sup> was used as a base for the review.

8. The emission inventory of Armenia was received on 15 February 2023 and thus by the deadline of 15 February. The Informative Inventory Report was received on 2 April 2023 and thus after the deadline of 15 March.

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<sup>2</sup> EMEP/EEA: EMEP/EEA 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 Armenia 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 that there is room for further improvement in the agriculture part of the inventory in terms of completeness and in terms of accuracy, comparability and consistency.

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

- provide a detailed description of applied methodologies, data sources, choice of emission factors and activity data for all categories in the IIR.
- apply a Tier 2 or higher method to all key categories.
- use the latest available version of the EMEP/EEA Air Pollutant Emission Inventory Guidebook
- ensure that the agriculture emission inventory is complete by extending the years reported to cover the whole timeseries from 1990
- include the Technical Correction calculated by the ERT to the next submission
- provide gridded data.

## **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 NH<sub>3</sub>, NMVOC and NO<sub>x</sub> emissions, also all other pollutants covered by the LRTAP Convention and its protocols (i.e. SO<sub>2</sub>, NO<sub>x</sub>, NMVOC, NH<sub>3</sub>, plus PM<sub>10</sub> PM<sub>2.5</sub>, BC, priority HMs and POP<sub>s</sub>) 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 Agriculture<sup>3</sup>**

ID	Pollutants	NFR category	Key Category	Tier 1 used for KC	Type	TAC <sub>1</sub> C <sub>2</sub> C <sub>3</sub>
AM-2023-3B-3D_1	All	3B and 3D	Yes	Yes	R	AC
<p><b>Observation</b> The ERT noticed that Armenia provided emissions for the year 2021, but not for the previous years.</p> <p><b>Recommendation</b> <b>The ERT recommends the Party to expand the reporting to cover the whole time series from 1990. The Armenian statistical office and FAOSTAT have sufficient information to calculate emissions for all years (1990-2021).</b></p>						
ID	Pollutants	NFR category	Key Category	Tier 1 used for KC	Type	TAC <sub>1</sub> C <sub>2</sub> C <sub>3</sub>
AM-2023-3B-3D_2	NH <sub>3</sub> , NMVOC	3B	Yes	Yes	R	AC <sub>3</sub>
<p><b>Observation</b> The ERT noticed that the IIR is very brief. The Party explains that all emissions are calculated using Tier 1 methods. However, the ERT noted that the IIR contains no information on which emission factors (high, low or the average) and which activity data is used.</p> <p><b>Recommendation</b> <b>The ERT recommends the Party to expand the IIR, to include more information on the emission factors used, the activity data and to explain trends that can be seen as well as any individual years with big changes.</b></p>						

<sup>3</sup> 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), C<sub>1</sub> (Completeness), C<sub>2</sub> (Comparability), C<sub>3</sub> (Consistency) for definitions of these criteria see EMEP/EEA Guidebook 2019

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

11. For the 2023 Review of the gridded emission data the focus was set on ammonia, NMVOC, NO<sub>x</sub> and PM<sub>2.5</sub> emissions.
12. Armenia did not submit gridded data.



## TECHNICAL CORRECTIONS CALCULATED BY ERT

13. In the Appendix of the 'EMEP/UNECE Review Guidelines 2018'<sup>4</sup> 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.

14. Armenia did not provide any Revised Estimates.

15. The ERT calculated Technical Corrections. Armenia did not respond if they agree or disagree to the Technical Corrections.

16. The ERT recommends Armenia to consider the Technical Corrections in their next inventory submission.

17. Details of the Technical Corrections and Revised Estimates presented in Table 3 are included in ANNEX I TECHNICAL CORRECTIONS

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<sup>4</sup> [https://www.ceip.at/fileadmin/inhalte/ceip/3\\_review/advance\\_version\\_ece\\_eb.air\\_142\\_add.1.pdf](https://www.ceip.at/fileadmin/inhalte/ceip/3_review/advance_version_ece_eb.air_142_add.1.pdf)

**Table 2 Summary of potential technical corrections identified by ERT for country**

<b>NFR category/ categories</b>	<b>Pollutants</b>	<b>Years*</b>	<b>RE/TC quantified (yes/no)</b>	<b>Potential contribution to national total (%)</b>
3B1, 3B4, 3Da2, 3Da3	NO <sub>x</sub>	2021	yes	+0.6
3B2, 3B3, 3B4, 3De	NM <sub>VOC</sub>	2021	yes	+0.1
3B1, 3B2, 3B3, 3B4, 3Da2a, 3Da3	NH <sub>3</sub>	2021	yes	+2.1
3B2, 3B3, 3B4, 3Da2a, 3Da3	PM <sub>2.5</sub>	2021	yes	+0.3
3B2, 3B3, 3B4, 3Da2a, 3Da3	PM <sub>10</sub>	2021	yes	+1.7

\*Note: Armenia only provided the NFR table for 2021 emissions, therefore potential contributions to years 2005 and 2020 were not calculated by the ERT.

## **LIST OF MATERIALS PROVIDED TO ERT**

1. IIR\_Armenia\_report\_2023
2. NFR\_Armenia\_rev21-2023

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

1. Responses to the question raised by ERT during the review

## ANNEX I TECHNICAL CORRECTIONS

18. Armenia did not send Revised Estimates during the review.

19. The ERT calculated Technical Corrections. Armenia did not respond whether they agree or disagree with the Technical Corrections. Detailed related information is provided separately in the Excel file:

- Armenia\_TC1-5-2023-NFR.xlsx

**Table 3: Technical Corrections calculated by the ERT**

<b>Technical Correction for NO<sub>x</sub> emissions in NFR 3B (Manure management), NFR 3Da2a (Animal manure applied to soils), NFR 3Da3 (Urine and dung deposited by grazing animals)</b>			
Year	Original estimate (kt)	Technical Correction calculated by the ERT (kt)	Difference between original estimate and Technical Correction (kt)
2005	NA	0.232	0.000
2020	NA	0.225	0.225
2021	0.079	0.225	0.145

**Table 6: Technical Corrections calculated by the ERT**

<b>Technical Correction for NMVOC emissions in NFR 3B2; 3B3, 3B4 (Manure management), NFR 3De (Cultivated crops)</b>			
Year	Original estimate (kt)	Technical Correction calculated by the ERT (kt)	Difference between original estimate and Technical Correction (kt)
2005	NA	6.683	6.683
2020	NA	6.626	6.626
2021	5.986	6.221	0.235

**Table 7: Technical Corrections calculated by the ERT**

<b>Technical Correction for NH<sub>3</sub> emissions in NFR 3B (Manure management), 3Da2a (Animal manure applied to soils), NFR 3Da3 (Urine and dung deposited by grazing animals)</b>			
Year	Original estimate (kt)	Technical Correction calculated by the ERT (kt)	Difference between original estimate and Technical Correction (kt)
2005	NA	17.323	17.323
2020	NA	17.486	17.486
2021	15.981	16.326	0.345

**Table 8: Technical Corrections calculated by the ERT**

<b>Technical Correction for PM<sub>2.5</sub> emissions in NFR 3B2, 3B3, 3B4 (Manure management)</b>			
Year	Original estimate (kt)	Technical Correction calculated by the ERT (kt)	Difference between original estimate and Technical Correction (kt)
2005	NA	0.190	0.190
2020	NA	0.186	0.186
2021	0.166	0.175	0.008

**Table 9: Technical Corrections calculated by the ERT**

<b>Technical Correction for PM<sub>10</sub> emissions in NFR 3B2, 3B3, 3B4 (Manure management)</b>			
Year	Original estimate (kt)	Technical Correction calculated by the ERT (kt)	Difference between original estimate and Technical Correction (kt)
2005	NA	0.450	0.450
2020	NA	0.444	0.444
2021	0.387	0.439	0.051

**Table 10: Effect of the Technical Corrections and Revised Estimates on the National Total and National Total for compliance for NO<sub>x</sub>**

Year	National Total (kt) <sup>5</sup>	National Total for Compliance (kt) <sup>6</sup>	Sum of Technical Corrections (kt)	National Total including Technical Corrections (kt)	National Total for Compliance including Technical Corrections (kt)
2005	NA	NA	NA	NA	NA
2020	NA	NA	NA	NA	NA
2021	23.750	23.750	0.145	23.895	23.895

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<sup>5</sup> Line 141 in Annex I to the reporting guidelines (NFR table)

<sup>6</sup> Line 152 in Annex I to the reporting guidelines (NFR table)

**Table 11: Effect of the Technical Corrections and Revised Estimates on the National Total and National Total for compliance NMVOC**

Year	National Total (kt) <sup>6</sup>	National Total for Compliance (kt) <sup>7</sup>	Sum of Technical Corrections (kt)	National Total including Technical Corrections (kt)	National Total for Compliance including Technical Corrections (kt)
2005	NA	NA	NA	NA	NA
2020	NA	NA	NA	NA	NA
2021	183.741	183.741	0.235	183.976	183.976

**Table 12: Effect of the Technical Corrections and Revised Estimates on the National Total and National Total for compliance for NH<sub>3</sub>**

Year	National Total (kt) <sup>6</sup>	National Total for Compliance (kt) <sup>7</sup>	Sum of Technical Corrections (kt)	National Total including Technical Corrections (kt)	National Total for Compliance including Technical Corrections (kt)
2005	NA	NA	NA	NA	NA
2020	NA	NA	NA	NA	NA
2021	16.220	16.220	0.345	16.565	16.565

**Table 13: Effect of the Technical Corrections and Revised Estimates on the National Total and National Total for compliance for PM<sub>2.5</sub>**

Year	National Total (kt) <sup>6</sup>	National Total for Compliance (kt) <sup>7</sup>	Sum of Technical Corrections (kt)	National Total including Technical Corrections (kt)	National Total for Compliance including Technical Corrections (kt)
2005	NA	NA	NA	NA	NA
2020	NA	NA	NA	NA	NA
2021	2.776	2.776	0.008	2.784	2.784

**Table 14: Effect of the Technical Corrections and Revised Estimates on the National Total and National Total for compliance for PM<sub>10</sub>**

Year	National Total (kt) <sup>6</sup>	National Total for Compliance (kt) <sup>7</sup>	Sum of Technical Corrections (kt)	National Total including Technical Corrections (kt)	National Total for Compliance including Technical Corrections (kt)
2005	NA	NA	NA	NA	NA
2020	NA	NA	NA	NA	NA
2021	3.082	3.082	0.051	3.133	3.133



## 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 <sub>3</sub>	Ammonia
NMVOG	Non-methane volatile organic compounds
NO	Not Occuring
NO <sub>x</sub>	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 <sub>10</sub>	Fine particulate matter: particles with an aerodynamic diameter equal to or less than 10 micrometres (µm)

PM <sub>2.5</sub>	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 <sub>2</sub>	Sulphur dioxide
SO <sub>x</sub>	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](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](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](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](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](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](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](https://www.ceip.at/fileadmin/inhalte/ceip/00_pdf_other/2022/technical_guidance_for_erc_adjustments_issue1.1.pdf)