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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  
SWITZERLAND**

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## INTRODUCTION

1. The mandate and overall objectives for the emission inventory review process under the LRTAP Convention is given by the UNECE document '*Methods and Procedures for the Technical Review of Air Pollutant Emission Inventories reported under the Convention and its Protocols*'<sup>(1)</sup> – hereafter referred to as the 'Methods and Procedures' document.
2. This annual review, has concentrated on SO<sub>2</sub>, NO<sub>x</sub>, NMVOC, NH<sub>3</sub>, plus PM<sub>10</sub> & PM<sub>2.5</sub> for the time series years 1990 – 2014 reflecting current priorities from EMEP Steering Body and the Task Force on Emission Inventories and Projections (TFEIP). HMs and POPs have been reviewed to the extent possible.
3. This report covers the stage 3 centralised reviews of the UNECE LRTAP Convention and EU NEC Directive inventories of Switzerland coordinated by the EMEP emission centre CEIP acting as review secretariat. The review took place from 20<sup>th</sup> June 2016 to 25<sup>th</sup> June 2016 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 – Ms. Charlotte Vanpoucke (Belgium), Energy - Mr. Ben Pearson (United Kingdom), Transport - Mr. Giorgos Melios (EU), Industry - Mr. Sebastian Plickert (German), Solvents - Ms. Maria Purzner (Austria), Agriculture - Mr. Juan José Rincón Cristóbal (Spain), Waste - Mr. Intars Cakars (Latvia).
4. Ms. Kristina Saarinen (Finland) was the lead reviewer. The review was coordinated by Ms. Katarina Marečková, (EMEP Centre on Emission Inventories and Projections - CEIP).

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<sup>1</sup> Methods and Procedures for the Technical Review of Air Pollutant Emission Inventories reported under the Convention and its Protocols. Note by the Task Force on Emission Inventories and Projections. ECE/EB.AIR/GE.1/2007/16 [http://www.unece.org/env/documents/2007/eb/ge1/ece\\_eb\\_air\\_ge.1.2007.16\\_e.pdf](http://www.unece.org/env/documents/2007/eb/ge1/ece_eb_air_ge.1.2007.16_e.pdf)

## **PART A: KEY REVIEW FINDINGS**

5. The ERT recognises the level of effort undertaken by Switzerland in providing an inventory with a significant level of detail and an extensive IIR to undertake a detailed review. Due to the quality of the IIR and Switzerland's responsiveness during the review the ERT was able to review the inventory in detail and to provide a number of detailed recommendations.

6. The inventory is generally in line with the 2013 EMEP/EEA inventory guidebook and UNECE Reporting Guidelines. Transport emissions are reported both based on fuels sold and fuels used. The ERT found the inventory to be sufficiently detailed and noted that national methodologies had been used.

7. The ERT found the 2016 submission to be of good quality and to show improvements in a number of issues. The ERT commends Switzerland for the work done. Nevertheless, the ERT identified the need for further improvements as described in Part B of the report.

In this report there is a table in the beginning of the review of each sector. Please note that under the column titled "Recommendations provided" the cross marks both actual recommendations as well as encouragements.

### **INVENTORY SUBMISSION**

8. Switzerland submitted NFR tables under the CLRTAP on 10<sup>th</sup> February 2016 by the set deadline date of 15<sup>th</sup> February. The submission included data for the Protocols' base years and a full time series 1980-2014 (the most recent year) for the Protocol pollutants, except for non-priority heavy metals and PCBs, in NFR 2014 format.

9. The Informative Inventory Report (hereafter IIR) was submitted on 14<sup>th</sup> March 2016 within the deadline date of 15<sup>th</sup> March.

10. Projected emissions were submitted in NFR 2014 format for 2020 and 2030. In addition, the submission included emission projections "with measures" and "with additional measures" in aggregated NFR categories up to 2050.

11. The Party reported gridded emissions for the complete time series 1980-2014 as well as data on LPS for the years 2007-2013.

### **KEY CATEGORIES**

12. Switzerland has carried out a level Key Category Analysis (KCA) consistent with the EMEP/EEA Guidebook (hereafter Guidebook) and identical to the CEIP analysis for emissions of the reported pollutants for 2014. Level KCAs have been performed for 1990 and 2014 and trend KCAs for 1990-2014.

13. Switzerland does not specify in the IIR that the results of the KCA are used to identify priorities in improvements of the inventory. The ERT recommends that Switzerland uses the results of the KCA to prioritise improvements in the inventory.

14. Tier 2 methodologies have been applied to most key categories, except in the agriculture sector. The ERT recommends that Switzerland uses higher Tier methods for all key categories in line with the Guidebook in order to increase the accuracy of the inventory.

## QUALITY

### Transparency

15. The ERT found the Swiss inventory to be generally transparent. The Swiss IIR is detailed and mainly follows the recommended structure for the IIR according to Annex II of the Reporting Guidelines. Assumptions and methodologies are clearly described for the majority of sources. The ERT encourages Switzerland to complete the excellent work done on the IIR, with some additional descriptions as indicated below at sector level in part B of this report.

16. Switzerland uses the notation keys “IE” (Include Elsewhere) and “NE” (Not Estimated) in some cases and provides explanations on where emissions are included in the IIR. The ERT commends Switzerland for providing the explanations.

The ERT noted the use of the notation key “NO” (Not Occurring) or “NA” (Not Applicable) instead of “NE” (Not Estimated) in some cases where emissions are expected to occur as explained in detail in part B of the report. The ERT recommends that the Party corrects the use of notation keys according to the definitions in the Reporting Guidelines.

### Completeness

17. The ERT acknowledges the effort which Switzerland has made to provide estimates of emissions for almost all pollutants in all sub-sectors. The ERT found the inventory to be generally complete in terms of sources, years and geographical coverage.

18. Regarding the completeness of pollutants reported, Switzerland does not report PCBs and non-priority heavy metals. Also some NFR 2 sources for BC are reported as “NE”. To the question raised by the ERT on non-priority heavy metals, Switzerland replied that there are no big sources of non-priority heavy metals and due to limited resources the inventory focus is on priority heavy metals. Regarding PCBs, Switzerland replied that a reasonable inventory could not be established due to incomplete information on PCB emission factors. Switzerland plans a study to assess the PCB emissions from the main sources to be able to report PCBs emissions in future. The ERT welcomes these plans and encourages Switzerland also to consider complementing the inventory by including non-priority heavy metals.

19. In addition to those identified by Switzerland, the ERT found some other missing emissions. As the completeness of the inventory is essential for checking compliance with obligations under the conventions, emission values or at least an assessment of the quantitative importance of the sources currently not estimated is needed. The ERT recommends that Switzerland completes the inventory with estimating the missing emissions in the energy, transport and agriculture sectors as explained in the sector chapters in Part B of the report, or corrects the notation key to “NE”.

20. Switzerland uses zero-values in some cases in the reporting tables. The ERT recommends that Switzerland estimate and report the actual value of emissions, or use an appropriate notation key as defined in the Reporting Guidelines.

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

21. Switzerland has undertaken consistent recalculations for almost all pollutants for the whole time series. Reasons for recalculations as well as quantitative information on differences to the previous submission are provided in detail in the IIR. The ERT commends Switzerland for this improvement.

22. According to the IIR, the trend analysis presented in the IIR is carried out for emissions based on fuels used. The ERT recommends that Switzerland presents the trend analysis for the data based on fuels sold instead of fuels used, as the reporting requirement is for fuels sold, and to make the comparison to other countries possible.

23. Drivers behind the trends are well described in the IIR. The ERT found some minor discrepancies regarding the trend analysis of cadmium (see Figures 2.4 and 9.5 and the text in the IIR). Switzerland clarified these and indicated that these will be corrected for the next submission. The ERT commends Switzerland for providing a comprehensive trend analysis.

### **Comparability**

24. The ERT notes that the inventory of Switzerland is comparable with those of other reporting Parties. The allocation of source categories follows the EMEP/UNECE reporting Guidelines and the methodologies are consistent with the Guidebook. The ERT encourages Switzerland to continue the inventory work with this approach.

### **CLRTAP/NECD comparability**

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

### **Accuracy and uncertainties**

26. The ERT did not find any systematic over- or underestimations in the Swiss inventory, however there is a need to further improve the completeness of the inventory as described above under “Completeness”.

27. Switzerland performed a quantitative uncertainty analysis for the main pollutants as well as for PM<sub>2.5</sub> and PM<sub>10</sub> as part of the 2016 submission. Compared to the results of the previous uncertainty analysis from 2015 there is a decrease of approximately 1%. The ERT commends Switzerland for providing information on uncertainties in the IIR and recommends that the Party include more information how the results of the uncertainty analysis were used to improve the inventory.

28. Tier 2 methodologies have been applied to most key categories. The ERT recommends that Switzerland uses Tier 2 or higher tier methods for all key categories in order to further increase the accuracy of the inventory.

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

29. The Swiss quality management system for the greenhouse gas reporting covers also the air pollutant inventory and is based on ISO9001:2008 (since superseded by ISO9001:2015).

30. Informal QC activities have been performed by the inventory agency experts and external authors of the IIR. Centralised plausibility checks are also performed comparing past emissions with those for the current submission. During the review Switzerland provided the ERT with further information on QC procedures not included in the IIR. The ERT commends Switzerland for their QA/QC activities and recommends that the Party complete the description in the IIR with further details.

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

31. Results from Stage 1 and Stage 2 reviews on the 2014 emission data have been used in this Stage 3 review. The ERT invites Switzerland to also refer to these previous reviews when examining this review report and when updating its improvement plans.

32. The ERT encourages Switzerland to reply on the findings of the Stage 2 review on CEIP's website.

The ERT commends Switzerland for the improvement of its inventory by implementation of almost all recommendations made in the previous Stage 3 report.

### **AREAS FOR IMPROVEMENTS IDENTIFIED BY SWITZERLAND**

33. Switzerland provides a list of planned improvements for the next year in the IIR. The ERT welcomes information provided by the Party in the IIR on the following priorities for future inventory improvement:

- (a) to include the final step of generating the emission reporting template into the quality system which already covers data collection, compilation and modelling.
- (b) to update the territorial road transportation model based on the last update of the handbook of emission factors for road vehicles;

- (c) to update activity data for the projection of road transportation 2035/2050;
- (d) to recalculate NH<sub>3</sub> emissions of Agriculture based on a 2015 survey on farm and manure management;
- (e) to carry out a study on PCBs emissions about their main emission sources, e.g. joint sealings, electrical equipment;

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

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

34. The ERT identifies the following cross-cutting issues for improvement in the Swiss inventory and recommends the Party:

- (a) to complete its emission inventory with estimating currently missing emissions;
- (b) to use the notation key "NE" where emissions are expected to occur but are not estimated;
- (c) to carry out the trend analysis for the data based on fuels sold;
- (d) to provide more detailed information on QC procedures in the IIR.

# SECTOR SPECIFIC RECOMMENDATIONS FOR IMPROVEMENTS IDENTIFIED BY ERT

## ENERGY

### Review Scope

<b>Pollutants Reviewed</b>		SO <sub>2</sub> , NO <sub>x</sub> , NMVOC, NH <sub>3</sub> , CO, TSP, BC, PM <sub>10</sub> & PM <sub>2.5</sub> , Cd, Hg, Pb, Dioxin, PAH, HCB		
<b>Years</b>		1990 – 2014		
<b>Code</b>	<b>Name</b>	<b>Reviewed</b>	<b>Not Reviewed</b>	<b>Recommendation Provided</b>
1A1a	Public electricity and heat production	X		
1A1b	Petroleum refining	X		
1A1c	Manufacture of solid fuels and other energy industries	X		
1A2a	Iron and steel	X		
1A2b	Non-ferrous metals	X		
1A2c	Chemicals	X		
1A2d	Pulp, Paper and Print	X		
1A2e	Food processing, beverages and tobacco	X		
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	X		
1A2gviii	Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR)	X		
1A3ei	Pipeline transport	X		
1A3eii	Other (please specify in the IIR)	-		
1A4ai	Commercial/institutional: Stationary	X		
1A4bi	Residential: Stationary	X		
1A4ci	Agriculture/Forestry/Fishing: Stationary	X		
1A5a	Other stationary (including military)	-		
1B1a	Fugitive emission from solid fuels: Coal mining and handling	X		
1B1b	Fugitive emission from solid fuels: Solid fuel transformation	X		
1B1c	Other fugitive emissions from solid fuels	-		
1B2ai	Fugitive emissions oil: Exploration, production, transport	X		
1B2aiv	Fugitive emissions oil: Refining / storage	X		
1B2av	Distribution of oil products	X		
1B2b	Fugitive emissions from natural gas (exploration, production, processing, transmission, storage, distribution and other)	X		
1B2c	Venting and flaring (oil, gas, combined oil and gas)	X		
1B2d	Other fugitive emissions from energy production	-		

## General recommendations on cross cutting issues

### **Transparency**

35. The ERT commends Switzerland for providing emission estimates at the most detailed level for all energy sectors. The Party's methodology and emission factors in the IIR are considered by the ERT to be transparent and well described and the use of notation keys extensive, considered, and transparent. However, the ERT encourages the Party to include more details in the IIR regarding:

- (a) Documentation of EFs from the literature at full precision where possible, or to indicate by means of a footnote or otherwise where and why EFs in the IIR have been rounded. For example, as indicated by the Party, in various NFR 1.A.2 and 1.A.4 EFs for PAHs and priority heavy metals, which are not presented in the IIR at the full precision used for calculation.
- (b) Providing additional details for EFs from the Guidebook and other sources of information, for example indicating which technology the EF is related to, particularly where the IIR's fuel or technology classification differs to that of the source, or where the EF has been modified from the original source (e.g. regarding NFR 1.A.4.a.i wood and NFR 1.A.4.b.i biomass, residual oil and petroleum coke BC proportion of PM<sub>2.5</sub>)
- (c) Documenting EFs for all pollutants in the IIR tables, e.g. all TSP and PAH EFs for NFR 1.A.1.a

36. The Party uses zero values in a number of cells of the NFR tables, for example for BC in NFRs 1.A.1.b, 1.A.3.e.i and for PCDD/F in NFRs 1.A.2.g.v.ii & 1.A.5.b, for NH<sub>3</sub> in NFR 1.A.3.e.i and for Pb in NFR 1.B.2.a.v. The ERT encourages the Party to report the actual emission values instead of zero emissions, or to use the appropriate notation keys according to their definitions in the Reporting Guidelines.

### **Completeness**

The inventory is generally complete and there are no "NE"s reported within the stationary energy sector except for PCBs.

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

37. Switzerland has undertaken recalculations of the complete time series of Cd in NFR 1.A.1.a, Pb & PAHs in NFR 1.A.4.a.i, and NH<sub>3</sub>, BC, Pb, PCDD/F, and PAHs in NFR 1.A.4.b.i.

38. The ERT commends Switzerland for the extensive explanations included in the IIR. However, the ERT encourages Switzerland to provide numerical indication of the proportional changes and impacts of the recalculations on the trends in the Energy sector in its IIR.

## **Comparability**

39. The Energy sector inventory is carried out using methodologies in accordance with the Guidebook.

## **Accuracy and uncertainties**

40. Emissions from all key categories have been estimated using appropriate methodologies as specified in the Guidebook's decision trees.

41. The uncertainty analysis covers emissions from the energy sector.

42. The Party carries out QA/QC procedures in the preparation of the energy sector inventory. The ERT encourages the Party to provide more information on sector specific QA/QC procedures and their results in the IIR.

## **Improvement**

43. The ERT commends the Party's approach in adjusting the determination of Tier levels to the decision trees of the Guidebook as well as the numerous improvements in the structure of the IIR. The ERT welcomes the Party's intention to include PCB emissions in the inventory and encourages the Party to consider the inclusion of non-priority heavy metals as a further improvement.

## **Sub-Sector Specific Recommendations**

### **Category issue 1: 1.B.2.a.iv - other pollutants than NMVOC**

44. The ERT noted that Switzerland reports "NA" for emissions of all pollutants other than NMVOC under NFR 1.B.2.a.i.v, and recommends that the Party review whether emissions of other pollutants might occur within this sector. Switzerland's IIR states clearly that primary crude oil refining exists, and the ERT considers that emissions of PM, CO, NO<sub>x</sub> and/or SO<sub>2</sub> may be likely to occur. The Party has advised the ERT that emissions of CO, NO<sub>x</sub> and SO<sub>2</sub> from refineries are included under NFR 1.B.2.c. If the Party considers that these emissions include fugitive emissions which cannot be separated, then the ERT recommends that the Party note this in their IIR and reports "IE" in NFR 1.B.2.a.iv for these pollutants.

45. The Party further indicated that emissions from Claus sulphur recovery units were included under NFR 2.H.3. The ERT considers that these would more appropriately be included under NFR 1.B.2.a.i.v in accordance with the inclusion of sulphur recover plant emission factors within the associated Guidebook chapter, and encourages the Party to provide an explanation of where emissions are included in the IIR.

### **Category issue 2: 1.A.2 & 1.A.4 - Non-priority heavy metals, PAHs, Transparency**

46. It is stated in Switzerland's IIR that EFs for Hg, Pb, Cd and PAHs are taken from the Guidebook 2013, however, the ERT noted some discrepancies between the

presented factors and those in the Guidebook. Based on the reply of Switzerland regarding the differences the ERT recommends to include in the IIR:

- (a) default EFs from the Guidebook at full precision where possible, and
- (b) a justification for the selection of EFs if taken from different tables of the Guidebook 2013, for example:
  - (i) PAH EFs for NFRs 1.A.4.a.i and 1.A.4.b.i: PAH for natural gas engines are from the table for stationary reciprocating engines (Nielsen et al. 2010), but Pb and Cd are the lower EFs from the table for gas turbines (Nielsen et al. 2013)
  - (ii) EFs for NFR 1.A.4.a.i Pb, Cd, dioxin and PAH for coal combustion are consistent with the table for 'Small single household scale, capacity <=50 kWth boilers' (Guidebook 2006 chapter B216), but Hg is estimated using the higher factor from the table for 'Advanced coal combustion techniques <1MWth - Manual Boiler' (Thistlethwaite, 2001).
  - (iii) EFs for NFR 1.A.2 gas oil boiler priority metals and PCDD/F are from the table for 'Small (single household scale, capacity <=50 kWth) boilers' (Pulles et al. 2012), but for PAHs for reciprocating engines are from Guidebook Chapter 1.A.4. table 3-37 based on Nielsen et al. 2010

### **Category issue 3: 1.A.1, 1.A.2 and 1.A.4 - TSP, Transparency**

47. The ERT noted that PAH emissions are estimated and reported from NFR 1.A.1.a, TSPs from NFRs 1.A.1, 1.A.2 and 1.A.4, but no methodology description or EFs are presented in the Party's IIR. The ERT recommends the Party document the methodologies in the IIR.

### **Category issue 4: 1.A.4.c.i - Non-priority heavy metals, Completeness, transparency**

48. The ERT identified two discrepancies which the ERT recommends the Party to review for future submissions;

- (1) the notation key "NO" is used for the reporting of Se from NFR 1.A.4.c.i, whereas all non-priority metals in the sector are recorded as "NR". The ERT recommends the Party revise the notation keys of non-priority heavy metals to "NE" (not estimated)
- (2) the notation key "NO" is used in the IIR for lead emissions from biomass (wood) combustion in NFR 1.A.4.c.i, The ERT recommends that the Party estimate and report the emissions or uses the notation key "NE" for not estimated emissions.

## TRANSPORT

### Review Scope

Pollutants Reviewed		All		
Years		1990 – 2014		
Code	Name	Reviewed	Not Reviewed	Recommendation Provided
1A2gvii	Mobile Combustion in manufacturing industries and construction: (please specify in the IIR)	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		

### General recommendations on cross cutting issues

#### **Transparency**

49. The estimates are provided at the most detailed level for all transport subsectors and the methodology and EFs presented in the IIR are considered by the ERT to be transparent.

50. Switzerland uses zero values in a small number of cells in the NFR tables. The ERT encourages Switzerland to report the actual emission value instead of zero or to use the appropriate notation keys according to their definitions in the Reporting Guidelines.

## **Completeness**

51. The ERT considers the Transport sector inventory to be generally complete, however emissions of all other heavy metals than lead have not been estimated. The ERT recommends that Switzerland increases the completeness of the inventory by estimating emissions of cadmium and mercury and encourages the Party to also include all non-priority heavy metals.

52. Switzerland reports some "IE"s for a small number of subsectors. The ERT recommends that Switzerland disaggregates and reports emissions separately where possible.

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

53. Switzerland has recalculated the entire non-road transport sector for all air pollutants and all years using updated information on activity levels and partially revised emission factors. The implications on the emissions levels and for the emission trends are quantified at national level in the IIR. The ERT encourages Switzerland to provide more detailed information on the impact of the recalculations at the subsector level.

54. The ERT considers the time series of emissions to be generally consistent.

## **Comparability**

55. The ERT considers the allocation of emissions to be in line with the Reporting Guidelines and the description of methodologies to be consistent with the Guidebook.

## **Accuracy and uncertainties**

56. There is underestimation of particle emissions as these are not calculated from mopeds and motorcycles. In addition, there is slight underestimation of mercury emissions due to the exclusion of mercury from the transport sector emissions inventory.

57. The Transport sector emissions are included at subsector level in a quantitative uncertainty analysis and the Quality Management System also covers the transport sector inventory.

## **Improvement**

58. The ERT commends Switzerland for the improvements in the transport sector and in particular for the non-road modes and encourages the Party to implement the planned improvements of updating the road transport model based on the latest version of the Handbook of emission factors and to include information on the timeline for these improvements in the IIR.

## Sub-Sector Specific Recommendations

### **Category issue 1: All Transport – HMs, Completeness**

59. The ERT noted that emissions of all heavy metals with the exception of lead are reported as “NA” or “NR” in the NFR table, although there are emission factors and the methodology for estimating these in the Guidebook. During the review, Switzerland clarified that only the lead, cadmium and zinc emissions are included in their transport model and that there is no plan to include more pollutants. The ERT recommends that Switzerland includes at least the priority heavy metal mercury for calculating emissions from road transport to improve the completeness of the inventory and encourages Switzerland also estimate and report emissions from all heavy metals in future submissions.

### **Category issue 2: 1.A.3.b.v.ii Automobile road abrasion – PM, Transparency**

60. The ERT noted that emissions from automobile road abrasion are reported as “IE” and are included under tyre and break wear. During the review, Switzerland has indicated that they plan to update their non-exhaust emissions calculation to estimate and report these emissions separately, but that this will not be available for next year’s submission. The ERT welcomes this plan.

### **Category issue 3: 1.A.3.b.iv Mopeds & motorcycles – PM, completeness, accuracy**

61. PM emissions from mopeds & motorcycles are reported as zero in the NFR table. To the question raised by the ERT on the issue, Switzerland acknowledged the mistake and explained that their transport model does not calculate PM emissions from mopeds & motorcycles and hence the “NE” notation key should be used instead. The ERT recommends that the Party includes particle emissions in the inventory to improve the completeness of the inventory

### **Category issue 4: 1.A.4.a.ii Commercial/institutional: Mobile – NMVOC and CO, Transparency**

62. The ERT noted that the IEF for NMVOC and CO from the off-road sector is much higher compared to other developed countries. For example in Germany and in the Netherlands the IEF is about 0.08 g/TJ, whereas it is 1.73 g/TJ for Switzerland. For CO the IEFs for Germany and the Netherlands are 0.23 and 4 g/TJ, respectively, whereas for Switzerland it is 25.9 g/TJ. One possible explanation might be that only 2-stroke gasoline engines (which have the highest emissions) are used in Switzerland, whereas a mix of 2-stroke and 4-stroke gasoline, as well as diesel engines are used in Germany and the Netherlands. During the review, Switzerland explained that only garden care and hobby mobile machinery are included in this subsector and they indeed use mainly 2-stroke gasoline engines, which explains that the relatively high IEF is justified. The ERT encourages the Party to include the explanation of this issue in the IIR.

**Category issue 5: 1.A.2.g.vii, 1.A.3.a.i(i), 1.A.3.C, 1.A.4.c.ii – PM<sub>10</sub> and TSP**

63. The ERT noted that the IEFs for PM<sub>10</sub> and TSP emissions from these off-road sectors are much higher compared to other Parties. During the review, Switzerland explained that the relatively high IEFs are justified for the same reasons as explained in their response to the previous issue (Category issue 4). The ERT encourages the Party to include the explanation of this issue in the IIR.

## INDUSTRIAL PROCESSES

64. Switzerland uses the notation key “NE” only for emissions of PCBs and some industrial sources of black carbon (BC) emissions.

### Review Scope

Pollutants Reviewed		SO <sub>2</sub> , NO <sub>x</sub> , NMVOC, NH <sub>3</sub> , PM <sub>10</sub> & PM <sub>2.5</sub>		
Years		1990 – 2014 + (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 (please specify in the IIR)		X	
2B1	Ammonia production	X		
2B2	Nitric acid production	X		
2B3	Adipic acid production		X	
2B5	Carbide production	X		
2B6	Titanium dioxide production		X	
2B7	Soda ash production		X	
2B10a	Chemical industry: Other (please specify in the IIR)	X		
2B10b	Storage, handling and transport of chemical products (please specify in the IIR)		X	
2C1	Iron and steel production	X		
2C2	Ferroalloys production		X	
2C3	Aluminium production		X	
2C4	Magnesium production		X	
2C5	Lead production		X	
2C6	Zinc production		X	
2C7a	Copper production	X		
2C7b	Nickel production		X	
2C7c	Other metal production (please specify in the IIR)	X		
2C7d	Storage, handling and transport of metal products (please specify in the IIR)		X	
2H1	Pulp and paper industry	X		
2H2	Food and beverages industry	X		
2H3	Other industrial processes (please specify in the IIR)	X		
2I	Wood processing	X		
2J	Production of POPs		X	
2K	Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)	X		
2L	Other production, consumption, storage, transportation or handling of bulk products (please specify in the IIR)		X	

## General recommendations on cross cutting issues

### **Transparency**

65. The Industrial Processes sector inventory generally shows a high level of transparency.

66. The ERT notes that for activities where only emissions of particular pollutants are reported, the notation key "NA" is used for all other pollutants, no matter if the pollutant in question is categorised as "not applicable" or as "not estimated" in the respective section of the Guidebook. The ERT encourages Switzerland either to complete the reported emissions (as far as data is available), or to improve the transparency by using the appropriate notation keys. "NA" should only be used for pollutants that are not emitted from the activity as indicated in the Guidebook. Where emissions of the pollutant in question are reported under the corresponding NFR activity 1.A.2.x (combustion in manufacturing industries), the ERT proposes to use the notation key "IE" and to indicate in the IIR under which NFR code the emissions are actually reported. For pollutants that may occur but where no emissions are reported the notation key "NE" should be used.

### **Completeness**

67. The ERT considers the industrial processes sector to be complete with regard to all pollutants where estimation methods are presented in the Guidebook. The methodology descriptions in the IIR are comprehensive with excellent levels of detail.

68. Regarding the activities where only emissions of particular pollutants are reported, the ERT encourages Switzerland to complete inventory by estimating and reporting other occurring emissions unless these pollutants are reported elsewhere or classified as "NA" in the Guidebook.

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

69. The ERT found the time-series in the Industrial Processes sector to be consistent.

70. The ERT notes that recalculations have been carried out for individual industrial sub-sectors and pollutants, and that this is clearly described in the IIR.

### **Comparability**

71. The methods used by Switzerland for the Industrial Processes sector are consistent with the Guidebook and country-specific methods are sufficiently described in the IIR.

### **Accuracy and uncertainties**

72. The ERT notes that Switzerland has carried out a Tier 1 uncertainty analysis for the main pollutants and particulate matter for the current submission, and that this also includes the emissions from industrial processes.

## **Improvement**

73. According to the IIR Switzerland does not plan improvements in the IP sector for the submission of 2017.

## **Sub-Sector Specific Recommendations**

### **Category issue 1: 2.A.3 Glass production**

74. In contrast to the information on glass production in the IIR section 3.2.3.2.7 (“Non-metallic minerals – 1.A.2.f”) , glass production is not mentioned in the Industrial Processes section of the IIR and “NA” is reported for NFR 2.A.3. This may lead to the misconception that no glass production exists in Switzerland, or that the emissions from glass production are not reported. The issue was discussed during the review, and the Party explained that all emissions from glass production in Switzerland are reported under NFR 1.A.2.f (Stationary combustion in manufacturing industries and construction: Non-metallic minerals) because the EFs were derived from air pollution control measurements and hence include both fuel and process emissions. Switzerland informed to clarify the reporting by changing the notation keys from “NA” to “IE” in the next submission.

75. The ERT appreciates the use of country-specific EFs based on domestic measurement data, but it recommends that Switzerland reports all emissions under NFR 2.A.3, except for NO<sub>x</sub>, SO<sub>x</sub> and CO, as indicated in the Guidebook. Accordingly, the ERT encourages Switzerland to relocate part of the information on glass production to the Industrial Processes section of the IIR, including information on the allocation of emissions between NFRs 1.A.2.f and 2.A.3.

76. For NO<sub>x</sub>, SO<sub>x</sub> and CO the notation key “IE” should be used under NFR 2.A.3, as it may apply for the other pollutants under NFR 1.A.2.f.

### **Category issue 1: 2.C.3 Aluminium production**

77. The ERT noted that the notation key “NA” is used for PCB emissions from NFR 2.C.3 in 2008-2014, whereas for all other pollutants “NO” is used for these years. The ERT recommends that the Party investigates the years the activity has existed in the country and reports all emissions from the period the activity was in operation.

## SOLVENTS

### Review Scope

<b>Pollutants Reviewed</b>		SO <sub>2</sub> , NO <sub>x</sub> , NMVOC, NH <sub>3</sub> , PM <sub>10</sub> & PM <sub>2.5</sub>		
<b>Years</b>		1990 – 2014 + (Protocol Years)		
<b>Code</b>	<b>Name</b>	<b>Reviewed</b>	<b>Not Reviewed</b>	<b>Recommendation Provided</b>
2D3a	Domestic solvent use including fungicides	X		X
2D3b	Road paving with asphalt	X		X
2D3c	Asphalt roofing	X		X
2D3d	Coating applications	X		X
2D3e	Degreasing	X		X
2D3f	Dry cleaning	X		X
2D3g	Chemical products	X		X
2D3h	Printing	X		X
2D3i	Other solvent use (please specify in the IIR)	X		X
2G	Other product use (please specify in the IIR)	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**

78. Activity data and emission factors are transparently presented in the IIR, and the emissions trends are explained. However, the ERT encourages the Party to provide more information on changes in methods as explained in the sector-specific chapter.

#### **Completeness**

79. The ERT considers the solvent emissions inventory to be complete.

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

80. The recalculations are consistent throughout the time series and transparently explained and justified in the IIR.

#### **Comparability**

81. The allocation of emissions is in line with the Reporting Guidelines and the methods used to calculate emissions are in accordance with the Guidebook and sufficiently documented in the IIR.

#### **Accuracy and uncertainties**

82. A Tier 1 uncertainty analysis covering all sectors has been provided since the last review.

83. The solvent sector is covered by the QA/QC.

84. Switzerland calculates emissions mostly following Tier 2 methods. Sometimes changes in EFs are described in the text, but only most recent EFs are provided in a table. Changes in methodology are usually only motivated by studies available on the EMIS database (which is in German only). The ERT encourages Switzerland to include more information in their IIR on EFs used throughout the time series, and more information on the reason for changes in methodology, in order to allow easier comparison.

### **Improvement**

85. Switzerland does not report any planned improvements in the Solvent sector inventory.

## **Sub-Sector Specific Recommendations**

### **Category issue 1: 2.D.3.a Domestic solvent use including fungicides – NMVOC, Transparency**

86. The ERT found that changes in methodology are not always clearly explained or referred to in the IIR and that only the EFs used from 2013 onwards are presented. The assumptions for the development of the EFs are based on studies not always available. The ERT encourages Switzerland to include more information on the increase of the emission factor in their IIR, and to include a list of EFs used over the years.

### **Category issue 2: 2.D.3.d Coating Application – NMVOC, Transparency**

87. According to the IIR the trend of coating application depends on the total consumption of paint that decreased considerably between 1990 and 1998 and then increased continuously since 2001. However, no information of drivers behind the trend are provided. The ERT encourages Switzerland to include this information in the IIR.

### **Category issue 3: 2.D.3.e Degreasing and 2.D.3.f. Dry Cleaning – NMVOC, Transparency**

88. In the IIR, Switzerland describes EFs used for Degreasing as “roughly based on data from industry surveys” and as “roughly based on data and information from a survey of dry cleaning facilities and import statistics” for Dry cleaning. On the question raised by the ERT the Party explained that “roughly based” refers to the fact that the survey of cleaning facilities is not complete and thus based on the assumption that the selected cleaning facilities are representative for the industry. The ERT encourages the Party to include this justification in the IIR.

## AGRICULTURE

### Review Scope:

Pollutants Reviewed		SO <sub>2</sub> , NO <sub>x</sub> , NMVOC, NH <sub>3</sub> , PM <sub>10</sub> & PM <sub>2.5</sub>		
Years		1990 – 2014 + (Protocol Years)		
Code	Name	Reviewed	Not Reviewed	Recommendation Provided
3B1a	Dairy cattle	X		X
3B1b	Non-dairy cattle	X		X
3B2	Sheep	X		X
3B3	Swine	X		X
3B4a	Buffalo	X		X
3B4d	Goats	X		X
3B4e	Horses	X		X
3B4f	Mules and asses	X		X
3B4gi	Laying hens	X		X
3B4gii	Broilers	X		X
3B4giii	Turkeys	X		X
3B4giv	Other poultry	X		X
3B4h	Other animals (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		X
3Da2c	Other organic fertilisers applied to soils (including compost)	X		
3Da3	Urine and dung deposited by grazing animals	X		
3Da4	Crop residues applied to soils	X		
3Db	Indirect emissions from managed soils	X		
3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products	X		
3Dd	Off-farm storage, handling and transport of bulk agricultural products	X		
3De	Cultivated crops	X		
3Df	Use of pesticides	X		X
3F	Field burning of agricultural residues	X		X
3I	Agriculture other (please specify in the IIR)	X		
11A	Volcanoes		X	
11B	Forest fires		X	

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

### General recommendations on cross cutting issues

#### Transparency

89. Switzerland has provided a detailed and generally transparent emissions inventory. Switzerland uses a combination of country specific methodologies, Guidebook 2013 methods and national methodologies based on the Guidebook 2013. The ERT encourages the Party to present more details regarding the country specific EFs once they are available, as well as a comparison of the national EFs and

the Guidebook EFs with a rationale of the discrepancies. The ERT also encourages the Party to improve the rationale of selecting the notation keys.

90. The ERT encourages Switzerland to include a comparison of the national emission factors, once the new country-specific emission factors are available, with the Guidebook default values and the rationale of the discrepancies.

### **Completeness**

91. The ERT considers the agriculture sector to be generally complete in terms of sources and pollutants included in the inventory. The following pollutants and sources are missing from the current inventory: NMVOC emissions for all animals in NFR 3.B (Manure Management), PM emissions from NFR 3.B.4.a (Buffalo) and NFR 3.B.4.h (Other Animals), PM emissions from NFR 3.D (Agricultural Soils) and emissions from all pollutants in NFR 3.F (Field Burning of Agricultural Residues).

92. The inventory is complete in terms of years reported and the geographical coverage.

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

93. Switzerland has provided a detailed explanation of the recalculation of emissions under NFR 3.D in its IIR.

### **Comparability**

94. The allocation of emissions is generally in line with the Reporting Guidelines and the methods used to calculate emissions are in accordance with the Guidebook.

### **Accuracy and uncertainties**

95. Switzerland has not provided a separate uncertainty analysis of the Agriculture sector, however, sources in agriculture are included in the general uncertainty assessment. The ERT encourages Switzerland to provide uncertainty estimates separately for the Agriculture sector in order to help inform the improvement process and to provide an indication of the reliability of the inventory data.

96. The IIR does not provide information on specific QA/QC checks in place in the Agriculture sector. The ERT encourages Switzerland to document sector specific QA/QC procedures and their results in the IIR.

### **Improvement**

97. Switzerland intends to develop national methodologies for several categories and to improve the transparency for its next submission including detailed explanations of the national EFs and the rationale of their selection. The ERT welcomes this development.

## Sub-Sector Specific Recommendations

### **Category issue 1: 3.B Manure management - NMVOC, Transparency, comparability**

98. NMVOC emissions from all animals under NFR 3.B subcategories - Manure Management are reported as “NA”. This is not in line with the 2013 EMEP Guidebook methodology that provides EFs for this pollutant. During the review, Switzerland explained that currently a poorly documented EF based on crop area is used for estimating NMVOC emissions from both animals and crops and that the emissions are included under NFR 3.D. Switzerland also explained that it is carrying out a study to obtain country-specific emission factors and will use the results of the study or the Tier 1 default EFs from Guidebook 2013 to estimate and report emissions in the 2018 submission. The ERT considers the current EF not to cover NMVOC husbandry emissions, therefore, “NE” should be used to report NMVOC emissions from NFR 3.B. The ERT welcomes the improvement. The ERT recommends that the Party estimates and reports NMVOC emissions from Manure management under NFR 3.B.

### **Category issue 2: 3.B Manure management - PM<sub>2.5</sub>, Transparency**

99. According to the IIR, PM<sub>2.5</sub> EFs from NFR 3.B – Manure Management originate from the former version of the national EMIS database where the data sources can no more be identified. The ERT also noted that no references are provided for PM<sub>10</sub> and TSP emission factors in the IIR and that these EFs do not match the Guidebook 2013 default values. To the question raised by the ERT Switzerland replied that it is carrying out a study to obtain country-specific emission factors and will use the results of the study or the Tier 1 default EFs from Guidebook 2013 to estimate and report these emissions in the 2018 submission. The ERT welcomes the improvement and recommends that Switzerland documents the EFs currently used more detailed in the IIR.

### **Category issue 3: 3.B Manure management - PM, Completeness**

100. The ERT noted that PM emissions from NFRs 3.B.4.a and 3.B.4.h - Manure Management, Buffalo and Other Animals were reported as “NO”, without further explanation in the IIR. During the review, the Party replied to provide estimates in its next submission. The ERT recommends that the Party estimates and reports these emissions using the methods available in the Guidebook 2013.

### **Category issue 4: 3.B Manure management - NO<sub>x</sub>, Accuracy**

101. The ERT noted that the EFs used by Switzerland for NO<sub>x</sub> emissions from NFR 3.B – Manure Management differ from Tier 1 default values in Guidebook 2013. According to the IIR, Switzerland uses EFs from Guidebook 2013 Table 3.8 and a fixed TAN content for all animals. The ERT considers that there is no basis to prove that the current Swiss approach provides better estimates than the default Tier 1 methodology of Guidebook 2013. The ERT recommends that Switzerland updates

its estimates according to the Guidebook 2013 Tier 1 methodology in its next submission.

#### **Category issue 5: 3.D Agricultural Soils- NO<sub>x</sub>, Transparency**

102. The ERT noted that Switzerland reports in the IIR that it uses an emission factor from Stehfest and Bouwman (2006) for estimating NO<sub>x</sub> emissions from NFR 3.D (Agricultural soils). The ERT also noted that this is also the reference for the EF in the Guidebook 2013, even though the values differ. The rationale of Switzerland is that the Guidebook 2013 EF includes NO emissions due to soils that should not be included in the EF as they are background emissions. However, after consulting the expert Panel on Agriculture and Nature (CLRTAP, TFEIP) and the Guidebook 2013 experts, the ERT considers that “Emissions of NO derived from soil N are not true background emissions but derived from earlier anthropogenic inputs of N. Therefore, soil N should be included as a factor in calculating annual NO emissions from agricultural soils”. The ERT recommends that Switzerland update its estimates according to the Guidebook 2013 Tier 1 methodology in its next submission.

#### **Category issue 6: 3.D Agricultural Soils - Particles, Completeness**

103. The ERT noted that particulate matter emissions from NFR 3.D (Agricultural Soils) were reported as “NA” or “NO” instead of “NE”. This is not in line with the Guidebook 2013 that provides EFs for particles. During the review, Switzerland explained that it is carrying out a study to obtain country-specific EFs and will include the results of the study or the Tier 1 default EFs of Guidebook 2013 in the 2018 submission. The ERT recommends that Switzerland estimates and reports the emissions according to the Guidebook methodology and recalculates emissions using the country specific EFs when available.

#### **Category issue 7: 3.D Agricultural Soils- NH<sub>3</sub>, Accuracy**

104. Switzerland reports in the IIR that it uses an EF from Vanderweerden and Jarvis (1997) for estimating NH<sub>3</sub> emissions from NFR 3.D – Agricultural soils. The ERT also noted that this article is also referenced in the Guidebook 2013, even though the emission factors differ. During the review, Switzerland explained that a re-evaluation of the NH<sub>3</sub> EFs for mineral fertilizers by the Swiss agricultural experts is scheduled for 2016. The ERT recommends that Switzerland undertakes this initiative and estimates and reports the recalculated emissions using either country specific EFs or the method provided in the Guidebook in its next submission.

#### **Category issue 8: 3.D.f Use of Pesticides - all pollutants, Completeness**

105. The ERT noted that Switzerland reports the emissions from NFR 3.D.f - Use of pesticides as “NO” for all years in the time series. The ERT also noted that there is no explanation in the IIR about the selection of this notation key. During the review, Switzerland explained that since the 1970’s the application of HCB is prohibited in Switzerland. The ERT considers that the explanation is sound. The ERT encourages Switzerland to include a short explanation with references explaining the

rationale of the notation key “NO” in the Agriculture chapter of the IIR in its next submission.

**Category issue 9: 3.F Field burning of agricultural residues - All pollutants**

106. The ERT noted that Switzerland reports the emissions from NFR 3.F - Field burning of agricultural residues as “NO” for all pollutants. The ERT also noted that the estimation of these emissions was raised in the 2010 Stage 3 Review Report as an issue. During the review, Switzerland informed the ERT that the emissions formerly allocated under NFR 3.F (NFR 4.F in the previous categorization) are currently allocated under the Waste sector (NFR 5.C.2) following a recommendation of the Expert Panel on Agriculture and Nature (CLRTAP, TFEIP). The ERT encourages Switzerland to include a short explanation of the rationale of the use of “NO” and the re-allocation of the emissions in the Waste sector under NFR 5.C.2 in its next submission.

## WASTE

### Review Scope:

Pollutants Reviewed		All		
Years		1990 – 2014		
Code	Name	Reviewed	Not Reviewed	Recommendation Provided
5A	Biological treatment of waste - Solid waste disposal on land	X		
5B1	Biological treatment of waste - composting	X		X
5B2	Biological treatment of waste - Anaerobic digestion at biogas facilities	X		
5C1a	Municipal waste incineration	X		
5C1bi	Industrial waste incineration	X		
5C1bii	Hazardous waste incineration	X		
5C1biii	Clinical waste incineration	X		
5C1biv	Sewage sludge incineration	X		
5C1bv	Cremation	X		
5C1bvi	Other waste incineration (please specify in the IIR)	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 (please specify in IIR)	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**

107. The waste sector inventory is generally transparent with good levels of detail in the methodology descriptions.

#### **Completeness**

108. The ERT considers the waste sector to be complete in terms of sources, pollutants and years reported as well as regarding geographical coverage.

#### **Consistency, including recalculation and time series**

109. The times series does not show large fluctuations.

110. Recalculations are transparently explained. The ERT notes that recalculations have been carried out for NFRs 5.A, 5.B.2, 5.C and 5.D.

#### **Comparability**

111. The allocation of emissions follows the Reporting Guidelines and the methods used to estimate emissions are consistent with the Guidebook 2013.

### **Accuracy and uncertainties**

112. Switzerland uses country-specific Tier 2 methods for the key sources of the waste sector.

113. No sector-specific uncertainty analysis has been carried out for waste sector emissions.

### **Improvement**

114. The IIR does not provide information on sector-specific planned improvements. The ERT encourages Switzerland to provide information on planned improvements on sector level in its IIR.

## **Sub-Sector Specific Recommendations**

### **Category issue 2: 5B — Biological treatment of waste, Transparency**

115. The Party replied to the question raised by the ERT on the information in the IIR (the assumption that the quantities for backyard composting are estimated as 10% of the amount of waste from composting plants), that this is an expert judgment which is not documented.

116. The ERT encourages Switzerland to document the expert judgement and provide relevant information in the next IIR to increase the inventory transparency.

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

1. Responses to questions raised prior to and during the review
2. Switzerland's Stage 2 S&A report 2016
3. Switzerland's Stage 1 report 2016
4. Switzerland's IIR 2016