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

2023

GERMANY

FINAL REPORT

CONTENT

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 NH_3, NMVOC and NO_x emissions, also all other pollutants covered by LRTAP Convention and its protocols (i.e. SO_2, NOx, NMVOC, NH_3, plus PM_{10} $PM_{2.5}$, 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 Germany'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)

[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

Ms. Aleksandra NESTOROVSKA-KRSTESKA (North Macedonia)

Mr. Lasha AKHALAIA (Georgia)

Mr. Hakam AL-HANBALI (Sweden)

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

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 basis of CLRTAP emission data officially reported by Germany, 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 2019[2] was used as a base for the review.

8. The emission inventory of Germany was received on 10 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. Germany provided a resubmission of the emission inventory on 14 March 2023. The resubmission has been considered for the review.

[2] 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 Germany in providing an inventory including a significant level of detail.

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

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

- provide clear references or links to previous IIR versions and other supporting documents which are referred to in the IIR
- in the dedicated IIR chapters “Planned Improvements” provide years in which recommendations from the CLRTAP review were implemented.
- include information from the linked documents in the presentation of the Tier 2 key category analysis in the respective IIR chapter
- ensure that the time series are consistent and provide explanations for the fluctuations of the time series and changes made in the calculations in the IIR

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_3, NMVOC and NO_x emissions, also all other pollutants covered by the LRTAP Convention and its protocols (i.e. SO_2, NO_x, NMVOC, NH_3, plus PM_{10} $PM_{2.5}$, 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 Agriculture[3]

ID	Pollutants	NFR category	Key Category	Tier level		Type	$TAC_1C_2C_3$
Germany-2023-3F-1	NH_3	3F	/	/		R	T
	Observation The ERT noted that for the category 3F-Field burning, the notation key NO is reported. In the IIR chapter 3.F, it is mentioned that field burning has been banned in Germany since 1990, but the ERT was not able to find reference to the national/international regulation in the IIR. The Party respond that more information can be found in Roseman et al. (2023) as stated in the IIR, however the chapter reference number was not correct. The Party has additionally provided the right reference number and link to this chapter which includes the required information. **Recommendation** **The ERT recommends Germany to include information and the correct reference in its IIR in the next submission.**						

[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), C_1 (Completeness), C_2 (Comparability), C_3 (Consistency) for definitions of these criteria see EMEP/EEA Guidebook 2019

ID	Pollutants	NFR category	Key Category	Tier level		Type	$TAC_1C_2C_3$
Germany-2023-0-1	NH_3	General: KCA	/	/		R	T
	Observation The ERT noted that the Key Category Analysis is calculated on Tier 1 level, due to missing information on uncertainty. The ERT asked Germany of its plans to improve the Key Category Analysis and to provide quantitative level and a trend KCA. Germany responded that to improve the compactness and readability of the IIR, the KCA is offered in form of a detailed table which denotes if a source is a key category according to level (L) or trend (T) or both. Germany explained that same information was also provided at the beginning of the corresponding source chapters. Furthermore, Germany elaborated that information on uncertainties, for instance, was offered in the uncertainties chapter, which clearly identifies the four major sources of uncertainty in the agriculture sector. Detailed quantitative information on uncertainty of the NH_3 sources is covered in the spreadsheet file linked to the corresponding paragraph of NH_3. Germany explained that these are also key categories for NH_3 emissions according to level and trend, therefore Germany does not plan further refining the KCA. **Recommendation** **The ERT recommends that Germany includes information on available the linked background files on the quantitative KCA level and trend assessment in its IIR in the next submission.**						
ID	Pollutants	NFR category	Key Category	Tier level		Type	$TAC_1C_2C_3$
Germany 2023-3B-1	NH_3	3B4h	No	/		R	C1
	Observation The ERT commend Germany in reference to chapter 8.2 of the IIR on their plan to include emissions from other animals in the 2024 submission. The ERT asked Germany to provide details for methodology that will be carried out for gathering activity data for this category. Germany responded that there was ongoing coordination in gathering activity data with the Federal Statistical Office, the Federal Animal Diseases Fund, and various animal breeding associations.						

	Recommendation **The ERT recommends the Party to continue the effort in calculating emissions from the category Other animals and to include more detailed information on the manner of the gathering activity data for this category in its next submission.**						
ID	Pollutants	NFR category	Key Category	Tier level		Type	$TAC_1C_2C_3$
Germany-2023-3B-2	NH3	3B2,3B4d,3B4e	No	Tier 2		R	T
	Observation The ERT noted that in reference to chapter 8.2, Germany stated that the recommendation of the previous review conducted in 2014, regarding the reasons for variations of activity data for sheep, goats and horses, is implemented. The ERT noticed in the CEIP tool available on the link https://www.ceip.at/review-of-emission-inventories/s3-review-tools, that these variations are still present, but could not find this information included in the current IIR and did not have access to check the implementation of this recommendation in the older IIR reports. Germany responded that this information is available in the Report on methods and data (RMD) (former "Thünen-Reports") to which the IIR refers as well in National Inventory Report from 2023 for the German Greenhouse Gas Inventory. Moreover, Germany explained that the decrease in numbers of sheep is not so sharp anymore as it was in Submission 2014, because the underlying official sheep numbers have been corrected since Submission 2015 for all years as of 2010 as it was stated in the NIR, Chapter 5.1.3.2.2. **Recommendation** **The ERT recommends Germany to add in the improvement plan a year in which the CLRTAP recommendation was implemented, to include a clear reference to the chapters of the NIR and other documents and to link the previous IIRs in the relevant chapters, as these currently are not accessible**.						

ID	Pollutants	NFR category	Key Category	Tier level		Type	$TAC_1C_2C_3$
Germany-2023-3B-3	NH3	3B1a, 3B3, 3B4gi	Yes, Yes, No	Tier 3, Tier 3, Tier 2		R	T
	Observation The ERT noted that in reference to chapter 8.2, that the recommendation of the previous review conducted in 2014 regarding the reasons for variation of the EFs for swine, dairy cattle, and poultry, was implemented. Germany explained that the technical reasons for these changes have been given in the review process in 2014, and that in the 2014 submission NH_3 IEFs were reported aggregated for manure management and manure spreading, and that currently manure management emissions (housing and storage) are reported in category 3.B and manure spreading emissions in 3.D (for all animal categories together). In addition, the Party explained that the underlying models (and in some cases the underlying data) have been changed since 2014 due to significant decreases and increases found for some NH3-IEFs. **Recommendation** **The ERT recommends Germany to include the provided justifications of fluctuations in emissions and changes in the calculations in its IIR, and to add in the improvement plan the year in which the recommendation was implemented and also provide the link to the previous IIRs**.						
ID	Pollutants	NFR category	Key Category	Tier level		Type	$TAC_1C_2C_3$
Germany-2023-3B-4	NH3	3B4gi	Yes	Tier 2		R	T
	Observation The ERT noted that for the laying hens, animal numbers show a sharp dip in 2010, but that there is no information in the IIR. Germany responded that information on animal numbers can be found in their latest Report on methods and data (RMD) (https://git-dmz.thuenen.de/vos/EmissionsAgriculture2023/-/wikis/home) in chapter 2.3. The Party further elaborated that in the sub-chapter "Official surveys" it was stated: “In previous surveys (in 2010 for the last time) significant numbers of poultry had not been counted as they were held by companies that did not need to report poultry						

	numbers. Hence, the rules of poultry counting were adjusted for the 2013 survey and the official 2013 poultry numbers were much higher than expected. As the Federal Statistical Office did not correct poultry numbers of earlier years, the poultry numbers used in the inventory exhibit a steep upward trend between 2010 and 2013. However, this trend does not reflect any real development in poultry numbers due to the different data collection methods for 2010 and 2013 and the increase in poultry numbers from 2013 to 2016 was significantly flatter. In the German NIR (2023), Chapter 5.1.3.2. more information is provided on animal numbers. **Recommendation** **The ERT recommends Germany to correct inconsistencies in the timeseries and to include explanations of any fluctuations with clear references to other documents and corresponding statements in its next IIR.**

ID	Pollutants	NFR category	Key Category	Tier level		Type	$TAC_1C_2C_3$
Germany-2023-3B-5	NH3	3B4gii	Yes	Tier 2		R	T

	Observation The ERT notes that the broilers numbers show a sharp jump in 2010-2013 and the IIR does not provide an explanation. Germany responded that the answer to this question is same as for the question of poultry numbers. **Recommendation** **The ERT recommends Germany to correct inconsistencies in the timeseries and to include explanations of any fluctuations with clear references to other documents and corresponding statements in its next IIR.**

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, NOx and $PM_{2.5}$ emissions.

12. The methods used by Germany to grid sectoral emissions are described transparently in the IIR.

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

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

15. There are no additional comments.

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

16. Germany did not provide any Revised Estimates and no Potential Technical Corrections were identified by the ERT.

LIST OF MATERIALS PROVIDED TO ERT

1. Germany Annex I reporting template
2. Germany Stage 2 S&A report
3. Germany Stage 1 report 2023
4. Germany IIR 2023
5. Repdab-Report
6. https://git-dmz.thuenen.de/vos/EmissionsAgriculture2023/-/wikis/home
7. Report for the Stage 3 in-depth review of emission inventories submitted under the UNECE LRTAP Convention and EU NEC Directive for Germany, October, 2014

LIST OF ADDITIONAL MATERIALS PROVIDED BY THE COUNTRY DURING THE REVIEW

1. Responses to the question raised by ERT have been used in this report
2. No additional information was provided by Germany either before or during the review.

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
NMVOC	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_DECISION_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

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