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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:**

**LUXEMBOURG**

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## INTRODUCTION

1. The mandate and overall objectives for the emission inventory review process under the LRTAP Convention is provided by the UNECE document '*Methods and Procedures for the Technical Review of Air Pollutant Emission Inventories reported under the Convention and its Protocols*'<sup>(1)</sup> – hereafter referred to as the 'Methods and Procedures' document.
2. This annual review, has concentrated on SO<sub>2</sub>, NO<sub>x</sub>, NMVOC, NH<sub>3</sub>, plus PM<sub>10</sub> & PM<sub>2.5</sub> for the time series years 1990 – 2009 reflecting current priorities from EMEP Steering Body and the Task Force on Emission Inventories and Projections (TFEIP). HMs and POPs have been reviewed to the extent possible.
3. This report covers the stage 3 centralised reviews of the UNECE LRTAP Convention and EU NEC Directive inventories of Luxembourg coordinated by the EMEP emission centre CEIP acting as review secretariat. The review took place from 27<sup>th</sup> June 2011 to 1<sup>st</sup> July 2011 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 – John van Aardenne (EEA), Energy – Julien Vincent (France), Transport – Michael Kotzulla (Germany), Industry – Kees Peek (the Netherlands), Solvents – Nadine Allemand (France), Agriculture and Nature – Jim Webb (UK), Waste – Magdalena Trajkovska Trpevska (Macedonia).
4. Kristina Saarinen (Finland) was the lead reviewer. The review was coordinated by Katarina Marečková, (EMEP Centre on Emission Inventories and Projections - CEIP).

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<sup>1</sup> Methods and Procedures for the Technical Review of Air Pollutant Emission Inventories reported under the Convention and its Protocols. Note by the Task Force on Emission Inventories and Projections. ECE/EB.AIR/GE.1/2007/16 <http://www.unece.org/env/documents/2007/eb/ge1/ece.eb.air.ge.1.2007.16.e.pdf>

## PART A: KEY REVIEW FINDINGS

1. Luxembourg did not submit an inventory under the CLRTAP in 2011. In 2010, however, Luxembourg reported emission data under the NECD .
2. The inventories submitted by Luxembourg are generally in line with *the EMEP EEA Inventory Guidebook* and the UNECE Reporting Guidelines.
3. The consistency of emissions reported under the CLRTAP and NECD could not be assessed due to the above mentioned reasons.
4. Luxembourg did neither submit an IIR (Informative Inventory Report) under the CLRTAP, nor under the NECD.
5. The ERT noted that Luxembourg did not report recalculations either.

### INVENTORY SUBMISSION

6. In 2011 Luxembourg did not submit a CLRTAP emission inventory. The latest submission by Luxembourg under the CLRTAP dates back to 2009 and included emission data (SO<sub>x</sub>, NO<sub>x</sub>, NMVOC and NH<sub>3</sub>) from 1990 to 2007. Under the NECD, Luxembourg submitted emission data in the NFR 2009 format for the years 1990-2006 and in 2009 for the year 2007 and 2008. The latter submission did not include updates for the earlier years. In 2010 the submission included data for the year 2009 only.
7. Luxembourg did not submit an IIR. The ERT was informed by the Party that the staff resources for the CLRTAP and NECD inventory work is limited to a single person holding also the responsibilities for UNFCCC inventory work. The ERT recognises that the large burden on the inventory preparation and reporting is resource demanding and recommends Luxembourg to provide sufficient resources for the work.
8. According to the information sent by Luxembourg during the review week, it is foreseen in the future that AP and GHG inventories are compiled together. For being able to do so, Luxembourg is currently establishing a common database (MESAP from Seven2One) which is also used by the Swiss and German inventory teams. This database will also allow Luxembourg to carry out the key category analyses. The ERT commends Luxembourg for its efforts to improve the AP inventory and encourages Luxembourg to implement these improvements for its next submission to increase the transparency, the consistency, the comparability and the accuracy of the inventory.
9. During the review Luxembourg informed the ERT that a draft IIR is being prepared. The ERT commends Luxembourg for this and recommends to include the IIR in the next submission.

10. Due to the lack of an IIR it was not possible for the ERT to properly carry out the review. The ERT would like to note that the recommendations made below do not constitute the recommendations that would result from a full IIR review.

11. As response to the questions raised by the ERT the Party referred to the NIR submitted by Luxembourg to the UNFCCC and noted that the air pollution emissions are compiled using the same or similar activity data as for the greenhouse gas inventory and that especially in the energy sector a large number of measurement data is being used. The ERT appreciates this effort to clarify the methodology used by the Party but would like to point out that it is not the task of the ERT to reconstruct the emission inventory data and assumptions using information other than the IIR.

12. Although the methodologies in the NIR would be the same for reporting indirect GHG emissions (SO<sub>2</sub>, NO<sub>x</sub>, NMVOC and CO) under the CLRTAP, NECD and UNFCCC submissions, the ERT found this information to be insufficient for the review under the CLRTAP and NECD. The ERT encourages Luxembourg to develop an IIR as the review under the UNFCCC targeting GHG emissions addresses mainly direct GHG emissions and relies on the UNECE review results for NMVOC and other air pollutant emissions. In addition, the NIR does not include any information regarding NH<sub>3</sub>, particles, heavy metals and POPs.

13. The ERT encourages Luxembourg to prepare an IIR for the next submission following the outline for an IIR as defined in the UNECE Reporting Guidelines (Recommended Structure for Informative Inventory Report, Annex VI to ECE/EB.AIR/97, Version: 30 Sept 2009).

### **KEY CATEGORIES**

14. Due to the absence of an IIR the ERT was not able to evaluate the key categories analysis and whether it is used in the prioritization of improvements in the inventory.

### **QUALITY**

#### ***Transparency***

15. As the Party did not submit an IIR, information on the methods applied is not available and therefore transparency of the inventory is limited. The ERT encourages the Party to provide an IIR in the next submission following the outline for an IIR as defined in the UNECE Reporting Guidelines (Recommended Structure for Informative Inventory Report, Annex VI to ECE/EB.AIR/97, Version: 30 Sept 2009).

16. Luxembourg provides a limited use of the notation keys IE (included elsewhere) and NE (not estimated) and the use of these is explained in the NFR table.

### **Completeness**

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

18. For the sectors reviewed, the ERT considers the Party's inventory as not yet complete due to the use of notation key NO (not occurring) for sources where emissions have already been reported in past CLRTAP submissions, for instance, in the transport sector. The ERT recommends that the Party performs additional reviews to identify potential gaps in the inventory. The usage of notation keys is highly recommended to support the finding of such gaps.

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

19. Due to the missing IIR and availability of only the submission under the CLRTAP in 2009 for emissions from 1990 to 2007 and the 2010 submission under NECD for data only for 2009, the ERT was unable to review the consistency and recalculations for the inventory.

20. The ERT recommends the Party to provide a full time-series of emissions including at least the absolute and relative changes between both submissions on a sub-sectoral level and the reasons for the recalculation carried out, as well as both the old and the recalculated current entire time-series.

### **Comparability**

21. As only the submission under the CLRTAP in 2009 for emissions from 1990 to 2007 and the 2010 submission under NECD for data only for 2009 are available from Luxembourg and no IIR was provided, comparability to other country's inventories is limited.

22. The ERT notes that the emissions are reported using the NFR 2009 format so limited comparison was possible. Moreover, the ERT was unable to verify IEFs because no activity levels are provided.

23. The ERT encourages Luxembourg to report its emissions in the appropriate NFR sectors consistently using the methods in the EMEP/EEA Guidebook, 2009.

### **CLRTAP/NECD comparability**

24. Since Luxembourg did not submit an inventory to the CLRTAP the ERT was unable to compare the submissions to the CLRTAP and the NECD.

### **Accuracy and uncertainties**

25. Luxembourg did not provide an uncertainty analysis. Therefore, the accuracy of the inventory cannot be reviewed. The ERT encourages Luxembourg to undertake an uncertainty analysis in order to feed into the improvement process and to provide an indication of the reliability of the inventory data in future IIRs.

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

26. Luxembourg did neither provide a QA/QC plan nor information on QA/QC procedures for the inventory. Therefore, the quality assurance/quality control

approaches cannot be reviewed properly. The Party responded to questions raised by the ERT referring to the NIR submitted to the UNFCCC but it is not clear to what extent QA/QC procedures applied to greenhouse gas emission inventory might affect the air pollutant emission inventory. The ERT encourages the Party to clarify the QA/QC procedures in the next submission and to provide a QA/QC plan for the air pollutant emission inventory.

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

27. Due to lack of information, a Stage 2 review could not be carried out for any inventory submitted by Luxembourg.

#### **AREAS FOR IMPROVEMENTS IDENTIFIED BY LUXEMBOURG**

28. According to the response by Luxembourg to the question raised by the ERT, PM, HM and POPs will be reported in the next submission. The ERT supports this initiative and recommends Luxembourg to carry out the inventory for the next submission and report a full time-series for all pollutants.

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

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

29. The ERT identifies the following cross-cutting issues for improvement:
- (a) The ERT recommends Luxembourg to estimate and report the missing emissions and to submit inventories both under the CLRTAP and the NECD.
  - (b) The ERT encourages Luxembourg to prepare an IIR for next year's emission inventory in accordance with the Recommended Structure for Informative Inventory Report (Annex VI to ECE/EB.AIR/97, Version: 30 Sept 2009).
  - (c) The ERT encourages Luxembourg to undertake an uncertainty analysis in order to help inform the improvement process and to provide an indication of the reliability of the inventory data.
  - (d) The ERT encourages the party to clarify the QA/QC procedures in the next submission and to provide a QA/QC plan and information of QA/QC activities in the future IIR.
  - (e) The ERT recommends Luxembourg to provide information on recalculations in the IIR.
  - (f) The ERT encourages Luxembourg to provide a key source analysis in the IIR.
  - (g) The ERT encourages Luxembourg to prepare an inventory improvement plan and to provide information on improvements already carried out.
30. Recommended improvements relating to specific source categories are presented in the relevant sector sections of this report.

**SECTOR SPECIFIC RECOMMENDATIONS FOR IMPROVEMENTS IDENTIFIED  
BY ERT**

**ENERGY**

*Review Scope*

Pollutants Reviewed		SO <sub>2</sub> , NO <sub>x</sub> , NMVOC, NH <sub>3</sub> , PM <sub>10</sub> & PM <sub>2.5</sub>		
Years		1990 – 2009 + (Protocol Years)		
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		NO	
1.A.1.c	Manufacture of solid fuels and other energy industries		NO	
1.A.2.a	iron and steel	X		X
1.A.2.b	non-ferrous metals	X		
1.A.2.c	chemicals	X		
1.A.2.d	pulp, paper and print		NO	
1.A.2.e	food processing, beverages and tobacco	X		X
1.A.2.f.i	Stationary Combustion in Manufacturing Industries and Construction: Other (Please specify in your IIR)	X		X
1 A 3 e	Pipeline compressors ?		NO	
1.A.4.a.i	commercial / institutional: stationary	X		x
1.A.4.b.i	residential plants	X		
1.A.4.c.i	Agriculture/forestry/fishing. stationary		NO	
1.A.5.a	other, stationary (including military)		NO	
1.A.5.b	other, mobile (including military, land based and recreational boats)?		NO	
1.B.1.a	coal mining and handling		NO	
1.B.1.b	solid fuel transformation		NO	
1.B.1.c	other fugitive emissions from solid fuels )		NO	
1 B 2 a i	Exploration, production, transport		NO	
1 B 2 a iv	Refining / storage		NO	
1 B 2 a v	Distribution of oil products	X		x
1 B 2 b	Natural gas	x		x
1 B 2 c	Venting and flaring			
1 B 3	Other fugitive emissions from geothermal energy production , peat and other energy extraction not included in 1 B 2		NO	

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

*General recommendations on cross-cutting issues.*

**Transparency:**

31. As no IIR or NFR tables are provided, the methodology used by Luxembourg to estimate emissions is not transparent enough to enable the ERT reviewing the inventory. The ERT's comments in this review report are mostly based on data reported for the year 2009 provided by Luxembourg during the review week in the file

“LU\_Subm2010\_2009\_101231.xls” and on answers received during the review week. Luxembourg provided the ERT with a complete data time-series but as emissions reported for the year 2009 are different from those defined in the file “LU\_Subm2010\_2009\_101231.xls”, these data cannot be used for the review.

32. The ERT noticed that “Luxembourg is currently in the process of streamlining the AD between GHG and LRTAP inventory, especially for the energy sector. This is relatively time consuming as for the GHG inventory the energy balance has been completely revised for the last submission. The calculation sheets need to be adjusted in a special way for being able to consider the plant specific data.” The ERT encourages Luxembourg to get a single set of data for all inventories as soon as possible.

33. According to replies by Luxembourg to questions raised by the ERT during the review week “the IIR is too resource intensive to be compiled by a single expert”. However, the ERT noticed that a draft IIR is being prepared by a consultant. The ERT recommends Luxembourg to provide this IIR with the NFR tables for the next submission as this is an essential tool to review the quality of the inventory.

34. Explanations for Notation key “IE” are directly inserted as comments in the Excel file “LU\_Subm2010\_2009\_101231.xls”.

#### **Completeness:**

35. The ERT considers the Energy sector to be complete in terms of sub-sectors considered. The ERT recommends Luxembourg to provide activity data for enabling a check of the completeness of the inventory.

36. The ERT noticed that only NECD pollutants are reported so far. According to Luxembourg, PM, HM and POPs will be reported in the next submission. The ERT supports this initiative and recommends Luxembourg to implement those calculations for the next submission for the whole time-series.

The ERT recommends Luxembourg to amend all the blank cells with the proper notation keys (i.e. IE, NE, NA, NO, C).

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

37. According to the information sent by Luxembourg during the review week, many major revisions have been carried out in the AP inventory in the last three years based on changes to the GHG inventory. The ERT encourages Luxembourg to provide more details on recalculations made during this period of time.

#### **Comparability:**

38. Luxembourg did not submit an IIR and therefore the ERT is unable to conclude whether the methodologies used in the energy sector inventory are in accordance with the EMEP/EEA Guidebook, 2009 and comparable with inventories from other countries.

39. As no activity levels are provided, the ERT is unable to verify the IEFs. However, the ERT noticed that for industrial sectors “there is no data currently

reported as the emissions of the main pollutants are included in the energy sector". Therefore it is not possible for the ERT to compare the emissions with other Parties` s findings. The ERT encourages Luxembourg to report the emissions in the appropriate NFR sectors in accordance with the EMEP/EEA Guidebook (see sub-sector recommendations below).

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

40. Luxembourg did not provide a general uncertainty analysis in the current submission. Because of limited resources, the priority for Luxembourg is to first report a consistent and complete inventory. However, the ERT encourages Luxembourg to undertake an uncertainty analysis for the Energy Sector as soon as possible in order to help support the improvement process and to provide an indication of the reliability of the inventory data.

41. The ERT noticed that Luxembourg did not submit a QA/QC plan and provided no information on QA/QC procedures. The ERT recommends Luxembourg to implement such information in the future IIR.

#### **Improvement:**

42. During the review Luxembourg informed the ERT that a draft IIR is being prepared. The ERT commends Luxembourg for this and recommends including the IIR in the next submission.

43. The ERT noted that some improvements are foreseen for the next submission as described under paragraphs 8-9.

#### *Sub-Sector Specific Recommendations.*

##### **Category issue 1: 1A2a – All pollutants**

44. According to the file "LU\_Subm2010\_2009\_101231.xls", emissions from sectors 2C1 and 2C3 are reported under 1A2a. According to answers received during the review week, everything is reported under 1A2a to avoid double counting as emissions are based on measurements,. The ERT encourages Luxembourg to verify if all emissions such as fugitive emissions from the process are effectively measured and reported by the plants. Otherwise, emissions might be underestimated. For transparency and comparability reasons, the ERT recommends Luxembourg to split data according to methodologies presented in the EMEP GB.

##### **Category issue 2: 1A2e – NMVOC, PM<sub>10</sub>**

45. According to the file "LU\_Subm2010\_2009\_101231.xls", emissions from sectors 2D2 are reported under 1A2e. According to the EMEP/EEA Guidebook, mostly NMVOC emissions have to be reported under 2D2 (PM<sub>10</sub> might be emitted from handling of manufacturing products). If no detailed data are available because only total emissions are measured and reported, these emissions could be estimated by subtracting emissions from combustion (calculated e.g. by using national EFs for) from the total reported NMVOC emissions which are now allocated under 1A2e. For

transparency and comparability reasons, the ERT recommends Luxembourg to split data according to methodologies presented in the EMEP/EEA Guidebook.

**Category issue 3: 1A2f – All pollutants**

46. According to the file “LU\_Subm2010\_2009\_101231.xls”, emissions from sectors 2A1, 2A6 and 2D3 are reported under 1A2f. For the sector 2A1, this is correct as emissions from combustion and process cannot be separated. For the sector 2A6, however, mostly NMVOC emissions should be reported from road paving with asphalt. For the sector 2D3 “Wood processing it would be worth to get data to separate particulate matter emissions from combustion from particulate matter from the process ” as there is only one plant in Luxembourg, PM should be emitted from different sources in the installation depending greatly on the kind of product manufactured. Regarding confidentiality issues, there should not be any problem on PM emissions even if the activity level cannot be reported (use notation key “C”). For transparency and comparability reasons, the ERT encourages Luxembourg to split data to the extent feasible according to methodologies presented in the EMEP/EEA Guidebook.

**Category issue 4: 1A2fi Stationary combustion in manufacturing industries and construction: Other – SO<sub>x</sub>**

47. According to the Stage 2 review, SO<sub>x</sub> emissions reported in 1995 are low compared to other years. According to answers received from Luxembourg during the review week, this issue should be resolved with the updated energy balance which will be used in the next submissions. The ERT encourages Luxembourg to explain this kind of time-series discrepancies in the future IIR.

**Category issue 5: 1A4bii to 1A5b – All pollutants**

48. According to the file “LU\_Subm2010\_2009\_101231.xls”, the notation key NO is used for these sectors. After discussion, Luxembourg recognised that the notation key IE would be probably more appropriate. Further discussions with National Statistics (STATEC) which compiles the energy balance will be needed to clarify this issue. The ERT encourages Luxembourg to clarify this issue for the next submission.

**Category issue 6: 1A4i Commercial / institutional: Stationary – NO<sub>x</sub>**

49. According to the Stage 2 review, NO<sub>x</sub> emissions reported in 2004 are high compared to other years. According to answers received from Luxembourg during the review week, this issue should be resolved with the updated energy balance which will be used in the next submissions. The ERT encourages Luxembourg to explain this kind of -eries discrepancies in the future IIR.

**Category issue 7: 1B2av, 1B2b – All pollutants**

50. According to the file “LU\_Subm2010\_2009\_101231.xls”, the notation key NO is reported for SO<sub>x</sub> emissions as the notation key NA is used for NO<sub>x</sub> and NH<sub>3</sub> emissions. The ERT recommends Luxembourg to check the consistency of the notation keys used.

## TRANSPORT

### Review Scope

Pollutants Reviewed		Main, CO, TSP + PM <sub>5</sub>		
Years		1990 – 2009		
NFR Code	CRF_NFR Name	Reviewed	Not Reviewed	Recommendation Provided
1.A.3.a.i.(i)	international aviation (LTO)	x		
1.A.3.a.i.(ii)	international aviation (cruise)	x		
1.A.3.a.ii.(i)	civil aviation (domestic, LTO)	x		
1.A.3.a.ii.(ii)	civil aviation (domestic, cruise)	x		
1.A.3.b.i	road transport, passenger cars	x		x
1.A.3.b.ii	road transport, light duty vehicles	x		x
1.A.3.b.iii	road transport, heavy duty vehicles	x		x
1.A.3.b.iv	road transport, mopeds & motorcycles	x		x
1.A.3.b.v	road transport, gasoline evaporation	x		x
1.A.3.b.vi	road transport, automobile tyre and brake wear	x		
1.A.3.b.vii	road transport, automobile road abrasion	x		
1.A.3.c	railways	x		
1.A.3.d.i (ii)	international inland navigation			
1.A.3.d.ii	national navigation	x		x
1.A.4.b.ii	household and gardening (mobile)	x		x
1.A.4.c	agriculture / forestry / fishing			
1.A.4.c.ii	off-road vehicles and other machinery	x		x
1.A.4.c.iii	national fishing			
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	
1 A 3	Transport (fuel used)			

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

### General recommendations on cross-cutting issues.

#### **Transparency:**

51. As the Party did not submit an IIR, information on the methods applied is not available and therefore the transparency is very limited at the moment. The ERT recommends the Party to improve the inventory by providing an IIR in line with the outline defined in the reporting requirements, in the next submission.

52. The ERT recommends the Party to provide as much explanatory information possible on the trends of the emissions estimates including information on the development of AD and EFs.

53. During the review no information on activity data was available to the ERT. Asked for such data for the transport sub-sectors, the Party sent detailed estimates on both fuel consumption and emissions for 1.A.3.a and 1.A.3.d.ii, further explaining that AD and emission calculations are documented in the NIR 2011 (submitted under the UNFCCC) with most of the AD being identical and originated from the fuel consumption.

54. The Party also informed the ERT that albeit not being in line with reporting requirements, emissions for sector 1.A.3.b are reported based on fuel used instead of fuel sold (see also: Sub-Sector Specific Recommendations below).

55. All Transport sub-sectors as well as other NFRs including mobile sources are reported separately, i.e. no IE notation keys are used here.

**Correctness:**

56. As limited fuel sales data are available from the national energy balances, the Party uses fuel used data estimating emissions from NFRs 1.A.3.b, 1.A.3.d i(i) and 1.A.3.d i(ii). The ERT acknowledges the explanation provided in the "Additional Info" NFR table, nevertheless stating that this is not in line with the reporting guidelines.

**Completeness:**

57. For the sectors reviewed, the ERT considers the Party's inventory as not yet complete due to the use of notation key NO ("not occurring") where emissions have already been reported in past LRTAP submissions (here: 2007; see sub-sector specific remarks as well).

58. In addition, the Party's NEC submission in 2010 seems to include minor data mistakes (see sub-sector specific remarks on 1A3dii). The ERT asked the Party to clarify this issue and to provide corrected data if necessary.

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

59. Due to the missing IIR and only data submitted under the LRTAP in 2009 (years 1990-2007) and under the NECD in 2010 (only for 2009) being available from Luxembourg, recalculations could not be reviewed.

60. The ERT therefore encourages the Party to provide all necessary information in the future IIR, including at least the absolute and relative changes between both submissions on the sub-sector level and the reasons for the recalculation carried out as well both the old and the recalculated current entire time-series.

**Comparability:**

61. As only data submitted under the LRTAP in 2009 (years 1990-2007) and under the NECD in 2010 (only for 2009) are available from Luxembourg and no IIR was provided, comparability to other country's inventories is limited.

62. As Luxembourg did not provide an IIR, information on methodologies applied is limited. Therefore, the ERT is unable to conclude if the methods used for calculation of transport sector emissions are consistent with the latest version of the EMEP/EEA Guidebook and thus with the findings of other countries.

**Accuracy and uncertainties:**

63. As mentioned under Completeness above, the notation key NO has been used where emissions have already been reported in the past CLRTAP submissions (here: 2007; see sub-sector specific remarks as well). Therefore, accuracy of the Party's inventory could be further improved.

64. Luxembourg did neither submit information on the QA/QC procedures implemented nor a QA/QC plan. The ERT recommends the Party to implement a QA/QC system and to provide a QA/QC plan in the future IIR.

65. As Luxembourg did not provide an uncertainty analysis for the transport sector, the accuracy cannot be reviewed properly. The ERT recommends the Party to undertake an uncertainty analysis and to use it as a tool in prioritizing improvements in the inventory and to provide an indication of the reliability of the inventory data.

**Improvement:**

66. During the review Luxembourg informed the ERT that a draft IIR is being prepared. The ERT commends Luxembourg for this and recommends Luxembourg to include the IIR in the next submission.

67. Luxembourg did not provide an inventory improvement plan or information on improvements already carried out in the inventory. The ERT recommends the Party to implement an improvement plan to help collect issues for further improvement as well as to monitor the improvements' progress.

Sub-Sector Specific Recommendations.

**Category issue 1: 1.A.3.a Air Transport - All Pollutants**

68. During the review the ERT asked the Party to provide explanatory information on the aviation sector in Luxembourg, including information on what information (especially AD) is available to the inventory compilers, and on whether also domestic aviation with piston engine aircraft takes place between small airfields in Luxembourg. The Party provided both data and explanatory information, stating that AD is taken from the energy balance (fuel consumption) and National statistics (LTO). Emissions from aviation using jet kerosene are calculated using the Tier 1 method in EMEP/EEA Guidebook (2009) (emission factors in Chapter 1A3 Aviation, Table 3-3, p.19). The distinction between LTO and Cruise is made but as there is only one airport in Luxembourg, all flights using jet kerosene are international flights. Here, LTO cycle emissions are accounted under 1.A.3.a i(i), whereas cruise emissions are accounted under Memo Items. The ERT thanks Luxembourg for the data and information provided.

69. In addition to the issue above, Luxembourg informed the ERT that emissions for small aircrafts (piston engines) using aviation gasoline are accounted for as domestic aviation (90%) and international aviation (10%) based on expert judgement. So the 10% are not included in the national total, but are reported under Memo items. The remaining 90% are reported under 1.A.3.a ii(i). Again, the ERT thanks Luxembourg for the data and information provided

**Category issue 2: 1.A.2.f.ii, 1.A.3.b - NO<sub>x</sub>**

70. The ERT noted that in its 2009 CLRTAP submission, 25.1% of NO<sub>x</sub> emissions originate from 1.A.3.b.iii, which is the main source, and 22 per cent from the entire 1.A.2.f sector. In comparison, in the NECD data submitted in 2010?, this situation

has changed so that about 30% originates from 1.A.2.f and only about 16.6% from 1.A.3.b.iii. To the question on which data have been revised thus resulting in these changes, Luxembourg responded that...“ *it is not clear whether this is still the case, due to a revised energy balance*”.

71. The Party stated that emissions from NFR 1.A.3.b are calculated using the COPERT model, which uses actual EFs, where emissions from NFR 1.A.2.f ii are calculated by a simple T1 method using a default EFs from the EMEP/EEA Guidebook version 2009 for mobile machinery, which might overestimate emissions. The ERT thanks Luxembourg for the answer provided asking the Party to further investigate this issue.

**Category issue 3: 1.A.3.b Road transport – all**

72. During the review no information on activity data was available to the ERT. Asked for such data the Party informed the ERT that for sector 1.A.3.b, where the COPERT IV model is used, only fuel used emissions are reported and that parameters fed into the model can be found in NIR 2011 (p.196-198). Here, the amount for fuel used is calculated by the COPERT model whereas the remaining fuel is considered to be exported (fuel sold-fuel used = fuel export), which is not considered in the CLRTAP inventory. The ERT warmly welcomes the Party's plan to calculate emissions from NFR 1.A.3.b on a fuel sold basis for the next CLRTAP submission.

**Category issue 4: 1.A.3.b.v Road transport - Gasoline Evaporation - NMVOC**

73. The ERT noted that in its 2010 submission under the NECD, the Party states that NMVOC emissions from gasoline evaporation do not occur (reported by the notation key NO) whereas the Party used the notation key IE in the 2009 CLRTAP submission including these emissions under sub-sector 1.A.3.b i. Apart from this mistake to be corrected, the ERT recommends the Party to improve the transparency of the inventory by separately reporting NMVOC emissions from gasoline evaporation. Luxembourg stated that NMVOC emissions from gasoline evaporation are calculated using the COPERT model but that they have by mistake been reported as NO. The Party furthermore announced that these emissions will be reported in the next submission.

**Category issue 5: 1.A.3.b.iii and iv Road transport - NMVOC**

74. The ERT noted that the time-series for NMVOC emissions from these sub-sectors provided with the Party's 2010 NECD submission show rather strong decreases for 2007 and 2005 respectively (see S&A data: time-series). During the review the ERT requested the Party to explain the reason. The Party responded that recalculated values show such a decrease for NFR 1.A.3.b iv and that they are only planning further investigations on that issue, assuming an incoherence in the fleet data. The ERT commends the Party's plan to solve this issue for the next submission.

**Category issue 6: 1.A.3.c Railways - all**

75. As mentioned above for the entire transport sector, no information on AD was available to the ERT during the review. Asked for this information, the Party stated that AD (fuel consumption) is from the only railway company operating in

Luxembourg and that emissions are calculated using default T1 EFs from the EMEP/EEA Guidebook 2009. The ERT welcomes the information provided, asking the Party to include such information in the future IIR.

**Category issue 7: 1.A.3.d.ii National Navigation - all**

76. Again, no information on AD was available to the ERT during the review. Asked for such information, the Party stated that AD (gasoil consumption) is derived from two companies refuelling their passenger ships in Luxembourg and that emission are calculated using Tier1 EFs. Luxembourg also stated that small leisure ships need to be added in the next submission. The ERT welcomes the information provided and warmly recommends the Party to improve its inventory in the described way.

**Category issue 8: 1.A.3.d.ii National Navigation - NMVOC, SO<sub>x</sub> and NH<sub>3</sub>**

77. During the review the ERT noted that in the NFR table submitted in 2010 under the NECD the same value (0.0002825 kt) is reported for NMVOC, SO<sub>x</sub> and NH<sub>3</sub>. To the question raised by the ERT on the issue Luxembourg stated that this was a mistake and provided corrected data taking into account emissions from diesel and gasoline from small leisure shipping.

**Category issue 9: Mobile sources in 1.A.4.a.ii, b ii and c ii + c.iii**

78. The ERT observed that there should be activities taking place in all of these sub-sectors in Luxembourg asking the Party to provide explanatory information on that issue and to check the issue for further submissions. The Party stated that the AD is the same as in the GHG inventory for diesel oil or gasoline in mobile machinery. Emissions are calculated using Tier1 default EFs. As the consumption is very small in these categories, in the data compiled by the IEA it might appear as 0 kt because it lies below 0.5 kt and the questionnaire does not allow digits. The ERT acknowledged the answer provided, welcoming the Party's statement that further discussions are ongoing with national statistics to get more precise figures.

**Category issue 10: 1.A.5.b Other, Mobile (Including military) - all pollutants**

79. The ERT noted that in the NFR table submitted by Luxembourg in 2011 under the NECD all emissions under sub-sector 1.A.5.b are reported as "NO", stating that this sector exists but that no emissions occur. In comparison, in the NFR tables submitted in 2007 under the CLRTAP emissions of all main pollutants are provided under NFR 1.A.5.b. The ERT asked the Party to provide explanatory information and to solve this inconsistency. The Party stated that AD is derived from the energy balance and the IEA Questionnaires, which do not report specific data on fuel consumption of off-road in these categories, and that the use of the notation key IE would be more appropriate, as this, indeed very small consumption (as Luxembourg is a small-sized country) is probably included under road transportation. Luxembourg also stated that further discussions with National Statistics (STATEC), which compiles the energy balance, will be needed, to clarify this issue. The ERT welcomes the response as well as the Party's interest to further discuss this issue.

## INDUSTRIAL PROCESSES

### Review Scope

Pollutants Reviewed		SO <sub>2</sub> , NO <sub>x</sub> , NMVOC, CO		
Years		1990 – 2009		
NFR Code	CRF_NFR Name	Reviewed	Not Reviewed	Recommendation Provided
2.A.1	Cement production	X		X
2.A.2	Lime production		NO	
2.A.3	Limestone and dolomite use	X		X
2.A.4	Soda ash production and use	X		X
2.A.5	Asphalt roofing		NO	
2.A.6	Road paving with asphalt		NO	
2.A.7.a	Quarrying and mining of minerals other than coal	X		X
2.A.7.b	Construction and demolition	X		X
2.A.7.c	Storage, handling and transport of mineral products	X		X
2.A.7.d	Other Mineral products	X		X
2.B.1	Ammonia production		NO	
2.B.2	Nitric acid production		NO	
2.B.3	Adipic acid production		NO	
2.B.4	Carbide production		NO	
2.B.5.a	Other chemical industry		NO	
2.B.5.b	Storage, handling and transport of chemical products		NO	
2.C.1	Iron and steel production	X		X
2.C.2	Ferroalloys production		NO	
2.C.3	Aluminium production	X		X
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		NO	
2.C.5.f	Storage, handling and transport of metal products		NO	
2.D.1	Pulp and paper		NO	
2.D.2	Food and drink	X		X
2.D.3	Wood processing	x		X
2.E	Production of POPs		NO	
2.F	Consumption of HM and POPs (e.g. Electrical and scientific equipment)	X		X
2.G	Other production, consumption, storage, transportation or handling of bulk products		NO	

### General recommendations on cross-cutting issues

80. The latest submission by Luxembourg under the CLRTAP in 2009 included emission data from 1990 to 2007. Emission data in the NFR 2009 format was submitted under the NECD in 2010 for the year 2009 (only the latest year). In 2011 Luxembourg did not submit a CLRTAP emission inventory. Furthermore,

Luxembourg did not submit an IIR. Due to these facts it was not possible for the ERT to carry out a proper review.

**Transparency:**

81. The ERT noted that in the NFR tables the notation keys NA, NR and NO have been used for several pollutants for a NFR category. The ERT recommends Luxembourg to use the notation key “NA” where the source exists but relevant emissions are considered never to occur and “NO” where sources not occur.

82. The ERT noted the notation keys used in the CLRTAP reporting tables mostly are not the same as those used in the NECD reporting tables. In the NECD submission NO often is used instead of NA. The ERT recommends Luxembourg to correct these deficiencies in the next submission.

**Completeness:**

83. Besides the absence of an IIR and a key source analysis, the ERT noted that only the main pollutants, excluding CO, are included in the CLRTAP and NECD reporting tables. The other pollutants and the activity data are missing. The ERT strongly recommends Luxembourg to prepare an IIR, with all the necessary information, in the next submission (see also under Improvements).

84. After consulting the NIR 2011 the ERT could clarify which sources do not occur (NO) in the Industrial Processes sector in Luxembourg. Because the emissions of main pollutants of the existing sources are included in the Energy sector, emissions reported under NFR 1A2 represent the sum of “combustion” and “process” emissions. Due to this unclear presentation, it is not evident if these sources are key sources for these pollutants. Additional details and specific recommendations are provided in the sub-sector section below.

85. Furthermore, the ERT noted that after analyzing the EPRTR database a possible key source, NFR 2C1, for priority heavy metals seems to be missing in the CLRTAP inventory. Additional details and specific recommendations are provided in the sub-sector section below.

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

86. The ERT noted that the cells for the Industrial processes sector of both the CLRTAP and NECD sheets are filled with the notation keys NA, NO and NO, and sometimes with the value 0. Therefore it is not obvious if recalculations for this sector have been performed. The ERT recommends Luxembourg to include emission figures in both the CLRTAP and NECD reporting tables in the next submission.

87. Because no activity data and emission figures are provided, a consistency check of time series of the activity data and EFs is not possible. The ERT recommends Luxembourg to include emission figures and activity data in both the CLRTAP and NECD reporting tables in the next submission.

**Comparability:**

88. Luxembourg did not submit an IIR and therefore it is not possible for the ERT to conclude whether the methodologies used in the industrial processes sector

inventory are in accordance with the EMEP/EEA Guidebook, 2009 and comparable with inventories from other countries. The ERT strongly recommends Luxembourg to prepare an IIR with all necessary information in the next submission.

**Accuracy and uncertainties:**

89. The ERT noted that Luxembourg did neither provide a QA/QC plan nor information on QA/QC procedures. The ERT recommends Luxembourg to include this information in the next submission.

90. Luxembourg did not provide an uncertainty analysis. The ERT recommends Luxembourg to undertake an uncertainty analysis for the Industrial processes sector in order to help feed into the improvement process and to provide an indication of the reliability of the inventory data.

**Improvement:**

91. During the review Luxembourg informed the ERT that a draft IIR is being prepared. The ERT commends Luxembourg for this and recommends Luxembourg to include an IIR in the next submission.

92. Furthermore, the ERT noted that Luxembourg intends to report PM, HM and POPs emissions in the next submission. The ERT support this initiative and recommends Luxembourg to carry out the inventory for the next submission and report a full time-series for all pollutants.

*Sub-Sector Specific Recommendations.*

**Category issue 1: 2.A.1 Cement Production**

93. In the CLRTAP reporting table for 2007 cells for NO<sub>x</sub>, NMVOC and SO<sub>x</sub> are filled with the notation key NA and in the NECD reporting table for 2009 with the notation key IE. Luxembourg replied that IE is the correct notation key, as this emissions are based on measurements, where it is impossible to separate emissions of these pollutants generated in the combustion and production processes, and that in order to avoid double counting, these emissions are all reported under 1A2f. The ERT encourages Luxembourg to investigate options to split the combustion and process emission estimates under the relevant NFR categories for the next submission.

**Category issue 2: 2.C.1 Iron- and steel production**

94. The ERT noted that the E-PRTR database included emissions of Pb, Cd and Hg from iron and steel production in Luxembourg for 2007 while in the CLRTAP 2007 reporting table the cells for these pollutants are filled with the notation keys NR and NA. After consultation the Party explained that these emissions are not yet included in the AP inventory as the emissions reported under PRTR have often been found erroneous and need to be inspected first. The focus of the AP inventory has been on the main pollutants but the inclusion of other pollutants is foreseen when resources allow. The ERT encourages Luxembourg to continue this planned improvement so that these emissions will be included in the CLRTAP inventory for the whole time-series.

**Kommentar [i1]:** ? needs to be explained

### **Category issue 3: 2.C.1 Iron- and steel production**

95. The ERT noted that the E-PRTR database included the following Cd emissions: 12.8 kg in 2007, 336 kg in 2008 and 12.8 kg in 2009. After consultation the Party replied that the emissions are identified based on measurements. These measurements are generally done once a year, in order to verify if HM concentrations are within the authorised limits. The measurement results are then used to estimate the emissions of one production year, based on production time. It sometimes happens that during the measurement the emissions are higher than average due to the metal scrap which is being melted. Luxembourg's iron and steel industry only uses scrap. The ERT thanks Luxembourg for this answer and recommends the Party to take into account these variations and improve the estimation of emissions to reflect the level of both the high and normal emissions.

## SOLVENTS

### Review Scope

<b>Pollutants Reviewed</b>		SO <sub>2</sub> , NO <sub>x</sub> , NMVOC, NH <sub>3</sub> , PM <sub>10</sub> & PM <sub>2.5</sub>		
<b>Years</b>		1990 – 2006 + (Protocol Years)		
<b>NFR Code</b>	<b>CRF_NFR Name</b>	<b>Reviewed</b>	<b>Not Reviewed</b>	<b>Recommendation Provided</b>
3.A.1	Decorative coating application	X		X
3.A.2	Industrial coating application	X		X
3.A.3	Other coating application (Please specify the sources included/excluded in the notes column to the right)	X		X
3.B.1	Degreasing	X		X
3.B.2	Dry cleaning	X		X
3.C	Chemical products,	X		X
3.D.1	Printing	X		X
3.D.2	Domestic solvent use including fungicides	X		X
3.D.3	Other product use	X		X
Note: Where a sector has been partially reviewed (e.g. some of the NFR codes please indicate which have and which have not in the respective columns.				

### General recommendations on cross-cutting issues

96. Luxembourg did not report NMVOC emissions from the Solvent and Other Product Use Sector under the CLRTAP for 2008 and 2009. However, Luxembourg reported NMVOC emissions under the NEDC for 2008 and 2009.

97. Luxembourg did not submit an IIR. In its replies to the questions raised by the ERT, Luxembourg provided a link to the NIR submitted under the UNFCCC in 2011, where Chapter 5 provides information on the methodologies used for reporting NMVOC emissions from solvent uses and explained that methodologies were the same under the CLRTAP, NECD and UNFCCC submissions. The ERT found this information to be insufficient for the review under the CLRTAP and NECD. The ERT encourages Luxembourg to develop an IIR as the review under the UNFCCC targeting GHG emissions addresses mainly direct GHG emissions and relies on the UNECE review results for NMVOC and other air pollutant emissions.

98. The methodology used by Luxembourg to estimate NMVOC is based on a methodology developed by *Windsperger and all.* for Austria for the year 2000. This methodology, based on the use of a combination of a bottom-up and a top-down approach, has been adapted to the technical and economical characteristics of Luxembourg. However, emission factors are based on the Austrian situation and have not been changed from 2000 to 2009. Chapter 5 for solvents of the 2011 NIR report for GHG emissions is not sufficiently developed and detailed to enable the correct evaluation of the characteristics of the emission inventory for NMVOC. The review of NMVOC emissions from the Solvent and Other Product use sector is therefore limited.

99. Considering that the Solvent and Other Product use categories are usually key sources of NMVOC emissions, the ERT encourages Luxembourg to try to provide an IIR. This will significantly improve the transparency of the inventory.

**Transparency:**

100. The air pollutant emission inventory for Solvent and Other Product Use sector is not sufficiently clear and comprehensible. Chapter 5 for solvents of the 2011 NIR report for GHG emissions provides pieces of information but is not sufficiently developed to enable the correct evaluation of the characteristics of the emission inventory for NMVOC. The ERT encourages Luxembourg to provide an IIR as outlined in the UNECE Reporting Guidelines.

**Completeness:**

101. The inventory is not fully complete. The following activities under NFR 3C are missing and it is not known if these activities are actually carried out in Luxembourg: 060301 Polyester processing, 060302 PVC processing, 060303 Polyurethane processing and 060304 Polystyrene foam processing

102. The ERT recommends Luxembourg to complete the inventory by estimating emissions from the missing emission sources if they exist using methodologies according to the EMEP/EEA Guidebook.

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

103. Luxembourg did not provide information of any recalculations.

**Comparability:**

104. The methodology used could be perfectly in line with a tier 3 method according to the EMEP/EEA Guidebook, 2009, if the emission factors were derived for national circumstances of Luxembourg and would be updated since 2000. The ERT encourages Luxembourg to set up an improvement programme for the methodology to consolidate the assumptions used and update the emission factors that have been unchanged since the year 2000.

**Accuracy and uncertainties:**

105. Chapter 5 for solvents of the 2011 NIR for GHG emissions provides pieces of information but is not sufficiently elaborated to enable correct evaluation of the accuracy of the emission inventory for NMVOC. Methodologies to adapt the Austrian situation to the conditions in Luxembourg are not sufficiently developed. The ERT concludes that while the bottom-up approach is based on the Austrian situation for 2000 and has not been updated since that year, the requirement for accuracy is not fully achieved. The ERT encourages Luxembourg to update the methodology for the most recent years.

106. The ERT encourages Luxembourg to conduct an uncertainty analysis for the sector.

107. In contrast to what Luxembourg responded to the ERT questions, NMVOC emissions reported under the NECD are not in accordance with what is reported

under chapter 5 for solvents of the 2011 NIR, as emissions for the years 2008 and 2009 are lower. For the years 1990 to 2007, emissions reported under the CLRTAP and under the NEDC are the same and in harmony with data presented in chapter 5 for solvents of the 2011 NIR. The ERT encourages Luxembourg to validate the emissions for these two years and to explain the discrepancies in the future IIR.

108. Improvement: Luxembourg did neither provide an inventory improvement plan nor inform about improvements already carried out.

109. During the review Luxembourg informed the ERT that a draft IIR is being prepared. The ERT commends Luxembourg for this effort and recommends to include the IIR in the next submission. The ERT encourages Luxembourg to provide an IIR and to explain the methodologies more transparently (please refer to the previous paragraphs). The ERT encourages Luxembourg to update the bottom-up methodology to better reflect the evolution of the emissions from 2000 and to develop country-specific emission factors.

#### Sub-Sector Specific Recommendations.

##### **Category issue 1: 3.A. Paints and Coatings – NMVOC**

110. The ERT encourages Luxembourg to provide an IIR report with a transparent description of sources used, expert estimations, activity levels (e.g. information on paint consumption) and other data. A comprehensive and detailed description of the methodology applied to identify the situation in Luxembourg based on conditions in Austria would be welcome.

111. The ERT encourages Luxembourg to update the share of solvent borne and water borne paints for the years 2000 to 2009 and also to take into account other types of paints such as powders and UV paints. Country-specific emission factors could also be developed.

112. The ERT encourages Luxembourg to implement an improvement programme on the methodology applied and to develop a country-specific approach. The present results fail to demonstrate if the EU directive 1999/13/EC on NMVOC from certain industrial activities and the directive 2004/42/EC on the solvent content of paints and varnishes have had an impact. Explanation for the relative stability of emissions would be useful. The lowest emission level for NFR 3A is observed for the year 2003. An explanation on this trend would be welcome.

##### **Category issue 2: 3.B. Dry Cleaning and Degreasing – NMVOC**

113. The ERT encourages Luxembourg to provide an IIR report with a clear description of sources, expert data, activity levels and other data used. A comprehensive and detailed description of the methodology applied to identify the situation in Luxembourg starting from conditions in Austria would be welcome.

114. The ERT encourages Luxembourg to update the assumptions used in the inventory by setting up an improvement programme for the methodology. Country-specific emission factors could also be developed.

115. The ERT encourages Luxembourg to implement an improvement programme for the methodology applied and to develop a country-specific methodology. The present results fail to demonstrate if the EU directive 1999/13/EC on NMVOC from certain industrial activities has had an impact. Explanation for the increase of emissions from 1990 to 2009 would be welcome.

**Category issue 3: 3.C. Chemical Products, Manufacture & Processing – NMVOC**

116. The ERT encourages Luxembourg to develop methodologies to estimate NMVOC emissions from SNAP sources 060301 to 060304 in case they exist in Luxembourg.

117. The ERT encourages Luxembourg to provide an IIR with a clear description of sources, expert data used and activity levels including a comprehensive and detailed description of the methodology applied to identify the situation in Luxembourg starting from the conditions in Austria.

118. The ERT encourages Luxembourg to develop an improvement programme for the methodology applied and to develop a country-specific methodology. The present results fail to demonstrate that the EU directive 1999/13/EC on NMVOC from certain industrial activities has had an impact. Explanation for the relative stability of emissions would be welcome to understand why emissions in 2009 are just slightly lower than in 1990 and why the lowest emission level could be observed in 2000.

119. Emission factors expressed in kg VOC/Mg solvent should be verified, for instance the emission factor for paint and ink manufacturing (SNAP 060307, SNAP 060308 and SNAP 060309) is 1,000 kg VOC/Mg solvent. A factor 1,000 means that solvents used are totally emitted into the atmosphere. However, in paint and ink manufacturing, the larger part of solvent used stay in the final product and thus a factor lower than 1,000 would be expected.

**Category issue 4: 3.D. Other uses of products – NMVOC**

120. The ERT encourages Luxembourg to provide an IIR with a clear description of sources, expert data used and activity levels. Furthermore, a comprehensive and detailed description of the methodology is recommended.

121. The ERT encourages Luxembourg to develop an improvement programme of the methodology used and to develop a country-specific methodology. The present results fail to demonstrate if the EU directive 1999/13/EC on NMVOC from certain industrial activities has had an impact. Explanation for the relative stability of emissions would be welcome to understand why emissions in 2009 are at the level of 1990.

## AGRICULTURE

### Review Scope:

Pollutants Reviewed		SO <sub>2</sub> , NO <sub>x</sub> , NMVOC, NH <sub>3</sub> , PM <sub>10</sub> & PM <sub>2.5</sub>		
Years		1990 – 2006 + (Protocol Years)		
NFR Code	CRF_NFR Name	Reviewed	Not Reviewed	Recommendation Provided
4 B 1 a	Cattle dairy	NH <sub>3</sub>		
4 B 1 b	Cattle non-dairy	NH <sub>3</sub>		
4 B 2	Buffalo			
4 B 3	Sheep	NH <sub>3</sub>		
4 B 4	Goats	NH <sub>3</sub>		
4 B 6	Horses	NH <sub>3</sub>		
4 B 7	Mules and asses	NH <sub>3</sub>		
4 B 8	Swine	NH <sub>3</sub>		
4 B 9 a	Laying hens	NH <sub>3</sub>		
4 B 9 b	Broilers			
4 B 9 c	Turkeys	NH <sub>3</sub>		
4 B 9 d	Other poultry			
4 B 13	4 B 13 Other	NH <sub>3</sub>		
4 D 1 a	Synthetic N-fertilizers	NMVOC, NH <sub>3</sub>		
4 D 2 a	Farm-level agricultural operations including storage, handling and transport of agricultural products			
4 D 2 a	Off-farm storage, handling and transport of bulk agricultural products			
4 D 2 c	N-excretion on pasture range and paddock unspecified (Please specify the sources included/excluded in the notes column to the right)			
4 F	Field burning of agricultural wastes			
4 G	Agriculture other(c)			
11 A	(11 08 Volcanoes)			
11 B	Forest fires			

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

### General recommendations on cross-cutting issues

122. Luxembourg reported NH<sub>3</sub> emissions for categories 4B1, 4B3, 4B4, 4B5, 4B6, 4B7, 4B9a. The AD used in calculation of these emissions can also be used to calculate NO<sub>x</sub>, PM<sub>2.5</sub> and PM<sub>10</sub> emissions using the default EFs provided in the EMEP/EEA Guidebook.

### **Transparency:**

123. Luxembourg did not submit an IIR so there is no transparency in respect to methodology, data sources or assumptions. The sectoral detail provided in the NFR tables for emissions of NH<sub>3</sub> makes only limited use of IE. Since there is no IIR the ERT cannot assess underlying assumptions and rationales for choices of data, methods and other inventory parameters. Due to the absence of data on livestock numbers and N fertilizer use trends are not transparent.

124. Luxembourg reports emissions of NO<sub>x</sub> for NFR categories 4B1, 4B3, 4B4, 4B5, 4B6, 4B7, 4B9a and 4D1a as NA. However, default EFs are provided for NO<sub>x</sub> emissions from agriculture in the EMEP/EEA Guidebook. The ERT recommends Luxembourg to carry out the inventory of NO<sub>x</sub> emissions for these sources.

**Completeness:**

125. Luxembourg reports NH<sub>3</sub> emissions for categories 4B1, 4B3, 4B4, 4B5, 4B6, 4B7, 4B9a. As Luxembourg already has collected AD used in the calculation of these emissions, the ERT recommends Luxembourg to also calculate emissions of NO<sub>x</sub>, PM<sub>2.5</sub>, PM<sub>10</sub> using the default EFs provided by the EMEP/EEA Guidebook.

126. Instead of using the notation key NA, Luxembourg should use the notation key NE for NO<sub>x</sub>, PM<sub>2.5</sub> and PM<sub>10</sub>, since AD is available as default EFs are provided in the EMEP/EEA Guidebook.

127. Comparability: Due to lack of an IIR it is not possible to determine if the methods used are consistent with those proposed in the EMEP/EEA Guidebook. The Party replied that the 'AD is the same as for the GHG inventory.. Mainly Tier 1 methodologies and default EFs are applied.' The ERT considers that, given the small-sized country of the Party, country-specific emission factors would not be appropriate. The activity data reported in the UNFCCC NIR are suitable for use in this inventory.

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

128. Luxembourg did not provide information on recalculations. The sector-specific recalculations reported in the UNFCCC NIR are not relevant to the air pollutant emissions inventory.

129. Emissions of NH<sub>3</sub> between 1990 and 2009 seem fairly constant. However, this is not consistent with reports of livestock numbers and N fertilizer use reported in the NIR. While numbers of other cattle (the largest source of NH<sub>3</sub> emissions) and pigs changed little over the years there has been a decrease of c. 50% in the numbers of dairy cattle and c. 30% in the use of N fertilizer from 1990 to 2009. Since dairy cows are the second largest source of NH<sub>3</sub> emissions such a decrease should be reflected in NH<sub>3</sub> emissions if these were calculated using a Tier 1 approach. It is not clear to the ERT whether a Tier 1 method was used. If Luxembourg has used a Tier 2 approach then decreased numbers of dairy cows would not automatically lead to a decrease in NH<sub>3</sub> emissions from that source.

Kommentar [i2]: ?about?

130. Table 6-4 of the NIR gives livestock population and trends for 1990-2009.

**Accuracy and uncertainties:**

131. Luxembourg did not provide an uncertainty analysis. The UNFCCC NIR report states that for Agriculture 'The uncertainty associated with activity statistics is generally believed to be quite small.' The ERT still encourages Luxembourg to undertake an uncertainty analysis for the Agriculture sector in order to help support

the improvement process and to provide an indication of the reliability of the inventory data.

132. Luxembourg did neither provide information on QA/QC procedures carried out in the inventory for the Sector, nor a QA/QC plan.

133. The Party acknowledges that the AP inventory is calculated and compiled by a single expert of the Environment Agency and hence has not been reviewed by third party experts not involved in preparing the inventory for the sector.

134. No information is available as to whether there has been an extensive review for key categories. From the response of the Party it does not seem that any periodic internal review of inventory preparation has taken place. The UNFCCC NIR report does cite category-specific QA/QC procedures.

135. The ERT encourages Luxembourg to record in any future IIR a report on QA/QC procedures, to provide a sector review and a QA/QC plan.

#### **Improvement:**

136. Luxembourg did not provide specific information on planned Sectoral improvements. The ERT notes that in the UNFCCC NIR, with respect to 4D3, (Indirect Emissions from Agricultural Soils), 'reviewing the ammonia balance to refine first estimates for this source sub-category' is listed as a planned improvement for the GHG Inventory. Such a review will also be of benefit to the estimation of total NH<sub>3</sub> emissions for the CLRTAP and NECD.

137. During the review Luxembourg informed the ERT that a draft IIR is being prepared. The ERT commends Luxembourg for this and recommends to include the IIR in the next submission.

#### Sub-Sector Specific Recommendations.

138. The reply from the Party indicates that Tier 1 emission factors are used. The ERT assumes that these were obtained from the EMEP/EEA Guidebook (2009). The ERT does not consider it necessary for the Party to develop country-specific emission factors. Activity data derived from national statistics are considered appropriate. The only apparent shortcomings are the omission of NO<sub>x</sub>, PM<sub>2.5</sub> and PM<sub>10</sub> of emissions for categories 4B1, 4B3, 4B4, 4B5, 4B6, 4B7 and 4B9a. The ERT recommends estimates of these could be made using the default EFs provided by the EMEP/EEA Guidebook since the necessary activity data are available.

#### Sub-Sector Specific Recommendations.

##### **Category issue 1: 4B1, 4B3, 4B4, 4B5, 4B6, 4B7, 4B9a – NO<sub>x</sub>, PM<sub>2.5</sub>, PM<sub>10</sub>**

139. The ERT encourages Luxembourg to calculate emissions of these pollutants using the default EFs provided by the EMEP/EEA Guidebook together with the AD used in the estimation of NH<sub>3</sub> emissions for these categories. Luxembourg replied to thank the ERT for this advice to consider this issue, and will include estimates based on EFs provided by the GB in a next submission. In addition, the Party clarified that

the same AD is used as for the GHG inventory. Therefore, information on AD can be found in the NIR 2011.

**Category issue 2: 4D1a – NO<sub>x</sub>**

140. The ERT encourages Luxembourg to calculate emissions of NO<sub>x</sub> using the default EF provided by the EMEP/EEA Guidebook together with the AD used in the estimation of NH<sub>3</sub> emissions for this category. Luxembourg thanked the ERT for this advice and replied, to consider this issue, and will include estimations based on EFs provided by the GB in a next submission. In addition, the Party explained that the same AD is used as for the GHG inventory, so, information on AD can be found in the NIR 2011.

## WASTE

### Review Scope:

<b>Pollutants Reviewed</b>		SO <sub>2</sub> , NO <sub>x</sub> , NMVOC, NH <sub>3</sub> , PM <sub>10</sub> & PM <sub>2.5</sub>		
<b>Years</b>		1990 – 2009		
<b>NFR Code</b>	<b>CRF_NFR Name</b>	<b>Reviewed</b>	<b>Not Reviewed</b>	<b>Recommendation Provided</b>
6.A	solid waste disposal on land	x	x	x
6.B	waste-water handling	x	x	x
6 C a	6 C a Clinical waste incineration (d)	x	x	x
6 C b	Industrial waste incineration (d)	x	x	x
6 C c	Municipal waste incineration (d)	x	x	x
6 C d	Cremation	x	x	x
6 C e	Small scale waste burning	x	x	x
6.D	other waste (e)	x	x	x
Note: Where a sector has been partially reviewed (e.g. some of the NFR codes please indicate which have and which have not in the respective columns.				

### General recommendations on cross-cutting issues.

#### **Transparency:**

141. Luxembourg did not provide any emissions for the Waste sector (NFR 6) and Sector – Other (NFR 7). The ERT encourages Luxembourg to develop an inventory for these sectors in accordance with the methodology provided in the EMEP/EEA Guidebook, 2009, and to report the emissions in NFR tables, and also to develop an IIR in accordance with the Reporting Guidelines for the Convention.

#### **Completeness:**

142. The inventory submitted by Luxembourg is not complete for the Waste sector (NFR 6) and Sector – Other (NFR 7).

143. In 2009 Luxembourg submitted NFR tables from 1990 until 2007 under the CLRTAP. However, the submission did not include emission data for the Waste sector for the years 2008 and 2009. The latest NFR tables for the Waste sector are for 2007 and are not in full compliance with NFR09 due to the fact that when the submission was made, an old version of the NFR template was used. The new NFR09 template for the waste sector includes sub-categories for NFR 6C: 6.C.a Clinical waste incineration (d), 6 C b Industrial waste incineration (d), 6.C,c Municipal waste incineration (d), 6 C d Cremation, 6 C e Small scale waste burning. To the question raised by the ERT, Luxembourg replied that emissions from waste incineration are aggregated under 1A1a and that the estimates are based on measured emissions reported by the plants. Luxembourg also informed the ERT about completing the inventory by adding emissions from cremation and small scale waste burning for the next submission. The ERT recommends Luxembourg to report waste incineration emissions separately under the correct NFR category.

144. No IIRs was submitted in 2011.

145. The ERT encourages Luxembourg to develop an inventory for these Sectors according to the methodology provided in the EMEP/EEA Guidebook and to report the emissions in NFR tables, and also to develop an IIR in accordance with the Reporting Guidelines for the Convention.

**Consistency, including recalculation and time-series:**

146. The Party has not reported any data regarding the waste sector, therefore the ERT is unable to comment on them. The ERT recommends Luxembourg to provide a full time-series of NFR Tables and to prepare an IIR including detailed information on any recalculations carried out as well as the reasons for any recalculations.

**Comparability:**

147. Due to the lack of emission data and an IIR, the ERT was unable to estimate comparability of the inventory with other countries' inventories. The ERT recommends Luxembourg to report emissions in a transparent way and to describe the methodologies applied - particularly where country-specific - in the future IIR, and providing sufficient activity data and emission factors to support those methodologies.

148. Accuracy and uncertainties: Due to QA/QC procedures carried out by Luxembourg. As soon as an inventory has been carried out, the ERT encourages the Party to undertake an uncertainty analysis for the Waste Sector and Sector - Other in order to help feed into the improvement process and to provide an indication of the reliability of the inventory data.

149. Luxembourg did not report any emissions under the Waste sector and neither provided an IIR. Therefore, no information on an uncertainty analysis or on QA/QC procedures are available. The ERT encourages the Party to estimate emissions from the waste sector and to carry out an uncertainty analysis for the emissions in order to support the improvement process and to provide an indication of the reliability of the inventory data. Furthermore, the ERT recommends the Party to provide a QA/QC plan and information on QA/QC activities carried out in the inventory.

150. Improvement: Due to the lack of an IIR, no information has been available to the ERT about improvements already carried out by Luxembourg for these two sectors.

151. During the review week Luxembourg explained their plans for improvements encompassing the revision of notation keys, calculation of NMVOC emissions and estimating emissions from Compost production and sludge spreading. The establishment of an emissions inventory for waste disposal on land is also foreseen. Moreover, the Party has plans to submit an IIR in a next submission. The ERT commends Luxembourg for this development.

152. However, the ERT recommends the Party to find out possibilities to calculate emissions for all pollutants covered by this sector for which methodologies are provided in the EMEP/EEA Guidebook 2009 version.

### Sub-Sector Specific Recommendations.

#### **Category issue 1: 6.A Solid waste disposal on land**

153. Luxembourg does not calculate emissions for this category. During the review week Luxembourg explained that waste disposal on land will be considered in the next submission including NMVOC emission calculation according to the 2009 EMEP/EEA Guidebook. The ERT commends Luxembourg for this development.

154. The ERT recommends Luxembourg to estimate air pollutants emitted from solid waste disposals on land (especially NMVOC) using the 2009 EMEP/EEA Guidebook default emission factors. A pollutant/CH<sub>4</sub> ratio could be applied to CH<sub>4</sub> emission estimated, available from the UNFCCC.

#### **Category issue 2: 6B Wastewater handling**

155. Luxembourg does not estimate emissions from wastewater handling.

156. During the review week Luxembourg explained that emissions could be estimated, but that this would need more investigation with regard to the activity data (m<sup>3</sup> waste water treated annually).

157. The ERT encourages the Party to estimate NH<sub>3</sub> and NMVOC emissions according to the methodology provided in the EMEP/EEA Guidebook 2009.

#### **Category issue 3: 6.Ca Clinical waste incineration:**

158. Luxembourg does not calculate emissions from clinical waste incineration. The latest submitted NFR tables from 2007 for this sector are not in full compliance with NFR09 due to the fact that when the submission was made an old NFR template was used. The new NFR09 for waste sector includes sub-categories for 6C: 6.C.a Clinical waste incineration (d), 6-C.b Industrial waste incineration (d), 6.C.c Municipal waste incineration (d), 6.C.d Cremation, 6.C.e Small scale waste burning.

159. During the review week Luxembourg explained that emissions from Waste incineration are reported under 1A1a and that the estimates are based on measured emissions reported by the plants.

160. The ERT recommends Luxembourg to estimate emissions according to the EMEP/EEA Guidebook 2009 or to provide an appropriate notation key. If other methods are applied than provided in the EMEP/EEA Guidebook these should be described in the IIR.

#### **Category issue 4: 6.Cb Industrial waste incineration:**

161. Luxembourg does not calculate emissions from industrial waste incineration. The last submitted NFR tables from 2007 are not in full compliance with NFR09.

162. During the review week Luxembourg explained that emissions from waste incineration are reported under 1A1a.

163. The ERT recommends Luxembourg to estimate emissions according to the EMEP/EEA Guidebook 2009 or to provide an appropriate notation key. If other

methods are applied than provided in the EMEP/EEA Guidebook they should be described in the IIR.

**Category issue 5: 6.Cc Municipal waste incineration:**

164. Luxembourg does not calculate emissions from municipal waste incineration. The last submitted NFR tables from 2007 are not in full compliance with NFR09 due to the fact that when the submission was made an old NFR template was used. The new NFR09 for waste sector includes sub-categories for 6C: 6.C.a Clinical waste incineration (d), 6.C.b Industrial waste incineration (d), 6.C.c Municipal waste incineration (d), 6.C.d Cremation, 6.C.e Small scale waste burning.

165. During the review week Luxembourg explained that emissions from waste incineration are reported under 1A1a.

166. The ERT encourages Luxembourg to estimate emissions according to EMEP/EEA Guidebook 2009 or to provide an appropriate notation key. If other methods are applied than provided in the EMEP/EEA Guidebook they should be described in the IIR.

**Category issue 6: 6 C d Cremation:**

167. Luxembourg does not calculate emissions from cremation. The last submitted NFR tables from 2007 are not in full compliance with NFR09 due to the fact that when the submission was made an old NFR template was used. The new NFR09 for waste sector includes sub-categories for 6C: 6.C.a Clinical waste incineration (d), 6.C.b Industrial waste incineration (d), 6.C.c Municipal waste incineration (d), 6.C.d Cremation, 6.C.e Small scale waste burning.

168. The ERT encourages Luxembourg to estimate emissions according to the EMEP/EEA Guidebook 2009. If other methods are applied than provided in the EMEP/EEA Guidebook these should be described in the IIR..

**Category issue 7:6 C e Small scale waste burning**

169. Luxembourg does not calculate emissions from cremation. The last submitted NFR tables from 2007 are not in full compliance with NFR09.

170. The ERT encourages Luxembourg to estimate emissions according to the EMEP/EEA Guidebook 2009. In If other methods are applied than provided in the EMEP/EEA Guidebook these should be described in the IIR.

**Category issue 8: 6 D Other waste**

171. Luxembourg reports NA, NO and NR for this sub-sector as well as zero-values for MNVOC and NH<sub>3</sub>.

172. During the review week Luxembourg explained that data are available on Compost production and sludge spreading, and that Luxembourg will estimate these emissions using EFs from the EMEP/EEA Guidebook 2009.

The ERT welcomes this development and encourages the Party to use notation keys instead of zero-values.

**Category issue 9: 7 A Other (included in national total for entire territory)**

173. Luxembourg does not calculate emissions for NFR 7 and reports NA, NO and NR for this subsector. If there are no activities in this sector the ERT recommends Luxembourg to use NO instead of NA or NR for the whole category. If Luxembourg chooses to use the notification key NA instead, an explanation should be provided in the IIR.

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

1. Responses to preliminary question raised prior to the review:
  - Luxembourg-Energy-20-06-11-Q1-reply.doc
  - Luxembourg-Transport+Mobile-09-06-11-Q2-LUResponse110701.doc
  
2. Responses to questions raised during the review:
  - Luxembourg-General-27-06-2011-reply.docx
  - Luxembourg-Energy-20-06-11-Q1-reply.doc
  - Luxembourg-Transport+Mobile-29-06-11-Q2-LUResponse110604.doc
  - Transport: Spreadsheets: Aviation.xls; Energy1A1-5\_110627; and Navigation.xls
  - Luxembourg-Waste-x-06-11-replies.doc