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**Report of the individual review of the greenhouse gas inventories of Monaco
submitted in 2007 and 2008***

* In the symbol for this document, 2008 refers to the year in which the inventory was submitted, and not to the year of publication.

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I. Overview

A. Introduction

1. This report covers the centralized review of the 2007 and 2008 greenhouse gas (GHG) inventory submissions of Monaco, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. In accordance with the conclusions of the Subsidiary Body for Implementation at its twenty-seventh session¹ the focus of the review is on the most recent 2008 submission. The review took place from 8 to 13 September 2008 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalists – Mr. Klaus Radunsky (Austria) and Mr. Marius Țăranu (Moldova); energy – Mr. Simon Eggleston (United Kingdom) and Ms. Roberta Quadrelli (International Energy Agency); industrial processes – Ms. Suvi Monni (European Community) and Mr. Menouer Boughedaoui (Algeria); agriculture – Ms. Tajda Mekinda-Majaron (Slovenia) and Mr. Sergio González (Chile); land use, land-use change and forestry (LULUCF) – Ms. Naoko Tsukada (Japan) and Mr. Walter Oyhantçabal (Uruguay); waste – Mr. Kai Skoglund (Finland) and Mr. Oscar Paz (Bolivia). Mr. Radunsky and Mr. González were the lead reviewers. The review was coordinated by Mr. Harald Diaz-Bone (UNFCCC secretariat).

2. In accordance with the “Guidelines for review under Article 8 of the Kyoto Protocol” (decision 22/CMP.1), a draft version of this report was communicated to the Government of Monaco, which provided comments that were considered and incorporated, as appropriate, into this final version of the report.

B. Inventory submission and other sources of information

3. A complete set of common reporting format (CRF) tables for the period 1990–2006 was submitted on 7 May 2008, and the national inventory report (NIR) was submitted on 20 June 2008. The expert review team (ERT) noted that this is not fully in line with decision 15/CMP.1. The Party indicated that the 2008 submission is also its voluntary submission under the Kyoto Protocol.² In its 2007 submission, Monaco presented a complete set of CRF tables for the period 1990–2005, submitted on 10 July 2007, and an NIR, submitted on 3 August 2007. In the course of the centralized review Monaco provided answers in response to questions raised by the ERT. The ERT recommends that Monaco submit its next inventory by 15 April 2009, as required by decision 15/CMP.1. Where needed the ERT also used previous years’ submissions, additional information provided during the review and other information. The full list of materials used during the review is provided in the annex to this report.

C. Emission profiles and trends

4. In 2006, the main GHG in Monaco was carbon dioxide (CO₂), accounting for 95.7 per cent of total GHG emissions³ expressed in CO₂ equivalent; nitrous oxide (N₂O) made up 2.9 per cent of total GHG emissions and methane (CH₄) 0.6 per cent. Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆) taken together accounted for 0.8 per cent of the total GHG emissions in the country, most of that share (0.6 per cent) being HFCs. The energy sector accounted for 98.1 per cent of the total GHG emissions, waste for 1.1 per cent and industrial processes for 0.8 per cent. Total GHG emissions in 2006 amounted to 93.58 Gg CO₂ eq, and had decreased by 13.2 per cent between the base

¹ FCCC/SBI/2007/34, paragraph 104.

² Parties may start reporting information under Article 7, paragraph 1, of the Kyoto Protocol from the year following the submission of the initial report, on a voluntary basis (decision 15/CMP.1).

³ In this report the term “total GHG emissions” refers to the aggregated national GHG emissions expressed in terms of CO₂ equivalent excluding LULUCF, unless otherwise specified.

year⁴ and 2006. In 2005, total GHG emissions amounted to 103.95 Gg CO₂ eq. The shares of gases and sectors in 2006 were similar to those in 2005. Large inter-annual fluctuations in the emission estimates have been noted for the industrial processes sector for almost the whole period (except between 2004 and 2005) and for the waste sector between 1990 and 1991 (40.2 per cent increase) and between 1992 and 1993 (11.7 per cent increase). Large inter-annual fluctuations in the emission estimates have been noted also for some gases – for N₂O emissions between 1990 and 1991 (16.1 per cent increase), between 1992 and 1993 (13.2 per cent increase) and between 1993 and 1994 (10.1 per cent increase), and for fluorinated gases for almost the whole period under review (except between 2004 and 2005).

5. Tables 1 and 2 show GHG emissions by gas and by sector, respectively.

D. Key categories

6. Monaco has reported a key category tier 1 analysis, both level and trend assessment, as part of its 2008 submission. The key category analysis performed by the Party and that performed by the secretariat⁵ produced similar results. Monaco has not included the LULUCF sector in its key category analysis, which was not performed in accordance with the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF), and the ERT cannot accept the small contribution from the LULUCF sector as justification for not following the IPCC good practice guidance for LULUCF. N₂O from road transportation was identified as a key category in the 2008 submission but not in the 2007 submission, whereas HFCs from other applications using ozone depleting substances (ODS) substitutes was identified as a key category in the 2007 submission but not in the 2008 submission.

7. The ERT recommends that Monaco include the LULUCF sector in its key category analysis for its next annual submission as this requirement of the good practice guidance is independent of the actual magnitude of the LULUCF sector. The ERT reiterates also the recommendation of the previous review for Monaco to include the full key category calculation tables in the NIR and perform a tier 2 category analysis for its next annual submission.

⁴ Base year refers to the base year under the Kyoto Protocol, which is 1990 for CO₂, CH₄ and N₂O, and 1995 for HFCs, PFCs and SF₆.

⁵ The secretariat identified, for each Party, the categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the Intergovernmental Panel on Climate Change *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. Key categories according to the tier 1 trend assessment were also identified for Parties that provided a full set of CRF tables for the base year. If the Party performed a key category analysis, the key categories presented in this report follow the Party's analysis. However, they are presented at the level of aggregation corresponding to a tier 1 key category assessment conducted by the secretariat.

Table 1. Greenhouse gas emissions by gas, 1990–2006

Greenhouse gas emissions	Gg CO ₂ eq								Change base year– 2006 (%)
	Base year ^a	1990	1995	2000	2003	2004	2005	2006	
CO ₂	105.37	105.37	111.85	112.88	106.54	100.03	98.70	89.54	–15.0
CH ₄	0.65	0.65	0.79	0.80	0.69	0.64	0.62	0.53	–18.4
N ₂ O	1.64	1.64	2.63	3.29	3.19	3.11	3.02	2.76	68.7
HFCs	0.01	NA, NE, NO	0.01	2.60	1.18	1.71	1.77	0.61	7 971.6
PFCs	NA, NE, NO	NA, NE, NO	NA, NE, NO	NA, NE, NO	0.03	0.04	0.06	0.07	NA
SF ₆	0.10	NA, NE, NO	0.10	0.10	0.10	0.08	0.08	0.08	–15.6

Abbreviations: NA = not applicable; NE = not estimated; NO = not occurring.

^a Base year refers to the base year under the Kyoto Protocol, which is 1990 for CO₂, CH₄ and N₂O, and 1995 for HFCs, PFCs and SF₆.

Table 2. Greenhouse gas emissions by sector, 1990–2006

Sectors	Gg CO ₂ eq								Change base year– 2006 (%)
	Base year ^a	1990	1995	2000	2003	2004	2005	2006	
Energy	107.01	107.01	114.27	115.91	109.35	102.68	101.29	91.84	–14.2
Industrial processes	0.10	NA, NE, NO	0.10	2.69	1.31	1.83	1.91	0.76	628.0
Solvent and other product use	NE	NE	NE	NE	NE	NE	NE	NE	NA
Agriculture	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA
LULUCF	NA	–0.03	–0.04	–0.04	–0.04	–0.04	–0.04	–0.04	NA
Waste	0.64	0.64	1.00	1.05	1.07	1.10	1.05	0.98	53.9
Total (with LULUCF)	NA	107.62	115.34	119.62	111.70	105.57	104.21	93.54	NA
Total (without LULUCF)	107.76	107.65	115.38	119.65	111.73	105.61	104.25	93.58	–13.2

Abbreviations: LULUCF = land use, land-use change and forestry; NA = not applicable; NE = not estimated; NO = not occurring.

^a Base year refers to the base year under the Kyoto Protocol, which is 1990 for all gases.

E. Main findings

8. The inventory is generally in line with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines) and the IPCC good practice guidance but does not properly follow the IPCC good practice guidance for LULUCF, for example, the LULUCF sector was included in neither the key category analysis, nor the uncertainty analysis.

9. The 2008 inventory submission shows that significant improvements have been made in the inventory between the 2007 and 2008 submissions based on the recommendations of previous reviews. The ERT noted that Monaco has included, for the first time as separate annexes in the NIR, a tier 1 key category analysis, both level and trend assessments, and an uncertainty analysis. The reported gaps in the solvents and LULUCF sectoral tables have been filled. The Party has submitted also CRF table 9 (completeness). Some missing estimates have been reported, such as potential emissions of fluorinated gases from 'Consumption of Halocarbons and SF₆'. However, the ERT identified a need for further improvements as follows: a revision of the NIR structure is needed in order to fully reflect the requirement of the "Guidelines for the preparation of national communications by Parties included in Annex I to the Conventions, Part I: UNFCCC reporting guidelines on annual inventories" (hereinafter referred to as the UNFCCC reporting guidelines); the transparency of the inventory should be improved by including additional information in the NIR on the identification of emission factors (EFs) used, improved descriptions of individual sectors, explanations on the selection of methodologies, and information on the sources of activity data (AD); the uncertainty analysis should be improved by using the sector split recommended by the IPCC and by addressing the LULUCF categories as well; and a full implementation of the national quality assurance/quality control (QA/QC) plan is needed for meeting all the requirements for the national inventory system and a description of the QA/QC and verification measures should be included in specific sections in the sectoral chapters of the NIR to follow the guidance in the UNFCCC reporting guidelines on the structure of the NIR.

10. Monaco acknowledged the findings at the time of the review and carried out major improvements to its GHG inventory during the review by submitting the revised inventories and by supplying the additional information requested by the ERT. Monaco has demonstrated sufficient capacity to comply with the UNFCCC reporting guidelines and the IPCC good practice guidance.

F. Cross-cutting issues

1. Completeness

11. A full CRF time series is available for the years 1990–2006. The inventory is complete in terms of years and GHG gases, and close to complete in terms of categories. Some categories with expected small contributions to total GHG emissions are still missing (e.g. CO₂ emissions from asphalt roofing and road paving with asphalt, HFC and PFC emissions from aerosols, solvents, other applications using ODS substitutes and electrical equipment, CO₂ and N₂O emissions from solvents and other product use, N₂O emissions from fertilizer use and N₂O emissions from industrial wastewater), the main reasons being lack of AD and/or of available methodologies. The ERT reiterates the recommendation of the review of the 2006 GHG inventory submission for Monaco to apply the notation keys consistently and to make appropriate use of the documentation boxes in the CRF tables. The ERT recommends that Monaco prepare and report estimates for all categories and provide in the NIR a detailed discussion of the categories that have not yet been estimated and of other potential sources or sinks not addressed in the current inventory submission; and identify plans for including them in submissions in the near future. The Party informed the ERT that in its next annual submission missing emission data might be included based on expert judgment, and that more information on missing source/sink categories will be included.

2. Transparency

12. The ERT noted a lack of transparency in the inventory, because no additional information was included in the 2008 NIR on the identification of EFs used, explanations as to the selection of methodologies applied, assumptions on parameters used, information on the sources of activity data and improved descriptions of individual sectors. The ERT reiterates the recommendation of the review of the 2006 GHG inventory submissions for Monaco, which encourages the Party to improve the transparency of the inventory by including all this information in the NIR.

3. Recalculations and time-series consistency

13. The ERT noted that recalculations reported by the Party of the time series 1990–2005 have been undertaken, using more accurate AD and improved EFs, mainly within the industrial processes and energy sectors, in accordance with the IPCC good practice guidance. These recalculations resulted in an increase in estimated total GHG emissions for 1990 by 0.3 per cent (both with and without the LULUCF sector), and for 2005 by 0.2 per cent, without LULUCF, and by 0.3 per cent, with LULUCF. The largest changes resulting from recalculations were in the industrial processes sector (estimates for emissions of fluorinated gases decreased by 3.7 per cent in 2005). The ERT noted that the rationale and impact of the recalculations are not fully addressed in either the chapter on recalculations or the sectoral chapters of the NIR. The ERT encourages Monaco to introduce better documentation on the recalculations performed in the NIR for its next annual submission, and to prepare recalculations for the whole time series as appropriate; the ERT found it difficult to understand why AD are available for earlier years (1990) but not for 2005 (CO₂ and CH₄ emissions for industrial processes).

4. Uncertainties

14. Monaco has provided in the NIR, for the first time, a tier 1 uncertainty analysis for both level and trend assessment. The quantitative uncertainty for the total GHG emissions was estimated as 5.6 per cent, and the uncertainty of the trend for 1990 to 2006 as 1.2 per cent, respectively. The ERT noted that this analysis is in accordance with the IPCC good practice guidance but relies mostly on default values for EFs and does not include the LULUCF sector. The ERT encourages the Party to use more country-specific information when performing the uncertainty assessment, and to include the LULUCF sector in the analysis for its next annual submission.

5. Verification and quality assurance/quality control approaches

15. Monaco has a QA/QC plan in place in accordance with the IPCC good practice guidance. QA measures include an external assessment of the inventory performed in 2005, conducted by the Centre interprofessionnel technique d'études de la pollution atmosphérique (CITEPA) in France. Because no specific changes on QA/QC procedures took place between the 2007 and 2008 submissions, the ERT reiterates the recommendation of the review of the 2006 GHG inventory submissions for Monaco to gain experience with the implementation of the QA/QC plan and further elaborate the specific checks for each category in line with its national circumstances. The ERT encourages Monaco to include the main features of its QA/QC plan in its next NIR (submission 2009).

6. Follow-up to previous reviews

16. Monaco has systematically addressed issues raised in the previous reviews and followed the recommendations where it was deemed appropriate or possible. Thus, a tier 1 key category analysis (both level and trend assessments) and an uncertainty analysis were presented for the first time as separate annexes to the NIR. The reported gaps in the solvents and LULUCF sectoral tables have been filled. The Party has also submitted CRF table 9 (completeness). Some missing estimates have been reported, such as potential emissions of fluorinated gases from consumption of halocarbons and SF₆.

G. Areas for further improvement

1. Identified by the Party

17. The 2008 NIR identified several areas for improvement in the sectoral chapters:
- (a) Collect the missing AD and provide estimates for fluorinated gas emissions from consumption of halocarbons and SF₆ for the period 1990–1994 for time series completeness;
 - (b) Collect the missing AD and provide estimates for non-methane volatile organic compounds (NMVOC) emissions from solvents and other product use for the period 1990–1994 for time series completeness;
 - (c) Estimate the vertical projection of the area covered by trees using aerial photographs and recalculate the time series of emissions/removals by settlements.

2. Identified by the expert review team

18. The ERT identifies the following cross-cutting issues for improvement:
- (a) Improve the NIR structure to fully reflect the requirement of the UNFCCC reporting guidelines;
 - (b) Improve the transparency of the inventory by including additional information in the NIR with regard to the identification of EFs used, improved descriptions of individual sectors, explanations about the selection of methodologies, and information on the sources of AD;
 - (c) Improve the uncertainty analysis by using the sector split recommended by the IPCC and by addressing the LULUCF categories as well;
 - (d) Fully implement the national QA/QC plan for meeting all the requirements for the national inventory system and include descriptions of the QA/QC and verification measures in specific sections in the sectoral chapters of the NIR to follow the guidance in the UNFCCC reporting guidelines on the structure of the NIR.

19. In its response to the ERT, Monaco indicated that the 2009 NIR will be more complete with respect to information on the national energy balance, the explanation on the identification of key categories, the description of the QA/QC plan and the explanations relating to completeness, and that the structure of the NIR will be better aligned with the UNFCCC guidelines.

20. Recommended improvements relating to specific source/sink categories are presented in the relevant sector chapters of this report.

II. Energy

A. Sector overview

21. In 2006, emissions from the energy sector amounted to 91.84 Gg CO₂ eq, or 91.8 per cent of total national GHG emissions. Within the sector, 37.7 per cent of the emissions were from other sectors, 37.2 per cent from transport and 25.1 per cent from energy industries. Emissions from the energy sector decreased by 14.2 per cent between 1990 and 2006, driven by the 78.5 per cent fall in emissions from energy industries. Manufacturing industries emissions are reported as “not applicable” (“NA”) or “not occurring” (“NO”) and fugitive emissions are reported as “NO” for the whole time series.

22. For all subsectors and gases, Monaco applied a tier 1 method with IPCC default EFs. During the review the Party informed the ERT that it used IPCC default factors because the fuel composition in Monaco was not the same as that of average French fuels and the IPCC defaults were good estimators of

European fuels. The ERT recommends that the Party consult fuel suppliers and large consumers to obtain more details of fuels used in Monaco, and review and revise the fuel CO₂ EFs. The ERT recommends that Monaco expand the explanations in the NIR, list EFs used with their sources, discuss reasons for significant trends, and improve the description of the methodologies for road transport, for example avoiding duplicate use of the same symbol for different variables (e.g. use of “N”).

23. In the 2007 submission heating oil was reported together with gas/diesel oil in the reference approach. In the 2008 reference approach Monaco has separated heating oil (reported under other oil) from gas/diesel oil and included residual oil as recommended by the previous ERT.

24. The party has quoted an uncertainty estimate of “0” for some categories in the NIR. The ERT noted that this is due to rounding and recommends that uncertainties be presented to at least one significant figure in the next NIR. The ERT also recommends that the Party reconsider uncertainties, noting that quoted values are sometimes volumetric measurement errors, which are not the only source of error in AD (e.g. uncertainties in calorific values), and suggests that Monaco consider uncertainty estimates made by other Parties.

25. Some sectors have large unexplained inter-annual fluctuations in fuel consumption (e.g. road transport 1991/1992, 15 per cent; aviation international bunkers 1999/2000, 15.8 per cent; and navigation 1998/1999, 41.3 per cent). During the review the Party explained this was because Monaco is a city of 30,000 inhabitants and, therefore, fuel sales can vary considerably from one year to another. The ERT recommends that the Party provide detailed explanations of these large inter-annual variations in emissions in the next NIR.

B. Reference and sectoral approaches

1. Comparison of the reference approach with the sectoral approach and international statistics

26. Monaco has provided estimates for the reference and sectoral approaches for all years. For 2006, the difference between reference approach and sectoral approach estimates is zero for energy consumption and -0.81 per cent for CO₂ emissions. The ERT recommends that Monaco use the same net calorific values and the same EFs for all products in the two methods. The ERT encourages Monaco to discuss why the two approaches give exactly the same energy consumption for all years. The ERT also encourages Monaco to fill in the column “apparent energy consumption (excluding non-energy use and feedstocks)” in table 1.A.c as this would improve the transparency of the comparison of energy consumption, as requested by the previous ERT.

27. The ERT recommends that Monaco include the complete time series of residual fuel oil in the next annual submission (2009) and welcomes information from the Party that action to this end has already been taken.

28. Comparison with international data was not possible, as data for Monaco are included in France’s submission to the International Energy Agency.

2. International bunker fuels

29. For aviation, all flights are considered to be international. Most of the fuel is bought in France and not included in the inventory. In its 2007 submission, Monaco did not include any estimates of the emissions deriving from fuel bought in Monaco and used for international aviation. The ERT was pleased to see that in its 2008 submission, Monaco followed the recommendation of the previous review report and included those emissions under the memo item on international aviation.

30. In 2006, fuel consumption for international maritime navigation was 91.0 per cent of the total fuel consumption for navigation, based on a 2005 survey. The ERT recommends that Monaco explain in more detail in the NIR how this share was computed for all the years of the submission, starting with the information of the survey.

3. Feedstocks and non-energy use of fuels

31. Monaco did not report any emissions under feedstocks and non-energy use of fuels. The ERT reiterates the recommendation of the previous report review that Monaco investigate the possibility of reporting emissions from feedstocks and non-energy use of fuels for the whole time series, especially from the use of bitumen and lubricants which are used in Monaco.

C. Key categories

1. Stationary combustion: other fuels – CO₂

32. This source includes emissions from municipal waste incineration with energy recovery. Emissions from this source accounted for 23.4 per cent of the total CO₂ emissions of the energy sector in 2006, and had decreased by 20.0 per cent from 1990 to 2006, considerably affecting the trend in the total GHG emissions. During the review, the Party explained that a large fall in emissions during 2006 was due to temporary closure of the waste incineration plant. However, it did not explain the long-term trend. The ERT recommends that Monaco explain in the NIR the reasons for such a trend, include data on the total quantity of waste incinerated to increase the transparency of the inventory, and explain how the shortfall in electricity generated is addressed.

33. Emissions from waste incineration were estimated using the IPCC tier 1 method with IPCC default values for the fossil fraction and for the carbon content of the fuel. The ERT supports the plan to survey waste composition, about which the ERT was informed during the review, and encourages the Party to implement it as soon as possible. The ERT also encourages the Party to consider carefully how it recalculates the entire time series on the basis of these new data. The Revised 1996 IPCC Guidelines state that these emissions should be reported under 1.A.a “other fuels” instead of “solid fuels” (coal and coal derived products). The ERT reiterates previous recommendations that Monaco should report these emissions in the correct category.

2. Stationary combustion: liquid fuels – CO₂

34. This source includes emissions from the use of liquid fuels in other sectors. Emissions from this source accounted for 26.3 per cent of the total CO₂ emissions of the energy sector in 2006, and had decreased by 34.8 per cent from 1990 to 2006, greatly affecting the trend in total GHG emissions. The ERT recommends that Monaco explain in the NIR the reasons for such a trend. The ERT also recommends that Monaco investigate the possibility of obtaining separate data for the commercial sector, which are now reported together with the residential sector.

3. Stationary combustion: gaseous fuels – CO₂

35. The ERT reiterated the recommendation from the previous review report that the Party contact the relevant authorities to obtain information for all years on the carbon content of the natural gas, and revise its emission estimates accordingly.

4. Road transportation: liquid fuels – CO₂

36. Specific national circumstances make the estimation of emissions from transport very difficult; the quantities of fuel sold in the country do not necessarily reflect the effective use of those fuels. The ERT noted that Monaco estimated CO₂ emissions based on the tier 1 IPCC methodology using the total fuel sold in the country and the relevant default EFs and net calorific values, in agreement with the recommendation of previous reviews.

D. Non-key categories

1. Stationary combustion: biomass – CO₂, CH₄, N₂O

37. In its 2007 submission, Monaco reported emissions from biomass in energy industries as “NO”. The ERT was pleased to see that in the 2008 submission, Monaco had included emissions from incineration of organic waste with energy recovery under “biomass” in 1.A.1.a. The ERT recommends that Monaco provide in the NIR a more detailed explanation on the quantities and types of biomass included here. The ERT also reiterates the recommendation of the previous review to ensure the inclusion of organic waste from maintenance of parks and public gardens in the quantity of organic waste incinerated for energy recovery.

2. Fugitive emissions: oil refining/storage, and natural gas distribution and other leakage – CH₄

38. Monaco did not report any fugitive emissions from its natural gas distribution system. The NIR states that those emissions were considered to be less than 0.02 per cent of the overall quantity of gas distributed. This is a small value compared to those of other countries; the Revised 1996 IPCC Guidelines indicate a minimum value of about 0.7 per cent. The ERT reiterates the recommendation of the previous review that Monaco further review this issue, consider data on similar systems in Europe, and provide a more detailed explanation and appropriate estimates of these emissions.

3. Road transportation: liquid fuels – N₂O

39. The 512 per cent increase in N₂O emissions from gasoline-fuelled vehicles is driven by the high EF for passenger cars equipped with a catalytic converter (0.05 g/km) published by the IPCC in 1997 and derived some years earlier. The implied EF for N₂O from gasoline vehicles in Monaco in 2006 was 12.67 kg/TJ whereas in France it was 1.56 kg/TJ. The ERT recommends that Monaco consider the use of more recent European emissions data for vehicles estimated after the Revised 1996 IPCC Guidelines were prepared (e.g. by the COPERT studies). In order to improve the transparency of the inventory, the ERT also encourages Monaco to include in the NIR the time series of the number of vehicles per category and all the EFs used to estimate emissions.

III. Industrial processes and solvent and other product use

A. Sector overview

40. In 2006, emissions from the industrial processes sector accounted for 0.76 Gg CO₂ eq, or 0.8 per cent of total GHG emissions. Emissions from the industrial processes sector increased by 628 per cent between 1995 and 2006. No GHG emissions were reported from the solvent and other product use sector. According to Monaco’s key category analysis, there are no key categories in either sector.

41. Emissions from the industrial processes sector have not been estimated for the years 1990–1994. In the solvent and other product use sector, the time series is complete only in the case of two sources of NMVOC. During previous stages of the review, Monaco reported that it plans to collect more data in order to provide a complete time series for these sectors. The ERT was informed by the Party that data for the years 1990–1994 have been collected and that emissions from industrial processes will be reported in the 2009 submission.

42. Many source categories do not occur in Monaco, as there are no industrial activities. Many products are consumed in Monaco, but the following categories are reported as “not estimated” (“NE”): asphalt roofing; road paving with asphalt; aerosols/metered dose inhalers; electrical equipment – HFCs and PFCs; solvents; other applications using ODS substitutes; and solvent and other product use. The ERT recommends that Monaco provide estimates for these categories in its next annual submission and welcomes information from the Party that emissions have been estimated for some activities in the

solvent and other product use sector and that the Party is planning to report emissions from road paving with asphalt.

43. The Party does not report on any QA/QC procedures or uncertainty calculations for the industrial processes sector. The previous review recommended that Monaco implement further QC procedures, redesign some of the existing questionnaires, and explore possibilities to establish cooperation with neighbouring countries in order to provide methodological consistency that could prevent gaps and duplications. The ERT reiterates these recommendations and welcomes information from the Party that cooperation with CITEPA is under development that will also address QA/QC procedures.

44. The NIR structure is not in line with the UNFCCC reporting guidelines and, as pointed out in the previous review, the methodologies used are not described.

45. As highlighted in the previous review, the ERT recommends that Monaco estimate emissions from the most important sources indicated as "NE" for completeness, estimate potential emissions of halocarbons, and complete the time series. The ERT encourages Monaco to apply QA/QC procedures, estimate uncertainties and structure the NIR according to UNFCCC reporting guidelines.

B. Non-key categories

1. Consumption of halocarbons and SF₆ – HFCs, PFCs and SF₆

46. Emissions from the refrigeration and air conditioning sector have been recalculated. In the 2008 submission the estimated emissions for 1995 and 2005 are 61 and 8 per cent lower, respectively, than those reported in 2007. Monaco has not described this recalculation in the NIR, and the ERT recommends that Monaco do so.

47. The ERT noted that emission estimates are missing for several categories, especially for the years 1990–1994. During the review, Monaco explained that work is currently being undertaken to obtain these data and the ERT welcomed the information provided by the Party that data for the years 1990–1994 are available.

48. The ERT reiterates recommendations from the previous review that Monaco investigate reasons for fluctuations in the time series and put in place gap-filling procedures in accordance with good practice, when fluctuations are due to incomplete data. The ERT also reiterates the recommendation from the previous review that Monaco investigate the use of data collection methods other than questionnaires, as set out in the IPCC good practice guidance. Such data collection methods have not been mentioned in the NIR.

49. The description of the method used to estimate emissions from refrigeration and air conditioning is not transparent. No data are reported in sectoral background tables 2(II).Fs1 and 2(II).Fs2. The ERT encourages Monaco to improve transparency of the NIR and the CRF tables by providing a description of the method used in its next NIR.

50. Actual emissions of SF₆ are reported to be higher than potential emissions for the years 2001 and 2005. The Party reports that actual emissions represent 1 per cent of potential emissions; however, the ERT noted that, when considering the trends, potential and actual emissions do not fluctuate accordingly. The Party informed the ERT that there is only one company (the Société monégasque de l'électricité et du gaz) that uses SF₆ in installing electrical appliances. The annual emission estimates are obtained directly from the company, and for the next inventory more information will be requested on how emissions are estimated. The ERT encourages this plan and recommends that Monaco apply QA/QC procedures to the data obtained from the company.

51. The ERT acknowledges that in this submission, following the recommendation of the previous review, Monaco has, reported non-zero values for SF₆ in electrical equipment for the entire time series

for the first time. This results in a difference in estimated emissions from industrial processes in the 2007 and 2008 submissions.

2. Solvent and other product use – NMVOCs

52. The trend in emissions of NMVOCs from paint application fluctuates, with peaks in 1996, 2001 and 2005. The Party informed the ERT that the data are based on an annual enquiry, and the number of responses and their quality may be different from year to year. The Party is encouraged to apply gap-filling procedures in accordance with the Revised 1996 IPCC Guidelines and the UNFCCC reporting guidelines to ensure time-series consistency, even if the completeness of data obtained from questionnaires would differ.

53. The following note is included in the documentation box of CRF table 3: “3.A Paint Application: the year 1995 is chosen as baseline year for the national inventory.” However, a base year different to 1990 should not be chosen for gases other than fluorinated gases. The Party informed the ERT that the emission estimates for 1990–1994 were not available when the inventory was compiled, because of incomplete responses to the questionnaire, and that emissions for 1990–1994 will be reported in the next inventory. The ERT encourages this and recommends that the Party no longer refer to a different base year in the documentation box.

IV. Agriculture

Sector overview

54. As stated in the NIR, the absence of crop production, pasture management and agricultural soil exploitation in its national territory gives Monaco the basis for considering sectoral GHG emissions as negligible.

55. In the 2007 and 2008 submissions, emissions from all categories were reported as “NA, NO” and subcategories as “NO” for the complete time series, except for table 4.F, where the notation key “NA” was also used for the subcategories. The ERT noted this change from the previous submission when the CFR tables were left blank.

V. Land use, land-use change and forestry

A. Sector overview

56. In 2006, the LULUCF sector accounted for net removals of 0.036 Gg CO₂ eq, corresponding to 0.04 per cent of total GHG emissions. Removals from the sector increased by 9.1 per cent between 1990 and 2006. For 2005, removals as reported in the NIR are 0.05 Gg higher than those reported in the CRF tables. The AD and EFs show small differences between both years in the CRF, and the reason is not explained in the NIR. The ERT recommends that Monaco provide an explanation on this issue in its next NIR.

57. In Monaco the only land-use category that can adequately represent LULUCF sector is settlements. According to the NIR, 42.64 ha of the territory of Monaco were occupied by public and private gardens in 2006. The total number of urban trees in parks and streets was 6,281 in 2006. Most of the trees (85 per cent) are considered mature and older than 20 years, so gains and losses are similar and close to zero; the remaining 15 per cent of trees have net removals in their living biomass. Compared to the base year, the area of settlements has increased by 9.6 per cent (from 38.91 ha in 1990) and the number of trees has increased by 14.3 per cent (from 5,496 in 1990).

58. According to the NIR, nitrogen (N) fertilizers are used in parks, and emissions of N₂O are estimated at 0.000087 Gg. The ERT noted that CRF table 5(I) reports these emissions as “NE”. The ERT encourages the Party to revise this inconsistency.

59. The information reported under the LULUCF sector in the NIR is not fully transparent. In particular the method used to calculate removals is not clearly described. The ERT recommends that the Party include all necessary data and methodological procedures in order to explain how calculations were done, so that an external reader can reconstruct the same outcomes.

60. Reiterating the advice of previous reviews, the ERT encourages Monaco to present simple category-specific procedures for QA/QC in this sector and to continue working on the implementation of a QA/QC plan following the recommendations of the IPCC good practice guidance for LULUCF. The ERT welcomes the information from the Party that cooperation with CITEPA is under development which will also address QA/QC procedures.

B. Non-key categories

1. Settlements – CO₂

61. Monaco correctly allocates areas of parks and gardens to the settlements category. As a result one of the two methodologies provided by the IPCC good practice guidance for LULUCF was selected: “tier 1 a”, which estimates removals from growing trees using as AD the area of land covered by tree crown (equation 3a.4.3A). These specific methodologies are provided by the IPCC good practice guidance for LULUCF in appendix 3A.4 “Settlements”. Countries may use country-specific parameters for crown cover area-based growth (CRW) or the default value of 2.9 t C per ha crown cover per year. Monaco does not have a country-specific value for CRW, and its parks contain many different species. Given the circumstances and the small weight of the LULUCF sector in the total GHG emissions in the inventory, the use of a default value is considered an appropriate choice, and it is conservative to apply it only to growing trees.

62. During the review the ERT found that the application of this “tier 1a” method is not fully in line with the recommendation of the IPCC good practice guidance for LULUCF. Crown areas are not estimated using aerial photography, but using number of trees and average surface of a hemisphere simulating the shape of a tree. This method of estimation does not strictly reflect the area covered by crowns in a vertical projection, due to the overlapping of crowns. During the in-country review in 2007, the ERT verified that Monaco has good resolution aerial photography that permits the estimation of the vertical projection of the area covered by trees. The Party says in the NIR that it intends to report area covered by crowns using aerial photography in the next inventory and, as a consequence, as AD may change, the time series of removals by settlements will be recalculated. However, in response to the draft report, the ERT was informed by the Party that the “tier 1a” method as described above will not be used in future because the LULUCF sector is not a key category, owing to the small size of the country and the complexity of using aerial photography as a basis for the estimate. The ERT recommends that the Party obtain available high resolution remote sensing images that could permit a good estimate of the area covered by trees in vertical projection. In this way, and by using the IPCC tier 1 default value for changes in carbon stocks, the reporting would be fully in line with the IPCC Guidelines.

63. The maintenance of parks produces a certain amount of biomass every year (mainly grass). In 2006 this amount is reported as 660.66 t of biomass. Once removed, this waste is carried to the incineration plant. Associated emissions of CH₄ and N₂O are accounted for in the energy sector in table 1.A(a).

2. Information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol

64. The ERT notes that, according to the report of the review of the initial report of Monaco (FCCC/IRR/2007/MCO), Monaco has chosen to account for activities under Article 3, paragraph 3, of the Kyoto Protocol on an annual basis and that Monaco did not elect any additional activity under Article 3, paragraph 4. Although Monaco has not reported voluntarily on activities under Article 3, paragraph 3, in its 2008 submission, the ERT encourages the Party to have all the relevant AD available to be in a position to provide the required information on any land-use change that relates to afforestation,

reforestation or deforestation, in case Monaco identifies forest land in its land area, according to the parameters selected for the forest definition.

VI. Waste

A. Sector overview

65. Between 1990 and 2006, emissions from the waste sector increased by 54.8 per cent. In 2006, emissions from the waste sector constituted 1.0 per cent of total GHG emissions. Emissions from wastewater handling account for 72 per cent of sector emissions. N₂O is the only GHG reported in this sector. Emissions from incineration of municipal solid waste are reported in the energy sector. Only emissions from the incineration of sewage sludge are reported in the waste sector, with N₂O and CH₄ emissions accounting for 23 and 4 per cent of sectoral emissions, respectively.

66. In general Monaco used the tier 1 IPCC methodologies and default EFs. The ERT noted that the 2008 NIR does not include more detailed information on AD and EFs compared with the previous NIR. The ERT recommends that the Party provide more detailed information in its next annual submission.

67. Monaco does not include a QA/QC analysis or detailed information on uncertainties. The ERT reiterates the recommendation from the previous review that Monaco should provide detailed information on QA/QC and the qualitative and quantitative evaluation of the uncertainties in its future annual submissions. The ERT welcomes the information from the Party that cooperation with CITEPA is under development which will also address QA/QC procedures.

B. Non-key categories

1. Wastewater handling – N₂O

68. Monaco does not explain why the amount of wastewater treated decreased from 2001 to 2006. The values for protein intake are estimated to be constant for the whole time series 1990–2006. In addition, the NIR describes the method used to estimate N₂O emissions only in general terms. The ERT recommends that Monaco provide a more detailed description on this category in its next annual submission.

2. Waste incineration – CO₂, CH₄, N₂O

69. In the 2008 submission, the amount of waste incinerated is not explained. The ERT recommends that a short summary on waste incineration should be included in the NIR under the waste sector to indicate the rationale for the sectoral allocation of emissions, and to improve transparency and consistency of reporting.

VII. Other issues

1. Changes to the national system

70. The ERT notes, with regard to the recommendations included in the initial report of Monaco, that:

- (a) No additional information on the improvement and implementation of the QA/QC plan has been provided since the publication of the above-mentioned report;
- (b) A centralized archiving system has been established at the Direction de l'environnement, de l'urbanisme et de la construction; the ERT was informed by the Party that the name of the organization was changed to "Direction de l'Environnement" at the beginning of 2008;

- (c) The national system does not have sufficient resources to provide more complete and detailed information.

71. The ERT recommends that high priority should be given to emission estimates for those categories that have not yet been estimated. The ERT also recommends the full implementation of the QA/QC plan in order to meet the requirements under the Kyoto Protocol.

2. Changes to the national registry

72. The ERT notes that no additional information about the national registry has been submitted since the publication of the initial report of Monaco. The ERT reiterates the request included in that document, that Monaco provide a list of the information available to the public on the internet through the national registry interface.

3. Commitment period reserve

73. In response to questions raised by the ERT during the review, Monaco reported its commitment period reserve to be 445,703 t CO₂ eq. The ERT disagrees with this figure; the figure included in the initial report, which was based on calculations by the Party and approved by the ERT, corresponds to 445,699 t CO₂ eq. The ERT recommends that Monaco explain the difference of 4 t CO₂ eq in its next annual submission.

VIII. Conclusions and recommendations

74. The inventory of Monaco is generally in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance but does not properly follow the IPCC good practice guidance for LULUCF. The inventory shows that important improvements have been made between the 2007 and 2008 submissions based on the recommendations of previous reviews. The ERT noted that Monaco has included a tier 1 key category analysis, both level and trend assessments, and an uncertainty analysis for the first time as separate annexes to the NIR. The reported gaps in the solvent and LULUCF sectoral tables have been filled. The Party has also submitted CRF table 9 (completeness). Some missing estimates have been reported, such as potential emissions of fluorinated gases from consumption of halocarbons and SF₆. However, the ERT noted a number of recommendations included in the initial report that were not addressed by the Party. In particular, the national system still lacks full implementation of the QA/QC plan, and some reporting gaps relating to emission data of some source categories have not been closed.

75. The key recommendations are that Monaco:

- (a) Submit its next inventory by 15 April 2009, as required by decision 15/CMP.1;
- (b) Improve the NIR structure to fully reflect the requirement of the UNFCCC reporting guidelines;
- (c) Improve the transparency of the inventory by including additional information in the NIR with regard to the identification of EFs used, improved descriptions of individual sectors, explanations about the selection of methodologies, and information on the sources of AD;
- (d) Fully implement the national QA/QC plan for meeting all the requirements for the national inventory system and include descriptions of the QA/QC and verification measures in specific sections in the sectoral chapters of the NIR in accordance with the UNFCCC reporting guidelines on the structure of the NIR;
- (e) Include the full key category calculation tables in the NIR and perform a tier 2 category analysis for its next annual submission;

- (f) Improve the uncertainty analysis by using the sector split as recommended by the Revised 1996 IPCC Guidelines and by addressing the LULUCF categories as well.

IX. Questions of implementation

76. The ERT did not identify any question of implementation during the review of the 2007 and 2008 inventory submission.

Annex**Documents and information used during the review****A. Reference documents**

Intergovernmental Panel on Climate Change. *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*. Available at <<http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm>>.

Intergovernmental Panel on Climate Change. *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. Available at <<http://www.ipcc-nggip.iges.or.jp/public/gp/english/>>.

Intergovernmental Panel on Climate Change. *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. Available at <<http://www.ipcc-nggip.iges.or.jp/public/gp/landuse/gp/landuse.htm>>.

“Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories”. FCCC/SBSTA/2006/9. Available at <<http://unfccc.int/resource/docs/2006/sbsta/eng/09.pdf>>.

“Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention”. FCCC/CP/2002/8. Available at <<http://unfccc.int/resource/docs/cop8/08.pdf>>.

“Guidelines for national systems under Article 5, paragraph 1, of the Kyoto Protocol”. Decision 19/CMP.1. Available at <<http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf#page=14>>.

“Guidelines for the preparation of the information required under Article 7 of the Kyoto Protocol”. Decision 15/CMP.1. Available at <<http://unfccc.int/resource/docs/2005/cmp1/eng/08a02.pdf#page=54>>.

“Guidelines for review under Article 8 of the Kyoto Protocol”. Decision 22/CMP.1. Available at <<http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf#page=51>>.

Status report for Monaco 2007. Available at <<http://unfccc.int/resource/docs/2007/asr/mco.pdf>>.

Status report for Monaco 2008. Available at <<http://unfccc.int/resource/docs/2008/asr/mco.pdf>>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2007. Available at <<http://unfccc.int/resource/webdocs/sai/2007.pdf>>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2008. Available at <<http://unfccc.int/resource/webdocs/sai/2008.pdf>>.

FCCC/ARR/2006/MCO. Report of the individual review of the greenhouse gas inventory of Monaco submitted in 2006. Available at <<http://unfccc.int/resource/docs/2007/arr/mco.pdf>>.

FCCC/IRR/2007/MCO. Report of the review of the initial report of Monaco. Available at <<http://unfccc.int/resource/docs/2007/irr/mco.pdf>>.

B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Claude Marmonteau (Direction de l'Environnement), including additional material on the methodology and assumptions used.
