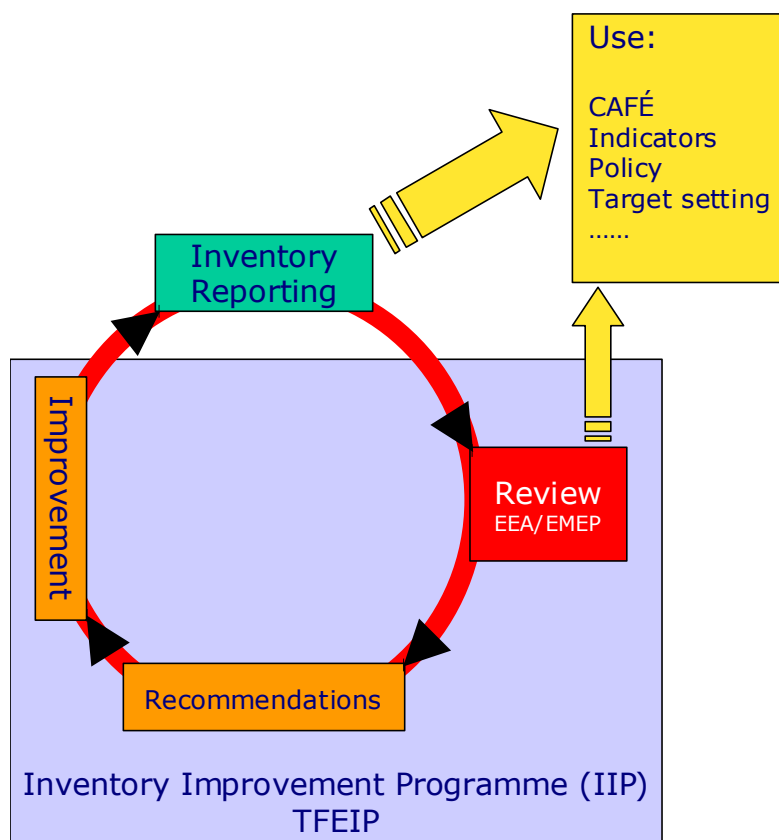


2003-2004 NEC AIR EMISSIONS REPORTING:

INVENTORY IMPROVEMENT REVIEW OVERVIEW REPORT



**ETC/ACC Technical Paper 2004/2
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*M Adams, M Downes and J Goodwin
AEA Technology Environment*



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Executive Summary

This overview report summarises the methods used and the results of a review of the NEC Directive inventories submitted by EU Member States to the European Commission in terms of data submission timeliness and quality. The review of the NEC emissions data has been performed in parallel with a review of the data submitted by Parties in 2004 to the United Nations Economic Commission for Europe (UNECE) Convention on Long-Range Transboundary Air Pollution (LRTAP). This report represents one of the outputs from the 2004 work programme of the European Topic Centre on Air and Climate Change (ETC-ACC), funded by EEA.

The review work covered tests for data compliance and comparability:

- **Compliance tests:** where the submissions were evaluated against the reporting guidelines. Checks included:
 1. dates of submission compared with the submission deadline;
 2. the reporting formats of data; and
- **Comparability tests:** where the inventories were reviewed for their quality. Checks made included:
 3. comparisons with other inventories (comparison of national totals reported to CLRTAP/NEC);
 4. recalculations – compares national totals reported in this recent reporting round with those from the previous year's reported national emissions; and
 5. highlighting dips and jumps within the time-series data.

Members of the UNECE TFEIP Expert Panel on Review have reviewed the results of the comparability checks to remove instances where the reasons for the identified inconsistencies were known. The questions raised from the review have also been made available to country experts via a web-based consultation being hosted by EMEP. Answers received from countries will be summarised in a joint EMEP/EEA inventory report to be published later this year.

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Introduction

This overview report summarises the methods used and the results of a review of the NEC Directive inventories submitted by EU Member States to the European Commission (due 31 Dec. 2003) in terms of data timeliness and quality. The review of the NEC emissions data has been performed in parallel with a review of the data submitted by Parties in 2004 to the United Nations Economic Commission for Europe (UNECE) Convention on Long-Range Transboundary Air Pollution (LRTAP). This report represents one of the outputs from the 2004 work programme of the European Topic Centre on Air and Climate Change (ETC-ACC), funded by EEA.

Use of emissions data and legal requirements for reporting

The European Commission requires air emissions data for both policy development and checking compliance with international agreements and legal obligations. The EEA (and its ETC/ACC) uses this data for assessments, primarily in the form of emission indicators, in support of European Union environmental programmes.

With respect to the legal requirements for reporting data, The European Union, a signatory to the Gothenburg protocol, notes in Directive 2001/81/EC of The European Parliament And Of The Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants (the NEC Directive) that Emission inventories are necessary to monitor progress towards compliance with the emission ceilings and must be calculated in accordance with internationally agreed methodology and reported on regularly to the Commission and the European Environment Agency (EEA). Under Article 7 of the National Emission Ceilings Directive (NECD) Member States are required to prepare and annually update emission inventories, using the methodologies agreed upon by the Convention on Long-range Transboundary Air Pollution and are requested to use the joint EMEP/CORINAIR Guidebook in preparing these inventories and projections.

Development of the review process

In accordance with the work-plan for the implementation of the LRTAP Convention (ECE/EB.AIR/2002/4, item 2.1), and at the invitation of the Government of Sweden, a Workshop on Validation and Evaluation of Air Emission Inventories was held in Gothenburg from 14-16 October 2002. The delegates critically examined the means of assuring the quality of air emission inventory data that form the basis for assessing the compliance with existing agreements and possible future revisions of international protocols, e.g. the 1999 Gothenburg Protocol and EC directive for transboundary air pollutants. It was recommended, among other things, that:

‘There was a need to undertake a review process, including a system of checking and gap filling and the preparation of national inventory reports. In addition, the workshop recommended that the TFEIP expert panel on verification and projections develop procedures for the review of inventories, taking account of the proposal by MSC-West; to carry out a pilot assessment of bias and data gaps and inconsistencies in early 2003, and to develop further these procedures in 2004. The workshop recommended, moreover, further harmonisation with the reporting and review process of UNFCCC’.

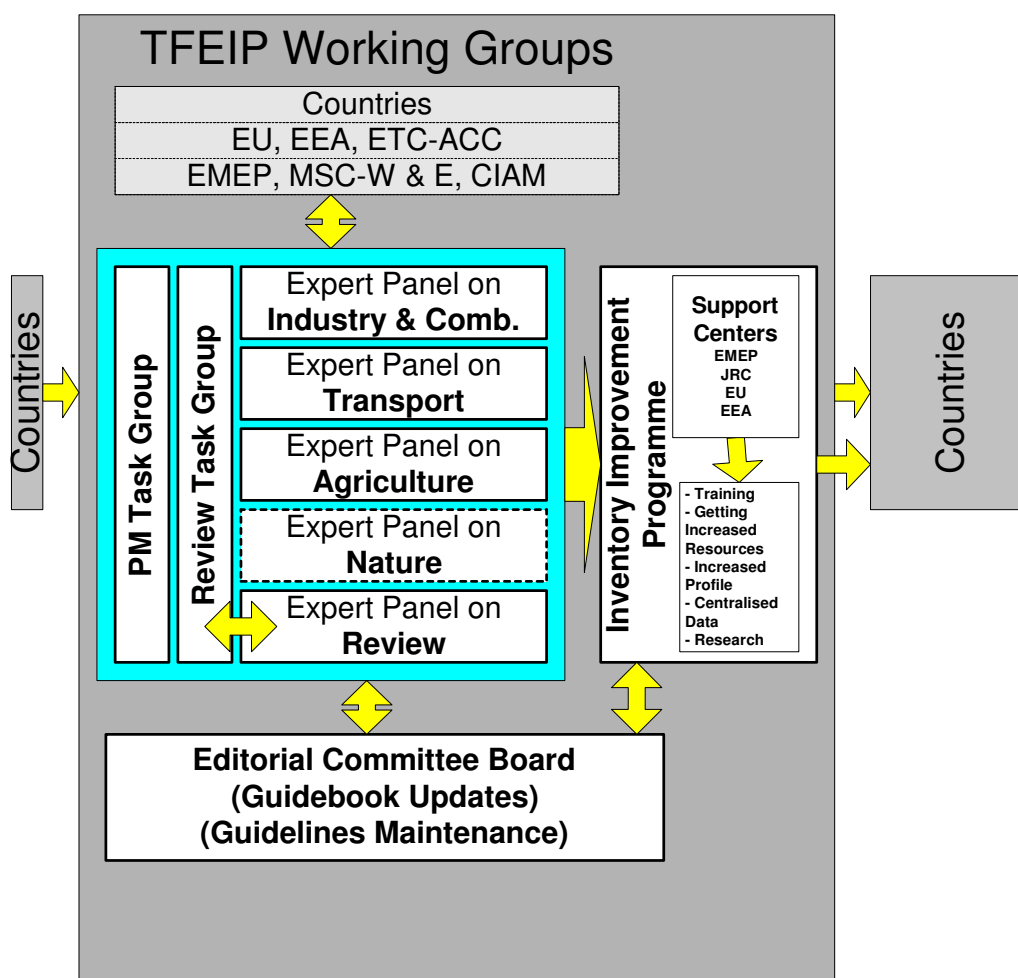
The Gothenburg meeting identified the need to assist countries with the submitting and checking of data in order to improve the timeliness of reporting. It further identified the need to address the inventory quality related properties of: completeness, comparability, consistency, transparency, and accuracy. It stressed that any additional measures must be cost effective and urged that relevant work carried out under other international programmes be adapted wherever feasible.

A trial emission inventory review process on NEC and LRTAP data was therefore undertaken between February and September 2003 as part of the EEA's ETC-ACC work programme in collaboration with EMEP/MSW. The main aim of the trial review was to develop and apply a set of inventory quality tests suitable for any future annual inventory review process. This trial review was therefore regarded as a first step towards an annual emission review process for NEC/LRTAP data to be agreed by the European Commission, the EMEP Steering Body or the UNECE/LRTAP Executive Body.

The trial review process subsequently served as the basis of discussion concerning such an annual review process at the joint workshop of EIONET and the UNECE Task Force on Emission Inventories and Projections (TFEIP) (Warsaw, 22-24 Sep. 2003) LRTAP. At this meeting it was decided that an Expert Panel on Review would be formed to take forward the review process; this body had its first meeting in Copenhagen on the 5-6th February 2004 where the scope of the 2004 review work was discussed and clarified.

The Expert Panel on Review is a new working group under the TFEIP as illustrated in Figure 1. It will oversee the work of the Review Task Group – the actual group that performs the review tests according to the procedures agreed with the Expert Panel on Review. The Review Task Group will decide on the questions that are put to Countries and report on responses. It is proposed that the Review Task Group is led by the EEA/ETC-ACC and should include technical representatives from: UNECE secretariat, MSC-W, CIAM, EEA/ETC-ACC and the Parties represented by experts from the three Expert Panels (Combustion, Transport and Agriculture).

Figure 1. Proposed structure of the TFEIP Working Groups



The work of the review task group will therefore be to review the NEC and UNECE emission inventories submitted each year. There will be two levels of review designed to fit in with the datasets that are reported.

- **Level 1:** (General Review) **Assessing Completeness & Internal Consistency** will be done every year and focus on automatic tests and expert review of the submitted inventory data. This review will include assessment of dips, jumps and gaps as well as the internal integrity of the data provided (do the subtotals add up to the national totals etc);
- **Level 2:** (Extended Review) **Assessing Comparability** (to be further discussed in TFEIP in 2004) will be undertaken less frequently and possibly every 5 years. This review will be more detailed than the Level 1 analysis, using for example detailed activity data to compare emission estimates for similar source sectors between countries (e.g. implied emission factor comparison). It will also provide and compare emission comparisons with UNFCCC inventories. The level 2 review will require regular use of the latest reported UNFCCC data (emissions and activity) using UNFCCC locator tools.

It is intended that this review work will provide the European Commission (DG Environment), EMEP Steering Body, and the LRTAP Executive Body with a consistent and transparent technical assessment for their various purposes. The results of the assessment can be used to assist further national inventory improvements through the EU NEC Directive (Committee) and the UNECE TFEIP.

Scope of Review

The inventory review of NEC data was able to cover all Member States that had reported emissions data by 18 March 2004 (the due date for submissions to be received by the Commission was 31 December 2003). Data from countries that reported emissions data after 18 March 2004 were not reviewed.

Methodology

The review work has used several diagnostic tools with the aim of assisting countries to optimise their own inventory quality checking routines. These include tests on:

- **Compliance tests:** where the submissions are evaluated against the reporting guidelines. Checks included:
 1. dates of submission compared with the submission deadline;
 2. the reporting formats of data; and
- **Comparability tests:** where the inventories are reviewed for their quality. Checks made included:
 3. comparisons with other inventories (comparison of national totals reported to CLRTAP/NEC);
 6. recalculations – compares national totals reported in this recent reporting round with those from the previous year's reported national emissions; and
 7. highlighting dips and jumps within the time-series data.

Technical details concerning the methodologies used for these tests are given in Appendix 1.

Results summary

Compliance tests

Details of the timeliness and formats of submissions are summarised in Table 1.

Table 1. Details of dates submission were received by the EEA, inventory years covered, and the format of the emissions data.

	Member State	Submission	Submission date	Latest data available	Years covered	Format emissions
MS that submitted on time:	Austria*	NEC	30 Dec 2003	2002	1990-2002	New NFR
	Finland*	NEC	12 Dec 2003	2001	2000-2001	Old NFR
	Ireland*	NEC	31 Dec 2003	2002	2001-2002	New NFR
	Ireland (update)*	NEC	16 Feb 2004	2002	2001-2002	New NFR
	Netherlands*	NEC	19 Dec 2003	2002	2001-2002	New NFR
MS that submitted late:	Sweden*	NEC	15 Dec 2003	2002	1988-2002	New NFR
	Belgium*	NEC	14 Jan 2004	2002	2001-2002	New NFR
	Denmark	NEC	22 Mar 2004	2002	1980-2002	detailed NFR
	France*	NEC	15 Jan 2004	2002	1980-2002	New NFR
	France (update)	CLRTAP/NEC	4 May 2004 (earlier to COM)	2002	1980-2002	New NFR
	Greece*	NEC	5 Jan 2004	2001	1990-2001	SNAP
	Italy	CLRTAP/NEC	12 May 2004 (earlier to COM)	2002	1980-2002	SNAP Level 2
	Luxembourg	NEC	30 Jan 2004			
	Spain	NEC	10 May 2004 (earlier to COM)	2002	2000-2002	New NFR
MS that had submitted no data by 1 June 2004:	United Kingdom	NEC	6 May 2004 (earlier to COM)	2002	1990-2002	New NFR
	Germany					
	Portugal					

* Data received from these countries was received in time to be able to be included in the comparability tests for data quality.

1. Timeliness of submissions

- Of the fifteen Member States (as at 31 December 2003), only five (AT, FI, IE, NL and SE) submitted inventory data on time (reporting deadline 31 December 2003).
- As of 1 June 2004, a further eight Member States (BE, DK, FR, GR, IT, LU, ES and UK) had submitted inventory data, but after the reporting deadline.
- As of 1 June 2004, two Member States (DE and PT) had still not reported emissions data to the Commission.
- Data from eight countries (AT, BE, FI, FR, GR, IE, NL, and SE) was received in sufficient time to be able to be included in the comparability tests for data quality (cut-off date of 18 March 2004).

2. Format and completeness of submissions

- 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 ten Member States all used the required New NFR format for reporting.
- Of the thirteen countries that did report data, two (FI and GR) did not report emissions data for 2002 as required. For both of these countries, the last year for which data was reported was 2001.
- Of the thirteen countries that reported data, only 6 (AT, DK, FR, IT, SE and UK) submitted a complete time-series for the years 1990-2002.

Comparability tests

These tests were performed on the submitted NEC data from the eight countries (AT, BE, FI, FR, GR, IE, NL, and SE) that was received in sufficient time in order to be included in the analysis.

3. Comparison of national totals reported to NEC/LRTAP

- 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 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 (NEC vs LRTAP country/pollutant/year comparisons), 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, 10 values were flagged where differences between the national totals reported to NEC and LRTAP differed by more than 0.1%. Details of these are shown in Table 2.
- There were four instances where differences between the reported national totals to NEC and LRTAP exceeded 2%. There was a large difference for values of SO₂ reported by the Netherlands in 2001 and 2002 Netherlands, 17.3% and 18.8% respectively.

Table 2. Flagged values indicating differences of >0.1% between national totals reported to NEC and LRTAP in 2004.

Country	Pollutant	Year	NEC reported national total (t)	LRTAP reported national total (t)	Percentage difference (NEC-LRTAP)
Belgium	NMVOC	2001	275,251	275,570	-0.1%
Belgium	NMVOC	2002	263,499	263,818	-0.1%
Ireland	NMVOC	2001	86,971	86,734	0.3%
Ireland	NO _x	2001	134,888	131,613	2.5%
Ireland	SO ₂	2001	126,053	125,792	0.2%

Netherlands	NM VOC	2002	243,607	243,281	0.1%
Netherlands	NO _x	2001	420,218	412,822	1.8%
Netherlands	NO _x	2002	414,421	406,121	2.0%
Netherlands	SO ₂	2001	89,131	75,985	17.3%
Netherlands	SO ₂	2002	84,535	71,144	18.8%

4. Recalculations

- The recalculation check is designed to indicate significant differences between national totals reported by Parties under the NEC Directive in the successive 2002-2003 and 2003-2004 reporting rounds.
- Due to the limited number of countries that reported data in 2003-2004, together with the lack of overlap between data reported by countries in the two reporting rounds, it was only possible to perform a limited number of data comparisons.
- 148 data comparisons were made out of a total possible number of 720 had all 15 Member States reported a full time-series 1990-2001 (12 years) in the 2002-2003 and 2003-2004 reporting rounds for the 4 NEC pollutants.
- Complete comparisons (1990-2001) for all four pollutants could only be made for Austria and France. For Greece a comparison was possible for 1990-2000. The only other countries for which comparisons were possible were Finland (2000) and Ireland (2001).
- The figures below show the results of the comparison. There was no change between the emissions data submitted by Greece in the two reporting rounds.
- Interpreting the information on these graphs requires caution due to the large uncertainties inherent in the reported national total estimates. However, for both Austria and France, the two countries for which a complete time-series comparison was possible, there appears to be a similar trend (which is shown most clearly for example in Figure 5). For both countries, the recalculated emissions reported in 2004 show either an increased value, (or a smaller decrease) for early years compared with emissions reported for the more recent years i.e. emissions in early years appear to have been under-estimated in earlier years compared with the later years. It is noted that the 2010 emission targets set in the NEC Directive are absolute targets, and not based on a percentage reduction from the baseline year (1990).
- The same trend is also observed at the EU regional level from data reported by Member States in 2004 to the UNECE Convention on Long-Range Transboundary Atmospheric Pollution (LRTAP Convention) and for which data from more countries was available for analysis (EMEP/EEA 2004¹). Again it is not clear why the recalculated values from more recent years should be more negative than those from the earlier years.

¹ EMEP/EEA Joint Review Report. Vestreng et al., June 2004. 1st Draft.

Figure 2. Change in NEC reported national totals from the 2002-2003 and 2003-2004 reporting rounds – NH3

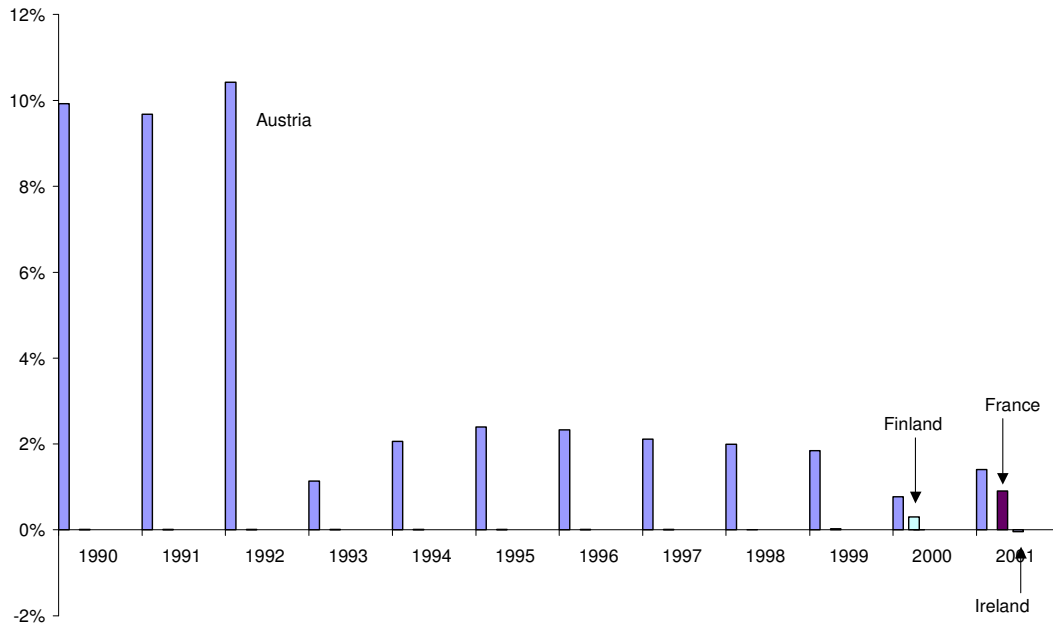


Figure 3. Change in NEC reported national totals from the 2002-2003 and 2003-2004 reporting rounds – NMVOC

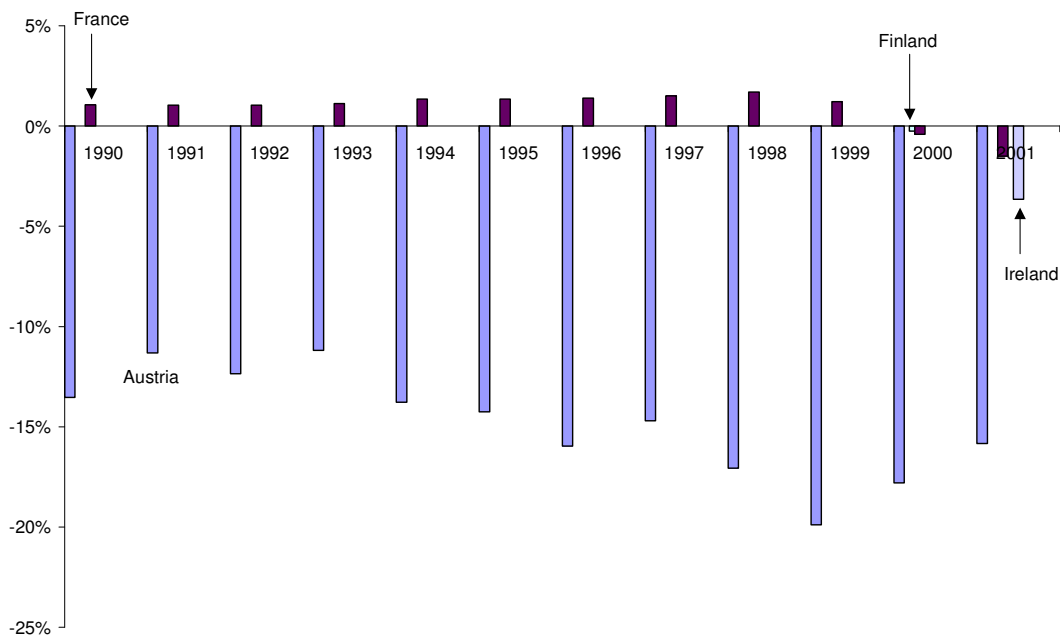


Figure 4. Change in NEC reported national totals from the 2002-2003 and 2003-2004 reporting rounds – NOx

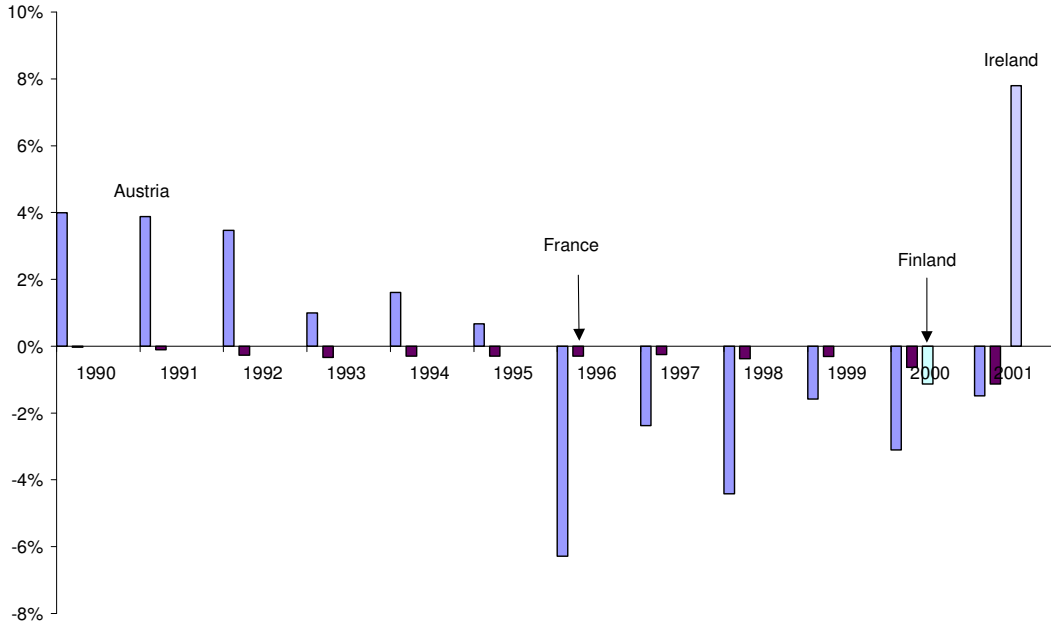
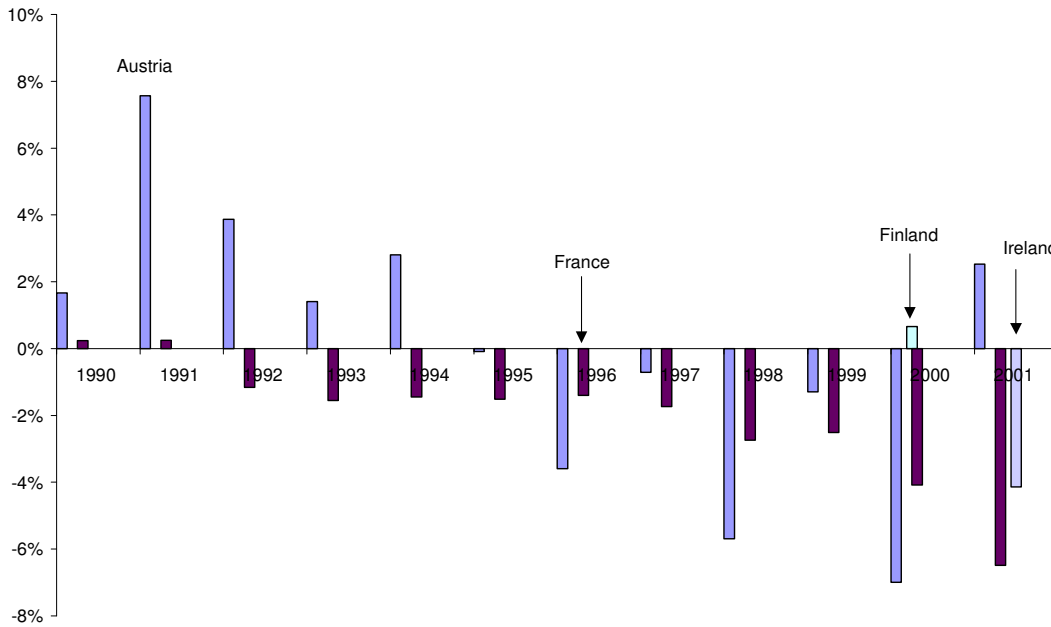


Figure 5. Change in NEC reported national totals from the 2002-2003 and 2003-2004 reporting rounds – SO2



5. Time series consistency – dips and jumps

- The time series checks identified instances of dips, jumps, and sudden trends in time series data reported by countries.
- 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.
- A total of 2512 time-series rows (country, pollutant, sector) were reviewed for potential inconsistencies. Of these, 29 rows contained at least one flag indicating a potential inconsistency.
- A summary of the results from the time-series checks is given below in Table 3.

Table 3. Summary of time-series check results

Country	No. of time-series flags	No. of time-series reviewed	No of flags as % of time-series reviewed
Austria	4	400	1.0%
Belgium	0	400	0.0%
Finland	1	56	1.8%
France	12	400	3.0%
Greece	7	56	12.5%
Ireland	0	400	0.0%
Netherlands	2	400	0.5%
Sweden	10	400	2.5%

Summary

The LRTAP and EU countries have called for better reporting of emissions - provided that this can be achieved without undue allocation of resources at national level. The revised Reporting Guidelines and the EMEP reporting system (REPDAB) have demonstrated that more comprehensive reporting, in a timely manner, is possible.

The work described in this report took the data submitted to NEC and looked at issues of data compliance and comparability.

The main findings from the review are:

- Only 5 Member States reported inventory emissions data to the European Commission by the reporting deadline (31 December 2003). The reason for the late submissions (or no submissions) from the remaining Member States needs to be investigated.
- Of countries that did submit data, 3 national submissions were not in the required New NFR reporting format.
- There were small differences between national totals submitted to NEC, and those submitted shortly afterwards to LRTAP. In four instances the differences between the

reported national totals exceeded 2%. For one Member State the differences for one pollutant exceeded 15% between the values reported to NEC and LRTAP.

- Only a limited recalculation check was possible due to data availability. For the few countries where full comparisons were possible there was a general trend for the changes in reported values in more recent years to be more negative than changes made to the times series in the early 1990's.
- A check of the time-series showed a number of instances where potential inconsistencies were identified. These have been referred to country experts for further clarification. Their responses will be captured and summarised in a joint EMEP/EEA report on the 2004 inventories to be published later this year.

Appendix 1. Methodologies used for inventory review tests

Comparison of national totals	
Aim of test	To compare NEC national totals reported in 2003/2004 with those reported in 2004 to LRTAP.
Data used	Source of data: NEC 2003-2004 submissions, LRTAP 2004 data submission Pollutants: NH ₃ , NMVOC, NO _x , SO ₂ Time series data: 1990-2002.
Methodology description	National totals for each country/pollutant combination were obtained from the 2004 NEC and LRTAP data submission datasets. The percentage differences between the two national totals reported were calculated. Years were flagged where differences between the reported national totals were >0.1%

Re-calculation check

Aim of test	To identify significant differences between national totals reported by Parties in the successive 2003 and 2004 submission years.
Data used	Source of data NEC 2003-2004 submissions Pollutants: NH ₃ , NMVOC, NO _x , SO ₂ Time series data: 1990-2001.
Methodology description	National totals for each country/pollutant combination were obtained from the 2003 and 2004 NEC data submission datasets. The percentage differences between the national totals reported in the 2004 and 2003 data submission 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%

Timeseries dips and jumps

Aim of test	To identify instances of dips, jumps, and sudden trends in time series data reported by countries.
Data used	<p>Source of data: NEC 2004 data submission.</p> <p>Pollutants: NH₃, NMVOC, NO_x, SO₂.</p> <p>Time series data: 1990-2002.</p> <p>Includes incomplete time series that also contained blank cells or zeros.</p>
Methodology description	<p>Reported time series data were log₁₀-transformed prior to analysis to reduce intra-series variability and improve general time series linearity.</p> <p>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.</p> <p>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).</p> <p>Finally, the flagged data were manually checked by members of the TFEIP Expert Panel on Review to remove those instances where reasons for the change in trend are known.</p>