**UNITED
NATIONS**

Distr.
GENERAL

CEIP/S3.RR/2023/
Bulgaria
26/09/2023

ENGLISH ONLY

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

2023

Bulgaria

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 Bulgaira'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 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 Bulgaria, 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 Bulgaria 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. Bulgaria provided resubmissions of the emission inventory on 22 February 2023, 15 March 2023 and 4 April 2023.These resubmissions have 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 Bulgaria 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 Bulgaria to

- Provide a chapter describing the methods used to generate the gridded data in the next submission of the IIR

- provide a detailed description of applied methodologies, data sources, choice of emission factors and activity data for all categories in the IIR for the agriculture sector.

- ensure that the agriculture emission inventory is complete

- provide gridded data.

- provide transparent information on recalculations.

- ensure that the time series are consistent

- increase the capacities of the air pollution inventory team in order to manage transparent, complete, comparable, consistent and accurate inventory submission within deadlines set up in the UNECE reporting Guidelines.

- provide detailed information on its QA/QC plan for its air emission inventory in future submissions.

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, NOx, 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$_1$C$_2$C$_3$
BG-2023-3B-1	NH$_3$	3B	Yes	Tier 2	R	T

Observation

The ERT noted that NH$_3$ emissions were estimated using the Tier 2 method, but there was no description provided on the manure management systems and nitrogen excretion per animal in the IIR. During the review process the Party provided information regarding requested parameters as follows:

- The activity data for manure management systems are country specific and they are a result of research. The variation in the period 1990-2021 shows that 90% of manure is treated in liquid systems for swine, decreasing to 27% in 2000 and increasing back to 83% in 2011. The reason for these variations are reforms in agricultural holdings. The Party stated that in the period 1993 – 2000 the agriculture sector was in a crisis. Most of the farms are small and this contributes to the reason for the increased proportion of solid storage and dry lot management system in these years.

- The values for nitrogen excretion per animal used are according to Volume 4, Chapter 10, table 10.19, IPCC. This information will be included in the IIR, submission 2024.

Recommendation
The ERT recommends the Party include comprehensive information about manure management systems for all subcategories of

---

[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

animals and provide a detailed description of the conditions in Bulgarian farms. Additionally, the ERT recommends including references to the appropriate IPCC Guidelines as a source for the NEX (Nitrogen Excretion) parameters.

ID	Pollutants	NFR category	Key Category	Tier level	Type	$TAC_1C_2C_3$
BG-2023-3B-2	NH_3, NO_x, NH_3	3B3	Yes	Tier 2	R	T,C_3

Observation

The ERT noticed that according to Table 51 (p. 95) provided in the IIR, swine bred in Bulgaria are housed in stables for only 29 days in 1990, 2015-2021, while most European countries breed swine for 365 days. The country declared that this was an error of consistency between the spreadsheet and IIR. The actual house period for swine bred which is used in the estimates is 365 days. This mistake will be fixed in the IIR in the next submission

Recommendation

The ERT recommends the Party correct values on housing time in 3B3 Swine category in Bulgarian IIR (p.95, Table 51) in the next submission.

ID	Pollutants	NFR category	Key Category	Tier level	Type	$TAC_1C_2C_3$
BG-2023-3B-3	PM_{10}, TSP	3B3	No	Tier 1	R	T,C_3

Observation

The ERT has noted discrepancies in the values reported in Table 39 (p.87). Specifically, the emission factors used for calculating PM_{10} and TSP in the sows and weaners categories are not in line with the 2019 EMEP/EEA Guidebook.

For sows, the TSP emission factor is reported as 0.62 kg AAP^{-1} a^{-1} in the IIR, while the EMEP/EEA Guidebook provides a value of 0.27 kg AAP^{-1} a^{-1}. Similarly, the PM_{10} emission factor for wows is reported as 0.17 kg AAP^{-1} a^{-1} in the IIR, while the EMEP/EEA Guidebook provides a value of 0.05 kg AAP^{-1} a^{-1}.

For weaners, the TSP emission factor is reported as 0.27 kg AAP^{-1} a^{-1} in the IIR, while the EMEP/EEA Guidebook provides a value of 0.62 AAP^{-1} a^{-1}. Similarly, the PM_{10} emission factor for Weaners is reported as 0.05 kg AAP^{-1} a^{-1} in the IIR, while the EMEP/EEA Guidebook provides a value of 0.17 kg AAP^{-1} a^{-1}. The country declared that this was an error of consistency between the reported data and IIR and will be corrected in next submission.

Recommendation

The ERT recommends the Party correct emission factors in 3B3 Swine category in Bulgarian IIR (p.87, Table 39) in the next submission. The ERT recommends improving the quality control process.

ID	Pollutants	NFR category	Key Category	Tier level	Type	TAC$_1$C$_2$C$_3$
BG-2023-3B-4	PM$_{2.5}$	3B4gi	NO	Tier 1	R	T

Observation

The ERT has noted discrepancies in the values reported in Table 39. Specifically, the emission factor used for calculating PM$_{2.5}$ in the laying hens category is not in line with the 2019 EMEP/EEA Guidebook. The IIR reports a value of 0.003 kg AAP-1 a-1, while the EMEP/EEA Guidebook provides a value of 0.0003 kg AAP^{-1} a^{-1}. The country has confirmed that the information in the table was not transcribed correctly and that they will prepare a correction in the next submission.

Recommendation

The ERT recommends the Party correct the emission factor in 3B4gi laying hens category in the Bulgarian IIR (p.87, Table 39) in the next submission.

ID	Pollutants	NFR category	Key Category	Tier level	Type	TAC$_1$C$_2$C$_3$
BG-2023-3B-5	NMVOC	3B1a	Yes	Tier 2	R	A,C$_1$, C$_3$

Observation

The TERT noted with reference to 3B1a Dairy cattle that reported NMVOC emissions is relatively low. During the review, the Party provided a spreadsheet with NMVOC estimations for 3B1a Dairy cattle and 3B1b Non-dairy cattle categories. From this, the ERT identified outliers in gross feed intake (row 3 in the spreadsheet provided) in the 3B1a Dairy cattle category with an impact on emissions in 2016 and 2017. Additionally, the dairy cow population for 2016 in the spreadsheet provided (cell AE2) was inconsistent with Table 40 (p89) in the IIR. The Party responded that the value of gross energy intake in 2017 was incorrect and provided a corrected value for the identified issue. The ERT also compared the reported population with the Bulgarian CRF used in GHG report, which identified inconsistencies between the inventories. The ERT appreciates the cooperation during the in depth review.

Recommendation

The ERT recommends the Party to conduct an overall quality control of NMVOC estimates in the 3B1a Dairy cattle category. This

quality control process should focus on the accuracy of the implemented livestock populations and other parameters involved in the emission estimation. Additionally, the Party is encouraged to provide a transparent description of the emission estimates and the parameters used.

ID	Pollutants	NFR category	Key Category	Tier level	Type	TAC$_1$C$_2$C$_3$
BG-2023-3D-1	NH$_3$, NOx	3Da1	Yes	Tier 2	Recommendation	T

Observation

The ERT noted that for 3Da1, Bulgaria uses the Tier 2 approach for estimating NH$_3$ emissions, but the activity data used were not transparently described in the IIR. The consumption of inorganic N fertilizers was reported as nitrogen total, while the Tier 2 approach requires activity for type of fertilizer. During the Review, the Party explained, that The Ministry of Agriculture provides activity data for the amount of urea and total nitrogen in N fertilizers applied to soils. The consumption of inorganic fertilizers by type (CAN, AS, AP) are portions of nitrogen total, according to Table A1.2 from EMEP GB 2019. The Party stated that explanations will be included in the IIR 2024.

Recommendation

The ERT recommends the Party improve the transparency of provided activity data concerning agricultural consumption of inorganic N-fertilizers per type in the 2024 submission.

ID	Pollutants	NFR category	Key Category	Tier level	Type	TAC$_1$C$_2$C$_3$
BG-2023-3D-1	NH$_3$, NO$_x$	3Da1	Yes	Tier 2	R	T

Observation

The ERT noted major recalculations of up to -21.7% for NO$_x$ and +5.3% for NH$_3$ for 3Da1 Inorganic N fertilizers (including urea) in the year 2020, which were not properly described in the IIR. During the review, the Party stated that the revision of the data was due to updated statistics from the Ministry of Agriculture.

Recommendation

The ERT recommends the Party to include a section on recalculations below each emission chapter in order to enhance the transparency of the Bulgarian IIR with sector specific recalculations. This will allow for future recalculations and ensure a clearer understanding of the emissions data presented.

ID	Pollutants	NFR category	Key Category	Tier level	Type	TAC$_1$C$_2$C$_3$
BG-2023-3D-3	NH$_3$, NO$_x$	3Da2b	NO	Tier 1	R	T

Observation

The ERT noted that there is a lack of transparency in the IIR regarding information concerning the share of nitrogen from sewage sludge. During the review, Bulgaria provided the share of nitrogen from sewage sludge without references. The share of nitrogen from sewage sludge is equal to 3.90% in dry matter. Bulgaria stated that this information will be included in the IIR submission in2024.

Recommendation

The ERT recommends the Party include information about share of nitrogen from sewage sludge into IIR for the 2024 submission with appropriate references.

ID	Pollutants	NFR category	Key Category	Tier level	Type	TAC$_1$C$_2$C$_3$
BG-2023-3D-4	HCB	3Df	NO	-	Recommendation	AC$_1$

Observation

The ERT noted that HCB emissions from pesticides (3Df) are not reported, while a Tier 1 method is available in the EMEP EEA Guidebook. No explanation for the use of the notation key "NO" was found in the IIR. Bulgaria explained during review, that activity data for pesticides is currently missing. Bulgaria will collect the necessary data on the quantities of pesticides used in agriculture for future submissions.

Recommendation

The ERT encourages the Party to include the necessary information about missing activity data concerning pesticides and encourages improving the completeness of the inventory to fill the gap relating to pesticide use in agriculture. This will contribute to a more comprehensive and accurate assessment of pesticide-related emissions and their impact on the environment.

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 ammonia, NMVOC, NO_x and $PM_{2.5}$ emissions.

11.   The methods used by Bulgaria to spatially resolve sectoral emissions are not described transparently enough in the IIR.

12.   The description does not include data sources that have been used for spatial distribution.

13.   Gridded emissions reported for GNFR K_AgriLivestock and L_AgriOther are not consistent with the corresponding NFR categories reported in Annex I.

14.   Table 2 provides the findings from the ERT related to the gridded data.

15.   The implementation of the recommendations will be followed up in a future CLRTAP inventory review.

Table 2: Findings from the CLRTAP stage 3 review 2023 for gridded emissions from the sector agriculture[4]

ID	Pollutants	GNFR category	TAC$_1$C$_2$C$_3$
BG-2023-GRID-GL-1	All supplied	GNFR-K&L	T
Observation The expert review team notes that there is a lack of transparency regarding the methods used to generate the gridded data **Recommendation** **The expert review team recommends Bulgaria to provide a chapter describing the methods used to generate the gridded data in the next submission of gridded data.**			

---

[4] 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

Revised estimates and technical corrections considered and/or calculated by ERT

16.   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.

17.   The ERT did not calculate any Technical Corrections and Bulgaria 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. Bulgaria Annex I reporting template
2. Bulgaria Stage 2 S&A report
3. Bulgaria Stage 1 report 2023
4. Bulgaria IIR 2020 and 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
    o   Spreadsheet with NMVOC emission estimation from 3B1a and 3B1b NFR Categories - Bulgaria 3B-NMVOC_D&non-D cattle.xlsx

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