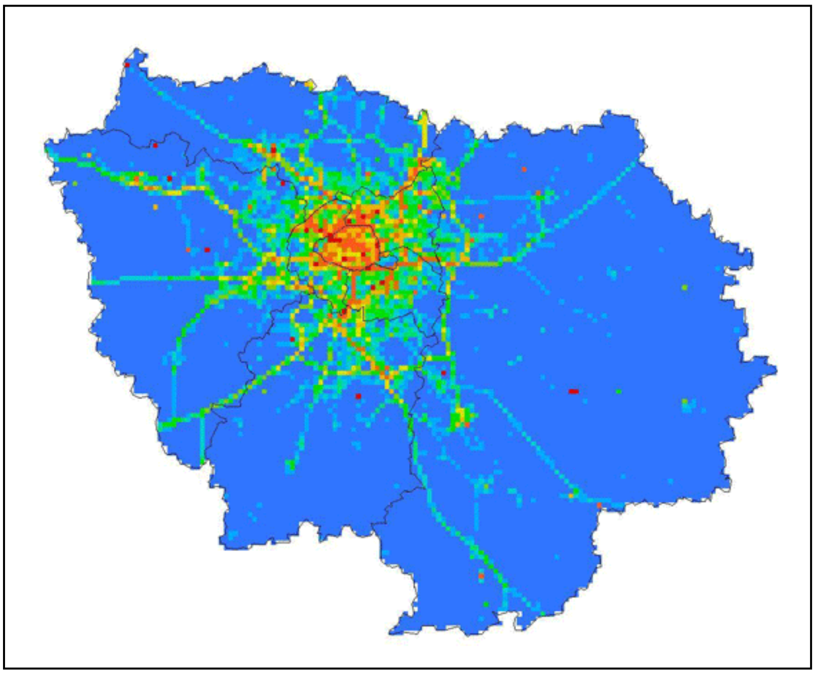
Air Implementation Pilot:

Assessing the emission inventories at the local level (Update for the 12 pilot cities)



ETC/ACM Technical Paper 2013/8
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European Topic Centre on Air Pollution and Climate Change Mitigation

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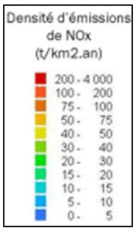
Front page picture:
_NO_x emissions in l'Île-de-France (source: http://www.airparif.asso.fr/etat-air/air-et-climat-bilan-emissions); Figure 3 of this paper._



Emission density classes of NO_x ($t/km^2 \cdot yr$);

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1. Background

This study within the Air Implementation Pilot aims at reviewing emission inventories of the twelve European cities taking part in the Air Implementation Pilot and to assess their ability to inform the development of air quality management plans (including addressing specific exceedances and source apportionment for concentration levels). Furthermore, their potential for identifying suitable mitigation measures is evaluated. An assessment of the emission inventories of the initial eight cities was published in a technical paper in 2012 (ETC/ACM, 2012).

The cities participating in the project are:

- Antwerp (Belgium),
- Berlin (Germany),
- Dublin (Ireland),
- Madrid (Spain),
- Malmö (Sweden),
- Milan (Italy),
- Paris (France),
- Ploieşti (Romania),
- Plovdiv (Bulgaria),
- Prague (Czech Republic)
- Vienna (Austria) and
- Vilnius (Lithuania).

Out of the 12 selected cities 11 (all but Dublin) dispose of local and/or regional emission inventories. By means of a questionnaire sent to the participating cities detailed information on the structure, methodologies, data and use of the urban emission inventories has been obtained and will be discussed in the following (the questionnaire can be found in Annex 1).

2. Overview of cities' emission inventories

In the following, the cities' replies to the questionnaire sent out in June 2012 to the initial eight cities and in January 2013 to the additional four cities which joined the initiative at a later stage (end of 2012) are summarised and presented ([1]).
The emission inventory of Dublin is currently being developed as a result of the city's participation in the Air Implementation Pilot; therefore, the questionnaire could not be answered by the city authorities. As soon as information will be available it will be included in an updated version of this report.

Conclusions and recommendations regarding the cities' emission inventories are presented in chapter 3.

2.1 Pollutants covered, spatial and temporal resolution

The pollutants included in the cities' emission inventories (EI) are shown in the table below (the abbreviations of the pollutants can be found in Annex 2).
Three pollutants are covered in all emission inventories considered: NO_x (as NO_2 in Plovdiv´s local EI), SO_2, PM_{10}.
Greenhouse gases (GHG) are currently not included in four emission inventories; $PM_{2.5}$ is not included in three emission inventories.
So far Antwerp and Malmö for specific sources are the only cities to cover black carbon (BC), which is both an indicator for traffic related air pollution and a short lived climate forcer.

For Plovdiv information was provided for both an emission inventory on a local level and an emission inventory provided by the national statistical institute for all cities exhibiting significant emissions. In the following, the local emission inventory is considered only.

Table 1: Pollutants included in the emission inventories. (Annex 2 lists the abbreviations of the pollutants)

city	Pollutants (#)			
	Gaseous	**PM**	**GHG**	**Other**
Antwerp	NO_x, SO_2	PM_{10}, $PM_{2.5}$, BC	CO_2	
Berlin	NO_x, VOC, SO_2, CO	TSP, EC, PM_{10}, $PM_{2.5}$		Benzene, BaP
Madrid	NO_x, VOC, NH_3, SO_2, CO	TSP, PM_{10}, $PM_{2.5}$	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6	As, Cd, Cr, Cu, Hg, Ni, Pb, Se, Zn, HCH, PCP, HCB, TCM, TCE, PCE, TCB, TCE, DIOX, PAHs
Malmö	NO_x, VOC, NH_3, SO_2, CO	PM_{10}	currently not included	BC for specific sources
Milan	NO_x, VOC, NH_3, SO_2, CO	TSP, PM_{10}, $PM_{2.5}$	CO_2, CH_4, N_2O	
Paris	NO_x, VOC, NH_3, SO_2, CO	TSP, PM_{10}, $PM_{2.5}$, PM_1	CO_2, CH_4, N_2O, HFCs	As, Cd, Cr, Cu, Hg, Mn, Ni, Pb, Se, V, Zn, PCDD_F, PCB, HCB, HCl, HF, PAH, BaP, BbF, BkF, Indpy, BghiPe, BaA, BahA, FluorA, BjF

([1]) The assessment of the initial eight cities was published in 2012 (ETC/ACM, 2012).

Ploieşti	NO_x, VOC, SO_2, CO	TSP, PM_{10}, $PM_{2.5}$	CO_2, CH_4, N_2O	heavy metals, POPs, PAH,
Plovdiv (+)	NO_2, SO_2	PM_{10}, $PM_{2.5}$		Cd, B(a)P
Prague	NO_x, VOC, NH_3, SO_2, CO, benzene	TSP (*), PM_{10}, $PM_{2.5}$		selected HMs* and POPs*
Vienna	NO_x, VOC, SO_2, CO, NO_2	PM_{10}	CO_2,	
Vilnius	NO_x, SO_2, CO	PM_{10}		

(*) stationary sources
(+) on a local level an EI has been developed for PM_{10}, $PM_{2.5}$, SO_2, NO_2, Cd and B(a)P. On a regional level an EI is provided by NSI for NO_x, SO_2, CH_4, NMVOC, CO, CO_2, N_2O, NH_3
(#) an explanation for the abbreviations of the pollutants can be found in Annex 2.

The coverage of pollutants laid down in EU legislation is summarized in Table 2. Next to legislation relevant for local emission inventories such as the Air Quality Directive, obligations on the national level such as the National Emission Ceilings Directive are listed.

Table 2: Pollutants included in cities' emission inventories in comparison to emission- and air quality-related obligations on local and national level

Pollutant	Obligation	Antwerp	Berlin	Madrid	Malmö	Milan	Paris	Ploieşti	Plovdiv	Prague	Vienna	Vilnius
NO_x	NEC, AQD (NO_2)	✓	✓	✓	✓	✓	✓	✓	✓ (*)	✓	✓	✓
VOCs	NEC, AQD		✓	✓	✓	✓	✓	✓		✓	✓	
SO_2	NEC, AQD	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
NH_3	NEC			✓	✓	✓	✓			✓		
PM_{10}	AQD	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
$PM_{2.5}$	AQD, GP	✓	✓	✓		✓	✓	✓	✓	✓		
CO	AQD			✓	✓	✓	✓	✓		✓	✓	✓
C_6H_6	AQD									✓		
PAH	DD4			✓			✓	✓	✓	✓		
HM	DD4			✓			✓	✓	✓	✓		
GHG	UNFCCC	✓		✓		✓	✓	✓			✓	

(*) as NO_2.
NEC: National Emission Ceiling Directive 2001/81/EC
AQD: Air Quality Directive 2008/50/EC
DD4: 4th Daughter Directive 2004/107/EC
GP: revised Gothenburg Protocol under the CLRTAP
UNFCCC: United Nations Framework Convention on Climate Change

All of the cities except Antwerp considered a bottom-up approach for their emission inventory. In some cities specific source categories are estimated via top-down data.

Table 3: Approach

City	Approach
Antwerp	Top-down (downscaled from regional EI of Flanders
Berlin	Bottom-up
Madrid	Bottom-up; top down for some activities
Malmö	Bottom-up; consumer data, NRMM top down
Milan	Mainly bottom-up
Paris	Bottom-up; top-down for some sectors
Ploieşti	Bottom-up
Plovdiv	Bottom-up
Prague	Bottom-up; top down for area sources

Vienna	Bottom-up
Vilnius	Bottom-up

The cities' emission inventories cover at least the city within its administrative boundaries. In the case of Milan, the emission inventory covers the whole region of Lombardy and more than 1500 municipalities altogether. In Paris the Île-de-France region is covered.

The spatial resolution for area sources ranges from 50 × 50 m² to 1000 × 1000 m². In most cases, point and line sources are allocated to specific spatial positions and road sections.

In all cities the emission inventories are in general based on annual emission data. However, additional temporal emission profiles are available for Madrid, Malmö, Milan, Paris, Plovdiv, Vienna and Vilnius. These temporal profiles are important for air quality modelling. In Plovdiv hourly emission rates are available for transport and industry, as well as seasonal for residential heating.

Table 4: Area covered by the emission inventory, spatial and temporal resolution

city	Area	Spatial resolution			Temporal resolution
		point	line	area	
Antwerp	City and harbour area	✓		1000 x 1000 m²	annual
Berlin	Admin. unit (891 km²)	✓	✓	1000 x 1000 m²	annual
Madrid	Municipal boundary (635 km²)	✓	✓	250 x 250 m²	annual (hourly profiles)
Malmö	Municipal boundary (155 km²), region: 100x100 km²	✓	✓	50 x 50 m² (domestic heating) 500 x 500 m² (NRMM)	annual, daily, monthly variation for traffic. Production pattern for LPS. Heating emission pattern
Milan	Lombardy region	1546 municipalities in region			Annual; hourly, daily, monthly modulation profiles
Paris	Île-de-France region	1000x1000 m²			Annual; monthly, daily and hourly profiles
Ploieşti	Prahova county	no information provided			annual (LCP quarterly)
Plovdiv	Municipal boundary (54 km²)			250 x 250 m² and 400 x 400 m²	industry and transport based on hourly emission rates; residential heating on seasonal basis (1 November to 1 April)
Prague	City of Prague	✓	✓	parts of city	annual
Vienna	Admin. unit (415 km²)	✓	✓	100 x 100 m²	annual, monthly, weekly and week-hours profiles
Vilnius	Admin. unit			130 x 130 m²	annual and seasonal (winter, summer, demi seasonal)

2.2 Classification, sources and database

Table 5 shows emission sources included in the emission inventory. Special attention was paid to fugitive emissions, such as resuspension of road dust and construction activities, which are relevant sources but very difficult to quantify.

Additionally, information on the classification system used is presented.

Table 5: Emission sources included in the inventory and classification scheme

City	Stationary	Large industrial	Small industrial and commercial	Residential	Road transport	Other transport	Agriculture	Fugitive					Classification System	Comment
								Wear	Resuspension	Evaporative loss	Construction	Solvents		
Antwerp	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	SNAP, NFR, CRF, NACE	
Berlin	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	✓	×	national classification	
Madrid	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	≈	✓	SNAP (CRF possible)	construction: exhaust emissions
Malmö	✓	✓	✓	✓	✓	✓	×	×	×	✓	≈	✓	custom classification	road surface emission model is under construction. construction: exhaust emissions
Milan	×	✓	✓	✓	✓	✓	✓	✓	×	✓	×	✓	SNAP	
Paris	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	×	✓	SNAP	
Ploieşti	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	×	✓	NFR	
Plovdiv	✓	✓	✓	✓	✓	×	×	✓	✓	×	✓	×	SNAP	
Prague	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	✓	✓	NFR national classification	fugitive: only totals for whole city. resuspension only for ATEM AQ model
Vienna	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	≈	✓	SNAP ÖNACE (national classification)	construction: exhaust emissions
Vilnius	✓	✓	×	✓	✓	≈	×	✓	✓	×	×	×	custom classification	other transport: railways only

Notation keys: ✓ included/ × not included/ ≈ partly included
SNAP – Selected Nomenclature for Air Pollution
NFR – Nomenclature For Reporting

The coverage of source categories in the emission inventory reflects on the one hand the relevance of the sectors for urban regions, and on the other hand the availability of reliable activity data and/or emission factors. This is indicated by the fact that agriculture, resuspension of road dust and emissions of construction activity (save exhaust emissions) are not included in the emission inventory of six, five and four cities, respectively.

Antwerp is the only city that covers all emission sources.

In three cases (Berlin, Malmö and Vilnius) a custom classification scheme is used in the emission inventory.

As an underlying database, MS Excel is used in three cases (Table 6). Three cities use a combination of different programs, two cities use Oracle, one PostgreSQL (open source SQL), one a GIS software.

Table 6: Spreadsheet, database used

City	Database
Antwerp	-
Berlin	MS Excel
Madrid	Microsoft Office Applications (MS Access, Excel, etc.)
Malmö	MS Excel and EnviMan AQEmissioner (Opsis AB, www.opsis.se)
Milan	Oracle
Paris	PostgreSQL
Ploieşti	MS Excel
Plovdiv	MS Excel
Prague	BDF, MS Access (HO BASE), Oracle (CHMI)
Vienna	Oracle
Vilnius	ArcGIS

"-": no information provided

2.3 Quality assurance and quality control

This chapter describes the QA-procedures in place, existing difficulties and improvement options. Table 7 summarizes the replies from the cities authorities. The QA procedures vary considerably including plausibility, consistency, homogeneity checks, dispersion modelling and use of ISO 9001, which is used in one city only (Antwerp) for the GHG inventory. It deems useful to exchange experiences on QA procedures and to support cities in setting up QA/QC systems.

Table 7: QA/QC procedure in place

City	QA / QC
Antwerp	QA/QC see UNFCCC and EMEP/LRTAP reporting, ISO 9001 for the GHG emission inventory of Flanders
Berlin	Plausibility checks are performed. The source apportionment is based on air quality monitoring representative for different environments and sources.
Madrid	Quality assurance procedures are performed. Criteria for the selection of estimation methodologies according to IPCC are applied. The principles of consistency and homogeneity over time are applied in inventory preparation. QA/QC procedures include the following: checking of data for anomalies, contradictions and missing information. In case of anomalies, their origin is investigated and any errors identified are resolved
Malmö	Each year air quality modelling is performed for about 15 locations and compared to simulations of previous years. This provides an end-of-the-line test of the whole system. Every 5 years passive sampling campaigns for NO_2 and VOCs are performed to compare with modelled concentrations. A formal QA/QC procedure is under development and is estimated to be implemented in March 2013.
Milan	The data are compiled in the SNAP nomenclature. The data set also includes information on data source and methodology applied. Cross-check tests are performed for emissions from the main SNAP groups, by comparing them with national EI results and previous editions of the regional EI results.
Paris	The procedure deals with several aspects of the validation (regional emissions trends are compared with national emissions trends...)

Ploieşti	QC procedures cover three areas: 1. Data and information for the EI: - Identification of all activities and processes which generate emissions and the associated NFR code; - Identification of emission sources, the physical parameters, the temporal variations of processes and emitting activities; - Data collection, - Checking of the data source, - Checking for errors and transmission of data, - Checking for proper registration, units and conversion factors. 2. Input data: - Selection of the method for estimating emissions: direct measurements, emission factors, mass balances, emission modelling, etc.; - Identification of the level of approach to estimate emissions: based on the availability of data, quality data collected, etc.; - Development of the EI; - Checking of the inventory (cross checking of input data, emission factors) 3. Reporting and use of the EI a) Preparation of reports b) Use: identification of sources of elevated pollutant levels in ambient air, air quality modelling, development of strategies and regulations, definitions of environmental priorities, etc. QA procedures include all checks, audits and reviews for quality assessment of the EI by independent experts or third parties.
Plovdiv	QA is ensured by the results of the dispersion modelling, where validation is performed regarding uncertainty in accordance with the data quality goals contained in the national legislation and described in Annex I, item A of AQD 2008/50/EC
Prague	Cross-checks with the previous EI database are performed
Vienna	The quality of the inventory is entrusted to the external partner (AIT Austrian Institute of Technology, Department of Foresight and Policy Development, http://www.ait.ac.at/departments/foresight-policy-development/). All activity data, emission factors and models are documented in a transparent way, and are open for scrutiny by all expert users. All assumptions are described and documented.
Vilnius	Actual observations, modelling and verification, comparison modelling results with national level modelling

As a first step to assess the comparability of emission inventory, the cities were asked whether their emission inventories are comparable to other cities within the country, or comparable to regional emission inventories. This is – to some extent - the case in about half of the cities considered.

Table 8: Comparability to other cities within the country

City	Comparability
Antwerp	Yes (downscaled from the regional inventory)
Berlin	Not comparable to other cities Results of the city EI are comparable to other emission data from regional inventories and used in modelling exercises (e.g. PAREST Project; http://www.umweltbundesamt.de/luft/infos/veranstaltungen/parest2010/index.htm)
Madrid	The local inventory has been exhaustively compared against the regional and national inventories. Specific harmonization procedures have been implemented for the compilation of the local and regional modelling inventories.
Malmö	Fully comparable with the regional (Scania) EI and the Goteborg EI, partly comparable to the Stockholm EI (bottom-up), but not directly comparable to the national EI (mostly top-down)
Milan	Yes (regional inventory containing data on each city in the region; the methodology is shared with 6 further regions and 2 provinces)
Paris	Yes, other regional inventories are built with the same methodologies
Ploieşti	No
Plovdiv	Yes
Prague	No
Vienna	Yes
Vilnius	No

Possible solutions to improve consistency and comparability of the emission inventories of European cities were suggested by the cities (Table 9).

A harmonisation of cities' emission inventories is deemed possible when the source categories (and their definitions), the methodology and the emission factors (which essentially covers the whole process) are harmonised. A working group is seen as necessary to exchange best practices.

Table 9: Suggestions for improving the consistency and comparability of emission inventories (EI)

City	Suggestions
Antwerp	-
Berlin	-
Madrid	Harmonisation and clear definition of emission source categories and subcategories Quality control comparison Presentation of results (index, indicators…)
Malmö	Guidelines
Milan	-
Paris	Need for a common methodology and accurate comparisons of emissions inventories
Ploieşti	Harmonization of methodology and emission factors
Plovdiv	Development of a standard European methodology for carrying out EI
Prague	Stronger use of a bottom-up approach for line sources
Vienna	Establishing a working group to discuss best practice methods
Vilnius	Collaboration, trainings, exchange of information

"-": no information provided

Table 10 summarizes the difficulties and main challenges encountered by the cities in the development of the emission inventory. Fugitive sources and uncertainties of emission factors are a common problem. Especially emission factors for fugitive sources are seen as a major challenge in most cities. This poses considerable problems in quantifying PM_{10} emissions, for which widespread exceedances of the air quality limit value occur. Improvements of these emission factors might be handled on a national and / or European scale. Also traffic data, esp. for heavy duty vehicles, are often not available with suitable quality, which needs to be improved on a local scale.

Table 10: Challenges and suggestions for improvement of the emission inventory (EI).

City	Difficulties & Challenges	Suggestions for improvement
Antwerp	Main challenges: - Historical data before 1997; - clear distinction between the background concentrations and the local contributions	-
Berlin	Main uncertainties in emission estimates: - Wood burning for domestic heating - Construction site activities: diffusive sources, machinery - Emission factors for EEV-Euro-5 vehicles Main challenges: - Uncertainty of emission factors - No formal database structure	- Emission inventory training and guidance - Common emission factors
Madrid	Main uncertainties: - Emission factors Main challenges: - Quality of input data - Standardisation of methodologies	- Taking into account GHG SCOPE 3 emissions would improve the quality of the EI. Efforts are underway in order to improve the reliability of traffic and household heating system data set - Activity data quality could be improved with better local statistics (gasoil boilers, railways information, etc.)
Malmö	Main difficulties: - The data from the street department are often of a very low quality due to the method of measurement, so extensive data examination and correction has to be done to provide an acceptable level of accuracy. Main challenges: - Quality of data for freight transport	- Emission factors: HBEFA and earlier Artemis are quite complicated systems with even some missing data for some classes. This leads to a great deal of efforts being spent on finding the right emission factors and testing the sets of factors used in the system. - Guidance on a QA/QC system
Milan	Main difficulties: - National/regional statistical data are not always	- Improvement of emission factors and activity data

	available for the current EI reference year. -relevant traffic flow data difficult to obtain from some institutions (in particular from highways licensees/concessionaries)	
Paris	Main difficulties: - The evolution of the format for the data files - Sustainability of the data	- Better emissions factors and activity data
Ploieşti	Main difficulties: - Data collection, - Checking of the data source, - Checking for errors and transmission of data, - Checking for proper registration, units and conversion factors - Fugitive sources – in construction activity Main challenges: - Completeness of the EI (fugitive sources)	- Using methods based on direct measurement (continuous) can provide a high degree of data certainty when measurements are made correctly and with performance devices. - The use of “class A” emission factors with a small probability error - Inventory training
Plovdiv	Main difficulties: - transport and residential heating due to lack of: 1. specific emission factors at a national level; 2. precise data about quantity and type of fuels used in the household sector with localization of emission sources; 3. sufficiently long-lasting monitoring of the intensity of traffic for obtaining representative data series.	- Municipality administration staff training for EI implementation – training and guidance - Creation of sufficiently representative data base for transport activity - Development of specific emission factors at a national level for transport and household sector - Improving the emission factors and emission inventory for residential heating on a local level - Setting up a register for the household heating installations using solid fuel – coals and biomass.
Prague	Main difficulties: - Lack of precise traffic load data, fleet composition and emission factors Main challenges: - Traffic and fugitive emissions	- Improvement of emission factors and activity data
Vienna	Main difficulties: - High spatial and a minimum (e.g. monthly) temporal resolution of the EI, reflecting the highly variable emission patterns in cities, are needed for air quality management in contrast to national inventories . Main challenges: - Costs - Uncertainties of emission factors (esp. for fugitive sources)	- Scientific research concerning emission factors (e.g. diffuse emissions, real life emission factors for domestic heating)
Vilnius	Main difficulties: - Data of residential sources, - No adapted data and information about aviation, - More frequent data on non-exhaust traffic emissions, - No data about stationary sources timescales	- Inventory training, - improving emission factor and methodology, - relevant laws

“-“: no information provided

Confidentiality of input data is only of minor concern to the cities. Where information was provided by the cities, emission data are publicly available. Data for large point sources or received by third parties are in most cases confidential, and are thus aggregated to census units and/or a gridded representation (Table 11).

Table 11: Confidentiality

City	Difficulties
Antwerp	Emission data for enterprises in the port area and some smaller industrial zones
Berlin	No
Madrid	Emission data are public, but the activity data for each large point source is confidential
Malmö	Possibly in very few cases of handling confidential emission data from certain companies. All other data are either open source or anonymized as a grid source.
Milan	-
Paris	Yes, for industrial point sources
Ploieşti	All data received by economic agents are confidential
Plovdiv	No
Prague	No
Vienna	All survey data that relate to point sources are confidential. On the other hand, there are no confidentiality restrictions for emission inventory results in which point sources and line sources are aggregated to census units and/or to a 100x100 m^2 grid system.
Vilnius	Emissions from stationary sources, timescales, data from regional vehicles database (non-exhaust traffic emissions)

"-": no information provided

2.4 Integration across environmental areas

In most cities, the authorities responsible for the preparation of the GHG (and air pollutant) inventory and for the development of air quality management strategies cooperate closely. In three cases no local climate change measures are foreseen (Table 12). However, only five cities consider completely air quality issues in climate change policies and vice versa (Table 13). At least the input data for air quality management and climate change policies are the same in most cases (Table 14).

Table 12: Greenhouse Gases

City	Authority responsible for GHG	Local GHG reduction measures
Antwerp	Same authority	Document "City of Antwerp: Local contribution to global climate change"
Berlin	Statistic units (CO_2 calculation);	Berlin energy programme / climate task force: http://www.stadtentwicklung.berlin.de/planen/stadtentwicklungsplanung/de/klima/download.shtml BERLIN (2006): Landesenergieprogramm BERLIN (2011): Klimaschutzbroschüre
Madrid	Same unit (Sustainability General Directorate)	MADRID (2008): Plan for the Sustainable Use of Energy and Climate Change Prevention 2008-2012; new plan 2013 – 2020 under development Party to the Covenant of Mayors and thus commitment to a GHG reduction for 2020.
Malmö	Under development	Local measures have been implemented
Milan	Same unit	-
Paris	Same authority	MAIRIE DE PARIS (2012): Plan Climat de Paris
Ploieşti	Same authority (NEPA Bucharest)	Information provided for national measures
Plovdiv	no GHG EI on city level	No local measures implemented
Prague	Only on national level	No local measures implemented
Vienna	Close cooperation with different department within City of Vienna	Yes, (WIEN 2009): KLiP Vienna, http://www.wien.gv.at/umwelt/klimaschutz/programm/
Vilnius	GHG project will start in 2013	GHG project will start in 2013

"-": no information provided

Table 13: Consideration of air quality issues in climate change programs and vice versa

City	AQ in climate change	Climate change in AQ
Antwerp	partly	partly
Berlin	✓	✓
Madrid	✓	Partly
Malmö	-	Partly
Milan	-	✓
Paris	✓	✓
Ploieşti	✓	✓
Plovdiv	Not applicable (no climate change program)	Not applicable (no climate change program)
Prague	Not applicable (no climate change program)	Not applicable (no climate change program)
Vienna	✓	✓
Vilnius	Not applicable (no climate change program)	Not applicable (no climate change program)

"-": no information provided

Table 14: Same input data for different environmental topics

City	Input data across topics
Antwerp	✓
Berlin	✓
Madrid	✓
Malmö	✓ (traffic data)
Milan	✓ (regional territorial plan)
Paris	✓
Ploieşti	unknown
Plovdiv	✓
Prague	✓ (spatial planning)
Vienna	✓
Vilnius	✓

2.5 Updates, guidance and references

The frequency of complete updates of the whole emission inventory data series is shown in Table 15: The majority of emission inventories is updated on an annual basis, although the frequency for certain sources varies from one to five years. In some cases, an update depends on significant changes to specific sources. The latest emission data available also show a broad time range between 2005 and 2012.

Table 15: Complete update of whole data series, frequency of updates and latest emission data.

City	Frequency	Last update	Latest emission data
Antwerp	annual	2012	2011
Berlin	mostly annual, small sources every 4 years	2009	2009
Madrid	whenever a substantial change occurs	2012	2010
Malmö	annual, domestic heating every 5 years	2013	2011
Milan	every 2 to 3 years	2011	2008
Paris	three times in five years	2013	2010
Ploieşti	annual	2011	2010
Plovdiv	as required	2011	2011
Prague	annual	2012	2011
Vienna	as required, industry every 5 years	2012	2005 (2010 next year)
Vilnius	traffic, industry: annual; residential heating: every 3 years	2012	2011

For the cities' emission inventory, a recalculation of emission inventory (e.g. due to changes in emission data or methodology) is hardly undertaken in the same way as it is done for national emission inventories (Table 16). The time interval of a recalculation varies from annual to irregular intervals of up to 5 years. Therefore, the time series obtained are not comparable to those in national emission inventory.

Table 16: Recalculation of emission inventory.

City	Recalculation	Fluctuation
Antwerp	Annual	Depending on the pollutant
Berlin	Approx. every 5 years	± 30 %
Madrid	Annual	Depending on the pollutant
Malmö	Old emission data are not saved in the system for time series. Therefore previous calculations of emissions, put in a time series, reflect both changes in emissions and in methodology. As a consequence, changes in the methodology are implemented quite seldom (every 5 years or less).	Unknown
Milan	A preliminary version is publicly reviewed in order to collect all available information from stakeholders. Thereafter the final version is released. The inventories referring to previous years are currently not recalculated, but a tool to evaluate the emission trends on the basis of new assumption is being developed	Not exactly specified
Paris	Once or twice in five years	-
Ploieşti	Dependent on necessity	-
Plovdiv	Traffic activity twice a year, industry once a year, residential heating as needed	Up to 5 %
Prague	Whenever necessary due to changes in traffic routes or volumes	Dependent on magnitude of changes in volumes
Vienna	Irregular updates depending on new input data, methods and models; typically 2 to 3 updates within 5 years	± 10 % (activity data)
Vilnius	Variable	30 %

"-": no information provided

The main references used in developing the emission inventory are the IPCC guidance documents for GHG and the EMEP/EEA air pollutant emission inventory guidebook ([2]) for air pollutants (Table 17). For traffic emissions either HBEFA 3.1 ([3]) or COPERT 4 ([4]) is used. In Prague a program called MEFA ([5]) is used.
The estimation of traffic volumes as well as the modelling of traffic (Table 18, Table 19) is rather diverse.

Table 17: General references used

City	References
Antwerp	CR-CORINAIR, CS-country specific, RS-region specific, OTH-other, PS-plant specific, M-modelled, D-default
Berlin	Traffic: IMMIS-em: (modelled), HBEFA 3.1 (www.hbefa.net) Tyre abrasion and resuspension: DÜRING & LOHMEYER (2004) Evaporative losses: HBEFA3.1 Heating: UMEG (2000) Construction machinery: IFEU (2004)
Madrid	GHG: IPCC; AP: EMEP/CORINAIR; traffic: COPERT 4
Malmö	-
Milan	GHG: IPCC; AP: EMEP/CORINAIR
Paris	national guidance CITEP (http://www.citepa.org/images/III-1_Rapports_Inventaires/OMINEA_9eme%20edition%202012sec.zip) and EMEP/CORINAIR
Ploieşti	GHG: IPCC; AP: EMEP/CORINAIR
Plovdiv	CR-CORINAIR, HBEFA, CS-country specific, PS-plant specific
Prague	EMEP/CORINAIR, national guidance for traffic emissions
Vienna	EMEP/CORINAIR, HBEFA
Vilnius	National guidance: (http://www3.lrs.lt/pls/inter3/dokpaieska.showdoc_l?p_id=332995&p_query=&p_tr2=)

"-": no information provided

([2]) http://www.eea.europa.eu/publications/emep-eea-emission-inventory-guidebook-2009
([3]) http://www.hbefa.net
([4]) http://www.eea.europa.eu/publications/copert-4-2014-estimating-emissions
([5]) http://www.mzp.cz/cz/vypocet_emisnich_faktoru

Table 18: References and models used for traffic emissions

City	Emission factors	Model
Antwerp	COPERT	MIMOSA (based on COPERT)
Berlin	HBEFA 3.1: exhaust, evaporative DÜRING & LOHMEYER (2004): non exhaust	IMMIS-em
Madrid	COPERT 4	COPERT IV
Malmö	HBEFA 3.1	*No*
Milan	COPERT 4	INEMAR (INventario EMissioni ARia) http://www.inemar.eu/xwiki/bin/view/Inemar/
Paris	COPERT 4	Traffic model which has been build during European project (HEAVEN, http://heaven.rec.org/Introduction.html)
Ploieşti	COPERT 4	Model by NEPA
Plovdiv	CORINAIR,HBEFA	AUSTAL, PROKAS_B
Prague	MEFA – výpočet emisních faktorů www.mzp.cz/cz/vypocet_emisnich_faktoru	MEFA 06 - model
Vienna	HBEFA 3.1	VISUM, operated by Traffic Planning Authority
Vilnius	Data from regional vehicles database, default	ADMS-Urban EMIT toolkit

Table 19: Estimation of traffic volumes

City	Traffic volume
Antwerp	Traffic activity data (hourly, counting points for heavy/light traffic), vehicle fleet data (number of vehicles per vehicle category), mileages, average speed, emission factors
Berlin	Daily traffic volume, fleet composition based on license plate km driven from www.vmzberlin.de
Madrid	Local traffic management model. Study on circulating fleet.
Malmö	Measured traffic data
Milan	Traffic flow monitoring and simulation on a road network. Mileage vs. vehicle age. Fuel sale statistics.
Paris	Traffic model, counting loops, regional survey of commuter traffic
Ploieşti	Fuel use
Plovdiv	1h Traffic counting, standard characteristics for daily and weekly traffic
Prague	TSK-UDI Counting campaigns for Prague, VISUM model. Fuel sold for country
Vienna	VISUM model, HBEFA 3.1, "level of service" calculations
Vilnius	ADMS-Urban EMIT toolkit

Internal guidance documents for supporting the emission inventory team are available in four cities (Table 20). These guidance documents might be used inter alia when developing an emission inventory (chapter 3).

Table 20: Internal guidance

City	Guidance
Antwerp	No
Berlin	No
Madrid	Yes, on request
Malmö	GUSTAFSSON (2007), "Building and validation of an air pollution emission database for Skane", licenciate thesis, Lund University
Milan	Methodology and information available at: http://www.inemar.eu/xwiki/bin/view/InemarDatiWeb/Metodologia+utilizzata
Paris	No
Ploieşti	Report - guidance on developing local and national emission inventories in conformity with EMEP/EEA – 2009
Plovdiv	No
Prague	URM Internal Guidelines for EI "Jednotné datové úložište REZZO Praha"; CHMI Internal Guidelines for REZZO "Provozní řád datové správy emisních údajů ISKO"
Vienna	No
Vilnius	No

2.6 Use of emission inventory and public accessibility

Technical documentation is available in seven cities (Table 21). The results of the emission inventory are publicly available in all but two cities (Vienna and Vilnius, Table 22). In most cases the results are available as tables or pie charts. In Berlin, traffic emissions are presented via a GIS-based website, where these data can be selected from a variety of environmental data.
Emission data are available for interested parties from all cities, at least in a summarized way. Examples of the representation of emission inventory results are shown in Figure 1 (Berlin), Figure 2 (Czech Republic), and Paris (Figure 3).

Table 21: Availability of technical documentation

City	Documentation
Antwerp	Available on request
Berlin	No
Madrid	Available on request
Malmö	GUSTAFSSON (2007)
Milan	http://www.inemar.eu/xwiki/bin/view/InemarDatiWeb/Metodologia+utilizzata
Paris	AIRPARIF website: http://www.airparif.asso.fr/_pdf/publications/Rinventaire_2005_201004.pdf
Ploieşti	No
Plovdiv	Yes
Prague	http://portal.chmi.cz/files/portal/docs/uoco/oez/emisnibilance_CZ.html
Vienna	No
Vilnius	No

Table 22: Availability of emission inventory and summarized results

City	Emission data
Antwerp	Annual report 'Lozingen in de lucht 1990-2010/2000-2011' on the VMM website: http://www.vmm.be/pub/jaarverslag-lozingen-in-de-lucht-2000-2011/rapport-lozingen-in-de-lucht-2000-2011/view (available only in Dutch)
Berlin	http://www.stadtentwicklung.berlin.de/umwelt/umweltatlas/ http://www.stadtentwicklung.berlin.de/umwelt/umweltatlas/db311_06.htm
Madrid	A brief report was published: http://www.madrid.es/medioambiente MADRID (2012) (only available in Spanish)
Malmö	Annual report and a web tool: http://malmo.se/Medborgare/Miljo--hallbarhet/Miljolaget-i-Malmo/Miljo--och-livsmedelsrapporter/Luft.html
Milan	http://www.inemar.eu/xwiki/bin/view/Inemar/HomeLombardia http://www.inemar.eu/xwiki/bin/view/InemarDatiWeb/Fonti+dei+dati
Paris	AIRPARIF website: http://www.airparif.asso.fr/_pdf/publications/inventaire-emissions-idf-2010-note-121217.pdf
Ploieşti	Emission inventory for Prahova county (total emissions per SNAP category): http://apmph.anpm.ro/articole/inventare_emisii_de_poluanti_atmosferici-53
Plovdiv	Partly in air quality progamme: http://www.plovdiv.bg/plovdiv/index.php?option=com_content&view=article&id=302&Itemid=329%3F%3Dbg&lang=bg
Prague	http://portal.chmi.cz/files/portal/docs/uoco/oez/emisnibilance_CZ.html http://portal.chmi.cz/files/portal/docs/uoco/web_generator/plants/index_CZ.html www.geoportalpraha.cz www.premis.cz/atlas
Vienna	No
Vilnius	No

Figure 1: Traffic emissions in Berlin (source: http://www.stadtentwicklung.berlin.de/umwelt/umweltatlas/db311_06.htm)

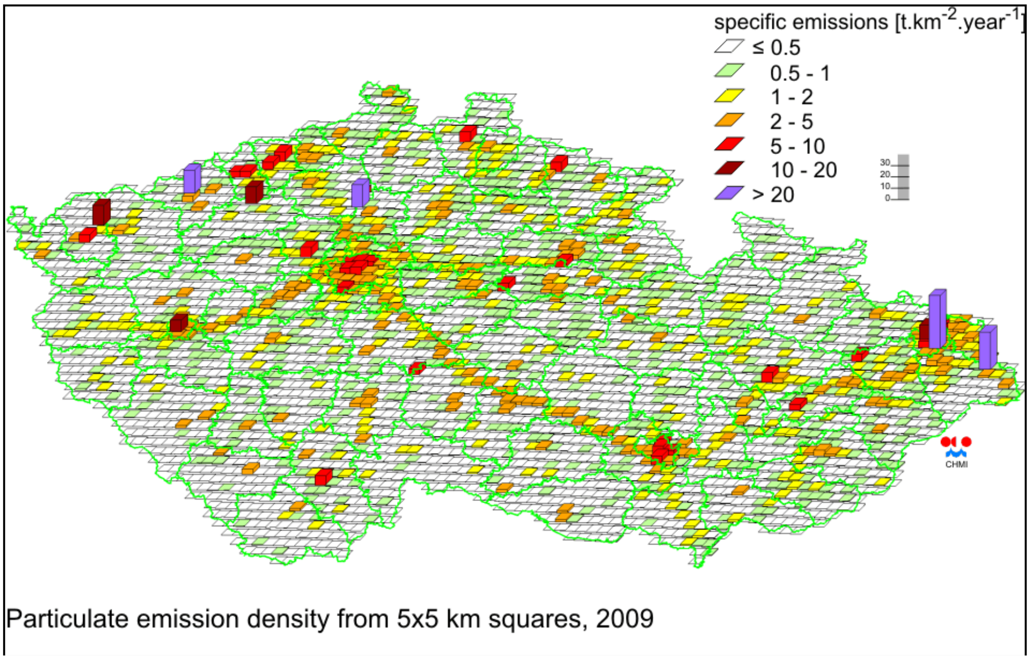

Figure 2: PM emissions in the Czech Republic 2009 (source: CHMI)

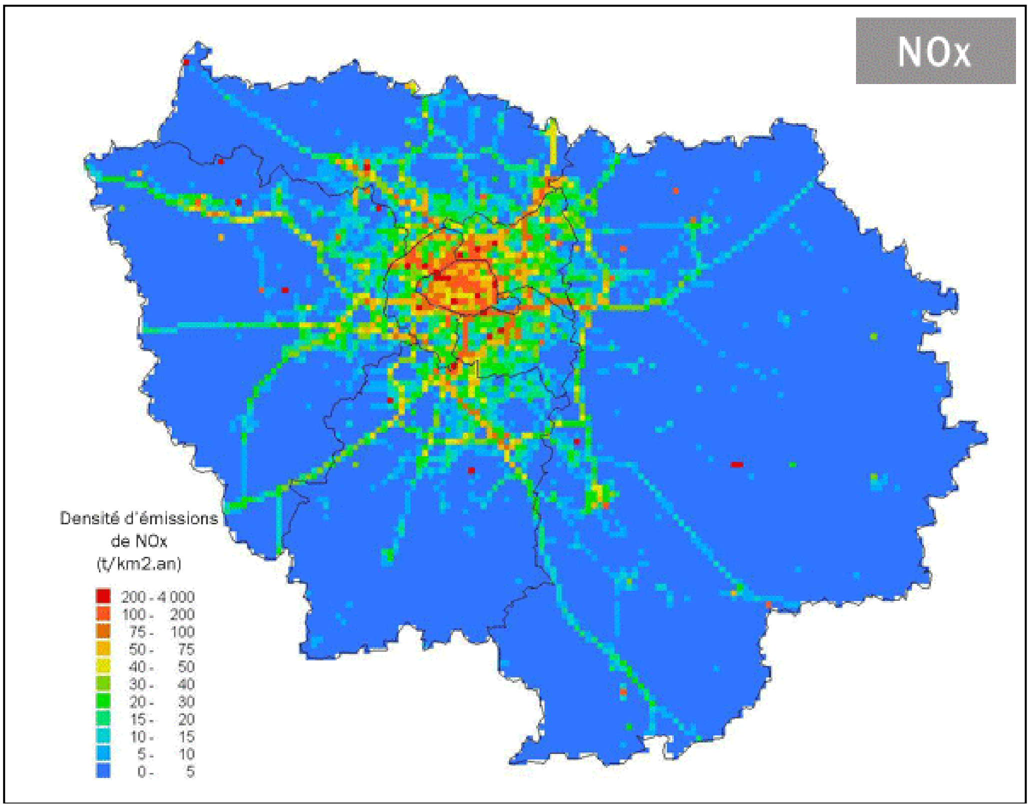

Figure 3: NO_x emissions in l'Île-de-France (source: http://www.airparif.asso.fr/etat-air/air-et-climat-bilan-emissions)

Emission inventories are used in all cities in order to identify measures for air quality improvement (except Plovdiv) and for modelling purposes (Table 23). The identification of emission sources is another application used in most cities.

Table 23: Main use of emission inventory

City	Identification of sources	Modelling	Identifying measures	Other
Antwerp	✓	✓	✓	
Berlin	✓	✓	✓	
Madrid	✓	✓	✓	Monitoring of policies' targets; sustainability index
Malmö	×	✓	✓	for graphic representation of sources (identification beforehand)
Milan	✓	✓	✓	
Paris	✓	✓	✓	
Ploieşti	✓	✓	✓	
Plovdiv	×	✓	×	
Prague	✓	✓	✓	
Vienna	✓	✓	✓	
Vilnius	✓	✓	✓	

Nine out of the eleven cities have notified a time extension. In three cities, the emission inventory has not been used for the time extension notifications (Table 24).

Table 24: Use of emission inventory (EI) for time extension notifications

City	Use of EI
Antwerp	Not used
Berlin	✓
Madrid	✓
Malmö	*No time extension necessary*
Milan	✓
Paris	Not used
Ploieşti	Not used
Plovdiv	✓
Prague	✓
Vienna	✓
Vilnius	*No time extension notified*

The impact of measures is reflected in eight emission inventories, at least for traffic measures (Table 25). In one city specific studies are undertaken.

Table 25: Quantification of changes due to actions

City	Quantification of change
Antwerp	✓
Berlin	Traffic data and fleet composition allow for a detailed emission estimate, which leads to detailed ambient air pollution calculations
Madrid	In general not. Specific studies are undertaken to evaluate the impact of measures
Malmö	For specific sectors (e.g. traffic)
Milan	✓
Paris	✓
Ploieşti	*No. An emission monitoring program would be necessary*
Plovdiv	✓
Prague	✓
Vienna	✓
Vilnius	-

"-": no information provided

There is hardly any information exchange between European cities concerning the methodology used. Nonetheless, some cities participate in European projects where experiences are discussed (Table 26).

Table 26: Exchange of information with other European cities

City	Methodology	Experience
Antwerp	*No exchange of information*	Covenant of Mayors
Berlin	Source apportionment approach	CityDelta (http://aqm.jrc.ec.europa.eu/citydelta/), HEAVEN (http://cordis.europa.eu/search/index.cfm?fuseaction=proj.document&PJ_RCN=5196314)
Madrid	*No exchange of information*	c40 network and Carbon Disclosure Project (https://www.cdproject.net/en-US/Pages/HomePage.aspx)
Malmö	*No exchange of information*	*No exchange of information*
Milan	-	-
Paris	Yes, within the CITEAIR II project*	Yes, within the CITEAIR II project
Ploieşti	*No exchange of information*	*No exchange of information*
Plovdiv	*No exchange of information*	*No exchange of information*
Prague	*No exchange of information*	CITEAIR II project
Vienna	Within Austria	Within Austria
Vilnius	*No exchange of information*	*No exchange of information*

"-": no information provided
* http://www.citeair.eu/fileadmin/Deliverables_and_documents/Guidebook_Integrated_Emission_Inventories_-_final.pdf

The annual resources for compiling city level emission data and for updating the emission inventory vary considerably between the cities: they range from about 0.25 to 3 person years (Table 27).

Table 27: Annual resources

City	Resources
Antwerp	about € 100,000 for additional research
Berlin	-
Madrid	2 full time technicians
Malmö	1.5 full time positions
Milan	3 full time positions
Paris	150 person days
Ploieşti	-
Plovdiv	-
Prague	400 person hours
Vienna	200 person hours staff + approx. € 25,000
Vilnius	two to six person months

"-": no information provided

3. Conclusions

Based on the replies of the participating cities to the questionnaire, several central questions may be answered:

1. Are the emission inventories used for modelling, source apportionment and management practices, and thus support the implementation of air quality (AQ) policies?

   The emission inventories used in the eleven cities clearly support the implementation of the AQ policies relevant for the local and regional scale. The emission inventories are used for modelling, for identifying sources of elevated pollutant levels and suitable measures, and partly also for quantifying and monitoring their impact.
   One of the participating cities is currently in the process of developing an emission inventory and an air quality model, which has been initiated by the Air Implementation Pilot, so the Pilot project is regarded as highly beneficial.

2. Are interactions between different policy areas sufficient? How can interactions be improved?

   There is a reasonable amount of interaction between policy areas such as air pollution, climate change and noise. However, GHG are not covered in all emission inventories; climate change policies are not considered in air quality programs in all cases and vice versa, even though the input data are mostly the same.
   The first step in improving this interaction would be to combine the different inventories, or to include GHG in the emission inventories. Based on common underlying data, a common database and thereby a common emission inventory, an integrated programme to reduce GHG emissions and air pollutants could be developed.

3. Are the emission inventories data available for ETC/ACM and other institutions?

   Summarised results of the emission inventory are readily available for most cities. The underlying emission inventory data themselves are usually not available. Therefore negotiations on ways to establish interfaces to the emission inventory data should start in parallel with a process to harmonize the emission inventories across different cities. This process could be guided by the EEA in close cooperation with the cities.

4. Are the emission inventories comparable to each other and to national inventories? Which aspects are comparable, which not?

   Currently, the emission inventories are not directly and easily comparable with each other due to different source classification schemes, pollutants covered, spatial resolutions, years of latest data, emission factors, inclusion of fugitive sources and the underlying type of database. The QA/QC procedures in place are rather different as well. For this reason only some emission inventories are comparable to regional inventories or to emission inventories from other cities within a member state. Generally speaking, the cities' inventories are also not comparable to national emission inventories. Furthermore, the effect of measures is only visible in some but not all emission inventories.

5. Can these emission inventories be used for certain tasks on a European scale? If not, how much effort would be necessary to make the emission inventories comparable and usable on a European scale?

   In their current state, the European emission inventory could mainly be used for a qualitative assessment of relevant pollutant sources in different cities, as they differ in many aspects (see above). Using the emission inventory in a common modelling exercise or quantitative source apportionments would thus require a considerable effort. The actual effort required would depend on the flexibility of the systems currently used; the completeness of the emission inventory with respect to pollutants and sources; the being up-to-date of the emission inventory; and the spatial resolution it uses.

6. How can cities be supported to set up an emission inventory and to improve comparability?

   All but one city have already established an emission inventory. Different aspects in these emission inventories can be regarded as best practice, so city administrations should make beneficial use of this vast experience when establishing an emission inventory.
   A guidance document might be set up in close collaboration with the cities to improve the comparability of emission inventories. This harmonization effort concerns all aspects of the emission inventories, namely source categories (and their definitions), the methodology and the emission factors. Moreover, the effect of measures on emissions should be made visible in all emission inventories. A working group within the Air Implementation Pilot might develop a process for harmonization in cooperation with the cities.
   PM_{10}, $PM_{2.5}$ (and partly benzo(a)pyren) are of major concern in many cities. However, emission factors for fugitive sources should be improved and uncertainties of emission factors for these pollutants reduced.
   Nonetheless, the foreseen use of the emission inventories on a European scale should be laid down in more detail, as it will have a determining influence on the structure and methodology of the emission inventories.

7. What are the main challenges for the cities to improve the emission inventory?

   The cities' main challenges relate to the uncertainties in emission factors for wood burning, construction activity and fugitive sources in general, as well as to real world emissions and future vehicles (e.g. Euro 5 and 6). In some cases the low quality of input (activity) data and difficulties to obtain these data pose a challenge to the cities.
   One of the main future challenges will be to develop a more standardized methodology for the development of urban emission inventories.

8. Which suggestions can be made to improve the emission inventory?

   The cities suggested improving the emission inventory by providing common emission factors, by simplifying the databases for emission factors (e.g. HBEFA) and especially by improving the quality of emission factors of the sources. The improvement of emission factors might be achieved through common research programs.
   The cities might be supported with guidance on setting up QA/QC systems, by training and guidance on compiling activity data and on emission inventories in general. A regular exchange of best practice and close cooperation with FAIRMODE ([6]) might be helpful as well.
   The EEA could facilitate these processes by chairing them and providing further support to the member states.

([6]) Forum for Air quality Modelling: http://fairmode.ew.eea.europa.eu/

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Annex 1: Questionnaire to pilot cities

Assessing emission inventories at the local level

Questionnaire to partner cities of the Air Pilot Study

The aim of the Air Pilot Study sub-project on local emission inventories is to compare emission inventories from the partner cities to assess their ability to inform the development of air quality management plans (including addressing specific exceedances and source apportionment for concentration levels) to help identify mitigation measures.

Objectives

1. **Describe** the quality and level of detail of the **emission inventories** and source apportionment data for air quality in the selected cities (with a potential focus on road-transport and other diffuse sources).
2. **Assess inventory comparability** across the selected cities of the pilot study, which may identify examples of good practice, needs for improved guidance, links with local climate change mitigation measures, etc.
3. **Explore with the nominated city contacts the possible sharing of local emission data with EEA**, at least for ad-hoc needs.

Steps

a) Distribution of questionnaire on the local city emission inventories to the nominated city contacts (1 June 2012)

b) Presentation of emissions questionnaire and discussion at the Air Quality Pilot kick-off meeting (6-7 June 2012)

c) Completion of questionnaire by the nominated city contacts (30 June 2012)

d) Follow-up interviews/questions (by telephone/email) if needed, to further understand the city experiences in developing and using local emission inventories (June/July)

e) Drafting of report assessing the ability of local emission inventories to inform air quality assessments, management practices, source apportionment, etc. (September 2012)

Outputs

EEA will be assisted in the study by experts from its European Topic Centre on Air Pollution and Climate Change Mitigation (ETC/ACM). These experts will compile a draft working paper that will provide:

- A description of the local inventories in the pilot cities,
- Their comparability,
- Conclusions about how the quality of city-level inventory data might be improved,
- The potential need for additional guidance, technical support etc.

A qualitative assessment will provide comment on the potential ability of the selected city emission inventories to be used, for example in AQ modelling activities, in source apportionment studies and to inform/develop management practices, etc.

The draft report will be shared with the nominated city contacts and will provide a starting point for the sharing of experiences concerning local emission inventories.

Contacts

ETC/ACM questionnaire leader (& contact for any questions concerning the questionnaire)

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Please return the completed questionnaire by 30 June 2012 to the three email addresses provided above.

Questionnaire form

The questionnaire consisted of the following sections numbered from 0 to 6:

0. Contact details

0	Please provide the contact details of the responsible authority in case of further enquiries (in case it is different from the address already provided. For internal use only)	
0.1	Name	
0.2	Organisation	
0.3	Address	
0.4	Telephone	
0.5	Email address	

1. General questions

1.1	Which pollutants are included in the Emission Inventory (EI)
	list of all pollutants (both air pollutants and greenhouse gases if relevant)
1.2	In general do you estimate your emissions using a 'bottom up' approach – or do you downscale from e.g. a regional or national emission inventory?
	descriptive text
1.3	Which area is covered by the EI?
	km x km, Air Quality Zone, or administrative unit
1.4	What is the spatial resolution of the EI?
	m x m
1.5	Air quality modelling often requires input data on hourly or daily basis, whereas emission inventories are most often based on annual data. If emission data is provided on smaller time scales as annually, which timescales are provided? How is the downscaling done?
	descriptive text
1.6	How often are input data and emission data of relevant sectors (traffic, residential heating, industry) updated?
	traffic: once a year; every x year *residential heating: once a year; every x year* *industry: once a year; every x year*
1.7	When was the EI last updated (complete update of whole data series)?
	date
1.8	For what year is the latest emissions data available in the inventory?
	date
1.9	Do you use any general reference sources (national, international etc) to guide the methods and emission factors used in your inventory? If yes, which?
	descriptive text (hyperlink, website, report)
1.10	Are internal guidelines or manuals used for the city authorities to prepare the inventory?
	hyperlink, website, report
1.11	Approximately how many resources do you spend each year on emissions data?
	estimate of staff time – estimate of budget (if contractors are used)

2. Technical questions

2.1	What sources are included in your emission inventory		
2.1.1	Stationary sources (e.g. large power plants)		*yes/no – descriptive text*
2.1.2	Large industrial sources		*yes/no – descriptive text*
2.1.3	Small industrial and commercial sources		*yes/no – descriptive text*
2.1.4	Residential sources		*yes/no – descriptive text*
2.1.5	Road transport		*yes/no – descriptive text*
2.1.6	Other transport (railways, aviation etc)		*yes/no – descriptive text*
2.1.7	Agriculture		*yes/no – descriptive text*
2.1.8	Fugitive sources		
2.1.8.1		non-exhaust traffic emissions (road, tyre, brake wear, particulate matter resuspension, evaporative losses from vehicle tank)	*descriptive text*
2.1.8.2		construction activity, generators etc	*descriptive text*
2.1.8.3		solvents	*descriptive text*
2.2	Which classification system do you use to describe the different source sectors (SNAP, NFR, CRF, any other?)?		
	descriptive text		
2.3	Which general data sources are used for emission factors?		
	(e.g. CR-CORINAIR, CS-country specific, OTH-other, PS-plant specific, M-modelled, D-default)		
2.4	Road transport sector		
2.4.1	What is the source of the emission factors used?		*descriptive text*
2.4.2	If you use a model to estimate road transport emissions, which model is used?		*descriptive text*
2.4.3	How do you estimate road traffic volumes, driving km, fuel use etc? (esp. NO_x, NO_2)		*descriptive text*
2.5	Recalculations of input data		
2.5.1	How often do recalculations of input data leading to changes in the time series of emissions, or methodological changes occur?		*descriptive text*
2.5.2	How high are data fluctuations due to these changes		*%*
2.6	What type of spreadsheet or database (Oracle, MS Access,...) is used?		
	descriptive text		

3. Documentation and information for the public

3.1	Is a technical documentation of the EI, its methods and description of data sources etc available?
	hyperlink, website, report
3.2	Is the emissions inventory data published?
	hyperlink, website, report
3.3	Is a report available describing the main results of the EI?
	hyperlink, website, report
3.4	If not, is the emission inventory/data accessible to interested parties upon request?
	descriptive text

4. Quality assurance and quality control

4.1	Please describe the QA/QC procedures in place – how do you ensure the quality of your emission inventory?
	descriptive text
4.2	Are the results of the city EI comparable to emission data derived from other sources such as regional inventories?
	descriptive text
4.3	Is the EI of your city comparable to the EI of other cities within your Member State?
	descriptive text
4.4	What difficulties did you encounter in taking stock, e.g. compiling relevant data sets (on city level), concerning data quality or other issues?
	descriptive text
4.5	Are there any issues of data confidentiality?
	descriptive text
4.6	What specific actions do you think would be useful to improve the quality of your inventory? *(e.g. inventory training, improved guidance, better emission factors, activity data etc)*
	descriptive text

5. Integrating across environmental areas

5.1	Does the same authority, which is involved in the development of air quality management strategies, compile or contract GHG and air pollutant emissions? If not, how do they cooperate and how is (background) information exchanged?
	descriptive text
5.2	Does your city also estimate GHG emissions?
	descriptive text
5.3	Many cities have targeted actions to reduce GHG emissions. Has your city implemented local measures to reduce GHG emissions? If yes, please provide a list of measures, link to documents etc
	descriptive text
5.4	If local GHG reduction measures have been implemented in your city, was the potential impact on air quality taken into account? (if relevant)
	descriptive text
5.5	Conversely, does the introduction of local air quality measures also take their impacts on GHG emissions into account?
	descriptive text
5.6	Is the same input data (e.g. traffic model and activity data) used for different activities such as noise maps, spatial land-planning etc.?
	descriptive text

6. Other

6.1	What is the emission inventory mainly used for?	
6.1.1	identification of sources of elevated pollutant levels in ambient air	*% – descriptive text*
6.1.2	ambient air quality modelling	*% – descriptive text*
6.1.3	identifying mitigation measures to reduce pollutant levels	*% – descriptive text*
6.1.4	other	*descriptive text*
6.2	Do you consider your emission inventory sensitive enough to quantify changes in emissions that occur after implementing actions at the local scale? If not, how do you quantify the effects of different emission reduction policies?	
	descriptive text	
6.3	Has the inventory been used for time extension notifications (if relevant)?	
	descriptive text	
6.4	Is the methodology exchanged with other cities within Europe?	
	descriptive text	
6.5	Do you already exchange experiences on local emission inventories with other European cities?	
	descriptive text, names of networks etc	
6.6	What do you consider are the difficulties and main challenges in developing an EI for your city?	
	descriptive text	
6.6	Your suggestions for improving the consistency and comparability of EI in European cities	
	descriptive text	

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Annex 2: Abbreviations of pollutants

As .... Arsenic

B(a)P........... benzo[a]pyrene
BaA............. benz[a]anthracene
BahA........... benzo(a,h)anthracene
BaP .... benzo[a]pyrene
BbF .... Benzo(b)fluoranthene
BC............... Black carbon
benzene....... benzene
BghiPe .... benzo(g,h,i)perylene
BjF.............. Benzo[j]fluoranthene
BkF .... Benzo(k)fluoranthen

Cd .... Cadmium
CH_4 .... Methane
CO .... carbon monoxide
CO_2 .... carbon dioxide
Cr................ Chromium
Cu .... Copper

DIOX.......... Dioxine

FluorA .... fluoranthene

HCB............ Hexachlorobenzene
HCH .... Hexachlorocyclohexane
HCl .... Hydrochloric acid
HF............... Hydrogen fluoride
HFCs........... hydrofluorocarbons
Hg............... Mercury

Indpy........... indeno(1,2,3-cd)pyrene

Mn .... Manganese

N_2O .... Nitrous oxide
NH_3 .... Ammonia
Ni .... Nickel
NO_2 .... nitrogen dioxide
NO_x .... nitrogen oxides

PAH .... Polycyclic aromatic hydrocarbons
Pb............... Lead
PCB............ Polychlorinated biphenyl
PCDD_F .... Polychlorinated dibenzo-p-dioxins and Polychlorinated dibenzofurans
PCE............ perchloroethylene
PCP .... Pentachlorophenol
PFCs .... perfluorinated compounds
PM_1 .... particulate matter < 1 µm
PM_{10}........... particulate matter < 10 µm
$PM_{2.5}$ .... particulate matter < 2.5 µm
POPs .... persistent organic pollutants

Se .... Selenium
SF_6 .... Sulfur hexafluoride
SO_2............. sulfur dioxide

TCB .... Trichlorobenzene
TCE............ trichloroethylene
TCM .... Trichloromethane
TSP .... Total suspended particles

V .... Vanadium
VOC........... Volatile organic compounds

Zn............... Zinc