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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

NORWAY

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INTRODUCTION

1. The mandate and overall objectives for the emission inventory review process under the LRTAP Convention is given by the UNECE document '*Updated methods and procedures for the technical reviews of air pollutant emission inventories reported under the Convention*'⁽¹⁾ – hereafter referred to as the 'Review guidelines 2018'.
2. This annual review, has checked all pollutants covered by LRTAP Convention and its protocols (SO₂, NO_x, NMVOC, NH₃, plus PM₁₀, PM_{2.5}, BC, 3 HMs and POP_S) for the time series years 1990 – 2017 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 review of the UNECE LRTAP Convention inventory of Norway coordinated by the EMEP emission centre CEIP acting as review secretariat. The review took place from 24th June 2019 to 28th June 2019 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 – Dan Wakeling (UK), Energy – Benjamin Cuniasse (France) and Kees Peek (the Netherlands), Transport – Giorgos Mellios (EU) and Magdalena Zimakowska-Laskowska (Poland), IPPU – Mirela Poljanac (Croatia) and Michaela Titz (Austria), Agriculture - Rikke Albrektsen (Denmark) and Simone Haider (Austria), Waste – Risto Saarikivi (Czechia).
4. Kristina Saarinen (Finland) was the lead reviewer. The review was coordinated by Katarina Marečková, (EMEP Centre on Emission Inventories and Projections - CEIP).

¹ Decision 2018/1 adopted by EB: *Updated methods and procedures for the technical reviews of air pollutant emission inventories reported under the Convention*. ECE/EB.AIR/142/Add.1
http://www.unece.org/fileadmin/DAM/env/documents/2002/eb/air/EB%20Decisions/Decision_2018_1.pdf

PART A: KEY REVIEW FINDINGS

5. The ERT thanks Norway for reporting data and information and for providing timely responses to the questions of the ERT during the review that enabled the ERT to conduct a full review of the inventory and give recommendations for further development of the inventory.

6. The ERT noted that the inventory is generally in line with the *EMEP/EEA Emission Inventory Guidebook* and the UNECE Reporting Guidelines and is generally transparent.

7. The ERT found the inventory to be generally transparent and that the IIR is prepared according to the template provided in the Reporting Guidelines Annex I and also includes a key category analysis (KCA), uncertainty analysis and projections.

8. Norway provided a full time series of NFR tables for the years 1990-2017 on 13 February 2019 and therefore before the reporting deadline of 15 February, as well as an IIR on 15 March 2019 before the deadline of 15 March 2019. The latest set of gridded data was submitted on 2 June 2017 after the deadline of 1 May 2017. Norway did not submit LPS data till the deadline of 1 May 2017. projections were reported on 3 July 2019 after the deadline of 15 March 2019.

9. The ERT considers the accuracy of the inventory good, no systematic over- or underestimates were found, and tier 2 or higher methods have been used for all key categories. Norway uses data reported by the plants according to their environmental permits in the inventory as well as detailed models with country-specific input parameters.

10. Transport emissions are calculated on basis of fuel sold.

11. The ERT, however, noted that

- a) the time series of some emissions and activity data are not complete,
- b) some source categories and/or pollutants are missing,
- c) some incorrect notation keys are used,
- d) lack for explanations on emission and activity data trends.

12. The ERT commends Norway for voluntarily reporting black carbon (BC) emissions as part of their inventory.

INVENTORY SUBMISSION

13. Norway has reported emissions for its Protocol base years and a time series from 1990 to 2017 (the latest year) for its protocol pollutants (NO_x, SO_x, NMVOC, PAHs, PCDD/F, and the mandatory heavy metals Pb, Hg and Cd) in the most recent NFR format (NFR 2014-2). In addition, Norway has also provided a time series from 1990 to 2017 for CO, PM₁₀, PM_{2.5}, TSP, NH₃, BC, additional heavy metals (As, Cr, Cu), HCB, and PCBs. However, emissions of some pollutants, some sources and years are missing.

14. In the previous Stage 3 review report from September 2013 it was noted that HCB and PCB emissions were reported as “NE”. The ERT commends Norway for now providing a full time-series for these pollutants.

15. The CLRTAP inventory submitted by Norway is of good quality, consistent with the recommended structure, and is in general well documented in the informative inventory report (IIR).

16. The national total for Norway is based on fuel sold (Line 141 of the Annex I Emissions reporting template). Norway in addition provided information based on fuel used (row 152).

17. The ERT notes that Norway reports emission values in the NFR tables in formatted as text, which makes checking of sums laborious for the ERT. The ERT therefore recommends Norway to report all values in the NFR tables as numbers and to use the three decimals display setting.

KEY CATEGORIES

18. The ERT commends Norway for a clear, detailed, and well-presented key category analysis (KCA).

19. Norway has compiled and presented in its IIR a KCA for the following pollutants: SO₂, NO_x, NH₃, NMVOC, CO, TSP, PM₁₀, PM_{2.5}, Pb, Hg, Cd, dioxins, PAH, HCB and PCBs. The assessment is performed for 2017 for all pollutants and the % contributions for 1990 are also given. All sectors have been included.

20. In the KCA gasoline evaporation (NFR 1A3bv) is included in NFR 1A3bi-iv. The ERT notes that Norway plans to add NFR 1A3bv gasoline evaporation as a separate key category based on qualitative criteria. The ERT recommends, however, that Norway includes 1A3bv as a key category in a quantitative way in their 2020 submission.

21. The ERT noted that the results of Norway’s KCA and the KCA performed by the CEIP provided similar results.

22. It is currently not clear from the IIR if the results of the KCA are used to prioritize improvements in the inventory. Therefore the ERT recommends that Norway provides information on how the KCA is used to prioritize improvements.

QUALITY

Transparency

23. The ERT recognises the level of effort undertaken by Norway in providing an inventory with a significant level of detail so it was possible to undertake a detailed review. The Norwegian IIR is detailed and well presented. EF and activity time series are almost always presented in detail, assumptions are indicated and references are given.

24. The ERT recognizes that according to the UNECE Reporting Guidelines (ECE/EB.AIR/125) the Parties should for “transparency” clearly explain the data sources, assumptions and methodologies used for an inventory (para 12) and that the submission of an IIR is strongly encouraged (para 43). However, lack of sufficient documentation in an IIR does not allow a technical review, and thus the Party needs

to provide the missing documentation during the review. Therefore, in this technical review report recommendations are given instead of encouragements in cases where there is need to improve the documentation of data, methods and assumptions used in the inventory.

25. The ERT recommends that Norway provides activity data where it is not provided in the NFR submission, and especially for key categories, within their IIR submission. This has been especially noted in the industrial processes, solvent and other product use, and agriculture sectors.

26. The IIR provides sufficient descriptions for most of the categories. However, improvement needs were identified e.g. for the issues listed below (see more detailed recommendations under the sector specific recommendations):

- (a) Detailed explanations for sub-sectors, especially for key categories, in the energy and industrial processes sectors.
- (b) Reporting of activity data, especially for key categories, especially in the industrial processes and solvents sectors.
- (c) Details of Tier of methods used for calculating key category sources, especially in the transport sector.
- (d) Explanations of dips and jumps in the time-series, especially for the industrial processes, agriculture and waste sectors.
- (e) Improvement of the use of correct notation keys in the transport, industrial processes, solvent and other product use, and agriculture sectors, including the use of "C" for confidential data.
- (f) Provision of more detailed information on recalculations in the energy sector.

Completeness

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

28. A general assessment of completeness is provided in section 1.8 of Norway's IIR. This section provides information on sources not covered and general information on the lack of related activity data, emission factors or known calculation methodology. The ERT recommends that Norway provides detailed justifications for the individual cases in the IIR in cases where it is not possible to estimate the emissions, or preferably that Norway estimates and reports the missing emissions in the next submission.

29. The ERT noted lack of completeness regarding the following issues (described in more details under the sector specific recommendations):

- (a) PMs from mopeds and motorcycles (NFR 1A3biv).
- (b) NMVOC, CO, TSP, PM₁₀, PM_{2.5} and BC from NFR 2D3c.
- (c) Emissions from activities under NFR 2B10a
- (d) NMVOC from NFRs 2D3a and 2D3h for 1990-2004.

- (e) TSP, PM₁₀ and PM_{2.5} from 2D3i.
- (f) NO_x from 3Da3.
- (g) NH₃, NMVOC and NO_x from NFR 3B4f.
- (h) Emissions from NFRs 5C2 and 5C1biv, NMVOC and NH₃ from NFR 5C1.

Consistency, including recalculations and time-series

30. Regarding consistency of methodology, the ERT notes that the inventory has been prepared using consistent methods and activity data for all years.

31. Regarding recalculations, the ERT notes that a generally transparent and detailed, documentation of recalculations was presented in the IIR and that all recalculations were justified. The ERT, however, recommends that the presentation of recalculated values is to be improved in future submissions regarding Table 8.5 of the IIR.

32. Regarding time series consistency, the ERT noted that there is need for explanations of outliers in the industrial processes and solvent use sectors, e.g. for NFRs 2C and 2D from 1990-2004.

Comparability

33. The ERT notes that as Norway uses methods in accordance with the EMEP/EEA Guidebook and the allocation of source categories follows that of the reporting guidelines (latest format of the NFR reporting table), the inventory of Norway is comparable with those of other reporting parties.

Accuracy and uncertainties

34. The ERT did not find any systematic over- or underestimations and considers the accuracy of the inventory to be good.

35. However, Norway has compiled a quantitative uncertainty analysis in 2001, and the results are provided in Appendix C of Norway's IIR. As the uncertainty analysis was taken from a 2001 report (Rypdal and Zhang (2001)), the ERT recommends that Norway updates the uncertainty analysis so that more recent data and updated uncertainty values can be considered as input for the uncertainty analysis and uncertainties for the latest reported historic year can be considered and a trend uncertainty analysis can be conducted using these updated data. In response to the question on the issue, Norway informed the ERT that they plan to update their uncertainty analysis in late 2019 and include the results in the 2020 IIR submission. The ERT strongly recommends Norway to provide an updated uncertainty analysis in the next submission.

36. There is no clear evidence in Norway's IIR that the results of the uncertainty analysis are used to prioritise improvements in Norway's inventory. The ERT recommends that it is to be clearer expressed in Norway's IIR how the results of the uncertainty analysis of the inventory are used to prioritise improvements.

Verification and quality assurance/quality control approaches

37. Norway has elaborated and implemented a detailed quality assurance/quality control (QA/QC) procedure, and provides detailed information on this in section 1.6 of Norway's 2019 IIR. Information on source-specific QA/QC checks is provided within the sector chapters below.

38. The ERT, however, noted that for the solvents category, QA/QC procedures are not extended to all source categories, and recommends Norway to improve the QA/QC procedures regarding this.

39. Regarding verification, information on various projects under the Nordic Council of Ministers is provided in section 1.6.4 of the IIR.

Reporting of Condensable Particulate Matter

40. Norway did not provide information on condensable particulate matter within their 2019 IIR submission. The ERT recommends that Norway provide this information in their 2020 IIR submission.

FOLLOW-UP TO PREVIOUS REVIEWS

41. In the previous stage 3 review report (September 2013) the ERT recommended Norway to include emissions of HCB and PCBs in the inventory. The ERT notes that in the 2019 submission Norway includes a full time-series for these pollutants.

42. In the previous stage 3 review report (September 2013) the ERT recommended that Norway review their current use of notation keys. The ERT reiterates this recommendation as there still are some inconsistencies in the use of notation keys as presented under the sector chapters below.

AREAS FOR IMPROVEMENTS IDENTIFIED BY NORWAY

43. The IIR identifies several areas for improvement. These include:

- (a) Updating of the uncertainty analysis. The updated analysis should also include uncertainties on particulate matter and CO.
- (b) Development of a trend key category analysis.
- (c) Updating of the HBEFA (Handbook Emission Factors for Road Transport) emission model for road traffic to version 4.1 when it becomes available.

44. The ERT notes that from the IIR it is not clear when the improvements will be implemented and therefore recommends that Norway provide clear schedules for the implementation of improvements.

TECHNICAL CORRECTIONS CONSIDERED AND OR CALCULATED BY THE ERT

45. No technical corrections were made. However, the ERT noted missing estimates, but was not able to estimate if these were below or above the threshold of

significance due to lack of information and data, as explained in detail under the sector specific recommendations (see NFRs 1A3, 2D, 3B, 3D and 5C).

PART B: RECOMMENDATIONS FOR IMPROVEMENTS TO THE PARTY

CROSS CUTTING IMPROVEMENTS IDENTIFIED BY THE ERT

46. The ERT identifies the following cross-cutting issues for improvement and recommends Norway in its next submission:

- (a) Complete time series for all pollutants.
- (b) Include all pollutants and source categories in the inventory for which methodologies exist in the Guidebook.
- (c) Correct the use of notation keys according to the definitions in the Reporting Guidelines.
- (d) Include explanations on the emissions and activity data trends, and to justify dips and jumps.
- (e) Justify in detail the reasons for not estimating emissions and to provide schedules for actions and plans of improvements in the improvement plan.
- (f) Complete missing activity data.
- (g) Improve the QA/QC procedures to capture all source categories.
- (h) Complete the documentation in the IIR according to the sector specific recommendations.
- (i) Include information on condensable particulate matter.
- (j) Change the format of data in the NFR tables into numbers with three decimals.
- (k) Update the uncertainty analysis.
- (l) Include information of how the KCA and uncertainty analysis are used in inventory improvement.

SECTOR SPECIFIC RECOMMENDATIONS FOR IMPROVEMENTS IDENTIFIED BY ERT

ENERGY

Review Scope

Pollutants Reviewed		SO ₂ , NO _x , NMVOC, NH ₃ , PM ₁₀ & PM _{2.5} , Cd, Hg, Pb, Dioxin, POPs, TSP, BC, CO, Cr, As, Cu		
Years		1990 – 2017		
Code	Name	Reviewed	Not Reviewed	Recommendation Provided
1A1a	Public electricity and heat production	X		X
1A1b	Petroleum refining	X		
1A1c	Manufacture of solid fuels and other energy industries	X		X
1A2a	Iron and steel	X		X
1A2b	Non-ferrous metals	X		
1A2c	Chemicals	X		X
1A2d	Pulp, Paper and Print	X		
1A2e	Food processing, beverages and tobacco	X		
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	X		
1A2gvii	Mobile Combustion in manufacturing industries and construction	X		
1A2gviii	Stationary combustion in manufacturing industries and construction: Other	X		
1A4ai	Commercial/institutional: Stationary	X		X
1A4aii	Commercial/institutional: Mobile			
1A4bi	Residential: Stationary	X		X
1A4bii	Residential: Household and gardening (mobile)	X		
1A4ci	Agriculture/Forestry/Fishing: Stationary	X		
1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	X		
1A4ciii	Agriculture/Forestry/Fishing: National fishing	X		
1A5a	Other stationary (including military)	X		X
1A5b	Other, Mobile (including military, land based and recreational boats)	X		
1B1a	Fugitive emission from solid fuels: Coal mining and handling	X		
1B1b	Fugitive emission from solid fuels: Solid fuel transformation	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		X
1B2b	Fugitive emissions from natural gas (exploration, production, processing, transmission, storage, distribution and other)	X		
1B2c	Venting and flaring (oil, gas, combined oil and gas)	X		
1B2d	Other fugitive emissions from energy production		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

47. The ERT thanks Norway for providing comprehensive and quick responses during the review. The ERT noted that the IIR gives general descriptions for the energy sector (NFRs 1A, 1A1, 1A2, 1A4, 1A5, 1B) but does not provide detailed explanations for all of the sub-categories, especially not on the methods and the tier level used for the key categories, activity data and an assessment of the emission time series, although estimates are provided at the most detailed level in the NFR tables. This was already pointed out in the 2013 Stage 3 Review Report. During the review, Norway agreed with the ERT's observations and indicated that the missing information will be provided in the next submission. The ERT recommends Norway to include information on the tiers of the methods used, references of data sources, activity data and assessment of the emission time series as well as more detailed explanations for recalculations, as explained below, in the next submission.

48. The ERT thanks Norway for its comprehensive explanations in the IIR about the recalculations carried out. However, the IIR does not include all the necessary explanations. The ERT encourages Norway to provide more detailed explanations of recalculations, especially regarding extensive recalculations affecting pollutants for each key category sector as explained in the sub-sector specific recommendations.

Completeness

49. The ERT considered Norway's emission estimates for the energy sector (NFR 1A) to be complete and commends Norway for their comprehensive work on this sector.

50. Concerning the fugitive emissions (NFR 1B), the ERT noted that the recommendations from the 2013 Stage 3 Review were implemented and commends Norway for their comprehensive work on this inventory sector.

Consistency including recalculation and time series

51. The ERT considers that Norway has prepared emission estimates for the energy sector using consistent methods over the years.

52. The ERT noted that recalculations had been carried out (especially for NFR sectors 1A1a, 1A2a, 1A4bii and 1B2av) and that the recalculations were carried out consistently.

Comparability

53. The ERT notes that the methods used by Norway are in accordance with the Guidebook and that the emissions are correctly allocated in the NFR tables and that the energy sector is thus comparable with other reporting Parties.

Accuracy and uncertainties

54. The ERT did not find any systematic under- or overestimations.

55. The ERT thanks Norway for carrying out the uncertainty analysis for the energy sector and commends Norway for their work on the reliability of this inventory sector.

56. The ERT noted that Norway has implemented very thorough QA/QC checks which are described in the IIR. However, the ERT encourages the Party to improve the efficiency of its OA/QC procedures to detect sudden jumps and dips in the times series or errors in the notation keys used in the reporting as explained in the sub-sector specific recommendations. The ERT considers Norway's emission estimates for the energy sector to be accurate and commends Norway for their work on this inventory sector.

Condensable Particulate Matter

57. The Party did not provide information of whether particle emissions include or exclude the condensable component. The ERT recommends Norway to include such information in the next submission.

Improvement

58. The ERT noted that Norway does not present planned improvements for the energy sector. However, the ERT identified some needs for improvement as explained under sub-sector specific recommendations below.

Sub-Sector Specific Recommendations

Category issue 1: 1.B.2.a.v - NMVOC

59. The ERT noted that Norway explains in its IIR that the method used to calculate emissions from the sector 1B2av is a tier 1 method, although this sector is a key category for NMVOC and it is considered good practice to use a higher tier methodology for key categories. During the review process, Norway explained that the method used to estimate the emissions from this sector was based on measurements and that the tier indicated in the IIR should have been tier II or III. The ERT recommends that Norway include the appropriate correction in their next submission to improve the transparency of the reporting.

Category issue 2: 1.A.1.c - SO_x

60. The ERT noted that Norway did not provide an explanation in its IIR regarding the sudden rise of 109 % in SO_x emissions in NFR sector 1A1c in 2005. During the review, Norway explained that this was an error and that it will be corrected in the next submission. The ERT recommends Norway to improve the efficiency of its QA/QC checks in order to detect this sort of errors prior to official reporting.

Category issue 3: 1.A.1.a - Hg

61. The ERT noted that Norway did not provide an explanation in its IIR regarding the sudden rise of 251% in Hg emissions in NFR sector 1A1a in 2008. During the review, Norway explained that the reason behind the anomalous value has not yet been further investigated but that it was due to the reporting of a single plant and that this will be corrected to the next submission. The ERT recommends Norway to correct the data and recommends Norway to improve the efficiency of its QA/QC checks in order to detect this sort of error prior to official reporting and particularly to improve its checks regarding to the integrity of the data directly reported by plants.

Category issue 4: 1.A.5.a – NO_x, NMVOC, SO_x, PM_{2,5}, PM₁₀, TSP, BC, CO, Pb, Cd, Hg, As, Cr, Cu and POPs

62. The ERT noted that Norway has not reported any emissions for the sector 1A5a for the years 1990-1994 in its 2019 submission whereas emissions had been reported in the previous submission. The ERT noted as well that the notation keys used between the emissions (“NE”) and the activity data (“NO”) in the reporting tables were not consistent. During the review, Norway explained that the correct notation key should have been “IE”, and that this case was due to the level of precision of the updated Energy Balance and that Norway expected to be able to report the emissions in NFR sector 1A5a in the next submission. The ERT recommends Norway to improve the efficiency of its QA/QC checks in order to detect this sort of errors regarding the use of notation keys prior to official reporting. Furthermore, the ERT recommends Norway to ensure completeness and consistency of the time series of this sector by estimating the splits necessary to complete the missing years.

Category issue 5: 1.A.2.a Iron and steel – CO

63. The ERT noted that there was no information available in the IIR regarding an update in the methodology for this pollutant and this sector following the recommendations of the previous Stage 3 review. During the review, Norway explained that the recommendation from the previous review had been implemented. In order to improve transparency, the ERT recommends Norway to describe in a more detailed manner the methodology used for each subsector in its IIR for the next submission as presented in the cross-cutting recommendations above.

Category issue 6: 1.A.2.c – Cr, Cd

64. The ERT noted that Norway did not provide any specific explanation in its IIR about the significant recalculations (more than 20 % in relative difference observed for some years) in this sector for these pollutants although the sector is a key category for Cr and Cd. During the review, Norway provided a comprehensive explanation for these recalculations. The ERT recommends Norway to include more detailed justifications of the recalculations in its IIR for the next submission to improve transparency.

Category issue 7: 1.A.4.a.i – Cr, Hg

65. The ERT noted that Norway did not provide an explanation for the significant recalculations (more than 20 % in relative difference observed for some years) in its IIR although the sector is a key category for Cr and Hg. During the review, Norway provided a comprehensive explanation for these recalculations. The ERT recommends Norway to include more detailed justifications of the recalculations in its IIR for the next submission to improve transparency.

Category issue 8: 1.A.4.b.i – SO_x

66. The ERT noted that Norway did not provide an explanation in its IIR for the significant recalculations (more than 20 % in relative difference observed for some years) in this sector for these pollutants although the sector is a key category for SO_x. During the review, Norway provided a comprehensive explanation for these recalculations. The ERT recommends Norway to include more detailed justifications of the recalculations in its IIR for the next submission to improve transparency.

TRANSPORT

Review Scope

Pollutants Reviewed		All		
Years		1990 – 2017		
Code	Name	Reviewed	Not Reviewed	Recommendation Provided
1A2gvii	Mobile Combustion in manufacturing industries and construction	X		
1A3ai(i)	International aviation LTO (civil)	X		X
1A3ai(ii)	International aviation cruise (civil)	X		X
1A3aii(i)	Domestic aviation LTO (civil)	X		
1A3aii(ii)	Domestic aviation cruise (civil)	X		
1A3bi	Road transport: Passenger cars	X		
1A3bii	Road transport: Light duty vehicles	X		
1A3biii	Road transport: Heavy duty vehicles and buses	X		
1A3biv	Road transport: Mopeds & motorcycles	X		X
1A3bv	Road transport: Gasoline evaporation	X		
1A3bvi	Road transport: Automobile tyre and brake wear	X		X
1A3bvii	Road transport: Automobile road abrasion	X		X
1A3c	Railways	X		
1A3di(ii)	International inland waterways	X		
1A3dii	National navigation (shipping)	X		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		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

67. Norway has provided a generally transparent emissions inventory. Detailed estimates are provided for all transport sub-sectors. Norway's methodology and emission factors in the IIR are considered by the ERT to be transparent and well described for the transport sector.

68. The ERT recommends Norway to provide more details in the IIR on the tier methods used for the calculation of emissions from sources identified as key categories (such as for non-exhaust PM emissions from tyre & brake wear and from road abrasion).

Completeness

69. Norway has provided emission estimates for almost all sources and pollutants in its current submission.

70. The ERT notes that PM emissions from mopeds and motorcycles are not estimated. During the review, Norway indicated its intention to include emission estimates for this sub-sector in its next submission.

71. The ERT notes that NH₃ emissions for many non-road transport sources are reported as “NE”, whereas there are no emission factors included in the Guidebook for these sources. The ERT recommends Norway to use the correct notation key “NA” in these cases.

Consistency including recalculation and time series

72. The ERT considers the time series provided in the current submission to be consistent.

73. Norway has recalculated its inventory for several mobile sources, presenting all necessary information within the IIR (rationales, years affected, absolute and relative changes in estimates, and effect on trends). The ERT commends Norway’s efforts to transparently display the process of revising their inventory.

Comparability

74. The methods used by Norway to estimate emissions of pollutants from the transport sector are generally consistent with those proposed in the Guidebook. For road transport the HBEFA model has been used. Despite some small differences for certain vehicle types and pollutants, the methods and emission factors are generally consistent with the Guidebook.

Accuracy and uncertainties

75. A quantitative uncertainty analysis, including different metrics such as standard deviation and probability density, has been carried out for both activity data and emission factors. Results from different studies as well as expert judgement have been used. The ERT commends the efforts made to estimate these uncertainties, the detailed description of the analysis and its results in the IIR.

76. Norway has established QA/QC procedures for all key categories as well as for some non-key categories. The ERT commends Norway for providing good information on the individual procedures used within the sectoral chapters.

Condensable Particulate Matter

77. Norway did not provide explanatory information on the condensable component of PM for any of the transport categories. In the IIR, there is no information of whether PM_{2.5} includes or excludes the condensable component. The ERT recommends Norway to include such information in the next submission.

Improvement

78. The ERT notes Norway’s intention to further improve its emission estimates for road transport by implementing the latest version of HBEFA, when this becomes available, and encourages the Party to implement planned improvements.

Potential Technical Corrections

79. The ERT did not identify any significant inconsistencies in the emission estimates and hence no technical corrections are suggested.

Sub-Sector Specific Recommendations

Category issue 1: 1.A.3.b.iv Road transport: Mopeds & motorcycles – PM_{2.5}, PM₁₀, TSP, BC

80. The ERT noted that for Mopeds and motorcycles (NFR 1A3biv), emissions of PM_{2.5}, PM₁₀, TSP and BC are reported as “NE”, whereas emission factors are available in the Guidebook. During the review, Norway responded that it was not aware of the emission factors available in the Guidebook and that it intends to address this in its next submission. The ERT recommends Norway to include the emissions in the 2020 submission.

Category issue 2: 1.A.3.b.vi-vii Road transport: Automobile tyre and brake wear and road abrasion – TSP, PM₁₀, PM_{2.5}, Pb, Hg, Cd

81. The ERT noted that NFR 1A3bvi and NFR 1A3bvii are key categories for TSP, PM₁₀, PM_{2.5}, Pb, Hg and Cd emissions for 2017, however the tier method used for calculating these emissions was not explicitly mentioned in the IIR. During the review, Norway responded that tier 2 methods were used for both road wear and brake/tyre wear emissions. Norway intends to address this in its next submission. The ERT recommends Norway to include documentation of the methods used in the 2020 submission.

Category issue 3: 1A2gvii, 1A3ai(i), 1A3ai(ii), 1A3dii, 1A3ei and 1A4ciii Off-road transport – NH₃

82. The ERT noted that following the previous Stage 3 review recommendation for the calculation of NH₃ emissions, Norway still reports NH₃ emissions as “NE” for the categories 1A2gvii, 1A3ai(i), 1A3ai(ii), 1A3dii, 1A3ei and 1A4ciii. During the review, Norway responded that for aviation and navigation/fishing (NFRs 1A3a, 1A3d, 1A4ciii) no emission factors are available in the Guidebook, therefore “NE” has been reported. Also, no emissions are reported under NFR 1A3ei, as pipeline emissions are included in emissions from oil and gas extraction under NFR 1A1c. The ERT recommends Norway to use appropriate notation keys according to the Reporting Guidelines paragraph 12. In case no emission factors are available (as in the case of NFRs 1A3a, 1A3d, 1A4ciii), “NA” has to be used; for emissions included elsewhere (as in the case of NFR 1A3ei) the “IE” notation key has to be used.

Category issue 4: 1.A.3.b.vi-vii Road transport: Automobile tyre and brake wear and road abrasion – Activity data

83. The ERT noted that the activity data reported for the calculation of non-exhaust PM emissions from tyre & break wear and from road abrasion do not match between these two categories. During the review, Norway responded that activity data for NFR 1A3bvi (tyre & break wear) includes the annual mileage for motorcycles which is not included in NFR 1A3bvii (road abrasion). As the Guidebook provides emission factors for mopeds and motorcycles, the ERT recommends Norway to include emissions from mopeds and motorcycles under NFR 1A3bvii (road abrasion) for the next submission.

INDUSTRIAL PROCESSES

Review Scope

Pollutants Reviewed		All		
Years		1990 – 2017		
Code	Name	Reviewed	Not Reviewed	Recommendation Provided
2A1	Cement production	X		X
2A2	Lime production	X		X
2A3	Glass production	X		X
2A5a	Quarrying and mining of minerals other than coal	X		X
2A5b	Construction and demolition	X		X
2A5c	Storage, handling and transport of mineral products	IE		X
2A6	Other mineral products	X		X
2B1	Ammonia production	X		X
2B2	Nitric acid production	X		X
2B3	Adipic acid production	NO		
2B5	Carbide production	X		X
2B6	Titanium dioxide production	X		X
2B7	Soda ash production	NO		
2B10a	Chemical industry: Other	X		X
2B10b	Storage, handling and transport of chemical products	IE		NO
2C1	Iron and steel production	X		X
2C2	Ferroalloys production	X		X
2C3	Aluminium production	X		X
2C4	Magnesium production	X		X
2C5	Lead production	NO		
2C6	Zinc production	X		X
2C7a	Copper production	NO		
2C7b	Nickel production	X		X
2C7c	Other metal production	X		X
2C7d	Storage, handling and transport of metal products	IE		X
2D3b	Road paving with asphalt	X		X
2D3c	Asphalt roofing	NE		
2H1	Pulp and paper industry	X		X
2H2	Food and beverages industry	X		X
2H3	Other industrial processes	X		X
2I	Wood processing	X		X
2J	Production of POPs	NE		X
2K	Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)	NE		X
2L	Other production, consumption, storage, transportation or handling of bulk products	NE		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

84. Norway has provided a generally transparent emission inventory for the industrial processes sector. Estimates are provided for almost all categories in the

scope of the industrial processes sector. Norway's methodology and emission factors in the IIR are considered by the ERT to be generally transparent.

Transparency

85. The ERT considers the emissions inventory for the Industrial processes sector to be generally transparent. However, the ERT recommends Norway to include in the IIR a presentation of activity statistics at least for key categories according to the recommended structure for the Informative Inventory Report (IIR) (Annex II to Reporting Guidelines, revised in 2018).

86. Norway does not report activity data for all industrial processes categories in the NFR14 tables and does not report any activity data (AD) in the IIR. During the review the Party indicated that AD cannot be presented in the NFR14 tables due to the AD consisting of different sources, or that for one of the sources regarding the different pollutants the AD is not the same. The ERT recommends that the AD that were used to calculate emissions is presented in the IIR because it cannot be presented in the NFR tables.

87. The ERT noted that reasons for dips and jumps in the time series are not included in the IIR. Therefore, the ERT recommends Norway to include missing trend descriptions in the IIR for the next submission.

88. Norway occasionally uses notation keys in the reporting tables for the industrial processes sector and the appropriate notation key is not always applied for activity data. The ERT recommends Norway to use appropriate notation keys according to the Reporting Guidelines paragraph 12 (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 emissions and activity data. The ERT also recommends Norway to explain the usage of notation keys in chapter 1.8 general assessment of completeness of the IIR for each of source for which Norway uses "NE", "IE" and "NO".

Completeness

89. In the 2019 submission, Norway has reported emissions for almost all source categories for the whole historic trend (1990-2017).

90. The ERT considers the industrial processes sector to be almost complete. However, the ERT noted that the following emissions are missing from the inventory:

a) NMVOC, CO, TSP, PM10, PM2.5 and BC from NFR 2D3c Asphalt roofing, although EFs are provided in the Guidebook. The ERT recognizes that the issue was not specifically raised during the review, but notes that in the IIR 2019 on p.17, there is an information that this source is not covered, even if emissions might be expected (NMVOC, PM). The ERT notes that it is not possible in a review to determine if the emissions would be above or below the threshold of significance as no activity data is available (see sector specific recommendations below). Emissions from activities under NFR 2B10a: it is not clear if several of the activities under NFR 2B10a exist in Norway and thus are missing from the inventory (see sector specific recommendations below).

b) The ERT notes as it was also detected in the previous review in 2013, that nickel (Ni), selenium (Se) and zinc (Zn) are not reported. The ERT recognises that the reporting emissions of these pollutants is voluntary according to Executive Body decision 2013/4 (see sector specific recommendations below).

91. The ERT commends Norway for including black carbon emissions for the whole time series in the relevant source categories of the Industrial processes sector.

Consistency including recalculation and time series

92. The emission trends and available activity data trend are in general consistent. However, during the review the ERT identified some outliers out of which Norway explained some. The ERT recommends Norway to include detailed explanations for all existent outliers in the time series for activity data and emissions in the next IIR.

93. The ERT notes that Norway has performed recalculations for two source categories, namely NFR 2B10a other chemical industry (Ethylene) and NFR 2C7c other metal production (Anodes) since the previous submission and that the recalculations are sufficiently justified in the IIR and resulted in an improvement of the inventory.

Comparability

94. Norway uses the EMEP/EEA methodology in combination with TNO and IIASA methodology and operator-reported site-specific emissions data for estimating emissions from the industrial processes sector. The methods used by Norway are consistent with the EMEP/EEA 2016 Guidebook. Norway also use country specific methods that are in line with the EMEP/EEA methodology. All methods are described transparently in the IIR.

95. Regarding the methods from the EMEP/EEA Guidebook 2013, the EMEP/CORINAIR Guidebook 2007 and EEA 1996 as well as TNO - Institute of environmental and energy technology 2002, IIASA Kupiainen and Klimont (2004) (used for particle size distribution), the ERT considers that these methods are outdated and recommends Norway to update them in line with EMEP/EEA's latest version of the guidebook, or alternatively, to provide justifications on their use in the IIR in case Norway considers these to be more accurate for the Norwegian conditions.

96. As activity data are not presented for all categories, the ERT was not able to fully compare the inventory with those of other Parties and the methodologies to the EMEP/EEA 2016 Guidebook.

Accuracy and uncertainties

97. The ERT found possible underestimates as explained under sub-sector specific recommendations.

98. Norway provided a quantitative uncertainty analysis for NO_x, SO_x, NMVOC and NH₃ prepared in 2001, however, the ERT notes that the analysis has not been updated since. The uncertainty analysis includes expert judgements of uncertainties for point sources by production type, standard deviation and probability density of activity data and emission factors by SNAP source category and uncertainty in emission levels of NO_x, SO_x, NMVOC and NH₃ prepared for 1990, 1998 and 2010* (*projected data with uncertainties as if they were historical). A qualitative uncertainty analysis for heavy metals, POPs and particles (including BC) is presented for all source categories under the industrial processes sector, however, CO emissions are not included. Since the missing quantitative uncertainty estimates for the latest historical years and the historic trend since 1990, the ERT recommends Norway to update the uncertainty quantification for all pollutants with the most appropriate methodologies available, taking into account guidance provided in the EMEP/EEA Guidebook as requested in the LRTAP Convention Guidelines for reporting emissions and projections data (ECE/EB.AIR/125) (para 31). The ERT also recommends Norway to include heavy metals, POPs, particulate matter (including BC) and CO in the next uncertainty analysis.

99. The ERT notes that Norway does not report in the IIR if the results of the uncertainty analysis are used to prioritize further improvements in the inventory and recommends that this information is to be included in the IIR.

100. In Norway's IIR information on source specific QA/QC procedures is provided and the ERT finds these consistent with the good practice. The ERT notes based on responses from Norway that source specific QA/QC procedures at the inventory agency are not extended to some source categories under NFR 2A, especially for 2A5a, 2A5b and 2A6 (except for ceramics). The ERT recommends Norway to cover all sources by source category specific QA/QC procedures and to document both those QA/QC activities carried out by authorities and those carried out in the preparation of the inventory, in the IIR. The ERT also notes, based on Norway's IIR that source specific QA/QC procedures are not extended to following source categories: NFR 2.B.5 Carbide production, NFR 2.B.6 Production of titanium dioxide, NFR 2.B.10.a Other chemical industry, NFR 2.C.6 Zinc production, NFR 2.C.7.b Nickel production, NFR 2.C.7.c Other metal production, NFR 2.D.3.b Road paving with asphalt, NFR 2.H.1 Pulp and paper industry, NFR 2.H.2 Food and beverages industry, NFR 2.H.3 Other industrial processes, NFR 2.I Wood processing) and recommends Norway to include source specific QA/QC procedures for these source categories.

Condensable Particulate Matter

101. Norway does not provide explanatory information in the IIR on whether PM_{2.5} includes/excludes the condensable component. The ERT recommends Norway to include such information in the next submission.

Improvement

102. Norway does not present planned improvements for the industrial processes sector. However, the ERT identified some needs for improvement as explained under sub-sector specific recommendations below.

Potential Technical Corrections

103. No potential technical corrections were calculated.

Sub-Sector Specific Recommendations

Category issue 1: 2 Industrial processes - Ni, Se, Zn

104. The ERT noted that on p.17 of the IIR there is a general assessment of completeness for heavy metals. Norway reports cadmium (Cd), lead (Pb) and mercury (Hg) which are mandatory to be reported under the CLRTAP and also arsenic (As), chromium (Cr) and copper (Cu), however not nickel (Ni), selenium (Se) and zinc (Zn) for which emission reporting is encouraged but not mandatory. To the question on the issue Norway responded that at the moment they are not planning to report Ni, Se and Zn. The ERT encourages Norway to pick up the voluntary reporting of nickel (Ni), selenium (Se) and zinc (Zn) in the future.

Category issue 2: 2.A.1 Cement production - NO_x, NMVOC, CO, NH₃ and PAHs

105. The ERT noted that in the NFR tables (1990-2017) Norway reports the notation key "NE" for NO_x, NMVOC, CO, NH₃ and PAHs. To the questions on the issue Norway responded that reporting "NE" for these components is consistent with the EMEP 2016 guidebook (see table 3.1 for 2A1) and that they cannot be sure that emissions are not already included in the energy sector (NFR 1A2f), and that since the emissions have been reported by the plants, these emissions might be included in the energy sector. The ERT recommends that Norway uses notation keys according to their definition under Reporting Guidelines paragraph 12. The ERT also recommends that Norway will further investigate this issue for the next submission. If the emissions are included in the energy sector the ERT recommends Norway to change the notation key to "NA" as these emissions are assumed to be related to combustion of fuels, see Guidebook Chapter 2A1 p.6 and p.10 under Table 3.1. If the emissions are not included in the energy sector, the ERT recommends Norway to estimate the emissions and to report them under the energy sector.

Category issue 3: 2.A.2 Lime production - NO_x, SO₂, NMVOC, CO, Pb and Hg

106. In the NFR tables (1990-2017) the ERT noted that for NO_x, SO₂, NMVOC, CO, Pb and Hg Norway reports the notation key "NE". To the questions on the issue Norway responded that reporting "NE" for these components is consistent with the EMEP 2016 guidebook (see table 3.1 for 2A1) and that they cannot be sure that emissions are not already included in the energy sector and that since the emissions have been reported by the plants, these emissions might be included in the energy sector. The ERT recommends that Norway uses notation keys according to their definition under Reporting Guidelines paragraph 12. The ERT recommends that Norway will further investigate this issue for the next submission and in case the emissions are included in the energy sector, to change the notation key to "NA" as these emissions are assumed to be related to combustion of fuels and not the process, see Guidebook Chapter 2A2 p.8 under Table 3.1. If the emissions are not included in the energy sector, the ERT recommends Norway to estimate the emissions and to report them under the energy sector.

Category issue 4: 2.A.2 Lime production - all

107. The ERT noted on p.119 of the IIR that the activity data for lime production is reported annually to the Norwegian Environment Agency and that in the NFR tables (1990-2017) for lime production Norway reports the notation key "NE". The ERT also registered that in Norway's CRF tables there is information on the lime production quantity. To the question on the issue and the invitation to provide the ERT a historic trend of activity data for this source category and to include these data in the IIR and in the NFR tables for the next submission, Norway provided the ERT with the production data for 1990-2017 and responded that they have planned to include the activity data in the NFR tables in the 2020 submission. Norway also responded that they will not include the activity data in the IIR due to their general approach to include the activity data in the NFR tables. The ERT recommends Norway to include the AD in the NFR tables in the 2020 submission. Due to transparency and completeness, the ERT recommends Norway to follow the recommended structure for the Informative Inventory Report (IIR) (Annex II to Reporting Guidelines, revised in 2018) and to include a presentation of activity data used to calculate emissions in the IIR submission in 2020. In case of confidential data, this should be clearly explained in the IIR.

Category issue 5: 2A5a Quarrying and mining minerals other than coal-all

108. The ERT noted that there is no information on material quarried [Mt] in the IIR, neither in the NFR tables (1990-2017) and that for NFR 2A5a Norway reports the notation key "NE". Nevertheless, on p.120 of the IIR, there is information that for one plant, Statistics Norway has calculated emissions based on production rates. To the question raised why no information on material quarried is reported in the NFR tables or the IIR and the invitation to provide the ERT a historic trend of activity data for this source category and to include these data in the IIR and in the NFR tables, Norway responded that as described in the IIR, these emissions are plant specific and reported to the Norwegian Environment Agency, except for one plant, and that due to confidentiality, Norway cannot deliver activity data for this plant and cannot include activity data in the NFR tables or in the IIR. The ERT thanks Norway on the clarification and recommends Norway to use the correct notation key "C" instead of "NE" and to put a clear explanation on this in its IIR for the next submission in 2020.

Category issue 6: 2A5b Construction and demolition- TSP, PM₁₀, PM_{2.5}

109. The ERT noted that on p.121 of the IIR, there is information that no emission factors are found in the literature for building of roads, railways, tunnels and demolition of buildings and therefore such emissions are not included in the inventory. The ERT noted that in the EMEP/EEA 2016 Guidebook, there are tier 1 emission factors for uncontrolled fugitive emissions for the following activities under source category 2A5b construction and demolition: construction of houses (detached single family, detached two family and single family terraced), construction of apartments (all types), non-residential construction (all construction except residential construction and road construction) and road construction. To the question on the issue Norway responded that they were not aware of the new emission factors in the EMEP/EEA 2016 Guidebook, and that they will investigate for which areas there are activity data available and will include the emissions where possible in the next submission. The ERT recommends Norway to search for activity data and to include the emissions into the 2020 submission.

Category issue 7: 2A5b Construction and demolition - TSP, PM₁₀, PM_{2.5}

110. The ERT noted that on p.122 of the IIR, there is information on the activity data used for the calculation of particle emissions for the source category 2A5b, which was the annual area of completed buildings from the building statistics from Statistics Norway. The ERT notes that there is no information on the annual area of completed buildings in the IIR submitted in 2019 and that Norway reports the notation key "NE" for the activity rate for this source category. To the question on the issue and the invitation to provide the ERT a historic trend of activity data for this source category Norway provided the ERT the activity data for 1990-2017 and responded that they have planned to include the activity data in the NFR tables of the 2020 submission and that the activity data will not be included in the IIR due to their general approach to include activity data in the NFR tables. The ERT recommends Norway include the emissions and the activity data in the 2020 submission. Due to transparency and completeness and also due to NFR 2A5b being a key source in 2017 for TSP and PM₁₀ emissions, the ERT recommends Norway to follow the recommended structure for the Informative Inventory Report (IIR) (Annex II to Reporting Guidelines, revised in 2018) and to include a presentation of activity data used to calculate emissions in the IIR for the next submission. In case of confidential data, this should be clearly explained in the IIR.

Category issue 8: 2.A.5.c Storage, handling and transport of mineral products - NO_x, SO_x, NH₃, PM_{2.5}, PM₁₀, TSP, BC, CO, Pb, Cd, Hg, As, Cr, PCDD/ PCDF, Cu, Ni, Se, Zn, PAHs, HCB and PCBs

111. The ERT noted that Norway uses notation key "IE" for NO_x, SO_x, NH₃, PM_{2.5}, PM₁₀, TSP, BC, CO, Pb, Cd, Hg, As, Cr, PCDD/F and the notation key "NE" for Cu, Ni, Se, Zn, PAHs, HCB and PCBs and also reports the activity data for 2A5c storage, handling and transport of mineral products. The ERT also noted that there is no information in the IIR on where these emissions are included and why the other emissions are not calculated and a historic trend of activity rate is reported. To the questions on the issue Norway responded that emissions of PM_{2.5}, PM₁₀ and TSP from 2A5c are included in the Guidebook Chapter 2A5c EFs and thus to their understanding reported under the relevant NFR codes (e.g. 2A1) and that they will make this clearer in the IIR. Norway also confirmed that for NO_x, SO_x, NH₃, PM_{2.5}, PM₁₀, TSP, BC, CO, Pb, Cd, Hg, As, Cr, PCDD/ PCDF, the use of the notation key "IE" in the NFR is a mistake and that they will change this to "NA", to be consistent with the 2016 Guidebook and that for Cu, Ni, Se, Zn, PAHs, HCB and PCBs, they will change the notation keys from "NE" to "NA", to be consistent with the 2016 Guidebook. The ERT recommends Norway to correct the "NE" and "IE" notation keys to "NA" and to document the allocation of emissions reported as "IE" in the IIR to the next submission.

Category issue 9: 2.A.6 Other mineral products - all

112. During the review the ERT noted that Norway reports emissions from numerous activities under NFR 2A6: ceramics, non-metallurgical magnesia production, sandpit and rock-crushing plant, concrete pumice stone, rock wool production, production of mineral white (plaster), construction and repairing of vessels – sandblasting, leather preparing and production of asphalt and that there are no historic trend of activity data reported for activities in the scope of NFR 2A6 and asked Norway to provide the ERT the missing historic trend of activity data for each of the activities reported under this NFR. Norway provided the ERT activity data for the historic trend for ceramics, non-metallurgical magnesia production, sandpit and rock-crushing plant, rock wool production and production of asphalt and responded that their general approach is to include activity in the NFR tables. The

ERT thanks Norway for providing the ERT with activity data and recommends, due to transparency and completeness and also as NFR 2A6 is a key source for TSP and PM₁₀ emissions, Norway to follow the recommended structure for the Informative Inventory Report (IIR) (Annex II to Reporting Guidelines, revised in 2018) and to include a presentation of activity data that were used to calculate the emissions. In case of confidential data, please clarify this in the IIR.i

Category issue 10: 2.A.6 Other mineral products – NH₃

113. The ERT noted that Norway reports NH₃ emissions from leather preparing under NFR 2A6 and not under 2D3g (SNAP 060313 - Leather tanning). To the question on the issue Norway responded that they will correct this source category allocation in the next submission. The ERT recommends Norway to reallocate the emissions under NFR 2D3g to document this in the next submission of the IIR.

Category issue 11: 2.A.6 Other mineral products and 2.D.3.b Road paving with asphalt - NMVOC, TSP, PM₁₀, PM_{2.5}, BC, PCDD/PCDF

114. The ERT noted that Norway reports BC and PCDD/PCDF emissions from production of asphalt under NFR 2A6 and NMVOC, TSP, PM₁₀ and PM_{2.5} emissions under 2D3b road paving with asphalt and that the activity data reported for both categories is the same: annual weight of asphalt for road paving in Norway, EBA (2014) (p.130 and p.169 of Norway's IIR 2019). To the question on the issue Norway responded that they will correct the allocation of BC and PCDD/F emissions to NFR 2D2b in the next submission. The ERT recommends Norway to reallocate the emissions and to document the allocation in the next submission of the IIR.

Category issue 12: 2.B.1 Ammonia production, 2.B.2 Nitric acid production, 2.B.10.a Other chemical industry - NO_x, NH₃, TSP, PM₁₀, PM_{2.5}, BC

115. The ERT noted that on p.132 of the IIR, there is information regarding ammonia production (NFR 2B1), nitric acid production (NFR 2B2): and production of nitrogenous-based fertiliser(s) (NFR 2B10a) in Norway. To the questions to provide further details on the production of nitrogenous-based fertiliser(s) and, on the reason for not including the information in the IIR under NFR 2B10a, as well as on splitting NH₃ emissions into the appropriate categories: 2B1, 2B2 and 2B10a instead of the current aggregation under 2B2, Norway responded that one plant produces ammonia, nitric acid and complete fertilizers (NPK and calcium nitrate) and thus the reported emissions cannot be split and are generally aggregated under 2B2. The exception is for CO from 2B1 where they have estimated emissions. Norway noted that for NH₃, they have used the notation key "NO" and written in chapter 4.3.1.2 for 2B1 that the process does not result in NH₃ emissions, as the NH₃ is absorbed in an argon facility. A second plant produces only nitric acid.

116. The ERT thanks Norway for the extra information provided and recommends Norway to include all the information provided to the ERT during the review in the next submission of the IIR.

Category issue 13: 2.C Metal industry - all

117. The ERT notes that in the IIR there is no information on activities included under the 2C source categories. To the questions on the issue Norway responded that under NFR 2C1 they report emissions from one steel producing plant that uses an electric arc furnace (EAF) and that they will include this information in next year's

IIR. Regarding the ERT's question on the missing activity data from NFR 2C4 magnesium production, Norway provided the production data already reported in the CRF tables for 1990-2006 and responded that they intend to include the activity data in the NFR tables in the 2020 submission. Regarding the question on missing activity data for NFRs 2C6 (Zinc production), 2C7b (Nickel production) and 2C7c (Manufacture of anodes), Norway responded that they use a consistent time series of emissions reported by the plants but that they only have partial time series for the production and have therefore chosen not to include this in the CRF nor in the NFR tables, but will include the information in the NFR tables.

118. The ERT thanks Norway for the information and recommends the Party to include the missing activity data in the NFR tables in the 2020 submission instead of using notation key "NE". Moreover, as NFR 2C4 is a key source for HCB (in 2005) in Norway and due to transparency and completeness, the ERT recommends Norway to include a presentation of activity data used in the calculation of emissions in the IIR of the next submission according to the recommended structure for the Informative Inventory Report (IIR) (Annex II to Reporting Guidelines, revised in 2018). In case of confidential data, this should be clarified in the IIR.

Category issue 14: 2.D.3.b Road paving with asphalt, allocation, all

119. During the review the ERT noted that on p.163 of the IIR there is information that within solvents and product use, Norway includes emissions from solvent losses, creosote-treated materials, road paving with asphalt, mercury-containing products, tobacco and use of fireworks. The ERT notes that NFR 2D3b road paving with asphalt is in the NFR tables allocated under B_Industry. To the question on the issue Norway responded that they will correct this in the next submission. The ERT recommends Norway reallocate the documentation under to the correct NFR codes.

Category issue 15: 2.H.1 Pulp and paper - all

120. The ERT noted that on p.174 of the IIR, there is information that for the estimates of NO_x, NMVOC and CO, production levels of pulp by different processing steps as reported by the plants are used and that for 2H1 Norway reports the notation key "NE" in the NFR table for activity data. To the question on the issue Norway responded that they will correct the notation key for 2H1 for CO to "NO" from the year 2014 onwards and that emissions of CO are reported for the years prior 2014. Norway also responded that activity data on the annual production of pulp by different processing steps are confidential and that it cannot be included. Due to transparency and completeness and also as NFR 2H1 is a key source for SO₂ emissions (e.g. 2010, 2005), the ERT recommends Norway to follow the recommended structure for the Informative Inventory Report (IIR) (Annex II to Reporting Guidelines, revised in 2018) and to include a presentation of activity data used in calculation of emissions, even at an aggregated level, and in case of confidential data, to clearly explain this in the IIR of the next submission

121. The ERT notes that the question on if fuel based NO_x, NMVOC and CO emissions are included under the energy sector was not raised during the review, however, notes that information on this should be clearly documented in the IIR and that in this case those emissions should be reported under NFR 2H1 as "NA". In case the emissions would not be included under the energy sector, the ERT notes that the emissions should be estimated and reported under the energy sector (NFR 1A2d). The ERT also notes that the notation key "NO" is reserved for cases where the activity does not exist (see Reporting Guidelines para 12).

Category issue 16: 2.H.2 Food and beverages industry - all

122. In the IIR, submitted in 2019, there is information that production volumes of bread and beverages (beer) are annually reported to Statistics Norway, however, in the NFR tables (1990-2017) the ERT notes that for 2H2 Norway reports the notation key "NE". To the question on the issue Norway provided the ERT these activity data and responded that they use tonnes of bread as activity data for bread and litres of beverages as activity data for beverages, since there is no common unit for the activity data of these two activities.

123. The ERT thanks Norway for providing the activity data for the activities of food (bread) and beverages (beer) in the scope of 2H2. Due to completeness, transparency and comparability to other Parties, the ERT recommends Norway to report the activity data on the aggregated level in the NFR tables. Norway uses notation key "NE" for reporting of AD for 2H2 (food and beverages) since in their opinion there is no common unit for AD for these two activities. Since the reported unit is in kilo-tonnes [kt] of food and beverages production and statistical data for wine, beer, and spirits are in hectolitres [hl], the ERT recommends Norway to convert [hl] in [kt] by using density for beer, ethanol and wine (red and white) as other Parties do and to document this in the IIR. In cases where the activity data cannot be presented in the NFR tables due to inclusion of activities from several sources with different activity data the ERT recommends Norway to present the activity data used to calculate the emissions in the IIR, because it cannot be presented in the NFR tables. The ERT notes that Norway can keep all products in the original units when the data is provided in the IIR separately for each product.

124. When comparing to other Parties, the ERT found the rate of food and beverage production to be lower in Norway and to confirm the completeness of activities allocated in Norway's inventory under 2H2. Norway responded that activities other than bread and beers are considered insignificant and have therefore not been included in the inventory. The ERT recommends Norway to improve the completeness of the inventory by including all sources for which methods exist in the Guidebook to the next submission or to demonstrate at least for the years 1990, 2005, 2010 and the last historic year that the production rates of these activities are insignificant in Norway and to document this demonstration in the IIR of the next submission.

Category issue 17: 2.I Wood processing - NMVOC

125. The ERT noted that on p.176 of the IIR there is information that the production volumes of wood processing products are annually reported to the Norwegian Environment Agency, although Norway reports the notation key "NE" in the NFR tables (1990-2017). As response to the question on the issue Norway provided the ERT with the production data for 1990-2017, responded that they have planned to include the activity data in the NFR tables in the 2020 submission and that activity data will not be included in the IIR. The ERT thanks Norway for providing the historic trend of production volumes of wood processing and recommends Norway to include this data in the NFR tables of the next submission, and preferably also in the IIR. In case of confidential data, this should be clearly explained in the IIR.

Category issue 18: 2.K Consumption of POPs and heavy metals - Hg, PCBs

126. The ERT noted that Norway reports emission of Hg from the source category 2K in the NFR tables (1990-2017) with the notation key "NE" and that the IIR does not contain any information regarding this category. The ERT notes that for Hg and

PCB emissions the 2016 EMEP/EEA Guidebook provides tier 1 EFs and that activity data used with these EFs is the country's total population. To the question of not reporting the emissions Norway responded that they report Hg emissions from mercury-containing thermometers and fluorescent tubes under NFR 2G, that the sale of these products decreased strongly since the mid-1990s, and the mercury content in these products has been reduced. Norway also informed the ERT that a prohibition against the production, import and export of mercury-containing products entered into force in 1998, except for some thermometers for professional use, which were prohibited in 2001 and therefore stated that using an EF per capita to calculate emissions will not properly reflect the situation in Norway. The ERT is aware that the method in the 2016 Guidebook will be removed from the 2019 version of the Guidebook and recommends that Norway reviews the methods in the updated 2019 version of the Guidebook for the next submission.

127. The ERT noted that Norway reports PCB emissions from the source category 2K in the NFR tables (1990-2017) with the notation key "NE" and that the IIR does not contain any information regarding this category. In response to questions on the issue Norway responded that they have no data for emissions from products but, due to the requirements of collecting waste containing PCB, they consider the emissions to be insignificant. Norway noted that building materials containing PCB, for example transformers and other electric equipment are treated as hazardous waste and since it is not allowed to use products with PCB, it is not correct to calculate emissions based on population size. In response to further questions by the ERT Norway replied that PCB is prohibited in products by Produktforskriften (product regulation), not available in English, but can be found in Norwegian under the link: <https://lovdata.no/dokument/LTI/forskrift/2011-11-17-1113>. This includes transformers ("transformatorer"), power capacitor ("kraftkondensator") and small capacitors ("kondensatorer"). Capacitors produced between 1965 and 1979 are only allowed if it can be documented that they are free of PCB. The ERT thanks Norway on the information provided and recommends Norway to include the information provided to the ERT in the 2020 IIR.

Category issue 19: 2.A Mineral products - all

128. The ERT noted that in the IIR, there is information that no source specific QA/QC procedures are applied for NFR sectors: 2A1, 2A2, 2A3, 2A5a, 2A5b, 2A6. To the question on the issue Norway responded that the text in the IIR does not reflect the reality in terms of QA/QC procedures for 2A, that emissions reported under 2A1, 2A2, 2A3 and some of the emissions under 2A6 (ceramics) are based on data reported by the plants according to their permits to the Norwegian Environment Agency (NEA). The case handler assesses the reported emissions and activity data and contacts the plants if needed. Emissions from these plants also include GHGs (green house gases), so the inventory team at NEA undertakes QA/QC procedures that also are relevant for other components. Statistics Norway does not have source specific QA/QC procedures for 2A5a, 2A5b and the rest of 2A6 because the companies and activities are so different. The sources are however covered by the general QA/QC of the time series. The ERT thanks Norway for providing this clarification and recommends Norway to include the information in the IIR for the next submission.

Category issue 20: 2.A.1, 2.B.1, 2.B.2, 2.B.5, 2.C.2, 2.C.3 trends - all

129. The ERT noted that in the IIR there is no information about dips and jumps in the activity data trend for the following NFR categories and years: 2A1- dips in 1991 and 2004; 2B1 – dip in 1999 and peaks in 2004 and 2015; 2B2 - dips in 1992 and

2009; 2B5 – dip in 2003; 2C1 – dip in 2008 and peak in 2012; 2C2 – dips in 1991 and 2009; 2C3 – dip in 2009. To the question on the issue Norway provided explanations for: NFR 2A1 – the dip in 1991 is due to the fact that one of the two cement producing plants was rebuilt and had neither production nor emissions, for 2004, they have no information of why the production was lower; for NFR 2B1 - the dip in 1999 (from 1998 to 1999 and 1999 to 2000) is likely to be a result of the plant upgrading production capacity and energy efficiency in 1999-2000, the increase in emissions from 2014 to 2015 is due to an expansion in production capacity for which imported ammonia is replaced with domestic ammonia production; for NFR 2B2 - the dip in 1992 is due to rebuilding of one of the production lines and the dip in 2009 reflects lower economic activity due to the economic recession (which also is the reason for the dip in 2009 for 2C3); for NFR 2B5 - the dip in 2003 is because a plant producing calcium carbide closed down in 2002; for NFR 2C1 - they do concurrently not have information on the dip and jump in 2008 and 2012, respectively. Norway responded that they will consider including some of this information in the IIR. The ERT thanks Norway for the explanations and recommends Norway to include all explanations in the IIR of the next submission.

Category issue 21: 2.B.10.a Other Chemical industry - all

130. The ERT noted that in the IIR there is no information about the existence of the following activities in the scope of the source category 2B10a other chemical industry in Norway and that for these activities there are emission factors in the Guidebook: SNAP 040404 Ammonium sulphate, SNAP 040405 Ammonium nitrate, SNAP 040406 Ammonium phosphate, SNAP 040407 NPK fertilisers, SNAP 040408 Urea, SNAP 040409 Carbon black, SNAP 040411 Graphite SNAP 040413 Chlorine production, SNAP 040414 Phosphate fertilisers, SNAP 040508 Polyvinylchloride, SNAP 040509 Polypropylene, SNAP 040510 Styrene, SNAP 040511 Polystyrene, SNAP 040512 Styrene butadiene, SNAP 040513 Styrene-butadiene latex, 040514 Styrene-butadiene rubber (SBR), SNAP 040515 Acrylonitrile Butadiene Styrene (ABS) resins, SNAP 040516 Ethylene oxide, SNAP 040517 Formaldehyde, SNAP 040518 Ethylbenzene, SNAP 040519 Phtalic anhydride, SNAP 040520 Acrylonitrile, SNAP 040523 Glyoxylic acid, SNAP 040525 Pesticide production. In response to the question on the issue Norway responded that with the exception of production of NPK fertilisers, which is included under NFR 2B2 (due to not being able to split plant-specific emission data), Norway has not included these activities as these activities have been assessed as not occurring in Norway and that for the next submission Norway will check if these activities are occurring. The ERT recommends Norway to check if these activities occur and in case they are, to estimate and report emissions from all existing activities to the next submission, or, if not occurring, to document this in the IIR of the next submission emissions.

Category issue 22: 2.A, 2.B, 2.C, 2.D.3.b, 2.H.2 - all

131. The ERT noted that according to the IIR EMEP/EEA Guidebook 2013 emissions factors, EMEP/CORINAIR Guidebook 2007 methodology and other sources (TNO - Institute of environmental and energy technology 2002, IIASA Kupiainen and Klimont (2004), and EEA 1996) are used for the calculation of particle size distributions. To the question on the issue Norway responded that this is the case for most of these emission calculations, but that there are also some sources that have plant specific data and that they will look into this and compare with the Guidebook. They also confirmed that EMEP/CORINAIR Guidebook 2007 is not in use. The ERT recommends Norway check the use of most suitable methodologies and to carefully document these in the IIR and also to check and correct information provided in the IIR.

Category issue 24: 2.G Activity data trends

132. The ERT noted that activity data for mercury-containing products, tobacco consumption and use of fireworks are not included in the IIR and the NFR tables. The ERT notes that Norway has not included in the inventory an activity like Use of shoes, and that this may have an impact on underestimating the pollutant emissions. In response to the question on these issues, Norway responded that it is not easy for them to show the activity data for the calculations for mercury-containing products, and regarding the activity Use of shoes that they were not aware that there is an EF for NMVOC in the EMEP 2016 Guidebook and that they will investigate which areas there are activity data available and include the emissions where possible in the next submission. Norway provided activity data for tobacco consumption and fireworks for 1990-2017 and responded that the activity data for tobacco consumption or fireworks will not be included in the IIR. Due to transparency and completeness and also as NFR 2G is a key category for Hg, Pb and Cr emissions, the ERT recommends Norway to follow the recommended structure for the Informative Inventory Report (IIR) (Annex II to Reporting Guidelines, revised in 2018) and at least include a presentation of activity statistics for key categories in the IIR for the next submission of the IIR in 2020. Moreover, as the source category 2G includes many activities and the activity data cannot be presented in the NFR tables as it includes several activities for which the activity data is not the same, the ERT recommends that the activity data that were used to calculate these emissions will be presented in the IIR. In case of confidential data, this should be clearly explained in the IIR.

Category issue 24: 2.A.5.a Quarrying and mining – PM₁₀

133. The ERT noted that in the period 1990 – 2017 PM₁₀ emissions vary from 0.015 kt to 0.074 kt per year except for the year 1996 when there is a peak of 0.65 kt. In response to the question on the issue Norway responded that there was a mistake in the calculation of TSP emissions leading to higher PM₁₀ emissions (for that year 100 times too high) and that this will be corrected to the next submission. The ERT recommends Norway to correct the value in 1996 to the next submission.

Category issue 25: 2.A.2 Lime production - PM₁₀

134. During the review the ERT noted that in the period 1990 – 2017 the trend of PM₁₀ emissions from 2A2 has big fluctuation. To the question on the issue Norway responded that the emissions are based on the reporting from one plant and that different methods may have been used for these years as opposed to other years. The ERT recommends Norway to check the emission levels for these years, e.g. by comparing to the relevant activity data and to make relevant corrections to the next submission, or to justify the dips in the IIR of the submission in 2020.

Category issue 26: 2.J, 2.L, notation keys

135. The ERT notes that Norway uses the notation key “NE” for several pollutants for the NFRs 2J and 2L and assumes that this is due to these pollutants being marked as “NE” in the Guidebook EF tables. The ERT notes that when the Guidebook does not provide EFs or there are no other methods available that the country prefers to use, these pollutants should be reported as “NA” (not available) and not “NE” (not estimated), which is reserved for cases where the emissions are not estimated by the Party although an EF is presented in the Guidebook, see Reporting Guidelines paragraph 12. The ERT therefore recommends Norway to change the notation keys to “NA” to the next submission.

Category issue 27: 2.D.3.c, NE

136. The ERT notes from the Norway's IIR that Norway uses the notation key "NE" for NMVOC, CO, TSP, PM10, PM2.5 and BC from NFR 2D3c Asphalt roofing, although EFs are provided in the Guidebook. The ERT notes that the issue was not raised during the review and not in the draft review report. However, the ERT believes that Norway would be willing to accept this note for further improvement of the inventory to collect data and to estimate relevant emissions for the next submission.

SOLVENTS

Review Scope

Pollutants Reviewed		All		
Years		1990 – 2017		
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	X		X
2D3g	Chemical products	X		X
2D3h	Printing	X		X
2D3i	Other solvent use	X		X
2G	Other product use	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

137. Norway has provided a generally transparent emission inventory for the solvent sector. Estimates are provided for almost all categories and years. To estimate emissions from the solvent and other product use sector Norway uses a general model, which is a simplified version of the methodology described in the EMEP/CORINAIR Guidebook 2007 (EEA 2007) and is based on the trade data from the Norwegian Product Register. For cosmetics Norway uses a side model, which is based on the trade data from the Norwegian Association of Cosmetics, Toiletries and Fragrance Suppliers (KLF) and data from point sources from the industrial sector “manufacture of chemicals and chemical products” (NACE 20). These methods are consistent with the guidance provided in the EMEP/EEA Guidebook and external sources are well referenced.

Transparency

138. Norway’s methodology and emission factors presented in the IIR are considered by the ERT to be generally transparent.

139. Norway does not report all activity data used in the emission calculations in the NFR tables or in the IIR for all categories and/ or for the whole historic trend. The ERT recommends Norway to follow the recommended structure for the Informative Inventory Report (IIR) (Annex II to Reporting Guidelines, revised in 2018) and to at least include the presentation of activity statistics for key categories in the IIR. Moreover, when the source category includes many activities for which the AD are not the same and thus cannot be presented in the NFR tables the ERT recommends that the activity data that were used to calculate emissions is presented in the IIR.

140. The ERT also notes that descriptions of the activity data trends in the IIR are missing. The ERT recommends Norway to include information on the drivers behind the activity data trends in the IIR of the next submission.

141. Norway occasionally uses the notation key “NA” instead of “NE” when reporting emissions. The ERT recommends Norway to check the correct use of notation keys against the definitions in the Reporting Guidelines.

Completeness

142. The ERT considers the solvent sector to be almost complete and comprehensive.

143. The ERT found missing estimates in the solvent and other product use sector in the Norwegian inventory as listed below. The ERT was unable to determine whether the missing estimates would be below or above the threshold of significance because no activity data was available. The ERT strongly recommends Norway to include the missing estimates to the next submission. Detailed recommendations are given in the sector specific recommendations below:

- (a) NMVOC emissions from NFRs 2D3a Domestic solvent use including fungicides for the period 1990-2004 and from 2D3h Printing for the period 1990-2004.
- (b) TSP, PM₁₀ and PM_{2.5} emissions from NFR 2D3i Other solvent use - Fat, edible and non-edible oil extraction for the period 1990-2017.

144. The ERT commends Norway for including the estimation of black carbon emissions for the whole time series in the relevant source category of the solvent sector.

Consistency including recalculation and time series

145. The emissions time-series and available activity data trends are in general consistent. However, during the review the ERT identified some outliers, to most of which Norway provided an explanation that the ERT accepted. The ERT recommends Norway to include detailed explanations for all outliers in its IIR as indicated in the sub-sector specific recommendations.

146. Norway has performed recalculations in the scope of the solvent sector in the latest submission for year 2016 for lots of NFR source categories, namely: 2.D.3.a Domestic solvent use including fungicides, 2.D.3.d Coating applications, 2.D.3.e Degreasing, 2.D.3.f Dry cleaning, 2.D.3.h Printing and 2.D.3.g Chemical products since the previous submission and recalculations are sufficiently justified in the IIR and resulted in an improvement of the inventory.

Comparability

147. The methods used by Norway to create the inventory are consistent with the EMEP/EEA 2016 Guidebook. Norway uses country specific methods and other methods for the solvent sector that are in line with the EMEP/EEA Guidebook. All methods are described transparently in the IIR or in a publicly available document. Methodology and emissions factors in Norway's inventory are well documented, but activity data not, which prevented the ERT from being able to compare the inventory (1990-2017) with those of other Parties.

148. The ERT did not identify over- or underestimates in the Norwegian inventory.

Accuracy and uncertainties

149. Norway has provided in the IIR a quantitative uncertainty analysis for NMVOC prepared in 2001. The uncertainty analysis includes expert judgements of uncertainties for point sources by production type, standard deviation and probability density of activity data and emission factors by SNAP source category and

uncertainty in emission levels of NMVOC for the years 1990, 1998 and 2010* (*projected data with uncertainties as if they were historical). Norway also provided a qualitative uncertainty analysis for pollutants under the solvent sector. The ERT recommends Norway to update the uncertainty quantification in its emission estimates with the most appropriate methodologies available, taking into account the guidance provided in the EMEP/EEA Guidebook to the next submission.

150. Norway does not report in the IIR on how its uncertainty analysis is used to prioritize further improvements in the inventory in the scope of the solvent sector. The ERT recommends Norway to use the results of the uncertainty analysis to prioritize improvements in the inventory.

151. Norway presents information in the IIR on source specific QA/QC procedures for most of the source categories in the scope of the solvent sector. The ERT found that there were some source categories, such as NFR 2.D.3.g Chemical products (Creosote-treated materials) and NFR 2.G Other product use (Mercury-containing products, Tobacco, Use of fireworks), where no QA/QC is carried out and recommends Norway to perform QA/QC procedures also for these source categories and to include information on these in the IIR.

Condensable Particulate Matter

152. Norway did not provide explanatory information in the IIR on the condensable component of PM for categories in the scope of the solvent sector. The ERT recommends Norway to include such information in the next submission.

Improvement

153. In the IIR Norway has not presented any improvement plans for the solvent sector. However, the ERT highlights that several source categories can be improved and recommends Norway to check/review them, include new information and implement improvement plans as soon as possible as indicated in the sub-sector specific recommendations below.

Potential Technical Corrections

154. No potential technical corrections were calculated by the ERT.

Sub-Sector Specific Recommendations

Category issue 1: 2.D.3.i – allocation, NMVOC

155. The ERT noted that it was not clear from the IIR if emissions from Glass wool and Mineral wool enduction, Application of glues and adhesives, Underseal treatment and conservation of vehicles, Vehicles dewaxing and Other (Concrete additive, Cooling lubricant, Lubricant, Pesticide, Aeroplane de-icing Agent) are included in the inventory. To the question on the issue Norway confirmed that these activities are included. The ERT recommends Norway to document the existence of activities falling under this category in Norway and the inclusion of the emissions in the inventory in the IIR of the next submission.

Category issue 2: 2.D.3.i – missing emissions, TSP, PM₁₀, PM_{2.5}

156. Regarding the category fat, edible and non-edible oil extraction Norway explained that the methodology which is proposed by the Guidebook to estimate

NMVOC and PM emissions is based on the amount of seeds used and this information is not available for Norway, but that Norway uses the amount of solvent used to estimate NMVOC emissions from this activity. Norway also responded that they will investigate in the future if the amount of seeds can be collected to estimate PM emissions, but as it is a small PM emission source, this cannot be prioritized. The ERT notes that the emissions are below the threshold of significance for a technical correction, however for the completeness of the inventory, recommends Norway to include this activity in the inventory as the relevant activity statistics are the quantities of seeds used in units of tonnes (Mg) that is available in the Statistics Norway – PRODCOM (CPA: 10.41.41 oil-cake and other solid residues, of vegetable fats or oils: 10.41.41.30, 10.41.41.50, 10.41.41.70, 10.41.41.90) and to document this in the IIR for the next submission.

Category issue 2: 2.D.3.g, 2.D.3.i – allocation, NMVOC

157. The ERT noted that Norway has included creosote-treated materials in the inventory in the scope of category 2D3g and that this activity falls under 2D3i according to 2016 EMEP/EEA methodology. To the question on the issue Norway responded that they can correct the allocation to the next submission. The ERT recommends Norway to correct the allocation to the 2020 submission.

158. The also ERT noted that according to 2016 EMEP/EEA Guidebook, besides creosote preservative type for wood preservation there are also solvent-borne preservative and water-borne preservative types that can be in use in Norway. To the question on the issue Norway responded that as explained in the IIR, for NMVOC emissions Norway uses a model, which is built on the consumption of products and that all products used are included in the Product Register. They also compare the approved wood preservatives with the chemicals in their calculations and that there will be no underestimation as long as these chemicals are specified among the chemicals they receive from the Product register. If they would find chemicals containing NMVOC that are not included, they would add them to the list. The ERT thanks Norway for the provided information. However, the ERT wants to draw Norway's attention on water-borne wood preservatives that are, according to the EMEP/EEA Guidebook 2016, also a source of NMVOC emissions ($EF_{\text{NMVOC}} = 5 \text{ g/kg}$ waterborne preservative) and also recommends Norway to confirm that these are included in the inventory and to document this in the IIR of the next submission.

Category issue 3: 2.D.3.a, 2.D.3.c, 2.D.3.d, 2.D.3.e, 2.D.3.f, 2.D.3.g, 2.D.3.h, 2.D.3.i – gaps 1990-2004 all pollutants

159. During the review the ERT noted that Norway reports activity data for 2D3a, 2D3d, 2D3e, 2D3f, 2D3g, 2D3h, 2D3i only since 2005, and that historic trends are not completed due to the missing activity data for the period 1990-2004. To the question on the issue Norway responded that emissions from solvent use have been calculated with different methods throughout the time series. Since 2005 the calculations are based on data from the Product register, while for the period 1990-2005 no AD is available. The ERT strongly recommends Norway to estimate the missing NMVOC emissions from NFRs 2D3a, 2D3c and 2D3h for the period 1990-2004 to the next submission by using some surrogate data e.g. GDP and methods provided in the Guidebook for these cases.

Category issue 4: 2.D.3.a, 2.D.3.d, 2.D.3.e, 2.D.3.f, 2.D.3.g, 2.D.3.h – trends, all pollutants

160. During the review the ERT noted that in the IIR there is no information about dips and jumps in the activity data trend for following source categories and years: 2D3a - dip in 2006 and peaks in 2009, 2012 and 2015; 2D3d –peak in 2011; 2D3e - dip in 2006 and peak in 2012; 2D3f – peak in 2006; 2D3g – dips in 2006 and 2009; 2D3h – dips in 2006 and 2009. In response to the issue Norway provided justifications to the trends which the ERT accepted. The ERT thanks Norway for the justifications and recommends Norway to include the information provided in the IIR of the next submission.

Category issue 5: 2.D.3.d – IEF, NMVOC

161. During the review the ERT noted that in the period 2005 – 2017 the implied emission factor (IEF) value for NMVOC varies from 0.51 to 0.77 except for the year 2011 where the IEF is much lower with a value of 0.11 (IEF: kt NMVOC emission/kt AD for 2D3d). To the question on the issue Norway responded that there was a high import in a product group with a low EF. The unusual high import (high AD) leads to a low IEF compared to years with lower import. The ERT thanks Norway for the clarification and recommends Norway to include this information in the IIR of the next submission.

Category issue 6: 2.D.3.f – IEF, NMVOC

162. The ERT noted that in the period 2005 – 2017 the IEF value for NMVOC is 0.57 except for the year 2014 where the IEF is much lower with a value of 0.35 (IEF: kt NMVOC emission/kt AD for 2D3f). To the question on the issue Norway responded that there is an error in the emission of NMVOC in 2014, that the emissions should be the same as in 2013 i.e. 0.123791 kt, which corresponds to an IEF of 0.57. Norway said that the figure will be corrected in the next submission. The ERT recommends Norway to include this correction in the NFR tables and the IIR of the next submission.

Category issue 7: 2.D.3.i – IEF, NMVOC

163. The ERT noted that in the period 2005 – 2017 the IEF value for NMVOC varies from 0.08 to 0.14 except for the year 2005 when the IEF is much higher with a value of 0.21, and for 2015 where the IEF is 0.20 (IEF: kt NMVOC emission/kt AD for 2D3i). Norway was asked to explain this issue. Norway responded that from 2006 and onwards, except for 2015, there have been high imports of certain petroleum products with low NMVOC content leading to a low IEF compared to years with lower import. The ERT thanks Norway for the clarification and recommends Norway to include this information in the IIR of the next submission.

Category issue 8: 2.D.3.g – IEF, NMVOC

164. During the review the ERT noted that in the period 2005 – 2017 the IEF value for NMVOC varies from 0.0015 to 0.0026 except for year 2008 where the IEF is much higher with a value of 0.0051 (IEF: kt NMVOC emission/kt AD for 2D3g). Norway was asked to explain this issue. Norway responded that in 2008 there was an extraordinary import of a product with a high NMVOC content in the category raw materials and that this import led to a high emission in 2D3g. The ERT thanks Norway for the clarification and recommends Norway to include this information in the IIR of the next submission.

AGRICULTURE

Review Scope

Pollutants Reviewed		SO ₂ , NO _x , NMVOC, NH ₃ , PM ₁₀ & PM _{2.5} , HCB		
Years		1990 – 2017 + (Protocol Years)		
Code	Name	Reviewed	Not Reviewed	Recommendation Provided
3B1a	Dairy cattle	X		
3B1b	Non-dairy cattle	X		X
3B2	Sheep	X		
3B3	Swine	X		
3B4a	Buffalo	X		
3B4d	Goats	X		
3B4e	Horses	X		
3B4f	Mules and asses	X		X
3B4gi	Laying hens	X		
3B4gii	Broilers	X		
3B4giii	Turkeys	X		
3B4giv	Other poultry	X		
3B4h	Other animals	X		
3Da1	Inorganic N-fertilizers (includes also urea application)	X		X
3Da2a	Animal manure applied to soils	X		
3Da2b	Sewage sludge applied to soils	X		X
3Da2c	Other organic fertilisers applied to soils (including compost)	X		X
3Da3	Urine and dung deposited by grazing animals	X		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		
3Dd	Off-farm storage, handling and transport of bulk agricultural products	X		
3De	Cultivated crops	X		
3Df	Use of pesticides	X		X
3F	Field burning of agricultural residues	X		
3I	Agriculture other	X		
11A	Volcanoes		X	
11B	Forest fires		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

165. In the 2019 submission Norway provided a generally complete, detailed and consistent emission inventory for the agriculture sector for the years 1990-2017.

Transparency

166. Norway has provided a detailed and generally transparent emissions inventory. Estimates are provided at the most detailed level for all agriculture sectors. Norway's methodology and emission factors in the IIR are considered by the ERT to be mostly transparent and well described for the agriculture sector.

167. The ERT recommends Norway to improve the transparency of the agriculture sector inventory by including information in the 2020 IIR on dips and jumps in the trends as well as more detailed information on the calculation of N₂ losses in its IIR. Additionally, the ERT recommends Norway to include more details on activity data in the IIR, either accompanying the methodological chapter or as separate annex: numbers of all livestock categories (equivalent to cattle), time series of fertiliser consumption for the different fertiliser types, land use data (grassland and crop land areas) and N amounts of the different organic fertilizers (e.g. manure, sewage sludge and other organic fertilizers), N amounts of the different types of mineral fertilisers, land use and harvest data as well as N amounts of the different organic fertilizers (e.g. manure, sewage sludge and other organic fertilizers).

Completeness

168. The ERT considers the agriculture sector to be generally complete. Agricultural emissions for the sectors manure management (3B), agricultural soils (3D), field burning of agricultural wastes (3F) and agriculture other (3I) have been reported for all relevant pollutants in Norway.

169. The ERT notes that the following emission sources are not included in the inventory and recommends Norway to include them (see detailed recommendations under category specific recommendations):

- NO_x from NFR 3Da3 Urine and dung deposited by grazing animals
- NH₃, NMVOC, NO_x and PMs from NFR 3B4f Mules and asses

170. For HCB emissions from use of pesticides (3Df) until 2008 and from 2009-2017 the notation key "NE" is used in the NFR tables. In the IIR it is explained that since 2008, no substances containing HCB have been sold in Norway. As response to a question raised during the review, Norway informed the ERT that the notation key "NO" will be used instead of "NE" in the next submission. The ERT considers this as a proper solution and recommends Norway to change the notation key accordingly.

171. Currently there is no default methodology provided in the 2016 Guidebook for NH₃ emissions from NFRs 3Da4 crop residues and 3De cultivated crops. The ERT notes that Norway reports NH₃ emissions of these sources as not estimated "NE". The ERT considers that the use of the notation key "NE" indicates the fact that emissions from this source are not estimated, however, as there is no method in the Guidebook, the ERT considers that Norway could also use the notation key "NA" which refers to the fact that no method is provided in the current Guidebook, and thus gives Norway better comparability with other reporting Parties. If Norway prefers to use "NE" the ERT encourages Norway to explain the likelihood of emissions and current lack of a methodology in the IIR, and encourages Norway to include these emissions as soon as methodology is available and to provide the TFEIP with information to be included to the Guidebook.

Consistency including recalculation and time series

172. The ERT considers the time series of the inventory to be consistent. The ERT commends Norway for the consistency of its agricultural inventory and encourages the Party to maintain the good quality in the future.

173. The ERT recognise that Norway has undertaken several recalculations for the agricultural sector in submission 2019. For example, NH₃ and NO_x emissions from manure management as well as NH₃ emissions from animal manure applied to soils and urine and dung deposited by grazing animals have been revised as a result of the new N model (e.g. new options of manure storage, updated EF, revised N-losses). The ERT encourages Norway to keep its detailed explanations in relation to any future recalculations in its IIR submissions. The ERT agrees with these recalculations, which resulted in an improvement of the quality and reliability of the agriculture inventory.

Comparability

174. The ERT notes that the methods used by Norway are consistent with the Guidebook and the inventory is thus comparable with those of other reporting Parties.

Accuracy and uncertainties

175. The ERT noted that Norway undertakes a quantitative uncertainty analysis as well as provides further information under the IIR chapter of agriculture that the uncertainty analysis is used to inform the inventory improvement process. During the review Norway informed the ERT on its plans to update the uncertainties for the coming submission. The ERT encourages the Party to pursue its plan.

176. The ERT noted that Norway has sector specific QA/QC systems in place within the national system and that the implementation of the QA/QC procedures has been described in the IIR. The ERT commends Norway for their thorough QA/QC systems.

Improvement

177. The ERT commends Norway for the improvements made since the last CLRTAP review in 2013, e.g. for including NO_x, NMVOC and PM emissions from the sectors manure management (3B) and field burning of agricultural residues (3F) and other (3I) as well as for the development and continuous improvement of a comprehensive N-flow model.

178. There are no specific improvements mentioned in the IIR 2019 for the agriculture sector. However, Norway plans a new survey on manure management systems. In response to a question raised by the ERT, Norway responded that it is planned to include the new survey's results in the 2020 submission. The ERT welcomes these plans and encourages Norway to include the new data for the next submission. Furthermore, the ERT encourages Norway to include such information under section "planned improvements" in its IIR in future submissions.

Potential Technical Corrections

179. No potential technical corrections were calculated.

Sub-Sector Specific Recommendations

Category issue 1: 3.B Manure management – NH₃, NMVOC

180. The ERT noted that the presentation of the methodology for calculating NH₃ emissions (N-flow) from manure management (3B) was not fully transparent. To the question on the calculations of N₂ losses at the stage of storage during the review Norway responded that for the calculation of N₂ losses the default EFs given in the EMEP/EEA 2016 (Table 3.10) are used, and applied to the total ammoniacal nitrogen TAN in slurry and solid manure during storage. The Party also acknowledged that it will include additional descriptions on the calculations of N₂ losses in its next submission. The ERT welcomes these plans and recommends Norway to include the documentation of the methods in the next IIR.

181. The ERT noted that NMVOC emissions resulting from manure management - non-dairy cattle (3B1b) are rated as a key source for the reporting year 2017 and estimated with a tier 1 method. During the review the Party indicated that the use of tier 2 methodology for estimating NMVOC from 3B1b, and the evaluation of how representative the tier 2 emission factors are for Norwegian conditions have not been prioritized in the inventory improvement work so far. The ERT notes that for a key category, emissions shall be estimated using at least a tier 2 method and recommends Norway to apply a tier 2 methodology in the next submission.

182. The ERT notes that the information provided in the IIR is not fully comprehensive and transparent. To improve the transparency of the inventory the ERT recommends Norway to provide more detailed information in its next IIR submission on the methodology used for the calculation of N₂ losses during storage of manure (see also para 178) as well as to include the activity data used for manure management (3B) (livestock numbers of all categories over the time series (equivalent to cattle, see also para 165) in the next IIR.

Category issue 2: 3.B.4.f Mules and asses

183. Emissions from manure management of mules and asses (3B4f) are reported as “not occurring” (NO). Norway informed the ERT that this source category should be actually reported as “not estimated” (NE) as there are livestock numbers available although the population is low and this source is of minor importance. The ERT recommends the Party to include the missing emission estimates or to change the notation key from “NO” to “NE”, or alternatively to provide evidence of the insignificant emission levels, which would also require the usage of the notation key “NE” (see Reporting Guidelines paragraph 12(a)) and to provide related information in the IIR of the next submission.

Category issue 3: 3.D.a.1 Inorganic N-fertilizers (includes also urea application) - NH₃

184. The ERT identified an emissions dip of NH₃ from inorganic fertilizers (NFR 3Da1) for the year 2010. Norway explained that the calculation is based on sales figures for each year and a strong price increase for nitrogen fertiliser caused a stock building in 2008 and corresponding lower sales in 2009. Furthermore, new fertilisation standards might also have influenced a reduction in the use of fertilisers. To correct for this, a transfer of fertiliser use has been made in the inventory from 2008 to 2009, but the effect is still reflected in the trend. The Party also informed the ERT that this explanation is to be included in the next IIR. The ERT thanks Norway for the information provided and welcomes these plans and recommends Norway to

include this information in its IIR. Additionally, the Party is recommended to further include detailed information on the breakdown of relevant national types of N fertilizers that are accounted for in emission estimates under NFR 3Da1, in its next IIR).

Category issue 4: 3.D.a.3 Urine and dung deposited by grazing animals – NO_x

185. The ERT noted that NO_x emissions from urine and dung deposited by grazing animals (NFR 3Da3) are reported as “NE” in the NFR tables although there is methodology available in the EMEP/EEA Guidebook 2016. The Party informed the ERT that NO_x emissions from NFR 3Da3 are planned to be included in the next submission, using the methodology provided in the latest version of the EMEP/EEA Guidebook. The ERT appreciates this plan and recommends Norway to include these emission estimates in its next submission.

Category issue 5: 3.D.a.2.b Sewage sludge applied to soils and 3.D.a.2.c Other organic fertilisers applied to soils (including compost) – NH₃

186. NH₃ emissions from sewage sludge (NFR 3Da2b) and other organic fertilizers applied to soils (3Da2c) are calculated by multiplying the respective amounts of N with the frac_{GASM}-factor (volatilised N in animal manure applied and dung and urine deposited by grazing animals as fraction of total N in the manure applied and dung and urine deposited). However, there are default emission factors available from the EMEP/EEA Guidebook 2016, which are significantly lower than the frac_{GASM}-factor. The Party informed the ERT of not being aware of the default EFs and that it will implement these new factors in future submissions. The ERT recommends Norway to check the applicability of the methodology and the EF provided in the latest version of the Guidebook for Norwegian conditions and to apply it if considered relevant for Norway.

Category issue 6: 3.D.f Use of pesticides - HCB

187. In Norway’s IIR it is explained that since 2008, no substances containing HCB have been sold in Norway. However, Norway uses the notation key “not estimated” (NE) for HCB from 3Df Use of pesticides from 2009-2017. As response to a question raised Norway informed the ERT that the notation key “NO” will be used instead of “NE” in the next submission. The ERT considers this as a proper solution and recommends Norway to change the notation key accordingly in its next submission.

WASTE

Review Scope

Pollutants Reviewed		SO ₂ , NO _x , NMVOC, NH ₃ , PM ₁₀ , PM _{2.5} , TSP, BC, Pb, Cd, Hg, As, Cr, Cu, PCDD/PCDF, Benzo a,b,k, Indeno pyr.		
Years		1990 – 2017 + (Protocol Years)		
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		
5C1bii	Hazardous waste incineration	X		
5C1biii	Clinical waste incineration	X		
5C1biv	Sewage sludge incineration	X		
5C1bv	Cremation	X		
5C1bvi	Other waste incineration	X		
5C2	Open burning of waste	X		
5D1	Domestic wastewater handling	X		
5D2	Industrial wastewater handling	X		
5D3	Other wastewater handling	X		
5E	Other waste	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

188. The ERT commends Norway for the transparency and completeness of the Informative Inventory Report, but noted that the waste sector could be further improved in terms of completeness and uncertainty analysis. Details are provided in the sections below.

Transparency

189. The ERT considers the IIR to be very transparent and commends Norway for the detailed descriptions provided in the IIR, however the ERT encourages Norway to describe sudden high peaks in trends, specifically the peak in NO_x emissions between 2011-2014 in Figure 6.1 of the IIR.

Completeness

190. The ERT notes that Norway has included emissions for NFRs 5A and 5D in the inventory as recommended in the previous review. However, there is need to further improve the completeness of the inventory by including emissions from open burning of waste (5C2), sewage sludge incineration (5C1biv) and NMVOC and NH₃ from waste incineration (5C1).

Consistency, including recalculation and time series

191. The ERT considers the emissions inventory data reported to be consistent, and also considers the NFR tables to be consistent with the IIR. The ERT noted that

Norway revised activity data for NFRs 5A1, 5D2 and reallocated one plant without energy utilisation to 5C1a.

Comparability

192. Norway has prepared the waste sector inventory in accordance with the EMEP/EEA Emissions Inventory Guidebook 2016, and also uses the up to date versions of the reporting templates for their inventory. In cases where Norway uses other methods than those presented in the Guidebook, these are sufficiently documented.

Accuracy and uncertainties

193. The ERT considers the inventory to show an acceptable level of accuracy. However, the ERT found errors that had occurred in the process of updating the 2019 version of the IIR text, as well as a calculation mistake which led to recommendations (see below).

194. The ERT noted that only NFRs 5C and 5E are included in the uncertainty analysis. The ERT recommends Norway to conduct an uncertainty analysis also for NFRs 5A, 5B and 5D in the next submission and use the results of the uncertainty analysis for prioritizing improvements.

195. The ERT noted that Norway has no source category-specific QA/QC procedures for waste sector, but refers to general QA/QC procedures in chapter 6.6.6. The ERT recommends Norway to implement source specific QA/QC procedures for Waste.

196. The ERT did not find any over- or underestimations.

Condensable Particulate Matter

197. The Party did not provide explanatory information on the condensable component of PM emissions for the waste sector. The ERT recommends the Party to include such information in the next submission.

Improvement

198. The ERT notes that the Party has carried out the improvements recommended in the previous review. The IIR also contains the chapter 8.2 planned improvements, however the improvement plan does not present schedules for improvements. The ERT recommends Norway to include timelines for planned improvements.

Potential Technical Corrections

199. No potential technical corrections were made.

Sub-Sector Specific Recommendations

Category issue 1: 5.A Solid waste disposal on land – NMVOC

200. The ERT commends Norway for a transparent IIR and for providing activity data in the NFR table. However, “NE” is reported for activity data for NFR 5A category. To the question on the issue the Party provided activity data for 1990-2017.

For the sake of transparency, the ERT recommends Norway to include activity data in the IIR and in the NFR tables.

Category issue 2: 5.B.1 Composting – NH₃ and CO

201. The ERT identified a difference between the increase in the emissions caused by recalculation regarding municipal waste activity data in chapter 8.1.2.4 of the IIR and the ERT data analysis. The Party agreed on the suggested 13.7% instead of 16%. The ERT recommends Norway to improve QC procedures to avoid mistakes.

Category issue 3: 5.B.2 Anaerobic digestion at biogas facilities

202. The ERT identified a consistency problem between the emission value provided in the IIR chapter 8.1.2.4 and in the notation key “NE” reported in the NFR table. The Party responded that there is a copy paste mistake in the IIR, and that the notation key in the NFR tables is correct as no activity data is available to estimate emissions. The ERT recommends Norway to improve QC procedures to avoid mistakes.

Category issue 4: 5.C.1.A Waste incineration – all relevant pollutants

203. To the question on the issue, the Party responded that: “the IIR is not completely updated since it says that all incineration facilities have energy recovery in Norway. There is one facility which incinerates waste without energy recovery which has been included in this sector in this submission. This will be added in the next IIR”. The ERT recommends Norway to correct the information to the IIR of the next submission.

Category issue 5: 5.D.1 Wastewater treatment – NMVOC, NH₃

204. The ERT noted that only 62 per cent of Norway’s population was connected to high-grade treatment plants in 2017 according Statistics Norway, and that they provide the share of population connected to various types of treatment plants. The ERT encourages Norway to apply a technology-specific approach to the inventory of waste water treatment in order to improve accuracy.

INFORMATION SUBMITTED by the Party in 2019

Filename	Short description of content
Annex_I_Emissions_Norway_2019	Annex I, MS Excel file , years 1990 – 2017
Notification form	Word file
TOMA_correction	Word file : Emissions of NMVOC in the total area and the TOMA area
IIR_Norway_2019.pdf	IIR 2019, pdf-document; 277 pg
Projections_IIR_ch9_26062019	Word file, 4 pg
Table_2A-Norway_Mildir	Excel file

LIST OF ADDITIONAL MATERIALS PROVIDED BY THE COUNTRY DURING THE REVIEW

1. Responses to preliminary questions raised prior to and during the review.
2. Additional material
 - Industry_nr 13_AD for 2C.xlsx
 - Industry_nr 16_AD for 2H2.xlsx
 - Industry_nr 17_AD for 2I.xlsx
 - Industry_nr 23_AD for 2GI.xlsx
 - Industry_nr 4_AD for 2A2.xlsx
 - Industry_nr 7_AD for 2A5b.xlsx
 - Industry_nr 9_production 2A6.xlsx
 - Norway q3 response
https://www.ssb.no/a/english/publikasjoner/pdf/rapp_200914_en/rapp_200914_en.pdf
 - Response to follow-up question raised during the review: Norway q18 response that PCB is prohibited in products by Produktforskriften (product regulation), <https://lovdata.no/dokument/LTI/forskrift/2011-11-17-1113>
 - Documentation of the N-flow model
<https://www.miljodirektoratet.no/publikasjoner/2019/januar-2019/calculation-of-atmospheric-nitrogen-emissions-from-manure-in-norwegian-agriculture/>
 - Waste_nr 2_AD for 5A
 - Waste_nr 3_AD for 5C