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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:**

**MONTENEGRO**

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## INTRODUCTION

1. The mandate and overall objectives for the emission inventory review process under the LRTAP Convention is given by the UNECE document '*Updated methods and procedures for the technical reviews of air pollutant emission inventories reported under the Convention*'<sup>(1)</sup> – hereafter referred to as the 'Review guidelines 2018'.
2. This annual review, has checked all pollutants covered by LRTAP Convention and its protocols (SO<sub>2</sub>, NO<sub>x</sub>, NMVOC, NH<sub>3</sub>, plus PM<sub>10</sub> PM<sub>2.5</sub>, BC, 3 HMs and POP<sub>s</sub>) for the time series years 1990 – 2019 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 reviews of the UNECE LRTAP Convention of Liechtenstein coordinated by the EMEP emission centre CEIP acting as review secretariat. The review took place during May and June and was performed as desk review with virtual meetings. The following team of nominated experts from the roster of experts performed the review: Generalist – Zuzana Herrera (Czechia), Energy – Tomas Gustafsson (Sweden), Transport – Giannis Papadimitriou (EU/Greece), IPPU – Mirela Poljanac (Croatia), Agriculture – Tim van der Zee (Netherlands), Waste – Tomas Gustafsson (Sweden).
4. Anne Misra was the lead reviewer. The review was coordinated by Katarina Marečková, (EMEP Centre on Emission Inventories and Projections - CEIP).

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<sup>1</sup> Decision 2018/1 adopted by EB: *Updated methods and procedures for the technical review of air pollutant emission inventories reported under the Convention*. ECE/EB.AIR/142/Add.1  
[http://www.unece.org/fileadmin/DAM/env/documents/2002/eb/air/EB%20Decisions/Decision\\_2018\\_1.pdf](http://www.unece.org/fileadmin/DAM/env/documents/2002/eb/air/EB%20Decisions/Decision_2018_1.pdf)

## **PART A: KEY REVIEW FINDINGS**

5. The inventory is generally in line with the 2019 EMEP EEA inventory guidebook and UNECE Reporting Guidelines. However, for aviation and road transport the 2013 version of the Guidebook is used.
6. Montenegro's inventory is largely complete for the pollutants reviewed for the majority of sectors. The inventories for the energy, agriculture and waste sectors are incomplete.
7. Activity data are reported for most sectors and years in the Annex I reporting template.
8. The ERT noted that emissions trends and recalculations have not been described in detail in the IIR. The information provided in the IIR and Annex I NFR tables are inconsistent, i.e. the IIR states that a Tier 1 EFs has been applied to estimate emissions of most key categories whereas a Tier 2 EFs has been used in the NFR tables.
9. ERT also noted that Montenegro applies Tier 1 methods and default parameters for some key categories (e.g. Road Transport, Agriculture).
10. The 2021 submission shows that improvement in the number of issues nevertheless the ERT identified a need for further improvements in the transparency, completeness and consistency of both the emission data and the IIR.
11. The ERT thanks Montenegro for participating actively in the Stage 3 review process by providing further information and data when requested. Based on that information, the ERT was able to review the inventory in detail and to provide several detailed recommendations.

### **INVENTORY SUBMISSION**

12. Montenegro reported emissions for its Protocol base years (1990) and a full time series to 2019 (the latest year) for its protocol pollutants in the NFR format. In addition, Montenegro also submitted a detailed IIR.
13. The CLRTAP inventory submitted by Montenegro is of good quality and is in general well documented in the informative inventory report (IIR).

### **KEY CATEGORIES**

14. Montenegro has compiled and presented a level Key Category Analysis for the following pollutants: NO<sub>x</sub>, CO, NMVOC, SO<sub>2</sub>, NH<sub>3</sub>, TSP, PM<sub>10</sub> and PM<sub>2.5</sub>, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn and Dioxins, PAH, HCB and PCBs. All sectors have been included.

## QUALITY

### Transparency

15. The ERT recognises the level of effort undertaken by Montenegro in providing an inventory of a significant level of detail. However, the ERT noted that the reported values frequently do not correspond to the reported activity data and EF default Tier values (according to the EMEP/EEA Guidebook 2019), that are referenced in the IIR. This AD and EFs seem not to have been used for the calculation and/or recalculation. The ERT recommends that Montenegro improves the quality and transparency of the IIR, by eliminating any inconsistencies in the activity data and EFs used in accordance with the EMEP/EEA Guidebook 2019.

### Completeness

16. The ERT acknowledges the effort to which Montenegro has gone to provide estimates of emissions for all sub-sectors and all pollutants reviewed.

17. Montenegro's inventory for the pollutants reviewed is generally complete. However, the ERT noted use of IE for all pollutants from *Mobile Combustion in manufacturing industries and construction* in the reporting tables and IIR. The ERT acknowledges the relatively small contribution of these sub-sectors and possible difficulties to obtain activity data. However, this issue affects not only the completeness but also quality and comparability of the inventory since the emissions of these sub-sectors are not reported separately according to the NFR format. The ERT encourages Montenegro to provide emission estimates separately for all subsectors according to the NFR format.

18. The ERT recommends that the Party performs additional reviews to identify potential gaps in the inventory.

### Consistency, including recalculations and time-series

19. Montenegro undertook a number of recalculations for their current submission. The ERT commends Montenegro on this effort, however, descriptions have not been provided in enough detail (see the individual sectoral reports below). The ERT encourages Montenegro to provide additional detail on the rationale for the recalculations as well as the impacts of the changes on the national totals and time series in its future IIR submissions. The ERT further recommends Montenegro to ensure that the information on recalculations is updated in the IIR and that redundant text is removed.

20. The ERT noted that some of the time series are inconsistent. Montenegro has explained that the method to collect activity data has changed over the years and indicated an intent to amend these issues in the next submission. The ERT strongly encourages Montenegro to improve the consistency of its time series in the next submission.

## **Comparability**

21. Montenegro did not provide updated information on methods and EF used in the IIR which hinders conducting a comparison with other Party's submissions. During the review, Montenegro explained the methods and EF used are based on the EMEP/EEA Guidebook 2019. However, the ERT noted several discrepancies between information in IIR and the Guidebook and, recommends Montenegro to ensure that updated information on methods and EFs used are provided in the next submission.

## **Accuracy and uncertainties**

22. Montenegro compiled uncertainty estimates for IPPU and Solvents. The ERT commends Montenegro on its effort and encourages Montenegro to perform quantitative uncertainty analysis also for other sectors.

## **Verification and quality assurance/quality control approaches**

23. Montenegro refers to general as well as some source-specific quality assurance/quality control (QA/QC) checks. The ERT commends Montenegro on its QA/QC activities. However, the ERT noted several errors in the inventory (see sub-sector specific recommendations below) that suggests that further QA/QC checks are needed. The ERT encourages Montenegro to consult the EMEP/EEA Guidebook 2019 regarding the sector-specific QA/QC procedures to ensure accurate emission estimations and that the IIR is updated with relevant details regarding the QA/QC plan in the next submission.

## **Reporting of Condensable**

24. Montenegro does not provide explanatory information in the IIR of whether particle emissions include or exclude the condensable component. The ERT recommends Montenegro to include such information in the next submission following Annex II of the 2014 Reporting Guidelines.

## **FOLLOW-UP TO PREVIOUS REVIEWS**

25. Montenegro provided detailed responses to all questions identified in stage 2 review. Due to the quality of the IIR and Montenegro's responsiveness, the ERT were able to review the inventory in detail and provide a number of detailed recommendations.

## **AREAS FOR IMPROVEMENTS IDENTIFIED BY MONTENEGRO**

26. In the IIR as well as in the review stages Montenegro identified several areas for improvement. These include:

- (a) Development of country-specific EF for SO<sub>2</sub>;
- (b) Development of new emission inventories for e.g. Waste with the help of the twinning light project;
- (c) Accounting for abatement technologies within the agriculture sector when calculating emissions;

- (d) Using additional activity data and exploring new data sources by searching international sources or estimating currently missing emissions with the use of economic parameters.

27. The ERT encourages the Party to implement planned improvements and report on the any changes in its next IIR.

## **TECHNICAL CORRECTIONS CONSIDERED AND OR CALCULATED BY ERT**

28. The ERT identified several possible underestimates and proposed technical corrections. Montenegro provided revised estimates of which one (for NFR 2.K) was not accepted by the ERT, and the ERT prepared technical corrections. The ERT recommends that Montenegro applies the calculated technical corrections proposed by the ERT to the following potential underestimates, or that it develops other methods that more accurately correspond to the conditions prevailing in Montenegro, to the following potential underestimates for the whole time series in the next submission. For more detailed information go to sectoral chapters.

**Table 1 Summary of potential technical corrections identified by ERT for country**

<b>NFR category (s)</b>	<b>Pollutants</b>	<b>Years</b>	<b>Calculated by country/ Calculated by ERT/ Not calculated</b>	<b>Potential contribution to national total (%)</b>
2.K	Hg	2005, 2010, 2019	ERT	+11.3% (2019), +9.2% (2010), +12.2% (2005)
2.K	PCBs	2005, 2010, 2019	ERT	+99.9% (2019), +99.9% (2010), +99.9% (2005)
2.D.3.b	NMVOC	2005, 2010, 2019	Montenegro	+0.04% (2019), +0.05% (2010), +0.01% (2005)
2.D.3.b	TSP	2005, 2010, 2019	Montenegro	+34.9% (2019), +38% (2010), +6.2% (2005)
2.D.3.b	PM10	2005, 2010, 2019	Montenegro	+11.4% (2019), +12.7% (2010), +1.6% (2005)
2.D.3.b	PM2.5	2005, 2010, 2019	Montenegro	+1.7% (2019), +2% (2010), +0.2% (2005)
2.D.3.b	BC	2005, 2010, 2019	Montenegro	+1.2% (2019), +8.6% (2010), +1.2% (2005)
2.D.3.f	NMVOC	2005, 2010, 2019	ERT	+2.1% (2019), +1.9% (2010), +2.2% (2005)

## **PART B: RECOMMENDATIONS FOR IMPROVEMENTS TO THE PARTY**

### **CROSS CUTTING IMPROVEMENTS IDENTIFIED BY THE ERT**

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

- (a) improve the quality and transparency of the IIR, by eliminating any inconsistencies in the activity data, methodology and EFs used in accordance with the EMEP/EEA Guidebook 2019.
- (b) provide emission estimates separately for all subsectors according to the NFR format.
- (c) provide additional detail on the rationale for the recalculations as well as the impacts of the changes on the national estimates and time series in its future IIR submissions.
- (d) improve the consistency of its time series in the next submission.
- (e) extend quantitative uncertainty analysis also for the remaining sectors.
- (f) consult the EMEP/EEA Guidebook 2019 regarding the sector-specific OA/QC procedures to ensure emission estimations are accurate and that the IIR is updated with relevant detail regarding the QA/QC plan in the next submission.
- (g) include information on condensable components in the next submission following Annex II of the 2014 Reporting Guidelines.
- (h) implement planned improvements and report on the any changes in its next IIR.



## SECTOR SPECIFIC RECOMMENDATIONS FOR IMPROVEMENTS IDENTIFIED BY ERT

### ENERGY

#### Review Scope

Pollutants Reviewed		SO <sub>2</sub> , NO <sub>x</sub> , NMVOC, NH <sub>3</sub> , PM <sub>10</sub> & PM <sub>2.5</sub> , Cd, Hg, Pb, Dioxin, PAH		
Years		1990 – 2019		
Code	Name	Reviewed	Not Reviewed	Recommendation Provided
1A1a	Public electricity and heat production	x		X
1A1b	Petroleum refining	NO		
1A1c	Manufacture of solid fuels and other energy industries	NE		
1A2a	Iron and steel	x		
1A2b	Non-ferrous metals	x		
1A2c	Chemicals	x		X
1A2d	Pulp, Paper and Print	x		
1A2e	Food processing, beverages and tobacco	x		X
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	x		
1A2gviii	Stationary combustion in manufacturing industries and construction: Other	x		
1A3ei	Pipeline transport	NO		
1A3eii	Other	NO		
1A4ai	Commercial/institutional: Stationary	x		
1A4bi	Residential: Stationary	x		X
1A4ci	Agriculture/Forestry/Fishing: Stationary	IE		
1A5a	Other stationary (including military)	NE		
1B1a	Fugitive emission from solid fuels: Coal mining and handling	x		
1B1b	Fugitive emission from solid fuels: Solid fuel transformation	NO		
1B1c	Other fugitive emissions from solid fuels	NO		
1B2ai	Fugitive emissions oil: Exploration, production, transport	NO		
1B2aiv	Fugitive emissions oil: Refining / storage	NE		X
1B2av	Distribution of oil products	NE		X
1B2b	Fugitive emissions from natural gas (exploration, production, processing, transmission, storage, distribution and other)	NE		X
1B2c	Venting and flaring (oil, gas, combined oil and gas)	NO		
1B2d	Other fugitive emissions from energy production	NA		
Note: Where a sector has been partially reviewed (e.g. some of the NFR codes) please indicate which have and which have not in the respective columns.				

## General recommendations on cross cutting issues

### **Transparency**

30. In its IIR, the Party refers to Tier 1 default EFs from the 2019 EMEP/EEA Guidebook for several pollutants and key categories in the energy sector. However, during the review Montenegro explained that in fact Tier 2 default EF from 2019 EMEP/EEA Guidebook and country specific net calorific values were used but that the information in the IIR was not updated accordingly. The ERT recommends that Montenegro update its IIR methods used and assumptions made in the next submission.

### **Completeness**

31. The ERT considers the Energy sector generally to be complete. However, Montenegro has not estimated emissions of NMVOC from 1B2aiv, 1B2av and 1B2b. The ERT recommends that Montenegro estimate the NMVOC emissions in line with the 2019 EMEP/EEA Guidebook.

### **Consistency including recalculation and time series**

32. Montenegro has recalculated its inventory of NO<sub>x</sub> emissions for 1A2c 2005-2008, 2011-2018. However, the IIR does not include all the necessary explanations but a general text that is not applicable to the specific recalculation. The ERT encourages Montenegro to provide more detailed explanation of recalculations, including the rational, the impact on the sector and implication to trends for the Energy sector in its IIR. The ERT further recommends Montenegro to ensure that the information on recalculations is updated in the IIR and that redundant text is removed.

### **Comparability**

33. Montenegro did not provide updated information on methods and EF used in the IIR. During the review, Montenegro explained what methods and EF from 2019 EMEP/EEA Guidebook were used. However, the ERT noted several discrepancies between information in IIR and EMEP/EEA Guidebook (see sub-sector specific recommendations below). The ERT recommends Montenegro to ensure that updated information on methods and EF used are provided in the IIR of the next submission.

### **Accuracy and uncertainties**

34. The ERT encourages Montenegro to undertake uncertainty analysis for the Energy Sector in order to help inform the improvement process and to provide an indication of the reliability of the inventory data.

35. The Party claims that source-specific QA/QC checks are performed before submission to the Convention. However, the ERT noted several errors in the inventory (see sub-sector specific recommendations below) that suggests that further QA/QC checks are needed. The ERT encourages the Party to implement sector specific QA/QC procedures in line with the 2019 EMEP/EEA Guidebook.

### **Condensable**

36. The Party did not provide explicit information on condensable component of PM for categories. However, the Montenegro uses default 2019 EMEP/EEA Guidebook. The ERT recommends Montenegro to include explicit information on condensable components of PM in the next submission.

### **Improvement**

37. Montenegro elaborates on several planned improvements in its IIR, e.g. development of country-specific EF for SO<sub>2</sub>, accounting for abatement technologies. The ERT encourages the Party to implement planned improvements and report on the any changes in its next IIR.

## **Potential Technical Corrections**

38. The ERT did not calculate any technical corrections for the Energy sector.

## **Sub-Sector Specific Recommendations**

### **Category issue 1: 1.A.1a Solid fuels - BC**

39. The ERT noted that BC emissions in 1A1a are relatively high compared to emissions of PM<sub>2.5</sub>. In its IIR (page 132), the Party provides EF used for emission estimations. The EF are referred to the Tier 1 default values from 2019 EMEP/EEA Guidebook. However, the ERT noted that the reported values do not correspond to the reported AD and the Tier 1 default EFs from Guidebook (BC/PM<sub>2.5</sub> ratio: 1% of PM<sub>2.5</sub> for brown coal and 2.2% for hard coal). During the review, Montenegro explained that there were errors in the underlying calculations and provided revised estimates and explained that the information in the IIR was incorrect, and that, in fact, EMEP/EEA Guidebook 2019 default Tier 2 EFs had been applied, referring to table 3-10 of the EMEP/EEA Guidebook 2019. However, the ERT noted that the revised estimates are not correct, and that Table 3-10 of EMEP/EEA Guidebook 2019 does not include EF for BC. The ERT recommends Montenegro to check its BC emission estimates to ensure accurate estimations and to revise the information provided in the IIR in its next submission.

### **Category issue 2: 1.A.1a Solid fuels - dioxins**

40. The ERT noted that the dioxin emissions in 1A1a are significantly lower than expected. In its IIR (page 132), the Party provides EF used for emission estimations, referring to Tier 1 default values from EMEP/EEA Guidebook 2019. However, the ERT noted that the reported values do not correspond to the reported AD and the Tier 1 default EFs from EMEP/EEA Guidebook 2019 (10 ng/GJ for solid fuels). The ERT noted that the reported values seem to be 1000 times too low. During the review, Montenegro explained that there were errors in the underlying calculations and provided revised estimates and explained that the information in the IIR was incorrect, and that, in fact, 2019 EMEP/EEA Guidebook default Tier 2 EFs had been applied, referring to table 3-10 of the EMEP/EEA Guidebook 2019. However, the ERT noted that the revised estimates are not correct. The ERT recommends Montenegro to check

its dioxin emission estimates to ensure accurate estimations (e.g. by paying specific attention to the unit for dioxins in the NFR tables (g I-TEQ) and the unit of the EF in EMEP/EEA Guidebook 2019 (ng I-TEQ/GJ)), and to revise the information provided in the IIR in its next submission.

**Category issue 3: 1.A.1a Solid fuels - Indeno (1,2,3-cd) pyrene**

41. In its IIR (page 132), the Party claims to apply the Tier 1 default EFs from 2019 Guidebook for its estimation of Indeno (1,2,3-cd) pyrene emissions in NFR 1A1a. However, the ERT noted that the reported values do not correspond to the reported AD and the Tier 1 default EFs from 2019 Guidebook (2.1 µg/GJ for brown coal and 1.1 µg/GJ for hard coal). During the review, Montenegro explained that there were errors in the underlying calculations and provided revised estimates and explained that the information in the IIR was incorrect, and that, in fact, 2019 Guidebook default Tier 2 EFs had been applied, referring to table 3-10 of the EMEP/EEA Guidebook 2019. The ERT noted that the same values are included in the revised estimates as in the official submission. The ERT also noted that there is an error in the underlying calculation sheets, the wrong unit conversion is used: 10<sup>9</sup> instead of 10<sup>12</sup>. The ERT recommends Montenegro to check its Indeno (1,2,3-cd) pyrene emission estimates to ensure accurate estimations and to revise the information provided in the IIR in its next submission.

**Category issue 4: 1.A.1a Solid fuels - benzo(k) fluoranthene**

42. In its IIR (page 132), the Party claims to apply the Tier 1 default EFs from 2019 Guidebook for its estimation of benzo(k) fluoranthene emissions in NFR 1A1a. However, the ERT noted that notation key "NO" was reported in NFR. During the review, Montenegro explained that there were errors in the underlying calculations and provided revised estimates and explained that the information in the IIR was incorrect, and that, in fact, 2019 Guidebook default Tier 2 EFs had been applied, referring to table 3-10 of the EMEP/EEA Guidebook 2019. The ERT noted that the revised estimates still refer to "NO". However, in the underlying calculations sheet, the revised estimates include values for this pollutant and source. The ERT recommends Montenegro to check its benzo(k) fluoranthene emission estimates to ensure accurate estimations are reported and to revise the information provided in the IIR in its next submission.

**Category issue 5: 1.A.1a Solid fuels - Total PAH1-4**

43. The ERT noted that Total PAH1-4 emissions in NFR 1A1a do not correspond to the sum of the individual PAHs. During the review, Montenegro explained that there were errors in the underlying calculations and provided revised estimates and explained that the information in the IIR was incorrect, and that, in fact, 2019 Guidebook default Tier 2 EFs had been applied, referring to table 3-10 of the EMEP/EEA Guidebook 2019. However, the ERT noted that the revised estimates are not correctly calculated and that the total PAH1-4 emissions do not correspond to the sum of the individual PAHs. The ERT recommends Montenegro to check its Total PAH1-4 emission estimates to ensure accurate estimations and to revise the information provided in the IIR in its next submission.

**Category issue 6: 1.A.1a Solid fuels - PCB**

44. The ERT noted that the PCB emissions in 1A1a are significantly higher than expected. In its IIR (page 132), the Party provides EF used for estimations, referring to Tier 1 default values from 2019 Guidebook. However, the ERT noted that the reported values do not correspond to the reported AD and the Tier 1 default EFs from 2019 Guidebook (3.3 ng/GJ for solid fuels). During the review, Montenegro explained that there were errors in the underlying calculations and provided revised estimates and explained that the information in the IIR was incorrect, and that, in fact, 2019 Guidebook default Tier 2 EFs had been applied, referring to table 3-10 of the EMEP/EEA Guidebook 2019. The ERT noted that the revised estimates include an EF for PCB of 2.1 ng/GJ and that the Tier 2 EF in EMEP/EEA Guidebook 2019 (table 3-10) is 3.3 ng/GJ. The ERT recommends Montenegro to check its PCB emission estimates to ensure accurate estimations and to revise the information provided in the IIR in its next submission.

**Category issue 7: 1.A.2c, 1A2e Liquid fuels, Biomass - BC**

45. The ERT noted that the BC emissions in NFR 1A2c and 1A2e are higher than respective PM<sub>2.5</sub> emissions. The ERT noted that the PM<sub>2.5</sub> emissions seem to be correctly estimated. During the review, Montenegro explained that there were errors in the underlying calculations and provided revised estimates together with underlying AD and EF. The ERT noted that the revised estimates are referred to as '1A2i' by the Party and do not correspond at all to the previously submitted data for 1A2e. The ERT recommends Montenegro to check its BC emission estimates to ensure accurate estimations and to revise the information provided in the IIR in its next submission.

**Category issue 8: 1.A.4bi Biomass – All pollutants**

46. In its IIR (page 277) the Party claims to apply the Tier 1 default EFs from 2019 Guidebook for its estimation of emissions from NFR 1A4bi (Residential: Stationary). However, the ERT noted that the EFs provided in IIR table 3.124 do not correspond to the 2019 Guidebook default Tier 1 factors. During the review, Montenegro provided the correct references to the EFs. The ERT recommends Montenegro to revise the information provided in the IIR in its next submission.

**Category issue 9: 1.A.4bi Biomass – NO<sub>x</sub>, NMVOC, NH<sub>3</sub>, BC and dioxin**

47. The ERT noted that the reported emissions of NO<sub>x</sub>, NMVOC, NH<sub>3</sub>, BC and dioxin in 1A4bi do not correspond to the reported AD and the Tier 1 default EFs from 2019 Guidebook. During the review, Montenegro provided the correct references to the EFs and revised estimates together with underlying AD and EF. However, the ERT noted errors in the underlying calculation sheets regarding unit conversion. The ERT recommends Montenegro to check its NO<sub>x</sub>, NMVOC, NH<sub>3</sub>, BC and dioxin emission estimates to ensure accurate estimations and to revise the information provided in the IIR in its next submission.

**Category issue 10: 1.A.4bi Biomass – Total PAH1-4**

48. The ERT noted that Total PAH1-4 emissions in NFR 1A4bi do not correspond to the sum of the individual PAHs. During the review, Montenegro explained that there were errors in the underlying calculations and provided revised estimates. The ERT

agrees with the revised estimates and recommends that Montenegro include the revised estimates in its next submission.

## TRANSPORT

### Review Scope

Pollutants Reviewed		All		
Years		1990 – 2019		
Code	Name	Reviewed	Not Reviewed	Recommendation Provided
1A2gvii	Mobile Combustion in manufacturing industries and construction	IE		x
1A3ai(i)	International aviation LTO (civil)	x		x
1A3ai(ii)	International aviation cruise (civil)	x		x
1A3aii(i)	Domestic aviation LTO (civil)	NO		x
1A3aii(ii)	Domestic aviation cruise (civil)	NA		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		x
1A3bvi	Road transport: Automobile tyre and brake wear	x		x
1A3bvii	Road transport: Automobile road abrasion	x		x
1A3c	Railways	x		x
1A3di(ii)	International inland waterways	x		x
1A3dii	National navigation (shipping)	x		x
1A4aii	Commercial/institutional: Mobile	IE		x
1A4bii	Residential: Household and gardening (mobile)	IE		x
1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	x		x
1A4ciii	Agriculture/Forestry/Fishing: National fishing	IE		x
1A5b	Other, Mobile (including military, land based and recreational boats)	NE		x
1A3di(i)	International maritime navigation	NE		x
1A3	Transport (fuel used)	x		
Note: Where a sector has been partially reviewed (e.g. some of the NFR codes) please indicate which have and which have not in the respective columns.				

### General recommendations on cross cutting issues

#### **Transparency**

49. The ERT commends Montenegro for the provision of an IIR, which was not available in the previous Stage 3 review (2012). The ERT believes that the transparency of the inventory can be further improved, by providing more details in the IIR and better description of the methodologies used to estimate emissions for each transport sub-sector.

50. The ERT recommends that the Party should avoid providing a lot of theoretical background in its IIR, since this information is already available in other relevant documents. Instead the Party should focus on details related to country specific activity data, i.e. vehicle fleet, equipment, sub-categories, technologies, explanations and justification of assumptions, etc.

### **Completeness**

51. The inventory of Montenegro includes emissions for the main transport sub-sectors and pollutants. However, the ERT believes that the completeness of the inventory can be improved, since there are missing emission estimates for some pollutants and sub-sectors. The methodology description in the IIR can also be improved by providing more details related to activity data and assumptions that have been made, etc.

### **Consistency including recalculation and time series**

52. Montenegro performed some source-specific recalculations related to transport, which are described in the end of each sub-sectoral chapter and in chapter 8.1 of the IIR. However, the impact of these recalculations is not clear and quantified. The description is very generic, without detailed information, and almost for all sub-sectors it is only stated that there has been a revision of activity data (i.e. fuel consumption) and country specific net calorific values. For some sub-sectors, the methodology and emission factors of the 2019 Guidebook have been used, but for aviation and road transport, the usage of the 2013 version of the Guidebook is presented as a recalculation/revision (i.e. improvement).

53. The ERT has some concerns about the consistency of emissions time series, since Montenegro does not use the 2019 version of the Guidebook for all transport sub-sectors and Tier 1 methods are always applied. Hence, the appropriate emission factors may not be used for each vehicle/equipment category, fuel used, age, technology/Euro standard, etc.

### **Comparability**

54. The ERT notes that Montenegro does not use methodologies in accordance with the 2019 version of the Guidebook for all transport sub-sectors. In addition, Tier 1 methods are used, and some sub-sectors are denoted as IE or NE. The emissions are reported in NFR2019 format. The comparability of the inventory of Montenegro (with respect to other reporting Parties) can be improved.

### **Accuracy and uncertainties**

55. The Party uses Tier 1 methods for all transport sub-sectors, while aviation and road transport are based on older versions of the Guidebook prior to 2019. The ERT believes that this may have an impact of the accuracy of the calculated emissions values. An over/underestimate has not been identified in the transport sector.

56. A QA/QC plan is provided in chapter 1.6 of the IIR. However, this plan is generic with a lot of theoretical background information. There are no specific examples of QA/QC checks and description of relevant procedures in the transport sector, apart from some general activities described in chapter 3.1.5.3.4 (p. 290) for



Agriculture/Forestry/Fishing: Off-road vehicles and other machinery (1A4cii). The ERT recommends Montenegro to include specific examples of QA/QC checks in the transport sector to improve the transparency of the IIR.

57. Montenegro does not provide in the IIR any information related to uncertainty analysis carried out for the transport sector, apart from Table 3.135 (p. 290) for Agriculture/Forestry/Fishing: Off-road vehicles and other machinery (1A4cii).

### **Condensable Particulate Matter**

58. Montenegro does not provide any information on the inclusion of the condensable component of PM emissions for the transport sector. The ERT recommends that Montenegro provides this information in the next submission, following the recommended structure for IIR in Annex II of the Reporting Guidelines.

### **Improvement**

59. The ERT commends Montenegro for the improvements implemented since the previous Stage 3 review (2012) and, specifically, for the provision of an IIR, which was not available in 2012. The improvements related to transport are described in the end of each sub-sectoral chapter of the IIR, together with the recalculations; hence, the assessment is similar to the one for recalculations, i.e. the description is very generic, without detailed information. For some sub-sectors, there has been an improvement by updating to the 2019 version of the Guidebook, but for aviation and road transport, the 2013 version is still used.

60. The planned improvements of Montenegro are summarised in chapter 8.2 of the IIR. The most significant is the update to a higher than Tier 1 methodology of the 2019 version of the Guidebook for aviation and road transport, with an update of fleet information and movements. Other planned improvements include check of time series consistency and split of aggregated activity data (i.e. fuel/energy consumption) into sub-sectors which are currently denoted as IE.

## **Potential Technical Corrections**

61. No potential technical corrections were made during the review.

## **Sub-Sector Specific Recommendations**

### **Category issue 1: 1A3a – Inconsistency in IIR methodology description**

62. The ERT noticed an inconsistency in the IIR regarding the methodology used for emission calculations from the aviation sector. In chapter 3.1.4.1.2.1 (p. 241) it is mentioned that the Tier 1 approach of the Revised 1996 IPCC Guidelines has been used. In the footnote of the same page, the 2019 version of the Guidebook is mentioned, while in chapter 3.1.4.1.3 (p. 246), it is stated that the 2013 Guidebook has been used. In response to a question raised during the review, Montenegro responded that this is due to a confusion between submissions of IIR (for air pollutants) and NIR (for GHG). For Air pollutants, the 2013 Guidebook has been used with Tier 1 emission factors.

63. The ERT recommends that Montenegro eliminates this inconsistency by making clear in the IIR the methodology that has been used for 1A3a. In any case, an update to a higher than Tier 1 methodology using the 2019 version of the Guidebook is recommended, as already planned. This will improve the accuracy of the calculated emission values and the comparability of the inventory.

#### **Category issue 2: 1A3aii – NO for LTO, NA for cruise**

64. The ERT noticed in the NFR tables that the notation key NO is used for the LTO part of domestic aviation (1A3aii(i)), while NA is used for cruise (1A3aii(ii)). On the other hand, according to Tables 3.98 and 3.99 (pp. 239-240) of the IIR, emissions from domestic aviation (1A3aii) have been estimated. Hence, there is an inconsistency related to whether emissions from domestic aviation are reported or not and what is the appropriate notation key that should be used, i.e. NO or NA. In response to a question raised during the review, Montenegro answered that NO should be used throughout.

65. The ERT recommends that Montenegro eliminates this inconsistency by making clear in the IIR if emissions from domestic aviation (1A3aii) are reported and also align the usage of the notation key throughout (i.e. IIR and NFR).

#### **Category issue 3: 1A3bi-iv – Tier 1 methodology**

66. The ERT noticed in the IIR (p. 247) that Tier 1 methodology of the 2016 version of the Guidebook is used for emission calculations from the road transport sector (1A3bi-iv). However, this approach has a significant impact on the accuracy of the calculated values, since it does not take into account all the parameters that affect the vehicle emissions, i.e. fuel used, segment, age, technology / Euro standard, speed, and other driving conditions. In response to a question raised during the review, Montenegro answered that Tier 1 methodology of the 2019 Guidebook has been used and that there is a plan with an ongoing project to update to Tier 3.

67. The ERT welcomes this plan and strongly recommends that Montenegro updates to a higher Tier methodology for road transport. This will improve the accuracy of the calculated emission values and the comparability of the inventory.

#### **Category issue 4: 1A3bi-iv – Accuracy related to vehicle categories/statistical data and emission factors**

68. The ERT noticed in the IIR (p. 247, Step 1 of activity data production) that the Light duty vehicles NFR category (1A3bii) is empty and the Heavy duty vehicles category (1A3biii) includes Buses + Goods vehicles + Road tractors from the National Transport Statistics of Montenegro. However, Light duty vehicles (LDV) are provided in the vehicle categories of Step 2, p. 248, including Vans and Special Passenger vehicles. Hence, there seems to be an inconsistency in the description of the various steps of activity data production. Furthermore, there are concerns related to the accuracy of the calculated emission values, since the emission factors have significant differences among the various vehicle categories and it is not clear from the IIR whether the appropriate emission factors are used for each vehicle category. In response to a question raised during the review, Montenegro answered that Tier 1 emission factors of the 2019 Guidebook have been used for each one of the road

transport sub-sectors (i.e. 1A3bi, 1A3bii, 1A3biii, 1A3biv) and that there is a plan with an ongoing project to update to Tier 3.

69. The ERT welcomes this plan and strongly recommends that Montenegro updates to a higher Tier methodology for road transport. In addition, the ERT recommends that Montenegro improves the quality and transparency of the IIR, by eliminating any inconsistencies in the description of the various steps of activity data production for road.

#### **Category issue 5: 1A3bii-iv – Same activity data values in NFR**

70. The ERT noticed in the NFR that the activity data (i.e. liquid and gaseous fuels, TJ) for road transport Light duty vehicles (1A3bii), Heavy duty vehicles and buses (1A3biii), and Mopeds and motorcycles (1A3biv), are identical, i.e. the same values are reported for each one of these sub-categories. The ERT found no explanation for this in the IIR. In response to a question on the issue, Montenegro answered that this is due to a broken link in the excel file with activity data, which was not identified by the QA/QC activities.

71. The ERT recommends that Montenegro reports the correct values of activity in the NFR tables and improves the QA/QC checks to eliminate similar errors.

#### **Category issue 6: 1A3bi-iv – SO<sub>x</sub>, BC, Cd, Hg, additional HMs, dioxins/furans, HCB, PCBs emissions NE**

72. The ERT noticed in the IIR (Table 1.26, p. 68) and in the NFR that SO<sub>x</sub>, BC, Cd, Hg, all additional HMs, dioxins/furans, HCB, PCBs emissions from road transport (1A3bi-iv) are NE. The ERT understands that this is possibly related to Tier 1 method used and lack of detailed information of the vehicle fleet (see Category issue 3). However, this issue affects the completeness of the inventory, since the emissions of these pollutants are not provided. In response to a question raised during the review, Montenegro answered that this is due to lack of capacity and that there is a plan with an ongoing project to update to Tier 3 for 1A3b and provide emission estimates which are currently missing.

73. The ERT recommends that Montenegro calculates and provides emissions from road transport (1A3bi-iv) for pollutants which are required according to the Reporting Guidelines paragraph 7, i.e. SO<sub>x</sub>, Cd, Hg, dioxins/furans, HCB, PCBs, in order to improve the completeness of the inventory. The ERT also encourages Montenegro to calculate and provide emissions from road transport (1A3bi-iv) for additional (i.e. non-priority) pollutants as mentioned in the Reporting Guidelines paragraph 8, i.e. BC, and additional HMs.

#### **Category issue 7: 1A3bv-vii – Inconsistency between IIR and NFR**

74. The ERT noticed in the IIR (Table 1.26, p. 68) that the pollutants related to Road transport: Gasoline evaporation (1A3bv), i.e. NMVOC, and Road transport: Automobile tyre and brake wear and road abrasion (1A3bvi-vii), i.e. all PM, are NE. However, this is inconsistent with NFR tables, where values are provided for years 1998-2019, while for years prior to 1997, NE is also used in the NFR. The NFR values are also summarised in the IIR chapter 11 Annex – NFR Tables (p. 400-411) for years 2019, 2005, 1990. This inconsistency among various tables within the IIR and between

IIR and NFR confuses the reader, while there is also an issue of completeness, since NFR values are not provided for years prior to 1997. In response to a question on the issue, Montenegro answered that there is an ongoing process to improve activity data collection and, hence, provide emission estimates for missing years.

75. The ERT recommends that Montenegro calculates and reports NMVOC emissions for 1A3bv and all PM emissions for 1A3bvi-vii for years prior to 1997 to improve the completeness of the inventory and also align the description of the IIR with NFR to improve the consistency of these documents.

#### **Category issue 8: 1A3b – Inconsistency in IIR Tables**

76. The ERT noticed in the IIR Tables 3.104 and 3.105 (p. 251) that in the first column (source category) the sub-sectors 1A3a, 1A2g7 are mentioned, in contrast to what would be expected according to the respective table headings, i.e. 1A3b road transport. In response to a question raised during the review, Montenegro answered that this is due to a copy-paste mistake.

77. The ERT recommends that Montenegro corrects this error to improve the consistency of the IIR.

#### **Category issue 9: 1A3c – No description in IIR**

78. The ERT noticed in the IIR (Table 1.26, p. 68) that NO<sub>x</sub>, NMVOC, NH<sub>3</sub>, all PM (except BC), CO, Cd, all additional HMs (except As), and PAHs, are calculated for the railways sub-sector (1A3c). BC, Pb, Hg, As, and dioxins/furans are reported as NE, SO<sub>x</sub> is reported as IE, and HCB, PCBs are reported as NA. Nevertheless, there is no methodological description, or any other information related to 1A3c. The only additional item related to railways is in chapter 11 Annex – NFR Tables (p. 400-411), where emission values are provided for years 1990, 2005, while for 2019 the notation key NO is used. In addition, the ERT noticed that in Annex I values, all emissions and activity data in the period 2011-2019 are reported as NO. Due to lack of relevant information in the IIR, no further assessment can be made. In response to a question raised during the review, Montenegro answered that Tier 1 emission factors from the Guidebook have been used and that the network has been electrified since 2011, hence, no emissions occur since then.

79. The ERT recommends that Montenegro provides the methodological description of 1A3c emission calculations in the IIR and align the usage of notation keys in the various sections of the IIR and NFR tables.

#### **Category issue 10: 1A3di(ii), 1A3dii – No description in IIR**

80. The ERT noticed in the IIR (Table 1.26, p. 68) that NO<sub>x</sub>, NMVOC, SO<sub>x</sub>, NH<sub>3</sub>, all PM (except BC), and CO, are reported as IE for international inland waterways (1A3di(ii)), while all remaining pollutant emissions are reported as NE, apart from HCB and PCBs which are reported as NA. In the same table, for national navigation (shipping) (1A3dii), NO<sub>x</sub>, NMVOC, NH<sub>3</sub>, all PM (except BC), and CO, are marked as calculated, SO<sub>x</sub> is reported as IE, while all remaining pollutants are reported as NE, apart from HCB and PCBs which are reported as NA. Nevertheless, there is no methodological description, or any other information related to 1A3d. The only additional item related to 1A3di(ii) and 1A3dii is in chapter 11 Annex – NFR Tables (p.

400-411) for years 2019, 2005, 1990, which present inconsistencies with Table 1.26. Looking at the NFR tables for the whole time series 1990-2019, NO<sub>x</sub> emissions are provided for 1A3di(ii) for years 2001-2007, 2009-2010, and remaining years are reported as IE. For 1A3dii, NO<sub>x</sub> emissions are provided for the period 1990-2016, while IE is reported for years 2017-2019. Various inconsistencies among Table 1.26 and NFR Tables also exist for other pollutants. However, due to lack of relevant information in the IIR, no further assessment can be made. In response to a question raised during the review, Montenegro answered that Tier 1 emission factors from the Guidebook have been used for 1A3d and that inconsistencies in emissions are due to inconsistencies of the national energy balance (i.e. activity data). In addition, the Party answered that the emissions from 1A3d will be completely revised and relevant description will be included in the IIR.

81. The ERT welcomes this plan and recommends that Montenegro provides the methodological description of 1A3d emission calculations in the IIR and eliminates the inconsistencies of the national energy balance (i.e. activity data) and inconsistencies between IIR and NFR.

#### **Category issue 11: 1A3dii – NMVOC time series potential inconsistency**

82. The ERT noticed in the NFR tables a possible inconsistency in the NMVOC time series of National navigation (shipping) (1A3dii), i.e. a significant jump in 2011 and 2012, which cannot be associated with activity data. However, no relevant explanation could be identified in the IIR. In response to a question raised during the review, Montenegro answered that this is due to the activity data provided by the national energy balance and, specifically, a jump of motor gasoline fuel in these years.

83. Combined with the category issue 10 above, the ERT welcomes the plan of Montenegro to revise all emission estimates from 1A3d and recommends that the Party provides the methodological description of 1A3d emission calculations in the IIR and eliminates the inconsistencies in the national energy balance (i.e. activity data).

#### **Category issue 12: 1A4cii – CO time series potential inconsistency**

84. The ERT noticed in the IIR (p. 281) a possible inconsistency in the CO time series of Agriculture/Forestry/Fishing: Off-road vehicles and other machinery (1A4cii), i.e. a significant jump in 2000 and 2011, which cannot be associated with activity data. However, no relevant explanation could be identified in the IIR. In response to a question on the issue, Montenegro answered that this is due to the activity data provided by the national energy balance and, specifically, a jump of motor gasoline fuel in these years. The ERT confirms.

85. The ERT recommends that Montenegro eliminates the inconsistencies of the national energy balance (i.e. activity data) and, in any case, provide relevant explanations in the IIR.

#### **Category issue 13: 1A2gvii, 1A4aii, 1A4bii, 1A4ciii – All pollutants IE**

86. The ERT noticed in the IIR (pp. 68-69, 215, 254, 268, 281) and in the NFR that all pollutant emissions from Mobile Combustion in manufacturing industries and construction (1A2gvii) are reported as IE, included in Stationary Combustion in manufacturing industries and construction (1A2gviii); and all pollutant emissions from

Commercial/Institutional: Mobile (1A4aii), Residential: Household and gardening (mobile) (1A4bii), and Agriculture/Forestry/Fishing: National fishing (1A4ciii) are reported as IE, included in Agriculture/Forestry/Fishing: Off-road vehicles and other machinery (1A4cii). The ERT acknowledges that the contribution of these sub-sectors to the national total is small and understands the possible difficulties in obtaining the relevant statistical activity data. However, this issue affects the quality and comparability of the inventory since the emissions of these sub-sectors are not reported separately according to the NFR format.

87. The ERT encourages Montenegro to provide emission estimates separately for 1A2gvii, 1A4aii, 1A4bii, and 1A4ciii, as already mentioned in the improvement plan of the relevant sub-sectors, by obtaining or estimating the activity data which are needed, in order to improve the quality and comparability of the inventory.

#### **Category issue 14: 1A5b, 1A3di(i) – All pollutants NE**

88. The ERT noticed in the IIR and NFR that all pollutant emissions from Other, Mobile (including military, land based and recreational boats) (1A5b) and International maritime navigation (1A3di(i)) are reported as NE. For 1A5b, it is mentioned in the IIR (p. 292) that the national energy statistics do not provide information regarding the use of fuels in this sub-category. For 1A3di(i), there is no description. This issue has an impact on the completeness and comparability of the inventory since emissions from 1A5b and 1A3di(i) are not provided. In response to a question raised during the review, Montenegro answered that there is an ongoing investigation related to activity performed by these sub-sectors.

89. The ERT recommends that Montenegro provides emission estimates for 1A5b and 1A3di(i), by obtaining or estimating the activity data which are needed, to improve the completeness and comparability of the inventory. Otherwise, if emissions from these sub-categories do not occur, the notation key should change to NO, or if they are included elsewhere, the notation key should change to IE and relevant explanation be provided in the IIR.

## INDUSTRIAL PROCESSES

### Review Scope

Pollutants Reviewed		All pollutants		
Years		1990 – 2019		
Code	Name	Reviewed	Not Reviewed	Recommendation Provided
2A1	Cement production	NO		
2A2	Lime production	x		x
2A3	Glass production	NO		
2A5a	Quarrying and mining of minerals other than coal	x		x
2A5b	Construction and demolition	x		
2A5c	Storage, handling and transport of mineral products	NE	x	
2A6	Other mineral products	NO		
2B1	Ammonia production	NO		
2B2	Nitric acid production	NO		
2B3	Adipic acid production	NO		
2B5	Carbide production	NO		
2B6	Titanium dioxide production	NO		
2B7	Soda ash production	NO		
2B10a	Chemical industry: Other	NO		
2B10b	Storage, handling and transport of chemical products	NO		
2C1	Iron and steel production	x		x
2C2	Ferroalloys production	NO		
2C3	Aluminium production	x		x
2C4	Magnesium production	NO		
2C5	Lead production	NO		
2C6	Zinc production	NO		
2C7a	Copper production	NO		
2C7b	Nickel production	NO		
2C7c	Other metal production	NO		
2C7d	Storage, handling and transport of metal products	NO		
2D3b	Road paving with asphalt	x/NE		x
2D3c	Asphalt roofing	x/NE		x
2H1	Pulp and paper industry	NO		
2H2	Food and beverages industry	x		x
2H3	Other industrial processes	NO		
2I	Wood processing	x/NO		
2J	Production of POPs	NO		
2K	Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)	x/NO		x
2L	Other production, consumption, storage, transportation or handling of bulk products	NO		

Note: Where a sector has been partially reviewed (e.g. some of the NFR codes please indicate which have and which have not in the respective columns.

## General recommendations on cross cutting issues

### **Transparency**

90. The ERT considers Montenegro's emissions inventory for the Industrial processes sector to be generally transparent and notes that it comprises of the NFR19 tables for the period 1990 – 2019 and the Informative Inventory Report (IIR) that follows recommended structure of Annex II to the Reporting Guidelines.

91. Montenegro reports activity data in NFR tables and in the IIR. The ERT commends Montenegro on this and recommends Montenegro on further improvements regarding activity data as indicated in the Sub-Sector Specific Recommendations.

92. The ERT notes that the methodology, emissions factors, and activity data are well documented in the IIR, and that Guidebook version 2019 is used for estimating emissions and that no country-specific methods are used. However, reasons for dips and jumps in the time series are not always included in the IIR. The ERT recommends Montenegro to include missing trends descriptions in the IIR to the next submission as indicated in the Sub-Sector Specific Recommendations.

93. The ERT notes that the notation keys are frequently used across the IIR and reporting tables when reporting the emissions and activity data within the Industrial processes sector and that the notation keys used are not always the appropriate ones. The ERT recommends Montenegro to use the notation keys in line with Reporting Guidelines paragraph 12 for the reporting of emissions and activity data. The ERT also recommends Montenegro to clearly explain the usage of notation keys in the IIR for each of source category for which Montenegro uses "NE", "NA" and "NO".

### **Completeness**

94. The ERT considers the Industrial processes inventory to be partly complete, and with many planned improvements reported in the IIR.

95. In the 2021 submission, Montenegro has reported emissions for the whole historic trend (1990-2019) for the Industrial process sector for categories: 2.A.2 Lime production, 2.A.5.a Quarrying and mining of minerals other than coal, 2.C.1 Iron and steel production, 2.C.3 Aluminium production, and 2.H.2 Food and beverages industry.

96. Regarding pollutants ERT considers the Industrial process sector to be partly complete, and with many planned improvements reported in the IIR (e.g., NFRs 2.A.5.b Construction and demolition, 2.D.3.b Road paving with asphalt, 2.D.3.c Asphalt roofing), however with places for some additional improvements (e.g., NFR 2.K) as explained under the Sub-Sector Specific Recommendations.

97. The ERT commends Montenegro 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**

98. The emission trends and activity data trend are in general consistent. However, during the review, the ERT identified some outliers out of which Montenegro explained all. The ERT recommends Montenegro to include detailed explanations for all outliers in the time series for activity data and emissions in the next IIR.



99. The ERT notes that Montenegro has performed recalculations and other changes for some pollutants emissions, source categories or years in the latest submission for the Industrial processes sector and documented the rationale and the impacts on the sector and emission trends in the IIR. The ERT commends Montenegro on this and recommends to further improve reporting of information on future recalculations and other changes made to the Industrial Processes sector such as the rationale, the impact on the sector and the implications for emission trends in the next IIR.

### **Comparability**

100. The ERT found the inventory of Montenegro to be comparable with those of other reporting Parties. Montenegro reports emissions in the NFR2019 table and uses Guidebook version 2019 for estimating emissions and does not use country-specific methods.

### **Accuracy and uncertainties**

101. The ERT found possible overestimates and underestimation of which some are because of missing emissions as explained under Sub-Sector sector-specific recommendations.

102. The ERT notes that Montenegro uses the T2 for all key categories for which emissions have been estimated.

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

104. Montenegro provided a quantitative a source-specific uncertainty analysis for the Industrial processes sector. The ERT commends Montenegro on its quantitative uncertainty analysis.

### **Condensable**

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

### **Improvement**

106. According to the IIR, Montenegro has implemented many improvements (for categories NFR 2.A.2 for the period 1990-2011 they applied Guidebook 2019, used of default Tier 1 EFs of Guidebook 2019, and revised activity data, for categories NFR 2.A.5.a and 2.H.2 for the period 1990-2019 they applied Guidebook 2019, used of default Tier 1 EFs of Guidebook 2019, and revised activity data, for categories NFR 2.C.1 and 2.C.3 for the period 1990-2019 they applied Guidebook 2019, used of default Tier 2 EFs of Guidebook 2019, and revised activity data) and has in the improvement plan for the next period (for category NFR 2.A.2 a plan is further investigation of the drop in Lime production in 2010, for category NFR 2.A.5.a a plan is to include activity

data on crushed stones, marble, pebbles etc. for years before 2010 by estimated them with the use of economic parameters, for categories NFR 2.C.1 and 2.C.3 a plan is to move from T2 to T3 for historic trend, for categories NFR 2.D.3.b and 2.D.3.c for the historic trend a plan is to calculate emissions based on the recommended methodologies and explore new data sources, for the category NFR 2.H.2 a plan is to search in international sources for production data of bread, beer, wine and spirits in the year 2000).

107. During the review, the ERT identified some further needs for improvement as explained under Sub-Sector Specific Recommendations.

## Potential Technical Corrections

108. The ERT has noted possible underestimations as listed below for which Montenegro provided revised estimates of which one (for NFR 2.K) was not accepted by the ERT, and the ERT prepared technical corrections. Montenegro used annual population statistics and production statistics (source: Statistical Yearbooks, Statistical Office of Montenegro - MONSTAT) as activity data and emission factors as recommended in the 2019 version of the Guidebook. The ERT used Montenegro's population in 2005, 2010 and 2019 as activity data (source: <http://data.worldbank.org/indicator/SP.POP.TOTL> ), and emission factors recommended in the 2019 version of the Guidebook. The ERT recommends that Montenegro applies the revised estimations and the calculated technical corrections proposed by the ERT to the following potential underestimates, or that it develops other methods that more accurately correspond to the conditions prevailing in Montenegro) to the following potential underestimates for the whole time series in the next submission see table below.

2.

NFR	Pollutant	Years	Calculated by Party/ ERT	Potential contribution to national total
2.K	Hg	2005, 2010, 2019	ERT	+11.3% (2019), +9.2% (2010), +12.2% (2005)
2.K	PCBs	2005, 2010, 2019	ERT	+99.9% (2019), +99.9% (2010), +99.9% (2005)
2.D.3.b	NM VOC	2005, 2010, 2019	Montenegro	+0.04% (2019), +0.05% (2010), +0.01% (2005)
2.D.3.b	TSP	2005, 2010, 2019	Montenegro	+34.9% (2019), +38% (2010), +6.2% (2005)
2.D.3.b	PM <sub>10</sub>	2005, 2010, 2019	Montenegro	+11.4% (2019), +12.7% (2010), +1.6% (2005)
2.D.3.b	PM <sub>2.5</sub>	2005, 2010, 2019	Montenegro	+1.7% (2019), +2% (2010), +0.2% (2005)
2.D.3.b	BC	2005, 2010, 2019	Montenegro	+1.2% (2019), +8.6% (2010), +1.2% (2005)

**Note:** Revised estimates provided by Montenegro and not accepted by the ERT during the review, NFR 2.K Consumption of POPs and heavy metals: possible underestimation of Hg and PCB emissions for 2019, 2010 and 2005,

Revised estimates provided by Montenegro and accepted by the ERT during the review, NFR 2.D.3.b Road paving with asphalt: possible underestimation of PM<sub>10</sub>, PM<sub>2.5</sub>, BC, TSP and NM VOC emissions for 2019, 2010 and 2005.

## Sub-Sector Specific Recommendations

### **Category issue 1: 2.A.2 Lime production – PM<sub>10</sub>, PM<sub>2.5</sub>, TSP, BC - Accuracy, transparency**

109. During the review, the ERT noted that the reported amount for the lime production in 2010 differ in the IIR (p.300ff, Table 4.2) where is 839 t (i.e. 0.839 kt), and in the NFR table, where is 33.0 kt, and that consequently, the resulted PM<sub>10</sub>, PM<sub>2.5</sub>, TSP and BC emissions are also differ. To a question on the issue Montenegro responded that they noticed a fixed link; thus for all years the activity data of 1990 were used in the NFR and sanded to the ERT the revised estimations (the attached file: 2.A.2.Lime) were the data used in the IIR are provided. The ERT recommends correction in the next IIR.

110. During the review, the ERT noted that the IIR in the Chapter 4.2.1 the explanation of the trend for lime production in Montenegro is missing. Montenegro was asked to explain the trend inconsistency in lime production and consequently in PM<sub>10</sub>, PM<sub>2.5</sub>, TSP and BC emissions (a dip in 1994 for 69%, a dip/peak in 2010). To the question on the issue Montenegro responded with the following explanations: 1994 - Economic Collapse during Yugoslav Wars, 2009/2010 - Economic crisis (worldwide). The ERT recommends including this information in the next submission.

### **Category issue 2: 2.A.5.a Quarrying and mining of minerals other than coal – All pollutants – Accuracy, transparency**

111. The ERT noted in the IIR that the first tables on p. 299 and p. 303 are the same, of which the table on p. 303 seems to be a copy/paste error and ask Montenegro to correct this error and present category 2A5a with new, correct table in the next submission of IIR. To the question on the issue Montenegro responded that this will be correct by adding a caption as in other chapters. The ERT recommends correction in the next IIR.

112. According to the Montenegro's IIR (p. 303) the data on crushed stones, marvel, sands and etc for the period 1990 - 2009 is missing and will be included, when the examination of the years before 2010 is finished. This category is included in the improvement plan (p.389, Table 8.1) and is characterized as high priority, but with no clear time frame. The ERT commended Montenegro for including the improvement plan in the IIR and asked Montenegro to present the schedule for the implementation in the next IIR submission. To the question on the issue Montenegro responded that there is currently a twinning light project in Montenegro starting, which focusses on the improvement and completeness of inventory in order to fulfil the TACC criteria, that issues like the higher tier for key categories or the estimates for missing sources will be addressed within this project. And that the results will be implemented mainly in submission 2022 and at latest in submission 2023 (<http://www.twinplace.eu/MyTwinPlace/Members/InterestDetails.aspx?3926>). The ERT recommends Montenegro doing as they said and including all results and new information in the next IIR.

**Category issue 3: 2.C.1 Iron and steel production, trend – All pollutants - Transparency**

113. The ERT noted that in the IIR in the Chapter 4.3.1 the explanation of the trend for steel production in Montenegro is missing. The Montenegro was asked to explain the trend inconsistency in steel production. To the question on the issue Montenegro responded with the following explanations: 1994 - Economic Collapse during Yugoslav Wars, degradation of Montenegro's infrastructure (ways, communications, electric power stations, etc.), however, delayed deliveries of raw materials and electricity, which, in turn, delayed or prevented needed deliveries, 2009/2010 - Economic crisis (worldwide), 2009 - lack of raw materials as the reason for the shutdown, 2014 - termination of Electrodes Factory Piva, which was a manufacturer of electrodes and welding wires, increase after 2012 - improvements/ modernisation of Toscelik Alloyed Engineering Steel Niksic (Steel Mill Niksic) and the statement that these descriptions will be provided in the next IIR. The ERT commends Montenegro on providing detail trend description and recommends including this information in the next submission.

**Category issue 4: 2.C.3 Aluminium production, trend – SO<sub>2</sub>, CO**

114. The ERT noted that in the IIR in the Chapter 4.3.2 the explanation of the trend for aluminium production in Montenegro is missing and asked for an explanation of the trend inconsistency in aluminium production, specifically dips in SO<sub>2</sub> and CO emissions in 1994. To the question on the issue Montenegro responded the following explanations: 1994 - Economic Collapse during Yugoslav Wars, degradation of Montenegro's infrastructure (ways, communications, electric power stations, etc.), however, delayed deliveries of raw materials and electricity, which, in turn, delayed or prevented needed deliveries, 2009 - closing alumina plant, 2014 - bankruptcy & takeover, 2015 - Shut down of Elektroliza, and the statement that these descriptions will be provided in the next IIR. The ERT commends Montenegro on providing detail trend description and recommends including this information in the next submission.

**Category issue 5: 2.D.3.b Road paving with asphalt, 2.D.3.c Asphalt roofing – All pollutants - Completeness, transparency**

115. The ERT noted that in the NFR tables 1990-2019 Montenegro uses a notation key "NE" for reporting the NMVOC, and for the emissions of other relevant pollutants, "NO". The ERT noted that according to Guidebook 2019, road paving with asphalt and asphalt roofing activities resulting with emission of many other pollutants, except NMVOC and asked the rationale for using the notation key "NO" for reporting the other relevant emitting pollutants. To the question on the issue Montenegro responded that this emissions NMVOC, TSP, PM<sub>10</sub>, PM<sub>2.5</sub>, and BC from Road paving with asphalt are now estimated and that further investigation on the use of asphalt will be done in the framework of Twinning Light Project. The ERT recommends including this information in the next submission.

**Category issue 6: 2.D.3.b Road paving with asphalt - NMVOC, TSP, PM<sub>10</sub>, PM<sub>2.5</sub>, BC - Completeness**

116. The ERT noted that the category 2D3b is included in the improvement plan on (p.389, Table 8.1) and is characterized as high priority, but with no clear time frame and asked Montenegro to present the schedule for the implementation in the next IIR

submission. Moreover, the ERT did a research and find in the Statistical Yearbook of Montenegro 2020 (Source: MONSTAT), Chapter 15: Construction, a data on annual amount of asphalt for the period 2015 – 2019 and asked Montenegro to calculate NMVOC, TSP, PM<sub>10</sub>, PM<sub>2.5</sub> and BC emissions now by using Guidebook 2019 Tier 1 methodology for period 2015 –2019. To the question on the issue Montenegro sent the revised estimations for the period 2001 - 2019 (attached file 2.D.3.b\_RoadPaving.xlsx), and that the time series 1990 - 2006 will be calculated for next submissions with the further investigation on the asphalt use, with providing the statement that they will include estimations and description in next IIR. The ERT commends Montenegro on revised estimations and recommends including them and all new information in the next submission.

**Category issue 7: 2.H.2 Food and beverages industry – NMVOC - Completeness**

117. The ERT noted that Montenegro estimates emissions of the food and beverages industry with the production data of bread, beer, wine, and spirits (p. 328, table 4.32). According to Guidebook 2019 the relevant activity statistics include also total production of home-killed meat, total fish and seafood landed, total production of poultry meat, total production of cakes, biscuits and breakfast cereals, total sugar production, total production of fats excluding butter, total weight of coffee beans roasted, and total production of animal feed. The ERT did a research and find in the Statistical Yearbook of Montenegro 2020 (Source: MONSTAT), Chapter 14: Industry, a data on annual amount of Roasted coffee, Cake and pastry products, Fresh or chilled carcasses, half-carcasses and cuts, of beef, veal, pig, lamb, sheep and chicken meat, and asked Montenegro to include this new data and complete the NMVOC emission inventory for the NFR 2H2 Food and beverages industry for the next submission in 2022. To the question on the issue Montenegro responded that they will estimate emissions from the activity 2.H.2 for next submission. The ERT recommends Montenegro doing as they said and including all new information in the next submission.

**Category issue 8: 2.K Consumption of POPs and heavy metals - Hg, PCBs - Completeness, transparency**

118. The ERT noted that Montenegro uses the notation key "NA" instead of actual emission estimates for Hg and PCB for category 2K and thus there may be an [over/under]-estimate of emissions. This [over/under]-estimate may have an impact on total emissions that is above the threshold of significance (i.e. a change in the National Total of more than 2%). The ERT also noted that "NA" is not the correct notation key to use because the 2019 Guidebook provides a methodology for Hg and PCB emission calculation based on population. The ERT asked Montenegro for an explanation on why Hg and PCB emissions are not calculated, although the historic data on country's total population is known, and to provide further justification for not reporting emissions or a revised estimate that resolves the potential [over/under]-estimate or evidence in case they consider that the impact of the [over/under]-estimate is below the threshold of significance. To the question on the issue Montenegro responded with the revised emission estimations for HCB and Hg for the period 1990 – 2019, based on Tier 1 methodology according to Guidebook 2019. Montenegro also noted that they need to review the reports prepared for submission under the Stockholm Convention (Fourth

reporting cycle), and that the final discussion incorporating the emissions in the national Air pollutant emission inventory will be decided together with the colleagues from the Ministry and together with the Twinning Light project team (with the attached link:

<http://ers.pops.int/ERS-Extended/FeedbackServer/fsadmin.aspx?fscontrol=respondentReport&surveyid=73&voterid=49299&readonly=1&nomenu=1>). The revised estimations for PCB and Hg emissions were not accepted by the ERT due to the errors in the estimations (population number, forgot the conversion factor). The ERT asked Montenegro revising their own estimations and resending corrected estimations. As the ERT did not get any repossesses back from Montenegro the technical corrections were prepared.

## SOLVENTS

### Review Scope

Pollutants Reviewed		All pollutants		
Years		1990 – 2019		
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		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 have and which have not in the respective columns.				

### General recommendations on cross cutting issues

#### **Transparency**

119. The ERT considers Montenegro's emissions inventory for the Solvents sector to be generally transparent and notes that it comprises of the NFR19 tables for the period 1990 – 2019 and the Informative Inventory Report (IIR) that follows recommended structure of Annex II to Reporting Guidelines.

120. Montenegro reports activity data for the Solvents sector (one category) in the IIR. The ERT commends Montenegro on this and recommends Montenegro to further improve reporting of activity data with the implementation of the improvement plan.

121. The ERT notes that the methodology, emissions factors, and activity data are well documented in the IIR, and that Guidebook version 2019 is used for estimating emissions and that no country-specific methods are used. However, reasons for dips and jumps in the time series are not always included in the IIR. The ERT recommends Montenegro to include missing trends descriptions in the IIR to the next submission as indicated in the Sub-Sector Specific Recommendations.

122. The ERT notes that notation keys are frequently used across the IIR and reporting tables when reporting the emissions and activity data within the Solvent sector and that the notation keys used are not always the appropriate ones. The ERT recommends Montenegro to use the notation keys in line with the Reporting Guidelines paragraph 12 for the reporting of emissions and activity data. The ERT also recommends Montenegro to clearly explain the usage of notation keys in the IIR for each of the source category for which Montenegro uses "NE", "NA" and "NO".

#### **Completeness**

123. In the 2021 submission, Montenegro has reported emissions for the whole historic trend (1990-2019) for the Solvents sector for one category (NFR 2.D.3.a) in the scope of the Solvents sector.

124. Regarding pollutants, the ERT considers the Solvents sector to be incomplete, but with many planned improvements reported in the IIR (e.g., NFRs 2.D.3.a, 2.D.3.d, 2.D.3.e, 2.D.3.f, 2.D.3.h, 2.G), however with places for some additional improvements (e.g., NFRs 2.D.3.a, 2.D.3.f, 2.D.3.i) as explained under the Sub-Sector Specific Recommendations.

125. The ERT recommends Montenegro for including black carbon emissions for the whole time series in the relevant source category of the Solvents sector, with the implementation of the improvement plan.

### **Consistency including recalculation and time series**

126. The emission trend and activity data trend are in general consistent for reported category (NFR 2.D.3.a). However, during the review, the ERT identified one outlier, which Montenegro explained, as explained under Sub-Sector sector-specific recommendations. The ERT recommends Montenegro to include detailed explanations for all outliers in the time series for activity data and emissions in the next IIR.

127. The ERT notes that Montenegro has performed recalculations and other changes for some pollutant emissions, source categories or years in the latest submission for the Solvent sector and documented the rationale and the impacts on the sector and emission trends in the IIR. The ERT commends Montenegro on this and recommends to further improve reporting of information on future recalculations and other changes made to the Solvent sector such as the rationale, the impact on the sector and the implications for emission trends in the next IIR.

### **Comparability**

128. The ERT considers the inventory to be comparable with those of other reporting Parties. The methods used by Montenegro to create the inventory for the Solvent sector are consistent with the Guidebook version 2019 and emissions are reported in the latest NFR19 format.

### **Accuracy and uncertainties**

129. The ERT did find one over- or under-estimation in the Solvent sector of which some are because of missing emissions as explained under Sub-Sector sector-specific recommendations.

130. The ERT notes that for the key category, emissions have not 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 overestimation of emissions.

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

132. Montenegro provided a quantitative a source-specific uncertainty analysis for the Solvents sector. The ERT commends Montenegro on its quantitative uncertainty analysis.



## Condensable

133. Montenegro does not provide explanatory information in the IIR of whether particle emissions include or exclude the condensable component. The ERT recommends Montenegro to include such information in the next submission following Annex II of the 2014 Reporting Guidelines.

## Improvement

134. According to the IIR, Montenegro has reported on improvements made (for category NFR 2.D.3.a, for the period 1990-2019 they applied Guidebook 2019, used of default Tier 1 EFs of Guidebook 2019, and revised activity data) and planned for the next period in the IIR (for the category NFR 2.D.3.a a plan is to move from T1 to T2 for historic trend, for categories NFR 2.D.3.d, 2.D.3.e, 2.D.3.f, 2.D.3.h and 2.G a plan is to calculate emissions based on the recommended methodologies and explore new data sources for the historic trend).

135. During the review, the ERT identified some additional needs for improvement as explained under Sub-Sector Specific Recommendations.

## Potential Technical Corrections

136. The ERT has noted possible underestimations and prepared technical corrections as listed below, using annual population statistics (source: <http://data.worldbank.org/indicator/SP.POP.TOTL>) as activity data and emission factor as recommended in the 2019 version of the Guidebook. The ERT recommends that Montenegro applies the calculated technical corrections proposed by the ERT to the following potential underestimates, or that it develops other methods that more accurately correspond to the conditions prevailing in Montenegro, to the following potential underestimates for the whole time series in the next submission. Technical corrections prepared by the ERT during the review see table below: NFR 2.D.3.f Dry cleaning: possible underestimation of NMVOC emissions for 2019, 2010 and 2005.

NFR	Pollutant	Years	Calculated by Party / ERT	Potential contribution to national total
2.D.3.f	NMVOC	2005, 2010, 2019	ERT	+2.1% (2019), +1.9% (2010), +2.2% (2005)

## Sub-Sector Specific Recommendations

### Category issue 1: 2.D.3.a Domestic solvent use including fungicides – NMVOC – Transparency, accuracy, consistency

137. According to the IIR (p. 327 Table 4.31) Montenegro is planning source-specific improvements for the key category NFR 2.D.3.a (move to T2), on which the ERT commends the Party. However, there is no clear timetable for the implementation of this improvement, and the ERT asked for clarification. To the question on the issue Montenegro responded that there is currently a twinning light project in Montenegro starting, which focusses on the improvement and completeness of inventory in order to fulfil the TACC criteria, and that the issues like the higher tier for key categories or the estimates for missing sources will be addressed within this project. Montenegro also stated in their response that the results of this project will be implemented mainly

in the submission 2022 and at latest in the submission 2023 (link to the project: <http://www.twinplace.eu/MyTwinPlace/Members/InterestDetails.aspx?3926>).

138. The ERT notes that according to the Reporting Guidelines paragraph 21 Parties should make every effort to use a Tier 2 or higher (detailed) methodology, including country-specific information for key categories, and recommends including all new information provided during the review, the schedule into the improvement plan and to report on progress of the work in the next IIR submissions.

139. The ERT noted in the NFR tables, the drop of NMVOC emissions in 2010 for around 6.2%. The ERT also noted that NMVOC emission in 2010 is the same as in 1990 and wanted to know if the error has occurred during the manipulation with the activity data (population number). According to Montenegro's IIR (p. 324, Table 4.28) the NMVOC emission in 2010 is 743.31 t, and in the NFR table for 2010 is 0.6958704 kt (i.e. 695.87 t), and asked Montenegro for an answer which of reported amounts for NMVOC emissions in 2010, is the correct one.

140. To the question on the issue Montenegro responded that this is a technical mistake: the link between calculation file and NFR tables is broken, and send the revised calculation file with activity data, emission factor and NMVOC emissions. The ERT recommends correcting and documenting this correction in the next submission.

#### **Category issue 2: 2.D.3.f Dry cleaning – NMVOC - Transparency, completeness**

141. The ERT noted that Montenegro is using a different notation key for presenting the NMVOC emissions from this source category across the IIR and NFR tables (1990-2019): "NO" is used in NFR tables, and "NE" in the IIR (p. 297ff, Table 4.1). The ERT also noted that Montenegro included this activity in the improvement plan with high priority, but with no clear implementation schedule. The ERT commended Montenegro for including it in the improvement plan and asked for an explanation of the rationale for using the notation key "NO" in the NFR tables. Moreover, the ERT asked Montenegro, while waiting the realization of the improvement plan when the annual quantity of material cleaned need to be collected, to calculate NMVOC emissions for the period 1990-2019 now, by using the annual population number and  $EF(NMVOC) = 0.3 \text{ kg/inhabitant}$  given in Guidebook 2019.

142. To the question on the issue Montenegro responded that the use of the notation key "NO" in the IIR is not correct as in Montenegro dry cleaning facilities are available, that emissions are not yet estimated but in the framework of the Twinning light, the subcategory solvent use will be estimated according to EMEP/EEA Guidebook 2019 and according to the key category analysis. Montenegro also responded that there is currently a twinning light project in Montenegro starting, which focusses on the improvement and completeness of inventory in order to fulfil the TACC criteria, and that the issues like the higher tier for key categories or the estimates for missing sources will be addressed within this project. Montenegro also stated in their response that the results of this project will be implemented mainly in the submission 2022 and at latest in the submission 2023 (<http://www.twinplace.eu/MyTwinPlace/Members/InterestDetails.aspx?3926>) . As the ERT did not get revised estimation from Montenegro the technical corrections were prepared.

143. The ERT recommends including revised technical corrections in the inventory in the next submission with all new information provided during the review, the schedule into the improvement plan and to report on progress of the work in the next IIR submissions.

**Category issue 3: 2.D.3.i Other solvent use – NMVOC – Transparency, Completeness**

144. The ERT notes that Montenegro is using a different notation key for presenting pollutants emissions from this source category: across the IIR and NFR tables (1990-2019): in the NFR tables "NE" is used for presenting the NMVOC emissions and "NO" or "NA" for all other pollutant's emissions, while in the IIR p.297ff, Table 4.1 "NO" is used, and on p. 68 Table 1.26 "NE" for NMVOC, and "NA" for other pollutants are used. The ERT also noted that Montenegro did not include the source category NFR 2.D.3.i Other solvent use in the improvement plan in the IIR (page 386, Table 8.1). The ERT noted that this category includes many activities such as: Glass wool and Mineral wool enduction, Fat, edible and non-edible oil extraction, Application of glues and adhesives, Underseal treatment and conservation of vehicles, Vehicles dewaxing, Other (Concrete additive, Cooling lubricant, Lubricant, Pesticide, Aeroplane de-icing Agent) of which some maybe exist or existed in Montenegro during the period 1990-2019.

145. Montenegro was asked for an explanation for the use of different notation keys and to provide evidence that activities in the scope of NFR 2.D.3.i don't exist in the Montenegro for the years 1990 to 2019. To the question on the issue Montenegro responded that the use of the notation key "NO" in the IIR is not correct, and that emissions are not yet estimated but in the framework of the Twinning light, the subcategory solvent use will be estimated according to EMEP/EEA Guidebook 2019 and according to the key category analysis. Montenegro also provided an information on a twinning light project starting in Montenegro, which focusses on the improvement and completeness of inventory in order to fulfil the TACC criteria and that issues like the higher tier for key categories or the estimates for missing sources will be addressed within this project. The results will be implemented mainly in the submission 2022 and at latest in the submission 2023 (link to the project: <http://www.twinplace.eu/MyTwinPlace/Members/InterestDetails.aspx?3926>).

146. The ERT recommends Montenegro correcting and documenting this correction, including all new information provided during the review, including the schedule into the improvement plan and to report on progress and the results of the work in the next IIR submissions.

## AGRICULTURE

### Review Scope

Pollutants Reviewed		NO <sub>x</sub> , NMVOC, NH <sub>3</sub> , PM <sub>10</sub> & PM <sub>2.5</sub>		
Years		1990 – 2019		
Code	Name	Reviewed	Not Reviewed	Recommendation Provided
3B1a	Dairy cattle	X		X
3B1b	Non-dairy cattle	X		X
3B2	Sheep	X		X
3B3	Swine	X		X
3B4a	Buffalo		NO	
3B4d	Goats	X		X
3B4e	Horses	X		X
3B4f	Mules and asses	X		X
3B4gi	Laying hens	X		X
3B4gii	Broilers	X		X
3B4giii	Turkeys	X		X
3B4giv	Other poultry	X		X
3B4h	Other animals		X	
3Da1	Inorganic N-fertilizers (includes also urea application)	X		X
3Da2a	Animal manure applied to soils	X		X
3Da2b	Sewage sludge applied to soils	X		X
3Da2c	Other organic fertilisers applied to soils (including compost)	X		X
3Da3	Urine and dung deposited by grazing animals	X		X
3Da4	Crop residues applied to soils	X		X
3Db	Indirect emissions from managed soils	X		X
3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products		X	
3Dd	Off-farm storage, handling and transport of bulk agricultural products		X	
3De	Cultivated crops	X		X
3Df	Use of pesticides	X		X
3F	Field burning of agricultural residues			X
3I	Agriculture other		X	
11A	Volcanoes		X	
11B	Forest fires		X	
Note: Where a sector has been partially reviewed (e.g. some of the NFR codes please indicate which have and which have not in the respective columns).				

### General recommendations on cross cutting issues

147. The Agricultural emissions reported by Montenegro have all been calculated using Tier 1 methods from the EMEP Guidebook 2019. The IIR provided by Montenegro initially lacked information on sector 3D, which was later provided. The activity data is not consisted throughout the time series due to changes in the statistical methodology.

148. Montenegro indicated it plans to build a nitrogen budget model to calculate its nitrogen emissions using a Tier 3 method. Montenegro indicated it will ensure the differences between the activity data sets will be amended in line with the EMEP Guidelines 2019 to prevent time series inconsistencies. The ERT recommends Montenegro to implement its planned improvements as soon as possible.

### **Transparency**

149. Montenegro has provided a detailed and generally transparent emissions inventory for the agriculture sector. Estimates are provided at the most detailed level. Montenegro's methodology and emission factors in the IIR are considered by the ERT to be transparent and well described for the agriculture sector. The ERT recommends Montenegro to include more detail in the IIR including the description of the trends, in particular dips and jumps in the time series, and explanation of any calculation errors or time series inconsistencies.

### **Completeness**

150. The ERT considers the agriculture sector to be close to complete and comprehensive with good levels of detail in the methodology descriptions. Emissions of some minor sources are missing from the inventory, namely: Field burning of agricultural residues, use of pesticides (HCB) and sewage sludge applied to soils (NH<sub>3</sub>).

### **Consistency including recalculation and time series**

151. The ERT notices that the time series are not consistent. Montenegro has explained that the method to collect activity data has changed over the years. Montenegro has indicated that it will amend these issues in the next submission. The ERT could not find alternative activity data at other sources (FAO and World Bank) that would improve the time series consistency. The ERT recommends Montenegro to improve the consistency of its time series in the next submission.

### **Comparability**

152. All methods applied by Montenegro are consistent with the Tier 1 methods provided by the EMEP/EEA Guidebook 2019. Montenegro has indicated that it will move to a Tier 3 method for NH<sub>3</sub> and NO<sub>x</sub> emissions in 2022 or 2023. Montenegro has collected sufficient activity data to calculate its emissions. Since all alternative databases contain the same Tier 1 activity data it was not possible to assess whether any over or underestimates have been made. The ERT recommends Montenegro to implement a Tier 2 or 3 method to calculate its nitrogen emissions from all key categories.

### **Accuracy and uncertainties**

153. An uncertainty assessment has not been undertaken and is not mentioned in the planned improvements. Montenegro displayed the general uncertainty estimates from the EMEP/EEA guidebook in the IIR. Montenegro uses multiple steps in its QA/QC procedure that are consistent with good practice. The activity data is compared to national and international statistics. The time series consistency is assessed to ensure all dips and jumps are explainable. The ERT recommends Montenegro to

include the check on time series consistency in the IIR to allow reviewers to assess the information.

### **Improvement**

154. Montenegro has provided a list of planned improvements in the IIR. Besides these planned improvements the ERT recommends Montenegro to: review its statistical data on activity data to improve the times series consistency, to include more information on the time series in the IIR, to calculate emissions from Field burning of agricultural residues, use of pesticides (HCB) and sewage sludge applied to soils (NH<sub>3</sub>), to implement a Tier 3 method to calculate its nitrogen emissions for all key categories.

## **Sub-Sector Specific Recommendations**

### **Category issue 1: QA/QC**

155. The ERT noted that Table 5.2 in the IIR, presenting the application of the different manure management systems, was incorrect. Montenegro responded by providing a new table with the correct percentages. The ERT recommends Montenegro to improve its QA/QC protocol to prevent such mistakes in the future.

### **Category issue 2: Transparency**

156. The ERT noted that no explanation was provided for any trends, dips or jumps in the activity data or emissions. Montenegro responded by providing information on the different agricultural statistical methods that have been used over the years. The results of the different statistical methods differ significantly, making it difficult to apply a harmonisation and prevent time series inconsistency. The ERT recommends Montenegro to provide the information on the different statistical methods as well as any developments that have had an actual impact on activity data or emissions in the next submission, but also to reassess using the EMEP/EEA Guidebook whether it is possible to implement a correction to create a more consistent time series.

### **Category issue 3: 3.D.f Use of pesticides – HCB**

157. The ERT notes that Montenegro has not estimated the emission of Hexachlorobenzene (HCB) from the use of pesticides. The EMEP/EEA guidebook 2019 provides a Tier 1 methodology to calculate the emissions of HCB from the application of pesticides. The ERT recommends Montenegro to include HCB emissions from the use of pesticides in the inventory.

### **Category issue 4: 3.B Manure management**

158. The ERT notes that Montenegro has estimated its NH<sub>3</sub> and NO<sub>x</sub> emissions using Tier 1 methods. Montenegro has indicated that it will implement a Tier 2 method in 2022 or 2023. The ERT recommends Montenegro to apply a higher Tier method as soon as possible.

## WASTE

### Review Scope

Pollutants Reviewed		SO <sub>2</sub> , NO <sub>x</sub> , NMVOC, NH <sub>3</sub> , PM <sub>10</sub> & PM <sub>2.5</sub>		
Years		1990 – 2019 + (Protocol Years)		
Code	Name	Reviewed	Not Reviewed	Recommendation Provided
5A	Solid waste disposal on land	X		x
5B1	Biological treatment of waste - Composting	NE		
5B2	Biological treatment of waste - Anaerobic digestion at biogas facilities	NO		
5C1a	Municipal waste incineration	NO/NE		
5C1bi	Industrial waste incineration	NO		
5C1bii	Hazardous waste incineration	NO		
5C1biii	Clinical waste incineration	NO		
5C1biv	Sewage sludge incineration	NO		
5C1bv	Cremation	NO		
5C1bvi	Other waste incineration	NO		
5C2	Open burning of waste	NE		
5D1	Domestic wastewater handling	NE		x
5D2	Industrial wastewater handling	NE		
5D3	Other wastewater handling	NO		
5E	Other waste	NO		
Note: Where a sector has been partially reviewed (e.g. some of the NFR codes please indicate which have and which have not in the respective columns.				

### General recommendations on cross cutting issues

#### **Transparency**

159. Montenegro have provided a generally transparent emissions inventory. The Party's methodology and emission factors in the IIR are considered by the ERT to be transparent and well described for the waste sector. However, in a few cases information in the IIR were not updated in the latest submission (see sub-sector specific recommendations below). The ERT recommends that Montenegro ensures that the information in the IIR is kept up-to-date in the next submission.

#### **Completeness**

160. The ERT consider the waste sector to be incomplete. E.g. Montenegro indicated that emissions occur, but that no emissions were estimated due to lack of resources and data, for the following categories:

- Biological treatment of waste - Composting (5.B.1)
- Industrial waste incineration (5.C.1.b.i)
- Clinical waste incineration (5.C.1.b.iii)
- Open burning of waste (5.C.2)
- Domestic wastewater handling (5.D.1)
- Industrial wastewater handling (5.D.2)

The ERT recommends that Montenegro consult the 2019 EMEP/EEA Guidebook on methods and EFs and make efforts to estimate emissions from the abovementioned categories.

### **Consistency, including recalculation and time series**

161. Montenegro has recalculated NMVOC and particle emissions from 5A for 2018 and NMVOC emissions from 5D1 for 1990-2018. Some explanations are provided in the IIR for recalculations of 5A but no information is provided about the NMVOC emissions from 5D1. The ERT recommends Montenegro to provide more detailed explanation of recalculations, including the rationale, the impact on the sector and implication to trends for the waste sector in its IIR.

### **Comparability**

162. Montenegro did not provide updated information on methods and EF used in the IIR. During the review, Montenegro explained what methods and EF from 2019 EMEP/EEA Guidebook were used. However, the ERT noted several discrepancies between information in IIR and EMEP/EEA Guidebook (see sub-sector specific recommendations below). The ERT recommends Montenegro to ensure that updated information on methods and EF used are provided in the IIR of the next submission.

### **Accuracy and uncertainties**

163. The ERT encourages Montenegro to undertake uncertainty analysis for the waste sector to help inform the improvement process and to provide an indication of the reliability of the inventory data.

164. In its IIR (p. 376), the Party refers to general QA/QC checks. However, the ERT noted that several errors occurred in the waste sector and that the information in the IIR was not updated in some cases. The ERT encourages Montenegro to implement sector specific QA/QC procedures to ensure accurate emission estimations and that the IIR is updated in the next submission.

### **Condensable**

165. The Party did not provide explicit information on condensable component of PM for categories. However, the Montenegro uses default 2019 EMEP/EEA Guidebook. The ERT recommends Montenegro to include explicit information on condensable components of PM in the next submission.

### **Improvement**

166. In its IIR (pages 379-380) the Party states that it is planning to develop emission inventories for NFR 5.C.2 Open burning of waste and NFR 5.D.2 Industrial wastewater handling. During the review, Montenegro explained that there is currently a twinning light project in Montenegro starting, which focusses on the improvement and completeness of the inventory to fulfil the TCCCA criteria. Issues such as higher Tier methodology for key categories or the estimation of emissions for missing sources will be addressed within this project. The results will be implemented mainly in submission 2022 and the latest in submission 2023. The Party explained that emissions of NFR 5.C.2 Open burning of waste and NFR 5.D.2 Industrial wastewater handling will be estimated during this project; However, for NFR 5.C.2 Open burning of waste,



discussions with local experts are planned. (<http://www.twinplace.eu/MyTwinPlace/Members/InterestDetails.aspx?3926>). The ERT commends Montenegro for its planned improvements and encourages Montenegro to report on the progress in the next submission.

## Potential Technical Corrections

167. The ERT did not perform any recalculations for the Waste sector.

## Sub-Sector Specific Recommendations

### **Category issue 1: 5.A.1 Landfills – TSP, PM<sub>10</sub>, PM<sub>2.5</sub>**

168. In its IIR table 6.4 (page 376), the Party provides the EFs used for estimation of NMVOC and Particle emissions from NFR 5A (Biological treatment of waste - Solid waste disposal on land), referring to the EMEP/EEA Guidebook 2019 Tier 1 factors. However, the ERT noted that the unit used for the particle fractions in table 6.4 are incorrect: kg/Mg waste instead of the Tier 1 factor units of g/Mg waste. The ERT noted that the emission estimations in NFR 5A seem to be correct. During the review, Montenegro concurred that the information in the IIR is incorrect and explained that the Party will improve its QA/QC procedures and correct the error in the next submission. The ERT recommends that Montenegro update the IIR with the correct information in its next submission.

### **Category issue 2: 5.D.1 Landfills – NMVOC**

169. The ERT noted that the Party reported emissions of NMVOC from Domestic wastewater handling (NFR 5D1) but no AD in its NFR tables. However, in its IIR (page 380) the Party states that currently no emissions were estimated due to lack of resources and data. During the review, Montenegro provided the information on the applied methodology together with underlying calculations, including AD, data source, and EFs. Further, the Party explained that the information in the IIR will be updated in the next submission. However, the ERT noted that there is an error in the underlying revised calculations sheets: unit conversion  $10^6$  is used instead of  $10^9$ . The ERT recommends Montenegro to check its NMVOC emission estimates to ensure accurate estimations, to provide AD in the NFR tables and to revise the information provided in the IIR in its next submission.

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

1. IIR-ME\_2021\_DRAFT
2. IIR-ME\_2021\_FINAL
3. ME\_ANNEX\_i\_1990-2019\_v1
4. ME-NFR\_1990-2019\_v2.0
5. Stage 3 RR from year 2012
6. Repdab Report
7. Stage 1 and 2 S&A report 2021
8. Extended checks

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

9. Answers to the questions of review team ("Clever space" platform at Umweltbundesamt website)
10. Material received from the Party during the Review
  - 1.A.3.b\_RoadTransport\_ActivityData.xlsx
  - 2.D.3\_Domestic solvent use.xlsx
  - 3.B. Table 5.2\_AMMS-revised.xlsx
  - 5.A\_Solid\_Waste\_Disposal.xlsx
  - 5.D\_WasteWater.xlsx
  - Copy of Montenegro Stage 3 review 2021\_Transport\_Solvents.xlsx
  - Copy of Montenegro Stage 3 review 2021\_Waste-Agriculture-General.xlsx
  - MNE\_EnergyBalance\_1990-2019\_s.xlsx

## ANNEX I POTENTIAL TECHNICAL CORRECTIONS

170. Technical corrections have been proposed by the ERT during the review week for the IPPU sector. Detailed related information is provided separately in the Excel file *ME-TC RE-IPPU-2021\_v2.xlsx*.

3.

Description	Reference	Pollutant estimates		
		2019	2010	2005
Hg		Pollutant estimates (t)		
National total as reported 2019 (row 141)	Annex I, 15 February 2021	0.049	0.061	0.044
Difference between original estimate and revised estimates provided by Party and accepted by the ERT				
2 K Consumption of POPs and heavy metals				
Difference between original estimate and technical correction deemed necessary by the ERT				
2 K Consumption of POPs and heavy metals		0.006	0.006	0.006
National total (row 141) including revised estimates and technical corrections accepted by MS	Calculated using data above	0.055	0.067	0.050
PCB		Pollutant estimates (kg)		
National total as reported 2019 (row 141)	Annex I, 15 February 2021	0.03	0.034	0.081
Difference between original estimate and revised estimates provided by Party and accepted by the ERT				
2 K Consumption of POPs and heavy metals				
Difference between original estimate and technical correction deemed necessary by the ERT				
2 K Consumption of POPs and heavy metals		62.21	61.94	61.43
National total (row 141) including revised estimates and technical corrections accepted by MS	Calculated using data above	62.248	61.977	61.507

NMVOC		Pollutant estimates (kt)		
National total as reported 2019 (row 141)	Annex I, 15 February 2021	8.55	9.741	8.362
Difference between original estimate and revised estimates provided by Party and accepted by the ERT				
2D3b Road paving with asphalt		0.0034	0.0046	0.0004
2D3f Dry cleaning				
Difference between original estimate and technical correction deemed necessary by the ERT				
2D3b Road paving with asphalt				
2D3f Dry cleaning		0.187	0.186	0.184
National total (row 141) including revised estimates and technical corrections accepted by MS	Calculated using data above	8.74	9.93	8.55

Description	Reference	Pollutant estimates		
		2019	2010	2005
PM10		Pollutant estimates (kt)		
National total as reported 2019 (row 141)	Annex I, 15 February 2021	4.89	5.937	5.302
Difference between original estimate and revised estimates provided by Party and accepted by the ERT				
2D3b Road paving with asphalt		0.63	0.863	0.083
Difference between original estimate and technical correction deemed necessary by the ERT				
2D3b Road paving with asphalt				
National total (row 141) including revised estimates and technical corrections accepted by MS	Calculated using data above	5.523	6.800	5.385

PM2.5		Pollutant estimates (kt)		
National total as reported 2019 (row 141)	Annex I, 15 February 2021	4.74	5.602	5.015
Difference between original estimate and revised estimates provided by Party and accepted by the ERT				
2D3b Road paving with asphalt		0.084	0.115	0.011
Difference between original estimate and technical correction deemed necessary by the ERT				
2D3b Road paving with asphalt				
National total (row 141) including revised estimates and technical corrections accepted by MS	Calculated using data above	4.820	5.717	5.027

BC		Pollutant estimates (kt)		
National total as reported 2019 (row 141)	Annex I, 15 February 2021	0.41	0.069	0.050
Difference between original estimate and revised estimates provided by Party and accepted by the ERT				
2D3b Road paving with asphalt		0.005	0.007	0.001
Difference between original estimate and technical correction deemed necessary by the ERT				
2D3b Road paving with asphalt				
National total (row 141) including revised estimates and technical corrections accepted by MS	Calculated using data above	0.413	0.076	0.051

TSP		Pollutant estimates (kt)		
National total as reported 2019 (row 141)	Annex I, 15 February 2021	5.49	6.566	5.871
Difference between original estimate and revised estimates provided by Party and accepted by the ERT				
2D3b Road paving with asphalt		2.94	4.03	0.39
Difference between original estimate and technical correction deemed necessary by the ERT				
2D3b Road paving with asphalt				
National total (row 141) including revised estimates and technical corrections accepted by MS	Calculated using data above	8.431	10.592	6.259