European Topic Centre on Air Emissions

REVIEW OF CORINAIR90 - PROPOSALS FOR AIR EMISSIONS 1994

By

Simon Eggleston

November 1996

This report was prepared under the supervision of G. McInnes, Programme Manager, European Environment Agency

Cover Design: Folkmann Design and Promotion
Printing:

Cataloguing data can be found at the end of this publication
ISBN XXXXXXXXXXXX

Printed XXXXXX on recycled and chlorine-free bleached paper

European Environment Agency
Kongens Nytorv 6
DK - 1050 Copenhagen K
Denmark
Tel: +45 33 36 71 00
Fax: +45 33 36 71 99
E-mail: eea@eea.dk
Homepage: http://www.eea.dk

TABLE OF CONTENTS

Note:

In order to reduce confusion in this document between the past and future European inventories this document uses the terms CORINAIR 90 to describe the inventory being completed for 1990 under the CORINE programme, and Air Emissions '94 to describe the proposed inventory for Europe for the year 1994. However it is recommended that due to its familiarity and in order to emphasise the continuity of the exercise, the CORINAIR name is retained for future inventories.

EXECUTIVE SUMMARY

CORINAIR 90 was initiated by the European Environment Agency Task Force to produce an European emission inventory. Its scope was wider than the EC countries at that time and now covers 31 countries. Now the European Environment Agency (EEA) wishes to continue with this inventory work and has set up a Topic Centre on Air Emissions. The first task of this Topic Centre is to review CORINAIR 90 and make proposals for the future, in particular for Air Emissions '94, the next proposed European emission inventory. The main points of this report are:-

- CORINAIR 90 has achieved a new level of co-operation and collaboration in this area of work. It has achieved agreement of classification and on default approaches to the different emission sources. It is now producing data for 1990 which give emission estimates with higher levels of consistency and comparability than those achieved before. A source classification system, SNAP (Selected Nomenclature for Air Pollution), has been agreed with the result that emission estimates are now becoming available in greater detail than before.
- There are a number of problems with CORINAIR 90. The main one is the time taken to complete the inventories. Only now, in 1995, are 1990 estimates becoming widely available.
- There are also a number of detailed points relating to the SNAP codes and consistency of use that need to be addressed. These are discussed in the report.
- A review of users' needs indicates that there are a number of priority needs. In particular national level data is needed on a short time-scale. The EU requires CO_2 estimates within 7 months. Some countries can already meet this deadline and it is proposed that the Topic Centre assists other countries to reach the same reporting speeds.
- It is proposed that inventories are collected annually with national level data being available within six months for some data and 12 months for a wider range. In the next year the spatial detail is collected and the estimates broadened to a wider range of pollutants. Thus the whole process is completed within 24 months with some data available at 6 and 12 months. The report gives the detail of this process.
- An important point is that some of this data will be provisional. In the past some countries have not wished to release provisional information and then revise it later. However the time-scales clearly indicate that final data will not be available to meet user requirements. Inventory data, by their very nature, are estimates. They can never be regarded as final figures as they may be improved at any time, thus data suppliers and users must realise that they are the best estimate available by a given deadline.
- This report also identifies a range of development tasks that need to be carried out. These range from improvement of the SNAP codes and software changes to urban emissions inventories and validation activities. These will need to progress in parallel with the data collection work. Some of these development tasks will need to progress in collaboration with others such as EUROSTAT (for SNAP) and the EMEP/CORINAIR guidebook and UNECE Task Force on Emission Inventories for methodological improvements.
- This report has identified a number of issues where further work is needed to clarify final solutions, e.g. in the treatment of confidential data.
- The Air Emissions Topic Centre will need to give much greater training and assistance to each country to ensure the speedy completion of the data collection tasks. This will require careful management to ensure that the development work and the data collection activities proceed in a timely and efficient fashion. In addition, there appears to be a number of tasks

that will be subcontracted outside the Air Emissions Topic Centre to ensure they are completed on time in a cost effective way.

1. INTRODUCTION

CORINE (**CO**o**R**dination d'**IN**formation **E**nvironnementale) was a work programme set up by the European Council of Ministers on 27 June 1985 (Decision 85/338/EEC). It aimed at gathering, co-ordinating and ensuring the consistency of information about the state of the environment and natural resources in the European Community. One of its components was CORINAIR - the **CORIN**e **AIR** emissions inventory.

This was compiled for the EC for 1985. Following the decision to establish the European Environment Agency (Regulation 1210/90 on 7 May 1990), but before the agency was established, CORINAIR was continued for 1990 and became CORINAIR 90.

A methodology was agreed across Europe. The aims were to produce a complete, consistent and transparent inventory within a reasonable time-scale to serve the needs of the user community.

CORINAIR 90 has produced an emission inventory for eight pollutants covering 28 European countries (on 22 March 1995) with a further three countries collaborating but which have not yet supplied any data. (Countries collaborating in CORINAIR 90 are shown in Table 1.) While the data has been collected, results have still not been reported yet. There are a wide range of potential users outside the CORINAIR 90 expert group including policy makers and researchers (see Table 2). The lateness of the final results is damaging its usefulness to these users.

The EEA has four main goals[a]:-

1. to produce objective, reliable and comparable information for both those concerned with European Policy and the European public,
2. to support the Commission, the Council and the European Parliament in preparing and evaluating environmental measures,
3. to co-ordinate the EIONET and publish a European state of the environment report every three years,
4. to liaise with relevant national, regional and global environmental programmes and institutes.

The emission inventory work will help meet all these goals. The collection of data and its transformation into useful information is fundamental to an emission inventory. The European approach to producing inventories for the continent has been a collaborative one with both institutes in each country and regional organisations involved. This collaboration will continue.

The European Environment Agency (EEA) now intends to compile an inventory for the year 1994. This is Air Emissions '94 (AE 94). It has established an Air Emissions Topic Centre whose first task is to review the success of CORINAIR 90 and recommend the methods and procedures necessary for Air Emissions '94 to be successful.

With the creation of EEA the voluntary collaboration which produced CORINAIR 90 has been superseded by a more formal system with National Focal Points (NFPs) in each country

[a] EEA **1994 Annual Report** Copenhagen 1995

to co-ordinate the contribution of data to the Topic Centre. This should enable more regular and timely production of data and help to give the emissions inventories a higher profile.

Table 1 Countries Collaborating in CORINAIR 90

EU Countries		**Other**	
Austria	Italy	Malta	Hungary
Belgium	Luxembourg	Norway	Latvia
Denmark	Netherlands	Switzerland	Lithuania
Finland	Portugal	Albania	Poland
France	Spain	Bulgaria	Slovakia
Germany	Sweden	Croatia	Slovenia
Greece	UK	Czech Republic	Romania
Ireland		Estonia	Russia

The work of the topic centre is determined by the EEA's multiannual work programme. This work programme has ten main areas. The inventory activities are performed under part 5 - *Source Oriented Monitoring, Assessment of Pressures*. This part of the programme group - *Monitoring and Databases*. The specific projects that the this topic centre is working on are SA1 - *Air Emission - General Approach and Assessment* and SA2 *Air Emissions Inventories '90 and '94*.

Emissions to land and water, integrated emission inventories and waste generation are not part of these projects and so are not considered in depth in this report. However there are links between these activities and its will be important that there is good communication between the projects.

Table 2 Potential Users of CORINAIR 90 Results

- The EEA. The first user of the data will be the EEA who will distribute it via its network - the EIONET.
- Policy makers in the European Commission, DGXI and national governments.
- The scientific community.
- Those interested in Air Quality Assessments.
- The UNECE and EMEP who are interested in regional air pollution under the Convention on Long Range Transport of Air Pollution Convention (LRTAP).
- The parties to the Framework Convention on Climate Change (FCCC) and the IPCC/OECD interested in greenhouse gases.
- OSPAR and HELCOM looking at deposition into the North Atlantic, North and Baltic Seas.
- WHO looking at air quality and health.
- OECD and IEA for energy related emissions.
- EUROSTAT who develop and publish environmental statistics including atmospheric emissions.
- GEMS the Global Environmental Monitoring Scheme
- A wide range of modelling efforts across Europe in addition to EMEP including GENIMIS and other parts of EUROTRAC, GEIA global inventories and IIASA's modelling of acidification and photochemical pollution.

2. AIMS

The aim is for Air Emissions '94, and its successors to become:

- the European emission inventory.

This would remove the need for other inventories. This raises a number of issues particularly the relationship of the IPCC and UNECE source descriptions and relationships with bodies collecting statistics such as EUROSTAT and the OECD

The main aim of the EEA is to provide information to policy makers - DGXI and member states. This needs to be objective, reliable and comparable. It is not just a 'stamp-collecting' exercise - data needs to be collected, interpreted, made available and presented in useful and timely ways.

To be successful Air Emissions '94 must meet as many of the needs of the user community as possible. When it meets those needs, it can become the European inventory.

The Emissions Inventory Topic Centre needs to first produce a methodology and then collect the data to produce a European inventory.

Ultimately the Emissions Inventory Topic Centre should be able to supply the data required by international agreements, for example the FCCC and the EU greenhouse gas reporting requirements. (These are discussed in Section 5.3.) The data collected for Air Emissions '94 should as far as possible be compatible with these agreements. The earliest requirement is for provisional data within seven months (CO_2 for the EU) — a deadline on a much shorter time-scale than CORINAIR 90 has been able to deliver. These agreements also determine a minimum level of data that countries should be able to provide.

The emission inventory data that is collected will be used in a number of ways. It will need to:-

- show trends and provide the basis of strategic analysis.

- provide the basis of a single system for both emission inventories and for emission projections and scenario analysis.

- need to be compatible with waste and water inventories which, in the future, will lead to the creation of integrated inventories.

- in addition provide the basis of any attempt to model air quality in Europe.

This implies that a national level inventory must be produced each year.

The Topic Centre must rely on national experts to produce inventories for their own countries. These should be compatible with the EMEP/CORINAIR Guidebook on Emissions Inventories and any divergence must be fully documented. Software will be available to assist this work. In all cases the Topic Centre will validate inventories and ensure compatibility between countries' inventories, thus assuring the quality of the data.

3. OVERVIEW OF THE CORINAIR 90 PROCESS

CORINAIR 90 was extended to include countries outside the EU and now includes 30 countries (although not all of these have reported as yet). All of these countries agreed to contribute and have worked together to produce a single system for the whole of Europe. Definitions had to be agreed. Software was distributed and data collected by national experts.

This effort involved:-

- SNAP90 (Selected Nomenclature for Air Pollution 90), a source sector hierarchical nomenclature with 260 activities, three levels and 11 main sectors.
- Extending the number of point sources.
- Covered eight pollutants:

sulphur dioxide (SO_2)
oxides of nitrogen (NO_x)
non-methane volatile organic compounds (NMVOC)
ammonia (NH_3)
carbon monoxide (CO)
methane (CH_4)
nitrous oxide (N_2O)
carbon dioxide (CO_2)

- Collaboration with UNECE which requires inventory information as part of the protocols of the Convention on Long Range Transboundary Air Pollution (LRTAP) and OECD (who were developing the IPCC methodology for greenhouse gas emissions). There has also been collaboration with the UNECE Task Force on Emissions Inventories that is producing the EMEP/CORINAIR guidebook on emission inventories based on the SNAP nomenclature.

When national CORINAIR 90 inventories have been compiled and checked, the data is then transferred to an ORACLE database held by the EEA, and the results of the European wide inventory are collated and distributed to users. Table 3 summarises the information which is contained in CORINAIR 90 and the requirements of some potential users. Table 4 is a summary of CORINAIR 90 data for Europe and an example of the more detailed data available from CORINAIR 90 is shown in Table 5.

Table 3 CORINAIR 90 Specifications and User Requirements

	CORINAIR 90	**UNECE**	**EMEP**	**IPCC**	**EU Large Combustion Plant Directive**	**OSPAR & HELCOM**	**EU Greenhouse Gas Reporting**	**Other (e.g. Policy makers, NFP)**
POLLUTANTS								
SO_2	•	•	•		•			
NO_x	•	•	•	•	•			
CO_2	•	•		•			•	
CH_4	•	•	•	•				
N_20	•			•				
NMVOC	•	•	•	•				
CO	•	•	•	•				
NH_3	•	•	•					
OTHER				• HFCs • CF_4 • C_2F_6 • SF_6		• Heavy metals[a] •Persistent organo-chlorides[b]	Other gases required by the IPCC but data 'requested' not 'expected'.	• Particulates • Specific VOCs
SOURCE CATEGORIES								
CORINAIR SNAP LEVEL 1 - 11 GROUPS	•	•	•					
CORINAIR SNAP LEVEL 2 - 57 CATEGORIES	•							
CORINAIR SNAP LEVEL 3 - ABOUT 240 CATEGORIES[c,d]	•							
OTHER	• Point Sources			• 6 groups split into 71 categories • Sinks (partial)	• Existing plant ≥ 300 MW • Existing plant 50 to 300 MW • New plant ≥ 50 MW		IPCC Source Categories	• DGXI VOC directive: to be specified • Policy makers: ISIC and socio - economic categories
SPATIAL RESOLUTION								
NUTS LEVEL 0 (NATIONAL)	•	•	•		•	•	•	•
NUTS LEVEL 3	•							•
OTHER	• Individual large point sources as defined by CORINAIR 9		• 50 x 50 km grid		• Individual large point source as defined in directive	• Not fully defined yet		• Individual point sources • Smaller grids • Urban inventories
TIME-SCALES								
PROVISIONAL DATA							7 months	
REVISED DATA		12 month	12 month	21 months	9 months		19 months	

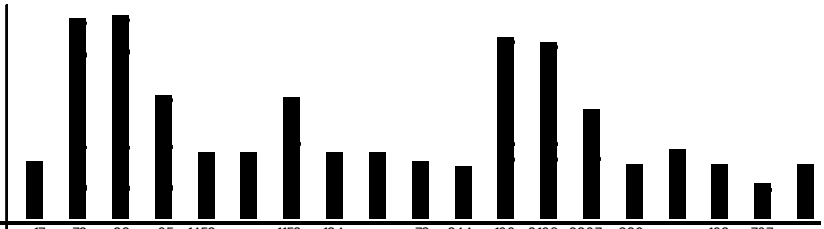
[a] As, Cd, Cr, Cu, Hg, Ni, Pb, Se, Zn.

[b] Hexachlorocyclohexane (HCL), pentachlorophenol (PCP), hexachlorobenzene (HCB), tetrachloromethane (TCM), trichloroethylene (TRI), tetrachloroethylene (PER), trichlorobenzene (TCB), trichloroethane (TCE), dioxins and furans.

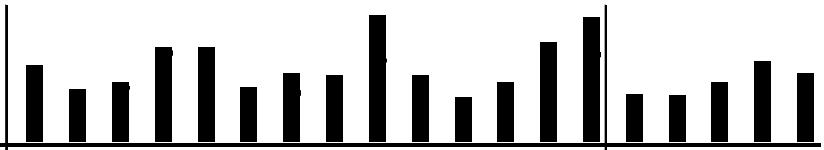
[c] Including subdivisions made on the basis of size or processing.

[d] Excluding subdivisions made on the basis of type of fuel used.

Table 4 CORINAIR 90 Summary for Europe



Emissions kTonnes SO2 per Year																		
1 Public Power etc	17	72	23	95	1453	1153	134		73	344	199	2108	2307	329		103	767	
2 Commercial, Domestic etc	19	24	11	35	121	458	9		20	116	134	459	593	38		30	82	
3 Industrial Combustion	39	72	58	130	328	173	27		78	514	445	1725	2170	27		39	574	
4 Production Processes	11	37	1	38	81	61	0		60	111	36	7	43	51		0	105	
5 Extraction of fossil fuels	NE	0	0	0	1	0	0		0	24	20	0	20	0		0	0	
6 Solvent Use	0	0	0	0	0	0	0		0	0	-	-	-	0		0	0	
7 Road Transport	7	8	5	13	10	0	7		4	145	51	26	77	13		5	103	
8 Other mobile sources	IE	NE	0	0	16	6	15		7	25	12	18	30	182		1	48	
9 Waste treatment and disposal	0	1	1	2	0	1	0		NE	19	NA	NE	-	0			4	
10 Agricultural	NE	0	0	0	0	0	0		0	0	-	-	-	0		0	0	
11 Nature	NE	0	0	0	0	0	0		0	3	-	-	-	1		0	570	
TOTAL	93	214	99	313	2008	1853	193	0	243	1300	897	4343	5240	641	0	178	2253	
Emissions - %of total																		
1 Public Power etc	18	34	23	30	72	62	70		30	26	22	49	44	51		58	34	
2 Commercial, Domestic etc	21	11	11	11	6	25	5		8	9	15	11	11	6		17	4	
3 Industrial Combustion	42	34	58	41	16	9	14		32	40	50	40	41	4		22	25	
4 Production Processes	11	17	1	12	4	3	0		25	9	4	1	1	8		0	5	
5 Extraction of fossil fuels	NE	0	0	0	0	0	0		0	2	2	0	0	0		0	0	
6 Solvent Use	0	0	0	0	0	0	0		0	0	-	-	-	0		0	0	
7 Road Transport	7	4	5	4	1	0	3		2	11	6	1	1	2		3	5	
8 Other mobile sources	IE	NE	0	0	1	0	8		3	2	1	0	1	28		1	2	
9 Waste treatment and disposal	0	1	1	1	0	0	0		NE	1	NA	NE	-	0		0	0	
10 Agricultural	NE	0	0	0	0	0	0		0	0	-	-	-	0		0	0	
11 Nature	NE	0	0	0	0	0	0		0	0	-	-	-	0		0	25	



Emissions kTonnes SO2 per Year																	
1 Public Power etc	1	0	44	1589	175	903	243	153	1463	15	2729	6382	8595	106	5494	###
2 Commercial, Domestic etc	3	1	4	444	4	230	117	17	98	16	208	759	1273	58	1387	2663
3 Industrial Combustion	8	12	43	1006	76	109	166	22	478	38	703	3068	4948	163	1804	6760
4 Production Processes	31	0	74	94	11	30	11	0	38	17	19	483	578	119	277	886
5 Extraction of fossil fuels	0	0	0	0	0	0	0	0	0	0	0	44	44	0	1	45
6 Solvent Use	0	0	0	0	0	0	AZ	0	0	NE	0	0	0	0	0	0
7 Road Transport	4	0	13	75	14	6	3	3	69	7	63	496	540	22	97	641
8 Other mobile sources	8	0	17	65	3	33	1	NE	17	11	66	386	422	26	121	551
9 Waste treatment and disposal	0	0	5	1	0	0	1	0	42	2	0	72	74	2	3	77
10 Agricultural	0	0	1	0	0	0	AZ	NE	0	NE	0	1	1	0	0	1
11 Nature	0	0	AZ	0	0	0	AZ	NE	0	0	0	574	574	0	0	574
TOTAL	54	14	201	3273	283	1311	542	195	2206	105	3787	###	###	495	9182	###
Emissions - %of total																
1 Public Power etc	2	0	22	49	62	70	45	78	66	14	72	52	50	21	60	54
2 Commercial, Domestic etc	6	6	2	14	1	18	22	9	4	15	5	6	7	12	15	10
3 Industrial Combustion	15	87	22	31	27	8	31	11	22	36	19	25	29	33	20	26
4 Production Processes	57	1	37	3	4	2	2	0	2	16	1	4	3	24	3	3
5 Extraction of fossil fuels	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 Solvent Use	0	0	0	0	0	0	AZ	0	0	NE	0	0	0	0	0	0
7 Road Transport	7	3	6	2	5	0	1	1	3	7	2	4	3	4	1	2
8 Other mobile sources	15	1	8	2	1	2	0	NE	1	10	2	3	2	5	1	2
9 Waste treatment and disposal	0	1	2	0	0	0	0	0	2	2	0	1	0	0	0	0
10 Agricultural	0	0	1	0	0	0	AZ	NE	0	NE	0	0	0	0	0	0
11 Nature	0	0	AZ	0	0	0	AZ	NE	0	0	0	5	3	0	0	2

Notes:-

*	not yet available
AZ	assumed to be zero
IE	included elsewhere
NA	not available
NE	not estimated
_	AZ, IE or NA

EU-12	EU-15	EFTA-5	PHARE-10	EUROPE
Belgium	EU-12	Austria	Bulgaria	EU-12
Denmark	Austria	Finland	Czech Republic	EFTA-5
France	Finland	Norway	Estonia	PHARE-10
Germany (former We	Germany (former Eas	Sweden	Hungary	Croatia
Greece	Sweden	Swirzerland	Latvia	Germany (former eas
Irelend			Lithuania	Malta
Italy			Poland	
Luxembourg			Romania	
Netherlands			Slovak Republic	
Portugal			Slovenia	
Spain				
United Kingdom				

Table 5 Detailed CORINAIR 90 Data for France - 1990 Emissions (as Mg except CO2 as Gg) for Industrial combustion plant and Processes with Combustion

SNAP	Process	SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_20	NH_3
030000	**Industrial combustion plant and processes with combustion**	514090	164965	7282	6623	598176	87391	2070	0
030100	**Combustion in boilers, gas turbines and stationary engines**	328113	66742	2398	2299	8328	44311	1570	0
030101	Combustion plants ≥ 300 MW	113600	18556	603	565	2337	12653	458	0
030102	Combustion plants ≥ 50 MW and < 300 MW	70365	17216	564	501	2028	11664	366	0
030103	Combustion plants < 50 MW	144116	29604	1200	1200	3871	19478	724	0
030104	Gas turbines	31	1366	33	33	91	517	23	0
030105	Stationary engines	IE	IE	IE	IE	IE	IE	IE	IE
030200	**Process furnaces without contact**(1)	63083	13959	594	586	5739	12247	283	0
030201	Refinery processes furnaces	49353	6246	205	202	1046	4854	190	0
030202	Coke oven furnaces	13196	7137	380	380	4282	1106	14	0
030203	Blast furnaces cowpers	0	454	0	0	394	6200	76	0
030204	Plaster furnaces	534	122	9	4	17	87	4	0
030300	**Processes with contact** (2)	122895	84263	4290	3739	584109	30833	217	0
030301	Sinter plant	26389	20994	660	2423	549998	3080	178	0
030302	Reheating furnaces steel and iron	3569	2521	986	118	508	833	0	0
030303	Gray iron foundries	374	104	187	21	12456	83	0	0
030304	Primary lead production	21804	85	1	0	18	78	0	0
030305	Primary zinc production	13946	61	1	0	11	49	0	0
030306	Primary copper production	9	103	0	0	0	0	0	0
030307	Secondary lead production	3700	0	0	0	0	0	0	0
030308	Secondary zinc production	0	15	18	0	0	0	0	0
030309	Secondary copper production	27	5	80	0	10	0	0	0
030310	Secondary aluminium production	107	82	22	0	13	0	0	0
030311	Cement	16572	33666	1158	1158	9262	17946	0	0
030312	Lime (including iron and steel and paper pul industries)	162	1750	14	0	174	2401	0	0
030313	Asphalt concrete plants	8640	576	227	0	1644	829	28	0
030314	Flat glass	22141	20946	0	0	288	3311	0	0
030318	Mineral wool (except binding)	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG
030319	Bricks and tiles	3976	2565	282	0	8209	1657	0	0
030320	Fine ceramic materials	706	456	50	0	1458	294	0	0
030321	Paper-mill industry (drying process)	773	335	18	18	61	272	11	0
030322	Alumina production	0	0	0	0	0	0	0	0

Key: 0 = non-existing activity or no emission expected,
NEG = neglected
IE = included elsewhere)
(1) Processes where flames and/or combustion gases are not in contact with other products
(2) Processes where flames and/or combustion gases are in contact with other products

Note: CO_2 estimated as '"at source"

3.1 Achievements of CORINAIR 90.

While this paper will discuss in detail the problems of CORINAIR 90 it is important to remember that the CORINAIR 90 project has had many significant successes.

CORINAIR 90 is a major step forward in the compilation of a European inventory system that has achieved the highest level of completeness, consistency, comparability and transparency reached to date in such a wide international collaboration. While there are many different ways in which the individual country's inventories differ the overall inventory is a major step forward in achieving its goals.

The collaboration, assisted by CITEPA, between EMEP and CORINAIR and other technical experts, has produced a system that covers 30 countries with a wide range of experience in the development of their national emission inventories. For some countries CORINAIR 90, was their first attempt at a national inventory while others already had a well developed national system.

CORINAIR 90 has resulted in a source classification, SNAP codes, that now has a wide acceptance in Europe. This is forming the basis of the joint EMEP/CORINAIR guidebook on emission inventories. Several countries wish to use CORINAIR 90 type inventories for data submission to UNECE (and EMEP) and IPCC (with the data conversion routines produced by CITEPA).

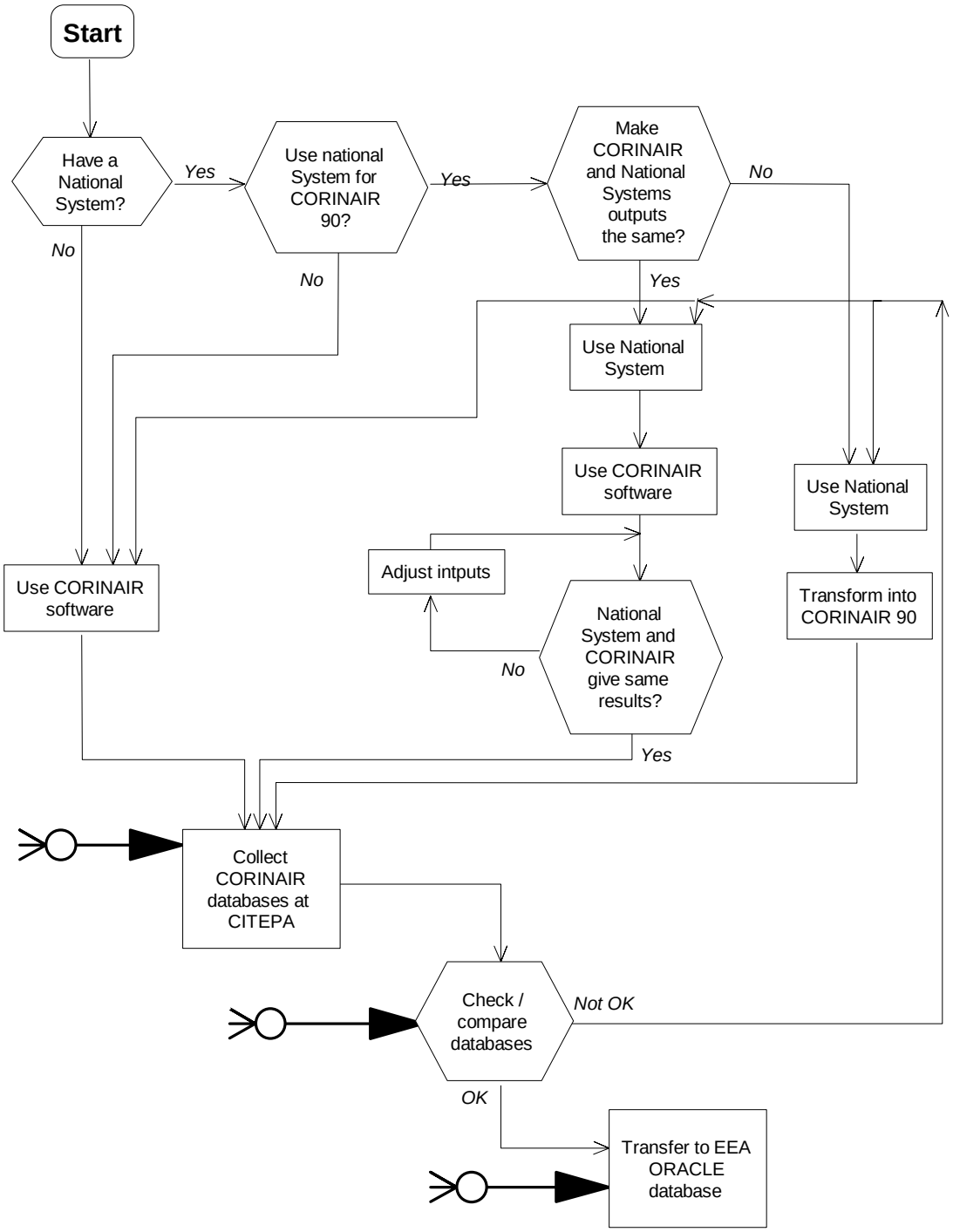
Unfortunately, the time-scale for completion of the CORINAIR 90 was not explicitly specified and adhered to as an important objective at the beginning of the project.

3.2 National Approaches to CORINAIR 90

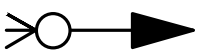
An overview of possible national approaches to producing CORINAIR 90 is shown in Figure 1. Countries have taken different approaches to CORINAIR 90. The questionnaires (with 17 replies out of 31 participants) show that 4 countries used CORINAIR 90 to produce their national estimates, while 7 have ensured that their national estimates are consistent with CORINAIR 90. (Annex A describes the results of the questionnaires. Box 1 gives examples of the approaches taken in particular countries, and Annex B summarises the characteristics of each country's CORINAIR 90 database).

Each country has reasons for adopting their individual approach and in the medium term the Emissions Inventory Topic Centre must either answer their concerns and needs or include them in any future methodology. A long term aim for the Topic Centre should be the adoption of a single methodology across Europe.

Figure 1 - Overview of Approaches to CORINAIR 90



In practice each country used the system in a different way and so the diagram only shows the major differences in approaches adopted.



Arrow indicates tasks for, or direct input from, the Technical unit. This is in addition to the continuing assistance with the software throughout the process

Box 1 Examples of National Approaches to CORINAIR 90

In **France**, CORINAIR is used for the national estimates. All SNAP codes are treated, but sometimes there was considerable difficulty in doing this. The rubrics have been used either to describe technical differences (e.g. different cement processes) or to distinguish different economic sectors (e.g. industrial combustion is divided according to economic sector). Sometimes the software's top-down approach has been used to spatially allocate data but at other times procedures outside the system have adopted a bottom-up approach. Some territorial unit specific emission factors have been used. Emissions measurements and other data (e.g. from mass balances) are included whenever they are available. A specific biogenic model is used for French biogenic emissions. In order to ensure that the transparency of CORINAIR is maintained, all activity rates and other data are provided in the inventory. This allows the recalculation of emissions factors and comparisons with other countries. Compiling CORINAIR is thus a mixture of a top-down and bottom-up approaches.

The **Netherlands** has a different system which measures or estimates emissions from many sources. The aim is to achieve a consensus system where the emissions are agreed by the individual companies and the contractors compiling the inventories (TNO). There is a specific problem in that the individual companies are allocated to economic categories according to their main income, which can be quite different from their emission activity. (For example, a manufacturing plant may be allocated to the trade sector.) They have entered the measured emissions into the CORINAIR 90 software with emission factors set to 1. Thus their contribution is not open and transparent as there is no way that their numbers can be compared with other countries' contributions. As this combines lots of individual data about individual sources this is a 'bottom-up' approach. The lack of transparency is also due to the CORINAIR 90 system expecting similar datasets to be collected for each country. As the original data collection and assumptions are open to limited inspection transparency could be achieved by looking at the original data.

Germany has two separate systems. Firstly the Lander estimated emission inventories for their areas. This is not done annually. However, due to legal restrictions separating the federal government and the regional Lander, these datasets are available to the federal authorities for specified uses only. The UBA (Berlin) has constructed an inventory for the whole of Germany and transferred this gridded dataset into the CORINAIR 90 system.

The **UK** has taken its existing methodology and entered the results into the CORINAIR 90 system. Thus the emission factors are taken from the national methodology. This has caused a few problems in areas where the sectoral splits do not exactly match. It does mean that the results are comparable and transparent as all the data used is entered into the system. As this works from national data this could be described as a 'top-down' approach. It was important for the UK that there was only one estimate for the emissions rather than a set of estimates for different purposes (i.e. a national estimate, a CORINAIR 90 estimate, an EMEP estimate and a IPCC estimate). However this estimate could be revised in the future. In other words improvements in technical knowledge and the methodology are applied retrospectively. The UK believes the speedy production of time series and trend data is important.

There are a number of countries with developed, computerised systems where effort was expended transferring data into the CORINAIR 90 system. These include **Norway, The Netherlands, UK and Sweden**. As the CORINAIR 90 software is not the final product, that is the EEA ORACLE database in Copenhagen, these countries thought that transferring data was into CORINAIR 90 first was an extra, unnecessary effort. If countries were to transfer data directly to the Oracle database then it would be important that the quality of the data is still checked and that validation and verification procedures are carried out.

The **Baltic states** did not have experience in compiling emission inventories. They received considerable support from RISØ on behalf of CORINAIR 90 and were able to complete their initial datasets within six months. They found the provision of a complete system and guidance very useful.

In some other countries, no single organisation may be responsible for producing the national emissions inventory; experts may each contribute to a particular aspect, and may not use the same base data or the same assumptions.

3.3 Time Taken to Complete the Project.

CORINAIR 90 is only now starting to produce its results. A complete inventory will only be available five years after the end of 1990. CORINAIR 85 has only been completely reported in 1995. These long delays have obscured the many successes of the projects and have severely compromised the usefulness of the whole exercise. It is possible that when the data is finally published it is of limited use to policy makers. It is far too late to supply the data requirements listed in Section 5.3.

There are a number of reasons for this. They include:-

- ***Time required.*** The effort needed ranged from 0.5 man-years to 5 man-years for different countries. This needs to be addressed. The Baltic States compiled provisional inventories within six months elapsed time. They had direct assistance and produced inventories with relatively few area activity rates.
- ***Time waiting for other statistics.*** Many countries reported that waiting for data from others, either for the publication of official statistics or statistics from source sectors, caused delay to CORINAIR 90. This problem must be addressed, but this is best done on a country by country basis. In the case of official statistics, it may be possible to use pre-publication copies of the data, rather than waiting for them to be officially published. This is possible in the UK. In other countries where this is not possible estimates based on provisional international statistics are possible.
- ***The effort required to learn to use the system***. Two approaches to this problem can be considered. The software could be made simpler, or more direct assistance could be made available.
- ***The low priority given to CORINAIR 90***. This is a matter of policy in individual countries. Greater timeliness of the data would raise the profile of the work, and thus the pressure to meet the deadlines. Pressure from the EEA to collaborate would also help.
- ***Shortage of funding and delayed contracts***. In some countries a shortage of national or CEC funding (e.g. under PHARE), or a delay in receiving a contract from the national customer or the CEC, delayed completion of CORINAIR 90. As above a higher profile for CORINAIR work, and pressure from the EEA to collaborate might help. The switch to a rolling programme of work may also help.
- ***The need to get internal agreement in an individual country*** to the data supplied. Again this is an policy consideration. In Belgium two inventories were compiled, one for each part, and this regional approach may help in other cases.
- ***The amount and variety of the data requested***. A lot of data was requested both sectoral and spatial. Despite requests from the EEA-TF little or no attempt was made to prioritise this and thus focus on the important parts. Similarly little attempt was made to collect fundamental data first (e.g. national totals) and the remaining data later.
- ***Reluctance of experts to submit data that is not final or subject to revision***. This is a particular problem with emission inventories as they are, by their nature, **estimates**. Thus many years can pass with experts 'perfecting' the estimates while users have to wait. Even then, these 'perfected' numbers are still estimates with, in some cases, large uncertainties. Another approach is to provide the best estimate that exists on a particular date. Provision can then be made for subsequent revision.

It is important to distinguish between technical problems that may delay the production of an inventory and structural or 'political' limitations. The former may include the late supply of data collected by others e.g. road transport statistics, while the latter may involve the need to get agreement from various official bodies about the data. Some of the 'institutional' problems which have occurred, e.g. delays in funding or contracts may be improved in Air Emissions 94 by the switch from a voluntary collaboration to a more structured framework of national focal points and national reference centres.

4. REVIEW OF CORINAIR 90

A number of problems with CORINAIR 90 have been reported either by the EEA, data suppliers or users. These are described below. In some cases they have occurred because users' needs have become more sophisticated since the original specifications for CORINAIR 90 were drawn up. Others draw attention to areas where the CORINAIR methodology and software need to be improved. In both cases, the Topic Centre must address these problems in AE 94 and subsequent inventories. Possible solutions to these problems are outlined here and discussed in more detail in Sections 7 and 8.

4.1 Software Usability

Several countries reported problems with the usability of the software - partly due to problems with the software itself, and partly due to inadequate descriptions of the software. Windows programs were requested by some users. The difficulties of transferring data files already on computers into a system requiring keyboard entry were discussed. While some countries had managed to transfer data files between their national systems and the CORINAIR system fairly easily, others had experienced considerable difficulties.

The software was designed to meet the needs of inventory 'producers'; it is self contained so that a national expert can produce a national inventory on a PC, without any additional commercial software and without needing any specific knowledge about databases. The software collects base data, calculates emissions from that data, collects surrogate statistics for spatial disaggregation and then performs the disaggregation. However, before the EEA can exploit the data, it must be transferred to a more powerful computer and transformed into a relational ORACLE based database.

Possible improvements to the software are discussed further in Sections 6.3 and 7.3.

4.2 Urban/Regional/National Data.

The spatial disaggregation used by the system is based on 'NUTS' level 3 regions. These have the advantage that they are defined across the EU. However they may not be ideal for air pollution assessment. Since CORINAIR 90 was developed, concern for urban air pollution has increased, and some users now want urban inventories. This need may not be well served by the 'NUTS' level 3 regions in CORINAIR 90 unless they are coincident with them.

For example, the NUTS level 3 region for London (UK) or Milan (Italy) is more or less coincident with the urban area. However, in Spain the area that includes Barcelona also includes a large rural area. Thus the CORINAIR 90 inventory cannot be used to give good information about urban areas throughout the EU. As urban air quality is an important issue this is a serious problem.

Local inventories are being compiled for specific cities for specific projects across Europe. As well as the spatial differences in areas covered identified above, these may differ from CORINAIR 90 inventories in several other ways. For example, local inventories may:

- Consider additional pollutants, e.g. heavy metals, POPs, and particulates. These are which are not included in CORINAIR 90, but are of interest at a local level. NMVOCs may be considered in a speciated way.
- Consider linear sources such as roads, rivers and railways, and 'localised' sources as well as area sources and large point sources.

- Consider more detailed source categories.

The EMEP/CORINAIR Emissions Inventory Guidebook indicates that inventory methodologies can be extended to urban areas. There may be a role for the Emissions Inventory Topic Centre in urban inventories. There are several possible options. For example, the Topic Centre could:

- collect local inventories which are being compiled and make them available to users across Europe;
- consider checking the consistency of local inventories;
- consider providing guidelines for the production of local inventories to help ensure their compatibility with each other and with national inventories. For example the Topic Centre could define smaller areas which are subsets of NUTS 3 regions for use in local inventories.

Further discussion and guidance from the EEA is needed to determine the exact role of the Air Emissions Topic Centre in this area.

4.3 Comparisons with Energy Balances

It is not possible to use the CORINAIR 90 software to summarise the fuel used to estimate emissions for comparison with energy balances. This comparison is an important step in ensuring the completeness of an inventory as many of the pollutants are predominantly energy related. (Comparison with other statistics is needed for some pollutants e.g. agricultural data for NH_3.) It is a concern that this simple validation procedure was not possible within the software. One reason is that this need was not foreseen in 1990. It is essential that this comparison against international energy balances should be part of the verification process in any future system.

4.4 Prioritisation of Information.

There has been little attempt to prioritise the data requirements despite recommendations to do so. All the data has been input over three years (1992-1995) and the outputs are only available at the end of the entire process, while the data needs outlined in Section 5.3 are clearly staggered. One problem is that (as discussed in Section 3.3), experts may be reluctant to provide provisional figures which have not been officially agreed at a national level and so, even if provisional high priority data is available, it is not released until the end of the entire process. A method for prioritising data requirements is suggested in Section 6.

4.5 SNAP Codes

The SNAP codes were designed with atmospheric emissions in mind. They do not fit well with socio-economic statistics. This is a problem when the emissions data is combined with economic data to determine the feasibility of various strategies and policies. However, the standard socio-economic statistics cannot handle some emissions sectors in a practicable manner (e.g. road transport).

A further problem is that apart from large point sources the current system does not record abatement technologies very well. It is impossible to answer questions such as ‘If abatement technology x were imposed what effect would that have on emissions?’ or ‘What percentage of emissions are unabated?’ These are important questions if any assessment of possible control strategies is contemplated. CORINAIR 90 was not designed to be able to answer

such speculative questions, but it should be considered whether future inventories should be able to meet these new user requirements.

'Rubric' codes provide a way of sub-dividing an area activity code. It is thus possible to use the 'rubric' codes to record abatement technologies for area sources. Rubrics can also be used to split SNAP activities into economic sectors, and this has been done by some countries (e.g. France). As there is no consistency between countries in their use, the potential of the 'rubrics' to address the issue of either abatement or socio-economic sectors has not been realised. It is not possible to use rubrics to solve both problems as the CORINAIR 90 software has only one rubric code per area activity. These areas need further investigation in order to find solutions.

4.6 CORINAIR Inconsistencies

An obvious inconsistency is that some countries do not provide estimates for some activities because, for example, data is unavailable either within the country or to the national expert. Another area of inconsistency is the treatment of other mobile sources. Some countries include these emissions under other headings.

There also appears to be some inconsistencies in the way in which countries reported CO_2 emissions in CORINAIR 90:

- some countries submitted estimates of CO_2 emissions as the actual emissions from the exhaust while others as the 'ultimate' CO_2 which assumes all the carbon in the exhaust will eventually be converted to CO_2.
- CO_2 emissions from biomass burning is another area of variation. Some countries include this while others exclude it. Most, if not all, of this emission is simply recycled carbon that is absorbed from the atmosphere into plants and foods that are then consumed.

These inconsistencies may be due to some experts using IPCC reporting conventions rather than the CORINAIR specification e.g. IPCC specifies the reporting of ultimate CO_2 while CORINAIR 90 specified end of pipe. We must be clear in our definitions. IPCC are developing guidelines on the treatment of CO_2 emissions and CO_2 sinks and it is proposed that the Topic Centre methodology follows these as far as possible.

Compatibility with the IPCC methodology is important. If Air Emissions 94 is to differ from the IPCC reporting format so that it meets other users needs, then it may be important to improve the existing IPCC/CORINAIR interface, so that IPCC compatible data can be extracted from CORINAIR quickly and easily. This will require some extra information to be collected due to the different coverages of the two inventories.

The general differences between the source categories used in the IPCC reporting format and CORINAIR 90 are shown in Table 6. A specific comparison for the UK is shown in Table 7. Further details of some of the inconsistencies in the CORINAIR 90 treatment of CO_2 emissions and differences between IPCC and CORINAIR 90 are given in Box 2.

Table 6 Correspondence between IPCC and CORINAIR Main Source Categories

IPCC		CORINAIR 90	
1 A 1	Public power District heating	01	Public power District heating
	Auto producers Refineries Solid fuel transformation Oil and gas extraction	03	Auto producers Refineries Solid fuel transformation Oil and gas extraction
1 A 2	Industrial combustion		Industrial combustion
	Industrial off-road		
1 A 3	Road transport	07	Road transport
	Civil domestic aviation	08	LTO cycles
	Rail and sea transport		Rail and sea transport
			Industrial off-road
1 A 5	Military		Military
	Household off-road		Household off-road
1 A 4	Agricultural/forestry off-road		Agricultural/forestry off-road
	Fishing		Fishing
	Commercial/institutional	02	Commercial
	Residential		Residential/institutional
1 B	Fugitive emissions from fuels	05	Fugitive emissions from fuels
	Flaring		
2	Industrial processes	04	Industrial processes
3	Solvents	06	Solvents
4	Enteric fermentation	10	Enteric fermentation
	Animal waste		Animal waste
	Rice		Rice
	Fertilisers		Fertilisers
	Agricultural waste		Stubble burning
	Savannah burning		
5	Land use change and forestry		- not included in 1990 inventory
6	Solid waste	09	Solid waste
	Wastewater		Wastewater
	Incineration		Incineration
			Agricultural waste
			Flaring
	International air bunkers		Cruising emissions
	International marine bunkers		- not included in 1990 inventory

Table 7 Comparison of IPCC and CORINAIR Data for UK 1990 CO2 Emissions (kTonnes as CO2).

IPCC source sectors	IPCC Data	CORINAIR 90	CORINAIR 11 Source sectors
Total National Emissions	580268	580400	
1 All Energy (fuel use and fugitive)			
A Fuel Combustion			
		199000	1 Public Power, cogeneration and district heating
		126000	5 Extraction and distribution of Fossil Fuels
Energy Transformation	229748[a]	*325000*	*Sum of 1 and % energy transformation etc.*
Industry (ISIC)	94851	122000	3 Industrial Combustion
		110300	7 Road Transport
		11000	8 Other Mobile Sources and Machines
Transport	120681[b]	*121300*	*Sum of 7 and 8 All Transport*
Commercial/Institutional	30419		
Residential	79924		
Sum of residential and commercial etc.	*110343*	110300	2 Commercial Institutional and Residential
Agriculture/Forestry	2688		
Other	[c]		
Biomass for energy	(809)[d]		
B Fugitive Emissions			
Oil and Natural Gas Systems	5665[e]		
Coal Mining			
2 Other Industrial Processes			
A Iron & Steel			
B Non-ferrous Metals			
C Inorganic Chemicals			
D Organic Chemicals			
E Non-Metallic Mineral Products	7421	7400	4 Production Processes
F Other	6085[f]		
3 Solvent Use			6 Solvent Use
A Paint Application			
B Degreasing and Dry Cleaning			
C Chemical Products Manufacture/Processing			
D Other			
4 Agriculture			10 Agriculture
A Enteric Fermentation			
B Animal Wastes			
C Rice Cultivation			
D Agricultural Soils			
E Agricultural Waste Burning			
F Savannah Burning	na		
5 Land Use Change and Forestry			11 Nature
A Forest Burning and On-Site Burning of Cleared Forests	na		
B Grassland Conversion	(0±1883)		
C Abandonment of Managed Lands			
D Managed Forest	(-9167)		
F Other	(1833)[g]		
6 Waste			
A Landfills	2750[h]	8800	9 Waste Treatment
B Wastewater			
C Other	[i]		

[a] Excludes emissions from fuel gas use on offshore platforms estimated at 8820 Gg CO_2.

[b] Includes aircraft ground movements and below 1km during landing and takeoff and shipping within coastal waters (<12 miles from the coast). These amount to 2613 and 2406 Gg CO_2 respectively.

[c] Included under Commercial/institutional.

[d] brackets indicate that figure is excluded from national total above.

[e] Includes emissions from gas flaring but excludes other emissions from offshore platforms estimated to be 10.3 Gg CO_2 in 1991.

[f] Incineration.

[g] Wetland drainage and peat extraction.

[h] Landfill gas flaring included in total although some may be of biogenic origin.

[i] Included elsewhere.

Box 2 Inconsistencies in the Treatment of Greenhouse gases

CO_2 emissions are not treated consistently within CORINAIR 90. It i**ncludes** emissions from:

- burning biomass fuels, solid wastes, black liquor and biogenic gas;
- fermentation;
- bacteria;
- breathing in some animals.

However it excludes:

- breathing in birds, insects, larvae, worms;
- the decay of organic material e.g. rotting grass, leaves wood and dead animals.

There are also a number of differences between CORINAIR 90 and IPCC reporting guidelines, and instances where CORINAIR cannot currently meet IPCC requirements. These include:-

- IPCC requires 'ultimate' CO_2 emissions and CORINAIR 90 required 'end-of-pipe' CO_2 emissions;
- IPCC includes only anthropogenic emissions and **changes** in biomass stocks; CO_2 emissions from burning biomass fuels, solid waste, biogenic gas and black liquor are recorded, but do not count towards the national total. In contrast, CORINAIR 90 does not record land use change; but does include emissions from the combustion of biomass.
- CORINAIR 90 does not include the new IPCC pollutants, HFCs, CF_4, C_2F_6 and SF_6
- Emissions from road vehicles are based on fuel **sales** in the country for IPCC and on fuels **used** in a country for CORINAIR 90.
- For civil aviation, IPCC requires emissions from all domestic air flights (at all heights) and emissions from international air bunker fuel use; CORINAIR 90 records emissions from the landing and take off of domestic and international flights (i.e. at heights less than 1000m).

In some cases e.g. for civil aviation, these differences can be resolved by increasing the coverage of future inventories. so that the data to supply both requirements is available within Air Emissions '94 . This would involve changes to the SNAP codes.

4.7 Confidentiality

Data may be confidential for a number of reasons, particularly legal requirements. However, confidentiality in emission inventories defeats some of the aims of the whole exercise. If the data that has been collected cannot be distributed to all users it is worthless. It had therefore been proposed that no confidential data should be collected. This was not accepted. There are a range of national approaches to confidentiality and some of these are discussed in Box 3.

A complex system of flags was incorporated into the CORINAIR 90 software which shows exactly which parts of the data are regarded as confidential. This enables each country to adopt a different approach. These flags are entered by each county at the same time as the data is collected. However some countries have flagged data differently to the general, written, descriptions of their confidentiality requirements. The EEA is taking the flags as the precise description of the confidential data.

4.8 COPERT

COPERT is a separate software tool that implements the recommendations of a CORINAIR working group on emission factors for calculating emissions from road transport. COPERT was used by some countries and not others; some used it as a check on their national methodology. (Box 4 gives examples of national approaches). COPERT is also used in other European activities (e.g. FORMOVE and CASPER)

It is important that variations in emission estimates reflect real differences between countries and not differences between methodologies. Road traffic emissions are an important source of several pollutants, and estimating traffic emissions is complex. It thus seems logical to retain COPERT as a default tool for countries to use if they wish to. It is not intended that it should replace more sophisticated national approaches.

Box 3 Examples of National Approaches to Confidentiality

France pointed out that many countries collect confidential data (Annex C), and in some countries there may be a legal requirement to keep this data confidential. This normally occurs where a limited number of firms are involved in an activity e.g. in France if there are less than three firms involved in an activity or, where one firm is responsible for more than 80% of the output. They believed that it was possible to satisfy most users' requests for data, without having to include confidential data. It thus proposed that countries should agree to provide a minimum data set which may be circulated freely to users, and a supplementary data set which may include confidential data to be used only by the EEA and the Topic Centre e.g. for validation purposes.

The ***Netherlands*** has collected a lot of plant specific information and has given assurances of confidentiality. As they do not use global statistics for many industrial and commercial sources the confidentiality needs to be maintained by not revealing plant data.

The ***United Kingdom*** felt that all emission data should be freely available and that CORINAIR 90 should not collect confidential data.

Spain wished to keep emissions from combustion plant defined under the EU's Large Combustion Plant Directive confidential. This is a different interpretation of that legislation to other countries who have regarded the emissions data as open to all users.

Box 4 Examples of National Approaches to COPERT

The **UK** did not use COPERT as it has its own methodology. In particular there were doubts about the cold start and evaporative methodologies. These were not based on measurements under UK conditions — where temperatures of 25°C are exceptional and fuel volatility is higher than is usual in Europe.

Germany uses its own model and is developing a more sophisticated system based on more recent measurement data and analysis. It would not want to replace this with a less sophisticated system such as COPERT.

France used COPERT to calculate its vehicle emissions. It has created some supplementary tools to create a link between national statistics and the information required for COPERT, and has also completed studies to estimate the sensitivity of the model. France uses the default COPERT emission factors.

Denmark used COPERT as its national estimate for road transport.

The COPERT methodology is in need of updating for two main reasons. Firstly, the European vehicle fleets have changed since 1989 when it was compiled and the methodology should change in line with this. Secondly, there have been a range of measurement programmes across Europe that have examined particular features of vehicle emissions such as cold starts, evaporative emissions, low speeds and temperature effects. These should also be included.

The COPERT software was a different style to CORINAIR 90. It was based around a spreadsheet and thus enabled entry directly into tables. Some preferred it and others did not. The software itself is in need of updating to become a more modern easy to use tool.

5. OTHER CONSIDERATIONS FOR FUTURE EUROPEAN EMISSION INVENTORIES

5.1 Pollution Emission Registers

Some states are setting up pollution registers. These contain information on many individual emission sources. These would appear to be a valuable source of data, particularly for some sectors e.g. industry and power generation, and for some pollutants, e.g. SO_2, NMVOC and N_2O . Unfortunately they are unlikely to be able to deliver much assistance before the first deadlines imposed on this process by the international reporting requirements. However they may be able to do this in time for the data to be included within two years.

5.2 New Pollutants

There are already requirements laid down by UNECE to extend the pollutants to be considered to include heavy metals, and persistent organic pollutants (POPs) in 1996. This will have to be included in any inventory system now as they will require a number of alterations to the source sectors. Most of the emissions of pollutants already included are emitted by fuel combustion or agriculture. These additional pollutants also come from sources such as metal processing, waste disposal and pest control. It will also be necessary to consider the implications of including the new pollutants required by the IPCC (HFCs, PFCs and SF_6).

5.3 National and International Obligations

Any European inventory system needs to comply with both the international reporting requirements and to national requirements. Clearly it will be easier if they coincide but this may not be the case. Box 5 gives examples of national and international obligations in some European countries.

Box 5 National and International Obligations in European Countries

The ***UK*** has no formal national legislation that enforces the production of emission estimates. However, it is a policy that national emission estimates should be produced and published within one year. The UK will produce emission inventories to meet the requirements of any international agreements to which it is a party. The production of spatially disaggregated inventories has a lower priority.

A broadly similar situation exists in ***France***, where national emissions estimates are produced every year, and emissions inventories are provided for international agreements. Few resources are available for the production of regional inventories.

The situation in ***Denmark*** is similar to that in the UK.

Netherlands has a system which involves visiting each plant in the country and agreeing emission estimates with the plant. The approach is based on consensus and so each plant must agree with its emission estimate. This is performed every four years but there are plans to increase this frequency.

Countries in Europe have committed themselves to supplying data under various international agreements. These agreements define a minimum availability of emissions data. The timing of these arrangements is shown below in Table 8.

Table 8 - International Reporting Deadlines

	1st Year			2nd Year		
	31th July	30th September	31th December	31th July	30th September	31th December
Greenhouse Gas data to IPCC					D	
Data to EMEP			D			
EU CO2 Reporting	I			R		
EU Large Combustion Plant Directive		D				
VOC Protocol *						
PARCOM & HELCOM *						

I - Initial data

R - Revised data and revisions to earlier years

D - Data and revisions to earlier years

* - Reporting deadlines not yet specified

In addition to the EMEP request for data by 31st December, the UNECE Strategies and Policies Working Group are requesting provisional data by 1st June. All of these deadlines are for national total data split by source sector. They do not require spatial disaggregation. The source sectors required are laid down in the reporting requirements. In addition, EMEP requires a spatial disaggregation every four years. This would coincide with CORINAIR 90 and AE 94.

Table 8, together with table 3, result in a priority list of data outputs that are required. These would, in time order, be:-

National Total CO_2 data within the first six months after the end on the year. This would fulfill the EU CO_2 reporting requirement. This data could be in any format.

National Total emissions for SO_2 , NOx, CO, NMVOC, NH_3 and CH_4 within one year. These are needed by the 11 UNECE/CORINAIR source sector groups. In practice CO_2 and N_2O could be added to this list as they will require little extra effort. Most of the relevant activity statistics will be collected to estimate the other pollutants.

Remaining data. This includes other pollutants and the more detailed spatial data. As the detailed spatial data is not required every year this could be only done when required, or, as suggested below, only done in a detailed way every few years and estimated from the national total data to fill in the gaps.

The LCP data are already being reported to the EU from member states. There would be no need to be involved in that process or alter it in any way. However that information would be very important in compiling the national totals and so would be an important input into the national totals and spatial disaggregations being produced after they become available.

Table 7 (in Section 4) summarised the IPCC and CORINAIR sectors for the UK. A software tool has been developed to transfer data from the CORINAIR 90 system to the IPCC reporting format. The EU reporting requires this detail for CO_2 only. This data should be collected and distributed within seven months. Countries that are not in the EU do not have to supply data under the EU greenhouse gas reporting requirements and therefore do not have to meet the 7 month deadline.

Data supplied to UNECE by 21 September 1994 is shown below in Table 9. This shows there is a wide variation in the ways countries report their data to UNECE. However it does show that a number of countries can report both CO_2 and SO_2 within nine months (many of these will be provisional data). It is interesting to note that of the four EEA countries that have produced 1993 estimates in 1994 three of them, Norway, Sweden and the United Kingdom use their own database systems. France uses a system based on CORINAIR 90. The Netherlands (which has reported 1993 SO_2) also has its own database system. The Topic Centre should not interfere with countries which have systems that are meeting reporting deadlines.

Table 9 also clearly shows which countries may have problems in submitting data on a tight timetable. It is not clear why countries that have SO_2 estimates have not produced CO_2 estimates. The majority of the emissions are likely to be from fuel use and that data is required for the SO_2 estimates.

Table 9 Emission Estimates Supplied to UNECE for 1993
Received by 21 September 1994 (data sorted by year of latest CO_2 data)

	Sulphur Dioxide			Carbon Dioxide		
	Latest Ye of data	Emission (kTonnes as SO_2)	Number of UNECE sour categories reported	Latest Ye of data	Emission (MTonnes as	
Bulgaria	1993	1100	7	1993	72	**CO_2 data**
France	**1993**	**1136**	**9**[a]	**1993**	**377**	**within 12**
Norway	**1993**	**37**	**7**	**1993**	**36**	**months**
Slovenia	1993	182	4	1993	13	
Sweden	**1993**	**103**	**7**	**1993**	**62**	
United Kingdom	**1993**	**3069**	**8**	**1993**	**545**	
Canada	1993	3042	n	1992	468	**CO_2 data**
Netherlands	**1993**	**168**	**7**	**1992**	**172**	**within 24**
Austria	**1992**	**76**	**5**	**1992**	**57**	**months**
Czech Republic	1992	1538	6	1992	148	
Denmark	**1992**	**189**	**6**	**1992**	**57**	
Hungary	1992	827	6[b]	1992	66	
Romania	1992	559	6	1992	198	
Russian Federation[c]	1992	3839	2	1992	1630	
Slovakia	1992	378	6[d]	1992	50	
Ireland	**1992**	**160**	**6**	**1991**	**32**	**CO_2 data**
Germany	**1991**	**4441**	**6**[e]	**1991**	**975**	**within 36 months**
Finland	**1992**	**139**	**6**	**1990**	**55**	**CO_2 data**
United States	1992	20621	7	1990	4400	**within 48**
Italy	**1990**	**2251**	**7**	**1990**	**520**	**months**
Portugal	**1990**	**284**	**n**	**1990**	**38**	
Spain	**1990**	**2316**	**7**	**1990**	**218**	
Ukraine	1993	2194	n			**No CO_2 data**
Switzerland	1993	58	8			
Cyprus	1993	43	5			
Poland	1992	2820	n			
Belgium	**1992**	**311**	**n**			
Liechtenstein	1990	0.1	n			
Greece	**1990**	**510**	**(4 in 1985)**	**1989**	**72**	
Croatia	1990	160	n			
Belarus	1989	596	n			
Turkey	1985	354	n			
Luxembourg	**1985**	**16**	**n**			
Iceland	**1985**	**6**	**n**			

Note: Highlighted countries are members of the EEA. Several countries have specified their 1993 estimates as preliminary or provisional. These are Germany, Netherlands, Sweden and the United Kingdom.

n indicates that the data was not in the requested UNECE source sectors.

Source: '1994 Major Review on Strategies and Policies for Air Pollution Abatement Tables and Figures', UNECE Document EB.AIR/R.87/Add.1, 21/9/94.

[a] Includes emissions from nature.
[b] Includes non-fuel agricultural emissions
[c] The European part that lies within EMEP only.
[d] No data in industrial combustion category. (Included elsewhere?)
[e] No data given for non-combustion processes. Extraction and distribution of fossil fuels is given as 0.

6. PRIORITIES

The approach should be to prioritise data requirements and to meet different needs on different time-scales. The following sections show the areas in which prioritisation can help meet the targets. These priorities can be described as follows:

1. ***Essential***. This is the most important information that must be included in any inventory produced by the EEA.
2. ***Desirable***. These data items should be included but their priority is lower. These are items that will become available on a longer time frame. For example, the full documentation of an inventory is required but can be published after the results become available.
3. ***Useful***. Some items of data would be useful to have but are not necessary to the overall project. For example, all the details of a power plants boilers are not needed at the European level and so this data would be useful but not essential or desirable.

6.1 Inventory Aims

The aim for Inventories in the past has been to be complete, consistent and transparent. These are defined as:-

"Complete." This means that the inventory should include all sources of each pollutant. In an absolute sense we can never be certain that all sources are included, but we must aim to be as complete as possible. Any source we can find must be included. However it is clearly most important to expend most effort on significant sources and not to spend a lot of time on sources that will not affect the result significantly.

"Consistent." Each contribution to the final inventory should be comparable between countries. It is important that differences between countries reflect reality. Thus differences between countries in emission factors or methodologies should reflect actual differences, for example in the emission rates, technology, control or operation. This does not mean that identical methodologies need to be used by all countries.

"Transparent." In order to demonstrate that a inventory is complete and comparable it must be transparent. The IPCC states that *"enough data should be provided to allow a third party to reconstruct the inventory from national activity data and assumptions"* (this is their working definition of transparency). They go on to state that, to limit the volume of data, any documentation should focus on describing fully any differences on method and assumptions from the default method. We propose to follow this. The default method is laid down in the EMEP/CORINAIR Guidebook on Emission Inventories whose first edition will be published in June. This guidebook has already been compiled along SNAP codes. This does not imply that the emission factors should be identical in each country, nor that the same methodologies should be used. Transparency can exist even if each country used completely different database systems.

It is clear that there is a fourth requirement, they must be ***timely***. This is perhaps the most important requirement of all, as inventory data must be produced in time to be useful to policy makers. This requirement may conflict with some of the above. Air Emissions '94 should have as its ***essential*** requirements:-

Timeliness
Consistency
Completeness

A ***desirable*** requirement is to be ***transparent***.

Completeness and consistency are needed in any inventory for it to be of use. It needs to arrive on time. The transparency can come later. For example, transparency may be desirable in the first year and essential after two years. The involvement of the topic centre in the inventory gathering process should assure users of the validity of the data.

6.2 Emissions Data

Many of the needs are for national total data not spatially disaggregated information. Data should be prioritised to ensure that the most urgent demands are met first.

The types of information can be classed, in order of importance, as follows:-

- ***National totals.*** These are the most important pieces of information for policy purposes. They are ***essential***. Preliminary provisional estimates should be provided within six months, at least for CO_2.
- ***Sectoral breakdown.*** This is needed to understand the sources of emissions. Some of this will need to be worked out to produce the national estimates and time series data. This is ***essential*** at the 11 sector "EMEP/CORINAIR" level. It is ***essential*** to have a more detailed sectoral split for other purposes. However this should not be an unlimited request for data.
- ***Time series.*** These are needed to indicate the ways in which emissions are changing. They indicate how a country is moving to meet its emission and environmental targets. These are ***essential***. They will be built up year by year by the topic centre.
- ***Spatial distribution.*** Here the spatial location of the emissions is determined. This is required to provide input into modelling exercises so that the transport and deposition of pollution can be studied and understood. Major source areas will be identified and the potential of targeted control measures can be assessed. Judged against the other needs from an inventory this requirement can be regarded as ***desirable,*** i.e. it can be met on a longer time-scale.

To meet user requirements, the data to be collected should be grouped as follows. (Over time the classification may change as user needs alter.)

- **Group 1**. Provisional data for main pollutants within six months. This should include CO_2. Although only CO_2 is required by the EU greenhouse gas reporting requirements within seven months, the energy data that has to be collected to do this will enable SO_2 and NO_x to be done at the same time with very little effort. The data required is given by the IPCC minimum tables. Although countries outside the EU are not obliged to meet this deadline it should be possible for them to provide data on this time-scale. Both Bulgaria and Slovenia were able to meet this deadline in 1994. Details on how this may be achieved are given in chapter 7.
- **Group 2**. National level emissions by eleven source sectors within 12 months. All the eight pollutants covered by CORINAIR 90 should be included here even if only provisional results can be given for some of them. Table 10 shows an example of this type of data.

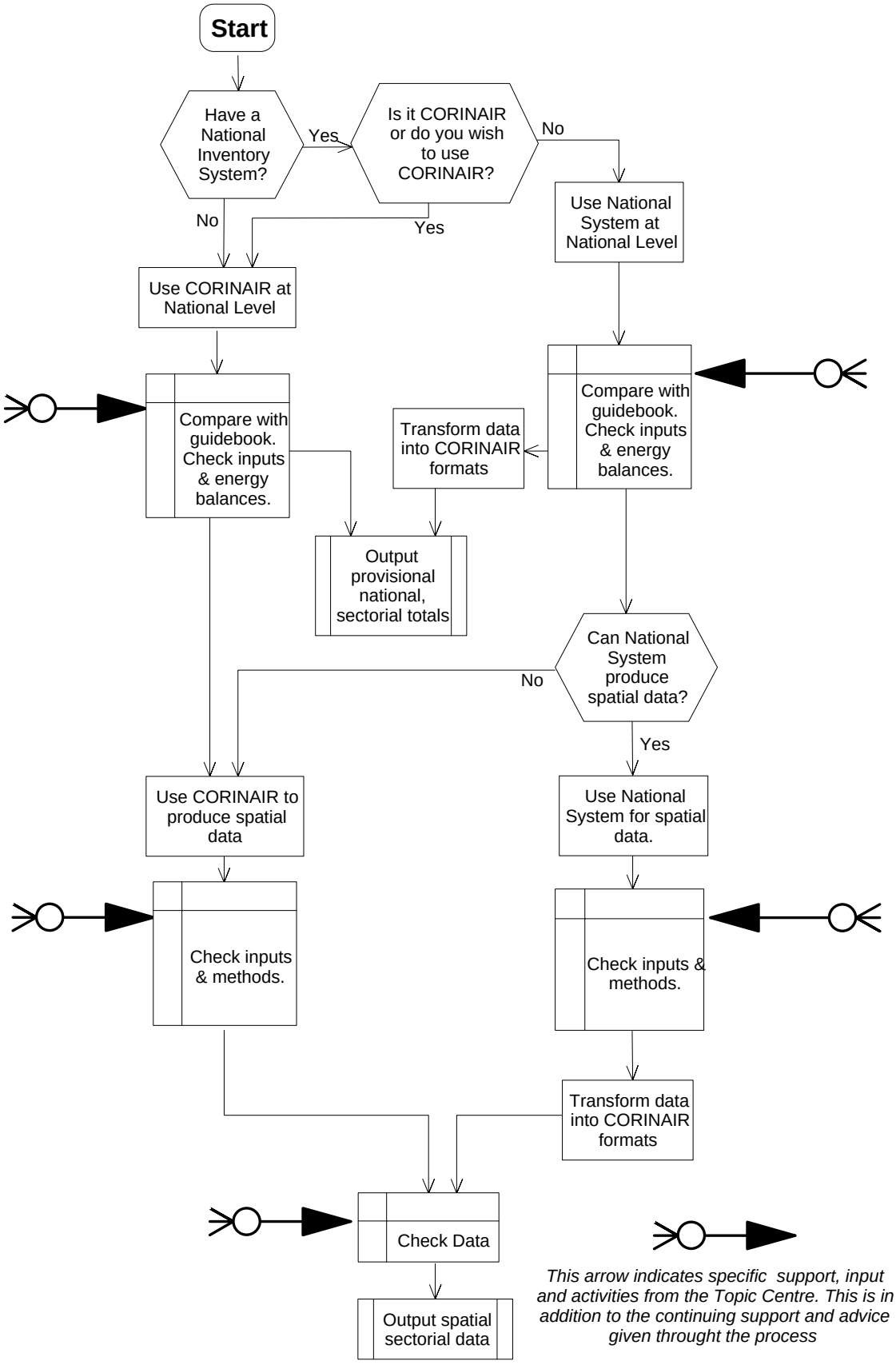
Table 10 Czech Republic CORINAIR 90 emissions by 11 source sectors (tonnes).

Sector	NM'							
1 Public Power, cogeneration and district heating	1162943	321247	4327	4326	27639	64963000	8550	0
2 Commercial, institutional and residential	458378	103248	58164	58094	500655	51085000	5562	0
3 Industrial Combustion	173266	144906	3487	829	275856	27127000	1865	0
4 Production Processes	61293	8039	28747	1420	82545	747000	2694	2400
5 Extraction and Distribution of fossil fuels	0	0	5585	844842	0	0	0	0
6 Solvent Use	0	0	93023	0	0	0	0	0
7 Road Transport	0	142675	52588	2605	143081	7667000	784	109
8 Other mobile sources and machinery	5862	51383	7247	341	9067	9121000	90	3
9 Waste treatment and disposal	888	1056	324	34258	5124	757000	101	0
10 Agriculture	0	1	6	507520	58	0	25898	88298
11 Nature	0	50	40180	94663	1	2060000	16350	0
Total	1862630	772605	293678	1548898	1044026	157527000	61894	90810

- **Group 3**. Updated data for all pollutants within 18-24 months at the latest. This should include all 8 pollutants described above together with any new pollutants e.g. heavy metals and POPs in Air Emissions '94. In the future it should be the aim to promote these extra pollutants to group 2.
- **Group 4.** Disaggregated emissions at least once every 5 years completed within 24 months. The first three groups provide data at national level only. This part is analogous to CORINAIR 90. The four year frequency comes from the EMEP requirements. The EEA may wish to reduce this interval. An alternative to reducing this interval would be to use interpolation and extrapolation techniques based on national totals to produce estimates for intermediate years. This should be possible as the large point sources have to have their emissions reported each year and the remaining emissions are unlikely to change too rapidly in four years.

Figure 2 shows the stages in the process and where the Emissions Inventory Topic Centre will provide specific input and support.

Figure 2 - Proposed process for Air Emissions 94



6.3 Principles

Inventory compilation should be tailored to meet the user's needs and to minimise the effort required by individual countries. The main points are outlined below:-

- ***Data should be collected in the individual countries by national experts in a similar manner to CORINAIR 90***. (The national expert is the person nominated by the National Focal Point to actually create the national inventory. They would have a similar role to the CORINAIR 90 national experts and may be the same people.) This has a number of advantages. Firstly it utilises the existing expertise and knowledge in a country and secondly it can ensure the acceptability of the estimates. National experts should know, or be able to find out, the technological and abatement changes that are occurring in their countries. This will not be apparent from international statistics. It will be important to ensure the necessary level of effort by the individual states. While the Emissions Inventory Topic Centre will give the support it can, the process will also need the commitment and support of the EEA and national governments.
- ***The Topic Centre should provide much more individual assistance than was available in CORINAIR 90***. This should be in the form of one-to-one meetings or very small groups of countries with similar situations. This help should cover not just the mechanics of using any software but also assist in producing data that are complete, transparent and consistent with the rest of Air Emissions '94. In the early stages assistance will need to focus on assisting in the production of provisional estimates to meet the tight deadlines.
- ***Emissions data should be provided in stages to the Emissions Inventory Topic Centre***. This would provide timely data to meet the needs outlined in Section 5.3. If the Emissions Inventory Topic Centre is in frequent contact with the individual countries' experts then there would be more confidence in the data because part of that contact would be devoted to a checking and validation role.
- ***The Emissions Inventory Topic Centre, together with each country, should estimate emissions based on international energy statistics***. As this will be separate (to some extent) from each countries' more detailed estimates this will provide a first stage check on the reasonableness of the data. While the two estimates should be consistent the one based on international energy statistics will not be able to capture all the detailed information that is available to the national experts. In the absence of data for a particular country this would also provide a 'default' emission estimate. Any emissions software used should be able to total fuels used to enable easy checking against national energy balances. Hence, in some cases it is an integral part of the process and in some it is separate.
- ***The CORINAIR 90 software is too complex for many of its users data needs***. As the first call is for provisional national level data, much simpler systems can be considered. To collect initial, provisional data, countries' existing systems should be considered in order to meet the tight deadlines for the provision of data. In addition, this will reduce the additional effort required by each national expert. Countries should be encouraged to make their internal systems compatible with Air Emissions '94. The Emissions Inventory Topic Centre should consider the provision of specific tools to assist this process. They are unlikely to be available immediately and so can be specified and developed in the light of experience and agreed priorities.
- ***Use as much of the EMEP/CORINAIR Task Force Guidebook as possible***. While time-scales may limit this, it should be possible to use much of the guidebook for Air Emissions '94. Not only should this provide the best default methodology it will also test the guidebook and any problems should be fed back to the Task Force so that the guidebook

can be refined. In the longer term the experience of Air Emissions '94 and other work of the Emissions Inventory Topic Centre will be used in improving the guidebook's methodology and emission factors. All the outputs should be in UNECE reporting formats.

- ***Make biomass and greenhouse gas sink definitions and methodologies compatible with the IPCC definitions***. As the UNECE Task Force on emission Inventories has agreed to use IPCC definitions and default methods for these sectors Air Emissions '94 should do the same. This is in fact an extension to the previous point. In areas where the IPCC and CORINAIR 90 source definitions conflict then extra data will be needed to enable both needs to be met.

- ***Complete energy use data should be collected***. This would enable the emissions database top be checked against energy balances. This would provide each user an initial check on the completeness of energy related emissions.

- ***It will be necessary to prioritise changes to the software so that the most important changes are made*** **quickly** because Air Emissions '94 needs to start collecting data as soon as possible for completion by the end of December 1996. The revised software needs to be developed, checked and distributed by the end of December 1995. The system will be made compatible with as much of the EMEP/CORINAIR Task Force guidebook as possible in the time-scale (the guidebook is based on SNAP90). Draft chapters are available so a start could be made now. (The first published version will be available before the end of the year.) Therefore it is proposed to base Air Emissions '94 on the existing software, modified where necessary. Annex D gives details of the proposed changes. The Emissions Inventory Topic Centre will not distribute empty files but attempt to complete the tables with existing data. For example, emission factors, 'rubrics', fuel definitions and surrogate data are unlikely to have altered much since CORINAIR 90. There is also the possibility that default emission factors from the EMEP/CORINAIR Guidebook could be entered into the database. Users would then only need to alter factors that are different in their country. This would leave 6 months (January to June 1996) for the data collection phase with the final data being collected within 2 years after the end of 1994. After June 1995 there will be work in parallel on development and on inventory collection to provide national level data for 1994 and 1995.

- ***Software documentation needs to be improved***. In particular it needs to be expanded to include a detailed explanation of each algorithm used. This would enable users to correctly assess any advantages to be gained by using the software.

- ***National emission estimates and trends are important***. These are important information and should be provided on a faster time-scale than the spatial distribution. Ideally this information should be provided as the first step in producing the full spatial map of emissions. Initially it may be necessary to do this as a separate exercise based on national systems and work to a closer integration in the future.

- ***It is vital that all parties recognise that these data will all be estimates***. They will be the best estimate of emissions that can be made in the time available. There is no point in wonderfully precise data that is ten years old when it is disseminated. At any time in the future the Emissions Inventory Topic Centre will accept revisions to earlier data where these can be justified. The important task is to arrive at consistent time series data. There will need to be a clear procedure to manage updates and revisions. This will be developed by December 1995.

- ***Separate tools similar to COPERT should be developed for specific tasks***. Such tools could include:-

  Power Plant
  Paper Pulp
  Agriculture
  Solvents

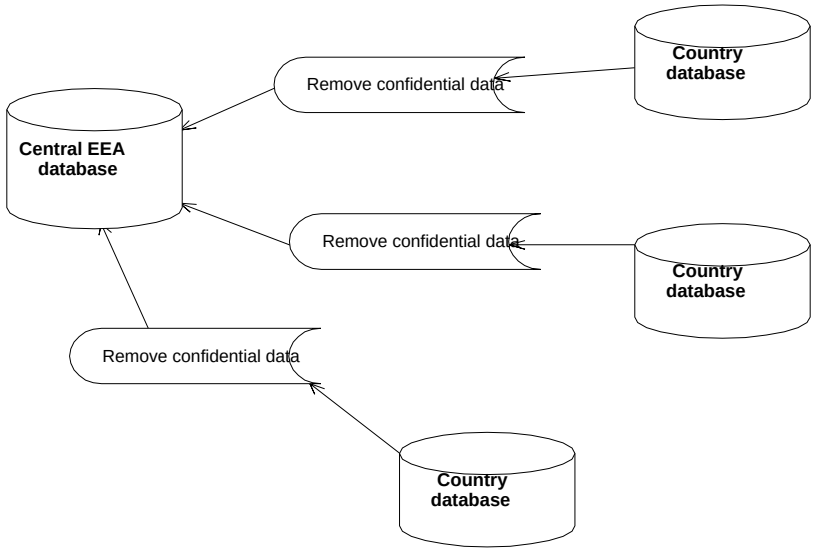
  Several of these tools are under development by Expert Panels of the UNECE Task Force on Emission Inventories and they will be available as part of a default methodology but are not intended to replace more sophisticated national approaches.

- ***Efforts should be made to develop SNAP90's compatibility with socio-economic statistics and abatement technologies***. The Topic Centre will conduct a review of this problem. It will aim to produce interim proposals by June 1995. This would allow its results to feed into the software development. In the longer term there may need to be more far-reaching changes to the database systems to include this information. Alternative source sector classifications to explicitly describe technologies and controls used in each source sector will be investigated in association with Eurostat. This review will also need to take into account the needs of integrated inventories. It could look at, for example, the ACCOR nomenclature which is being developed with integrated inventories in mind.

- ***There should be some form of 'user forum'*** where representatives of the different user groups can discuss the progress of European inventory work and provide input into its development.

- ***The central EEA Emissions Inventory Database should not hold confidential data***. As this data cannot be distributed to other users, its usefulness is very limited at that level. One possible solution to the problem is that each countries database should hold all the data including confidential data. Countries would then transfer to the central database only the data that is not confidential. This would be done in co-operation with the Air Emissions Topic Centre. This is outlined in Figure 3.

Figure 3 - Distributed databases for confidential data



This is similar to the CORINAIR 90 system except that all the data was transferred to the central database. The country databases could potentially be held in each country and accessed electronically at an appropriate time by the Emissions Inventory Topic Centre for validation and verification. Alternatively they could be held centrally with the need for the EEA to provide extra security to ensure confidentiality.

The Emissions Inventory Topic Centre may not need access to all the data to validate the inventories. Paper records could be used. Data ranges and summaries could also be used for validation if the complete datasets were not open.

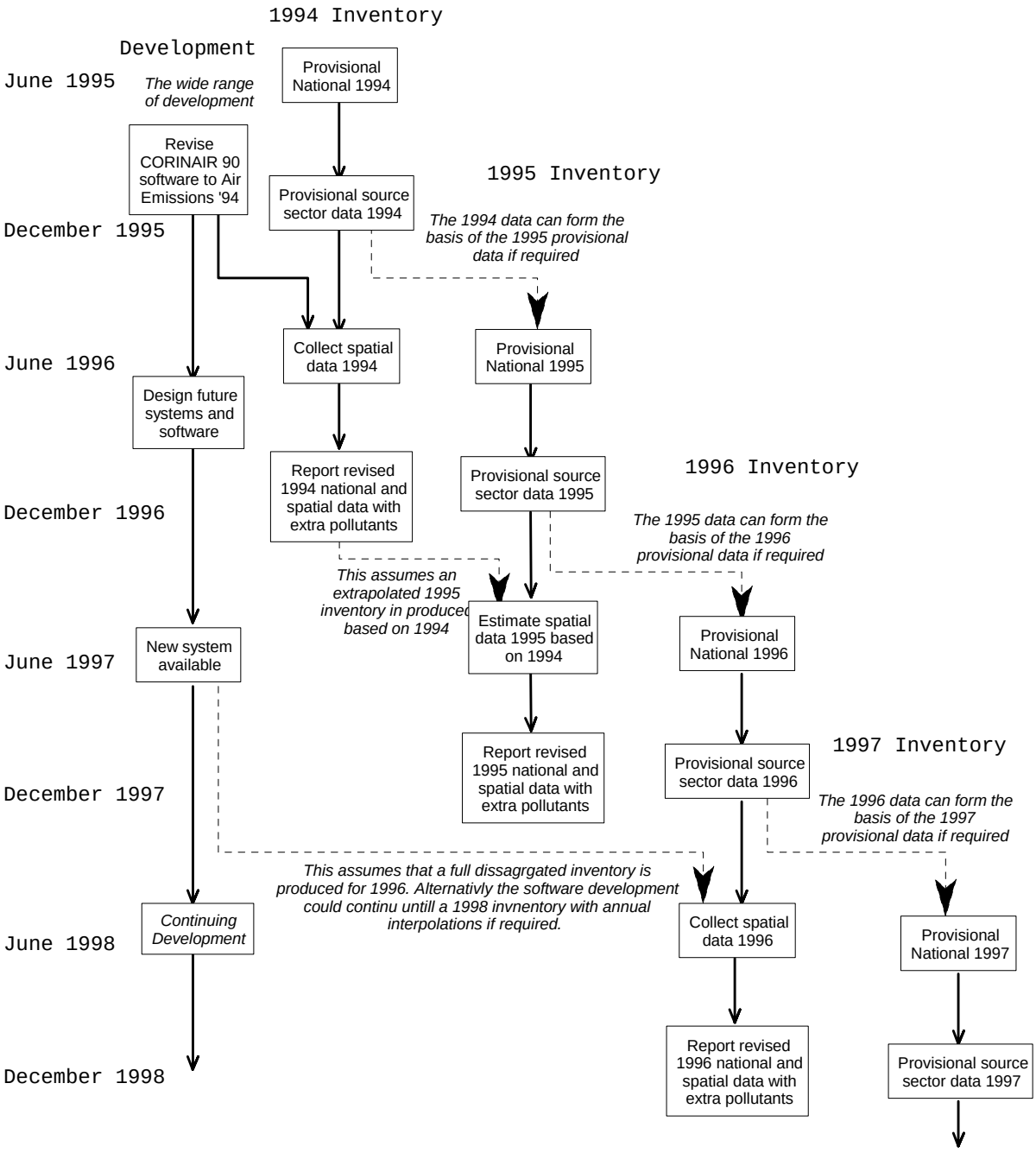
The master database could, in principle, be situated anywhere with networked links between the EEA, the Emissions Inventory Topic Centre partners, the NFPs and NRCs and any other users. However it would be appropriate that the database were located at the EEA. This would provide the EEA with the quickest access to the data especially as the form of the connection of the EEA to international networks has not been decided.

Confidentiality is a complex issue, with different requirements in each country . The Topic Centre will look at a range of possible solutions.

7. INVENTORY PROCESS TO MEET THESE REQUIREMENTS.

To meet the needs of users, the collection of emissions data should progress in parallel with the development of the European inventory systems. The data collection needs to proceed in overlapping stages which are described below.

Figure 4 - Schematic Showing how Inventory Stages Relate to Each Other (For clarity this is extended until the end of 1998).



7.1 Stage 1 - National Figures

This programme will have three steps:-

- Firstly some provisional data should be collected by six months after the end of the year.
- Then final data for the main sectors and pollutants should be collected over the next six months.
- The next year is then used to finalise all the results.

As the CORINAIR 90 software was designed for the compilation of a spatially disaggregated inventory it will **not** be immediately suitable for this task. Development work may enable this to be done but this will not be available before the end of 1995 at the earliest.

Initially this data collection should be based on existing national systems with the close support of the Emissions Inventory Topic Centre. There is no need to interfere with countries which have systems that already supply data on time. For them the Emissions Inventory Topic Centre's role is limited to assisting the transfer of data to the Emissions Inventory Topic Centre and to ensuring consistency between countries. In the future consideration should be given to the provision of specific data collection or transfer tools for these countries. These would ensure the compatibility between countries in the data collected. Those countries that have used CORINAIR 90 to produce their national emissions may need a 'cut down' version to assist them in this programme.

The Emissions Inventory Topic Centre together with each member state will produce 'default' estimates in parallel to the one produced by the national experts. These will be based on international energy and industrial statistics. In the event that a national expert is unable to meet the deadlines in this programme this 'default' data will be used.

The data that countries have committed themselves to supplying was described in Section 5.3. This would be the minimum expected from countries.

7.1.1 Step 1 - the first six months

Countries prepare their provisional estimates of pollutant group 1 data (CO_2, SO_2 and NO_x). Where individual countries wish this could be based on their existing systems with the Emissions Inventory Topic Centre providing the help needed to make the results compatible with other countries. In the longer term data collection software could be considered. The Emissions Inventory Topic Centre will provide close support. This should speed up the process and will also ensure compatibility between each country's submission.

Given the short timetable some of the data will need to be estimated. Therefore it is anticipated that most, if not all, of these datasets will be provisional.

In addition the Emissions Inventory Topic Centre will assist each member state to make separate estimates based on international energy balances and other data where necessary together with each member country.

These will be used as a comparison and verification with the countries' own estimate as part of the validation process. In addition, in the event of a country not providing any data, these Emissions Inventory Topic Centre estimates could be used as default numbers.

This step will provide provisional emission estimates for each country within six months.

7.1.2 Step 2 - from July to December

The provisional inventories produced in step one will be refined and corrected to produce estimates of emissions at national level by the second level of the SNAP codes. This is the first subdivision of the eleven UNECE source sectors. IPCC reporting formats will also be needed. This will result in emissions of the main pollutants (pollutant groups 1 and 2) by the most important source sectors. Again this will need close support by the Emissions Inventory Topic Centre.

Again the Emissions Inventory Topic Centre will provide close support and help maintain the separate estimates based on international statistics produced with each country. These separate estimates could be used as a last resort.

7.1.3 Step 3 - the second year

Here the emphasis changes to refining the data already collected and to producing any greater detail that is required. Emission estimates of pollutant groups 1-3 will be provided.

The Emissions Inventory Topic Centre's support will still be needed as well as its separate emissions estimates.

7.2 Stage 2 - Geographic Data

The collection of spatially disaggregated data should proceed in parallel. This will be based on the modified CORINAIR 90 software for Air Emissions '94. The importance on incorporating as much of the EMEP/CORINAIR guidebook as possible has been discussed above. The frequency of subsequent spatially disaggregated inventories should be agreed with the interested parties. There are a number of alternatives including:-

- Only repeating the whole exercise every five years. This is an essential minimum.
- Repeating the whole exercise at shorter intervals may be desirable.
- Doing a complete inventory every fourth year and extrapolating the results, based on national estimates and point source emissions to fill in the gaps.

The third alternative would require the least effort from each member state, but may result in their being little continuity in the compilation of the complete spatial datasets. Only if this alternative was desired by enough countries would specific tools be developed to assist in this process.

Much point source data has to be made available within the year following the emissions so it will be possible to update the major point sources each year.

To ensure that Air Emissions '94 is completed before the end of 1996 the Emissions Inventory Topic Centre will take a number of measures.

- It must provide close, one-to-one, help and assistance, not just on the software, but also on any problems with the methodology.
- It will 'pre-fill' the software with data based on the CORINAIR 90 contributions.
- It will assist in the production of estimated default datasets for countries that are unable to meet the deadlines alone.

7.3 Stage 3 - Development

In the longer term there are a number of areas in which the system needs to be developed. In order to meet the user needs for quick results it is proposed that little development is done before the start of Air Emissions '94. However it is very important that development of the methodology, software, verification and validation procedures proceeds at the same time as the other programmes to enable the production of efficient, user orientated emission estimates beyond Air Emissions '94.

The areas which need developments are:-

- ***SNAP90 codes***. These need to be developed to include all the relevant sources. Additional pollutants will require that SNAP90 is extended. The nomenclature should be adjusted so that it is more in line with socio-economic statistics to aid in the analysis of the results. The identification of any abatement techniques used is also important. This needs to be developed in association with the work undertaken by EUROSTAT and the EEA both on the improvement of classifications and integrated inventories.

- ***Methodology***. The methodology will need to continue to be developed. This will need to be done in line with the EMEP Task Force on Emission Inventories. The methods proposed in this Task Force guidebook should be adopted and refined. The guidebook will continue to be developed. The experience of Air Emissions '94 and other users will feed into a process of continuous development.

- ***National Estimates***. The collection of national emission estimates described in Section 7.1 is initially based on existing national systems. It may be appropriate to construct tools to assist national experts in these activities. Any such tools will need to implement the recommendations of the EMEP/CORINAIR Emissions Inventories' Guidebook. These should aim to lead to a 'Emissions Inventory Topic Centre methodology' which should be followed throughout Europe. They would aim to relieve the experts of the more simple data collection work and enable them to concentrate on improving the estimation methods by contributing their special national knowledge and perspectives.

- ***Software***. The role of the software systems should be considered. How much should the distributed software do and how much should be performed centrally? If the scheme of the existing system is to be followed then there are a number of changes that should be made. These are changes that are beyond those that can be included in Air Emissions '94. These include, in addition to any changes to methodology, use of Windows, a wider range of data entry, more consistency checking and better compatibility with the EEA's own database system. The software should also sum all the energy consumption accounted for in the emissions and so produce data that can be compared with an energy balance for each country. The software needs to integrate with other software tools constructed for specific purposes. This will be an invaluable tool for checking the completeness of the data. Given the range of alterations this is the time to consider a completely new software tool that can be distributed in place of the revised CORINAIR 90 software for spatial inventories beyond Air Emissions '94.

- ***COPERT.*** The COPERT software is in need of updating if only to include advances in our knowledge of emission rates and the more detailed methodologies being proposed by Germany and others. It is proposed that a small group similar to the original CORINAIR working group on road transport emissions be established. This should aim to collect necessary data and propose changes within six months (by September 1995). The COPERT software should then be updated in line with this by the end of December. It may be necessary to fund some individuals outside the topic centre to participate in the group

and the alteration of the software should be the subject of a specific sub-contract from the Emissions Inventory Topic Centre.

- ***Other tools***. There may be a need for other tools to assist national experts. For example, assistance with producing national totals (see above), checking, comparison and documentation. The tools discussed above should be considered for development either by the Emissions Inventory Topic Centre itself or as part of specific subcontracts.
- ***Validation***. This is checking that the emissions data have been compiled in accordance with the agreed methodology. In other words "Has the methodology been followed?". This can be assisted with tools that check numbers are reasonable and compare them with default values.
- ***Verification***. Verification is a series of checks that show that the emissions data are good estimates of the true emissions. In other words "Does the agreed methodology actually give good estimates of the true emissions?". These will need to be developed. The UNECE Task Force on Emissions Inventories has an expert panel on Validation and Verification and their ideas and suggestions should provide the basis for this.

  All of the development work described above will need to take into account the requirements of integrated inventories.

7.4 Timetable

Table 11 indicates how the parallel processes of collecting national level and spatial data should proceed. At the same time the Emissions Inventory Topic Centre should be conducting a major review of the whole system including the software so that new software and updated methodologies will be ready for the next spatial inventory. Table 12 shows specific tasks which the Air Emissions Topic Centre will undertake and Table 13 the reports which the Topic Centre will produce on CORINAIR 90.

Table 11 - Timetable for the Emissions Inventory Topic Centre
(April 1995 to December 1996)

	National Emission Estimates	**Spatial Emission Estimates**	**Contacts with NFP/NRC**
APRIL 1995	Topic Centre to identify contacts in EEA Member States and appropriate experts in Eastern European countries	Define detail of revisions to software. Send out scoping study to National Focal Points.	Confirm contacts and, if possible, experts compiling inventories for direct assistance. Receive Topic Centre scoping study
MAY 1995	Initial Contacts with participating countries for provisional national CO_2 ($+SO_2$ and NO_x?) emission data for 1994	Topic Centre Meeting Finalise intended changes to SNAP codes and new pollutants to be included. Start to consider validation procedures. Start to revise software and incorporate EMEP/CORINAIR Guidebook changes	Discuss national estimates and methodologies Distribute proposed SNAP code changes for comment
JUNE 1995	Continue Data Collection and comparison	Confirm timetable for Air Emissions '94 at CORINAIR '90 meeting in Oslo	Contribute data collected for EU CO_2 reporting.
AUG 1995	Topic Centre issues provisional national CO_2 ($+SO_2$ and NO_x?) emission data for 1994		Countries should start collecting data for spatial inventories.
SEPT 1995	Start working with energy balance data		Discuss with experts
OCT 1995	Topic Centre contacts participating countries for provisional national totals for all 8 pollutants by 11 main source sectors for 1994	First version of revised software available. Distribute first version to Topic Centre for extended testing.	Contacts with individual countries for provisional 1994 national data. Continue collecting spatial data.
NOV 1995	Continue above	Final corrections to software.	Continue above
DEC 1995	Participating countries submit provisional 1994 national totals for all 8 pollutants by 11 main source sectors	Distribute revised CORINAIR software to the participating countries	Finalise above Receive software
JAN 1996	Provisional national totals, of 8 for 1994 available for distribution. Topic Centre contacts participating countries for national totals for new pollutants for 1994	Participating countries to enter data into revised software, with close support and assistance from the Topic Centre including visits to national experts compiling databases	Direct contact and assistance from Topic Centre including training sessions with new software.
FEB to APRIL 1996		Continue	Continue
MAY 1996	Initial Contacts with participating countries for provisional national CO_2 ($+SO_2$ and NO_x?) 1995 emission data.	Participating countries to deliver first completed database to Topic Centre	Discuss national estimates and methodologies
JUNE 1996	Continue Data Collection and comparison	Start Validation and Verification Possible meeting with National Experts after UNECE meeting	Contribute 1995 data collected for EU CO_2 reporting.
AUG 1996	Topic Centre issues provisional national CO_2 ($+SO_2$ and NO_x?) 1995 emission data	Continue	
SEPT 1996		Continue	
OCT 1996	Topic Centre contacts participating countries for provisional national totals for all 8 pollutants by 11 main source sectors for 1995	Finish transfer of data to EEA Oracle database and start preparing reporting data	Contacts with individual countries for provisional 1995 national data
NOV 1996	Continue above		Continue above
DEC 1996	Participating countries submit provisional national totals for 1995 totals for 8 pollutants by 11 main source sectors Participating countries submit final national totals for 8 pollutants plus new pollutants for 1994.	Topic Centre distributes final database and reports to users *	Finalise above

* It is anticipated that the final report on Air Emissions '94 will be published in April 1995

Input required from National Reference Centres

Table 12 - Timetable of Specific Tasks for the Emissions Inventory Topic Centre

Subject	Start	Finish	Notes
SNAP for Air Emissions '94	Now	3 May Meeting Vienna	Changes already proposed and in line with EMEP/CORINAIR guidebook
Decide Pollutant list for Air Emissions '94	Now	3 May Meeting Vienna	
Long Term SNAP revision	May '95	May '96	Need to collaborate with EUROSTAT
Methodology	July '95	on-going	A continuing process of improvement
Software for Air Emissions '94 detailed design	April '95	3 May Meeting Vienna	Need to agree details at this meeting
Software for Air Emissions '94 updating	May '95	October '95	CITEPA to lead, tables to be 'pre-filled' with default data
Software for Air Emissions '94 checking	October '95	December '95	ALL Emissions Inventory Topic Centre partners to test and report
Longer term Software review	May '95	May '96	Group to review and propose specification for future software
Validation & Verification Review	April '95	September '95	Study to propose verification & validation procedures
Validation & Verification Pilot Implementation	September '95	September '96	Test and refine verification and validation procedures
COPERT Review	April '95	September '95	Special sub-group of road transport experts
COPERT software revision	September '95	December '95	Specific sub-contract for software development
Assist EEA in reporting CORINAIR 90	Now	December '95	Work on-going with UBA (Vienna)
EMEP/CORINAIR guidebook	June '95	on-going	Take over responsibility for producing next edition and co-ordinating contributions
Refine proposals for Air Emissions '94	Now	16th June '95 Meeting Oslo	Proposals to be presented in OSLO after task force meeting
Collect pilot national totals for 1994	16th June '95 Meeting, Oslo	December '95	Start process of collecting national totals
Refine national totals for 1994	January '96	December '96	Refine totals and collect data about group 3 substances
Collect national totals for 1995	May '96	June '96	Collection based on experience gained in '95
Refine national totals for 1995	July '96	December '96	Refine totals and collect data about group 3 substances
Specify other software tools	April '95	December '95	Decide on and specify appropriate tools to be developed
Develop other software tools	September '95	December '96	Either within the Emissions Inventory Topic Centre or outside contractors
Assist in production of default estimates	June '95	on-going	In line with the production of National totals
Collect information on Urban Inventories	April '95	on-going	Create catalogue of urban inventories and their specifications and uses
Make proposals about Urban inventories	June '95	June '96	Decide what the Emissions Inventory Topic Centre can contribute, e.g. guidelines, assistance etc.
Collation, summarisation and reporting of National Level data	June '95	on-going	Reports on initial country data
Collation, summarisation and reporting of spatial data	June '96	December '96	Initial reporting and data distribution from the full spatial inventory
Report on 1994 Spatial Inventory	November '96	February '97	The full report on Air Emissions '94 produced within two months of the data distribution.
Produce Newsletter	June '95	on-going	Periodic report on progress and information dissemination
Training in Air Emissions '94	January '96	February '96	All Emissions Inventory Topic Centre partners
Direct assistance with Air Emissions '94	January '96	June '96	All Emissions Inventory Topic Centre partners

Table 13 Timetable for Topic Centre Reports on CORINAIR 90

Report	Completed
No. 1:An Overview of CORINAIR 90	May 1995
No. 2:CORINAIR 90 - sub-group split	July 1995
No. 3:Geographical Distribution of Emissions	to be decided by EEA
Nos. 4 to 11: Analysis of Emissions and Emission factor for each Pollutant	December 1995

7.5 Products: The Supply of Information on European Emissions

These need to be designed in line with user needs so that the Emissions Inventory Topic Centre not only supplies data but summarises and analyses data to provide useful information. While updates to the estimates can be received by the Emissions Inventory Topic Centre at any time it is suggested that the information produced by the Emissions Inventory Topic Centre is updated at regular intervals (once or twice a year). This should eliminate confusion that would arise if the numbers were updated at random intervals.

There are a wide range of possible ways of presenting the data that will be collected. This needs to be collated and presented in suitable report formats so that useful information can be distributed. Examples of what could be produced are given below.

7.5.1 System Outputs

The inventory software should be able to produce summaries of the emissions in a number of formats. Formats that have already been suggested are:-

- EMEP/CORINAIR 11 source sector summaries;
- IPCC tables;
- By different SNAP code levels;
- Standard reports similar to those being produced for CORINAIR 90.

As the data should be available in a much quicker timetable these reports will be of much greater interest than for CORINAIR 90.

7.5.2 Emissions Inventory Topic Centre Data Outputs

The Emissions Inventory Topic Centre should supply its data to the EEA and other interested parties as soon as possible. In particular the data from the 1994 disaggregated inventory should be available before the end of December 1996.

The data can be distributed either as printed tables or in an electronic form. Some of the ways the data could be provided are described below:-

- ***Tabular data on paper***. This is most suitable for short tables and summaries rather than the whole database.
- ***Tabular data on disks or tapes***. This could include all the data.

- ***Data on CD-ROM***. This is being considered for the EMEP/CORINAIR guidebook. The inventory could be distributed in this form together with any reports describing its construction.
- ***Network access to a main database***. This could be provided across an international computer network, for example the Internet. This would need a central server and consideration given to the security aspects, but would enable users quick access to any updates and could be used to alert users to any changes in the status of any of the data.
- ***Data could be transferred from NUTS 3 regions to 50 x 50 km grids*** for use by EMEP and others.

The outputs would need to satisfy as far as possible all the user needs identified earlier inTable 3.

It may be useful to consider developing a standard format for emissions data provided on disk or tapes. There is already a DIN/ISO guideline on the transfer of air quality data, and this might provide a useful starting point.

7.5.3 Emissions Inventory Topic Centre Reports

Reports explaining the inventory results need to be produced. There will need to be at least one for the national totals at the beginning of 1996 and one fully describing the spatially disaggregated inventories in early 1997. (The data should be distributed in time for the deadline with some explanation but the full report can be produced within four months afterwards.)

8. CONCLUSIONS

The process outlined above has been designed both to provide faster data collection and to meet the user needs more closely. It builds on existing systems while aiming for the development of a single European inventory system. The collection of national level emissions data will be made a specific task.

To meet the need for faster national total emission data existing data collection exercises in individual countries will be utilised.

The main features that will speed up the collection of spatial data are:-

- The provision of close support from the Air Emissions Topic Centre on a one-to-one basis.
- The data collection will build on the existing emission inventory data collection systems in each country. The collection of data will proceed in stages with the essential data being collected first.
- The distribution of pre-filled databases based on CORINAIR 90 (these could also provide default datasets where a country is unable to provide their own estimates).
- The experience of CORINAIR 90 will mean that there is a wider pool of knowledge in each country on which to draw.
- Air Emissions '94 will use an updated version of the CORINAIR 90 software which will be compatible with the EMEP/CORINAIR guidebook . This will enable an early start to be made on the data collection, and will have the added advantage of displaying changes between 1990 and 94.
- In the longer term, CORINAIR 90 needs to be developed together with specific tools to assist in the collection, verification and validation of the data.
- The EEA and its network of National Focal Points will give a stronger framework for this work. It should give a greater commitment to the tasks from the member countries and should assist in the timely collection of data.

This study has considered many issues and proposed solutions to the majority. However there are some important issues where further discussion and guidance from the EEA are required. These include:

- Confirmation that CO_2 sources and sinks should be treated in line with IPCC guidelines.
- A system to deal with confidential data.
- Confirmation of the Topic Centre's role with regard to urban inventories.

GLOSSARY

AE 94	Air Emissions 94
CASPER	Model for EU for estimating emissions of air pollutants.
COPERT	Software implementing default CORINAIR methodology for estimating emissions from road transport
CORINAIR	CORINe Air Emissions Inventory
CORINE	CO oRdination d'INformation Environnementale
EEA	European Environment Agency
EEA-TF	European Environment Agency Task Force
EIONET	European Information and Observation Network
EMEP	European Monitoring and Evaluation Programme for the long range transmission of air pollutants in Europe
EU	European Union
EUROSTAT	The EU's statistical office
FCCC	Framework Convention on Climate Change
FORMOVE	Model for EU forecasting emissions from road transport.
HELCOM	Helsinki Convention on pollution in the Baltic Sea
HFC	Hydrofluorocarbon
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
LCPD	Large Combustion Plant Directive
LRTAP	Long Range Transboundary Air Pollution
NFP	National Focal Point
NRC	National Reference Centre
NUTS	The EU's system of classifying territorial units.
OECD	Organisation for Economic Co-operation and Development
OSPAR	Oslo and Paris Conventions on the pollution of the North Sea
PFC	Perfluorocarbon (e.g. carbon tetrachloride CF_4 and hexafluorethane C_2F_6)
POP	Persistent Organic Pollutant
SNAP	Selected Nomenclature for Air Pollution
UNECE	United Nations Economic Committee for Europe
WHO	World Health Organisation

ANNEX A CORINAIR 90 QUESTIONNAIRES

A questionnaire on the CORINAIR 90 methodology was sent out in early 1994. 16 out of the 30 participants returned completed questionnaires to the EEA:

EEA Members	Eastern European Countries
Belgium (Flemish)	Bulgaria
Belgium (Walloon)	Czech Republic
Germany	Hungary
Spain	Poland
France	Slovenia
Luxembourg	
Portugal	
Finland	
Norway	
Sweden	
UK	

In 1995 the Air Emissions Topic Centre contacted seven countries who had not completed the questionnaire to establish their general views on the CORINAIR 90 methodology. The countries contacted were:

Greece	Slovakia
Ireland	Croatia
Italy	Romania
Switzerland	Russia

The main results of the questionnaire are discussed below. As only just over half of participants replied to the questionnaire in full **the results can only be taken as indicative**.

1. Resources

Between 1 to 2 man-years were generally required to compile CORINAIR 90, although some of the Eastern European countries compiling CORINAIR for the first time took 4 to 5 man-years.

2. Relationships with National Inventories and International Reporting Requirements

Only four countries used the CORINAIR database as the basis of a national methodology; in addition in Germany CORINAIR was used to help complete the national inventory, and in France, CORINAIR is initially developed in parallel with rough national estimates, and is then used as the national inventory as it is developed further. In six countries CORINAIR is used to reproduce estimates made in the national emissions inventory, and in the remaining four countries the two inventories are completely independent.

Just over half of countries (10) used the 11 main CORINAIR/EMEP source sectors to report to LRTAP, and half were planning for CORINAIR data to be used by EEA-TF in the preparation of EMEP data. Just under half were preparing greenhouse gas emissions data for

the Framework Climate Change Convention using CORINAIR methodology and the proposed IPCC reporting format.

3. Reasons for Delay in Completing CORINAIR 90

The most common reported reasons for delay which were reported were all linked to data requirements (Table 1). Data was seen as difficult to find and data requirements as demanding; in addition waiting for the publication of official statistics and for data from various source sectors caused delay. For some countries official statistics for 1990 were not available until the end of 1992 or mid 1993, and in France and Germany, source data for some activities was not available until 1994. In some countries, data was only available in socio-economic categories and additional work was required to extract data in the technological categories required for CORINAIR. This was a particular problem in countries completing CORINAIR for the first time.

A lack of priority for CORINAIR work was also identified as a cause for concern. In some countries there is an emphasis on producing a 'top down' national inventory quickly first, before beginning work on CORINAIR.

Table 1 Reported Reasons for Delay in Completing CORINAIR 90[*]

Reason	No. of countries	No. of countries as % of those responding (20)
Data difficult to find	15	1%
Data requirements very demanding	13	65%
Dependent on data supply from various source sectors	13	65%
Dependent on publication of official statistics	11	55%
Priority given to other work	10	50%
Shortage of national funding	10	50%
Needed training in use of software	9	45%
Data requirements very complicated	8	40%
Software difficult to understand	7	35%
Shortage of CEC funding	7	35%
Late receipt of contract from national/regional customer	7	35%
Shortage of (experienced) staff	6	30%
Changes in software/data requirements lead to duplication of effort	5	25%
Late entry into CORINAIR programme	5	25%
Dependent on completion of emission estimates using national methodology	4	20%
Late reply from EEA-TF following request for help	3	15%
Late receipt of contract from CEC (EEA-TF or PHARE)	2	10%
Need to completely verify database before sending to CITEPA or Zierock/Samaras	2	10%
Staff switched/lost from CORINAIR during data build	2	10%
Late reply from CITEPA or Zierock/Samara with consistency check reports	0	0%
Late reply from CITEPA or Zierock/Samara following request for help	0	0%

[*] Based on replies from 16 countries returning questionnaire plus information from Croatia, Romania, Slovakia and Russia.

4. Inconsistencies

The questionnaire revealed inconsistencies in the way that CORINAIR is compiled. Half of countries submitted estimates of CO_2 emissions as the actual emissions from the exhaust, and

half as 'ultimate' CO_2 which assumes that all the carbon in the exhaust will eventually be converted to CO_2. Similarly, about half of countries included CO_2 emissions from biomass burning and half excluded them.

5. Verification

The most common sources of information for verifying CORINAIR were emissions estimates made using the national methodology and emission factors in the Default Emission Factor Handbook (Table 2). National energy statistics and emission estimates from point source operators were also used in many countries.

Table 2 Other Information used to Verify CORINAIR 90

Verification against:	No. of countries	No. of countries as % of those responding (16)
National methodology emissions estimates	14	87%
Emission factors in Default Emission Factor Handbook	13	81%
National energy statistics	11	69%
Point source operators emissions estimates	10	62%
Emissions estimates from local/urban/regional inventories	7	44%
Other international energy statistics	5	31%
Eurostat emissions estimates	4	25%
EMEP emissions estimates	3	19%
OECD emissions estimates	3	19%
Eurostat energy statistics	1	6%
UNECE emission estimates	1	6%

6. CORINAIR Material and Software

CORINAIR and COPERT **material** (software and manuals/instructions) were rated as average, and additional information, check reports, progress meetings etc. as good. Although the use of English for all printed material caused few difficulties on average, 7 participants asked for material in an alternative language - French (3), German (2), Russian (1) and Portuguese (1).

The various aspects of the CORINAIR **software** were rated as average or good:

Average		**Good**
Screen data entry		Overall design
Speed of response		Data Build - emissions calculations
File transfer (without screen interface)		Initialisation
Data Build -	definitions and data files	Options - indexing
	allocation procedures	Options - backup/restore
	checking procedures	Options - COPERT import
Data Edit -	data files	Options - empty temp files (very good)
	emissions files	

There were also a number of specific comments on individual aspects of the software's usability (Table 3).

With regard to the overall design, there were several calls for a Windows-based application of the software - the system was not felt to be user friendly by today's standards, and data entry in the current software was found to be very time consuming, with a lot of duplication (e.g. area sources, ratio and emission factors have to be filled in one by one, fuel emission factors

for point sources have to be repeated many times). These aspects could be remedied by using spreadsheets for data entry. It was also felt that it was not easy to aggregate data and to produce summary tables, or e.g. to produce tables giving all the data on one particular point source, or one SNAP code. At least two countries had transferred data from CORINAIR files to their own database systems to allow them to produce tables, cross-check data, and edit results.

*Table 3 Comments on Aspects of the CORINAIR and COPERT Software**

CORINAIR	Comments
Screen data entry	very slow, lot of duplication; too many keystrokes necessary to enter data; problem with numeric fields which do not have decimal places;
Speed of response	calculations take too much time;
File transfer (without screen interface)	non-existent;
Data build - data files	for some classification groups it is impossible to add new items such as types of units; for area activities when the default socio-economic variable (BASEA) is not used, problems with the conversion ration which must be defined;
Data build - allocation procedures	time consuming, very slow to update; slow; needs error messages stored simply; incomplete- lacks a good facility to aggregate data;
Data build - emissions calculations	very slow - need to process after each correction to view the result; slow and old fashioned;
Data build - checking procedures	very slow - need to process after each correction to view the result; not possible to choose printer ports; too many messages, many of which have little information value;
Data edit - data files	large number of codes make the screens difficult to understand; impossible to do some types of queries (e.g. to view LPS's with an activity rate above a certain level);
Data edit - emission files	not possible to look at emissions from separate parts of an LPS;
Initialisation	problems when CORINAIR is in use on a PC in network (LAN); need to change parameters and reboot at start of each session;
Options - backup/restore	backup is only possible to diskette; not operational with DOS 6; problems -does not work properly;
COPERT	In COPERT there is no clear differentiation between data and procedure files (except for COPERT/CORINAIR transfer) - this applies to file transfer, data build, definitions and data files , data edit files and emission files; Screen data entry - spreadsheet design not so good;

* Each of the comments in the Table were made by one expert only

One country felt that CORINAIR should allow more flexible input of data on point sources; it suggested point source data should be entered whatever the size of the source, and CORINAIR should then have the capability to select **large** point sources through a given selection criteria.

Other comments included:

- weighted emission factors have to be calculated 'manually' when specific emission factors are defined;
- it is not possible to define fuels and area sources everywhere;
- in EDIT, a unit for emission factors would be helpful; an opportunity to choose the fuel code would be helpful;

- in EMISSION, for sub-codes such as 0301XX, the main code (30100) is included in SUMMARY, so values are doubled;
- graphical representation of data would be useful;
- the software should make using a 'bottom-up' approach easier;
- it would be helpful if the software allowed the definition of new activity units.

6. Surrogate Definitions

Table 4 Surrogate Parameters provided for CORINAIR 90

Type of surrogate data	No. of countries			No of countries as a % of those responding (16)		
	Provided	Not available	Not provided but available	Provided	Not available	Not provided but available
Nos. of road vehicles	8	1	5	50%	6%	31%
Distances travelled by road vehicles	4	2	7	25%	13%	44%
Nos. of non-road vehicles	6	4	2	38%	25%	13%
Forest area	9	0	5	56%	0%	31%
Agricultural area	10	1	3	63%	6%	19%
Other land use	4	2	5	25%	13%	31%
Nos. of households	4	1	9	25%	6%	56%
Nos. of employees/workers	5	0	8	31%	0%	50%

7. COPERT

6 countries directly used COPERT, 2 used it to cross check data, and 8 did not use it all. Some countries expressed difficulty in obtaining data in the format required for inclusion in COPERT e.g. mileage per vehicle.

8. SNAP Codes

Suggestions for SNAP codes which should be subdivided, added, or aggregated or deleted are shown in Tables 5a, 5b and 5c. More general comments included:

Additions/completeness

- Some countries suggested that particular SNAP codes (02, 03.03, 04.03, 04.04, 04.05, 04.06, 06.03, 06.04) should include an 'other' category for completeness, and two countries suggested that every SNAP code should finish with an 'other category'. Transparency could be maintained by attaching comments to such categories.
- Category 11, 'Nature' should be more comprehensive if it is to be used to compile a complete inventory of emissions of CO2 and other pollutants.

Areas for improved clarity/definitions

- One area causing concern to several countries was processes where emissions arise both from combustion and from the process itself and the material used in it (e.g. the pulp and paper industry, cement and glass production). It was suggested that each sub-code in 03.03 should be split to allow for emissions from combustion and for emissions from non-fuel materials which are combusted.

- It should be clearly specified how to assign consumption of fuel between subgroup 3.01 (industrial combustion in boilers, gas turbines and stationary engines), and subgroups 03.02/03.03 (process furnaces without contact/processes with contact) for economic sectors which have both types of activities.
- For some activities there should be a distinction between 'immediate' and 'lagged' emissions.
- SNAP codes should be accompanied by other nomenclatures such as
  - NAPACT (ISIC, NACE...) economic-sectoral
  - NAPTEC -techniques
  - NAPCONT - control reduction technologies
  - NAPFUE - fuels
- Thought should be given to SNAP codes where emissions might be considered to be non-anthropogenic - e.g. waste handling and combustion of black liquor in the pulp and paper industry .

Deletion/Aggregation

- One country suggested activities causing relatively low emissions (<0.1% of emission total) should be deleted. Another suggested that before deleting any codes, checking whether SNAP codes were empty because there is no activity or because of lack of data.

Table 6 shows reasons why it was not possible for countries to complete the CORINAIR database - either because the activity definition was unclear, or activity data or emission factors were unavailable. Some of the comments reflect ambiguities already mentioned above (e.g. the split between combustion and process dependent emissions in some industries); other problems are probably particular to one country. The main areas where several countries experienced problems were solvent use (06), other transport (08), and nature (011) .

In some countries, the mismatch between SNAP codes and categories used for socio-economic data had caused some problems in data collection for some sectors.

Table 5a SNAP codes to be Sub-divided

Code	Description	To be split into:
02	Commercial, institutional and residential combustion plants	commercial residential tertiary
02.00.02	Commercial, institutional and residential combustion plants - combustion plants <50 MW	residential non-residential
03.03.11	Processes with contact - cement	dry method wet method
04.07	Cooling plants	ammonia plants freon plants
04.02.08	Iron and steel processes - rolling mills	hot rolling cold rolling
05.01.02	Underground coal mining	with methane emission reduction without methane emission reduction
05.05.01	Refinery dispatch station	railway tanker pipeline tanker
06.01.01 to 06.01.04	Solvent use paint application	using water solvent using non-water solvent
06.01.02	Other industrial paint application	automobile repair
06.04.02	Other uses of solvents -fat, edible and non-edible oil extraction	grinding
06.04.03	Other uses of solvents -printing	packaging edition printing
06.04.04	Other uses of solvents - fat, edible and non-edible oil extraction	grinding degreasing
06.04.06	Other uses of solvents - preservation of wood	impregnation coating
06.04.07	Underseal treatment of vehicles	undersealing treatment of hollow spaces
06.04.06	Domestic use of solvents	use of cosmetics
06.04.09	Vehicle dewaxing	vehicle dewaxing vehicle waxing
08.03	Inland waterways	inland waterways coastal navigation
09.01	Waste water treatment	refinery industry municipal
09.07	Open burning of agricultural waste	open burning of agricultural waste open burning of forestry wastes

Table 5b Activities to be Added

To Code	Description	Add
03.02	Process Furnaces without Contact	drying kilns (e.g. in car manufacture)
03.03	Process with contact	sugar
04.03	non-combustion processes in ferrous metal industries	production of silicon carbide
04.05	Production processes- organic chemical industry	ethylene glycol aniline cyclohexane ethylene dichloride
06.03	Chemical products manufacturing or processing	additional substances for chemical production processing of synthetic materials (excluding 06.03.02)
06.04	Other uses of solvents and related activities	other industrial cleaning protective coatings for the construction industry (excluding O6.04.06) metal treatment pesticides other industrial applications
10.04	Animal breeding	poultry
10.04	Animal breeding (enteric fermentation)	tame reindeer
10.05	Animal breeding (excretion)	tame reindeer
11	Nature	Land use changes Others? (as relevant to IPCC/OECD reporting format)
?	not specified by respondent	charcoal production
?	not specified by respondent	nickel or other non-ferrous metal production
?	not specified by respondent	production of soda fluffy
?	not specified by respondent	furnace induction for cast iron
?	not specified by respondent	coal drying
?	not specified by respondent	caprolactam
?	not specified by respondent	well testing

Table 5c Activities to be Deleted or Aggregated

Code	Description	
04.04.11	graphite	delete
04.06.09	bark gasifier	delete
04.06.12 04.06.13 04.06.14	Cement Lime Glass	aggregate
09.08.00	Latrines	delete
11.07.02	termites	delete

Table 6 Reasons for Incomplete Database

SNAP code	Activity definition	Activity definition unclear	Activity data unavailable	Emission factors unavailable	Note
1	**PUBLIC POWER, COGENERATION AND DISTRICT HEATING PLANTS**				
10104	GAS TURBINES		*		
10105	STATIONARY ENGINES		*		
10204	GAS TURBINES		*		
10205	STATIONARY ENGINES		*		
2	**COMMERCIAL, INSTITUTIONAL AND RESIDENTIAL COMBUSTION PLANTS**				
20003	GAS TURBINES		*		
20004	STATIONARY ENGINES		*		
3	**INDUSTRIAL COMBUSTION PLANTS AND PROCESSES WITH COMBUSTION**				
30104	GAS TURBINES		*		
30105	STATIONARY ENGINES		*		
30311	CEMENT	*			Confusion with 40612 and 40613, cement and glass, non combustion processes
30314	FLAT GLASS	*			
30318	MINERAL WOOL		*		
30320	FINE CERAMICS MATERIAL	*			
4	**NON COMBUSTION PROCESSES**				
40100	PRODUCTION PROCESSES - PETROLEUM INDUSTRIES	*			Difficult to differentiate between emissions from constituent parts and overlap with refinery furnaces (30201)
40302	FERRO ALLOYS	*	*	unclear	
40406	AMMONIUM PHOSPHATE		*		
40411	GRAPHITE		*		
40500	PRODUCTION PROCESSES -ORGANIC CHEMICAL INDUSTRY				In addition to the problems reported below one country reported general difficulties with activity data and emissions factors for all 405XX codes
40503	1,2 DICHLOROETH (EXCEPT 040505)		*		
40505	1,2 DICHLOROETH + VINYLCHL (BALANCED PROCESS)	*			
40513	STYRENE-BUTADIENE LATEX	*			
40514	STYRENE-BUTADIENE RUBBER (SBR)	*			
40515	ACRYLONIT. BUTADIENE STYRENE (ABS) RESINS	*			
40522	STORAGE AND HANDLING OF CHEMICAL PRODUCTS	*	**	**	

Key: * reported by one country; ** reported by two countries

Table 6 Reasons for Incomplete Database (cont'd)

SNAP code	Activity definition	Activity definition unclear	Activity data unavailable	Emission factors unavailable	Note
40601	CHIP BOARD	*			
40606	WINE		*	*	
40607	BEER		*	*	
40608	SPIRITS		*	*	
40609	BARK GASIFIER	*	**	**	
40610	ASPHALT ROOFING MATERIALS		**	**	
40611	ROAD PAVING WITH ASPHALT		*	*	
40612	CEMENT	*			Confusion with 30311 and 30314
40613	GLASS	*			
40700	PRODUCTION PROCESSES - COOLING PLANTS	*	*	*	
5	**EXTRACTION AND DISTRIBUTION OF FOSSIL FUELS**				
50103	STORAGE OF SOLID FUELS	*			
50201	LAND BASED EXTRACTION, 1ST TREATMENT AND LOADING OF LIQUID FUELS	*			
50502	OFF-SHORE EXTRACTION, 1ST TREATMENT AND LOADING OF LIQUID FUELS	*			
50302	OTHER LAND BASED EXTRACTION, 1ST TREATMENT AND LOADING OF GASEOUS FUELS	*			
50303	OFF-SHORE EXTRACTION, 1ST TREATMENT AND LOADING OF GASEOUS FUELS	*			
50502	TRANSPORT AND DEPOTS FOR GASOLINE DISTRIBUTION		* partially		
50602	PIPELINE COMPRESSOR STATIONS		* partially		
6	**SOLVENT USE**				
60101	MANUFACTURE OF AUTOMOBILES		*		
60102	OTHER INDUSTRIAL APPLICATIONS		**		
60103	CONSTRUCTION AND BUILDINGS		*		
60104	DOMESTIC USE		*		
60201	METAL DEGREASING		**		
60202	DRY CLEANING		*		
60300	SOLVENT USE -CHEMICAL PRODUCTS MANUFACT/PROCESSING				In addition, one country reported general difficulties with activity data and emissions factors for all 603XX codes.
60301	POLYESTER PROCESSING	*			

Key: * reported by one country; ** reported by two countries

Table 6 Reasons for Incomplete Database (cont'd)

SNAP code	Activity definition	Activity definition unclear	Activity data unavailable	Emission factors unavailable	Note
60302	POLYVINYLCHLORIDE PROCESS	*			
60303	POLYURETHANE PROCESSING	*			
60304	POLYSTYRENE FOAM PROCESS	*			
60305	RUBBER PROCESSING	*			
60305	PHARMACEUTICAL PRODUCTION MANUFACTURING		**		
60310	ASPHALT BLOWING		*		
60311	ADHESIVE TAPES MANUFACTURE	*	* partially	*	
60401	GLASS WOOL ENDUCTION		*		
60402	MINERAL WOOL ENDUCTION		**		
60404	FAT EDIBLE AND NON-EDIBLE OIL EXTRACTION	*			
60405	APPLICATION OF GLUES AND ADHESIVES	*	*		
60406	PRESERVATION OF WOOD	*			
60407	UNDERSEAL TREATMENT OF VEHICLES		**	*	
60408	DOMESTIC SOLVENT USE (OTHER THAN PAINT)		**	*	
8	**OTHER TRANSPORT**				
80100	OFF ROAD VEHICLES AND MACHINES				One country reported unclear activity definitions for all 801XX codes; two countries reported that activity data and emissions factors were partially or wholly unavailable
80103	INDUSTRY		**		
80104	MILITARY		*		
80105	HOUSEHOLD/GARDENING		**	*	
80400	MARINE ACTIVITIES		*unclear	*	
80401	HARBOURS	*			
80500	AIRPORTS (LTO CYCLES AND GROUND ACTIVITIES)	*	*	*	For ground activities
9	**WASTE TREATMENT AND DISPOSAL**				One country reported that data was incomplete and unavailable and that emissions factors were unavailable for all code 9 data
90100	WASTE WATER TREATMENT	*			
90203	FLARING IN OIL INDUSTRY		*	*	
90204	FLARING IN CHEMICAL INDUSTRIES	*	*	*	
90300	SLUDGE SPREADING		*	*	

Key: * reported by one country; ** reported by two countries

Table 6 Reasons for Incomplete Database (cont'd)

SNAP code	Activity definition	Activity definition unclear	Activity data unavailable	Emission factors unavailable	Note
90600	BIOGAS PRODUCTION	*			
90700	OPEN BURNING OF AGRICULTURAL WASTES	*			
90800	LATRINES		*	*	
10	**AGRICULTURE**				One country reported that emission factors for methane and NMVOCs were unavailable for all SNAP code 10 activities
100100	CULTURES WITH FERTILISERS				One country reported that it was not possible to distinguish between data for 10100 and 10200
100200	CULTURES WITHOUT FERTILISERS				
100510	FUR ANIMALS	*	*		
11	**NATURE**				One country reported that an emission factor for methane was unavailable for all SNAP code 11 activities. Another country queried where scrublands and open forests should be included.
110501	UNDRAINED AND BRACKISH MARSHES	*			
110502	DRAINED MARSHES	*			
110602	RAISED BOGS	*	*	*	
110603	SHALLOW SALTWATERS	*	*	*	
110604	GROUND WATERS	*	*	*	
110605	DRAINAGE WATERS		**	**	
110606	RIVERS		*		
110607	DITCHES AND CANALS		*	*	
110701	OPEN SEA			*	
110702	TERMITES		*	*	
110800	MAMMALS		*		
110900	NEAR SURFACE DEPOSITS	**	*	*	

Key: * reported by one country; ** reported by two countries

ANNEX B CHARACTERISTICS OF CORINAIR 90 DATABASES

Table B.1 The number of area source data defined by each country in CORINAIR 90 is given below. They show the range of approaches adopted to completing CORINAIR 90 by individual countries.

	Rubrics	**Fuels**	**Activities**	**Territorial units**	**Activity rates**	**Emission factors**
Belgium (Flemish Region)	20	62	184	29	2297	2705
Belgium (Wallonie region)	29	32	153	28	2884	1232
Germany (former west)	10	84	268	366	16405	?
Germany (former east)	12	84	182	229	4829	5060
Denmark	17	64	175	21	3642	952
Spain	200	142	509	78	39702	3616
France	109	260	516	128	50335	5316
Greece	0	12	228	67	12568	1665
Ireland	0	28	95	12	1140	683
Italy	4	20	242	127	17134	3491
Luxembourg	11	22	124	1	124	579
Netherlands	48	25	683	57	15702	683
Portugal	22	65	170	38	5780	2256
United Kingdom	1	22	173	95	16340	573
Austria	27	19	115	10	1150	549
Finland	27	18	229	14	836	894
Norway	76	21	187	23	4301	1559
Sweden	2	91	124	25	1708	1836
Bulgaria	44	29	283	11	2322	1507
Czech Republic*	1	177	188	10	1276	4202
Hungary	2	34	144	147	2823	438
Poland	18	148	164	51	8364	761
Romania	8	14	171	44	4284	15643
Slovak Republic	22	48	138	43	5680	862
Estonia	3	18	86	19	1126	2322
Latvia	8	24	162	12	1104	3158
Lithuania	8	13	99	12	1032	3900
Slovenia	58	17	57	75	58	185

ANNEX C NATIONAL CONFIDENTIALITY REQUIREMENTS

Country	All Open	SNAP Groups restricted	1 Location	2 Source data	3 Operations	4 Activity data	5 Emissions	Comments
Belgium-Flemish	YES							
Belgium-Walloon	?							
Denmark	YES							
Germany	?							
Greece	NO	Refineries	O	X	X	X	X	
Spain	NO	LPS	O	O	X	X	O except LCPs	LCP data more restricted
France	NO	ALL LPS	O	X	X	X	O	
Ireland	YES							
Italy		ALL LPS	O	O	O	X	O	
Luxembourg	YES							
Netherlands	NO	ALL LPS	O	X	X	X	O	
Portugal	NO	ALL LPS	X	X	X	X	O	Coordinates restricted
United Kingdom	YES							
Austria	?							
Finland	?							
Norway	NO	3 & 4	O	X	X	X	O	Area source activity/emission factor restrictions
Sweden	O LPS							
Switzerland	?							
Albania	?							
Bulgaria	YES							
Croatia	?							
Czech Republic	NO	All LPS	X	X	O	X	O	Coordinates restricted
Estonia	YES							
Hungary	NO	All LPS	O	X	O	O	O	Capacity restricted
Latvia	YES							
Lithuania	?							
Poland		All LPS	X	X	X	X	O	Coordinates restricted
Romania	?							
Russia	?							
Slovakia		All LPS	O	X	X	X	O	
Slovenia	YES							

Key X confidential
O unrestricted
? No reply received to questionnaire

ANNEX D PROPOSED SOFTWARE CHANGES FOR AIR EMISSIONS 94

1 Proposed Changes

It is proposed that the following changes are made to the CORINAIR 90 software by the end of 1995.

1.1 Data model

Two new elements will be introduced:

- A **'National Energy Statistics'** module where national energy data can be entered, and an **'Energy Balance Process'** where a comparison can be made between the national energy statistics and estimates of fuel use in the emissions inventory.
- A facility to enter data at a national aggregated level.

1.2 Inventory Specifications

New pollutants (heavy metals, POPs and possibly others) will be included. SNAP 90 will be modified to include sources of the new pollutants and to ensure as good a compatibility with IPCC requirements as possible.

1.3 Software Facilities

Default emissions factors from the UNECE guidebook will be included in the revised software.

Some data handling and input facilities will be improved:

- there will be an option to 'call-up' default emissions factors stored in the software;
- a 'bottom-up' function will be introduced, i.e. it will be possible to aggregate spatial data (activity rates or emission factors);
- some other changes suggested in the CORINAIR 90 questionnaires (Annex A) will be implemented. For example, it will be possible to edit aggregated emissions results without an intermediate 'data build' step.

2. Benefits of the Proposed Approach

The main benefits of the proposed changes are:

- It will be possible to use the revised software to complete both a detailed spatial inventory and to produce national annual totals.
- The revised software will be fully compatible with the CORINAIR 90 software as the changes will extend, rather than modify the structure of the CORINAIR 90 data model.

This compatibility with the existing CORINAIR 90 structure will have other advantages. Firstly, countries which have already developed a procedure to transfer their national

inventories into a CORINAIR 90 format, will not have to undertake major revisions to the procedure. Secondly, it will be possible to provide a starting point for the Air Emissions 94 inventory by prefilling the revised software with the CORINAIR 90 data.

3. Conclusions

The proposed changes take into account the main issues identified in this scoping study:

- the production of both annual national totals and more detailed spatial inventories;
- achieving convergence between these two processes
- ensuring that a comparison with national energy balances is carried out as part of a validation process;
- the need to speed up the inventory process by improving the usability of the software and allowing the CORINAIR 90 data to be used as a basis for the 1994 inventory.

The revised version of the CORINAIR software will be distributed to national experts at the end of 1995.