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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
TURKEY

CONTENT

INTRODUCTION

1. This annual review, has checked all pollutants covered by LRTAP Convention and its protocols (SO_2, NO_x, NMVOC, NH_3, plus PM_{10} $PM_{2.5}$, 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.

2. This report covers the stage 3 centralised review of the UNECE LRTAP Convention 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).

3. Kristina Saarinen (Finland) was the lead reviewer. The review was coordinated by Katarina Marečková, (EMEP Centre on Emission Inventories and Projections - CEIP).

PART A: KEY REVIEW FINDINGS

4. The ERT thanks Turkey 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 to give recommendations for a further development of the inventory.

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

6. The ERT found the inventory to be generally transparent and partly complete. The IIR is prepared according to the template provided in the Reporting Guidelines Annex I and includes a key category analysis.

7. The inventory is generally comparable with those of other reporting Parties and partly consistent over the time series

8. Turkey provided NFR tables for 1990-2017 on 15th February 2019 and therefore within the reporting deadline of 15 February and an IIR on 15th March 2019 within the deadline of 15 March 2019.

9. Turkey does not currently include an uncertainty analysis, projections, LPS data or gridded data in the submissions. The ERT recommends Turkey to include these in the submissions in the near future.

10. The ERT notes that the annual national total emissions are partly complete because emissions from several source categories where methods are provided in the Guidebook have not been estimated, among these potential key categories. Also, several pollutants are completely missing. The ERT recommends Turkey to complete the inventory for all pollutants, sources and years.

11. The ERT found that the accuracy of the inventory is compromised due to the use of tier 1 methods for key categories, for which tier 2 or higher tier methods should be used according to the Reporting Guidelines.

12. Transport emissions are calculated on basis of fuels sold.

13. A summary of main findings for further improvement is presented below:

a) Transparency: Some incorrect uses of notation keys, information missing on drivers behind activity data and emission trends, some values reported as zero (0) instead of emission values or notation keys

b) Completeness: Emissions of pollutants already included in the inventory are missing for several years and especially for several categories, some of which are potential key categories, activity data are incomplete in the IIR and missing in the NFR tables, the following are not included in the submission: uncertainty analysis, projections, LCP data, and gridded data

c) Accuracy: Tier 1 methods are used for many key categories

INVENTORY SUBMISSION

14. In their 2019 submission, Turkey reported emissions in the NFR 2014-2 format for the years 1990-2017 (the most recent year) for NO_x, NMVOC, SO_x, NH_3, $PM_{2.5}$, PM_{10}, Pb, Cd, and Hg. The ERT notes that the annual inventories 1990-2017 for these pollutants are not complete due to missing source categories, some of which are likely to be key categories for the country. The ERT recommends that Turkey completes the NFR tables by reporting emissions of all pollutants from all NFR categories for all years in the next submission.

15. The ERT noted that Turkey does not report emissions of the following pollutants: TSP, heavy metals and POP emissions and that CO emissions were not reported for the year 2017.The ERT recommends that Turkey completes the reporting of pollutants by including a full time series of carbon monoxide (CO) emissions, as well as PM_{10} emissions, priority heavy metals: cadmium (Cd), lead (Pb) and mercury (Hg), as well as POP compounds: polycyclic aromatic hydrocarbons (PAH-4) and the indicator compounds benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3_cd)pyrene; polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/F); polychlorinated biphenyls (PCBs) and hexachlorobenzene (HCB), to the next submission. The ERT encourages Turkey to report black carbon (BC) in the next inventory and consider reporting of non-priority heavy metals arsenic (As), chromium (Cr), copper (Cu), nickel (Ni), selenium (Se) and zinc (Zn) in the future submissions.

16. The ERT notes that no activity data were presented in the NFR tables. The ERT strongly recommends Turkey to include activity data in the NFR tables in the next submission.

17. The ERT found the CLRTAP inventory submitted by Turkey to be consistent with the recommended NFR reporting format and IIR structure and to be in general transparently documented in the Informative Inventory Report (IIR).

KEY CATEGORIES

18. The ERT notes that emissions from several potential key categories are not included in the inventory as explained under sector-specific recommendations. These shortcomings especially impact the NMVOC emissions. The ERT recommends Turkey to

include emissions from these missing categories as priority items to the next submission to enable reporting of complete national total emissions of pollutants.

19. Turkey uses tier 1 methods for key categories while tier 2 or higher methods should be used according to the Reporting Guidelines. The ERT strongly recommends Turkey to move to tier 2 or higher methods for all key categories to the next submission.

20. Turkey's key category analysis (KCA) includes SO_x, NO_x, NH_3, NMVOC, and PM_{10}. The ERT recommends that Turkey includes CO, TSP, priority heavy metals and POPs in the key category analysis, once these are reported and recommends that the KCA is updated after the inclusion of the currently missing categories.

21. The ERT noted that in the 2012 and 2016 review reports it was recommended that Turkey carry out a full trend and level key category analysis in the next submissions. The ERT also notes that in the 2019 IIR, it is stated that Turkey follow the IPCC approach that covers both level and trend key category analyses. However, the ERT noted that the table 1.1 of the IIR only gives the result of a level key category analysis for 2017 and that neither data nor results on trend key category analysis are reported in the IIR. The ERT reiterates its recommendation of the 2012 and the 2016 reviews for the third time that Turkey carry out a full key category analysis in the next submission.

QUALITY

Transparency

22. The ERT recognises the level of effort undertaken by Turkey in providing an inventory of with a significant level of detail to undertake a detailed review. The ERT also notes the improvements in the transparency of Turkey's IIR since the last reviews.

23. The ERT recognizes that in 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). As lack of sufficient documentation in an IIR does not allow the ERT to perform a technical review, the Party needs to provide the missing documentation during the review. 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.

24. The ERT noted that the IIR follows the recommended IIR structure (Annex II of the Reporting Guidelines) and that the 2019 IIR provides information on emissions, methodology and recalculations divided by sub-categories. Emission factors are well documented and referenced. However, the ERT noted several areas where there still is need for further improvements as explained in details in the sub-sector specific recommendations:

a) Include activity data values in the IIR and in the NFR tables;
b) Include source category descriptions explaining sources existing in Turkey;
c) Include information on drivers behind activity data and emissions;
d) Instead of zero (0) values use emission values or notation keys as defined in the Reporting Guidelines and report all emissions in the three (3) decimal format;
e) Review the "Table of Contents" and page numbers of the 2020 IIR submission, because Turkey's 2019 IIR submission has an issue with page numbers: 1.5 starts on page 30 and section 1.6 starts on page 17.

Completeness

25. The ERT found the inventory of Turkey to be not complete. Turkey reports NO_x, NMVOC, NH_3, SO_x, and PM_{10} emissions for 1990-2017, and CO for 1990-2016, however, for $PM_{2.5}$ and priority heavy metals, only some NFR categories are included in the inventory. The ERT recommends that Turkey improves the completeness of the reporting by including in the inventory emissions for all pollutants from all source categories for the whole time series from 1990 onwards as requested in the Reporting Guidelines.

26. The ERT also noted that several of the source categories that are missing from the inventory are potential key categories. Therefore the ERT strongly recommends Turkey to include these categories as priority items into the next submission as explained under sector-specific recommendations below.

27. In general, the ERT recommends that Turkey maintains a summary in the general part of the IIR under chapter 1.7 “General Assessment of the Completeness” with a list of not estimated (NE) emissions of pollutants by NFR categories and provides justifications for each of these separately on reasons of why these are not included, what actions are already taken and what actions will be carried out with clear schedules for their implementation.

28. The ERT recommends that Turkey performs additional reviews to identify potential gaps in the inventory, and acts upon all recommendations from all review reports (2012, 2016 and 2019).

29. Regarding missing activity data from the NFR tables and the IIR, the ERT recommends that Turkey searches the missing data by harmonizing with Turkey’s GHG inventory, where most of the data already is available, or collects the data from other sources such as international databases and statistics, or through questionnaires or inquiries to facilities or competent authorities. The ERT also notes that Turkey’s CRF tables are publicly available from UNFCCC websites.

Consistency, including recalculations and time-series

30. Regarding the consistency of methodology, the ERT noted both in the time series not estimated emissions and emissions estimated with non-consistent methodologies. The ERT strongly recommends to include the missing emissions and to recalculate all emissions using consistent methodologies over the time series.

31. According to the IIR Turkey have undertaken some recalculations for their 2019 submission as mentioned in the IIR, however, the ERT notes that information on the impact of recalculations has not been provided. The ERT recommends that Turkey provide justifications for the recalculations, more details on the methodologies in the recalculations and include quantitative information on the impact of recalculations to the national totals.

Comparability

32. The ERT notes that Turkey mainly uses methods in accordance with the 2016 version of the EMEP/EEA Guidebook and that the allocation of source categories follows that of the CLRTAP Reporting Guidelines (NFR 2014-2 format) and that the inventory of Turkey is thus comparable with those of other reporting Parties.

CLRTAP/NECD comparability

33. Turkey is not an EU country and therefore does not report emissions under the EU National Emission Ceilings (NEC) Directive.

Accuracy and uncertainties

34. The ERT noted that Turkey uses a tier 1 method for several key categories although tier 2 or higher tier methodologies shall be used for all key categories according to the Reporting Guidelines. The ERT recommends Turkey to move to higher tier methodologies for estimating emissions to the next submission.

35. The ERT identified several under- and overestimations of emissions as described in detail under the sector specific recommendations.

36. The ERT notes that the IIR does not include a presentation of uncertainty values although in some sectoral chapters the uncertainties are mentioned. During the 2016 review, Turkey stated that they were planning to compile the uncertainty analysis after the completion of a project (NAPEMS). To the question on the issue during the 2019 review Turkey responded that an uncertainty analysis will be included in the 2020 IIR submission. The ERT recommends Turkey to include an uncertainty analysis and to update it regularly.

37. There is no clear evidence in Turkey's IIR that the results of the uncertainty analysis are used to prioritise improvements in the inventory. The ERT recommends that a clear statement is expressed in Turkey's IIR on how the results of the uncertainty analysis are used to prioritise improvements.

Verification and quality assurance/quality control approaches

38. Turkey does not provide information on the verification of the inventory in the IIR. The ERT recommends that Turkey establishes external and independent data comparisons e.g. with inventory estimates made by other bodies or through alternative methods and reports on these in the IIR of the next submission.

39. The ERT notes that Turkey states in the IIR that it has elaborated and implemented a quality assurance/quality control (QA/QC) plan in accordance with the EMEP Guidebook (Inventory Management Chapter). However, the ERT notes that sector specific checks are not documented in the IIR. The ERT recommends that Turkey provides information on sector specific QA/QC procedures in the IIR of the next submission.

Reporting of Condensable Particulate Matter

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

FOLLOW-UP TO PREVIOUS REVIEWS

41. In the previous stage 3 review reports from 2016 and 2012 the ERT recommended Turkey to:

a) Include activity data in the NFR tables. The ERT found that this has not been addressed.

b) Compare the Turkish key category analysis results with the key category analysis results provided by CEIP's RepDab tool. The ERT found that this has not been addressed.

c) Summarise the actual recalculations from the sectoral chapters and present them in the recalculations chapter. The ERT found that this has not been addressed.

d) Improve its quality control management in order to present the same values in both the NFR tables and the IIR. The ERT found that this has not been improved.

e) Review its use of the appropriate notation keys. The ERT found that this has been partly addressed.

f) Recommendations on transparency in the energy sector have only partly been addressed.

42. The ERT recommends that Turkey address issues that were raised from this 2019 review, as well as the previous 2012 and 2016 reviews.

AREAS FOR IMPROVEMENTS IDENTIFIED BY TURKEY

43. The ERT notes from the 2019 submission and from Turkey's responses to the 2019 review that Turkey is currently working towards improving its emission inventory within the framework of a national project EMISSION. The ERT noted that Turkey has taken into account recommendations from the 2016 review and added them to its improvement plan. The ERT welcomes the improvement plan.

44. The IIR identifies several areas for improvement:

a) Improving data provision and consistency

b) Obtaining reliable point source data to improve NO_x and SO_2 emission estimates.

c) Analysis of road transport input data to provide a consistent time series.

d) Developing of a more country-specific method for estimating NMVOC emissions from solvent use.

e) Checking that the generic NMVOC emission factors used for residential wood combustion are appropriate.

f) Inclusion of missing source categories, e.g. 1B.

TECHNICAL CORRECTIONS CONSIDERED AND OR CALCULATED BY ERT

45. The IIR identified several significant inconsistencies in the inventories and proposed the Party technical corrections for the transport sector. For more detailed information go to sectoral chapters.

Table 1 Summary of potential technical corrections identified by ERT for country

NFR categories	Pollutants	Years	Calculated by ERT	Potential contribution to national total (%)
1A3bi-1A3biv	NOx	2010-2017	yes	2017: 18%, 2016: 22%, 2015: 19%, 2014: 20%, 2013: 16%, 2012: 20%, 2011: 7%, 2010: 6%
1A3bi-1A3biv	PM2.5	2010-2017	yes	2017: 68%, 2016: 87%, 2015: 85%, 2014: 81%, 2013: 81%, 2012: 96%, 2011: 52%, 2010: 61%
1A3biv	CO	2010-2017	yes	2017: 121764%, 2016: -2.4%, *2015: -0.3%, 2014: -1.1%, 2013: -1.2%, 2012: -1.0%,* 2011: -2.3%, 2010: -1.7%

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 Turkey in its next submission to:

a) Complete the incomplete annual inventories by reporting emissions from all source categories, at least for those for which methods are provided in the Guidebook and to prioritize potential key categories.

b) Estimate emissions from all key categories with tier 2 or higher methods.

c) Implement the issues that were raised from this and the previous 2012 and 2016 reviews.

d) Collect missing activity data and report it in both, the NFR tables and in the IIR.

e) Check the use of the notation keys according to the Reporting Guidelines.

f) Update the KCA by including currently missing emissions.

g) Establish sector-specific QA/QC procedures to identify possible errors.

h) Provide a quantitative uncertainty analysis and use the results to prioritize improvements in the inventory.

i) Include information on improvements by pollutant and NFR category (or provide a separate improvement plan) with a list of actions, separately for each issue, on the steps already taken for the improvement of the issue and tasks for further actions needed with clear schedules for implementation, and to update the plan for each annual submission. In cases where no actions are needed to provide a justification separately for each issue.

j) Replace zero values with emission values or relevant notation keys.

k) Use a three (3) decimal reporting format for all values in the NFR table.

SECTOR SPECIFIC RECOMMENDATIONS FOR IMPROVEMENTS IDENTIFIED BY ERT

ENERGY

Review Scope

Pollutants Reviewed		NO_X, SO_X, NMVOC, NH_3, CO and PM_{10}		
Years		1990 – 2017		
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
1A2gvii	Mobile Combustion in manufacturing industries and construction		X	
1A2gviii	Stationary combustion in manufacturing industries and construction: Other			
1A4ai	Commercial/institutional: Stationary		X	
1A4aii	Commercial/institutional: Mobile		X	
1A4bi	Residential: Stationary	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	
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		X
1B1c	Other fugitive emissions from solid fuels			
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)	X		X
1B2d	Other fugitive emissions from energy production	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

47. The ERT noted that Turkey has improved the overall transparency of each energy sub-sector of the IIR following the recommendations of the 2016 stage 3 review report and that extensive information is provided on the emission factors used in the energy sector. However, the ERT still noted a significant lack of information regarding

- Information on energy production processes, such as on the installed combustion technologies, energy production rates and installed abatement technologies. The ERT recommends the Party to improve the transparency by providing exhaustive source descriptions by e.g. harmonizing the information in the IIR with the information provided in the NIR to ensure complete source descriptions.

- Explanations of emission trends in the IIR are currently not transparent as information on drivers behind the trends are not documented. The ERT recommends Turkey to include information on economic, social, national/international trends that are related to e.g. fuel use or the development of technologies.

48. The ERT noted some incorrect uses of notation keys as explained under the sub-sector specific recommendations and recommends Turkey to correct these.

Completeness

49. The ERT noted that Turkey does not report any energy activity data, neither in the NFR tables, nor in the 2019 IIR. The ERT reiterates its recommendation from the 2012 and the 2016 reviews for the third time to report the activity data in the IIR and in the NFR tables for the next submission.

50. The ERT noted the following improvement needs for completeness explained in details under the sub-sector specific recommendations:

- To include emissions from several missing sources under the subcategories 1A1, 1A2 and 1B.To report emissions separately which are marked as included elsewhere (notation key IE) for the following sub-sectors: 1A2gvii, 1A4ai, 1A4aii, 1A4bii, 1A4cii, 1A4ciii, 1A5A and 1A5b.

Consistency including recalculation and time series

51. The 2012 and the 2016 review reports recommend Turkey to improve the IIR description on how it ensures consistent emission estimates. However, the ERT noted that the 2019 IIR still lacks in that regard. Furthermore, the ERT noted as well that the chapter on recalculations states that the energy balance has been revised and that these revisions are included in the 2019 inventory e.g. for sub-sectors 1A2a, 1A2b and 1A2c. However, for several energy sources it is mentioned that no recalculations have been implemented. The ERT reiterates its recommendations from the 2012 and the 2016 review reports for the third time that Turkey improves the IIR description regarding recalculations.

52. The ERT noted inconsistencies in the time series of NFR 1A4bi and recommends Turkey to recalculate the emissions.

Comparability

53. The ERT noted that the methods used in the energy sector are consistent with the 2016 version of the EMEP/EEA Guidebook, that the emissions are reported in the NFR 2014-2 format and that the energy sector inventory is thus comparable with those of other reporting Parties.

Accuracy and uncertainties

54. The ERT noted that Turkey uses a tier 1 methodology for most energy sector key categories. The ERT reiterates the recommendation from the 2016 stage 3 review report that tier 2 or higher tier methodologies shall be used for key categories.

55. The ERT noted that Turkey has improved the overall transparency of the use of NCV (Net Calorific value) following the recommendations of 2012 and 2016 stage 3 review reports and that NCV values are no longer originating from UK sources. The ERT noted as well that NCV values were now country specific with reference to Turkey's NIR. The ERT recommends the Party to improve the transparency of reporting by including the numerical NCV values in the IIR along with the discussion during the review.

56. The ERT noted that the information on uncertainties in the energy sector is incomplete as the uncertainties are not quantified. The ERT also notes that some of the uncertainty values are referenced to originate from the 2013 Guidebook (1A2a) while no information is provided for some sectors (1A2d, 1A2e, 1A2f, 1A2gviii, 1A4bi and 1A4ci). The ERT reiterates its recommendation for the third time that Turkey presents a clear uncertainty analysis for every subcategory by distinguish overall uncertainties, activity data uncertainties and EFs uncertainties.

57. The ERT noted that Turkey carries out some basic QA/QC checks. The ERT recommends the Party to improve the efficiency of its QA/QC procedures to detect errors in the time series (see sub-sector specific recommendation, category issue 7) and in the use of notation keys (see sub-sector specific recommendations, category issues 3, 6, 10 and 13).

Condensable Particulate Matter

58. There is no information on condensable particulate matter in the energy sector of the IIR.

Improvement

59. As noted in the 2016 stage 3 report, in the IIR from the 2019 submission and in some answers to the ERT of the 2019 review process, Turkey is currently working towards improving its emission inventory within the framework of a national project EMISSION. The ERT noted that Turkey has taken every recommendation from the last review into account in its improvement plan. The ERT welcomes this initiative and is looking forward to seeing the improvements being implemented in future submissions.

Sub-Sector Specific Recommendations

Category issue 1: 1.A.1 – $PM_{2.5}$

60. The ERT noted that Turkey does not report any emission of $PM_{2.5}$ even though the pollutant is one of the obligatory pollutants in the Reporting Guidelines and though EFs are available in the 2016 EMEP/EEA Guidebook. During the review Turkey explained that this pollutant was intended to be reported step by step starting from the next submission but did not provide any further detailed information on the reporting schedule other than a 2023 deadline linked to the HEY Portal" project. The ERT recommends that Turkey starts reporting $PM_{2.5}$ emissions for all these sub-sectors for the next submission. The ERT points out that this particular recommendation could easily be implemented for the next submission without waiting for completion of the integration of the HEY Portal since all the necessary data are either already used in the calculations or available in the Guidebook.

Category issue 2: 1.A.1.a - SO_X, NO_X

61. The ERT noted that Turkey uses a tier 1 methodology to report SOX and NOX emissions for this sector although this sector is the first key category for both pollutants. According to the Reporting Guidelines Parties should use a tier 2 or a higher tier methodology for key categories. During the review, Turkey explained that the use of higher tier methodologies for key categories was part of the planned improvements of the Air Emission Portal integration mentioned in its IIR. However, Turkey did not provide the ERT any further detailed information on the implementation schedule of these improvements other than a 2023 deadline. The ERT strongly recommends Turkey to implement the use of tier 2 or higher tier methodologies for the emissions from key categories to the next submission to improve the overall accuracy of the reporting.

Category issue 3: 1.A.1.b – all pollutants

62. The ERT noted that Turkey reports emissions from NFR 1A1b or the year 2011, and for PM_{10} over the entire 2010-2014 time period, as "included elsewhere" (IE) in the reporting tables but that there was no information in the IIR explaining where the emissions were included or any justifications for the allocation. In response to questions on the issue Turkey explained that this was due to changes in the Energy Balance Turkey for the year 2011 but did not explain in which sector the emissions were included or on the implementation schedule of the correction other than specifying the deadline of the year 2023. The ERT strongly recommends that Turkey justifies the use of the notation key in its IIR and updates the information for each submission about any use of the "IE" notation key, to indicate where in the inventory the emissions are reported. The ERT also strongly recommends Turkey to estimate the emissions for the missing year and to report it under the correct category for the next submission.

Category issue 4: 1.A.2.a – all pollutants

63. As noted in the 2016 stage 3 review report, Turkey still uses a tier 1 approach for NFR 1A2a. The ERT noted that the 2016 version of the Guidebook stipulates that inn NFR sectors where large (> 50 MW) combustion plants are known to be used, the default tier 1 emission factors provided in chapter 1A1a of the guidebook may be more appropriate, as it is very likely to be the case for almost all plants in the iron industry. To

the question on the issue Turkey explained that this recommendation will be assessed via the Air Emission Portal and that it would be done by 2023 latest, The ERT reiterates the recommendation already made in the 2016 stage 3 report that Turkey uses a higher tier in the next submission for this key category or assess whether the use of the 1A1a emission factors would be more appropriate according to the power of the combustion plants for Turkey in the 1A2a sub-sector, and if so, to recalculate the entire time series. The ERT points out that the second part of this particular recommendation could easily be implemented for the next submission without waiting for completion of Turkey's data within the Air Emission Portal since it is unrelated.

Category issue 5: 1.A.2.a and 1.A.2.f – all pollutants

64. As noted in the 2016 stage 3 review report, Turkey still uses a tier 1 approach for these source sectors whereas about 50% of these facilities are equipped with continuous measurement systems and that for these key categories a higher tier method shall be used. During the review Turkey explained that still only 50% of the plants are equipped with continuous measurements but that this data was still not available because of some security and software issues contrary to what had been answered by Turkey during the 2016 stage 3 review process and that Turkey is confident that this recommendation could be addressed by 2023 at the latest. The ERT recommends that Turkey to highlight the usefulness of this measurement data to competent authorities in order to accelerate the process at hand so that it can be used in the implementation of a higher tier methodology for these sectors as soon as possible. Meanwhile, as the NFRs are key categories, the ERT recommends that Turkey uses the continuous measurement data for those plants for which this data is available in the inventory, and for those plants for which measurement data not yet is available, calculates emission based on fuel use and implied emission factors (IEFs) using data from similar plants where measurement data is available. The ERT also recommends that when continuous data becomes available for additional plants, this is included in the inventory instead of the calculated emissions.

Category issue 6: 1.A.2.d – all pollutants

65. The ERT noted that Turkey reports emissions of all pollutants from NFR1A2d for the years 1990-2010 as included elsewhere ("IE") and that no other information is provided in the IIR than that the emissions were allocated "to stationary sources" During the review Turkey explained that this was due to changes in the EBT but did not explain in which sector precisely the emissions were included for these years and did not provide any detailed information on the implementation schedule of the correction other than a 2023 deadline. The ERT strongly recommends that Turkey justifies the use of the notation key in its IIR, provides information on the exact allocation of emissions, and updates the information for each submission. The ERT strongly recommends Turkey to estimate the emissions for the missing years and to report these in the correct category for the next submission.

Category issue 7: 1.A.2.b, 1.A.2.c and 1.A.2.e - all pollutants

120. The ERT noted that there was no explanation in the IIR about exceptionally low emissions for all pollutants in these sectors in 2008 and onwards. During the review Turkey explained that the sudden drops in NFR 1A2b and 1A2c emissions originated from the consumption values in the EBT? but did not provide any further details, e.g.

information on possible changes in the consumption values of the EBT. For category 1A2e Turkey explained that the exceptionally low emissions were the sum-up of food, sugar and drinks categories in the EBT. The ERT notes that the perimeters of each sub-sector should be the same over the entire time series in order to ensure comparability and completeness and therefore it seems that some of the emissions are missing for these years for those sectors in the EBT tables. The ERT recommends that Turkey justifies the sudden changes in the emissions of the pollutants in these sectors and more generally describes and explains the trends for every energy sub-sector, especially for any outliers and trend changes including information on economic, social and national or international trends that could be related to the trends of fuel consumption and emissions. Regarding the possibly missing emissions, the ERT recommends that Turkey checks if any data are missing from the EBT and calculates the missing emissions either using the relevant statistical data or estimates the trends of the missing activity data and calculates the emissions, to the next submission.

Category issue 8: 1.A.4.b.i – NO_X and SO_X

66. The ERT noted that Turkey indicated in its IIR that it was not able to report the emissions for some sectors and the notation key "IE" was used due to the structure of the Energy Balances Tables provided by the Ministry. The ERT noted that this was the case for the following sub-sectors: 1A2gvii, 1A4ai, 1A4aii, 1A4bii, 1A4cii, 1A4ciii, 1A5A and 1A5b. The ERT encourages Turkey to continue to investigate the feasibility of splitting the activity data into the right sectors for the next submission.

Category issue 9: 1.A.4.b.i – NO_X and SO_X

67. The ERT noted that there was no explanation in the IIR about the sudden changes in SO_X emissions in this sector in 2012 and regarding NO_X emission in 2015 although the emission trends were clearly documented in each sub-sector in the IIR. During the review Turkey explained that these changes were related to the petroleum consumption that is provided in the EBT, but did not provide further explanation on the drivers impacting the consumption trends. The ERT recommends that Turkey justifies the sudden changes of the emissions by providing information for example on any related economic, social and national or international trends or issues impacting the fuel consumption.

Category issue 10: 1.B.1.b, 1.B.2.a.i, 1.B.2.a.iv, 1.B.2.a.v, 1.B.2.b and 1.B.2.c - NMVOC, NO_X, SO_X, PM_{10} and CO

68. The ERT noted that Turkey still uses the incorrect notation key "IE" instead of "NE" for all these sectors and pollutants in the time period 1990-2014. The ERT noted as well that the previous recommendation regarding the use of notation keys had been implemented but only for the time period 2015-2017. During the review Turkey recognized it was an error and indicated that the corrections will be implemented. The ERT recommends Turkey to implement those corrections for the next submission and to improve its QA/QC checks in order to detect this sort of errors prior to official reporting.

Category issue 11: 1.B.2.a.i and 1.B.2.c – NMVOC

69. The ERT noted that Turkey did not yet implement the recommendation of the 2016 stage 3 review (Stage 3 Review Report - paragraph 63) related to NMVOC emissions of

these sectors, usually accounting for a large amount in oil and gas producing countries like Turkey. During the review Turkey explained that it had difficulties to obtain the data from the relevant institutions but that it was confident to solve this issue and estimate fugitive emissions of NMVOC for the next review at the latest. The ERT recommends that Turkey places this collection of the data of the oil and gas industry as a high priority in order to be able to solve it already for the next submission. The ERT reminds the Party that these sectors are often key categories for NMVOC and therefore cannot remain as not estimated. The ERT points out that such oil and gas production data for Turkey is publicly available for example on the IEA website for at least the time period 1990 – 2016 and probably also available from other public sources as well. The ERT strongly recommends the Party to use any already publicly available data for a first estimate of NMVOC emissions from these categories for the next submission. In case these categories would become key categories of NMVOC for Turkey, the ERT recommends Turkey to obtain the relevant activity data to use a tier 2 or a higher method.

Category issue 12: 1.B.2.a.iv and 1.B.2.a.v – NMVOC

70. The ERT noted that emissions from several source categories under NFR 1B are still not reported, neither in the IIR nor in the NFR tables. The ERT notes that activity data is available for several of these categories and that some of these sources can be substantial and therefore the total emissions, especially for NMVOC, are most likely significantly underestimated. During the review, Turkey explained that it had difficulties to obtain the data from the relevant institution but that it was confident to solve this issue for the next review at the latest. The ERT reiterates the recommendation from the 2016 review and recommends that Turkey places this data collection from the oil and gas industry as a high priority issue in order to be able to solve it for the next submission. The ERT reminds the Party that these sectors are often key categories for NMVOC emissions and therefore cannot be reported as “not estimated”. In case these categories would become key categories of NMVOC for Turkey, the ERT recommends Turkey to obtain relevant activity data to use a tier 2 or a higher method.

Category issue 13: 1.B.2.d - NO_X, NMVOC, SO_X, PM_{10}, CO, NH_3, Hg and As

71. The ERT noted that Turkey did not yet implement the recommendation of the 2016 stage 3 review (Stage 3 Review Report - paragraph 66) related to the emissions of geothermal plants existing in Turkey (EFs available in the GB for NH_3, Hg and As) (sector 1B2d) and related to the notation keys used in this sector (“IE” and “NA” used instead of “NE” according to which pollutant is involved). The ERT noted as well that the previous recommendation regarding the use of notation keys had been implemented but only for the time period 2015-2017. In response to questions on the issue Turkey answered not to have activity data to solve this issue but did not provide any explanation about the use of inadequate notation keys nor provide detailed information on the implementation schedule of the missing estimations but only that it should be addressed for the next ‘cycle’ The ERT notes that instead of “IE” the notation key “NE” should have been used for 1990-2014 and strongly recommends that Turkey estimates the emissions for the next submission. The ERT points out that the emissions can be estimated based on the electricity produced and that such data is publicly available for example on the IEA website for at least the time period 1990 – 2016 for Turkey. In case these categories would become key categories of NMVOC for Turkey, the ERT recommends Turkey to obtain relevant activity data to use a tier 2 or a higher method.

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		
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		
1A3bv	Road transport: Gasoline evaporation	X		
1A3bvi	Road transport: Automobile tyre and brake wear	X		
1A3bvii	Road transport: Automobile road abrasion	X		
1A3c	Railways	X		
1A3di(ii)	International inland waterways	X		
1A3dii	National navigation (shipping)	X		
1A4aii	Commercial/institutional: Mobile	X		
1A4bii	Residential: Household and gardening (mobile)	X		
1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	X		
1A4ciii	Agriculture/Forestry/Fishing: National fishing	X		
1A5b	Other, Mobile (including military, land based and recreational boats)	X		
1A3di(i)	International maritime navigation	X		
1A3	Transport (fuel used)		X	
Note: Where a sector has been partially reviewed (e.g. some of the NFR codes) please indicate which have and which have not in the respective columns.				

General recommendations on cross cutting issues

Transparency

72. Turkey provided a generally transparent transport sector emission inventory with detailed estimates for most transport sub-sectors. Turkey's methodology and emission factors in the IIR are considered by the ERT to be transparent and well described for the transport sector. The ERT recommends Turkey to provide more details in the IIR including the actual activity data used for the calculation of emissions and a description of where emission are allocated in cases where the "IE" notation key is used.

73. The ERT notes that Turkey provides information on how the activity data have been collected, as well as the origin of the relevant sources. However, the actual data is still not reported in the IIR and in the NFR tables. As recommended in the previous stage

3 reviews, the ERT strongly recommends Turkey to include as much information as possible on the activity data used (fuel consumption data by fuel type, vehicle kilometres driven, etc.) for transparency purposes.

74. The notation key "IE" has been used for the following transport sub-sectors: 1A2gvii, 1A4aii, 1A4bii, 1A4cii, 1A4ciii, and 1A5b, however, the IIR does not indicate in which NFR categories the emissions are included. The ERT recommends Turkey to calculate and report these emissions separately in the next submission.

Completeness

75. Turkey provided emission estimates for the main pollutants (NO_X, NMVOC, SO_X, NH_3), $PM_{2.5}$, PM_{10}, and CO in its current submission. Some limited information is also provided for the priority heavy metals (Pb, Cd, Hg). The ERT notes that the following sources and pollutants are not estimated by the Party:

a) PM and heavy metals emissions from aviation (1A3ai(i) and 1A3aii(i))

b) CO emissions for 2017

c) Heavy metal emissions from all sub-sectors except for national navigation (1A3dii) and pipeline transport (1A3ei)

d) Non-exhaust PM emissions from tyre & brake wear and from road abrasion (1A3bvi and 1A3bvii)

e) NH_3 emissions from shipping (1A3di(ii) and 1A3dii) and pipeline transport (1A3ei)

76. During the review, Turkey indicated its intention to improve the emission estimates – in particular for road transport by using the COPERT model – in its next submission. The ERT recommends Turkey to carry out this improvement plan.

Consistency including recalculation and time series

77. The ERT notes that the Party has implemented the recommendation from the previous stage 3 review by recalculating emissions with a coherent methodology resulting in a consistent time series of emission estimates from 1994 onwards for the road transport sector. However, the IIR does not include all the necessary explanations. The ERT recommends Turkey to provide more detailed explanations of recalculations, including the rational, the impact on the sector and the implication to trends for the transport sector in its IIR.

Comparability

78. The methods used by Turkey to estimate emissions of pollutants from the transport sector are generally consistent with those proposed in the Guidebook. The ERT notes that no activity data (AD) are provided in the NFR tables. AD in the NFR tables are helpful to compare IEFs with other countries. The ERT reiterates its recommendation that Turkey completes the NFR tables with AD in its next submission.

Accuracy and uncertainties

79. There is no uncertainty analysis included in the IIR. The ERT recommends Turkey to undertake uncertainty analysis for the transport sector in order to help inform the improvement process and to provide an indication of the reliability of the inventory data.

121. Turkey has some basic QA/QC checks for the transport sector, which are described in the IIR. The ERT recommends Turkey to implement sector specific OA/QC procedures for the transport sector.

Condensable Particulate Matter

80. Turkey did not provide explanatory information on condensable component of PM emissions for any of the transport categories. In the IIR, there is no information of whether $PM_{2.5}$ emissions include/exclude the condensable component. The ERT recommends Turkey to include such information in the next submission.

Improvement

81. The ERT notes that Turkey has improved the calculation of road transport emissions by using the COPERT model. The ERT recommends Turkey to use the latest version of the software for its calculations and to report emissions from all pollutants as produced by the software.

82. The ERT notes Turkey's intention to improve its emission estimates for aviation and mobile machinery and recommends the Party to implement these planned improvements.

Potential Technical Corrections

83. The ERT considers emissions of most pollutants from the road transport sector to be considerably underestimated based on vehicle fleet and fuel consumption figures from various international sources (such as e.g. from Eurostat, DG MOVE, ACEA, etc.) As a result of the above significant inconsistencies in the emission estimates the ERT proposed technical corrections for NO_X, $PM_{2.5}$ and CO in the sub-sectors 1A3bi, 1A3bii, 1A3biii, 1A3biv, 1A3bv, 1A3bvi and 1A3bvii to Turkey. The ERT recommends Turkey to review vehicle fleet data and recalculate emissions from road transport by using the latest version of the COPERT model.

Sub-Sector Specific Recommendations

Category issue 1: 1.A.3.ei Pipeline Transport – $P_{2.5}$, PM_{10}

84. The ERT noted that for pipeline transport (1A3ei), for the years 2010 and 2017, $PM_{2.5}$ emissions are slightly higher than PM_{10} emissions. During the review, Turkey responded that this will be corrected in the next submission. The ERT recommends Turkey to correct the emissions.

Category issue 2: 1.A.3.b.iv Road Transport: Mopeds & motorcycles, 1.A.3.b.v Road Transport: Gasoline evaporation, 1.A.3.b.vi-vii Road transport: Automobile tyre and brake wear and road abrasion, 1.A.3.c Railways – PM_{10}, NMVOC, SO_X

85. The ERT noted that emission values of PM_{10} for the categories 1A3biv and 1A3bv, NMVOC and SO_X for the 1A3bvii category, NMVOC for the 1A3bvi category, and SO_X for the 1A3c category are reported as zero for the year 2017. During the review, Turkey responded that for the next submission the NFR submission will be revised. The ERT

notes that instead zero values the appropriate notation key (in this case the notation key should be “NE”) should be used, and recommends that Turkey includes the emission values in the next submission.

Category issue 3: 1.A.2.g.vii, 1.A.3.a.i(i), 1.A.3.a.i(ii), 1.A.3.d.ii, 1.A.3.e.i and 1.A.4.c.iii Off-road transport – All pollutants

86. The ERT noted that for the main pollutants, NO_X, NMVOC, SO_X, NH_3 and PM_{10}, the “IE” notation key has been used, but relevant information on where these emissions have been included was not provided in the IIR. During the review, Turkey responded that notation keys for these sectors will be corrected for the next submission. The ERT recommends Turkey to use correct notation keys and if “IE” is used, sufficient explanation should be provided in the IIR.

Category issue 4: 1.A.3.ai(i) International aviation LTO (civil), 1.A.3.aii(i) Domestic aviation LTO (civil) – $PM_{2.5}$, PM_{10}

87. The ERT noted that for categories 1A3ai(i) and 1A3ai(ii), PM emissions have not been estimated, even though the EMEP/EEA Guidebook 2016 provides emission factors. Since emissions for other pollutants (NO_X, MNVOC and SO_X) have been estimated, presumably the relevant activity data are already available. During the review, Turkey responded that for these categories PM emissions will be calculated for the next submission. The ERT recommends Turkey to include the emissions to the next submission.

Category issue 5: All transport-related NFR categories – TSP, BC, CO, Heavy Metals, POPs

88. The ERT noted for all transport-related NFR categories and for the pollutants TSP, BC, CO, Heavy Metals and POPs, that no values are provided. During the review, Turkey, responded that other pollutants will also be estimated for all transport-related NFR categories and emissions will be included in the next submission. The ERT recommends Turkey to include emissions for all pollutants in the emissions reporting template to the next submission or to use appropriate notation keys in case no emission values can be provided.

Category issue 6: 1.A.3.d.ii National Navigation (shipping) – NOx, SO_2, NMVOC, CO, PM10

89. The ERT noted for category 1A3dii and for NOx, SO2, NMVOC, CO and PM10 emissions, a high variability in the emission values: there is a decrease (about two orders of magnitude) for 2012 emissions, then an increase for 2013-2014 and then again lower values are reported, especially for the year 2016. During the review, Turkey responded that for the next submission the national energy balance tables will be investigated and the fluctuation of the time series will be clarified. The ERT recommends Turkey to correct the values and to report a consistent emission time series.

Category issue 7: 1.A.3.d.ii National Navigation (shipping) – NO_X, $PM_{2.5}$

90. The ERT noted that NFR 1A3dii is a key category (KC) for NO_X and $PM_{2.5}$ emissions and in the IIR (page 128) it is mentioned that "the applied methodology is

TIER 1". During the review, Turkey responded that there is an intention of using higher tier methodologies for KC in the next submissions. The ERT recommends Turkey to use at least a tier 2 methodology since this category is a KC, in the next submission.

Category issue 8: 1.A.3.bi-vii Road transport related categories – All pollutants

91. The ERT noted that emissions from the road transport sector seem rather low, taking into account the size of the vehicle fleet as reported in various international sources such as in Eurostat, in the DG MOVE Statistical Pocketbook and in ACEA. There is no information on the vehicle fleet size and activity in the IIR. The ERT encouraged Turkey to provide a revised estimate, since emissions from road transport seem to be considerably underestimated. During the review, Turkey responded that since the software that prepares input data for COPERT is still under development, a revised time series should be available for the next submission. The ERT calculated a technical correction and recommends Turkey to reflect this in the next submission.

INDUSTRIAL PROCESSES

Review Scope

Pollutants Reviewed		SO_2, NO_X, NMVOC, NH_3, PM_{10} & $PM_{2.5}$		
Years		1990 – 2017 + (Protocol Years)		
Code	**Name**	**Reviewed**	**Not Reviewed**	**Recommendation Provided**
2A1	Cement production	X		
2A2	Lime production	X		
2A3	Glass production	X		X
2A5a	Quarrying and mining of minerals other than coal	X		
2A5b	Construction and demolition	X		
2A5c	Storage, handling and transport of mineral products	X		
2A6	Other mineral products	X		
2B1	Ammonia production	X		X
2B2	Nitric acid production	X		X
2B3	Adipic acid production	X		X
2B5	Carbide production	X		
2B6	Titanium dioxide production	X		
2B7	Soda ash production	X		
2B10a	Chemical industry: Other	X		X
2B10b	Storage, handling and transport of chemical products	X		
2C1	Iron and steel production	X		X
2C2	Ferroalloys production	X		X
2C3	Aluminium production	X		
2C4	Magnesium production	X		
2C5	Lead production	X		X
2C6	Zinc production	X		X
2C7a	Copper production	X		X
2C7b	Nickel production	X		
2C7c	Other metal production	X		
2C7d	Storage, handling and transport of metal products	X		
2D3b	Road paving with asphalt	X		X
2D3c	Asphalt roofing	X		X
2H1	Pulp and paper industry	X		X
2H2	Food and beverages industry	X		
2H3	Other industrial processes	X		
2I	Wood processing	X		
2J	Production of POPs	X		
2K	Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)	X		X
2L	Other production, consumption, storage, transportation or handling of bulk products	X		
Note: Where a sector has been partially reviewed (e.g. some of the NFR codes please indicate which have and which have not in the respective columns.				

General recommendations on cross-cutting issues

92. The ERT notes that Turkey has only submitted emissions for some pollutants (SO_X, NO_X, NMVOC, NH_3, CO and PM_{10}) for the period 1990 - 2017 in the NFR tables for the industrial processes sector. Thus the ERT's review work is based solely on the information provided.

93. The ERT identified that heavy metals are only estimated for category 2C1 and that no CO emissions were provided for 2017.

Transparency

94. The ERT notes that notation keys seem to be properly used for the reported pollutants, while for all other pollutants Turkey uses zero ("0") instead of the proper notation key. The ERT recommends Turkey to fill in the NFR tables with notation keys instead of "0".

95. The ERT finds that emission estimates in the IIR are reported transparently with good method descriptions and references to data sources and EFs. Trends are not described in detail for all sectors. The ERT recommends Turkey to include information on the drivers behind the trends in the IIR.

96. The ERT notes that notation keys have not always been used for those source categories where Turkey does not report emissions. Turkey also uses the notation keys “IE” and “NE” for many source categories in the scope of the industrial processes sector, which also decreases the transparency of the inventory. Additionally, the Party does not provide the information in which sectors the emissions reported as included elsewhere (“IE”) are allocated. The ERT recommends Turkey to provide appropriate notation keys as defined in the Reporting Guidelines and to provide information in the IIR where sources reported as “IE” are included.

Completeness

97. As Turkey only submitted emissions for a few pollutants (SO_X, NO_X, NMVOC NH_3, CO and PM_{10}) the inventory is considered incomplete. The ERT recommends that Turkey calculates and provides emissions for all pollutants, for which there are reporting obligations in the Reporting Guidelines: SO_X, NO_X, NMVOC, NH_3, CO, PM_{10}, $PM_{2.5}$, Pb, Cd, Hg, PAHs (benzo(a) pyrene, benzo(b) fluoranthene, benzo(k) fluoranthene, and indeno(1,2,3_cd) pyrene), dioxins and furans, PCBs and HCB.

98. Turkey did not include CO emissions for 2017. The ERT recommends Turkey to report CO emissions for the whole time series.

99. The ERT finds that not all significant sources occurring in Turkey in the industrial processes sector are included in the inventory. Turkey has not estimated emissions for the following source categories that are likely to be emitting sources in Turkey: 2A2, 2A3, 2A5a, 2A5b, 2A5c, 2A6 , 2B6, 2B7, 2B10b, 2C4, 2C6, 2C7b,2C7c, 2C7d, 2D3b, 2D3c, 2D3h, 2D3i, 2H3, 2G, 2I and 2L. However, in the IIR Turkey stated with each source category that they were planning to include emission estimates for at least particles from each source category once information on the proper activity data would be collected. The ERT recommends the Party to collect all needed activity data for emission calculation for the next submission and where this cannot be implemented, to include an

inventory improvement plan with clear information on steps already taken, tasks to be completed and schedules.

Consistency including recalculation and time series

100. During the review, the ERT noted that emission trends for the industrial processes sector are not consistent. The ERT identified peaks and dips that Turkey justified. Recommendations on these issues are listed in the section sub-sector specific recommendations below.

Comparability

101. The ERT finds that the methods applied for the Turkish inventory preparation are consistent with those proposed in the EMEP/EEA Guidebook for the industrial processes sector. Turkey described the methodology transparently in the IIR along with the assumptions used, referencing the sources of activity data and emission factors. The ERT considers the Turkish inventory for the industrial processes sector to be comparable with those of other reporting Parties regarding the methodology.

102. The ERT also notes that the allocation of industrial source categories follows that of the EMEP/UNECE Reporting Guidelines. However, the ERT notes that the NFR tables submitted are not complete and that the use of notation keys is extensive. The ERT recommends Turkey to report all missing emissions from each source category for all years in the industrial processes sector.

Accuracy and uncertainties

103. The information provided in the IIR is partly inconsistent with the NFR-tables. The ERT recommends the Party to develop a simple QA/QC procedure for the final check of the submission.

104. In the IIR the Party referred in some chapters to the EMEP EEA GB 2013. In response to a question on the issue Turkey responded that only the EMEP EEA GB 2016 is used and the references will be corrected in the next submission. The ERT recommends Turkey to correct the references.

105. Turkey did not provide a quantitative nor a qualitative uncertainty analysis for the industrial processes sector. In the case of 2C3 and 2C5b, Turkey provides the uncertainty of the activity data but no uncertainty calculation is performed. The ERT recommends Turkey to undertake an uncertainty analysis for the industry sector in order to help inform the improvement process and to provide an indication of the reliability of the inventory data.

Improvement

106. Turkey has provided information on planned improvements for the each of the source categories in the industrial processes sector. The ERT notes this improvement made in the industrial processes sector and notes Turkey's intention to carry out additional improvements in the future.

Sub-sector Specific Recommendations

Category issue 1: 2.A.2 Glass production

107. There are inconsistencies in between the PM_{10} emissions from 2A2 glass production in the NFR tables and the IIR. The ERT recommends the Party to remove these inconsistencies.

Category issue 2: 2.B.1 Ammonia production, 2B2 Nitric acid production

108. The ERT notes that the time series data on ammonia and nitric acid production can be found in the IIR, but not in the reporting tables. During the review, Turkey stated that these numbers would be added to the reporting in the following years. The ERT recommends that Turkey includes these data in the NFR tables for the next submission.

Category issue 3: 2.B.3 Adipic acid production

109. There are inconsistencies in between the NO_X emissions from 2B3 adipic acid production in the NFR- tables and the IIR. Turkey responded, that the information in the IIR is correct and adipic acid production is not occurring in Turkey and that these will be corrected in the next submission. The ERT recommends the Party to correct these to the next submission.

Category issue 4: 2.B.10.a Chemical industry other

110. The ERT have identified a drop of PM_{10} emissions in 2014 for fertiliser production. The Party responded, that it checked the data and determined an error, which will be corrected in the next inventory cycle. The ERT recommends the Party to correct this error.

111. The reporting on production of fertilizers is not transparent and to the question on the issue Turkey replied that the fertilizer data will be given more detailed in the IIR in the next cycle. The ERT recommends to include fertilizer production data on an aggregated level in the NFR tables, and on disaggregated level by fertilizers type in the IIR.

112. In the last review the ERT encouraged Turkey to collect information on the fluctuations of NMVOC emissions (ethylene and polyethylene production). In response to the question on the issue the Party provided the explanation that fluctuations are caused by a financial crisis in the country and no problems were determined in the activity data set. The ERT recommends Turkey to include this explanation in the IIR.

113. The ERT noted, that Turkey partly uses the NFR09 format for category 2B5a instead of the NFR14 format 2B10a in the IIR while the NFR 14 format is used in the NFR submission. The Party explained that NFR 2B5a is written in some parts mistakenly in the IIR and that this will be corrected. The ERT recommends the Party to correct this mistake.

114. The ERT have identified a problem with the integration of Turkstat Data in the inventory. The ERT recommends the Party to provide an documented estimate for the production of 1,2-Dichloroethane, Vinyl chloride (chloroethylene), Styrene, Methanal (formaldehyde), Polystyrene in primary forms, Expansible polystyrene in primary forms, Propylene, Carbon (carbon blacks and other forms of carbon) in the IIR for at least one

year, possibly to include the data provided by national authorities, in order to prove, if emissions from these sources are not relevant.

Category issue 5: 2.C.1 Iron and Steel production

115. The ERT investigated, that the EF for Hg, Pb and Cd estimates used for the emission estimates in iron and steel production are out of the confidential interval given in the EMEP EEA GB 2016. In response to a question on the issue the Party responded that the EMEP EEA GB 2016 EFs were used, anyhow the EFs differ and there seems to be a mistake in the units. The ERT strongly recommends Turkey to recalculate these emissions based on EFs in the latest version of the Guidebook.

Category issue 6: 2.C.2 Ferroalloys production

116. NO_X emissions from category 2C2 ferroalloys production are reported in the NFR tables as "IE", without information in the IIR on the allocation of emissions. In response to a question on the issue Turkey responded, that only PM_{10} emissions were calculated as stated in IIR, and that the notation key for NO_X will be corrected. The ERT recommends the Party to correct the notation key and to provide an explanation in the IIR in the next submission.

Category issue 7: 2.C.5 Lead production

117. Turkey reports zero ("0") values for PM_{10} emissions since 2004. The ERT recommends Turkey to estimate the emissions or to use the proper notation key with an explanation in the IIR, if no emissions of this source are occurring.

118. Turkey reported NO_X, heavy metal and $PM_{2.5}$ emissions as "NA". During the review the Party informed the ERT that SO_X, $PM_{2.5}$ and heavy metals will be estimated in the future. The ERT recommends Turkey report all of the occurring emissions and to document the estimation in the IIR to the next submission.

119. The ERT noted that the PM_{10} emission factor given in the IIR in Table 4.31, differs from the EMEP GB 2016 value. The Party informed the ERT, that the TSP emission factor in the EMEP GB 2016 was used instead of the PM_{10} one and that this will be corrected. The ERT recommends using the PM_{10} emissions factor of the Guidebook in the next submission.

Category issue 8: 2.C.6 Zinc production

120. The ERT in the previous review found that emissions from zinc production were not estimated due to doubts concerning the data source. However, Turkey submitted GHG emissions along with zinc production data in their CRF tables. Turkey responded that most data used for GHG reporting in the industry sector cannot be used due to the strict confidentiality rules of TURKSTAT. The ERT strongly recommends that Turkey shares all available data between both conventions (UNFCCC and LRTAP) in order to ensure completeness and consistency. The ERT also recommends Turkey to include information on steps and schedules of this improvement in the IIR and in case of delays to ask the data directly from the plants or relevant authorities or search international databases and

statistics. The ERT notes that Turkey's CRF tables where most of the AD are presented are publicly available on UNFCCC websites.

Category issue 9: 2.C.7.a Copper production

121. Turkey does not estimate SO_X, $PM_{2.5}$ and heavy metals emissions from this source. To a question on the issue the Party informed on plans to estimate SO_X, $PM_{2.5}$ and heavy metals in the next inventory cycle. The ERT recommends including the emissions to the next submission.

122. For PM_{10} Turkey reported emissions in 2017 as zero ("0") values. The ERT recommends reporting the emissions or using the proper notation key in the next submission.

Category issue 10: 2.D.3.b Road paving with asphalt

123. The ERT notes that Turkey does not report emissions from this source category, because there is no data on asphalt production volumes. The review report of the last review in 2016 already recommended the use the data that could be found in the national Annual Industrial Products (PRODCOM) Statistics. In response to a question on the issue Turkey informed that shingle production data will be collected for the next inventory cycle. The ERT recommends the Party to contact the companies, which are producing shingles or contact the authorities that are responsible for this production sector, and to report the emissions in the next submission.

Category issue 11: 2.D.3.c Asphalt roofing

124. The ERT notes that Turkey does not report emissions for this source category, because there is no data on asphalt production volumes. The last review report from 2016 already recommended Turkey to use the data on bitumen and asphalt that could be found in the national Annual Industrial Products (PRODCOM) Statistics. In response to the question on the issue Turkey informed that emissions could not be estimated because no country-specific statistical data for this category was available but that they will try to collect activity data (asphalt data) for the next inventory cycle. The ERT recommends the Party to use all available data to report these emissions to the next submission.

Category issue 12: 2.H.2 Food and beverages industry

125. The last ERT found trend outliers, i,e, a drop in NMVOC emissions in 2008, particularly in sugar-cube production, and a decrease in 2008 in the production of biscuits, margarine, bread, beer, wine and raki. In response to a question on the issue Turkey stated that crystal sugar production amount declined in 2008 due to economic crisis. The ERT recommends Turkey to collect information that could explain all dips and peaks in time series trends and to include that information in the IIR of the next submission to ensure transparency and better understanding of possible country specific circumstances (e.g. financial crisis, reducing/increasing of the production, implementation of abatement technologies etc.).

Category issue 13: 2.K Consumption of POPs and heavy metals

126. The ERT found that for activities under NFR code 2K Turkey did not calculate Hg and PCB emissions. In response to a question on the issue Turkey informed to calculate the emissions based on the tier 1 approach per capita in the next cycle. The ERT recommends that Turkey calculates and reports Hg and PCB emissions along with activity data for the full historic trend in its the next submission.

SOLVENTS

Review Scope

Pollutants Reviewed		SO_2, NO_X, NMVOC, NH_3, PM_{10} & $PM_{2.5}$		
Years		1990 – 2017 + (Protocol Years)		
Code	**Name**	**Reviewed**	**Not Reviewed**	**Recommendation Provided**
2D3a	Domestic solvent use including fungicides	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

127. Turkey's methodology and emission factors in the IIR are considered by the ERT to be generally transparent and well described for the solvents sector.

128. The ERT notes that Turkey uses the NFR14 format for reporting, but in some places of the IIR's solvents sector chapter there are still references to the NFR09 format. The ERT recommends the Party to update these in the IIR text for the next submission.

Completeness

129. The ERT considers the solvent sector to be generally complete. Still, the ERT notes that Turkey has not reported emissions for the NFR categories 2D3h printing, 2D3i other solvent use and 2G other product use. During the review, Turkey explained that the Party planned to search for suitable methods to collect related activity data for these sectors. The ERT recommends Turkey to report these emissions in the next submission.

Consistency including recalculation and time series

130. The ERT finds the time series of the solvents sector to be generally consistent, but recommends Turkey to include information of emission trends and drivers impacting the trends in the IIR in the next submissions.

131. The ERT notes that no recalculations have been reported.

Comparability

132. The ERT notes that Turkey uses methods from the 2016 EMEP/EEA Guidebook to calculate pollutant emissions from the solvent sector, except for the degreasing and dry cleaning sectors where the Party uses emission factors based on the UK's and Ireland's

emission inventories. Turkey also uses the 2014-2 NFR reporting format. The ERT considers the inventory to be comparable with the inventories from other reporting Parties.

Accuracy and uncertainties

133. The ERT notes that for key categories the Parties shall use tier 2 or higher tier methods. In the IIR, Turkey stated that they were actively searching for better sources for sector-specific activity data to improve the inventory's quality. The ERT recommends Turkey to use tier 2 or higher tier methods for estimating emissions from all key categories.

134. The ERT notes that no uncertainty analysis has been performed by Turkey for the solvents sector. The ERT recommends Turkey to undertake an uncertainty analysis for the solvents sector in order to prioritise improvement activities and to provide an indication of the reliability of the inventory data.

Improvement

135. The ERT notes that no specific improvements for the solvents sector have been reported in the IIR. The ERT recommends Turkey to include an improvement plan with information on steps already taken, actions to be taken and clear schedules in the IIR.

136. The ERT notes that Turkey plans to check the consistency of the air emission inventory with the data used in the Turkish greenhouse gas inventory and to try and fill the existing data gaps. The ERT recommends Turkey to carry out this improvement as soon as possible.

137. The ERT also recommends Turkey to continue to investigate the possibilities of obtaining solvent consumption data (possibly using import/export/manufacturing statistical data) for better accuracy of NMVOC emission estimates.

Sub-sector Specific Recommendations

Category issue 1: 2.D.3.d Coating application and 2.D.3.e Degreasing -NMVOC

138. The ERT found that emission estimates of coating applications and degreasing in Turkey are based on population data, although correlations with economic data like sectorial GDP would be more appropriate. In response to a question on the issue the Party explained that GDP cannot be used since no country specific data is available, but it is intended to change methodology if more specific data can be collected. The ERT recommends Turkey to search for GDP data for Turkey, which is publicly available through many sources on the Internet, and to use this data to recalculate emissions to the next submission, and also to investigate the possibilities to use other more accurate data sources for more accurate estimates.

Category issue 3: 2.D.3.f Dry cleaning – NMVOC

139. In order to upgrade the NMVOC emission calculations to tier 2, in the last review report it was recommended that Turkey checks the calculation methodology used by Iceland (Annual Icelandic Informative Inventory Report to UNECE, 2016; Page 61, Chapter 4.7.3), which uses the EMEP/EEA 2013 Guidebook methodology, but does not assume one to have the knowledge of how much solvent is used in dry cleaning. To the question on the

issue Turkey responded that it is decided not to change methodology until country specific data is available. The ERT recommends the Party to collect data on dry cleaning in order to implement a tier 2 approach to the next submission, or to use the recommendation of the previous review report.

Category issue 4: 2.D.3.g Chemical products – NMVOC

140. For paints, varnishes, inks and glues manufacturing, the ERT notes that a tier 1 method is used although the activity data already are at tier 2 level. To the question on the issue Turkey responded to use the tier 2 EF in the next inventory cycle. The ERT recommends that Turkey uses the EMEP/EEA 2016 Guidebook (Chapter 2.D.3.g Chemical products, Table 3-11) tier 2 emission factor of 11 g/kg product instead of the tier 1 emission factor in the next submission.

Category issue 5: 2.G Other product use

141. The ERT recognized that in the NFR tables Turkey reported emissions from this source as “NA” except NMVOC emissions, which are reported as “NE”, while there are methods available in the EMEP EEA GB 2016 for several pollutants. To a question on the issue Turkey responded that the missing emissions will be calculated after activity data at tier 2 level are collected. The ERT recommends Turkey to report all of the occurring emissions in the next submission.

AGRICULTURE

Review Scope

Pollutants Reviewed		SO_X, NO_X, NMVOC, NH_3, PM_{10} & $PM_{2.5}$		
Years		1990 – 2017 + (Protocol Years)		
Code	**Name**	**Reviewed**	**Not Reviewed**	**Recommendation Provided**
3B1a	Dairy cattle	X		X
3B1b	Non-dairy cattle	X		X
3B2	Sheep	X		X
3B3	Swine	X		X
3B4a	Buffalo	X		X
3B4d	Goats	X		X
3B4e	Horses	X		X
3B4f	Mules and asses	X		
3B4gi	Laying hens	X		X
3B4gii	Broilers	X		X
3B4giii	Turkeys	X		X
3B4giv	Other poultry	X		X
3B4h	Other animals (please specify in IIR)	X		X
3Da1	Inorganic N-fertilizers (includes also urea application)	X		X
3Da2a	Animal manure applied to soils	X		X
3Da2b	Sewage sludge applied to soils	X		
3Da2c	Other organic fertilisers applied to soils (including compost)	X		
3Da3	Urine and dung deposited by grazing animals	X		X
3Da4	Crop residues applied to soils	X		
3Db	Indirect emissions from managed soils	X		
3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products	X		X
3Dd	Off-farm storage, handling and transport of bulk agricultural products	X		
3De	Cultivated crops	X		
3Df	Use of pesticides	X		
3F	Field burning of agricultural residues	X		X
3I	Agriculture other (please specify in the IIR)	X		

General recommendations on cross-cutting issues

Transparency

142. The ERT considers that the data provided in the agriculture sector is transparent and complied in a way similar to that recommended in the Guidebook. The calculation of NH_3 emissions from livestock production is generally transparent as livestock numbers, nitrogen (N) excretion rates, manure management systems and EFs are cited in the IIR.

Completeness

143. No PM emissions are reported for agriculture, which could be a key category. The ERT recommends Turkey to include the emissions to the next submission as the activity data (livestock numbers) and methodology in the Guidebook are available for Turkey.

Consistency including recalculation and time series

144. Recalculations are mentioned in IIR but no explanations on reasons for the recalculations are given. The ERT recommends Turkey to provide justifications and information on methodology and impacts of recalculations on the emissions in the next submission.

Comparability

145. Turkey uses methods in accordance with the EMEP/EEA Guidebook and allocates emissions in the NFR 2014-2 format, thus the inventory is comparable with those of other reporting Parties.

Accuracy and uncertainties

146. The ERT found some issues presented in the section on sub-sector specific recommendations where some measures to increase the accuracy of the inventory submission can be implemented.

147. Turkey does not report uncertainty analysis. The ERT recommends Turkey to include an uncertainty analysis for the agriculture sector inventory.

Improvement

148. The ERT notes that planned improvements are reported in the IIR.

Sub-sector Specific Recommendations

Category issue 1: 3.B and 3.D – PM - Completeness

149. In the 2016 stage 3 review report Turkey was strongly recommended to include emissions of PM from 3B and 3D in future inventories, because this could be a key source for PM emissions. In the submission of 2019 NFR tables Turkey does not include PM emissions, neither information on planned improvements for including PM emissions is mentioned in the 2019 IIR, but during the review Turkey informed the ERT that PM emissions will be included in the next submission. The ERT reiterates the strong recommendation to include PM emissions from 3B and 3D in the next submission.

Category issue 2: 3 – All pollutants - Transparency

150. The ERT noted that no activity data are provided in the NFR tables. During the review Turkey indicated that ongoing work will compile all calculations by 2023 and the assessments will be finalised by that year and activity data information will be assessed for NFR tables to be covered by then. The ERT welcomes this improvement and recommends the Party to describe this in the plan for improvements in the IIR of the next submission.

Category issue 3: 3.B – NMVOC - Transparency

151. In 2016 stage 3 review report Turkey was recommended to include information on methodology used for estimation of NMVOC from 3B. The ERT noted that no information on emission factors or tier method used for this was included in the 2019 IIR. The Party informed the ERT that a tier 2 approach had been used to calculate these emissions and that it will be reported more clearly in next cycle. ERT strongly recommend Turkey to include this information for the next submission.

Category issue 4: 3.D.a.1 Inorganic N-fertilizers - Transparency

152. The ERT noted that no activity data for category 3Da1 inorganic N-fertilisers were provided in the NFR tables or in the IIR. In the 2016 stage 3 review report the Party was encouraged to include information on activity data for inorganic N-fertiliser and methodology used. During the review Turkey indicated that ongoing work will compile all calculations by 2023 and the assessments will be finalised by that year and activity data information will be assessed for NFR tables to be covered by then. The ERT welcomes this improvement and recommends the Party to describe this in the plan for improvements in the IIR of the next submission.

Category issue 5: 3.B.4.g.i Lying hens – NMVOC and NH_3 - Accuracy

153. The ERT noted that the emission of NH_3 and NMVOC from 3B4gi laying hens have a high increase in 1992 and decrease again in 1993. The same trend is seen in the number of laying hens. The Party explained this was due to an error. The ERT recommends that this will be corrected for the next submission.

Category issue 6: 3.B.3 Swine and 3.B.4.h Other animals - NMVOC and NH_3 - Accuracy

154. The ERT noted that the emission r in NFR from categories 3B3 swine and 3B4h other animals (Camels) in 2017 are reported as zero (0) while the notation key "NA" is used for NH_3, even though activity data given in IIR indicate that the emission should be occurring. The Party explained that the emission value is rounded by the first decimal and thus results in a zero value and as an expert judgement nearly zero. The ERT recommends Turkey to be consistent in the reporting of emissions and include the emission with the agreed 3 decimals format in the NFR tables for all years.

Category issue 7: 3.D.a.1 Inorganic N-fertiliser- NMVOC - Accuracy

155. The ERT noted that emissions of NMVOC for agricultural soils were reported under category 3Da1 inorganic N-fertiliser. Given in Guidebook 2016 Table 3.1 in Chapter 3.D, emissions of NMVOC from agricultural soils should be reported in category 3De cultivated crops. ERT recommends Turkey to report the emission of NMVOC from agricultural soils in NFR 3De in the next submission.

Category issue 8: 3.D.a.3 Urine and dung deposited by grazing animals – NMVOC – Accuracy

156. The ERT noted that emissions of NMVOC reported in NFR 3Da3 were equal to the sum of emissions reported in category 3B. During the review Turkey explained the emissions reported in 3Da3 were from manure management. This is a potential double counting and therefore an overestimation. In the IIR only emissions from category 3Da1 are provided for category 3D. ERT strongly recommends Turkey to report emissions of NMVOC from manure management in NFR 3B and only emissions from grazing animals in NFR 3Da3 in the next submission.

Category issue 9: 3.B.4.g.ii Broilers, 3.B.4.g.iii Turkeys and 3.B.4.g.iv Other poultry – NMVOC – Accuracy

157. The ERT noted that emission factors for NMVOC from 3B4gii broilers, 3B4giii turkeys and 3B4giv other poultry are the default EFs from the Guidebook in 1990-2016 but different in 2017. During the review Turkey explained that default EF values are used for all years. ERT recommends Turkey to correct this for the year 2017 for the next submission.

Category issue 10: 3.B manure management, 3.D.a.2.a Animal manure applied to soils, 3.D.a.3 Urine and dung deposited by grazing animals – NH_3 – Transparency and completeness

158. For calculation of NH_3 emissions Turkey uses a tier 2 method and in the IIR emissions factors for all animal categories are divided in housing, storage, spreading and grazing. ERT welcomes this, but notes that Turkey reports most emissions in NFR 3B, some in NFR 3Da3 and in NFR 3Da2a using the notation key "NE". Based on information given in IIR the emissions are divided between manure management, animal manure applied to soils and grazing. ERT recommends Turkey to report emissions from housing and storage in NFR 3B manure management, emissions from spreading in NFR 3Da2a

animal manure applied to soils and emissions from grazing in NFR 3Da3 urine and dung deposited by grazing animals in the next submission.

Category issue 11: 3.F Field burning of agricultural residues

159. Turkey reports the emissions from NFR 3F field burning of agricultural residues as “NE” for all pollutants and years. In the IIR it is stated that field burning of agricultural residues are legally restricted and no data on illegal field burning is available. ERT recommends the Party to provide a reference for the legal restriction in the IIR in the next submission.

WASTE

Review Scope

Pollutants Reviewed		SO_2, NOx, NMVOC, NH_3, TSP, PM_{10} & $PM_{2.5}$		
Years		1990 – 2015 + (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	
5C1a	Municipal waste incineration	X		
5C1bi	Industrial waste incineration	X		X
5C1bii	Hazardous waste incineration	X		
5C1biii	Clinical waste incineration	X		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

Transparency

160. The IIR of Turkey is to a certain extent transparent and largely follows the structure of the reporting guidelines. Methodologies and emission factors are well documented in the IIR.

161. Turkey describes emission trends for categories 5A1, 5C1biii, 5C2 and 5D1 in the IIR, however, no information is provided on the drivers behind the trends. The ERT recommends the Party to elaborate drivers behind the trends in the next submission.

Completeness

162. The ERT notes that the reporting of waste sector emissions is incomplete. Turkey reports on main pollutants NO_X, NMVOC; SO_X, NH_3 and PM_{10} from solid waste disposal (5A), clinical waste incineration (5C1biii), open burning of waste (5C2) and domestic waste water handling (5D1). municipal waste incineration (NO) and cremation (5C1bv) are reported as not occurring ("NO"). However, Turkey does not include emissions of other particulate matter, heavy metals and POPs in the inventory and does not estimate emissions from several categories listed below. The ERT recommends Turkey to include the missing pollutants (PM_{10}, TSP) in the next submission, as well as emissions from the missing categories:

- Composting (5B1),
- Anaerobic digestion at biogas facilities (5B2),
- Industrial waste incineration (5C1bi)
- Hazardous waste incineration (5C1bii),
- Sewage sludge incineration (5C1biv)
- Other waste incineration (5C1bvi)
- Industrial wastewater handling (5D2)
- Other wastewater handling (5D3) and
- Other waste (5E)

163. The ERT notes that Turkey has included TSP and $PM_{2.5}$ emissions for NFRs 5A and 5C and NH_3 from latrines as recommended in the previous review.

164. Turkey reports no activity data for the waste sector in the NFR14 tables and only current year activity data in the IIR. To a question on the issue Turkey responded by referring to the Emission Portal which will be ready by 2023. The ERT reiterates the earlier recommendation and strongly recommends Turkey to include activity data in its future NFR and IIR submissions and to elaborate more clearly for which years inter- or extrapolations have been made.

Consistency, including recalculation and time series

165. Turkey reports no recalculations for the waste sector for 2019 submission. The ERT noted that Turkey applied 2016 activity data for year 2017, because TURKSTAT provided no activity data for any of the waste categories this year. The IIR chapter 8.3, p 291 provides information on a planned improvement for activity data synchronization with TURKSTAT. The ERT recommends Turkey for cooperation with TURKSTAT to ensure timely delivery of data.

Comparability

166. Turkey applies methodologies in accordance with the EMEP/EEA Guidebook and uses the NFR 2014-2 reporting format, thus the inventory is comparable with those of other reporting Parties.

Accuracy and uncertainties

167. The ERT noted that no uncertainty analysis was included in the waste sector. The ERT reiterates the encouragements from the 2012 and 2016 reviews and recommends that Turkey applies an uncertainty analysis for the waste categories, and uses the results for prioritising improvements.

168. The ERT noted that Turkey provides information on general QA/QC procedures, but does not elaborate waste specific QA/QC procedures in the IIR. The ERT recommends Turkey to apply and describe sector specific QA/QC procedures in the waste chapters in the IIR.

Condensable Particulate Matter

169. 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

170. The ERT notes improvements made by Turkey since the last review, e.g. regarding inclusion of latrines as well as particle emissions from NFRs 5A and 5C. Turkey includes planned improvements in the category-specific chapters of the IIR.

Potential Technical Corrections

171. The ERT did not prepare any technical corrections for the waste sector inventory of Turkey.

Sub-Sector Specific Recommendations

Category issue 1: 5.A Solid waste disposal on land – NMVOC, TSP, PM_{10}, $PM_{2.5}$

172. The ERT noted that Turkey reports $PM_{2.5}$ and NMVOC emissions in the NFR tables and in addition provides TSP and PM_{10} emissions in the IIR table 6.1. To the question on the issue Turkey responded that the values are small. The ERT recommends Turkey to include TSP and $PM_{2.5}$ emissions to NFR14 tables for completeness.

173. The ERT noted that Turkey reports no activity data in NFR14 waste tables 5A1 and only current year activity data in the IIR. Turkey responded by referring to Emission Portal which will be ready by 2023. In the previous review report there already is a recommendation to include the activity data. The ERT strongly recommends Turkey to include activity data in the next submission and to elaborate more clearly for which years inter- or extrapolation has been used.

174. The ERT noted a difference of 11 kt in AD between 28433 kt mentioned in the IIR and 28421.58 kt mentioned in Turkey's GHG inventory CRF table 5.A for the year 2016. Comparing 2017 AD values, the difference is 798 kt, because the IIR 2017 value is same as 2016 value, while the GHG CRF AD value is 20,231 kt. 14 kt for 2017. This would lead to an underestimation of NMVOC 2017 value by 1.17 kt (45.60-44.43=1.17kt). To the question on the issue Turkey responded that their GHG inventory is prepared by another department. The ERT recommends Turkey to be consistent with the activity data between the different submitted documents and to use the same AD for all calculations, both under the UNFCCC and the UNECE CLRTAP. The ERT notes that Turkey's CRF tables are publicly available on UNFCCC websites.

Category issue 2: 5.B.1 Composting – NH_3

175. The ERT notes that composting is mentioned in the category 5E instead of 5B, where it shall be allocated, and that the NFR14 tables have the notation keys "NA" and "NE" for both 5E and 5B1. However, Turkey's GHG inventory has a full time series 1990 - 2017 for the composting AD. To the question on the issue Turkey responded that category 5B1 is considered for biological waste treatment composting for which they have no data, but will

check the availability of 2017 CRF values from TURKSTAT. The ERT notes that the CRF tables are publicly available at the UNFCCC websites and recommends Turkey to report emissions from composting under category 5B1 – composting in the next submission. The ERT also recommends to be consistency between the submitted documents and to report on that in the next submission.

Category issue 3: 5.C. Waste Incineration – NO_X, SO_X, NMVOC, CO, TSP, PM_{10}

176. According to the IIR, there is one facility incinerating industrial waste. However, emissions under industrial waste incineration (5C1bi) are not reported, because activity data are not available for the whole time period (IIR chapter 6.3). To the question on the issue Turkey answered that TURKSTAT has not produced data yet. The ERT reiterates the previous recommendation that Turkey clarifies this issue and reports on emissions from this source in future submissions. For years where no data is available extrapolation or surrogate data may be used for gap filling (please refer to Part A, chapter 4 on "Time series consistency" of the EMEP/EEA 2013 Guidebook) or by enquiring the data from the facility or from relevant authorities. The ERT also notes that Turkey's CRF tables, where activity data are presented since 1990 are publicly available on the UNFCCC website.

177. The ERT noted that Turkey reports no activity data in NFR14 tables for category 5C1.biii clinical waste incineration. To the question on the issue Turkey responded by referring to the Emission Portal which will be ready by 2023. The previous review report also includes a recommendation to include the activity data. The ERT strongly recommends Turkey to include activity data in its future submissions and to elaborate more clearly for which years inter- or extrapolation has been used.

Category issue 4: 5.E Other Waste

178. The ERT noted that Turkey reports "NA" in the NRF tables for category 5E. The ERT recommends Turkey to gather the necessary AD for estimating sources to be reported under NFR 5E: sludge spreading, biogas production and other production of fuels, in case these occur in Turkey, and to report related emissions or explain possible non-existence of the sources in Turkey, in the next submission.

INFORMATION SUBMITTED BY THE PARTY IN 2019

Filename	Short description of content
Annex_I_Emissions_reporting_2019_v1.xls	Annex I, **MS Excel file** , years 1990-2017
IIR_Turkey_2019.pdf	**IIR 2019, pdf-document**;299 pg

LIST OF ADDITIONAL MATERIALS PROVIDED BY THE COUNTRY DURING THE REVIEW

1. Response to preliminary questions raised prior to the review and during the review: TURKEY Stage 3 review 2019_17062019_answers
2. Turkey Stage 2 S&A report
3. Turkey Stage 1 report 2019
4. Turkey IIR 2019-2017
5. Turkey Stage 3 review reports 2012 and 2016

ANNEX I POTENTIAL TECHNICAL CORRECTIONS

Technical corrections have been proposed by the ERT during the review week for the transport sector. Detailed related information is provided separately in the excel file:TC-TR-2019-Transport.xlsx.

Description	Reference	Pollutant estimates (kt)							
		2017	2016	2015	2014	2013	2012	2011	2010
NOx									
National total as reported 2018 (row 141)	**Annex I, 2019**	**785**	**722**	**713**	**705**	**710**	**656**	**745**	**707**
Difference between original estimate and revised estimates provided by Party and accepted by the ERT									
Difference between original estimate and technical correction deemed necessary by the ERT									
1A3bi Road transport: Passenger cars		-76.077	-71.119	-59.808	-55.604	-37.791	-78.187	-54.835	-54.800
1A3bii Road transport: Light duty vehicles		-5.950	-13.759	-8.806	-9.372	-4.578	-2.271	9.707	12.950
1A3biii Road transport: Heavy duty vehicles and buses		-57.701	-71.239	-66.263	-72.954	-72.136	-49.653	-7.080	-0.550
1A3biv Road transport: Mopeds & motorcycles		0.237	-0.056	0.015	0.089	0.153	0.247	0.319	0.302
National total (row 141) including revised estimates and technical corrections accepted by MS	Calculated using data above	**924.492**	**878.172**	**847.862**	**842.841**	**824.352**	**785.863**	**796.889**	**749.098**
NMVOC									
National total as reported 2018(row 141)	**Annex I, 2019**	**1,099**	**1,062**	**1,077**	**1,039**	**1,039**	**1,094**	**1,034**	**1,049**
Difference between original estimate and revised estimates provided by Party and accepted by the ERT									
Difference between original estimate and technical correction deemed necessary by the ERT									
1A3bi Road transport: Passenger cars		-8.756	-14.842	-16.748	-17.355	-19.561	-23.515	-25.708	-29.718
1A3bii Road transport: Light duty vehicles		6.866	6.204	6.596	6.863	7.303	7.990	9.833	10.608
1A3biii Road transport: Heavy duty vehicles and buses		-0.059	-0.350	-0.191	-0.339	-0.307	0.322	1.723	1.885

Description	Reference	Pollutant estimates (kt)							
		2017	2016	2015	2014	2013	2012	2011	2010
1A3biv Road transport: Mopeds & motorcycles		0.718	-2.278	-2.289	-2.241	-2.295	-2.476	-2.574	-3.129
1A3bv Road transport: Gasoline evaporation		15.817	11.218	10.977	11.395	11.875	12.581	13.160	13.654
National total (row 141) including revised estimates and technical corrections accepted by MS	Calculated using data above	**1,084.414**	**1,062.048**	**1,078.655**	**1,040.676**	**1,041.985**	**1,099.099**	**1,037.566**	**1,055.699**

SO2									
National total as reported 2018(row 141)	**Annex I, 2019**	**2,350**	**2,250**	**1,948**	**2,149**	**1,940**	**2,703**	**2,637**	**2,557**
Difference between original estimate and revised estimates provided by Party and accepted by the ERT									
Difference between original estimate and technical correction deemed necessary by the ERT									
1A3bi Road transport: Passenger cars		-0.184	-0.177	-0.153	-0.145	-0.120	-0.136	-0.091	-0.099
1A3bii Road transport: Light duty vehicles		-0.022	-0.026	-0.018	-0.017	-0.011	-0.006	0.018	0.017
1A3biii Road transport: Heavy duty vehicles and buses		-0.096	-0.093	-0.081	-0.079	-0.071	-0.051	-0.018	-0.013
1A3biv Road transport: Mopeds & motorcycles		0.030	-0.002	-0.002	-0.002	-0.002	-0.001	-0.001	-0.002
National total (row 141) including revised estimates and technical corrections accepted by MS	Calculated using data above	**2,350.272**	**2,250.299**	**1,948.254**	**2,149.242**	**1,940.205**	**2,703.196**	**2,637.093**	**2,557.096**

NH3									
National total as reported 2018(row 141)	**Annex I, 2019**	**740**	**683**	**673**	**704**	**755**	**713**	**643**	**606**
Difference between original estimate and revised estimates provided by Party and accepted by the ERT									
Difference between original estimate and technical correction deemed necessary by the ERT									
1A3bi Road transport: Passenger cars		-1.867	-2.106	-2.068	-1.959	-1.894	-2.072	-1.943	-2.401
1A3bii Road transport: Light duty vehicles		-0.093	0.155	0.195	0.230	0.249	0.305	0.419	0.368

Description	Reference	Pollutant estimates (kt)							
		2017	2016	2015	2014	2013	2012	2011	2010
1A3biii Road transport: Heavy duty vehicles and buses		-0.163	-0.119	-0.103	-0.099	-0.090	-0.062	-0.029	-0.019
1A3biv Road transport: Mopeds & motorcycles		-0.007	-0.006	-0.006	-0.005	-0.005	-0.004	-0.004	-0.004
National total (row 141) including revised estimates and technical corrections accepted by MS	Calculated using data above	**742.130**	**685.076**	**674.981**	**705.834**	**756.740**	**714.833**	**644.556**	**608.057**

PM2.5									
National total as reported 2018(row 141)	**Annex I, 2019**	**17.00**	**13.87**	**13.69**	**15.00**	**15.03**	**12.00**	**15.93**	**14.08**
Difference between original estimate and revised estimates provided by Party and accepted by the ERT									
Difference between original estimate and technical correction deemed necessary by the ERT									
1A3bi Road transport: Passenger cars		-2.574	-2.811	-2.788	-3.026	-3.091	-3.096	-2.291	-2.572
1A3bii Road transport: Light duty vehicles		-1.598	-1.763	-1.828	-2.060	-2.122	-2.110	-1.536	-1.578
1A3biii Road transport: Heavy duty vehicles and buses		-2.122	-2.326	-2.347	-2.523	-2.637	-2.454	-1.721	-1.772
1A3biv Road transport: Mopeds & motorcycles		-0.049	-0.053	-0.053	-0.053	-0.055	-0.059	-0.060	-0.072
1A3bvi Road transport: Automobile tyre and brake wear		-3.591	-3.475	-3.184	-3.067	-2.869	-2.565	-1.865	-1.813
1A3bvii Road transport: Automobile road abrasion		-1.657	-1.604	-1.470	-1.419	-1.334	-1.189	-0.859	-0.835
National total (row 141) including revised estimates and technical corrections accepted by MS	Calculated using data above	**28.591**	**25.901**	**25.359**	**27.149**	**27.138**	**23.473**	**24.262**	**22.722**
PM10									
National total as reported 2018(row 141)	**Annex I, 2019**	**765**	**721**	**807**	**551**	**779**	**889**	**870**	**907**
Difference between original estimate and revised estimates provided by Party and accepted by the ERT									

Description	Reference	Pollutant estimates (kt)							
		2017	2016	2015	2014	2013	2012	2011	2010
Difference between original estimate and technical correction deemed necessary by the ERT									
1A3bi Road transport: Passenger cars		-1.720	-1.956	-1.779	-1.765	-1.423	-3.073	-2.268	-2.557
1A3bii Road transport: Light duty vehicles		0.973	0.807	0.906	0.861	1.029	1.147	1.984	2.248
1A3biii Road transport: Heavy duty vehicles and buses		0.337	0.133	0.222	0.114	0.148	0.555	1.335	1.472
1A3biv Road transport: Mopeds & motorcycles		-0.049	-0.053	-0.053	-0.053	-0.055	-0.059	-0.060	-0.072
1A3bvi Road transport: Automobile tyre and brake wear		-4.823	-6.497	-3.915	-3.611	-3.000	-3.079	-1.630	-1.603
1A3bvii Road transport: Automobile road abrasion		-3.068	-2.970	-2.723	-2.628	-2.470	-2.202	-1.592	-1.547
National total (row 141) including revised estimates and technical corrections accepted by MS	Calculated using data above	**773.351**	**731.536**	**814.342**	**558.081**	**784.772**	**895.711**	**872.229**	**909.059**

CO									
National total as reported 2018(row 141)	**Annex I, 2019**	**0.17**	**2,050**	**2,185**	**1,961**	**2,044**	**2,827**	**2,597**	**2,900**
Difference between original estimate and revised estimates provided by Party and accepted by the ERT									
Difference between original estimate and technical correction deemed necessary by the ERT									
1A3bi Road transport: Passenger cars		-143.168	-33.030	-84.058	-77.718	-83.228	-97.930	-101.965	-126.183
1A3bii Road transport: Light duty vehicles		-11.419	99.191	106.704	114.676	121.990	134.610	157.219	170.988
1A3biii Road transport: Heavy duty vehicles and buses		-35.712	-22.226	-20.747	-22.472	-22.272	-15.771	-4.472	-2.741
1A3biv Road transport: Mopeds & motorcycles		-16.701	4.498	5.266	6.538	7.342	8.548	8.939	6.445
National total (row 141) including revised estimates and technical corrections accepted by MS	Calculated using data above	**207.169**	**2,001.567**	**2,177.835**	**1,939.975**	**2,020.168**	**2,797.542**	**2,537.278**	**2,851.491**