Convention on Long-range Transboundary Air Pollution

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Co-operative programme for monitoring and evaluation of the long-range transmission of air pollutants in Europe

TECHNICAL REPORT CEIP
4/2019

Inventory Review 2019

Review of emission data reported under the LRTAP Convention and NEC Directive

Stage 1 and 2 review

Status of gridded and LPS data

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European Environment Agency & CEIP

Clean Air 40 YEARS

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[1] EMEP – Co-operative Programme for Monitoring and Evaluation of the Long-range Transmissions of Air Pollutants in Europe

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EXECUTIVE SUMMARY

The main objective of *technical review*[2] *of national inventories* is to check and assess Parties' data, with a view to improve the quality of emission data and associated information reported to the Convention. The review of data reported under CLRTAP is performed jointly with those reported under the revised National Emissions Ceilings Directive (2016/2284/EU).

This report summarizes the main findings of the annual technical review[3] (stage 1 and stage 2) of emission data, submitted under the LRTAP Convention and the new NEC Directive before 03th of June 2019.

Table 1 presents an overview on the submission status of 51 Parties to the Convention from which 28 are EU Member States. Under the LRTAP Convention reporting of emission data and IIRs was in the most cases sufficient, but particularly some countries of the EMEP East area did not provide any information. 2019 was a reporting year for projections, but not for gridded data and LPS data. Projections were reported by 53% of the parties (27 out of 51), gridded data in new resolution and LPS data for reference years are still missing from a number of countries, especially from the EMEP East area. The submission under the new NEC Directive was sufficient (see Table 1).

The assessment in Table 1 refers to:

- Article 8 of the 1979 Convention on Long-range Transboundary Air Pollution, Executive Body Decision 2013/04 (ECE/EB.AIR/122/Add.1) Annex I,
- Executive Body Decision 2013/03 (ECE/EB.AIR/122/Add.1),
- Guidelines for Reporting Emissions and Projections Data under the CLRTAP (ECE/EB.AIR/125)
- Directive (EU) 2016/2284 of the European Parliament and of the Council of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC

Table 1: Overview on submission status

	CLRTAP						NECD					
Country	Timeliness	Completeness	IIR	Projections**	LPS**	Gridded data**	Timeliness	Completeness	IIR	Projections**	LPS**	Gridded data**
AL	☺	😐	☹	☹	☺	☹						
AM	☺	😐	😐	☹	☹	☹						
AT	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺
AZ	☺	😐	☺	☹	☺	☹						

[2] See EB Decision 2018/01 Updated methods and procedures for the technical reviews of air pollutant emission inventories reported under the Convention (ECE/EB.AIR/142/Add.1)

[3] Review process: detailed information see at http://www.ceip.at/review_process/review_process_general/

	CLRTAP						NECD					
Country	Timeliness	Completeness	IIR	Projections**	LPS**	Gridded data**	Timeliness	Completeness	IIR	Projections**	LPS**	Gridded data**
BA	☹	☹	☹	☹	☹	☹						
BE	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺
BG	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺
BY	☺	😐	☺	☹	☹	☹						
CA*	☺	😐	😐									
CH	☺	☺	☺	☺	☺	☺						
CY	☺	☺	☺	☺	☺	😐	☺	☺	☺	☺	☺	😐
CZ	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺
DE	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺
DK	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺
EE	☺	☺	☺	☺	☺	😐	☺	☺	☺	☺	☺	😐
ES	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺
EU	☺	☺	☺	☺	☺	☺						
FI	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺
FR	☺	☺	☺	☹	☺	☺	☺	☺	☺	☹	☺	☺
GB	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺
GE	☺	😐	☺	☹	☺	☺						
GR	☹	☹	☹	☹	☺	☺	☹	☹	☹	☹	☺	☺
HR	😐	☺	☺	☺	☺	☺	😐	☺	☺	☺	☺	☺
HU	😐	☺	☺	☺	☺	☺	😐	☺	☺	☺	☺	☺
IE	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺
IS	😐	☺	☺	☹	☺	☹						
IT	😐	☺	☺	☺	☺	☺	😐	☺	☺	☺	☺	☺
KG	😐	😐	😐	☹	☹	☹						
KZ	☹	☹	☹	☹	😐	☹						
LI	☹	☹	☹	☹	☹	☹						
LT	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺
LU	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺

	CLRTAP						NECD					
Country	Timeliness	Completeness	IIR	Projections**	LPS**	Gridded data**	Timeliness	Completeness	IIR	Projections**	LPS**	Gridded data**
LV	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺
MC	☺	☺	☹	☹	☺	☺						
MD	☹	☹	☹	☹	☹	☹						
ME	☹	☹	☹	☹	☹	☹						
MK	☺	☺	☺	☹	☺	☺						
MT	😐	😐	☹	☹	☺	☺	😐	😐	☹	☹	☺	😐
NL	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺
NO	☺	☺	☺	☹	☺	☺						
PL	😐	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	😐
PT	☺	☺	☺	☹	☺	☺	☺	☺	☺	☹	☺	😐
RO	☺	😐	☺	☺	☺	😐	☺	😐	☺	☺	☺	😐
RS	☺	☺	☺	☹	☹	☹						
RU	☺	☹	☺	☹	☺	😐						
SE	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺
SI	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	😐
SK	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	😐
TR	☺	☹	☺	☹	☹	☹						
UA	☺	😐	😐	☹	☹	☹						
US*	😐	☺	☺									

Legend to Table 1:

Timeliness: *green – submission within deadline, yellow – submission after deadline, red – no submission; empty – no obligations towards NECD*

Completeness (NECD): *green – reported all 4 pollutants; empty – no obligations towards NECD*

Completeness (CLRTAP): *green – full priority + activity data all years; yellow – up to ca. 80% priority (i.e. 10 of 13) (or all priority but not all years and/or no activity data); Red – below 80% priority,*

IIR: *green – IIR submitted, structure and content correlate to the template; yellow – IIR submitted, structure and content not like the template; red – no IIR submitted*

Projections: *green – min. 2020, 2025, 2030 reported; yellow – min. one year reported or submission after deadline; red – no projections submitted*

Gridded and LPS data: ***green*** *– new gridded data for at least the years 2000, 2005, 2010 and 2015 submitted,* ***blue*** *– new gridded data for at least one year submitted,* ***yellow*** *– last year's 50x50 gridded data submitted or submission after deadline,* ***orange*** *– 50x50 gridded data since 2017 submitted,* ***red*** *– no gridded data at all submitted, empty – no obligations*

** Canada and the USA have different reporting obligations. They are not included in the EMEP LRT models so the reporting of LPS and gridded data is not required.*

*** 2019 was a reporting year for Projections, but not for gridded data and LPS. All submitted Projections in 2019 LPS data since 2015 and gridded data since 2017 are taken into account.*

1 INTRODUCTION

This report has been prepared by the Centre on Emission Inventories and Projections (CEIP) in cooperation with the European Environment Agency (EEA). CEIP is a data centre under the European Monitoring and Evaluation Programme (EMEP). The report reflects the progress achieved in emission reporting under the LRTAP Convention and in emission reporting under the new NECD during the 2019 reporting round.

Box 1. Reporting obligations and guidelines

The EMEP Executive Body Decision 2013/03 (ECE/EB.AIR/122/Add.1) adopted the *"Guidelines for reporting emissions and projections data under the Convention on Long-range Transboundary Air Pollution"* - latest version ECE/EB.AIR/128. Detailed information on reporting obligations under the CLRTAP convention can be found on the CEIP website www.ceip.at/reporting_instructions.

For information about the reporting obligation under the new NECD the following website can be consulted http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2016.344.01.0001.01.ENG.

The *National Emissions Ceilings (NEC) Directive* (2016/2284/EU) entered into force on 31 December 2016, replacing earlier legislation, (Directive 2001/81/EC). The 2016 NEC Directive sets 2020 and 2030 emission reduction commitments for five main air pollutants: nitrogen oxides (NO_x), non-methane volatile organic compounds (NMVOCs), sulphur dioxide (SO_2), ammonia (NH_3) and primary particulate matter (PM).

The directive introduces a number of new reporting requirements for Member States. These are defined in Annex I of the directive and include annual information on emissions of a number of pollutants.

For more information on the review process please consider the technical report „*Methodologies applied to the technical review of emission data*" available on CEIP's website: http://www.ceip.at/fileadmin/inhalte/emep/pdf/2019/Methodology_Report_2019.pdf.

Table 2: Comparison of reporting obligations and deadlines under CLRTAP and the new NECD

Deadlines	CLRTAP		NECD	
Emission data	15. February	annually	15. February	annually
IIR	15. March	annually	15. March	annually
Projections	15. March	every four years (starting year 2015)	15. March	every two years (starting year 2017)
Gridded Data	1. May	every four years (starting year 2017)	1. May	every four years (starting year 2017)
LPS information	1. May	every four years (starting year 2017)	1. May	every four years (starting year 2017)

Note: orange labels indicate differences in the reporting obligations

This report summarises the main findings of the annual technical review of emission data, focusing on future challenges for improving the quality of this data reported under the Convention and the NECD. To present the progress of the reporting status the actual year is compared with the status in 2008, when the review process was performed for the first time.

The review assesses the transparency, consistency, comparability, completeness and accuracy of reported data[4]. Details on the review methods can be found in *the Methodology Report – Review of emission data reported under the LRTAP Convention and NEC Directive* (www.ceip.at/review_proces_intro/review_process).

All Parties to the LRTAP Convention which submitted data[5] in the *standard format* before 03th June 2019 (Figure 1) were included in the review. This review report is structured as follows: in chapter 2, the results of the initial review (the stage 1) are presented, covering timeliness, completeness, format and transparency of the submission. Chapter 3 provides a summary of findings of the extended review (stage 2). Within that stage, differences in emissions due to recalculations, differences between NECD, the United Nations Framework Convention on Climate Change (UNFCCC) and CLRTAP submissions, the share of sectors and the consistency of the time series were analysed. Further checks were made which included the key categories emissions per capita and gross national income.

In addition, completeness of gridded and of large point sources (LPS) data are discussed in chapter 4. A table with detailed per country information on reporting in 2019 is provided in the Appendix.

The stage 1 and stage 2 review is annually complemented with an in-depth review of selected country inventories (in 2019: Albania, Georgia, Norway, the Russian Federation, Serbia and Turkey). Review findings are published in country reports at http://www.ceip.at/review_process/review_process_general/.

Eight annexes with detailed results can be found on CEIP's homepage at: http://www.ceip.at/ms/ceip_home1/ceip_home/review_results/review_reports.

Table 3: Overview of annexes to the Inventory Report 2019

Annexes 2019	
A	Completeness of reported data
B	Analysis of recalculations performed by countries
C	Recalculations of CLRTAP and NECD emission data in 2019
D	Emissions per capita and per GDP comparison of 1990 and 2017 (2000 and 2017 for $PM_{2.5}$ and PM_{10})
E	Comparison of share of sectors between countries for reported pollutants
F	Key category analysis (KCA): Comparison EMEP West with EMEP East area
G	Inventory Comparisons between CLRTAP, UNFCCC and NECD data for 1990 and 2017
H	LPS reporting under CLRTAP from 2017-2019

[4] See Reporting guidelines 2014, section III, para 5 (a) to (e) for definitions.

[5] See details at http://www.ceip.at/ceip_home/status_reporting/2019_submissions/

2 INITIAL (STAGE 1) REVIEW

Key messages

Over the last ten years, timeliness and completeness of reporting has improved:

In 2019, 45 Parties reported CLRTAP data, which is an increase of 50% compared to the number of submitting Parties in 2008 – only 30 Parties submitted data in the first year, in which the annual inventory took place.

37 Parties provided their submissions by the due date of 15 February 2019. No data were provided (by 3rd June) by four Parties with mandatory reporting obligations – ***Greece, Liechtenstein, Montenegro and the Republic of Moldova****.*

In 2019, 82 % of the EU Member States provided NECD data by the required reporting deadline and almost all EU Member States, except Greece, submitted data. In 2008, the submission percentage within deadline was 70%.

Similar to 2018, major pollutants (CLRTAP) were reported by 45 Parties in 2019 compared to 40 in 2008.

82 % of the Parties submitted an Informative Inventory Report (IIR) with their CLRTAP submission in 2019 compared to 66% in 2008. It should be noted that the provision of an IIR is essential for a complete centralised stage 3 review.

Black Carbon (BC) was voluntarily reported for the first time in 2015 by 28 countries, the number of Parties reporting BC raised to 39 countries in 2019.

Armenia, Belarus, Bosnia and Herzegovina, Georgia, Kazakhstan, Kyrgyzstan, Montenegro, Republic of Moldova, Ukraine and Turkey *are in particular encouraged to make efforts to improve the regularity, completeness and transparency of their reporting.*

Although in the quality of the data submitted by the Parties to the LRTAP Convention has improved over the years in terms of completeness, consistency and timeliness not all Parties provide a complete time series for emission inventory data/Therefore the viability for time series assessments for these countries is limited. Hence, further improvement of submissions in the above-mentioned aspects of data quality is strongly recommended: ***Bosnia and Herzegovina, Kazakhstan and the Republic of Moldova*** *did not report any data to EMEP,* ***Montenegro*** *did not report data since 2013,* ***Armenia, Belarus and Kyrgyzstan*** *only provided data for the current reporting year. Other countries – namely* ***Georgia, Ukraine and Russia*** *– provided data for a few years only (less than 10 years).*

2.1 Timeliness

Inventory data reported under the LRTAP Convention serve as input for gridded data, which are used as input by diverse EMEP models for annual environmental analyses. If data are not reported according to the agreed deadline, expert estimates must be used instead. As a result, late reporting has last not least a negative impact on the accuracy of the EMEP (modeling) assessments.

2.1.1 CLRTAP

47 Parties (out of 51) to the Convention submitted inventories by 3rd June 2019 (see Figure 1). 37 Parties reported emission data by the due date[6] of 15th February 2019, the same number of Parties as during the 2018 reporting round. 25 Parties resubmitted NFR tables and/or an IIR. Montenegro and the Republic of Moldova were the only countries with mandatory reporting obligations that did not submit any data. Liechtenstein submitted data by 11th June, Greece provided their submission by 17th July and therefore could be not included in further analyses. More details are provided in the Appendix (Table 6).

2.1.2 NECD

Similar to the emissions reporting obligations under CLRTAP a number of pollutants, that were no reporting priority under the 2001 NECD, have to be reported now under the 2016 NECD. In the 2019 NEC Directive reporting round[7], 23 of the 28 Member States submitted their national emission inventories of the pollutants listed below to the European Commission by the reporting deadline:

- five main pollutants (NO_X, NMVOCs, SO_2, NH_3 and CO),
- particulate matter ($PM_{2.5}$, PM_{10}, and, if available BC and TSP),
- heavy metals (Cd, Pb, Hg),
- if available additional heavy metals (As, Cr, Ni, Se, Zn) and persistent organic pollutants (PAHs, Dioxins, PCBs and HCB).

Croatia, Hungary and Malta delivered their inventories a few days after the deadline and Italy on 1st March 2019 and Greece by 4th July 2019 (see Figure 2). All Member States, delivered national emission inventories. 18 Member States provided additional or revised data until 09 May 2019 – the date of the latest emission data submission received for 2019.

An overview of the status of reporting under the NECD is given in Table 9 and Table 10.

[6] The reporting deadline for the EU-28 inventory is 30th April. For the IIR it is 30th May (UNECE, 2014).

[7] Pursuant to Annex I of the NECD Member States are required to report their emission inventories by 15 February each year, deadline for the IIR is March 15 (Directive (EU) 2016/2284).

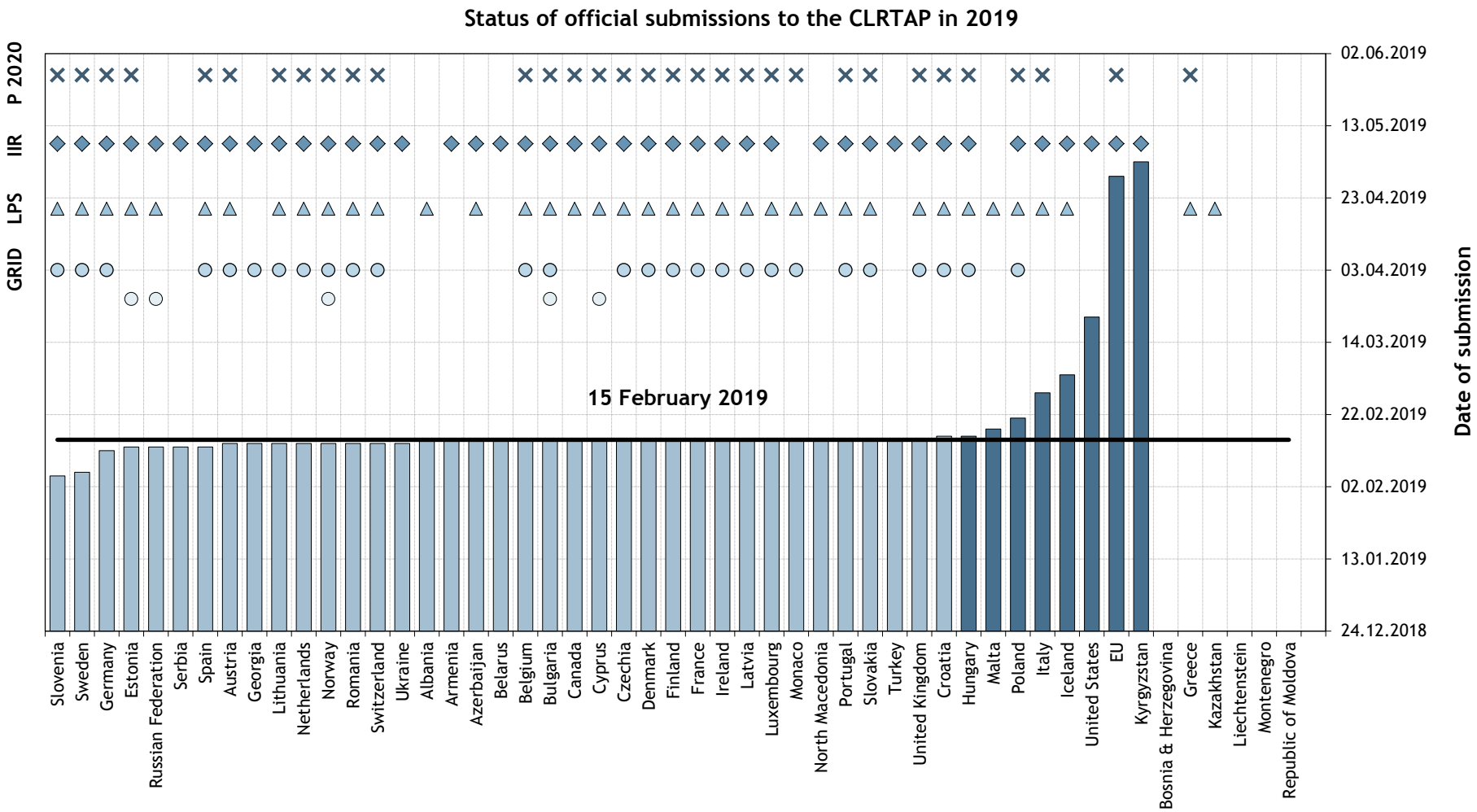


Figure 1: Status of official submissions to the CLRTAP in 2019 as of 3rd June 2019 (the deadline for the EU to submit its inventory is 30th April)

Note: *Bars indicate the submission of NFR tables. Symbols indicate the submission of Informative Inventory Reports (IIR). Gridded data (GRID) in the 50x50 grid (light blue circles), the new grid (dark blue circles) and Large Point Sources (LPS) in 2018 and 2019.*
2020 projections (P2020) from 2015 to 2019. For detailed information, see Table 7 in the Appendix.

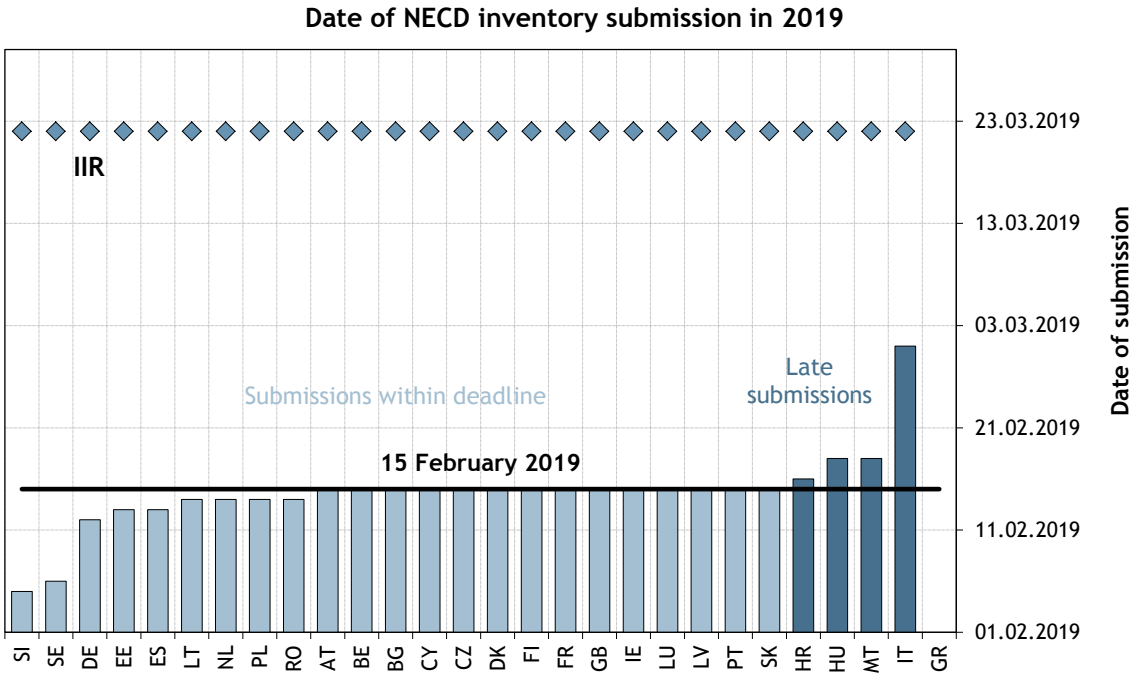


Figure 2: Date of NECD inventory submission to the CDR or the European Commission in 2019 as of 3rd June 2019

2.2 Completeness

2.2.1 CLRTAP

Completeness – pollutants: 45 Parties to the Convention submitted inventories but not all inventories were complete. All submitting Parties reported their 2017 emissions of the five *main pollutants*. *Cadmium, Mercury and Lead* emissions were reported by 44 Parties, *additional HMs* by 38, PMs by all 45 and priority POPs by 43 Parties. *Activity data* were reported by 39 Parties (see Appendix, Table 7). Reporting remained stable for the *main pollutants* and additional *HMs*; a slight decrease in the number of reporting Parties can be noticed for the *HMs, additional HMs, POPs and activity data* in 2019 (Figure 3). For the fourth time *BC* was reported, where 39 Parties submitted data (39 Parties in 2018; 37 Parties in 2017).

Completeness of time series: A number of Parties to the Convention who submitted data during the 2019 reporting round did not provide complete time series in the standard format as specified by the current reporting requirements. Complete time series of the *main pollutants* in NFR format for 1990–2017 were reported by 34 Parties. 34 Parties provided complete time series (1990–2017) of the *priority heavy metals*. 36 Parties provided the requested time series of *particulate matter* (2000–2017). 31 Parties provided full time series (at least 1990–2017) of *POPs*, 22 Parties submitted a full time series (1990-2017) of BC. Armenia, Belarus and Kyrgyzstan provide only emissions of the current year but not the whole time series, which would make it possible to see improvements and the effect of recalculations (see Appendix, Table 7).

Projections: 2019 was a reporting year for 2020, 2025 and 2030 projections. 27 Parties (17 in 2008) submitted emission projections, and all of them (12 in 2008) submitted data for 2020, 2025 and 2030 projections (see Appendix, Table 8). Up to now, 32 Parties have provided 2020 projections (submitted either in 2012, 2013, 2014, 2015, 2016, 2017, 2018 or in 2019; see Figure 1).

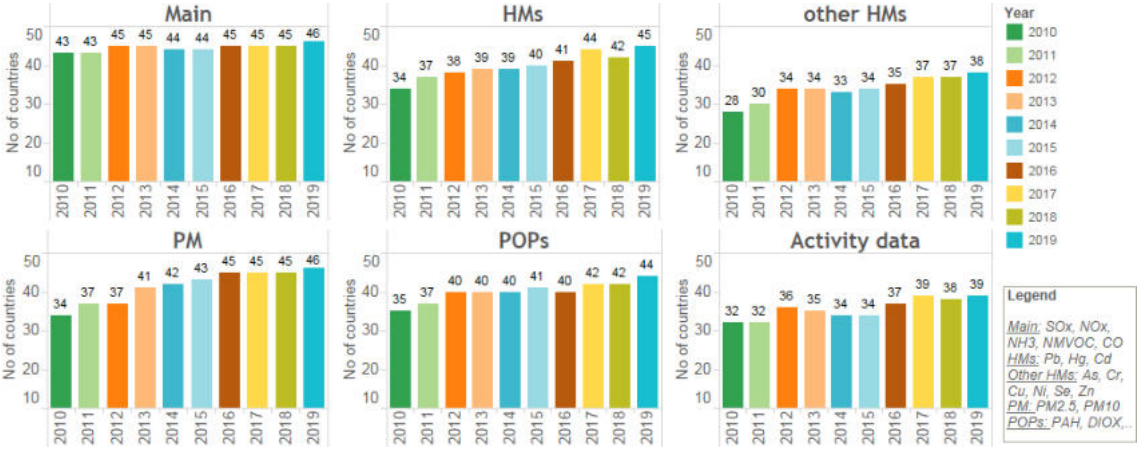


Figure 3: Number of Parties reporting various groups of pollutants, 2010 to 2019 reporting rounds as of 3rd June 2019

An up-to-date overview of the data as submitted by Parties during the 2019 reporting round is available at www.ceip.at/status_reporting/2019_submissions.
In addition, officially reported emission data can be accessed online at www.ceip.at/webdab_emepdatabase/reported_emissiondata.

A number of Parties do not submit information regularly during the annual reporting rounds under the LRTAP Convention. *Bosnia and Herzegovina, Kazakhstan, Montenegro and the Republic of Moldova* did not submit any data in 2019; *Greece and Liechtenstein* were not taken into account due to a late submission.

Figure 4 shows the split of the submitted data into priority and non-priority pollutants for the 2017 data. 45 parties submitted data. 38 Parties submitted data for all priority pollutants. Only 32 Parties submitted data for all 25 pollutants listed in paragraph 7 and 8 of the Guidelines of Reporting Emissions and Projections Data under the Convention on Long-range Transboundary Air Pollution (Azerbaijan, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, European Union, France, Georgia, Germany, Hungary, Iceland, Ireland, Italy, Kyrgyzstan, Latvia, Lithuania, Malta, Monaco, North Macedonia, Norway, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Ukraine and the United Kingdom). Activity data was only reported by 39 Parties from 45 Parties submitting NFR tables.

Figure 5 shows a simple compilation indicating completeness of reporting for the CLRTAP inventories (years 2005, 2010, 2015 and 2017) for two country groups, based on the NFR templates originally submitted. The number of the notation keys or values used for source categories in the NFR templates and the amount of missing data are compiled across all countries within each country group and expressed as percentage values. In Figure 5 results for the main pollutants **NO_X, NMVOCs, SO_X, NH_3 and CO** are shown. Analyses for all other pollutants are given in Annex A (see Annexes).

Within the area '*EMEP West'* reporting completeness is high, with improving data quality over the recent years. In the country group '*EMEP East'* the reporting situation has considerably improved over the years. For the year 2017 (reported in 2019), the share of '*no submissions'* amounted to 20 % for the 'EMEP East' region, in 2015 (reported in 2017) it accounted for almost 60 %. The frequent use of the notation key 'NA' in 2019 (12 – 43 %) can be explained by the fact that some air pollutants are only relevant for specific emission sources (e.g. NH_3 mainly for agriculture). The notation key 'NO' has been used frequently in the country group *'EMEP West'* in 2017 (18 %), and in the geographical area *'EMEP East'* 'NA' is often used (up to 30 %) (see Annex F – KCA: Comparison EMEP West with EMEP East area – Annexes)

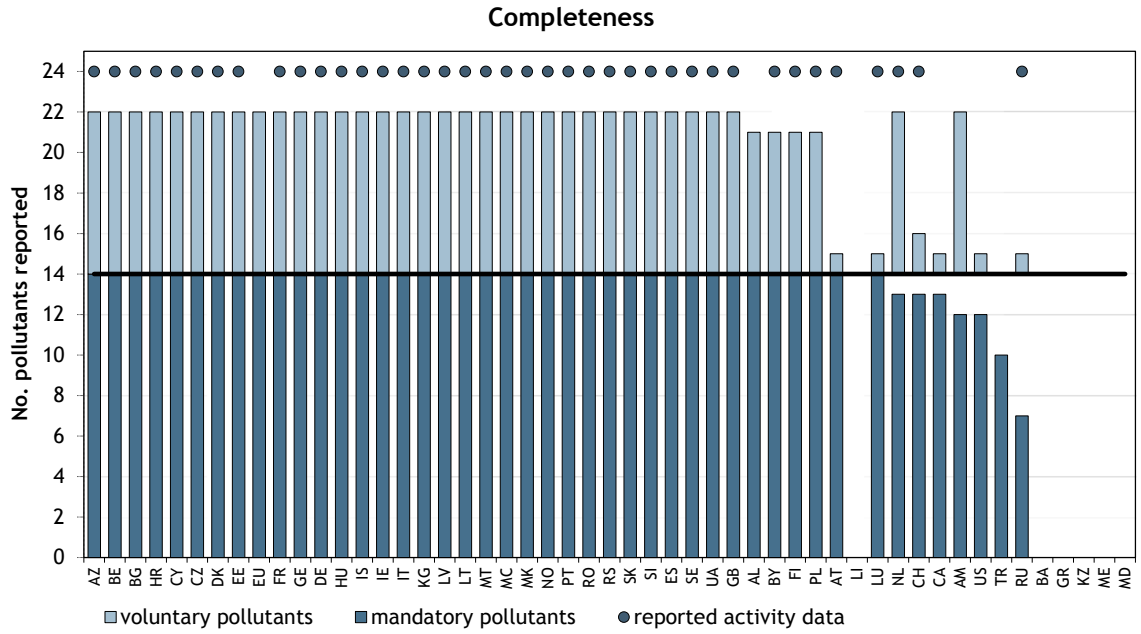


Figure 4: Completeness of submitted pollutants per country for the year 2017 as of 3rd June 2019

Note: *priority pollutants: NO_X, SO_X, NH_3, NMVOC, CO,, Cd, Hg, Pb, $PM_{2.5}$, PM_{10}, PAH, DIOX, HCB, PCB*
voluntary pollutants: BC, TSP,, As, Cr, Cu, Ni, Se, Zn

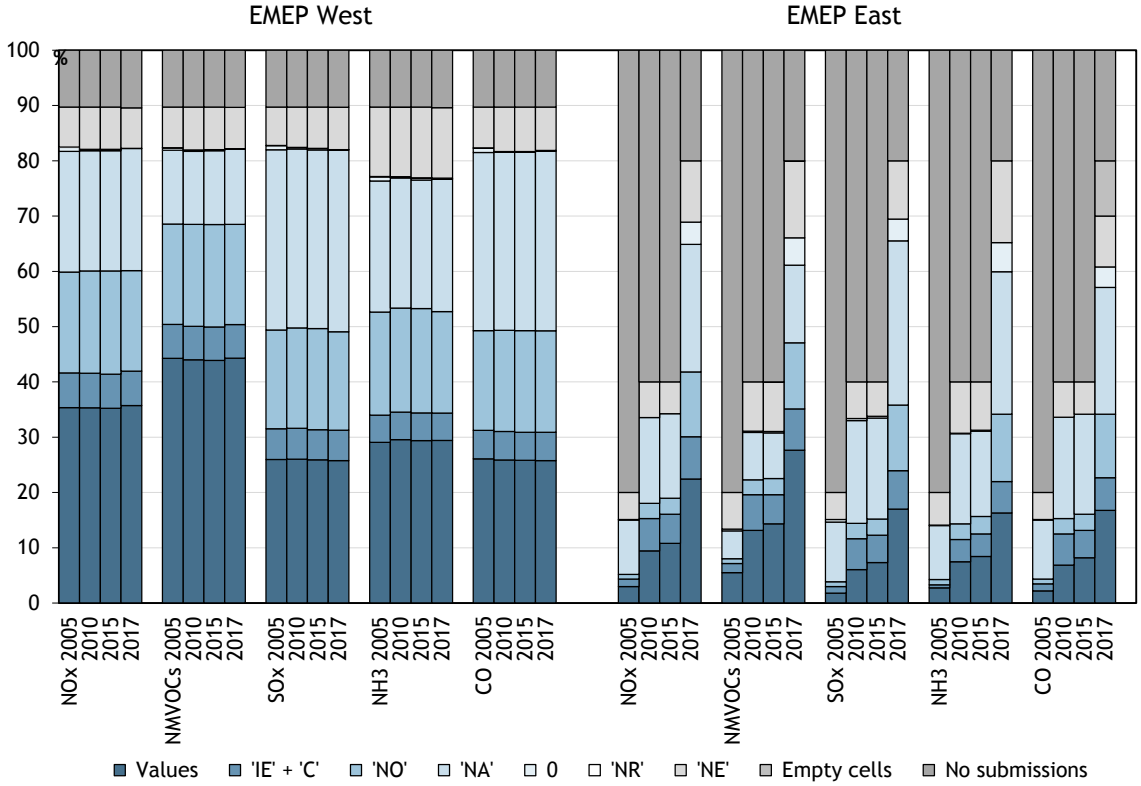


Figure 5: Completeness of CLRTAP submissions for two country groups[8] based on information provided in individual cells of the reporting tables as of 3rd June 2019.
('NE' – not estimated, 'NR' – not relevant, 'NA' – not applicable, 'NO' – not occurring, 'IE' – included elsewhere, 'C' – confidential)

[8] For more detailed information see Units and abbreviations

2.2.2 NECD

The second reporting round under the 2016 NECD in 2019[9], was completed by four late submissions received after the reporting deadline of February 15th. Three submissions were received soon after the reporting deadline (*Croatia, Hungary and Malta*). The submission for *Italy* was received on 01st March, *Greece* provided its submission by 4th July. All submitting Parties provided emission data for main pollutants for the year 2017. 2019 was a reporting year for 2020, 2025 and 2030 projections and 24 EU Member states, excluding France and Malta, submitted projections within the official reporting deadline (15th March); Greece and Portugal submitted projections in July 2019. The last reporting year for gridded data and LPS emissions under the new NECD was 2017. Gridded data was reported by three countries with all countries submitting data within the official reporting deadline of May 1st. In addition, two countries provided LPS emission data in 2019 within the reporting deadline of May 1st. An overview of NECD emission inventory data (status as of 3rd of June 2019) is provided in Table 9 and Table 10.

The EEA's NEC Directive data viewer provides access to the latest air pollutant emission inventory and projections data reported to EEA by EU Member States under the NEC Directive (see: https://www.eea.europa.eu/data-and-maps/dashboards/necd-directive-data-viewer-2).

2.3 Format of data

For CEIP the use of the standardised reporting format is inevitable for efficient processing of data. The same is true for reviews, comparisons across countries and the import of data into the CEIP database „WebDab". Parties have to use the latest version of tables provided in Annexes to reporting guidelines. (see http://www.ceip.at/reporting_instructions/annexes_to_guidelines).

CLRTAP

With the exception of Albania, all Parties submitted their inventories using the revised NFR14 templates[10]. Albania submitted emission data in the old NFR09 format.

NECD

The consistency of the reporting formats submitted under the NECD is similar to the previous reporting round. All 28 Member States submitted data in standard formats (NFR14 templates).

[9] The reporting deadline for the actual NECD reporting cycle was 15 Feb2019.

[10] Reporting templates can be downloaded from the CEIP website at www.ceip.at/reporting_instructions/annexes_to_guidelines

2.4 Transparency and Informative Inventory Reports

Transparency means that Parties provide clear documentation (IIR) and references, and that they report emissions and activity data at a level of disaggregation which provides sufficient understanding of how the inventory was compiled, thereby ensuring that it meets good practice requirements. Parties are strongly encouraged to submit the IIR[11],

In 2019, the number of Informative Inventory Reports (IIRs) submitted by Parties under the CLRTAP increased by two to 42 (all of those submitting inventories), compared to the previous year.

The quality of submitted national IIRs has improved within the last years. Comprehensive reports were submitted by *Austria, Azerbaijan, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, North Macedonia, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.*

The IIRs of *Azerbaijan, North Macedonia and Ukraine* show significant improvements within the last years but still lack in completeness or transparency. Other countries do not regularly submit IIRs (i.e. *Albania, Armenia, Belarus, Bosnia and Herzegovina, Czechia, Georgia, Greece, Ireland, Kazakhstan, Kyrgyzstan, Luxembourg, Malta, Monaco, Montenegro, Republic of Moldova and Ukraine*).

It should be noted that a complete in-depth review (stage 3) is only possible for Parties which have submitted an IIR.

Under the NECD, providing inventory reports or explanatory information that describes the methods and sources of reported data is mandatory. All countries, except *Greece and Malta,* submitted an IIR together with their NECD emission inventories in 2019.

The number of submitted IIRs in relation to the total number of Parties (51 Parties to the CLRTAP) increased from 29 submissions in 2008 to 42 submissions in 2019. This trend also applies to IIR submissions under NECD (5 submissions in 2008 to 26 submissions in 2019).

[11] see Reporting Guidelines 2014, para 43 (ECE/EB.AIR/125)

3 EXTENDED (STAGE 2) REVIEW

Key messages:

***Recalculations** of 2005, 2010 and 2015 emissions: 11 Parties reported recalculations for **over 30%** of the emission data for the years 2005, 2010 and 2015. Most recalculations were applied to NMVOC (2010 and 2015) and BC (2005, 2010 and 2015). The most frequent reasons for the recalculations were **changes in activity data and or emission factors**.*

***Key category analysis:** A number of emission categories have been identified as key categories for both the 'EMEP East' and 'EMEP West' area country groups. Combustion of fossil fuels in energy industries and transport is the most important contributor to emissions of NO_X, SO_X and PM. The sectors are also dominating emissions sources of HMs and POPs. NH_3 occurs mainly in the agricultural sector (typically by more than 80% in the single countries). A significant difference for some pollutants (e.g. POPs, PMs) in the number of key categories was observed between 'EMEP East' - and 'EMEP West' areas. This seems to indicate that inventories are often not complete and/or Parties allocate emissions to NFR categories not always in line with the EMEP/EEA Inventory guidebook[12]. In comparison with the previous submission, the biggest change of the sectoral share occurs in EMEP East area for PCB emissions in category 2K (Public electricity and heat production)*

***Portugal** was the only country that submitted different values under NECD and CLRTAP, because of different territorial coverage under NECD and CLRTAP.*

*The comparison between CLRTAP and UNFCCC emissions shows differences of 2% or below for 86% of the reported values. In eight countries there are differences of more than 10% for at least one pollutant (up to -260.8% in SO_X emissions reported by **Bulgaria**) which seems to indicate inconsistent reporting across different reporting obligations.*

***Emissions per capita** for at least one pollutant, in some cases for several pollutants, rose in 24 countries between 1990 and 2017 (2000 and 2017 for PMs) whereas **emissions per gross domestic product based on purchasing power parity(GDP/PPP) for at least one pollutant** rose for 7 Parties over the same time period.*

3.1 Recalculations

All emission estimates within a time series should be calculated consistently, i.e. the time series should be calculated using the same method and data sources for all years. It is important and necessary to document inventory recalculations and to understand their origin in order to correctly evaluate the officially reported emission data. This is especially the case when emission ceiling targets are expressed in absolute terms (as in the Gothenburg Protocol and the NECD) and not as percentage reduction targets (as in the Kyoto Protocol for greenhouse gases and the 2020/2030 reduction commitments set in the NECD). The magnitude of the recalculations can also provide an indication of the general uncertainty in emissions estimates.

[12] EMEP/EEA air pollutant emission inventory guidebook 2016, see https://www.eea.europa.eu/publications/emep-eea-guidebook-2016

3.1.1 CLRTAP

A first test to check the recalculations is to calculate *differences between the national total emissions* for the full time series as reported by Parties to the CLRTAP in 2019 and 2018. Then the variances larger than ± 10% are flagged[13] (see Annex C, Annexes). Of 46 reporting Parties, 40 provided recalculated data for at least some pollutants. Among main reasons for recalculation were:

- updates of activity data,
- changes in inventory calculation methodologies
- updates of emission factors mainly due to the revision of the EMEP/EEA guidebook and
- corrections of errors

Five parties, namely *Albania, Armenia, Belarus, Kyrgyzstan and Ukraine* did not report any recalculations. Albania has provided NFR tables for the whole time series (1990-2017) but did not perform any recalculations. All other of the listed countries have provided only emissions for the most recent reporting year (2017)..

In the second test, where the focus is on the number of *recalculations larger than ± 10%* (highlighted cells in Annex A – Recalculations of CLRTAP and NECD emission data in 2019) it was found that 19%[14] of all recalculations were larger than ± 10%. Large differences in relative terms were most frequently observed for **PAH**, **HCB, Pb, Se, Hg and Cu**. Extreme differences were observed for Bulgaria (PAH, all years), Germany (HCB, 1990-2001), Malta (HCB 2005-2016), Slovenia (HCB, 1990-2001) and Slovakia (BC, all years).

Next, the recalculations of 2005, 2010 and 2015 emissions as reported in subsequent years were analysed. Figure 6 shows the recalculations for the emissions of **SO_X and $PM_{2.5}$** reported by selected countries. For recalculations with a deviation above 30% the IIRs were consulted and if no explanation was found, the Parties were contacted.

More information on recalculations and explanations is available in Annex B at the CEIP website under http://www.ceip.at/ms/ceip_home1/ceip_home/review_results/review_reports.

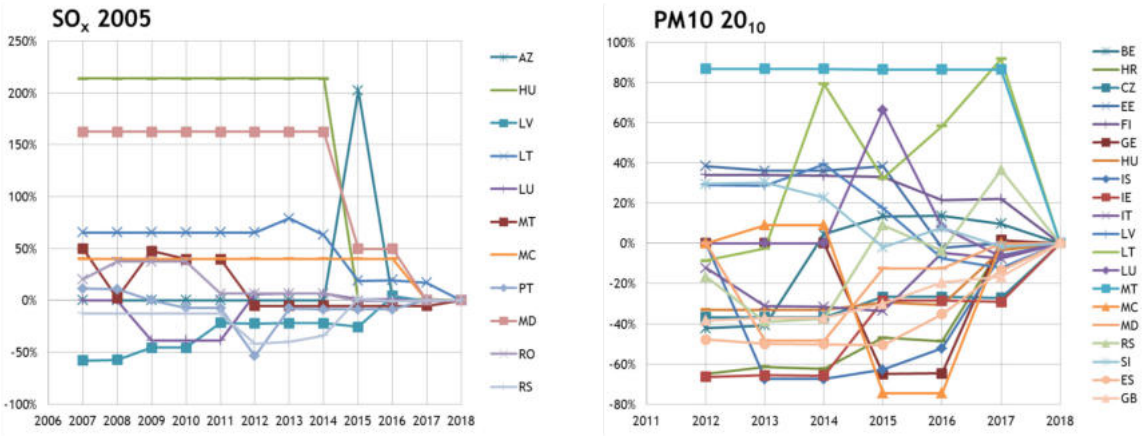


Figure 6: Difference of SO_X (for the year 2005) and PM_{10} (for the year 2010) national total emissions as reported for the period 2007-2019 and 2015-2019, respectively (in %; only countries with recalculations leading to changes in the inventories of more than ± 30%)

[13] The formula used to calculate the magnitude of the recalculations is $100*[(X_{2019}-X_{2018})/X_{2018}]$, where X_{2019} denotes emissions reported in 2019 and X_{2018} represents emission reported in 2018.

[14] Share of recalculations larger than ± ten percent: 26% in 2018, 30% in 2017, 27% in 2016, 31% in 2015, 22% in 2014, 14% in 2013, 11% in 2012, 15% in 2011, 23% in 2010 and 16% in 2009.

Frequent reasons for significant recalculations were **updates of activity data**, e.g. due to new emission estimates *(Azerbaijan, Cyprus, Iceland, Lithuania, Netherlands, Spain and Switzerland*). Further, **changes to emission factors** are often the reason for more significant recalculations. In some cases (e.g. *Azerbaijan, Lithuania, Netherlands, Spain and Switzerland*), updates of emission factors were necessary mainly due to the revision of the EMEP/EEA guidebook 2016 (see References). Other frequent reasons for recalculations are changes in inventory calculation **methodologies** (e.g. Slovakia).

Further reasons for recalculations are **corrections of errors**. An example is the correction of the reporting of emissions in the wrong category, double counted emissions or errors in activity data (e.g. Iceland, Netherlands and Switzerland).

Table 4 shows an overview of the largest recalculations (>30%) for the inventories of NO_X, NMVOCs, SO_X, NH_3, $PM_{2.5}$, PM_{10} and CO and for the years 2005, 2010 and 2015 reported for the 2018 to the 2019 reporting round. The table summarizes the main reasons for the recalculation, the sectors concerned and the year when the recalculations were submitted. Detailed information on these recalculations is provided in Annex G (see Annexes). For detailed information about the largest recalculations in previous years please consult last year's report; the download link is available in the 'References'-section.

Table 4: Recalculations above 30% of NO_X, NMVOC, SO_X, NH_3, $PM_{2.5}$, PM_{10} and CO emissions for the reported years 2005, 2010 and 2015.

Party	Pollutant	Emissions in	Main reason	Sector
Azerbaijan	NH_3	2015	M, EF	1A3bi, 1A3biii, 1A3c, 1A4aii, 1A4bii, 3B1a, 3B2, 3B3, 3B4a, 3B4d, 3B4e, 3B4f, 3B4giv
	BC	2015	C, AD, M, EF	1A1a, 1A2b, 1A2c, 1A4ai, 2A1, 2A2, 2C1
Cyprus	NMVOC	2010, 2015	AD, C, M	1A3, 2D3b, 2D3c, 2D3d, 2D3g, 2H2
Iceland	BC	2010	error, AD	1A2b, 1A2e, 1A2f, 1A2gviii, 1A3bi, 1A3bii, 1A3biii, 1A3biv, 1A4ai, 1A4bi, 1A4ciii
Liechtenstein	NMVOC	2015	EF	1A4cii
	PM_{10}	2005, 2010, 2015	EF	1A4cii
Lithuania	$PM_{2.5}$	2005, 2010, 2015	AD, EF, C	1A1a, 1A1b, 1A1c, 1A2c, 1A2e, 1A2gvii, 1A2gviii, 1A3bvi, 1A4ai, 1A4aii, 1A4bi, 1A4ci, 1A4cii, 2A2, 2A3, 2A5a, 2A5b, 3B1a, 3B1b, 3B2, 3B4d, 3B4e, 3B4gii, 3B4giv, 3B4h, 3Dc, 5A, 5E, 1A2d
Malta	NH_3	2005, 2010, 2015	No information provided	1A1a, 1A3bi, 1A3bii, 1A3biii, 1A3biv, 3B1a, 3B1b, 3B2, 3B3, 3B4d, 3B4e, 3B4gi,3B4gii, 3B4h, 1A4ciii, 2D3b, 5C1bv
	BC	2005, 2010, 2015	No information provided	1A2gviii, 1A3bi, 1A3bii, 1A3biii, 1A3biv, 1A4ai
Monaco	CO	2005, 2010, 2015	M, EF	1A1a, ,1A3ai(i), 1A3aii(i), 1A3di(i), 1A3dii, 1A4bi, 2G, 2D3d, 1A1a, 1A1a, 2A5b
	NH_3	2005, 2010, 2015	M, EF	1A3di(i), 1A3dii, 2G
	NMVOC	2010, 2015	M, EF	1A3ai(i), 1A3aii(i), 1A3dii, 1A4bi, 2D3d, 2D3f, 2G
	PM_{10}	2005, 2010	M, EF	1A1a, 1A4bi, 2A5b, 2D3b, 2G
	$PM_{2.5}$	2005, 2010, 2015	M, EF	1A1a, 1A4bi, 2A5b, 2D3b, 2G
	SO_x	2005, 2010, 2015	M	1A1a, 1A3ai(i), 1A3aii(i), 1A3di(i), 1A3dii, 1A4bi
	BC	2005, 2010, 2015	M, EF	1A1a, 1A3di(i), 1A3dii, 1A4bi, 2D3b, 2G
Netherlands	NMVOC	2005, 2010, 2015	AD, EF, error	1A1a, 1A1c, 1A2c, 1A2d, 1A2e, 1A2gviii, 1A3, 1A4ai, 1A4aii, 1A4bi, 1A4bii 1A4ci, 1B2b, 2D3a, 2D3i, 2H3, 3De, 5A, 5E

Party	Pollutant	Emissions in	Main reason	Sector
Slovakia	CO	2005, 2010, 2015	M	1A4bi
	NMVOC	2005, 2010, 2015	M	1A4bi
	PM_{10}	2015	M	1A4bi
	$PM_{2.5}$	2015	M	1A4bi
	BC	2005, 2010, 2015	M	1A4bi
Spain	BC	2010, 2015	AD, EF	5C2, 2G, 1A2gviii, 3F
Switzerland	BC	2005, 2010, 2015	AD, error, EF,	1A1a, 1A1c, 1A2f, 1A2gviii, 1A3, 1A4ai, 1A4bi, 1A4cii, 1A5b, 2G, 5B2, 5C1biv

Notes: *M – change in methodology* *AD – updated activity data* *error – error*
EF – change of emission factor *C – correction*

3.1.2 NECD

In this reporting cycle all countries except Portugal (due to different territorial coverage under NECD and CLRTAP) provided identical inventories for their reporting obligations under the CLRTAP and NECD (see chapter 0). Therefore, reasons for recalculations under NECD are identical with those under LRTAP (see chapter 3.1.1)

3.2 Time series consistency (1990-2017)

The focus on checks on time series consistency presented in this report is on the consistency between reported PM_{10}-, $PM_{2.5}$- and BC emissions.

Checks addressing time series consistency of reported data at sector level are provided at the CEIP website and can be accessed via the interactive data viewer http://www.ceip.at/data_viewers/official_tableau/.

3.2.1 Consistency between reported PM_{10}, $PM_{2.5}$, and BC emissions

As $PM_{2.5}$ emissions are assumed to be a subset of PM_{10} emissions, it was checked whether the former are lower than the latter in all years for all countries.

Another basic comparison was performed to check whether reported BC emissions are lower than reported $PM_{2.5}$ emissions. The results show that one Party (*Armenia)* reported higher BC emissions than $PM_{2.5}$ emissions which indicates an error in the data.

A comparison of the share of the national total of $PM_{2.5}$ in the national total of PM_{10} was made to identify differences between the submitting Parties (Figure 7).

Armenia reported the same number of PM_{10} as for $PM_{2.5}$ for 2014 as national total. The party has improved the reporting since then and does estimate in the current submission PM emissions in 18 subcategories, while it reported for the year 2014 only PM emissions from 6 subcategories, which is mainly the cause for the identical numbers of both pollutants in 2014.

The analysis also shows dips and jumps for some countries, which might indicate time series inconsistencies in either $PM_{2.5}$ or PM_{10} submissions. Further, countries like *Azerbaijan, Canada, Kazakhstan, Ukraine, Turkey and the US h*ave a relatively low **$PM_{2.5}$** share between **0.5%** and

31%. On the upper end, countries as *Georgia, Iceland, Italy, Luxembourg, Latvia, Lithuania, Norway, Slovakia and Slovenia* show a share above **83%.** The majority of the submitting Parties have a share between approximately 55% and 75%; a more in depth check of this outcome is planned for future reviews.

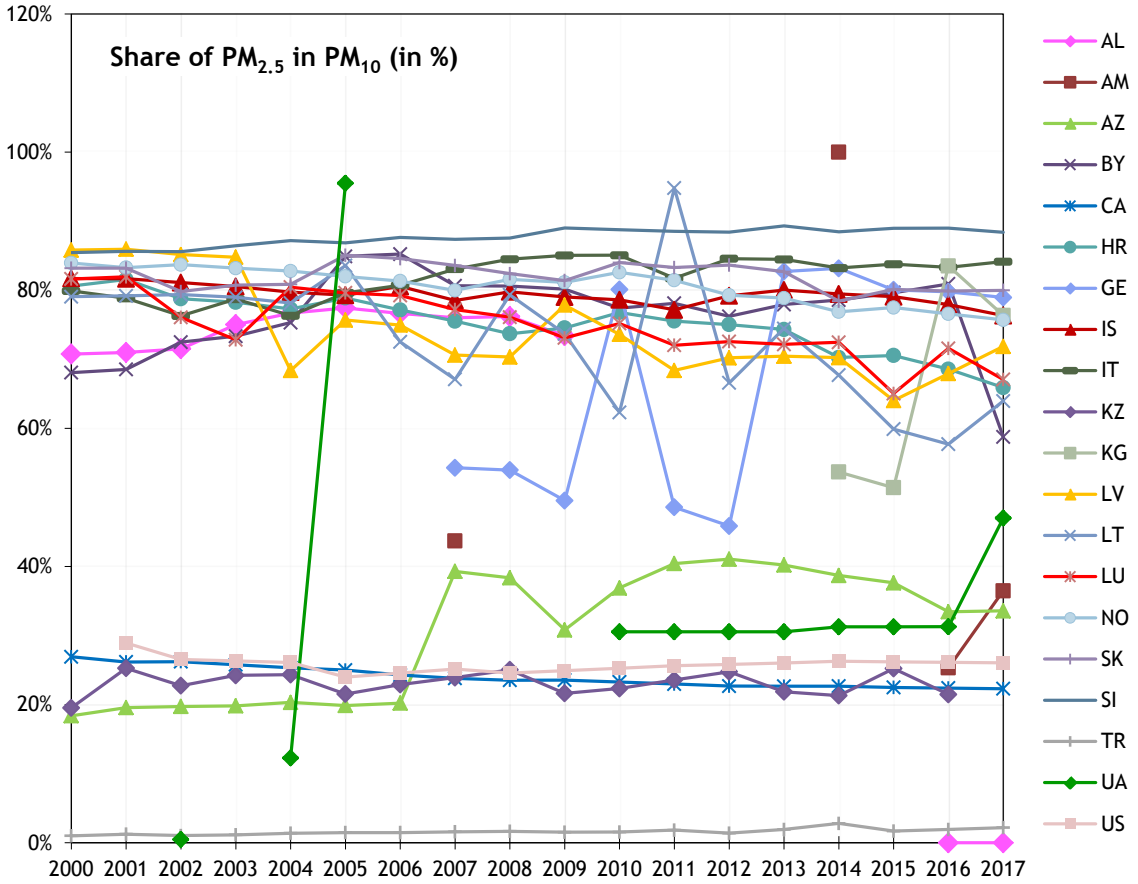


Figure 7: Share in per cent of $PM_{2.5}$ national total emissions in PM_{10} national total emissions 2000-2017 for the upper and lower 10%

3.3 Key category analysis (KCA)

KCA helps to identify significant air pollution sources in the EMEP area and in individual countries. Key categories are those categories that cumulatively contribute 80% of the total emissions of a specific pollutant. Annex F (see Annexes) shows the share of the key categories in the total emissions for the two groups of Parties: on the one hand for the group of 'EMEP West' area and on the other hand for the 'EMEP East' area[15]. Results of KCA for individual Parties can be downloaded from www.ceip.at/review_results/review_results_2019.

In the following table (Table 5), the total number of key categories is shown for each of the pollutants as well as the trend in the number of key categories over the last seven years.

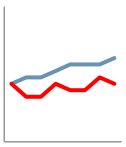
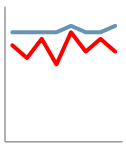
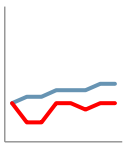
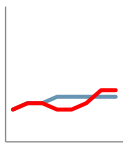
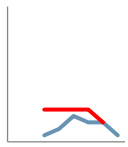
[15] Please note that for the 'EMEP East' area Kazakhstan and Republic of Moldova are not included as no data was reported.

The biggest difference between the *EMEP East* and *EMEP West* area in the number of key categories can be seen for reported **PM_{10}** emissions. While the countries of the 'EMEP West' area have identified 20 key categories, the group of the 'EMEP East' area has identified only 11 categories for PM_{10}.

Also the number of key categories of **CO, Pb, Cd, Hg, DIOX** and **HCB** is quite different between *EMEP West* and *EMEP East*.

In countries of the '*EMEP East'* area, the sector 2B10a (*Chemical Industry – Other*) with a share of 32% is the dominating sector in the KCA for **PM_{10}** because of high **PM_{10}** emissions reported by *Turkey* whereas in the '*EMEP West'* area the sector 1A4bi (*Residential – Stationary)* dominates **PM_{10}** emissions with a share of 37%.

Table 5: Total number of categories identified as key categories in the 2017 inventories for individual pollutants in the countries of the EMEP West and EMEP East area. The figures below the numbers illustrate the trend in the number of key categories over the last seven years. Blue: EMEP West, red: EMEP East.

NO_X		NMVOC		SO_X		NH_3		$PM_{2.5}$		PM_{10}		BC		PBC	
West	East	West	East	West	East	West	East	West	East	West	East	West	East	West	East
12	9	17	14	8	6	6	8	15	16	19	11	7	5	3	1
															

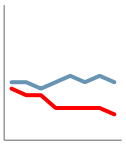
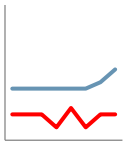
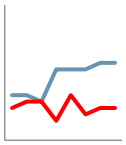
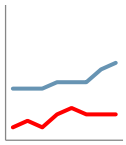
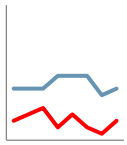
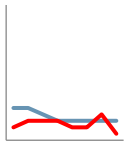
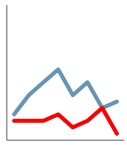
CO		Pb		Cd		Hg		DIOX		PAH		HCB	
West	East	West	East	West	East	West	East	West	East	West	East	West	East
8	4	10	4	11	5	11	4	7	3	2	1	5	1
													

Figure 8 gives an overview of all key categories in the EMEP East and EMEP West area. Figure 9 shows a comparison for the share of key categories for each pollutant between the EMEP East and EMEP West region. A darker colour indicates a higher share of the respective category. The comparison shows that:

- *1A4bi Residential – Stationary* is the most important source of the pollutants assessed for this report: like in previous years, *1A4bi* is a key source of all pollutants except **NH_3** and ranks among the top three key categories for most pollutants.
- *1A1a Public Electricity and Heat Production* is among the key categories for ten assessed pollutants (except NMVOC, NH_3, BC, CO and PCBs). It is the most important key source of **SO_X**, **Hg** and **Se** in the countries of the 'EMEP West' area and for **NO_X**, **SO_X**, **$PM_{2.5}$**, **BC**, **Pb**, **Cd**, **Hg**, **DIOX** and **HCB** in the 'EMEP East' area.
- 1A2a *Stationary combustion in manufacturing industries and construction: Iron and steel* is key category for eight out of fifteen assessed pollutants (all except NH_3, NMVOC, BC, DIOX, PAH, HCB and PCBs).

- *1A3bi Road Transportation – Passenger cars* is a key source of **NO_X**, **NMVOC**, **$PM_{2.5}$**, **PM_{10}**, **BC**, **CO** and **Pb** emissions.
- Sectors 3B1a (*Manure management – Dairy cattle*), 3B1b (*Manure management – Non-dairy cattle*) are the key sources of NH_3 emissions in the 'EMEP East' area, they play a minor role in the 'EMEP West area where 3Da2a (*Animal manure applied to soils)* is dominating **NH_3** emission source.
- The energy sector *(mainly 1A4bi – Residential stationary)* is the dominating source of **PM_{10}** emissions in the 'EMEP West' area, whereas the industry sector (*particularly 2B10a – Chemical industries – other*) is the main source of **PM_{10}** emissions in the 'EMEP East' area.
- In the 'EMEP West' area 52% of the **$PM_{2.5}$** emissions come from *1A4bi – Residential stationary*, while the most important key category for this pollutant in the 'EMEP East' area is *1A1a Public Electricity and Heat Production* with a share of 24%.

2015 was the first year when black carbon (BC) was reported by Parties and significant differences in the number of key categories for this pollutant were observed between the 'EMEP East' (4 KCs) and 'EMEP West' (8 KCs) area. In the 2019 reporting round the difference of key categories between the two areas is not as big anymore (7 KCs in EMEP West and 5 KCs in EMEP East area). In the EMEP West area the dominating key category for BC is 1A4bi (*Residential – Stationary)* whereas in the EMEP East area 1A1a (*Public electricity and heat production*) and 1A4bi (*Residential – Stationary*) are the main sources of BC.

Most of the reporting 'EMEP West' Parties submitted emission data for BC, except Austria and Luxembourg. From the 'EMEP East' area Armenia, Azerbaijan, Belarus, Georgia, Kyrgyzstan and Ukraine submitted emission data for this pollutant at least for one year.

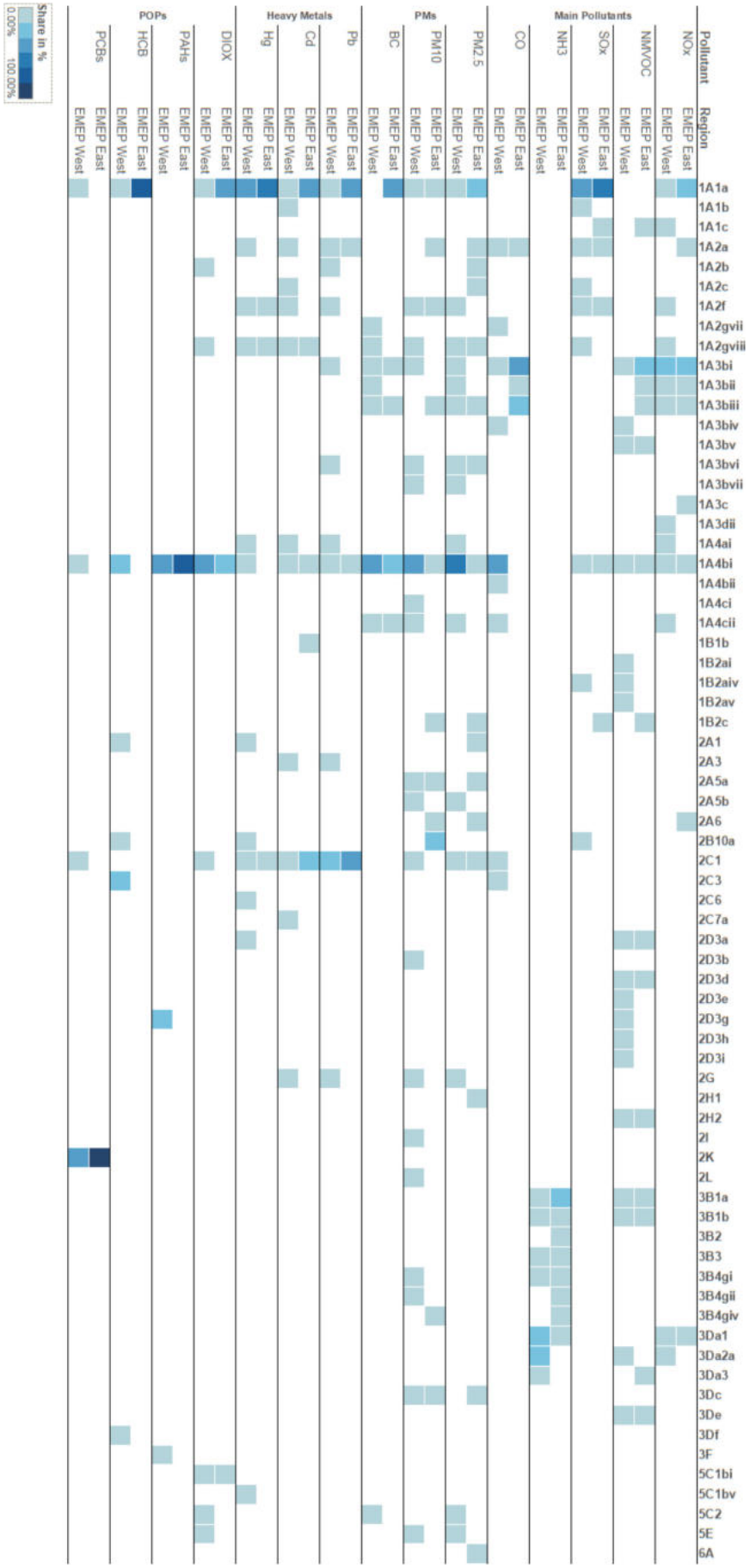


Figure 8: Overview of key categories for the EMEP East and EMEP West area

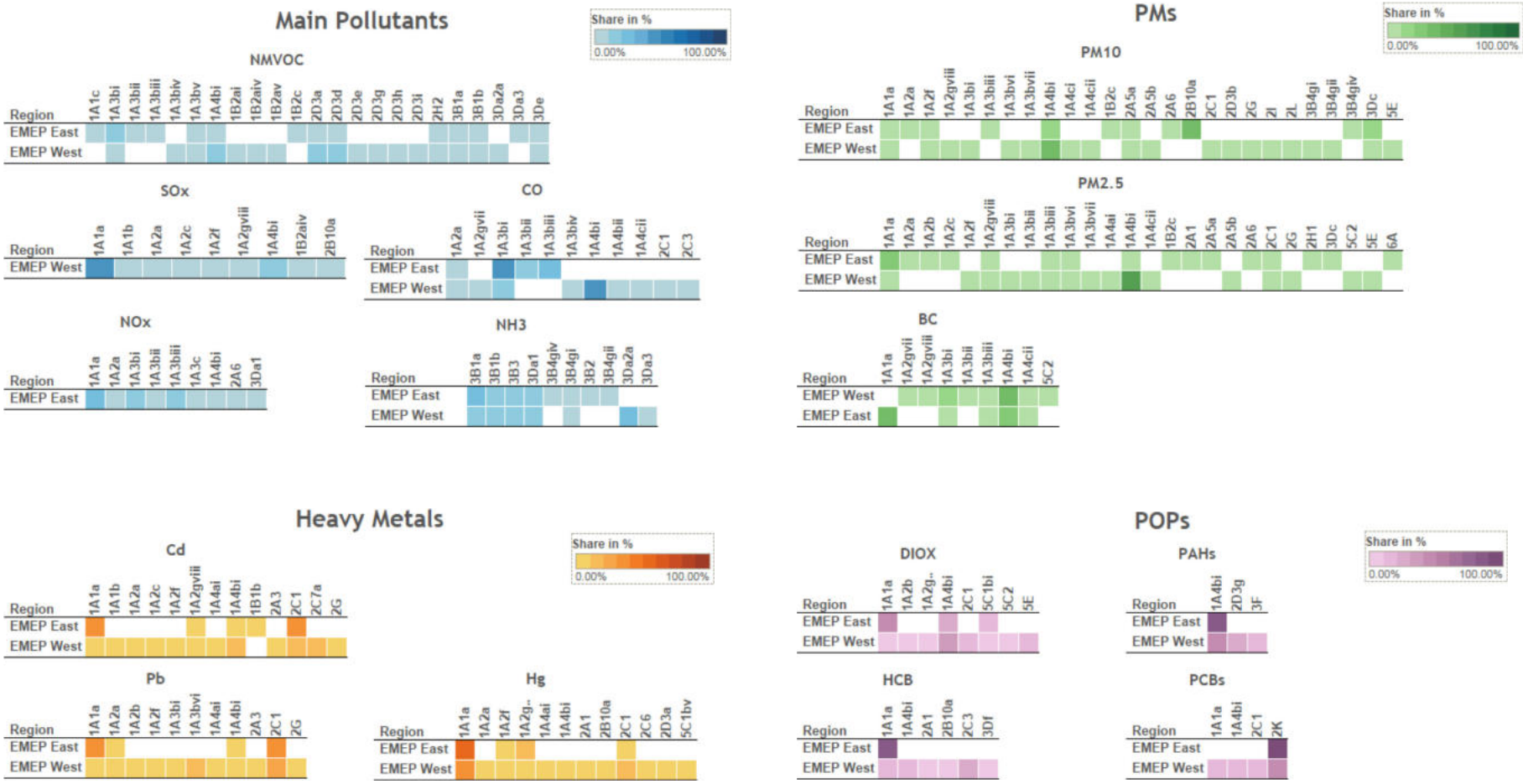


Figure 9: Comparison of key categories for each pollutant for the EMEP East and EMEP West region

3.4 Inventory comparisons

In the following, the share of sectors contributions for specific pollutants reported under the CLRTAP is presented. The results of the comparison between data reported officially under the new NECD, CLRTAP and UNFCCC for 1990 and the most recent reported year (2017) is provided in Annex G (see Annexes). Differences are expressed as percentages (%).

3.4.1 Share of aggregated sectors (GNFR[16])

The share of aggregated NFR14 sectors for each pollutant and each party was assessed to check consistency of reporting between the countries and also potentially identify outliers in reporting.

Figure 10 displays the share of GNFR sector for **NMVOC** emissions for each reporting Party in 2017. Since 1990, reported NMVOC emissions in the EMEP area are decreasing. The dominating sectors for this pollutant are *'Solvents', Agricultural Livestock, "Road Transport'* and '*Other Stationary Combustion'* for almost all Parties. The primary source of NMVOC emissions in Norway and Serbia is the sector '*Fugitive'*. The main sector for Ukraine's NMVOC emissions is the '*Industry*' sector.

Figure 11 shows the share of sectors for **BC** emissions in each country. Most countries report BC emissions mainly in the sectors '*Road Transport*' and/or '*Other Stationary Combustion*', '*Off-road*' and '*Industry*'. Azerbaijan, Monaco, the Netherlands and Norway reported significant emissions in the '*Shipping*' sector. Spain reported a fair amount of its BC emissions in the sector '*Waste*', whilst Portugal reported some of its emissions in the sector '*Aviation*'. This might indicate that the reporting of BC emissions is still rather inconsistent across countries.

Figures with comparisons for the remaining pollutants are provided in Annex E (see Annexes).

[16] The allocation of NFR14 sector codes to GNFR codes is provided in the conversion table on the CEIP homepage

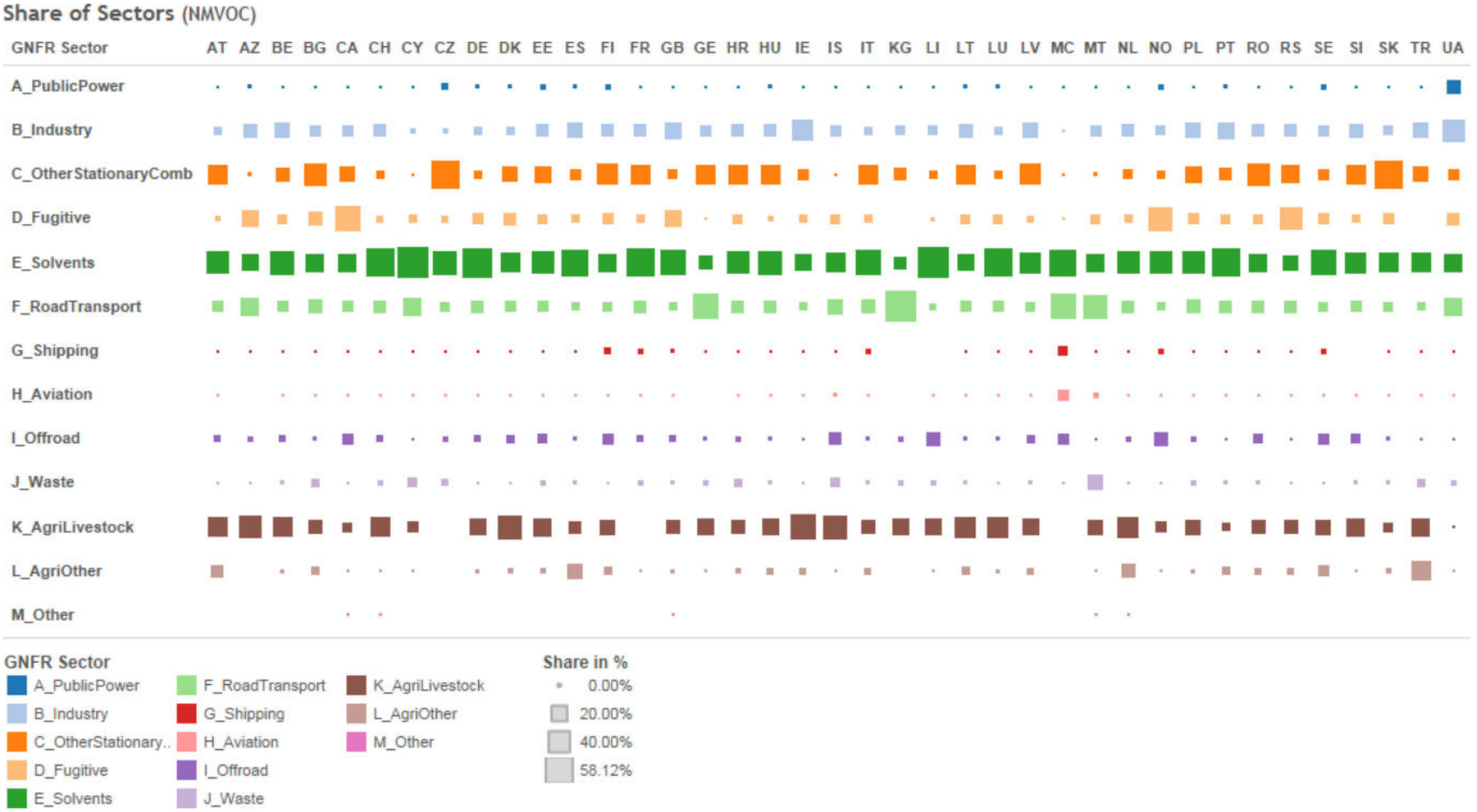


Figure 10: Share of GNFR sectors on NMVOC emissions for individual Parties in 2017. Only countries that submitted emission data for this pollutant are presented in the figure.

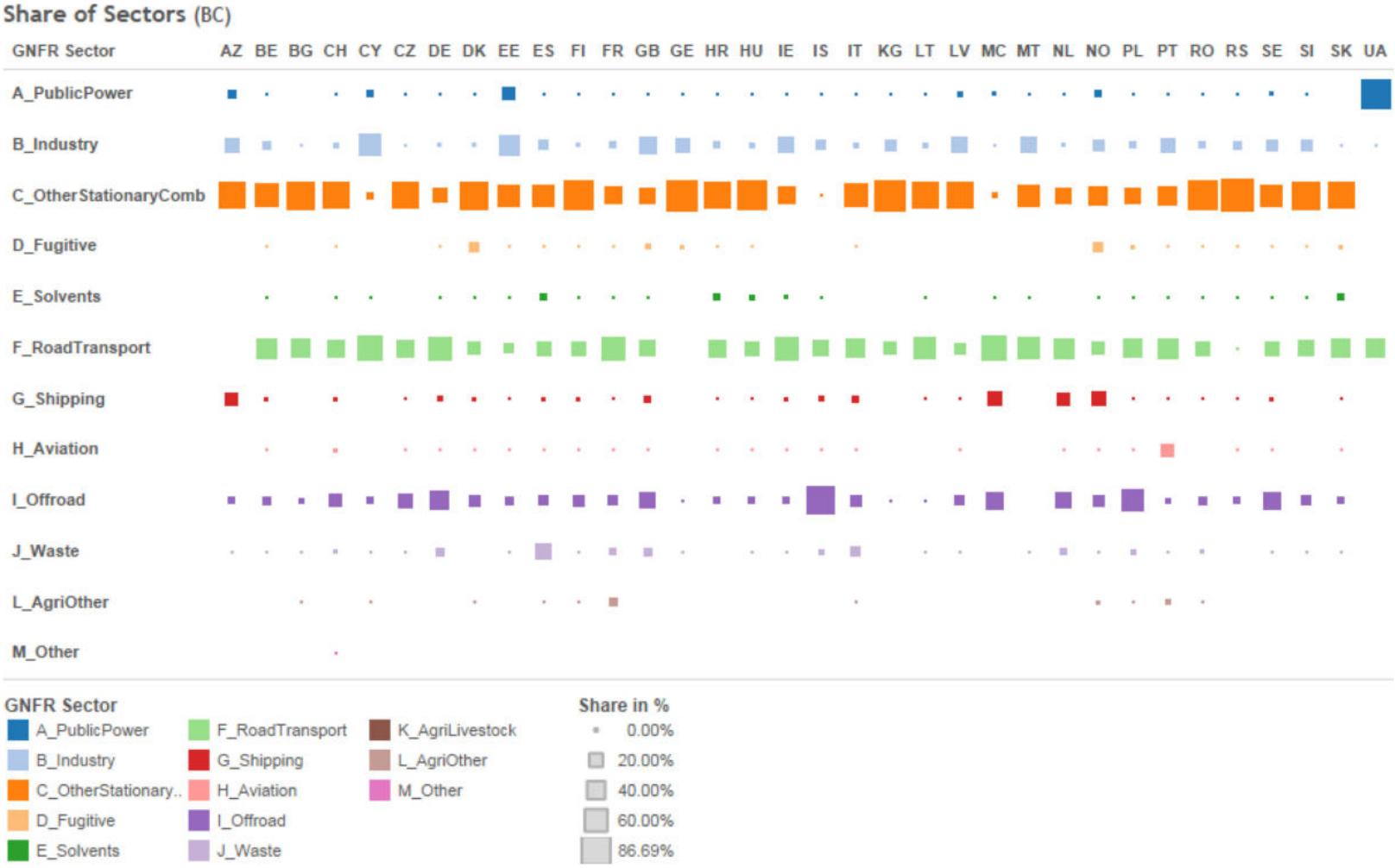


Figure 11: Share of GNFR sectors on BC emissions for individual Parties in 2017. Only countries that submitted emission data for this pollutant are presented in the figure.

3.4.2 CLRTAP/NECD comparisons[17]

As mentioned before, reporting obligations under CLRTAP and the new NECD are now identical for all countries except Portugal due to different territorial coverage. Under the CLRTAP Portugal is obliged to report all emissions occurring in the EMEP-domain including the ones from Madeira and the Azores. Under the NEC Directive Portugal has to report emissions occurring in the geographical scope of the NEC Directive therefore does not include emissions from Madeira and the Azores.

In general, all disparities which indicate that CLRTAP emissions are lower than NECD levels suggest potential errors in one of the data sets.

3.4.3 CLRTAP/UNFCCC comparisons[18]

Larger differences between national total emissions reported under CLRTAP and emissions reported under UNFCCC occur more frequently than when comparing CLRTAP and NECD inventories. Not all of these differences can be explained by different reporting obligations and indicate inconsistent reporting.

Differences of more than 10% in the **NO_X** emission data for 2017 were found in 10 countries with the biggest differences found for data reported by Croatia (130.6%) and Malta (105.8%).

The largest differences in the **SO_X** emissions for 2016 were found in 6 countries (Bulgaria (-78.6%), Luxembourg (-96.8%), Estonia (-18.4%), France (12.4%), Malta (384.6%) and Slovenia (-16.4%)).

In 2017, **NMVOC** data with a difference of 10% or more were provided by 10 countries. The largest differences could be found for France (266.2%).

Two countries (Portugal and Romania) showed the largest differences in **CO** emissions in 2017 (143.9% and 124.1%, respectively)

Errors in inventories, which also result in differences between inventories, cannot be identified by automated tests. These errors can only be detected during the stage 3 review. However, such big differences often indicate a lack of communication between institutions responsible for compiling emission inventories at national level, i.e. inconsistent use of data sets for the two inventories.

[17] Reported NECD data is taken as 100%. A reported difference below 0% means that reported CLRTAP data is below reported NECD data.

[18] Reported UNFCCC data is taken as 100%. A reported difference below 0% means that reported CLRTAP data is less than reported UNFCCC data.

3.5 Comparability – emissions per capita, emissions per GDP

Population and GDP/PPP (gross domestic product/purchasing power parity) have been selected as indicators for the comparison with national total emissions available in standardised format for all Parties. The aim is to further elaborate the check with additional parameters that are relevant for selected key categories/pollutants.

National total emissions reported for 1990 or 2000 (for PM) and 2017 were divided by the number of inhabitants and by the total value of the GDP/PPP. Values for each Party are presented in Annex D (see Annexes). It should be noted that not all Parties submitted 1990 and 2017 data for all analyzed pollutants, and that therefore these statistics cannot fully reflect the developments in the whole EMEP domain. Tables with complete time series for these indicators were posted in a separate file on the CEIP webpage (http://www.ceip.at/review_results/review_results_2019).

Figure 12 and Figure 13 show that for all assessed pollutants the highest and lowest per capita emissions per GDP/PPP emissions differ significantly from the average values (sometimes by a few orders of magnitude). A more detailed analysis of these indicators is outside the scope of this report, but the information is regularly provided to the reviewers during the checking of national inventories under the stage 3 review. Outliers might indicate differences in national economies but also errors in calculations. Low per capita and per GDP/PPP emissions in some Parties also seem to indicate incomplete national inventories, particularly with respect to PM and POPs data. More detailed information on country level is provided in Annex D (see Annexes) on the CEIP webpage (http://www.ceip.at/review_results/review_results_2019).

3.5.1 Emissions per capita

Between 1990 (or 2000 for PM) and 2017 *per capita emissions* rose in 23 Parties.

Significant differences between Parties can be seen for each reported pollutant in per capita emissions. For example, *Malta* reports in 2017 the lowest value with 0.32 kg of **SO_X** emissions per capita while *Iceland* reports 145 kg SO_X emissions per capita, which is 538 times higher than Malta's SO_X emissions and 13 times higher than the average reported emissions per capita (see Figure 12).

3.5.2 Emissions per GDP

Again, not all Parties reported emissions for both 1990 (or 2000 for PM) and 2017. Emissions per GDP/PPP differ significantly among the Parties. The biggest difference can be seen in PAH submissions: Armenia is reporting 0.004µg DIOX/GDP PPP while Portugal is reporting 1700µg PAH/GDP PPP, which is 400 000 times higher. Trends in emissions per GDP/PPP do not follow exactly the same trends as per capita emissions. Between 1990 and 2017 emissions per GDP/PPP rose in 7 Parties (see Figure 13).

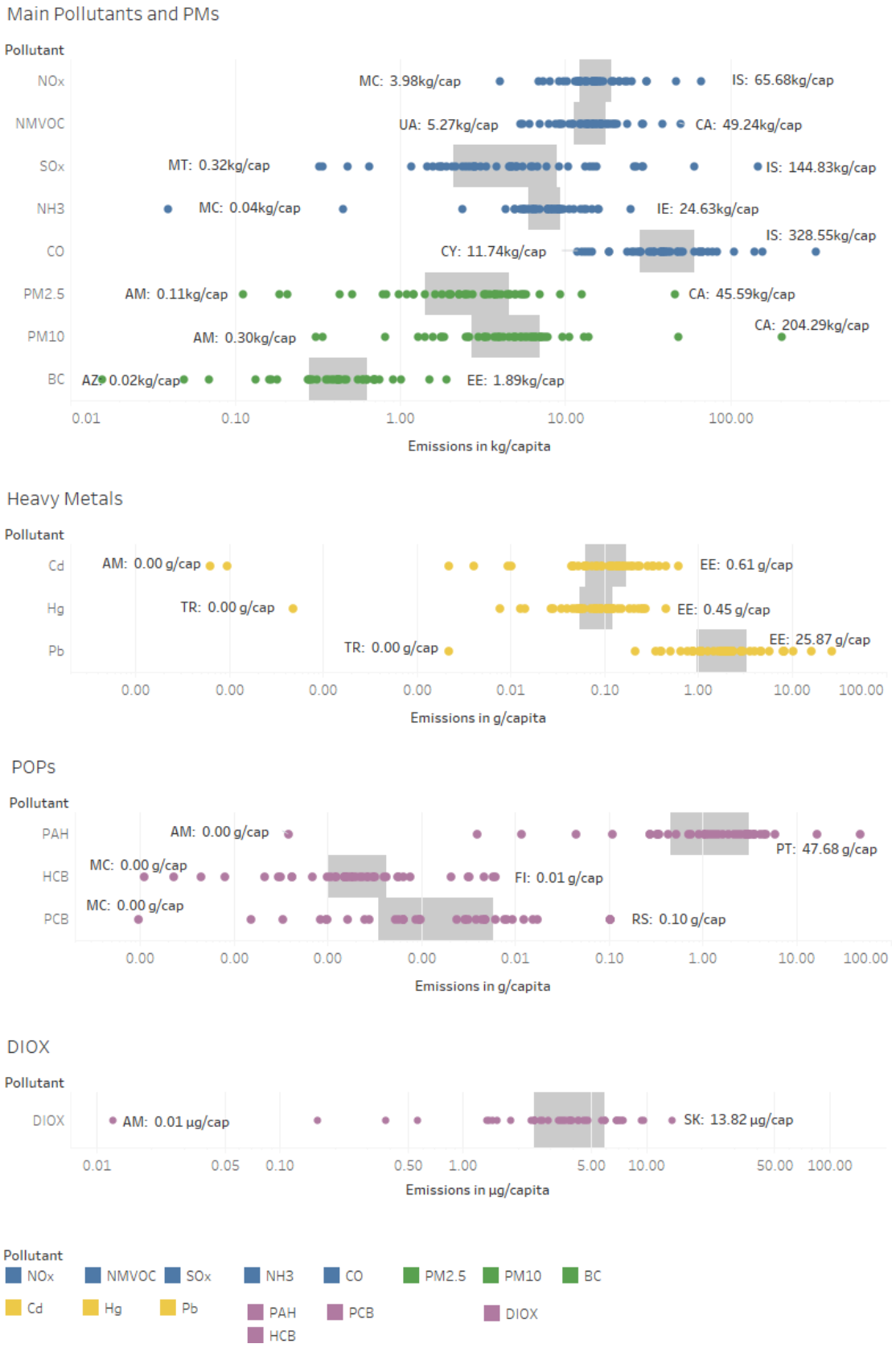


Figure 12: Minimum and maximum value and middle 50%-range of per capita emissions for each pollutant in 2017.

Note: The axes of the graphs are scaled logarithmically for a better readability. Units in each graph are different. Grey sections mark the 25% to 75% quartile.

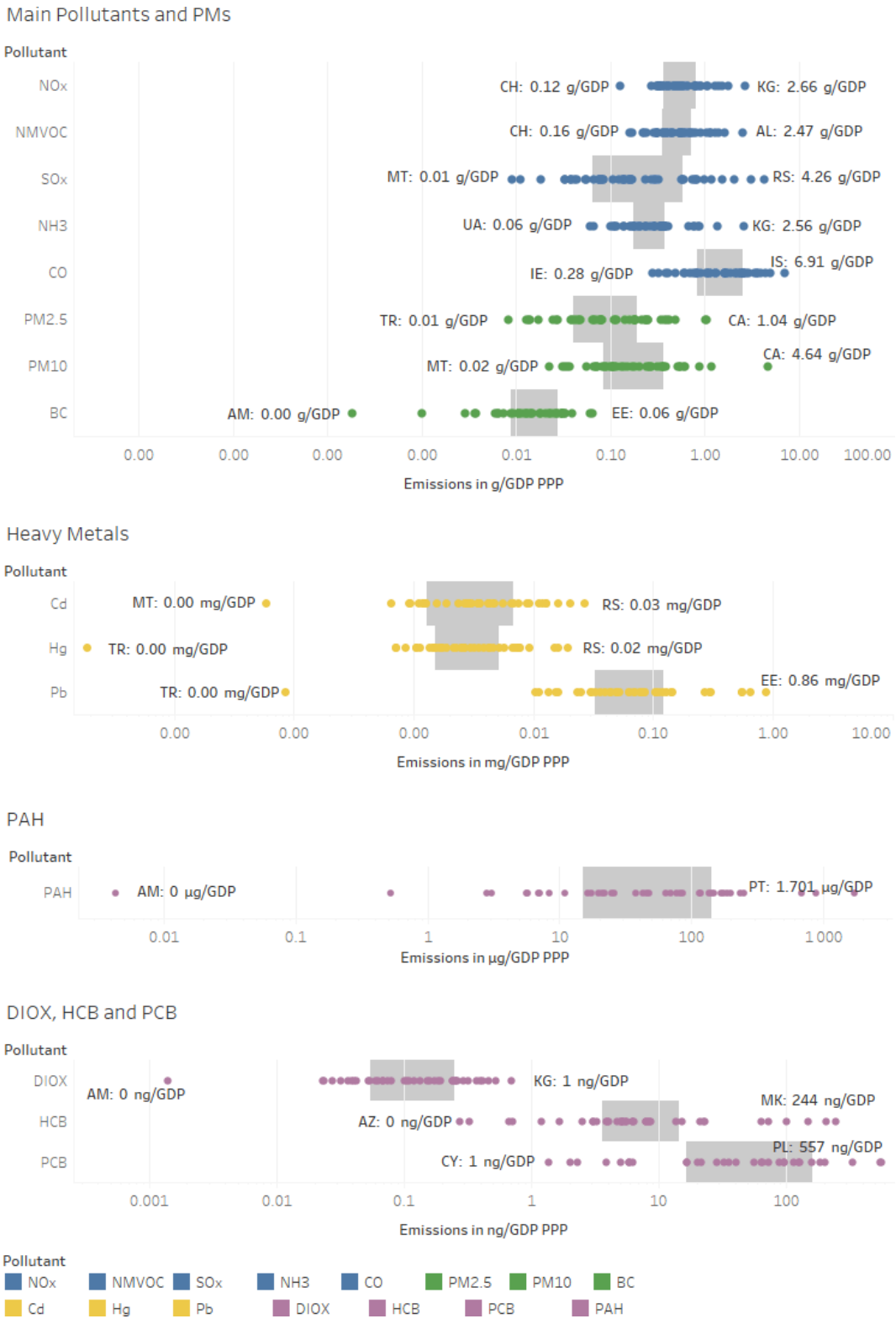


Figure 13: Minimum and maximum value and middle 50%-range of emissions per GDP/PPP for each pollutant in 2017

Note: The axes of the graphs are scaled logarithmically for a better readability. Units in each graph are different. Grey sections indicate the 25% to 75% quartile.

4 INITIAL CHECKS OF GRIDDED EMISSIONS AND LARGE POINT SOURCES

Key messages:

Overall, 30 Parties provided gridded sectoral emissions in 0.1° x 0.1° (long/lat) resolution until June 2019. This covers ***only 42% of the area*** *of all reporting Parties.*

In 2019, four Parties reported sectoral data in the new EMEP grid resolution of 0.1° x 0.1° (long/lat) for the year 2017.

For about 56% (main pollutants and PM) to 61% (heavy metals and persistent organic pollutants) of the grid cells from 49[19] Parties, data on spatially distributed emissions had to be partly or completely estimated or adjusted by CEIP.

42 out of 49 Parties submitted Large Point Source (LPS) data (independent from the reporting year). Seven parties (Armenia, Belarus, Bosnia and Herzegovina, Kazakhstan, Kyrgyzstan, Liechtenstein and Montenegro) did not report any LPS data yet.

4.1 Reporting of gridded emissions in 2019

Completeness: Gridded data is part of the four-year reporting obligation and was not due in 2019. Nevertheless, in 2019 five Parties, which are considered to be part of the extended EMEP area, did report sectoral gridded emissions in resolution 0.1° x 0.1° long/lat and four of them reported gridded emissions for the year 2017. One Party reported gridded emissions only for 2015; one Party for the years 1990, 1995, 2000, 2005, 2010, 2015 and 2017; one Party for the whole time series from 1990 to 2017 and one Party for the whole time series from 1980 to 2017.

Overall, **30** Parties provided gridded GNFR14 sectoral emissions in 0.1° x 0.1° (long/lat) resolution so far (see Figure 14).

No gridded sectoral data so far, neither in 0.1° x 0.1° (long/lat) nor in 50 x 50 km² PS resolution, was submitted by Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Kazakhstan, Kyrgyzstan, Liechtenstein, Montenegro, Moldova, Serbia and Turkey.

From Belarus, Cyprus, Estonia, Iceland, the Russian Federation and Ukraine reported gridded sectoral data is available only in the old 50 x 50 km² PS resolution.

Completeness pollutants: Overall, 30 Parties reported **sectoral gridded emissions for at least one year in 0.1° x 0.1° resolution** for main pollutants, particulate matter, heavy metals and persistent organic pollutants.

Reported gridded sectoral data in 0.1° x 0.1° (long/lat) resolution covers only 43% of the grid cells of all reporting Parties (see Figure 15).

More information on gridded data is available via the CEIP website at https://www.ceip.at/new_emep-grid.

[19] Without Canada and the United States of America.

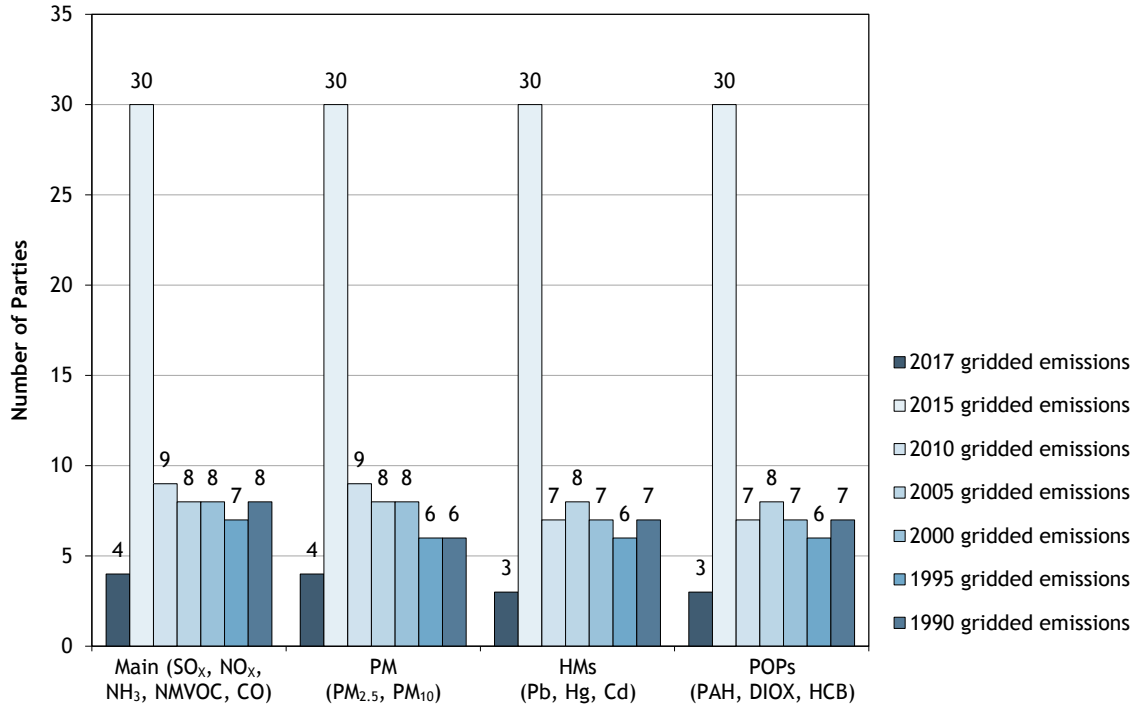


Figure 14: Total number of Parties reporting gridded sectoral data in 0.1° x 0.1° (long/lat) resolution for the years 1990, 1995, 2000, 2005, 2010, 2015 and 2017, reported to EMEP by 2019.

Main pollutants (NO_X, NMVOC, SO_X, NH_3, CO) and PM ($PM_{2.5}$, PM_{10})

Priority heavy metals (Pb, Cd, Hg) and POPs (PCDD/PCDF, PAH and HCB)

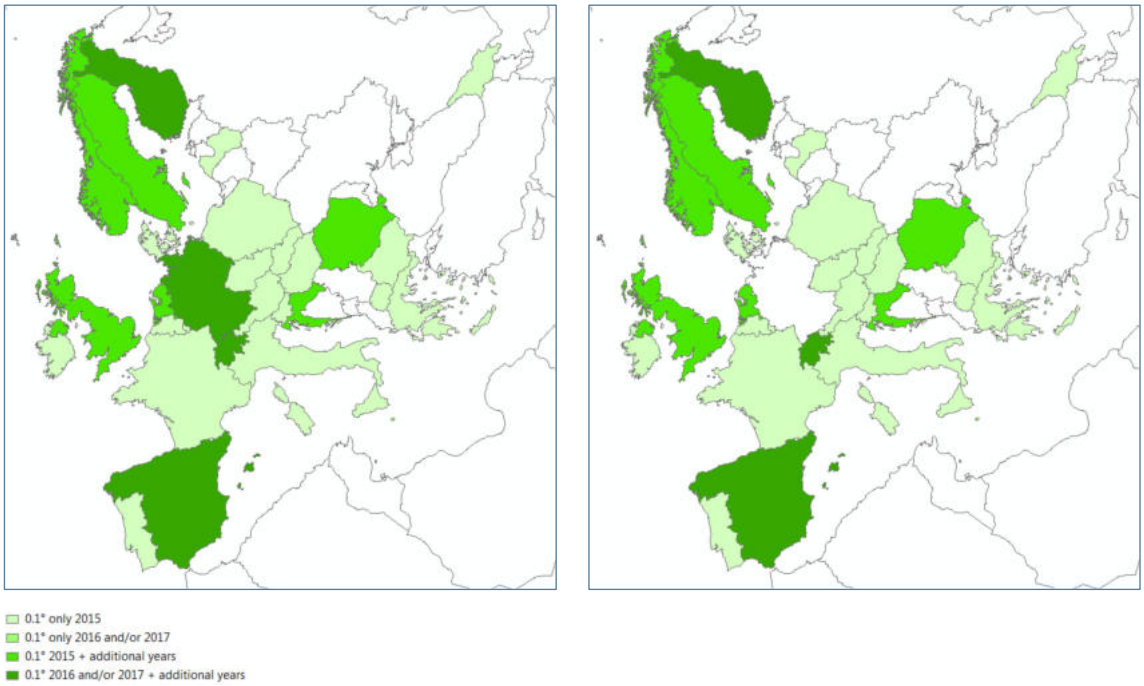


Figure 15: Visualisation of reported gridded emissions in 0.1° x 0.1° (long/lat) resolution in the EMEP area. Brighter green – reported data only for 2015, 2016 or 2017 is available; Darker green – additional historical years are available; White – no reporting of gridded emissions in 0.1° x 0.1° (long/lat) resolution

Lithuania reported gridded emissions only on national total level, which could not be used for the gridding, which is done on sectoral level. For *Poland, Portugal and Spain* the spatial disaggregation of sector 'F – Road Transport' had to be replaced by CAMS proxies. Reported gridded data from *Italy* had to be completely replaced by CAMS and EDGAR proxies.

For about 56% (main pollutants and PM) to 61% (heavy metals and persistent organic pollutants) of the grid cells from 49 reporting Parties to the LRTAP Convention[20] data on spatially distributed emissions had to be partly or completely estimated or adjusted by air pollutant emission experts in 2019. This is, either because this information was missing or because the reported data could not be used (areas with no reporting at all, like the sea areas, North Africa and areas in the extended EMEP domain are not considered here).

More detailed information on the gap-filling and gridding for emission data used in EMEP models can be found in the „EMEP Status Report 1/2019[21]".

4.2 Large point sources (LPS)

„Large point sources" (LPS) are defined as facilities whose combined emissions, within the limited identifiable area of the site premises, exceed certain pollutant emission thresholds[22]. LPS reporting is encouraged to include information on stack heights according to the stack height class categories as defined in the emission reporting guidelines[23]. Submitted LPS information should be consistent with the information reported for European Pollutant Release and Transfer Register (E-PRTR) facilities[24]

Regardless the reporting year, 42 out of 49 parties submitted LPS data. In 2019 Finland submitted LPS data for 2017, Spain submitted LPS data for the whole time series from 1990 to 2017 and Switzerland submitted LPS data for the whole time series from 2007 to 2016. Seven parties (Armenia, Belarus, Bosnia and Herzegovina, Kazakhstan, Kyrgyzstan, Liechtenstein and Montenegro) did not report any LPS data yet.

Annex H – LPS reporting under CLRTAP until 2019 (see Annexes) shows in detail which Party submitted LPS data for which years.

Figure 16 presents maps for main pollutants, PMs, priority heavy metals and POPs with Large Point sources reported until 2019.

[20] Without Canada and the United States of America.

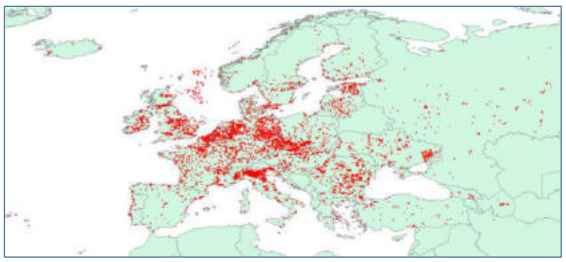
[21] http://www.emep.int/mscw/mscw_publications.html

[22] These thresholds have been extracted from the full list of pollutants in Regulation (EC) No. 166/2006 of the European Parliament and of the Council of 18 January 2006 concerning the establishment of a European Pollutant Release and Transfer Register and amending Council Directives 91/689/EEC and 96/61/EC (E-PRTR Regulation) and its annex II 6. See Table 1 in Guidelines for Reporting Emissions and Projections Data under the Convention on Long-range Transboundary Air Pollution – ECE/EB.AIR/125 (www.unece.org/fileadmin/DAM/env/documents/2013/air/eb/ece.eb.air.125_E_ODS.pdf)

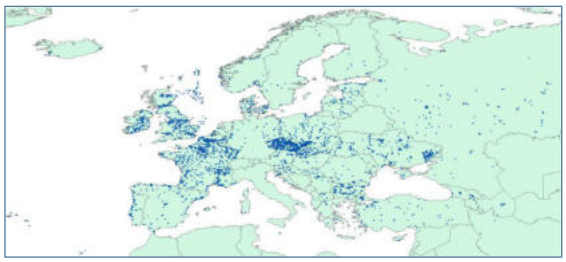
[23] See Table 2 in Guidelines for Reporting Emissions and Projections Data under the Convention on Long-range Transboundary Air Pollution – ECE/EB.AIR/125 (www.unece.org/fileadmin/DAM/env/documents/2013/air/eb/ece.eb.air.125_E_ODS.pdf)

[24] https://prtr.eea.europa.eu

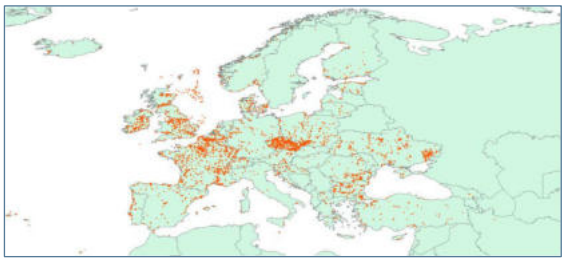
Main pollutants (NO_X, NMVOC, SO_X, NH_3, CO)



Particulate matter ($PM_{2.5}$, PM_{10})



Priority heavy metals (Pb, Cd, Hg)



POPs (PCDD/PCDF, PAH and HCB)

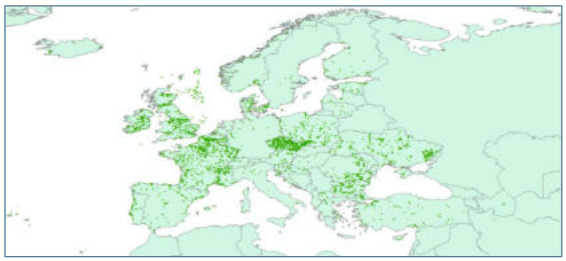


Figure 16: Maps with Large Point Sources reported until 2019

5 UNITS AND ABBREVIATIONS

5.1 Units

kg ..... 1 kilogram = 10^3 g (gram)
t ..... 1 tonne (metric) = 1 megagram (Mg) = 10^6 g
kt ..... 1 000 tonnes …
Mg ..... 1 megagram = 10^6 g = 1 tonne (t)
Gg ..... 1 gigagram = 10^9 g = 1 kilotonne (kt)
Tg ..... 1 teragram = 10^{12} g = 1 megatonne (Mt)
TJ ..... 1 terajoule

5.2 Abbreviations

As ..... Arsenic
BC ..... Black carbon – carbonaceous particulate matter that absorbs light
Cd ..... Cadmium
CDR ..... Central data repository of EEA's Eionet Reportnet
CEIP ..... EMEP Centre on Emission Inventories and Projections
CH_4 ..... Methane
CLRTAP ..... LRTAP Convention
CO ..... Carbon monoxide
CO_2 ..... Carbon dioxide
COPERT ..... Computer Programme to calculate Emissions from Road Transport
Cr ..... Chromium
CRF ..... Common reporting format (UNFCCC for greenhouse gases)
Cu ..... Copper
EEA ..... European Environment Agency
Eionet ..... European environmental information and observation network
EMEP ..... Co-operative Programme for Monitoring and Evaluation of the Long-range Transmissions of Air Pollutants in Europe
E-PRTR ..... European Pollutant Release and Transfer Register
ETC/ATNI ..... European Topic Centre on Air pollution, Transport, Noise and Industrial pollution
EU ..... European Union
GDP, PPP ..... Gross domestic product converted to international dollars using purchasing power parity rates
HCB ..... Hexachlorobenzene – Chemical Abstracts Service (CAS) Registry Number 118-74-1
Hg ..... Mercury
HMs ..... Heavy metals
IIR ..... Informative inventory report
IEF ..... Implied emission factor
KCA ..... Key category analysis

LRTAP Convention.... UNECE Convention on Long-range Transboundary Air Pollution

LRT ..... Long Range Transport

LPS ..... Large point source

Main pollutants..... NO_X, NMVOC, SO_X, NH_3 and CO

Main HMs ..... Cd, Hg and Pb

NECD ..... National Emission Ceilings Directive (2001/81/EC)

NEMO ..... Network Emission Model

NFR ..... UNECE Nomenclature For Reporting (of air pollutants)

NH_3 ..... Ammonia

Ni ..... Nickel

NMVOCs ..... Non-methane volatile organic compounds – all organic compounds of an anthropogenic nature, other than methane, that are capable of producing photochemical oxidants by reaction with nitrogen oxides in the presence of sunlight

NO_2 ..... Nitrogen dioxide

NO_X ..... Nitrogen oxides – means nitric oxide and nitrogen dioxide, expressed as nitrogen dioxide (NO_2);

PAHs ..... Polycyclic aromatic hydrocarbons – for the purposes of emission inventories, the following four indicator compounds shall be used: benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3_cd)pyrene;

Pb ..... Lead

PCBs ..... Polychlorinated biphenyls – aromatic compounds formed in such a manner that the hydrogen atoms on the biphenyl molecule (two benzene rings bonded together by a single carbon-carbon bond) may be replaced by up to 10 chlorine atoms;

PCDD/PCDF ..... Dioxins and furans – polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF), tricyclic, aromatic compounds formed by two benzene rings, connected by two oxygen atoms in PCDD and by one oxygen atom in PCDF, and the hydrogen atoms of which may be replaced by up to eight chlorine atoms;

PM ..... Particulate matter – air pollutant consisting of a mixture of particles suspended in the air. These particles differ in their physical properties (such as size and shape) and chemical composition.

PM_{10} ..... Particulate matter, or particles with an aerodynamic diameter equal to or less than 10 (μm);

$PM_{2.5}$ ..... Particulate matter, or particles with an aerodynamic diameter equal to or less than 2.5 micrometres (μm);

POPs ..... Persistent organic pollutants

Se ..... Selenium

SO_2 ..... Sulphur dioxide

SO_X ..... Sulphur oxides – means all sulphur compounds expressed as sulphur dioxide (SO_2) (including sulphur trioxide (SO_3), sulphuric acid (H_2SO_4), and reduced sulphur compounds, such as hydrogen sulphide (H_2S), mercaptans and dimethyl sulphides, etc.);

TSP ..... Total suspended particles

UNECE..... United Nations Economic Commission for Europe

UNFCCC ..... United Nations Framework Convention on Climate Change

VOCs ..... Volatile organic compounds

Zn ..... Zinc

5.3 ISO Country codes

AL ..... Albania
AM ..... Armenia
AT ..... Austria
AZ ..... Azerbaijan
BA ..... Bosnia and Herzegovina
BE..... Belgium
BG ..... Bulgaria
BY ..... Belarus
CA ..... Canada
CH ..... Switzerland
CY ..... Cyprus
CZ..... Czechia
DE ..... Germany
DK ..... Denmark
EE..... Estonia
ES ..... Spain
EU ..... European Union
FI ..... Finland
FR..... France
GB ..... United Kingdom
GE ..... Georgia
GR ..... Greece
HR ..... Croatia
HU ..... Hungary
IE ..... Ireland
IS ..... Iceland
IT ..... Italy
KG ..... Kyrgyzstan
KZ..... Kazakhstan
LI ..... Liechtenstein
LT ..... Lithuania
LU..... Luxembourg
LV..... Latvia
MC ..... Monaco
MD..... Republic of Moldova
ME ..... Montenegro
MK..... North Macedonia
MT ..... Malta
NL..... Netherlands
NO ..... Norway
PL ..... Poland
PT ..... Portugal
RO..... Romania
RS ..... Serbia
RU..... Russian Federation
SE ..... Sweden
SI..... Slovenia
SK ..... Slovakia
TR ..... Turkey
UA ..... Ukraine
US ..... United States of America

'**EMEP West'** comprises Albania, Austria, Belgium, Bosnia & Herzegovina, Bulgaria, Croatia, Cyprus, Czechia, Germany, Denmark, Estonia, European Union, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, North Macedonia, Malta, Monaco, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

'EMEP East' comprises Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Republic of Moldova, Russian Federation, Turkey and Ukraine.

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APPENDIX

Status of 2019 reporting under the LRTAP Convention

Table 6: Status of reporting under the LRTAP Convention as of 03rd June 2019.

PARTY	Submission Date EMEP	Resubmission Date	NFR template (version)	Gridded Data	LPS Data	2020 Proj.	IIR 2019
Albania	15.02.2019		2009-1				
Armenia	15.02.2019		2014-2				x
Austria	14.02.2019		2014-2			x	x
Azerbaijan	15.02.2019	06.04.2019	2014-1				x
Belarus	15.02.2019	14.03.2019	2014-2				x
Belgium	15.02.2019	15.03.2019	2014-2			x	x
Bosnia & Herzegovina							
Bulgaria	15.02.2019		2014-1			x	x
Canada	15.02.2019	28.06.2019	2014-1			x	x
Croatia	16.02.2019	15.03.2019	2014-1			x	x
Cyprus	15.02.2019	15.03.2019	2014-2			x	x
Czechia	15.02.2019	15.03.2019 30.04.2019 09.05.2019	2014-2			x	x
Denmark	15.02.2019		2014-1	x		x	x
Estonia	13.02.2019	13.03.2019	2014-2			x	x
European Union	29.04.2019	03.06.2019	2014-2				x
Finland	15.02.2019	13.03.2019	2014-2	x	x	x	x
France	15.02.2019		2014-2				x
Georgia	14.02.2019		2014-1				x
Germany	12.02.2019	12.03.2019	2014-2	x		x	x
Greece*	17.07.2019		2014-2			x	x
Hungary	16.02.2019	18.03.2019	2014-2			x	x
Iceland	05.03.2019	15.05.2019	2014-2				x
Ireland	15.02.2019		2014-2			x	x
Italy	28.02.2019	14.03.2019 19.04.2019	2014-1			x	x
Kazakhstan							
Kyrgyzstan	03.05.2019		2014-2				x
Latvia	15.02.2019	15.03.2019	2014-2			x	x
Liechtenstein*	11.06.2019						x
Lithuania	14.02.2019	15.02.2019	2014-2			x	x
Luxembourg	15.02.2019	15.03.2019 26.03.2019 26.04.2019	2014-2			x	x
Malta	18.02.2019		2014-1				
Monaco	15.02.2019		2014-2				
Montenegro							
North Macedonia	15.02.2019	16.04.2019	2014-1				x
Norway	14.02.2019		2014-2			x	x
Poland	21.02.2019	15.03.2019	2014-1			x	x

PARTY	Submission Date EMEP	Resubmission Date	NFR template (version)	Gridded Data	LPS Data	2020 Proj.	IIR 2019
Portugal	15.02.2019	15.03.2019 30.04.2019	2014-1				x
Republic of Moldova							
Romania	14.02.2019	15.03.2019	2014-2			x	x
Russian Federation	13.02.2019		2014-2				x
Serbia	13.02.2019	04.03.2019	2014-2				x
Slovakia	15.02.2019	15.03.2019	2014-2			x	x
Slovenia	05.02.2019		2014-2			x	x
Spain	13.02.2019		2014-2	x	x	x	x
Sweden	06.02.2019		2014-2			x	x
Switzerland	14.02.2019		2014-2	x	x	x	x
the Netherlands	14.02.2019	04.04.2019	2014-2			x	x
Turkey	15.02.2019		2014-2				x
Ukraine	14.02.2019		2014-2				x
United Kingdom	15.02.2019		2014-2			x	x
USA	21.03.2019		2014-2				x

**Note: Greece and Liechtenstein provided their submission after 3rd of June 2019 and can therefore not be included to further analyzes*

Table 7: Completeness of CLRTAP submissions as of 03rd June 2019.

PARTY	SO_2, No_x, CO, NH_3, NMVOC	Cd,Hg, Pb	additional HMs	$PM_{2.5}$, PM_{10}	TSP	BC	POPs (PAH PCDD/ PCDF, HCB, PCBs)	Activity Data
Albania	1990-2017	1990-2009	1990-2009	1990-2017	2005, 2008, 2009		1990-2009	
Armenia	2017	2017	2017	2017	2017	2017	2017	
Austria	1990-2017	1990-2017		1990, 1995, 2000-2017	1990, 1995, 2000-2017		1990-2017	1990-2017
Azerbaijan	1990-2017	1995-2017	1995-2017	1990-2017	1990-2017	2014-2017	1995-2017	1990-2017
Belarus	2017	2017	2017	2017	2017	2017	2017	2017
Belgium	1990-2017	1990-2017	1990-2017	2000-2017	2000-2017	2000-2017	1990-2017	1990-2017
Bosnia & Herzegovina								
Bulgaria	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017
Canada	1990-2017	1990-2017		1990-2017	1990-2017		1990-2017	
Croatia	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017
Cyprus	1990-2017	1990-2017	1990-2017	2000-2017	2000-2017	2000-2017	1990-2017	1990-2017
Czechia	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017
Denmark	1985-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1980-2017
Estonia	1990-2017	1990-2017	1990-2017	2000-2017	1990-2017	2000-2017	1990-2017	1990-2017
European Union	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	
Finland	1980-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017
France	1980-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1980-2017
Georgia	2007-2017	2007-2017	2007-2017	2007-2017	2007-2017	2000-2017	2007-2017	2007-2017
Germany	1990-2017	1990-2017	1990-2017	1995-2017	1990-2017	2000-2017	1990-2017	1990-2017
Greece								

PARTY	SO_2, No_x, CO, NH_3, NMVOC	Cd,Hg, Pb	additional HMs	$PM_{2.5}$, PM_{10}	TSP	BC	POPs (PAH PCDD/ PCDF, HCB, PCBs)	Activity Data
Hungary	1990-2017	1990-2017	1990-2017	2000-2017	2000-2017	2000-2017	1990-2017	1990-2017
Iceland	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017
Ireland	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017
Italy	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017
Kazakhstan								
Kyrgyzstan	2017	2017	2017	2017	2017	2017	2017	2017
Latvia	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017
Liechtenstein	1990-2017	1990-2017		1990-2017	1990-2017		1990-2017	
Lithuania	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017
Luxembourg	1990-2017	1990-2017		1990-2017	1990-2017		1990-2017	1990-2017
Malta	2000-2017	2000-2017	2000-2017	2000-2017	2000-2017	2005-2017	2005-2017	2000-2017
Monaco	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017
Montenegro								
Netherlands	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017
North Macedonia	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017
Norway	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017
Poland	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017
Portugal	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017
Republic of Moldova								
Romania	1995-2017	1995-2017	1995-2017	1995-2017	1995-2017	1995-2017	1995-2017	1995-2017
Russian Federation	2010-2017			2010-2017	2010-2017			2010-2017
Serbia	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017
Slovakia	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017
Slovenia	1980-2017	1990-2017	1990-2017	2000-2017	2000-2017	2000-2017	1990-2017	1990-2017
Spain	1990-2017	1990-2017	1990-2017	2000-2017	2000-2017	2000-2017	1990-2017	1990-2017
Sweden	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	2000-2017	1990-2017	1990-2017
Switzerland	1980-2017	1980-2017		1980-2017	1980-2017	1980-2017	1980-2017	1980-2017
Turkey	1990-2017	1990-2017		1990-2017				
Ukraine	2016-2017	2016-2017	2016-2017	2016-2017	2016-2017	2017	2017	2016-2017
United Kingdom	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017
United States of America	2012-2017	2014		2012-2017		2014	2014	

Table 8: Completeness of CLRTAP submissions as of 03rd June 2019 (since 2015 reporting of Projections mandatory every 4 years, since 2017 reporting of Gridded data and LPS data mandatory every 4 years).

PARTY	Template version 2014-1 or 2014-2					Gridded new	LPS Emissions
	Projections WM	Projections WaM	Activity data WM	Activity data WaM	Gridded data 50x50		
Albania							
Armenia							
Austria	2020, 2025, 2030		2020, 2025, 2030				
Azerbaijan							
Belarus							
Belgium	2020, 2025, 2030	2020, 2025, 2030	2020, 2025, 2030	2020, 2025, 2030			
Bosnia & Herzegovina						2015	
Bulgaria	2020, 2025, 2030	2020, 2025, 2030					
Canada	2020, 2025, 2030		2020, 2025, 2030			2017	2017
Croatia	2020, 2025, 2030, 2040, 2050	2020, 2025, 2030, 2040, 2050	2020, 2025, 2030, 2040, 2050	2020, 2025, 2030, 2040, 2050			
Cyprus	2020, 2025, 2030		2020, 2025, 2030			1990, 1995, 2000, 2005, 2010, 2015, 2017	
Czechia	2020, 2025, 2030	2020, 2025, 2030	2020, 2025, 2030, 2040	2020, 2025, 2030, 2040			
Denmark	2020, 2025, 2030, 2040	2020, 2025, 2030	2020, 2025, 2030, 2040				
Estonia	2020, 2025, 2030	2020, 2025, 2030	2020, 2025, 2030	2020, 2025, 2030			
EU	2020, 2025, 2030, 2040, 2050	2020, 2025, 2030, 2040, 2050					
Finland	2020, 2025, 2030		2020, 2025, 2030				
France							
Georgia							
Germany	2020, 2025, 2030	2020, 2025, 2030					
Greece							
Hungary	2020, 2025, 2030		2020, 2025, 2030				
Iceland							
Ireland	2020, 2025, 2030	2020, 2025, 2030	2020, 2025, 2030	2020, 2025, 2030			
Italy	2020, 2025, 2030		2020, 2025, 2030				
Kazakhstan							
Kyrgyzstan						1990-2017	1990-2017
Latvia	2020, 2025, 2030	2020, 2025, 2030	2020, 2025, 2030, 2040, 2050	2020, 2025, 2030, 2040, 2050			

PARTY	Template version 2014-1 or 2014-2					Gridded new	LPS Emissions
	Projections WM	Projections WaM	Activity data WM	Activity data WaM	Gridded data 50x50		
Liechtenstein							
Lithuania	2020, 2025, 2030	2020, 2025, 2030	2020, 2025, 2030				
Luxembourg	2020, 2025, 2030		2020, 2025, 2030				
Malta							
Monaco							
Montenegro							
Netherlands	2020, 2025, 2030	2020, 2025, 2030	2020, 2030				
North Macedonia							
Norway							
Poland	2020, 2025, 2030		2020, 2025, 2030				
Portugal							
Republic of Moldova							
Romania	2020, 2025, 2030	2020, 2025, 2030	2020, 2025, 2030	2020, 2025, 2030			
Russian Federation							
Serbia							
Slovakia	2020, 2025, 2030	2020, 2025, 2030					
Slovenia	2020, 2025, 2030		2020, 2025, 2030				
Spain	2020, 2025, 2030, 2040	2020, 2025, 2030, 2040	2020, 2025, 2030, 2040	2020, 2025, 2030, 2040			
Sweden	2020, 2025, 2030		2020, 2025, 2030				
Switzerland	2020, 2025, 2030, 2040, 2050	2020, 2025, 2030, 2040, 2050	2020, 2025, 2030, 2040, 2050	2020, 2025, 2030, 2040, 2050			
Turkey						1980-2017	2007-2017
United Kingdom							
United States of America	2020, 2025, 2030		2020, 2025, 2030				

Status of 2019 reporting under the NECD

Table 9: Status of reporting under the NECD as of 03rd June 2019.

PARTY	Annual reporting						2-year reporting	4-year reporting	
	Submission date	Date of resubmission	Projection submission Date	Date of additional information	Date of IIR	Format (NFR template)	Projections	Gridded data	LPS emissions
Austria	15.02.2019	15.03.2019	15.03.2019	15.03.2019	15.03.2019	NFR 2014-2	2020/2025/2030		
Belgium	15.02.2019	15.03.2019	15.03.2019		15.03.2019	NFR 2014-2	2020/2025/2030		
Bulgaria	15.02.2019		15.03.2019		15.03.2019	NFR 2014-1	2020/2025/2030		
Croatia	16.02.2019	15.03.2019	15.03.2019		15.03.2019	NFR 2014-1	2020/2025/2030/ 2040/2050		
Cyprus	15.02.2019	15.03.2019	15.03.2019		15.03.2019	NFR 2014-2	2020/2025/2030		
Czechia	15.02.2019	15.03.2019 30.04.2019 09.05.2019	15.03.2019 12.04.2019		15.03.2019 30.04.2019	NFR 2014-2	2020/2025/2030		
Denmark	15.02.2019		15.03.2019	15.02.2019	15.03.2019	NFR 2014-1	2020/2025/2030/ 2040		
Estonia	13.02.2019	13.03.2019	13.03.2019		15.03.2019	NFR 2014-2	2020/2025/2030		
Finland	15.02.2019	13.03.2019	15.02.2019	15.02.2019	14.03.2019 05.05.2019	NFR 2014-2	2020/2025/2030	01.05.2019	01.05.2019
France	15.02.2019			15.02.2019	15.03.2019	NFR 2014-2			
Germany	12.02.2019	12.03.2019	28.05.2019		15.03.2019	NFR 2014-2	2020/2025/2030	25.04.2019	
Greece									
Hungary	18.02.2019	18.03.2019	18.03.2019		18.03.2019	NFR 2014-2	2020/2025/2030		
Ireland	15.02.2019		15.03.2019		15.03.2019 02.05.2019 07.05.2019	NFR 2014-2	2020/2025/2030		
Italy	01.03.2019	14.03.2019 19.04.2019	14.03.2019		20.03.2019 19.04.2019	NFR 2014-1	2020/2025/2030		
Latvia	15.02.2019	15.03.2019	28.03.2019		15.03.2019 28.03.2019	NFR 2014-2	2020/2025/2030		
Lithuania	14.02.2019	15.02.2019	15.03.2019 02.04.2019		15.03.2019	NFR 2014-2	2020/2025/2030		
Luxembourg	15.02.2019	15.03.2019 26.03.2019 26.04.2019	15.03.2019	15.02.2019 15.03.2019	15.03.2019 24.05.2019	NFR 2014-2	2020/2025/2030		
Malta	18.02.2019					NFR 2014-1			
Netherlands	14.02.2019	04.04.2019	15.03.2019 04.04.2019		15.03.2019 04.04.2019	NFR 2014-2	2020/2025/2030		
Poland	14.02.2019	15.03.2019	15.03.2019		15.03.2019	NFR 2014-1	2020/2025/2030		
Portugal	15.02.2019	15.03.2019 30.04.2019			15.03.2019 30.04.2019	NFR 2014-1			
Romania	14.02.2019	15.03.2019	15.03.2019		15.03.2019	NFR 2014-2	2020/2025/2030		
Slovakia	15.02.2019	15.03.2019	16.03.2019		15.03.2019	NFR 2014-2	2020/2025/2030		
Slovenia	05.02.2019		13.03.2019		14.03.2019	NFR 2014-2	2020/2025/2030		
Spain	13.02.2019		14.03.2019	13.02.2019 14.03.2019 15.03.2019	15.03.2019	NFR 2014-2	2020/2025/2030/ 2040	26.04.2019	26.04.2019
Sweden	06.02.2019		01.04.2019		08.03.2019	NFR 2014-2	2020/2025/2030		
United Kingdom	15.02.2019		15.03.2019		15.03.2019 12.04.2019	NFR 2014-2	2020/2025/2030		

Table 10: Completeness of NECD submissions as of 03rd June 2019.

PARTY	Activity data	Reporting details				
		SO_2, NO_X, CO, NH_3, NMVOC	Cd, Hg, Pb	additional HM	$PM_{2.5}$, PM_{10}, TSP, BC	POPs
Austria	1990-2017	1990-2017	1990-2017		$PM_{2.5}$, PM_{10}, TSP: 1990, 1995, 2000-2017	1990-2017
Belgium	1990-2017	1990-2017	1990-2017	1990-2017	2000-2017	1990-2009 (Total PAHs); 2010-2016
Bulgaria	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017
Croatia	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017
Cyprus	1990-2017	1990-2017	1990-2017	1990-2017	2000-2017	1990-2017
Czechia	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017
Denmark	1980-2017	1985-2017; SO_x: 1980-2017	1990-2017	1990-2017	1990-2017	1990-2017
Estonia	1990-2017	1990-2017	1990-2017	1990-2017	2000-2017; TSP: 1990-2017	1990-2017
Finland	1990-2017	NO_x, SO_x, NH_3: 1980-2017; NMVOCs: 1987-2017; CO: 1990-2017	As, Cr, Cu, Ni, Zn: 1990-2017	1990-2017	1990-2017	1990-2017 (Total PAHs)
France	1980-2017	1980—2017; NMVOCs: 1988—2017	1990-2017	1990-2017	1990-2017	1990-2017
Germany	1990-2017	1990-2017	1990-2017	1990-2017	$PM_{2.5}$, PM_{10}: 1995-2017; TSP: 1990-2017; BC: 2000-2017	1990-2017
Greece						
Hungary	1990-2017	1990—2017	1990-2017	1990-2017	2000-2017	1990-2017
Ireland	1990-2017	NOx, NMVOCs, SOx: 1987, 1990-2017; NH3, CO: 1990-2017	1990-2017	1990-2017	1990-2017	1990-2017
Italy	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017 (Total PAHs)
Latvia	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017
Lithuania	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017
Luxembourg	1990-2017	1990-2017	1990-2017		$PM_{2.5}$, PM_{10}, TSP: 1990-2017	1990-2017
Malta	2000-2017	2000-2017	2000-2017	2000-2017	2000-2017; BC: 2005-2017	2005-2017
Netherlands	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017; PCBs: 1995-1998
Poland	1990-2017	1990-2017	As, Cr, Cu, Ni, Zn: 1990-2017	1990-2017	1990-2017	1990-2017
Portugal	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017
Romania	1995-2017	1995-2017	1995-2017	1995-2017	1995-2017	1995-2017
Slovakia	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017
Slovenia	1990-2017	NO_x, SO_x, CO: 1980-2017; NH_3: 1986-2017; NMVOCs: 1990-2017;	1990-2017	1990-2017	2000-2017	1990-2017
Spain	1990-2017	1990-2017	1990-2017	1990-2017	2000-2017	1990-2017 (Total PAHs)
Sweden	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017; BC: 2000-2017	1990-2017
United Kingdom	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017

ANNEXES

All eight annexes with detailed results are available on CEIP's homepage at:
http://www.ceip.at/ms/ceip_home1/ceip_home/review_results/review_reports

Table 11: Overview of annexes to the Inventory Report 2019

Annexes 2019	
A	Completeness of reported data
B	Analysis of recalculations performed by countries
C	Recalculations of CLRTAP and NECD emission data in 2019
D	Emissions per capita and per GDP comparison of 1990 and 2017 (2000 and 2017 for $PM_{2.5}$ and PM_{10})
E	Comparison of share of sectors between countries for reported pollutants
F	KCA: Comparison EMEP West with EMEP East area
G	Inventory Comparisons between CLRTAP, UNFCCC and NECD data for 1990 and 2017
H	LPS reporting under CLRTAP from 2017-2019

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