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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:**

AUSTRIA

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INTRODUCTION

1. The mandate and overall objectives for the emission inventory review process under the LRTAP Convention is given by the UNECE document "*Methods and Procedures for the Technical Review of Air Pollutant Emission Inventories reported under the Convention and its Protocols*"¹ – hereafter referred to as the "Methods and Procedures" document. This year an updated version² of the "Methods and procedures" document proposed by the Task Force on Emission Inventories and Projections (TFEIP) was tested.
2. This annual review, has concentrated on SO₂, NO_x, NMVOC, NH₃, plus PM₁₀ & PM_{2.5} for the time series years 1990 – 2015 reflecting current priorities from EMEP Steering Body and the Task Force on Emission Inventories and Projections (TFEIP). HMs and POPs have been reviewed to the extent possible.
3. This report covers the stage 3 centralised reviews of the UNECE LRTAP Convention and EU NEC Directive inventories of Austria coordinated by the EMEP emission centre CEIP acting as review secretariat. The review took place from 19th June 2017 to 23th June 2017 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 – Eva Krtkova (CZ), energy Isabelle Higuet (BE), transport – Giannis Papadimitriou (EU), industry & solvents - Neil Passant (UK) , agriculture - Hakam Al Hanbali (SE), waste - Intars Cakars (LV).
4. Jean-Pierre Chang (FR) was the lead reviewer. The review was coordinated by Katarina Marečková (EMEP Centre on Emission Inventories and Projections - CEIP).

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

² Proposal for updating the 'Methods and procedures' document laying down the process for the EMEP emission inventory review Available at: http://www.unece.org/fileadmin/DAM/env/documents/2016/AIR/EMEP/Informal_Document/3_Methods_Procedures_update_proposal_May2016_ISSUE1_TFEIP.pdf

PART A: KEY REVIEW FINDINGS

5. Austria's inventory is well in line with the EMEP/EEA inventory guidebook and UNECE Reporting Guidelines. The ERT concludes from its assessment that Austria's data submission and informative inventory report (IIR) are good examples of high quality inventory submissions, with an actual improvement process. In the frame of the current 2017 trial exercise of the technical correction procedure, no potential technical correction was identified for Austria.

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

INVENTORY SUBMISSION

7. In its 2017 submission, Austria has reported emissions for its protocol base years (1990) and a full time series to 2015 (the latest year) for its protocol pollutants in the NFR14 format. Austria reported gridded emissions and LPS for 2015. Austria also reported projections for 2020, 2025 and 2030. Austria also submitted a detailed IIR.

8. The CLRTAP inventory submitted by Austria is of high quality and is well documented in the informative inventory report (IIR).

9. The ERT commends Austria for the good work done on the air emission inventory and for a good cooperation during the review.

KEY CATEGORIES

10. Austria has compiled and presented a key category analysis (hereafter KCA) for the following pollutants in its IIR: SO₂, NO_x, NMVOC, NH₃, CO, PMs: TSP, PM₁₀, PM_{2.5}, HMs: Cd, Hg, Pb, POPs: PAH, PCDD/F, HCB, PCBs. Approach 1 was used for level and trend assessment, as well as the suggested aggregation from Table 2-1 from Chapter 2 of the EMEP/EEA emission inventory guidebook 2016. The same level of aggregation was used for all pollutants. The KCA was performed for all gases via level and trend assessment for 1990 and 2015.

11. The ERT welcomes the improvement in the KCA by including information on the level and trend assessment for each category and pollutant reported in the IIR and encourages Austria to keep up the good work for future submissions as well.

12. During the review, Austria clarified, that for the upcoming years Austria will focus mostly on improving the uncertainty analysis on the whole. The next step would be the implementation of approach 2 of the KCA. The ERT welcomes these plans and encourages Austria to include approach 2 for the KCA in its future submissions.

QUALITY

Transparency

13. The ERT recognises the level of effort undertaken by Austria to be able to provide an inventory with significant level of detail, which allows the ERT to undertake a detailed review. Austria's IIR is detailed and well presented. EFs and activity time series are presented in detail, assumptions are indicated and references are given. The ERT compliments Austria for the excellent work done on the IIR with some additional descriptions indicated below (for specific sectors)

14. Following the recommendation from the last review, Austria included chapters for projections and planned improvements in its IIR. The ERT commends Austria for the improvement and encourages Austria to keep the work in future submissions as well.

15. Following the recommendation from last review, a description of the type of methodology was incorporated in the IIR. The ERT commends Austria for the improvement and encourages Austria to keep the work in future submissions as well.

Completeness

16. The ERT acknowledges the effort to which Austria has gone to provide estimates of emissions for all sub-sectors and all pollutants reviewed. Austria's inventory for the pollutants reviewed is generally complete.

17. For more detailed information on minor gaps in the inventory please refer to the sector-specific chapters in Part B of this report.

Consistency, including recalculations and time-series

18. Austria has undertaken a number of recalculations for its 2017 submission, namely in the energy, IPPU, agriculture and waste sectors. The recalculations are not particularly large considering the total emissions; the largest impact of a recalculation concerns NO_x for 1990 (5%), the impact of the other recalculations is less than 2%.

19. The recalculations have been explained in Chapter 7 including the impact of recalculations on the pollutant emission levels. The ERT welcomes the improvement, which followed the recommendation from the last review, and encourages Austria to keep the transparent reporting of recalculations also in future submissions.

Comparability

20. The ERT notes that the inventory of Austria is comparable with those of other Parties. The allocation of source categories follows that of the EMEP/UNECE Reporting Guidelines. The ERT encourages Austria to continue with this approach for its national inventory.

CLRTAP/NECD comparability

21. NEC Directive (EU) 2016/2284 sets out national emission reduction commitments for the pollutants SO₂, NO_x, NMVOC, NH₃ and PM_{2.5}. Austria uses the national emission totals calculated on the basis of fuel used (thus excluding emissions from fuel exports in the vehicle tank) for compliance assessment under the NEC Directive. Following the recommendation from the last review, Austria added an explanatory note pointing out the differences between UNECE/LRTAP and Directive (EU) 2016/2284 (NEC Directive) at the beginning of the IIR. The ERT welcomes this improvement of transparency and encourages Austria to keep up the good work in future submissions as well.

Accuracy and uncertainties

22. Austria compiled a qualitative uncertainty analysis and additionally a quantitative uncertainty analysis for the main pollutants (SO₂, NO_x, NMVOC, NH₃ and PM_{2.5}). The methods for uncertainty analysis are presented clearly in the IIR. Austria uses both the results from its uncertainty analysis and KCA for the prioritisation of inventory improvement activities

Verification and quality assurance/quality control approaches

23. Austria has elaborated and implemented a quality assurance/quality control (QA/QC) plan in accordance with the EMEP/CORINAIR Guidebook (Inventory Management Chapter). This includes general QC procedures (tier 1) as well as source category-specific procedures (tier 2) for categories and for those individual categories in which significant methodological revisions and/or data revisions have occurred. The ERT encourages Austria to keep expanding the QA/QC activities in future submissions.

FOLLOW-UP TO PREVIOUS REVIEWS

24. Austria has improved its national inventory submission in 2017 by taking into account the Stage 3 review recommendations (2010). Due to the quality of the IIR and Austria's responsiveness the ERT were able to review the 2017 inventory submission in detail and to provide a number of new detailed recommendations.

AREAS FOR IMPROVEMENTS IDENTIFIED BY AUSTRIA

25. The IIR 2017 identifies several areas for improvements. These include:
- (a) Decrease of uncertainty of the category 1.A.4 due to update of emission factors for CO, NMVOC and TSP arising from new residential biomass boilers.
 - (b) Further investigation of the chipboard production in order to avoid double counting in the inventory.

- (c) The methodology for calculating the emissions caused by non-ferrous metal and iron and steel production will be improved based on country specific data.
- (d) Further investigations concerning emission factors for the full implementation of the data obtained from the VOC installations ordinance are still required. Austria has indicated that this evaluation is still ongoing.
- (e) Revision of Austria's agriculture practice, which is ongoing.

TECHNICAL CORRECTIONS CONSIDERED AND OR CALCULATED BY ERT

26. Within this 2017 trial exercise of technical corrections, the ERT did not identify significant inconsistencies in the inventory (higher than the 2% threshold) which would result in potential technical corrections (PTC) or in a request for revised estimates from the Party.

PART B: RECOMMENDATIONS FOR IMPROVEMENTS TO THE PARTY

CROSS CUTTING IMPROVEMENTS IDENTIFIED BY THE ERT

27. The ERT identifies the following cross-cutting issues for improvement:
- (a) The ERT encourages Austria to continue improving the transparency of the IIR by providing more details on methodologies and tier level implementations for each of the sector presented in the IIR.
 - (b) The ERT encourages Austria to provide key category analysis also using approach 2.
 - (c) Recommended improvements relating to specific source categories are presented in the relevant sector sections of this report.

SECTOR SPECIFIC RECOMMENDATIONS IDENTIFIED BY ERT

ENERGY

Review Scope

Pollutants Reviewed		SO ₂ , NO _x , NMVOC, NH ₃ , PM ₁₀ & PM _{2.5} , Cd, Hg, Pb, Dioxin, PAH		
Years		1990 – 2015		
Code	Name	Reviewed	Not Reviewed	Recommendation Provided
1A1a	Public electricity and heat production	X		X
1A1b	Petroleum refining	X		X
1A1c	Manufacture of solid fuels and other energy industries	X		X
1A2a	Iron and steel	X		X
1A2b	Non-ferrous metals	X		X
1A2c	Chemicals	X		X
1A2d	Pulp, Paper and Print	X		X
1A2e	Food processing, beverages and tobacco	X		X
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	X		X
1A2gviii	Stationary combustion in manufacturing industries and construction: Other	X		X
1A3ei	Pipeline transport	X		X
1A3eii	Other	NO		
1A4ai	Commercial/institutional: Stationary	X		X
1A4bi	Residential: Stationary	X		X
1A4ci	Agriculture/Forestry/Fishing: Stationary	X		X
1A5a	Other stationary (including military)	X		X
1B1a	Fugitive emission from solid fuels: Coal mining and handling	X		
1B1b	Fugitive emission from solid fuels: Solid fuel transformation	X		X
1B1c	Other fugitive emissions from solid fuels	NO		
1B2ai	Fugitive emissions oil: Exploration, production, transport	X		X
1B2aiv	Fugitive emissions oil: Refining / storage	X		X
1B2av	Distribution of oil products	X		X
1B2b	Fugitive emissions from natural gas (exploration, production, processing, transmission, storage, distribution and other)	X		X
1B2c	Venting and flaring (oil, gas, combined oil and gas)	IE		
1B2d	Other fugitive emissions from energy production	NO		

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

General recommendations on cross cutting issues

Transparency

28. The ERT finds that Austria has provided a detailed and generally transparent emission inventory. Estimates are provided at the most detailed level for all energy sectors. The reported methodology and emission factors in the IIR are considered by the ERT to be transparent and well described per sub-sector. The Austria explains the trends for each key category in the IIR. The ERT encourages Austria to continue with this level of detail. The ERT also encourages Austria to maintain the present level of transparency in future emissions.

29. The ERT commends Austria for providing emission factors in the sector 1A4ci as recommended in the previous review.

30. The ERT encourages Austria to include the answers that were provided to questions raised by the ERT during the 2017 review week in future submissions (see Sub-sector Specific Recommendations).

Completeness

31. The ERT considers the energy sector to be complete and comprehensive with a good level of detail in the methodology descriptions. The ERT commends Austria for including emissions for NMVOC from coal mining and handling prior 2007 as recommended in the previous review. The ERT also commends Austria for the absence of the notation key "NE" reported in the energy sector.

Consistency including recalculation and time series

32. The time series are in general consistent for the energy sector. Austria has justified most of the identified outliers but the ERT encourages Austria to include explanations for all large fluctuations highlighted during the stage 2 review in the IIR report.

33. The ERT commends Austria for clearly explaining the recalculations and presenting them per sub-sector.

Comparability

34. The ERT notes that the inventory of Austria is comparable with those of other Parties. The ERT commends Austria for using methodologies in accordance with the EMEP/EEA 2016 Guidebook for the energy sector and for providing complete NFR tables with a minimal use of notation keys. The allocation of source categories follows that of the EMEP/UNECE Reporting Guidelines. The ERT encourages Austria to continue providing comparable inventory data.

Accuracy and uncertainties

35. The ERT commends Austria for the higher tier methods (tier 2 and 3) used to identify the key categories. The ERT commends Austria for estimating a quantitative

uncertainty analysis for the stationary energy sector as recommended in the previous review.

36. The ERT notes that the QA/QC procedures are clearly explained in the IIR including energy-specific checks and verification. The ERT encourages Austria to continue explaining the various QA/QC procedures used and developed.

Improvement

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

Potential Technical Corrections

38. The ERT has not found any issues that would require a technical correction for energy sectors.

Sub-Sector Specific Recommendations

Category issue 1: 1.A.1.a Public electricity and heat production – NO_x, SO_x and TSP

39. The ERT notes that large point source emission measurements are the basis for the reported emissions. During the review Austria provided the share of emissions measured for the year 2000 and the year 2015 as well as an explanation for the decreasing trend of this share throughout the time series. The ERT encourages Austria to include similar information in the IIR in order to increase transparency.

Category issue 2: 1.A.1.a Public electricity and heat production – NMVOC and NH₃

40. The ERT notes that emission factors for NMVOC and NH₃ for combustion installations > 50 MWth aren't presented in the IIR. During the review Austria provided these emission factors by fuel type for the year 2015. The ERT encourages Austria to include similar information in the IIR in order to increase transparency.

Category issue 3: 1.A.1.a Public electricity and heat production – NO_x

41. During the review the ERT tried to recalculate emissions by using activity data and emission factors from table 65 in the IIR but the calculated emissions weren't consistent with the NFR data. Austria answered that the NO_x emission factor of heavy fuel oil was misleading in the table. The ERT encourages Austria to correct the table accordingly.

Category issue 4: 1.A.1, 1.A.2, 1.A.3.e.i, 1.A.4 Stationary Combustion - SO_x

42. The ERT noted that according to the IIR, the emissions of SO_x are not applicable ("NA") for the combustion of natural gas and biogas while the EMEP/EEA Emission Inventory Guidebook 2016 suggests emission factors for SO_x for natural gas. In that case the biogas contains sulphur. For example, biogas has an SO_x emission factor of 19,2-25 g/GJ in the Danish IIR and an SO_x emission factor of 10 g/GJ in the Finnish IIR. No emission factor could be a result of a total desulphurization, which is not common in Europe. If there are H₂S emission limit values for biogas, an emission factor could also be deduced to estimate the SO_x emissions. ERT recommends that Austria investigates and estimates SO_x emissions from biogas combustion and estimates SO_x emissions from natural gas combustion.

Category issue 5: 1.A.2.g – SO₂

43. During the review the ERT tried to recalculate emissions by using activity data and emission factors from table 101 in the IIR but the calculated emissions weren't consistent with the NFR data. Austria answered that the SO₂ emission factor of industrial waste had been revised from 130 g/GJ to 11g/GJ because the fuel, which was reported in the energy statistics, was mainly used in pulp and paper and wood manufacturing industries and the "waste" was more equal to solid biomass. Therefore the emission factor for fuel wood had been selected. Austria will update the table 101 accordingly for the next submission.

Category issue 6: 1.A.5.a Other stationary – All pollutants

44. In source category 1A5a all emissions are flagged as "NO". However in the IIR (p. 141), Austria had written that the emissions from military facilities were included in 1A4a. Austria answered it was a mistake and will change the notation key to "IE" for the next submission.

Category issue 7: 1.A.4.bi Residential : stationary – NMVOC

45. The ERT notes an increase of the NMVOC emissions in the residential sector. Austria answered that the increase of NMVOCs was due to added emissions from char coal use which was estimated for the first time in the 2017 submission. The amount of char coal was 267 TJ in 2015 and an emission factor of 2000 g NMVOC/GJ had been selected. This led to additionally 0.5 kt of NMVOC in 2015. The ERT recommends that Austria explains this new source of NMVOC emissions in the IIR to increase transparency.

Category issue 8: 1.B.1.b Fugitive emissions from solid fuels transformation – All pollutants

46. In source category 1B1b all emissions are flagged as "NO". Austria explained that all emissions from the solid fuels transformation were reported under category 1A2a. The ERT recommends that Austria changes the notation keys from "NO" to "IE" or "NA" and explains the allocation of the emissions in the IIR.

Category issue 9: 1.B.2.a and 1.B.2.b Fugitive emissions – NMVOC

47. During the review the ERT tried to recalculate emissions by using activity data and emission factors from tables 172 and 173 in the IIR but the calculated emissions weren't consistent with the NFR data. Austria answered during the review that these tables were misleading. The ERT encourages Austria to correct these tables in order to be consistent.

Category issue 10: 1.B.2.aiv Fugitive emissions oil: Refining/storage – All pollutants

48. In source category 1B2aiv all emissions are flagged as "NA" (except NMVOC). The ERT recommends that Austria changes the notation keys from "NA" to "IE" and explains the allocation of the emissions in the IIR.

TRANSPORT

Review Scope

Pollutants Reviewed		All		
Years		1990 – 2015		
Code	Name	Reviewed	Not Reviewed	Recommendation Provided
1A2gvii	Mobile Combustion in manufacturing industries and construction	X		
1A3ai(i)	International aviation LTO (civil)	X		
1A3ai(ii)	International aviation cruise (civil)	X		
1A3aii(i)	Domestic aviation LTO (civil)	X		
1A3aii(ii)	Domestic aviation cruise (civil)	X		
1A3bi	Road transport: Passenger cars	X		
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		
1A4aii	Commercial/institutional: Mobile	X		X
1A4bii	Residential: Household and gardening (mobile)	X		
1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	X		
1A4ciii	Agriculture/Forestry/Fishing: National fishing	X		
1A5b	Other, Mobile (including military, land based and recreational boats)	X		
1A3di(i)	International maritime navigation	X		
1A3	Transport (fuel used)		X	

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

General recommendations on cross cutting issues

Transparency

49. The ERT commends the already a good level of detail in the methodology descriptions for the whole transport sector. Following recommendation from previous Stage 3 review (2010), Austria has been continuously improving the methodological chapter on emissions from the transport sector. The ERT encourages Austria to continue improving the transparency of IIR by providing even more details when necessary.

Completeness

50. The ERT considers the transport sector of Austria's inventory to be complete and comprehensive. Minor recommendations for improving the completeness of the inventory are discussed below.

Consistency including recalculation and time series

51. Austria applied minor changes to all emission components in the road transport sector by using the most recent version of the NEMO model. Also, the railways sector was marginally revised for the year 2014. Detailed information is provided in the respective sectoral chapters of the IIR, as well as in chapter 7 of the IIR. The ERT commends Austria for the details provided concerning recalculations in the transport sector.

Comparability

52. The emissions of Austria's transport sector were compared to those of other countries and no significant issues were identified.

Accuracy and uncertainties

53. The ERT commends Austria for the QA/QC procedures implemented and the description of these procedures in the IIR. Austria has undertaken a specific quantitative uncertainty analysis for the transport sector (NO_x, SO₂, NMVOC, NH₃, and PM_{2.5}).

Improvement

54. The ERT commends the Party for the improvements carried out and still planned within the transport sector, encouraging the Party to further improve its inventory where necessary. The ERT also notes that in section 7.4 of IIR 2017, the Party explicitly provides responses to all the recommendations of the previous Stage 3 review in 2010 (implemented or planned improvements).

55. During the current Stage 3 review process, the ERT identified some sub-sector specific issues, which are described below, and encourages Austria to address them in order to further enhance the quality of the transport sector of the inventory.

Potential Technical Corrections

56. The ERT has not found any issues that would require any technical correction for the transport sector.

Sub-Sector Specific Recommendations

Category issue 1: 1.A.3.b.i.v Road transport: Mopeds and motorcycles - PM_{2.5}

57. The ERT noted that for category 1A3biv, PM_{2.5} emissions are indicated as "IE" and asked where these emissions are included. The Party answered that PM_{2.5}

emissions from mopeds and motorcycles should be reported as “NE” and not as “IE”. This is because there are no CS measurements for PM_{2.5} exhaust emissions of 2-wheelers in Austria and the Guidebook suggests no calculation method for estimating those emissions according to Tier 3 (EMEP/EEA Update Dec. 2016 p.57). Austria will consider implementing the suggested Tier 2 default PM_{2.5} emission factors for mopeds and motorcycles in the emission model NEMO for the next submission. The ERT acknowledges that the contribution of mopeds and motorcycles to PM_{2.5} emissions is small (under the 2% threshold compared to national total). The ERT has therefore not calculated a technical correction; however, in any case, these emissions can be calculated and, therefore, it is recommended that the Party calculates and reports these emissions in the next submission.

Category issue 2: 1.A.3.b.v.i, 1.A.3.b.v.ii Road transport: automobile tyre and brake wear, automobile road abrasion - PMs, HMs

58. The ERT noted that the emissions from category 1A3bvi are reported as “NA” and asked the Party to explain the reason for not reporting emissions from this category. The ERT also noted that it is stated in the IIR (2017, p. 251) that “PM emissions from tyre and brake wear are included in road abrasion”; nevertheless, the ERT wants to encourage Austria to provide separate estimates for both sub-categories in future submissions. In any case, the notation key “IE” should be used instead of “NA”, since the emissions from 1A3bvi are included in 1A3bvii. Austria answered that emissions from 1A3bvi tyre and break wear are definitely included in 1A3bvii automobile road abrasion. Hence, the notation key indeed should be “IE” instead of “NA”. The Party will discuss if the emissions model NEMO can provide PM_{2.5} non-exhaust emissions for tyre/break wear and road abrasion separately. The ERT welcomes this plan.

59. Following up on a relevant question from previous Stage 3 review report (2010, Transport, Category issue 5), the ERT wants to encourage Austria to provide estimates for “Additional HMs” for the categories 1A3bvi, 1A3bvii, although these are not mandatory to report.

Category issue 3: 1.A.4.a.ii Commercial/institutional: mobile - All pollutants

Following up on a relevant question from previous Stage 3 review report (2010, Transport, Category issue 6), the ERT wants to encourage Austria again to provide separate emission estimates for categories 1A4aii, 1A4bii (commercial/institutional: mobile, and residential: household and gardening (mobile), respectively). Currently, the emissions from 1A4aii are included in 1A4bii. Austria clarifies this in the IIR and mentions that a new study on fuel consumption and pollutant emissions of NRMM is considered for future submissions. Then, input data for the off-road sector will be updated and recalculated with the model GEORG. The ERT welcomes this plan.

INDUSTRIAL PROCESSES

Review Scope

Pollutants Reviewed		SO ₂ , NO _x , NMVOC, NH ₃ , PM ₁₀ & PM _{2.5}		
Years		1990 – 2015 + (Protocol Years)		
Code	Name	Reviewed	Not Reviewed	Recommendation Provided
2A1	Cement production	X		
2A2	Lime production	X		
2A3	Glass production			
2A5a	Quarrying and mining of minerals other than coal	X		
2A5b	Construction and demolition	X		X
2A5c	Storage, handling and transport of mineral products			
2A6	Other mineral products			
2B1	Ammonia production	X		
2B2	Nitric acid production	X		
2B3	Adipic acid production			
2B5	Carbide production			
2B6	Titanium dioxide production			
2B7	Soda ash production			
2B10a	Chemical industry: Other	X		
2B10b	Storage, handling and transport of chemical products	X		
2C1	Iron and steel production	X		
2C2	Ferroalloys production			
2C3	Aluminium production	X		X
2C4	Magnesium production			
2C5	Lead production	X		X
2C6	Zinc production			
2C7a	Copper production			
2C7b	Nickel production			
2C7c	Other metal production	X		
2C7d	Storage, handling and transport of metal products			
2D3b	Road paving with asphalt			
2D3c	Asphalt roofing			
2H1	Pulp and paper industry			
2H2	Food and beverages industry	X		
2H3	Other industrial processes			
2I	Wood processing			
2J	Production of POPs			
2K	Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)			
2L	Other production, consumption, storage, transportation or handling of bulk products			

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

60. The Party provides full reporting in the NFR tables and uses notation keys where estimates are not available or necessary.

61. The IIR generally provides a good level of detail on the methods and data for the Austrian inventory. However the IIR could usefully provide more transparency on the selection of country-specific methods over Guidebook defaults (see comparability section below).

Completeness

62. The ERT consider the industrial processes sector to be largely complete. Emission estimates are missing for a few sources which are mentioned in the discussion of sub-sector issues below, but which are expected to be relatively trivial.

Consistency including recalculation and time series

63. A full time series of data are provided for sources and the time series seem to be calculated in a consistent manner. The IIR includes information on recalculations in an appropriate level of detail.

Comparability

64. Methods for many sectors are country-specific and in some cases the emission factors used are not expressed in a way which is compatible with the factors provided in the Guidebook. As a result, it is difficult to compare the country-specific methods with those recommended in the Guidebook and to identify if these country-specific methods result in estimates that are significantly higher or lower than would be obtained using Guidebook methods. The ERT therefore recommends that the Party provides additional information that will aid comparisons with the Guidebook - for example by providing country-specific factors expressed on the same basis as those in the Guidebook wherever possible.

Accuracy and uncertainties

65. The Party includes an assessment of uncertainty in the IIR for individual NFR categories and pollutants within the industrial processes sector. This indicates that the uncertainty ranges from 20% to 200%, although it is not clear to what extent these assessed uncertainties are then used to prioritize improvements. For example, the estimates for PM_{2.5} from 2A1, 2A2 and 2A5 are all reported to have the highest uncertainty but there is no discussion of whether improvements are feasible or planned. The ERT therefore encourages the Party to provide more context for the improvement options: where emission estimates are most uncertain, what options exist to improve them, and what country-specific barriers are there to collecting better data.

66. The Party provides details of both general QA/QC procedures and those specific to the industrial processes sector.

Improvement

67. Austria provides details of planned improvements. As discussed above, it is not clear how these improvements were selected and more discussion of the options for improvement and country-specific barriers would provide a useful context.

Potential Technical Corrections

68. The ERT has not found any issues that would require any technical correction for the industry sector.

Sub-Sector Specific Recommendations

Category issue 1: 2.A.1, 2.A.2 Cement and lime production

69. The ERT asked for clarification on the reporting of emissions from cement and lime kilns, since the approach to reporting does not seem to be consistent across all member states. The Party confirmed that pollutants other than particulate matter are reported in 1A2f, while for particulate matter, emissions are reported in 2A1 & 2A2. This is consistent with the Guidebook, but the Party agreed that, for 2A1, changing the notation key for pollutants other than particulate matter from the current "NA" to "IE" would improve transparency. The Party indicated that this would be done in the next submission. The ERT noted that the implied emission factors for particulate matter from 2A1 are significantly lower than the 2016 Guidebook factors for uncontrolled processes: the Party stated however that abatement technologies are commonly used at Austrian cement works.

Category issue 2: 2.A.5.a Quarrying and mining of minerals other than coal

70. The ERT notes that country-specific methods are used for this sector. The emission factors are specific to particular minerals, whereas those in the Guidebook are generic for all minerals, but many of the Austrian factors are higher than the generic Guidebook factor, so that the Austrian approach does yield higher estimates. The Party commented, however, that the country-specific factors also cover 2A5c, and so the ERT concludes that it is plausible for Austrian factors to be higher than the generic Guidebook factor. The ERT encourages Austria to include information on the comparison of EFs in the sectoral QA/QC section of the IIR.

Category issue 3: 2.A.5.b Construction and demolition

71. The ERT notes that country-specific methods are used for this sector and that the IIR states that PM_{2.5} emissions for 2A5 are subject to an uncertainty of 200%. The IIR gives a single emission factor for all construction activity and this emission factor is comparable to the Guidebook factor for the construction of houses. This is the lowest of the four factors in the Guidebook, with significantly higher emission

factors for apartments, non-residential construction and especially for road construction (27 times higher than factor for houses). However, the Guidebook factors can be modified in order to account for local conditions (abatement, soil moisture etc.) so it is difficult to assess how the Austrian method compares with the Guidebook approach. Since the Austrian factor is similar to the lowest of the base factors in the Guidebook, it is possible that the Austrian method generates much lower estimates than would be achieved if the Guidebook factors were used, modified to reflect local factors. The Party has commented that the Austrian method does distinguish between building construction and road construction. Given the large range in the Guidebook factors for different types of construction, and the high uncertainty of the Austria estimates, the ERT recommends that: a) Austria should calculate emissions of PM_{2.5} using the Guidebook approach in order to determine how those estimates compare with the country-specific method, and b) if the two methods give significantly different results, either provide an appropriate level of justification for continuing to use the country-specific method given the uncertainty of that method, or use the Guidebook method instead.

Category issue 4: 2.B.10 Chemical industry

72. In response to a review question, the Party confirmed that the Austrian inventory does include emission estimates for 2B10b but that these are reported in 2B10a. The Party agreed that the notation key "IE" would be used in future submissions.

Category issue 5: 2.C.1 Iron & Steel

73. The ERT noted that some factors for this sector are referenced to earlier versions of the Guidebook. The Party responded that the factors actually corresponded to the values given in the 2016 Guidebook and that they would update the reference in future.

Category issue 6: 2.C.3 Secondary aluminium

74. The ERT noted that the Party reports lead emissions for this category but does not report particulate matter. Aluminium production data are confidential but lead emissions from the sector were 0.3% of national totals in 2005 and 0.2% of national totals in 2015 so the ERT believes that emissions of particulate matter are likely to be of similar significance, so this source is unlikely to exceed the threshold of significance. The ERT has therefore not calculated a technical correction but recommends the Party to include emission estimates for TSP, PM₁₀ and PM_{2.5} in the next submission.

Category issue 7: 2.C.5 Secondary lead

75. The ERT noted that the Party reports lead emissions for this category but does not report particulate matter. Lead production is given as 24 kt in both 2005 and 2015, so applying the 2016 Guidebook Tier 1 factor for PM_{2.5} would yield an emission estimate of 0.06 tonnes for both years, which is well below the 2% threshold of significance. The ERT has therefore not calculated a technical

correction but recommends the Party to include emission estimates for TSP, PM₁₀ and PM_{2.5} in the next submission.

Category issue 8: 2.C.7.c Other metal production

76. In response to a review question, the Party stated that emissions of metals from this sector are reported in 1A2b.

SOLVENTS

Review Scope

Pollutants Reviewed		SO ₂ , NO _x , NMVOC, NH ₃ , PM ₁₀ & PM _{2.5}		
Years		1990 – 2015 + (Protocol Years)		
Code	Name	Reviewed	Not Reviewed	Recommendation Provided
2D3a	Domestic solvent use including fungicides	X		X
2D3d	Coating applications	X		X
2D3e	Degreasing	X		X
2D3f	Dry cleaning	X		X
2D3g	Chemical products	X		X
2D3h	Printing			X
2D3i	Other solvent use			X
2G	Other product use	X		X
Note: Where a sector has been partially reviewed (e.g. some of the NFR codes please indicate which have and which have not in the respective columns.				

General recommendations on cross cutting issues

Transparency

77. The Party provides full reporting in the NFR with use of notation keys where estimates are not available or necessary.

78. The IIR generally provides a good level of detail on the methods and data for the Austrian inventory.

Completeness

79. The ERT consider the Solvents sector to be complete except for 2G other products, where some pollutants are not estimated. A recommendation has been made that this is addressed in future submissions (see below).

Consistency including recalculation and time series

80. A full time-series of data are provided for sources and time-series seem to be calculated in a consistent manner. The IIR includes an appropriate level of detail on recalculations.

Comparability

81. Methods for the solvents sector are mostly country-specific and the methods employed do not yield emission factors that can easily be compared with factors provided in the Guidebook. As a result, it is not possible to compare the country-specific methods with those recommended in the Guidebook and to identify if these country-specific methods result in estimates that are significantly higher or lower than would be obtained using Guidebook methods. However, the Party estimates the uncertainty in NMVOC emissions from 2D as 20% so among the lowest for NFR 2.

The Party has given a detailed description of the method used to estimate NMVOC emissions for 2D3 so the ERT is satisfied that the country-specific method is able to produce more accurate results than the default methods in the Guidebook. The ERT encourages the Party to provide additional information that will aid comparisons with the Guidebook - for example by generating per capita emission factors for 2D3a from the Austrian estimates for this sector, which can then be compared with the Tier 1 emission factor in the Guidebook.

Accuracy and uncertainties

82. The Party includes an assessment of uncertainty in the IIR for individual NFR categories and pollutants within the solvents sector – these are relatively low compared with the uncertainties quoted for some categories within the industrial processes sector. ERT encourages the Party to provide information tangling the uncertainty assessment the IIR.

83. The Party provides details of both general QA/QC procedures and those specific to the solvents sector.

Improvement

84. Austria provides details of planned improvements, which include some measures for the solvents sector.

Potential Technical Corrections

85. The ERT has not found any issues that would require a technical correction for the solvents sector.

Sub-Sector Specific Recommendations

Category issue 1: 2.D.3 Solvent use

86. Table 199 in the IIR presents implied emission factors for NMVOC from solvent use sectors. These factors are expressed in terms of g/t solvent used and so should not exceed the value 1,000,000. Some of the implied factors are actually greater than this and the Party has explained that this is an error in the way in which the AD are calculated and that they are working on a solution to this problem. The ERT recommends that the Party provides corrected emission factors and/or activity data in future submissions.

Category issue 2: 2.G Other product use

87. The Party confirmed that for use of tobacco, Austria only reports emissions of particulate matter. The 2016 Guidebook provides emission factors for many other pollutants including NO_x, CO, NMVOC, NH₃, metals and POPs. No activity data was available and so no technical correction could be made. The ERT recommends that emission estimates for all pollutants listed in the Guidebook are included in the next submission.

AGRICULTURE

Review Scope

Pollutants Reviewed		SO ₂ , NO _x , NMVOC, NH ₃ , PM ₁₀ & PM _{2.5}		
Years		1990 – 2015 + (Protocol Years)		
Code	Name	Reviewed	Not Reviewed	Recommendation Provided
3B1a	Dairy cattle	X		
3B1b	Non-dairy cattle	X		
3B2	Sheep	X		
3B3	Swine	X		
3B4a	Buffalo	X		
3B4d	Goats	X		
3B4e	Horses	X		
3B4f	Mules and asses	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		
3Da2a	Animal manure applied to soils	X		
3Da2b	Sewage sludge applied to soils	X		
3Da2c	Other organic fertilisers applied to soils (including compost)	X		
3Da3	Urine and dung deposited by grazing animals	X		
3Da4	Crop residues applied to soils	X		
3Db	Indirect emissions from managed soils	X		
3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products	X		
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

Transparency

88. Austria has provided a detailed and generally transparent emission inventory for agriculture. Estimates are reported on the most detailed level for the whole agriculture sector. The ERT considers the methodologies and emission factors are well described in the IIR and therefore, transparent. The ERT commends Austria for

its efforts to make the inventory highly transparent by including detailed information in its IIR.

Completeness

89. The ERT considers the agriculture inventory of Austria comprehensive as it covers a wide set of pollutants and the inventory is quite complete with respect to the most important sources of emissions. The ERT commends Austria for the completeness, quality and the good level of detail in the methodology descriptions. Only one case of incompleteness was identified. See sub-sector specific recommendations (Category issue 1).

Consistency including recalculation and time series

90. The ERT finds that the time series of the inventory is consistent. The ERT commends Austria for the consistency work on the whole time series. The ERT notes that recalculations were undertaken in response to:

- Revised numbers of horses in the inventory. The revision resulted in significantly increased animal numbers in 2014.
- Following a recommendation of the CLRTAP stage 3-review 2010, PM emissions from different animal categories are now reported for the respective livestock categories under 3B manure management instead of under 3I other.
- *Also recalculations were carried out for other organic fertilizers applied to soils (3Da2c) as compost application was considered as a new activity for the first time in Austria. This update of the activity data for this category resulted in additional NH₃ and NO_x emissions for all reported years.*
- Improvement of methodologies and emission factors for field Burning of agricultural waste (3F) by using the EMEP/EEA Guidebook 2016 and improved consistency with the parameters used in the GHG inventory (residue/crop product ratio) resulted in slightly revised emissions.

91. The ERT commends Austria for undertaking these recalculations, which resulted in an improvement of the quality and reliability of the agriculture inventory.

Comparability

92. Austria uses methods for estimating NH₃ emissions for the agriculture sector which are consistent with the methods proposed in the EMEP/EEA Guidebook 2016. Emissions from cattle and swine are estimated using a country specific methodology. NH₃ emissions from the non-key animal categories sheep, goats, poultry, horses and deer have been estimated using the detailed Tier 2 method following the EMEP/EEA Guidebook 2016. The used tier 2 method reflects the country's conditions.

93. The ERT recognized neither over- nor underestimation of air pollutant estimates of the inventory during the review process.

Accuracy and uncertainties

94. Austria has carried out an uncertainty analysis of its activity data and emission factors for the agriculture sector. Detailed QA/QC checks have also been performed. The ERT commends Austria for the comprehensive uncertainty analysis and OA/QC procedures undertaken for its inventory.

95. The ERT encourages Austria to further extend the uncertainty analysis of the activity data by including other animal categories in the inventory, such as sheep, goats, laying hens and turkeys in order to further promote the reliability of the inventory data.

Planned Improvements

96. The Party stated in its IIR that there is an ongoing project regarding the investigation on Austria's agricultural practice and the implementation of the results is planned for the 2018 submission. The ERT commends Austria for the planned improvement of its inventory.

Potential Technical Corrections

97. The ERT has not found any issues that would require a technical correction for the agriculture sector.

Sub-Sector Specific Recommendations

Category issue 1: 3.D.f Use of pesticides) - HCB

98. The ERT notes that Austria does not estimate emissions of HCB from the use of pesticides (3Df) as it was reported not occurring ("NO"). However, the ERT informed the Party that there has been a consumption of pesticides between 2011 and 2014 according to the Eurostat Agri-environmental indicator. The use of particular pesticides in agriculture can be a source of POP emissions due to the presence of HCB in some pesticides as a contaminant. In response to a question raised by the ERT during the review, Austria clarified that the EMEP/EEA GB 2016 provides default emission factors for 11 pesticides (Table 3-1). All of the listed pesticides are not occurring in Austria as they are forbidden compliant with the Stockholm Convention on Persistent Organic Pollutant and European legislation (POP Regulation (EG) Nr. 850/2004). Austria revised its National Action Plan about POPs in 2012 and therefore fulfills its obligations under the Convention. However, Austria agrees that there is some pesticide consumption in the country. As for these types of pesticides no emission factors and methodologies are available in the guidebook, Austria considers to use the notation key "NA" instead of "NO" in the next submission.

99. The ERT thanks Austria for the quick reply and encourages the Party to report emissions of HCB from relevant pesticides when reliable methodologies are available.

WASTE

Review Scope

Pollutants Reviewed		All		
Years		1990 – 2015		
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		
5C1a	Municipal waste incineration	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		X
5D1	Domestic wastewater handling	X		X
5D2	Industrial wastewater handling	X		
5D3	Other wastewater handling	X		
5E	Other waste	X		X

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

General recommendations on cross cutting issues

100. Austria reports emissions in 6 out of 15 sub-sectors from the waste sector for the year 2015. The coverage of reported pollutants for waste sub-sectors varies throughout the time series. The notation key “NO” is used for 7 sub-sectors, for 2 sub-sectors only the notation key “NA” is reported.

Transparency

101. Austria’s IIR provides descriptions on the emissions factors and methodologies used to calculate emissions. The description of activity data sources is transparent.

Completeness

102. The ERT notes that the waste sector is relatively complete and comprehensive with a good level of detail for methodology descriptions. Austria reports “NO” for sub-sector 5E other waste. In the EMEP/EEA Guidebook 2016 sludge spreading, car fires and building fires are described in this sub-sector. The ERT recommends Austria to improve completeness of the inventory for the sub-sectors where it is possible.

Consistency, including recalculation and time series

103. Austria's provided calculations in 6 sub-sectors are consistent regarding emission trends. Methodologies and EFs are provided and described clearly. Specific recalculations for waste sector are mentioned in IIR and clearly described.

Comparability

104. Austria provides methodologies and EFs for emission calculations. Methodologies are well described and comparable with EMEP/EEA Guidebook 2016. Austria uses many specific EFs for waste sector calculations. Explanations of these EFs are provided in Austria's IIR.

Accuracy and uncertainties

105. Austria describes QA/QC procedures and uncertainty analyses for waste sector in its IIR. The ERT encourages Austria to continue the development of an uncertainty analyses.

Improvement

106. There are no improvements mentioned for the waste sector in Austria's IIR. The ERT encourages Austria's to plan improvements for waste sector regarding the transparency of the inventory.

Sub-Sector Specific Recommendations

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

107. Descriptions of emission calculations and activity data estimations are comprehensive and transparent. Austria uses notation key "IE" (included elsewhere) for NO_x and SO_x emissions. The ERT assumed according to the previous Stage 3 review that these emissions are from landfill gas recovery. The ERT encourages Austria to provide an explanation about that in IIR.

Category issue 2: 5.B Biological treatment of waste

108. Austria reports emissions in 5B1 biological treatment of waste – composting. The calculations are described in good quality and in detail. For the sub-sector 5B2 anaerobic digestion at biogas facilities Austria reports the notation key "NA" (not applicable). The ERT encourages the Party to provide an explanation in IIR tangling the use of notation key.

Category issue 3: 5.C Incineration of waste

109. According to NFR tables Austria reports emissions in 3 sub-sectors industrial waste incineration, clinical waste incineration and cremation. For sewage sludge, municipal and industrial waste incineration activity data is only estimated for the years 1990-1991. For open burning of waste the notation key "NO" (not occurring) is used. The ERT encourages Austria provide a short description about the open burning of wastes in the IIR. Austria should clarify in its IIR if such activities also occur if forbidden.

Category issue 4: 5.D Wastewater handling

110. Austria calculated emissions for the sub-sector 5D1 domestic wastewater handling. Calculations were provided for the first time. The ERT accepts Austria's approach of activity data estimation and chosen EF. Regarding NH₃ emissions from 5D1 the ERT encourages to add a description of latrine uses in Austria in the IIR of the next submission.

Category issue 5: 5.E Other waste

111. Austria reports the notation key "NO" (not occurring) for 5E. In EMEP/EEA Guidebook 2016 sludge spreading, car fires and building fires emissions calculations are described for this sub-sector. The ERT encourages to investigate the possibility to obtain activity data for car and building fires. Default emission factors for calculations could be used. In most European countries fire and rescue services collect information about fires. In the EMEP/EEA Guidebook 2016 EFs regarding the number of fire accidents are provided.

MATERIALS USED BY THE REVIEW TEAM

1. Austria's IIR (pdf)
2. Annex 1 NFR tables 1990 – 2015 (Excel document)
3. Austria Stage 1 report 2017
4. Austria Stage 2 S&A report 2017
5. Austria Stage 3 review 2010
6. Data and tools developed by CEIP (<http://unece-stage3.wikidot.com/data-analysis>)

LIST OF ADDITIONAL MATERIALS PROVIDED BY THE COUNTRY DURING THE REVIEW

1. Response to preliminary questions raised prior to the review (wiki)
2. Response to questions raised during the review (wiki)

REFERENCES

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ANNEX I - POTENTIAL TECHNICAL CORRECTIONS

No potential technical correction was identified for Austria.