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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
FINLAND

CONTENT

INTRODUCTION

1. The mandate and overall objectives for the emission inventory review process under the LRTAP Convention is given by the UNECE document '*Methods and Procedures for the Technical Review of Air Pollutant Emission Inventories reported under the Convention and its Protocols'* [(1)] – hereafter referred to as the 'Methods and Procedures' document.

2. This annual review, has concentrated on SO_2, NO_X, NMVOC, NH_3, plus PM_{10} & $PM_{2.5}$ for the time series years 1990 – 2016 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 Finland coordinated by the EMEP emission centre CEIP acting as review secretariat. The review took place from 18th June 2018 to 21th June 2018 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 – Ben Pearson (UK), Energy – Marion Pinterits (EC) and Isabelle Higuet (Belgium), Transport – Magdalena Zimakowska-Laskowska (Poland) and Giorgos Melios (Greece), IPPU – Julien Jabot (Norway) and Ben Pearson (UK), Agriculture & Nature – Anais Durand (France), Waste – Kees Peek (Netherlands).

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

[1] Methods and Procedures for the Technical Review of Air Pollutant Emission Inventories reported under the Convention and its Protocols. Note by the Task Force on Emission Inventories and Projections. ECE/EB.AIR/GE.1/2007/16
http://www.ceip.at/fileadmin/inhalte/emep/review/RevGuid_ece.eb.air.ge.1.2007.16.e.pdf

PART A: KEY REVIEW FINDINGS

5. Finland's inventory is well in line with the EMEP/EEA Inventory Guidebook and UNECE Reporting Guidelines. The ERT concludes from its assessment that Finland's data submission and informative inventory report (IIR) are good examples of high quality inventory submissions, with an actual improvement process. No potential technical correction was identified for Finland.

6. Nevertheless, the ERT identified some minor issues and provides recommendations for improvements in this report, e.g. on still better transparency of the IIR, further details on tier 2 QA/QC information at sectoral level, improvements for some notation keys, some improvements for completeness.

INVENTORY SUBMISSION

7. In its 2018 submission Finland reported emissions for its protocol base years and a full time series to 2016 (the latest year) for its protocol pollutants in the NFR format. In addition, Finland has also provided a full NFR 1980 – 1989 time series for NO_X, SO_X, and NH_3 and a full NFR 1987 – 1989 time series for NMVOC. Finland reported 2016 gridded emission data and large point sources for Gothenburg protocol pollutants. Finland also submitted a detailed IIR.

8. Emissions are reported in NFR14 categories with high level of detail. Transport emissions are based on fuel sold.

9. The CLRTAP inventory submitted by Finland is of good quality and is in general well documented in the informative inventory report (IIR).

KEY CATEGORIES

10. Finland has compiled and presented in its IIR a level and trend Key Category Analysis (KCA) for the following pollutants: NO_X, CO, NMVOC, SO_X, NH_3, TSP, PM_{10} and $PM_{2.5}$**,** BC**,** heavy metals, PCDD/F, PAHs, HCB and PCBs. All sectors have been included. The level assessment has been performed for 2016 for all pollutants.

QUALITY

Transparency

11. The ERT recognises the level of effort undertaken by Finland to provide an inventory with a significant level of detail to undertake a detailed review. The Finnish IIR is detailed and well presented, with EF references clearly stated, and activity data presented at an appropriate level of detail for almost all sectors.

12. Overall the ERT was impressed with the quality of Finland's IIR, and the Party has indicated in response to ERT questions that most issues identified are due to the limited resources available to the inventory team, particularly due to extensive efforts on recalculations and other improvements. The ERT recognises this constraint and

would encourage the allocation of additional resources if possible to compliment the excellent work hitherto established by the Finnish inventory team.

13. The ERT identified a number of inconsistent, missing or duplicated references in the report, and typographical errors in some sections of text. Whilst the ERT did not find that these impacted the transparency significantly, particularly due to the Party's prompt and detailed responses to ERT questions. The ERT nevertheless encourages Finland to attempt to resolve these as far as reasonably possible for future submissions in order to improve the navigation within the IIR.

14. Finland uses notation keys well in its NFR submission, except for a small number of instances which were identified by sector experts and subsequently resolved in communication with the Party. The ERT commends this approach and the Party's stated intention to further improve notation key management through improved QA/QC procedures.

15. The ERT noted that activity data were not presented in the NFR tables for a number of sectors which have emissions, however data for many of these sectors is available in the Party's IIR. Finland has indicated in response to ERT enquiries that it is not possible always to always present AD in the NFR, especially for the IPPU sector, due to the confidentiality of bottom-up data which is used to estimate parts of the emissions in these sectors, which often represents a very small number of sites. The ERT recommends that Finland seeks to present non-confidential alternate sources of activities where possible if these are representative of sector activity, in order to facilitate the analysis of IEF trends and comparability in future submissions. Alternatively, where this is not possible due to confidentiality, it is recommended to use the notation key "C" instead of the currently used "NA"[2].

Completeness

16. The ERT acknowledges the effort to which Finland has gone to provide estimates of emissions for all sub-sectors and all pollutants reviewed. No overarching issues of completeness were identified in the general review of NFR tables, and the ERT did not consider there to be any significant gaps in the Party's inventory.

Consistency, including recalculations and time-series

17. Finland has undertaken a number of recalculations for its 2018 submission, across the majority of sectors and years. The ERT commends Finland for including descriptions of these recalculations in the IIR, in most cases with sufficient detail to allow a detailed review for every sector. These descriptions include the rationale for the recalculations as well as the impacts of the changes on the national estimates and time series.

[2] *Comment from Finland: Finland notes that the recommendation cannot be directly implemented as such because the sources included under a NFR can be various, out of which some confidential, some not. We try to find a way to explain this more clearly in the IIR or in the NFR*

18. Where the time series is not consistent, Finland has in general provided adequate explanations either in its IIR or in response to ERT questions. The ERT thanks Finland for its active and constructive engagement in the review process.

Comparability

19. The ERT considers that the inventory of Finland is comparable with those of other reporting parties. The allocation of source categories follows that of the EMEP/UNECE reporting Guidelines. The ERT encourages Finland to continue with this approach for national inventory calculation.

CLRTAP/NECD comparability

20. The ERT noted that there are no differences between the estimates provided by Finland under LRTAP and NECD for any sector or reported pollutant.

Accuracy and uncertainties

21. The ERT commends Finland for compiling uncertainty estimates using a Tier 2 Monte-Carlo model as recommended in the EMEP/EEA guidance, and furthermore for presenting detailed results and methodological descriptions in its IIR.

22. The ERT noted however that uncertainty estimates only covered the latest year's emission data in its UNECE submission. Finland indicated in its IIR that it plans to develop estimates of trend uncertainties, and during the review the Party indicated that this should be completed in time for the next submission. The ERT encourages Finland to compile these and looks forward to the provision of trend uncertainty estimates in future submissions.

Verification and quality assurance/quality control approaches

23. Finland's IIR describes the quality assurance/quality control (QA/QC) plan implemented for its inventory in detail, in accordance with the EMEP/EEA Guidebook (Inventory Management Chapter). This includes general Tier 1 QC procedures, as well as Tier 2 source category-specific procedures for key categories and for those individual categories in which significant methodological and/or data revisions have occurred.

24. The ERT commends Finland on its general quality assurance/quality control (QA/QC) activities, and in particular on the documentation of sector specific checks throughout the IIR. The ERT encourages Finland to continue to provide information on sector specific information on QA/QC procedures in future submissions.

FOLLOW-UP TO PREVIOUS REVIEWS

25. Finland provided detailed responses to the questions identified in the stage 2 review on outliers of implied emissions factors. Due to the quality of the IIR and

Finland's responsiveness the ERT were able to review the inventory in detail and provide a number of detailed recommendations.

AREAS FOR IMPROVEMENTS IDENTIFIED BY FINLAND

26. The Finnish IIR sets out in detail improvements carried out in the latest submission, outlines a history of previous improvements, and identifies several areas for improvement in future submissions. Identification of improvements is based on previous reviews, and on a continuous basis according to annual work programmes. Prioritisation of improvements is based on uncertainty analysis as recommended in EMEP/EEA guidance, and on the availability of resources allocated to the team.

TECHNICAL CORRECTIONS CONSIDERED AND OR CALCULATED BY ERT

27. The ERT did not identify significant inconsistencies in the inventory (higher than the 2% threshold) which would result in potential technical corrections (PTC) or in a request for revised estimates from the Party.

PART B: RECOMMENDATIONS FOR IMPROVEMENTS TO THE PARTY

CROSS CUTTING IMPROVEMENTS IDENTIFIED BY THE ERT

28. The ERT identifies the following cross-cutting issues for improvement:

(a) The ERT encourages Finland to elaborate on the rationale and explanation for the recalculations and their implication for trends in some sectors of the IIR.

(b) The ERT noted that details of methods, data sources and assumptions for some sources in theIIR had not been updated to be consistent with recent revisions and methodological changes. The ERT encourages Finland to enact these updates in time for future submissions.

(c) The ERT encourages Finland to provide more detailed descriptions of the time series in the IIR, in particular for sources which have large step changes in emissions throughout the time series.

(d) The ERT encourages Finland to seek to apply more rigorous checking of text and references in the IIR prior to submission, in order to improve transparency and accessibility for users.

(e) The ERT noted that activity data were not presented in the NFR tables for a number of sectors which have emissions, however data for many of these sectors is available in the Party's IIR. The ERT would encourage Finland to report these data in NFR tables where possible.

(f) The ERT encourages Finland to seek to move to higher tier methodologies for key sources where possible, particularly where noted by Transport and Agriculture sector experts.

SECTOR SPECIFIC RECOMMENDATIONS FOR IMPROVEMENTS IDENTIFIED BY ERT

ENERGY

Review Scope

Pollutants Reviewed		SO_2, NO_X, NMVOC, NH_3, CO, PM_{10} & $PM_{2.5}$, Cd, Hg, Pb, Dioxin, PAH, HCB, PCBs		
Years		1990 – 2016		
Code	**Name**	**Reviewed**	**Not Reviewed**	**Recommendation Provided**
1A1a	Public electricity and heat production	X		X
1A1b	Petroleum refining	X		X
1A1c	Manufacture of solid fuels and other energy industries	X		X
1A2a	Iron and steel	X		X
1A2b	Non-ferrous metals	X		X
1A2c	Chemicals	X		X
1A2d	Pulp, Paper and Print	X		X
1A2e	Food processing, beverages and tobacco	X		X
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	X		X
1A2gviii	Stationary combustion in manufacturing industries and construction: Other	X		X
1A3ei	Pipeline transport	X		
1A3eii	Other	X		
1A4ai	Commercial/institutional: Stationary	X		
1A4bi	Residential: Stationary	X		
1A4ci	Agriculture/Forestry/Fishing: Stationary	X		
1A5a	Other stationary (including military)	X		
1B1a	Fugitive emission from solid fuels: Coal mining and handling	X		
1B1b	Fugitive emission from solid fuels: Solid fuel transformation	X		X
1B1c	Other fugitive emissions from solid fuels	X		
1B2ai	Fugitive emissions oil: Exploration, production, transport	X		
1B2aiv	Fugitive emissions oil: Refining / storage	X		
1B2av	Distribution of oil products	X		
1B2b	Fugitive emissions from natural gas (exploration, production, processing, transmission, storage, distribution and other)	X		X
1B2c	Venting and flaring (oil, gas, combined oil and gas)	IE		
1B2d	Other fugitive emissions from energy production	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

29. The ERT finds that Finland has provided a detailed and generally transparent emission inventory. Estimates are provided at the most detailed level for all energy sectors. The reported methodology and emission factors in the IIR are considered by the ERT to be transparent and well described per sub-sector. The ERT encourages Finland to continue with this level of detail and commends Finland for providing details for all sub-sectors as recommended in the previous review.

30. The ERT encourages Finland to explain the trends for each key category in the IIR. Regarding the IIR, the trends are already explained in the general part of the IIR and it is planned to include the explanations on the trends by NFR category in the submission 2019.

31. The ERT notes that in the IIR Finland provides tables which show the evolution of fuel consumption per fuel, per year and by NFR code (1A1, 1A2,…). The ERT commends Finland for providing these detailed explanations as recommended in the previous review. However, these tables have been taken from Finland's NIR and are not consistent with the energy use reported in the NFR tables. The ERT encourages Finland to update the IIR with the data in the NFR tables to be consistent.

32. The ERT notes that the number of Finnish energy plants is given in the IIR for the NFR codes 1A1 and 1A2 in the tables 2.9 and 2.12. The ERT encourages Finland to provide the list of sub-sectors included in NFR codes 1A2f (Stationary combustion in manufacturing industries and construction: Non-metallic minerals) and 1A2gviii (Stationary combustion in manufacturing industries and construction: Other)in the energy part of the IIR to improve transparency.

33. The ERT encourages Finland to include the answers that were provided to questions raised by the ERT during the review week in future submissions (see Sub-sector Specific Recommendations).

Completeness

34. The ERT considers the energy sector to be complete and comprehensive with good levels of detail in the methodology descriptions. The ERT commends Finland for the absence of the notation key "NE" reported in the energy sector.

Consistency including recalculation and time series

35. The time series are in general consistent for the energy sector.

36. The ERT encourages Finland to justify the outliers and to include explanations for all large fluctuations highlighted during the stage 2 review.

37. The ERT encourages Finland to correct the data in order to remove outliers. During the review, mistakes in the inventory leading to outliers were highlighted: misallocation of SO_2 emissions in 2001 (1A2b), a missing petroleum coke entry from one facility operator in 1997 (1A1b), erroneous entries by facility operators in 2008 (1A1a) and in 1991 and 1999 (1A2gviii). ERT recommends Finland to investigate further and to correct these inaccuracies if necessary.

38. The ERT commends Finland for the recalculation of the fuel consumption time series, the update of the allocation of emissions to energy and industrial sectors and the addition of the NMVOC emissions from natural gas distribution.

Comparability

39. The ERT notes that the inventory of Finland is comparable with those of other reporting parties. The ERT commends Finland for using methodologies in accordance with the EMEP/EEA 2016 Guidebook for the energy sector and for providing complete NFR tables with a minimal use of notation keys. The ERT encourages Finland to continue providing comparable inventory data.

40. The ERT commends Finland for providing a comparison between the CRF tables and the NFR tables. However, this comparison only explains a small part of the differences. In response to the review, Finland indicated that it will investigate and harmonize the allocation of emissions between the greenhouse gas inventory and the air pollutant inventory where possible until the next submission in 2019. ERT commends Finland for this future investigation. ERT encourages Finland to do the same work for the activity data.

Accuracy and uncertainties

41. The ERT commends Finland for the high-tiered methods (tier 2 and 3) used for many of the identified key categories. The ERT commends Finland for estimating a quantitative uncertainty analysis with a Monte Carlo simulation.

42. The ERT notes that the QA/QC procedures are explained in the IIR including energy-specific checks and verification (in particular, the data obtained from VAHTI is cross-checked with data reported to the UNFCCC). The ERT encourages Finland to continue explaining the various QA/QC procedures used and encourages to continue developing verification approaches in order to ensure a good quality inventory.

Improvement

43. The ERT notes that Finland has provided information on improvements planned for the next submission. The ERT commends Finland for providing this information and encourages Finland to continue describing planned improvements in the next submission.

Sub-Sector Specific Recommendations

Category issue 1: 1.A.1.c Manufacture of solid fuels and other energy industries – All pollutants

44. In source category 1A1c all emissions are flagged as "NO". However there is coke production in Finland. Finland responded that all emissions from fuel use in coking are allocated to the category 1A2a. The coking plant is part of a very large steel factory complex and at the moment all fuel based emissions from that complex are allocated under the category 1A2a. However, the fuel use based emissions in the greenhouse gas inventory from coking are allocated to the category 1A1c. Therefore, the difference between the NFR and CRF tables is due to differences in allocation of emissions. The ERT encourages Finland to change the notation keys for this sector or to consider the need of changing the allocation of the emissions.

Category issue 2: 1.B.1.b Fugitive emission from solid fuels – NOx and CO

45. In source category 1B1b, according to the NFR tables, the emissions of NO_X and CO are not applicable ("NA") for the fugitive emissions from the production of coke while the EMEP/EEA Emission Inventory Guidebook 2016 suggests emission factors in table 3-1. Finland answered that these emissions are allocated under the category 1A2a and it will investigate the possibility to split between energy and that process emissions for the 2019 submission. The ERT encourages Finland to change the notation keys for these pollutants or to try to split these emissions.

Category issue 3: 1.A.1 and 1.A.2 Stationary Combustion - PCBs

46. The ERT noted that according to the NFR tables, the emissions of PCBs are not applicable ("NA") for the combustion in some sectors in 1A1 and 1A2 while the EMEP/EEA Emission Inventory Guidebook 2016 suggests emission factors for PCBs for solid fuels and biomass. Finland answered that following the recalculation of the time series 1990-2015 there was no time for thorough checks and that these emissions were not included in the 2018 submission. However, PCB emissions from these categories will be calculated and reported in the 2019 submission. The ERT strongly recommends Finland to estimate PCB emissions from stationary combustion.

Category issue 4: 1.A.2 Stationary Combustion – NH_3

47. The ERT noted that according to the NFR tables, the emissions of NH_3 are not applicable ("NA") for the combustion in some sectors in 1A2 while the EMEP/EEA Emission Inventory Guidebook 2016 suggests emission factors for NH_3 for biomass. Finland responded that it had checked the possibility of ammonia emissions withthe plants in 2015 and the conclusion from the discussions with energy industry emission experts was that ammonium emissions are not occurring and it would be incorrect to calculate these as ammonia emissions can be expected only from NO_X abatement using SNCR/SCR techniques, however, these units are rare in Finland. Following the

EMEP/EEA Emission Inventory Guidebook, the NH_3 EF for biomass in 1A2 is 37 g/GJ and the source is : “Roe S.M., Spivey, M.D., Lindquist, H.C., Kirstin B. Thesing, K.B., Randy P. Strait, R.P & Pechan,E.H. & Associates, Inc, 2004:Estimating Ammonia Emissions from Anthropogenic Non-Agricultural sources. Draft Final Report April 2004”. In this report, it’s noticed that the emission factors are established considering that “all emissions are assumed to be uncontrolled”. Other emission factors are included in this report in the case of SCR or SNCR. The ERT strongly recommends Finland to estimate NH_3 emissions from stationary combustion while being aware that there will be a likely revision of the Tier 1 NH_3 emission factor for biomass from these sectors in the Guidebook[3].

Category issue 5: 1.B.1.b Fugitive emission from solid – NMVOC

48. During the review the ERT noticed that in the table 2.50 in the IIR, the IEF for NMVOC seems to be 77,6 g/Mg coke while in the Guidebook, the EF for NMVOC is 7,7 g/Mg coke. Finland answered that there is a mistake in the IIR. The ERT encourages Finland to correct the table accordingly.

Category issue 6: 1.B.2.b Fugitive emission from natural gas – Activity data

49. Concerning the sector 1B2b, ERT noticed that there is no source of the activity data in the IIR and the activity data are not included in the NFR tables. Finland answered that the activity data presented in the IIR is from the Energy Statistics (Statistics Finland, 2017). The ERT encourages Finland to include information on the activity data source in the IIR and to include the figures in the NFR tables.

[3] Comment of Finland: *Finland studies carefully if NH3 emissions could be emitted in the Finnish conditions, and, instead of estimating and reporting emissions will document the results in the IIR, if it is concluded that these emissions are not occurring.*
However, Finland believes that the EF information provided in the Guidebook is not accurate.

TRANSPORT

Review Scope

Pollutants Reviewed		All		
Years		1990 – 2016		
Code	**Name**	**Reviewed**	**Not Reviewed**	**Recommendation Provided**
1A2gvii	Mobile Combustion in manufacturing industries and construction	X		
1A3ai(i)	International aviation LTO (civil)	X		
1A3ai(ii)	International aviation cruise (civil)	X		
1A3aii(i)	Domestic aviation LTO (civil)	X		
1A3aii(ii)	Domestic aviation cruise (civil)	X		
1A3bi	Road transport: Passenger cars	X		X
1A3bii	Road transport: Light duty vehicles	X		X
1A3biii	Road transport: Heavy duty vehicles and buses	X		X
1A3biv	Road transport: Mopeds & motorcycles	X		X
1A3bv	Road transport: Gasoline evaporation	X		X
1A3bvi	Road transport: Automobile tyre and brake wear	X		
1A3bvii	Road transport: Automobile road abrasion	X		
1A3c	Railways	X		
1A3di(ii)	International inland waterways	X		
1A3dii	National navigation (shipping)	X		
1A4aii	Commercial/institutional: Mobile	X		
1A4bii	Residential: Household and gardening (mobile)	X		
1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	X		
1A4ciii	Agriculture/Forestry/Fishing: National fishing	X		
1A5b	Other, Mobile (including military, land based and recreational boats)	X		
1A3di(i)	International maritime navigation	X		
1A3	Transport (fuel used)	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

50. Finland has provided a detailed and generally transparent emission inventory. Estimates are provided at the most detailed level for all transport subsectors. Finland's methodology and emission factors in the IIR are considered by the ERT to be transparent by the ERT. The ERT encourages Finland to include more details in the IIR including a better description of the emission factors included in Finland's national model LIPASTO.

Completeness

51. The ERT considers the transport sector to be complete and comprehensive.

Consistency including recalculation and time series

52. Finland has recalculated most of the transport sector using updated fuel consumption figures and has provided the related information in the IIR. Finland has also recalculated the emissions for selected pollutants and years for other subsectors based on updated methodology (e.g. using the latest 2016 version of the Guidebook). The ERT encourages Finland to document the differences in emissions in the IIR.

Comparability

53. Finland has used different versions of the Guidebook for calculating emissions from the transport sector. Finland is planning to update the road transport inventory to be consistent with the 2016 Guidebook version for its next submission.

54. The ERT identified possible underestimates in the road transport emissions as a result of using a previous (2013) version of the Guidebook. The ERT welcomes Finland's plan to use the latest 2016 version for its next submission.

55. The data submitted under the CLRTAP and the NECD are consistent in the transport sector.

Accuracy and uncertainties

56. ERT commends Finland for having undertaken a quantitative uncertainty analysis for the transport sector. The IIR does not specify if the results are used to prioritize improvements in the transport sector. The ERT notes that the inherently high uncertainty of some of the default emission factors needs to be kept in mind when interpreting the results of the uncertainty analysis.

57. Finland has undertaken QA/QC checks for the transport sector. The ERT encourages Finland to provide a more detailed description and the relevant outcomes of these QA/QC checks in the IIR.

Improvement

58. The ERT notes that Finland indicates in its IIR that it will recalculate road transport emissions for the entire time series following a scheduled update of the LIPASTO model to be in line with the latest (2016) Guidebook version. The ERT commends Finland for its commitment to complete a consistent time series and encourages Finland to implement the planned improvements.

Sub-Sector Specific Recommendations

Category issue 1: 1.A.3.b Road Transport - All Pollutants

59. The ERT noted that emissions of most pollutants from the road transport sector calculated with the LIPASTO model seem to be underestimated. Whereas the emission factors reported on the LIPASTO website are consistent with the latest Guidebook version 2016, the emissions reported in the NFR table are much lower than the activity levels reported in the IIR. *For example, an average emission factor of 0.33 g/km is reported for NOx for passenger cars. A value of 41.2 billion kilometres is reported for passenger cars in the IIR (table 2.21, page 54). A simple multiplication gives a NO_X emission value of 13.6 kt, which is much higher than the reported value of 9.95 kt. The same observation is true for most vehicle categories and most pollutants calculated with the LIPASTO model.* During the review week Finland has indicated that the emissions were calculated with the 2013 version of the Guidebook and that an update of the LIPASTO model to become consistent with the latest 2016 Guidebook is ongoing.

60. The ERT noted that in the IIR it is stated that "for each automobile type, the cold driving emission and fuel consumption surplus is calculated according to the EMEP/EEA emission inventory guidebook 2016". However, it is not clear whether these calculations are included in the LIPASTO model or not and hence it is not clear whether the average emission factors reported on the relevant webpage include cold start emissions or not. During the review week Finland has clarified that the emission factors included in the webpage of the LIPASTO model were actually not used in the calculations and cold start emissions were calculated with the 2013 Guidebook version.

61. The ERT noted that in the IIR the method for calculating NMVOC emissions from off-road machinery is described on page 62. The relevant section is included in chapter 2.5 (gasoline evaporation) which implies that NMVOC emissions from off-road machinery are included in NFR code 1A3bv. During the review week Finland has clarified that the description of NMVOC emissions from off-road machinery is included in the wrong chapter and that emissions are reported in the correct NFR code.

62. The ERT noted that in the IIR it is stated that "LIPASTO calculation system uses evaporation emission factors of 0.6 g VOC/km for vehicles not equipped with a catalyst and 0.06 g VOC/km to vehicles equipped with catalysts". The ERT also noted that the presence of a catalyst in road vehicles is irrelevant for evaporation emissions, unless it was assumed that catalyst-equipped vehicles are also equipped with an evaporation control system (such as a carbon canister for example). During the review week Finland has clarified that it is working on improving the methodology for estimating emissions from fuel evaporation. The ERT recommends Finland to apply a more detailed methodology (at least Tier 2 and preferably Tier 3) for the estimation of emissions from fuel evaporation for the next submission.

63. The ERT noted that in the NFR tables there is no activity data included for biomass and the NA notation key has been used. However, in the IIR it is mentioned that different types of biofuels are used for road transport purposes (e.g. bioethanol, biodiesel, ETBE, etc). During the review week Finland has clarified that the notation key "NA" in the NFR table will be replace by "IE" in the next submission. The ERT recommends Finland to make an effort to report biofuels separately.

INDUSTRIAL PROCESSES

Review Scope

Pollutants Reviewed		SO_2, NOx, NMVOC, NH_3, PM_{10} & $PM_{2.5}$		
Years		1990 – 2016 + (Protocol Years)		
Code	**Name**	**Reviewed**	**Not Reviewed**	**Recommendation Provided**
2A1	Cement production	X		
2A2	Lime production	X		
2A3	Glass production	X		
2A5a	Quarrying and mining of minerals other than coal	X		
2A5b	Construction and demolition	X		X
2A5c	Storage, handling and transport of mineral products	X		
2A6	Other mineral products	X		
2B1	Ammonia production	X		
2B2	Nitric acid production	X		
2B3	Adipic acid production			
2B5	Carbide production			
2B6	Titanium dioxide production	X		
2B7	Soda ash production	X		
2B10a	Chemical industry: Other	X		X
2B10b	Storage, handling and transport of chemical products	X		
2C1	Iron and steel production	X		X
2C2	Ferroalloys production		X	
2C3	Aluminium production		X	
2C4	Magnesium production	NO		
2C5	Lead production	NO		
2C6	Zinc production	X		X
2C7a	Copper production		X	
2C7b	Nickel production	X		X
2C7c	Other metal production	X		X
2C7d	Storage, handling and transport of metal products		X	
2D3b	Road paving with asphalt		X	
2D3c	Asphalt roofing		X	
2H1	Pulp and paper industry	X		
2H2	Food and beverages industry	X		
2H3	Other industrial processes	NO		
2I	Wood processing	X		
2J	Production of POPs	NO		
2K	Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)	NO		
2L	Other production, consumption, storage, transportation or handling of bulk products		X	
Note: Where a sector has been partially reviewed (e.g. some of the NFR codes please indicate which have and which have not in the respective columns.				

General recommendations on cross cutting issues

64. Finland provided a detailed and generally transparent emission inventory for the industrial processes sector. The IIR and the NFR tables are detailed enough to enable reviewers to fully assess methods, activity data, emission factors and other inventory parameters. Nevertheless, it appears during the review that methodology descriptions in the IIR have not been updated for some categories, due to lack of time. Finland provided the ERT with detailed methodology for those categories during the review. The ERT commends Finland for it and recommends Finland to update methodology descriptions and emission factors in the IIR for the next submission.

65. The ERT noted that Finland did not include any activity data in the NFR table and used the notation key “NA” for most of the sectors although activity data are described in the IIR. The ERT recommends Finland to report activity data in the next submission and to use appropriate notation keys (e.g. “NO” where emissions are “Not Occurring”, “NE” where emissions are “Not Estimated”, “IE” where emissions are “Included Elsewhere” and “NA” where emissions are "Not Applicable") for the reporting of activity data where estimates are not available or not necessary.

66. The ERT noted that in the IIR, trends are not transparently described for all categories and that the reasons for possible dips and jump are not included in the descriptions. Therefore the ERT encourages Finland to include more detailed trend descriptions in the IIR for the next submission.

67. During the review, Finland has provided the ERT with detailed answers enabling the ERT to implement the stage 3 review and to provide recommendations. Finland even provided the ERT with confidential activity data. The ERT commends Finland for its willingness to cooperate, and would like to thank Finland for its efficient assistance.

Completeness

68. The ERT considers the Industry processes sector to be complete and comprehensive.

69. The ERT noted that Finland uses the notation key “NE” for Cr emissions from copper production although the 2016 EMEP/EEA Guidebook provides a default emission factors for Cr from copper production. The ERT encourages Finland to estimate Cr emissions from Copper production using the emission factor provided by the 2016 EMEP/EEA Guidebook and to include these emissions in its next submission.

Consistency including recalculation and time series

70. The ERT noted that recalculations of the time series 1990 to 2016 have been undertaken for a number of categories and pollutants including significant changes for pollutants and years. These recalculations have been explained in the IIR.

71. For some categories, the ERT noted that emissions of some pollutants have been reported only for some years and that the notation key “IE” has been used for the rest of the time series. Finland explained during the review that, due to lack of time, all consistency checks have not been run for those categories and that it will be done for the next submission. The ERT recommends Finland to run an all consistency check for the next submission.

Comparability

72. Finland's inventory is comparable with inventories from other countries as defined in the reporting guidelines under UNECE LRTAP Convention/EMEP. Methodology, emissions factors and activity data are well described in the IIR and enabled the ERT to compare the inventory with other countries and methodologies provided by the 2016 EMEP/EEA Guidebook. The methods used by Finland in the inventory are consistent with the Guidebook.

Accuracy and uncertainties

73. The ERT noted that Finland has carried out a Tier 2 uncertainty analysis using a Monte Carlo analysis at NFR subcategory 3 level for all reported pollutants.

74. General QA/QC procedures have been implemented by Finland for most processes in the industrial processes sector. Procedures include trends and a magnitude check for statistics and reported activity data and emissions by plants. This is considered consistent with the good practice by the ERT

Improvement

75. The ERT noted that detailed improvement plans are provided in the IIR for all categories within the industrial processes sector. The ERT commends Finland for its improvement plan and encourages Finland to implement the planned improvements for the next submission.

Sub-Sector Specific Recommendations

Category issue 1: 2.A.5.b - Construction and demolition

76. The ERT noted that As, Cu, Cr, Pb, Ni and Hg emissions from that category have only been reported for a few years of the time series. The notation key “IE” has been used for the rest of the time series. During the review, Finland explained that these emissions are all facility reported emissions and the correct allocation of emissions should be in the energy sector, category 1A2f. The ERT recommends Finland to revise the allocation of these emissions in the next submission and to use the notation key “IE” for the reporting of these pollutants for the whole time series.

Category issue 2: 2.B.10.a - Chemical industry: Other

77. The ERT noted that As, Cd, Cr, Cu, Pb, Ni, Se, PAH and Zn emissions from category 2B10a have only been reported for a few years of the time series. The

notation “IE” has been used for the rest of the time series. During the review, Finland explained that these emissions should be allocated to the energy sector, but due to lack of time it has not been done for the 2018 submission. The ERT recommends Finland to revise the allocation of these emissions in the next submission and to use the notation key “IE” for the reporting of these pollutants for the whole time series.

78. The ERT noted Finland uses different size fraction factors for PM_{10} and $PM_{2.5}$ emissions from production of fertilizers and phosphates and for PM_{10} and $PM_{2.5}$ emissions from production of PVC than the values given by the 2016 EMEP/EEA Guidebook. During the review, Finland confirmed to the ERT that size fraction factors will be updated with factors from the Guidebook for the next submission. The ERT recommends Finland to take the 2016 EMEP/EEA Guidebook into account for these categories in the next submission.

79. The ERT noted a sharp decrease of Hg emissions from the category 2B10a between 1990 and 1993. These variations have not been justified in the IIR. During the review, Finland explained to the ERT that the use of elemental chlorine in pulp and paper industry ceased between 1990 and 1993 and thus did the production volumes in chlorine production. The ERT recommends Finland to include this clarification in the IIR of the next submission.

80. The ERT noted an inconsistency between the methodology described in the IIR for the estimation of HCB emissions from potassium sulphate production and the emissions presented in the NFR table for the years prior to 2001. During the review, Finland explained to the ERT that an assessment of the plant was used to estimate HCB emissions from potassium sulphate for the years prior to 2001. The ERT recommends Finland to update the IIR according to the provided information for the next submission.

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

81. The ERT noted that CO emissions from that category have only been reported for a few years of the time series. The notation key “IE” has been used for the rest of the time series. During the review, Finland explained that these emissions should be allocated in the energy sector and due to lack of time it has not been done for the 2018 submission. The ERT recommends Finland to revise the allocation of these emissions in the next submission and to use the notation key “IE” for the reporting of CO for the whole time series.

82. The ERT noted a sharp increase of Hg emissions from that category between 2002 and 2006. These variations have not been justified in the IIR. During the review, Finland explained to the ERT that the production capacity increased during that period.

83. The ERT noted a sharp increase of PCDD/PCDF emissions from that category in 2010. This variation has not been justified in the IIR. During the review, Finland was not able to provide the ERT with an explanation on this trend. As iron and steel production is a key category for PCDD/PCDF for the year 2010, the ERT

recommends Finland to further investigate this issue and provide explanation on the reason for that trend in the IIR of the next submission.

84. The ERT noted that Finland estimates PAH and PCDD/PCDF emissions from steel production for the plants which do not report emissions directly to the authorities with the use of different emission factors than the emission factors given by the 2016 EMEP/EEA Guidebook. During the review, Finland confirmed to the ERT that emission factors will be updated with emission factors given by the Guidebook for the next submission. The ERT commends Finland to have included it in its improvement plan for the next submission.

85. The ERT noted an inconsistency between the methodology as described in the IIR for the estimation of PAH emissions from iron production and the emissions presented in the NFR table. During the review, Finland explained to the ERT that emissions are calculated with a country specific emission factor based on measurements at the plant. The ERT recommends Finland to update the IIR according to the provided information for the next submission.

Category issue 4: 2.C.6 - Zinc production

86. The ERT noted an inconsistency between the methodologies as described in the IIR for the estimation of HMs, TSP, NMVOC and PCDD/PCDF emissions from zinc production and the emissions presented in the NFR table. During the review, Finland explained to the ERT that TSP and HM emissions are not estimated but are reported by the plants while NMVOC and PCDD/PCDF emissions are estimated using implied emission factors calculated from data reported by the plants. The ERT recommends Finland to update the IIR according to the provided information for the next submission.

87. The ERT noted that Hg, Cu and Ni emissions from that category have only been reported for a few years of the time series. The notation key “IE” has been used for the rest of the time series. During the review, Finland explained that these emissions should be allocated to the energy sector, but due to lack of time it has not been done for the 2018 submission. The ERT recommends Finland to revise the allocation of these emissions in the next submission and to use the notation key “IE” for the reporting of these pollutants for the whole time series

Category issue 5: 2.C.7.b - Nickel production

88. The ERT noted that SO_X emissions from that category have only been reported for a few years of the time series. The notation key “IE” has been used for the rest of the time series. During the review, Finland explained that these emissions should be allocated to the energy sector, but due to lack of time it has not been done for the 2018 submission. The ERT recommends Finland to revise the allocation of these emissions in the next submission and to use the notation key “IE” for reporting of SO_X for the whole time series.

Category issue 6: 2.C.7.c - Other metal production

89. The ERT noted a sharp decrease of As emissions from that category in 1995 followed by a sharp increase in 1996. These variations have not been justified in the IIR. During the review, Finland explained to the ERT that large investments were made during that period, leading to increases in production volumes. The ERT recommends Finland to include this clarification in the IIR in the next submission.

90. The ERT noted a sharp increase of NH3 emissions from that category in 1999 followed by a sharp decrease in 2000. These variations have not been justified in the Industrial processes chapter in the IIR. During the review, Finland explained to the ERT that the large emissions in 1999 resulted from an accident reported by a plant to the authorities and that explanations are available in the general part of the IIR. The ERT recommends Finland to include this clarification in the corresponding subchapter of the industrial processes chapter in IIR for the next submission.

91. The ERT noted that SO_X emissions from that category have only been reported for a few years of the time series. The notation IE has been used for the rest of the time series. During the review, Finland explained that these emissions should be allocated to the energy sector and due to lack of time it has not been done for the 2018 submission. The ERT recommends Finland to revise the allocation of these emissions in the next submission and to use the notation key “IE” for reporting of SO_X for the whole time series.

SOLVENTS

Review Scope

Pollutants Reviewed		SO_2, NO_X, NMVOC, NH_3, PM_{10} & $PM_{2.5}$		
Years		1990 – 2016 + (Protocol Years)		
Code	**Name**	**Reviewed**	**Not Reviewed**	**Recommendation Provided**
2D3a	Domestic solvent use including fungicides	X		X
2D3d	Coating applications	X		X
2D3e	Degreasing	X		X
2D3f	Dry cleaning			
2D3g	Chemical products	X		X
2D3h	Printing			
2D3i	Other solvent use	X		X
2G	Other product use	X		X
Note: Where a sector has been partially reviewed (e.g. some of the NFR codes please indicate which have and which have not in the respective columns.				

General recommendations on cross cutting issues

Transparency

93. Finland provided a detailed and generally transparent emission inventory for the industrial processes sector. The IIR and the NFR tables are detailed enough to enable reviewers to fully assess methods, activity data, emission factors and other inventory parameters. Nevertheless, it appears during the review that methodology descriptions in the IIR have not been updated for some categories, due to lack of time. Finland provided the ERT with detailed methodology for those categories during the review. The ERT commends Finland for it and recommends Finland to update methodology descriptions and emission factors in the IIR for the next submission.

94. The ERT noted that Finland did not include any activity data in the NFR table and used the notation key “NA” although most activity data are described in the IIR. The ERT recommends Finland to report activity data in the next submission and to use appropriate notation keys (e.g. “NO” where emissions are “Not Occurring”, “NE” where emissions are “Not Estimated”, “IE” where emissions are “Included Elsewhere” and “NA” where emissions are "Not Applicable") for reporting of activity data where estimates are not available or not necessary.

95. The ERT noted that in the IIR, trends are not transparently described for all categories and that the reasons for possible dips and jump are not included in the descriptions. Therefore the ERT encourages Finland to include more detailed trends descriptions in the IIR for the next submission.

96. During the review, Finland has provided the ERT with detailed answers enabling the ERT to implement the stage 3 review and to provide recommendations. The ERT commends Finland for its willingness to cooperate, and would like to thank Finland for its efficient assistance.

Completeness

97. The ERT considers the solvents sector to be complete and comprehensive.

Consistency including recalculation and time series

98. The ERT noted that recalculations of the time series 1990 to 2016 have been undertaken for NMVOC emissions from all categories within the solvents sector. Nevertheless due to lack of time, these recalculations have not been described in detail in the IIR. The ERT recommends Finland to include a description of recalculations in the IIR.

99. The ERT noted that NMVOC emissions from the categories 2D3e, 2D3f, 2D3g, 2D3h and 2D3i had been reported with the use the notation key 'IE' in previous submissions. In the 2018 submission, Finland has reported emissions for NMVOC from these categories. The ERT commends Finland for this improvement.

Comparability

100. Finland's inventory is comparable with inventories from other countries as defined in the reporting guidelines under UNECE LRTAP Convention/EMEP. The methods used by Finland in the inventory are consistent with the 2016 EMEP/EEA Guidebook.

Accuracy and uncertainties

101. The ERT noted that Finland has carried out a Tier 2 uncertainty analysis using a Monte Carlo analysis at NFR subcategory 3 level for all reported pollutants.

102. General QA/QC procedures have been implemented by Finland for most processes in the solvents sector. Procedures include trends and magnitude check for statistics and reported activity data and emissions by plants. This is considered consistent with the good practice by the ERT.

Improvement

103. The ERT noted detailed improvement plans described in the IIR for all categories within the solvents sector. The ERT commends Finland for its improvement plan and encourages Finland to implement the planned improvements for the next submission.

Sub-Sector Specific Recommendations

Category issue 1: 2.D.3.d – Coating application

104. The ERT noted that the description of the methodology used to estimate NMVOC emissions from coating applications is not fully transparent in the IIR. Finland provided the ERT with clarifications and the ERT commends Finland for it.

The ERT recommends Finland to clarify the methodology description in the IIR for the next submission.

Category issue 2: 2.D.3.g – Chemical products

105. The ERT noted that NMVOC emissions from chemical products have been calculated for the subcategories according to replies from a survey, both for installations, which answered the survey, and installations, which did not answer, assuming that 40% of unanswered surveys are considered to have NMVOC emissions. During the review, Finland provided the ERT with more detailed information about this assumption, which is not included in the IIR. The ERT recommends Finland to include a fully transparent description of the methodology used to estimate emissions from installations, which did not answer the survey.

AGRICULTURE

Review Scope

Pollutants Reviewed		SO_2, NO_X, NMVOC, NH_3, PM_{10} & $PM_{2.5}$		
Years		1990 – 2016 + (Protocol Years)		
Code	**Name**	**Reviewed**	**Not Reviewed**	**Recommendation Provided**
3B1a	Dairy cattle	X		X
3B1b	Non-dairy cattle	X		X
3B2	Sheep	X		X
3B3	Swine	X		X
3B4a	Buffalo	X		X
3B4d	Goats	X		X
3B4e	Horses	X		X
3B4f	Mules and asses	X		X
3B4gi	Laying hens	X		X
3B4gii	Broilers	X		X
3B4giii	Turkeys	X		X
3B4giv	Other poultry	X		X
3B4h	Other animals	X		X
3Da1	Inorganic N-fertilizers (includes also urea application)	X		X
3Da2a	Animal manure applied to soils	X		X
3Da2b	Sewage sludge applied to soils	X		
3Da2c	Other organic fertilisers applied to soils (including compost)	X		
3Da3	Urine and dung deposited by grazing animals	X		
3Da4	Crop residues applied to soils	X		
3Db	Indirect emissions from managed soils	X		
3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products	X		X
3Dd	Off-farm storage, handling and transport of bulk agricultural products	X		
3De	Cultivated crops	X		
3Df	Use of pesticides	X		
3F	Field burning of agricultural residues	X		X
3I	Agriculture other	X		
11A	Volcanoes	X		
11B	Forest fires	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

106. The ERT thanks Finland for facilitating the review process by providing detailed information requested during the review and by answering quickly to the different questions asked.

Transparency

107. Finland provides a very transparent inventory for the agriculture sector, including useful details in the IIR regarding livestock numbers, N excretions, manure management systems, N input from fertilisers, EFs used and more. The ERT commends Finland for the thorough presentation of the methods and the data used for the agriculture inventory.

108. The ERT asked Finland during the review to provide data regarding the nitrogen flow. These data were useful to understand the methodology implemented in Finland, which is quite complex. Thus, the ERT recommends that Finland includes a diagram of the nitrogen flow in its IIR, for example presenting values for one animal category.

Completeness

109. Finland estimates most of the important agricultural sources of NH_3, NO_X, NMVOC, PM_{10} and $PM_{2,5}$ emissions for the whole period. The ERT commends Finland for the completeness and the quality of the inventory provided.

110. Finland did not estimate PM emissions for sheep (3B2), goats (3B4d) and other animals (3B4h) for the 2018 submission. However, Finland clearly mentioned in its IIR that the calculation of particle emissions could not be done for the 2018 submission but that a project has been scheduled. The ERT strongly recommends that Finland implements the calculation of particle emissions for next submission.

Consistency including recalculation and time series

111. The ERT concludes that the agricultural emissions are consistent throughout the time series. No outliers have been identified and the trends for the different pollutants are described in the IIR. The ERT commends Finland for the consistency of the inventory provided and for the detailed explanations provided on trends.

112. Finland mentions in its IIR that recalculations were carried out per subcategory. However, there is no information included regarding the impact of the recalculations on the sector and the implication on trends for the agriculture sector. The ERT commends Finland for the explanations already provided on recalculations and encourages Finland to add more information in future submissions regarding the impact of the recalculations and the implication on trends.

Comparability

113. Finland follows the recommendations of the EMEP/EEA Emission Inventory Guidebook and the emissions are represented in the NFR 2014 format. For NH_3 emissions, the Finnish agricultural calculation model follows the principles of Tier 2 method described in the 2016 EMEP/EEA Guidebook. However, it has some features which move it strongly towards the Tier 3 method: greater number of livestock categories and manure types, inclusion of emission abatement measures, and application of temperature correction factors. The ERT commends Finland for the method implemented.

114. Finland mentions in its IIR that the calculation of particle emissions in the 2018 submission is based on the 2013 EMEP/EAA Guidebook, but that it will be revised for the next submission to upgrade the method with the 2016 EMEP/EAA Guidebook. The ERT recommends that Finland implements the calculation of particle emissions for next submission.

Accuracy and uncertainties

115. Finland has carried out an uncertainty analysis of its activity data and emission factors for the agriculture sector. The ERT commends Finland for the comprehensive uncertainty analysis for its inventory.

116. In its IIR, Finland mentions that normal quality checks related to the assessment of magnitude and trends have been carried out. Data and functions of the method used were also cross-checked with the GHG inventory. However, Finland mentions that no verification has been carried out for specific source-sector emissions in agriculture. The ERT encourages Finland to implement sector-specific QA/QC procedures for agriculture and to provide more details on the QA/QC procedures

Improvement

117. The ERT commends Finland for its improvement in the agriculture sector, especially regarding the revised calculations of NH_3, NO_X and NMVOC emissions, and the implementation of the different recommendations from previous reviews.

118. The ERT notes Finland's intention to revise the calculation of particles emissions from agriculture. The ERT commends Finland for the planned improvement of its inventory.

Sub-Sector Specific Recommendations

Category issue 1: 3.B Manure management – NH_3, PM, NO_X and NMVOC

119. During the review, Finland provided a detailed file regarding the nitrogen flow. The ERT detected that, in the example given (dairy cows), for manure managed as deep litter, the emissions from spreading (NH_3, NO, N_2O) 80% of the manure managed as deep litter were missing. Finland confirmed that these emissions were missing and mentioned that it will be corrected for the next submission. The ERT recommends that Finland corrects this point for the next submission.

120. As pointed out on the previous remark, the ERT noted that having detailed information on the nitrogen flow is very useful to check the calculations made. Thus, the ERT strongly encourages Finland to include an example of the nitrogen flow in its IIR.

Category issue 2: 3.D Agricultural Soils – Activity data

121. The ERT noticed during the review that the activity data reported in the NFR tables are not expressed in kilograms of nitrogen but in kilotons of nitrogen. Finland confirmed this point during the review and mentioned that it will be corrected as soon as possible. The ERT recommends Finland to correct the unit for the next submission.

Category issue 3: 3.D Agricultural Soils - PM

122. For 3Da1, the ERT noticed that Finland uses the notation key “IE” for TSP, PM_{10} and $PM_{2,5}$ emissions and reports those emissions in 3Dc. In the IIR, Finland mentioned that the EF applied to estimate the emissions of particles from 3Dc is the EF from 2016 EMEP/EAA Guidebook. However, in the Guidebook, it is mentioned that the EF provided does not include emissions from fertilisers. The question was asked during the review and Finland agreed that the notation key should be corrected. Thus, the ERT recommends that Finland reports the notation key “NE” for TSP, PM_{10} and $PM_{2,5}$ emissions from 3Da1.

Category issue 4: 3.F Field burning of agricultural residues

123. For category 3F Finland provided explanations in the IIR, however some additional data would be needed to fully understand the calculation done. The ERT encourages Finland to add explanations on the IIR section regarding the field burning of agricultural residues, especially for dry matter calculation.

Category issue 5: 11.B Forest fires

124. Finland reported the notation key “NA” for all pollutants in 11B. However, emission can occur thus the notation key should be “NO” or “NE”. The question was asked during the review and Finland mentioned that this source has not been considered but additional explanation will be provided in future submissions. The ERT encourages Finland to add explanations in future IIRs.

WASTE

Review Scope

Pollutants Reviewed		SO_2, NOx, NMVOC, NH_3, PM_{10} & $PM_{2.5}$		
Years		1990 – 2016)		
Code	**Name**	**Reviewed**	**Not Reviewed**	**Recommendation Provided**
5A	Solid waste disposal on land	X		X
5B1	Biological treatment of waste - Composting	X		X
5B2	Biological treatment of waste - Anaerobic digestion at biogas facilities	X		X
5C1a	Municipal waste incineration	X		X
5C1bi	Industrial waste incineration	X		X
5C1bii	Hazardous waste incineration	X		X
5C1biii	Clinical waste incineration	X		X
5C1biv	Sewage sludge incineration	X		X
5C1bv	Cremation	X		X
5C1bvi	Other waste incineration	X		X
5C2	Open burning of waste	X		X
5D1	Domestic wastewater handling	X		X
5D2	Industrial wastewater handling	X		X
5D3	Other wastewater handling	X		X
5E	Other waste	X		X
Note: Where a sector has been partially reviewed (e.g. some of the NFR codes please indicate which have and which have not in the respective columns.				

General recommendations on cross cutting issues

Transparency

125. The waste sector of Finland is not completely transparent. The ERT notes that Finland uses the notation key “NO” for the source categories 5C1a, 5C1bi, 5C1biii, 5C1biv and 5Cbv in both Table 5-1 and the NFR tables, while these sources exist but are included in the energy sector. After consulting, the Party responded that it will consider moving the documentation of waste combustion as fuel under NFR 1A1a the next IIR submission in 2019. The ERT recommends Finland to replace the notation key “NO” with “IE” for these source categories in next submission.

126. The ERT notes that in a number of tables (5.3, 5.7, 5.10, 5.22, 5.27) 2015 emissions have been reported, while the NFR table includes emissions for 2016. After consulting Finland responded that these are mistakes that will be corrected in future submissions. The ERT commends Finland for this.

127. In the previous Stage 3 Review Report (from 2009) the ERT encouraged Finland to present the methodologies applied for solid waste disposal on land and wastewater handling as well as the VAHTI database (The Compliance Monitoring Data system) descriptions in the IIR and specific additional assumptions applied for air pollutants in order to improve transparency. The ERT notes that Finland includes this information in the chapter for waste in its IIR and compliments Finland on this.

Completeness

128. The ERT considers the waste sector to be almost complete and comprehensive with good levels of detail in the methodology descriptions. NH_3 emissions from composting have been added to the inventory from year 1990 onwards.

129. In the previous Stage 3 Review Report (from 2009) Finland responded to the ERT that NH_3 emissions from landfills are considered irrelevant under Finnish conditions and that it would add this explanation to its future IIRs. The ERT notes that this has not been done and recommends Finland to add this explanation to its future IIRs.

Consistency, including recalculation and time series

130. The ERT notes that both the time series for the activity data and EFs used to calculate emissions are consistent.

131. In the previous Stage 3 Review Report (from 2009) the ERT encouraged Finland to implement its recalculations for waste incineration for the years 1990-1999 as identified in its IIR waste incineration for the years 1990-1999. The ERT also encouraged Finland to consider possible recalculations for solid waste disposal on land, wastewater handling and other waste. The ERT notes that Finland has implemented source-specific recalculations made in response to the review processes and compliments Finland on this.

Comparability

132. Finland reported its emission inventory in accordance with the reporting requirements and submitted it in the requested NFR format. Furthermore, the ERT notes that the NMVOC emissions reported under the UNECE CLRTAP, the EU NECD and the UNFCCC are consistent.

Accuracy and uncertainties

133. In the previous Stage 3 Review Report (from 2009) the ERT encouraged Finland to identify possible methods for QC to verify the estimates for the specific source-sector emissions. The ERT notes that since the last review normal statistical quality checking related to the assessment of the magnitude and trends has been carried out and compliments Finland for this.

134. The ERT notes that a detailed sector specific uncertainty analyses has been performed which can be found in Annex 7 of the 2018 IIR. The ERT commends Finland for this.

Improvement

135. In the previous Stage 3 Review Report (from 2009) the ERT encouraged Finland to revise the methodology for emissions of NMVOC from wastewater handling as well as waste incineration and to implement the improvements in the coming inventory. The ERT notes that Finland has implemented these improvements and compliments Finland on this. Besides the ERT notes that the methodology for

solid waste disposal on land and other waste has been updated. In the paragraphs "Source specific planned improvements" of the waste sector a lot of the planned improvements are included.

Sub-Sector Specific Recommendations

Category issue 2: 5.D.1 Domestic wastewater handling – NMVOC

136. The recommendation of the 2017 NECD Technical Review to revise the method to calculate NMVOC emissions could not be implemented because the wastewater volume data are not accurate enough to implement the method from the 2016 Guidebook. Instead, the COD/BOD values of wastewaters which are also used to estimate CH_4 emissions from wastewater are used to estimate the NMVOC emissions. This method is considered to be more accurate and is also consistent with the one used for the greenhouse gas reporting. The NMVOC emissions are likely overestimated using the above described method. However, the data on wastewater flows that is needed to apply the default method presented in the EMEP/EEA Emission Inventory Guidebook 2016 is highly uncertain. The current method is therefore used until a better method or more accurate data on wastewater flows can be achieved. The ERT commends on this temporary solution but recommends Finland to use a more accurate method of NMVOC estimation from waste water handling.

MATERIALS USED BY THE REVIEW TEAM

1. Annex 1 NFR tables; 1980– 2016, resubmission_13042018
2. LPS_emissions2016_4May2018
3. Annex_IV_Projections_15022018
4. Finland Stage 1 report 2018
5. Stage 2 S&A report
6. IIR 2018
7. Finland Stage 3 review report 2009
8. Data and tools developed by CEIP (http://unece-stage3.wikidot.com/data-analysis)

LIST OF ADDITIONAL MATERIALS PROVIDED BY THE COUNTRY DURING THE REVIEW

1. Response to preliminary questions raised prior to the review (wiki)
2. Response to questions raised during the review (wiki)
3. Excel file : FI S3 2018 A3 DC Nflow.xlsx

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TFEIP, 2017. A Process for Technical Revisions During CLRTAP Emissions inventory Review. Available at: http://webdab1.umweltbundesamt.at/Inventory_Review_2017/00_General/Technical%20corrections%20guidance/CLRTAP_Technical_Revisions_v3.pdf

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