MSC-W Technical Report 1/04

Inventory Review 2004 Emission Data reported to CLRTAP and under the NEC Directive
EMEP/EEA Joint Review Report, by Vigdis Vestreng, Martin Adams and Justin Goodwin

Convention on Long-range Transboundary Air Pollution

emep

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

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eea & msc-w

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EMEP/EEA JOINT REVIEW REPORT

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This work has been supported through joint funding from EMEP and the European Environment Agency through its European Topic Centre on Air and Climate Change (ETC/ACC). We are grateful for their interest in the continuous work of improving emission inventory quality.

EXECUTIVE SUMMARY

This first annual LRTAP/NEC emission inventory review has been performed according to the recommendations from the TFEIP/EIONET meeting in 2003 (EB.AIR/GE.1./2004/9).

For the first time, the general annual review of emission inventory quality indicators (timeliness, completeness, internal consistency) has been extended to include a series of more detailed comparability analysis.

This is also the first time that the review of the inventory data has been performed jointly for emission data reported under the Convention on Long Range Transboundary Air Pollution (LRTAP) and the National Ceilings Directive (NEC). As far as it has been possible giving the time constraints of the review process, all pollutants reported to the Convention have been analysed. However, in some of the tests priority has been given to testing the data on main pollutants in order to facilitate the comparison with the submissions under the NEC. It is intended that in the next review round, emissions of Heavy Metals and POPs will be more comprehensively analysed.

The review included data received by the review team by 24th March 2004. Ten review tests were performed that had the aim of assisting countries to optimise their own inventory quality checking routines. These included General Tests that evaluated official submissions of emissions data with respect to due date (timeliness), format of submission, completeness and consistency. Extended Tests including a key source analysis, checked the year to year comparability per country for emission time series (1990-2002), recalculation, country specific implied emission factors and the differences between the LRTAP and NEC submissions. In addition, a test was performed on the geographical coverage of reported gridded data.

The analysis of results has benefited from feedback from bilateral discussions with Parties/Member States. Further discussions are expected in the next meeting of the TFEIP in order to prepare prioritised tasks for an extended in-depth review to be included as part of the Inventory Improvement Programme under the Task Force.

The main messages generated from the review process are summarised below. Results from the general tests are presented first, followed by those from the extended tests. Further details on each review issue are provided in the main body of the report. General recommendations arising from the work are summarised in the final section of the Executive Summary.

Feedback from the review process

- 73% of Parties acknowledged the receipt of information by accessing their respective online review site. Approximately 40% of the Parties participated actively in the review process by returning information to the review team.
- Parties generally appreciated the bilateral contacts of the annual review
- Parties wanted one review document containing all questions. This should be a document easy to share with others, easy to update and print and easy to store. The document should have reference to the deadline and feedback request.

- Parties generally noted that the time allowed for responses was short. The review team should make sure that the result of the review is in future years available by mid April.
- The methodology used for the Implied Emission Factor test should be refined.
- The timeliness of Parties submission of their National Inventory Reports needs to be considered within the time frame of the review.

Timeliness of submissions

- CLRTAP: 55% of submissions from Parties were received on time.
- NEC: 40% of submissions from Member States were received on time.
- CLRTAP experienced a clear improvement in emissions received on time in 2003 when the deadline for submissions was moved from 31 December to 15 February. The improvement was also observed this year. The CLRTAP deadline in February may adapt better to the inventory working routines and data availability in countries. An alternative explanation may also be that as the submissions required under CLRTAP and NEC are similar, some Parties/MS may send just one data submission, timed to comply with the CLRTAP reporting deadline.
- It should be further investigated whether it is possible for the Commission to harmonize the NEC submission deadline with the LRTAP Convention deadline. Harmonisation of the reporting procedures is desirable so that Parties reporting to both bodies might do so with one submission and at the same time.
- Co-operation between the Commission, the UNECE and EEA should be further strengthened in order to eliminate unnecessary formal errors in the reporting.

Format of submissions

- CLRTAP: 94% of the received submissions were in the new NFR format. However of these, only 34% passed the REPDAB format test indicating that the submitted data was not entered exactly as required in the reporting template. NEC: 65% of the received submissions were in the new NFR format. The switch from SNAP to NFR has been successfully carried out, especially by Parties to the Convention.
- The format of submissions do not always agree with the electronic templates. The main reasons for only 34% of submissions passing the REPDAB format tests is that Parties modify the reporting template to facilitate data entry and recording of footnotes. It is recommended that Parties check that their submissions meet the required template format using the REPDAB.
- It should be discussed at the Expert Panel on Review whether footnotes should be reported in the National Inventory Report (NIR) or in another document submitted together with the data.

Completeness

- There has been a significant increase in the information reported to LRTAP in relation to reporting under the 1997 Reporting Guidelines.
- A common trend is observed for most countries and pollutants: The number of reported information increases from 1980 to 1990 and from 1990 to 2000. This trend is illustrated in Figure ES1.
- Reporting of particularly NH_3 in the 1980s, POPs and both $PM_{2.5}$ and PM_{10} should be improved.

- Parties completed between 20-40% of the 100 sectors by emission values for year 2002. The rest are notation keys, zeroes and or blank cells.
- It is difficult to establish the actual level of completeness, because of the definition and use of notation keys is not currently harmonised.
- 23% of the Parties submitted complete datasets for at least one year in 2004.

National totals:
- Completeness for 2002 is about 60% for Main pollutants, 50% for HMs and 40% for POPs and PMs.
- There were no reporting of emissions values for Annex I POPs and DDT in 2002.

Time series 1980-2002:
- 8% of the Parties met the minimum requirement.
- The percentage of unique values does not exceed 25% of the total for any country.
- Completeness of Main pollutants is about 15%.
- No sectors exceed 20% of completeness.

A number of recommendations have been identified to help improve the levels of reporting completeness. These include:
- Parties are kindly requested to report complete time series of emissions data in NFR format, and whenever recalculations are performed.
- Actions to be taken by the TFEIP:
    - Parties should be made aware of the need of reporting notation keys. Notation keys are as important as actual values
    - The TFEIP should agree on a harmonised definition of notation keys
    - Reporting guidelines and spreadsheets should be improved to clarify definition and use of notation keys
- Recommendations for the Expert Panel on Review:
    - Prepare a definition of notation keys compatible with UNFCC to be discussed at TFEIP
    - Initiate work to change the templates of the 2002 Guidelines in order to introduce shading where NA should apply.
- Recommendations for REPDAB: specific improvements that could be made to the completeness checking in REBDAP include:
    - Adjustment to reflect the reporting years required for HMs, POPs and PMs.
    - Removal of incompleteness flags for sectors marked “Other”.

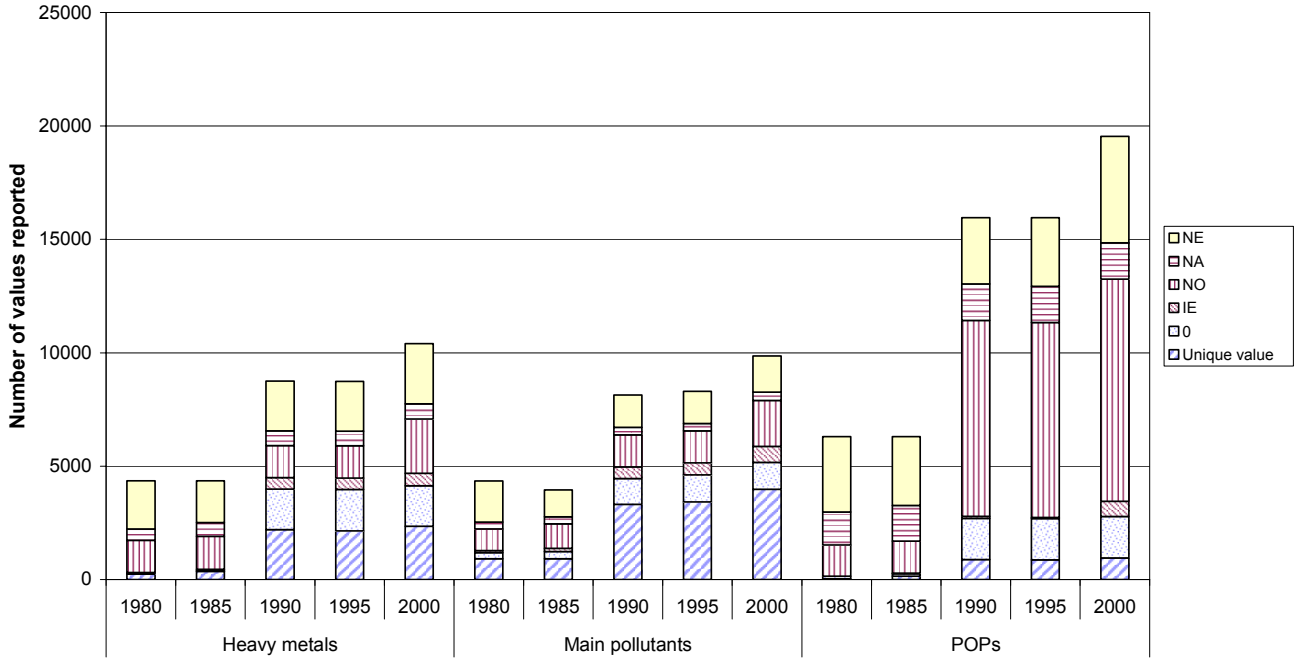

Figure ES1. Illustration of improved reporting levels and use of notation keys by Parties to the LRTAP Convention (note the three pollutant groupings contain different numbers of pollutants).

Consistency

- 30% of the Parties submitted internally inconsistent data to LRTAP, i.e. the sum of sub sectors did not add up to sector or national totals. However, this does not imply that 70% of submissions reported fully consistent data, since consistency checking in REPDAB is linked to the completeness and cannot be performed if an incomplete dataset is reported.
- Parties should be made aware of the need to test their submissions for internal consistency (the task can be facilitated by REPDAB).
- The Expert Panel on Review is recommended to initiate work to review the templates of the 2002 Guidelines in order to introduce colour lines in aggregated levels.
- Specific improvements that could be made to the internal consistency checking in REPDAP include: the Reporting templates should be developed to include automatic "on-the-fly" consistency checking to be performed by Parties while filling in the tables. Such a template development will substitute the existing REPDAB consistency checking when fully implemented. The calculated sub-sector sums from REPDAB should be imported into WEBDAB.

Key source analysis tests

- The key source analysis listed emission sources that contributed the largest fractions of the total emission for Main components and PM emissions and the aggregated result is shown in Table ES1 below.

- Analysis by CIAM allowed the identification of ambiguities in the definition of certain source sectors which results in unharmonised reporting by the Parties, in particular in sectors related to direct soil emissions, manure management and solvent use.
- The TFEIP is recommended to assist Parties to be aware in which sectors there are different interpretations of what emissions should be included, and should propose actions to harmonise reporting in conflictive sectors.
- The Expert Panel on Review is recommended to prepare a template for the NIR to facilitate transparency in reporting emissions in sectors with conflictive NFR definition.

Table ES1 NFR Key Sources per component generalised for all LRTAP Parties

NFR	SOURCE CATEGORY	SO_2	NO_x	NH_3	NMVOC	CO	$PM_{2.5}$	PM_{10}	TSP
1A1a	Public Electricity and Heat Production	■	▒						▒
1A2	Manufacturing Industries and Construction	▒							
1 A 3 b	Road Transport, Heavy duty vehicles /Passenger cars		■		■	■	▒		▒
4 B	Manure Management, Dairy/ Swine			■					
4 D	Agricultural Soils			▒					
3A	Paint Application				▒				
1 A4 b i	Residential plants					▒	■	■	■

Time series tests

- Tests were performed on the data provided in the 2004 LRTAP and NEC submission to identify potential inconsistencies in the time series reported. These were flagged as dips or jumps in the data.
- There is a low level of flagged data that indicated discontinuities in the reported time series. Based on feedback received from Parties, many of the identified dips and jumps in the time series data represent real fluctuations in emissions e.g. changes in power plant and refinery activities, and not errors or inconsistencies (although some confirmed errors were identified).
- CLRTAP: Approximately 0.5% of the reported values were flagged as being potentially inconsistent. NEC: Approximately 0.4% of the reported values were flagged as being potentially inconsistent.
- Most dips/jumps occurred in the agricultural and "energy" sectors, and there are indications that there are real reasons for flagged changes in power plant & refinery activity.
- Most dips/jumps occurred for POPs, followed by HMs and NO_x.

Recalculation

- The recalculation check was designed to indicate significant differences between national totals reported by Parties under NEC and LRTAP in different inventory submission years for the main air pollutant species CO, NH_3, NMVOC, NO_x and SO_2.
- Comparison of emission data from different submission years shows that Parties recalculate their emissions for previous years. These recalculations show small differences in the reported national emission data with a comparison of emission data submitted in 2002 and in 2004 revealing differences in national totals are generally below 10%. However the magnitude of changes may be substantially larger for individual countries.

- Recalculations have on average led to higher emissions of the main pollutants reported in 2004 for the new Member States and to lower reported emissions in the EU15.
- For the New Member States (new EU10) the magnitude of emissions reported to LRTAP has generally increased in the 2004 reporting round compared to the 2002 reports, particularly for CO but also for NH_3 and NMVOC. The increase is generally not larger than 10%. For NO_x and SO_2 the estimates have generally been stable in the 2002 and 2004 submissions over the period 1990-2000 (Figure ES2).
- For the EU15 the magnitude of emissions for CO, NH_3, and SO_2 has generally decreased in the 2004 reporting round with respect to 2002 reports. The largest decrease in the recalculations over the period 1990-2000 is for the reported ammonia emissions (-6% on average) and for the emissions reported for year 2000 for NMVOC (-6%) and SO_2 (-8%). NO_x emission estimates over the period 1990-2000 have also been recalculated but in this case the recalculations in 2004 show steadily higher NO_x emissions over the years than in the 2002 reports (Figure ES2).
- The TFEIP is recommended to make Parties aware of the need to explain the reasons for their recalculations in the NIR.
- The Expert Panel on Review is recommended to prepare a template for information on recalculations to be included in the NIR.

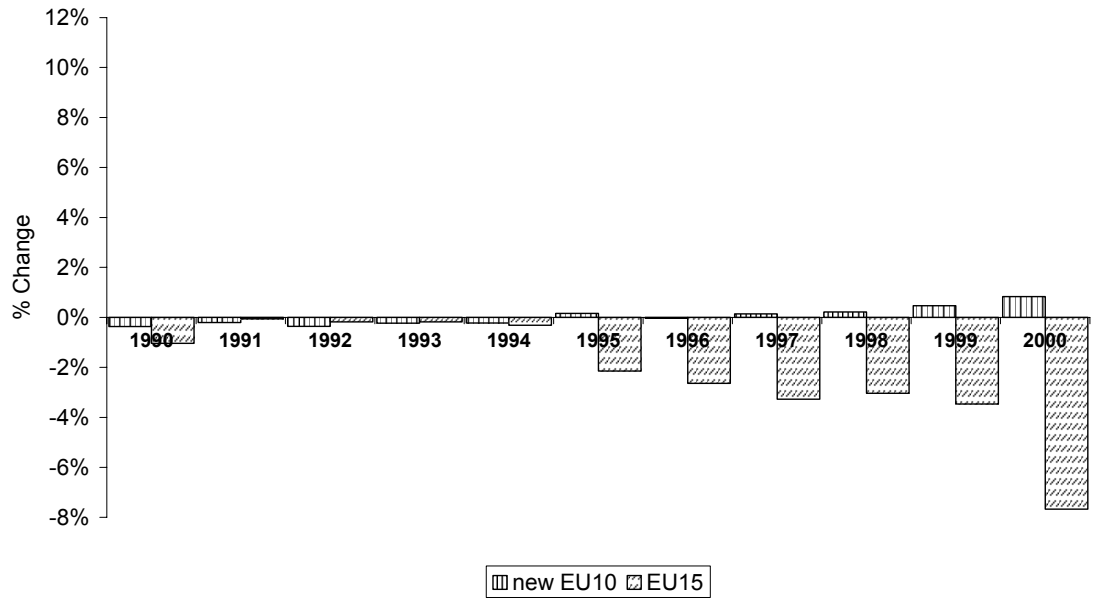

Figure ES2 Change in LRTAP reported national totals for SO_2 by region between the 2002 and 2004 reporting rounds

Implied emission factors

- The objective of the implied emission factors (IEF) check was to identify significant differences in the IEFs derived from emissions data reported by Parties to LRTAP and sectoral activity reported to UNFCCC (i.e. do emissions appear to have been compiled using a broadly similar basis in terms of emission factors?)
- This was the most preliminary test in the Extended 2004 review and used only a basic methodology. When the methodology is fully developed and extended to include other

pollutants such as to include POPs, HMs and particulates, comparison of IEFs could be an important driver for inventory improvements.

- In the initial feasibility test approximately 25% of the tested data was flagged indicating a range of IEFs used by Parties. There is a significant variation in the NH_3 implied emission factors which identifies this area as susceptible to uncertainties and shows lack of harmonisation among Parties.
- The IEF test was hampered by the limited access to activity data and information. It is recommended that the TFEIP establishes links with UNFCCC to allow ready access to up-to-date activity data and that Parties are encouraged to report activity data in order to increase transparency.
- The IEF review needs to involve expertise from different expert panels for the analysis of the implied emission factors and to be linked to the improvement of the EMEP/CORINAIR Guidebook.
- It is recommended to review the guidance for calculating emissions for NH_3. The variability of the implied emission factors, together with the fact that NH_3 showed consistently large recalculations for most countries, seem to indicate that guidance on the calculation of NH_3 emissions might be further required.

LRTAP and NEC inventory comparability

- The aim of this test was to check the consistency of the NEC national totals reported in 2003/2004 with those reported shortly afterwards in 2004 by Parties to LRTAP.
- In general the inventory data reported to LRTAP and NEC data are comparable.
- There were only 10 occurrences where differences in reported data were greater than +/- 0.1%. All 10 occurrences were less than +/- 3% - except for SO_2 emissions from the Netherlands where there was a +17% – 18% difference. These differences will be discussed with the Dutch national expert.

Gridded data boundary check

- Most Parties distribute their emissions spatially within their own territory.
- Poland was the only country reporting emissions larger than 5% of the national total in grid cells outside the country border as defined by EMEP.
- Bilateral discussions have been initiated in order to further increase the accuracy of the gridded data coverage.

General recommendations arising from the review

The 2004 review did not include an in-depth review. Work should be continued within the Expert Panel on Review (EPR) to define such a review which will rely heavily on the provision of timely National Inventory Reports (NIR). The EPR should formalise and further develop the annual review and develop a template for the NIR, the Bodies should adopt the review and clarify the Guidelines, reporting templates and REPDAB to improve countries' ability to report their data. The Parties should adopt the review, take note of the review results and integrate them into their inventories in order to enhance the quality.

More specifically, it is recommended that:

- *For the Expert Panel on Review:*
  Formalise the annual review;

Streamline/develop the review process including improvement of tests and involvement from TFEIP expert groups in review.

- *For Bodies:*
  Adopt the review process;
  Further develop the clarity and accessibility of the reporting guidelines for NEC and CLRTAP;
  Harmonise reporting deadlines for NEC and CLRTAP;
  Further develop the clarity and usability of the reporting tests, templates, spreadsheets and definitions and use of the notation keys.

- *For Countries:*
  Adopt and participate in the review process;
  Making & integrating emission inventory improvements including recommended quality and completeness improvements as well as reporting in the correct data formats and consistent nomenclature (NFR);
  Development of National Inventory Report (NIR) to provide the required transparency of the system.

It is also recommended that the UNECE Secretariat (in co-operation with the Parties) update the Designated List of Emission experts annually before the reporting round as this can improve the number and timeliness of submissions and participation in the review. In addition, the TFEIP should look into the possibility of altering the Guidelines to encourage submission of the NIR together with the data by 15 February so that the NIR can be used in the review.

Content

1 INTRODUCTION

At its twenty-first session, 21st January 2004, the Executive Body of the Convention on Long-range Transboundary Air Pollution recognized the importance of high-quality emission data and strongly encouraged further work on its improvement and validation (ECE/EB.AIR/79, paras. 56 and 60(n)). The Convention's Task Force on Emission Inventories and Projections (TFEIP), in collaboration with the European Environmental Agency (EEA) and the European Commission's Joint Research Centre (JRC), has initiated an Inventory Improvement Programme. The initiative was very much appreciated and supported by DG ENV as it relates as well to emission data submitted under Directive 2001/81/EC of the European Parliament and of the Council on national emission ceilings for certain atmospheric pollutants (NEC Directive)[1]. As part of this programme, a trial review of inventory submissions was performed in 2003. The Task Force agreed at its last meeting (21-23 September 2003, Warsaw) to extend this trial review in 2004. It was further decided to divide the review in Tier 1 (General review) tests and Tier 2 (Extended review) tests (EB.AIR/GE.1/2004.9).

The review of 2004 submissions addressed data submitted before 24th March 2004 in Nomenclature For Reporting (NFR) format both to the secretariat of the Convention, and to the European Commission (NEC Directive). The purpose of the review is to give feedback to Parties of the Convention as well as to EU Member States, on their inventory submission and to provide useful information to users of the emission data about the quality of the inventory. The review consists of checks on timeliness and format, followed by completeness, consistency, comparability and gridded data tests. This first year, the review covers reported emissions of main pollutants (and particulate matter) in more detail than reported emissions of heavy metals and persistent organic compounds because the review includes also a comparison with data reported under the NEC Directive. However, the intention is to extend the review in the next year to equally analyse all pollutants reported to the Convention. The results can be used to prioritise future activities of the Task Force and the European Environment Information and Observation Network (EIONET).

The experiences with the review procedures will be discussed at the 2004 joint EIONET/TFEIP meeting in October. ETC/ACC and MSC-West will present this report on the results of the 2004 inventory review, and the Task Force and EIONET will have the opportunity to give feedback, taking account of comments from the EMEP Steering Body, with the aim of improving review procedures in the following years.

This report discusses first the procedure and the feedback from the review. The main body of the report is divided into two parts based on the nature of the individual review tests contained therein. Each part presents the review tests, results and recommendations in individual chapters named after the tests. Key messages are outlined in the beginning of each chapter. Finally, the conclusions and recommendations are summarized.

[1] OJ L 309, 27.11.2001, p. 22

1.1 Review Procedure

The review procedure and timing for the 2004 review is presented below:

- 21-23 September 2003: The TFEIP agrees to extend the trial review in 2004.
- 31 December/15 February 2004: Submission of emission data to NEC/LRTAP
- 15 February-24 March 2004: GENERAL review tests and data loading
- 24 March 2004-11 May 2004: EXTENDED review tests were performed
- 25 March 2004: Memorandum explaining the review was sent via e-mail to national designated emission experts
- 27 April 2004: EP on Review sends EXTENDED review questions out to all other EPs. Response deadline 9th May. Only one expert panel responded to the review questions.
- 11 May-25 May 2004: Country specific review reports and web site were created
- 25 May 2004: Launch of review web site: *http://www.emep.int/REVIEW/2004/index.html*. Email with passwords and other information sent to designated emission experts.
- 1st July: 36 Parties had logged in to their review site and 19 had replied (Appendix Ia).

1.2 Communication

The bilateral discussions with designated emission experts was hampered by the available contact information. Table 1 in Appendix Ia second column shows that only 36 out of 49 Parties seemed to be contacted (73%). To avoid such problems in the future it is recommended to regularly update the list of designated emission experts to whom information about the review should be sent, and from whom the responses should be expected.

The Review Team sent out information about the 2004 review and provided password access to country specific web pages to all on the list of Designated Emission Experts (Appendix Ib) as available from the UNECE Secretariat. We hope that we have successfully reached all Parties with the information about the 2004 review, but we do not have positive confirmation that the information reached the experts from the following countries: Georgia, Iceland, Ireland, Latvia, Liechtenstein, Lithuania, Luxembourg, Republic of Moldova, Serbia and Montenegro, Slovakia, Slovenia, Switzerland, Turkey and Ukraine. In order to be sure that we have the correct information about Designated Experts and contact details from your country, please check in Appendix Ib the list of Designated Emission Experts that was updated during the 2004 Review. You are kindly asked to send any further updates to Brinda Wachs: *Brinda.Wachs@unece.org*.

1.3 Feedback from the countries

Key messages – Feedback

- *73% of Parties acknowledged the receipt of information by entering their respective review site 39% of Parties responded to the GENERAL tests*
- *30% responded to the EXTENDED tests*

Conclusions and Recommendations

- *Parties generally appreciated the bilateral contacts of the annual review.*
- *Parties wanted one review document containing all questions. This should be a document easy to share with others, easy to update and print and easy to store. The document should have reference to the deadline and feedback request.*
- *Parties generally noted that the time allowed for responses was short. Parties generally noted that the time allowed for responses was short. The review team should make sure that the result of the review is in future years available by mid April.*
- *One Party suggested that the methodology used for the Implied Emission Factor test should be refined*
- *The timeliness of Parties submission of their National Inventory Reports needs to be considered within the time frame of the review*
- *MSC-W/TFEIP/Expert Panel on Review: Update REPDAB and reporting templates*

By 15th of June, 36 Parties out of 49 had logged in to their country specific review site (73%). Of these, 19 had replied to the MSC-W (39%) and 6 had sent back the spreadsheet that contained the extended test results (Appendix Ia). The extended test results were only available for 20 countries due to limited data availability. There was not a strong correlation between Parties that reported data within the deadline this year and Parties responding to the review. In one case, Romania, data were reported for the first time in eight years and for the first time electronically as a direct consequence of the review process itself. Less encouraging was the observation that some Parties that reported emission data to the UNECE before the deadline did not log into the review site. There are at least two factors which could be the reasons for this, lack of communication and lack of time.

1.3.1 Feedback on the review process

- Parties replied that they appreciated the initiation of annual review.
- Parties commented that more time was needed to go through and reply to the extended tests.
- Parties wanted one review document containing all questions. This should be a document easy to share with others, easy to update and print and easy to store. The document should have reference to the deadline and feedback request.
- The National Inventory Reports (NIR) (from the current or previous years) should be scrutinized before the review results are sent to Parties.

1.3.2 Feedback on individual test results

- REPDAB should be updated in order to facilitate completeness and consistency checking.
- Most Parties indicated that data flagged in the comparability tests was explainable.
- The Key Source analysis performed was appreciated by the Parties, and most Parties agreed to the analysis carried out.
- The methodology used for the Implied Emission Factor test should be refined.
- Five Parties advised EMEP to update the country fraction file, other Parties will adjust their reporting of grid cells. Bilateral discussions are underway to secure consistent grid data reporting and assessments.

I GENERAL TESTS

The first part of this report concerns the official submissions of emissions data to the Convention on LRTAP and the NEC Directive with respect to due date, format of submission, completeness and consistency. The review included data received by 24th March 2004. An overview of the 2004 submissions is given in Appendix II. The emission data officially reported to the UNECE is tabulated in EB.AIR/GE.1/2004.10 and available together with activity data and expert estimates, from WEBDAB: *http://webdab.emep.int/*

2 TIMELINESS

Key messages –Timeliness of submissions

- *CLRTAP: 55% of submissions from Parties were received on time.*
- *NEC: 40% of submissions from Parties were received on time.*

Conclusions and Recommendations

- *CLRTAP experienced a clear improvement in emissions received on time in 2003 when the deadline for submissions was moved from 31 December to 15 February. The CLRTAP deadline in February may adapt better to the inventory working routines and data availability in countries. An alternative explanation may also be that as the submissions required under CRLTAP and NEC are very similar, some Parties/MS may send just one submission of data, timed to comply with the CLRTAP reporting deadline.*
- *Whether it is possible for the Commission to harmonize the NEC submission deadline with the LRTAP Convention deadline should be investigated. Harmonisation of the reporting procedures is desirable so that Parties reporting to both bodies can do so with one submission and at the same time.*
- *Co-operation between the Commission, the UNECE and EEA should be further strengthened in order to eliminate unnecessary formal errors in the reporting.*

Timeliness is crucial both with respect to inventory improvement (participation in the review) and in order for emission data to be included in the various assessments that are subsequently performed under the Convention on LRTAP and the European Commission.

2.1 LRTAP

During the 2004 reporting round, 32 parties out of a total of 49 (i.e. 65%) reported emissions data to the UNECE. Twenty-seven Parties of the total (55%) reported by the submission deadline (16th February 2004). The timeliness of submissions increased compared with the 2002 reporting round (33% of all Parties), but was slightly below that achieved in 2003 (59% of all Parties). The reason for the general increase in timeliness compared with 2002 seems to be that the February deadline corresponds better to the inventory working routines in the countries. The reason why the timeliness decreased slightly this year compared to last year, might be due to confusion about data submissions to CLRTAP and the Commission. Three

Parties did not send their submission to the UNECE as they had already submitted data to the Commission and possibly thought that the data would be shared between the two bodies. MSC-W recognized this, and contacted the Parties. Submissions from two of these three Parties were then received by the UNECE. In future, Parties need to make sure that they submit data on time directly to all the bodies requiring data. In addition, co-operation between the Commission, the UNECE and EEA should be further strengthened in order to eliminate unnecessary formal errors in the reporting.

Figure 1 shows the Parties that reported emission data in 2004 before the UNECE database, WEBDAB, was frozen and the review process initiated (24th March 2004). The Parties reporting within deadline are displayed to the left, the others to the right. Parties displayed with black bars submitted data too late to be included in the review. The fourth version of WEBDAB was made publicly available by MSC-W by mid July.

In addition to the 32 Parties reporting emission data in time to be included in WEBDAB and the review, Ukraine, Italy, Greece and Romania also submitted data. These emission data together with updates and revisions from other Parties were received after 24th March and will be taken into account during the next reporting round and the next update of WEBDAB. In total 36 Parties (73% of total) reported emissions data to the UNECE before July 1st 2004. This is the same number as last year.

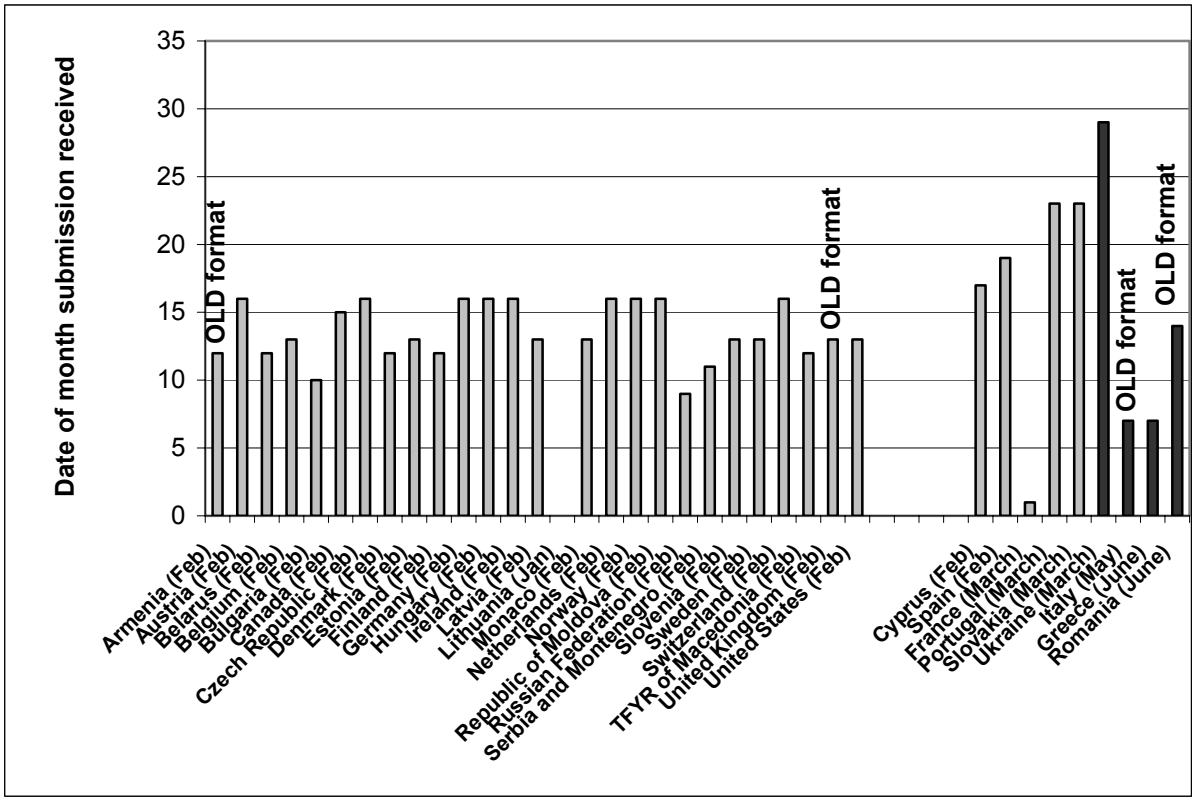

Figure 1 Date of submission to the UNECE for Parties to the CLRTAP. Parties submitting data within the deadline (16th February 2004) are displayed to the left. Parties displayed with black bars submitted their data too late to be included in the review (24th March 2004)

2.2 NEC

Details of the timeliness of submissions under the requirements of the NEC Directive are shown in Figure 2.

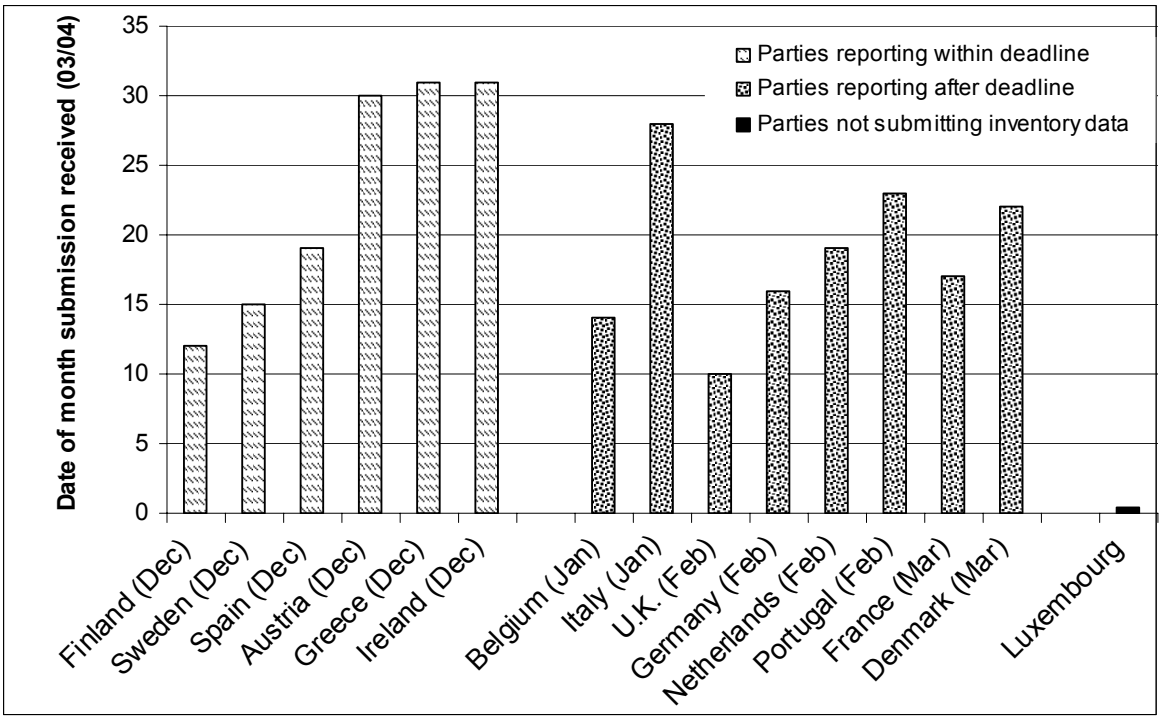

Figure 2 Date that submission by Member States under the NEC Directive was received by the Commission. Parties submitting data within deadline are displayed to the left, the others to the right.

Of the fifteen Member States at the time of the reporting deadline (31 December 2003), only six (AT, ES, FI, GR, IE, and SE) submitted inventory data on time to the Commission.

As of 1 July 2004, a further eight Member States (BE, DE, DK, FR, IT, LU, NL, and UK) had submitted inventory data, but after the reporting deadline. One Member State (LU) had still not reported emissions data to the Commission by this date.

In terms of the data comparability tests that are described in later chapters, data from eight countries (AT, BE, FI, FR, GR, IE, NL, and SE) was received from EEA by the ETC-ACC in sufficient time to allow it to be included in the various review tests for data quality (cut-off date of 24th March 2004).

3 FORMAT OF SUBMISSIONS

Key messages –Format of submissions

- *CLRTAP: 94% of the received submissions were in the new NFR format. However of these, only 34% passed the REPDAB format test indicating that the submitted data was not entered exactly as required in the reporting template.*
- *NEC: 65% of the received submissions were in the new NFR format.*

Conclusions and Recommendations

- *The switch from SNAP to NFR has been successfully carried out, especially by Parties to the Convention.*
- *The format of submissions do not always agree with the electronic templates. The main reasons for only 34% of submissions passing the REPDAB format tests is that Parties modify the reporting template to facilitate data entry and recording of. In addition that they report empty templates and do not fill inn required table heading information correctly.*
- *It is recommended that Parties check that their submissions meet the required template format using the REPDAB.*
- *It should be discussed at the Expert Panel on Review whether footnotes should be reported in the National Inventory Report (NIR) or in another document submitted together with the data.*

The format in which submissions are reported is important for reasons of transparency, consistency and comparability of data hold in the UNECE database, WEBDAB (i.e. all countries should report the same information in the same manner). This facilitates the subsequent use of the inventory data in policy analysis and modelling activities. Reporting data in the specified format also means that the automatic loading of data into a database is possible, therefore minimising any potential errors that might occur if manual reformatting of data is required.

3.1 LRTAP

Thirty Parties (94% of the number of reviewed Parties) reported emissions data for 2002 in the NFR format. Only two Parties, Armenia and Switzerland reported in the old format. This is a clear improvement from last year and indeed encouraging with respect to the success of the adoption of the NFR by the Parties. However, only 11 Parties managed to report their data in the required reporting template. This means that only 64% of the reporting countries could benefit from the automatic consistency and completeness tests from REPDAB. This situation also creates difficulties for the automatic upload of the reported data to the WEBDAB, and might inadvertently introduce errors. Hopefully the detailed feedback each Party has got through the Country Specific Reports (CSR) available on the password protected web site *http://www.emep.int/REVIEW/2004*, will improve the future reporting in this area. 27 parties

out of 32 reported both on-time and in the new format (84%). This means that there is no connection between timeliness and formats and further that reporting in the right format does not necessarily imply delays in the submissions.

3.2 NEC

Of the 13 Member States that had reported emissions data by 1 June 2004, three countries (FI, GR and IT) reported emissions in the old SNAP-based reporting format. Interestingly, shortly after their submissions to NEC, both FI and GR subsequently reported emissions data to LRTAP using the New NFR reporting format. It is not known why they did not also use this format for reporting under the NEC Directive. The remaining 10 Member States all used the required new NFR format for reporting.

4 COMPLETENESS

Key messages – Completeness

- *There has been a significant increase in the information reported to LRTAP in relation to reporting under the 1997 Reporting Guidelines.*
- *A common trend is observed for most countries and pollutants: The number of reported information increases from 1980 to 1990 and from 1990 to 2000.*
- *Reporting of particularly NH_3 in the 1980s, POPs and both $PM_{2.5}$ and PM_{10} should be improved.*
- *Parties completed between 20-40% of the 100 sectors by emission values for year 2002. The rest are notation keys, zeroes and or blank cells.*
- *It is difficult to establish the actual level of completeness, because of the definition and use of notation keys is not currently harmonised.*
- *23% of the Parties submitted complete datasets for at least one year in 2004.*

National totals:

- *Completeness for 2002 is about 60% for Main pollutants, 50% for HMs and 40% for POPs and PMs.*
- *There were no reporting of emissions values for Annex I POPs and DDT in 2002.*

Timeseries 1980-2002:

- *8% of the Parties met the minimum requirement.*
- *The percentage of unique values does not exceed 25% of the total for any country.*
- *Completeness of Main pollutants is about 15%.*
- *No sectors exceed 20% of completeness.*

Conclusions and Recommendations

Parties are kindly requested to report complete time series of emissions data in NFR format, and whenever recalculations are performed.

- *Actions to be taken by the TFEIP:*
  - *Parties should be made aware of the need of reporting notation keys. Notation keys are as important as actual values*
  - *The TFEIP should agree on a harmonised definition of notation keys*
  - *Reporting guidelines and spreadsheets should be improved to clarify definition and use of notation keys*
- *Recommendations for the Expert Panel on Review:*
  - *Prepare a definition of notation keys compatible with UNFCC to be discussed at TFEIP*
  - *Initiate work to change the templates of the 2002 Guidelines in order to introduce shading where NA should apply.*
- *Recommendations for REPDAB: specific improvements that could be made to the completeness checking in REBDAP include:*
  - *Adjustment to reflect the reporting years required for HMs, POPs and PMs.*
  - *Removal of incompleteness flags for sectors marked "Other".*

Completeness of reported data is important both with respect to the comparability, their accuracy (i.e. all sources included) and with respect to the analysis of trends in the emission data (all sources included for all years). If incomplete inventories are reported then any subsequent analysis performed using the data for purposes of, for example, policy analysis or air quality modelling, may lead to wrong conclusions.

We have analysed the completeness of emissions by first looking at the completeness of national totals, thereafter the sector data and finally the use of notation keys. The completeness has been analysed by pollutant, by year, by sector and by most recent year available (2002).

4.1 National totals

In this chapter, we first analyse how the completeness of the national totals has changed from 1980 to 2000 for Main pollutants, Heavy metals and POPs.

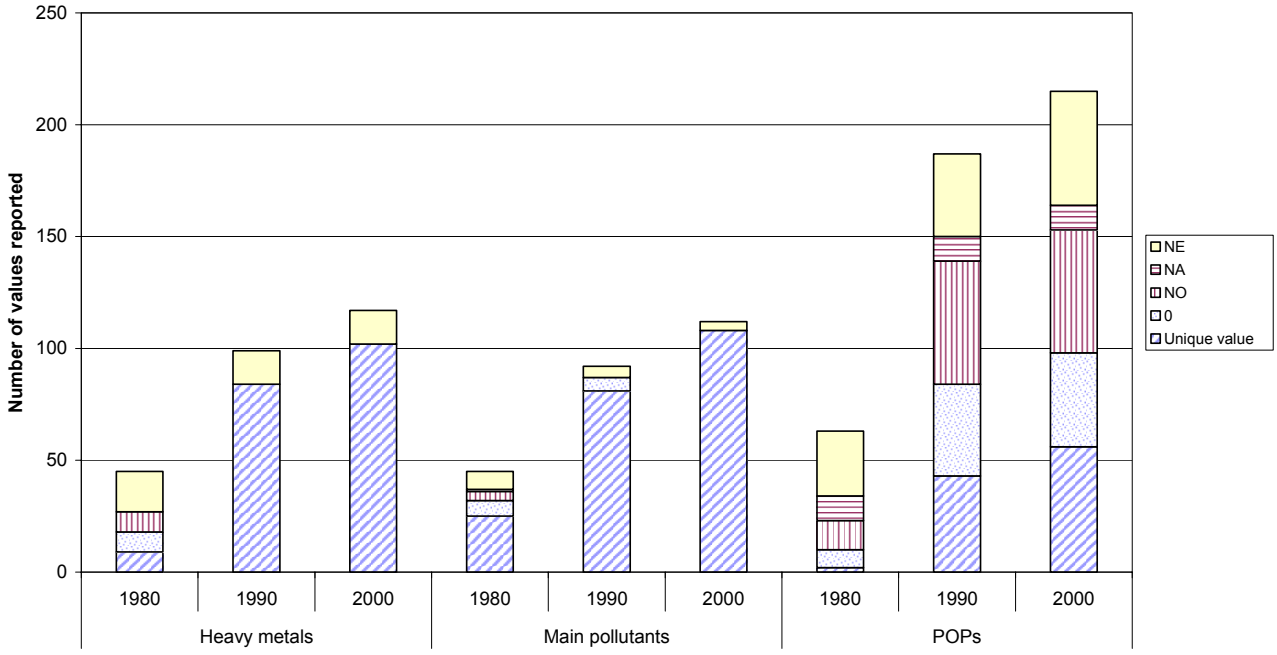

Figure 3. The increase in reporting of unique values and notation flags for national totals by year and pollutant group (note that different pollutant groups comprise different numbers of individual pollutants).

Figure 3 gives an overview of the increase in reporting of national totals from 1980 to 2000 for these three groups of pollutants. It shows the number of unique values reported by countries per year, together with the numbers of zeros and notation keys. The data analysed here are those reported to the Convention in 2004 in NFR format. Please note that different pollutant groups comprise different numbers of pollutants. The amount of reporting should therefore not be compared between pollutant categories. For the Main pollutants, the reporting of unique values has trebled from 1980 to 2000. Reporting of Heavy Metals and POPs is only requested from 1990, but there is some reporting also in the 1980s of these species. The

increase in reporting from 1990 to 2000 is similar between pollutant groups. The reporting of Main pollutants and POPs has increased by approximately 30%, while the increase for HMs is about 20%.

Figure 4 shows in more detail the completeness (in percent of all the Parties to the Convention) of the most recent national totals reported to the LRTAP Convention for Main Pollutants (SO_2, NO_2, CO, NMVOC, and NH_3) from 1980-2000, regardless of reporting year and format. The completeness is seen to be far better in the 1990s than in the 1980s for all pollutants. The completeness of SO_2 is best (or equal to NO_2) during the whole time period, followed by NO_2, CO, NMVOC and NH_3. The completeness of SO_2 and NO_2 is approximately 75% in the 1980s and 90% in the 1990s. The largest increase in reporting has occurred for NH_3. While the completeness of NH_3 is around 35% in the 1980s, the completeness has increased to approximately 75% in the 1990s, about the same completeness as for CO and NMVOC. The difference in completeness between compounds has decreased in the 1990s compared to the 1980, possibly because NH_3 and NMVOC were included in the 1999 Gothenburg Protocol and in the NEC Directive. The reporting of SO_2 and NO_2 reaches 90% in the 1990s. There is a small, unexplainable, and possibly insignificant decrease in reporting of all pollutants between 1995 and 2000.

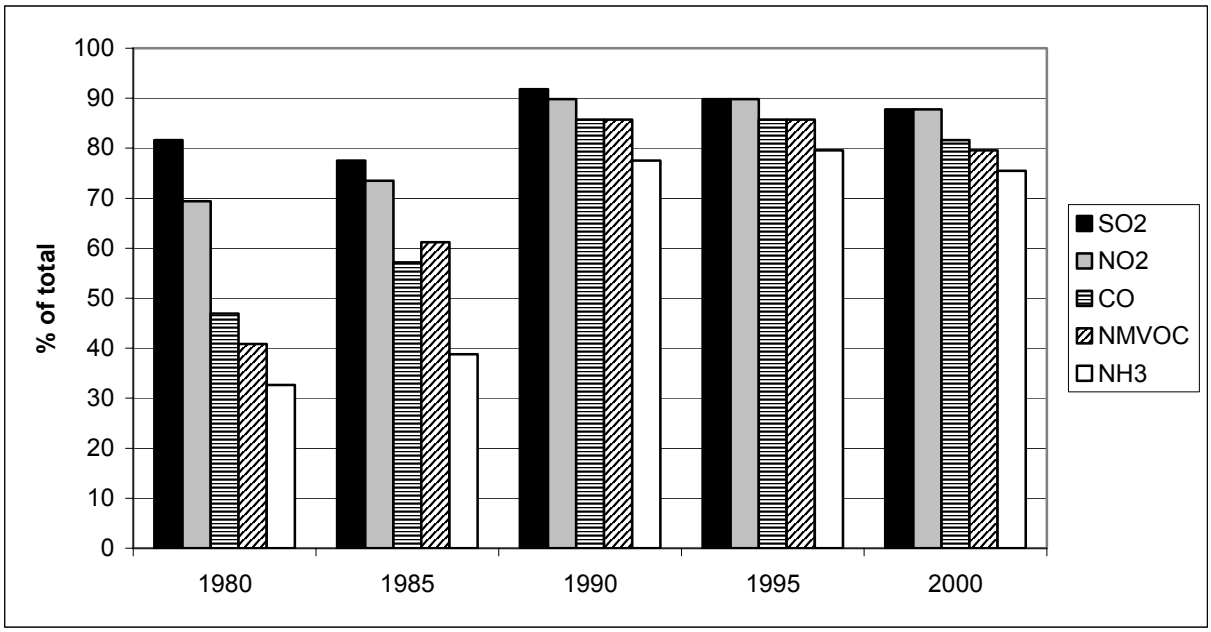

Figure 4 Completeness of national totals reported to the LRTAP convention for emission of Main pollutants from 1980-2000 (%)

Figure 5 below shows the completeness of national totals for Heavy Metals (HMs) and Persistent Organic Pollutants (POPs) from 1990-2000. The completeness is relatively constant over the 10 year period, approximately 70% for HMs and 55% for POPs. Compared to the reporting of Main pollutants, the reporting of HMs and particularly POPs is poor. The reporting of POPs is for instance 30% lower than the reporting of SO_2 and NO_2 for emissions in year 2000.

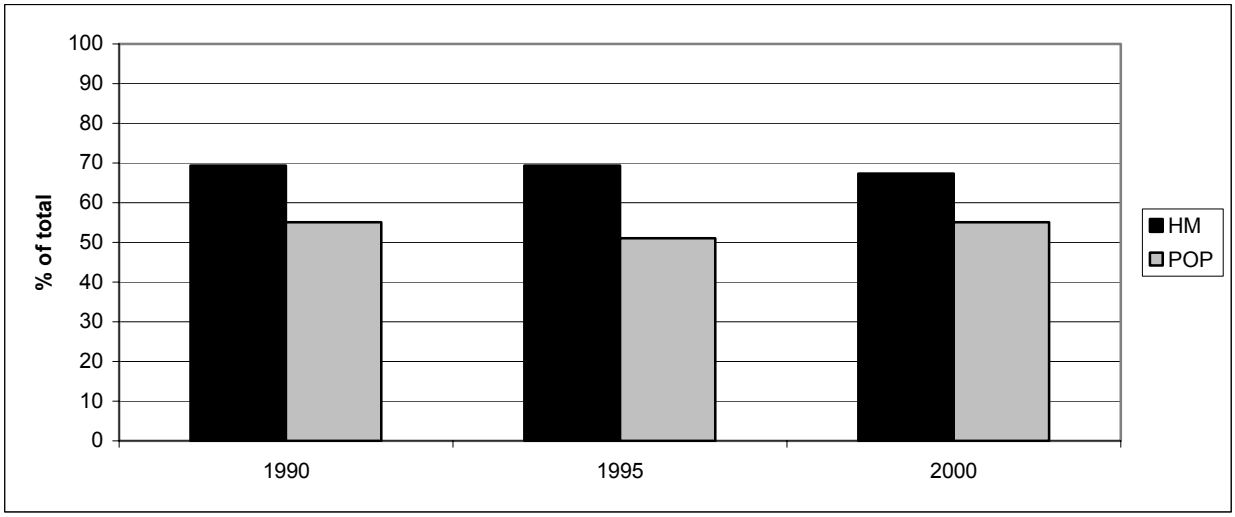

Figure 5 Completeness of national totals reported to the LRTAP Convention for emission of HMs and POPs from 1990-2000 (%)

Figure 6 shows the completeness of the national totals reported to the LRTAP Convention for emissions of PM from 2000-2002. The completeness is below 50% for all the three years for which reporting of PMs is required, and is comparable with the level of completeness for NH_3 in the 1980s. There has been a slight increase in the completeness of TSP and $PM_{2.5}$, while completeness of PM_{10} varies. In order to have consistent sets of PM data for input in modelling assessments, both $PM_{2.5}$ and PM_{10} are needed. The reporting of PMs should clearly be strengthened.

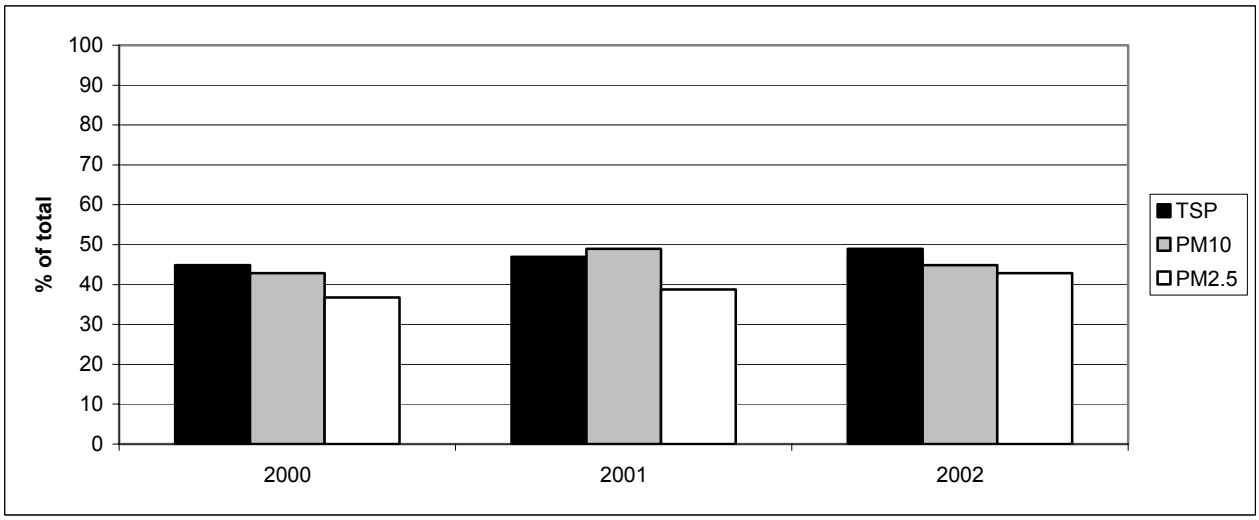

Figure 6 Completeness of national totals reported to the LRTAP Convention for emission of PMs from 2000-2002 (%)

Tables III.1.-III.6 in Appendix III gives an overview of national total emissions used for modelling purposes at MSC-W. The completeness differ somewhat from the completeness of all reported data to the Convention because only Parties within the EMEP modelling domain

are included and because reported data that is flagged in the review is substituted by expert estimates. The grey shaded cells in tables III.1-III.6 shows where there is a lack of official reporting of national totals for Main pollutants and for PMs. Emission figures in bold indicates that there has been recalculations since last year's reporting. The trends for the time period 1980-2002, 2010, 2020 for the individual Parties and the whole EMEP area are also depicted. We see that the same conclusions as arrived above are valid; completeness is generally better in the 1990s than in the 1980s and the completeness is best for SO_2 and NO_2 and worst for NH_3. Further, only 11 Parties (22%) reported both $PM_{2.5}$ and PM_{10} from year 2000 to 2002 as shown in Table III.6. Note that for consistency, reported PM emissions cannot be included in the EMEP modelling assessment unless both PM sizes are reported.

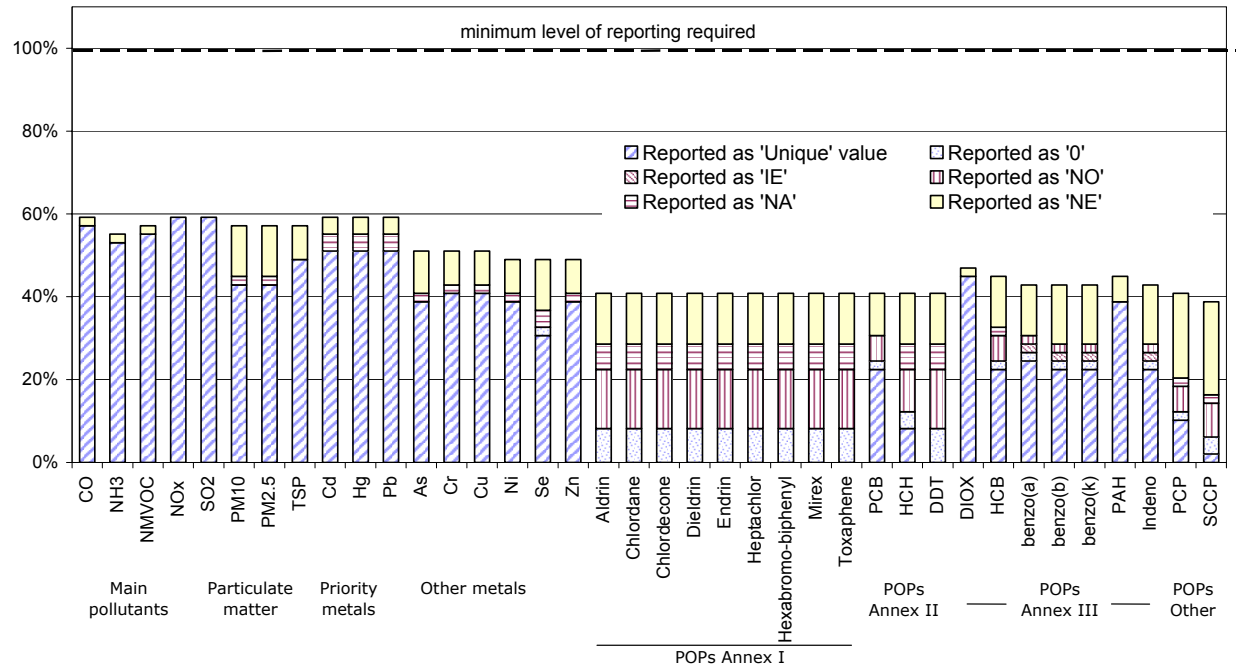

Figure 7 Completeness of national total 2002 emissions reported to CLRTAP before 24th March 2004 (%)

Figure 7 shows the completeness of national total 2002 emissions reported to the Convention before 24th March 2004 in NFR format. It shows the number of unique values reported by countries in 2002, together with the relative numbers of zeros and notation keys. The minimum reporting requirement level i.e. the number of values/notation keys that should be reported by countries in order to meet the required minimum level of reporting is indicated by the 100% line. The level of completeness is indeed lower than for 2000 emissions (see figures 4-6). This is quite normal, as late submissions are not included and some Parties do not manage to report 2002 emissions before 2005, i.e. emissions are reported three years after they are emitted. The UNECE extended the deadline for data submission under the LTRAP Convention in order to facilitate timely reporting from the Parties. As noted in Chapter 2, this has improved the timeliness, but there is still room for improvement. The completeness of pollutant categories for 2002 national total emissions vary between approximately 60% for Main pollutants, about 50% for priority metals and 40% for both POPs (DIOX and PAH) and PMs ($PM_{2.5}$ and PM_{10}). The completeness in general, and for POPs and PMs in particular should be improved.

Regarding the reporting of POPs, we also note that there are no reporting of unique values for Annex I POPs. These are compounds scheduled for elimination, and as far as reporting is concerned, it seems that we had no emissions of Annex I POPs in 2002. Annex II compounds are scheduled for restricted use, and according to the reporting, DDT was no longer in use in Europe in 2002. However, there is a constant 10% of Not Estimated (NE) national total emissions reported, indicating that one should be careful interpreting the results. The reporting of PCB emissions is at the same level as the reporting of Annex III POPs, while reporting of HCH is much lower. Annex III compounds, Dioxins and Furans, are reported to same extent as PMs while the reporting of PAH is somewhat lower but still second largest of the POPs.

4.2 Sectoral emissions

4.2.1 Time series 1980-2002

The data analysed in this section are the CLRTAP 2004 submissions in NFR format of emissions of all pollutants. We have analysed the completeness of the time series 1980-2002 by country, by pollutant, by year and by sector. Further, we have used the REPDAB reports to quantify the number of Parties submitting complete datasets for at least one year in 2004.

Figure 8 gives an overview of the 2004 submissions in NFR format in the period between1980-2002 for Convention Parties. All pollutants required by the LRTAP Convention are included in this overview. It shows the number of unique values reported by countries during this period, together with the relative numbers of zeros and notation keys. The minimum reporting requirement level i.e. the number of values/notation keys that should be reported by countries in order to meet the required minimum level of reporting is indicated by the 100% line. The minimum required level is related to the time frame of each pollutant. Submissions of data beyond that frame will result in completeness values above 100%. The 'additional metals' are included in the 100% threshold level.

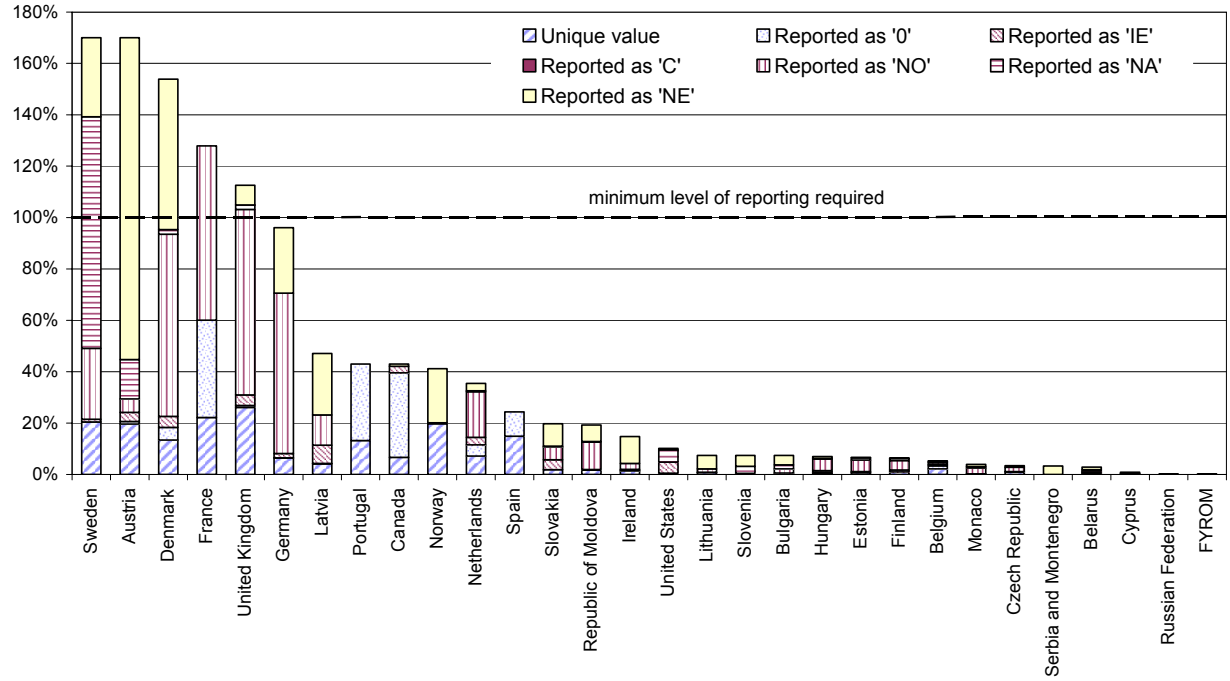

Figure 8 Completeness of LRTAP data for 1980-2002 reporting in 2004: by country

Figure 8 shows the differences in the degree of reporting completeness across the Convention countries for the period 1980-2002. Only four countries (Sweden, France, United Kingdom and (almost) Denmark), i.e. 8% of the Parties, have met the minimum reporting requirements by reporting either an emission estimate or entered a *notation key different from Not Estimated (NE)* where an entry is required in the reporting template for the whole time series 1980-2002. Note that these countries also exceed the minimum reporting requirement by reporting emissions of particulate matter ($PM_{2.5}$, PM_{10} and TSP), POPs and/or Heavy Metals beyond the required minimum timeframe for each pollutant[2].

Of the 10 new Member States, none have met the minimum level of reporting. Of these, Latvia provided the most complete submissions, with approximately 25% completeness. For other countries the reports from Canada exceeded 40% completeness, but for the rest, the level of completeness was 20% or lower.

There are large differences between the numbers of unique values made by each of the Parties, and the notations used to explain absence of estimates. Figure 8 shows that for the whole time series 1980-2002, the percentage of unique values does not exceed 25% of the total for any country, the rest of the reporting consists of zeroes and notation keys. The use of notation keys for emissions in 2002 will be analysed in detail in the next chapter. From Figure 8, we can already conclude that the use of notation keys varies significantly between the countries. Sweden and Austria have reported the same amount of information, so the level of reporting is the same. The level of unique values and zeroes reported is also the same, 20% and approximately zero percent respectively. The distribution of notation keys between Not

2 Main Pollutants should cover the time span from 1980 to latest year. HM should cover the time span from 1990 to latest year. PM should cover the time span from 2000 to latest year. POPs should cover the time span from 1990 to the latest year.

Occurring (NO), Not Estimated (NE) and Not Applicable (NA) is however very different. This may indiate that these countries interpret the notation keys differently, which can hamper the determination of the completeness and make it difficult to compare the completeness between countries.

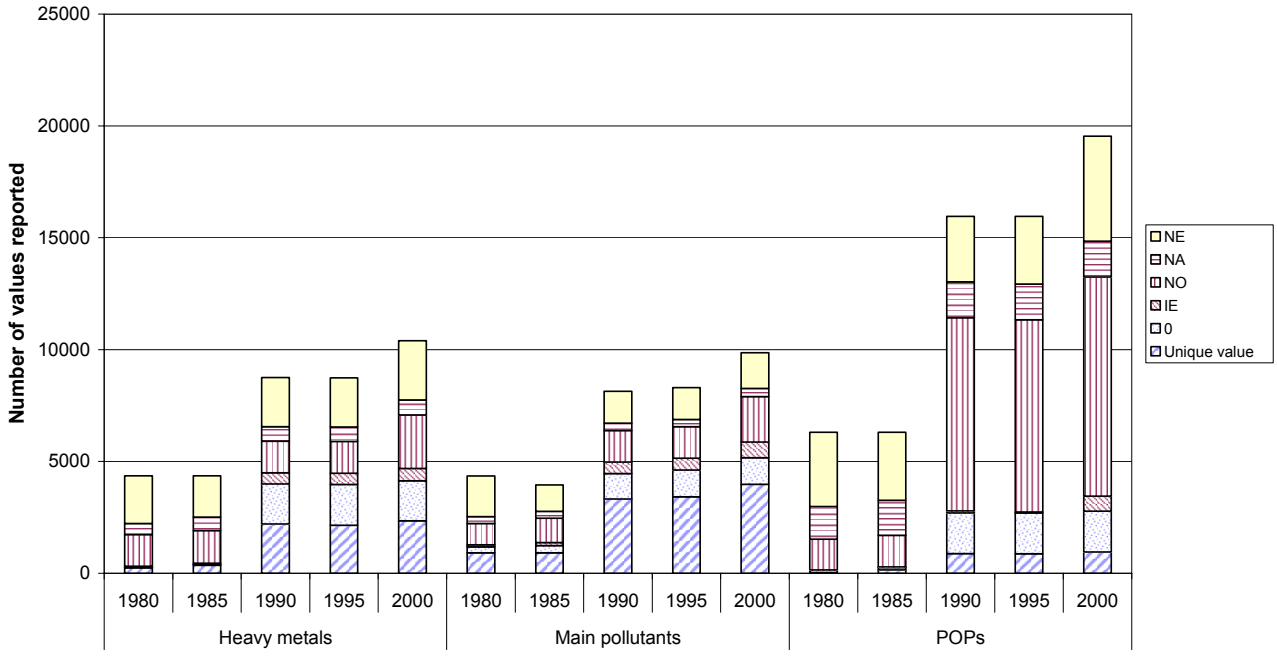

Figure 9 Increase in completeness of LRTAP data for 1980-2002 reporting in 2004: by year and pollutant category

Figure 9 shows the development in completeness of sector data from 1980 to 2000 for data reported to CLRTAP in 2004. For Main pollutants, there is a large increase in completeness from 1985 to 1990. This is probably because 1990 is the base year of the Gothenburg Protocol and for Member States, reporting under the National Emissions Ceilings Directive (NEC) is only requested from 1990 onwards. There is also a large increase in the reporting of sector data for Heavy Metals and POPs from 1985 to 1990, but this is because reporting of HMs and POPs is only requested from 1990 onwards. Between 1990 and 2000, the increase seen in the completeness of national totals (Figure 3) of HMs and POPs, does not seem to be mirrored by the sector data reporting which is fairly constant.

Figure 10 gives an overview of the 2004 submissions in NFR format in the period between 1980-2002 for Convention Parties by pollutant. It shows the number of unique values reported by countries during this period, together with the relative numbers of zeros and notation keys. The minimum reporting requirement level i.e. the number of values/notation keys that should be reported by countries in order to meet the required minimum level of reporting is indicated by the 100% line. The minimum required level is related to the time frame of each pollutant. Submissions of data beyond that frame will result in completeness values above 100%. Figure 10 shows that for the complete time series 1980-2002 (1990-2002 for HMs and POPs, 2000-2002 for PMs), the completeness of Main pollutants is 15%. The completeness of priority Heavy Metals is 25%, while the completeness of Dioxins and Furans and PAH is close to 20%. The completeness of PMs is nearly about 75%. There are evidently countries reporting PMs for more years than required (2000-2002). The reporting of unique values does not exceed 10% except for PMs where it is about 40% i.e. the reporting of notation keys exceeds

the reporting of unique values for all pollutants. Parties are kindly requested to report complete time series of emissions data in NFR format, and whenever recalculations are performed.

Figure 11 shows the level of completeness of sector data from 1980-2002 by sector. There are no sectors exceeding 15% completeness of unique values. Sectors 1A1a, Public Electricity and Heat Production, and 1A4a, Commercial/Institutional, have most complete reporting of unique values. We see however that for e.g. Road Transport, the aggregated sector, 1A3b, is obviously not reported in many cases, as the completeness of the aggregated sector is lower than the sub-sectors. The same is the case with sector 1A4c, Agriculture /Forestry/Fishing and other aggregated sectors. Please remember that REPDAB cannot calculate the aggregated sector sums if one or more of the sectors are reported as NE. In this case the (incomplete) aggregated sector value should be filled in the reporting template. Completeness reaches 20% when zeros and notation keys other than NE are included. The level of NE is about 10% for all sectors, while reporting of other notation keys varies widely. We see further that some sectors have very few if any, unique values reported: 3A-C, Paint Application, Degreasing and Dry Cleaning, Chemical Products, Manufacture and Processing, 4B, Manure Management, 4C, Rice Cultivation, 5B, Forest and Grassland Conversion, 6B, Waste-Water Handling, together with "Other" sectors, 1A4a, Other, Stationary (including Military), 3D, and Other, Solvent and other Product Use 2G, Other Industrial Processes, 4G, Other, Agriculture, and finally memo item X, Volcanoes.

4.2.2 Individual years

Since the 2003 reporting round, a web application, REPDAB, has been available to countries to check the completeness and consistency of submissions in the reporting templates (*http://webdab.emep.int/repdab.html*). REPDAB has been used here to establish the completeness of the reported data in NFR sectors for single years.

In order to fully make use of the tool, the input file to REPDAB needs to be in the reporting format template. As mentioned in the previous chapter, many Parties have modified the reporting template, and therefore they do not receive a full report on completeness and consistency of their report from REPDAB. To facilitate the use of the REPDAB by the Parties in the future, we therefore chose to link the complete REPDAB reports to each Party's Country Specific Report (CSR) after editing of the reported templates.

Table IV.1 second column in Appendix IV shows that only 17% (5 out of 30 submissions in NFR format) of the Parties' 2004 submissions passed all REPDAB tests. Furthermore, information in column three shows that only 23% (7 out of 30) of the Parties reported complete datasets for at least one of the years reported in 2004. The main reason for this low level of completeness per year is that Parties' frequent reporting of Not Estimated (NE) is recorded as an incomplete submission by REPDAB.

Figure 12 and Figure 13 show the year 2002 sectoral level of completeness for Main pollutants and PMs for EU-15 (Figure 12) and for remaining LRTAP Parties (Figure 13).

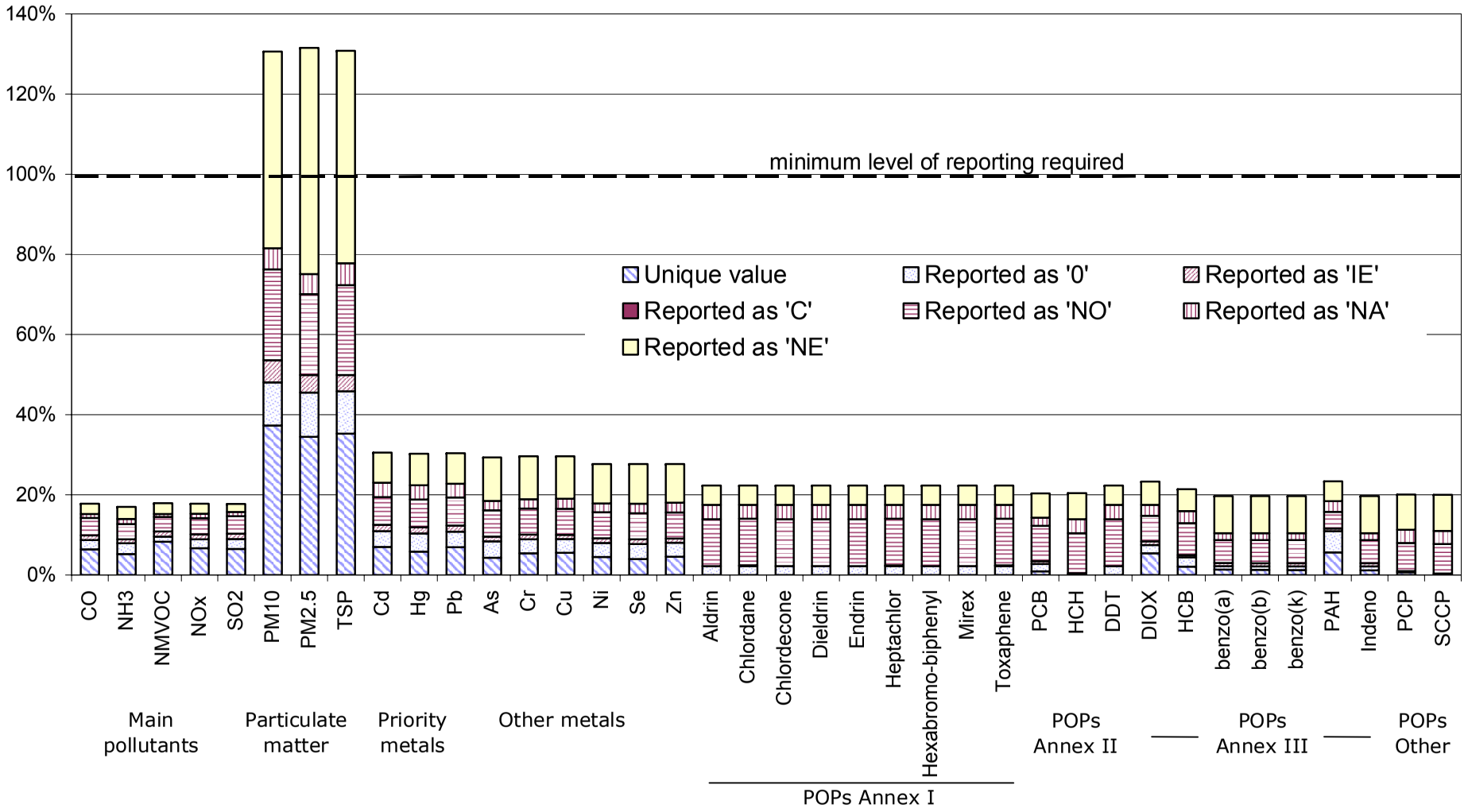

Figure 10 Completeness of LRTAP data for 1980-2002 reporting in 2004: by pollutant

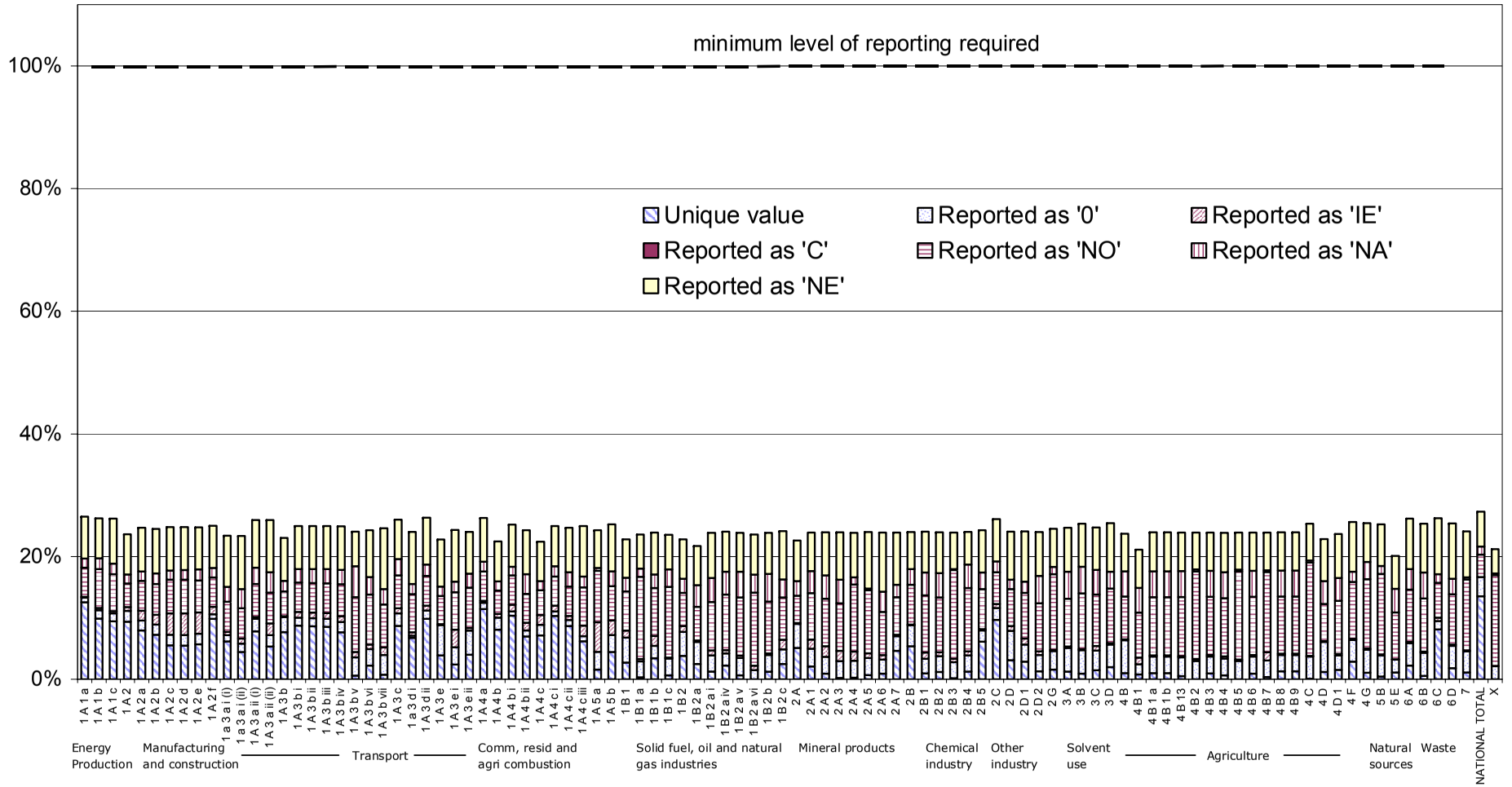

Figure 11 Completeness of LRTAP data for 1980-2002 reporting in 2004: by sector

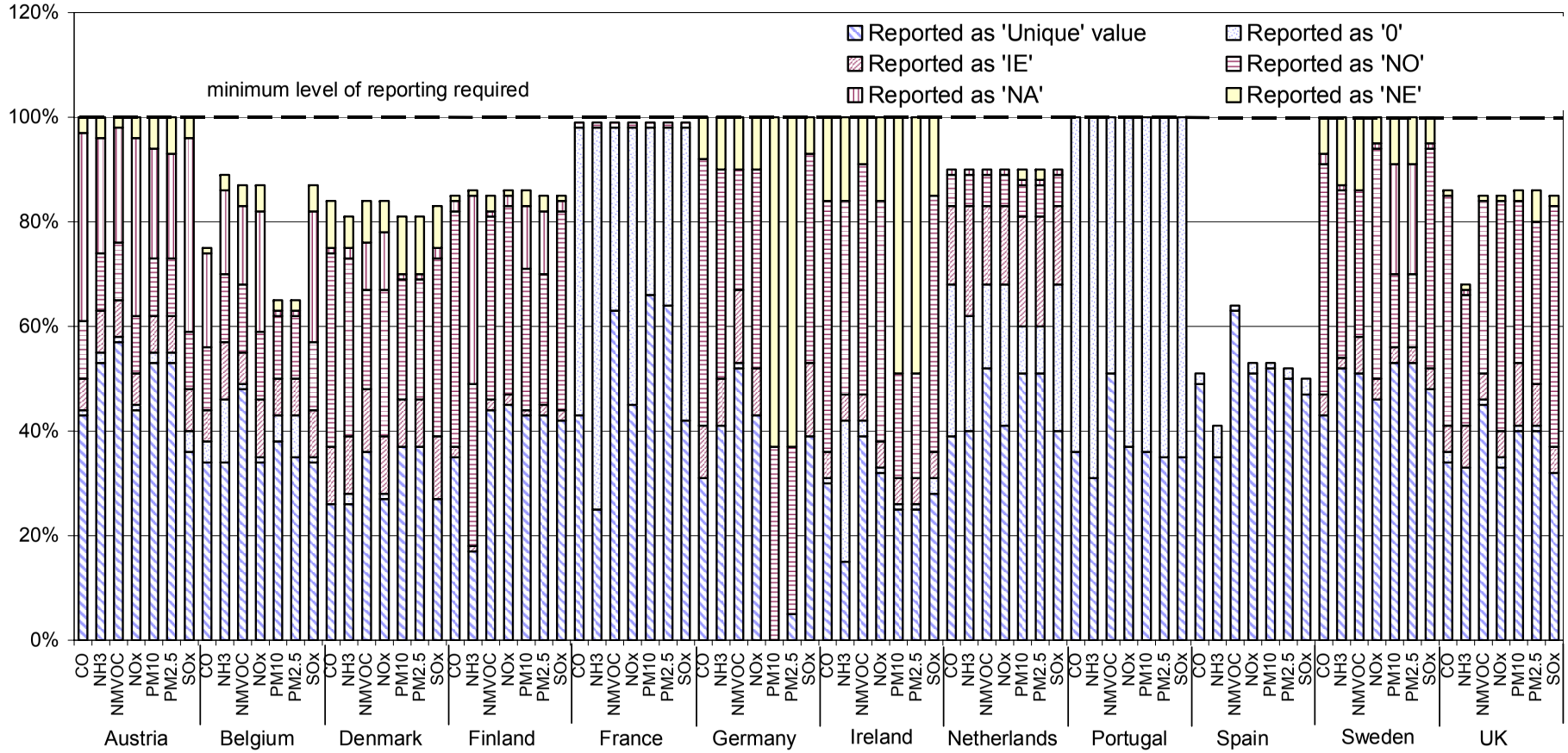

Figure 12 Completeness of year 2002 reporting to the LRTAP for selected pollutants: EU-15

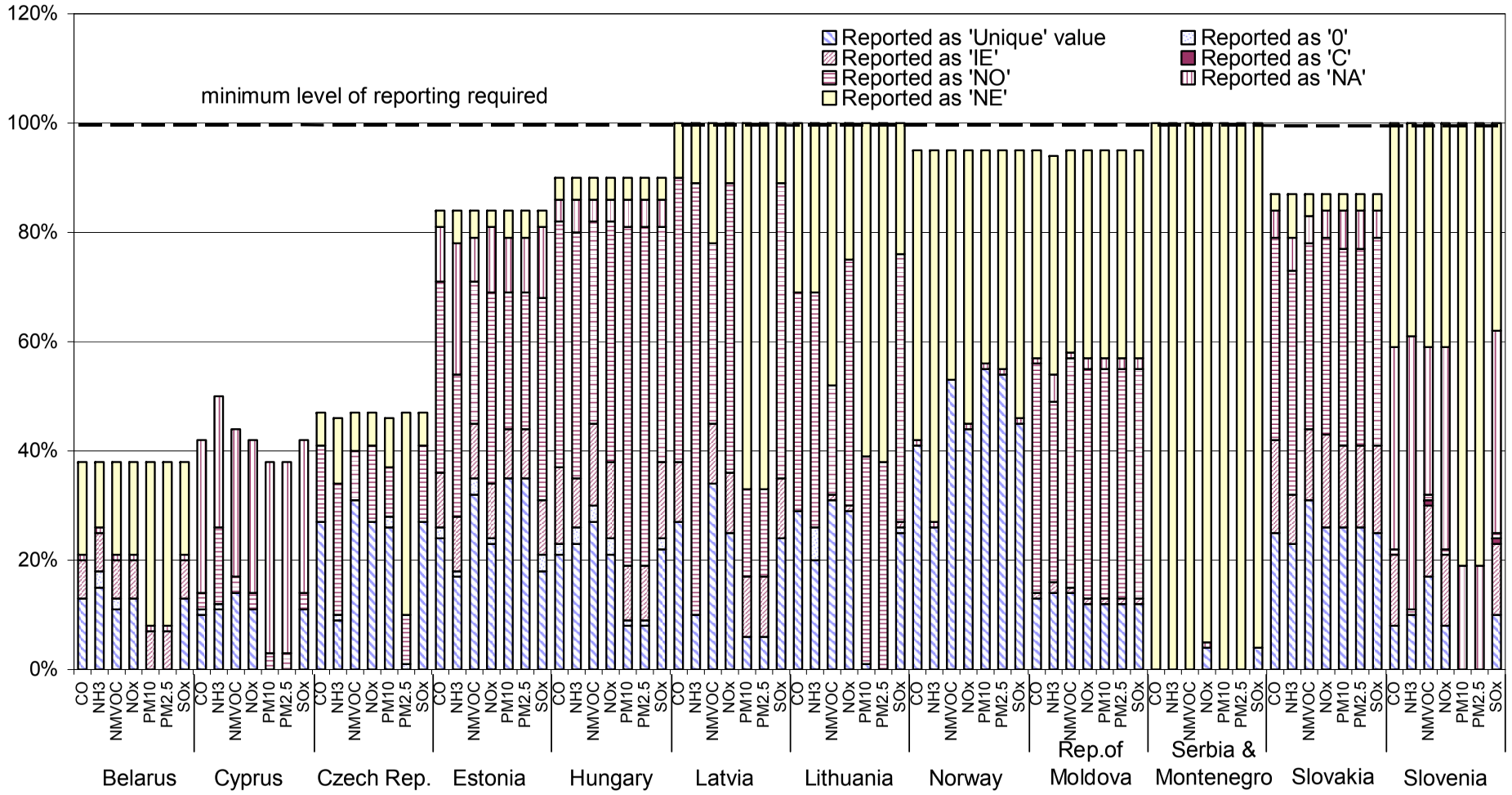

Figure 13 Completeness of year 2002 reporting to the LRTAP for selected pollutants: Remaining Convention Parties

As noted before, few Parties submit 100% complete data. The reporting of unique values, other than zero, differs between the two groups of countries. For EU-15 (Figure 12), there are reported emission values other than zero in 40-45% of the 100 sectors. The rest of the reporting consists of notation keys , zeros and blanks. For the other Convention Parties (Figure 13), the reporting of unique values is less and about 20%, i.e. half of the amount reported by the EU-15 Member States (MS). Only Norway reports emission data to a level comparable with the MS.

On the other hand, this analysis of the completeness of sector data shows that there has been a significant increase in the information reported to LRTAP in relation to the reporting under the 1997 Guidelines. The amount of emission data reported in 2002 was four times larger than before for the EU-15 MS and two times larger for the other Convention countries.

4.3 Notation key use

The introduction of the notation keys in the new Guidelines has to a large extent eliminated the problem previously observed where many blank cells were reported. While there are still countries reporting blank cells, the problem is much smaller than before. Correct use of notation keys might be crucial in order to interpret the completeness of a data submission correctly as pointed out in the previous sub chapter.

The analysis of the use of notation keys is a good way to establish of the level of reporting of emissions ***values*** and on completeness**.** Reporting of Included Elsewhere (IE) requires a separate note submitted together with the emission data, explaining where the data is included. The result of an analysis of the notation key use shows that the use varies widely between compounds and between countries. For some components (notably PMs) some Parties only report notation keys.

An analysis of the reporting of notation keys was carried out for emission year 2002 for Parties reporting emission data to the CLRTAP before 24th March 2004. Figure 12 and Figure 13 show the result for two groups of countries that reported 2002 emission data to CLRTAP. A complete overview per country of the use of notation keys are given in Appendix V, Tables V.1-V.4.

The use of notation keys for the EU-15 MS is demonstrated in Figure 12. We can see that Spain does not use notation keys at all, but reports a value different from zero for all but a few sectors. Germany on the other hand reports only notation keys for PM_{10}.While several MS do not report any "NA" (Not Applicable), Austria report between 20 and 40% of emission data as "NA". Portugal and France report many zeros, and little or no notation keys. 50% of the EU-15 MS report blanks instead of notation keys. The use of notation keys differs also between pollutants. Finland for example, reports more than 60% notation keys for NH_3, while only 40% notation keys for the other pollutants.

The use of notation keys is generally higher in the second group of 'Remaining Convention countries' (Figure 13). Norway is the only country in this group reporting emission data at the same level as the EU-15 MS. In addition, there are more blanks reported. This is not so obvious as countries reporting no notation keys only blanks (The Russian Federation and TFYR of Macedonia) are not included in Figure 13. Other countries excluded from the figure are Canada which reports a substantial amount of zeros, and the US which reports only

Included elsewhere (IE). Otherwise we see the same "features" as for the EU-15 grouping e.g. while Serbia and Montenegro only report values in a few sectors (and pollutants) and "NE" for the remainder, Slovakia and Estonia have a high level of reported values. Cyprus does not report any "NE" or "IE" (but a lot of blanks), while Serbia and Montenegro report 96-100% "NE". Norway does not differentiate between the notation keys and report only "NE". Slovenia is the only Party reporting Confidential (for SO_2, sector 2A1, Cement Production, and NMVOC, 2D1, Pulp and Paper Production) (Not shown in the plots).

In conclusion, reporting of notation keys vary by amount, by pollutant and between countries and country groups. In order to establish the completeness of submissions work on harmonising the use and definition of notation keys is needed.

4.3 Further work

The analysis of completeness and notation keys has shown that:

- In order for the Parties to receive as useful and correct information from REPDAB as possible, it is recommended that REPDAB is updated with respect to reporting years such as completeness is defined for:
  - Main pollutants 1980-"latest year"
  - HMs and POPs from 1990-"latest year"
  - PMs from 2000-"latest year".
- Sectors named "Other" should not be included in the completeness test.
- There is a need to harmonize the use of notation keys among Parties by clarifying the definitions in the Guidelines.
- There is a need to go through the reporting templates and shade cells where emissions are regarded Not Applicable (NA).

5 CONSISTENCY

Key messages –Internal consistency

- *30% of the Parties submitted internally inconsistent data to LRTAP, i.e. the sum of sub sectors did not add up to sector or national totals. However, this does not imply that 70% of submissions reported fully consistent data, since consistency checking in REPDAB is linked to the completeness and cannot be performed if an incomplete dataset is reported.*

Conclusions and Recommendations

- *Actions to be taken by the TFEIP:*
  - *Parties should be made aware of the need to test their submissions for internal consistency (the task can be facilitated by REPDAB)*

- *Recommendations for Expert Panel on Review:*
  - *Initiate work to review the templates of the 2002 Guidelines in order to introduce colour lines in aggregated levels.*

- *Recommendations for REPDAB: Specific improvements that could be made to the internal consistency checking in REPDAB include: the Reporting templates should be developed to include automatic "on-the-fly" consistency checking to be performed by Parties while filling in the tables. The calculated sub-sector sums should be imported into WEBDAB.*

Table 1, column four in Appendix IV shows that according to the REPDAB results, apparently as many as 70% of the Parties reported consistent data. This high number is however connected to the fact that the consistency checks in REPDAB cannot be performed in many cases due to lack of completeness, so the level of inconsistency might be higher. In order to check the inconsistency, there cannot be any missing values among sectors classified as sub-sectors i.e. if sector 1A3biv (Automobile tyre and break wear) is missing in the reporting, sector 1A3b (Road Transport) cannot be calculated by REPDAB as the sum of sub-sectors.

Additionally, a comparison between the calculated sum and the reported aggregated value cannot be done if Parties have not reported the aggregated values. One problem here might be that Parties are not aware how notation keys and blanks are treated by REPDAB. If "NE" (Not Estimated) and or "C" (Confidential) and or blanks are reported, REPDAB will not be able to perform a consistency checking because data is regarded as incomplete. In contrast, if "NO" (Not Occurring) and or "NA" (Not Applicable) and or "IE" (Included Elsewhere) is reported REPDAB converts these notation keys to zero, and calculates the resulting sum of sectors.

Tests on the internal consistency of the sectoral emissions for different pollutants from the same country have not been performed. Such tests are not yet included but it is expected that cross-pollutant consistency checks will be included in future versions of the review.

II EXTENDED TESTS

The review work has used several comparability test diagnostic tools with the aim of assisting countries to optimise their own inventory quality checking routines.

The first comparability test in Chapter 6 looks at Key Sources by listing the sources contributing most to the total for Main components and PM emissions. The data analysed are emissions reported to the Convention on LRTAP in 2004 for emissions in 2002.

The next comparability tests in Chapter 7-10 review the year to year comparability per country for emission time series (1990-2002), recalculation, country specific and average implied emission factors and the differences between the CLRTAP and NEC submissions. A technical description of the review test methodologies is presented in Appendix VII. At least one or more of the tests could be performed for the twenty countries marked in grey in Appendix Ia Table I.1.

6 KEY SOURCE ANALYSIS TESTS

Key messages –key source analysis

- *A key source analysis was carried out on reported data in NFR format.*
- *Analysis by CIAM allowed the identification of ambiguities in the definition of certain source sectors which results in unharmonised reporting by the Parties, in particular in sector related to direct soil emissions, manure management and solvent use.*

Conclusions and Recommendations

- *Actions to be taken by the TFEIP:*
  - *Parties should be made aware in which sectors there are different interpretations of what emissions should be included*
  - *Propose actions to harmonise reporting in conflictive sectors.*

- *Recommendations for Expert Panel on Review:*
  - *Prepare a template for the NIR to facilitate transparency in reporting emissions in sectors with conflictive NFR definition.*

A comparison of key sources between countries and between compounds has been carried out for the 2004 submission of 2002 data. The analysis may also reveal missing sources in one country relative to a neighbouring country. The key source analysis was carried out on officially reported CLRTAP 2002 emission data of SO_2, NO_2, NH_3, NMVOC, CO, $PM_{2.5}$, PM_{10} and TSP. Appendix VI, Table 1-8, tabulates the most important sectors contribution to the national total emissions. The source sector definitions are given in Appendix VI, Table VI. 9. An overview of the results is given in Table 1 below. This analysis is planned to be extended to include HMs and POPs next year.

Table 1 NFR Key Sources per component for all LRTAP Parties[3]

NFR	SOURCE CATEGORY	SO_2	NO_x	NH_3	NMVOC	CO	$PM_{2.5}$	PM_{10}	TSP
1A1a	Public Electricity and Heat Production								
1A2	Manufacturing Industries and Construction								
1 A 3 b	Road Transport, Heavy duty vehicles /Passenger cars								
4 B	Manure Management, Dairy/ Swine								
4 D	Agricultural Soils								
3A	Paint Application								
1 A4 b i	Residential plants								

The Key Sources in terms of NFR sector codes are listed in the first column of table 1, with the description of the source sector is given on column two. The compounds analysed follow in the preceding eight columns. The darker the colour, the larger contribution to total emissions for the individual sectors and compounds.

6.1 Sulphur dioxides

For SO_2, the primary key source reported by 76% of reporting Parties is sector 1A1a, 'Public Electricity and Heat Production'. Norway and Canada report 'Metal production' to be the largest SO_2 source, while Austria, Monaco and Moldova report the largest SO_2 emissions occurring in sector 1A4bi, 'Residential plants'. Belarus is the only country reporting sector 1A3b, 'Road Transport', to be the largest sulphur dioxides source. The second largest source is sector 1A2, 'Manufacturing Industries and Construction'. 52% of the Parties report this sector to be the second most important sector.

6.2 Nitrogen oxides

The primary key sector is sector 1A3b, 'Road Transport'. 59% of the Parties report this sector or its sub-sectors as the main key source. Sector 1A3biii, 'Road Transport, Heavy duty vehicles' is the main sub-sector, together with sector 1 A 3 b i 'Road Transport, Passenger cars'. The next most important sector is sector 1A1a, 'Public Electricity and Heat Production'. Norway and Monaco are the only two Parties reporting other sectors as the main emitting sector. They report sectors A 4 c iii, 'National Fishing' and 1 A 3 d ii, 'National Navigation' as the most important NO_2 sources.

6.3 Ammonia

81% of reporting Parties reported sector 4 B, 'Manure Management', as the main source of ammonia. The sub-sector, 4 B 1 a, 'Dairy', was the main contributor, followed by sector 4 B 8, 'Swine'. Lithuania, Norway, Portugal and Spain report sector 4 D, 'Agricultural Soils', to be primary Key Source. Monaco report sector 1 A 3 b i, 'Road Transport, Passenger cars' to be the largest ammonia source.

[3] Largest contribution to total emissions occurs from the darkest coloured sectors

6.4 Non-Methane Volatile Organic Compounds

The key sector is 1 A 3 b, 'Road Transport' (52% report this sector as the main emitting sector). There are many different sectors also reported as important, and there are also seven Parties (Austria, Bulgaria, France, Ireland, Portugal, Spain and United Kingdom) reporting emissions in sector 5E, 'Other not included in the national total'. Unfortunately the activity causing these emissions is not explained by countries other than France. In France the main contributor to sector 5E is emissions from trees. Emissions are also reported as important in sector 3 D, 'Other, Solvent and other Product Use', by Austria, Germany, Ireland, and the United Kingdom without a note explaining the activities included. Finally, sector 3A, 'Paint Application', has been reported to be an important sector next to Road Transport by many countries.

6.5 Carbon monoxide

Sector 1 A 3 b i, 'Road Transport, Passenger cars' is clearly the most important CO emission source. 82% report emissions connected to Road Transport as the Key Source, while 50% of the Parties specify further the emissions to come from passenger cars. The second most important is sector 1 A 4 b i, 'Residential plants'.

6.6 Particulate matter ($PM_{2.5}$)

The Key Source is 1 A 4 b i, 'Residential plants', according to the reporting. 50% of Parties reported this sector as the main emitting sector, while Road Transport, particularly emissions from passenger cars (sector 1 A 3 bi) is reported as the second most important.

Exceptions are provided by Belgium where 'Metal Production' (Sector 2C) is most important in terms of $PM_{2.5}$ emissions. Emissions from sector 1 A 2, 'Manufacturing Industries and Construction', are most important in Ireland and Slovakia, while 1 A 4 c ii 'Off-road Vehicles and Other Machinery', emits most $PM_{2.5}$ in the Netherlands and Spain. The Russian Federation report 1 A 1 a, 'Public Electricity and Heat Production' and 1 A 2 a, 'Iron and Steel' to be the most and second most important sectors respectively.

There also seems to be a difference between Europe and Canada in the source distribution, as Canada report sector 1 A 3 b vii, 'Road Transport, Automobile road abrasion' to be the most important for both $PM_{2.5}$ and PM_{10} emissions.

6.7 Particulate matter (PM_{10})

The Key Source is 1 A 4 b i, 'Residential plants', according to the reporting. 50% of Parties reported this sector as the main one. It is difficult to define a second most important sector from the reported data: these range from 1 A 2, 'Manufacturing Industries and Construction' (Ireland, Slovakia and Spain) to 1 A 3 b, 'Road Transport' (Canada, Estonia, Finland and Sweden) to 4 B 9, 'Poultry' (Netherlands and Spain).

6.8 Total Suspended Particulate matter (TSP)

The Key Source for TSP is 1 A 4 b i, 'Residential plants'. 25% of Parties reported this sector as the main sector. Emissions from sector 1 A 1 a, 'Public Electricity and Heat Production', and 1A1b, 'Road Transport', are also important.

6.9 Key sources in different regions

While Table 1 illustrates the key sources for the whole of the EMEP region, Table 2 shows the key sources for western European countries. There are some clear differences. For NO_x we see the effect of regulations in the transport sector leading to a switch in the order of the most important NO_x source from transport for the whole of EMEP to power plant in Western Europe. Source sector allocation for NH_3, NMVOC, PM_{10} and TSP illustrates a problem covered in more detail in the next section. Emissions are reported in a multitude of sectors, notably in sectors marked "other" because Parties find it difficult to allocate emissions to the sectors subscribed in the reporting templates. Moreover, while sector 4D, 'Agricultural soils', turned out to be a key source looking at the whole of EMEP, this sector does not appear in Table 2.

Table 2 NFR Key Sources per component for western European countries

NFR	SOURCE CATEGORY	SO_2	NO_x	NH_3	NMVOC	CO	$PM_{2.5}$	PM_{10}	TSP
1A1a	Public Electricity and Heat Production	■	■						Multitude of different sources
1A2	Manufacturing Industries and Construction	▒							
1 A 3 b	Road Transport, Heavy duty vehicles / passenger cars		▒		▒	■	▒		
4B1	Manure Management, Cattle			■					
4B8	Manure Management, Swine			▒					
3D	Other				■				
1 A4 b i	Residential plants					▒	■	▨	

6.10 Ambiguity in allocation of emission sources

Between November 2003 and June 2004, the CIAM group at IIASA carried out a series of bilateral consultations with national experts. These meetings were part of the European Commission CAFE program and were organized in order to compare and review the national assumptions employed in RAINS IAM model including verification of the base year (2000) emissions. For the latter purpose, national submissions to the UNECE LRTAP Convention, NEC Directive and RAINS model estimates were compared and analyzed. The arising discrepancies were thoroughly discussed during the consultation meetings.

Some of the issues brought up during these bilateral discussions were common to a number of countries. These includes difficulties or differences in allocating some emission sources to specific NFR codes. In other words, the interpretation of the NFR categories varied between countries. Examples would include such sectors as 4D1 (Direct soil emissions) where for ammonia most countries included emissions from nitrogen mineral fertilizers while some

added also losses of N from organic fertilizers (the former countries included them in the manure management categories (4B1, Cattle to 4B13, Other, Manure Management)). Another problem was observed for the categories 3C, Chemical Products, Manufacture and Processing and 3 D, Other, Solvent and other Product Use (including products containing HMs and POPs) where a large number of solvent use sectors was typically included; consequently due to this aggregation it was very difficult or impossible to verify these estimates without detailed background documentation.

The difficulties or differences in allocating some emission sources have been initially discussed within the Expert Panel on Review and as a follow up of the consultations a short questionnaire addressed to the national experts will be distributed shortly. Results of that questionnaire will be summarized at a special session of the forthcoming TFEIP meeting. Further on, during that session, there will be possibility to discuss these issues in greater detail and seek immediate solutions prior to introduction of any changes in the reporting format.

7 TIME SERIES TESTS

Key messages – Time series dips and jumps

- *There is a low level of flagged data that indicates discontinuities in the reported time series. Based on feedback received from Parties, many of the identified dips and jumps in the time series data represent real fluctuations in emissions e.g. changes in power plant and refinery activities, and not errors or inconsistencies (although some confirmed errors were identified). The level of flags is expected to be larger is reported data from different submission years is mixed.CLRTAP: Approximately 0.5% of the reported values were flagged as being potentially inconsistent.NEC: Approximately 0.4% of the reported values were flagged as being potentially inconsistent. Most dips/jumps occurred in the agricultural and "energy" sectors, and there are indications that there are real reasons for flagged changes in power plant & refinery activity.*
- *Most dips/jumps occur for POPs followed by HMs and NO_x*

Tests were performed on the data provided in the 2004 LRTAP and NEC submission to identify potential inconsistencies in the time series reported. These were flagged as dips or jumps in the data. An explanation of the calculation methodology used is provided in Appendix VII. The initial test results were subsequently manually reviewed by members of the TFEIP Expert Panel on Review Panel to remove instances where reasons for the change in trend were already known.

Such tests help to provide an overview across countries, pollutants and sectors regarding comparability of data. Values flagged as dips or jumps, may be explained by significant changes in activity data used by Parties to derive emission estimates (e.g. removal of lead from leaded petrol), or could reflect potential errors in estimation for a single year(s) within the time series. By helping Parties identify potential errors in the time series data, these tests help countries improve the quality of their submitted inventory data.

7.1 LRTAP time series test results

The graphs in this section involve discontinuities larger than 3% of the reported values in the time series in which they belong (i.e. defined as a dip or jump). These graphs also indicate the general level of reporting (in terms of the number of individual time-series reported by countries). Only data provided in the 2004 submissions have been included in these tests.

A total of 83,220 values were reviewed. There were 407 flags identified. Obviously the thresholds of the automatic checks can be adjusted to generate a greater (or fewer) number of flags. However, in terms of the review results it was felt that this approximate number of flagged values is about correct.

Figure 14 provides an analysis for all LRTAP countries, showing the number of flagged data points expressed as a percentage of the number of total values reported (excluding blanks

cells, and cells where zeroes were reported). The percentage of flagged values is low, typically below 1% of reported values.

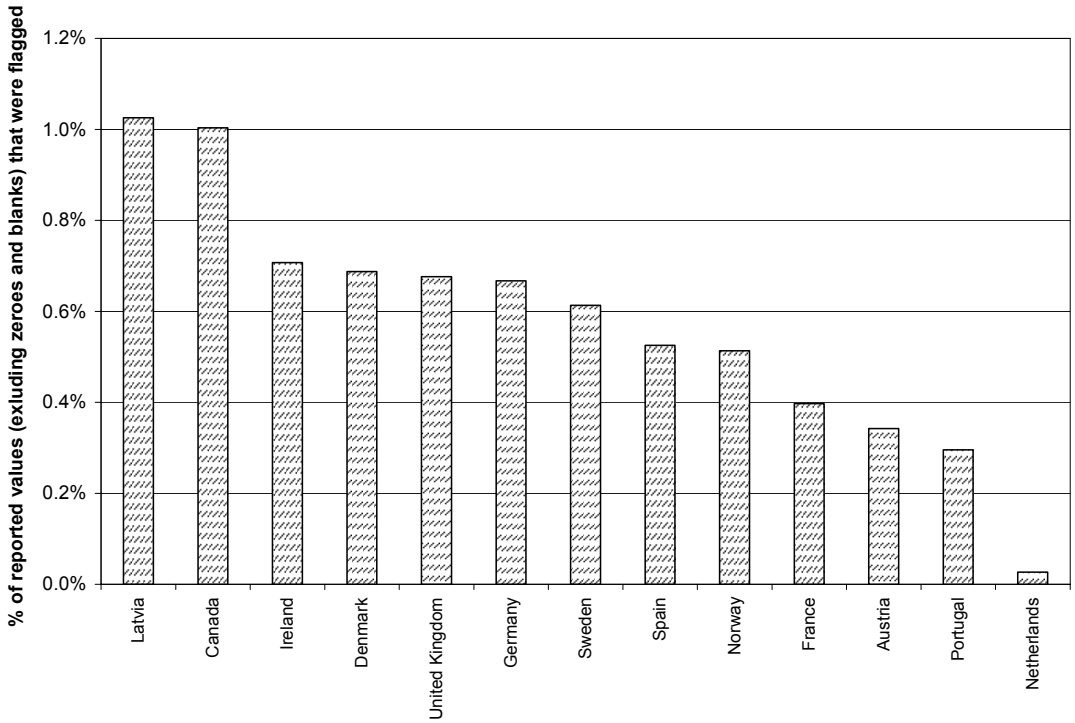

Figure 14. Number of flagged dips and jumps as a percentage of the number of values reported by country: 2004 reported data, 1990-2002.

Potential inconsistencies were identified in the reported data from the 13 countries shown in Figure 13. The level of potential inconsistencies in the time-series that were detected ranged from 0% to over 1% (for Latvia and Canada), when the number of flagged values were expressed as a percentage of the number of values reported (excluding emissions reported as zero, or blanks). The majority of other countries for which dips and jumps were identified had levels of flagged values between 0.3% and 0.7% of the total number of reported values.

Test results are also shown below in Figure 15 by pollutant. This figure enables the levels of consistency (based on the number of dips and jumps) to be identified for specific pollutants.

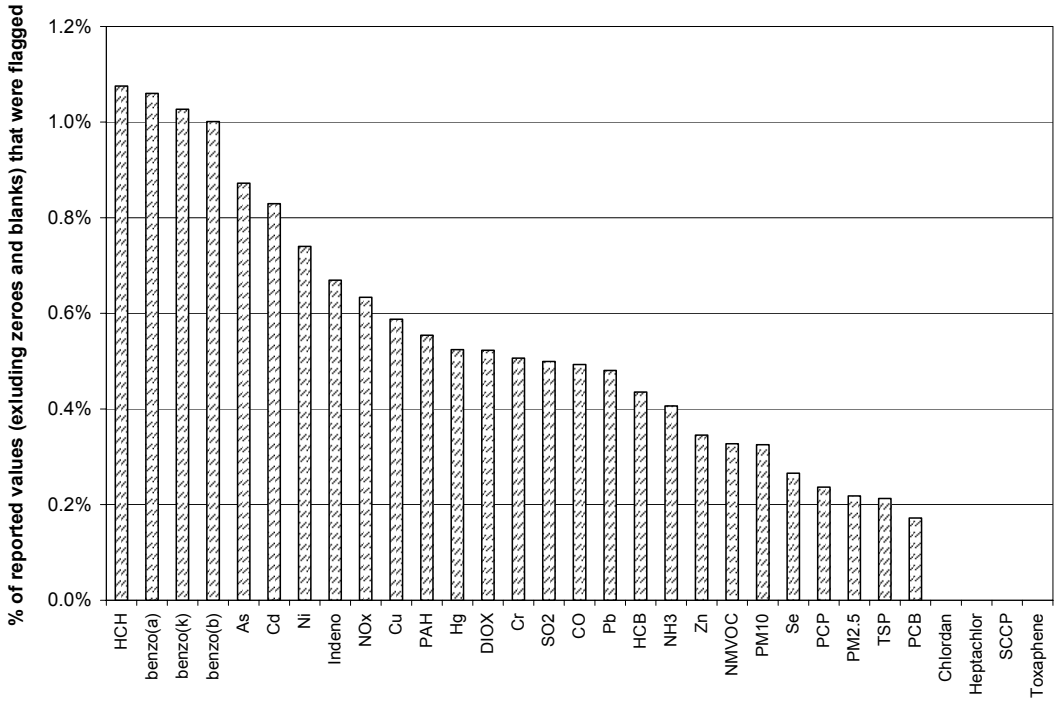

Figure 15. Number of flagged dips and jumps as a percentage of the number of values reported by pollutant: 2004 reported data, 1990-2002.

On a percentage basis (number of flagged points as a percentage of the total number of reported values for an individual pollutant) HCH, the benzene derivatives, and the heavy metals As, Cd and Ni had highest levels of flagged values (>0.7% of the number of total reported values for these pollutants). This is likely to be due in part to the difficulty in estimating emissions for these species, which itself is indicated by the relatively low level of reporting of these components compared for example, with the main pollutants. The main pollutants, which are far better reported, have a lower percentage rate of inconsistencies identified, approximately 0.3% – 0.6%.

In the same way that reported data by pollutants has been assessed in the above graphs, data can also be assessed on a sectoral basis. A sector overview can be seen in Figure 16. Such analysis may be able to identify sectors where reporting of data is not as consistent (based on number of dips and jumps) relevant to other sectors.

There is clearly a wide variation in the number of emission estimates reported for each sector. Again, as was seen in the previous figure, there is a tendency for the sectors with low levels of reporting (and for which calculating emissions may be more difficult); to have relatively higher levels of flagged values. In particular, a number of agricultural sectors (NFR sector code 4-*xx*) were flagged as having relatively high levels of potential time series inconsistencies. However, interestingly, the sector which had the highest number of reported values (1 A 1 a - Public Electricity and Heat Production) also had a high proportion of flagged values (2.1%). The reasons for the high number of flagged values in this sector are not known. may reflect the actual discontinuities that could be expected to occur in this sector.

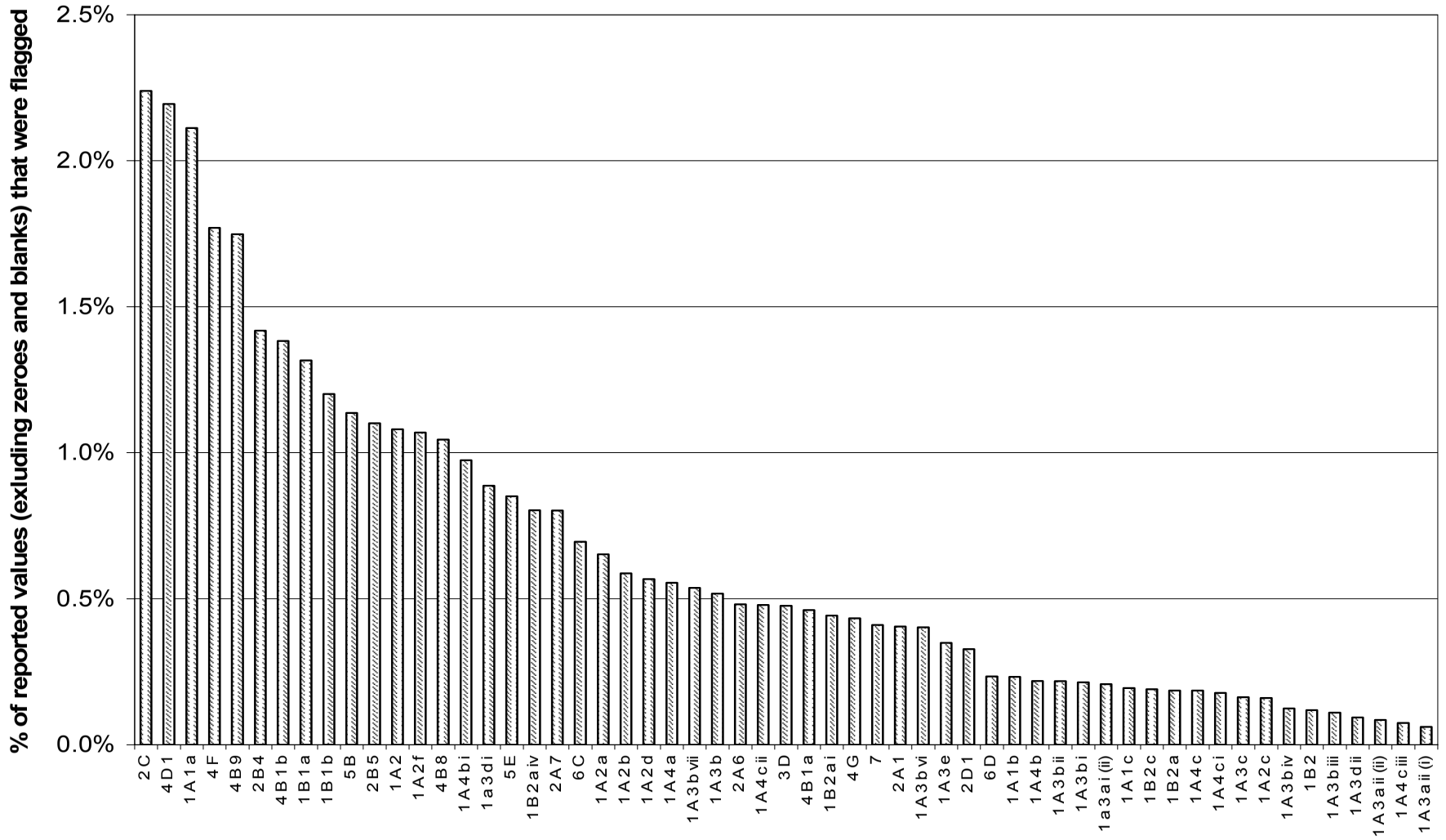

Figure 16. Number of flagged dips and jumps as a percentage of the number of values reported by sector: 2004 reported data, 1990-2002.

7.2 NEC time series test results

As for the LRTAP data described above, the time series checks were also performed using the 2004 reported NEC data to identify instances of dips, jumps, and sudden trends in time series data reported by Member States. Again the initial test results were manually reviewed by members of the TFEIP Expert Panel on Review Panel to remove instances where reasons for the change in trend were known.

As noted previously, only a limited amount of NEC data was received by ETC-ACC in time to be included in the review. A total of 8,529 values were reviewed for potential inconsistencies. Of these, only 34 values were flagged to indicate a potential inconsistency to countries. A summary of the results from the time-series checks is given below in Figure 17.

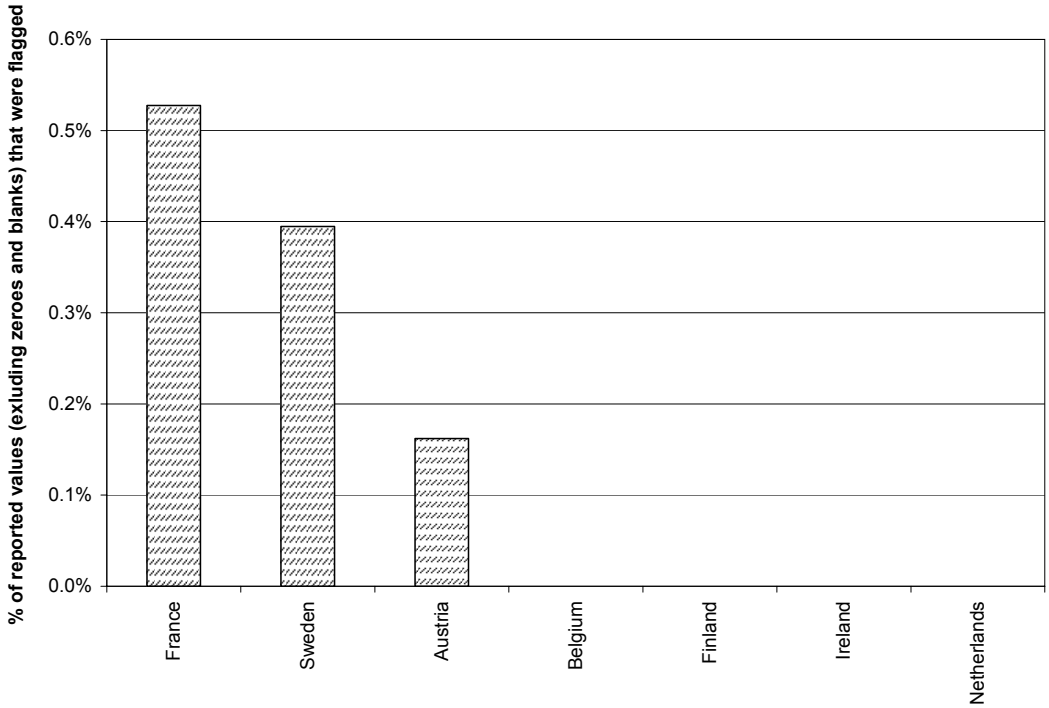

Figure 17. Number of flagged dips and jumps as a percentage of the number of values reported by country: 2004 reported data, 1990-2002.

Of the Member States for which data in the new NFR format was available, France had the highest percentage of flagged values (0.53%), followed by Sweden (0.39%) and Austria (0.16%). For four Member States (BE, FI, IE and NL), no flags were identified in the reported time series data.

Figure 18 illustrates the number of flagged values for the four NEC pollutants. There was a similar level of reporting, in terms of the total number of emission estimates provided by countries, for NH_3, NO_x and SO_2; the number of emission estimates for NMVOCs was somewhat higher. However, the level of potential inconsistencies flagged was broadly similar, falling between 0.3% and 0.5% for all pollutants.

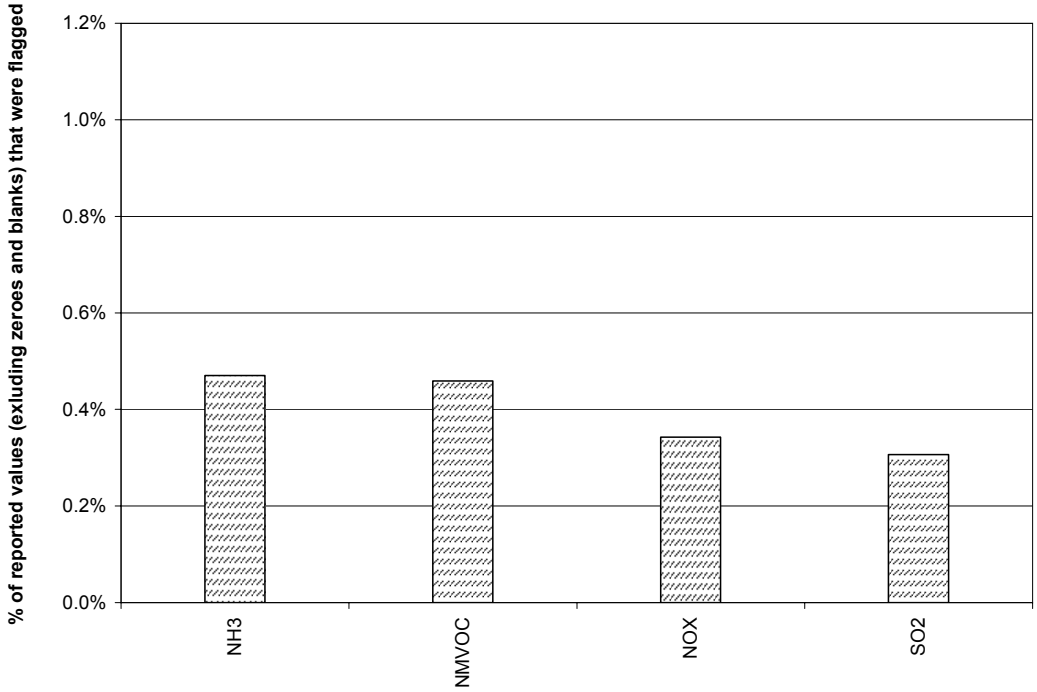

Figure 18. Number of flagged dips and jumps as a percentage of the number of values reported by pollutant: 2004 reported data, 1990-2002.

8 RECALCULATION

Key messages – Recalculation

- *Comparison of emission data from different submission years shows that Parties recalculate their emissions for previous years. These recalculations show generally small differences in the reported national emission data. Comparison of emission data submitted in 2002 and in 2004 show that differences are generally below 10%.*
- *Recalculations have on average led to higher emissions of the main pollutants reported in 2004 for the new Member States and to lower reported emissions in the EU15.*

LRTAP:

New Member States (new EU10)

- *The magnitude of emissions has generally increased in the 2004 reporting round compared to the 2002 reports, particularly for CO but also for NH_3 and NMVOC. The increase is generally not larger than 10%.*
- *For NO_x and SO_2 the estimates have generally been stable in the 2002 and 2004 submissions over the period 1990-2000.*

EU15

- *The magnitude of emissions for CO, NH_3, and SO_2 has generally decreased in the 2004 reporting round with respect to 2002 reports. The largest decrease in the recalculations over the period 1990-2000 is for the reported ammonia emissions (-6% on average) and for the emissions reported for year 2000 for NMVOC (-6%) and SO2(-8%) .*
- *NO_x emission estimates over the period 1990-2000 have also been recalculated but in this case the recalculations in 2004 show steadily higher NO_x emissions over the years than in the 2002 reports.*
- *All changes in reported national totals are less than 10%. However the magnitude of changes may be substantially larger for individual countries.*

NEC:

- *Only a small number of comparisons was possible, because limited time series data have been reported.*
- *Results were similar to those observed for LRTAP data.*

Conclusions and Recommendations

- *Actions to be taken by the TFEIP:*
  - *Parties should be made aware of the need to explain the reasons for their recalculations in the NIR*
- *Recommendations for Expert Panel on Review:*
  - *Prepare a template for the information on recalculations to be included in the NIR.*

The recalculation check is designed to indicate significant differences between national totals reported by Parties under NEC and LRTAP in different inventory submission years for the

main air pollutant species CO, NH_3, NMVOC, NO_x and SO_2. The study on recalculations was not extended this time to Particulate matter, Heavy Metal and POP emissions but it will be included in next year review. Further details of the methodology used are provided in Appendix VII. A check of recalculations is important as it provides some indication of the extent to which changes in emission estimation methodology used by Parties, and/or the availability of improved activity data/emission factors have changed the levels of the previously reported emissions.

8.1 LRTAP recalculations

The following graphs show the extent to which the reported national total estimates have been revised in the 2004 reporting round compared with the estimates provided by CLRTAP Parties in 2002 i.e. they show how much the emission estimates have changed since originally reported two years ago. For illustration purposes, the analysis is shown at a regional basis – for EU15 and the new Member States for each pollutant. Obviously individual countries within each region may have a greater (or smaller) change than the average value shown.

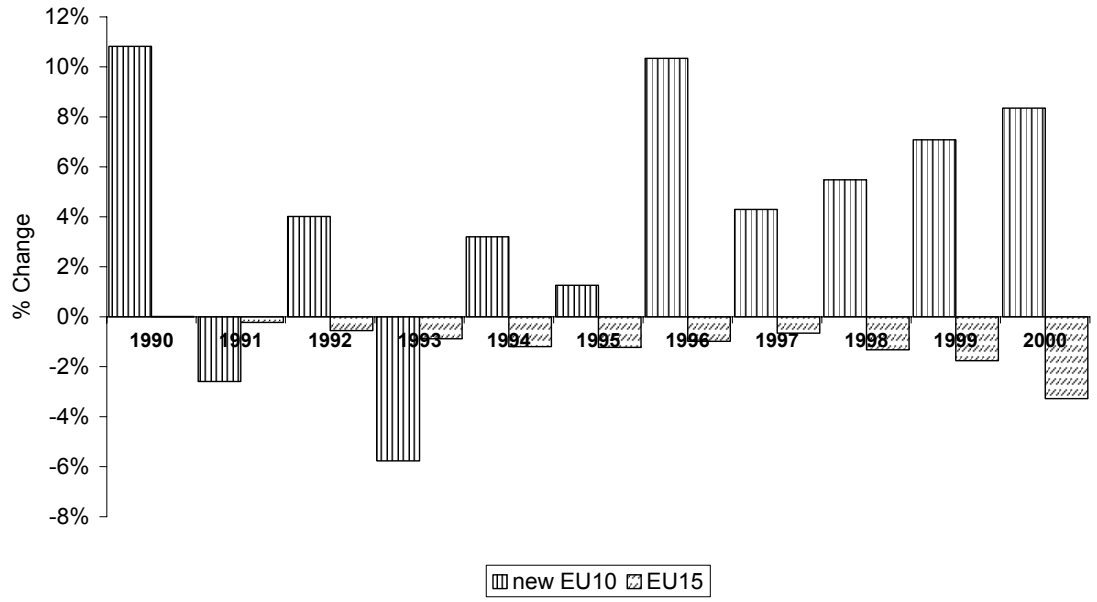

Figure 19 Change in LRTAP reported national totals for CO by region between the 2002 and 2004 reporting rounds

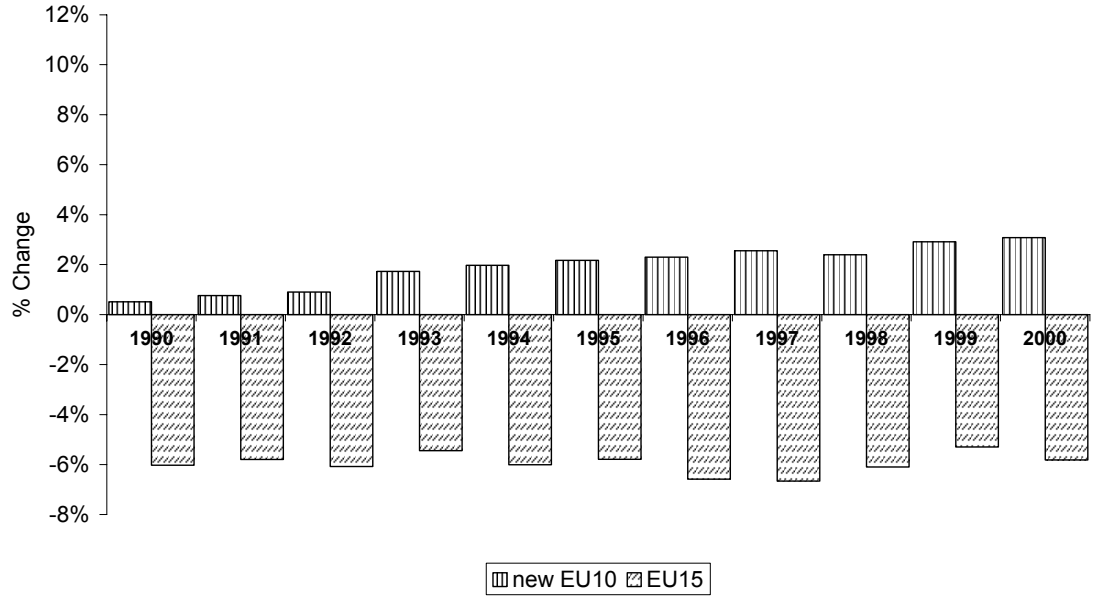

Figure 20 Change in LRTAP reported national totals for NH_3 by region between the 2002 and 2004 reporting rounds

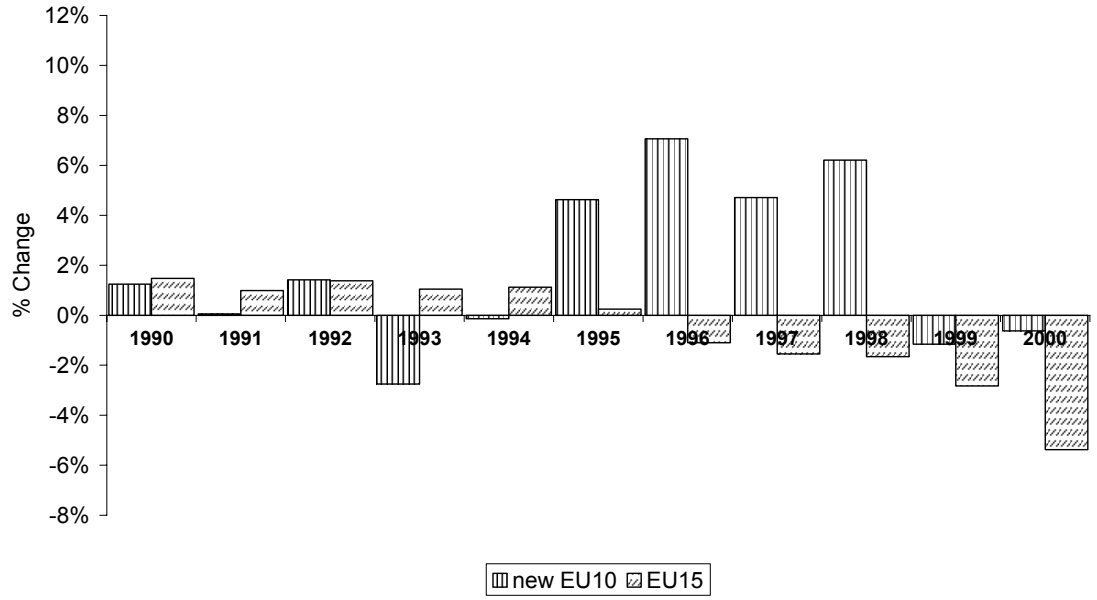

Figure 21 Change in LRTAP reported national totals for NMVOC by region between the 2002 and 2004 reporting rounds

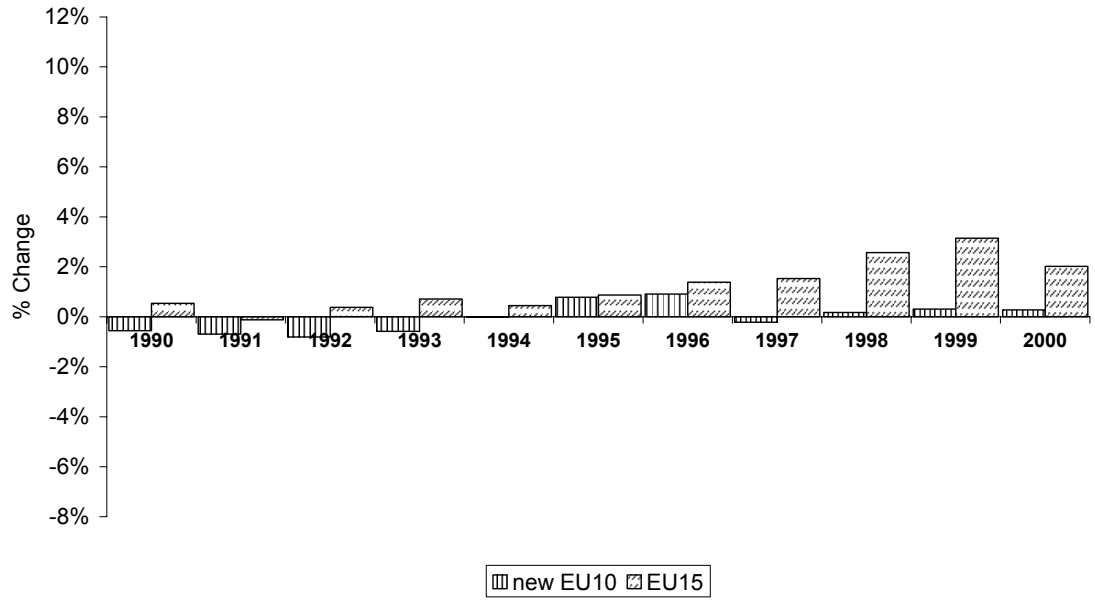

Figure 22 Change in LRTAP reported national totals for NO_x by region between the 2002 and 2004 reporting rounds

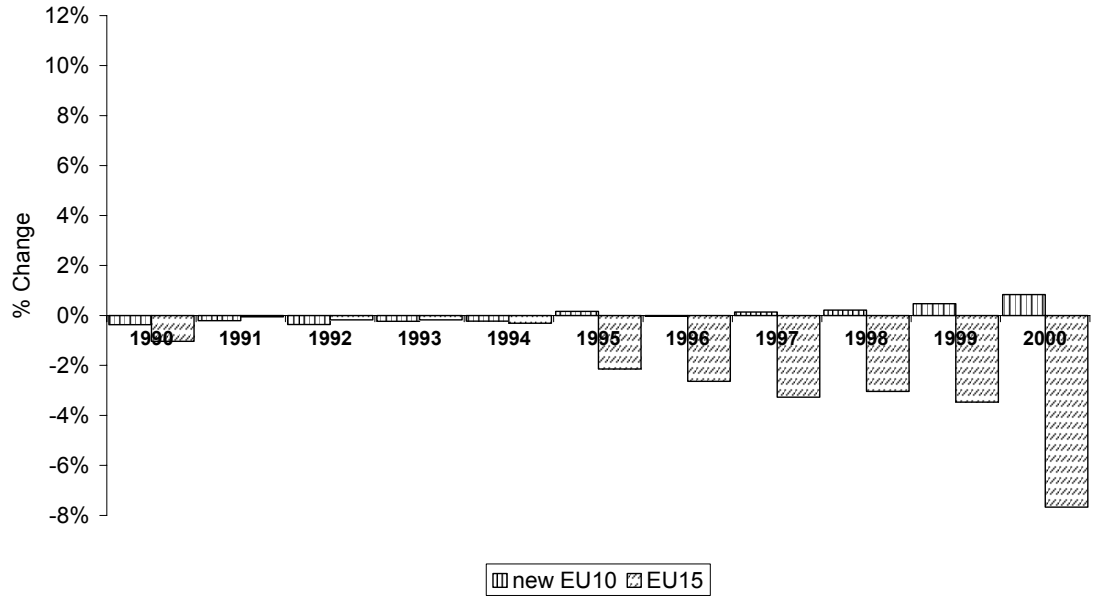

Figure 23 Change in LRTAP reported national totals for SO_2 by region between the 2002 and 2004 reporting rounds

Interpreting the information on these graphs requires caution, due to the uncertainties inherent in the reported national total estimates. The general magnitude of change between reported national totals in the different reporting years is generally in the order of -3% to 8%. This percentage variation in the reported national totals is considered to be small and well below the expected uncertainty margins of the emission totals which is considered to be in the order of +/- 20% or greater (EEA, 2003).

For the EU15 region, there is a general trend in the recalculations for the period 1990-2000 for CO, NMVOC and SO_2 (Figures 14, 16 and 18), where emission re-estimates made for more recent years have been reduced with respect to emissions submitted in earlier years. The reason why there should be a clear pattern in the magnitude of emission changes for different years is not clear. For NH_3 (Figure 15), there has been an approximately 6% reduction in the EU15 emission estimates made for all years 1990-2000. For NO_x (Figure 17), estimates of emissions for more recent years have increased relative to those reported in the earlier years of this period, in contrast to the trend observed for the other main pollutants.

Although comparison of emission data submitted in 2002 and in 2004 show that differences are generally below 10%, the magnitude of changes may be substantially larger for EU15 individual countries. Particularly in those cases, it is necessary for the Parties to report the reason for their recalculations in their National Inventory Reports.

For the new EU10 Member States, there is no clear trend apparent in the changes to national totals that have occurred through recalculation. In general, for most years and pollutants the emission estimates have increased as a result of recalculation. For CO (Figure 14) the increase observed after recalculation is larger, although there are also large decreases in the level of emissions observed for two individual years.

8.2 NEC recalculations

Due to the limited number of countries that reported data to the Commission in 2003-2004 in NFR format and which was received by ETC-ACC in time to be included for the review, together with the lack of overlap between data reported by countries in these two available reporting rounds, it was only possible to perform a small number of data comparisons. Complete comparisons (1990-2001) for all four pollutants could only be made for Austria and France. For both countries, results for most pollutants followed the trend described above for the EU15 region as a whole i.e. the recalculated values in the most recent reporting years tended to be more negative than those from the early years of the 1990-2001 period.

9 IMPLIED EMISSION FACTORS

Key messages – Implied emission factors

- *This is the most preliminary test in the Extended 2004 review. The current methodology is basic and at an aggregated sector level. When the methodology is fully developed and extended to include other pollutants such as to include POPs, HMs and particulates, comparison of IEFs can be an important driver for inventory improvements*
- *In the initial feasibility test approximately 25% of the tested data was flagged, indicating a range of IEFs used by Parties.*
- *There is a significant variation in the NH_3 implied emission factors which identifies this area as susceptible to uncertainties and shows lack of harmonisation among Parties.*

Conclusions and Recommendations

- *The IEF test was hampered by the limited access to activity data and information. It is recommended that the TFEIP establishes links with UNFCCC to allow ready access to up-to-date activity data and that Parties are encouraged to report activity data in order to increase transparency.*
- *The IEF review needs to involve expertise from different expert panels for the analysis of the implied emission factors and to be linked to the improvement of the EMEP/CORINAIR Guidebook.*
- *It is recommended to review the guidance for calculating emissions for NH_3. The variability of the implied emission factors, together with the fact that NH_3 showed consistently large recalculations for most countries, seem to indicate that guidance on the calculation of NH_3 emissions is further required.*

The objective of the implied emission factors (IEF) check was to identify significant differences in the IEFs derived from emissions data reported by Parties to LRTAP and sectoral activity reported to UNFCC (i.e. do emissions appear to have been compiled using a broadly similar basis in terms of emission factors? Implied emission factors were calculated for a range of sectors (refer to methodology description in Appendix IV for a complete list) for the year 2001 (the most recent year for which activity data was available) and for the main air pollutants CO, NMVOC, NH_3, NO_x and SO_2. The implied emission factors calculated for a country/sector/pollutant combination were compared with the average IEF from similar countries (i.e. a Western and Eastern Europe country grouping average IEFwas calculated). Variation in IEFs within the country groupings will of course also reflect differences between countries such as the use of different types of emission abatement equipment.

Due to the limited number of Member States that reported emissions data under the NEC Directive in time to be included in the review tests, a comparison of IEFs obtained from NEC data reported in 2004 was not performed.

An important point to emphasise is that activity data being used in this analysis (from the UNFCC Locator database) may be significantly different from the activity data actually used

in the calculation of the emission estimate for the different Parties. The use of different types of activity data, and data from different sources, could lead to significant differences between implied emission factors, as tested by their deviation from the average.

Figure 24 shows an example of the analysis performed to determine which points were significantly different from the average IEF and which subsequently were flagged for expert review for the 1A4b - residential combustion sector. In this instance, reasons for the flagged values are known. For example, the IEF for Sweden differs from the average due to the higher use of bio fuels in this sector, Belgium and the Netherlands due to higher electricity use and low fuel use in the residential sector, and Germany due to the use of district heating.

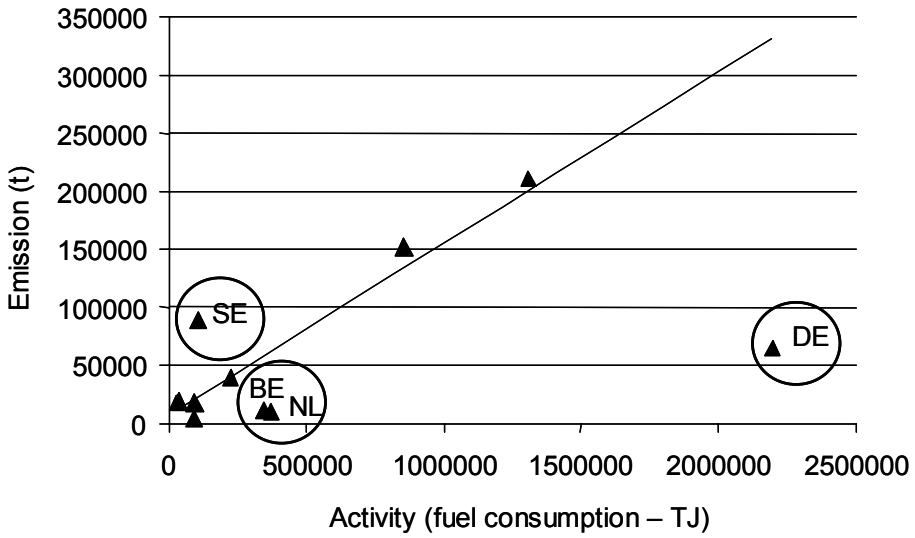

Figure 24. Example of implied emission factor analysis showing data points that were flagged as being significantly different than the average IEF (NMVOC, 1A4b – Residential combustion, 2001)

Figure 25 shows the number of flagged values by pollutant expressed as a percentage of the number of IEF comparisons that were able to be made. On a percentage basis, the highest number of flags occurred for NH_3 followed by SO_2. The lowest number occurred for NO_x. The number of flags also provides an indication of the degree of variation in the IEFs determined i.e. a higher number of flags for a given pollutant (or sector) indicates that more IEFs lay away from the mean calculated IEF value and hence indicates more variation.

It is expected that SO_2 IEFs will show a high level of variability which reflects the intrinsic differences between abatement options and technologies (and rates of implementation) in different countries. Reasons for the large variability of NH_3 IEFs is less clear, as the majority of emissions come from the agriculture sector where the impact of abatement methods to control emissions (if any) is much lower. It is therefore recommended to review the guidance for calculating emissions for NH_3, as the variability of the implied emission factors, together with the fact that NH_3 showed consistently large recalculations for most countries, seems to indicate that guidance on the calculation of NH_3 emissions is further required.

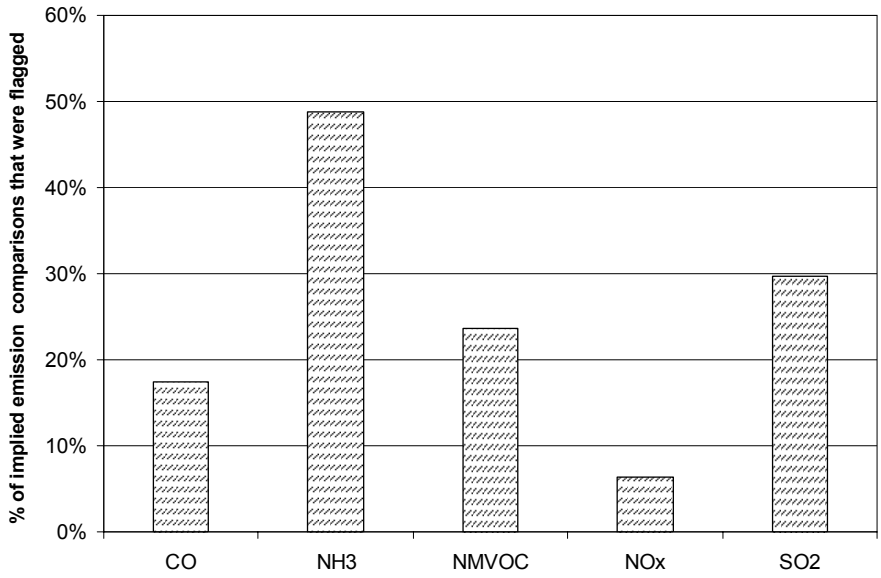

Figure 25. Number of IEF flagged values by pollutant expressed as a percentage of the number of IEF comparisons that were able to be made.

10 LRTAP AND NEC INVENTORY COMPARABILITY

Key messages – Inventory comparability

- *In general the inventory data reported to LRTAP and NEC data are comparable*
- *There were only 10 occurrences where differences were greater than +/-0.1%*
- *All 10 occurrences were less than +/-3% - except for SO_2 emissions from The Netherlands were there was a +17% – 18% difference. Bilateral discussions have been initiated in order to understand this result.*

The aim of this test was to check the consistency of the NEC national totals reported in 2003/2004 with those reported shortly afterwards in 2004 by Parties to LRTAP. Due to the limited number of countries for which complete time-series data was available, and the different years reported by countries to NEC/LRTAP it was not possible to perform full comparisons for all Member States. Years were flagged where differences between the reported national totals were >0.1%.

180 data comparisons were made (comparisons of country/pollutant/year combinations for data reported to both NEC and LRTAP), out of a total possible number of 780 had all 15 Member States reported a full time-series 1990-2002 (13 years) for the 4 NEC pollutants. Of these 180 comparisons made, 10 values were flagged where differences between the national totals reported to NEC and LRTAP differed by more than 0.1%.

Even though the deadline for data submission to LRTAP and NEC differs by 6 weeks, reported emissions data do not seem to differ greatly.

The reason for the most significant discrepancy identified for the Netherlands submission of SO_2 emissions for year 2001 and 2002 is presently under bilateral discussion with Dutch experts.

11 GRIDDED DATA BOUNDARY CHECK

Key messages – Gridded data

- *Most Parties distribute their emissions spatially within their own territory.*
- *Poland was the only country reporting SO_2 emissions larger than 5% of the national total in a grid cell outside the country border as defined by EMEP.*
- *Bilateral discussions have been initiated in order to further increase the accuracy of the gridded data coverage.*

Gridded data, both national totals and sector data, is crucial for the modelling work under the Convention. This year we included a simple test to see if the reported grid cells by the countries were within the country land boarders as defined by the EMEP/UNECE country fraction file (See: *http://www.emep.int/grid/index.html*). Please note that the information in this file do not imply official endorsement or acceptance by the UNECE.

The test was carried out mostly on year 2000 SO_2 emissions reported to the CLRTAP in year 2002, because in 2004 gridded data was not specifically requested. Gridded data was tested here to prepare consistency for the next reporting round requesting gridded data planned for 2007, for Parties reporting gridded data updates in accordance with the NFR sector definitions before that time, and for MSC-W to quality control the grid fraction file. This test was only performed for those countries reporting gridded data to the Convention on LRTAP of a vintage and quality that can be used in modelling work.

27 countries out of 49 (55%) received feed back on reported gridded data. Of those, 23 had reported emissions outside the land area as defined in the EMEP grid fraction file (85%). The amount of total emissions reported outside the land area and which were not part of fishing and other off shore emissions, was well below 1% for all but four Parties. Two of these four Parties (Finland and Norway) asked EMEP to include grid cells covering islands not currently included in the EMEP grid fraction file. Belarus, Germany, Hungary also asked for minor updates. Two Parties, Poland and Slovakia, had 5.4 and 2.7% of the total emissions outside the country border as defined by EMEP. In the case of Poland, it seems like Poland needs to adjust the reporting of gridded data. In the case of Slovakia, it seems like MSC-W should update the grid fraction file after discussions with Slovakia.

MSC-W will continue the bilateral discussions about the gridded data coverage with the Parties in order to increase the accuracy of the reporting and assessments further.

Based on the responses form the Parties, EMEP will consider to change the country fraction file currently used and/or request Parties not to report emissions outside their territory in the next reporting of gridded data. Bilateral discussions between the Parties and MSC-W are presently undertaken to secure a consistent description of the country land areas in the next reporting rounds.

12 CONCLUSIONS

This first annual LRTAP/NEC emission inventory review has been performed according to the recommendations from the TFEIP/EIONET meeting in 2003 (EB.AIR/GE.1./2004/9).

For the first time, the general annual review of emission inventory quality indicators (timeliness, completeness, internal consistency) has been extended to a series of more detailed comparability analysis including key source sector analysis, evaluation of discontinuities in the reported time series, analysis of recalculations, an initial study of implied emission factors and checks of the reported gridded data boundaries.

This is also the first time that the review of the inventory data has been done jointly for emission data reported under the Convention on Long Range Transboundary Air Pollution (LRTAP) and the National Ceilings Directive (NEC). As far as it has been possible giving the time constraints of the review process, all pollutants reported to the Convention have been analysed. However, in some of the tests priority has been given to testing the data on main pollutants in order to facilitate the comparison with the submissions under the NEC. It is intended that in the next review round, emissions of Heavy Metals and POPs will be more comprehensively analysed.

The review tests, analysis of results and the feedback have benefited from feedback from bilateral discussion with Parties/Member States. Further discussions are expected in the new meeting of the TFEIP in order to prepare prioritized tasks for an extended in-depth review to be included as part of the Inventory Improvement Programme under the Task Force.

The main conclusions and recommendations from the review are:

- In general data reported to CLRTAP and under the NEC was comparable.
- 55% of CLRTAP and 40% of NEC submissions were received on time.
- 94% of CLRTAP and 65% of NEC submissions were in the NFR format.
- The information on source sectors has increased by a factor of two to four relative to the 1997 Guidelines.
- The level of reporting completeness increases from 1980 to 2002.
- 23% of Parties reported complete datasets for 2002, while only 15% have reported complete datasets for the time series 1980-2002 this year.
- Notation keys are increasingly used and have replaced “blanks”. Their use by countries is not harmonized.
- 30% of Parties reported internally inconsistent data.
- The key sources analysis showed that Parties seem to have their key sources correct.
- Time series reported in the same reporting round generally contains consistent data. Only 0.5% of the reported values were flagged as being potential inconsistent.
- Recalculations between preceding years are generally below 10%. The magnitude of emissions seems to decrease in the Western European countries and increase in the Eastern European countries for most of the main pollutants. Biased recalculations might occur.
- 25% of the data was flagged in the Implied Emission Factor (IEF) test indicating a wide variability in the emission factors used (which reflects at least in part, the

different abatement technologies and rates of implementation in countries). The results indicated that EFs for NH_3 could be a priority for inventory improvement.
- Most Parties distribute their emissions spatially within their own territory.

13 GENERAL RECOMMENDATIONS

A number of general recommendations have been identified from the review work. These are described in the following sections and are grouped according to those actions relevant to the review process itself, and actions for general inventory improvement.

13.1 Review improvements

The 2004 review did not include an in-depth review. Work is in progress in co-operation with the Expert Panel on Review to define the in-depth review and more information on this will be presented at the TFEIP. However, from the work performed in 2004 there are a number of areas identified that are necessary for further development in order to improve the review process. These occur at three levels of organisation i.e.

- *For the Expert Panel on Review:*
  Formalise the annual review;
  Streamline/develop the review process including improvement of tests and involvement from TFEIP expert groups in review.
- *For Bodies:*
  Adopt the review process;
  Further develop the clarity and accessibility of the reporting Guidelines for NEC and CLRTAP;
  Harmonise reporting deadlines for NEC and CLRTAP;
  Further develop the clarity and use of the reporting tests, templates, spreadsheets and definitions and use of the notation keys.
- *For Countries:*
  Adopt and participate in the review process;
  Making & integrating emission inventory improvements including recommended quality and completeness improvements as well as reporting in the correct data formats and consistent nomenclature (NFR);
  Development of National Inventory Report (NIR) to provide the required transparency of the system.

In terms of the Expert Panel on Review, a number of potential actions have been identified to assist with the general aims of both formalising and further developing the review process (Box 1).

Box 1 Potential actions for the Expert Panel on Review

1. Review Formalisation

- *To finalise and formalise the Terms of Reference;*
- *To clearly define and communicate the review Process, Teams and Expert panels involvement;*
- *Make further improvements to the automation of the review process and improve the links of the review to REPDAB & WEBDAB;*
- *Improve and formalise links to UNFCCC data through a Memorandum of Understanding;*
- *Formalise protocols for communication:*
  - *with countries (when presenting question and requesting responses);*
  - *with steering groups including the EMEP Steering body and CAFÉ;*
  - *of recommendations and interaction with the Inventory Improvement Programme.*

2. Review Development

- *Development of additional review tests including:*
  - *EPER vs NEC/LRTAP;*
  - *Repeated values test;*
- *Develop REPDAB and WEBDAB to support review data and process;*
- *Use of national inventory reports. Additional resources required!*
- *Develop a review learning process to remember country answers to review questions so they are not asked again in the next review.*

13.2 Inventory improvements

In some instances, the inventory review process has already identified confirmed errors in the national submissions reported to LRTAP, and which will therefore be improved in future reporting. Additionally, there are two generic areas of inventory improvement that have been potentially identified for action by Parties, and as areas for which support for Parties could be given by EMEP/TFEIP etc. These areas are:

1. Improving data reporting; and
2. Improving data quality.

In each category, a number of possible actions have been identified. These are summarised in Box 2.

Box 2 Potential actions for the area of inventory improvement

1. Improving data reporting

Centralised efforts

- *Development and clarification of the Nomenclature For Reporting;*
- *Development of the reporting templates to improve the ability of countries to complete the required reporting forms (shadings for NA's, colouring of aggregated sectors);*
- *Improve the definition of notation keys;*
- *More informative testing & feedback (REPDAB);*
- *Development of clearer Reporting Guidelines & links to NEC;*
- *Move reporting to the NEC to 15th February.*

Country efforts

- ***Improve the timeliness of reporting***
- *Improve pre 1990 reporting of Main pollutants, and reporting of POPs, PMs and heavy metals*
- *Consistent use of notation keys*
- *Reporting in NFR and completing all cells of required reporting templates*
- *Improve the internal consistency of reporting.*

2. Improving data quality

Transparency

- *Annotation of "other" & "IE";*
- *Consistent sector allocation to NFR;*
- *Delivery of NIRs in required format.*

Quality/Completeness

- *Development of guidebook for sectors with reporting problems, gridding of emissions and new and diverse pollutants;*
- *Improvement of completeness / sector "detail" through reporting to the requested level of detail in the NFR.;*
- *EF development (POPs, HM, NH_3, PM_{10} & $PM_{2.5}$) through additional measurement and desk studies to review existing measurement data used for other purposes such as compliance monitoring.*

CLRTAP/NEC/UNFCCC collaboration:

- *Country level;*
- *International level;*
- *Review.*

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All UNECE/EMEP documents are available from: *http://www.unece.org/env/emep/*
Other UNECE/CLRTAP documents are available from: *http://www.unece.org/env/lrtap/*

This report and other EMEP reports are available from the EMEP home page:
http://www.emep.int/

APPENDICES

Appendix I a: Review responses

Table I.1 Overview of responses from Parties[4]

Party/Response	Logged in	Review sheet	Comparability	Comment
Armenia	X	X		
Austria	X	X	X	
Azerbaijan	X			
Belarus	X	X		
Belgium	X			Not possible to reply until 1st of July 2004
Bosnia and Herzegovina	R			
Bulgaria	X	X		
Canada	X	X		
Croatia	X			
Cyprus	R			
Czech Republic	X			
Denmark	X	X	X	
Estonia	X	X		More time needed to respond to comparability test results
Finland	X	X	X	
France	X	X		More time needed to respond to comparability test results
Georgia				
Germany	X	X	X	
Greece	X			
Hungary	X	X		
Iceland				
Ireland				
Italy	R			
Kazakhstan	X			
Kyrgyzstan	R			
Latvia				
Liechtenstein				
Lithuania				
Luxembourg				
Malta	X			
Monaco	X	X		
Netherlands	X			
Norway	X	X		More time needed to respond to comparability test results
Poland	X			
Portugal	X	X		
Republic of Moldova				
Romania	X	X		Sent emission data 1998-2000
Russian Federation	R			
Serbia and Montenegro				
Slovakia	X			Need more time to respond
Slovenia				
Spain	X	X		
Sweden	X	X	X	
Switzerland				
TFYR of Macedonia	X			
Turkey				
Ukraine				
United Kingdom	X	X		
United States	X	X	X	
European Community	X			

[4] R: Automatic reply received from Party. Gray background: Comparability tests possible to perform.

Appendix I b: List of Designated Emission Experts (As of June 2004)

List of Contacts as of 8 June 2004

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Appendix II: Overview of the 2004 reporting under the CLRTAP and NEC

Table II.1: LRTAP submissions received at the UNECE Secretariat as of 13 June 2004

PARTY	Date Rec'd	Format used	Main pollutants SOx/NOx/NH3/ CO/VOC	HMs	POPs	PMs: PM2.5 PM10 TSP	Projections: 2010, 2015 2020
Armenia	12/02/04**T**[1]	OLD	X	X	-	-	-
Austria	16/02/04**T**	NEW	X	X	X	X	-
Azerbaij	No data	-	-	-	-	-	-
Belarus	12/02/04**T**	NEW	X	X	X	X	2010,2015,2020
Belg[2]	13/02/04**T**	NEW	X	X	X	X	-
B&H	No data	-	-	-	-	-	-
Bulgaria	10/02/04**T**	NEW	X	X	X	-	2010,2015,2020
Canada	15/02/04**T**	NEW	X	X	X	X	2010,2015,2020
Croatia	No data	-	-	-	-	-	-
Cyprus	17/02/04	NEW	X	Pb	X	X	2010,2015,2020
CZ	16/02/04**T**	NEW	X	X	X	X	2010,2015,2020
DK	12/02/04**T**	NEW	X	X	X	X	2010,2015,2020
Estonia	13/02/04**T**	NEW	X	X	X	X	2010,2015,2020
Finland	12/02/04**T**	NEW	X	X	X	X	2010, 2020
France	01/03/04	NEW	X	X	X	X	-
Georgia	No data	-	-	-	-	-	
Germ	16/02/04**T**	NEW	X	-	-	X	-
Greece	07/06/04	NEW	X	-	-	-	2010
Hung	16/02/04**T**	MIXED	X	X	X	X	2010,2015,2020
Iceland	No data	-	-	-	-	-	-
Ireland	16/02/04**T**	NEW	X	X	X	X	-
Italy	07/05/04	OLD	X	X	X	X	-
Kazakhs	No data	-	-	-	-	-	-
Kyrgyz	No data	-	-	-	-	-	-
Latvia	13/02/04**T**	NEW	X	X	X	X	2010,2015,2020
Liechten	No data	-	-	-	-	-	-
Lith	30/1/04**T**	NEW	X	X	X	X	2010,2015,2020
Luxemb	No data	-	-	-	-	-	-
Malta	No data						
Monaco	13/02/04**T**	NEW	X	X	X	X	2010 (SO2 only)
Neth	16/02/04**T**	NEW	X	X	X	X	2010
Norway	16/02/04**T**	NEW	X	X	X	X	2010
Portugal	23/02/04	NEW	X	X	-	X	forthcoming
RepMol[3]	16/2/04	NEW	X	X	X	X	2010
Romani	No data.	-	-	-	-	-	-
RF	9/02/04**T**	NEW	X	X	X	X	-
SerbMo	11/02/04**T**	NEW	SOxNOx	-	-	-	-
Slovakia	23/02/04	MIXED	X	X	X	X	
Slovenia	13/02/04**T**	MIXED	X	X	X	X	X
Spain	19/02/04	NEW	X	X	X	X	-
Sweden	13/02/04**T**	NEW	X	X	X	X	-
Switz.	16/02/04**T**	OLD	X	X	-	X	2010,2015,2020
TFYRM	12/02/04**T**	NEW	X	X	X	-	-
Turkey	No data	-	-	-	-	-	-
Ukraine	23/03/04	NEW	X	X	X	X	-
UK	13/02/04**T**	NEW	X	X	X	X	2010
US	13/02/04**T**	NEW	X	X	X	X	-
EC	No data	-	-	-	-	-	-

[1] **T** indicates data received on-time (by 16 Feb. 2004);
[2] Belgium: submitted final data for 2001 and preliminary data for 2002.
[3] Republic of Moldova submitted data for 2000 only.

Table II.2. Date of receipt for LRTAP and NEC submissions by the European Commission and the EEA, years covered and NFR Tables available from Member States By 10 May 2004[5].

Member State	Submission	Date of receipt Commission	Date of receipt EEA	Latest data available	Years covered	Gases covered	Format emissions
AT	NEC	Received: 30.12.03, sent to EEA: 5.1.04		2002	1990-2002	SO_x, NO_x, VOC, NH_3	New NFR (Table 1A)
BE	NEC	Received: 14.1.04, sent to EEA: 14.1.04		2002	2001-2002	SOx, NOx, VOC, NH3	New NFR (Table 1A)
DK	NEC	Received: 22.3.04 (Cc: EEA)		2002	1980-2002	SO_x, NO_x, VOC, NH_3	detailed NFR
FI	NEC	Received: 11/12.12.03 (Cc: EEA)		2001	2000-2001	SO_x, NO_x, VOC, NH_3	Old NFR
FR	NEC		15.1.04	2002	1980-2002	SO_x, NO_x, VOC, NH_3, CO, PM, HM, POP	New NFR (Table 1A, 1B)
FR	CLRTAP/NEC	Received: 17.03.04, reference to NEC and CRLTAP; sent to EEA: 23/24.03.04		2002	1980-2002	SO_x, NO_x, VOC, NH_3, CO, PM, HM, POP	New NFR
DE	CLRTAP/NEC	1) received: 13.2.04, reference to CLRTAP (Cc: EEA) 2) received: 16.2.04, reference to NEC, sent to EEA: 1.6.04		2002	1990-2002	SO_x, NO_x, VOC, NH_3, CO, PM	New NFR
GR	NEC	Received: 31.12.03, sent to EEA: 5.1.04		2001	1990-2001	SO_x, NO_x, VOC, NH_3	SNAP
IE	NEC	Received: 31.12.03, sent to EEA: 5.1.04		2002	2001-2002	SO_x, NO_x, VOC, NH_3, CO	New NFR (Table 1A)
IE	NEC		16.2.04	2002	2001-2002	SO_x, NO_x, VOC, NH_3, CO	New NFR (Table 1A)
NL	NEC	Received on paper: 5.2.04, by e-mail: 19.2.04, sent to EEA: 19.2.04		2002	2001-2002	SO_x, NO_x, VOC, NH_3	New NFR (Table 1A, 2A)
PT	CLRTAP/NEC	1) received, reference to NEC, sent to EEA: 23.2.04; 2) received revised version I:		2002	1990-2002	SO_x, NO_x, VOC, NH_3, CO, PM, HM	New NFR

[5] Source: Annual European Community CLRTAP emission inventory 1990-2002. Submission to the Executive Body of the UNECE Convention on Long-range Transboundary Air Pollution. Final draft 8 July, 2004. European Environment Agency Technical Report No. /2004.

		10.3.04 (Cc: EEA)					
ES	NEC	Received: 7.4.04, sent to EEA: 7.4.04		2002	2000-2002	NO_x, NMVOC, SO_x, NH_3	New NFR (Table 1A)
SE	NEC	Received: 19.12.03, sent to EEA: 22.12.03		2002	1988-2002	SO_x, NO_x, VOC, NH_3	New NFR (Table 1A, 2A)
UK	CLRTAP/NEC	Received: 10.2.04, reference to NEC, sent to EEA: 11.2.04		2002	1980-2002	SO_x, NO_x, VOC, NH_3, CO, PM, HM, POP	New NFR

Note: The table shows only the first submission date of each Member State to the European Commission or EEA. Note also that some Member States sent their CLRTAP inventory data to the European Commission, but sending CLRTAP inventory data to the European Commission is not mandatory to the Member States.

Appendix III: Completeness of national totals

Table III.1: National total emission trends
Emissions of sulphur dioxide (1980-1991) used for modelling at the MSC-W (Gg of SO_2 per year)[1]

Area/Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Albania	72	72	72	72	72	72	72	72	72	72	72	68
Armenia	141	111	101	110	97	100	111	111	104	63	72	60
Austria	**360**	**319**	**303**	**227**	**207**	**188**	**168**	**146**	**108**	**101**	**80**	**77**
Azerbaijan	15	15	15	15	15	15	15	15	15	15	15	15
Belarus	740	730	710	710	690	690	690	761	720	668	637	652
Belgium	828	712	694	560	500	400	377	367	354	325	362	330
Bosnia and Herzegovina	482	482	482	482	482	482	482	482	482	482	482	457
Bulgaria	2050	2103	2156	2209	2261	2314	2367	2420	2228	2180	2008	1665
Croatia	150	153	156	159	162	165	168	171	174	177	180	108
Cyprus	28	28	33	30	33	35	38	39	42	42	46	33
Czech Republic	2257	2341	2387	2338	2305	2277	2177	2164	2066	1998	1881	1780
Denmark	452	370	379	323	**306**	**336**	**283**	**250**	**245**	**191**	**177**	**236**
Estonia	287	280	274	267	261	254	256	255	254	254	252	246
Finland	584	534	484	372	368	382	331	328	302	244	260	194
France	**3214**	**2529**	**2427**	**2001**	**1786**	**1497**	**1364**	**1350**	**1246**	**1408**	**1326**	**1444**
Georgia	230	242	250	267	267	273	255	258	255	249	248	194
Germany	7514	7441	7440	7346	7633	7732	7641	7397	6487	6165	**5326**	**3996**
Greece	400	420	440	460	480	500	499	497	496	494	493	532
Hungary	1633	1580	1545	1480	1440	1404	1362	1285	1218	1102	1010	913
Iceland	18	18	18	18	19	18	18	16	18	17	24	23
Ireland	222	192	158	142	142	140	162	174	152	162	186	180
Italy	**3440**	**3171**	**2924**	**2517**	**2220**	**2016**	**2017**	**2120**	**2057**	**1955**	**1748**	**1635**
Kazakhstan	289	289	289	289	289	289	289	289	289	289	289	324
Latvia	96	96	96	96	96	96	96	96	96	96	**96**	71
Lithuania	311	312	304	310	303	304	316	316	300	298	222	234
Luxembourg	24	21	17	14	15	16	16	16	15	15	15	15
Netherlands	490	464	404	323	299	258	264	263	250	204	**191**	173
Norway	136	128	111	104	96	98	91	73	68	58	52	44
Poland	4100	4140	4180	4220	4260	4300	4200	4200	4180	3910	3210	2995
Portugal	*253*	265	278	*291*	239	*188*	*222*	*207*	*194*	**211**	***229***	***227***
Republic of Moldova	308	305	287	284	270	282	297	317	273	238	265	260
Romania	1055	1095	1104	1229	1223	1255	1293	1305	1469	1517	1311	1041
Russian Federation	7323	7110	7252	7095	6663	6350	5880	5806	5333	4875	4671	4603
Serbia and Montenegro	406	408	409	440	456	478	470	484	502	506	508	446
Slovakia	780	747	713	680	646	613	604	614	589	573	542	445
Slovenia	234	254	256	274	250	241	247	222	210	211	196	180
Spain	2913	2848	2811	2828	2583	2448	2323	2193	1845	2178	***2098***	***2091***
Sweden	491	431	371	305	296	266	272	228	224	160	106	99
Switzerland	116	108	100	92	84	76	68	62	56	49	42	41
TFYR of Macedonia	107	107	107	107	107	107	107	107	107	107	107	105
Turkey	1030	1043	1062	1125	1186	1345	1500	1432	1269	1566	1590	1666
Ukraine	3849	3492	3427	3498	3470	3463	3393	3264	3211	3073	2783	2538
United Kingdom	**4852**	**4397**	**4184**	**3844**	**3696**	**3716**	**3876**	**3871**	**3808**	**3694**	**3721**	**3537**
North Africa	413	413	413	413	413	413	413	413	413	413	413	413
Remaining Asiatic areas	854	854	854	854	854	854	854	854	854	854	854	854
Baltic Sea	228	228	228	228	228	228	228	228	228	228	228	228
Black Sea	57	57	57	57	57	57	57	57	57	57	57	57
Mediterranean Sea	1189	1189	1189	1189	1189	1189	1189	1189	1189	1189	1189	1189
North Sea	454	454	454	454	454	454	454	454	454	454	454	454
Remaining N-E Atlantic Ocean	901	901	901	901	901	901	901	901	901	901	901	901
Natural marine emissions	743	743	743	743	743	743	743	743	743	743	743	743
Volcanic emissions	2144	2144	2144	2144	2144	2144	2144	2181	2114	2493	2607	1645
TOTAL	61262	58886	58193	56535	55256	54462	53659	53063	50335	49525	46575	42457

[1] All years except 2010 and 2020: Reported values with white background, expert estimates in grey. Values in bold differ from reporting in 2003. Values in italic are reported values modified for modelling purposes by MSC-W. Projections (Base Line Scenario) provide by IIASA (April 2004) in grey boxes. Reported values or extrapolations in white.

Table III.1 Cont.: National total emission trends
Emissions of sulphur dioxide (1992-2002, 2010, 2020) used for modelling at the MSC-W (Gg of SO_2 per year)[2]

Area/Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2010	2020
Albania	64	59	55	51	52	54	55	57	58	58	58	30	31
Armenia	44	5.5	4.2	2.5	1.5	0.4	3.3	0.84	8.4	4.4	7.5	4	4
Austria	61	59	53	52	49	45	41	38	35	38	36	30	28
Azerbaijan	15	15	15	15	15	15	15	15	15	15	15	15	15
Belarus	458	382	324	275	246	209	190	164	143	151	143	350	296
Belgium	315	294	252	257	240	219	212	181	165	160	153	105	97
Bosnia and Herzegovina	433	408	383	359	371	383	395	407	419	419	419	411	380
Bulgaria	1115	1426	1480	1476	1420	1365	1251	943	982	940	940	979	828
Croatia	107	114	89	70	66	80	90	91	58	58	58	69	65
Cyprus	39	43	42	41	45	47	49	50	50	48	51	18	10
Czech Republic	1543	1424	1275	1089	944	697	438	268	264	251	237	126	70
Denmark	182	147	147	138	174	101	75	55	29	26	25	18	14
Estonia	187	154	149	119	125	119	110	103	95	92	88	44	11
Finland	141	123	114	96	105	99	90	87	74	85	82	63	62
France	1261	1093	1041	978	954	806	823	705	627	570	537	404	339
Georgia	135	71	47	20	30	33	20	9	6	6	6	9	9
Germany	3307	2945	2473	1937	1339	1039	836	735	636	643	611	450	426
Greece	546	545	517	541	525	521	528	540	483	485	485	165	110
Hungary	827	757	741	705	673	659	592	590	486	400	359	262	95
Iceland	24	25	24	24	24	25	27	27	27	27	27	29	29
Ireland	172	161	175	161	147	166	176	157	131	126	96	34	20
Italy	1533	1414	1332	1263	1203	1063	1002	893	752	709	709	366	298
Kazakhstan	324	321	273	271	201	234	240	220	237	237	237	237	237
Latvia	59	58	71	55	51	39	36	29	16	13	12	11	9
Lithuania	139	125	117	94	93	77	94	70	43	49	43	33	25
Luxembourg	15	15	13	9	8	6	4	4	3	3	3	3	2
Netherlands	172	164	146	130	135	118	108	103	77	76	71	68	70
Norway	36	35	35	33	33	30	30	28	27	25	22	23	22
Poland	2820	2725	2605	2376	2368	2181	1897	1719	1511	1564	1564	1045	722
Portugal	*281*	*240*	*217*	*249*	*186*	*195*	*241*	*248*	*220*	*200*	*205*	103	87
Republic of Moldova	168	156	109	64	67	36	32	12	13	12	15	117	102
Romania	951	928	912	912	912	912	912	912	912	912	912	669	405
Russian Federation	4033	3637	3131	2969	2774	2524	2275	2062	1997	2031	2130	2470	2019
Serbia and Montenegro	396	401	424	462	434	522	521	355	387	394	382	277	168
Slovakia	380	325	238	239	227	202	179	171	124	129	102	54	38
Slovenia	186	183	177	125	112	118	123	104	99	68	71	22	19
Spain	*2068*	*1946*	*1902*	*1754*	*1540*	*1709*	*1577*	*1606*	*1488*	*1433*	*1507*	411	353
Sweden	93	87	87	77	81	76	73	59	55	57	58	61	62
Switzerland	38	34	31	34	30	26	28	26	19	21	19	16	14
TFYR of Macedonia	105	105	105	105	105	105	105	105	105	137	166	82	72
Turkey	1647	1593	1817	1772	1929	1990	2118	2104	2112	2112	2112	1821	1821
Ukraine	2376	2194	1715	1639	1293	1132	1028	1029	1129	1230	1329	1146	842
United Kingdom	3463	3117	2676	2363	2028	1670	1607	1229	1189	1115	1002	364	224
North Africa	413	413	413	413	413	413	413	413	413	413	413	413	413
Remaining Asiatic areas	854	854	854	854	854	854	854	854	854	854	854	854	854
Baltic Sea	228	228	228	228	228	228	228	228	228	228	228	228	228
Black Sea	57	57	57	57	57	57	57	57	57	57	57	57	57
Mediterranean Sea	1189	1189	1189	1189	1189	1189	1189	1189	1189	1189	1189	1189	1189
North Sea	454	454	454	454	454	454	454	454	454	454	454	454	454
Remaining N-E Atlantic Ocean	901	901	901	901	901	901	901	901	901	901	901	901	901
Natural marine emissions	743	743	743	743	743	743	743	743	743	743	743	743	743
Volcanic emissions	2235	2027	1918	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
TOTAL	39332	36921	34291	32240	30196	28487	27086	25149	24146	23968	23944	19853	17389

[2] All years except 2010 and 2020: Reported values with white background, expert estimates in grey. Values in bold differ from reporting in 2003. Values in italic are reported values modified for modelling purposes by MSC-W. Projections (Base Line Scenario) provide by IIASA (April 2004) in grey boxes. Reported values or extrapolations in white

Table III.2: National total emission trends
Emissions of nitrogen oxides (1980-1991) used for modelling at the MSC-W (Gg of NO_2 per year)[1]

Area/Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Albania	24	24	24	24	24	24	24	24	24	24	24	24
Armenia	15	15	17	17	16	45	53	52	56	51	46	40
Austria	246	232	228	230	230	234	227	225	219	214	212	217
Azerbaijan	**43**	**43**	**43**	**43**	**43**	**43**	**43**	**43**	**43**	**43**	**43**	**43**
Belarus	234	235	235	237	240	238	358	263	262	263	285	281
Belgium	442	419	395	372	348	325	317	338	345	357	334	326
Bosnia and Herzegovina	79	79	79	79	79	79	79	79	79	79	**79**	74
Bulgaria	416	416	416	416	416	416	416	416	415	411	361	256
Croatia	60	63	66	68	71	74	77	79	82	85	88	65
Cyprus	13	13	14	14	14	14	15	16	17	17	18	16
Czech Republic	937	819	818	830	844	831	826	816	858	920	544	521
Denmark	**307**	**307**	**307**	**307**	**307**	**307**	**328**	**319**	**307**	**288**	**283**	**332**
Estonia	70	70	70	70	70	70	70	70	70	69	68	63
Finland	295	276	271	261	257	275	277	288	293	301	300	290
France	**2024**	**1927**	**1895**	**1874**	**1871**	**1847**	**1807**	**1838**	**1842**	**1902**	1897	**1962**
Georgia	121	126	130	138	137	140	134	134	135	131	130	113
Germany	3334	3259	3219	3258	3305	3276	3286	3350	3230	3011	**2845**	**2610**
Greece	306	306	306	306	306	306	296	285	304	297	290	298
Hungary	273	270	268	266	264	263	264	265	258	247	238	203
Iceland	21	21	21	22	22	21	22	24	25	25	26	27
Ireland	73	86	86	85	84	91	100	115	122	127	118	120
Italy	**1585**	**1558**	**1557**	**1537**	**1552**	**1641**	**1705**	**1822**	**1845**	**1904**	**1919**	**1973**
Kazakhstan	89	89	89	89	89	89	89	89	89	89	89	100
Latvia	**83**	**83**	**83**	**83**	**83**	**83**	**83**	**83**	**83**	**83**	**83**	**65**
Lithuania	152	154	156	158	162	166	169	171	172	173	158	166
Luxembourg	23	22	22	21	21	21	20	20	21	22	23	24
Netherlands	583	575	562	555	573	589	587	599	602	584	**579**	568
Norway	191	178	182	187	201	213	228	230	224	225	224	**214**
Poland	1229	1283	1337	1392	1446	1500	1510	1530	1550	1480	1280	1205
Portugal	*158*	166	174	*182*	137	*91*	*105*	*110*	*116*	**169**	**222**	**233**
Republic of Moldova	115	114	107	99	101	123	129	128	131	127	100	97
Romania	523	528	516	542	546	542	559	580	590	579	546	464
Russian Federation	3634	3815	3902	3876	3779	3803	3771	3411	3287	3335	3600	3435
Serbia and Montenegro	192	195	195	198	203	203	203	205	208	207	211	200
Slovakia	197	197	197	197	197	197	197	197	212	227	216	193
Slovenia	51	52	52	51	52	53	58	57	59	58	63	58
Spain	1068	982	972	994	1007	979	1001	1059	1092	1185	***1206***	***1246***
Sweden	404	417	412	401	411	426	432	437	432	418	**324**	**321**
Switzerland	170	172	174	175	177	179	176	174	172	169	154	146
TFYR of Macedonia	39	39	39	39	39	39	39	39	39	39	**39**	37
Turkey	364	377	408	433	459	483	528	570	571	609	644	649
Ukraine	1145	1145	1153	1153	1102	1059	1112	1094	1090	1065	1097	989
United Kingdom	**2580**	**2495**	**2486**	**2496**	**2456**	**2535**	**2618**	**2734**	**2789**	**2789**	**2771**	**2645**
North Africa	96	96	96	96	96	96	96	96	96	96	96	96
Remaining Asiatic areas	169	169	169	169	169	169	169	169	169	169	169	169
Baltic Sea	352	352	352	352	352	352	352	352	352	352	352	352
Black Sea	86	86	86	86	86	86	86	86	86	86	86	86
Mediterranean Sea	1639	1639	1639	1639	1639	1639	1639	1639	1639	1639	1639	1639
North Sea	648	648	648	648	648	648	648	648	648	648	648	648
Remaining N-E Atlantic Ocean	1266	1266	1266	1266	1266	1266	1266	1266	1266	1266	1266	1266
Natural marine emissions	0	0	0	0	0	0	0	0	0	0	0	0
Volcanic emissions	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	28164	27898	27939	28032	27997	28189	28593	28634	28616	28654	28033	27165

[1] All years except 2010 and 2020: Reported values with white background, expert estimates in grey. Values in bold differ from reporting in 2003. Values in italic are reported values modified for modelling purposes by MSC-W. Projections (Base Line Scenario) provide by IIASA (April 2004) in grey boxes. Reported values or extrapolations in white.

Table III.2 Cont.: National total emission trends
Emissions of nitrogen oxides (1992-2002, 2010, 2020) used for modelling at the MSC-W (Gg of NO_2 per year)[2]

Area/Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2010	2020
Albania	24	24	24	24	25	26	27	28	29	29	**29**	**27**	**34**
Armenia	22	12	12	15	11	15	11	11	10	13	**13**	**13**	**13**
Austria	207	199	194	189	194	190	194	190	190	196	**204**	**157**	**123**
Azerbaijan	**43**	**43**	**43**	**43**	**43**	**43**	**43**	**43**	**43**	43	**43**	**43**	**43**
Belarus	224	207	203	**195**	173	189	164	142	135	135	**137**	**266**	**285**
Belgium	334	330	333	359	315	306	312	289	329	292	**284**	**227**	**196**
Bosnia and Herzegovina	69	64	59	**54**	54	54	55	55	55	55	**55**	**53**	**56**
Bulgaria	230	242	230	266	259	225	223	202	**184**	**188**	**188**	**141**	**105**
Croatia	56	59	66	66	69	73	76	77	77	77	**77**	**91**	**101**
Cyprus	19	20	20	19	21	21	22	22	23	18	**22**	**22**	**19**
Czech Republic	496	454	375	368	366	349	321	313	321	332	**318**	**187**	**117**
Denmark	**290**	**289**	**292**	**274**	312	**266**	243	**226**	**208**	**203**	**200**	**146**	**105**
Estonia	39	38	41	42	44	45	46	40	41	38	**40**	**28**	**16**
Finland	284	282	282	258	268	260	252	247	236	222	**208**	**150**	**1124**
France	**1914**	**1790**	**1742**	**1704**	**1673**	**1607**	**1586**	**1512**	**1431**	**1395**	**1352**	**1051**	**812**
Georgia	48	33	21	27	50	55	42	30	**42**	**44**	**44**	**30**	**30**
Germany	**2417**	**2298**	**2129**	**2000**	**1918**	**1822**	**1765**	**1718**	**1639**	**1566**	**1499**	**1176**	**906**
Greece	297	292	299	296	306	310	334	326	321	331	**331**	**274**	**227**
Hungary	183	184	187	190	196	200	203	201	185	185	**180**	**132**	**92**
Iceland	28	29	29	28	30	29	28	28	28	28	**28**	**30**	**30**
Ireland	130	119	115	115	120	119	122	119	125	**132**	**125**	**93**	**61**
Italy	**1991**	**1896**	**1813**	**1785**	**1727**	**1650**	**1539**	**1441**	**1360**	**1317**	**1317**	**980**	**669**
Kazakhstan	94	93	74	71	63	53	57	51	50	50	**50**	**50**	**50**
Latvia	**52**	51	**49**	**51**	**44**	**43**	**42**	**40**	**38**	**41**	**41**	**30**	**18**
Lithuania	98	78	77	65	65	57	60	54	48	55	**51**	**41**	**29**
Luxembourg	24	25	23	21	22	18	17	16	17	17	**17**	**27**	**18**
Netherlands	556	535	510	**497**	501	453	428	429	**423**	**413**	**406**	**327**	**259**
Norway	212	221	219	221	230	233	234	237	224	220	**213**	**204**	**189**
Poland	1130	1120	1105	1120	1154	1114	991	951	838	805	**805**	**616**	**393**
Portugal	**250**	**242**	**242**	**250**	**239**	**238**	**249**	**250**	**248**	**243**	**265**	**233**	**167**
Republic of Moldova	67	53	46	38	38	37	22	17	27	23	**25**	**62**	**60**
Romania	357	318	319	319	319	319	319	319	319	319	**319**	**269**	**193**
Russian Federation	3123	3054	2667	2570	2467	2379	2488	2494	2357	2462	**2566**	**2500**	**2782**
Serbia and Montenegro	189	177	166	155	155	156	156	157	158	158	**158**	**168**	**173**
Slovakia	181	174	164	174	132	125	130	118	**107**	106	**102**	**65**	**52**
Slovenia	58	63	66	67	70	71	64	58	58	**57**	**58**	**39**	**28**
Spain	***1276***	***1249***	***1257***	***1267***	***1229***	***1274***	***1270***	***1314***	***1333***	***1305***	***1339***	**924**	**668**
Sweden	**317**	**305**	**308**	**298**	**291**	**279**	**274**	**262**	**250**	**247**	**242**	**193**	**150**
Switzerland	138	129	124	120	113	107	104	99	96	98	**94**	**74**	**59**
TFYR of Macedonia	36	34	32	**30**	30	30	30	30	30	32	**37**	**37**	**40**
Turkey	667	748	731	800	873	879	863	952	951	951	951	**2044**	**951**
Ukraine	830	700	568	531	467	455	558	543	561	583	**587**	**587**	**588**
United Kingdom	**2566**	**2391**	**2311**	**2188**	**2190**	**2022**	**1938**	1810	**1718**	**1647**	**1582**	**1113**	**803**
North Africa	96	96	96	96	96	96	96	96	96	96	**96**	**96**	**96**
Remaining Asiatic areas	169	169	169	169	169	169	169	169	169	169	**169**	**169**	**169**
Baltic Sea	352	352	352	352	352	352	352	352	352	352	**352**	**352**	**352**
Black Sea	86	86	86	86	86	86	86	86	86	86	**86**	**86**	**86**
Mediterranean Sea	1639	1639	1639	1639	1639	1639	1639	1639	1639	1639	**1639**	**1639**	**1639**
North Sea	648	648	648	648	648	648	648	648	648	648	**648**	**648**	**648**
Remaining N-E Atlantic	1266	1266	1266	1266	1266	1266	1266	1266	1266	1266	**1266**	**1266**	**1266**
Natural marine emissions	0	0	0	0	0	0	0	0	0	0	**0**	**0**	**0**
Volcanic emissions	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**
TOTAL	25822	24921	23824	23426	23123	22453	22159	21717	21119	20927	20858	19176	17090

[2] All years except 2010 and 2020: Reported values with white background, expert estimates in grey. Values in bold differ from reporting in 2003. Values in italic are reported values modified for modelling purposes by MSC-W. Projections (Base Line Scenario) provide by IIASA (April 2004) in grey boxes. Reported values or extrapolations in white

Table III.3: National total emission trends
Emissions of ammonia (1980-1991) used for modelling at the MSC-W (Gg of NH_3 per year)[1]

Area/Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Albania	32	32	32	32	32	32	32	32	32	32	32	31
Armenia	25	25	25	25	25	25	25	25	25	25	25	24
Austria	**52**	52	**53**	**54**	54	54	53	54	51	**53**	**57**	**59**
Azerbaijan	25	25	25	25	25	25	25	25	25	25	25	25
Belarus	142	142	142	142	142	142	142	142	142	142	142	142
Belgium	89	89	89	89	89	89	91	93	95	97	99	93
Bosnia and Herzegovina	31	31	31	31	31	31	31	31	31	31	31	29
Bulgaria	144	144	144	144	144	144	144	144	144	144	144	124
Croatia	37	37	37	37	37	37	37	37	37	37	37	32
Cyprus	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5
Czech Republic	156	156	156	156	156	156	156	156	156	156	156	134
Denmark	**138**	**138**	**138**	**138**	**138**	138	139	136	132	133	133	129
Estonia	24	24	24	24	24	24	24	24	24	24	24	22
Finland	39	40	41	41	42	43	41	45	43	40	38	40
France	795	804	807	812	799	799	809	806	784	781	779	774
Georgia	97	97	97	97	97	97	97	97	97	97	97	97
Germany	835	821	817	841	853	857	846	845	835	823	**735**	**654**
Greece	79	79	79	79	79	79	79	79	79	79	79	78
Hungary	157	156	154	153	151	150	170	150	160	170	124	93
Iceland	3	3	3	3	3	3	3	3	3	3	3	3
Ireland	112	112	112	112	112	112	112	112	112	112	112	115
Italy	**441**	**438**	**427**	**464**	**443**	**448**	**456**	**457**	**459**	**443**	**428**	**435**
Kazakhstan	18	18	18	18	18	18	18	18	18	18	18	18
Latvia	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**37**
Lithuania	**85**	**86**	**86**	**87**	**88**	**89**	**89**	**90**	**89**	**86**	**84**	**85**
Luxembourg	7	7	7	7	7	7	7	7	7	7	7	7
Netherlands	234	240	244	244	246	248	258	258	237	232	232	228
Norway	**20**	23	23	23	23	23	23	**21**	21	**21**	**20**	**21**
Poland	550	550	550	550	550	550	550	550	550	550	508	450
Portugal	***96***	***96***	***96***	***96***	***96***	***96***	***96***	***96***	***96***	***96***	***96***	***95***
Republic of Moldova	53	54	55	56	57	58	56	54	53	51	49	49
Romania	340	332	327	311	359	343	350	329	339	341	300	267
Russian Federation	1189	1192	1214	1245	1247	1239	1286	1277	1269	1258	1191	1161
Serbia and Montenegro	90	90	90	90	90	90	90	90	90	90	90	88
Slovakia	63	63	63	63	63	63	63	63	63	63	63	56
Slovenia	24	24	24	24	24	24	24	24	24	24	24	23
Spain	285	276	292	295	299	296	304	330	331	339	***327***	***316***
Sweden	54	54	54	54	54	54	54	54	54	54	54	55
Switzerland	77	73	69	64	60	74	73	73	72	72	72	71
TFYR of Macedonia	17	17	17	17	17	17	17	17	17	17	17	17
Turkey	321	321	321	321	321	321	321	321	321	321	321	321
Ukraine	729	729	729	729	729	729	729	729	729	729	729	734
United Kingdom	361	361	361	361	361	361	361	361	361	361	**361**	**363**
North Africa	235	235	235	235	235	235	235	235	235	235	235	235
Remaining Asiatic areas	278	278	278	278	278	278	278	278	278	278	278	278
Baltic Sea	0	0	0	0	0	0	0	0	0	0	0	0
Black Sea	0	0	0	0	0	0	0	0	0	0	0	0
Mediterranean Sea	0	0	0	0	0	0	0	0	0	0	0	0
North Sea	0	0	0	0	0	0	0	0	0	0	0	0
Remaining N-E Atlantic	0	0	0	0	0	0	0	0	0	0	0	0
Natural marine emissions	0	0	0	0	0	0	0	0	0	0	0	0
Volcanic emissions	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	8627	8612	8634	8715	8746	8746	8842	8816	8768	8738	8423	8116

[1] All years except 2010 and 2020: Reported values with white background, expert estimates in grey. Values in bold differ from reporting in 2003. Values in italic are reported values modified for modelling purposes by MSC-W. Projections (Base Line Scenario) provide by IIASA (April 2004) in grey boxes. Reported values or extrapolations in white.

Table III.3 Cont.: National total emission trends

Emissions of ammonia (1992-2002, 2010, 2020) used for modelling at the MSC-W (Gg of NH_3 per year)[2]

Area/Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2010	2020
Albania	30	29	28	**28**	29	30	31	32	32	32	**32**	**26**	**26**
Armenia	23	22	21	20	19	18	17	16	15	14	**12**	**25**	**25**
Austria	**55**	**57**	**59**	**58**	**57**	**58**	**57**	**56**	54	54	**53**	**56**	**54**
Azerbaijan	25	25	25	25	25	25	25	25	25	25	**25**	**25**	**25**
Belarus	142	142	142	142	142	142	142	142	142	137	**128**	**147**	**147**
Belgium	93	97	96	100	99	99	102	100	81	**85**	**83**	**79**	**76**
Bosnia and Herzegovina	27	25	24	**23**	23	23	23	23	23	23	**23**	**17**	**17**
Bulgaria	111	109	101	99	83	77	66	60	56	**56**	**56**	**124**	**124**
Croatia	27	26	24	25	23	23	23	24	23	23	**23**	**33**	**33**
Cyprus	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5	8,5	**6,6**	**6**	**6**
Czech Republic	115	99	91	86	81	81	80	75	74	77	72	**63**	**64**
Denmark	127	124	120	113	110	109	110	105	**105**	**104**	**101**	**93**	**91**
Estonia	18	13	13	11	9,6	9,7	9,8	8,5	8,8	9	**9,1**	**11**	**12**
Finland	41	39	37	35	35	38	38	35	33	33	**33**	**38**	**37**
France	765	757	762	766	778	783	785	787	784	**786**	**778**	**732**	**701**
Georgia	97	97	97	97	97	97	97	97	97	97	**97**	**97**	**97**
Germany	**636**	**631**	**600**	**609**	**613**	**606**	**612**	**610**	**602**	**614**	**614**	**624**	**606**
Greece	75	75	73	85	73	71	74	73	73	73	**73**	**54**	**52**
Hungary	84	77	76	77	78	76	74	71	71	66	**65**	**83**	**85**
Iceland	3	3	3	3	3	3	3	3	3	3	**3**	**3**	**3**
Ireland	117	117	119	120	122	123	127	127	122	**123**	**119**	**131**	**123**
Italy	**428**	**429**	**424**	**426**	**419**	**434**	**435**	**436**	**429**	**442**	**442**	**421**	**402**
Kazakhstan	18	18	18	18	18	18	18	18	18	18	**18**	**18**	**18**
Latvia	**29**	**17**	**15**	**15**	**14**	**13**	**12**	**11**	**10**	**11**	**11**	**14**	**16**
Lithuania	**81**	**80**	**80**	**38**	**36**	**35**	**35**	**29**	**25**	**50**	**51**	**55**	**57**
Luxembourg	7	7	7	7	7	7	7	7,3	7,2	7	**7**	**4**	**4**
Netherlands	180	191	166	193	146	188	170	166	152	**142**	**136**	**154**	**150**
Norway	**22**	**22**	**22**	**23**	**24**	**23**	**23**	**23**	**23**	**23**	**22**	**27**	**27**
Poland	447	382	384	380	364	350	371	341	322	**328**	**328**	**328**	**335**
Portugal	***91***	***90***	***90***	***90***	***91***	***90***	***92***	***94***	***92***	***92***	***93***	**69**	**67**
Republic of Moldova	44	37	35	33	31	25	25	25	25	26	**27**	**45**	**44**
Romania	255	223	221	221	221	221	221	221	221	221	**221**	**285**	**285**
Russian Federation	1084	903	772	824	749	730	675	657	650	625	**600**	**835**	**833**
Serbia and Montenegro	85	83	80	**78**	78	78	78	79	79	79	**79**	**69**	**69**
Slovakia	47	42	39	40	38	36	32	30	30	28	**29**	**32**	**33**
Slovenia	24	23	22	22	22	19	20	20	19	19	**19**	**20**	**20**
Spain	***315***	***296***	***316***	***304***	***338***	***338***	***356***	***368***	***386***	***380***	***379***	**382**	**370**
Sweden	55	**61**	62	**63**	**61**	**61**	60	**58**	**58**	**55**	**55**	**51**	**48**
Switzerland	71	71	70	69	69	69	68	68	68	68	**67**	**63**	**61**
TFYR of Macedonia	17	16	16	16	16	16	16	16	16	16	**16**	**15**	**15**
Turkey	321	321	321	321	321	321	321	321	321	321	**321**	**321**	**321**
Ukraine	691	620	585	540	518	483	410	364	358	378	**378**	**324**	**270**
United Kingdom	**347**	**345**	**347**	**337**	**338**	**341**	**335**	**331**	**311**	**306**	**296**	**320**	**307**
North Africa	235	235	235	235	235	235	235	235	235	235	235	**235**	**235**
Remaining Asiatic areas	278	278	278	278	278	278	278	278	278	278	278	**278**	**278**
Baltic Sea	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**
Black Sea	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**
Mediterranean Sea	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**
North Sea	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**
Remaining N-E Atlantic Ocean	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**
Natural marine emissions	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**
Volcanic emissions	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**
TOTAL	7792	7363	7125	7102	6940	6910	6798	6674	6566	6590	6513	6832	6669

[2] All years except 2010 and 2020: Reported values with white background, expert estimates in grey. Values in bold differ from reporting in 2003. Values in italic are reported values modified for modelling purposes by MSC-W. Projections (Base Line Scenario) provide by IIASA (April 2004) in grey boxes. Reported values or extrapolations in white

Table III.4: National total emission trends
Emissions of non-methane volatile organic compounds (1980-1991) used for modelling at the MSC-W (Gg of NMVOC per year)[1]

Area/Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Albania	31	31	31	31	31	31	31	31	31	31	31	30
Armenia	26	26	24	24	22	93	98	104	93	90	81	70
Austria	**437**	**413**	**408**	**406**	**407**	**400**	**393**	**390**	**378**	**346**	**298**	**286**
Azerbaijan	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**	**9**
Belarus	549	546	543	543	540	516	506	509	535	511	533	546
Belgium	274	274	274	274	274	274	274	274	274	274	274	267
Bosnia and Herzegovina	51	51	51	51	51	51	51	51	51	51	51	49
Bulgaria	309	309	309	309	309	309	309	309	309	263	217	178
Croatia	105	105	105	105	105	105	105	105	105	105	105	87
Cyprus	**14**	**14**	**14**	**14**	**14**	**14**	**14**	**14**	**14**	**14**	**14**	**14**
Czech Republic	275	275	275	275	275	275	308	341	375	408	441	394
Denmark	**194**	**194**	**194**	**194**	**194**	**194**	**193**	**193**	**189**	**187**	**164**	**166**
Estonia	81	81	81	81	81	81	83	83	84	87	88	82
Finland	210	210	210	210	210	210	210	210	225	227	224	210
France	**2734**	**2734**	**2734**	**2734**	**2734**	**2734**	**2734**	**2734**	**2734**	**2700**	**2499**	**2479**
Georgia	46	47	48	50	49	49	48	48	48	46	46	8,2
Germany	3224	3152	3134	3152	3191	3190	3218	3274	3256	3202	**3591**	**3137**
Greece	255	255	255	255	255	255	255	255	255	255	255	253
Hungary	215	218	222	225	229	232	263	228	215	205	205	150
Iceland	7,7	7,7	7,7	7,6	7,7	8	8,4	12	13	13	13	14
Ireland	111	111	111	111	111	111	111	111	111	111	111	111
Italy	**2032**	**1980**	**1935**	**1911**	**1879**	**1847**	**1865**	**1939**	**1970**	**2061**	2041	**2109**
Kazakhstan	89	89	89	89	89	89	89	89	89	89	89	100
Latvia	**152**	**152**	**152**	**152**	**152**	**152**	**152**	**152**	**152**	**152**	**152**	**103**
Lithuania	100	102	104	105	106	112	108	108	109	109	108	111
Luxembourg	15	15	15	15	15	15	16	16	17	18	19	19
Netherlands	579	555	543	526	513	502	489	485	538	468	**490**	462
Norway	173	182	189	201	212	231	249	253	249	275	294	294
Poland	1036	912	889	954	985	1011	1029	1014	1026	1016	831	833
Portugal	189	189	189	189	189	***189***	**202**	**215**	**228**	**241**	**255**	**264**
Republic of Moldova	105	105	105	105	105	105	101	102	102	96	157	151
Romania	829	810	772	796	812	787	830	884	846	812	772	678
Russian Federation	3410	3410	3410	3410	3410	3410	3410	3410	3396	3444	3668	3361
Serbia and Montenegro	142	142	142	142	142	142	142	142	142	142	142	137
Slovakia	**252**	**252**	**252**	**252**	**252**	**252**	**252**	**252**	**252**	**252**	**252**	**217**
Slovenia	39	39	39	39	39	39	39	39	39	42	44	41
Spain	1392	1372	1350	1377	1371	1393	1420	1475	1510	1544	***1591***	***1617***
Sweden	**528**	**528**	**528**	**528**	**528**	**528**	**528**	**528**	**528**	**524**	**503**	**483**
Switzerland	323	323	323	324	324	324	318	311	305	298	279	261
TFYR of Macedonia	19	19	19	19	19	19	19	19	19	19	19	18
Turkey	359	361	379	387	384	379	403	430	450	453	463	457
Ukraine	1626	1626	1626	1626	1626	1626	1660	1687	1604	1512	1369	1302
United Kingdom	**2100**	**2090**	**2129**	**2165**	**2218**	**2225**	**2292**	**2367**	**2438**	**2476**	**2419**	**2337**
North Africa	96	96	96	96	96	96	96	96	96	96	96	96
Remaining Asiatic areas	204	204	204	204	204	204	204	204	204	204	204	204
Baltic Sea	8	8	8	8	8	8	8	8	8	8	8	8
Black Sea	2	2	2	2	2	2	2	2	2	2	2	2
Mediterranean Sea	34	34	34	34	34	34	34	34	34	34	34	34
North Sea	15	15	15	15	15	15	15	15	15	15	15	15
Remaining N-E Atlantic Ocean	25	25	25	25	25	25	25	25	25	25	25	25
Natural marine emissions	0	0	0	0	0	0	0	0	0	0	0	0
Volcanic emissions	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	25030	24700	24603	24756	24853	24902	25218	25586	25696	25561	25591	24280

[1] All years except 2010 and 2020: Reported values with white background, expert estimates in grey. Values in bold differ from reporting in 2003. Values in italic are reported values modified for modelling purposes by MSC-W. Projections (Base Line Scenario) provide by IIASA (April 2004) in grey boxes. Reported values or extrapolations in white.

Table III.4 Cont.: National total emission trends

Emissions of non-methane volatile organic compounds (1992-2002, 2010, 2020) used for modelling at the MSC-W (Gg of NMVOC per year)[2]

Area/Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2010	2020
Albania	30	29	29	28	29	30	32	33	34	34	34	35	40
Armenia	31	20	17	23	18	18	17	17	16	28	14	28	28
Austria	257	250	233	232	226	213	201	190	190	195	193	164	157
Azerbaijan	9	9	9	9	9	9	9	9	9	9	9	9	9
Belarus	412	372	366	347	328	345	294	240	225	215	229	250	258
Belgium	266	265	258	262	242	249	269	248	233	276	264	173	175
Bosnia and Herzegovina	46	44	41	39	40	40	41	41	42	42	42	44	51
Bulgaria	179	208	175	173	147	120	132	118	120	123	123	118	90
Croatia	64	69	75	74	82	80	79	77	80	80	80	104	107
Cyprus	14	14	14	14	14	14	14	14	14	14	16	3	3
Czech Republic	366	346	310	292	293	277	242	234	227	220	203	150	137
Denmark	164	165	162	158	157	149	143	138	132	126	124	86	81
Estonia	45	42	45	48	50	54	54	42	34	33	38	34	29
Finland	204	196	194	188	182	175	171	166	161	157	151	130	106
France	2424	2314	2187	2107	2020	1947	1888	1806	1719	1648	1542	1024	937
Georgia	3,9	2,2	1,7	1,5	2,4	2,8	11	19	28	29	29	19	19
Germany	2864	2643	2471	2251	2112	2044	1968	1844	1700	1595	1478	1141	867
Greece	261	270	274	273	284	285	290	291	305	268	268	180	166
Hungary	142	149	142	150	150	145	141	170	173	166	155	83	72
Iceland	14	14	14	12	12	9,8	10	10	10	10	10	7	7
Ireland	114	109	107	105	112	116	118	98	90	87	81	72	70
Italy	2157	2109	2055	2034	1988	1920	1815	1722	1557	1467	1467	971	732
Kazakhstan	94	93	74	71	63	53	57	51	50	50	50	50	50
Latvia	84	74	77	80	83	86	87	87	81	85	89	24	14
Lithuania	66	52	52	77	82	81	79	68	61	71	72	42	38
Luxembourg	18	18	18	16	16	15	13	15	15	15	15	11	12
Netherlands	438	405	389	361	362	317	301	291	266	250	243	237	242
Norway	322	338	352	367	371	369	361	368	380	391	345	299	147
Poland	805	756	819	769	766	774	730	731	599	576	576	453	417
Portugal	276	272	278	279	282	283	285	276	271	266	271	298	258
Republic of Moldova	99	75	66	62	64	69	43	22	21	25	28	38	38
Romania	627	634	638	638	638	638	638	638	638	638	638	369	287
Russian Federation	3297	3062	2924	2857	2622	2386	2376	2451	2450	2614	2777	2643	2915
Serbia and Montenegro	132	128	123	118	120	122	124	126	129	129	129	140	144
Slovakia	182	148	145	154	158	133	128	124	85	88	87	62	63
Slovenia	40	42	44	44	49	48	42	40	40	49	49	33	25
Spain	*1600*	*1501*	*1559*	*1509*	*1488*	*1488*	*1537*	*1532*	*1496*	*1477*	*1459*	832	794
Sweden	470	438	418	410	395	365	341	318	306	297	295	176	168
Switzerland	242	226	213	199	191	182	173	165	159	145	143	102	96
TFYR of Macedonia	17	16	15	14	15	15	16	16	17	17	17	31	36
Turkey	479	527	516	677	755	784	803	785	726	726	726	1935	726
Ukraine	1171	972	1024	811	718	665	254	272	271	269	282	282	282
United Kingdom	2252	2131	2090	1958	1869	1800	1658	1479	1364	1265	1186	902	863
North Africa	96	96	96	96	96	96	96	96	96	96	96	96	96
Remaining Asiatic areas	204	204	204	204	204	204	204	204	204	204	204	204	204
Baltic Sea	8	8	8	8	8	8	8	8	8	8	8	8	8
Black Sea	2	2	2	2	2	2	2	2	2	2	2	2	2
Mediterranean Sea	34	34	34	34	34	34	34	34	34	34	34	34	34
North Sea	15	15	15	15	15	15	15	15	15	15	15	15	15
Remaining N-E Atlantic	25	25	25	25	25	25	25	25	25	25	25	25	25
Natural marine emissions	0	0	0	0	0	0	0	0	0	0	0	0	0
Volcanic emissions	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	23163	21930	21398	20675	19988	19301	18368	17767	16907	16648	16410	14168	12140

[2] All years except 2010 and 2020: Reported values with white background, expert estimates in grey. Values in bold differ from reporting in 2003. Values in italic are reported values modified for modelling purposes by MSC-W. Projections (Base Line Scenario) provide by IIASA (April 2004) in grey boxes. Reported values or extrapolations in white

Table III.5: National total emission trends
Emissions of carbon monoxide (1980-1991) used for modelling at the MSC-W (Gg of CO per year)[1]

Area/Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Albania	84	84	84	84	84	84	84	84	84	84	84	84
Armenia	405	405	405	405	405	405	405	417	417	399	304	377
Austria	**1786**	**1743**	**1717**	**1693**	**1740**	**1714**	**1649**	**1579**	**1496**	**1437**	**1249**	**1253**
Azerbaijan	293	293	293	293	293	293	293	293	293	293	293	293
Belarus	1654	1654	1654	1654	1654	1654	1605	1601	1590	1615	1722	1717
Belgium	1285	1285	1285	1285	1285	1285	1285	1285	1285	1285	1285	1103
Bosnia and Herzegovina	277	277	277	277	277	277	277	277	277	277	277	259
Bulgaria	997	997	997	997	997	997	997	997	995	985	891	608
Croatia	655	655	655	655	655	655	655	655	655	655	655	565
Cyprus	46	46	49	49	49	49	53	56	60	60	63	56
Czech Republic	894	900	906	901	895	899	740	738	737	884	1257	1179
Denmark	**1036**	**1036**	**1036**	**1036**	**1036**	**1036**	**1015**	**1032**	**941**	**993**	**745**	**788**
Estonia	400	400	400	400	400	400	417	423	419	448	434	399
Finland	660	650	640	630	620	610	600	589	579	569	559	552
France	**15810**	**15041**	**14584**	**14150**	**14214**	**14046**	**13649**	**13410**	**12975**	**12420**	**10947**	**10832**
Georgia	648	617	632	648	651	637	643	639	648	597	526	441
Germany	14046	13027	12438	11980	12176	12134	12135	12438	12081	11430	**11212**	**9528**
Greece	1298	1298	1298	1298	1298	1298	1298	1298	1298	1298	1298	1290
Hungary	1019	1001	984	996	949	931	942	952	963	980	997	913
Iceland	44	44	44	43	44	46	48	54	57	57	58	59
Ireland	401	401	401	401	401	401	401	401	401	401	401	394
Italy	**7164**	**7099**	**7177**	**7107**	**7270**	**7303**	**7265**	**7347**	**7219**	**7365**	**7146**	**7492**
Kazakhstan	*410*	*410*	*410*	*410*	*410*	*410*	*410*	*410*	*410*	*410*	*410*	*494*
Latvia	**752**	**752**	**752**	**752**	**752**	**752**	**752**	**752**	**752**	**752**	**752**	**634**
Lithuania	541	548	543	550	550	545	554	564	578	568	519	577
Luxembourg	193	193	193	193	193	193	189	186	182	179	175	190
Netherlands	1530	1418	1374	1354	1357	1381	1252	1192	1179	1131	1128	1025
Norway	**878**	**815**	**824**	**816**	**842**	**844**	**872**	**886**	**869**	**869**	867	**800**
Poland	7406	7406	7406	7406	7406	7406	7406	7406	7406	7406	7406	7245
Portugal	***745***	***745***	***745***	***745***	***745***	***745***	***745***	***745***	***745***	***745***	***745***	***756***
Republic of Moldova	394	392	395	388	387	483	478	474	496	476	453	468
Romania	3245	3217	3152	3030	3463	3307	3378	3196	3317	3314	3186	2695
Russian Federation	13520	15005	13617	13696	13672	14122	13142	13270	13144	12210	13329	13000
Serbia and Montenegro	672	683	683	693	711	711	711	718	728	725	739	699
Slovakia	491	491	491	491	491	491	491	491	491	491	**493**	**438**
Slovenia	68	66	63	61	64	68	78	79	75	75	81	78
Spain	3494	3372	3343	3370	3344	3305	3347	3437	3620	3807	3702	**3769**
Sweden	**1202**	**1202**	**1202**	**1202**	**1202**	**1202**	**1202**	**1202**	**1202**	**1202**	**1202**	**1178**
Switzerland	1280	1222	1164	1106	1048	990	933	877	820	764	673	629
TFYR of Macedonia	77	77	77	77	77	77	77	77	77	77	77	77
Turkey	2934	2961	3110	3141	3141	3121	3305	3477	3610	3505	3585	3579
Ukraine	9832	9832	9832	9832	9832	9832	9722	9269	9085	8794	8141	7406
United Kingdom	7669	**7657**	**7751**	**7566**	**7651**	**7452**	**7453**	**7496**	**7554**	**7798**	**7417**	**7186**
North Africa	336	336	336	336	336	336	336	336	336	336	336	336
Remaining Asiatic areas	449	449	449	449	449	449	449	449	449	449	449	449
Baltic Sea	29	29	29	29	29	29	29	29	29	29	29	29
Black Sea	8	8	8	8	8	8	8	8	8	8	8	8
Mediterranean Sea	139	139	139	139	139	139	139	139	139	139	139	139
North Sea	59	59	59	59	59	59	59	59	59	59	59	59
Remaining N-E Atlantic	111	111	111	111	111	111	111	111	111	111	111	111
Natural marine emissions	0	0	0	0	0	0	0	0	0	0	0	0
Volcanic emissions	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	109364	108546	106212	104991	105860	105720	104082	103898	102939	100959	98613	94236

[1] All years except 2010 and 2020: Reported values with white background, expert estimates in grey. Values in bold differ from reporting in 2003. Values in italic are reported values modified for modelling purposes by MSC-W. Projections (Base Line Scenario) provide by IIASA (April 2004) in grey boxes. Reported values or extrapolations in white.

Table III.5 Cont.: National total emission trends

Emissions of carbon monoxide (1992-2002, 2010, 2020) used for modelling at the MSC-W (Gg of CO per year)[2]

Area/Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2010	2020
Albania	84	84	84	84	88	91	95	98	102	102	102	160	196
Armenia	195	145	128	174	126	224	124	124	110	104	106	104	104
Austria	1209	1171	1118	1031	1038	978	938	891	833	837	812	727	695
Azerbaijan	293	293	293	293	293	293	293	293	293	293	293	293	293
Belarus	1381	1201	1241	1253	1242	1223	1034	786	718	711	712	837	951
Belgium	1123	1088	1044	1175	1000	938	1114	1017	1100	1006	1019	306	286
Bosnia and Herzegovina	242	224	207	189	189	189	193	193	193	193	193	160	203
Bulgaria	768	820	855	846	613	515	650	617	667	619	619	568	393
Croatia	417	375	369	374	428	431	409	399	402	402	402	480	514
Cyprus	67	70	70	67	74	74	77	77	81	85	83	85	85
Czech Republic	1170	1103	1125	999	1012	944	765	716	648	649	546	475	438
Denmark	778	786	758	742	747	695	634	609	602	603	577	358	309
Estonia	208	210	241	242	268	283	281	215	202	177	178	126	105
Finland	478	457	444	436	461	474	452	547	526	605	600	644	602
France	10353	9770	9070	8913	8320	7864	7663	7138	6624	6261	5954	4795	4576
Georgia	130	143	149	250	390	429	353	223	216	218	218	222	222
Germany	8351	7701	7080	6580	6166	5993	5554	5200	4925	4573	4311	1036	967
Greece	1320	1285	1264	1254	1354	1356	1489	1386	1531	1366	1366	1240	1120
Hungary	836	796	774	761	727	733	737	722	633	592	620	492	487
Iceland	61	60	60	49	50	39	40	40	40	40	40	19	19
Ireland	395	350	329	304	307	312	318	285	280	270	254	204	192
Italy	7653	7552	7362	7140	6844	6696	6173	5914	5221	4965	4965	365	309
Kazakhstan	*490*	*450*	*356*	*355*	*363*	*345*	*336*	*297*	*279*	*279*	*279*	*279*	*279*
Latvia	615	326	330	391	408	399	399	396	364	381	378	185	133
Lithuania	350	292	303	286	312	358	358	320	282	229	224	228	155
Luxembourg	204	219	145	107	103	80	51	50	49	49	49	42	37
Netherlands	983	960	907	849	903	749	739	702	699	673	653	622	678
Norway	778	781	766	734	707	670	634	600	571	560	530	1552	1542
Poland	7083	8655	5115	4547	4837	4700	4301	4363	3463	3528	3528	2863	3068
Portugal	*776*	*763*	*750*	*747*	*733*	*710*	*701*	*684*	*675*	*638*	*644*	1794	1810
Republic of Moldova	279	218	171	192	170	210	153	100	102	104	107	192	199
Romania	2506	2434	2325	2325	2325	2325	2325	2325	2325	2325	2325	1034	845
Russian Federation	11703	11320	10603	9945	9401	10332	10383	10804	10811	11164	11517	9805	7924
Serbia and Montenegro	660	621	582	543	543	546	546	550	553	553	553	573	639
Slovakia	384	412	385	380	348	350	327	322	300	300	297	240	231
Slovenia	78	87	93	91	95	93	77	70	68	93	89	199	203
Spain	3831	3623	3578	3215	3308	3159	3145	2876	2774	2743	2623	3362	3176
Sweden	1174	1134	1119	1113	1081	996	957	897	838	796	766	624	598
Switzerland	581	544	516	491	467	443	422	399	394	374	383	346	331
TFYR of Macedonia	77	77	77	77	77	77	77	77	77	76	81	214	248
Turkey	3662	3936	3769	3987	4135	4179	4156	4047	3778	3778	3778	3778	3778
Ukraine	5496	4218	3375	2906	2567	2516	2810	2672	2708	2744	2780	3055	3824
United Kingdom	6872	6361	6010	5651	5644	5251	4874	4531	3928	3636	3238	1924	1810
North Africa	336	336	336	336	336	336	336	336	336	336	336	336	336
Remaining Asiatic areas	449	449	449	449	449	449	449	449	449	449	449	131	131
Baltic Sea	29	29	29	29	29	29	29	29	29	29	29	15	15
Black Sea	8	8	8	8	8	8	8	8	8	8	8	8	8
Mediterranean Sea	139	139	139	139	139	139	139	139	139	139	139	2,5	2,5
North Sea	59	59	59	59	59	59	59	59	59	59	59	91	91
Remaining N-E Atlantic Ocean	111	111	111	111	111	111	111	111	111	111	111	133	133
Natural marine emissions	0	0	0	0	0	0	0	0	0	0	0	0	0
Volcanic emissions	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	87224	84246	76470	73218	71394	70392	68287	65702	62114	60824	59922	47324	45291

[2] All years except 2010 and 2020: Reported values with white background, expert estimates in grey. Values in bold differ from reporting in 2003. Values in italic are reported values modified for modelling purposes by MSC-W. Projections (Base Line Scenario) provide by IIASA (April 2004) in grey boxes. Reported values or extrapolations in white

Table III.6: National total emission trends
Emissions of Particulate Matter (1999-2002, 2010 & 2020) used for modelling at the MSC-W (Gg of $PM_{2.5}$ & PM_{10} per year)[1]

	PM 2.5							PM 10					
Area/Year	**1999**	**2000**	**2001**	**2002**	**2010**	**2020**		**1999**	**2000**	**2001**	**2002**	**2010**	**2020**
Albania	**6**	**6**	**6**	**6**	**5**	**6**		**8**	**8**	**8**	**8**	**6**	**7**
Armenia	**5**	**5**	**5**	**5**	5	5		**7**	7	7	7	7	7
Austria	**25**	**25**	**26**	**26**	**29**	**25**		**39**	**38**	**40**	**41**	**42**	**37**
Azerbaijan	**19**	19	19	19	19	19		**30**	30	30	30	30	30
Belarus	**36**	**36**	**36**	**36**	**33**	**28**		**51**	**51**	**51**	**51**	**44**	**36**
Belgium	**36**	36	**37**	**34**	**24**	**21**		**65**	65	66	**64**	**43**	**40**
Bosnia and Herzegovina	**20**	**20**	**20**	**20**	**17**	**16**		**47**	**47**	**47**	**47**	**36**	**33**
Bulgaria	**56**	**56**	**56**	**56**	**46**	**38**		**90**	**90**	**90**	**90**	**76**	**66**
Croatia	**18**	**18**	**18**	**18**	**14**	**14**		**27**	**27**	**27**	**27**	**19**	**20**
Cyprus	**3**	**3**	**3**	**3**	**3**	**3**		**5**	**5**	**5**	**5**	**5**	**5**
Czech Republic	**55**	**55**	**55**	**55**	**34**	**23**		**83**	**83**	**83**	**83**	**53**	**37**
Denmark	**15**	**15**	**15**	**14**	**18**	**15**		**22**	**22**	**23**	**22**	**28**	**24**
Estonia	**21**	**21**	**25**	**25**	**13**	**7**		**41**	**41**	**35**	**35**	**18**	**9**
Finland	**38**	38	38	**39**	**31**	**26**		48	48	54	**55**	**37**	**33**
France	**307**	**290**	**288**	**275**	**196**	**161**		**556**	**535**	**531**	**518**	**274**	**248**
Georgia	**8**	**8**	**8**	**8**	8	8		12	12	12	12	12	12
Germany	**166**	**166**	**166**	**166**	**132**	**117**		**254**	**254**	**254**	**254**	**217**	**204**
Greece	**50**	**50**	**50**	**50**	**50**	**44**		**66**	**66**	**66**	**66**	**68**	**62**
Hungary	**20**	26	24	**24**	**26**	**24**		**46**	47	**45**	**43**	**38**	**37**
Iceland	**3**	3	3	3	3	3		3	3	3	3	3	3
Ireland	**13**	**13**	**12**	**11**	**11**	**8**		**14**	14	**17**	**15**	**17**	**14**
Italy	**202**	**202**	**202**	**202**	**126**	**93**		**264**	**264**	**264**	**264**	**176**	**144**
Kazakstan	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Latvia	**2.9**	**2.9**	**3.1**	**3.1**	**6**	**4**		**4.22**	**4.22**	**4.19**	**4.21**	**8**	**6**
Lithuania	**17**	**17**	**17**	**17**	**14**	**12**		**20**	**20**	**20**	**20**	**18**	**15**
Luxembourg	**3**	**3**	**3**	**3**	**2**	**2**		**4**	**4**	**4**	**4**	**4**	**3**
Netherlands	**37**	**31**	**29**	**28**	**29**	**25**		**63**	**49**	**46**	**45**	**52**	**48**
Norway	**59**	**60**	**59**	**55**	**43**	**40**		**65**	66	**65**	**62**	**48**	**45**
Poland	**135**	135	142	**142**	**146**	**104**		282	282	**303**	**299**	**206**	**155**
Portugal	**45**	**45**	**45**	**45**	**38**	**36**		**58**	**58**	**58**	**58**	**48**	**47**
Republic of Moldova	**22**	**22**	**22**	**22**	**21**	**14**		**39**	**39**	**39**	**39**	**36**	**22**
Romania	**104**	**104**	**104**	**104**	**83**	**67**		**151**	**151**	**151**	**151**	**122**	**102**
Russian Federation	**876**	**876**	**876**	**876**	**857**	**868**		**1352**	**1352**	**1352**	**1352**	**1353**	**1337**
Serbia and Montenegro	**44**	**44**	**44**	**44**	**39**	**41**		**89**	**89**	**89**	**89**	**73**	**78**
Slovakia	**18**	**18**	**16**	**16**	**14**	**13**		**25**	**25**	**25**	**25**	**22**	**20**
Slovenia	**15**	**15**	**15**	**15**	**10**	**7**		**21**	**21**	**21**	**21**	**14**	**11**
Spain	***147***	***147***	***148***	***145***	**107**	**86**		***213***	***213***	***213***	***217***	**157**	**138**
Sweden	**46**	**44**	**45**	**45**	**21**	**17**		**67**	66	**66**	**67**	**31**	**27**
Switzerland	**10**	**10**	**10**	**10**	**7**	**6**		26	26	24	**15**	**13**	**12**
TFYR of Macedonia	**9**	**9**	**9**	**9**	**8**	**8**		**20**	20	20	**20**	**15**	**14**
Turkey	223	223	223	223	223	223		420	420	420	420	420	420
Ukraine	**310**	**310**	**310**	**310**	**269**	**282**		**499**	**499**	**499**	**499**	**430**	**443**
United Kingdom	**115**	**102**	**102**	**93**	**81**	**65**		**199**	**179**	**180**	**161**	**135**	**116**
North Africa		**NA**	**NA**	**NA**	**NA**	**NA**		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Remaining Asiatic areas		**NA**	**NA**	**NA**	**NA**	**NA**		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Baltic Sea		**NA**	**NA**	**NA**	**NA**	**NA**		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Black Sea		**NA**	**NA**	**NA**	**NA**	**NA**		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Mediterranean Sea		**NA**	**NA**	**NA**	**NA**	**NA**		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
North Sea		**NA**	**NA**	**NA**	**NA**	**NA**		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Remaining N-E Atlantic		**NA**	**NA**	**NA**	**NA**	**NA**		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Natural marine emissions		**NA**	**NA**	**NA**	**NA**	**NA**		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Volcanic emissions		**NA**	**NA**	**NA**	**NA**	**NA**		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Totals	3360	3329	3334	3300	2861	2624		5395	5340	5337	5308	4454	4167

[1] All years except 2010 and 2020: Reported values with white background, expert estimates in grey. Values in bold differ from reporting in 2003. Values in italic are reported values modified for modelling purposes by MSC-W. Projections (Base Line Scenario) provide by IIASA (April 2004) in grey boxes. Reported values or extrapolations in white.

Appendix IV: Overview of feedback from REPDAB on Completeness and Consistency

Table IV.1 Overview of Completeness and Consistency for data reported in 2004 (2002 emissions)

Country	Table passed all RepDab tests	Table is incomplete	Table contains inconsistent data
Austria		1980-2002	
Belgium		2001-2002	2001-2002
Bulgaria	2002		
Belarus		2002	
Canada		1985-2002	
Serbia & Montenegro		2002	
Cyprus	2002		
Czech Republic		2002	
Germany		1990-2002	1990-2002
Denmark		1980-2002	1985-2002
Estonia		2002	
Spain		1990-2002	
Finland		2002	
France	1980-1987, 1990-2002		1988-1989
United Kingdom			1980-2002
Hungary	2002		
Ireland		2002	
Lithuania		2002	
Monaco		2002	
TFYR of Macedonia		2002	
Latvia		1990-2002, 2010, 2015, 2020	1990-2002, 2010, 2015, 2020
Republic of Moldova		2000-2002	
Netherlands	1990,1995, 2000-2002		
Norway		1980, 1987, 1989-2002	
Portugal			1990-2002
Russian Federation		2002	
Sweden		1980-2002	
Slovenia		2002	2002
Slovakia		2000-2002	
United States		1999, 2002	1999

Appendix V: Notation keys tables

The maximum numbers of entries/sectors are 100 when memo items are included and 95 if we exclude memo items. The Notation Keys have the following meaning:
NO: Not Occurring
NE: Not Estimated
NA: Not Applicable
IE: Included Elsewhere
C: Confidential (Not included here)

Table V. 1 Number and type of notation keys used for SO_2 (left) and NO_2 (right)

Country	IE	NA	NE	NO	Total	IE	NA	NE	NO	Total
Armenia	NR	NR	NR	NR		NR	NR	NR	NR	
Austria	8	37	4	11	**60**	6	34	4	11	**55**
Azerbaijan	NR	NR	NR	NR	**0**	NR	NR	NR	NR	
Belarus	7	1	17	0	**25**	7	1	17	0	**25**
Belgium	9	25	5	13	**52**	11	23	5	13	**52**
Bosnia and Herzegovina	8	37	4	11	**60**	6	34	4	11	**55**
Bulgaria	0	13	5	51	**69**	0	13	5	50	**68**
Canada	0	0	0	0	**0**	0	0	0	0	**0**
Croatia	NR	NR	NR	NR		NR	NR	NR	NR	
Cyprus	0	28	0	3	**31**	0	28	0	3	**31**
Czech Republic	0	0	6	14	**20**	0	0	6	14	**20**
Denmark	12	2	8	34	**56**	11	11	6	28	**56**
Estonia	10	13	3	37	**63**	10	12	3	35	**60**
Finland	2	2	1	38	**43**	2	2	1	36	**41**
France	0	0	0	1	**1**	0	0	0	1	**1**
Georgia	NR	NR	NR	NR		NR	NR	NR	NR	
Germany	14	0	7	40	**61**	9	0	10	9	**28**
Greece	NR	NR	NR	NR		NR	NR	NR	NR	
Hungary	14	5	4	43	**66**	14	4	4	44	**66**
Iceland	NR	NR	NR	NR		NR	NR	NR	NR	
Ireland	5	0	15	49	**69**	5	0	16	46	**67**
Italy	NR	NR	NR	NR		NR	NR	NR	NR	
Kazakstan	NR	NR	NR	NR		NR	NR	NR	NR	
Kyrgystan	NR	NR	NR	NR		NR	NR	NR	NR	
Latvia	11	0	11	54	**76**	11	0	11	53	**75**
Liechtenstein	NR	NR	NR	NR		NR	NR	NR	NR	**0**
Lithuania	1	0	24	49	**74**	1	0	25	45	**71**
Luxembourg	NR	NR	NR	NR		NR	NR	NR	NR	
Malta	NR	NR	NR	NR		NR	NR	NR	NR	
Monaco	1	7	3	30	**41**	1	7	3	30	**41**
Netherlands	15	1	0	6	**22**	15	1	0	6	**22**
Norway	0	1	49	0	**50**	0	1	50	0	**51**
Poland	NR	NR	NR	NR		NR	NR	NR	NR	
Portugal	0	0	0	0	**0**	0	0	0	0	**0**
Republic of Moldova	1	2	38	42	**83**	1	2	38	42	**83**
Romania	NR	NR	NR	NR		NR	NR	NR	NR	
Russian Federation	0	0	0	0	**0**	0	0	0	0	**0**
Serbia & Montenegro	0	0	96	0	**96**	0	0	95	0	**95**
Slovakia	16	5	3	38	**62**	17	5	3	36	**61**
Slovenia	13	37	38	1	**89**	13	37	41	1	**92**
Spain	0	0	0	0	**0**	0	0	0	0	**0**
Sweden	4	1	5	42	**52**	4	1	5	44	**54**
Switzerland	NR	NR	NR	NR		NR	NR	NR	NR	
TFYR of Macedonia	0	0	0	0	**0**	0	0	0	0	**0**
Turkey	NR	NR	NR	NR		NR	NR	NR	NR	
Ukraine	NR	NR	NR	NR		NR	NR	NR	NR	
United Kingdom	5	0	2	46	**53**	5	0	1	44	**50**
United States	87	0	7	0	**94**	87	0	7	0	**94**
European Community	NR	NR	NR	NR		NR	NR	NR	NR	

Table V.2 Number and type of notation keys used for NH_3 (left) and NMVOC (right)

Country	IE	NA	NE	NO	Total	IE	NA	NE	NO	Total
Armenia	NR	NR	NR	NR		NR	NR	NR	NR	
Austria	8	22	4	11	**45**	7	22	2	11	**42**
Azerbaijan	NR	NR	NR	NR		NR	NR	NR	NR	
Belarus	7	1	12	0	**20**	7	1	17	0	**25**
Belgium	11	16	3	13	**43**	6	15	4	13	**38**
Bosnia and Herzegovina	8	22	4	11	**45**	7	22	2	11	**42**
Bulgaria	2	11	5	61	**79**	0	13	4	33	**50**
Canada	0	0	0	0	**0**	0	0	0	0	**0**
Croatia	NR	NR	NR	NR		NR	NR	NR	NR	
Cyprus	0	24	0	14	**38**	0	27	0	3	**30**
Czech Republic	0	0	12	24	**36**	0	0	7	9	**16**
Denmark	11	2	6	34	**53**	12	9	8	19	**48**
Estonia	10	24	6	26	**66**	10	8	5	26	**49**
Finland	1	36	1	31	**69**	2	1	3	35	**41**
France	0	0	0	1	**1**	0	0	0	1	**1**
Georgia	NR	NR	NR	NR		NR	NR	NR	NR	
Germany	9	0	10	40	**59**	14	0	10	23	**47**
Greece	NR	NR	NR	NR		NR	NR	NR	NR	
Hungary	9	6	4	45	**64**	15	4	4	37	**60**
Iceland	NR	NR	NR	NR		NR	NR	NR	NR	
Ireland	5	0	16	37	**58**	5	0	9	44	**58**
Italy	NR	NR	NR	NR		NR	NR	NR	NR	
Kazakstan	NR	NR	NR	NR		NR	NR	NR	NR	
Kyrgystan	NR	NR	NR	NR		NR	NR	NR	NR	
Latvia	0	0	11	79	**90**	11	0	22	33	**66**
Liechtenstein	NR	NR	NR	NR		NR	NR	NR	NR	
Lithuania	0	0	31	43	**74**	1	0	48	20	**69**
Luxembourg	NR	NR	NR	NR		NR	NR	NR	NR	
Malta	NR	NR	NR	NR		NR	NR	NR	NR	
Monaco	1	7	6	29	**43**	1	7	3	30	**41**
Netherlands	21	1	0	6	**28**	15	1	0	6	**22**
Norway	0	1	68	0	**69**	0	0	42	0	**42**
Poland	NR	NR	NR	NR		NR	NR	NR	NR	
Portugal	0	0	0	0	**0**	0	0	0	0	**0**
Republic of Moldova	2	5	40	33	**80**	1	1	37	42	**81**
Romania	NR	NR	NR	NR		NR	NR	NR	NR	
Russian Federation	0	0	0	0	**0**	0	0	0	0	**0**
Serbia & Montenegro	0	0	99	0	**99**	0	0	99	0	**99**
Slovakia	9	6	8	41	**64**	13	5	4	34	**56**
Slovenia	0	50	39	1	**90**	13	27	40	1	**81**
Spain	0	0	0	0	**0**	0	0	0	0	**0**
Sweden	2	1	13	32	**48**	7	0	14	28	**49**
Switzerland	NR	NR	NR	NR		NR	NR	NR	NR	
TFYR of Macedonia	NR	NR	NR	NR		NR	NR	NR	NR	
Turkey	NR	NR	NR	NR		NR	NR	NR	NR	
Ukraine	NR	NR	NR	NR		NR	NR	NR	NR	
United Kingdom	8	1	1	25	**35**	5	0	1	33	**39**
United States	87	0	7	0	**94**	87	0	7	0	**94**
European Community	NR	NR	NR	NR		NR	NR	NR	NR	

Table V. 3 Number and type of notation keys used for CO (left) and TSP (right)

Country	IE	NA	NE	NO	Total	IE	NA	NE	NO	Total
Armenia	NR	NR	NR	NR		NR	NR	NR	NR	
Austria	6	36	3	11	**56**	7	21	6	11	**45**
Azerbaijan	NR	NR	NR	NR		NR	NR	NR	NR	
Belarus	7	1	17	0	**25**	7	1	16	0	**24**
Belgium	6	18	1	12	**37**	7	1	2	12	**22**
Bosnia and Herzegovina	6	36	3	11	**56**	7	21	6	11	**45**
Bulgaria	0	13	5	54	**72**	0	19	61	18	**98**
Canada	0	0	0	0	**0**	0	0	0	0	**0**
Croatia	NR	NR	NR	NR		NR	NR	NR	NR	
Cyprus	0	28	0	3	**31**	0	32	0	3	**35**
Czech Republic	0	0	6	14	**20**	0	0	9	9	**18**
Denmark	11	1	9	37	**58**	9	1	11	23	**44**
Estonia	10	10	3	35	**58**	9	9	5	25	**48**
Finland	2	2	1	45	**50**	1	13	2	25	**41**
France	0	0	0	1	**1**	0	0	0	1	**1**
Georgia	NR	NR	NR	NR		NR	NR	NR	NR	
Germany	10	0	8	51	**69**	0	0	16	35	**51**
Greece	NR	NR	NR	NR		NR	NR	NR	NR	
Hungary	14	4	4	14	**36**	9	5	4	58	**76**
Iceland	NR	NR	NR	NR	**0**	NR	NR	NR	NR	
Ireland	5	0	16	48	**69**	5	0	49	20	**74**
Italy	NR	NR	NR	NR		NR	NR	NR	NR	
Kazakstan	NR	NR	NR	NR		NR	NR	NR	NR	
Kyrgystan	NR	NR	NR	NR		NR	NR	NR	NR	
Latvia	11	0	10	52	**73**	11	0	67	16	**94**
Liechtenstein	NR	NR	NR	NR		NR	NR	NR	NR	
Lithuania	0	0	31	40	**71**	0	0	37	38	**75**
Luxembourg	NR	NR	NR	NR		NR	NR	NR	NR	
Malta	NR	NR	NR	NR		NR	NR	NR	NR	
Monaco	1	7	3	30	**41**	1	7	8	30	**46**
Netherlands	15	1	0	6	**22**	21	1	2	6	**30**
Norway	0	1	53	0	**54**	0	1	39	0	**40**
Poland	NR	NR	NR	NR		NR	NR	NR	NR	
Portugal	0	0	0	0	**0**	0	0	0	0	**0**
Republic of Moldova	1	1	38	42	**82**	1	1	38	42	**82**
Romania	NR	NR	NR	NR		NR	NR	NR	NR	
Russian Federation	0	0	0	0		0	0	0	0	
Serbia & Montenegro	0	0	99	0	**99**	0	0	99	0	**99**
Slovakia	17	5	3	37	**62**	15	7	3	36	**61**
Slovenia	13	37	41	1	**92**	0	19	81	0	**100**
Spain	0	0	0	0	**0**	0	0	0	0	**0**
Sweden	4	2	7	44	**57**	3	21	9	14	**47**
Switzerland	NR	NR	NR	NR		NR	NR	NR	NR	
TFYR of Macedonia	0	0	0	0	**0**	NR	NR	NR	NR	
Turkey	NR	NR	NR	NR		NR	NR	NR	NR	
Ukraine	NR	NR	NR	NR		NR	NR	NR	NR	
United Kingdom	5	0	1	44	**50**	2	1	55	28	**86**
United States	87	0	7	0	**94**	NR	NR	NR	NR	
European Community	NR	NR	NR	NR		NR	NR	NR	NR	

Table V. 4 Number and type of notation keys used for $PM_{2.5}$ (left) and PM_{10} (right)

Country	IE	NA	NE	NO	Total	IE	NA	NE	NO	Total
Armenia	NR	NR	NR	NR		NR	NR	NR	NR	
Austria	7	20	7	11	**45**	7	21	6	11	**45**
Azerbaijan	NR	NR	NR	NR		NR	NR	NR	NR	
Belarus	7	1	29	0	**37**	7	1	29	0	**37**
Belgium	7	1	2	12	**22**	7	1	2	12	**22**
Bosnia and Herzegovina	7	20	7	11	**45**	7	21	6	11	**45**
Bulgaria	0	19	62	18	**99**	0	19	62	18	**99**
Canada	0	0	0	0	**0**	0	0	0	0	**0**
Croatia	NR	NR	NR	NR		NR	NR	NR	NR	
Cyprus	0	34	0	3	**37**	0	34	0	3	**37**
Czech Republic	0	0	36	9	**45**	0	0	9	9	**18**
Denmark	9	1	11	23	**44**	9	1	11	23	**44**
Estonia	9	10	5	25	**49**	9	10	5	25	**49**
Finland	2	12	3	25	**42**	1	12	3	27	**43**
France	0	0	0	1	**1**	0	0	0	1	**1**
Georgia	NR	NR	NR	NR		NR	NR	NR	NR	
Germany	0	0	63	32	**95**	0	0	62	37	**99**
Greece	NR	NR	NR	NR		NR	NR	NR	NR	
Hungary	10	5	4	62	**81**	10	5	4	62	**81**
Iceland	NR	NR	NR	NR		NR	NR	NR	NR	
Ireland	5	0	49	20	**74**	5	0	49	20	**74**
Italy	NR	NR	NR	NR	**0**	NR	NR	NR	NR	
Kazakstan	NR	NR	NR	NR		NR	NR	NR	NR	
Kyrgystan	NR	NR	NR	NR		NR	NR	NR	NR	
Latvia	11	0	67	16	**94**	11	0	67	16	**94**
Liechtenstein	NR	NR	NR	NR	**0**	NR	NR	NR	NR	**0**
Lithuania	0	0	61	38	**99**	0	0	60	38	**98**
Luxembourg	NR	NR	NR	NR		NR	NR	NR	NR	
Malta	NR	NR	NR	NR		NR	NR	NR	NR	
Monaco	1	7	13	30	**51**	1	7	13	30	**51**
Netherlands	21	1	2	6	**30**	21	1	2	6	**30**
Norway	0	1	40	0	**41**	0	1	39	0	**40**
Poland	NR	NR	NR	NR		NR	NR	NR	NR	
Portugal	0	0	0	0	**0**	0	0	0	0	**0**
Republic of Moldova	1	2	38	42	**83**	1	2	38	42	**83**
Romania	NR	NR	NR	NR		NR	NR	NR	NR	
Russian Federation	0	0	0	0	**0**	0	0	0	0	**0**
Serbia & Montenegro	0	0	99	0	**99**	0	0	99	0	**99**
Slovakia	15	7	3	36	**61**	15	7	3	36	**61**
Slovenia	0	19	81	0	**100**	0	19	81	0	**100**
Spain	0	0	0	0	**0**	0	0	0	0	**0**
Sweden	3	21	9	14	**47**	3	21	9	14	**47**
Switzerland	NR	NR	NR	NR		NR	NR	NR	NR	
TFYR of Macedonia	NR	NR	NR	NR		NR	NR	NR	NR	
Turkey	NR	NR	NR	NR		NR	NR	NR	NR	
Ukraine	NR	NR	NR	NR		NR	NR	NR	NR	
United Kingdom	8	0	6	31	**45**	12	0	2	31	**45**
United States	87	0	7	0	**94**	87	0	7	0	**94**
European Community	NR	NR	NR	NR		NR	NR	NR	NR	

Appendix VI: Tabulation of reported Key Sources per compound (Table VI.1-VI.8) and description of NFR sectors (Table VI.9).

Information from countries appearing with grey background has been updated based on the review replies from these countries.

Table VI.1 Suphur (SO_2) Year 2002 Emissions Key Sources[6]

Country / key source	1	2	3	4	5
Armenia	1A2b	1A1a	OLD	OLD	OLD
Austria	1A4bi	1A2a	1A1a	1A1b	2B5
Azerbaijan	NR	NR	NR	NR	NR
Belarus	1A3b	1A1a	1A2	1A4a	2B
Belgium	1A1a	1A1b	1A4b	1A2a	1A2f
Bosnia and Herzegovina	NR	NR	NR	NR	NR
Bulgaria	1A1a				
Canada	2C	1A1a	1B2		
Croatia	NR	NR	NR	NR	NR
Cyprus	1A1a	1A3b	1A2		
Czech Republic	1A1a	1A2	1A4bi		
Denmark	1A1a	1A2	1A3dii	1A4bi	1A4ci
Estonia	1A1a	1A2f			
Finland	1A1a	1A2d			
France	1A1a	1A1b	1A2f	1B2avi	
Georgia	NR	NR	NR	NR	NR
Germany	1A1a	1A2	1A4bi	1A1b	
Greece	NR	NR	NR	NR	NR
Hungary	1A1a	1A2	1A4bi		
Iceland	NR	NR	NR	NR	NR
Ireland	1A1a	1A2	1A4bi		
Italy	NR	NR	NR	NR	NR
Kazakhstan	NR	NR	NR	NR	NR
Kyrgyzstan	NR	NR	NR	NR	NR
Latvia	1A1a	1A3b	1A4b	1A2	1A4a
Liechtenstein	NR	NR	NR	NR	NR
Lithuania	1A1a	1A1b	1B2aiv	1A2	
Luxembourg	NR	NR	NR	NR	NR
Malta	NR	NR	NR	NR	NR
Monaco	1A4bi	6C	1A1a		
Netherlands	1A1b	1A1a	1B2aiv	1A2c	
Norway	2C	1A2	2B4	1A3dii	1B2aiv
Poland	NR	NR	NR	NR	NR
Portugal	1A1a	1A1b			
Republic of Moldova	1A4bi	1A4a	1A3b	1A1a	1A4cii
Romania	NR	NR	NR	NR	NR
Russian Federation	1A1a	1A2	1A3b		
Serbia and Montenegro	1A1a				
Slovakia	1A1a	1A2c	1A2a		
Slovenia	1A1a	1A2			
Spain	1A1a	1A2f			
Sweden	1A1a	1A2d	2D	1A1b	2C
Switzerland	OLD	OLD	OLD	OLD	OLD
TFYR of Macedonia	1A1a	2G	2A		
Turkey	NR	NR	NR	NR	NR
Ukraine	NR	NR	NR	NR	NR
United Kingdom	1A1a	1A2f	1A4bi		
United States	NR	NR	NR	NR	NR
European Community	NR	NR	NR	NR	NR

[6] Listed according to largest contribution (in terms of Gg) to the National Total. Memo items excluded. NR: Not Reported. Gray shaded countries: Updates based on review feedback.

Table VI.2 Nitrogen dioxides (NO_2) Year 2002 Emissions Key Sources[7]

Country / key source	1	2	3	4	5
Armenia	1A3b	1A1a	OLD	OLD	OLD
Austria	1A3biii	1A3bi	1A2f	1A4cii	1A4bi
Azerbaijan	NR	NR	NR	NR	NR
Belarus	1A3b	1A1a	1A2		
Belgium	1A3bi	1A3biii	1A1a	1A2a	1A4b
Bosnia and Herzegovina	N R	NR	NR	NR	NR
Bulgaria	1A3bi	1A1a	1A3eii	2B2	
Canada	1A3b	1A3e	1A1a	1A1c	
Croatia	NR	NR	NR	NR	NR
Cyprus	1A3b	1A1a	2A1		
Czech Republic	1A1a	1A3b	1A4cii	1A2	
Denmark	1A1a	1A3bi	1A3biii	1A4cii	1A2
Estonia	1A1a	1A3bi	1A3biii	1A4cii	
Finland	1A1a	1A3bi	1A3biii	1A2f	
France	1A3bi	1A4c	1A4cii	1A3biii	
Georgia	NR	NR	NR	NR	NR
Germany	1A3biii	1A1a	1A2		
Greece	NR	NR	NR	NR	NR
Hungary	1A3b	1A1a			
Iceland	NR	NR	NR	NR	NR
Ireland	1A1a	1A3bi	1A3bii	1A2	
Italy	NR	NR	NR	NR	NR
Kazakhstan	NR	NR	NR	NR	NR
Kyrgyzstan	NR	NR	NR	NR	NR
Latvia	1A3b	1A1a	1A4b	1A2	
Liechtenstein	NR	NR	NR	NR	NR
Lithuania	1A3bi	1A3biii	1A1a	1A3bii	
Luxembourg	NR	NR	NR	NR	NR
Malta	NR	NR	NR	NR	NR
Monaco	1A3dii	1A3bi	1A1a	1A4bi	
Netherlands	1A3biii	1A3bi	1A3dii	1A1a	
Norway	1A1c	1A4ciii	1A3biii	1A3bi	
Poland	NR	NR	NR	NR	NR
Portugal	1A1a	1A3bi	1A3bii	1A3biii	1A2f
Republic of Moldova	1A3b	1A1a	1A4cii		
Romania	NR	NR	NR	NR	NR
Russian Federation	1A3b	1A1a	1A3eii	1A2	
Serbia and Montenegro	1A1a				
Slovakia	1A3biii	1A1a	1A3bi	1A2f	1A2a
Slovenia	1A3bii	1A1a	1A3bi		
Spain	1A1a	1A3bi	1A3biii	1A2f	1A4c
Sweden	1A3biii	1A2f	1A3bi	1A4cii	
Switzerland	OLD	OLD	OLD	OLD	OLD
TFYR of Macedonia	1A1a	1A3b	2A		
Turkey	NR	NR	NR	NR	NR
Ukraine	NR	NR	NR	NR	NR
United Kingdom	1A1a	1A3biii	1A3b1	1A2f	
United States	NR	NR	NR	NR	NR
European Community	NR	NR	NR	NR	NR

[7] Listed according to largest contribution (in terms of Gg) to the National Total. Memo items excluded. NR: Not Reported. Gray shaded countries: Updates based on review feedback..

Table VI.3 Ammonia (NH_3) Year 2002 Emissions Key Sources[8]

Country / key source	1	2	3	4	5
Armenia	4B	OLD	OLD	OLD	OLD
Austria	4B1b	4B8	4B1a	4D1	4B9
Azerbaijan	NR	NR	NR	NR	NR
Belarus	4B	4D			
Belgium	4B1	4B8	4D		
Bosnia and Herzegovina	N R	NR	NR	NR	NR
Bulgaria	4B	2B	6C		
Canada	NR	NR	NR	NR	NR
Croatia	NR	NR	NR	NR	NR
Cyprus	4B8	4B9	1A4ci		
Czech Republic	4B				
Denmark	4B8	4D1	4B1a		
Estonia	4B1a	4B1b	4B8	4D	4B9
Finland	4B1a	4B1b	4B8	4B13	
France	4B1b	4B9	4D	4B1a	4B8
Georgia	NR	NR	NR	NR	NR
Germany	4B1a	4B1b	4D	4B8	
Greece	NR	NR	NR	NR	NR
Hungary	4B8	4D	4B9	4B1a	4B1b
Iceland	NR	NR	NR	NR	NR
Ireland	4B1b	4B1a	4D		
Italy	NR	NR	NR	NR	NR
Kazakhstan	NR	NR	NR	NR	NR
Kyrgyzstan	NR	NR	NR	NR	NR
Latvia	4B1a	4B1b	4B8	4B9	
Liechtenstein	NR	NR	NR	NR	NR
Lithuania	4D	4B1a	4B8	4B1b	
Luxembourg	NR	NR	NR	NR	NR
Malta	NR	NR	NR	NR	NR
Monaco	1A3bi	1A1a			
Netherlands	4B1a	4B8	4B1b		
Norway	4D	4B13	1A3bi		
Poland	NR	NR	NR	NR	NR
Portugal	4D	4B9	4B1	4B8	
Republic of Moldova	4B1a	4B9	4B13	4B8	4B1b
Romania	NR	NR	NR	NR	NR
Russian Federation	4B				
Serbia and Montenegro	NR	NR	NR	NR	NR
Slovakia	4B8	4B1a	4B1b	4B9	4D
Slovenia	4B1a	4B8	4B1b		
Spain	4D	4B8			
Sweden	4B1	4B8	1A3bi		
Switzerland	OLD	OLD	OLD	OLD	OLD
TFYR of Macedonia	NR	NR	NR	NR	NR
Turkey	NR	NR	NR	NR	NR
Ukraine	NR	NR	NR	NR	NR
United Kingdom	4B1	4D1	4B9	4B8	
United States	NR	NR	NR	NR	NR
European Community	NR	NR	NR	NR	NR

[8] Listed according to largest contribution (in terms of Gg) to the National Total. Memo items excluded. NR: Not Reported. Gray shaded countries: Updates based on review feedback..

Table VI.4 Non Methane Volatile Organic Compounds (NMVOC) Year 2002 Emissions Key Sources[9]

Country / key source	1	2	3	4	5
Armenia	1A3b	OLD	OLD	OLD	OLD
Austria	3D	1A4bi	1A3b	3A	
Belarus	1A3b	1B2	1A4c		
Belgium	5B	3D	1A3bi	2B	3A
Bulgaria	1A3bi	4D	1A4bii		
Canada	1B2	3B	1A3b	4G	1A3e
Cyprus	1A3b	1A2	1A1a		
Czech Republic	1A3b	3A	3D	3B	1A4bi
Denmark	3A	1A3bi	3D	1A3dii	1A4bi
Estonia	1A4bi	1A3bi	3D	1B2ai	1B2b
Finland	1A3bi	1A4bi	1A4c	3A	3D
France	1A3b	3A	3A	3D	1A4b
Georgia	NR	NR	NR	NR	NR
Germany	3D	3A	4B	1A3bi	
Greece	NR	NR	NR	NR	NR
Hungary	1A3b	3A	1A4bi		
Iceland	NR	NR	NR	NR	NR
Ireland	3D	1A3bi	3A	1B2av	
Italy	NR	NR	NR	NR	NR
Kazakhstan	NR	NR	NR	NR	NR
Kyrgyzstan	NR	NR	NR	NR	NR
Latvia	1A3b	3A	1A4b	3D	
Liechtenstein	NR	NR	NR	NR	NR
Lithuania	3A	1A4bi	1B2a	1A3bi	1B2aiv
Luxembourg	NR	NR	NR	NR	NR
Malta	NR	NR	NR	NR	NR
Monaco	1A3biv	1A3bi	1A3bv	1A1a	
Netherlands	1A3bv	3A	1A3bi	1A3biv	1B2b
Norway	1B2ai				
Poland	NR	NR	NR	NR	NR
Portugal	1A3b	3C	4D	1B2	
Republic of Moldova	1A3b	1A1a	1A2e		
Romania	NR	NR	NR	NR	NR
Russian Federation	1A3b	1A2	1B2		
Serbia and Montenegro	NR	NR	NR	NR	NR
Slovakia	1A3bi	3A	2A6	3C	
Slovenia	3A	1A4b	1A3bi	1A3bii	
Spain	4D	1A3b	3A		
Sweden	1A4bi	1A3bi	3D		
Switzerland	OLD	OLD	OLD	OLD	OLD
TFYR of Macedonia	NR	NR	NR	NR	NR
Turkey	NR	NR	NR	NR	NR
Ukraine	NR	NR	NR	NR	NR
United Kingdom	3D	1B2ai	1A3bi	3A	
United States	NR	NR	NR	NR	NR
European Community	NR	NR	NR	NR	NR

[9] Listed according to largest contribution (in terms of Gg) to the National Total. Memo items excluded. NR: Not Reported. Gray shaded countries: Updates based on review feedback.

Table VI.5 Carbon monoxides: Year 2002 Emissions Key Sources[10]

Country / key source	1	2	3	4	5
Armenia	1A3b	2A1	OLD	OLD	OLD
Austria	1A4bi	1A3bi	1A2a		
Azerbaijan	NR	NR	NR	NR	NR
Belarus	1A3b	1A2	1A4a	2C	1A4c
Belgium	1A2a	1A3bi	2C	1A4b	
Bosnia and Herzegovina	N R	NR	NR	NR	NR
Bulgaria	1A4bii	1a3bi	1A2a		
Canada	1A3b	1A3e	1A2	1A4b	
Croatia	NR	NR	NR	NR	NR
Cyprus	1A3b				
Czech Republic	1A3b	1A4bi	1A2	2C	1A4cii
Denmark	1A3bi	1A4bi			
Estonia	1A4bi	1A3bi			
Finland	1A3bi	1A4bi	3A	3D	1A3bv
France	1A3bi	1A4bi	2C	1A2a	
Georgia	NR	NR	NR	NR	NR
Germany	1A3biii	1A3bi	1A2	2C	
Greece	NR	NR	NR	NR	NR
Hungary	1A3b	2C			
Iceland	NR	NR	NR	NR	NR
Ireland	1A3bi	1A4bi			
Italy	NR	NR	NR	NR	NR
Kazakhstan	NR	NR	NR	NR	NR
Kyrgyzstan	NR	NR	NR	NR	NR
Latvia	1A4b	1A3b			
Liechtenstein	NR	NR	NR	NR	NR
Lithuania	1A4bi	1A3bi	1A3bii	1A3biii	
Luxembourg	NR	NR	NR	NR	NR
Malta	NR	NR	NR	NR	NR
Monaco	1A3bi	1A3dii	1A3biv		
Netherlands	1A3bi	1A4bi	1A2a	1A3biv	
Norway	1A3bi	1A4bi			
Poland	NR	NR	NR	NR	NR
Portugal	1A3bi	1A4bi	5E		
Republic of Moldova	1A3b				
Romania	NR	NR	NR	NR	NR
Russian Federation	1A3b	1A2			
Serbia and Montenegro	NR	NR	NR	NR	NR
Slovakia	1A3bi	1A2a			
Slovenia	1A4b	1A3bi	1A3bii		
Spain	1A3bi	1A4bi	2c	1A2	
Sweden	1A3bi	1A4bi	1A4bii		
Switzerland	OLD	OLD	OLD	OLD	OLD
TFYR of Macedonia	1A3b	3C			
Turkey	NR	NR	NR	NR	NR
Ukraine	NR	NR	NR	NR	NR
United Kingdom	1A3bi	1A2f	1A2a	1A4bi	
United States	NR	NR	NR	NR	NR
European Community	NR	NR	NR	NR	NR

[10] Listed according to largest contribution (in terms of Gg) to the National Total. Memo items excluded. NR: Not Reported. Gray shaded countries: Updates based on review feedback..

Table VI.6 Particulate Matter ($PM_{2.5}$) Year 2002 Emissions Key Sources[11]

Country / key source	1	2	3	4	5
Armenia	OLD	OLD	OLD	OLD	OLD
Austria	1A4bi	2A7	1A4cii	1A3bi	1A2f
Azerbaijan	NR	NR	NR	NR	NR
Belarus	NR	NR	NR	NR	NR
Belgium	2C	1A3biii	1A3bi	1A4b	1A3bii/2A
Bosnia and Herzegovina	N R	NR	NR	NR	NR
Bulgaria	N R	NR	NR	NR	NR
Canada	1A3bvii	1A4b	1A2	4G	
Croatia	NR	NR	NR	NR	NR
Cyprus	NR	NR	NR	NR	NR
Czech Republic	NR	NR	NR	NR	NR
Denmark	1A4bi	1A4cii	1A3bii	4B8	
Estonia	1A4bi	1A3bi	1A1a		
Finland	1A4bi	1A4c			
France	1A4bi	1A3b	2A7	4D	
Georgia	NR	NR	NR	NR	NR
Germany	1A3biii	1A3bi	1A3bii		
Greece	NR	NR	NR	NR	NR
Hungary	1A4bi	1A3b	1A2f		
Iceland	NR	NR	NR	NR	NR
Ireland	1A2	1A3bii	1A4bi	1A4c	1A1a
Italy	NR	NR	NR	NR	NR
Kazakhstan	NR	NR	NR	NR	NR
Kyrgyzstan	NR	NR	NR	NR	NR
Latvia	1A4b	1A1a	1A2		
Liechtenstein	NR	NR	NR	NR	NR
Lithuania	NR	NR	NR	NR	NR
Luxembourg	NR	NR	NR	NR	NR
Malta	NR	NR	NR	NR	NR
Monaco	NR	NR	NR	NR	NR
Netherlands	1A4cii	1A3biii	1A3bii	1A3bi	1A4bi
Norway	1A4bi				
Poland	NR	NR	NR	NR	NR
Portugal	2A7	1A4bi	1A3bii		
Republic of Moldova	1A4a	1A3b			
Romania	NR	NR	NR	NR	NR
Russian Federation	1A1a	1A2a	1A4b	1A2b	2A
Serbia and Montenegro	NR	NR	NR	NR	NR
Slovakia	1A2a	1A4bi	1A33biii	1A1a	
Slovenia	NR	NR	NR	NR	NR
Spain	1A4cii	1A4bi	1A2f	1A3bi	1A1a
Sweden	1A4bi	1A1a	1A3b	2D1	
Switzerland	OLD	OLD	OLD	OLD	OLD
TFYR of Macedonia	NR	NR	NR	NR	NR
Turkey	NR	NR	NR	NR	NR
Ukraine	NR	NR	NR	NR	NR
United Kingdom	1A4bi	1A2f	1A3bii	2A7	
United States	NR	NR	NR	NR	NR
European Community	NR	NR	NR	NR	NR

[11] Listed according to largest contribution (in terms of Gg) to the National Total. Memo items excluded. NR: Not Reported. Gray shaded countries: Updates based on review feedback.

Table VI.7 Particulate Matter (PM_{10}) Year 2002 Emissions Key Sources[12]

Country / key source	1	2	3	4	5
Armenia	**OLD**	**OLD**	**OLD**	**OLD**	**OLD**
Austria	**2A7**	**1A4bi**	**1A3bvi**	**1A4cii**	**1A2f**
Azerbaijan	**NR**	**NR**	**NR**	**NR**	**NR**
Belarus	**NR**	**NR**	**NR**	**NR**	**NR**
Belgium	**1A5b**	**2C**	**A3biii**	**A3bi**	**2A**
Bosnia and Herzegovina	**N R**	**NR**	**NR**	**NR**	**NR**
Bulgaria	**NR**	**NR**	**NR**	**NR**	**NR**
Canada	**1A3bvii**	**4G**	**2A**		
Croatia	**NR**	**NR**	**NR**	**NR**	**NR**
Cyprus	**NR**	**NR**	**NR**	**NR**	**NR**
Czech Republic	**1A4bi**	**1A2**	**1A3B**	**1A4cii**	**2A**
Denmark	**4B8**	**1A4bi**	**1A4cii**	**1A3bii**	
Estonia	**1A4bi**	**1A3bi**	**1A1a**		
Finland	**1A4bi**	**1A3bvi**	1B1a	1A4c	
France	**2A7**	**4D**	**1A4bi**	**1A3b**	
Georgia	**NR**	**NR**	**NR**	**NR**	**NR**
Germany	**NR**	**NR**	**NR**	**NR**	**NR**
Greece	**NR**	**NR**	**NR**	**NR**	**NR**
Hungary	**1A4bi**	**1A3b**	**1A2f**	**1A1a**	
Iceland	**NR**	**NR**	**NR**	**NR**	**NR**
Ireland	**1A2**	**1A4bi**	**1A1a**	**1A3bii**	**1A4c**
Italy	**NR**	**NR**	**NR**	**NR**	**NR**
Kazakhstan	**NR**	**NR**	**NR**	**NR**	**NR**
Kyrgyzstan	**NR**	**NR**	**NR**	**NR**	**NR**
Latvia	**1A4b**	**1A1a**	**1A2**		
Liechtenstein	**NR**	**NR**	**NR**	**NR**	**NR**
Lithuania	**NR**	**NR**	**NR**	**NR**	**NR**
Luxembourg	**NR**	**NR**	**NR**	**NR**	**NR**
Malta	**NR**	**NR**	**NR**	**NR**	**NR**
Monaco	**NR**	**NR**	**NR**	**NR**	**NR**
Netherlands	**4B9**	**2B5**	**1A4cii**	**1A3biii**	**1A3bii**
Norway	**1A4bi**				
Poland	**NR**	**NR**	**NR**	**NR**	**NR**
Portugal	**1A4bi**				
Republic of Moldova	**1A4bi**	**1A4a**	**1A3b**		
Romania	**NR**	**NR**	**NR**	**NR**	**NR**
Russian Federation	**1A1a**	**1A4b**	**1A2a**	**1A2b**	**2A**
Serbia and Montenegro	**NR**	**NR**	**NR**	**NR**	**NR**
Slovakia	**1A2a**	**1A4bi**	**1A1a**	**1A2f**	**1A3biii**
Slovenia	**NR**	**NR**	**NR**	**NR**	**NR**
Spain	**1A2f**	**4B9**	**1A1a**	**1A4cii**	**1A4bi**
Sweden	**1A4bi**	**1A3bvi**	**2D1**		
Switzerland	**OLD**	**OLD**	**OLD**	**OLD**	**OLD**
TFYR of Macedonia	**NR**	**NR**	**NR**	**NR**	**NR**
Turkey	**NR**	**NR**	**NR**	**NR**	**NR**
Ukraine	**NR**	**NR**	**NR**	**NR**	**NR**
United Kingdom	**1A7**	**1A4bi**	**1A2f**	**1A3bii**	
United States	**NR**	**NR**	**NR**	**NR**	**NR**
European Community	**NR**	**NR**	**NR**	**NR**	**NR**

[12] Listed according to largest contribution (in terms of Gg) to the National Total. Memo items excluded. NR: Not Reported. Gray shaded countries: Updates based on review feedback.

Table VI.8 Total Suspended Particulate Matter (TSP) Year 2002 Emissions Key Sources[13]

Country / key source	1	2	3	4	5
Armenia	2A1	OLD	OLD	OLD	OLD
Austria	2A7	1A3bvi	1A4bi	2C	1A4cii
Azerbaijan	NR	NR	NR	NR	NR
Belarus	1A3b	1A4b	1A2	1A4c	
Belgium	1A5b	1A3biv	2C		
Bosnia and Herzegovina	NR	NR	NR	NR	NR
Bulgaria	NR	NR	NR	NR	NR
Canada	1A3bvii	2A	4G		
Croatia	NR	NR	NR	NR	NR
Cyprus	1A1a	2A1			
Czech Republic	1A4bii	1A3b	2A	1A2	1A4ci
Denmark	4B8	1A4bi			
Estonia	1A1a	1A4bi	1A2f		
Finland	1A4bi	1A3bvi	1B1a		
France	2A7	4D	1A4bi	1A3bvi	2G
Georgia	NR	NR	NR	NR	NR
Germany	2C	7	1A3biii	2A	1A4bi
Greece	NR	NR	NR	NR	NR
Hungary	1A4bi	1A3b	1A1a	1A2a	1A2f
Iceland	NR	NR	NR	NR	NR
Ireland	1A4bi	1A1a	1A2	1A3b	
Italy	NR	NR	NR	NR	NR
Kazakhstan	NR	NR	NR	NR	NR
Kyrgyzstan	NR	NR	NR	NR	NR
Latvia	1A4b	1A1a	1A2		
Liechtenstein	NR	NR	NR	NR	NR
Lithuania	1A4bi	1A2	1A3biii	1A1a	1A4a
Luxembourg	NR	NR	NR	NR	NR
Malta	NR	NR	NR	NR	NR
Monaco	1A1a	1A3biii	1A3bi	1A3bii	
Netherlands	4B9	2B5	1A4bi	1A4cii	1A3biii
Norway	1A4bi	2A7			
Poland	NR	NR	NR	NR	NR
Portugal	2A6	2A7	1A4bi		
Republic of Moldova	1A4bi	1A4a	1A3b		
Romania	NR	NR	NR	NR	NR
Russian Federation	1A1a	1A2a	1A4b	1A2b	2A
Serbia and Montenegro	NR	NR	NR	NR	NR
Slovakia	1A2a	1A1a	1A4bi	1A2f	
Slovenia	NR	NR	NR	NR	NR
Spain	4B9	1A2f	1A1a	4D	1A4bi
Sweden	1A3bvi	1A4bi	4G		
Switzerland	OLD	OLD	OLD	OLD	OLD
TFYR of Macedonia	NR	NR	NR	NR	NR
Turkey	NR	NR	NR	NR	NR
Ukraine	NR	NR	NR	NR	NR
United Kingdom	NR	NR	NR	NR	NR
United States	NR	NR	NR	NR	NR
European Community	NR	NR	NR	NR	NR

[13] Listed according to largest contribution (in terms of Gg) to the National Total. Memo items excluded. NR: Not Reported. Gray shaded countries: Updates based on review feedback.

Table VI.9 NFR sector codes (excluding memo items) and descriptions

1 A 1 a Public Electricity and Heat Production
1 A 1 b Petroleum refining
1 A 1 c Manufacture of Solid fuels and Other Energy Industries
1 A 2 Manufacturing Industries and Construction
1 A 2 a Iron and Steel
1 A 2 b Non-ferrous Metals
1 A 2 c Chemicals
1 A 2 d Pulp, Paper and Print
1 A 2 e Food Processing, Beverages and Tobacco
1 A 2 f Other, Manufacturing Industries and Construction
1 A 3 a ii (i) Civil Aviation (Domestic, Cruise)
1 A 3 a ii (ii) Civil Aviation (Domestic, LTO)
1 A 3 b Road Transport
1 A 3 b i Road Transport, Passenger cars
1 A 3 b ii Road Transport, Light duty vehicles
1 A 3 b iii Road Transport, Heavy duty vehicles
1 A 3 b iv Road Transport, Mopeds & Motorcycles
1 A 3 b v Road Transport, Gasoline evaporation
1 A 3 b vi Road Transport, Automobile tyre and brake wear
1 A 3 b vii Road Transport, Automobile road abrasion
1 A 3 c Railways
1 A 3 d ii National Navigation
1 A 3 e Other, Transport below 1000 (please specify)
1 A 3 e i Pipeline compressors
1 A 3 e ii Other mobile sources and machinery
1 A 4 a Commercial / Institutional
1 A 4 b Residential
1 A 4 b i Residential plants
1 A 4 b ii Household and gardening (mobile)
1 A 4 c Agriculture / Forestry / Fishing
1 A 4 c i Stationary (A,F,F)
1 A 4 c ii Off-road Vehicles and Other Machinery (A,F,F)
1 A 4 c iii National Fishing
1 A 5 a Other, Stationary (including Military)
1 A 5 b Other, Mobile (including military)
1 B 1 a Coal Mining and Handling
1 B 1 b Solid fuel transformation
1 B 1 c Other, Fugitive Emissions from Solid Fuels
1 B 1 Fugitive Emissions from Solid Fuels
1 B 2 a Oil
1 B 2 a i Exploration, Production, Transport (Oil)
1 B 2 a iv Refining, Storage (Oil)
1 B 2 a v Distribution of oil products
1 B 2 a vi Other, Oil
1 B 2 b Natural Gas
1 B 2 c Venting and flaring (Oil and Gas)
1 B 2 Oil and natural gas

2 A Mineral Products
2 A 1 Cement Production
2 A 2 Lime Production
2 A 3 Limestone and Dolomite Use
2 A 4 Soda Ash Production and Use
2 A 5 Asphalt Roofing
2 A 6 Road Paving with Asphalt
2 A 7 Other, Mineral Products (including Non Fuel Mining & Construction)
2 B Chemical Industry
2 B 1 Ammonia Production
2 B 2 Nitric Acid Production
2 B 3 Adipic Acid Production
2 B 4 Carbide Production
2 B 5 Other, Chemical Industry
2 C Metal Production
2 D Other Production
2 D 1 Pulp and Paper Production
2 D 2 Food and Drink Production
2 G Other Industrial Processes
3 A Paint Application
3 B Degreasing and Dry Cleaning
3 C Chemical Products, Manufacture and Processing
3 D Other, Solvent and other Product Use (including products containing Hms and POPs)
4 B Manure Management
4 B 1 a Dairy
4 B 1 b Non-Dairy
4 B 1 Cattle
4 B 13 Other, Manure Management
4 B 2 Buffalo
4 B 3 Sheep
4 B 4 Goats
4 B 5 Camels and Llamas
4 B 6 Horses
4 B 7 Mules and Asses
4 B 8 Swine
4 B 9 Poultry
4 C Rice Cultivation
4 D Agricultural Soils
4 D 1 Direct Soil Emission
4 F Field Burning of Agricultural Wastes
4 G Other, Agriculture
5 B Forest and Grassland Conversion
5 E Other (not included in National Total)
6 A Solid Waste Disposal
6 B Waste-Water Handling
6 C Waste Incineration
6 D Other, Waste
7 Other (included in National Total)

Appendix VII: Methodology used for the extended review

2004 Extended Review of LRTAP and NEC data submissions

Methodology

Key source analysis tests

Aim of test	Define the sectors contributing most (in terms of Gg) to the National total emissions
Data used	Source of data: LRTAP 2002 emission data reported in 2004 Pollutants: SO_2, NO_x, NH_3, MNVOC, CO, $PM_{2.5}$, PM_{10}, TSP Only data in new NFR reporting format were analysed.
Methodology description	The 2002 sector emissions were displayed graphically, and the 4-5 sectors contributing most to the National Total were picked out. Memo item sectors were excluded. The intention was to list the most important sources at the highes possible level of detail. One obstacle was that countries report different level of details, and one country might report different level of details for different sectors or compounds. This is the reason why the Key Sources are listed at different levels of detail between countries, sectors and pollutants.

Timeseries dips and jumps for expert review

Aim of test	To identify significant discontinuities, i.e. instances of dips, jumps, and sudden trends in time series data reported by countries.
Data used	Source of data: NEC/LRTAP 2004 data submission. Pollutants: All. Time series data: 1990-2002. Only data in new NFR reporting format were analysed. Includes incomplete time series that also contained blank cells or zeros.
Methodology description	Reported time series data were $\log_{10}$-transformed prior to analysis to reduce intra-series variability and improve general time series linearity. A linear regression was subsequently applied to the log-transformed values for each time series. An individual value within the time series was identified as a dip/jump if the respective residual value (regression forecast value - reported value) was greater than 1.75 standard deviations from the mean of all residuals within the time series. Only time series where the flagged data value contributed a significant fraction (>3%) of the national total for the given year are included in this dataset for expert review. Duplicate flagged time-series arising from sector aggregations were also removed from the dataset i.e. for a given country/pollutant combination, the more aggregated time series (e.g. 1 A 4 b) was deleted from the review dataset if the flagged value was directly attributable to a flagged value in an underlying detailed sector time series (e.g. 1 A 4 b i). A final manual check was performed on the flagged data series before the dataset was sent to the Expert Panel for Review.

Re-calculation check

Aim of test	To identify significant differences between national totals reported by Parties in the 2002 and 2004 submission years.
Data used	Source of data: LRTAP 2004, 2003 and 2002 data submissions, NEC 2003-2004 submissions Pollutants: CO, NH3, NMVOC, NOx, SO2 Time series data: 1990-2000/2001.
Methodology description	National totals for each country/pollutant combination were obtained from the 2002 and 2004 LRTAP data submission datasets. The percentage differences between the national totals reported in the 2004 and 2002 data submissions were calculated. Years were flagged where differences between the reported national totals in consecutive years fell in the ranges: 5-10%, 10-20% and >20%

Implied Emission Factors Check

Aim of test	To identify significant differences in Implied Emission Factors between Parties.
Data used	Source of data: LRTAP 2004 data submission - 2001 data, UNFCC Activity Data 2001 Pollutants: CO, NH3, NMVOC, NOx, SO2 Sectors: 1A1a, 1A1b, 1A1c, 1A2, 1A3b, 1A3c, 1A3e, 1A4b, 1B1a, 1B1b, 2A1 and 2A2
Methodology description	Activity data obtained from the UNFCC locator tool were used in conjunction with LRTAP data to calculate implied emission factors for 2001. An average IEF per pollutant and sector was calculated. Individual country emission factors were flagged if they were more than 4 times greater or less than 0.25 of the average IEF for the country grouping in which the country was assigned (Western or Eastern Europe). This is only an initial simple test in order to check the feasibility of the IEF testing, and it is recognised that the analysis of emission factors should be harmonised with the recommendations at the EMEP/CORINAIR Guidebook.

LRTAP and NEC inventory comparability

Aim of test	To identify significant differences between inventory data submitted to CLRTAP and NEC.
Data used	Source of data: LRTAP and NECD 2004 data submissions Pollutants: NH3, NMVOC, NOx, SO2 Sectors: National totals
Methodology description	National totals for the four respective pollutants from submissions to LRTAP and NEC were compared. Years were flagged where differences between the reported national totals were >0.1%