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Report for the Stage 3 in-depth review of emission inventories submitted under the UNECE LRTAP Convention and EU National Emissions Ceilings Directive for:

STAGE 3 REVIEW REPORT
NORTH MACEDONIA

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. Under thhis annual review, all pollutants covered by LRTAP Convention and its protocols (SO2, NOx, NMVOC, NH3, plus PM10 PM2.5, BC, 3 HMs and POPS) have been checked for the time series years 1990 – 2018 reflecting current priorities from EMEP Steering Body and the Task Force on Emission Inventories and Projections (TFEIP). HMs and POPs have been reviewed to the extent possible.

3. This report covers the Stage 3 centralised review of the UNECE LRTAP Convention of North Macedonia coordinated by the EMEP Centre on Emission Inventories and Projections (CEIP) acting as review secretariat. The remotely conducted review took place from 22nd June 2020 to 26th June 2020. The following team of nominated experts from the roster of experts performed the review: Generalists – Risto Saarikivi (CZ), Ben Richmond (UK), Energy – Erik Honig (NL), Marion Pinterits (EU), Garmt Jans Venhuis (NL) and Kristina Jurich (DE), Transport – Giannis Papadimitriou (EU) and Magdalena Zimakowska-Laskowska (PL), IPPU Mirela Poljanac (HR), Juan Luis Martin Ortega (ES), Michaela Titz (AT), Agriculture - Peder Gjølstad Røhnebæk (NO), Hakam Al-Hanbali (SE) and Gwenaëlle Le Borge (FR), Waste – Zuzana Jonacek (SK) and Sabino Del Vento (UK).

4. Kristina Saarinen (FI) was the lead reviewer. The review was coordinated by Katarina Marečková (CEIP).

[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

PART A: KEY REVIEW FINDINGS

5. The ERT recognises the level of effort undertaken by North Macedonia in providing an inventory with a sufficient level of detail to enable a detailed review and thanks the Party for providing timely responses to the questions of the ERT during the review that enabled the ERT to give recommendations for further development of the inventory.

6. North Macedonia provided NFR tables for 1990-2018 on 13th February 2020 within the reporting deadline of 15th February, and a resubmission on 13th April 2020. The IIR was submitted on 4th May 2020 after the reporting deadline of 15th March. In 2017 the Party submitted gridded emissions for Gothenburg Protocol pollutants on 6h September and LPS data on 11th May after the reporting deadline of 1st May.

7. The 2020 submission shows improvements in a number of issues since the last submission.

8. The ERT found the inventory to be generally transparent. The use of notation keys does not always follow the definitions in the Reporting Guidelines. The IIR has been prepared according to the template provided in Annex I to the Reporting Guidelines and includes a key category analysis and an uncertainty analysis.

9. The inventory is almost complete. The ERT noted that emissions from some emission sources were not included and that emissions were missing for some years in the time series.

10. The inventory is generally consistent; however, the ERT noted that the recalculations had not always been applied consistently over the years.

11. The inventory methodologies are generally in line with the *EMEP EEA Emission Inventory Guidebook* (hereafter Guidebook) and reporting is mainly in line with the UNECE Reporting Guidelines (hereafter Reporting Guidelines); thus, the inventory is generally comparable with those of other reporting Parties.

12. The Party applies Tier 2 methods to some but not to all key categories. The ERT has not identified systematic under- or over-estimates that would compromise the accuracy of the inventory.

13. During the review, North Macedonia provided several revised estimates (REs) for the Industrial Processes, Agriculture and Waste sectors, which the ERT accepted with the exception of one revised estimate for which the ERT made a technical correction.

14. Transport emissions are calculated on basis of fuels sold.

15. As a summary of the main findings, further improvement needs have been identified for the following items:

a) Transparency: information on emission sources in North Macedonia, explanations of emission trends, recalculations and other improvements, checking and documentation of notation keys.

b) Completeness: completion of all emissions for which there are methods in the Guidebook

c) Consistency: completion of the time series

a) Accuracy: use of Tier 2 or higher methods for all key categories

INVENTORY SUBMISSION

16. In the 2020 submission, North Macedonia has reported emissions for its Protocol base years (1990) and a full time series to 2018 (the latest year) for its Protocol pollutants in the NFR 2019 format. In addition, North Macedonia provided a full NFR 1990 – 2018 time series for CO, PM10, PM2.5, heavy metals and POPs. The 2020 submission includes a detailed IIR.

17. Emissions are reported by NFR categories; however, some categories are reported as included elsewhere (IE): 1A2f, 3B4a, 3B4f, 3Da2a and 3Da3) and emissions from the following categories are not estimated (NE): 1A3ei, 1A3eii, 1A4ciii, 1A5a, 2B10a, 2B10b, 2C7d, 2H3, 2L, 3Dc, 3De, 5B1 and 6A.

18. The CLRTAP inventory submitted by North Macedonia is of good quality and is in general well documented in the informative inventory report (IIR).

19. National totals are reported for the entire territory. North Macedonia also reported national totals for compliance, which are equal to the national totals reported in row 141 of NFR19.

KEY CATEGORIES

20. North Macedonia has compiled and presented in its IIR a level key category analysis (KCA) for the following pollutants: NOx, CO, NMVOC, SOx, NH3, TSP, PM10 and PM2.5, BC, Pb, Cd, Hg and Dioxins, PAHs and PCBs. All sectors have been included. The level assessment has been performed for the year 2018 for all pollutants.

21. The key category analysis of North Macedonia is consistent with the results obtained by the CEIP and the ERT commends the Party for following the previous recommendation that all subcategories to the KCA as well as a trend assessment should be included. The ERT also found inconsistencies in the reporting of key categories in IIR Tables 8, 20 and 23, which, as North Macedonia explained, were due to copy pasting errors, possibly a link error in the case of Table 23 and incorrectly updating of tables. The ERT recommends that North Macedonia devote more time to QC processes to avoid errors in the next submission.

22. The ERT notes that North Macedonia uses the results of the key category analysis (KCA) to prioritise developments of the inventory, e.g. moving to higher Tier methods as documented in the improvement plan.

23. The ERT recommends that the Party document the reasons for not yet moving to higher tiers in the IIR and put the issue in the improvement plan with clear steps and schedule, and that it report on progress in the IIR. However, the ERT refers to the previous recommendation and the recommendation in paragraph 8, namely that higher tier methods should be used for all key categories.

24. North Macedonia uses Tier 2 (T2) or higher methods for some but not for all key categories. The ERT reiterates the previous recommendation that North Macedonia moves to higher tiers as soon as possible to increase the accuracy of the inventory. According to paragraph 21 of the Reporting Guidelines, Tier 2 or higher methods should be used for all key categories. The ERT notes that Tier 1 (T1) methodology is still applied for key categories in the following sectors:

- 1A1a: NO_x, SO_x, $PM_{2.5}$, PM_{10}, TSP, Pb, Hg, As, Cu, Ni
- 1A2a: $PM_{2.5}$, PM_{10}, TSP, CO, BC, Pb, Hg, Cu, Zn, PCDD/F, PAHs
- 1A2gvii: NO_x, Cu
- 1A2gviii: NO_x, BC, Pb, Cu, Se
- 1A4ai: Ni
- 1A4bi: NMVOC, $PM_{2.5}$, PM_{10}, TSP, CO, BC, Cd, Cu, Ni, Zn, PCDD/F, PAHs
- 1A4bii: Pb
- 1A3bi and 1A3biii: NO_x, CO in 1990-2013,
- 1B2av and 1A3bv for NMVOC
- 2A5a: TSP
- 2C3: HCB
- 2D3d, 2D3a and 2D3e: NMVOC
- 3B1a and 3B1b: NMVOC, NH_3
- 3Da2a, 3Da3 and 3B3: NH_3
- 5A: NMVOC
- 5C1biii: Hg and Cu
- 5C2: Zn

QUALITY

Transparency

25. The ERT recognises that according to the UNECE Reporting Guidelines (ECE/EB.AIR/125), the Parties should, to improve "Transparency", clearly explain the data sources, assumptions and methodologies used for an inventory (para 12). The submission of an IIR is strongly encouraged (para 43). As a lack of sufficient documentation in an IIR prevents the ERT from performing a technical review, the Party would need, in case of a missing or a not transparent IIR, to provide the missing information during the review. For this reason, in this technical review report,

recommendations are given instead of encouragements in cases where there is a need to improve the documentation of data, methods and assumptions used in the inventory.

26. The ERT notes that the 2020 IIR submission follows the recommended structure in Annex II of the Reporting Guidelines and provides information on emissions, methodology and recalculations at sub-category level. Emission factors and activity data are almost always presented in detail, references provided, assumptions and methodologies are clearly documented for the majority of the sources, and the time series are explained.

27. However, the ERT has noted several areas where there still is a need for further improvement as explained in detail in the sub-sector specific recommendations:

(a) Information on emission factors (EFs) is contradictory in some cases (NFR 5.A NMVOC, CO, NH3) or no information is provided (NFR 5Cii As, Zn, Ni). The ERT recommends that the Party corrects or includes this information in the IIR.

(b) Information is not always provided on the allocation of emissions and on activity data marked as IE in the NFR table (e.g. 3Da2a). The ERT recommends that the Party include information on the allocations in the IIR.

(c) Explanation for the use of the notation key Not Estimated (NE) is not always provided (e.g. 1A3eii, 5D1 and 5D2). The ERT recommends that the Party include an explanation in the IIR for all cases where NE is used.

(d) Some incorrect uses of notation keys have been identified, e.g. the notation key NA is used instead of NO in NFRs 1A1b and 1A1c, NE instead of IE in NFR 2C7d, and NO instead of NE in NFR 5 as explained under Sub-Sector Specific Recommendations. The ERT recommends that the Party use the appropriate notation keys in compliance with paragraph 12 of the the Reporting Guidelines.

(e) Not all outlier IEFs are explained in the IIR. The ERT recommends that the Party include the explanations provided during the review in the IIR.

(f) Some references are not updated (e.g. NFR 2K EFs refer to the 2013 Guidebook). The ERT recommends that the Party update the references.

(g) Reasons for dips and peaks in the time series are not always included in the IIR. The ERT recommends that the Party explore the reasons, as proposed by MK, during the review with the Statistical Office, and that it document the reasons behind the time series fluctuations in the IIR.

(h) There are numerous tables in the IIR; the ERT encourages the Party to present some of them as Annexes at the end of the IIR.

28. The ERT notes that North Macedonia has carried out improvements as recommended in the previous review; for instance, it has included emissions in NFRs 3Da2a and 3Da3, but then it has not updated the descriptions in the relevant parts of the IIR to reflect the changes. The ERT recommends that the Party keep the text in the IIR up to date with the changes made to the categories.

Completeness

29. The ERT acknowledges the effort that the Party has made to provide estimates of emissions for the sub-sectors and the pollutants reviewed. The inventory is mainly complete regarding the sources, pollutants and years reported as well as geographical coverage. However, the ERT identified some missing emissions as explained in detail under Sub-Sector Specific Recommendations:

(i) NFR 5B – composting, NH3. The ERT recommends that the Party estimate emissions for the next submission.

(j) Gaps in the Transport sector time series. The ERT recommends that the Party apply suitable gap-filling techniques, i.e. inter– and extrapolation (or similar) as described in the EMEP EEA Guidebook 2019 Part A 4 (Time series consistency) in the next submission, and that it explain transparently in the IIR which years have been gap-filled.

(k) In cases where (i) the notation key Not Estimated (NE) was used, (ii) a Tier 1 methodology was available in the Guidebook and (iii) the Party had activity data for the source category, the ERT requested the Party to provide revised estimates (RE) during the review. The Party sent REs to the ERT for the Energy, IPPU, Agriculture and Waste categories as described under Sub-Sector Specific Recommendations below.

30. The ERT commends North Macedonia for including BC emissions as encouraged in the previous review. However, BC emissions from NFRs 1A3ai(i), and 1A3aii(i), 1A3c, 1A3b are not reported for the full time series. The ERT encourages North Macedonia to report all non-mandatory emissions for the whole time series and where needed to use the gap-filling techniques as explained under para 15.

Consistency, including recalculations and time-series

31. The ERT notes that recalculations have been performed for the year 2017 mainly using consistent methodologies as follows:

- NO_x: NFRs 1A1,1A2,1A3,1A4, 2, 3 and 5
- NMVOCs, PCDD/F and HCB: NFRs 1A2,1A4, 2, and 5
- SO_x and CO: NFRs 1A2,1A3, 1A4, 2, and 5
- NH_3: NFRs 1A2 and 1B.
- $PM_{2.5}$: NFRs 1A1, 1A2, 1B and 2
- PM_{10}, TSP: NFRs 1A1, 1A2, 1A4, 1B, 2, and 5
- Pb and Cd: NFRs 1A2, 1A4, 2, 3 and 5
- Hg: NFRs 1A2, 1A4, 5
- PAHs: NFRs 1A2, 1A4 and 2
- PCBs: NFRs 1A4, 2 and 5

32. The ERT also notes that North Macedonia has provided transparent explanations of recalculations in IIR chapter 9 as recommended in the previous review. North Macedonia provided additional information during the review. The ERT recommends that the Party include this information, as well as all information on

recalculations and other changes made, the rationale, the impact on the sector and the implications for emission trends in future IIRs.

33. The ERT notes further a need for improvement in the recalculations in source categories 1A2, 1A3ai(i), 1A3bi, 1A4bi/ci/cii, 2A5a/b, 2C3, 2C5 and 2C6, for which information on years and pollutants is not clearly reported in the IIR. For instance, regarding NFR 1A3ci, there is only the information that recalculations have been made for some emissions. The ERT recommends that the Party provide documentation for all years and all pollutants as requested under Sub-Sector Specific Recommendations.

34. The ERT notes that recalculations have not always been carried out for the full time series and reiterates the previous review recommendation that the full time series should be included in the recalculations.

35. The ERT notes that the time series is not fully consistent, for instance in the Transport sector and for NFR 2.C.1. In response to a question about the issue, North Macedonia explained that it was aware of the problem of inconsistency that arises when applying a T2 method for only a part of the time series and described a detailed plan to upgrade the methodology for the whole time series to T2 in the next submission. The ERT recommends that North Macedonia always apply the same tier method for the full time series from 1990 to the latest year. For possible deviations in consistency, the ERT recommends that the Party include the relevant issues in the improvement plan with clear steps and a schedule and that it report on progress in the IIR.

Comparability

36. The ERT notes that North Macedonia uses methods in accordance with the latest version of the EMEP/EEA Emission Inventory Guidebook but also earlier versions, and that the allocation of source categories follows that of the CLRTAP Reporting Guidelines (NFR 2019 format). The ERT considers the inventory of North Macedonia mainly comparable with those of other reporting Parties. The ERT recommends that the Party move to the 2019 version of the Guidebook, also in those cases where methods from the 2009, 2013 and 2016 versions of the Guidebook are used.

Accuracy and uncertainties

37. The ERT did not identify systematic under- or over-estimates of emissions and notes that the Party uses Tier 2 or higher tier methods for all key categories with the exceptions mentioned under paragraph 8, and that the use of Tier 1 methods may lead to under- or overestimation of emissions. The ERT reiterates its recommendation from the previous review that North Macedonia use Tier 2 or higher tier methods for all key categories.

38. The ERT commends North Macedonia for compiling Tier 1 uncertainty estimates as recommended in the 2016 review, and for providing a qualitative

uncertainty analysis for the Industrial Processes sector, taking into account guidance provided in the EMEP/EEA Guidebook 2019.

39. The IIR does not mention the use of the uncertainty analysis (UCA) results; thus; the ERT recommends that North Macedonia use the results of the UCA as a tool for prioritising improvements in the inventory in future submissions. North Macedonia agreed to do this during the review.

Verification and quality assurance/quality control approaches

40. North Macedonia has elaborated and implemented a quality assurance/quality control (QA/QC) plan in accordance with Guidebook 2019 Part A6 (Inventory Management), which includes general QC procedures (Tier 1) as well as most of the source category-specific procedures (Tier 2) for key categories, and describes the plan in the IIR with a schedule for the preparation of a QA/QC plan for 2021-22. However, the ERT identified some improvement needs as follows:

(a) For those individual categories in which significant methodological and/or data revisions have occurred, the ERT has found multiple inserting and updating errors as indicated in the Sub-Sector Specific Recommendations and recommends that the Party improve the QA/QC checks in future submissions.

(b) Source category specific QA/QC processes are sometimes described briefly or not at all. The ERT recommends that North Macedonia explain source category level QA/QC checks more transparently in the next submission.

(c) The ERT reiterates the previous recommendations :

- ensure correct allocation of AD (5D1 and 5D2),
- update calculation sheets correctly (1A3bi),
- update references in the IIR after making changes (3Da2, 3Da3),
- avoid using zero values (2C1),
- check correct use of parameters and emission factors (5A, 2C1) and
- use appropriate notation keys (all sectors).

41. North Macedonia provides information on quality control but does not provide information on the verification of the inventory in the IIR. North Macedonia developed, during the review, their cooperation with the Greenhouse Gas Inventory Project and TAEIX expert missions (July 2020). The ERT recommends that the Party includes this information in the IIR and establishes in future also external and independent data comparisons e.g. with inventory estimates made by other bodies or through alternative methods, and reports on these in the IIR.

Reporting of Condensable Particulate Matter

42. North Macedonia does not provide information on the condensable component of PM in the IIR. In response to a question about the issue, North Macedonia answered that they would take this into account and include this

information in a forthcoming project (during 2021). The ERT recommends that North Macedonia include this project in the improvement plan in the next submission and include the results of the project regarding the condensable component in IIR Table A6.1 as requested in the Reporting Guidelines Annex II.

FOLLOW-UP TO PREVIOUS REVIEWS

43. North Macedonia provided detailed responses to the questions identified in Stage 2 review.

44. The ERT notes that North Macedonia has implemented the following recommendations from the S2 and S3 reviews:

- Made correction of the notation keys as proposed in the report
- Included information on the existence of abatement technology in category 1A1a
- Included emissions from previously missing sources : 1A2gviii, 1A5b, 1A4aii/bii/cii, 1A3bi-iv, 1A3c, 2D3i and 2G.
- Reported emissions in the latest NFR 2019 format.
- Implementation of a key category analysis, a trend analysis and a Tier 1 uncertainty analysis.
- Included transparent explanations of recalculations in the IIR (chapter 9)

45. The ERT notes that North Macedonia has not yet implemented the following recommendations. It therefore reiterates its previous recommendations:

- Estimate and report emissions that are currently missing e.g. 5B, 1A4ciii, 1A5a and 1A3eii.
- Include all years from 1990 onwards in the recalculations (a full time series).
- Move to T2 or higher methods in all KCs.
- Use the latest version of the Guidebook, and in cases where this is not possible, provide explanations in the IIR on why older version methods are used.

AREAS FOR IMPROVEMENT IDENTIFIED BY NORTH MACEDONIA

46. In the IIR, several areas for improvement have been identified. In its response to previous reviews and review stages this year, the Party indicated these improvements:

- Implement a higher Tier method for all the key categories.
- Submission of projection data is planned for the following submissions.
- A review of the potential underestimation of fuel oil combustion in refineries
- Development of projects to incorporate high quality facility level data (e.g. EUETS) into the national estimates and to generate country specific emission factors.

- Recalculations will be provided for the whole time series in the following submissions.
- Review of the inventory's compatibility with the energy balance including continuing efforts to use fuel consumption data obtained directly from several sources - Large Combustion Plants (LCP) reporting and EUETS.
- Preparing the QAQC plan is scheduled for the 2021-2022 submission.
- Improvements to the estimates in the Solvent sector for paint application, degreasing and dry cleaning, the printing industry and rubber processing.
- Inclusion of gridded and LPS data in the IIR for the 2021 submission.
- The applicability of the emission factors used in the calculation of NH3 emissions from grazing for 4B Manure Management.
- Update the latest emission factors for category 1A1b.
- Use the correct NKs recommended by the ERT.
- Integration of some of the missing sources (cremation of corpses and carcasses, incineration of waste oils) in the next submission
- To improve knowledge concerning industrial wastewater treatment.

47. The ERT commends North Macedonia for its improvement plan under improvements are prioritised and scheduled. During the review, North Macedonia provided detailed plans for improvements for specific issues identified by the ERT as indicated under Sub-Sector Specific Recommendations. The ERT recommends that the Party include all these different improvements issues in the improvement plan for the next submission.

TECHNICAL CORRECTIONS CONSIDERED AND OR CALCULATED BY THE ERT

48. The ERT noted a possible underestimate of NMVOCs from NFR 5A for which North Macedonia provided a revised estimate during the review. Nevertheless, the ERT provided a technical correction as presented in Table 1 and Annex I, as it did not accept the revised estimate provided by the Party.

49. The ERT noted possible underestimations for which North Macedonia provided revised estimates during the review. The ERT accepted the revised estimates provided by North Macedonia for the Industrial Processes, Agriculture and Waste sectors as presented in Table 2 and in Annex I. The ERT recommends that the Party implement the revised estimates in the next submission.

50.

Table 1 Summary of potential technical corrections identified by the ERT

NFR	Pollutant	Years	Calculated by	Potential contribution to national total
5A	NMVOC	2005-2018	ERT	-11.2%(2018), -7.9%(2010), -5.5% (2005)

Table 2 Summary of revised estimates provided by the Party and accepted by the ERT

NFR	Pollutant	Years	Calculated by	Potential contribution to national total
2B10a	Hg	1994-1999	North Macedonia	approx. +0.001%
2B10a	SOx	1994-1999	North Macedonia	approx. +1.6%
2B10a	CO	-	North Macedonia	-
2B10a	NMVOC	2005-2018	North Macedonia	approx. +0.002%
2B10a	NH3	-	North Macedonia	-
2B10a	PM2.5	2007-2018	North Macedonia	approx. +0.0003%
2B10a	PM10	2007-2018	North Macedonia	approx. +0.002%
2B10a	TSP	2007-2018	North Macedonia	approx. +0.005%
2C1	NOx	2016-2018	North Macedonia	+0.19% (2018),+0.18% (2017),+0.11% (2016)
2C1	PM2.5	2016-2018	North Macedonia	+0.07% (2018), +0.07% (2017), +0.06% (2016)
2C1	Se	2016-2018	North Macedonia	-7.1% (2018), -7.9% (2017), -4.44% (2016)
2C1	Zn	2016-2018	North Macedonia	+5.36% (2018), +5.56% (2017), +3.09% (2016)
2C1	PAH-4	2016-2018	North Macedonia	+3.47% (2018), +3.76% (2017), +1.84% (2016)
2C1	PCDD/F	2016-2018	North Macedonia	+2.2% (2018), +2.3% (2017), +1.2% (2016)
2C1	HCB	2016-2018	North Macedonia	-7.89% (2018), -6.09% (2017), -9.84% (2016)
2C1	PCBs	2016-2018	North Macedonia	+2.35% (2018), +3.31% (2017), +2.35% (2016)
2C7c	SO2	1994-1998	North Macedonia	approx. +0.0005%
2C7c	TSP	1990-1998	North Macedonia	approx. +0.0005%
2.K	Hg	1990-2018	North Macedonia	+9% (2018), +6% (2010), +6% (2005)
2.K	PCBs	1990-2018	North Macedonia	+88% (2018), +98% (2010), +98% (2005)
3Da1	NOx	1990-2018	North Macedonia	+1.05%(2018), +0.58%(2010), 0.55%(2005)

NFR	Pollutant	Years	Calculated by	Potential contribution to national total
3Da1	NMVOC	1990-2018	North Macedonia	-3.75%(2018), -2,62%(2010), -2.79%(2005)
3Da1	PM2.5	1990-2018	North Macedonia	-0.88%(2018), -0.29%(2010), -0.26%(2005)
3Da1	PM10	1990-2018	North Macedonia	-13.82%(2018), -4.86% 2„010), -4.65% (2005)
3Dc	PM2.5	1990-2018	North Macedonia	+0.88%(2018), +0.29%(2010), +0.26%(2005)
3Dc	PM10	1990-2018	North Macedonia	+13.82%(2018), +4.86% 2„010), +4.65% (2005)
3Dc	TSP	1990-2018	North Macedonia	+11.18% (2018), +4.07% (2010), +3.68% (2005)
3De	NMVOC	1990-2018	North Macedonia	+3.75%(2018), +2.62%(2010), +2.79%(2005)
5A	PM2.5	1990-2018	North Macedonia	-0.001%(2018),-0.0003%(2010), -0.0002%(2005)
5C2	Se	1990-2018	North Macedonia	-1.2% (2018), -0.9%(2010), -0.8%(2005)
5C2	Zn	1990-2018	North Macedonia	-43%(2018), -23%(2010), -27%(2005)
5C2	B(A)P	1990-2018	North Macedonia	+1.4%(2018), +1.1%(2010), +1.5%(2005)
5C2	B(b)F	1990-2018	North Macedonia	+4.5%(2018), +2.2%(2010), +2.8%(2005)
5C2	B(k)F	1990-2018	North Macedonia	+14%(2018). +7.2%(2010), +9%(2005)
5C2	PAH-4	1990-2018	North Macedonia	+4.3%(2018), +1.9%(2010), +2.5%(2005)
5C1biii	PCDD/F	2016-2018	North Macedonia	+422%(2018), +95%(2010), +91%(2005)

PART B: RECOMMENDATIONS FOR IMPROVEMENTS TO THE PARTY

CROSS CUTTING IMPROVEMENTS IDENTIFIED BY THE ERT

51. The ERT identified the following cross-cutting issues for improvement and recommends that the Party:

(a) Include in the IIR
- information on sources included under each sub-category
- an assessment of completeness including a list of possibly missing sources and justifications for emissions that are not estimated
- explanations for all notation keys
- information on the allocation of emissions reported as IE
- documentation for all AD, EFs and assumptions in the IIR with references to the information sources
- explanations of emission trends
- explanations for IEF outliers
- explanations of all changes to previous submissions
- justifications for recalculations and information on their impact on emission levels
- information on inclusion/exclusion of the condensable component of PM
- all planned improvements with clear steps and a schedule and update on progress
- corrections to other information details specified under Sub-Sector Specific Recommendations

b) Include all emissions for which there are methods in the Guidebook. In the 2020 submission the ERT identified the following missing emissions:
- 1A2c - Se
- 1A2d – NH_3
- 1A2gviii – NH_3
- 1A3b - recalculate all emissions 1990-2000 instead of copy-pasting constant values from a previous submission
- 1A3bi-iv – TSP, PM_{10}, $PM_{2.5}$, As, ID(1,2,3,cd)P, B(k)F, B(b)F, B(a)P, PCDD/F and PCBs
- 1A4ci – NH_3
- 1A4ai – PAH-4
- 1A4ci – all
- 1A5a – all
- 2B7 – (check if the activity exists)
- 2B10a – emissions from Sulphuric acid (1990-2993) and Chlorine (1990-1993) production
- 2D3a – NMVOCs from Car care products, Household products, DIY/buildings, Pesticides and Pharmaceutical products.
- 2D3g – NMVOCs, TSP, Cd, As, Cr, Ni, Se, PAHs from Asphalt blowing, Adhesive tape manufacturing, Textile finishing, Manufacture of tyres and Pharmaceutical products
- 2D3i – NMVOCs from Glass wool enduction, Mineral wool enduction, Application of glues and adhesives, Underseal treatment and conservation of vehicles, Vehicles dewaxing

- 2G - NMVOCs from Use of fireworks, Other product use (concrete additive, cooling lubricant, lubricant, pesticide and other industrial application of solvents in products), barbecues

c) Include all revised estimates and technical corrections provided during the 2020 review (Tables 1 and 2 and Annex I) in the next inventory submission.

d) Use T2 or higher methods for all key categories.

e) Always use the latest version of the Guidebook for the whole time series, also taking into account, however, possible changes in emission levels over the years according to Guidebook Part 5 Time series consistency.

f) Use gap-filling techniques presented in the EMEP EEA Guidebook 2019 Part A 4 (Time series consistency) and document in the IIR which years are gap-filled.

g) Check and always use notation keys in line with paragraph 12 of the Reporting Guidelines.

h) Further improve the implementation of QA/QC processes (reiteration of previous recommendation).

i) Implement the sub-sector specific detailed recommendations as indicated under Sub-Sector Specific Recommendations.

52. The ERT encourages North Macedonia

(a) to present part of the tables as Annexes at the end of the IIR to increase the legibility of the IIR.

(b) to include BC emissions from NFRs 1A3ai(i), and 1A3aii(i), 1A3b and 1A3c

(c) to include additional heavy metals, e.g. Zn from NFR 2C5 (1990-2014) and Hg from NFR 2K and emissions from Polyurethane production

SECTOR SPECIFIC RECOMMENDATIONS FOR IMPROVEMENTS IDENTIFIED BY ERT

ENERGY

Review Scope

Pollutants Reviewed		SO_2, NO_x, NMVOC, NH_3, PM_{10} & $PM_{2.5}$, Cd, Hg, Pb, PCDD/F, PAHs		
Years		1990 – 2018		
Code	**Name**	**Reviewed**	**Not Reviewed**	**Recommendation Provided**
1A1a	Public electricity and heat production	X		X
1A1b	Petroleum refining	NO		X
1A1c	Manufacture of solid fuels and other energy industries	NO		X
1A2a	Iron and steel	X		
1A2b	Non-ferrous metals	X		X
1A2c	Chemicals	X		X
1A2d	Pulp, Paper and Print	X		X
1A2e	Food processing, beverages and tobacco	X		
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	IE		
1A2gviii	Stationary combustion in manufacturing industries and construction: Other	X		X
1A3ei	Pipeline transport	NE		X
1A3eii	Other	NE		X
1A4ai	Commercial/institutional: Stationary	X		X
1A4bi	Residential: Stationary	X		
1A4ci	Agriculture/Forestry/Fishing: Stationary	X		X
1A5a	Other stationary (including military)	NE		X
1B1a	Fugitive emission from solid fuels: Coal mining and handling	X		
1B1b	Fugitive emission from solid fuels: Solid fuel transformation	NO		X
1B1c	Other fugitive emissions from solid fuels	NO		X
1B2ai	Fugitive emissions oil: Exploration, production, transport	NO		X
1B2aiv	Fugitive emissions oil: Refining / storage	X		X
1B2av	Distribution of oil products	X		X
1B2b	Fugitive emissions from natural gas (exploration, production, processing, transmission, storage, distribution and other)	NO		
1B2c	Venting and flaring (oil, gas, combined oil and gas)	X		
1B2d	Other fugitive emissions from energy production	X		X
Note: Where a sector has been partially reviewed (e.g. some of the NFR codes) please indicate which codes have been reviewed and which have not in the respective columns.				

General recommendations on cross cutting issues

Transparency

53. The ERT commends North Macedonia for having provided a detailed and generally transparent Energy sector emissions inventory. Estimates are provided at the most detailed level for all Energy sector categories.

54. The IIR of North Macedonia includes information on subsector level on source descriptions and on methodology and emission trend descriptions. The ERT recommends that North Macedonia include per subsector detailed descriptions on activity data and emission factors used in the inventory with references to the information sources, as well as details related to completeness, recalculations, QA/QC and planned improvements.

Completeness

55. The ERT considers the Energy sector to be generally complete. The ERT notes that the following emission estimates are missing from the Energy sector inventory:

56. NFR category 1A3ei: the notation key NO is used for the activity data for Liquid Fuels, NA for the other fuels, and NE for all of the pollutants. North Macedonia states in the IIR that emissions could not be calculated because of the absence of AD. The Party has included this matter in the improvements planned for 2021. The ERT recommends that North Macedonia follow up on their planned improvements in order to improve on completeness.

57. NFR category 1A5a: In the IIR it is stated that this sector is not estimated due to a lack of activity data and that this does not seem to have a major impact on the national emissions and will be calculated or categorised as IE when activity data or information become available for the future submissions. The ERT recommends that North Macedonia includes this issue in their planned improvements and follows up on them.

Consistency including recalculation and time series

58. The ERT commends North Macedonia for presenting time series that are well described in the IIR for all sectors and substances and acknowledges that North Macedonia has followed up on recommendations for time series and recalculations that were made in the previous review.

59. The ERT notes that in the IIR (pages 95 and 96) the Party reports on the emission trend for PAHs, which shows a significant decrease from 2011 onwards. In response to a question about the issue, North Macedonia stated that biomass was used less and that the use of gas was increasing. Furthermore, also the burning of pellets has increased due to subsidies for pellet stoves in the last few years. The ERT recommends that North Macedonia includes this explanation in the IIR.

Comparability

60. The ERT considers the inventory of North Macedonia to be comparable with those of other reporting Parties. The methods used in the Energy sector are consistent with the 2019 version of the Guidebook and the emissions are reported in the NFR 2019 format. The IIR contains, in general, enough information to understand how the emissions were estimated.

Accuracy and uncertainties

61. The ERT did not identify any systematic over- or under-estimates and commends North Macedonia for the thorough quality work in the Energy sector and for providing information on general QA/QC procedures in its IIR.

62. The ERT notes that North Macedonia uses a Tier 2/3 methodology only for sector 1A1a. For most of the other key categories, a Tier 1 methodology is applied using emission factors from the Guidebook. The Party has included its plan to move to higher tier methods in the improvements planned for 2020-2021. The ERT recommends that North Macedonia follow up on their planned improvements and move to a higher tier method in future submissions as according to paragraph 21 of the Reporting Guidelines, Parties should make every effort to use a Tier 2 or higher (detailed) methodology.

Condensable Particulate Matter

63. The ERT notes that North Macedonia does not provide any information on the condensable component in PM for relevant categories. The ERT recommends that the Party include information on whether particle emissions include or exclude the condensable component in the next submissions in line with Annex II of the Reporting Guidelines.

Improvement

64. The ERT commends North Macedonia on all the improvements made so far in both the IIR and NFR, e.g. using final fuel consumption data for NFRs 1A2 and 1A4, recalculating implied EFs for NFR 1A1a and updating emission factors for NFR 1A4, and recommends that North Macedonia include in the IIR a general paragraph on planned improvements with priorities and schedules.

Potential Technical Corrections

65. The ERT concludes that for the Energy sector no significant inconsistencies were found and that therefore no further recommendations are necessary.

Sub-Sector Specific Recommendations

Category issue 1: 1A1a Calculated IEF for NOx, SO2, CO and PM for Lignite and Heavy fuel - Comparability

66. The ERT notes that in the IIR (Table 53, pages 106 and 107) the Party reports that IEFs were calculated and used for sector 1A1a for NO_x, SO_x, CO and particle emissions from the fuels Lignite and Heavy fuel. The IEFs are close to the outer limits or outside the ranges mentioned in the Guidebook for the pollutants and fuels mentioned. The ERT also noted that the IEFs were the same for both fuels although they would be expected to differ in chemical composition. In response to a question about the issue, North Macedonia stated that the IEFs had been developed with Austrian experts under a Twinning project, using measurement data from a period of several years for which there was good coverage of measurements (there is no automatic monitoring). Default emission factors from the Guidebook are not considered suitable due to the fact that coal is domestic and the Party assumes that the expert judgement that led to the development of emission factors from the measurements has resulted in less uncertainty than using default emission factors from the Guidebook. The ERT recommends that North Macedonia includes this explanation in the IIRs.

Category issue 2: 1A1b, 1A1c Use of notation keys - Completeness/transparency

67. The ERT acknowledges the information provided in the IIR (Table 50 and pages 102 and 103) that sectors 1A1b and 1A1c are no longer occurring in North Macedonia. In the NFR table for 2018, however, the notation key NA is used for Activity Data Other, and the notation keys NE and NA are used for the substances NH_3, BC, HCB and PCBs, where the notation NO is expected due to the ceased activity. In response to a question about the issue, North Macedonia stated that for activity data and emissions since 2015 NO should be used and that for the years 1990-2014 North Macedonia used notations keys as proposed in the absence of EFs in the Guidebook: if no EF is available in the Guidebook (as in the case of ammonia), the Party is not able to estimate emissions or to judge if the impact is under- or over-estimated. North Macedonia agreed to correct the notation keys for 1A1b in 2015-2018 to NO (the activity did not exist in 2015-2018) and all years for 1A1c to NO (the activity did not exist in any year) for the next submission. The ERT recommends that North Macedonia perform the corrections for the next submissions of the NFR to improve transparency.

Category issue 3: 1A2b, 1A2c, 1A4ci Use of notation key NO – HCB and PCBs

68. The ERT notes that North Macedonia uses the notation key NO for emissions of HCB and PCBs in the NFR for the sectors 1A2b, 1A2c and 1A4ci. In response to the question of whether emissions of HCB and PCBs are indeed not occurring in the mentioned sectors or if the notation key NA should have been used, North Macedonia stated that the notation key NO was used because the fuel for which EFs are available in the Guidebook was not consumed in those years and that if the ERT recommends that in such cases NA should be used, they would correct the notation keys. . The ERT notes that a pollutant can be reported as NA if it is not relevant

for the source or if a method is not provided in the Guidebook, while NO can be used for a source not occurring, but not for an individual pollutant from an existing source. The ERT recommends that North Macedonia correct the notation keys in line with definitions provided in paragraph 12 of the Reporting Guidelines in the next submissions.

Category issue 4: 1A2c Use of notation key NO for Se where estimates are expected - Completeness/transparency

69. The ERT notes that in the NFR table for sector 1A2c North Macedonia uses the notation key NO for Se. When asked why they had not used a Tier 1 methodology from the Guidebook to calculate emissions using the reported activity data, North Macedonia responded that in 2000 the sector had been reported as NO due to the fact that fuel consumption was 0 in that year and that they had copied the notation keys by mistake for the other years, instead of using a formula for the total emissions from the use of different fuels, and that they would correct this for the next submission. The ERT notes that a pollutant can be reported as NA if it is not relevant for the source or if a method is not provided in the Guidebook whereas NO can only be used for a source not occurring, not for an individual pollutant from an existing source. The ERT recommends that North Macedonia correct the notation keys in line with definitions provided in paragraph 12 of the Reporting Guidelines in the next submissions.

Category issue 5: 1A2c Use of notation key NE – NH_3

70. The ERT notes that North Macedonia uses the notation key NE in the NFR table for NH_3 in sector 1A2c although in the Guidebook no emission factors are given for known activity data. The ERT recommends that the Party use NA in line with definitions provided in paragraph 12 of the Reporting Guidelines in the next submissions because no method is provided in the Guidebook.

Category issue 6: 1A2d, 1A2gviii, 1A4ci Use of notation key NE – NH_3

71. The ERT notes that North Macedonia uses the notation key NE for NH_3 in the sectors 1A2d, 1A2gviii, 1A4ci and that activity data for biomass is included in the NFR. As an EF is given in the Guidebook, the ERT recommends calculating emissions using the reported activity data for biomass and including the emissions in the next submissions.

Category issue 7: 1A3eii Use of notation key NE – All pollutants

72. The ERT notes that for sector 1A3eii North Macedonia uses the notation key NA for AD Other activity and NO for all others fuels and the notation key NE for all pollutants. In the IIR no remarks on this subject could be found. In response to a question about the issue, North Macedonia stated that the notation key NO should have been used for all pollutants/activities and that the Party would correct this for next submission. The ERT recommends that North Macedonia correct the notation keys in line with paragraph 12 of the Reporting Guidelines for the next submissions.

Category issue 8: 1A4ai Use of notation keys instead of totalled emissions –PAHs

73. The ERT notes that for sector 1A4ai North Macedonia uses the notation key NE for total PAHs where the sum of the individual PAHs is expected. In response to a question about the issue, North Macedonia sent a file with corrected data and responded that they would be corrected. The ERT recommends that North Macedonia report the sum of indicator PAHs in the NFR table in the next submissions.

Category issue 9: 1A4ci Use of notation key NE – Other fuels

74. The ERT notes that for AD Other fuels in sector 1A4ci North Macedonia uses the notation key NE in the NFR table. The ERT recommends that North Macedonia investigate and collect activity data for the mentioned sector and report the activity data, or use the notation key NO or NA in line with paragraph 12 of the Reporting Guidelines instead in the next submissions, or in case this is not possible, that it include this in their inventory improvement plan with steps and a schedule for the work to be done.

Category issue 10: 1A5a Use of notation key– All pollutants and most AD

75. The ERT notes that North Macedonia uses NE for sector 1A5a for all pollutants and NO for most activity data. The use of NE and the absence of AD is described in the IIR. The ERT recommends that North Macedonia investigate the source and o collect activity data for this sector and that it calculate emissions using the Guidebook for the next submissions, or in case this is not possible, that it include this in the inventory improvement plan with steps and a schedule for the work to be done.

Category issue 11: 1B1b, 1B1c, 1B2ai Use of notation key NA where NO is expected - Completeness/transparency

76. The ERT notes that according to the IIR (Table 50, page 102) activities under sectors 1B1b, 1B1c and 1B2ai are not occurring in North Macedonia. In the NFR table for 2018, however, the notation key NA is used for all Activity Data except for Other. The notation key NA is also used for the substances HCB and PCBs in 1B1b, instead of the notation key NO for not occurring sources. In response to a question about the issue, North Macedonia stated that they would correct the notation keys to NO in the reporting table for the next submission. The ERT recommends that North Macedonia correct the use of the notation key in the next submissions in line with paragraph 12 of the Reporting Guidelines.

Category issue 12: 1B2aiv Use of notation key NA where NO is expected - Completeness/transparency

77. The ERT notes that according to the IIR (Table 118, page 167/168), activities under sector 1B2aiv have not occurred in North Macedonia since the year 2015. In the NFR table for 2018, however, the notation key NA is used for these years for all activity data except for Other, and also for the substances PAHs, HCB and PCBs

instead of the notation key NO for not occurring sources. In response to a question about the issue, North Macedonia stated that they had used the notation keys from the Guidebook in the calculation sheets and had not corrected them when this category ceased to exist and that NA needed to be replaced with NO. The ERT notes that the notation keys presented in the Guidebook's EF tables are not the same as those that are expected to be reported in the NFR table and recommends that North Macedonia change the notation key to NO in the next submissions in line with paragraph 12 of the Reporting Guidelines.

Category issue 13: 1B2av Typing error in the title of paragraph 4.7.3 - IIR

78. The ERT notes in the IIR (page 169) that North Macedonia, according to paragraph 4.7.3 Distribution of oil products, reports these emissions under NFR 1B2v. When asked if the correct NFR should be NFR 1B2av, North Macedonia responded that they would make the correction. The ERT recommends that North Macedonia corrects the allocation of emissions in the IIR.

Category issue 14: 1B2d Use of notation key NE – Most pollutants

79. The ERT notes that in sector 1B2d, North Macedonia uses the notation key NE for other pollutants in the NFR, except for NH_3, Hg and As. The ERT recommends that North Macedonia use NA for pollutants other than NH3, Hg and As, because the Guidebook does not provide methods for pollutants other than NH3, Hg and As.

TRANSPORT

Review Scope

Pollutants Reviewed		All		
Years		1990 – 2018		
Code	**Name**	**Reviewed**	**Not Reviewed**	**Recommendation Provided**
1A2gvii	Mobile Combustion in manufacturing industries and construction	x		x
1A3ai(i)	International aviation LTO (civil)	x		
1A3ai(ii)	International aviation cruise (civil)	x		x
1A3aii(i)	Domestic aviation LTO (civil)	x		x
1A3aii(ii)	Domestic aviation cruise (civil)	x		x
1A3bi	Road transport: Passenger cars	x		x
1A3bii	Road transport: Light duty vehicles	x		x
1A3biii	Road transport: Heavy duty vehicles and buses	x		x
1A3biv	Road transport: Mopeds & motorcycles	x		x
1A3bv	Road transport: Gasoline evaporation	x		
1A3bvi	Road transport: Automobile tyre and brake wear	x		
1A3bvii	Road transport: Automobile road abrasion	x		
1A3c	Railways	x		
1A3di(ii)	International inland waterways	x		
1A3dii	National navigation (shipping)	x		
1A4aii	Commercial/institutional: Mobile	x		x
1A4bii	Residential: Household and gardening (mobile)	x		
1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	x		x
1A4ciii	Agriculture/Forestry/Fishing: National fishing	x		x
1A5b	Other, Mobile (including military, land based and recreational boats)	x		
1A3di(i)	International maritime navigation	x		
1A3	Transport (fuel used)	x		
Note: Where a sector has been partially reviewed (e.g. some of the NFR codes) please indicate which codes have been reviewed and which have not in the respective columns.				

General recommendations on cross cutting issues

Transparency

80. The IIR is generally transparent for the Transport sector, including activity data and the EFs used for the emission calculations, and the default EFs from the Guidebook are clearly presented.

81. The ERT notes that North Macedonia uses some unknown sources of activity data in parts of the time series. The ERT recommends that the Party check whether another methodology would be more appropriate to gap-fill the time series, e.g. the methods presented in EMEP/EEA Guidebook 2019 Part A6 (Time series

consistency) and that it document the method used in the IIR, in order to increase the transparency of the inventory.

Completeness

82. North Macedonia has not estimated emissions for some years from the sources and pollutants listed below. During the review, the Party indicated its intention to include these emission estimates in its next submission. The ERT welcomes this plan and recommends that the Party carry out this improvement.

- BC emissions from NFRs 1A3ai (i), and 1A3aii (i), 1A3c, 1A3b;
- TSP, PM_{10}, $PM_{2.5}$ emissions from NFRs 1A3bi, 1A3bii, 1A3biii, 1A3biv;
- As, ID(1,2,3,cd)P, B(k)F, B(b)F, B(a)P, PCDD/F and PCBs emissions from NFRs 1A3bi, 1A3bii, 1A3biii, 1A3biv (during the review the Party sent calculations for PAHs and POPs for 1A3b category).

83. The ERT notes an inconsistent use of notation keys by North Macedonia for the following sectors in the NFR tables:

- 1A2gvii (Other Stationary Combustion in Manufacturing Industries and Construction): the notation key NE is used for As, BkF and IP when there is no methodology in the Guidebook. In cases where no default method is provided in the Guidebook the ERT recommends the use of notation key “NA” according to paragraph 12 of the Reporting Guidelines.
- 1A3b(i-iv) (Road Transport): the notation keys NE and NA are used for BC although there are EFs provided in Guidebook 2019 to calculate emissions. The ERT encourages the Party to calculate the values.
- 1A4aii (Commercial/institutional: Mobile): the notation key NE is used for As, benzo(k) fluoranthene, Indeno(1,2,3-cd)pyrene, when there is no methodology in the Guidebook. In case where no default method is provided in Guidebook 2019 the ERT recommends the use of the notation key "NA" according to paragraph 12 of the Reporting Guidelines.
- 1A4cii (Agriculture/Forestry/Fishing: Off-road vehicles and other machinery): the notation key NE is used for BC although there are EFs provided in Guidebook 2019 to calculate emissions. The ERT encourages the Party to calculate the values.
- 1A4ciii (Agriculture/Forestry/Fishing: National fishing for all pollutants): the notation keys “NE” or “NO” are used. In case National fishing does not occur in the North Macedonia, the ERT recommends that the Party use the "NO" notation key and explain this in the IIR, see Reporting Guidelines paragraph 12.

- 1A3ai(i) (International aviation LTO (civil)): the notation key NE is used for Activity Data whereas in the IIR a value is provided. The ERT recommends that the Party put the value in the NFR table.

- 1A3aii(ii) and 1A3aii(i) (Domestic aviation cruise (civil) and (LTO)): the notation key NE is used for Activity Data whereas in the IIR the source is reported as not occurring "NO". In case Domestic aviation does not occur, the ERT recommends that the Party report NO for both 1A3aii(i) and 1A3aii(ii) and document this in the IIR.

- 1A4aii (Commercial/Institutional: Mobile): the notation key IE is used; however, there is no information on where this category is included. The ERT recommends that the Party provide information on the allocation of emissions in the IIR or that it report the values separately for 1A4aii in the NFR table.

84. The ERT recommends that the Party calculates and reports emissions for the above sources and pollutants in their future submissions.

Consistency including recalculation and time series

85. The ERT notes an inconsistency of data in the Road Transport category. In the IIR MK provides the information that "emission data for the period 1990-2000 has been taken directly from NFR tables reported in 2013. There is no detail background data on the type of fuel consumption, or the EF used for this reporting period." In response to questions about the issue, the Party responded that they were aware of the differences in the methodologies used: up to 2016 the inventory was prepared by a consulting company from which no detailed background data was received and that there also were challenges in getting detailed vehicle fleet data from the Ministry of the Interior. The Party stated that they would make an effort to obtain the missing data and to use the COPERT model for all years. The ERT recommends that the Party get as much data as possible and carry out calculations to estimate the emissions instead of copying them from a previous submission.

Comparability

86. The ERT notes that North Macedonia in general uses methods that are consistent with those proposed in the EMEP/EEA Emission Inventory Guidebook to estimate emissions of pollutants from the Transport sector, and that the emissions are calculated on the basis of fuels sold.

87. However, methods from different versions of the Guidebook were used for different source categories: for instance, the 2009 Guidebook was used for NFR 1A4bii while the 2019 Guidebook was used for NFR 1A4cii. The ERT recommends that the Party always use the latest Guidebook version (currently 2019) consistently for all sources and pollutants and prepare time series in accordance with the EMEP/EEA Guidebook 2019 Part A6 (Time series consistency). The ERT also notes that in case national or international methods are available, it should be considered that these are better able to reflect the national situation and produce more accurate estimates than

the default methods as they are based on scientific research and compatible with the EMEP/EEA Guidebook as well as documented in the IIR (see Reporting Guidelines, paragraph 19.)

Accuracy and uncertainties

88. The IIR indicates that quality control activities are performed by sector experts during and after the inventory preparation. The ERT recommends that the Party provide more detailed information on the sector specific QA/QC procedures in the IIR in future submissions.

Condensable Particulate Matter

89. The Party did not provide explanatory information on the condensable component of PM for the categories of the Transport sector. In the IIR, there is no clear information on whether $PM_{2.5}$ emissions in the Transport sector include or exclude the condensable component. The ERT notes that there is information about the condensable component of PM regarding the Guidebook default methods in Chapter 1A3b of the Guidebook. The ERT recommends that North Macedonia include such information in the next submission.

Improvement

90. The ERT notes the Party's improvement plans related to NFRs 1A3a, 1A3b, 1A3c, and 1A3dii and recommends that the Party carry out these improvements to increase the completeness and accuracy of the inventory.

Potential Technical Corrections

91. The ERT has not prepared any technical corrections for the Transport sector inventory of NM.

Sub-Sector Specific Recommendations

Category issue 1: 1A3b Road Transport - All Pollutants

92. The ERT notes that the EF used for passenger car gasoline fuel for Euro 0 vehicles in IIR Table 74 (emission factor for source category 1A3bi Road Transport: Passenger cars used for calculation of emissions in the period 2014-2018 by use of Tier 2 methodologies) differs from the EF in Guidebook 2019. The ERT recommends that the Party adds an explanation for the use of this EF and documents the calculation of Euro 0 passenger car gasoline emissions in the IIR.

Category issue 3: 1A3b Road Transport – All pollutants

93. In response to a question about the methodology used for Road Transport emissions the Party provided a detailed clarification on the methodology currently used for NFR 1A3b. The ERT recognised the effort made by the Party to reproduce a consistent time series of emission estimates from Road Transport based on the limited

background information that was documented in the previous inventories. The Party indicated its intention to move from Tier 1 to a higher tier methodology for NFR 1A3b by using the COPERT software, along with detailed vehicle data for the period since 2005 that would be made available by the Party's Ministry of the Interior. The ERT welcomes this improvement plan because Road Transport is a key source for NO_x, NMVOC and CO emissions in the country, and recommends that the Party clearly document the methodology and any assumptions used (e.g. how the detailed vehicle data will be gap-filled consistently for the years before 2005) in the IIR.

Category issue 4: 1A3b Road Transport – CO

94. The ERT identified some errors in the reported values such as CO from NFR 1A3b in the 2019 submission and in the 2020 submission. In the 2019 submission the value of CO emissions for 1991 was 35,295 kt, and in the 2020 submission the value of CO emission was 56,323 kt. During the review the Party explained that there was a mistake in the 2019 submission and that the value in the 2020 submission was correct.

INDUSTRIAL PROCESSES

Review Scope

Pollutants Reviewed		All pollutants		
Years		1990 – 2018		
Code	**Name**	**Reviewed**	**Not Reviewed**	**Recommendation Provided**
2A1	Cement production	x		x
2A2	Lime production	x		x
2A3	Glass production	x		x
2A5a	Quarrying and mining of minerals other than coal	x		x
2A5b	Construction and demolition	x		x
2A5c	Storage, handling and transport of mineral products	x		x
2A6	Other mineral products	NE		
2B1	Ammonia production	x		
2B2	Nitric acid production	x		
2B3	Adipic acid production	NO		
2B5	Carbide production	NO		
2B6	Titanium dioxide production	NO		
2B7	Soda ash production	NO		
2B10a	Chemical industry: Other	x		x
2B10b	Storage, handling and transport of chemical products	IE		x
2C1	Iron and steel production	x		x
2C2	Ferroalloys production	x		
2C3	Aluminium production	x		x
2C4	Magnesium production	x		x
2C5	Lead production	x		x
2C6	Zinc production	x		x
2C7a	Copper production	x		x
2C7b	Nickel production	NO		
2C7c	Other metal production	x		
2C7d	Storage, handling and transport of metal products	NO		
2D3b	Road paving with asphalt	x		x
2D3c	Asphalt roofing	x		x
2H1	Pulp and paper industry	x		
2H2	Food and beverages industry	x		x
2H3	Other industrial processes	NO		
2I	Wood processing	x		x
2J	Production of POPs	NO		
2K	Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)	x		x
2L	Other production, consumption, storage, transportation or handling of bulk products	NE		
Note: Where a sector has been partially reviewed (e.g. some of the NFR codes) please indicate which codes have been reviewed and which have not in the respective columns.				

General recommendations on cross cutting issues

Transparency

95. The ERT considers North Macedonia's emissions inventory for the Industrial Processes sector to be generally transparent and notes that it is comprised of the NFR19 tables for the period 1990 – 2018 and an Informative Inventory Report (IIR) that follows the recommended structure of Annex II to the Reporting Guidelines.

96. North Macedonia reports activity data in NFR tables and in the IIR. The ERT commends North Macedonia on this and recommends that North Macedonia include further improvements regarding activity data as indicated in the Sub-Sector Specific Recommendations.

97. The ERT notes that the methodology, emissions factors, and activity data are well documented in the IIR, and that the Guidebook versions 2013, 2016 and 2019 are used for estimating emissions and for some sectors (sectors 2C1 and 2C2(are used measurements as well as implied EFs (e.g. for NFR 2C2) are used. However, the reasons for dips and jumps in the time series are not always given in the IIR. The ERT recommends that North Macedonia include missing trends descriptions in the IIR in the next submission as indicated in the Sub-Sector Specific Recommendations.

98. The ERT notes that notation keys are used where estimates are not available or necessary for all source categories within the Industrial Processes sector. However, the appropriate notation key is not always applied for emissions and activity data. The ERT recommends that North Macedonia use notation keys strictly in line with paragraph 5 of the Reporting Guidelines. The ERT also recommends that North Macedonia explain the usage of the notation keys in Chapter 2.8 General assessment of completeness of the IIR for each of source category for which North Macedonia uses "NE", "IE" and "NO".

Completeness

99. The ERT considers the Industrial processes inventory to be almost complete; however, there is room for additional improvements as explained under the Sub-Sector Specific Recommendations.

100. In the 2020 submission, North Macedonia has reported emissions for almost all source categories for the whole historical time series, although the ERT identified missing emissions from the following source categories: 2B10a, 2B10b, 2C1 (2016-2018), 2C5 (2010-2014), 2C7a (1990-2006), 2C7d, 2H3, 2K, and 2L). For the NFRs 2B10a, 2C1, 2C7c and 2K the Party provided revised estimates (Table 2) that were accepted by the ERT. The ERT commends North Macedonia for including black carbon emissions for the whole time series in the relevant source categories of the Industrial Processes sector.

Consistency including recalculation and time series

101. The emission trends and activity data trends are in general consistent. However, during the review, the ERT identified some outliers, all of which were explained by North Macedonia. The ERT recommends that North Macedonia include detailed explanations for all outliers in the time series for activity data and emissions in the next IIR.

102. The ERT notes that North Macedonia has performed recalculations and other changes for some pollutant emissions, source categories or years in the latest submission and documented the rationale and the impacts on the sector and emission trends in the IIR.

Comparability

103. The ERT found the inventory of North Macedonia to be comparable with those of other reporting Parties. North Macedonia reports emissions in the NFR2019 table and uses Guidebook versions 2013, 2016 and 2019 for estimating emissions along with measurements data (e.g. for NFRs 2C1 and 2C2), and implied emission factors (e.g. for NFR 2C2). .

Accuracy and uncertainties

104. The ERT found possible overestimates and underestimations as explained under Sub-Sector sector-specific recommendations.

105. The ERT notes that not all key categories have been estimated with T2 or higher methods as explained under Source Specific Recommendations and notes that using a Tier 1 method can lead to an under- or overestimation of emissions.

106. North Macedonia has provided a description of the quality management system in the IIR including QA/QC checks for the Industrial Processes sector. The ERT commends North Macedonia on its general QA/QC activities and recommends that North Macedonia include some additional QC checks to avoid e.g. typo errors as explained under Sub-Sector sector-specific recommendations.

107. North Macedonia has provided a qualitative uncertainty analysis for the Industrial Processes sector. The ERT commends the Party for using the results of the uncertainty analysis to prioritise improvements in the inventory. The ERT also recommends that the Party include a quantitative uncertainty analysis in line with paragraph 31 of the Reporting Guidelines.

Condensable Particulate Matter

108. North Macedonia does not provide explanatory information in the IIR on whether particle emissions include or exclude the condensable component. The ERT recommends that North Macedonia include such information in the next submission following Annex II of the 2014 Reporting Guidelines.

Improvement

109. According to the IIR, North Macedonia has implemented improvements since the last review, e.g. historical AD was revised and notation keys corrected for some categories, and in 2C5 and 2D3b the methods were upgraded from T1 to T2. In the improvement plan the following planned improvements are listed (among others): collection of data for NFRs 2A5b, 2C3, 2C5, 2D3b, 2H2 and 2I, in NFR 2C1 moving to T2 and harmonising EFs with the Guidebook in NFR 2C7c.

110. During the review the ERT identified some further need for improvement as explained under Sub-Sector Specific Recommendations.

Potential Technical Corrections

111. No technical corrections were made during the review.

112. The ERT noted possible underestimations for which North Macedonia provided revised estimates, using annual population statistics as activity data and emission factors recommended in Guidebook 2019. The ERT recommends that North Macedonia apply the revised estimations to the following potential underestimates for the whole time series in the next submission:

113. Table 2. Revised estimates provided by North Macedonia and accepted by the ERT during the review

NFR	***Pollutant***	***Years***	***Calculated by Party***	***Potential contribution to national total***
2B10a	Hg	1994-1999	North Macedonia	approx. +0.001%
2B10a	SOx	1994-1999	North Macedonia	approx. +1.6%
2B10a	CO	-	North Macedonia	-
2B10a	NMVOC	2005-2018	North Macedonia	approx. +0.002%
2B10a	NH3	-	North Macedonia	-
2B10a	PM2.5	2007-2018	North Macedonia	approx. +0.0003%
2B10a	PM10	2007-2018	North Macedonia	approx. +0.002%
2B10a	TSP	2007-2018	North Macedonia	approx. +0.005%
2C1	NOx	2016-2018	North Macedonia	+0.19% (2018), +0.18% (2017), +0.11% (2016)
2C1	PM2.5	2016-2018	North Macedonia	+0.07% (2018), +0.07% (2017), +0.06% (2016)
2C1	Se	2016-2018	North Macedonia	-7.1% (2018), -7.9% (2017), -4.44% (2016)
2C1	Zn	2016-2018	North Macedonia	+5.36% (2018), +5.56% (2017), +3.09% (2016)

NFR	*Pollutant*	*Years*	*Calculated by Party*	*Potential contribution to national total*
2C1	PAH-4	2016-2018	North Macedonia	+3.47% (2018), +3.76% (2017), +1.84% (2016)
2C1	PCDD/F	2016-2018	North Macedonia	+2.2% (2018), +2.3% (2017), +1.2% (2016)
2C1	HCB	2016-2018	North Macedonia	-7.89% (2018), -6.09% (2017), -9.84% (2016)
2C1	PCBs	2016-2018	North Macedonia	+2.35% (2018), +3.31% (2017), +2.35% (2016)
2C7c	SO2	1990-1998	North Macedonia	approx. +0.0005%
2C7c	TSP	1990-1998	North Macedonia	approx. +0.0005%
2.K	Hg	1990-2018	North Macedonia	+9% (2018), +6% (2010), +6% (2005)
2.K	PCBs	1990-2018	North Macedonia	+88% (2018), +98% (2010), +98% (2005)

Sub-Sector Specific Recommendations

Category issue 1: 2.A.1 Cement production – all relevant

114. The ERT noted a jump of 44% in the clinker produced in 2000 and a dip of 43% in 2009. In response to a question about the issue, North Macedonia responded that since 2000 the cement factory had been working with a new owner who had previously carried out several modernisations in production. In 2009, the decline in production was due to the economic crisis and data availability thereafter is gradually increasing and being consolidated. The ERT thanks North Macedonia for providing a detailed description of trend fluctuations and recommends including the information in the IIR of the next submission.

Category issue 2: 2.A.5.a Quarrying and mining of minerals other than coal, 2.C.2 Ferroalloys production – TSP – KCA

115. According to the IIR page 88, the main emission sources for TSP in 2018 are NFR 1A4 Other Sectors (residential heating) 40% (22% in 1990), NFR 1A1 Energy Industries 32% (22% in 1990) and NFR 2 Industrial Processes and Other Product Use (mainly NFR 2C2 Ferroalloys Production) 11% (50% in 1990). The ERT noted that when comparing with IIR Table 8 on page 54 the only key category within the IPPU sector is NFR 2A5a Quarrying and mining of minerals other than coal with a contribution of 5.12% in 2018 (1.84% in 1990), while NFR 2C2 contributed only 0.33% to the TSP national total in 2018 (42.53% in 1990). In response to a question about the issue North Macedonia stated that when explaining the main emission sources they use the KCA tool, where sectors and several NFRs are shown and that the reason for mentioning NFR 2C2 was that this category was one of the major sources until 2016, and that they should also use KCA here for the latest year to avoid confusion. The ERT recommends that North Macedonia implement this in the next submission of the IIR.

116. The ERT noted for activity data in NFR 2A5a a dip by 74% in 2003 and an 8-fold jump (713%) in 2005. In response to a question about the issue North Macedonia responded that data were taken from the Statistical Office and that they did not know the reason for the dip and jump but could send a request for an explanation and incorporate the explanation in the next submission. The ERT recommends that North Macedonia contact the Statistical Office to get an explanation on the fluctuations in the trend and include this in the IIR for the next submission.

117. The ERT notes that NFR 2A5a is according to Table 8 p. 54 a Key category for TSP and that North Macedonia uses a Tier 1 method for the emission calculation and also that according to IIR p. 183 North Macedonia is not planning improvements for this category. The ERT notes that using a Tier 1 method could result in an over- and/or under-estimate of emissions and that according to paragraph 21 of the Reporting Guidelines, Parties should make every effort to use a Tier 2 or higher (detailed) methodology, including country-specific information. In response to a question about the possibility to use a Tier 2 method if activity data can be stratified according to the different techniques and to calculate all relevant emissions with the Tier 2 method of the Guidebook, North Macedonia stated that this issue would be put in the improvement plan. The ERT recommends that the Party move to the Tier 2 method to the next submission or, if this is not possible, that it include the issue in the Improvement plan with clear tasks and a schedule, and that it report on progress on the issue in the next submissions.

Category issue 3: 2.B Chemical industry – NFR categories

118. During the review, the ERT noted that according to IIR p. 186 the notation key NE for NFR 2B7 was used since the process should be checked and that the NFR categories: 2B5a - Other chemical industry and 2B5b - Storage handling and transport of chemical products in national inventory were reported as NE due to a lack of official activity data. The ERT also noted that according to the NFR nomenclature, category 2B5a should be 2B10a and that NFR 2B5b was actually 2B10b. The ERT recommends that North Macedonia correct these typos in the next submission.

Category issue 4: 2B6, 2B7, 2B10a, 2B10b Chemical industry – missing categories

119. The ERT notes that there is no improvement plan in the IIR for categories within the scope of NFR 2B, and that in the NFR tables for the period 1990-2018 the notation key "NE" is used for categories 2B6, 2B7, 2B10a and 2B10b when reporting activity data. In the same time, when reporting relevant emissions for 2B6 and 2B7, North Macedonia uses the notation key "NO". When asked which of notation key was correct and whether information could be collected about the existence of missing activities, North Macedonia responded that the notation keys in the reporting NFR tables were correct, and that unfortunately they had problems with activity data and that their capacity to extend the calculations to sources that are not estimated was limited, but that they would add this to their plan for future submissions. The ERT is aware of the challenge; however, it recommends that North Macedonia find out if these activities exist in the territory of North Macedonia for the next submission, and with regard to the completeness of the inventory, that it include data collection and the

calculation of emissions in the improvement plan with clear steps and a schedule for the work to be done, while also reporting on progress with the issue in the next IIR submissions.

Category issue 5: 2.B.10.a Chemical industry: Other - NO_x, SO_x, CO, NMVOC, NH_3, PM_{10}, $PM_{2.5}$, TSP – completeness - missing emissions – RE – Revised Estimates

120. The ERT notes that according to IIR p. 186 emissions from 2B5a (should be 2B10a) are reported as NE due to the lack of official activity data. When asked whether it had been assumed that any of the activities falling under the scope of NFR 2B10a existed in the territory of North Macedonia and in case they did exist, whether the Party could estimate emissions using the guidance given by the ERT, North Macedonia responded that the following activities had existed in earlier years or still existed: Sulphuric acid (040401), Fertiliser (which one is not known), Chlorine production - mercury cell (040413), Phosphate fertilisers (040414), Polyethylene low density (040506) and polyethylene high density (040507), Polyvinylchloride (040508). North Macedonia also provided revised estimates (RE) for the historic trend 1990-2018 with following explanation:

121. Sulphuric acid was produced in smelter company in Veles which was closed in 2003. The Party found electronic data for the period 1994-1999 which was used to calculate REs for the sulphuric acid production process (a wet process) and for which the EF of 17000 g/Mg was used. The Party also stated that they would investigate this in greater detail for the next submission as there is a possibility of available data for 1990-1993 in a hard copy.

122. Production of chlorine with a Hg cell occurred in a major company OHIS (chemical company established in 1960 in Yugoslavia) which is now closed. The Party calculated Revised Estimates (RE) for the period 1994-1999 and stated that there may be data available for 1990-1993.

123. For fertiliser production the Party used data proposed by the ERT from the MACSTAT database; however, as there is no clarification on the type of fertilisers in statistical publications, efforts will made to get this data per type of fertiliser from the Agriculture Ministry for the next submission.

124. For PVC the Party found that suspension of polyethylene occurs in the country but there was no information on whether it was high or low density, so they used the higher EF in the RE.

125. For polyurethane production the Party did not find an EF in the Guidebook but provided activity data and asked the ERT for information about a suitable EF to calculate the emissions.

126. The ERT commends North Macedonia for providing the ERT with the Revised Estimates, the contributions of which are low compared to the national totals. However, to improve the completeness of the inventory, the ERT recommends that North Macedonia include and document all new estimates and information in the

inventory for the next submission. For those estimates that cannot be completed, the ERT recommends that North Macedonia include the work in the improvement plan with clear steps and a schedule and that it report on progress with the work in future submissions.

127. Moreover, the ERT recommends that North Macedonia, to improve the completeness of the inventory, collect the still missing historical data for sulphuric acid (1990-1993) and production of chlorine (1990-1993) and estimate missing emissions for the next submission of its inventory. The ERT encourages the collection of details regarding the type of fertiliser from the Agriculture Ministry which will help improve the accuracy of the estimates. The ERT recommends that North Macedonia make an effort and try to find out if the produced polyethylene is high or low density, and in case they cannot find the information, that they continue using the higher EF.

128. Regarding polyurethane production the ERT notes that Guidebook 2019 does not provide a methodology for emission estimation; however, the ERT encourages the Party to investigate if suitable methods to estimate air pollutants from the source are available elsewhere.

Category issue 6: 2.B.10.b Storage, handling and transport of chemical products – all relevant – Notation key

129. The ERT notes that North Macedonia uses the notation key NE for NFR 2B10b due to the lack of official activity data and that, according to the Guidebook Chapter 2B Chemical industry p. 17, Tier 1 emission factors for estimating emissions of the storage, handling and transport of chemical products (2B10b) are not provided, since these emissions are included elsewhere (source categories 2B1–2B10a). All default Tier 1 emission factors for the chemical industry also include storage and handling in production. The ERT recommends that North Macedonia correct the notation key for 2B10b from NE to IE in the NFR table and that it specify in the IIR in which of the source categories 2B1–2B10a these emissions are included.

Category issue 7: 2.C.1 Iron and steel production – Hg – KCA

130. During the review, the ERT noted that according to the IIR (page 54, Table 8) NFR 2C1 was one of the key categories for Hg emissions, and that on page 59 in Table 20, where the results of the level and trend assessment for Hg are presented, the key Hg category 2C1 was missing. In response to a question about the issue, North Macedonia stated that this was an error in the IIR and to confirm this, they provided the ERT with a KCA analysis for Hg. The ERT recommended that North Macedonia correct this in the next IIR.

Category issue 8: 2.C.1 Iron and steel production –NO_x, $PM_{2.5}$, Zn, Se, HCB, PCB, PCDD/F, and total PAH-4 – EFs, Revised Estimates

131. During the review, the ERT noted that according to IIR p. 186 the method to calculate emissions from NFR 2C1 for the period 1990-2015 was Tier 1 and for the period 2016-2018 Tier 2 (with the inclusion of techniques for emission reduction). However, the ERT notes that the reference in IIR table 144 (p. 187-188) is to the Tier

2 method in Guidebook 2019 (Ch. 2C1, Table 3-19), where the EFs are not the same for Zn, Se, HCB, PCB, PCDD/F, and for total PAH-4 and that this could be a reason for an over-/under-estimation of emissions. The ERT also notes that in the NFR tables submitted for 2016, 2017 and 2018, emissions for NOx, $PM_{2.5}$ and PCB are reported using the notation key "NE", and emissions of Zn as zero ("0"), although there are EFs in the Guidebook.

132. Moreover, the ERT notes that North Macedonia has calculated emissions of HCB, Se and NH3, although the Guidebook does not provide EFs for them. In response to a question about these issues North Macedonia stated that for 1990-2015 Guidebook 2019 Tier 1 EFs had been used (Table 3.1), and for 2016-2018 Tier 2 methods, calculating emissions from steel production cold mills and hot mills separately, and that these emissions were summed up for 1990-2015, and that a problem had occurred in the table which is linked with the reporting table. North Macedonia also sent revised estimates for NOx, NMVOC, SO_x, NH_3, $PM_{2.5}$, PM_{10}, TSP, BC, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, PCDD/F, benzo(a)pyrene, total PAHs, HCB PCBs for 2016, 2017 and 2018 by technology. The ERT accepted the revised estimates and considers that the underestimates for PCBs, PCDD/F and total PAHs have a significant influence on the total emissions.

133. The ERT recommends that North Macedonia applies the revised estimates and reports the activity data (by technology) in the next submission (i.e. amount of steel produced and amount of steel processed in rolling mills), and notes that the activity data for NFR 2C1 is the amount of steel produced without the amount of steel processed in rolling mills. The ERT also recommends that the Party document details of the methods used to calculate emissions in the IIR and correct possible differences between the years e.g. T1 instead of T2.

134. The ERT commends North Macedonia on the explanations provided during the review and recommends that North Macedonia carry out, for the next inventory submission, basic checks for correspondence between EFs tables in the Guidebook and in the calculation tables.

Category issue 9: 2.C.2 Ferroalloys production – all relevant

135. The ERT noted dips in the ferroalloys production activity data in 2001 by 85% and 64% in 2009 and a jumps in 2004 by 346% (approx. a 4.5-fold increase) and 121% in 2010 (approx. a 4.2-fold increase). In response to a question about the issue, North Macedonia stated that there were several reasons for the fluctuation in the trend of ferroalloys production activity: the dip in 2001 was due to national war in Macedonia, the dip in 2009 due to the economy crisis, and also due to the fact that two main companies changed ownership over the years and that this influenced production. The ERT recommends including this information in the next submission.

Category issue 10: 2.C.3 Aluminium production, trend – HCB

136. The ERT noted jumps in the activity data for secondary aluminium production in 1999 by 84% and 54% in 2002, and a dip in 2004 by 80%. In response to a question about these fluctuations, North Macedonia stated that there were

changes in production capacity, and that a major company was closed in March 2004. The ERT recommends including this information in the next submission.

137. In the IIR p. 97 an explanation is given for the HCB trend stating that the significant emission reduction between 2003 and 2004 was due to aluminium production. In response to a question about the issue, North Macedonia stated the plant was closed. The ERT recommends including this information in the next submission.

Category issue 11: 2.C.5 Lead production – PCBs, Zn

138. The ERT notes in the IIR p. 99 that within the IPPU sector the main contributor to PCB emissions is Lead Production with a share of 95% (99% in 1990) of the national total. The ERT noted that the contribution of lead production in 1990 to the national total was actually 69.3% while the contribution of the whole IPPU sector in 1990 was 99%. In response to a question about the issue, North Macedonia agreed that there was an inconsistency. The ERT recommends correcting this in the IIR.

139. The ERT notes that North Macedonia reports emissions of Zn from Primary lead production for the period 1990 - 2014 using the notation key "NA" although a method is given in the Guidebook. In response to a question about the issue, North Macedonia stated that while inserting Tier 2 EFs from the Guidebook, Zn was unintentionally missed and that they would correct this for the next submission even if reporting of Zn was not obligatory. The ERT commends North Macedonia for reporting additional heavy metals and encourages North Macedonia to continue with voluntary reporting also in the future.

Category issue 12: 2.C.6 Zinc production – all relevant

140. The ERT noted that according to IIR pp. 197-198 Tables 157 and 158, all EFs used for emission estimation from primary zinc production as well as TSP and PM_{10} EFs for secondary zinc production were from the 2013 version of the Guidebook, although they corresponded to the 2019 version of the Guidebook. In response to a question about the issue, North Macedonia confirmed this and stated that they would correct it for the next submission. The ERT recommends that North Macedonia correct the references for the next submission.

Category issue 13: 2.C.7.c Other metal production – SO_2 – missing emissions, TSP, SO_2 – Revised Estimates

141. The ERT notes that North Macedonia, according to IIR p. 201, uses the Tier 1 method from the 2013 of the Guidebook for the calculation of TSP emissions from silver production. The ERT notes that in the 2019 version of the Guidebook there are Tier 1 EFs for both TSP and SO_2 and that the missing SO_2 emissions lead to an underestimation of SO_2 emissions. As the activity data on silver production is available for the period 1990 - 1998 the ERT asked North Macedonia to provide revised estimates for SO_2 and TSP during the review. North Macedonia provided the ERT with the revised estimates which were low compared to the national totals. The ERT recommends that North Macedonia document the methodology and report all revised

estimates for all years during which the activity has existed in the country in the next submission.

Category issue 14: 2.D.3.b Road paving with asphalt - NMVOC, TSP, PM10, PM2.5, BC

142. According to the IIR pp. 203- 204, North Macedonia is planning, in cooperation with the Statistical Office (SSO), to gather more reliable historical activity data for 2D3b as statistical data on asphalt production is incomplete due to changes of ownership and the closure of some asphalt production companies. The ERT noted the possibility for underestimation of NMVOC, TSP, PM10, PM2.5 and BC emissions for the historical period 1990-2014 and asked for a time frame for the investigation and correction of these activity data. North Macedonia explained that the time frame depended on the SSO's options for obtaining these data and that they had started to fill the MAKSTAT database with historical data and would discuss the possibility to obtain historical data with the SSO in September - October. There is also the problem that after 1990 all asphalt bases were within 4-5 state-owned enterprises and during the 1990s several of these companies went bankrupt, making it difficult to obtain historical activity data due to no longer existing contacts, but that they would try to solve this issue within the IPA Technical Project in 2021. The ERT is aware of the difficulties and recommends that the Party include these issues in the improvement plan with clear steps and a time frame and that it report on progress on the issues while also including the information provided during the review in the next submission.

143. The ERT noted a jump in all emissions of 145% in 1999 (an approx. 2.4-fold increase) in road paving with asphalt. In response to a question about the issue North Macedonia stated that in the statistics the length of roads was at its highest level in 1999. The ERT recommends that North Macedonia include this information in the next submission.

Category issue 15: 2.K Consumption of POPs and heavy metals - Hg, PCBs, Revised Estimates

144. The ERT notes that the notation key "NE" is used for emissions of Hg and PCB from category 2K. The ERT notes that an EF based on population is given in the Guidebook. When asked why it had not calculated Hg and PCBs emissions, North Macedonia responded that they would make efforts to obtain valid historical activity data and use the Tier 2 method of the Guidebook, but that it was difficult to set a time frame to achieve that, and that there was also a possibility that some of the historical activity data from some of the bankrupt companies would never be obtained but the Ministry of Environment and Physical Planning, in cooperation with the SSO, would make every effort to obtain more accurate historical activity data in the next 3-4 years. The ERT recommends that North Macedonia attempts to obtain valid historical activity data which can be probably used for Tier 3 emission modelling, and the use of facility data, once they become available. In the meantime, to improve the completeness of the inventory, the ERT asked North Macedonia to send a revised estimate of PCB and Hg emissions from NFR 2K using the Guidebook Tier 1 method for 2005, 2010 and 2018. North Macedonia provided a revised estimation for the whole historical trend for Hg and PCB emissions. The ERT recommends that North Macedonia include these

estimates in the next submissions and that it also include the information provided during the review in the IIR, while also including the further development of methods in the improvement plan and reporting on progress in future submissions.

SOLVENTS

Review Scope

Pollutants Reviewed		All pollutants		
Years		1990 – 2018		
Code	**Name**	**Reviewed**	**Not Reviewed**	**Recommendation Provided**
2D3a	Domestic solvent use including fungicides	x		x
2D3d	Coating applications	x		x
2D3e	Degreasing	x		x
2D3f	Dry cleaning	x		x
2D3g	Chemical products	x		x
2D3h	Printing	x		
2D3i	Other solvent use	x		x
2G	Other product use	x		x
Note: Where a sector has been partially reviewed (e.g. some of the NFR codes) please indicate which codes have been reviewed and which have not in the respective columns.				

General recommendations on cross cutting issues

Transparency

145. North Macedonia provided a generally transparent emission inventory for the Solvents sector. The methodology, emissions factors, and activity data in North Macedonia's inventory are generally well documented in the IIR and the use of notation keys is appropriate. North Macedonia does not use country-specific methods for the Solvents sector.

146. North Macedonia reports activity data for the Solvents sector categories in the NFR19 tables and in the IIR. The ERT commends North Macedonia on this and recommends that North Macedonia further improve reporting of activity data as indicated in the Sub-Sector Specific Recommendations.

147. North Macedonia has provided reasons for dips and jumps in the time series in the IIR. The ERT commends North Macedonia for the trend descriptions.

Completeness

148. In the 2020 submission, North Macedonia has reported emissions for the whole historical trend (1990-2018) for the Solvents sector for all categories within the scope of the Solvents sector.

149. Regarding pollutants, the ERT considers the Solvents sector to be almost complete; however, there is room for additional improvement and the estimation of missing emissions (e.g. NFRs 2D3a, 2D3d, 2D3e, 2D3g, 2D3i, 2G) as explained under the Sub-Sector Specific Recommendations.

150. The ERT commends North Macedonia for including black carbon emissions for the whole time series in the relevant source categories of the Solvents sector.

Consistency including recalculation and time series

151. The emission trend and activity data trend are in general consistent. During the review, the ERT did not identify any outliers for the Solvents sector.

152. The ERT notes that North Macedonia has performed recalculations and other changes in emissions, source categories and years in its latest submission in response to the review process and documented the rationale and the impacts on the sector and emission trends in the IIR.

Comparability

153. The ERT considers the inventory to be comparable with those of other reporting Parties. The methods used by North Macedonia to create the inventory for the Solvent sector are consistent with the Guidebook and emissions are reported in the latest NFR19 format.

Accuracy and uncertainties

154. The ERT did not find any over- or under-estimations in the Solvent sector as explained under Sub-Sector sector-specific recommendations.

155. The ERT notes that not all key categories have been estimated with T2 or higher methods as explained under Source Specific Recommendations and notes that using a Tier 1 method can lead to under- or overestimations of emissions.

156. North Macedonia provided a description of the quality management system in the IIR. North Macedonia has source-specific QA/QC checking procedures for the Solvents sector. The ERT commends North Macedonia on its general quality QA/QC activities; however, the ERT noted a need for some additional checks as indicated under the Sub-Sector Specific Recommendations.

157. North Macedonia provided a source-specific qualitive uncertainty analysis for the Solvents sector. The ERT recommends that North Macedonia include a quantitative uncertainty analysis in line with paragraph 31 of the Reporting Guidelines.

Condensable Particulate Matter

158. North Macedonia does not provide explanatory information in the IIR on whether particle emissions include or exclude the condensable component. The ERT recommends that North Macedonia include such information in the next submission following Annex II of the 2014 Reporting Guidelines.

Improvement

159. North Macedonia reported on improvements made and planned for the next period in the IIR. During the review the ERT identified some additional need for improvement as explained under Sub-Sector Specific Recommendations.

Potential Technical Corrections

160. No potential technical corrections were identified by the ERT.

Sub-Sector Specific Recommendations

Category issue 1: 2.D.3.a, 2.D.3.d, 2.D.3.e – trends, NMVOCs

161. The ERT noted on IIR p. 54 Table 8 information on key categories for NMVOC emissions, which among others include NFRs 2D3d, 2D3a and 2D3e and on pp. 55-56 Table 10 the results of the level and trend assessment for NMVOC, which do not include NFRs 2D3d, 2D3a, 2D3e. In response to a question about the issue North Macedonia stated that this was an error and provided explanations which the ERT accepted. The ERT recommends that North Macedonia correct the information in the IIR.

Category issue 2: 2.D.3.a Domestic solvent use including fungicides – missing NMVOCs

162. The ERT notes on IIR p. 54 Table 8 that North Macedonia is not planning any source-specific improvements for category 2D3a; however, using a Tier 1 method is not a best practice method for a key category and could result in an over- and/or under-estimate of emissions that may have an impact on the total emissions above the significance threshold. In response to a question about whether the use of a Tier 2 method could be possible for North Macedonia if activity data could be stratified according to the different products and product types and a request to provide a revised estimate using a Tier 2 method, North Macedonia stated that they were using Tier 1 since they did not have detailed data or the capacity to use the time consuming Tier 2 approach; however, they were planning to improve the Solvent and Agriculture inventory in the upcoming IPA Technical Project on Air quality in 2021 and would apply for an additional TAEIX expert mission at the end of this year. The ERT notes that according to the paragraph 21 of the Reporting Guidelines, Parties should make every effort to use a Tier 2 or higher (detailed) methodology, including country-specific information for key categories.

163. Aware of the challenges of moving to Tier 2, the ERT recommends that North Macedonia include moving to Tier 2 in its short-term improvement plan with clear steps and a schedule and that it report on progress in the IIR. The ERT also notes that the national statistical office, wholesale businesses or industry associations may have the statistics on the consumption of different products that are part of domestic use and required for the calculation of NMVOC emissions with Tier 2b of the Guidebook. Alternatively, as presented on p.18 of Ch. 2D3a in Guidebook 2019, product consumption may be calculated from statistics on the production of these products,

provided that import and export data are available. If only production data are available for a certain product and import/export data are not available for that same product, import/export data on a related (chemical) product could be used as a proxy to estimate the use of this product. Product and product types for which consumption data is needed are: Cosmetics and toiletries, Household products, Car care products, Do it yourself (DIY)/buildings (adhesives, sealants, filling agents), Pesticides and Pharmaceutical products. Guidebook 2019 also presents additional emission factors for product use. However, these are per-capita emission factors and it is recommended that these be used only in specific cases, for instance if the product statistics for the use of the Tier 2b approach are not complete in terms of the product types covered by domestic solvent use. The ERT also noted that on p. 15 of Ch. 2D3a in Guidebook 2019 there is Box 1 with an overview of the typical products covered by domestic use with an example of the products within the range of Cosmetics and toiletries. When asked to check if these data existed in the country, North Macedonia responded that there were some data, but that in the import-export statistics only the most important product were listed by country and by quantity, and that the data were not detailed or complete. The Party also provided an Excel file with data that could be used for the Tier 2 calculations for the next submission.

164. The ERT commends North Macedonia for the checks it has performed and the search for activity data and recommends that North Macedonia, to complete the required set of activity data, checks e.g. in MACSTAT the existence of the following products, in addition to Cosmetics and toiletries: Car care products - all types of Aerosols, Antifreeze, Brake fluids, Car waxes and polishes, De-icer pumps, Engine degreasers, Windscreen washing fluid; Household products - all types of Aerosols, General purpose cleaners, Glass cleaner, slow release Air freshener, Toilet block, Disinfectants, Waxes and polishes; and DIY/buildings - Carpet/tile adhesives, Pipe cements, Construction adhesives, Paint thinners, Paint remover, Solvents; Pesticides; Pharmaceutical products.

165. The ERT recommends that North Macedonia collect all mentioned activity data that exist in North Macedonia and calculate NMVOC emissions from 2D3a with the Tier 2 methodology according to the Guidebook for the next submission of the inventory and that it document the methods used by clearly indicating which of the products are still missing from the inventory. Regarding the remaining products, the ERT recommends that North Macedonia include these in the improvement plan with clear steps and a schedule for collecting the data and that it report on progress in the next submissions.

Category issue 3: 2.D.3.d Coating applications – NMVOCs

166. The ERT notes on IIR p. 208 that North Macedonia does not include category 2D3d in the improvement plan, and that according to p. 54 Table 8, NFR 2D3d is a key category for NMVOC in 2018. The ERT notes that using a Tier 1 method is not a best practice method for a key category and could result in an over- and/or under-estimate of emissions and that according to paragraph 21 of the Reporting Guidelines, Parties should make every effort to use a Tier 2 or higher (detailed) methodology, including country-specific information for key categories. The ERT notes

that that the relevant activity statistics include: the number of painted buses/cars/trucks to calculate the emissions for vehicle coatings; the mass of wire coated to calculate the emissions for wire coating; the mass of leather coated to calculate the emissions for leather finishing; the use of paint to calculate the emissions for all other sources like paint application-construction and buildings, paint application-domestic use (except SNAP 060107), wood coating, coil coating, vehicle refinishing, or other non-industrial paint application.

167. When asked if the use of a Tier 2 method could be possible for North Macedonia if activity data could be stratified according to the different objects being painted, as well as the different paints used and the quality of these paints (VOC emission reduction measures that may be in place), North Macedonia answered that they would include this in the improvement plan.

168. The ERT recommends that North Macedonia include its plan to move to a Tier 2 methodology in the improvement plan with an indication of clear steps and a schedule while also reporting on progress with the work in future submissions.

Category issue 4: 2.D.3.e Degreasing – NMVOCs

169. The ERT noted in the IIR p. 209 that North Macedonia applied a Tier 1 method according to the 2006 version of the Guidebook for NMVOC emissions from category 2D3e, and that according to p. 54 Table 8 NFR 2D3e is a key category for NMVOC in 2018. The ERT notes that using a Tier 1 method is not a best practice method for a key category and could result in an over- and/or under-estimate of emissions and that according to paragraph 21 of the the Reporting Guidelines, Parties should make every effort to use a Tier 2 or higher (detailed) methodology, including country-specific information for key categories.

170. The ERT notes that NMVOC emissions can be calculated using solvents statistics on the sales of cleaning products and the Tier 2 method according to Guidebook 2019. The ERT notes that according to the Guidebook the most common organic solvents for vapour cleaning are: methylene chloride (MC), tetrachloroethylene (PER), trichloroethylene (TRI) and xylenes (XYL) that normally require a closed cleaning machine while for batch-loaded cold cleaners the primary solvents used are mineral spirits, Stoddard solvents (white spirit) and alcohol like propylene glycol.

171. As agreed with North Macedonia during the review, the ERT recommends that the Party move to the Tier 2 method for the next submission as soon as possible, or that it meanwhile include this improvement in the improvement plan with clear steps and a schedule, and that it also report on progress with the work in the next submissions.

Category issue 5: 2.D.3.g Chemical products – missing emissions NMVOCs, TSP, Cd, As, Cr, Ni, Se, PAHs

172. During the review, the ERT looked through the activities included in the inventory under category 2D3g, and noted that some of the activities covered in the 2019 version of the Guidebook, were not included in the inventory of North Macedonia,

such as: Asphalt blowing, Adhesive tape manufacturing, Pharmaceutical products manufacturing, Textile finishing and Manufacture of tyres. In the IIR on p. 213, there is information about a plan to check the availability of data on Textile finishing and Pharmaceutical products manufacturing and to report the related emissions in the following submissions; however, there is no information on why activities such as Asphalt blowing, Adhesive tape manufacturing and Manufacture of tyres are not included.

173. The ERT notes that as activities such as Asphalt blowing, Adhesive tape manufacturing, Textile finishing, Manufacture of tyres and Pharmaceutical products manufacturing are not included in the inventory, o NMVOC, TSP, Cd, As, Cr, Ni, Se and PAH emissions are under-estimated. In response to a question about the issue, North Macedonia stated that some activities could be included in the inventory in the next submission, for instance Pharmaceutical products and Textile finishing, but also that a Technical Project would be carried out in 2021, which would include a component for inventory improvement and that they would include this recommendation in the activities. The ERT recommends that North Macedonia estimate and include the missing emissions in the inventory with the related documentation in the IIR as soon as possible, and where not possible, that it include the remaining parts in the inventory improvement plan with clear steps and a schedule, while also reporting on progress with the work in the next submissions.

Category issue 6: 2.D.3.i, 2.G Other solvent and product use – NMVOCs, allocation of emissions and documentation

174. The ERT notes that according to information in the IIR p. 214, emissions for the activities Fat, edible and non-edible oil extraction, Preservation of wood, Use of tobacco and Use of shoes are included under NFR 2G while for NFR category 2D3i, the notation key “IE” has been used, and that in the NFR19 tables emissions are reported in both categories. When asked about the allocation of NMVOC emissions, North Macedonia responded that under 2G they reported emissions from Tobacco use (tonnes) and Use of shoes calculated from produced, imported and exported products, and that under 2D3i emissions from Fat, edible and non-edible oil extraction and Preservation of wood were included. The ERT recommends that North Macedonia add the missing information on the sources included as well as a full documentation of the methods used for calculation of emissions to its next IIR submission.

175. Moreover, the ERT notes in the IIR p. 214 Table 176 that there are no units for the activities and that Table 177 on pp. 215-217 should be in line with Guidebook 2019 Table 3-15 on Tier 2 emission factors for the source categories 2D3i and 2G. The ERT recommends that North Macedonia correct the information in the next submission.

Category issue 7: 2.D.3.i, 2.G Other solvent and product use – NMVOCs, missing emission sources

176. The ERT noted that North Macedonia did not include emissions estimates in the inventory for activities like

177. Use of fireworks, Other product use (concrete additive, cooling lubricant, lubricant, pesticide and other industrial applications of solvents in products) and Barbecue, which fall under the scope of NFR 2G and

178. Glass wool enduction, Mineral wool enduction, Application of glues and adhesives, Underseal treatment and conservation of vehicles, Vehicles dewaxing and Other (preservation of seeds,...), which fall in the scope of NFR 2D3i.

179. In response to a question about the issue North Macedonia stated that for Use of fireworks they could not find data, and for other activities they would ask for information and if no information was found they would discuss in upcoming projects how to proceed with the calculations. The ERT recommends that North Macedonia check whether the mentioned activities under 2.G and 2.D.3.i existed in the territory of North Macedonia (e.g. MACSTAT), and that it include information on existing sources in the IIR for the next submission. The ERT also recommends that North Macedonia make an effort to collect activity statistics and calculate all missing emissions using the methodology presented in the Guidebook, and that it document the calculations in the IIR in the next submission. In case this is not possible for all missing sources, the ERT recommends that the Party include the remaining missing sources in the inventory improvement plan with clear steps and a schedule and that it report on progress with the work in the next submissions.

AGRICULTURE

Review Scope

Pollutants Reviewed		SO_2, NOx, NMVOC, NH_3, PM_{10}, $PM_{2.5}$ & TSP		
Years		1990 – 2018 + (Protocol Years)		
Code	**Name**	**Reviewed**	**Not Reviewed**	**Recommendation Provided**
3B1a	Dairy cattle	x		x
3B1b	Non-dairy cattle	x		x
3B2	Sheep	x		
3B3	Swine	x		x
3B4a	Buffalo	IE		
3B4d	Goats	x		
3B4e	Horses	x		
3B4f	Mules and asses	NE		
3B4gi	Laying hens	x		x
3B4gii	Broilers	x		
3B4giii	Turkeys	x		x
3B4giv	Other poultry	x		
3B4h	Other animals	NO		
3Da1	Inorganic N fertilisers (includes also urea application)	x		x
3Da2a	Animal manure applied to soils	x		x
3Da2b	Sewage sludge applied to soils	NA		
3Da2c	Other organic fertilisers applied to soils (including compost)	NA		
3Da3	Urine and dung deposited by grazing animals	x		x
3Da4	Crop residues applied to soils	NA		
3Db	Indirect emissions from managed soils	NA		
3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products	NE		x
3Dd	Off-farm storage, handling and transport of bulk agricultural products	NA		
3De	Cultivated crops	NE		x
3Df	Use of pesticides	NO		
3F	Field burning of agricultural residues	NO		
3I	Agriculture other	NO		
11A	Volcanoes	NO		
11B	Forest fires		x	
Note: Where a sector has been partially reviewed (e.g. some of the NFR codes) please indicate which codes have been reviewed and which have not in the respective columns.				

General recommendations on cross cutting issues

Transparency

180. The ERT considers the Agriculture sector inventory in general transparently described in the IIR. Information on data sources including references is provided and the recalculations are documented. However, the ERT identified

(a) a further need to complete and update the documentation regarding some emission sources on page 224 and page 237 Table 191 as explained under Sub-Sector Specific Recommendations below.

(b) a need to revise incorrectly reported notation keys in line with paragraph 12 of the Reporting Guidelines as explained under Sub-Sector Specific Recommendations.

(c) a need to explain the recalculation for NFR 3Da in greater detail in the IIR regarding emissions, sources, years and the impact of the recalculations on emission levels.

Completeness

181. The ERT considers the Agriculture sector to be complete in terms of sources, pollutants and years.

Consistency including recalculation and time series

182. The ERT considers the Agriculture sector inventory time series internally consistent for all reported years and for all elements across the subsectors, categories and pollutants. No outliers were identified.

183. According to the IIR, no major recalculations have been carried out in the Agricultural sector, except for minor corrections in NOx emissions for the years 2008-2017 in category 3Da in the 2020 submission.

Comparability

184. The ERT considers the Agriculture sector inventory to be in general comparable with those of other reporting Parties. The methodologies used in the inventory are in accordance with the Guidebook, except for the use of some old emission factors from the 2013 version of the Guidebook as explained under Sub-Sector Specific Recommendations below. The inventory has been submitted in the latest NFR format.

Accuracy and uncertainties

185. The ERT did not identify any under- or over-estimates.

186. The Party does not use Tier 2 or higher methods for all of the key categories e.g. for NH_3 from NFR 3B. The ERT recommends that the Party use Tier 2 or higher methods for all key categories in line with paragraph 21 of the Reporting Guidelines.

187. The IIR contains a section presenting uncertainties for activity data and emission factors for 3.B Manure Management and 3.D.a inorganic fertiliser; however, this is areference to the Guidebook of 2013. The ERT commends the Party for estimating uncertainties for the sector and recommends the use of information on uncertainties from the 2019 version of the Guidebook in its next annual submission.

188. The Party carries out some basic QA/QC checks that are presented in the IIR.

Improvement

189. The ERT notes that the Party has made the following improvements: information on uncertainty analysis and QA/QC checks has been included as well as an explanation of trends. The method used for inorganic fertilisers has also been improved according to former recommendations. Particle emissions have been calculated and documented in the IIR; however, emissions from NFR 3D1 should be accounted for under NFR 3Dc as explained in the Sub-Sector Specific Recommendations below.

190. The ERT notes the following planned improvements: the Party's intention to move from Tier 1 to the Tier 2 method for estimating NH_3 emissions from the key category 3B. The work to include emissions from the application of sewage sludge has not been finalised and is not included in the 2020 submission. During the review North Macedonia provided information about progress concerning activity data and possibilities for including these emissions in the future submissions. The ERT welcomes these improvements.

Condensable Particulate Matter

191. North Macedonia does not provide information on whether particle emissions include/exclude the condensable component, The ERT recommends that the Party include this information in line with Annex II of the Reporting Guidelines.

Potential Technical Corrections

192. No technical corrections were made during the review. North Macedonia provided revised estimates as explained under Sub-Sector Specific Recommendations and documented in Annex I.

Sub-Sector Specific Recommendations

Category issue 1: 3.B Manure management - Accuracy

193. The calculation of NH_3 emissions from manure management is transparent as livestock numbers and EFs are given in the IIR. This is a key category contributing to 91 per cent of the total national NH_3 emissions. Though a recommendation was made in the previous stage 3 review, the Party is still using a Tier 1 method. The ERT recommends that North Macedonia estimate emissions from key categories using at least the Tier 2 method provided in Chapter 3B of the Guidebook. During the review North Macedonia communicated its plan to implement this in 2021. If this project is not finished in time for the next submission, the ERT recommends that the Party use the updated Tier 1 EFs from the 2019 Guidebook and provide information on the improvement work with clear steps and a schedule and that it report on progress with the work.

194. The ERT identified the following improvement needs in the use of notation keys and recommends that the Party use notation keys in line with paragraph 12 of the Reporting Guidelines:

- For 3B3, 3B4gi, 3B4giii the Party has reported emissions for Black carbon (BC) using the notation key “NE”. Emissions of these pollutants are not expected from these categories as no methods are provided in the Guidebook. The ERT recommends using the notation key “NA”.

- For 3B3, emissions of Pb are reported using the notation key “NE”. Emissions of this pollutant are not expected from this category as no methods are provided in the Guidebook, and “NA” is recommended.

- For 3B1b, emissions of CO are reported using “NE”. Emissions of this pollutant are not expected from this category as no methods are provided in the Guidebook, and the notation key “NA” is recommended.

Category issue 2: 3.D. Agricultural Soils - Transparency

195. The NH_3 emissions from manure application to land (3Da2a) and from excreta deposited during grazing (3Da3) are wrongly described in the IIR as being included elsewhere “IE” under NFR 3B. In the NFR reporting tables the emissions are reported under 3D. The ERT encourages North Macedonia to correct the information in the future IIR.

196. NO_x emissions from NFRs 3Da2a and 3Da3 are reported as “IE”. However, it is possible to calculate emissions using emission factors and activity data if the Party chooses to implement a Tier 2 method using the nitrogen-flow tool.

197. Notation keys: For NFRs 3Da2a and 3Da3 the Party has reported emissions for black carbon (BC) using the notation key “NE”. Emissions of these pollutants are not expected from these categories and no methods are provided in the Guidebook. The ERT recommends using notation key “NA”.

Category issue 3: 3.D.1 Inorganic fertilisers - Consistency and Transparency

198. The ERT notes that North Macedonia uses emission factors from the 2013 Guidebook and reports NMVOC, $PM_{2.5}$ and PM_{10} emissions from inorganic fertilisers under NFR 3D1. According to the 2016/2019 versions of the Guidebook there is no method for calculating these emissions. The ERT therefore recommends that the Party report the notation key “NA” instead of emission values.

199. The ERT also notes with regard to the use of emission factors from the 2013 Guidebook in NFR 3Da1 that the 2016/2019 Guidebook versions refer to NFR 3De, Cultivated crops (NMVOC) and NFR 3Dc, Farm-level agricultural operations ($PM_{2.5}$ and PM_{10}). There are no methods given for 3Da1 in the 2016/2019 Guidebook, the ERT therefore recommends the use of "NA" in NFR 3Da1 for NMVOC, $PM_{2.5}$ and PM_{10}. In addition, the Party should estimate the currently missing NMVOC emissions

from NFR 3De and $PM_{2.5}$ and PM_{10} emissions from NFR 3Dc using the 2019 Guidebook version Table 3.1. For 3D1 the ERT recommends that the Party replace the emission values with the notation key “NA”.

200. During the review North Macedonia made corrections and provided a revised timeseries for NMVOC emissions from NFR 3De and particle emissions, $PM_{2.5}$, PM_{10} and TSP from NFR 3Dc as presented in Annex I to this review report.

201. The Party uses an emission factor for NOx emissions from inorganic fertiliser from the 2013 version of the Guidebook, but the IIR refers to an EF from the 2016 Guidebook. To improve consistency, the ERT recommends that the Party always use updated EFs from the same and the latest Guidebook version and recalculate the emissions for the time series for the next submission. During the review North Macedonia provided a revised estimate for NOx emissions from NFR 3D1 using updated emission factors as presented in Annex I to this review report.

Category issue 4: 3.D.c Farm-level agricultural operations and 3.D.e - Cultivated crops

202. The ERT identified the following incorrect uses of the notation keys and recommends that the Party always use notation keys in line with paragraph 12 of the Reporting Guidelines:

- For NFRs 3Dc and 3De the Party has reported NOx emissions using the notation key “NE”. As these emissions are not expected from these categories and no methods are given in the Guidebook, the ERT recommends the use of the notation key “NA”.
- For NFRs 3Dc and 3De the Party has also reported emission of SO_2 using the notation key “NE”. As emissions of these pollutants are not expected from these categories and no methods are provided in the Guidebook, the ERT recommends the use of the notation key “NA”.
- For NFR 3Dc the Party has reported emissions of NH_3, BC, CO heavy metals and POPs as “NE”. As emissions of these pollutants are not expected from this category and no methods are presented in the Guidebook, the ERT recommends the use of the notation key “NA”.

WASTE

Review Scope

Pollutants Reviewed		SO_2, NOx, NMVOC, NH_3, PM_{10} & $PM_{2.5}$, Heavy metals, POPs		
Years		1990 – 2018 + (Protocol Years)		
Code	**Name**	**Reviewed**	**Not Reviewed**	**Recommendation Provided**
5A	Solid waste disposal on land	X		X
5B1	Biological treatment of waste - Composting		X	
5B2	Biological treatment of waste - Anaerobic digestion at biogas facilities		X	
5C1a	Municipal waste incineration		X	
5C1bi	Industrial waste incineration		X	
5C1bii	Hazardous waste incineration		X	
5C1biii	Clinical waste incineration	X		X
5C1biv	Sewage sludge incineration		X	
5C1bv	Cremation		X	
5C1bvi	Other waste incineration		X	
5C2	Open burning of waste	X		X
5D1	Domestic wastewater handling	X		X
5D2	Industrial wastewater handling	X		X
5D3	Other wastewater handling		X	
5E	Other waste	X		X
Note: Where a sector has been partially reviewed (e.g. some of the NFR codes) please indicate which have codes have been reviewed and which have not in the respective columns.				

General recommendations on cross cutting issues

Transparency

203. North Macedonia has provided a detailed and generally transparent emissions inventory. Estimates are provided at a detailed level for all waste sub-sectors. The ERT considers North Macedonia's methodology and emission factors in the IIR to be generally transparent and well described. The ERT has provided several recommendations for further improving the transparency in the Chapter Sub-sector specific recommendations.

204. The ERT notes that notation keys are not always used in compliance with paragraph 12 of the Reporting Guidelines as listed below. The ERT recommends that the Party correct the notation keys and provide detailed information of their use in the IIR:

a) NFRs 5C1bi, 5C1bii, 5C1biv: "NE" is reported for NH_3 emissions, while the other pollutants are reported as "NO", the Party responded that they would correct the notation keys;

b) NFR 5C1bv: “NA” is reported for NH_3 emissions, while the other pollutants are reported as “NO”, the Party responded that they would correct the notation keys;

c) NFR 5D1: “NE” is reported for NH_3 emissions, while the other pollutants are reported as “NA”, the Party responded that they included an explanation in the IIR and could reallocate the emissions;

d) NFR 5D2: “NE” is reported for NH_3 emissions, while the other pollutants except NMVOC are reported as “NA”, the country responded that they included an explanation in the IIR and would correct the notation key to NA;

e) NFR 5B2: “NA” is reported for the whole category, the Party responded that they included an explanation in the IIR; the ERT notes that pollutants for which there are methods in the Guidebook should be reported or the notation key NE should be used;

f) NFR 5C1a: “NO” is reported for the whole category, the Party responded that they included an explanation in the IIR;

g) NFR 5C1bvi: “NA” is reported for the whole category, the Party responded that they included an explanation in the IIR; the ERT notes that pollutants for which there are methods in the Guidebook should be reported or the notation key NE should be used;

h) NFR 5D3: “NA” is reported for the whole category, the Party responded that they included an explanation in the IIR;

i) NFR 5E: “NO” is reported for the whole category, the Party responded that they would change the notation key to NE and try to obtain the data necessary for estimating this category.

205. The ERT recommends that North Macedonia use the notation key NO for all pollutants when an activity does not occur in the country and that it explain the use of the notation key in their IIR in line with paragraph 12 of the Reporting Guidelines.

206. The ERT notes that several emission factors are missing in the IIR. North Macedonia responded that they would include them in the next IIR. The ERT recommends that North Macedonia include them for:

a) NFR 5C1biii: emission factors of SO_x, Hg, As and Ni

b) NFR 5C2: emission factors of As, Ni, Zn

207. The ERT recommends that North Macedonia include an explanation of emission trends in the IIR for all reported categories and pollutants.

208. The ERT recommends that North Macedonia report the same set of activity data for category 5A for the calculations and in the IIR.

Completeness

209. The ERT considers the Waste sector inventory to be incomplete and the ERT has provided recommendations for the missing pollutants and sources under Sub-Sector Specific Recommendations. In the Waste sector, North Macedonia reports emissions only from NFR 5A Solid waste disposal on Land, NFR 5C1biii Clinical waste incineration, NFR 5C2 Open burning of waste since 1990 and NFR 5D2 Industrial wastewater handling. The ERT recommends establishing a system for the collection of waste statistics data at national level which can be used as activity data in the inventories. The ERT recommends completing the inventory by estimating and reporting emissions from all existing sources and documenting them in the IIR.

210. The ERT notes that NH_3 emissions from domestic wastewater handling have been allocated to NFR 5D2 and recommends reallocating the emissions to category 5D1.

211. The ERT notes that NMVOC emissions from 5D2 are reported only forone year in the inventory and recommends collecting activity data for the whole time-series for category 5D2. Only emissions from industrial wastewater handling should be reported under category 5D2.

Consistency, including recalculation and time series

212. The ERT noted some inconsistencies in the time series as explained under Sub-Sector Specific Recommendations.

213. North Macedonia has recalculated several categories in the 2020 submission, but the IIR does not include all the necessary explanations. The ERT recommends that North Macedonia provide detailed explanations of recalculations, including the rationale, the impact on the sector and the implications for trends in the Waste sector in its IIR.

Comparability

214. The ERT considers the Waste sector inventory to be comparable with other reporting Parties. The allocation of emissions and the methodologies used are generally in line with Guidebook 2019. Recommendations for improvements are provided under Sub-Sector specific Recommendations (see below). The inventory has been prepared using the latest version of the NFR table.

Accuracy and uncertainties

215. The ERT did not identify systematic under- or overestimations.

216. Tier 1 methods from Guidebook 2019 are used for all categories, including NMVOC and CO from NFR 5A, Cu, Hg and PCDD/PCDF from 5C1biii and Zn from 5C1 which are key categories of the mentioned pollutants. The ERT has provided a recommendation about this issue in the sub-sector specific recommendations below. The ERT has also prepared a technical correction for NMVOC emissions from the

category 5A, which the Party has accepted, confirming that that it would implement it in the next submission.

217. North Macedonia provided a quantitative uncertainty analysis in this submission. The ERT recommends that North Macedonia elaborate on how the results of the UCA are used to prioritise further improvements in the future submissions.

218. The Party provides a description in the IIR of the QA/QC checks carried out in the Waste sector. However, due to several calculation errors identified during the review within the Waste sector, the ERT recommends that North Macedonia improve its QA/QC procedure to ensure the accuracy of the data and avoid errors in the next submissions

219. The Party provided several Revised Estimates during the review related to the ERT's observations and the ERT accepted these and recommends that the Party include them in the next submission.

Condensable Particulate Matter

220. The ERT did not find any clear information on whether particle emissions include or exclude the condensable component The ERT recommends that North Macedonia search for the relevant information available in Guidebook 2019 and for other sources used for estimations, and that it include this information in the next submission as explained in Annex II of the Reporting Guidelines.

Improvement

221. The ERT commends North Macedonia for its continuous improvements of the Waste sector inventory. The ERT acknowledges North Macedonia´s efforts to establish a national data reporting system for waste and to improve the collection of comprehensive time-series data for estimating emissions from domestic wastewater handling.

222. The ERT recommends that North Macedonia include in the improvements the checking of the availability of data on industrial wastewater handling and on accidental car/administrative buildings/houses fires to estimate emissions from these activities for the whole time-series.

Potential Technical Corrections

223. The ERT provided a technical correction for NMVOC emissions from category 5A during the review. North Macedonia calculated several revised estimates during the review as presented in Annex I of this review report.

Sub-Sector Specific Recommendations

Category issue 1: 5A Solid waste disposal on land – Key category of NMVOC, CO, emission factors, accuracy, transparency

224. Landfill disposal has been identified by the ERT as a key category of NMVOC emissions and North Macedonia uses a Tier 1 method for its estimations. The Party sent a revised estimate, but the ERT did not accept it, due to an error in the calculation. The ERT sent a technical correction and the Party agreed to include it in the next submission.

225. The ERT notes that $PM_{2.5}$ emissions are higher than the emissions of PM_{10}. In response to a question about the issue, the Party stated that they missed one zero in the emission factor and sent the ERT a revised estimate, which the ERT accepted. The ERT recommends that North Macedonia correct the emission factor for $PM_{2.5}$ in line with the revised estimate sent to the ERT during the review in the next submission.

226. The ERT notes that the methodology used to calculate NMVOC and CO emissions is not transparently described in the IIR. In response to a question about the issue, the Party stated that they calculated the emissions of these pollutants using two methods, the Tier 1 methodology from Guidebook 2019 for emissions of NMVOC and estimations based on the data on landfill gas for NH_3 and CO. The ERT recommends that the Party provide a detailed explanation of the methodology used for the calculation of emissions in the IIR for the next submission.

Category issue 2: 5C1biii Clinical waste incineration – emission factors, transparency, accuracy, potential key category of PCDD/F,

227. The ERT identified a problem with emission estimates of PCDD/F, which were 1000 times lower than expected when using the EF from Guidebook 2019. In response to a question about the issue, the Party stated that they had used the wrong correction factor and sent a revised estimate, which the ERT accepted. The ERT recommends that North Macedonia correct these PCDD/F emissions in the next submission according to the revised estimate sent to the ERT.

228. The ERT noted that after the correction of the above mentioned PCDD/F emissions, this category became a key category for emissions of PCDD/F and asked North Macedonia if was possible to use a higher tier method to estimate emissions from this category. The Party responded that there was only one emission source in this category in the country and that they could use a higher method. The ERT recommends that North Macedonia develop a higher tier method, as in line with paragraph 21 of the Reporting Guidelines, Parties should make every effort to use a Tier 2 or higher (detailed) methodology for key categories, including country-specific information.

229. The ERT notes that no information is provided in the IIR regarding a reference for the source of emission factors of SO_x, Hg, As and Ni. In response to a question about the issue, the Party stated that they would include the reference in the

next submission. The ERT recommends that the Party provide the reference and an explanation of the methodology used to estimate emissions in the next submission.

Category issue 3: 5C2 Open burning of waste – Key category of Zn, transparency, emission factors

230. The ERT noted that to estimate Zn emissions an EF of 400 g/Mg was used; however, the Party referred to the use of the EF from Guidebook 2019 where the EF value is different. In response to a question about the issue, the Party stated that the emission factor was used properly; however, the problem was that the wrong field in the excel sheets had been used for the calculation. The Party sent a revised estimate during the review, which the ERT accepted. The ERT recommends that North Macedonia use the revised estimate sent to the ERT in the next submission.

231. The ERT also noted that the emission factor for Se was not from Guidebook 2019 as referred to in the IIR. In response to a question about the issue, the Party responded that the emission factor was used properly, but that the problem was that the wrong field in the activity data excel sheets had been used for the calculation. The Party provided a revised estimate, which the ERT accepted. The ERT recommends that North Macedonia use the revised estimate sent to the ERT in the next submission.

232. The ERT noted that emissions of PAHs were calculated using other emission factors than those listed in the IIR. In response to a question about the issue, the Party stated that the emission factor was used properly, but that the problem was that the wrong field in the activity data excel sheets had been used for the calculation. The Party provided a revised estimate, which the ERT accepted. The ERT recommends that North Macedonia use the revised estimate sent to the ERT in the next submission.

Category issue 4: 5D1 Domestic wastewater handling – Completeness, transparency

233. The ERT notes that activity data for domestic wastewater handling are available in the IIR for the period 1990-2018, but that the corresponding emissions are reported under the category 5D2 - Industrial wastewater handling. Activity data for industrial wastewater handling are available in the IIR only for the year 2018. In response to a question about the issue, the Party stated that according to Table 3-3 in the Guidebook, NH_3 emissions should be reported under NFR 5D1, and that under NFR 5D2 both SNAPs were listed for domestic and industrial wastewater treatment, and that they could reallocate the emissions from domestic wastewater treatment to category 5D1 if necessary. The Party also showed a plan to obtain data about industrial wastewater handling for a longer period. The ERT commends North Macedonia for their effort to obtain the missing data and recommends that the Party report emissions from domestic wastewater handling within category 5D1 and emissions from industrial wastewater handling within category 5D2. The ERT also recommends that the Party try to obtain data about industrial wastewater handling for the period 1990-2018 and estimate emissions for the next submission.

Category issue 5: 5D2 Industrial wastewater handling – Consistency

234. The ERT noted a significant decrease and subsequent increase in emissions of NMVOC in category 5D2, with no explanation provided in the IIR. The ERT recommends that the Party t report data on domestic and industrial wastewater handling separately and explain in the IIR the decrease in NMVOC emissions from industrial wastewater handling in 2017.

Category issue 6: 5E Other waste – Completeness, all pollutants

235. The ERT noted that emissions under category 5E were reported as NO although this category includes accidental fires of cars, of detached/undetached houses and administrative, industrial buildings. The ERT notes that this data could be collected mostly by national fire engineering offices and that it is obvious that accidental fires appear in every country and that therefore using the notation key NO should be reconsidered. The Party responded that they would use the notation key NE in the next submission and try to contact the relevant institutions to obtain the relevant data. The ERT recommends that North Macedonia collect the data needed to estimate emissions and report emissions from this source in the next submission, or in case this is not possible, include the issue in the improvement plan with clear steps and a schedule, while also reporting on progress with the work in the next submission.

LIST OF MATERIALS PROVIDED TO ERT

1. List of North Macedonia Stage 2 S&A report
2. North Macedonia Stage 1 report 2020
3. North Macedonia IIR 2020
4. NFR 14 MK 1980-1987-1988 and 1990-2018 v02 PM2.5 PM10 2001 2013.xlsx
5. S3 review report of the Former Yugoslavian Republic of Macedonia 2016

F ADDITIONAL MATERIALS PROVIDED BY THE COUNTRY DURING THE REVIEW

6. Responses to preliminary question raised prior to the Review
7. Material received from the Party during the Review
    - NFR_KCA_Tool_updated_Andreas - 2018v02. xlsl
    - Ink activity data.xlsl (confidential)
    - Email2016Review.PNG
    - KCA_NMVOC_Hg.docx
    - ActivityData_2Da3.xls
    - Macedonia IPCC Waste Model Lizi17population.xls
    - MACSTAT IPPU 2007-2018.xls
8. Revised estimates received from the Party during the Review
    - Revised estimates for 2.K Hg and PCB for the period 1990-2018 (2.K_Consuption of POPs.xls)
    - Revised estimates for NFR 2.C.1 for Zn, PCDD/, PAH and PCB emissions in 2016, 2017 and 2018
    - Revised estimates for NFR 2.B.10.a for NMVOC emissions in for the period 2005-2018, for SOx for the period 1994-1999, for PM10, PM2.5 and TSP for the period 2007-2018, and for Hg for the period 1994-1999. (2.B.10.a.xls)
    - Revised estimates for NFR 2.C.7.c for SOx and TSP emissions in the period 1990-1998 (2.C.7.c_GB 2019_EF)
    - Revised estimate (3Da1mk GB 2019.xls)
    - Revised estimate (3Da2 Animal application mkGB2016.xls)
    - Revised estimate (3Dc.xls)
    - Revised estimate (5Acorrected.xls) and (5Acorrected_v02.xls)
    - Revised estimate (5.c.1diiicorrected.xls)
    - Revised estimate (5C2corrected.xls) and (5C2corrected_v02.xls)

ANNEX I TECHNICAL CORRECTIONS AND REVISED ESTIMATES

236. The ERT made one Technical Correction and accepted the Revised Estimates proposed by the Party during the review. Detailed related information is provided separately in the MSExcel files:

- MK-RE-IPPU-2020.xlsx
- MK-RE-Agriculture-2020.xlsx
- MK-RE-Waste-2020.xlsx
- MK-TC-Waste-2020.xlsx

TC|REVISED ESTIMATES

Description	Reference	Pollutant estimates (kt)			
		2018	2015	2010	2005
NOx					
National total as reported in 2020 (row 141)	**Annex I, 13/04/2020**	**18.510**	**20.290**	**41.350**	**39.520**
Difference between original estimate and revised estimates provided by the Party and accepted by the ERT					
2C1 Iron and Steel		0.035			
3Da1 - Inorganic N-fertilizers (includes also urea application)		0.20	0.24	0.22	
Difference between original estimate and technical correction deemed necessary by the ERT					
National total (row 141) including revised estimates and technical corrections accepted by MS	**Calculated using data above**	**18.745**	**20.530**	**41.570**	**39.520**
PM2.5					
National total as reported in 2020 (row 141)	**Annex I, 13/04/2020**	**8.640**	**14.820**	**23.570**	**28.030**
Difference between original estimate and revised estimates provided by the Party and accepted by the ERT					
2B10a Chemical industry: Other		0.001	0.00007	0.001	
2C1 Iron and Steel		0.0057			
3Da1 - Inorganic N-fertilizers (includes also urea application)		-0.08	-0.07	-0.07	
3Dc - Farm-level agricultural operations including storage,		0.08	0.07	0.07	
Difference between original estimate and technical correction deemed necessary by the ERT					
5A Biological treatment of waste - Solid waste disposal on		-0.0007	-0.0007	-0.0006	-0.0005
National total (row 141) including revised estimates and technical corrections accepted by MS	**Calculated using data above**	**8.646**	**14.819**	**23.570**	**28.030**
PM10					
National total as reported in 2020 (row 141)	**Annex I, 13/04/2020**	**14.270**	**22.260**	**36.000**	**41.250**
Difference between original estimate and revised estimates provided by the Party and accepted by the ERT					
2B10a – Chemical industry: Other		0.001	0.0007	0.001	
3Da1 - Inorganic N fertilisers (includes also urea application)		-1.97		-1.75	-1.92
3Dc - Farm-level agricultural operations including storage,		1.97		1.75	1.92
Difference between original estimate and technical correction deemed necessary by the ERT					
National total (row 141) including revised estimates and technical corrections accepted by MS	**Calculated using data above**	**14.271**	**22.261**	**36.001**	**41.250**

TC|REVISED ESTIMATES

Description	Reference	Pollutant estimates (kt)			
		2018	2015	2010	2005
TSP					
National total as reported in 2020 (row 141)	**Annex I, 13/04/2020**	**15.660**	**25.109**	**41.170**	**50.240**
Difference between original estimate and revised estimates provided by the Party and accepted by the ERT					
2B10a – Chemical Industry: Other		0.001	0.002	0.001	
3Dc - Farm-level agricultural operations including storage,		1.97		1.75	1.92
Difference between original estimate and technical correction deemed necessary by the ERT					
National total (row 141) including revised estimates and technical corrections accepted by MS	**Calculated using data above**	**17.631**	**25.111**	**42.921**	**52.160**
NMVOC					
National total as reported in 2020 (row 141)	**Annex I, 13/04/2020**	**28.950**	**29.910**	**36.740**	**37.860**
Difference between original estimate and revised estimates provided by the Party and accepted by the ERT					
2B10a – Chemical industry: Other		0.001	0.001	0.001	0.002
3Da1 - Inorganic N-fertilizers (includes also urea application)		-1.09	-0.96	-1.06	
3De - Cultivated crops		1.09	0.96	1.06	
Difference between original estimate and technical correction deemed necessary by the ERT					
5A Biological treatment of waste - Solid waste disposal on land		-3.250	-3.206	-2.890	-2.094
National total (row 141) including revised estimates and technical corrections accepted by MS	**Calculated using data above**	**25.701**	**26.705**	**33.851**	**35.768**
Hg					
National total as reported in 2020 (row 141)	**Annex I, 13/04/2020**	**0.217**	**0.261**	**0.304**	**0.310**
Difference between original estimate and revised estimates provided by the Party and accepted by the ERT					
2 K Consumption of POPs and heavy metals		0.0208	0.0207	0.0206	0.0204
Difference between original estimate and technical correction deemed necessary by the ERT					
National total (row 141) including revised estimates and technical corrections accepted by MS	**Calculated using data above**	**0.238**	**0.282**	**0.325**	**0.330**
Se					
National total as reported in 2020 (row 141)	**Annex I, 13/04/2020**	**1.573**	**1.850**	**2.160**	**2.270**
Difference between original estimate and revised estimates provided by the Party and accepted by the ERT					
2C1 Iron and steel		-0.1117			
5C2 Open burning of waste		-0.019	-0.019	-0.019	-0.019
Difference between original estimate and technical correction deemed necessary by the ERT					
National total (row 141) including revised estimates and technical corrections accepted by MS	**Calculated using data above**	**1.443**	**1.831**	**2.141**	**2.251**
Zn					
National total as reported in 2020 (row 141)	**Annex I, 13/04/2020**	**11.686**	**14.740**	**20.860**	**19.190**
Difference between original estimate and revised estimates provided by the Party and accepted by the ERT					
2C1 Iron and steel		0.6266			
5C2 Open burning of waste		-4.960	-4.911	-4.819	-5.221
Difference between original estimate and technical correction deemed necessary by the ERT					
National total (row 141) including revised estimates and technical corrections accepted by MS	**Calculated using data above**	**7.352**	**9.829**	**16.041**	**13.969**

TC|REVISED ESTIMATES

Description	Reference	Pollutant estimates (kt)			
		2018	2015	2010	2005
B(k)F					
National total as reported in 2020 (row 141)	**Annex I, 13/04/2020**	**0.500**	**0.590**	**1.000**	**0.850**
Difference between original estimate and revised estimates provided by the Party and accepted by the ERT					
5C2 Open burning of waste		0.074	0.073	0.072	0.078
Difference between original estimate and technical correction deemed necessary by the ERT					
National total (row 141) including revised estimates and technical corrections accepted by MS	**Calculated using data above**	**0.574**	**0.663**	**1.072**	**0.928**
B(a)P					
National total as reported in 2020 (row 141)	**Annex I, 13/04/2020**	**2.090**	**1.520**	**2.660**	**2.190**
Difference between original estimate and revised estimates provided by the Party and accepted by the ERT					
5C2 Open burning of waste		0.030	0.030	0.029	0.032
Difference between original estimate and technical correction deemed necessary by the ERT					
National total (row 141) including revised estimates and technical corrections accepted by MS	**Calculated using data above**	**2.120**	**1.550**	**2.689**	**2.222**
B(b)F					
National total as reported in 2020 (row 141)	**Annex I, 13/04/2020**	**1.320**	**1.580**	**2.660**	**2.260**
Difference between original estimate and revised estimates provided by the Party and accepted by the ERT					
5C2 Open burning of waste		0.060	0.059	0.058	0.063
Difference between original estimate and technical correction deemed necessary by the ERT					
National total (row 141) including revised estimates and technical corrections accepted by MS	**Calculated using data above**	**1.380**	**1.639**	**2.718**	**2.323**
PAH-4					
National total as reported in 2020 (row 141)	**Annex I, 13/04/2020**	**3.772**		**8.170**	**6.880**
Difference between original estimate and revised estimates provided by the Party and accepted by the ERT					
2C1 Iron and Steel		0.1308			
5C2 Open burning of waste		0.164	0.162	0.159	0.173
Difference between original estimate and technical correction deemed necessary by the ERT					
National total (row 141) including revised estimates and technical corrections accepted by MS	**Calculated using data above**	**4.067**	**0.162**	**8.329**	**7.053**
PCDD/F					
National total as reported in 2020 (row 141)	**Annex I, 13/04/2020**	**8.648**	**11.260**	**19.570**	**16.520**
Difference between original estimate and revised estimates provided by the Party and accepted by the ERT					
2C1 Iron and Steel		0.1907			
5C1biii Clinical waste incineration		36.459	36.103	18.585	15.021
Difference between original estimate and technical correction deemed necessary by the ERT					
National total (row 141) including revised estimates and technical corrections accepted by MS	**Calculated using data above**	**45.298**	**47.363**	**38.155**	**31.541**
PCBs					
National total as reported in Gui2020 (row 141)	**Annex I, 13/04/2020**	**29.024**	**9.990**	**4.407**	**4.221**
Difference between original estimate and revised estimates provided by the Party and accepted by the ERT					
2C1 Iron and Steel		0.681			

	2 K Consumption of POPs and heavy metals		207.71	207.13	205.73	203.85
	Difference between original estimate and technical correction deemed necessary by the ERT					
	National total (row 141) including revised estimates and technical corrections accepted by MS	**Calculated using data above**	**237.415**	**217.120**	**210.137**	**208.071**