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

STAGE 3 REVIEW REPORT
MONACO

CONTENT

INTRODUCTION

1. The mandate and overall objectives for the emission inventory review process under the LRTAP Convention is given by the UNECE document "*Methods and Procedures for the Technical Review of Air Pollutant Emission Inventories reported under the Convention and its Protocols*"[1] – hereafter referred to as the "Methods and Procedures" document. This year an updated version[2] of the "Methods and procedures" document proposed by the Task Force on Emission Inventories and Projections (TFEIP) was tested.

2. This annual review, has concentrated on SO_x, NO_x, NMVOC, NH_3, plus PM_{10} & $PM_{2.5}$ for the time series years 1990 – 2015 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 and EU NEC Directive inventories of Monaco coordinated by the EMEP emission centre CEIP acting as review secretariat. The review took place from 19th June 2017 to 23th June 2017 in Copenhagen Denmark and was hosted by the European Environment Agency (EEA). The following team of nominated experts from the roster of experts performed the review: generalist – Ms. Elo Mandel (Estonia), energy - Ms. Marion Pinterits (EU), transport - Ms. Antonella Bernetti (Italy), industry - Ms. Maria Purzner (Austria), solvents - Ms. Mirela Poljanac (Croatia), agriculture - Ms. Simone Haider (Austria), waste - Mr. Dirk Wever (Netherlands).

4. Ms. Kristina Saarinen (Finland) was the lead reviewer. The review was coordinated by Ms. Katarina Marečková, (EMEP Centre on Emission Inventories and Projections - CEIP).

[1] Methods and Procedures for the Technical Review of Air Pollutant Emission Inventories reported under the Convention and its Protocols. Note by the Task Force on Emission Inventories and Projections. ECE/EB.AIR/GE.1/2007/16 http://www.ceip.at/fileadmin/inhalte/emep/review/review_guidelines.pdf

[2] Proposal for updating the 'Methods and procedures' document laying down the process for the EMEP emission inventory review Available at: http://www.unece.org/fileadmin/DAM/env/documents/2016/AIR/EMEP/Informal_Document/3_Methods_Procedures_update_proposal_May2016_ISSUE1_TFEIP.pdf

PART A: KEY REVIEW FINDINGS

5. The ERT considers Monaco`s air pollutant emission inventory to be generally in line with the EMEP/EEA air pollutant emission inventory guidebook – 2016 (hereafter 2016 EMEP/EEA Guidebook or Guidebook) and the UNECE Reporting Guidelines (hereafter Reporting Guidelines). Transport emissions are reported based on fuel sold.

6. Emissions data in NFR tables and the Informative Inventory Report (hereafter IIR) were submitted with a delay with respect to the timeframe set in the UNECE Reporting Guidelines.

7. The ERT noted that recalculations have been carried out. In the 2017 submission Monaco has reported more pollutants and a full time series since the previous 2012 CLRTAP Stage 3 in-depth review. Nevertheless, the ERT identified areas for further improvement regarding the transparency and the completeness of the inventory.

8. During the review the ERT did not specify possible technical corrections for the inventory.

9. The ERT thanks Monaco 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 a number of detailed recommendations.

INVENTORY SUBMISSION

10. Monaco submitted NFR tables under the CLRTAP on 2th June 2017 after the deadline of 15th February. In the 2017 submission Monaco reported emissions in the NFR 2014 format for the whole time series for all pollutants from 1990 to 2015 (the most recent year).

11. The IIR was submitted on 2th June 2017 after the deadline of 15th March.

12. Projections with measures up to 2030 were submitted on 2th June 2017 in the NFR 2014 format.

13. In the 2017 submission Monaco reported gridded emissions and LPS data for the years 2014 and 2015.

KEY CATEGORIES

14. Monaco has not provided a key category analysis (KCA). During the review week, Monaco indicated that they would provide a key category analysis for the next submission. The ERT welcomes this and reiterates the recommendation from the 2012 CLRTAP S3 in-depth review that Monaco undertakes a KCA to help prioritize the available resources for improvement of data and methods on key categories.

15. The ERT used the key category analysis performed by the CEIP for Monaco's inventory for the review. The ERT encourages Monaco to use higher Tier methods for all key categories in line with the Guidebook in order to increase the accuracy of the inventory.

QUALITY

Transparency

16. The ERT found Monaco´s inventory to be generally transparent. The IIR is brief and principally follows the recommended structure for an IIR according to Annex II of the Reporting Guidelines.

17. The ERT notes that the IIR does not provide sufficient information on methodologies, activity data and emission factors used to calculate emissions from the industrial processes, transport, waste and solvent sectors. The ERT recommends Monaco to provide this information as well as references to sources of the information, in order to enhance the transparency of the inventory.

18. The ERT notes that Monaco provides explanations on the use of notation keys in the IIR. The ERT recommends Monaco to provide the explanations for the use of notation keys in table format, as this would make it easier to follow the explanations.

Completeness

19. The ERT acknowledges the effort Monaco has taken to provide estimates of emissions for almost all pollutants for almost all sub-sectors. The ERT found the inventory to be generally complete in terms of sources, pollutants, years and geographical coverage. However, missing sources were identified e.g. in the transport, solvent Use and agriculture sectors as explained under the sub-sector specific recommendations. The ERT recommends Monaco to include these in the inventory.

20. The ERT noted that Monaco uses the notation keys "NE" (Not estimated) and "IE" (Included Elsewhere) in a number of areas. The ERT recommends Monaco to collect data and use the methods provided in the 2016 EMEP/EEA Guidebook to calculate all relevant emissions instead of reporting "NE" or "IE". Where not possible to report emission values instead of "IE" the ERT encourages Monaco to provide a justification for the use of the notation key in the IIR.

Consistency, including recalculations and time-series

21. Monaco has carried out recalculations in the transport sector and a short explanation on them is provided in the 2017 IIR. However, the IIR does not provide justifications for recalculations nor quantitative information on differences to previous estimates. The ERT encourages the Party to include this information in the IIR.

22. Monaco reported a full time series 1990-2015. Due to the lack of information provided in the IIR, and due to missing activity data for all reported emissions the ERT cannot completely assess the consistency of the time series.

Comparability

23. The ERT notes that Monaco uses methods from the Guidebook and the allocation of source categories follows that of the Reporting Guidelines, and considers thus the inventory to be comparable with those of other reporting Parties. The ERT encourages Monaco to continue the inventory work with this approach.

24. Monaco states in its IIR that methodologies from both the 2013 and the 2016 version of the EMEP/EEA Guidebook are applied. The ERT recommends applying the methodologies from the most recent 2016 EMEP/EEA Guidebook.

CLRTAP/NECD comparability

25. Monaco is not an EU country and therefore does not report emissions under the EU National Emission Ceilings (NEC) Directive.

Accuracy and uncertainties

26. The ERT notes that Tier 2 or higher methodologies have been applied only to some of the key categories. The ERT encourages Monaco to use Tier 1 or higher Tier methods for all key categories in line with the Reporting Guidelines in order to increase the accuracy of the inventory.

27. Monaco did not report an uncertainty analysis as part of the 2017 submission. During the review week, Monaco indicated that they would provide an uncertainty analyses for the next submission. The ERT welcomes this and recommends Monaco to undertake an uncertainty analysis to help guide the inventory improvement process and to provide an indication of the reliability of the inventory data.

Verification and quality assurance/quality control approaches

28. The IIR does not provide information on verification of the inventory.

29. The quality control and quality assurance (QA/QC) procedures carried out for the air pollutant inventory are described in the IIR. The ERT noted that the QA/QC procedures do not cover all sectors, e.g. solvent use. The ERT recommends Monaco to extend the QA/QC checks for all sectors and to report on them and their results in the IIR.

FOLLOW-UP TO PREVIOUS REVIEWS

30. Results from Stage 1 and Stage 2 reviews of the 2015 emission data were used in this Stage 3 review. The ERT invites Monaco to also refer to these previous reviews when examining this review report and when updating its improvement plans.

31. Monaco has improved its inventory since the 2012 CLRTAP S3 in-depth review by reporting more pollutants and by providing a full time series. However, there are some areas where the recommendations from previous reviews are not implemented, such as the key category analysis and the uncertainty analysis. The ERT has listed areas for improvement in Part B.

AREAS FOR IMPROVEMENTS IDENTIFIED BY MONACO

32. Monaco has not provided an improvement plan in the IIR. During the review week, Monaco indicated that they would provide information on improvements in the next IIR submissions. The ERT welcomes this and encourages Monaco to include an improvement plan in the next IIR submission.

33. The ERT welcomes information provided by the Party during the in the review on the following future inventory improvement needs:

(a) to perform a KCA level assessment;

(b) to provide information about planned improvements;

(c) to establish an uncertainty analysis;

(d) to apply the methodologies from the most recent EMEP/EEA Guidebook 2016;

(e) to estimate emissions of the entire time series from road transport with new transport model;

(f) to provide activity data for NFR categories 1A3dii, 1A3di(i) and 2D3h;

(g) to use more relevant notification in NFR category 2A1.

TECHNICAL CORRECTIONS CONSIDERED AND/OR CALCULATED BY THE ERT

35. The ERT did not identify significant inconsistencies in the inventory and therefore did not propose the party potential technical corrections.

PART B: RECOMMENDATIONS FOR IMPROVEMENTS TO THE PARTY

CROSS CUTTING IMPROVEMENTS IDENTIFIED BY THE ERT

36. The ERT identified the following cross-cutting issues for improvement in Monaco´s inventory:

(a) The ERT recommends Monaco to report data within deadlines set-up in the UNECE Reporting Guidance.

(b) The ERT recommends Monaco to apply the methodologies from the 2016 EMEP/EEA Guidebook.

(c) The ERT recommends Monaco to estimate and report emissions currently reported as “NE”, at least for those for which methods are presented in the 2016 EMEP/EEA Guidebook. For those that cannot be estimated, the ERT recommends Monaco to investigate the relevance of the source in the country and to assess the quantitative importance of the emissions.

(d) The ERT recommends Monaco to document the calculation of emissions in detail, presenting emission factors and activity data as well as assumptions made in the IIR of the next submission.

(e) The ERT recommends Monaco to undertake a key category analysis for all pollutants.

(f) The ERT encourages Monaco to perform and present an uncertainty analysis and to use it as a tool to focus on planned improvements.

37. Recommended improvements relating to specific source categories are presented in the relevant sector sections of this report.

SECTOR SPECIFIC RECOMMENDATIONS FOR IMPROVEMENTS IDENTIFIED BY ERT

ENERGY

Review Scope

Pollutants Reviewed		SO_2, NO_x, NMVOC, NH_3, PM_{10} & $PM_{2.5}$, Cd, Hg, Pb, Dioxin, PAHs		
Years		1990 – 2015		
Code	**Name**	**Reviewed**	**Not Reviewed**	**Recommendation Provided**
1A1a	Public electricity and heat production	X		X
1A1b	Petroleum refining	-		
1A1c	Manufacture of solid fuels and other energy industries	-		
1A2a	Iron and steel	-		
1A2b	Non-ferrous metals	-		
1A2c	Chemicals	-		
1A2d	Pulp, Paper and Print	-		
1A2e	Food processing, beverages and tobacco	-		
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	-		
1A2gviii	Stationary combustion in manufacturing industries and construction: Other	-		
1A3ei	Pipeline transport	-		
1A3eii	Other	-		
1A4ai	Commercial/institutional: Stationary	X		
1A4bi	Residential: Stationary	X		
1A4ci	Agriculture/Forestry/Fishing: Stationary	-		
1A5a	Other stationary (including military)	-		
1B1a	Fugitive emission from solid fuels: Coal mining and handling	-		
1B1b	Fugitive emission from solid fuels: Solid fuel transformation	-		
1B1c	Other fugitive emissions from solid fuels	-		
1B2ai	Fugitive emissions oil: Exploration, production, transport	-		
1B2aiv	Fugitive emissions oil: Refining / storage	-		
1B2av	Distribution of oil products	X		X
1B2b	Fugitive emissions from natural gas (exploration, production, processing, transmission, storage, distribution and other)	X		X
1B2c	Venting and flaring (oil, gas, combined oil and gas)	-		
1B2d	Other fugitive emissions from energy production	-		
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

38. Monaco has provided a generally transparent emission inventory. However, the split of fuels is not transparently described in the IIR for NFR 1A1a. The ERT commends Monaco to provide more detailed information in the IIR on net caloric values and emission factors used in the calculations to increase the transparency of the inventory.

Completeness

39. Monaco does not report all pollutants under the energy sector. ERT recommends Monaco to estimate all pollutants according to methods provided in the 2016 EMEP/EEA Guidebook.

Consistency including recalculation and time series

40. The submitted data for NMVOC, Pb, Cd, PCDD/F and HCB emissions show a sharp increase from 1990 to 1991 in NFR 1A1a. The ERT encourages Monaco to provide detailed information on inconsistencies and to ensure time series consistency.

Comparability

41. Monaco reports in its IIR that it applies emission factors from the 2013 EMEP/EEA Guidebook. The ERT recommends Monaco to apply emission factors from the most recent Guidebook, i.e. 2016, as requested by the Reporting Guidelines, to enable better comparability to other reporting Parties.

Accuracy and uncertainties

42. The ERT notes that Monaco has not provided an uncertainty analysis and therefore recommends Monaco to undertake an 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.

Improvement

43. The ERT notes Monaco's intention to improve the knowledge of waste emissions characterization for incinerated waste and direct measurements at the chimney outlet. The ERT encourages Monaco to implement the planned improvements. The ERT also recommends Monaco to include an inventory improvement plan for the energy sector in the IIR.

Potential Technical Corrections

44. The ERT did not prepare any technical corrections for the energy sector inventory for Monaco.

Sub-Sector Specific Recommendations

Category issue 1: 1.A.1.a Public electricity and heat production – Activity data

45. The ERT noted that emissions from NFR 1A1a include also emissions from the incineration of solid waste and sewage sludge but the Party does not provide detailed information on the net caloric values and applied emission factors. The ERT encourages Monaco to provide more detailed information on the methodology to ensure transparency of the inventory in its IIR.

Category issue 2: 1.B.2.a.v (Distribution of oil products) and 1.B.2.b (Natural gas) - NMVOC

46. The ERT notes that Monaco has not calculated NMVOC emissions from NFR 1B2av and 1B2b but reports these as “NE”. The ERT noted that activities like service stations and a natural gas distribution network are associated with NMVOC emissions and are likely to occur in Monaco. The ERT recognized that there are only 5 small service stations, but encourages Monaco to estimate emissions from these sources using methods from the Guidebook.

47. The ERT noted that Monaco describes a methodology in its IIR (p. 23) for estimating emissions from NFR 1B2b but reports these emissions as “NA” or “NE” in the NFR tables. The ERT recommends Monaco to estimate and report the emissions using the described methodology to ensure completeness of the inventory.

Category issue 3: 1.A.1.a (Public electricity and heat production) - BC

48. The ERT noted that the reported black carbon (BC) emissions from NFR 1A1a are higher than the reported $PM_{2.5}$ emissions for the whole time series (1990-2015). In response to a question raised by the ERT Monaco provided revised estimates using a corrected emission factor for BC emissions for sewage sludge. The ERT recommends Monaco to provide the revised estimates in its next submission.

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TRANSPORT

Review Scope

Pollutants Reviewed		All		
Years		1990 – 2015		
Code	**Name**	**Reviewed**	**Not Reviewed**	**Recommendation Provided**
1A2gvii	Mobile Combustion in manufacturing industries and construction	X		
1A3ai(i)	International aviation LTO (civil)	X		X
1A3ai(ii)	International aviation cruise (civil)	X		X
1A3aii(i)	Domestic aviation LTO (civil)	X		X
1A3aii(ii)	Domestic aviation cruise (civil)	X		X
1A3bi	Road transport: Passenger cars	X		X
1A3bii	Road transport: Light duty vehicles	X		X
1A3biii	Road transport: Heavy duty vehicles and buses	X		X
1A3biv	Road transport: Mopeds & motorcycles	X		X
1A3bv	Road transport: Gasoline evaporation	X		
1A3bvi	Road transport: Automobile tyre and brake wear	X		X
1A3bvii	Road transport: Automobile road abrasion	X		X
1A3c	Railways	X		
1A3di(ii)	International inland waterways	X		
1A3dii	National navigation (shipping)	X		X
1A4aii	Commercial/institutional: Mobile	X		
1A4bii	Residential: Household and gardening (mobile)	X		
1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	X		
1A4ciii	Agriculture/Forestry/Fishing: National fishing	X		
1A5b	Other, Mobile (including military, land based and recreational boats)	X		
1A3di(i)	International maritime navigation	X		X
1A3	Transport (fuel used)	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

49. Monaco provided a generally transparent emission inventory. The ERT noted that the estimates are not always provided on the most detailed level for all subsectors, for instance for aviation as explained below.

50. The ERT encourages Monaco to improve the general transparency of the transport sector by including activity data, emission factors and methodologies applied as well as information about emissions trends and explanations for the dips and jumps, inconsistencies and recalculations in the IIR.

Completeness

51. The ERT considers the transport sector to be almost complete and comprehensive with a sufficient level of detail in the methodology descriptions. Nevertheless, the ERT found missing estimates for pollutants and sub-sectors as explained below. The ERT recommends Monaco to estimate all the relevant pollutant emissions by applying higher Tier methods from the 2016 EMEP/EEA Guidebook where feasible.

Consistency including recalculation and time series

52. The ERT noted some inconsistencies in the reported emissions as explained below and recommends Monaco to assure emissions time series consistency and to justify any remaining inconsistencies in the IIR.

53. Monaco reports in the IIR that recalculations are related to the annual update of the biofuels annual penetration rate for passenger cars in the road transport sector and to the adoption of the EMEP/EEA emission inventory guidebook 2013. The ERT encourages Monaco to provide more detailed explanations of recalculations, including the rationale and information on the impact of recalculations on the sector and to the emissions trends in the IIR of the next submission.

Comparability

54. Monaco reports in its IIR that it applies emission factors from the 2013 EMEP/EEA Guidebook. The ERT noted that the use of older versions of the Guidebook decreases the comparability of emissions to other countries because according to the Reporting Guidelines the use of the latest version of the Guidebook is required (i.e. version from 2016) and recommends Monaco to update the methods according to the 2016 EMEP/EEA Guidebook.

55. The ERT noted that Monaco does not always report emissions under the dedicated NFR categories as explained below (e.g. for aviation) and recommends Monaco to improve the allocation of emissions by collecting more accurate data and by detecting and solving discrepancies in the time series and following the methods provided in the Guidebook.

56. The ERT noted that the inventory is comparable to the inventories of other countries regarding the basis of the transport sector emissions, as Monaco reports emissions from road transport based on the fuel sold.

Accuracy and uncertainties

57. The ERT noted that Monaco has not yet carried out an uncertainty analysis for the transport sector. The ERT recommends Monaco to undertake the uncertainty analysis in order to help inform the improvement process and to provide an indication of the reliability of the inventory data.

58. Monaco mentions to implement basic QA/QC checks for each inventory category in the IIR, the ERT encourages the Party to provide information on the results of OA/QC procedures for the transport sector in the IIR.

Improvement

59. The ERT noted Monaco's efforts to improve emission estimation by taking into account local conditions, in particular regarding domestic and foreign vehicles, improving the estimation of navigation emissions, including new pollutants (PM, TSP, BC and PAHs) and developing a national calculation tool. The ERT recommends Monaco to implement the improvements and to include detailed information in the IIR of the next submission. The ERT also recommends Monaco to include an inventory improvement plan for the transport sector in the IIR.

Potential Technical Corrections

60. The ERT did not specify any potential technical corrections for the transport sector inventory of Monaco.

Sub-Sector Specific Recommendations

Category issue 1: 1.A.3.a Aviation – All Pollutants

61. According to the IIR, helicopters based at the heliport of Monaco mainly carry out journeys abroad, in particular from Monaco to Nice. The ERT notes that LTO and cruise emissions are reported aggregated under 1A3ai(i) international aviation LTO (civil) and 1A3aii(i) domestic aviation LTO (civil), while for the memo items 1A3ai(ii) international aviation cruise (civil) and 1A3aii(ii) domestic aviation cruise (civil) are reported as "NO". Monaco explains that emissions from aviation are based on fuel sold and that the share between domestic and international aviation can be estimated on the basis of an annual ratio between national and international destinations for each flight, but that Monaco has not yet implemented this. The ERT recommends Monaco to use the appropriate notation keys, for cruise emissions in this case "IE", and to calculate the LTO and cruise phases separately. The ERT also notes that the current method results in overestimation of emissions and recommends Monaco to correctly distinguishing between LTO and cruise phases according to the 2016 EMEP/EEA Guidebook.

Category issue 2: 1.A.3.b Road Transport – All pollutants

62. According to the IIR, emissions from road transport are based on fuel sold and given the geographic peculiarity of Monaco, a share of emissions is expected to be attributed to foreign vehicles. Monaco explains that the calculation of emissions is based on an internal tool which is taking Monaco's specificities regarding fleet distribution into account, age and road traffic data. The work to develop this COPERT like model started in 2015, however, the first results haven't been reported yet due to some inconsistencies and uncertainties related to the lack of local and specific activity data. Additional work has been undertaken in 2016-2017 to achieve a sufficient level of confidence and the results are expected before the end of 2017. The ERT encourages Monaco to include these results in the next submission and to provide detailed information in the IIR.

63. The ERT noted some inconsistencies in the emissions time series related to road transport emissions, in particular regarding CO, NMVOC, PM_{10} emissions fromNFR 1A3bii light duty vehicles and CO, NOX, PM_{10}, Cd emissions from NFR 1A3biii heavy duty vehicles and buses due to discrepancies in the fleet distribution. The ERT noted also discrepancies in the CO, NMVOC emissions from NFR 1A3biv mopeds and motorcycles. To the question on the issue Monaco replied that a change

in the fleet database occurred in 2014 leading to some discrepancies in the fleet distribution and that Monaco is working in order to ensure time series consistency and that the Party is currently updating the road transport emissions calculation model. The ERT recommends Monaco to assure emissions time series consistency and to provide detailed information on the recalculations in the IIR.

Category issue 2: 1.A.3.b Road Transport – Particles and POPs

64. The ERT noted for particle emissions that only PM_{10} is reported for exhaust emissions and that PAH emissions are reported as "NE". Monaco neither reports particle emissions from road transport automobile tyre and brake wear and road abrasion. To the question on the issue Monaco replied that the inventory calculation tool does currently not integrate $PM_{2.5}$, TSP and PAH emissions. The ERT recommends Monaco to include these pollutants in the reporting on the basis of the 2016 EMEP/EEA Guidebook considering that regarding exhaust emissions from vehicles the coarse fraction ($PM_{2.5}$-PM_{10}) is considered negligible in vehicle exhausts. The Guidebook also provides BC fractions of PM and Tier 1 emission factors for PAH emissions. For Tyre and brake wear, and road abrasion the Guidebook provides Tier 1 $PM_{2.5}$, PM_{10}, TSP emission factors.

Category issue 3: 1.A.3.d Navigation – Missing emissions

65. Regarding NFR 1A3d Monaco states in the IIR that emissions from navigation have been estimated on the basis of fuel sold (gasoline and diesel). The ERT noted that not all pollutants for which a Tier 1 or Tier 2 default emission factor is available in the Guidebook are reported. To the question on the issue Monaco replied to be working on the calculation model that takes these into account. The ERT recommends Monaco to estimate the missing emissions according to the Guidebook and to include documentation of the methods in the IIR.

INDUSTRIAL PROCESSES

Review Scope

Pollutants Reviewed		SO_2, NO_x, NMVOC, NH_3, PM_{10} & $PM_{2.5}$		
Years		1990 – 2015 + (Protocol Years)		
Code	**Name**	**Reviewed**	**Not Reviewed** * reported as "NO" in the NFR tables	**Recommendation Provided**
2A1	Cement production		X*	
2A2	Lime production		X*	
2A3	Glass production		X*	
2A5a	Quarrying and mining of minerals other than coal		X*	
2A5b	Construction and demolition		X	X
2A5c	Storage, handling and transport of mineral products		X*	
2A6	Other mineral products		X*	
2B1	Ammonia production		X*	
2B2	Nitric acid production		X*	
2B3	Adipic acid production		X*	
2B5	Carbide production		X*	
2B6	Titanium dioxide production		X*	
2B7	Soda ash production		X*	
2B10a	Chemical industry: Other		X*	
2B10b	Storage, handling and transport of chemical products		X*	
2C1	Iron and steel production		X*	
2C2	Ferroalloys production		X*	
2C3	Aluminium production		X*	
2C4	Magnesium production		X*	
2C5	Lead production		X*	
2C6	Zinc production		X*	
2C7a	Copper production		X*	
2C7b	Nickel production		X*	
2C7c	Other metal production		X*	
2C7d	Storage, handling and transport of metal products		X*	
2D3b	Road paving with asphalt		X	X
2D3c	Asphalt roofing		X	X
2H1	Pulp and paper industry		X*	
2H2	Food and beverages industry		X*	
2H3	Other industrial processes		X*	
2I	Wood processing		X	X
2J	Production of POPs		X*	
2K	Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)		X*	
2L	Other production, consumption, storage, transportation or handling of bulk products		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

1. As explained in Part A of this report, Monaco has provided an IIR with limited documentation of sources which do not extend to the industrial processes sector. The ERT recommends Monaco to provide more details on industrial activities in Monaco as well as information on production volumes and their trends in the next submission.

Completeness

2. The ERT considers the industry sector to be complete; however, information on the methodologies used to calculate emissions and on the drivers behind the emission trends is not described. The ERT strongly encourages Monaco to include more information on these issues in the IIR of the next submission.

Consistency including recalculation and time series

3. Monaco provided time series for all calculated emissions. However, due to the lack of information provided in the IIR, the ERT could not completely assess the consistency of the time series. No information on recalculations for the industry sector is presented in the IIR, other than the use of the updated EFs from the 2016 version of the Guidebook. The ERT encourages Monaco to complete the IIR with this information.

Comparability

4. The ERT considers the inventory not to be fully comparable with other reporting Parties as Monaco does not use the methods provided in the latest version of the Guidebook, and therefore recommends Monaco to update the methods according to the 2016 EMEP/EEA Guidebook.

Accuracy and uncertainties

5. The ERT noted that Monaco does not carry out an uncertainty analysis for the Industrial processes sector. As explained in Part A of this report, the ERT recommends Monaco to undertake an uncertainty analysis for the inventory in order to provide an indication of the reliability of the inventory data.

Improvement

6. The IIR does not specify sector specific improvements. The ERT recommends Monaco to include an inventory improvement plan for the industrial processes sector.

Potential Technical Corrections

7. The ERT did not specify any potential technical corrections for the industrial processes sector inventory of Monaco.

Sub-Sector Specific Recommendations

Category issue 1: 2.A.5.b Construction and Demolition

8. The ERT noted that Monaco reports emission factors from the 2012 EMEP/EEA Guidebook in the IIR, even though it is stated that the whole inventory has been updated according to the 2016 EMEP/EEA Guidebook. During the review week, Monaco replied that they are going to update this information in their next submission. The ERT recommends the Party to do so.

9. The ERT noted fluctuations in the emission trends that are not described in the IIR. During the review week, Monaco replied that due to the small size of the country, and some bigger construction works in certain years, the trends might vary. The ERT encourages Monaco to include this information in the IIR, together with a diagram of the most important trends.

Category issue 2: 2.D.3.b Road Paving with Asphalt

10. The ERT noted fluctuations in the emission trends that are not described in the IIR. During the review week, Monaco responded that this is due to some activity related to the Grand Prix. The ERT encourages Monaco to include information on the emission trends in the IIR.

Category issue 3: 2.D.3.c Asphalt Roofing

11. Emissions from asphalt roofing are reported as “NE”. During the review week, Monaco responded that there is no asphalt roofing industry in Monaco. The ERT thus recommends Monaco to report emissions from this sector as “NO”, and encourages Monaco to justify the absence of emissions from this sector in the IIR.

Category issue 4: 2.I Wood processing

12. Monaco reports NMVOC emissions from wood preservation in this sector. Those emissions should, however, be reported under NFR 2D3, solvent use. During the review week, Monaco stated that they would correct this in their next submission. The ERT recommends that Monaco does so, and reports emissions for wood processing under NFR 2I in future submissions.

SOLVENTS

Review Scope

Pollutants Reviewed		SO_2, NO_x, NMVOC, NH_3, PM_{10} & $PM_{2.5}$		
Years		1990 – 2015 + (Protocol Years)		
Code	**Name**	**Reviewed**	**Not Reviewed**	**Recommendation Provided**
2D3a	Domestic solvent use including fungicides	X		X
2D3d	Coating applications	X		X
2D3e	Degreasing		X	
2D3f	Dry cleaning	X		X
2D3g	Chemical products		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

13. The ERT noted that the IIR contains only basic information about the methodologies, data sources and assumptions used for the air pollutant emission estimations. Moreover, all activity data used in the emission calculations are not included in the NFR tables. The ERT recommends Monaco to provide more detailed information on methods used to calculate emissions, as indicated below in the sub-sector specific findings, to increase the transparency of reporting in order to enable the ERT to review the solvents sector inventory.

14. The ERT noted that the use of notation keys is not always transparently explained and therefore strongly encourages Monaco to revise all notation keys and to provide clear information on the rationale for their use for each source category in the IIR.

Completeness

15. The ERT considers that the solvent sector is not complete and comprehensive because the methodology descriptions do not contain detailed enough information to understand how the emissions were calculated. There is no activity data reporting in the IIR. In the NFR tables, Monaco reports activity data only for NFRs 2D3d and 2D3h. The ERT strongly encourages Monaco to report all relevant activity data instead of using the notation key “NE”.

16. The ERT considers that some sources may be missing from the solvent Use sector inventory for which Monaco uses the notation key “NO”. Details are provided in the sub-sector specific chapters below. The ERT strongly encourages Monaco to reconsider the use of the notation key “NO” for these NFR categories and to provide clear information in the IIR on which activities occur in Monaco.

Consistency including recalculation and time series

17. Monaco reports the time series for all emissions in NFR tables. However, due to lack of information provided in the IIR, and due to the missing activity data for all reported emissions the ERT cannot completely assess the consistency of the time series.

18. Monaco has not provided information on recalculations in the IIR. The ERT encourages Monaco to report information on recalculations in the next submission and to also state if no recalculations were performed.

19. During the review the ERT identified a few outliers and Monaco responded with explanations. The ERT commends Monaco for that and recommends that Monaco includes the explanations provided during the review for all the years and NFR categories where outliers were identified in the IIR of the next submission.

Comparability

20. The ERT noted that information on methodologies used for the estimation of emissions from the solvent sector is included in the IIR only on a general level. The ERT encourages Monaco to provide more detailed information as indicated in the sub-sector specific recommendations below to increase the comparability of the inventory to other reporting Parties.

Accuracy and uncertainties

21. The ERT noted that neither a quantitative nor qualitative uncertainty analysis has been provided in the IIR. The ERT recommends Monaco to include an uncertainty analysis for the solvent sector in order to help inform the improvement process and to provide an indication of the reliability of the inventory data.

22. The ERT notes that the IIR does not provide information on QA/QC procedures for the solvent sector. The ERT recommends Monaco to include information on QA/QC activities and their results carried out for the solvent sector inventory.

Improvement

23. The ERT noted that for the Solvent sector there is no improvement plan reported in the IIR. The ERT encourages Monaco to develop an improvement plan based on the findings in this report and to include information on this improvement plan in the next IIR submission.

Potential Technical Corrections

24. The ERT did not specify no potential technical corrections for the solvent sector inventory of Monaco.

Sub-Sector Specific Recommendations

Category issue 1: 2.D.3.i, 2.G Other solvent and product use

25. The ERT noted that Monaco reports the notation key "NO" for all pollutants under NFRs 2D3i and 2G. The ERT considers that activities like: SNAP 060404 fat, edible and non-edible oil extraction, SNAP 060405 application of glues and adhesives, SNAP 060601 use of fireworks, SNAP 060602 use of tobacco, SNAP 060603 use of shoes are likely to occur in most countries. According to the 2016 EMEP/EEA Guidebook these activities are sources of NMVOC emissions, while some of them can also be sources of TSP, PM_{10}, $PM_{2.5}$, PAH, PCDD/F, SO_2, CO, NO_x and HM emissions. The ERT notes that there may be a potential underestimation of emissions. The ERT recommends Monaco to identify activities falling under NFR categories 2D3i and 2G that occur in Monaco and to provide information on these in the IIR. For those activities that occur the ERT recommends Monaco to collect data[3] and estimate emissions applying the Tier 2 methodologies provided in the Guidebook for the next submission and to document the calculation of emissions in the IIR. To enable Monaco to divide activities between the NFR categories 2D3i and 2G the ERT recommends Monaco to use the mapping table linking categories of different reporting formats, which is available on the CEIP homepage (http://www.ceip.at/ms/ceip_home1/ceip_home/reporting_instructions/) for information on how SNAP codes and NFR codes are linked.

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

26. The ERT noted that for the calculation of NMVOC emissions from coating applications Monaco uses the IEF 0.15 kt NMVOC/kt paint applied, which is in line with the Tier 1 EF for NMVOC for source category 2.D.3.d decorative coating application (NMVOC EF = 150 g NMVOC/kg paint applied) and that the EF is consistent through the whole reporting period. However, in the IIR there is no information on activities where the paint is applied. Paint is likely to be used in activities like car repairing, boat, ship, yacht building and repairing, which are in the scope of industrial coating application for which a higher EF for NMVOC emission calculation needs to be used. The ERT also notes that the Tier 1 EF for NMVOC emissions from other coating application is higher (eg. paint applied on roads (marks). Regarding this, the ERT considers that there is a possible underestimation of NMVOC emissions. The ERT recommends Monaco to revise paint application activities and to recalculate NMVOC emissions for NFR 2D3d coating applications, and to include information on the recalculations in the IIR.

[3] Data to be collected: quantities of oil extracted and seed used, adhesives and glues or the quantities of solvents in the solvent-based adhesives and glues, the use of fireworks, tobacco combustion, pairs of shoes sold and imported.

27. During the review the ERT identified outliers for NMVOC emissions in the years 2005, 2007 and 2013. In response to the question on the issue Monaco responded with a reasonable explanation. The ERT encourages Monaco to include that explanation in the IIR of the next submission.

Category issue 3: 2.D.3.h Printing – NMVOC

28. During the review the ERT identified outliers in the NMVOC emission trend for the years 2005 and 2008. To the question on the issue Monaco responded with a reasonable explanation and the ERT encourages Monaco to include that explanation in the IIR of the next submission.

Category issue 4: 2.D.3.f Dry cleaning – NMVOC

29. During the review the ERT identified outliers for NMVOC emissions for the years 2000, 2005, 2011 and 2012. To the question on the issue Monaco responded with a reasonable explanation and the ERT encourages Monaco to include that explanation in the IIR of the next submission.

30. During the review the ERT identified some lack of transparency in the use of notation keys in the NFR tables for the years 1990, 1991 and 1992. The ERT recommends Monaco to correct the notation keys for the next submission.

AGRICULTURE

Review Scope

Pollutants Reviewed		SO_2, NO_x, NMVOC, NH_3, PM_{10} & $PM_{2.5}$		
Years		1990 – 2015 + (Protocol Years)		
Code	**Name**	**Reviewed**	**Not Reviewed**	**Recommendation Provided**
3B1a	Dairy cattle		X	
3B1b	Non-dairy cattle		X	
3B2	Sheep		X	
3B3	Swine		X	
3B4a	Buffalo		X	
3B4d	Goats		X	
3B4e	Horses		X	
3B4f	Mules and asses		X	
3B4gi	Laying hens		X	
3B4gii	Broilers		X	
3B4giii	Turkeys		X	
3B4giv	Other poultry		X	
3B4h	Other animals		X	
3Da1	Inorganic N-fertilizers (includes also urea application)	X		X
3Da2a	Animal manure applied to soils		X	
3Da2b	Sewage sludge applied to soils		X	
3Da2c	Other organic fertilisers applied to soils (including compost)		X	
3Da3	Urine and dung deposited by grazing animals		X	
3Da4	Crop residues applied to soils		X	
3Db	Indirect emissions from managed soils		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	
3Df	Use of pesticides		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

31. As Monaco is characterized by its urban area no emissions arise from animal husbandry. The green spaces consist mainly of public parks and gardens, private gardens and some natural areas. During the 2012 CLRTAP S3 in-depth review Monaco stated that emissions only originate from the application of mineral fertilizers to parks and gardens.

Transparency

32. Monaco has reported emissions from all NFR 3 agriculture sub-sectors as Not Occurring ("NO") in the NFR tables. However, in Monaco´s IIR 2017 the methodology for calculating NH_3 emissions from the application of Inorganic N-fertilizers is described. Monaco informed the ERT that for this emission source the notation key "NE" should have been used instead of "NO" and that the description in the current IIR is a mistake. Furthermore, Monaco explained that it has developed a new calculation tool in 2017 for estimating emissions of inorganic N-fertilizers within the framework of their GHG inventory but the calculations of the air pollutants are still in progress. The ERT welcomes these plans and recommends that Monaco reports the new emission estimates and provides an updated methodological description in its IIR of the next submission. The ERT also encourages Monaco to provide more detailed information on the methodological approach, the applied emission factors and activity data in the IIR of its next submission.

Completeness

33. The ERT considers the agriculture sector not to be complete due to the occurring application of inorganic N-fertilizer in parks and gardens, which was confirmed by the Party during the review, and, as this source is reported under the UNFCCC (under sector LULUCF). In the IIR Monaco states that emissions are calculated based on the 2013 EMEP/EEA Guidebook (Tier 1). However, in the NFR tables no emissions from this source category are reported for the whole time series 1990-2015. The 2016 EMEP/EEA Guidebook provides methodology and emission factors for calculating NH_3 and NO_x emissions from the usage of mineral fertilizers. To a question on the issue Monaco responded that they plan to report these estimates in the 2018 submission. The ERT welcomes these plans and recommends Monaco to report NH_3 and NO_x emission estimates in accordance with the Guidebook. Furthermore, the ERT has the opinion that the emissions from inorganic N-fertilizers applied to parks and gardens should not be allocated under NFR sector 3 agriculture but would better fit under NFR sector 6.A Other and recommends Monaco to report its emissions accordingly.

Consistency including recalculation and time series

34. Monaco has not reported emissions from sector agriculture.

Comparability

35. When including emissions from agricultural sources in the inventory, the ERT recommends Monaco to apply methods of the 2016 EMEP/EEA Guidebook, as according to the Reporting Guidelines the Parties shall as a minimum use the methodologies from the latest version of the Guidebook.

Accuracy and uncertainties

36. Monaco has not reported emissions from NFR 3 agriculture and accordingly, no uncertainty analysis of the agriculture sector has been prepared. The ERT recommends Monaco to develop an uncertainty analysis for the emissions to be estimated and reported under the agriculture sector for future inventories.

Improvement

37. Monaco has not reported emissions from the agriculture sector. The ERT recommends Monaco to include an inventory improvement plan for the agriculture sector.

Potential Technical Corrections

38. The ERT did not prepare technical corrections for the agriculture sector inventory of Monaco.

Sub-Sector Specific Recommendations

Category issue 1: 6.A Other - NH_3, NO_x

39. The ERT noted that NH_3 and NO_x emissions from the application of mineral fertilizers are not reported in Monaco´s inventory. The ERT calculated potential technical corrections for NFR 6A Other, NH_3 and NO_x emissions from the usage of mineral fertilizers to parks and gardens. The ERT noted that there is no significant underestimation as the resulting NH_3 and NO_x emissions were below 2% of national total NH_3 and NO_x emissions, and thus below the threshold of significance for a technical correction.

40. The ERT recommends Monaco to calculate NH_3 and NO_x emissions from mineral fertilizer application to parks and gardens based on the methodology provided in the 2016 EMEP/EEA Guidebook, under section agricultural soils, but to report these emissions under NFR source category 6A. Furthermore, the ERT recommends Monaco to include a detailed description of the activity data and emission factors used as well as on the allocation of the emissions in the respective chapter of the IIR.

WASTE

Review Scope

Pollutants Reviewed		SO_2, NO_x, NMVOC, NH_3, PMs, heavy metals and POPs		
Years		1990 – 2015 + (Protocol Years)		
Code	**Name**	**Reviewed**	**Not Reviewed**	**Recommendation Provided**
5A	Solid waste disposal on land	X		
5B1	Biological treatment of waste – Composting	X		
5B2	Biological treatment of waste - Anaerobic digestion at biogas facilities	X		
5C1a	Municipal waste incineration	X		X
5C1bi	Industrial waste incineration	X		X
5C1bii	Hazardous waste incineration	X		X
5C1biii	Clinical waste incineration	X		X
5C1biv	Sewage sludge incineration	X		X
5C1bv	Cremation	X		X
5C1bvi	Other waste incineration	X		X
5C2	Open burning of waste	X		
5D1	Domestic wastewater handling	X		X
5D2	Industrial wastewater handling	X		X
5D3	Other wastewater handling	X		X
5E	Other waste	X		X
Note: Where a sector has been partially reviewed (e.g. some of the NFR codes please indicate which have and which have not in the respective columns.				

General recommendations on cross cutting issues

Transparency

41. The ERT notes that there is a small chapter on the waste sector in the IIR. The only emission source reported under the waste sector are those from waste water handling. The ERT notes that the source description is insufficient to enable a proper review of the inventory. The ERT therefore reiterates the recommendation from the 2012 CLRTAP S3 in-depth review to provide a comprehensive description of the emission sources and to document the methodology, activity data and emission factors used to calculate emissions in the IIR of the next submission.

Completeness

42. The ERT noted that the time series of the emissions is complete and commends the Party for this. As emissions are reported only from categories that deal with waste water handling, the ERT also recommends Monaco to calculate and report emissions from the other waste sector subcategories or to provide an explanation in the IIR in case these activities do not occur in Monaco, for the next submission

Comparability

43. The ERT considers the waste sector inventory to be comparable with other reporting Parties as Monaco has reported the emission inventory in accordance with the reporting requirements and submitted it in the requested NFR2014 format.

Accuracy and uncertainties

44. The ERT commends the Party for having an elaborated QA/QC plan implemented and for presenting a full description of this in the 2017 IIR.

45. Monaco does not present an uncertainty analysis for the Waste sector in the IIR. The ERT recommends Monaco to estimate and report uncertainties from the waste sector in order to help inform the improvement process and to provide an indication of the reliability of the inventory data.

Improvement

46. The ERT noted that Monaco does not provide information on planned improvements for the waste sector inventory. The ERT recommends Monaco to include an inventory improvement plan for the waste sector.

Potential Technical Corrections

47. The ERT did not specify any potential technical corrections for the waste sector inventory of Monaco.

Sub-Sector Specific Recommendations

Category issue 1: 5.C. Waste incineration – All pollutants

48. The ERT notes that Monaco reports in both the IIR and in the NFR tables that the emissions from the incineration of municipal waste, clinical waste and sewage sludge are included under NFR 1A1a. Furthermore, the ERT notes that Monaco refers to the 2013 EMEP/EEA Guidebook for the EFs used for the calculation of emissions for the subsectors 5C1a and 5Cbiv in the IIR, and that no reference is made about the EFs used for the calculation of the emissions from NFR 5C1biii. Also, no activity data is presented for the incinerated amounts of clinical waste (NFR 5C1biii) and sewage sludge (NFR 5C1biv). The ERT recommends the Party to use the 2016 EMEP/EEA Guidebook and to provide an overview of the amounts of different waste types incinerated in the IIR, and provide an explanation on how the emissions from incineration of clinical waste are calculated, in the IIR of the next submission.

Category issue 2: 5.D. Waste water handling – NMVOC

49. The ERT notes that the source description of waste water handling is insufficient for the purpose of the review because no information on activity data, methodology and emission factors is presented in the IIR. The ERT recommends Monaco to provide a full description of the sources, to document activity data ,

methodology and emission factors used in the calculation of emissions in the IIR of the next submission.

50. The ERT notes that the Party reports “NO” for all pollutants except for NMVOC emissions from this source. As Monaco did not reply the question of the ERT during the review on the issue , the ERT assumes that the TIER1 methodology is used. Table 3-1 of Chapter 5D of the 2016 EMEP/EEA Guidebook states that for NO_x, CO, SO_x, PCB, PCDD/F and POP emissions the notation key “NA” should be used and furthermore, that for the pollutants NH_3, particulate matter and heavy metals the notation key “NE” should be used. The ERT recommends Monaco to correct the notation keys for the complete time series for the next submission.

Category issue 3: 5.E. Other waste – All pollutants

51. The ERT notes that for the purpose of the review information on how sewage sludge coming from waste water handling is treated is relevant. When dried by spreading NH_3 emissions will occur. The ERT recommends the Party to include a description on sewage sludge handling in the IIR of the next submission. Furthermore, the ERT recommends the Party to calculate the emissions from sludge spreading, if relevant, for the next submission.

52. The ERT notes that Monaco reports no emissions coming from accidental house, industry and car fires. The ERT recommends the Party to collect data and to estimate and report these emissions according to the methods provided in the Guidebook.

MATERIALS USED BY REVIEW TEAM

1. Monaco's Stage 2 S&A report
2. Monaco's Stage 1 report 2017
3. Data and tools developed by CEIP (http://unece-stage3.wikidot.com/data-analysis)

LIST OF ADDITIONAL MATERIALS PROVIDED BY THE COUNTRY DURING THE REVIEW

1. Monaco's IIR 2017 (Raport informatif d inventaire 2017 pour Monaco) Word document
2. Annex I emissions 1990-2015 (Excel file)
3. Response to preliminary questions raised prior to the review (wiki)
4. Response to questions raised during the review (wiki)

REFERENCES

EMEP/EEA, 2016. EMEP/EEA air pollutant emission inventory guidebook – 2016. EEA Technical report No 21/2016. Available at: www.eea.europa.eu/publications/emep-eea-guidebook-2016

EMEP/EEA, 2013. EMEP/EEA air pollutant emission inventory guidebook – 2013. EEA technical report No. 1209/2013. European Environment Agency, Copenhagen. Available at: www.eea.europa.eu//publications/emep-eea-guidebook-2013

TFEIP, 2016. Proposal for updating the 'Methods and procedures' document laying down the process for the EMEP emission inventory review. Available at: www.unece.org/fileadmin/DAM/env/documents/2016/AIR/EMEP/Informal_Document/3_Methods_Procedures_update_proposal_May2016_ISSUE1_TFEIP.pdf

UNECE, 2007. Methods and procedures for the technical review of air pollutant emission inventories reported under the Convention and its protocols (EB.AIR/GE.1/2007/16). Available at: www.ceip.at/fileadmin/inhalte/emep/review/RevGuid_ece.eb.air.ge.1.2007.16.e.pdf

UNECE, 2014. Guidelines for Reporting Emissions and Projections Data under the Convention on Long-range Transboundary Air Pollution (ECE/EB.AIR/125). Available at: www.ceip.at/fileadmin/inhalte/emep/reporting_2009/Rep_Guidelines_ECE_EB_AIR_97_e.pdf

ANNEX I POTENTIAL TECHNICAL CORRECTIONS

The ERT did not specify technical corrections for Monaco.