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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:**

**MONACO**

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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 '*Methods and Procedures for the Technical Review of Air Pollutant Emission Inventories reported under the Convention and its Protocols*'<sup>(1)</sup> – hereafter referred to as the 'Methods and Procedures' document.
2. This annual review has concentrated on SO<sub>2</sub>, NO<sub>x</sub>, NMVOC, NH<sub>3</sub>, plus PM<sub>10</sub> & PM<sub>2.5</sub> as well as Persistent Organic Pollutants (POPs) for the time series years 1990 – 2010, reflecting current priorities from the EMEP Steering Body and the Task Force on Emission Inventories and Projections (TFEIP). Heavy Metals (HMs) 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 25th – 29<sup>th</sup> June 2012 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 – Melanie Hobson (UK), Energy - Stephan Poupa (Austria) and Emmanuel Deflorenne (France), Transport & Mobile Sources – Jean-Marc Andre, Industry – Kristina Saarinen (Finland), Solvents – Ioannis Sempos (Greece), Agriculture & Nature - Bernard Hyde (Ireland), Waste – Kees Peek (The Netherlands).
4. Chris Dore (United Kingdom) 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> 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.unece.org/env/documents/2007/eb/ge1/ece.eb.air.ge.1.2007.16.e.pdf>

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

5. The ERT acknowledges the effort that Monaco has taken to provide emission estimates for some pollutants.

6. Monaco has only provided a very short IIR and therefore the ERT encourages the submission of a more detailed IIR, which follows the recommended IIR template and contents, for subsequent years. This would help improve the transparency (and accuracy) of the inventory.

### **INVENTORY SUBMISSION**

7. In its 2012 submission, Monaco has reported emissions of its protocol pollutants for the latest year (2010) in the NFR09 format. The full time series (1990-2010) was given in an Excel file in the previous format NFR (NFR1 level 1). In addition, Monaco has submitted a short IIR.

8. Emissions for the year 2010 are reported in NFR09. Categories 1A4a and 6Cb are reported as "IE" and categories 1A4bii, 2A7b, 6B, 6Cd are reported as "NE". Transport emissions are based on fuel sold.

### **KEY CATEGORIES**

9. Monaco did not provide a key category analysis (KCA), or an uncertainty analysis. The ERT encourages Monaco to undertake a KCA and consider options for uncertainty analysis because these are important steps in supporting the inventory improvement process and they provide an indication of the reliability of the inventory data.

### **QUALITY**

#### ***Transparency***

10. The ERT recognises the level of effort undertaken by Monaco in providing an inventory, and commends Monaco for their work. However, Monaco has provided an IIR which contains limited information on the estimates that have been made. The ERT recommends that Monaco provides a complete IIR with descriptions of activities in Monaco as well as of the methods used to quantify emissions. In cases where emissions occur but are not estimated (NE), the ERT recommends that Monaco estimates the emissions or explain in the IIR why the emissions have not been calculated. The first step in this process would be to use the recommended IIR template and structure. This would probably result in a report that includes several sections where there will be very limited, or no, content. However, it will lead to more transparent reporting.

11. There are occasions where Monaco does not use the appropriate notation key, and specific examples are included in sectoral chapters later in this report. The ERT encourages Monaco to use the appropriate notation keys ("NO", "NA", "NE" and "IE").

## ***Completeness***

12. Monaco does not estimate all the pollutant emissions in the sectors concerned. The ERT encourages Monaco to estimate all the pollutant emissions, using at least the Tier 1 method of the EMEP EEA Emission Inventory Guidebook 2009 to ensure a suitable level of completeness. The ERT have provided specific examples in the sectoral chapters later in this report.

13. In the 2012 submission, Monaco submitted an inventory only for the year 2010 in the NFR09 format. The ERT strongly encourages Monaco to provide a full time series in the NFR09 format.

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

14. Monaco has submitted an NFR table for one year only (2010) and an Excel file with NFR1 level 1 for the period (1990-2010). It is not possible to estimate the consistency of emissions due to a lack of time series with enough sectoral detail. The ERT strongly recommends that Monaco submits all years of the time series as NFR tables to improve consistency.

15. In the NFR tables, the use of notation keys varies between pollutants for the same sector as explained in the chapters below. The ERT recommends that Monaco reviews the use of notation keys, and ensures consistency across the pollutants and sectors.

## ***Comparability***

16. It is not possible to estimate the comparability of the Monaco inventory with those of other countries due to the lack of information on the sources and methods used in the inventory. The ERT encourages Monaco to improve the level of detail that is provided in the IIR, so that emissions can be compared with other countries.

## ***CLRTAP/NECD comparability***

17. Monaco does not report emissions under the NECD, so assessing comparability between CLRTAP and NECD is not relevant.

## ***Accuracy and uncertainties***

18. The ERT encourages Monaco to undertake an uncertainty analysis for all sectors in order to help inform the improvement process and to provide an indication of the reliability of the inventory data.

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

19. Monaco has provided some information on basic QA/QC checks, but there is no detailed description of QA/QC procedures. The ERT encourages Monaco to improve the reporting of QA/QC procedures in their IIR and, based on the information that has been provided, recommends that Monaco improves the QA/QC procedures that are currently in place.

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

20. A Stage 2 Review could not be undertaken by CEIP due to Monaco not providing any activity statistics.

## **AREAS FOR IMPROVEMENT IDENTIFIED BY MONACO**

21. The ERT notes Monaco's intention to improve transparency with a chapter on the EFs that have been used in the inventory, and by providing an assessment of completeness in their subsequent IIR. The ERT commends Monaco for this intention.

22. The ERT notes Monaco's intention to correct the notation keys where applicable and commends Monaco on this initiative. The ERT hopes that the information provided in this report will help to support this activity.

23. The ERT notes Monaco's intention to improve completeness by estimating pollutants which are missing, and including these in the next submission. The ERT commends Monaco for this initiative, and looks forward to seeing the results.

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

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

24. The ERT encourages Monaco to submit an IIR in a format that is consistent with that provided in Annex VI of ECE/EB.AIR97, Version 30<sup>th</sup> September 2009. This would help improve the transparency of the inventory calculations.

25. The ERT recommends that Monaco submits all years of the time series (as a minimum 1990, 1995, 2000 and 2005 onwards) as NFR tables to improve the consistency and comparability of the inventory.

26. The ERT recommends that Monaco provides activity data in CLRTAP submissions. This would allow that implied EFs are calculated, which provides helpful information on comparability with other countries.

27. In the IIR Monaco states that the notation key "NA" is used when the activity is so small that it is negligible. The ERT recognises that sometimes it is difficult to select the correct notation key – particularly for small countries. However, according to the guidance document, "NA" should be used when an activity does not emit the pollutant concerned. If the emissions are very small or negligible, then the notation key "NE" should be used. The ERT encourages Monaco to review their use of the notation keys and make amendments where appropriate (see sectoral chapters for specific recommendations).

## 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> , POPs, HM		
Years		1990 – 2010 + (Protocol Years)		
NFR Code	CRF_NFR Name	Reviewed	Not Reviewed	Recommendation Provided
1.A.1.a	public electricity and heat production	X		X
1.A.1.b	petroleum refining	X		
1.A.1.c	Manufacture of solid fuels and other energy industries	X		X
1.A.2.a	iron and steel	X		
1.A.2.b	non-ferrous metals	X		
1.A.2.c	chemicals	X		X
1.A.2.d	pulp, paper and print	X		X
1.A.2.e	food processing, beverages and tobacco	X		X
1.A.2.f.i	Stationary Combustion in Manufacturing Industries and Construction: Other (Please specify in your IIR)	X		
1.A.2.f.ii	Mobile Combustion in Manufacturing Industries and Construction: (Please specify in your IIR)	X		X
1.A.3.e	Pipeline compressors ?		X	
1.A.4.a.i	commercial / institutional: stationary	X		X
1.A.4.a.ii	commercial / institutional: mobile ?	X		X
1.A.4.b.i	residential plants	X		X
1.A.4.b.ii	household and gardening (mobile)	X		X
1.A.4.c.i	Agriculture/forestry/fishing. stationary	X		X
1.A.4.c.ii	off-road vehicles and other machinery?	X		
1.A.4.c.iii	national fishing?	X		
1.A.5.a	other, stationary (including military)	X		
1.A.5.b	other, mobile (including military, land based and recreational boats)?	X		
1.B.1.a	coal mining and handling	X		
1.B.1.b	solid fuel transformation	X		
1.B.1.c	other fugitive emissions from solid fuels )	X		
1.B.2.a.i	Exploration, production, transport	X		
1.B.2.a.iv	Refining / storage	X		
1.B.2.a.v	Distribution of oil products	X		X
1.B.2.b	Natural gas	X		X
1.B.2.c	Venting and flaring	X		X
1.B.3	Other fugitive emissions from geothermal energy production, peat and other energy extraction not included in 1.B.2	X		

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

### General recommendations on cross-cutting issues.

#### **Transparency:**

28. Sometimes Monaco does not use the right notation key in NFR tables. Some examples are given in the category issues below.

29. The methodology used for the estimation of the total consumption of the different fuels and the split of the fuels in the different sectors is not described in the IIR. Monaco gives some explanation on how the estimation of total fuel consumption is calculated. ERT encourages Monaco to add, in the next IIR, more detailed explanations and descriptions of the methodology used to split the fuels into the different sectors.

30. Monaco does not explain the choice of EFs used in the IIR. Monaco has indicated that there is information in the NIR on some of the pollutants and that in future they will provide a chapter explaining the choice of EFs used by Monaco, including all references. The ERT commends this intention and encourages Monaco to include this chapter in their next IIR.

#### **Completeness:**

31. As explained in Part A of this report, Monaco does not estimate all the pollutant emissions in the sectors concerned. ERT encourages Monaco to estimate all the pollutants emissions with, at least, the Tier 1 method of the EMEP EEA Emission Inventory Guidebook 2009.

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

32. As explained in Part A of this report, Monaco has submitted an NFR table for one year only (2010) and an Excel file with NFR1 level 1 for the period (1990-2010). The ERT recommends that Monaco submit all years of the time series as NFR tables to improve consistency.

#### **Comparability:**

33. The methods used by Monaco are not well described in the IIR and little information is given about the EFs used and the estimation of activity by sub-sector. The ERT encourages Monaco to describe the methodology used in more detail in the IIR.

34. Monaco refers to the use of EFs obtained from IPCC guidance. The ERT recommends that Monaco uses the EMEP/EEA Emissions Inventory Guidebook as the main source of EFs because it will have been updated more recently, and it will ensure consistency with other countries reporting under the LRTAP Convention.

#### **Accuracy and uncertainties:**

35. As explained in Part A of this report, no uncertainty analysis has been undertaken. The ERT encourages 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.

36. Monaco has some basic QA/QC checks as far as the saving of data is concerned. As explained in Part A of this report, the ERT encourages Monaco to include a better description of their QA/QC procedures in the next IIR.

**Improvement:**

37. The ERT notes Monaco's intention to improve transparency by introducing a chapter on EFs in the next year, and to improve completeness by adding, in the next submission, estimations of pollutants which are not taken into account in the 2012 submissions. ERT commends Monaco for this intention.

38. The ERT notes Monaco's intention to correct notation keys in the future, and commends Monaco on this initiative.

*Sub-sector Specific Recommendations*

**Category issue 1: 1.A.1.a Public electricity and heat production - PM<sub>2.5</sub>, PM<sub>10</sub>, As, Cr, Cu, Ni, Se, Zn, PAHs**

39. The ERT has found that the emissions of PM<sub>2.5</sub>, PM<sub>10</sub>, As, Cr, Cu, Ni, Se, Zn, PAHs are reported as not estimated (NE). The ERT recommends that Monaco estimates these emissions, and encourages the use of the EMEP/EEA Emission Inventory Guidebook 2009, which includes emission factors for these pollutants.

**Category issue 2: 1.A.1.c Manufacture of solid fuels & 1.A.2.f.i stationary combustion in other manufacturing industries and construction– Pb, Cd, Hg**

40. The ERT has found that Monaco uses the notation key "NA" for Pb, Cd and Hg. However, there are EFs available in the EMEP/EEA Emission Inventory Guidebook 2009 for these pollutants. The ERT recommends that Monaco uses the notation key "NO" if there is no activity for these sources.

**Category issue 3: 1.A.2.c & 1.A.2.d & 1.A.2.e Stationary combustion in manufacturing industries and construction (chemicals, pulp, paper and print, food processing) – all pollutants**

41. Monaco uses the notation key "NA" for 1A2c, 1A2d and 1A2e. However, there are EFs available in the EMEP/EEA Emission Inventory Guidebook 2009 for these sectors. Monaco has informed the ERT that there is no estimation of emissions in this sector because there is no activity. ERT recommends that Monaco uses the notation key "NO".

**Category issue 4: 1.A.4.a Commercial/Institutional – all pollutants**

42. According to the NFR table and the IIR, emissions of 1A4a are included in 1A4bi. The ERT recommends splitting the emissions between Residential and Commercial/institutional because the EFs used in these sectors are different. Moreover, the notation key "IE" is used for 1A4ai and 1A4aai for all pollutants even if in 1A4bi these pollutants are not estimated. In this case, ERT encourages Monaco to use the notation key "NE" because the pollutants are really not estimated.

**Category issue 5: 1.A.4.b.i Residential: Stationary plants – TSP, PM10, PM2.5, HMs, PAHs, dioxins**

43. ERT notes that TSP, PM10, PM2.5, HMs, PAHs, dioxins are not estimated for 1A4bi. However, there are EFs for these pollutants in the EMEP/EEA Emission Inventory Guidebook 2009. The ERT recommends estimating these emissions by using the information in the EMEP/EEA Emission Inventory Guidebook 2009.

**Category issue 6: 1.A.4.b.ii Residential: household and gardening - all pollutants**

44. The ERT notes that fuel consumption and emissions associated with 1A4bii are not estimated the NFR tables. Monaco has indicated that the emissions of 1.A.4.b.ii are included in 1.A.4.b.i. ERT encourages Monaco to split the emissions into 1.A.4.b.i and 1.A.4.b.ii or (if the split is not possible) to use, at least, the notation key "IE".

**Category issue 7: 1.A.4.c.i Agriculture/Forestry/Fishing: stationary - NH3**

45. The ERT notes that, in the NFR table, Monaco indicates no activity for 1A4ci. However, NH3 emissions are reported for this NFR code. Monaco has indicated that this is a mistake, and the ERT therefore recommends that this is corrected before the next submission.

**Category issue 8: 1.B.2.a.v distribution of oil products & 1.B.2.b natural gas - NMVOC**

46. The ERT notes that Monaco has not calculated NMVOC emissions for 1B2av and 1B2b ("NO" is used in the NFR table). But there are service stations and a natural gas distribution network and NMVOC emissions associated with these activities in Monaco. The ERT recognises that there has been an update of the gas network, and that there are only 5 small service stations, but encourages Monaco to estimate emissions from these sources. The ERT suggests using the EMEP/EEA Emission Inventory Guidebook 2009, which gives EFs for these 2 emission sources.

## TRANSPORT

### 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> , POP's, HM		
Years		1990 – 2010 + (Protocol Years)		
NFR Code	CRF_NFR Name	Reviewed	Not Reviewed	Recommendation Provided
1.A.3.a.i.(i)	international aviation (LTO)	X		X
1.A.3.a.i.(ii)	international aviation (cruise)	X		X
1.A.3.a.ii.(i)	civil aviation (domestic, LTO)	X		X
1.A.3.a.ii.(ii)	civil aviation (domestic, cruise)	X		X
1.A.3.b.i	road transport, passenger cars	X		X
1.A.3.b.ii	road transport, light duty vehicles	X		X
1.A.3.b.iii	road transport, heavy duty vehicles	X		X
1.A.3.b.iv	road transport, mopeds & motorcycles	X		X
1.A.3.b.v	road transport, gasoline evaporation	X		X
1.A.3.b.vi	road transport, automobile tyre and brake wear	X		X
1.A.3.b.vii	road transport, automobile road abrasion	X		X
1.A.3.c	railways	X		X
1.A.3.d.i (ii)	international inland navigation	X		X
1.A.3.d.ii	national navigation	X		X
1.A.4.b.ii	household and gardening (mobile)		X	
1.A.4.c	agriculture / forestry / fishing		X	
1.A.4.c.ii	off-road vehicles and other machinery		X	
1.A.4.c.iii	national fishing		X	
1.A.5.b	other, mobile (including military, land based and recreational boats)		X	
1 A 3 d i (i)	International maritime navigation	X		X
1 A 3	Transport (fuel used)		X	

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

### General recommendations on cross-cutting issues.

#### **Transparency:**

47. Monaco has provided a generally transparent transport sector emissions inventory. However, its transparency can be improved by providing a detailed explanation of the methodology used for road transport in the IIR. To further improve the transparency of the inventory, the ERT encourages Monaco to include more information on the sector description, time series of emissions and explanations of trends and activity data.

48. As explained in Part A of this report, Monaco has provided data for all of the time series, but not in the NFR09 format. The Party has indicated that they intend to address this issue. The ERT encourages Monaco to develop a new tool to provide NFR09 tables for the whole time series.

#### **Completeness:**

49. The ERT considers the transport sector to be almost complete and comprehensive, but notes that some NE notation keys are not in accordance with the EMEP/EEA Guidebook. The ERT recommends that Monaco checks the Guidebook to see which EFs are available, and then estimates emissions for these source sectors, and also uses “NE” in the relevant parts of the NFR tables.

**Consistency including recalculation and time series:**

50. The ERT understands that Monaco has recalculated its inventory but the time series are not in the NFR09 format. The ERT notes that there is no explanation in the IIR regarding these recalculations. The ERT recommends that Monaco provides explanations of the recalculations and that the data are provided in the NFR09 format.

**Comparability:**

51. Monaco is using a fuel sold methodology to estimate emissions from the transport sector. This method does not allow Monaco to estimate emissions occurring within Monaco’s boundaries, because one can expect that these emissions are greatly influenced by import/export through “tank tourism”. The ERT recommends that Monaco uses the Tier 3 methodology, or equivalent, which allows the estimation of emissions from all sectors for all pollutants.

**Accuracy and uncertainties:**

52. As explained in Part A of this report, the ERT notes that no uncertainty analysis is mentioned in the IIR. ERT encourages Monaco to develop an uncertainty analysis and to report it in the IIR.

53. During the course of the review, Monaco indicated that QA/QC procedures are undertaken, but that there is no information on these procedures in the IIR. The ERT encourages Monaco to apply specific QA/QC procedures for the transport sector and report these in the IIR.

**Improvement:**

54. As explained in Part A of this report, the ERT notes that there is no information on improvements in the IIR. However, Monaco has indicated that some activities are planned. The ERT recommends that Monaco reports such improvement in the IIR.

*Sub-sector Specific Recommendations.*

**Category issue 1: 1A3ai(i), 1A3aii(i) and 1A3aii(ii): NO<sub>x</sub>, NMVOC, SO<sub>x</sub>, CO, NH<sub>3</sub>, HM, POPs**

55. The ERT has found some mistakes in the use of notation keys in the 2010 NFR table (NO and NA instead of IE or NO and NA instead of NE) which are detailed below. Monaco has indicated its agreement with these findings, and they will make the relevant corrections. The ERT encourages Monaco to continue improving the inventory.

**Category issue 2: 1A3ai(i), 1A3aii(i) and 1A3aii(ii): PM2.5, PM10, TSP**

56. The ERT notes that all aviation emissions are reported as a single value. The ERT recommends that Monaco split the activity data in LTO and cruise phases in order to estimate the different emissions. Monaco has indicated that they will take this proposal into account, and will try to improve the inventory in order to estimate LTO emissions.

**Category issue 3: 1.A.3.b: All pollutants**

57. As explained in Part A of this report, the ERT notes that there is no clear explanation for road transport methodology in the IIR. Monaco explained that calculations are based on a fuel sold methodology, as in the Kyoto protocol inventory report. The ERT recommends that the methodology is clearly explained in the IIR for this sub-sector.

**Category issue 4: 1A3bi to 1A3biv: PM10, PM2.5, TSP**

58. The ERT notes that PM10 and PM2.5 emissions are not estimated. The 2009 EMEP/EEA Guidebook indicates that that TSP=PM10=PM2.5. Monaco has indicated its willingness to use the TSP emission estimates for PM10 and PM2.5.

**Category issue 4: 1A3bvi and 1A3bvii: PM10, PM2.5, TSP**

59. The ERT notes that no emissions have been estimated for these sub-sectors. Monaco has explained that this is due to calculations being based on a fuel sold methodology, rather than using vehicle km data. As a result, emissions from tyre and brake wear cannot be estimated. The ERT encourages Monaco to revise and improve the methodology in this sub-sector, so that emissions from tyre and brake wear can be estimated, particularly because they represent a significant source of PM emissions.

**Category issue 5: 1A3bv: NMVOC**

60. The ERT notes that the activity data are not provided for this sub-sector, even though (fuel) activity data for 1A3bi to 1A3biv sub-sectors are provided. The ERT encourages Monaco to improve the inventory by using the available activity data to make emission estimates for 1A3bv.

**Category issue 6: 1A3bv: PCDD/ PCDF, PAHs (BaP, BbF, BkF, IndPy, total PAH)**

61. The ERT has noted some mistakes in the notation keys in the 2010 NFR table (NE instead of NA). Monaco has agreed with the ERT's findings. The ERT therefore encourages Monaco to improve the inventory as suggested.

**Category issue 7: 1A3bi to 1A3biv: All pollutants**

62. The ERT has noted that biofuel activity data has only been provided for 1A3bi and not for the other sub-sectors. The ERT encourages Monaco to improve the inventory by estimating the relevant activity data.

**Category issue 8: 1A3c, 1A3di(ii): Pb, Cd, Hg, HCB, HCH, PCBs**

63. The ERT has noted some mistakes in the notation keys in the 2010 NFR table (NA instead of NO). Monaco has indicated that they agree with the findings of the ERT. The ERT therefore encourages Monaco to continue improving the inventory.

**Category issue 9: All: All**

64. As explained in Part A of this report, the ERT has noted that the NFR tables are only available for 2010. Monaco has indicated that they will introduce a new system to generate NFR09 tables for the complete time series. The ERT encourages Monaco to make these improvements.

## INDUSTRIAL PROCESSES

### Review Scope

Pollutants Reviewed		NMVOC, particles		
Years		2000-2010		
NFR Code	CRF_NFR Name	Reviewed	Not Reviewed * source NO	Recommendation Provided
2.A.1	Cement production		X *	
2.A.2	Lime production		X *	
2.A.3	Limestone and dolomite use		X *	
2.A.4	Soda ash production and use		X *	
2.A.5	Asphalt roofing		X	X
2.A.6	Road paving with asphalt	X		X
2.A.7.a	Quarrying and mining of minerals other than coal		X *	
2.A.7.b	Construction and demolition		X	X
2.A.7.c	Storage, handling and transport of mineral products		X *	
2.A.7.d	Other Mineral products (Please specify the sources included/excluded in the notes column to the right)		X *	
2.B.1	Ammonia production		X *	
2.B.2	Nitric acid production		X *	
2.B.3	Adipic acid production		X *	
2.B.4	Carbide production		X *	
2.B.5.a	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)		X *	
2.B.5.b	Storage, handling and transport of chemical products (Please specify the sources included/excluded in the notes column to the right)		X *	
2.C.1	Iron and steel production		X *	
2.C.2	Ferroalloys production		X *	
2.C.3	Aluminium production		X *	
2.C.5.a	Copper Production		X *	
2.C.5.b	Lead Production		X *	
2.C.5.c	Nickel Production		X *	
2.C.5.d	Zinc Production		X *	
2.C.5.e	Other metal production (Please specify the sources included/excluded in the notes column to the right)		X *	
2.C.5.f	Storage, handling and transport of metal products (Please specify the sources included/excluded in the notes column to the right)		X *	
2.D.1	Pulp and paper		X *	
2.D.2	Food and drink		X *	
2.D.3	Wood processing		X *	
2.E	Production of POPs		X *	
2.F	Consumption of HM and POPs (e.g. Electrical and scientific equipment)		X *	
2.G	Other production, consumption, storage, transportation or handling of bulk products (Please specify the sources included/excluded in the notes column to the right)		X *	

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

### General recommendations on cross-cutting issues

#### **Transparency:**

65. 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 that Monaco provide a more detailed IIR, with descriptions of industrial activities as well as the methods used to quantify emissions. In cases where emissions occur but are not estimated (NE), the ERT recommends that Monaco estimate the emissions or explain in the IIR why the emissions have not been calculated.

#### **Completeness:**

66. As explained in Part A of this report, the ERT has noted that some sources may be missing from the industrial processes part of the inventory. In addition, some pollutants that are likely to be emitted from these sources are currently not included in the inventory. More detail is included in the chapters below.

67. In 2012 Monaco submitted emission estimates in NFR09 only for the year 2010.

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

68. As explained in Part A of this report, the use of notation keys in the NFR tables varies between pollutants for the same sector. Specific examples are given in the chapters below.

69. As explained in Part A of this report, it is currently not possible to estimate the consistency of emissions due to the lack of a time series in NFR09. The ERT has reviewed the industrial sector inventories for the years 2006-2009 that were submitted separately year by year, but encourages Monaco to submit a time series that is completely in the NFR09 format.

#### **Comparability:**

70. As explained in Part A of this report, it is not possible to estimate the comparability of the Monaco inventory with other countries due to a lack of information on sources and the methods used in the inventory.

#### **Accuracy and uncertainties:**

71. As explained in Part A of this report, the ERT encourages Monaco to undertake an uncertainty analysis and to develop a quality system for the inventory in order to help inform the improvement process and to provide an indication of the reliability of the inventory data.

#### **Improvement:**

72. Monaco has not provided information on industrial processes in their IIR; so it is not possible to estimate whether improvements have been made in the inventory.

### Sub-sector Specific Recommendations.

#### **Category issue 1: 2A Cement production - All Pollutants**

73. Monaco has reported all pollutants from this source as not occurring (NO). The ERT encourages Monaco to add information to the IIR to justify the use of this notation key for this source.

#### Category issue 3: 2A2 Lime production - All pollutants

74. Monaco has reported all pollutants from this source as not occurring (NO). The ERT encourages Monaco to add information to the IIR to justify the use of this notation key for this source.

#### **Category issue 3: 2A3 Limestone and dolomite use - All pollutants**

75. It is not clear if this source exists in Monaco. In the NFR table Monaco has used the notation key NA. The ERT recommends that Monaco investigate if this source exists, and if it does, that Monaco calculate emissions and document the methods in the IIR.

#### Category issue 4: 2A4 Soda ash production and use - All pollutants

76. Monaco has reported all pollutants from this source as not occurring (NO). The ERT encourages Monaco to add information to the IIR to justify the use of this notation key for this source.

#### **Category issue 5: 2A5 Asphalt roofing - All pollutants**

77. Asphalt roofing is a source of NMVOC and particle emissions. It is not clear if the source exists in Monaco. In the NFR table Monaco has used both of the notation keys NO and NA. The ERT recommends that Monaco investigate if the source exists, and if so, that they calculate possible emissions and document the methods in the IIR.

#### **Category issue 6: 2A6 Road paving with asphalt - All pollutants**

78. Monaco reported NMVOC emissions from this source for 2010 as well as for the years 2008-2009 separately in the earlier years. For the years before 2008 emissions from this source were reported as NE. It is not possible for the ERT to evaluate the quality of the reported values due to the lack of documentation of the methods used in the calculation. The ERT recommends that Monaco documents the methods in the IIR and checks whether current reporting is a consistent time series of emission estimates.

79. Road paving is also a source of particle and PCDD/F emissions. The ERT recommends that Monaco include estimates of these pollutants in the inventory for all years since 1990.

**Category issue 7: 2A7a Quarrying and mining of minerals other than coal - All pollutants**

80. Monaco has reported all pollutants from this source as not occurring (NO). The ERT encourages Monaco to add information to the IIR to justify the use of this notation key for this source.

**Category issue 8: 2A7b Construction and demolition - All pollutants**

81. Construction and demolition is a source of particle emissions. Monaco did not report emissions from this source, though, according to the reply from Monaco, the source exists in Monaco. Monaco has also indicated that data collections and estimations for quantifying emissions from this source have as yet not been carried out. The ERT recommends that Monaco collects activity data and uses the methodologies presented in the EMEP/EEA Emission Inventory Guidebook (2009) to calculate the emissions.

**Category issue 9: 2A7c Storage, handling and transport of mineral products - All pollutants**

82. Monaco has reported all pollutants from this source as not occurring (NO). The ERT encourages Monaco to add information to the IIR to justify the use of this notation key for this source.

**Category issue 10: 2A7d Other Mineral products - All pollutants**

83. Monaco has reported all pollutants from this source as not occurring (NO). The ERT encourages Monaco to add information to the IIR to justify the use of this notation key for this source.

**Category issue 11: 2B Chemical industry categories - All pollutants**

84. Chemical industry sources do not exist in Monaco. For NFR 2B2 and 2B3 Monaco reports both the notation keys NO and NA. The ERT recommends that Monaco changes the notation key NA to NO for all pollutants if the source does not exist, or estimates possible emissions and documents the calculation in the IIR.

**Category issue 12: 2C Metal industry categories - All pollutants**

85. Monaco has reported all pollutants from this source as not occurring (NO). The ERT encourages Monaco to add information to the IIR to justify the use of this notation key for this source.

**Category issue 13: 2D1 Pulp and paper - All pollutants**

86. Monaco has reported all pollutants from this source as not occurring (NO). The ERT encourages Monaco to add information to the IIR to justify the use of this notation key for this source.

**Category issue 14: 2D2 Food and drink industry – NMVOC**

87. Monaco has reported the notation key NA for all pollutants from this source. In its reply to the ERT Monaco stated that there was no food production in Monaco.

The ERT recommends that Monaco changes the notation key NA to not occurring (NO).

**Category issue 15: 2D3 Wood processing – All pollutants**

88. Monaco has reported all pollutants from this source as not occurring (NO). The ERT encourages Monaco to add information to the IIR to justify the use of this notation key for this source.

**Category issue 16: 2E Production of POPs – All pollutants**

89. Monaco has reported all pollutants from this source as not occurring (NO). The ERT encourages Monaco to add information to the IIR to justify the use of this notation key for this source.

**Category issue 17: 2F Consumption of POPs and heavy metals– All pollutants**

90. Monaco has reported all pollutants from this source as not occurring (NO). The ERT encourages Monaco to add information to the IIR to justify the use of this notation key for this source.

**Category issue 15: 2G Other - All pollutants**

91. Monaco has reported all pollutants from this source as not occurring (NO) and has explained to the ERT that there are no other industrial activities in Monaco that might fall under this category.

## SOLVENTS

### Review Scope

Pollutants Reviewed		NMVOC		
Years		1990 – 2010		
NFR Code	CRF_NFR Name	Reviewed	Not Reviewed	Recommendation Provided
3.A.1	Decorative coating application	X		
3.A.2	Industrial coating application	X		
3.A.3	Other coating application (Please specify the sources included/excluded in the notes column to the right)	X		
3.B.1	Degreasing	X		
3.B.2	Dry cleaning	X		
3.C	Chemical products,	X		
3.D.1	Printing	X		
3.D.2	Domestic solvent use including fungicides	X		
3.D.3	Other product use	x		

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

### General recommendations on cross-cutting issues

#### **Completeness:**

92. The ERT has noted that although in most countries the solvents sector is a key source of NMVOC emissions, this is not the case for Monaco; according to the Stage 2 review key source analysis for CLRTAP, no key source of NMVOC emissions from the solvents sector was identified. The above mentioned observation is an indication of a possible underestimation of the solvents sector's emissions, and the ERT recommends that Monaco undertakes a review of the solvent sector to ensure that all relevant sources are included.

93. The ERT has noted that very limited information is provided in the IIR about which solvents categories' NMVOC emissions were estimated and reported in the NFR. During the review, Monaco explained that they estimated and reported NMVOC emissions for the following categories, 3A1 – SNAP 060103 "Construction and buildings", 3B2 – SNAP 060202 "Dry cleaning" and 3D1 – SNAP 060403 "Printing industry". The ERT considers that the following activities, which are not estimated by the Party, are likely to be significant sources of NMVOC emissions:

- 3A1 – SNAP 060104 "Domestic use (except 060107)"
- 3A2 – SNAP 060102 "Car repairing" and SNAP 060107 "Wood"
- 3D2 – SNAP 060408 "Domestic solvent use (other than paint application)"
- 3D3 – SNAP 060405 "Application of glues and adhesives", SNAP 060411 "Domestic use of pharmaceutical products" and SNAP 060601-4 "Other".

Therefore, the NMVOC emissions from the solvents sector are most probably underestimated. In the EMEP/EEA air pollutant emission inventory guidebook, there are simple-to-apply Tier 1 and 2 methods for estimating NMVOC emissions from these sources. The ERT therefore recommends that Monaco estimate and include these emissions in the next submission.

94. The ERT has noted that NMVOC emissions from 3A2, 3D2 and 3D3 categories were reported as NO or NA. Based on the observations described in the previous paragraph, the ERT recommends that Monaco verify the correct use of these notation keys and replace them with the notation key NE where applicable.

#### **Transparency:**

95. The ERT has noted that the section of the IIR relating to the solvents sector does not contain information about the methods, data sources and assumptions used for the emissions estimation. Moreover, the NFR tables do not indicate the activity data used in the emission calculations. In order to increase transparency of reporting and to enable the ERT to assess the solvents sector, the ERT recommends that Monaco provide in a comprehensive way, with a good level of detail, the above mentioned information in next year's IIR and NFR tables.

96. During the review, Monaco provided information about which SNAP categories were considered in the emission calculations. The ERT recommends that Monaco include this information in the next submission.

#### **Accuracy and uncertainties:**

97. The ERT has noted that no uncertainty analysis is performed by Monaco for the solvents sector concerning the CLRTAP emissions. During the review, Monaco explained that, as the activity data are the same as those used for the Kyoto Protocol, they considered the uncertainty analysis to be the same. The ERT encourages Monaco to report in the next IIR the results of the Kyoto protocol uncertainty analysis that are pertinent to the solvents sector's CLRTAP emissions, a quantified estimation of the uncertainty for each category of the solvents sector and how the uncertainty analysis is used to prioritize further improvements of the solvents sector inventory.

98. During the review, Monaco explained that the QA/QC system for the CLRTAP emissions was the same as the one used for the Kyoto Protocol annual inventory. The ERT encourages Monaco to develop specific QA/QC procedures for the solvents sector that aim to improve the transparency and completeness of the inventory, and that aim at the improvement / verification of the quality of the activity data used in emission calculations. The ERT encourages Monaco to report accordingly in the next IIR.

99. During the review, Monaco explained that CITEPA from France performed an external review of the CLRTAP inventory, including the solvents sector. The ERT commends Monaco for including an external review of the emissions inventory, and encourages Monaco to include the findings and recommendations of this external

review in the next IIR, along with the actions taken by the Party based on the findings of the reviews.

**Comparability:**

100. The ERT noted that the activity data and the methods / emission factors / assumptions used for the estimation of emissions are omitted from the IIR. As a result, the ERT are not able to assess the comparability of the inventory. The ERT encourages Monaco to include detailed comprehensive descriptions of activity data and methodologies in next year's IIR.

**Consistency including recalculation and time series:**

101. The ERT has noted that no information on recalculations is reported in the 2012 submission.

102. The ERT has noted that the time series of the reported NMVOC emissions for the solvents sector shows a peak in 2005 that is more than two times the emissions of 2004 and 2006. During the review, Monaco explained that the variations in the time series trends reflected significant business changes in printing and paint activities. Given the fact that the emissions from Monaco are relatively small compared to other countries, the ERT acknowledges that any change in source activities practices may have significant impact on the relative change of emissions. Therefore, the ERT thanks Monaco for this explanation, and recommends that Monaco include a description of the emission trends from the solvent sector in the next IIR, with explanations for any particular features in the time series.

**Improvement:**

103. The ERT has noted that no improvement plan for the solvents sector is reported in the IIR. The ERT encourages Monaco to develop an improvement plan for the solvents sector, based on the external review performed by CITEPA and the findings included in this report. The ERT encourages Monaco to include information on this improvement plan in their next IIR.

## AGRICULTURE

### 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 – 2010 + (Protocol Years)		
NFR Code	CRF_NFR Name	Reviewed	Not Reviewed	Recommendation Provided
4 B 1 a	Cattle dairy			
4 B 1 b	Cattle non-dairy			
4 B 2	Buffalo			
4 B 3	Sheep			
4 B 4	Goats			
4 B 6	Horses			
4 B 7	Mules and asses			
4 B 8	Swine			
4 B 9 a	Laying hens			
4 B 9 b	Broilers			
4 B 9 c	Turkeys			
4 B 9 d	Other poultry			
4 B 13	4 B 13 Other			
4 D 1 a	Synthetic N fertilizers	NH <sub>3</sub>		
4 D 2 a	Farm-level agricultural operations including storage, handling and transport of agricultural products			
4 D 2 a	Off-farm storage, handling and transport of bulk agricultural products			
4 D 2 c	N excretion on pasture range and paddock unspecified (Please specify the sources included/excluded in the notes column to the right)			
4 F	Field burning of agricultural wastes			
4 G	Agriculture other(c)			
11 A	(11 08 Volcanoes)			
11 B	Forest fires			

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

### General recommendations on cross-cutting issues

#### **Transparency:**

104. The ERT has found that Monaco has not reported any pollutant emissions for the agriculture sector in its NFR tables. However, Monaco does include estimates of NH<sub>3</sub> for the sector for the period 2000-2010 in the Annex to its IIR. Monaco also provides estimates of NH<sub>3</sub> for the sector in the Annex IV reporting template, Table IV 2A-WM. However, emissions are reported at the aggregated level of sector 4 rather than at sub-sectoral level. During the review week, in response to a question raised by the ERT, Monaco stated that NH<sub>3</sub> emissions in the agriculture sector arose from the application of fertilizer in parks and gardens and that emissions are estimated using the IPCC Guidelines. The ERT encourages Monaco to report emissions at the correct level of disaggregation (i.e. 4D1) and to use the appropriate emission factors from the latest EMEP/EEA Emission Inventory Guidebook in future submissions.

105. The ERT also encourages Monaco to provide information on the methodological approach, the emission factors used and on activity data in the Informative Inventory Report of its next annual submission.

**Completeness, Consistency, Comparability, Accuracy, Improvements:**

106. With the information provided, the ERT is not able to make any detailed comments on these aspects of the agricultural emission estimates.

## WASTE

### Review Scope:

<b>Pollutants Reviewed</b>		NO <sub>x</sub> , NMVOC, SO <sub>x</sub> , NH <sub>3</sub> , PM <sub>10</sub> , PM <sub>2.5</sub> , TSP, HM, POPs		
<b>Years</b>		1990 – 2010		
<b>NFR Code</b>	<b>CRF_NFR Name</b>	<b>Reviewed</b>	<b>Not Reviewed</b>	<b>Recommend ation Provided</b>
6.A	solid waste disposal on land	X		X
6.B	waste-water handling	X		X
6 C a	Clinical waste incineration (d)		NO	
6 C b	Industrial waste incineration (d)	X		X
6 C c	Municipal waste incineration (d)	X		X
6 C d	Cremation		NO	
6 C e	Small scale waste burning		NO	
6.D	other waste (e)	X		X
Note: Where a sector has been partially reviewed (e.g. some of the NFR codes) please indicate which codes have been reviewed and which have not in the respective columns.				

### General recommendations on cross-cutting issues

#### **Transparency:**

107. The ERT considers the level of detail in the IIR for the waste sector to be insufficient (there is no waste chapter included in the IIR).

108. The ERT notes that for the waste sector Monaco has provided emission data in the NFR tables, but insufficient information on activity data, default emission factors, methodologies, explanations of major changes in emission trends, notation keys, QA/QC, uncertainties and improvements in the IIR. In response to questions from the ERT, the Party provided some activity data and emission factors and the ERT compliments the Party on this.

109. As part of the Stage 2 Review, a key source analysis for CLRTAP has been performed. This shows that 6Cc is a key source for NO<sub>x</sub> and SO<sub>x</sub> in Monaco.

110. The ERT recommends that Monaco includes a waste chapter with the necessary level of detail in their next IIR, including descriptions of data sources, assumptions and methods, explanations of major changes in emission trends, notation keys, QA/QC, uncertainties and improvements at least for key categories.

#### **Completeness:**

111. The ERT has noted that only NFR Tables for 2008, 2009 and 2010 are available. The ERT encourages Monaco to include a complete time series of NFR09 tables in the future.

112. The ERT has noted that the notation key NE has been used many times in the waste sector. To avoid underestimations, the ERT recommends that Monaco includes plans to address the missing emissions (NE) in its IIR, either by obtaining

data to allow an emission estimate to be made, or by reporting the emissions as not applicable (NA).

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

113. The ERT has noticed that, as opposed to other sectors, Monaco has not performed recalculations for the waste sector. It has not been possible to determine whether there are differences between the 2012 and 2011 submissions because Monaco only submitted NFR tables for the last year (2010 data in 2012).

114. Both the time series of the activity data and EFs used to calculate emissions are not complete. The ERT encourages Monaco to include complete time series in its IIR for at least the key sources in the next submission.

#### **Comparability:**

115. Monaco has reported its emissions inventory in accordance with the reporting requirements and submitted it in the requested NFR09 format. However, the ERT has noted that Monaco have not used the available EFs from the EMEP/EEA Emission Inventory Guidebook 2009. To avoid under/over-estimation, the ERT recommends that Monaco uses the available EFs from the EMEP/EEA Emission Inventory Guidebook 2009 or country- or plant-specific EFs in the future.

#### **Accuracy and uncertainties:**

116. As explained in Part A of this report, the ERT has noted that Monaco has not provided a QA/QC plan or information on QA/QC procedures. The ERT recommends that Monaco includes this information in their next submission.

117. Monaco did not provide an uncertainty analysis. The ERT recommends that Monaco undertake an uncertainty analysis for the waste sector in order to help inform the improvement process and to provide an indication of the reliability of the inventory data.

#### **Improvement:**

118. The ERT has found that there are no planned improvements specified in the IIR. The ERT encourages Monaco to list desired improvements for the waste sector (e.g. uncertainty analysis, a description per sub-sector) in its IIR to help to support improvement prioritization.

#### **Sub-sector Specific Recommendations.**

##### **Category issue 1:**

##### **6 C b Industrial waste incineration / 6 C c Municipal waste incineration**

119. The ERT has noted that emissions from the incineration of sludge from waste water treatment have been reported under 6Cc. However, according to the 2009 Guidebook, this source should be reported under 6Cb. The ERT recommends that Monaco report these emissions under 6Cb in future submissions.

120. The ERT has noted that in the NFR tables no PM, HM, POPs emissions for 6Cc or 6Cb are reported. The “additional sheet” explains that there are no EFs available. However, EFs for PM, HM and POPs are included in the 2009 Guidebook. The ERT therefore recommends that Monaco report these missing emissions under 6Cb in the next submission.

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

1. The ERT raised a number of questions prior to and during the review, as listed below. Monaco responded to all of the questions.
  - Energy questions Q1 – Q17
  - Transport questions Q1 – Q13
  - Industrial Processes questions Q1 – Q2
  - Solvents questions Q1 – Q7
  - Agriculture questions Q1
  - Waste questions Q1 – Q3
2. Monaco also provided some data to support its answer to Q2 on transport “Monaco transports 27-06-2012 Q2 files”.
3. Monaco Stage 2 S&A report
4. Monaco Stage 1 report 2010
5. Monaco IIR 2010