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

**STAGE 3 REVIEW REPORT
CROATIA**

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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*' ⁽¹⁾ – hereafter referred to as the 'Methods and Procedures' document.
2. This annual review has concentrated on SO₂, NO_x, NMVOC, NH₃, plus PM₁₀ & PM_{2.5} for the time series years 1990 – 2012, reflecting current priorities from the EMEP Steering Body and the Task Force on Emission Inventories and Projections (TFEIP). HMs and POPs have been reviewed to the extent possible.
3. This report covers the Stage 3 centralised reviews of the UNECE LRTAP Convention and EU NEC Directive inventories of Croatia coordinated by the EMEP emission centre CEIP acting as review secretariat. The review took place from 23rd June 2014 to 27th June 2014 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 – Kristina Saarinen (Finland), Energy – Garnt Jans Venhuis (the Netherlands), Transport - Michael Kotzulla (Germany), Industry – IIs Moorkens (the Netherlands), Solvents – IIs Moorkens (the Netherlands), Agriculture + Nature – Michael Anderl (Austria), Waste – Intars Cakars (Latvia).
4. Kristina Saarinen was the lead reviewer. The review was coordinated by Katarina Marečková (EMEP Centre on Emission Inventories and Projections - CEIP).

PART A: KEY REVIEW FINDINGS

5. The Croatian inventory is generally in line with the *EMEP EEA Inventory Guidebook* and the UNECE Reporting Guidelines. Transport emissions are calculated on the basis of fuels sold. The ERT found the Croatian inventory to be sufficiently detailed and noted that national methodologies had been used for many sources.
6. The ERT recognises the level of effort undertaken by Croatia in providing an inventory of with a significant level of detail so as to enable an in-depth review.
7. The ERT notes that recalculations have not always been applied consistently through the entire time series. Justifications for the recalculations are provided in the IIR.
8. According to the results of the Stage 2 review, the Croatian submissions under the CLRTAP, the NECD and the UNFCCC are partly consistent.
9. The 2014 submission shows improvements on a number of issues (since the last review in 2011 as well as since the last submission in 2013) and the ERT commends Croatia on the work done. The ERT noted several areas for further improvements, some of which are listed in Part B of this report and in the cross-cutting recommendations below.

INVENTORY SUBMISSION

10. Croatia submitted its inventory under the NECD on 30th December 2013, by the deadline of 31st December. The inventory was submitted in NFR09 (Version 2009-1) for the years 1990-2012 (the most recent year) for NO_x, SO_x, NMVOC and NH₃. The submission included an Informative Inventory Report (IIR) and projections for NO_x, SO_x, NMVOC, NH₃, PM₁₀ and PM_{2.5} in 2015 and 2020.
11. Croatia submitted the inventory under the UNECE CLRTAP on 14th February 2014, by the deadline of 15th February. The inventory was submitted in NFR09 (Version 2009-1) for the years 1990 to 2012 (the most recent year) for NO_x, NMVOC, SO_x, NH₃, CO, TSP PM₁₀, PM_{2.5}, heavy metals, PCDD/F, PAH-4, PCBs and HCB. The submission also included projections for NO_x, NMVOC, SO_x, NH₃, PM₁₀ and PM_{2.5} for 2015 and 2020, gridded emissions for 2010 and LPS data for 2012. The Informative Inventory Report (IIR) was submitted on 13th March 2014, by the deadline of 15th March, and an IIR resubmitted on 31st March 2014.

The ERT found the inventory submitted by Croatia to be of good quality and in general well documented in the Informative Inventory Report (IIR). Because of the good quality of the IIR and the Party's responsiveness, the ERT was able to review the inventory in detail and provide a number of detailed recommendations.

KEY CATEGORIES

12. Croatia has compiled and presented in its IIR a level key category analysis of all reported pollutants (KCA) for the most recent inventory year 2012. The Tier 1 key category analysis covers all NFR sectors and has been carried out according to the Guidebook. The results from the KCA performed by the CEIP are equal to the results reported by Croatia except for TSP emissions. To the question raised by the ERT about this issue Croatia replied that the differences result from an error in the IIR (NFR1.A.3.b.vi Road transport TSP emissions indicated as “NE”). The ERT commends Croatia for carrying out a KCA and recommends that Croatia checks future KCAs for errors.

13. Croatia does not specify in the IIR that the results of the KCA are used to identify priorities in resource allocation and data collection or for QA/QC and higher-tier methodologies in the inventory. The ERT recommends that Croatia uses the results to prioritise improvements in the inventory.

QUALITY

Transparency

14. The ERT recognises the level of effort undertaken by Croatia in providing an inventory of with a significant level of detail so as to allow a detailed review.

15. The ERT found the IIR to be generally comprehensive and transparent. To further improve the transparency of the IIR, the ERT recommends that Croatia systematically provides (1) information on activity data as well as detailed information on the methodologies used to quantify emissions, (2) the rationale behind the choice of the methods and data sources, and (3) country-specific circumstances, as explained in the relevant sector chapters.

16. The ERT notes that Croatia reports emissions from some sources as aggregates (e.g. the Energy, Transport and Industrial Processes sectors). The ERT recommends that Croatia investigates possibilities for reporting these emissions separately under the relevant NFRs, or documents the reasons for aggregated reporting in the IIR.

17. Croatia provides explanations on the use of notation keys both on the NFR table sheet “Additional Info” and in the IIR. The ERT commends Croatia for providing this information. However, the ERT makes the following observations and recommendations:

- (a) The use of notation keys (for emissions and activity data) is not always consistent between the NFR tables and the IIR (e.g. in the Transport sector) or within the NFR tables. The ERT recommends that Croatia corrects the errors in the use of notation keys and improves the consistency of the information in the NFR tables and in the IIR (repeating the recommendation of the previous ERT).

- (b) Croatia uses the notation key “NO” instead of “NE” for some sources, e.g. in the Agriculture sector for sources which do exist but from which emissions are not estimated.
- (c) Croatia uses the notation key IE for several sources (e.g. in the Energy and Transport sectors). However, the IIR does not always provide explanations for aggregated reporting. The ERT recommends that Croatia includes information in the IIR to explain why these sources are reported as IE, and that it specifies the category under which they are reported.
- (d) Croatia uses the notation key NA for pollutants that are likely to be emitted from a particular source (e.g. in the Transport and the Industrial Processes sectors). The ERT recommends that Croatia replaces the notation key NA in these cases by the notation key NE (not estimated) as explained in the relevant sector chapters below.
- (e) For those sources where the notation key NE has been used the ERT recommends that Croatia estimates the missing emissions, or checks that a justification for not estimating the emissions is provided in the IIR.

Completeness

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

19. The ERT found Croatia’s inventory for the pollutants reviewed to be partly complete. The ERT also found it challenging to assess the completeness of the inventory due to the varying uses of notation keys throughout the NFR tables and the IIR. During the review the ERT found some missing emission estimates as specified in the sector findings below. Croatia also uses “not estimated” (NE) for various pollutants in the Energy, Transport, Industrial Processes, Agriculture and Waste sectors. The ERT recommends that Croatia estimates the missing emissions or justifies the use of “NE” in the IIR.

Consistency, including recalculations and time-series

20. The ERT notes that there are fluctuations in the emission and activity data time series as indicated in the relevant sector chapters (e.g. Industrial Processes, Solvents, Agriculture). The ERT recommends that Croatia checks the reasons for these fluctuations and corrects errors or documents the reasons behind the fluctuations.

21. The ERT notes that the recalculations of emissions carried out since the last submission are not consistent for all sectors, for instance in the Industrial Processes, the Agriculture and the Waste sectors. The ERT also notes that Croatia provides explanations in the IIR for recalculations and thanks Croatia for the additional information received during the review. The ERT recommends that Croatia includes this additional information in the IIR.

22. The ERT found the information on recalculations rather unsystematic throughout the IIR and recommends that Croatia further improves the transparency of recalculations by compiling information on recalculations under an IIR Chapter 10 Recalculations and Improvements, according to the recommended contents of the chapter as presented in the IIR outline in Annex VI to the Reporting Guidelines.

In its IIR, Croatia has provided information on factors affecting emission levels throughout the time series. To enable a comparison of this information with the consistency test carried out by CEIP, Croatia provided the ERT with explanations on the dips, jumps, missing emissions and other changes. The ERT thanks Croatia for the comprehensive information and recommends that Croatia includes this additional information in the IIR and that it corrects some errors as indicated in the reply to enable future reviewers to understand the reasons behind the emission fluctuations.

Comparability

The ERT notes that the inventory of Croatia is generally comparable with those of other reporting parties. The methodologies used in the inventory are consistent with the EMEP/EEA Guidebook and the allocation of source categories follows that of the EMEP/UNECE Reporting Guidelines. The ERT encourages Croatia to continue with this approach towards providing comparable inventory and also recommends that Croatia implements methodologies from the latest version of the Guidebook (2013) where appropriate, to further improve the comparability of the inventory.

CLRTAP/NECD comparability

23. According to the results of the Synthesis and Assessment (Stage 2 Review), there are some inconsistencies between the Croatian air pollutant inventory submissions under the UNECE CLRTAP, the EU NECD and the UNFCCC. For NH₃ the differences vary between 8.6 to 12.2% in 1990-2012, and for NO_x between 0.2-0.4% in 2008-2012. Between the inventories under the CLRTAP and UNFCCC the differences for NO_x varied between 1.6 and 11.1% in 1990-2012, for NMVOC between 0.1-4.7%, for CO 0.1-1% and for SO_x 0.1-0.6%. Between the NECD and the UNFCCC submissions, the differences in 1990-2012 were: for NO_x 1.6-11.1%, for NMVOC 0.1-5% and for SO_x 0.1-0.6%. In the IIR there are no explanations for these inconsistencies. Croatia indicated that the differences resulted from not resubmitting the corrected inventories under the NECD and that the comparison had not been carried out with the final data submitted under the UNFCCC. The ERT encourages Croatia to resubmit revised data to avoid differences in the official submissions and recommends that Croatia includes the justifications for the differences in the IIR.

Accuracy and uncertainties

24. At the moment the Croatian inventory is mainly calculated at Tier 1 level using methods from the EMEP/EEA Emission Inventory Guidebook 2009 or from other international sources. Tier 2 methods have been used for some of the Energy, Industrial Processes and Solvent Use activities, where bottom-up data from the Croatian Environmental Pollution Register (EPR) were available to derive country-specific methods as included in the inventory. The ERT commends Croatia for the

work carried out to improve the accuracy of the inventory, and recommends that Croatia further improves the accuracy of the methods used to better reflect the national circumstances.

25. Croatia uses Tier 1 methods for several key categories, for example in the Energy, Transport, Solvent and other product use and in the Agriculture sectors. The use of Tier 1 methods for key categories is not in line with the Reporting Guidelines. With Tier 1 methods, it is not possible to reflect changes in the actual emission trends in the inventory which are due to developments of legislation and abatement techniques, or possible exceptional situations that may increase emission levels. Therefore, there is risk of either over- or under-estimating emissions. The ERT therefore recommends that Croatia moves on to higher tier methods in the inventory for all key categories.

26. The ERT identified a possible over-estimation of emissions in the Transport sector and recommends that Croatia checks and corrects the data as described in the sector recommendations.

27. The ERT notes with pleasure that Croatia has performed a first uncertainty analysis under the CLRTAP for the submission in 2014. The UC analysis is performed at Tier 1 level using the methodology presented in the EMEP/EEA Emission Inventory Guidebook 2009. The ERT noted that uncertainties were considered only at the aggregated level of NFR sectors. To the questions raised by the ERT, Croatia replied that national circumstances or uncertainties in bottom-up data were not reflected in the uncertainty values used in the assessment. The ERT recommends that Croatia moves on to a Tier 2 uncertainty assessment and includes these factors in the uncertainty assessment to ensure that all NFR categories are considered in the uncertainty analysis and that it uses the results of the analysis to prioritise improvements in the inventory. The ERT also recommends that Croatia corrects the error which was found in the PM10 uncertainty estimates during the review.

Croatia includes information about source category-specific, planned improvements under the NFR sector-specific chapters of the IIR. The ERT commends Croatia for providing this clear information in the IIR.

Verification and quality assurance/quality control approaches

28. Croatia has provided information in the IIR on the elements of the QA/QC procedures carried out in the inventory. The ERT notes that Croatia has improved its QA/QC checks to ensure data integrity, correctness and completeness in some sectors of the inventory. The ERT commends Croatia for the work already carried out, and recommends that Croatia further completes its documentation of its source-specific QA/QC activities in the relevant sector chapters of the IIR.

29. The ERT notes that bottom-up data is used in the Industry and Energy sectors of the inventory and that from the IIR it is not clear how the quality of the data is checked. To the question raised by the ERT on this, issue Croatia replied that the bottom-up data had been taken from the Croatian Environmental Pollution Register

(EPR) and that the competent authorities, in cooperation with the competent inspectorate, were responsible for the quality of the data submitted by the operators. During inventory preparation, the CEA checks dips or peaks in trends of fuel consumption or in productivity in cooperation with the individual plant. In addition, fuel consumption in public electricity and heat production are also compared against fuel sold in the National Energy Balance. The ERT commends Croatia for the work already carried out and recommends that Croatia implements sector-specific QA/QC procedures especially in the Industrial Processes sector. The ERT also recommends that Croatia completes the descriptions on general and source-specific QA/QC procedures in the IIR with information provided to the ERT during the review.

30. During the review, the ERT noted some errors in the emission data as described below in the sector findings. The ERT recommends that Croatia corrects these errors and carries out additional quality checks for the data reported by the plants before including it in the inventory (e.g. comparisons with statistical data or data from industry associations), and that it documents source-specific QA/QC activities in the relevant sector chapters of the IIR.

31. The ERT notes that Croatia includes in the IIR information on verification procedures carried out for AD in some source sectors. The IIR does not indicate whether a final approval of the inventory has taken place. In response to the ERT's questions about these issues, Croatia explained that the CEA carries out verification and peer reviews before the inventory is submitted and that the final approval of the inventory is carried out by the Ministry of the Environment and Nature Protection. The ERT recommends that Croatia includes more information on the verification and approval processes for the inventory in the IIR and that it ensures that peer reviews and a verification of the inventory are undertaken by external experts rather than CEA experts.

FOLLOW-UP TO PREVIOUS REVIEWS

32. The ERT notes that Croatia has carried out some of the recommended improvements since the last Stage 3 review in 2011:

- (a) implementation of an uncertainty analysis
- (b) improved QA/QC procedures
- (c) estimation of some of the missing emissions

33. The ERT notes that the following recommendations from the previous Stage 3 review still need to be implemented:

- (a) complete the estimation of not estimated (NE) sources;
- (b) further develop QA/QC procedures to identify gaps and errors in emission and activity data and in time-series consistency
- (c) systematically provide information on activity data in all sectors, emission factors with their units and the rationale for the choice of emissions and sources of data

AREAS FOR IMPROVEMENTS IDENTIFIED BY CROATIA

34. The IIR includes dedicated paragraphs for planned improvements for all sectors. The list in the IIR Chapter 10.2 Planned Improvements covers:

- a) Reporting of energy consumption from NFR 1.A.2 categories on a disaggregated level instead of reporting all the data combined under NFR 1.A.2.f.i
- b) Apply Tier 2 methodology for NFR 1.A.1.b
- c) Estimate missing pollutants from NFRs 1.A.1.a
- d) Recalculate emissions from NFR 2.A.2
- e) Improve calculation of NMVOC emissions from NFRs 3.B.1, 3.B.2
- f) Harmonise EFs for activities listed under NFRs 3.C and 3.D.2 according to the Guidebook
- g) Estimate missing NMVOC emissions from NFR 4.B and NMVOC, PM10 and PM2.5 emissions from NFR 4.D
- h) Improve the methodology for NH₃ emissions from NFR 4.B according to the Guidebook

PART B: RECOMMENDATIONS FOR IMPROVEMENTS TO THE PARTY

CROSS CUTTING IMPROVEMENTS IDENTIFIED BY THE ERT

35. The ERT has identified the following cross-cutting issues for improvement:
- (a) Assess the importance of sources reported as NE for Croatian emissions and estimate emissions where the emission levels are considered to be not negligible, and to document the reasons if they are reported as NE.
 - (b) Further improve the transparency of reporting by including more information on (1) activity data and the methodologies used to quantify emissions, (2) rationales for the choice of the methods and data sources, (3) country-specific circumstances affecting emission trends, and (4) recalculations.
 - (c) Further improve the transparency of reporting by reporting emissions separately under the relevant NFRs and improving the consistency of the use of notation keys in the NFRs and the IIR.
 - (d) Further improve the accuracy of reporting by checking and correcting the use of notation keys and errors in calculations, estimating missing emissions in the Energy, Transport, Industrial Processes, Agriculture and the Waste sectors; reviewing the methodology used for key categories to correspond to the Tier 2 methodology and to those presented in the latest version of the Guidebook (2013) in the Energy, Transport, Solvent and other product use and the Agriculture sectors.
 - (e) Implement a Tier 2 uncertainty analysis and use the results to prioritise improvements in the inventory.
 - (f) Further develop source-specific QA/QC activities to capture errors and document these in the IIR.
 - (g) Provide explanations in the IIR for any differences between data reported under the UNECE CLRTAP; EU NECD and UNFCCC.
 - (h) Include more information on the verification and approval processes of the inventory in the IIR and ensure that peer reviews and verification of the inventory are undertaken by external experts.

SECTOR SPECIFIC RECOMMENDATIONS FOR IMPROVEMENTS IDENTIFIED BY ERT

ENERGY

Review Scope

Pollutants Reviewed		SO ₂ , NO _x , NMVOC, NH ₃ , TSP, PM ₁₀ & PM _{2.5} , CO, heavy metals		
Years		1990 – 2012		
NFR Code	CRF_NFR Name	Reviewed	Not Reviewed	Recommendation Provided
1.A.1.a	Public electricity and heat production	X		
1.A.1.b	Petroleum refining	X		X
1.A.1.c	Manufacture of solid fuels and other energy industries	X		
1.A.2.a	Iron and steel	X IE 1.A.2.f.i		
1.A.2.b	Non-ferrous metals	X IE 1.A.2.f.i		
1.A.2.c	Chemicals	X IE 1.A.2.f.i		
1.A.2.d	Pulp, paper and print	X IE 1.A.2.f.i		
1.A.2.e	Food processing, beverages and tobacco	X IE 1.A.2.f.i		
1.A.2.f.i	Stationary Combustion in Manufacturing Industries and Construction: Other (Please specify in your IIR)	X		X
1 A 3 e	Pipeline compressors	X IE 1.A.1.c		
1.A.4.a.i	Commercial / institutional: stationary	X		
1.A.4.b.i	Residential plants	X		X
1.A.4.c.i	Agriculture/forestry/fishing. stationary	X		
1.A.5.a	Other, stationary (including military)	X IE 1.A.4.a.i		
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 NO		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		
1 B 2 c	Venting and flaring	X		
1 B 3	Other fugitive emissions from geothermal energy production, peat and other energy extraction not included in 1 B 2	X NO		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

36. The ERT commends Croatia for the descriptions provided in the IIR on activity data and on the methods used, and for the clear description of the use of notation keys in the IIR. The annexes to the IIR provide a clear picture of the applied EFs and the national energy balance. However, the ERT recommends some further improvements to further increase the transparency of the Energy sector inventory.

37. Emissions from all sub-sectors under NFR 1.A.2 are reported under the NFR code 1.A.2.f.i: Stationary combustion in manufacturing industries and construction: Other. Since data on energy consumption in Croatia are available at a disaggregated level, the ERT recommends that Croatia improves the transparency of the inventory by reporting all sub-sectors under the relevant NFR codes.

Completeness

38. The ERT considers the Energy sector inventory to be almost complete in terms of the sectors, pollutants and years that are covered.

39. The ERT notes that the notation key "NE" (Not Estimated) for HCBs, HCHs and PCBs has been replaced either by emissions or by the notation key NA. The ERT commends Croatia for following up on previous review recommendations. However, the ERT encourages Croatia to complete the NFR table with the missing estimates, especially in the NFR 1.B sectors for Fugitive emissions, using EFs from the EMEP/EEA Guidebook.

Consistency, including recalculation and time series:

40. Croatia has recalculated its inventory in some of the Energy sectors for different years (between 1990 and 2011). The ERT commends Croatia for the information on these recalculations provided in the IIR and for the effort to complete the inventory with new sectors. Recalculations have significantly increased time-series consistency. The ERT encourages Croatia to maintain the level of consistency and to further improve it where needed.

Comparability

41. The ERT notes that the inventory of Croatia is comparable with those of other reporting parties. The allocation of source categories follows that of the EMEP/UNECE Reporting Guidelines. Sufficient AD is collected to support the calculations. The ERT encourages Croatia to continue providing comparable inventory data.

Accuracy

42. The ERT commends Croatia for its thorough, high quality work. Croatia describes general and specific QA/QC procedures in its IIR. The ERT notes that Croatia has improved on QA/QC checks to ensure data integrity, correctness and completeness and to identify errors and omissions. No systematic over- or under-estimates were identified during the review. The ERT encourages Croatia to further improve its QA/QC procedures for the Energy sector.

43. Croatia uses Tier 1 methods for some of the key categories in the energy sector as indicated below. The ERT recommends that Croatia moves on to Tier 2 methodology for all key categories.

Improvement

44. The ERT notes that Croatia has described improvements made since the previous submissions and improvements planned for the future submission. The ERT commends Croatia for the improvements carried out in the Energy sector, and encourages Croatia to further plan and implement the new improvements.

45. The ERT takes note of Croatia's intention to improve comparability between the NFR and CRF sectors 1.A.1.b Refinery, and recommends that Croatia expands these improvements so that they include the key categories of the NFRs 1.A.1.b, 1.A.2.f.i, 1A4bi and 1.B.2.a.v.

The ERT notes that Croatia has followed up on previous review recommendations and improved the energy consumption split between fuel categories (fuels have not always been reported in the proper category). The ERT also notes that Croatia has improved the inventory so that it always includes PM2.5 emissions whenever PM10 and TSP emissions are reported. The ERT commends Croatia on both improvements.

Sub-sector Specific Recommendations

Category issue 1: 1.A.1.b, 1.A.2.f.i, 1.A.4.b.i, 1.B.2.a.v - Methodology

46. The ERT notes that Croatia shows in the IIR Table 1.5-1 an overview of key categories per pollutant. In paragraph 1.4.2 on page 45, Croatia indicates that Tier 2 methods were used for some key categories, but that Tier 1 methods were used for the key categories of the NFRs 1.A.1.b, 1.A.2.f.i, 1.A.4.b.i and 1.B.2.a.v. On page 31 (Table ES6-1) Croatia indicates that for NFR 1.A.1.b, Tier 2 methodology will be used in the future. To the question raised by the ERT (if Croatia was planning to upgrade the methodology for the above mentioned key categories to Tier 2 as well), Croatia replied that they did not have the detailed information needed for the Tier 2 methodology but was aware of the need to apply Tier 2 methods for all key categories. The ERT recommends that Croatia includes this improvement in their overview of future improvements.

Category issue 2: 1.B.1.c, 1.A.3 –Notation keys

47. The ERT notes that Croatia uses "NA" for most pollutants and activity data in NFRs 1.B.1.c and 1.B.3.e. However, in the IIR Croatia states in Table 1.8.3-1 that these sectors do not occur (notation key "NO"). The ERT recommends that Croatia checks and corrects the use of notation keys in the NFR.

TRANSPORT

Review Scope

Pollutants Reviewed		SO ₂ , NO _x , NMVOC, NH ₃ , PM ₁₀ & PM _{2.5}		
Years		1990 – 2006 + (Protocol Years)		
NFR Code	CRF_NFR Name	Reviewed	Not Reviewed	Recommendation Provided
1.A.2.f. ii	Mobile Combustion in Manufacturing Industries and Construction: Other	x		x
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		
1.A.3.b.ii	road transport, light duty vehicles	x		
1.A.3.b.iii	road transport, heavy duty vehicles	x		
1.A.3.b.iv	road transport, mopeds & motorcycles	x		
1.A.3.b.v	road transport, gasoline evaporation	x		
1.A.3.b.vi	road transport, automobile tyre and brake wear	x		
1.A.3.b.vii	road transport, automobile road abrasion	x		
1.A.3.c	railways	x		x
1.A.3.d.i (ii)	international inland navigation		x	
1.A.3.d.ii	national navigation	x		x
1.A.4.a ii	commercial / institutional: Mobile		x	
1.A.4.b.ii	household and gardening (mobile)	x		x
1.A.4.c.ii	agriculture/forestry: off-road vehicles and other machinery	x		x
1.A.4.c.iii	national fishing	x		
1.A.5.b	other, mobile (including military, land based and recreational boats)		x	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:

48. In its IIR, Croatia provides information on the methods used, including the origin of the activity data and the emission factors. As information on AD and EFs is provided separately in the IIR and not presented in NFRs but on a more aggregated level, the information is not always useful when performing a review of a certain NFR category. Also, the level of detail of the information provided on the specific NFR categories varies in the Transport sector. The ERT encourages Croatia to document the methods used at a more detailed level to further improve the transparency of the inventory.

49. The use of notation keys is properly explained in the “Additional info” table of the NFR as well as in the IIR. The ERT commends Croatia for providing this

information. However, the ERT notes that this information is not always consistent and recommends that Croatia further harmonises the explanatory information presented in the NFR Additional Info sheet and in the IIR, especially regarding the use of notation keys.

50. Croatia reports several sources as included elsewhere ("IE") in the Transport sector. To the question raised by the ERT, Croatia replied that there were problems with the availability of sector-specific activity data. Croatia provides information on where the emissions are included both in the IIR and in the Additional info sheet of the NFR table. The ERT recommends that Croatia tries to collect related activity data and checks the use of notation keys.

Completeness:

51. Croatia uses the notation key "NA" for many sources in the Transport sector. The ERT notes that "NA" is in many cases used for pollutants which are likely to occur from fuel combustion in mobile sources (especially heavy metals, PCDD/F and PAHs). However, the notation key "NE" should be used instead (see Sub-sector Specific Recommendations). Hence, the ERT does not consider the inventory to be complete for these pollutants.

Consistency including recalculation and time series:

52. The ERT considers the methods used for the calculation of Transport sector emissions to be consistent with the EMEP/EEA Guidebook.

Comparability:

53. The ERT found the inventory of Croatia to be comparable with those of other reporting parties. Transport sector emissions are calculated on basis of fuels sold.

Accuracy and uncertainties:

54. The ERT notes that Tier 1 methods have been applied to several key categories in the Transport sector (see Sector-specific Recommendations below). As this issue was already raised by the previous ERT, the ERT reiterates its recommendation for Croatia, namely that more effort should be put into improving the accuracy of its emission estimates.

55. The ERT also identified an overestimation of aviation emissions.

Improvement:

56. The ERT commends Croatia for the improvements carried out in the Transport sector inventory since the last review. However, the ERT notes that several of the improvements identified during the last review have, as yet, not been implemented: for instance, Tier 2 methodology for all key categories, and reporting separate emissions data for the cruise phase of both domestic and international aviation.

57. The ERT notes that the IIR lists only one improvement that is planned in the Transport sector for the submission in 2015, namely the improvement of some heavy metal emission estimates. Based on findings from the current review, the ERT recommends that Croatia considers focusing on (i) the application of higher tier

methods for key categories and (ii) the estimation of heavy metal, PCDD/F and PAH emissions (where estimates are currently missing).

Sub-sector Specific Recommendations

Category issue 1: 1.A.2.f ii – Tier 1 applied to key category for NO_x emissions

58. NFR 1.A.2.f ii is a key category for NO_x emissions in Croatia. However, Croatia applies a Tier 1 method for this source, which is not in line with the Reporting Guidelines. To improve the accuracy of the emission estimates, the ERT recommends that Croatia implements a Tier 2 approach to estimate these emissions in the next submission.

Category issue 2: 1.A.2.f ii - NO_x and CO, 1990

59. The ERT notes that the values reported for 1990 are rather high for NO_x (6,898 kt in 1990 vs. 3,594 kt in 1991) and low for CO (2,492 kt in 1990 vs. 13,515 kt in 1991). To a question about these contradictory trends Croatia replied that they could be explained by both an extreme increase in gasoline consumption (8,918 GJ in 1990 vs. 370,097 GJ in 1991) and an even stronger decrease in diesel consumption (1990: 5,855,541 GJ; 1991: 2,998,242 GJ). As the EF for CO is higher for gasoline (33.5 kg/GJ) and lower for diesel oil (0.37 kg/GJ), this has resulted in an extreme increase of CO emissions. As, in contrast, the EF for NO_x for gasoline (0.17 kg/GJ) is much lower than the EF for diesel oil (1.2 kg/GJ), the overall NO_x emissions show a strong decrease from 1990 to 1991. The ERT thanks Croatia for the explanatory information and the data provided, nonetheless asking for more information to enable the review teams to understand the discrepancy between the jump in gasoline consumption (+ 4,000 %) and the decrease in diesel oil consumption (- 50%). The ERT also recommends that Croatia includes information on these national circumstances in the future IIRs.

Category issue 3: 1.A.3.a - Overestimation of National Totals

60. During the review, the ERT noted that emissions from the cruise phase in aviation (Memo Item NFRs 1.A.3.a ii (ii) and 1.A.3.a i (ii)) are reported as included in the corresponding values provided for the LTO stages (NFRs 1.A.3.a ii (i) and 1.A.3.a i (i),) resulting in an overestimation of the national total emissions. As this issue had already been raised by the previous review team and Croatia had explained that they were planning to improve the inventory in this respect, and as some AD (to enable a calculation of the trend from 1990 onwards) is still missing, the ERT recommends that Croatia provides background information in the IIR on possible problems that might hinder a solution to this issue.

61. During the review, Croatia informed the ERT that for the submission 2015 or 2016, emissions from the LTO and cruise phases would be disaggregated according to the Tier 1 methodology proposed in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy, Chapter 3.6., proposing that according to these Guidelines, 10% of the emissions from kerosene combustion (except NMVOC and CO) are emitted during the LTO cycle. Regarding the avgas emissions, Croatia furthermore stated that emissions would be allocated entirely to the LTO cycle. The ERT acknowledges the explanation provided and welcomes the Party's plan to implement the approach described above in order to disaggregate

emissions from the LTO and cruise phases. Nonetheless, the ERT states that the Tier 1 methodology provided in the 2006 IPCC Guidelines includes the assumption that 10 percent of the fuel is used during the LTO phase of the flight. In order to follow the IPCC Tier 1 approach, emissions during the LTO cycle should be estimated by allocating 10 per cent of the overall kerosene consumption to the LTO cycle and by using the LTO emission factors provided in the 2013 EMEP/EEA Guidebook. The ERT has found that, as NFR 1.A.3.a is not a key category within the Croatian inventory, the implementation of the Tier 1 method can be considered reasonable, and encourages the Party to further investigate this issue in order to find a fuel derivation that better represents the national circumstances. The ERT further recommends that Croatia checks the use of data provided by Eurocontrol (European Organisation for the Safety of Air Navigation) via the EEA (European Environment Agency). According to Croatia, there is a project under way ("Development of a methodology for assessing the data and estimation of uncertainty of data on emissions from transport with integrated assessment of the environmental impact of the sector - phase 1 Activity data for aviation and rail transport".) to obtain all necessary data to improve the methodology for calculating GHG emissions and that the outcomes of this project might be used for improving the methodology applied for CLRTAP reporting, too. The ERT welcomes this development.

Category issue 4: 1.A.3.a ii (i) - NH₃ reported as not applicable in 1990 and 1996

62. The ERT notes that Croatia has provided NH₃ emission data for 1991 to 2012, but that for 1990 emissions are reported as not applicable ("NA"). To the question raised by the ERT about this issue, Croatia replied that NH₃ emissions had been calculated for aviation gasoline but not for jet kerosene. So, as no avgas was used in 1990 and 1996, the notation key "NA" has been used. The ERT thanks Croatia for the explanatory information, nonetheless recommending that Croatia uses the notation key "NE" instead, as long as no proper emission factor is available for jet kerosene, and also stating the fact that only little information is available on NH₃ emissions from several mobile sources.

Category issue 5: 1.A.3.a ii (i), 1.A.3.a i (i) - potential emissions reported as "NA"

63. The ERT further notes that PM_{2.5} and PM₁₀ emissions from NFRs 1.A.3.a ii (i) and 1.A.3.a i (i) are reported as "NA" whereas emission values are provided for TSP. To the question raised by the ERT Croatia replied that it had been assumed that all PM emissions from NFR 1.A.3.a were supposed to be larger than 10µm (PM₁₀). The ERT thanks Croatia for the information provided, nonetheless asking the Party to further check the use of the notation key "NA" and recommending that Croatia makes a comparison with inventories from other countries and uses the notation key "NE" instead, as long as no other data is available. Furthermore, the ERT warmly encourages the Party to check with the relevant chapter of the 2013 EMEP Guidebook, where Tier 1 EFs for PM_{2.5} are provided for jet kerosene, as well as information related to aviation gasoline.

Category issue 6: 1.A.2.f ii, 1.A.3.a, (1.A.3.c) 1.A.4.b ii, 1.A.4.c ii - potential Pb, Hg and As emissions reported as "NA"

64. The ERT notes that, in contrast to several other mobile sources where Pb, Hg and As emissions are reported, the notation key "NA" is used for these sectors. As fuels and engines are supposed to be rather similar to comparable sectors (i.e.

1.A.3.b), the ERT recommends that Croatia includes a rationale in the IIR for using this notation key here.

65. To the question raised by the ERT about this issue Croatia responded that the use of the notation key "NA" depended on fuel consumed within a specific sector and that the Guidebook does not provide EFs for all types of fuels (gasoline: no EF for As and Hg, kerosene: no EF, diesel/gas oil: no EF for Hg). The Party furthermore stated that for NFR 1.A.3.b (in the COPERT 4 model) only Pb emissions had been calculated while the notation key "NE" had been used for As and Hg. Regarding solid fuels used in NFR 1.A.3.c, Croatia has estimated Pb, As and Hg emissions for 1990 and 1991. The ERT thanks Croatia for the information provided and notes that the Guidebook does not provide emission factors for all heavy metals (depending on the type of fuel) and that, with respect to the avgas used in NFR 1.A.3.a and the diesel oil used in NFR 1.A.3.c, the 2013 Guidebook provides the information that EFs for Pb, Hg, and As have not been estimated. The ERT recommends that the Party further studies this issue and replaces, for sectors where emissions occur and no emissions have been estimated, the notation key "NA" by "NE". The ERT considers that as long as no methodological guidance is available to inventory compilers, the use of the notation key "NE" is appropriate for heavy metal emissions from NFRs 1.A.2.f ii and 1.A.4.c ii.

Category issue 7: 1.A.3.c - Pb, Hg and As

66. The ERT notes that the notation key "NA" is used in a rather non-transparent way over the time series as for some years, emission data are provided whereas for other years the notation key "NA" is used. From the replies provided by Croatia regarding the issue, the ERT understands that in 1990 and 1991 the use of solid fuels resulted in heavy metal emissions. For 1995 "NA" is provided in the case of Hg, as well as for Hg and As in 2000 and for all three priority heavy metals in 2011, when no solid fuels were used any more. According to the reply from Croatia, the use of the notation key "NA" depends on the fuels consumed in a specific year, and Pb, As and Hg emissions are not applicable for diesel (1990-2012), kerosene (1990-1996) and fuel oil (1990-1995) as the Guidebook does not provide EFs, and for gas oil (1990-1997) Hg emissions are not applicable for the same reason. The ERT notes that for diesel oil the 2013 Guidebook provides the information that EFs for Pb, Hg, and As have not been estimated. The ERT recommends that Croatia uses the notation key "NE" for the entire time series (as diesel oil has been used since 1990) as long as no other data is available.

Category issue 8: 1.A.2.f ii, 1.A.3.a, 1.A.3.c, 1.A.3.d ii, 1.A.4.b ii, 1.A.4.c ii - PCDD/F, B (k)F, I (1,2,3-cd)P

67. Croatia has reported emissions of PCDD/F, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene as "NA". As these pollutants are likely to occur from all mobile combustion sources, the ERT recommends that Croatia uses the notation key "NE" in case no emissions have been estimated and documents the reason for not estimating emissions in the IIRs.

Category issue 9: 1.A.3.a i (i) - PAH emissions reported as “NA”

68. The ERT notes that in contrast to NFR 1.A.3.a ii (i) the notation key “NA” is provided for the international aviation sub-sector. The ERT recommends that Croatia uses the notation key “NE” as methodologies exist to estimate these emissions.

Category issue 10: 1.A.3.d ii, 1.A.3.d i (i) - potential POP emissions reported as “NA”

69. Croatia has reported POP emissions from these sources as “NA”. As POP emissions are likely to occur from these sources, the ERT recommends that Croatia uses the notation key “NE” and documents the reasons for not estimating these emissions in the IIR.

Category issue 11: 1.A.3.e – Transparency: information on the use of Notation key 'IE'

70. Croatia reports emissions from this sector as aggregated into NFR 1.A.1.c and explains that the estimate is based on the total amount of exhausted fuel for coal mining, gas and oil extraction and pipeline compressors. The ERT recommends that Croatia provides a better justification for this aggregation in the IIR, and investigates whether natural gas consumption data is not available separately (so that emissions can be reported under NFR 1.A.3).

Category issue 12: 1.A.4.c ii - Tier1 applied to PM2.5 key category

71. According to the KCA undertaken by the CEIP, NFR 1.A.4.c ii is a key category for PM2.5 emissions. According to information provided in the IIR, the Party estimates emissions using a Tier 1 method. As this estimation of emissions from key categories is not in line with the Reporting Guidelines, and to improve the accuracy of the inventory, the ERT recommends that Croatia estimates the emissions using a Tier 2 approach in the next submission.

Category issue 13: Completeness - 1.A.5.b - Emissions reported as confidential (“C”)

72. Croatia reports emissions from military vehicles as confidential (“C”). The ERT finds that this is justified. However, the ERT recommends that Croatia further documents the reasons for reporting these emissions as confidential in the IIR and that it makes sure that the confidentiality of military emissions does not result in an underestimation of the national emissions. The ERT also recommends that Croatia documents in the IIR the allocation of emissions from military vehicles to NFR 1.A.3.b and of other mobile military combustion to NFR 1.A.4.a i.

Category issue 14: 1.A.5.b - Transparency: emissions covered by NFR 1.A.5.b

73. Emissions from this source category are reported as confidential (“C”) and include, according to the IIR and the Additional Info sheet of the NFR table, military vehicles inter alia. However, the information on what other sources are included under this NFR sector is contradictory between the NFR table and the IIR. The ERT recommends that Croatia harmonises the information provided in the 'Additional info' table and in the IIR.

Category issue 15: 1.A.3.d i (i) – 2012 emissions reported as “NO”

74. Croatia reports emissions in 2012 from this source as not occurring (“NO”) while emissions for the years 1990-2011 are reported. The ERT recommends that Croatia estimates and reports the missing emissions for 2012.

INDUSTRIAL PROCESSES

Review Scope

Pollutants Reviewed		NO _x , SO _x , NH ₃ , CO, NMVOC, TSP, PM ₁₀ , PM _{2.5} , Pb, Cd, Hg, PCDD/F, PAH-4, HCH, HCB and PCB		
Years		1990 – 2012 + (Protocol Years)		
NFR Code	CRF_NFR Name	Reviewed	Not Reviewed	Recommendation Provided
2.A.1	cement production	x		
2.A.2	lime production	x		
2.A.3	limestone and dolomite use		NO	
2.A.4	soda ash production and use		NO	
2.A.5	asphalt roofing	x		
2.A.6	road paving with asphalt	x		
2.A.7.a	Quarrying and mining of minerals other than coal	x		
2.A.7.b	Construction and demolition	x		
2.A.7.c	Storage, handling and transport of mineral products		NA	
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		NO	
2.B.4	carbide production		NO	
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)		NA	
2.C.1	iron and steel production	x		
2.C.2	ferroalloys production		NO	
2.C.3	aluminium production		NO	
2.C.5.a	Copper Production		NO	
2.C.5.b	Lead Production		NO	
2.C.5.c	Nickel Production		NO	
2.C.5.d	Zinc Production		NO	
2.C.5.e	Other metal production (Please specify the sources included/excluded in the notes column to the right)		NO	
2.C.5.f	Storage, handling and transport of metal products (Please specify the sources included/excluded in the notes column to the right)		NA	
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			
2.F	consumption of HM and POPs (e.g. electrical)	x		

	and scientific equipment)			
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)		NO	
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:

75. The ERT considers the Industrial Processes inventory to be sufficiently detailed and generally transparent.

76. However, Croatia reports activity data for several sources as “NO” while emissions are reported as “NA”. The ERT repeats the recommendation of the previous ERT, namely that Croatia uses the notation key “NA” consistently in all cells (pollutant and activity data cells) where the source exists but relevant emissions are reported as not occurring and “NO” for both pollutants and activity data where sources do not occur.

77. The ERT notes that Tier 2 emission factors are used for the majority of the key categories in the Industrial Processes sector. According to the IIR, emission factors used in the calculations are either default factors from the Guidebook or country/plant specific emission factors. The country-specific emission factors are based on emissions reported by the plants to the Croatian EPR² database.

Completeness:

78. The ERT considers the Industrial Processes sector to be almost complete and comprehensive regarding sectors, pollutants and years. The ERT notes that only the emissions of PCBs from iron and steel production (NFR 2.C.1) for 2000 are missing. The ERT commends Croatia for providing a complete inventory.

79. The ERT notes that no “NEs” have been used for the Industrial Processes sector. The ERT commends Croatia on its good and detailed work.

Consistency including recalculation and time series:

80. Croatia has recalculated its inventory for some specific sectors (NRFs 2.B.5.a, 2.D.2 and 2.F) due to changes in activity data, and has included explanations for these in the IIR. However, the ERT notes that the time series are not consistent for various sectors (NFRs 2.A.1, 2.A.2, 2.A.5, 2.B.1, 2.B.2 and pollutants (TSP, PM_{2.5}, PM₁₀, CO, NO_x) and recommends that Croatia reports consistent time series in the next submission.

81. The IIR does not provide information on the fluctuations of emissions in the Industrial Processes sector. However, during the review Croatia provided more explanations on the sharp increases/decreases for some sectors. The ERT thanks

Croatia for this information and repeats the recommendation made by the previous ERT, namely that explanations should be included for the sharp increases, decreases or other changes in the time series.

Comparability:

82. The ERT notes that Croatia has reported emissions from the Industrial Processes sector in accordance with the Reporting Guidelines and that the inventory is comparable with those of other reporting parties.

Accuracy and uncertainties:

83. Croatia has performed Industrial Processes sector-specific QC activities which are documented in the IIR, but has not yet implemented QA procedures in the inventory. The ERT encourages Croatia to implement sector-specific QA procedures.

84. Croatia includes the Industrial Processes sector in the uncertainty analysis. The ERT commends Croatia for performing a sector-specific uncertainty analysis.

Improvement:

85. According to the IIR, Croatia plans improvements in NFR 2.A.2 in order to include quantities of lime produced in sugar factories, if activity data become available.

86. In response to questions raised by the ERT, Croatia indicated that it would improve emission estimates for various other sectors and pollutants, including the consistency of emission trends and the split of emissions between combustion and non-combustion in the cement sector in its next submission, as indicated below.

Sub-sector Specific Recommendations.

Category issue 1: 2.A.1 Cement production:- PM10, PM2.5 and TSP

87. During the review, the ERT asked Croatia to provide an explanation for the sharp decline in the IEF for PM_{2.5}, PM₁₀ and TSP since 2007 in this category. In its response, Croatia indicated that from 2007 onwards, they had used emission data from the Croatian Environmental Pollution Register (EPR) database for each of the point sources. From 1990 to 2006 default emission factors from the EMEP/EEA Guidebook 2009 had been used with no inclusion of abatement technologies and that this was the reason for the sharp decline in the IEF for PM_{2.5}, PM₁₀ and TSP emissions. Croatia indicated that they were aware of this problem, and informed the ERT that regarding this issue, a project was planned for this autumn to focus on the improvement of emission factors for this sector, to improve the split of emissions into combustion and non-combustion and to include the impact of abatement technologies in specific years for each of the point sources. Croatia also informed the ERT that this project would be done in direct communication with all cement industry sources in Croatia. The ERT commends Croatia on this planned improvement and recommends that Croatia reports on the status and the results of this project, and that it also includes the revised estimates, if already available, in its next submission.

Category issue 2: 2.B.5a Other chemical industry – NO_x, SO_x, NH₃, CO, TSP, other

88. Part of these activities no longer occur in Croatia. However, the ERT recommends that Croatia includes the emission factors used in the estimation of emissions for the years for which emissions have been reported from these sources in the IIR in its next submission.

89. During the review Croatia provided the ERT with emission factors developed on the basis of emissions reported by the plants from the Croatian EPR for the following chemical industry production processes: sulphuric acid (EF for SO_x), NPK fertilisers (EFs for NO_x, NH₃, TSP), urea (EF for NH₃) and carbon black (EF for CO). Croatia includes emissions reported by the plants since 1998 in the inventory and emissions before 1998 are calculated based on default emission factors from the Guidebook. The ERT notes that the EFs based on the emissions reported by the plants since 1998 can vary strongly and thus create an inconsistent time series. The ERT recommends that Croatia further investigates the quality of the emission data of the EPR, to look for possible explanations for strong variations and to investigate how the time series could be made more consistent. The ERT recommends that Croatia reports on these actions in its next submission.

Category issue 3: 2.A.1 Cement production - CO

90. To the question raised by the ERT about the increase of the IEF for CO since 2010 Croatia answered that after 2007 (with the exception of 2009), emissions reported by one plant to the EPR have been used in the inventory instead of calculated emissions. For the period 1990-2006 and 2009 emissions from this plant have been calculated using the national EF of 600 g CO/t clinker, which is still used for other cement plants. Croatia is aware of this emission trend inconsistency and is trying to solve this problem, referring (in its reply) to an ongoing project in the cement sector (see paragraph 92 above). The ERT commends Croatia on the planned improvement and recommends that Croatia reports about the status and the results of this project, and includes revised estimates, if available, in its next submission.

Category issue 4: 2.A.1 Cement production - NO_x

91. Croatia has not reported emissions of NO_x from cement production before 2005. In the previous IIR 2013 Croatia explained that for the period 1990-2004 data to calculate disaggregated emissions were not available; hence NO_x emissions from cement production (fuel combustion NO_x emissions and process NO_x emissions) were calculated and reported as aggregates under NFR1.A.2.f.i., although this leads to an inconsistent time series. To a question of the ERT, Croatia answered that it was not that simple to split NO_x emissions across the combustion and Industrial Processes sector and that all emissions from cement production were included although the allocation was not the same for the whole period of time. Croatia hopes that this problem will be solved with the realisation of the project planned for this autumn in the cement industry. The ERT also recommends that Croatia reports about the status and the results of this project, and if available, includes the revised estimates in its next submission.

Category issue 5: 2.A.2 Lime production - PM10, PM2.5 and TSP

92. During the review the ERT noted that Croatia had not reported emissions of TSP/PM10/PM2.5 from lime production (notation key "NA"). However, appropriate EFs exist in the EMEP/EEA Guidebook 2009. The ERT recommends that Croatia provides emissions for these pollutants in the next submission.

Category issue 6: 2.A.5 Asphalt roofing and 2.C.2 Ferroalloys production – PM₁₀, PM_{2.5}

93. During the review the ERT noted that emissions of TSP had been estimated but not emissions of PM_{2.5}, PM₁₀. Croatia answered that these emissions had not been estimated because the EMEP/EEA Guidebook 2009 did not provide default EFs for these pollutants. Since the new version of the Guidebook (2013) provides these EFs, Croatia has now informed the ERT that it will improve the inventory with estimations of these pollutants for the next submission. The ERT recommends that Croatia includes these emission estimates in its next submission and properly documents the methodology used.

Category issue 7: 2.A.6 Road paving with asphalt – activity data

94. During the review the ERT noted that the activity data for this sector for the years from 2003 onwards was significantly higher than for the previous years (1990-2002). To a question raised about this issue Croatia replied that the reason was an extensive construction of major roads since 2003. The ERT recommends that Croatia includes this explanation in its next submission.

Category issue 8: 2.A.7a. Quarrying and mining of minerals other than coal – activity data

95. During the review the ERT noted that the activity data for this sector showed an increasing trend for the period 2000-2008, then a dip and then a constant trend for 2010-2012. To a question raised about this issue Croatia replied that this trend was due to the economic growth in the period 2000-2008 followed by the economic crisis in 2008. The ERT recommends that Croatia includes this explanation in the IIR.

Category issue 9: 2.B.1 Ammonia production and 2.B.2 Nitric acid production - NO_x

96. During the review the ERT noted that the IEF for ammonia production showed a significant decrease from 2009 onwards and the IEF for nitric acid production from 2011 onwards. Croatia responded that this problem had to be clarified directly with the producer. The ERT encourages Croatia to do so and to provide the information in the IIR and, if available, also to report the revised estimates for these categories.

Category issue 10: 2.C.1. Iron and steel production – PCB

97. During the review the ERT noted that no PCB emissions had been reported for 2000 (notation key NA) while emissions had been estimated for all the other years. To a question raised about this issue Croatia informed the ERT that this was

an error. The ERT recommends that Croatia provides the emission estimate in its next submission.

SOLVENTS

Review Scope

Pollutants Reviewed		SO ₂ , NO _x , NMVOC, NH ₃ , PM ₁₀ & PM _{2.5}		
Years		1990 – 2006 + (Protocol Years)		
NFR Code	CRF_NFR Name	Reviewed	Not Reviewed	Recommendation Provided
3.A.1	Decorative coating application			x
3.A.2	Industrial coating application			
3.A.3	Other coating application (Please specify the sources included/excluded in the notes column to the right)			
3.B.1	Degreasing			x
3.B.2	Dry cleaning			
3.C	Chemical products			
3.D.1	Printing			x
3.D.2	Domestic solvent use including fungicides			
3.D.3	Other product use			

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:

98. The IIR is generally transparent and well organised for the Solvent sector although some additional improvements are recommended, as detailed below. The ERT recommends that Croatia provides information systematically - on activity data, emission factors with their units, rationales for the choice of the emission factors and the sources of data.

99. The previous ERT recommended that Croatia should provide explanations for sharp increases/decreases in the IIR. Some explanations for sharp increases/decreases in emission trends for various pollutants are already included in the IIR, although not all the necessary explanations are included. The ERT recommends that Croatia includes all the explanations in its next submission.

Completeness:

100. The ERT considers the Solvent sector to be almost complete. However, the previous ERT noted that some activities were missing and in the current submission some are still missing, such as:

- a) NFR 3.C: SNAP 060311 adhesive and magnetic tapes, films and photographs
- b) NFR 3.D.1: Printing activities - the emissions inventory is limited to rotogravure, heat set web offset and flexography. Other printing activities are missing such as screen printing and cold set web offset.

101. The ERT recommends that Croatia checks if these activities do or do not exist in the country. If yes, the ERT encourages Croatia to estimate their emissions using

the EMEP/EEA Guidebook. If no, the ERT encourages Croatia to mention this in the IIR.

Consistency including recalculation and time series:

102. In the IIR Croatia provides information on recalculations for NFRs 3.B, 3.C, 3.D.2 and 3.D.3 (SNAP 060407 and SNAP 060406). The ERT commends Croatia for this.

Comparability:

103. A considerable number of emission factors used in the Solvent sector inventory are derived from the EMEP/CORINAIR Guidebook version 1999 or older. The ERT recommends that Croatia updates the emission factors with the latest version of the Guidebook in order to improve the comparability of the inventory with those of other countries.

Accuracy and uncertainties:

104. According to the IIR, the uncertainty analysis covers only NFR 3.D for NMVOC emissions from the Solvent and other product use sector. The ERT recommends that Croatia includes all sources and pollutants from NFR 3 in the uncertainty analysis.

105. Croatia uses Tier 2 methods for some categories (NFRs 3.C and 3.D) but still uses a Tier 1 method for various categories. This implies that there is a risk to either overestimate or underestimate emissions. Moreover, the use of a Tier 1 method does not allow a follow-up of the evolution of emissions resulting from the implementation of regulations which are aimed at limiting emissions. The ERT encourages Croatia to further set up a step by step approach to improve the emission inventory.

Improvements:

106. The ERT commends Croatia on its improvements achieved in NFR 3.A for NMVOC emissions following the previous ERT's recommendation that methodologies should be developed to enable a distinction at least between the use of decorative paints for building and household applications (NFR 3.A.1) and the use of paints for industry and car repairing (NFR 3.A.2). Croatia developed a methodology based on the EVOC³ database and assumptions in order to make a distinction between the emissions from these categories. The ERT recommends that Croatia further analyses the data and looks for possible refinements of the methodology.

Sub-sector Specific Recommendations.

Category issue 1: 3.A. Decorative coating application – NMVOC

107. In the IIR Croatia states that EFs from the Guidebook 2009 are used for the whole time series. During the review the ERT found that the IEFs for 1990 and 1991 significantly differed from those used for 1992-2012: e.g. for NFR 3.A.1, 400 g/kg for 1990 and 1991; and 150 g/kg for the years from 1992 onwards. The ERT

³ The EVOC database at the Croatian Environment Agency covers the application of solvent use in industry for the years from 2007 onwards.

recommends that Croatia checks and corrects the EFs for all the categories under NFR 3.A.1 in its next submission.

Category issue 2: 3.B.1 Degreasing - NMVOC

108. In response to a question during the review about the refinement, of their method, Croatia informed the ERT that they had carried out a survey to investigate the possibility of implementing method improvements. Croatia reported that data on annual organic solvent usage since 2006 was available within the EVOC database. The EVOC database covers 15 activities with solvent usage. One of these activities is degreasing but that activity covers only solvent usage in metal degreasing without degreasing in other industries (like boat building) where solvent usage for surface cleaning prior to painting or cleaning of equipment is significant. The EVOC database is not stratified in the sense that it indicates for which activity the solvent is used, so when it comes to allocating emissions to specific categories there is a significant risk of double counting. Croatia states that further investigations need to be carried out in order to improve the calculations of emissions from degreasing. The ERT encourages Croatia to carry out these investigations, to report about the results and, if possible, to provide revised estimates in its next submission.

Category issue 3: 3.D.2 Domestic solvent use including fungicides - NMVOC

109. Croatia uses a Tier 1 method for this category although this is a key category. In response to a question from the ERT, Croatia stated that the available data was not sufficient for a Tier 2 method. The ERT recommends that Croatia considers the available data and method in its next submission and includes an explanation for the choice of method in the IIR.

Category issue 4: 3.D.3 Other product use – NMVOC

110. The activity data for various categories shows strongly varying trends, e.g. for SNAP 060406b (e.g. years 2009, 2010 and 2012), for SNAP 060406a (e.g. from 2003 onwards), for SNAP 060413 (1994) and for SNAP 060404 (several years). The ERT recommends that Croatia checks with the Statistics Bureau whether explanations for these variations could be found and if not, that outliers are removed and missing data interpolated.

AGRICULTURE

Review Scope:

Pollutants Reviewed		NO _x , NH ₃ , TSP, PM ₁₀ & PM _{2.5}		
Years		1990 – 2012		
NFR Code	CRF_NFR Name	Reviewed	Not Reviewed	Recommendation Provided
4 B 1 a	Cattle dairy	X		
4 B 1 b	Cattle non-dairy	X		
4 B 2	Buffalo	X		
4 B 3	Sheep	X		
4 B 4	Goats	X		
4 B 6	Horses	X		
4 B 7	Mules and asses	X		
4 B 8	Swine	X		
4 B 9 a	Laying hens	X		
4 B 9 b	Broilers	X		
4 B 9 c	Turkeys	X		
4 B 9 d	Other poultry	X		
4 B 13	4 B 13 Other			
4 D 1 a	Synthetic N fertilisers	X		
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)		HCH	
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:

111. Croatia uses Tier 1 methods for the emission calculations for all agricultural sources and pollutants. Most of the relevant information is included in the IIR, but there is still room for improvement.

112. The ERT commends Croatia for considering the recommendation of the previous review, i.e. including an activity data table with livestock numbers grouped per individual livestock category. The ERT encourages Croatia to further improve transparency by providing a detailed description of the activity data trends and recommends that Croatia presents activity data on synthetic fertiliser application (on the level of the different fertilisers in use). Additional information on the derivation of average animal waste management systems (AWMS) should be provided in the IIR.

Completeness:

113. The Agriculture inventory of Croatia is partly complete. The inventory covers all relevant sources of the main pollutants NH₃ and NO_x. Buffalos (NFR 4.B.2) are not occurring in Croatia (notation key "NO"). Emissions from N excretion on pasture range and paddock unspecified (NFR 4.D.2.c) are included in NFR 4.B manure management ("IE"). PM emissions from Sheep (NFR 4.B.3), Goats (NFR 4.B.4), Farm-level agricultural operations (NFR 4.D.2.a) and Off-farm storage and handling (NFR 4.D.2.b) are reported as "NA". Emissions from NFR 4.D.1 field burning are reported as not occurring ("NO"). Emissions of CO, heavy metals and POPs are reported as "NA" for all sources except field burning ("NO").

114. The ERT found the use of notation keys to be accurate in most cases. However, instead of "NO" for PM emissions from Farm-level agricultural operations (NFR 4.D.2.a) and Off-farm storage and handling (NFR 4.D.2.b) the notation key "NE" (not estimated) would be adequate.

Consistency including recalculation and time series:

115. Croatia revised the proportions of livestock manure handled in liquid or solid animal waste management systems (AWMS). The new proportions are based on the results of an international study (Menzi et al. 2003). Methodological revisions of the correction factors and AWMS led to increased NH₃ emissions from NFR 4.B by an average value of 18% and an increase in total NH₃ emissions by 11% on average. The ERT recommends that Croatia provides additional information on the derivation of its AWMS data, and a justification on the applicability of international study results for Croatia in its IIR of the next submission. The ERT also recommends that Croatia implements new country-specific AWMS data from its ongoing national research project as soon as possible.

116. In its submission 2014 Croatia corrected the activity data in sub-sector NFR 4.D.1.a - Synthetic N fertilisers - for the time period 2006-2011 for NPK fertilisers and in NFR 4.B.9.d Other poultry the numbers for 2011. The ERT commends Croatia for these improvements.

Comparability:

117. Croatia applied Tier 1 methods of the EMEP/EEA Guidebook 2007 and 2009. The ERT considers the inventory results to be generally comparable with those of other reporting parties.

118. Croatia removed "correction factors" related to the housing period in the calculation method for ammonia emissions from manure management but did not correct its calculation methods for PM emissions. The correction factors introduce an underestimation of emissions and are not in line with the definition of the Tier 1 emission factors which include emissions during grazing. The ERT recommends that Croatia corrects the methodologies also for PM calculations.

Accuracy and uncertainties:

119. Croatia uses Tier 1 methods also for key categories, which results in a lack of accuracy of the inventory. Croatia has plans to move on to Tier 2 methods and has started a related research project. The ERT commends Croatia for its efforts to improve the inventory and recommends that Croatia implements the use of Tier 2 methods for key categories.

Improvement:

120. The ERT notes that the recalculations have led to improvements of the inventory and commends Croatia for starting a national research project to develop Tier 2 methodologies and national NH₃ emission factors for sectoral manure management.

Sector-specific Recommendations.**Category issue 1: 4.B Manure Management – NH₃**

121. Croatia estimates ammonia emissions using the Tier 1 default approach although the NFR categories 4.B.8 Swine, 4.B.1.a Dairy cattle and 4.B.1.b Non-dairy cattle have been identified as key categories. In the IIR Croatia states that a specific project will be launched to improve the methodology. In response to the ERT's question regarding the current status of this project, Croatia explained that the University of Zagreb, Faculty of Agriculture, has already been contracted to carry out the project and that final results will be available in March 2015. The objective of the project is to develop national emission factors for NH₃, CH₄ and N₂O from manure management. The ERT commends Croatia for starting the work on this important improvement and recommends that Croatia implements study results as soon as possible.

Category issue 2: 4.B Manure Management – TSP, PM₁₀, PM_{2.5}

122. In the IIR on page 209 Croatia indicates that PM emissions from manure management were calculated using the Tier 1 emission factors of the Guidebook 2009. However, the ERT has found that the EFs provided in Annex 4 of the IIR differ from those listed in the Guidebook. In its response to a question regarding this issue Croatia explained that for PM and TSP emission calculation "correction factors" (representing the housing period during the year) were applied, which is not in line with the Guidebook Tier 1 methodology. Croatia indicated that the correction factors would be removed from the methodology used for the next submission. The ERT recommends that Croatia makes these corrections for the next submission.

Category issue 3: 4.D.1.a Synthetic fertilizers – NH₃

123. According to the IIR, Croatia follows the methodology of the EMEP/EEA Guidebook 2007. The ERT encourages Croatia to apply the fertiliser type-specific EFs provided in the Tier 2 technology approach of the latest version of the EMEP/EEA Guidebook (2013).

Category issue 4: 4.D.1.a Synthetic fertilizers – TSP, PM₁₀, PM_{2.5}.

124. Croatia does not estimate emissions of particulate matter from NFR 4.D Crop production and agricultural soils. Croatia indicates in the IIR that it plans to collect data to enable the calculation of PM₁₀ and PM_{2.5} emissions with the Tier 1 methodology. The ERT encourages Croatia to carry out the improvement and to provide a clear time schedule for the work in the IIR.

WASTE

Review Scope:

Pollutants Reviewed		All		
Years		2012		
NFR Code	CRF_NFR Name	Reviewed	Not Reviewed	Recommendation Provided
6.A	solid waste disposal on land	x		x
6.B	waste-water handling	x		
6 C a	6 C a Clinical waste incineration (d)	x		x
6 C b	Industrial waste incineration (d)	x		x
6 C c	Municipal waste incineration (d)	x		x
6 C d	Cremation	x		
6 C e	Small scale waste burning	x		x
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:

125. The ERT finds the explanations for emission calculations in the IIR to be transparent. However, the ERT found that more details about activity data sources should be provided. The notation key "IE" is used in NFR 6.C.b Industrial Waste Incineration for all pollutants for the years 2009-2012 and the notation key "NO" is used for NFR 6.C.c Municipal Waste Incineration across the entire time series. The ERT encourages Croatia to include, in the IIR, an explanation for the use of the notation keys for the Industrial and Municipal waste incineration categories to enable an understanding of the waste management system in Croatia.

Completeness:

126. The inventory of the Waste sector is partly complete. Croatia reports emissions from cremation, wastewater handling, solid waste disposal, clinical waste incineration and other waste for 1990 – 2012. The ERT commends Croatia for providing emission estimates for most of the sources in the waste sector and recommends that Croatia completes the inventory by estimating the missing emissions.

Consistency, including recalculation and time series:

127. The ERT notes that the emission times series presented in the IIR are not always consistent and that explanations for the fluctuations which seem to depend on fluctuations in activity data are not provided in the IIR. The ERT recommends that Croatia corrects the activity time series for each source or provides explanations for the fluctuations.

Comparability:

128. The methods used to calculate emissions are based on the Guidebook and explained in the IIR and the emissions are reported under relevant NFR categories.

The ERT considers the Waste sector inventory to be comparable with those of other countries.

Accuracy and uncertainties:

129. According to the information provided in the IIR, QA/QC procedures are carried out for the Waste sector inventory and a source-specific uncertainty assessment covers the emission estimates in the sector.

Improvement:

130. In the IIR, inventory improvements have been identified for the Waste sector. The ERT supports the planned improvements and provides some detailed recommendations in the sub-sector chapters.

Sub-sector Specific Recommendations

6A - Solid waste disposal on land

131. NMVOC emissions depend on CH₄ emissions from solid waste disposal. Croatia explained that the increase of NMVOC emissions in this sector was mainly due to the increased amount of estimated landfill gas.

132. Croatia does not include TSP, PM₁₀ and PM_{2.5} emissions in the inventory. The ERT recommends that Croatia estimates these emissions according to the methods provided in the Guidebook 2013.

6B- Waste-water handling

133. Croatia reports NMVOC and NH₃ emissions from this sector. Activity data for Domestic and commercial wastewater for the years 1990 – 1994 is reported as “NO” in the IIR on page 223, Table 8.1., while no emissions for these years are reported. The ERT recommends that Croatia carries out an extrapolation of the data until the year 1990, includes the emissions in the inventory and provides explanations for the methodology in the IIR.

134. Croatia does not provide explanations for the fluctuations in NMVOC and NH₃ emissions in the IIR. The ERT recommends that Croatia includes such explanations in the next IIR.

6Ca, 6Cb, 6Cc – Waste incineration (clinical, industrial, municipal)

135. Croatia reports emissions from clinical waste incineration as “not occurring” (“NO”) for 1990-1999. The ERT recommends that Croatia provides explanations for the use of the notation key “NO” for 1990-1999 and includes activity data for the years after 2000 in the IIR.

136. The ERT found inconsistencies between the IIR and the NFR tables. For industrial waste incineration the notation key “IE” has been used for the years 2009-2012 in the NFR tables, but in the IIR Table 8-1 activity data is reported as “NO”. The ERT recommends that Croatia corrects the data for the next submission and uses consistent notation keys in the NFR tables and in the IIR.

137. The ERT encourages Croatia to provide explanations in the IIR as to where industrial waste incineration is included, which methods have been used to estimate emissions from the source and concerning the extrapolation of data on industrial wastes for the years 1990 – 1996.

138. Croatia reports NFR 6.C.c Municipal waste incineration as “not occurring” (“NO”). No explanation for the use of the notation key “NO” is provided in the IIR. The ERT recommends that Croatia explains the use of “NO” in the next IIR.

6Cd Cremation

139. Croatia reports emissions from this sub-sector. In the IIR both activity data and the methodology are presented. The ERT commends Croatia on its transparent inventory of this sub-sector.

6Ce Small-scale waste burning

140. Croatia reports emissions from small-scale waste as “not occurring” (“NO”). The ERT recommends that Croatia investigates possible data sources for small-scale waste burning in the country and estimates possible emissions, or that it includes in the IIR an explanation for the reason why emissions do not occur or have not been estimated.

6D Other wastes

141. Croatia reports emissions in this sub-sector from (detached and undetached) house fires, apartment building fires, industrial building fires, and car fires. The ERT commends Croatia for estimating and reporting the emissions. According to the IIR, the activity data are taken from official statistics.

142. Croatia does not report emissions from sludge spreading or compost production from waste. The ERT encourages Croatia to collect activity data and to calculate these emissions using the methodology from the Guidebook.

LIST OF ADDITIONAL MATERIALS PROVIDED BY THE COUNTRY DURING THE REVIEW

1. Responses from Croatia to preliminary question raised prior to the review
2. Response from Croatia to questions raised during the review
3. Croatia Stage 2 S&A report 2014
4. Croatia Stage 1 report 2014
5. Croatian IIR 2014