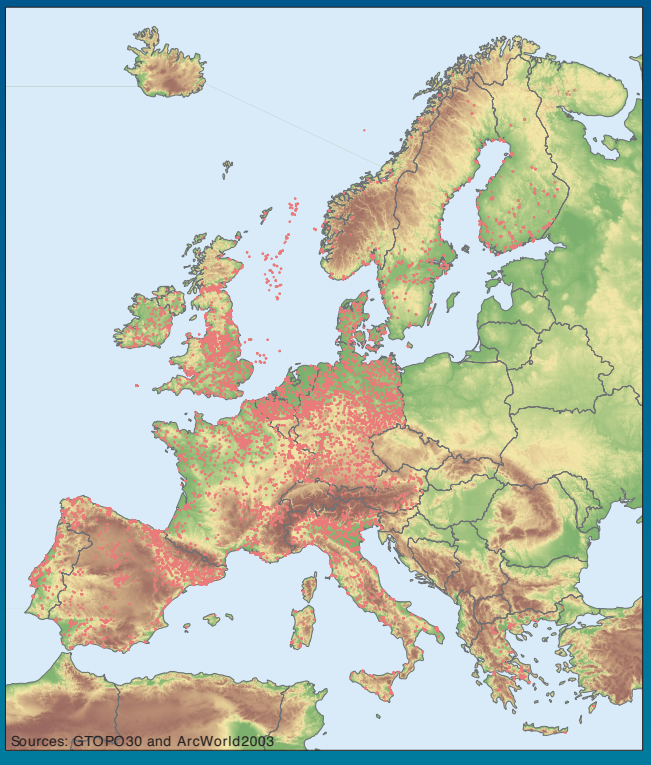
EPER

European Commission

European Pollutant Emission Register



EPER review report

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Executive summary

This is the first EPER Review report, as requested by Article 3.3 from the Decision 2000/479/EC on the implementation of a European Pollutant Emission Register (EPER) according to Article 15(3) of the EU Directive 96/61/EC on Integrated Pollution Prevention and Control (IPPC).

The report is dealing with two review aspects for the first data delivery respectively:

- The evaluation of the data collection and reporting process;
- The evaluation of the completeness, the contents and the quality of the data.

In the evaluation, the link between reported emissions and their origin (countries, industrial activities, type (receiving media), determination methodology) was analysed. Based on these evaluations, conclusions were drawn, leading to recommendations for further improvement of the EPER data collection and the reporting process, the completeness and the quality of data for the next reporting period.

Conclusions on the data collection and reporting process

This review has shown the following:

- Strengths:
  - The first data set in the European Pollutant Emission Register, compiled in 2003
    - stores emission data for 9387 individual facilities in all Member States of the European Union and Norway;
    - contains 23113 emission records for these facilities; two thirds of these are emissions to air and one third emissions either directly or indirectly to water.

  The first EPER database therefore is a large and comprehensive source of information on the environmental pressure as caused by large and medium-sized individual facilities that will prove its usefulness to both the general public, NGOs, industry and other lay and professional users.

- The procedure to collect this large amount of data has worked reasonably well:
  - all Member States were able to deliver EPER data to the Commission;
  - most Member States have established additional legislation to ensure the data flow from individual facilities towards the authorities and the EPER reporting process;
  - all national experts have used the tools as provided by the Commission (both the Guidance document and the software tools) and regard these tools as very useful;

  - the use of the validation tool has resulted in the absolute absence of any corrupt data in the sense of non-existing pollutants, activities or other attributes, showing that an electronic data delivery procedure is feasible and well suited for the reporting of large amounts of environmental data.

  The Member States have generally appreciated the tools as provided by the Commission
- Weaknesses
  - The first data set of EPER should be used with care since
    - not all Member States were able to submit complete data sets. Some countries do not report any data for some activities, e.g. pig and poultry farms, landfills as well as surface treatment;
    - both facilities and national and regional authorities in the Member States had sometimes difficulties in finding the appropriate methodology to determine the emissions of certain pollutants;
    - it appears that Member States have understood the quality indicators "measured", "estimated" or "calculated" as defined in the Guidance document in different ways, which hinders the interpretation of the quality of the data in the database.
  - The data collection and reporting procedure encountered a few problems and difficulties
    - some Member States indicate that actors in the data collection and reporting process need some more experience in determining emissions and in delivering these in the formats as requested by the EPER guidance; these problems are partly to be seen as start-up problems that might be overcome in future reporting cycles;
    - the EPER software tools were not always compatible with the hard- and software as installed at the Member States' experts desks; the software showed difficulties in older versions and non-English versions of the Windows operating system.
- National reports on the EPER Reporting website were generated by the EEA from the facility reports. This procedure could be also applied in future EPER reporting cycles.

Conclusions on the resulting data

– Users of the data set as now published on the EPER website, can be quite confident that most of the data are reasonably well representing the real emissions at facility level, although they cannot be sure that each and every number is accurate.

– No facilities with main activity “Installations for the production of asbestos or asbestos-based products” were reported. This activity was mentioned as additional activity only for one facility (Volkswagen AG Werk Kassel)

– For nine pollutants (Organotin – compounds, Chloroalkanes (C10-13), Hexachlorobenzene (HCB), Hexachlorobutadiene (HCBD), Hexachlorocyclohexane(HCH), Trichloroethane-1,1,1 (TCE), Trichlorobenzenes (TCB), Brominated diphenylether, Pentachlorophenol (PCP)) 10 or less emissions have been reported.

– Comparison of the data with the expected emission reports on the basis of the “sector-specific sub-lists of pollutants” (tables 4 and 5 in the Guidance Document) shows
  – that most pollutants expected for each of the activities indeed have been reported.
  – a number of pollutants, not marked for a specific activity in the checklists have been reported additionally.

  This information could be used to update the sector-specific pollutant lists. Doing so however is not easy since many facilities comprise more than one activity and pollutants reported but marked in the sub-lists could come from such additional activities.

– Within the framework of this review, only a preliminary and limited analysis could be performed on the accuracy or precision of the data.

The first EPER data set provides all actors in the European Union with a valuable and comprehensive set of data on individual facilities. However using these data for bench marking might be hampered by the fact that no underlying information for the emissions (size of the facility, type of fuel used, technology applied (BAT or other)) is available. It is obvious that a larger facility will in general emit more of the same pollutants, whereas the implementation of BAT might decrease the emissions and the use of another fuel might give rise to the emission of other pollutants.

Recommendations

Over all we conclude that the first EPER reporting was reasonably successful, although a number of starting-up problems have been encountered. Additional attention should be focused on the completeness of the reports by the Member States and for the use of the emission determination methodology.

Member States need to take action to ensure that reporting in the next cycle is complete and covering the agreed reporting period 2004. For some Member States this might mean that additional legal or other provisions must be implemented.

The Commission might consider to improve the existing software tools to make them better portable to the different operational systems as used by the Member States. In addition, both facilities and authorities indicate that a better accessibility to emission determination methods is needed.

The Commission might consider in addition to the information already given in the Guidance Document to further enhance and facilitate the information exchange with expert groups in the framework of international conventions there as are UNECE Convention on Long Range Transboundary Air Pollutants (LRTAP), United Nations Convention on Climate Change (UNFCCC) and the Guidelines of the Intergovernmental Panel on Climate Change (IPCC), Pollutant Release and Transfer Registers (PRTR) as developed under the Århus Convention.

Whether or not the threshold values are set on such a level that indeed about 90 % of the emissions is reported, is very difficult to assess, since emissions below the threshold are not reported and hence not known. Further statistical analyses on the data available might give some information on this matter.

The EPER website could be improved by adding translations to the various official European languages and by reviewing part of the meta-information to allow better interpretation by the general public.

Within the framework of this report it was not possible to review the accuracy of the emission data in the EPER database. Such a review would require additional information and efforts, whereas methods for such a review are not readily available. The UNFCCC and LRTAP Conventions are developing methods to review emission data reported by the parties. The applicability of such methods to the EPER data could be investigated. In addition, the availability of more than one reporting year will enable better analyses in this respect. The review of the next reporting cycle therefore should include an analysis of the differences between the first and second reporting.

1. Introduction

1.1 Objective of this report

This is the first EPER Review report, as requested by Article 3(3) in the Decision 2000/479/EC of 17 July 2000 on the implementation of a European Pollutant Emission Register (EPER) according to Article 15 of the EU Directive 96/61/EC on Integrated Pollution Prevention and Control (IPPC)(see Annex A for the full text of the EPER Decision). According to Article 15 (3) of the IPPC Directive,

> *"an inventory of the principal emissions and sources responsible shall be published every three years by the Commission on the basis of the data supplied by the Member States. The Commission shall establish the format and particulars needed for the transmission of information in accordance with the procedure laid down in Article 19".*

The EPER Decision obliges Member States to regularly (once every three years) report emissions of pollutants to air and water to the European Commission. This concerns emissions caused by facilities that are carrying out activities within the scope of the EU Directive 96/61/EC on Integrated Pollution Prevention and Control (IPPC Directive). The EPER Decision states in its Article 3.3:

> *"After each reporting cycle the Commission will **publish** the results of the reporting by Member States and **review** the reporting process within six months after the delivery dates for Member States as mentioned in Article 2."*

All emission data collected through the EPER process are published on a website (www.eper.cec.eu.int), which was officially launched on 23 February 2004 in Copenhagen. This website enables all stakeholders, including the general public, governmental experts, industry and non-governmental organisations (NGOs) to look at and use the reported information.

1.2 The Review Report

This report describes the Commission's review of both the EPER data collection process and of all data itself, as available on the EPER website as requested by the EPER Decision:

– The evaluation of the first reporting process: how have Member States arranged the collection of the data and the delivery of these data to the Commission?

This question will be answered on the basis of a questionnaire sent to the Member States and other countries participating in the first EPER reporting (Norway and Hungary) and an analysis of the use of the tools the Commission has developed to support this data flow.

– The evaluation of the first data delivery: what data is now available and what can be concluded on the contents and quality of these data?

  This question will be answered by numerical analysis and graphical presentation of the aggregated data in the EPER database, as now available on the web site by mid May 2004.

The EPER review is conducted in detail as follows:

1. Review of the process of the EPER data collection and publication on the web site.
   Information for the review of the EPER reporting process was collected by means of a questionnaire. This questionnaire was sent to all Member States' representatives in the IPPC Article 19 Committee. The information, as gained in this way, was combined and analysed to get insight in:
   – general and legal conditions;
   – data collection;
   – resulting data set;
   – reporting and reporting tools;
   – the use of the EPER web site.
   The analysis reflects the information as gained from questionnaires as received until 21 March 2004.

2. Numerical analyses of all data
   The review of data should address all types of cross sections over the complete dataset, taking into account:
   – the various countries;
   – the various main activities of the facilities;
   – the various pollutants;
   – the type of emissions (to air, to water);
   – the level of pollutant emissions

The analyses are made on the data status as of 23th of May 2004. This dataset includes a number of corrections and additions provided by the national experts after the first draft of this report was discussed at the meeting of the Article 19 Committee on April 5, 2004.

The data provided by the Member States, Hungary and Norway are the first set of data collected under the EPER Decision. Any evaluation of quality aspects will suffer from an incomplete data set. Therefore an analysis of completeness of in-

formation will be the first step in this data review. It is of importance on beforehand to recognise that the analyses and their results must be viewed in the perspective of constraints of this first data delivery. (See chapter 3).

1.3 Structure of the review report

This review report is structured as follows

Chapter 1 briefly describes the background and the project approach used to prepare this review report.

Chapter 2 describes briefly the constraints that apply to this review. It provides the reader with some feeling of the limitations of the analyses that can be performed on the data of this first reporting cycle.

Chapter 3 presents the review of the EPER reporting process as derived from the response on the questionnaire. This chapter aims at identifying the strengths and weaknesses of the process as experienced by the Member States and provides some recommendations for improvements therein.

Chapter 4 analyses the data with respect to completeness: have all requested data been delivered by the Member States? This chapter provides overviews of the number of facilities and emission reports that have been compiled and delivered by the Member States in this first reporting cycle.

Chapter 5 reviews the emissions as reported: what are the emissions as reported by the Member States? In this chapter graphical and tabular overviews are presented of the emissions that occur in IPPC facilities that have been reported under the EPER Decision.

Chapter 6 analyses the use of emission determination methods as applied by the Member States for the various pollutants and activities. The EPER Guidance allows the Member States to use either of three different emission determination methods (measurements, calculations and estimations). The chapter analyses what methods Member States have applied.

Chapter 7 describes some first and preliminary analyses on the quality of the reported emission data. This analyses can at this state of development only be limited and preliminary, since only one reporting cycle has been completed.

Chapter 8 finally presents analyses, performed by European Topic Center Air and Climate Change comparing the EPER emission data with national totals, reported in the scope of various international obligations.

2. Constraints for the review

The data collected under the EPER Decision are subject to a number of constraints that are relevant for the interpretation of the results of the review:

– The emissions as reported in the national EPER reports refer to facilities in a country that are operating an activity above a certain capacity threshold which is listed in Annex I to the IPPC Directive and that have emissions that are higher than the thresholds described in Annex A1 of the EPER Decision. Consequently, facilities with lower capacities or lower emissions are not included.

  In this review we do not have the possibility to check whether or not the Member States have applied these thresholds correctly.

– Every facility is characterized by its "main activity", but in practice will in many cases have more activities operating within the facility. A main activity could be defined as the Annex I activity within the facility that causes the highest environmental pressures. Those parts of emissions which originate from other activities than the main activity are finally counted under the main activity. This might distort the comparison of emissions for different activities.

– Additionally, a number of specific limiting conditions for a complete analysis follow from the remarks as reported by the Member States to their data delivery:
  – Some activities are only partly included or not included at all in the data set. This particularly addresses the agricultural facilities (e.g. AT, FR, NL, BE).
  – Some pollutants are not or only partly included in the data delivery:
    - Mercury in combustion installations (ES)
    - emissions of fluorinated gases (HFC's, SF6, PFC's), PM10, CO2 from some industrial processes (Flanders region in BE);
    - Denmark has not reported a number of pollutants, because they have been identified as not relevant for Danish facilities.;
  – Emissions from indirect charges to water are not complete or missing. (e.g. SE);
  – Some pollutants are substituted by other similar pollutants. (e.g. PM-10 data were substituted by total dust data in ES);
  – Reporting year for emissions is often not identical in a Member State, for emission types and even facilities (e.g. DE);
  – Data delivery was not complete for all regions in the Member State (e.g. SE);

– Some data are kept confidential (Poultry and pig farms in UK).

It should be noted that the aforementioned specific constraints are valid for specific country deliveries.

Due to these constraints an analysis of the quality aspects “accuracy” and “comparability” can only be performed in a limited way. The constraints will influence the statistical conditions for comparative judgements of data. Hence, the review mainly has to address analysing and commenting on completeness issues in order to anticipate a better data set for the next reporting.

3. Review of the data collection and reporting process

3.1 EPER data collection and reporting process

This chapter describes an analysis of the reporting process as experienced by the Member States. EPER reporting is a stepwise process as depicted in Figure 1.

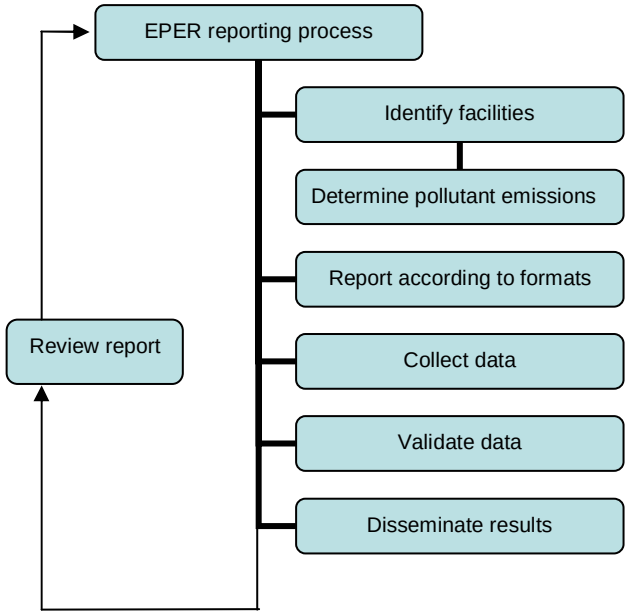


Figure 1 EPER reporting process

Step 1. Identification and selection of all facilities in the country with one or more activities as mentioned in Annex I of the IPPC Directive. Activities are identified by the source categories as specified in Annex A3 of the EPER Decision.

Step 2. Determination of pollutant specific emissions from all individual facilities with Annex I activities for all pollutants for which the threshold values as specified in Annex A1 of the EPER Decision are exceeded.

Step 3. Reporting of the emissions for each individual facility with Annex I activities according to the format of Annex A2 of the EPER Decision.

Step 4. Validation of data by competent authorities in the Member States

Step 5. Data transfer to the Commission/EEA

Step 6. Dissemination (every three years) of all reported data by the Commission/EEA as publicly accessible on the Internet

Step 7. The Commission evaluates the complete reporting process including the collection, quality, management and dissemination of the reported data after each reporting cycle. This report describes this evaluation for the first reporting cycle.

Based of the results and on the experiences of all parties, the Commission will recommend improvements in EPER data reporting.

The EPER Decision and Guidance Document are requesting the Member States to also produce “national reports”, summarizing all facility reports in the country. For reasons of harmonisation, national reports were generated from the facility reports by the Commission/EEA.

3.2 The questionnaire

The review on the reporting process is based on a questionnaire, sent to the Member State representatives in the IPPC Article 19 Committee (See Annex 2 to this report). The questionnaire addresses several fields of interest:
– General and legal status in the country;
– Data collection process;
– Resulting data set;
– Reporting and Reporting tools;
– The EPER Reporting Web site.

The countries included in the review by questionnaires were the Member States Austria, Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom as well as Norway and Hungary. Since EPER data from Hungary were included in March 2004, their questionnaire results were also evaluated.

3.3 Results from the questionnaire

3.3.1 General and legal status

The following table presents an overview of the legal implementation of the EPER reporting process in national legislation in the various countries.

Table 1 Implementation of EPER in national legislation

Country	EPER related legislation in place	Type of legislation	Title of legislation
Austria	Yes	Regulation	Reporting of pollutant emission loads for the development of a European Pollutant Emission Register (EPER-Regulation)
Belgium	Partly		
(Region Flanders)		Regulation	Vlarem II Art. 4.1.8
(Brussels)		Decree and decision	
(Walony)			
Denmark	Yes	Law and statutory order	The Environmental Protection Act with the amendment of August 25, 2001 Statutory order from the ministry of Environment No. 594 of July 07, 2002, on the duty of certain listed activities to draw up green accounts.
Finland	Yes	Environmental Protection Act	
France	Yes	Arrêté	Arrêté du 24 décembre 2000 relatif à la déclaration annuelle des émissions polluantes des installations classées soumises à autorisation
Germany	Yes	Ordinances	Air emissions: Elfte Verordnung zur Durchführung des Bundes-Immissionsschutzgesetzes (Verordnung über Emissionserklärungen und Emissionsberichte -11. BImSchV), implemented in the Bundersländer
			Water emissions: Ordinances per Bundesland
Greece	Yes	Ministerial Decision and Note by the General Secretary of the Ministry for the Environment	a) Ministerial Decision KYA 11014/703 /F 104/2003, article 12.3.i."Environmental appraisal ,Evaluation and permitting procedure. Environmental Conditions Decision contents.". b) Note by the General Secretary 117266 /27-5-2003, Implementation of the provisions of article 12 .3 of της KYA 11014/703 /F 104/2003 regarding the obligation of sending information to the responsible authorities for releases (emission and wastes).
Hungary	No		
Ireland	No		
Italy	Yes	Decree of Environmental Ministry	M.D. 23.11.2001 published on suppl. ord. G.U. n. 37 13.02.2002
Luxembourg	No		

Table 1 (Cont.)

Country	EPER related legislation in place	Type of legislation	Title of legislation
Netherlands	Yes	AMVB Milieuverslaglegging	Wet Milieubeheer[1]
Norway	Yes		
Portugal	Yes	Decree-law	Decree-law nº 194/2000, of August 21
Spain	Yes	LEY (Law)	Ley 16/2002 de 1 de julio de Prevención y Control Integrados de la Contaminanción (general requeriments about EPER) The EPER Decision specific requeriments are included in a new REGLAMENTO (Regulation) which is now being disscussing (Draft version)
Sweden	Yes	Ordinance	Ordinance (1998:899) concerning Environmentally Hazardous Activities and the Protection of Public Health
United Kingdom	Yes	Implementation of the IPPC Directive via PPC Acts in the UK	Pollution Prevention and Control (England and Wales) Regulations 2000, PPC (Scotland) Regulations 2002, PPC (Northern Ireland) Regulations 2003

The table shows that most EU Member States have generated legislation related to EPER reporting at national level. In Belgium legislation is in force in the Flanders and Brussels regions. In Ireland and Luxembourg such legislation is not generated.

[1] The Netherlands at present is arranging legislation for inclusion of those IPPC/EPER facilities that are not included in this law as yet.

3.3.2 Data collection

3.3.2.1 Identification of EPER Facilities

The identification of EPER facilities is done in various ways in the countries. The following table gives an overview.

Table 2 Overview of identification methods, used by the countries

Country	Information from regional authorities	Permits	Facilities Information	Other sources
Austria	Identified potential EPER facilities		Obligatory facility reports	
Belgium	Identified EPER facilities using activity codes and thresholds			
Denmark	Identified EPER facilities based on permit information			Central Business Register
Finland				
France		Permit data		
Germany			Obligatory facility reports	
Greece		Capacity data in permit		
Hungary	Data from regional inspectorates			
Ireland		Permit data		
Italy			Facilities are obliged to identify themselves as EPER facility	
Luxembourg				Expert judgment; Luxembourg Industry Federation
Netherlands			Obligatory facility reports	
Norway			Obligatory facility reports	
Portugal			Obligatory facility reports	
Spain	Regional authorities receive emission reports		Obligatory facility reports	
Sweden	Regional authorities database			
United Kingdom	Regulators checked for coverage of all EPER facilities	Permit data		Climate Change Levy database

A number of countries used existing reporting obligations from individual facilities, mostly based on permitting systems. Databases containing this information were in several cases maintained by regional authorities. In a number of cases capacity data in the permits themselves were used.

3.3.2.2 Data transfer

Most countries used mainly paper reports to collect and transfer data from industry to the competent authorities (see table below). In some countries (Austria, Finland, Italy, Portugal) mainly electronic data transfer was used.

Table 3 Data transfer to authorities

Country	electronically	on paper
Austria	100%	0%
Belgium	-	100%
Denmark	0%	100%
Finland	95%	5%
France	10%	90%
Germany	30%	70%
Greece	-	-
Hungary	-	100%
Ireland	-	-
Italy	90%	10%
Luxembourg	-	-
Netherlands	0%	100%
Norway	0%	100%
Portugal	80%	20%
Spain	60 – 70%	40 – 30%
Sweden	-	100%
United Kingdom	20	80

Concerning data validation by the competent authorities, in many countries more than 50 % of the facilities were at least contacted once. Italy and Sweden did contact individual facilities in 8% and 20% of the cases only.

In Denmark all facilities were contacted and asked to validate and complete data if any data were missing. Most of the facilities in the industry sector responded and a few data were corrected and completed. Ireland did not record this information.

Table 4 Contacts with facilities for data validation

Country	0: no contact with facilities	1 time	2 or 3 times	more than 3 times
Austria	20%	-	-	-
Belgium	50%	40%	10%	-
Denmark	100%	0%	0%	0%
Finland	60%	25%	15%	-
France	69%	20%	10%	1%
Germany	0%	70%	20%	10%
Greece	20%	45%	25%	10%
Hungary	0%	80%	20%	0%
Ireland	-	0%	0%	0%
Italy	92%	8%	0%	0%
Luxembourg	-	-	-	-
Netherlands	50%	50%	-	-
Norway	65%	30%	5%	-
Portugal	10%	20%	40%	30%
Spain	50%	20%	20%	10%
Sweden	80%	20%	-	-
United Kingdom	-	-	-	-

3.3.2.3 Confidentiality

Only Germany and the United Kingdom indicated confidentiality issues.

- In Germany name, address and coordinates of 91 installations were not submitted because they were operated by private persons.
- Farms in the UK applied for confidentiality due to data protection act issues and lack of public availability of location information in the UK (protected under the Climate Change Levy scheme).

3.3.2.4 Difficulties in collecting and reporting data

The countries indicated a series of difficulties in collecting and reporting EPER data. The countries both could indicate difficulties they have been observing at the facilities and in the validation of the data.

From the point of view of the authorities, facilities face difficulties in identifying the EPER facilities and attributing the “Main activity” and other activity codes. Some countries mention that data reporting by the facilities is new for them or in a new format. This has led to misunderstandings and misinterpretations. Some countries indicate that emission determination methods (measurements, calculations or

Some countries indicate that emission determination methods (measurements, calculations or estimations) are not always readily available for the facilities. These problems might decrease over time when facilities get used to the EPER reporting.

In Austria some technical difficulties were encountered in the electronic data transfer system that has been set up. Since Austria appears to be the only country that uses a fully electronic data transfer, other countries could probably learn from the Austrian experience in this respect.

Validation of the data encounters problems as reported in the questionnaire mainly due to lack of emission estimation methods for some emissions. This is also reflected in some remarks on the time pressure induced by the reporting process, that does not allow for doing the emissions determination and validation properly. Authorities apparently do not have enough access to the necessary knowledge and expertise that can support them in validating the emission data.

3.3.3 Resulting data set

The following table presents the estimated percentage of all IPPC facilities that have reported under EPER. In most countries this percentage is between 10 and 50 %. This is due to the fact that EPER only requests reporting for those facilities that are exceeding certain emission thresholds. The 95 % as reported by Austria is probably due to a different interpretation of the relevant item in the questionnaire. Also the Netherlands apparently interpreted the question differently.

Table 5 Reports under EPER

Country	Percentage of facilities reported under EPER compared with all IPPC facilities in the country
Austria	95%
Belgium	30%
Denmark	10-15%
Finland	33%
France	20%
Germany	24%
Greece	26%
Hungary	9%
Ireland	25-30%
Italy	10%
Luxembourg	-
Netherlands	- (1)
Norway	50%
Portugal	28%
Spain	28%
Sweden	18%
United Kingdom	40%

(1) 100% of the industrial facilities reported; agricultural facilities and waste disposal sites could not be reported.

Although only 10 to 50 % of the IPPC facilities are included in the EPER database, these still can in principle be responsible for 90 % or more of the emissions, since the threshold ensures that the largest facilities in terms of capacities and emissions are included in the reports.

3.3.4 Reporting and Reporting tools

Reporting by the countries has taken place between May 2003 and March 2004. All countries, except Germany and Portugal used the validation tool to produce the XML-file for the Central Data Repository in EEA (see table below).

Table 6 Reporting and reporting tools evaluation

Country	In which time period the majority of data have been delivered to the EEA?	Did you use the validation tool to create the XML-file for the CDR?
Austria	between June 2003 and January-2004	Yes
Belgium	between September 2003 and October 2003	Yes
Denmark	between July 2003 and October 2003	Yes
Finland	between June 2003 and October 2003	Yes
France	between June 2003 and September 2003	Yes
Germany	between May 2003 and June 2003	No
Greece	between November -2003 and January-2004	Yes
Hungary	between January 2004 and March 2004	Yes
Ireland	between June 2003 and February 2004	Yes
Italy	between October 2003 and November 2003	Yes
Luxembourg		
Netherlands	between September 2003 and October 2003	Yes
Norway	between October 2003 and October 2003	Yes
Portugal	between September 2003 and April 2004	Yes
Spain	between October 2003 and January 2004	Yes
Sweden	between September 2003 and November 2003	Yes
United Kingdom	Between May 2003 and July 2003	Yes

Most countries indicate to have experienced no problems with the validation tool and the delivery process into the Central Data Repository. Some (Luxembourg and France) indicate problems with specific versions of the operating systems (the tool did not run under Windows NT 4.1 in Luxembourg; France remarked that the tool did not run smoothly in a French version of the operating system). This issue needs attention from the software developers.

Countries indicated only minor issues and proposals, related to the further development and improvement of the tools. The most important one was the portability of the tools to different versions of the operating systems. This will be taken into account in the upgrade of the tools done in the second half of 2004.

3.3.5 The EPER Reporting Web site

Countries were asked to assess the quality of the EPER web site for different target groups. The countries' judgements are summarized in the table below.

Table 7 Appreciation of the EPER web site

Country	General Public	Government Experts	Industry	NGO's
Austria	Very well	Very well	Very well	Very well
Belgium	Good	Sufficient	Good	Good
Denmark				
Finland	good			
France	Very well	Very well	Very well	Very well
Germany	Poor	Good	Sufficient	Good
Greece	Very well	Good	Good	Very well
Hungary	Good	Sufficient	Sufficient	Very well
Ireland	Very well	Very well	Very well	Very well
Italy	Good	Good	Good	Good
Luxembourg	-	-	-	-
Netherlands	Poor	Poor	Poor	Poor
Norway	Good	Good	Good	Good
Portugal	Good	Good	Good	Good
Spain	Sufficient	Sufficient	Good	Good
Sweden	Good	Good	Good	Good
United Kingdom	Sufficient	Good	Sufficient	Good

With the exception of the Netherlands, the countries' judgements on the web site were quite positive. Some countries also provided proposals and ideas for further improvements (translation in EU languages, improving meta-information, support interpretation of the large amount of data). These suggestions will be taken into account when further developing the website.

Conclusion and recommendations on the EPER reporting process

- Most, but not all, Member States have implemented legislation to ensure a dataflow from facilities towards the authorities, needed for reporting under EPER;
- Apart from names, addresses and co-ordinates of mostly agricultural facilities, no confidentiality issues have been raised by the countries or by the facilities. In the case of the agricultural facilities confidentiality might be related to protection of personal data by European law(e.g. DE).
- This first reporting cycle leads to some difficulties, mostly related to the fact that this reporting is occurring for the first time. In addition countries indicate that emission determination methods are not always readily available, hindering both the reporting by the facilities and the validation by the authorities.
- The tools provided by the Commission are well used and countries indicate that these tools are very useful. Some attention however is needed for the portability to different versions of the operating systems, both in releases (Windows NT in Luxembourg) and in language versions (French windows version).
- National reports were generated by the EEA from the facility reports. This procedure could be also applied in future EPER reporting cycles
- Countries feel that the EPER web site is useful to most users.

4. Review of completeness of the data

4.1 General

In this chapter numbers of facilities and emission reports are counted to numbers of data reported under EPER by the various countries (EU Member States, Hungary and Norway). This will provide an overview of the amount of data available in the EPER database and on the web site and will provide insight concerning the completeness of these data sets.

In Annex I of the IPPC Directive a list of categories of industrial activities is defined. For reporting, Annex A3 of the EPER Decision refers to these activities (source categories) and establishes emission thresholds above which emission data of these activities should be reported.. The nomenclature for the activities as applied in this report complies with those in the EPER Decision. In the graphs and tables below we use either the full names as defined in IPPC or the abbreviated names as listed in the glossary (page 167).

This chapter will analyse the number of data provided by the countries, both as direct counts of data records and data fields and as specified for countries and IPPC activities.

4.2 Data submission information

According to the format for reporting in Annex A2 to the EPER Decision, the date of submission should be June 2003. Besides, details on contact person in the Member State should be provided.

As for the submission date, the majority of data was sent to the Commission by June 2003.

The Member States were allowed to correct apparent errors in their delivered data during the test of the EPER website in winter 2003/2004.

Table 8 Reporting of a contact person in Member State

Reporting item	Share of maximum [%]	Remarks
Contact name	81,4	Partly (not for all facilities) reported by Austria and Greece. Not reported at all by ES and FI.
Phone number	81,4	Mainly due to lack of contact name. Not reported by AT, ES and FI.
Fax number	79,6	Mainly due to lack of contact name. Not reported by AT, ES and FI.
E-mail	79,5	Mainly due to lack of contact name Not reported by AT, ES, FI and PT.

4.3 Facilities in the EPER database

The database contains data on 9256 facilities in Europe. This section explores quantitatively the information as available at the facility level on

– identification of each facility
– the information on activities performed by each facility
– the emission data reported for each facility

4.3.1 Identification

Each of the facilities should be uniquely identifiable. For that a number of data items are obligatory within the reporting process. Paragraph 4.3.1.1 presents an overview to what extent this obligatory information has been provided. Paragraph 4.3.1.2 summarises the availability of voluntary optional data.

4.3.1.1 Mandatory identification items

The review of the mandatory identification is reported in Table 9 below.

Table 9 Identification items (mandatory)

Reporting item	Share of maximum completeness [%]	Remarks
Parent Company name	98,7	68 blank (GR) 45 N/A (not available) (DK) 6 (-), 12 (“keine”) (not available) (DE) 1 a number instead of a name (IT)
Facility name	87,1	1191 (12,9%) not available (UK); For 4743 facilities (51.2%) the facility name equals Parent Company name.
Facility Address	85,3	See remark *)
Postal code	82,8	See remark **)
Longitude / Latitude	84,7	141 facilities (1,5 %) with a set of identical coordinates (UK) 1295 facilities (13,8 %) with no longitude, latitude values (0,0) (UK: 1201, NO: 2, IE: 10, DE: 92)
NACE code	Complete	

*) Facility addresses

- A number of the facility addresses was missing.
  - 1268 were indicated as not available, (all from UK);
    91 were not provided for confidentiality reasons (DE).

Besides, addresses of facilities were provided in rather various ways, like:

- postal code;
- only city name;
- road identification number;
- name of the industrial area.

**) Postal codes

- More than 17 % of the postal codes were not provided or were not practicable as such.
- Amongst them, codes were indicated:
  - as not available (154 in IE and 1284 in UK);
  - not presented (57 mainly in UK);
  - indicated as 0 (8 in LU);
  - indicated by dummy (91 in DE for confidentiality reasons).
- The missing postal code information strongly coincides with missing information of addresses.

4.3.1.2 Voluntary identification items

For the voluntary part, the results are presented in Table 10.

Table 10 Identification items (voluntary)

Reporting item (Voluntary)	Share of maximum [%]	Remarks
Production volume	4,5	Only reported by a number of facilities in AT, ES, GR, UK For other facilities in other countries, no production volume was reported.
Regulatory bodies	38,2	From all countries, 6 did provide information about a Regulatory body (GR, SP, DK, UK, NL and IE) All other countries didn't report a Regulatory body.
Number of installations	34,7	Maximum 16, minimum 1. Average of those reported: 1,2 Only reported by ES, IE, GR, NL, UK. Reporting by IE was complete. The number of installations was 1. For the other 4 countries reporting of this item was not complete.
Operating hours	7,2	Maximum 8760, minimum 5. Only reported by AT, ES, GR, UK. Reporting of this item by these countries was not complete.
Number of employees	6,0	Maximum 10300, minimum 2; Only reported by ES, GR, UK. Reporting of this item by these countries was not complete.

A final remark can be made about the identification code for facilities as applied for the data delivery. It appears that the various countries use different conventions for coding their facilities. It might be an option to apply a standard methodology for coding facilities for all countries.

4.3.2 Activities

Each facility is attributed one or more activities. Table 11 presents an overview of the number of activities reported for each facility. For the vast majority (84.5 %) of facilities only one activity is reported. For about 13 % two activities are reported and for relatively few facilities more than two activities are reported.

Within the EPER database the concept of "main activity" is introduced. Each of the facilities in the database has one and only one main activity defined.

Table 11 Number of activities per facility

Number of activities (including main activity)	Number of facilities	Share of total number [%]
1	8158	87.0
2	1052	11.2
3	112	1.2
4	32	0.3
5	14	0.2
6	7	0.1
7	0	0
8	2	< 0.1
Total	9377	100

4.3.3 Emissions

4.3.3.1 Emissions reported per facility

For the 9377 facilities in the database a total of 23113 emissions are reported, and average of 2.5 per facility.

Table 12 Number of emissions reported in the database

Number of emissions	Number of emissions	Minimum number of emissions per facility	Maximum number of emissions per facility
Air	15663	1	22
Water direct	4763	1	19
Water indirect	2687	1	14
Total	23113		

4.3.3.2 Reporting year

According to the EPER Decision, the first EPER report shall provide data on emissions in 2001 (or optionally 2000 or 2002, when data for 2001 are not available). Table 13. shows that about 62.2 % of the facilities reported 2001 data. In 12 % of the cases data from 2000 were reported, whereas in 25.9 % of the cases more recent data have been reported.

Table 13 Facilities and reporting year

Reporting year	Number of facilities	Share of total [%]
2000	1111	11.8
2001	5836	62.2
2002	1755	25.9
2003	1	< 0.1
Total	9377	100.0

Germany mentioned in their comments to the delivery that facilities reporting to air were covering the year 2000 while facilities reporting to water were covering 2001 or 2002. For each facility Germany has set the reporting year to the most recent of the two.

Conclusions

- Data allowing identification of facilities in the EPER data set is not complete.
- For all facilities information on the activities and the emissions within the facility is given.
- The bulk of the emission data is for the preferred reporting year 2001; about 37.7 % of the data are either for 2000 or for 2002.

4.3.3.3 Emission determination methods

All emission values to air or to water (direct or indirect) were marked by the determination methodology (“measured”, “calculated” or “estimated”). Table 14 presents an overview of the numbers of emissions that have been determined using these methods.

Table 14 Number of emissions reported in the database

Number of emissions	Calculated	Estimated	Measured	Total
Air	7678	2942	5043	15663
Water direct	549	509	3705	4763
Water indirect	662	270	1755	2687
Total	8889	3721	10503	23113

A more detailed review of the determination methodologies is elaborated in chapter 6.

4.4 EPER data per activity sector

4.4.1 Number of facilities for each activity

The number of facilities for each of the IPPC Annex 1 activities differs between these activities as illustrated in the graph below (Figure 2). This figure presents the number of facilities counted per main activity.

By far the most frequent activity are the pig and poultry facilities (almost 30 % of all facilities). Non-hazardous waste landfills, combustion and metal industry are the most frequent other activities. Coke ovens (IPPC code 1.3), Coal plants (1.4), Biocides and explosives (4.4 / 4.6), Tanning (6.1), Animal waste (6.5) and production of Carbon (6.8) occur less than 50 times in the database, whereas Asbestos production (3.2) is not reported at all.

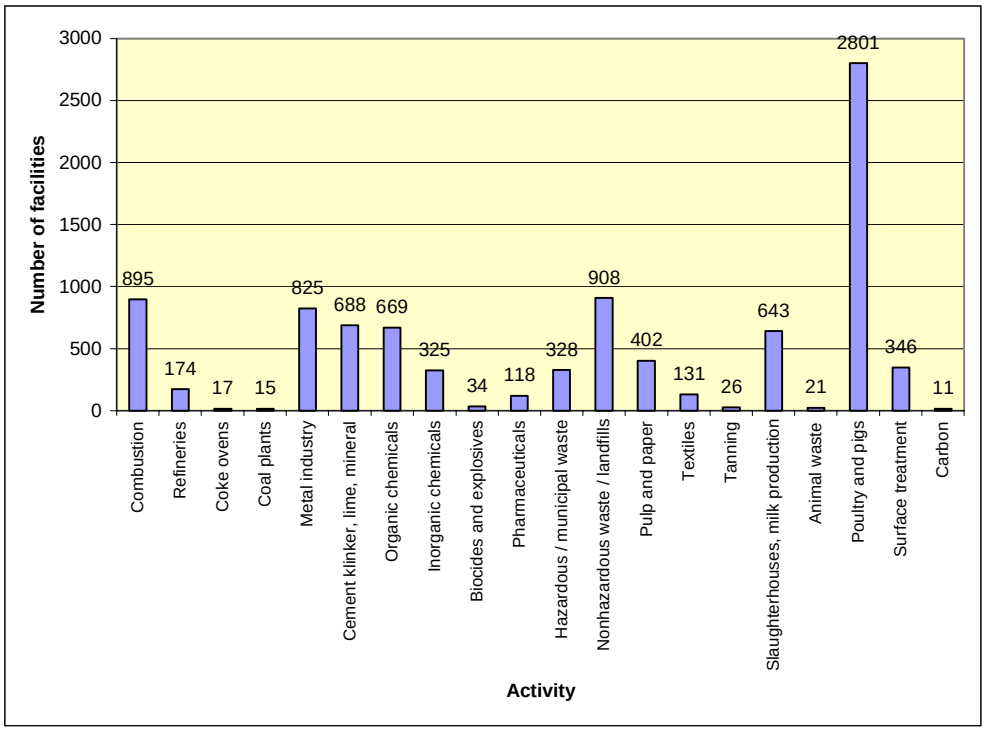


Figure 2 Number of facilities per Annex 1 Activity

4.4.2 Facilities per emission type for each activity

The contribution of the various sectors to the total reporting was analysed, which gave the following key figures. (only acilities of the 15 old member states).

Table 15 Number of facilities per activity, reporting the various emission types

Activity code	Activity name	Facilities reporting air emissions	Facilities reporting water emissions	Facilities reporting direct water emissions	Facilities reporting indirect water emissions
1.1	Combustion	882	162	145	22
1.2	Refineries	161	98	91	8
1.3	Coke ovens	17	8	7	1
1.4	Coal plants	15	4	3	1
2.1-2.6	Metal industry	550	473	257	228
3.1/3.3-3.5	Cement klinker, lime, mineral	674	48	32	18
3.2	Asbestos	0	0	0	0
4.1	Organic chemicals	418	437	247	217
4.2/4.3	Inorganic chemicals	247	202	159	50
4.4/4.6	Biocides and explosives	18	19	11	8
4.5	Pharmaceuticals	69	90	39	54
5.1/5.2	Hazardous / municipal waste	255	119	51	75
5.3/5.4	Nonhazardous waste / landfills	839	109	58	54
6.1	Pulp and paper	221	348	280	74
6.2	Textiles	18	118	33	88
6.3	Tanning	4	24	6	19
6.4	Slaughterhouses, milk production	184	523	115	423
6.5	Animal waste	10	13	5	8
6.6	Poultry and pigs	2780	42	39	3
6.7	Surface treatment	270	127	65	64
6.8	Carbon	11	1	1	0
All activities		7643	2965	1644	1415

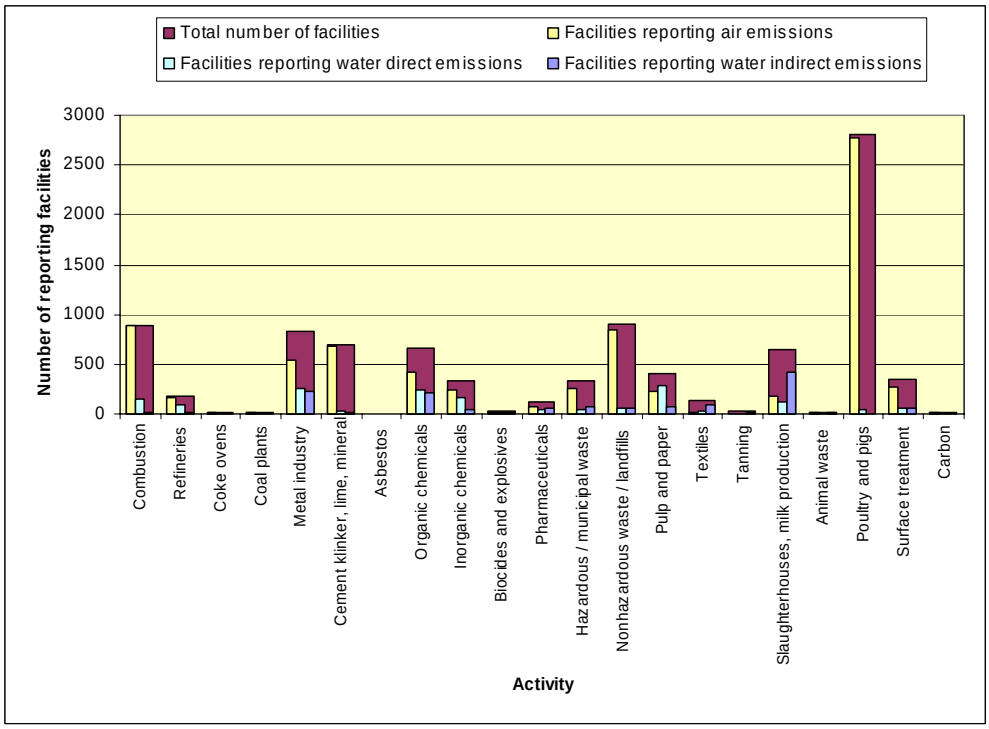


Figure 3 Facilities by main activity, reporting by emission type

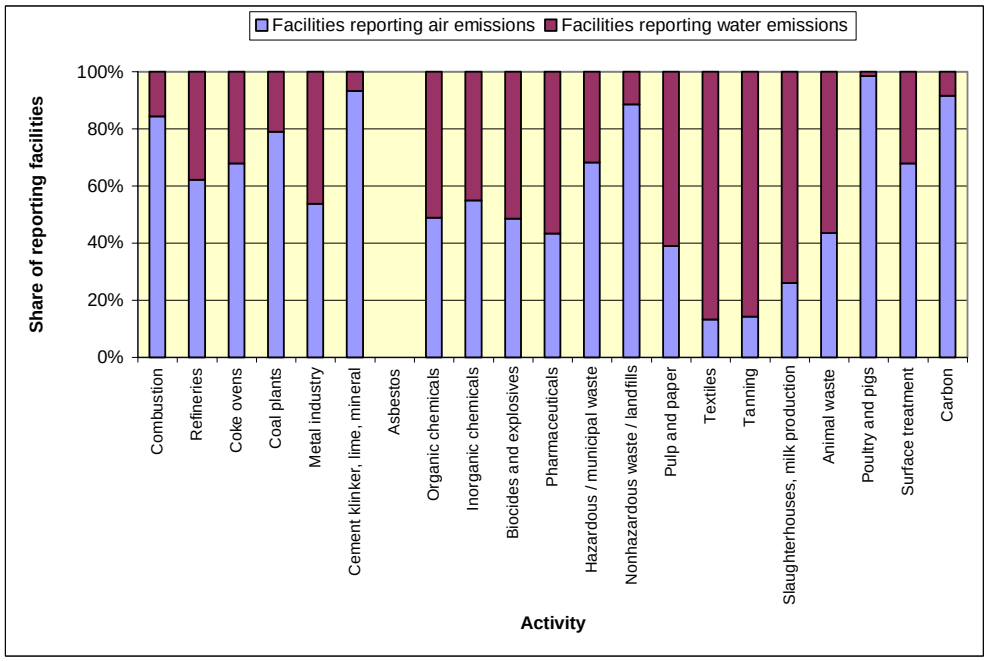


Figure 4 Share of facilities per activity, reporting by emission type

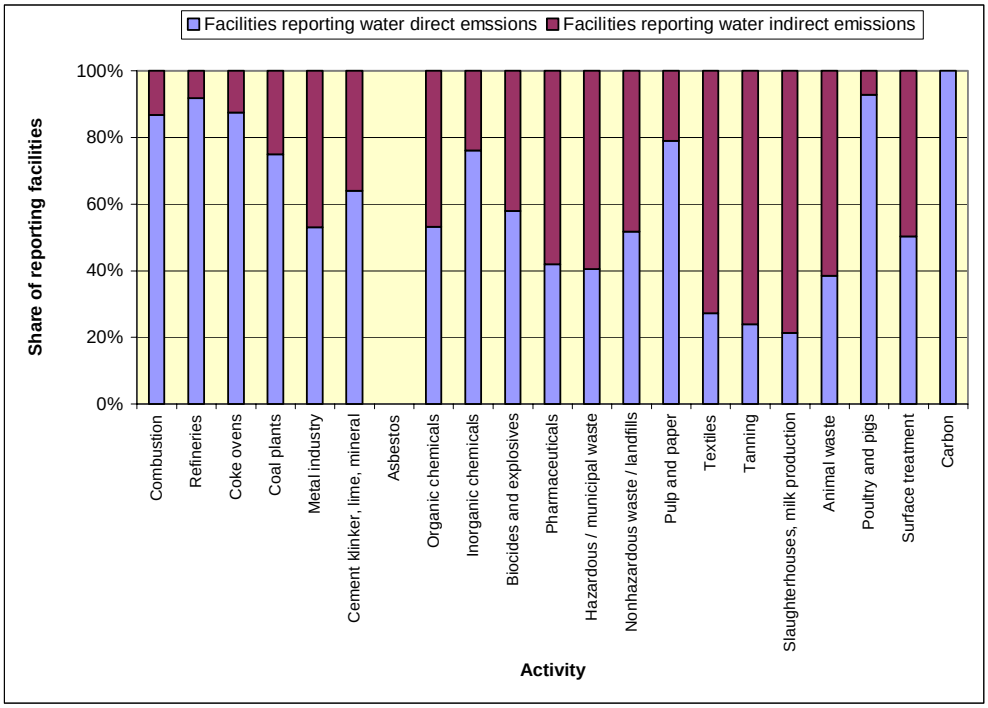


Figure 5 Share of facilities per activity, reporting by water emission type

4.4.3 Number of emission reports per activity

4.4.3.1 Absolute numbers

The number of emission reports for all activities – when sorted in descending order - is presented in the graph below (Figure 6).

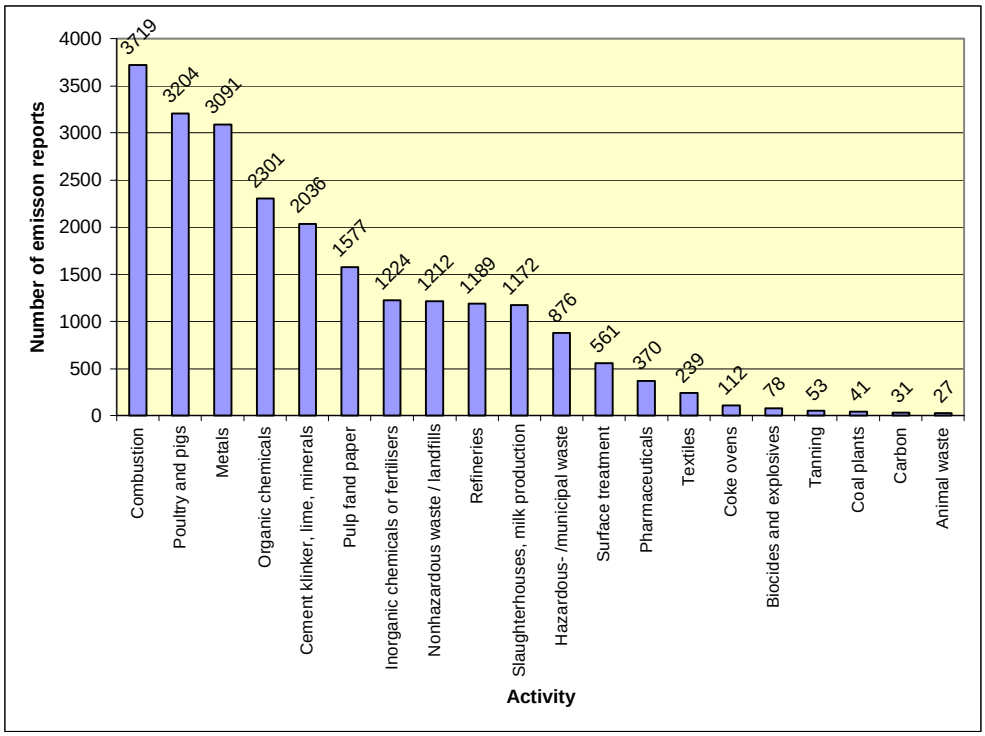


Figure 6 Number of emissions reported for each IPPC Annex 1 activity

The most frequently reported main activities are activity 1.1: Combustion, 6.6: Poultry and pigs and 2.1 -2.6: Metal industry. Each of these main activities is responsible for about 15% of all emission reports.

For five main activities only a limited (about 100 or less) number of emission reports is present in the database. This is the case for activity 1.4 Coal plants, 4.4 - 4 6: Biocides and explosives, 6.3: Tanning and 6.5: Animal waste. These activities are each representing less than 0,5 % of the total number of emission reports. Please note that each of these activities also are reported as non-main activity in a number of facilities e.g. coke ovens in Metal Industry.

All other activities are represented by more than 100 emission reports. These reports correspond to contributions in the range of approximately 1 to 10% from the total number of reports.

4.4.3.2 Relative numbers

As can be expected, the number of emissions reported for each IPPC Annex 1 activity will vary. Figure 7 shows that for poultry and pig farms on the average emissions for 1.1 pollutant per facility is reported. For refining this number is 6.8 pollutants.

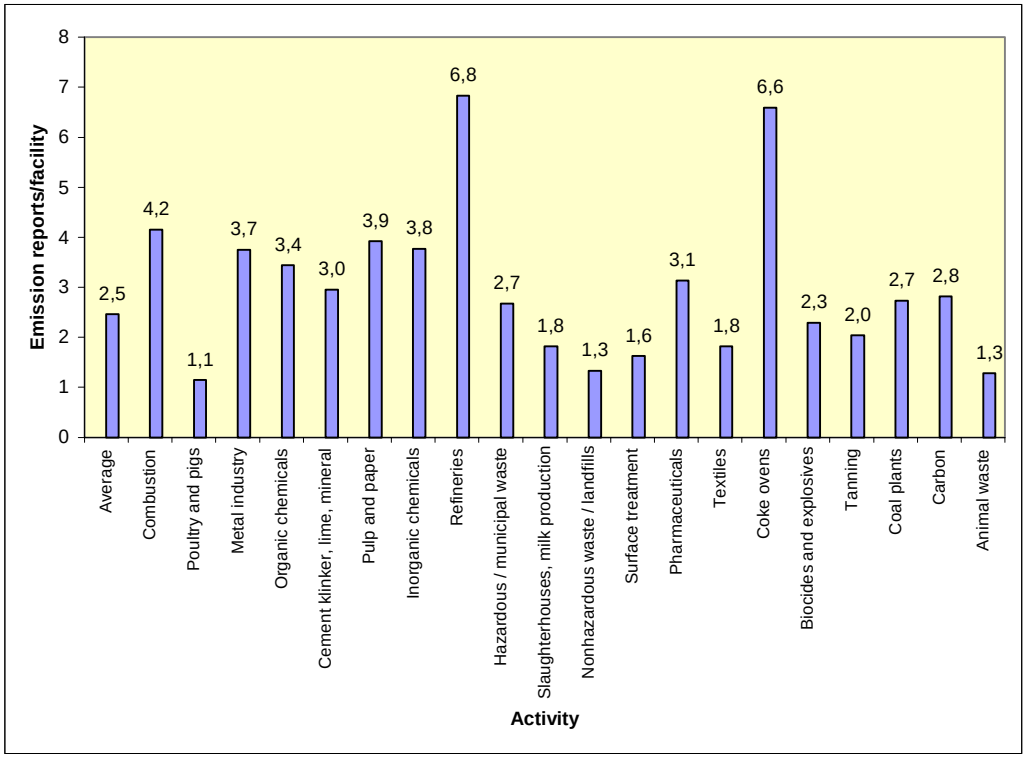


Figure 7 Averaged number of emission reports for each IPPC Annex 1 activity

4.4.4 Emission reports by emission type and activity

The contribution of the various (main) activities within the total reporting was analysed, which gave the following key figures

Table 16 Emission reports by activity and emission type

Activity code	Activity name	Reports to air	Reports to water	Water direct reports	Water indirect reports
1.1	Combustion	3370	349	305	44
1.2	Refineries	829	360	330	30
1.3	Coke ovens	89	23	14	9
1.4	Coal plants	32	9	8	1
2.1-2.6	Metal industry	1898	1193	803	390
3.1/3.3-3.5	Cement klinker, lime, mineral	1941	95	74	21
3.2	Asbestos	0	0	0	0
4.1	Organic chemicals	927	1374	879	495
4.2/4.3	Inorganic chemicals	568	656	560	96
4.4/4.6	Biocides and explosives	28	50	35	15
4.5	Pharmaceuticals	113	257	125	132
5.1/5.2	Hazardous / municipal waste	523	353	158	195
5.3/5.4	Nonhazardous waste / landfills	894	318	194	124
6.1	Pulp and paper	612	965	839	126
6.2	Textiles	22	217	64	153
6.3	Tanning	5	48	9	39
6.4	Slaughterhouses, milk production	309	863	182	681
6.5	Animal waste	12	15	5	10
6.6	Poultry and pigs	3136	68	65	3
6.7	Surface treatment	327	234	111	123
6.8	Carbon	28	3	3	0
All activities		15663	7450	4763	2687

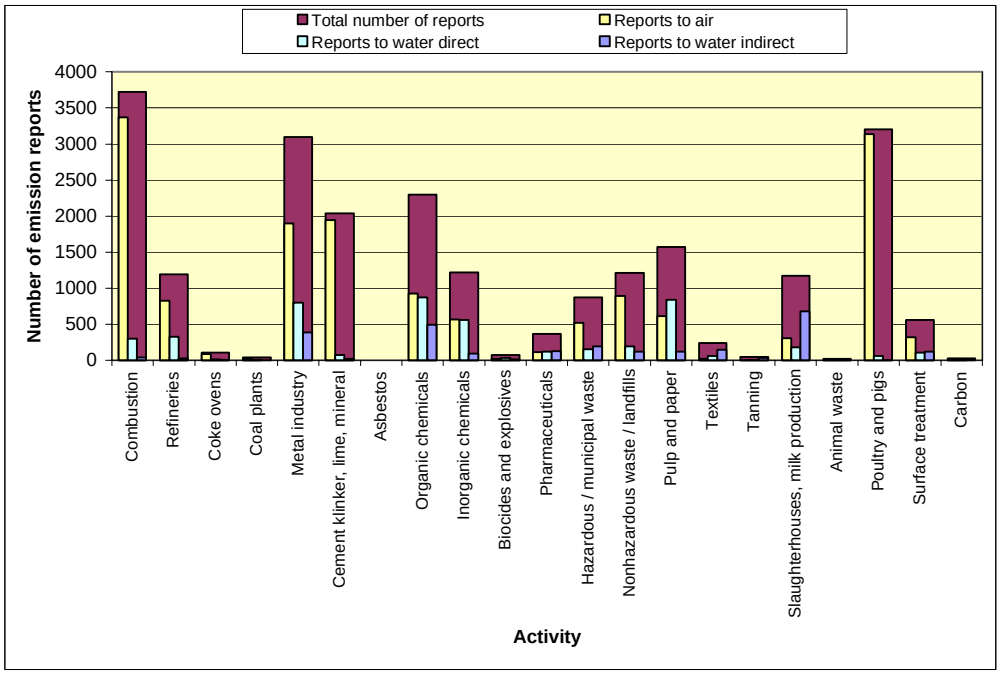


Figure 8 Number of emission reports by activity and emission type

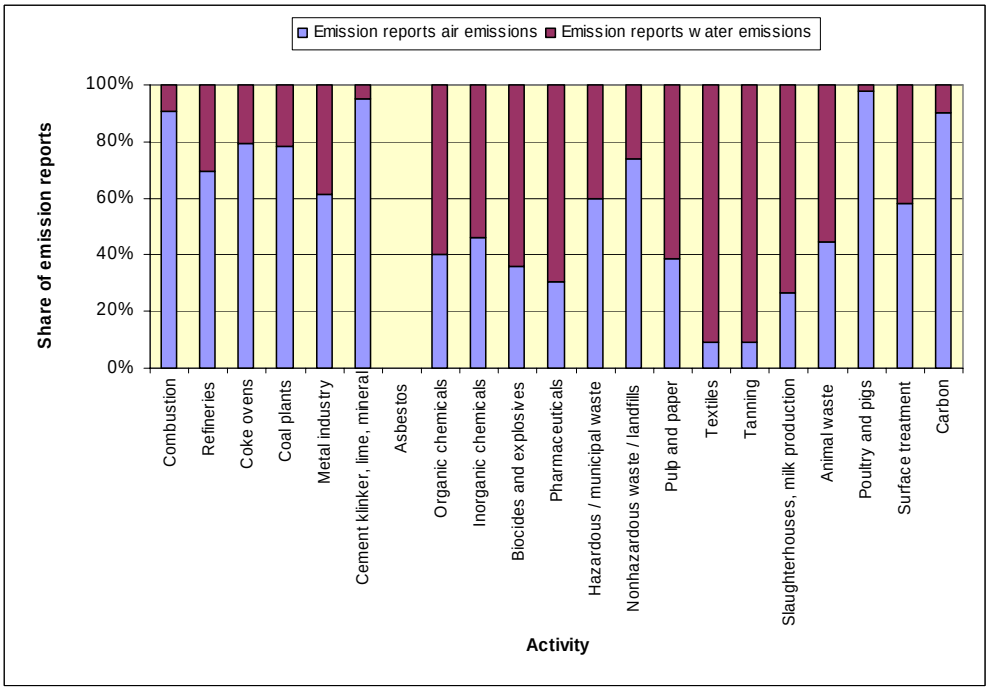


Figure 9 Share of emission reports by activity and emission type

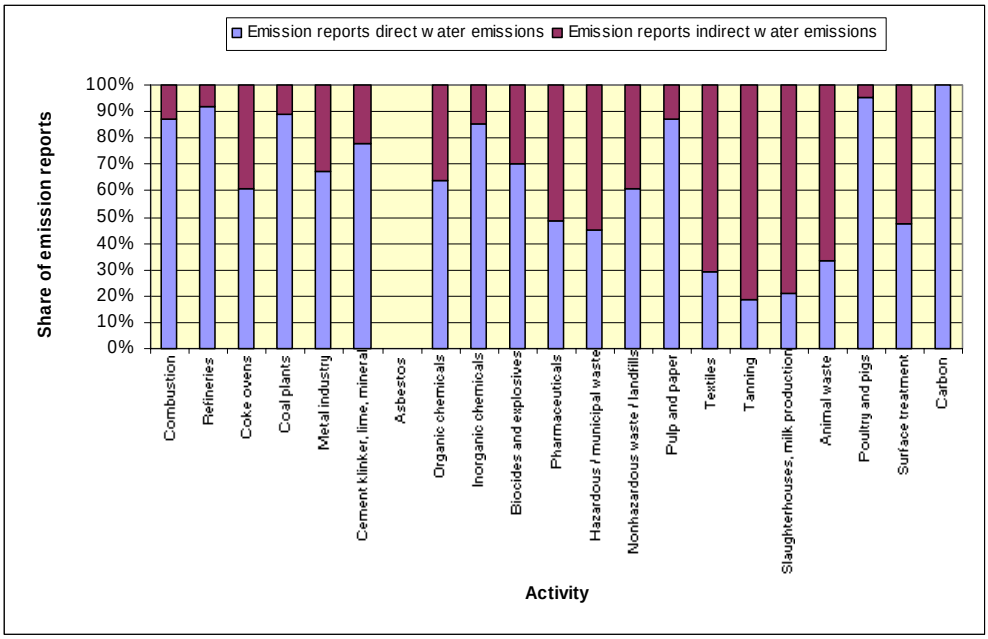


Figure 10 Share of reports by activity and water emission type

Conclusions

- The split between the number of reports to air and reports to water is highly variable depending on the activity.
- A number of 4 activities, respectively 1.1: Combustion, 6.6: Poultry and pigs, 2.2-2.6: Metals and 3.1;3.3-3.5: Cement klinker, lime and mineral represent approximately two third of the reports to air.
- Activity 1.1: Combustion is responsible for the largest number of reports to air.
- A number of 4 activities respectively 2.2-2.6: Metals, 4.1: Organic chemicals, 6.1: Pulp and paper and 6.4: Slaughterhouses, milk production represent more than half of the water reports.
- The share of the number of reports direct to water compared to the reports of emissions indirect to water is highly variable depending on the activity.
- Activity 4.1: Organic chemicals represents the highest number of reports to water (18,4%) and direct to water (18,5%) Activity 6.4: Slaughterhouses, milk production represents the main contributor (25.3%) for emission reports indirect to water.
- Activity 3.2 Asbestos was not represented and consequently did not report any emission to water.
- Most of the activities report mainly emissions directly to water: large industrial sites are often located at rivers or the coast and have often their own wastewater treatment plant.
- Some activities reflect only a very small number of reports: A number of 4 activities show less than 50 reports to air and to water.

The figures by country are provided in the following table and graphs:

4.5 EPER data per country

4.5.1 Number of facilities in each country

The number of facilities reported in each country obviously differs. This number varies between 12 for Luxembourg and 24966 for the United Kingdom (Table 17 and Figure 11). It is obvious that large countries will have more reporting facilities than smaller ones. In Table 17 the population size is used as a proxy for the country size. The right part of Table 17 and Figure 1 show that the number of facilities per country varies between 7.5 (Greece) and 42.4 per million inhabitants. By scaling with the population sizes, the range of numbers decreases from a factor of 200 to a factor of 6.

Table 17 Facilities in countries (key figures)

	Number of facilities		Facilities per million inhabitants	
All countries: Total	9377	(including NO and HU)	23.9	(including NO and HU)
EU countries: Total	9194		24.4	
All countries: Minimum	12	(LU)	7.5	(GR)
EU countries: Maximum	2496	(UK)	42.4	(UK)

There might be different reasons for the apparent differences in numbers of facilities reported for each country:

– Not all countries have reported all facilities that are requested (see chapter 2, Constraints).
– Apart from the population sizes, the economic strength (for instance measured as Gross Domestic Product), the economic structures (countries differ in importance and composition of economic sectors like agriculture or industry)and other parameters influence the number of facilities that need to be reported under EPER.

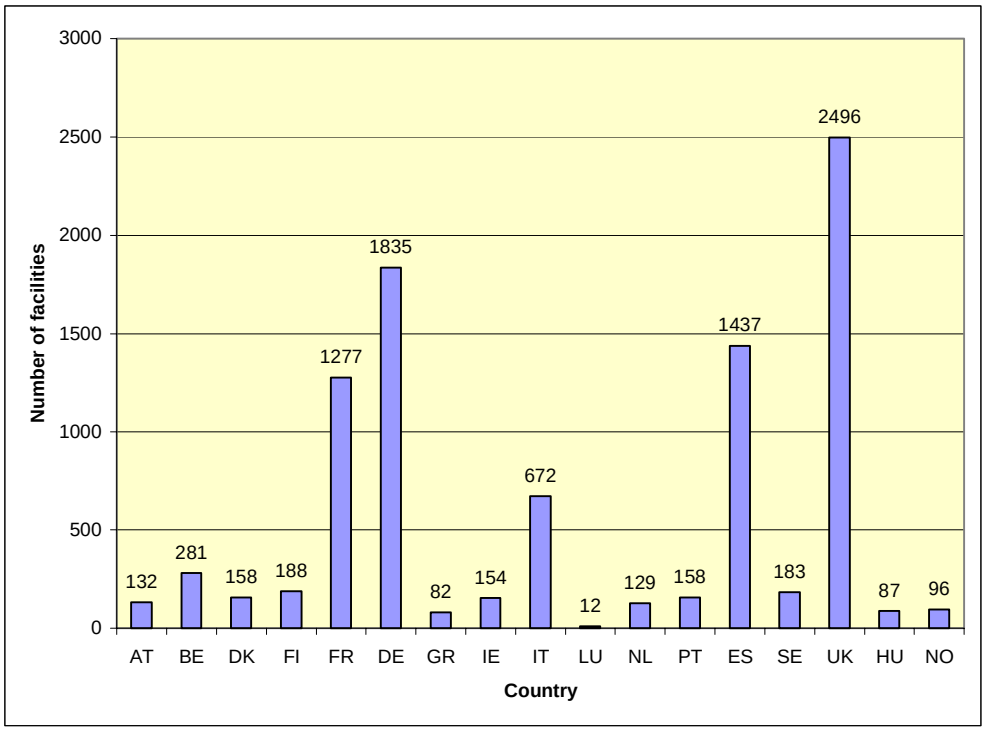


Figure 11 Number of facilities for each country

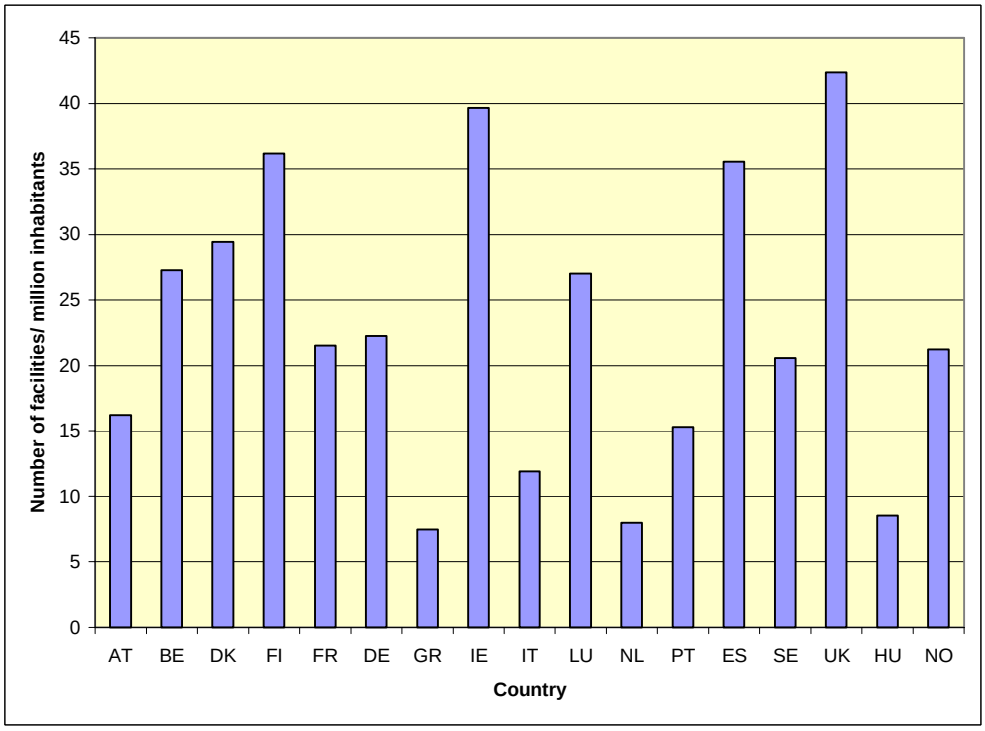


Figure 12 Number of facilities for each country relative to population size in 2001

– The size of enterprises and facilities might be dependent on the size of a country. Larger countries might also have larger facilities, simply because the domestic market is larger. This will lead to relatively more facilities that exceed the capacity thresholds.
– Differences in BAT implementation might result in different environmental performance of facilities and in non-exceedance or exceedance of emission thresholds.

A comparison, based on the countries' Gross Domestic Production value" gives a similar distribution but within a smaller bandwidth. It will be worthwhile to find scaling methods that can improve the basis for future evaluation or comparison of data. In the current situation, this will be difficult due to missing information (production figures), gaps, estimated values etc.

4.5.2 Number of emission reports in each country

The key characteristics for the reports under evaluation are summarised in Table 18 and Figure 13. This shows a similar distribution pattern as for the number of facilities (paragraph 4.4.1). Once again it is clear that the larger countries will have more reports than the smaller ones. In order to get a better basis for comparison, the number of reports for each country is scaled by the number of its inhabitants (as per end of 2001). The distribution of scaled number of reports by country is provided in Figure 14. This pattern is globally matching the previous distribution of scaled number of facilities per country.

Table 18 Emissions reported in countries (key figures)

	Number of emissions		Emissions per million inhabitants	
All countries: Total	23113	(including NO and HU)	59.0	(including NO and HU)
EU countries: Total	22463			
All countries: Minimum	36	(LU)	22.7	(GR)
EU countries: Maximum	4762	(UK)	126.1	(UK)

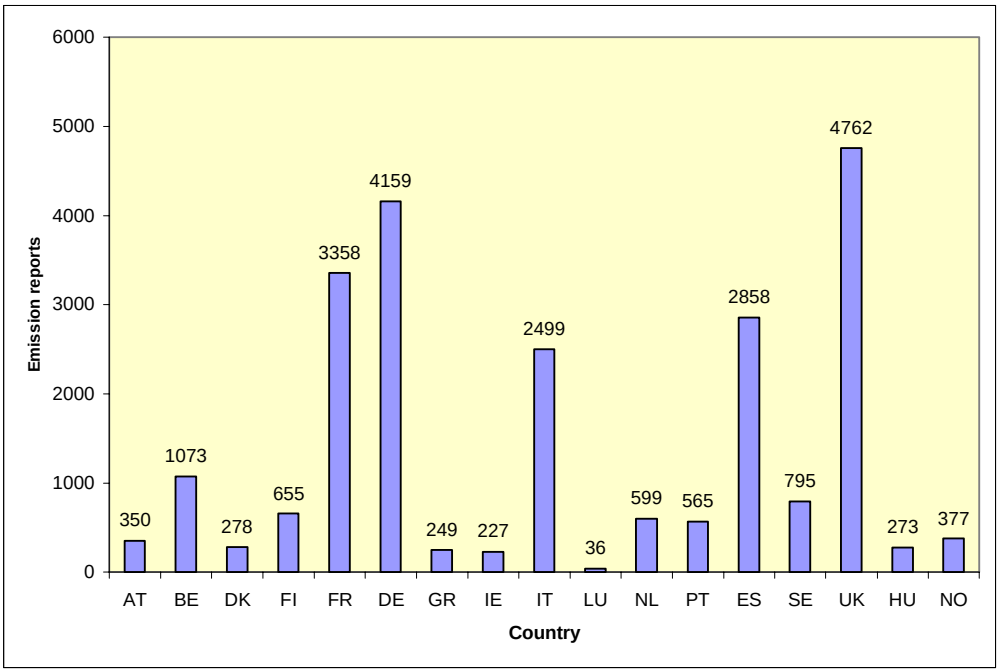


Figure 13 Emissions reported in each country

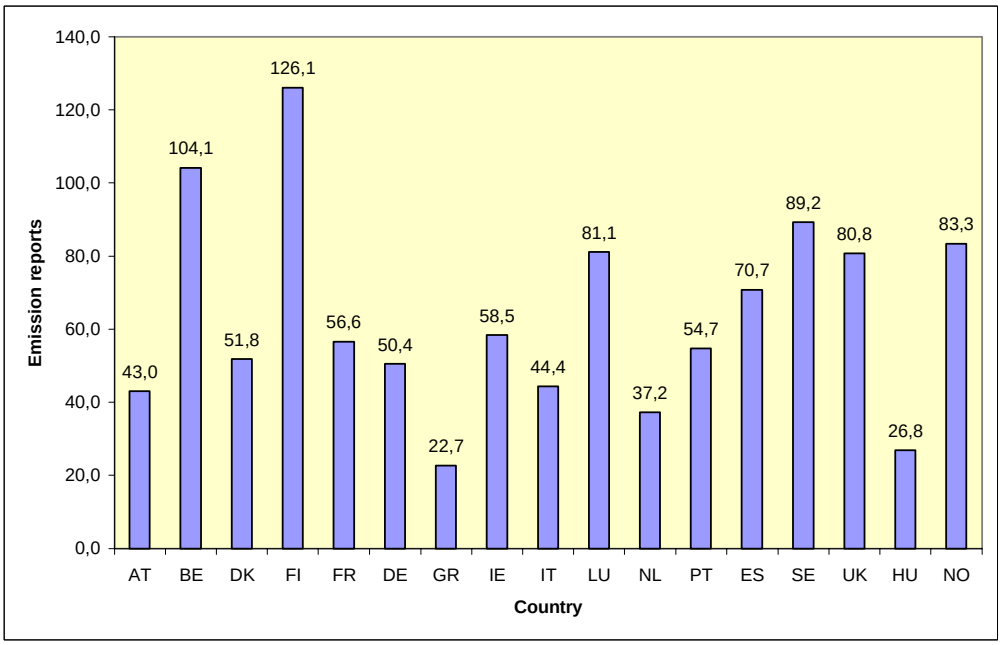


Figure 14 Emissions reported in each country relative to population

4.5.3 Emission reports per facility

Also the number of emissions reported per facility differs between countries (Table 19 and Figure 15), although this number only varies a factor of three between the countries.

Table 19 Number of emissions per facility

	Emissions reported per facility	
All countries: Average	2.5	
All countries: Minimum	1.5	(IE)
All countries: Maximum	4.6	(NL)

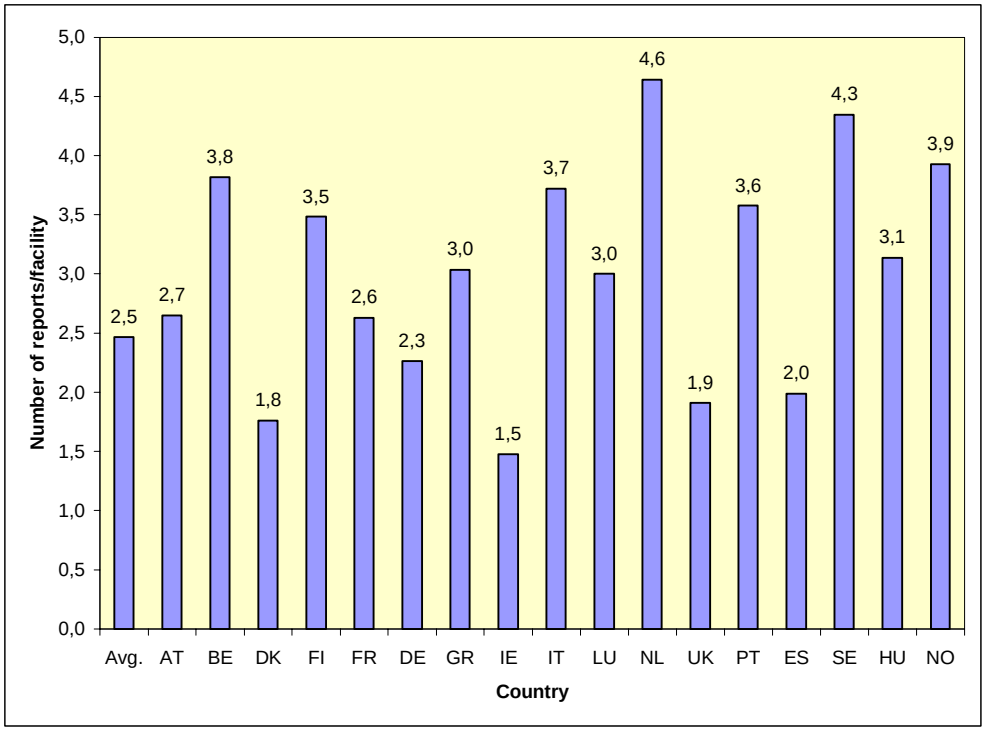


Figure 15 Emission reports per facility in individual countries

Conclusions

- On a per capita basis the number of facilities and the number of emissions reported per country varies within a factor of 6 between the highest and the lowest number. Taking into account that reporting is as yet not complete for all countries, this variability seems to be reasonable.
- The number of reports compared to the number of facilities per country shows a more general and consistent pattern

4.5.4 Facilities per emission type for each country

Some facilities are reporting both emissions to air and water, some are solely dealing with emissions to air and others are reporting with emissions solely to water. The latter group can be subdivided into facilities with:
– direct emissions to water;
– indirect emissions to water.

1. Detailing by country
In the following table and graphs, the figures are detailed by country.

Table 20 Number of facilities per country, reporting the various emission types

Country	All types	Facilities reporting air emissions	Facilities reporting water emissions	Facilities reporting direct water emissions	Facilities reporting indirect water emissions	*both direct and indirect water emission type*
AT	132	97	63	36	28	*1*
BE	281	200	155	108	47	*0*
DK	158	127	38	5	33	*0*
FI	188	158	81	71	14	*4*
FR	1277	913	606	375	248	*17*
DE	1835	1576	423	178	256	*11*
GR	82	71	31	21	10	*0*
IE	154	138	24	11	14	*1*
IT	672	508	317	205	134	*22*
LU	12	11	2	2		*0*
NL	129	79	88	57	50	*19*
PT	158	111	93	80	17	*4*
ES	1437	1250	295	131	164	*0*
SE	183	150	91	90	2	*1*
UK	2496	2117	556	192	373	*9*
HU	87	64	37	19	23	*5*
NO	96	73	65	63	2	*0*

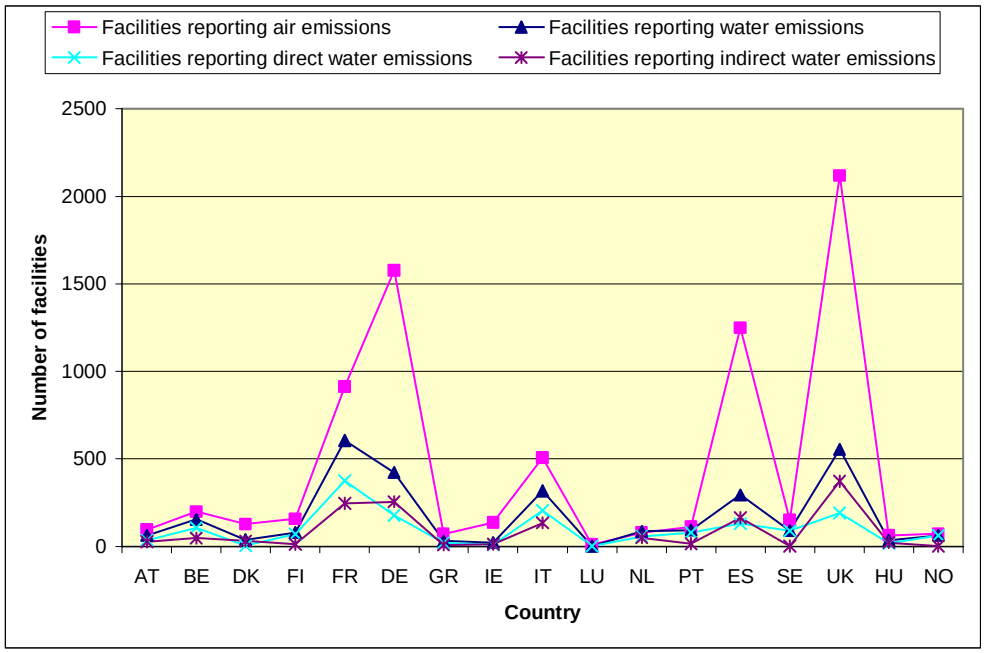


Figure 16 Number of facilities by country and emission type

Based on these figures, the share of facilities reporting to air and water is presented in the next graph.

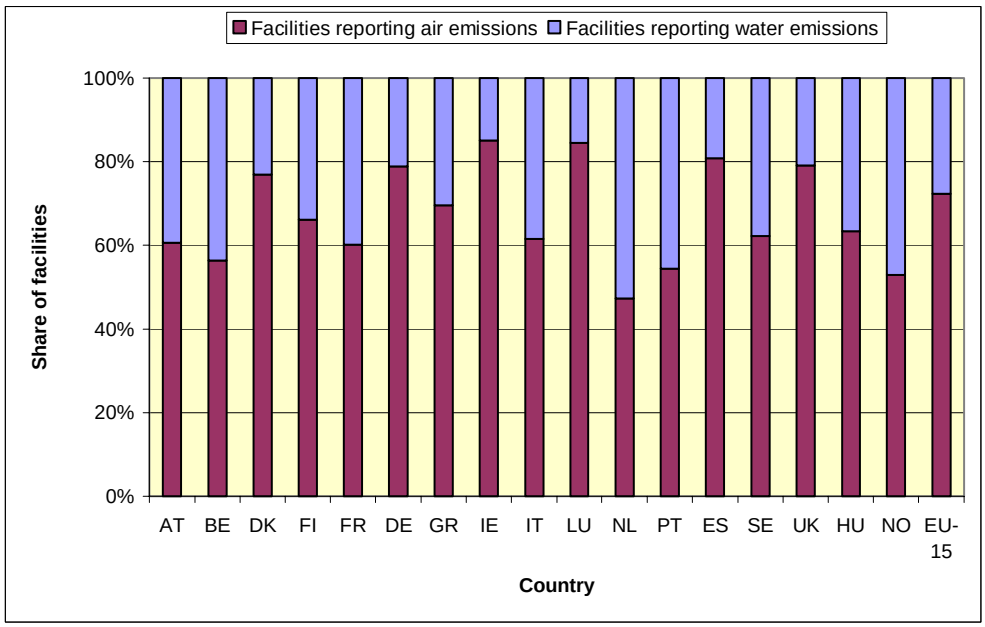


Figure 17 Share of facilities by country and emission type

More in detail, the subdivision of facilities reporting to water is presented in the graph below.

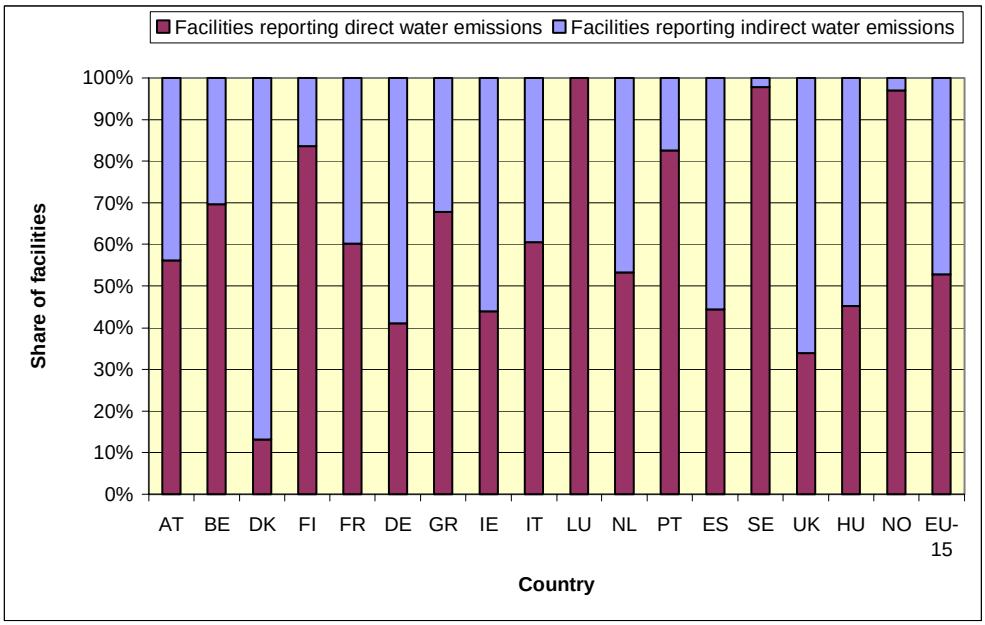


Figure 18 Share of facilities by country and water emission type

4.5.5 Emission reports by emission type and by country

Some industrial pollutants are solely emitted to air, others are emitted solely to water and another group of pollutants is emitted to both air and water. (For a specification, see also 4.6.1.2). As a consequence, in the reporting to EPER, the emission of pollutants must be characterised by one of the following emission types:

– Emissions to air;
– Emissions to water, with a subdivision into:
  – emissions to water – direct;
  – emissions to water – indirect.

For the EPER data this resulted in the following key figures (Table 21).

Table 21 Number of emissions per emission type reported in the database

	All types	Air emission type	Water emission type	Water emission type	
				direct	indirect
All countries: Total number	23113	15663	7450	4763	2687
EU-countries: Total number	22463	15266	7197	4569	2628
All countries: Share of total [%]	100	67,8	32,2	20,6	11,6
EU-countries: Share of total [%]	100	68,0	32,0	20,3	11,7
Maximum number	4762 (UK)	3563 (UK)	1372 (FR)	932 (FR)	633 (UK)
Minimum number	36 (LU)	32 (LU)	4 (LU)	4 (LU)	0 (LU)
Maximum share of country total		88,9 (LU)	52,3 (NL)	46,7 (SE)	22,7 (DK)
Minimum share of country total		47,7 (NL)	11,1 (LU)	2,2 (DK)	0 (LU)

Analysis of the emission reports by emission type gave the following distribution over the various countries (Figure 18):

Table 22 Emission reports by emission type and country

	Country	All types	Air emission reports	Water emission reports	Water - direct emission reports	Water - indirect emission reports
AT	Austria	350	191	159	97	62
BE	Belgium	1073	656	417	319	98
DE	Germany	4159	3103	1056	572	484
DK	Denmark	278	209	69	6	63
ES	Spain	2858	2196	662	361	301
FI	Finland	655	446	209	190	19
FR	France	3358	1986	1372	932	440
GR	Greece	249	190	59	45	14
IE	Ireland	227	196	31	15	16
IT	Italy	2499	1431	1068	718	350
LU	Luxembourg	36	32	4	4	0
NL	Netherlands	599	286	313	198	115
PT	Portugal	565	361	204	175	29
SE	Sweden	795	420	375	371	4
UK	United Kingdom	4762	3563	1199	566	633
NO	Norway	377	237	140	138	2
HU	Hungary	273	160	113	56	57

These results are presented in the following graphs.

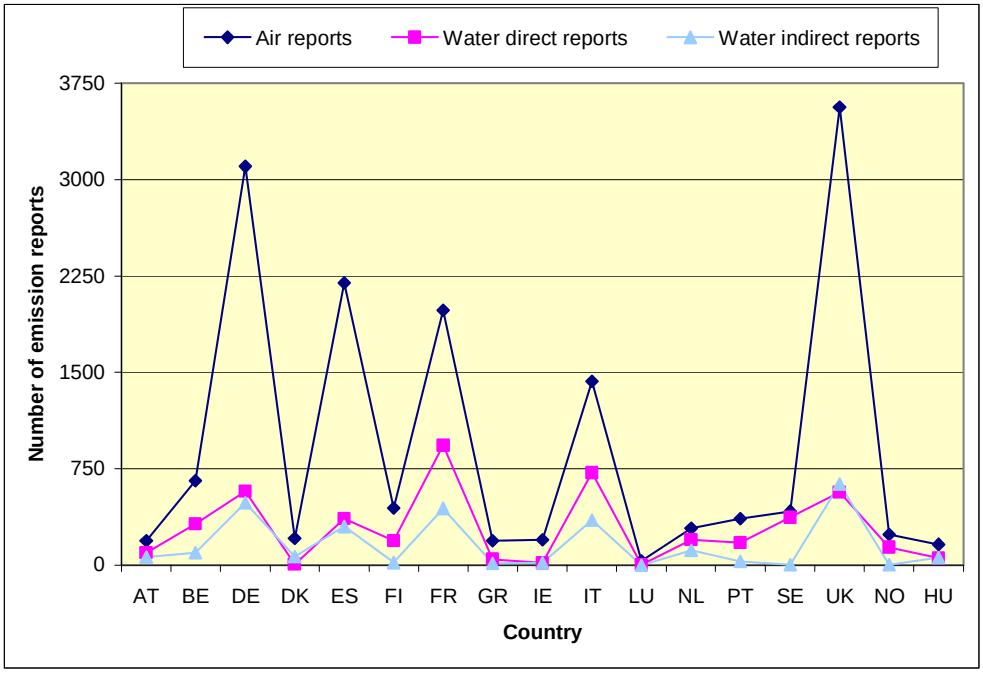


Figure 19 Number of emission reports by country

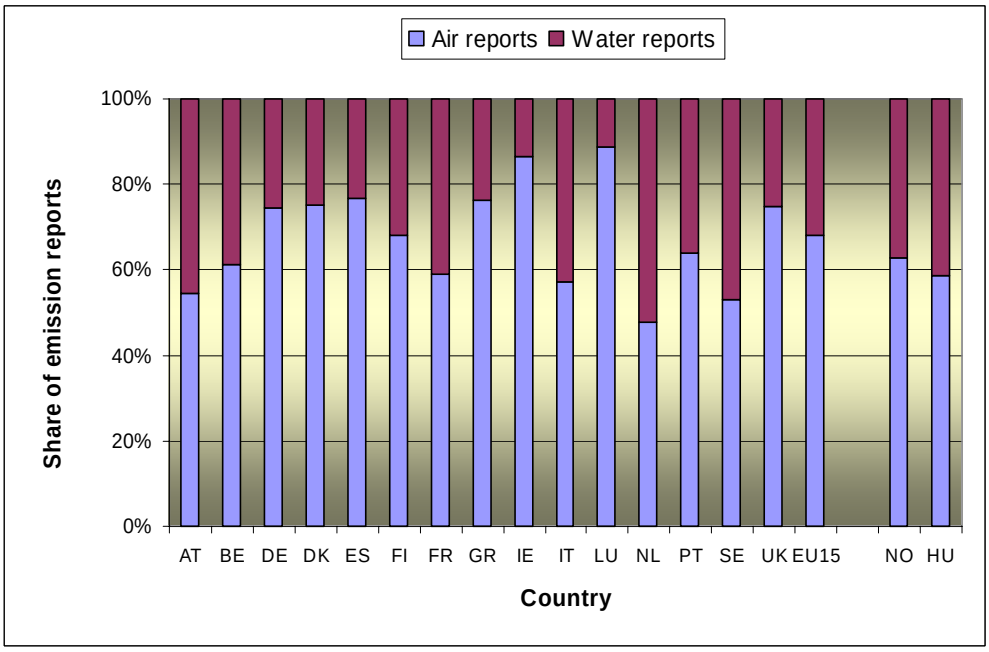


Figure 20 Share of emission reports by country and emission type

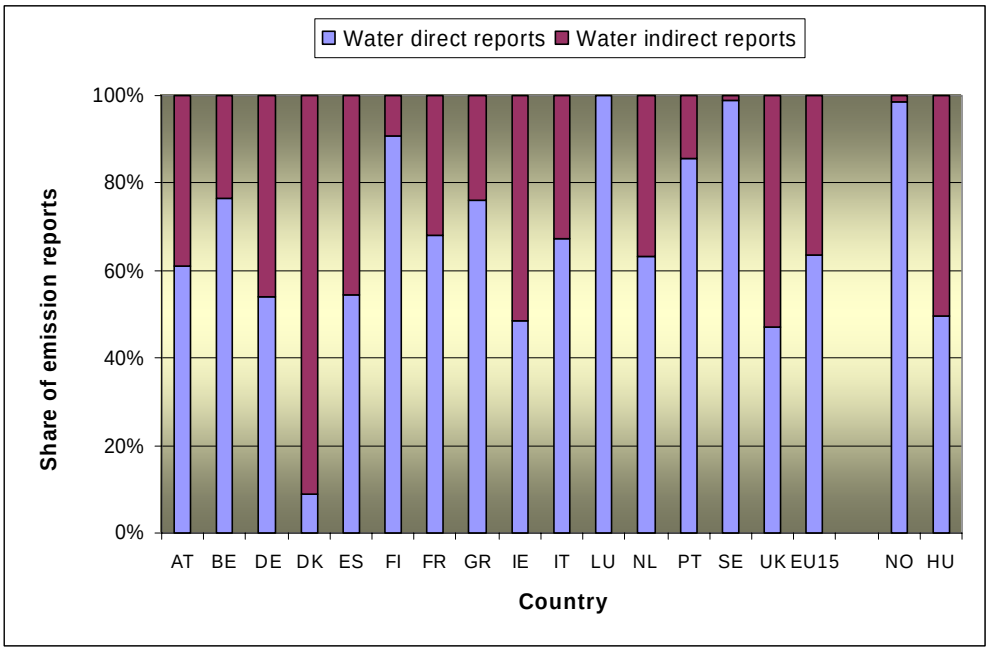


Figure 21 Share of emission reports by country and water emission type

Conclusions

- All emission type reports are represented in the overall EPER reporting.
- The number of pollutant reports to air is dominant in the total number of reports.
- The number of direct water pollution reports is dominant to the number of indirect water pollution reports (except for DK).
- The share of reports by its origin of emission type is fairly consistent over the reporting countries.
- The limited share of specific report types (the emission reports to water direct and indirect) might become a barrier for a meaningful deeper analysis.
- UK and Germany provide the highest number of reports to air.
- For emissions to water, France and the UK delivered the highest number of reports.
- Regarding emissions to water, the share of emission reports between direct and indirect emissions to water is highly variable over the countries.

4.6 Facilities per country and activity

The distribution of facilities by country and activity is shown in the graph below. Due to its character, the number of facilities with activity 6.6: Poultry and pigs is rather dominant. This especially applies for DK, UK and ES.

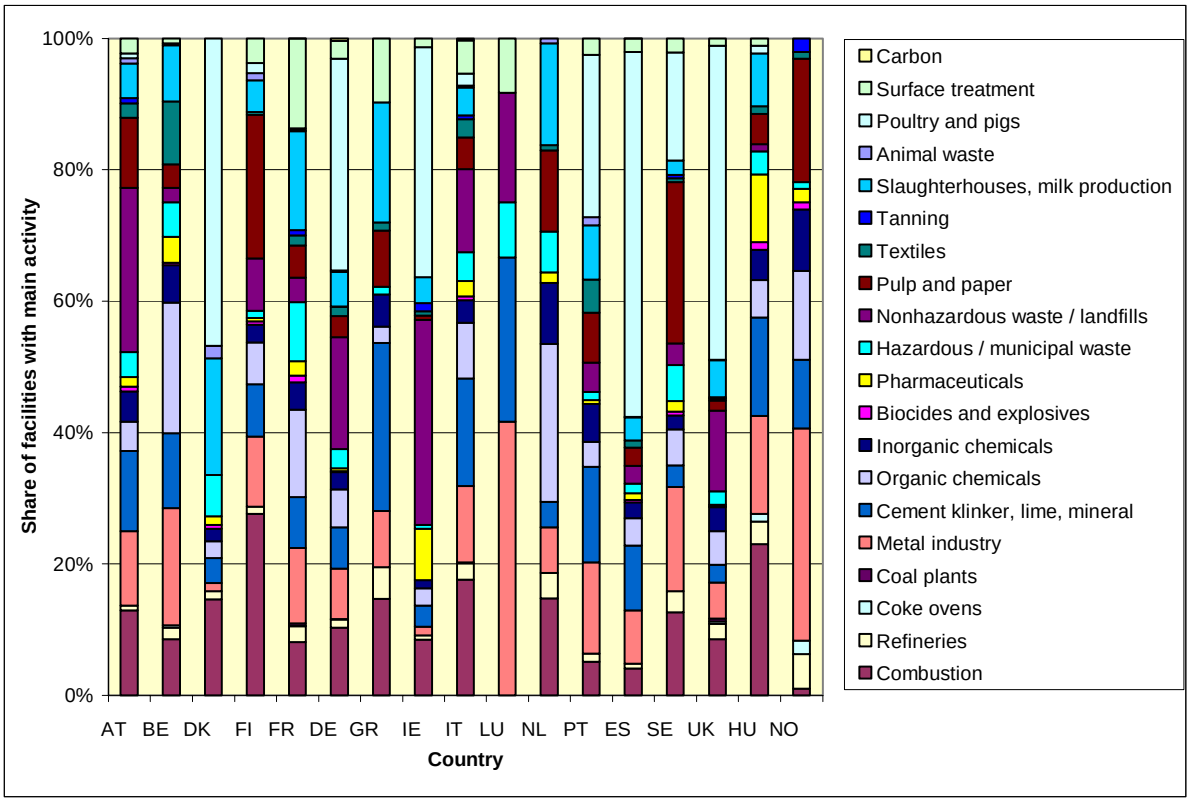


Figure 22 Share of facilities by main activity per country

Extraction of all facilities for activity 6.4 Poultry and pigs, gives a more evenly spread distribution but still shows a broad variety over the countries.

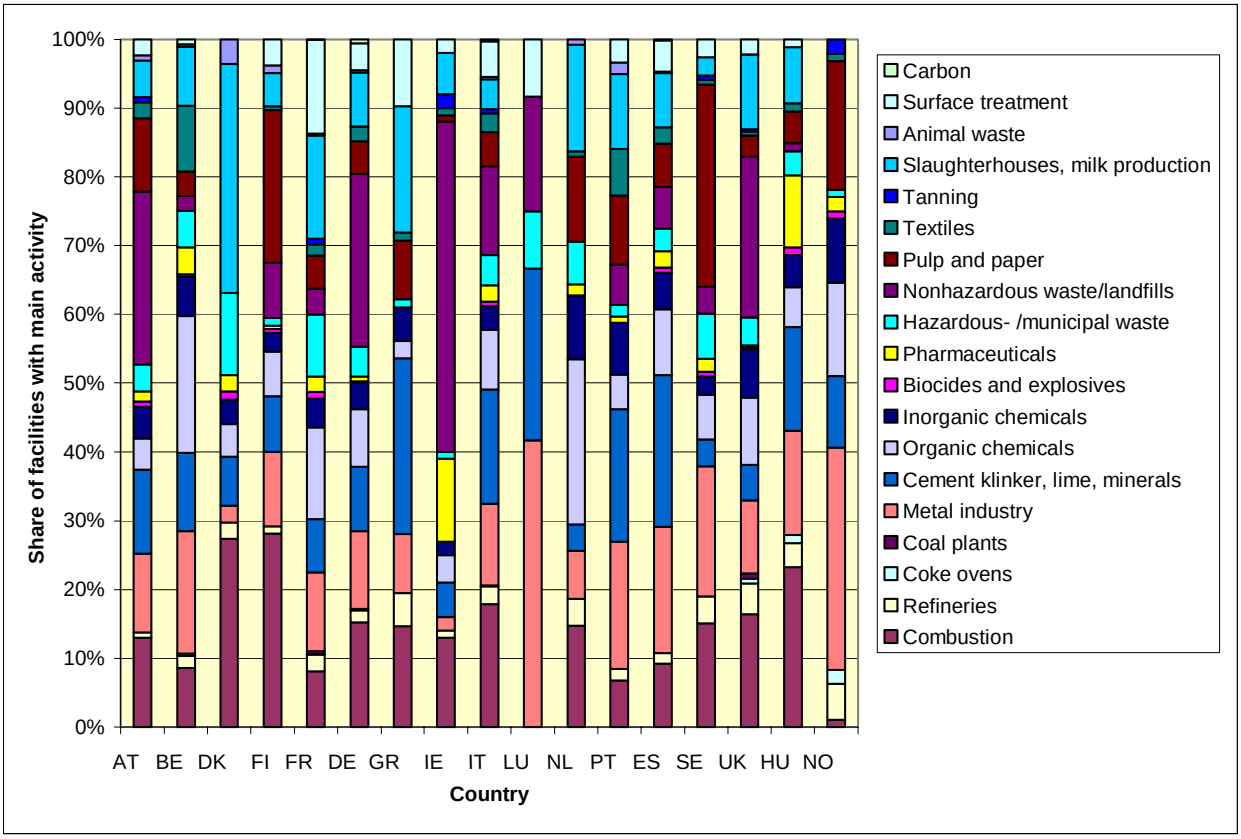


Figure 23 Share of facilities by main activity per country (excluding Poultry and pigs)

4.6.1 Emission reports

4.6.1.1 Emission reports by activity and country

The number of main activities according to Annex 3 of the EPER Decision amounts 21.
Apart from the non-reported activity 3.2: Asbestos, the contribution of the respective countries to reporting for a specific activity is presented in Figure 24 below.

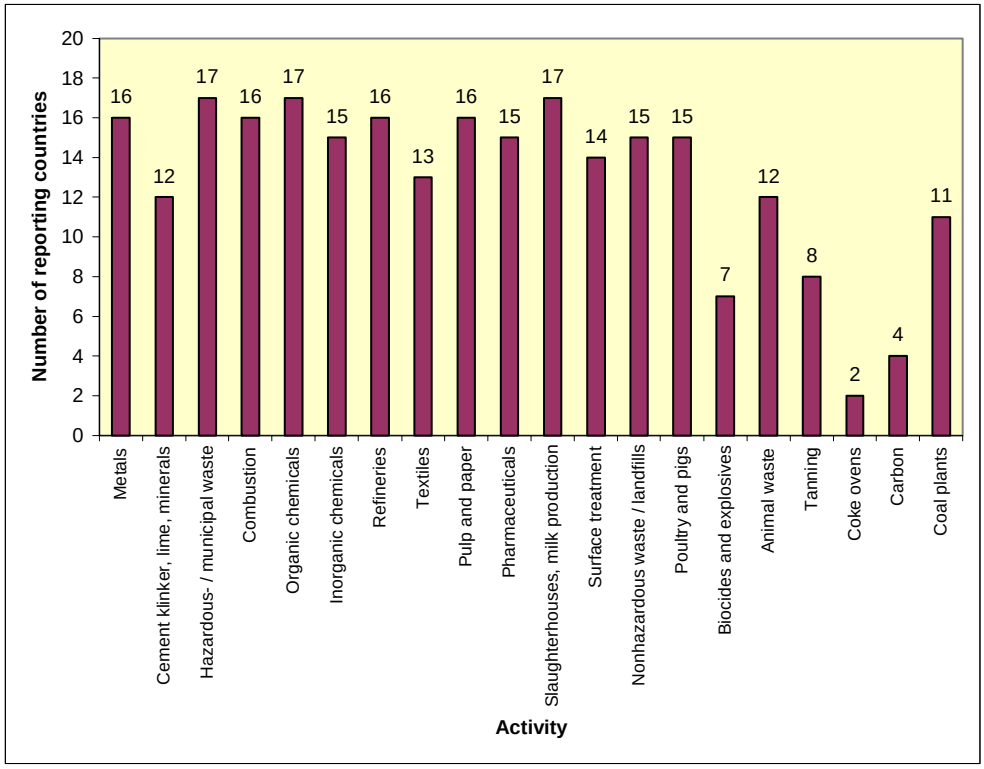


Figure 24 Contribution to reporting in activities by country

For the following 3 activities <u>all</u> countries have reported emissions:

activity 2.1 -2.6 : Metal industry;
activity 3.1, 3.3 – 3.5 : Cement klinker, lime, minerals;
activity 5.1, 5.2 : Hazardous- / municipal waste.

A number of activities are only covered in 50% or less of the number of reporting countries, respectively:

activity 1.3 : Coke ovens;
activity 1.4 : Coal plants;
activity 6.3 : Tanning;
activity 6.8 : Carbon.

The following specification by country gives more insight in the origin of the figures above.

Table 23 Non-reported activities by country

		Combustion	Refineries	Coke ovens	Coal plants	Metals	Cement klinker, lime, minerals	Organic chemicals	Inorganic chemicals or fertilisers	Biocides and explosives	Pharmaceuticals	Hazardous- /municipal waste	Nonhazardous waste / landfills	Pulp fand paper	Textiles	Tanning	Slaughterhouses, milk production	Animal waste	Poultry and pigs	Surface treatment	Carbon
Luxembourg	15	●	●	●	●			●	●	●	●			●	●	●	●	●	●		●
Greece	9			●	●					●	●		●			●		●	●		●
Denmark	8			●	●								●	●	●	●				●	●
Netherlands	8			●	●					●			●			●			●	●	●
Norway	7				●								●				●	●	●	●	●
Ireland	5			●	●					●								●			●
Portugal	5			●	●					●						●					●
Belgium	4				●											●			●		●
Finland	4			●	●											●					●
Sweden	4			●	●													●			●
Hungary	4				●											●		●			●
Austria	3			●	●																●
Spain	3			●	●											●					
Germany	1				●																
Italy	1				●																
United Kingdom	1																				●
France	0																				

The aforementioned situation results in an average distribution pattern for the share of emission reports per activity. This pattern, as an overall figure for all countries, is shown in Figure 25 below.

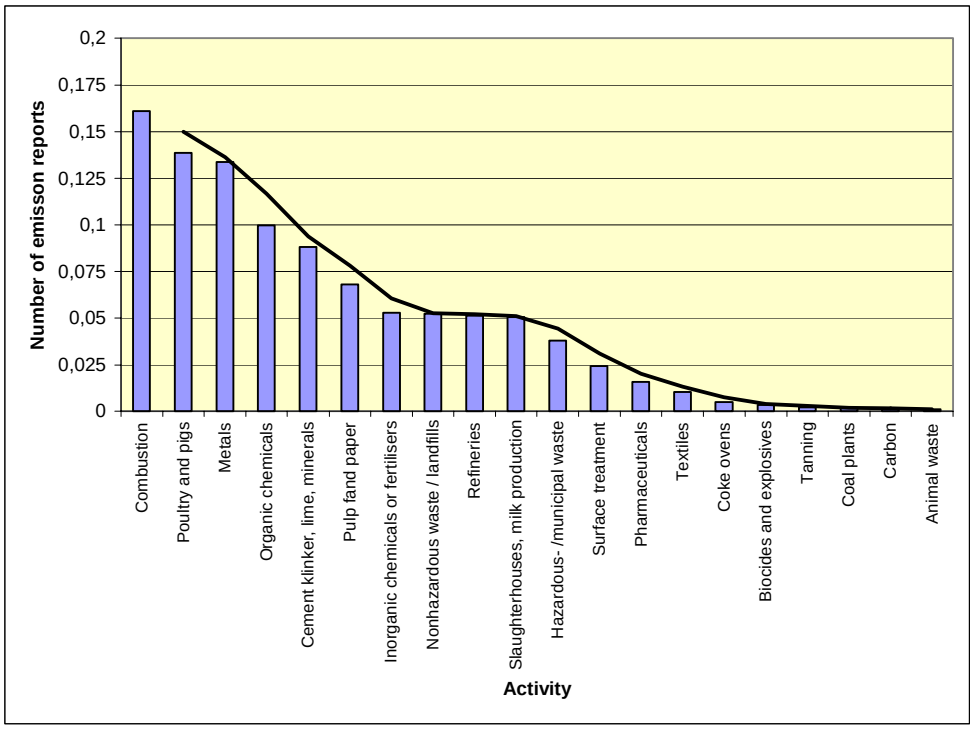


Figure 25 Share of EPER emission reports by activities (average pattern for Europe)

A comparison of country-specific distribution patterns with this average pattern shows:

– For a number of large countries (FR, DE, IT) (and to less extent PT, ES and UK) the country-specific distribution pattern is more or less similar to the overall average.
– For other countries the distribution patterns show typical deviations from the "average", representing a relatively dominant activity (to be characterised by overrepresented) or a limited reporting from specific activities (to be characterised by underrepresented). (See table below).

Activities reported less than 50 % of the average are indicated as underrepresented. Activities reported more than twice the average are indicated as overrepresented. Comparison with an expected average resulting in less than 10 facilities for a country was not considered.

Table 24 Contribution by countries to activity specific reporting

	Overrepresented activities Δ						Underrepresented activities ∇						Not-reported activities ▼							
Country	**Combustion**	**Refineries**	**Coke ovens**	**Coal plants**	**Metal industry**	**Cement klinker, lime, minerals**	**Organic chemicals**	**Inorganic chemicals**	**Biocides and explosives**	**Pharmaceutical**	**Hazardous-/municipal waste**	**Nonhazardous waste landfills**	**Pulp and paper**	**Textiles**	**Tanning**	**Slaughterhouse, milk production**	**Animal waste**	**Poultry and pigs**	**Surface treatment**	**Carbon**
Luxemburg	▼	▼	▼	▼	Δ	Δ	▼	▼	▼	▼			▼	▼	▼	▼	▼	▼		▼
Greece			▼	▼		Δ	∇		▼	▼	∇	▼			▼		▼	▼		▼
Denmark			▼	▼	∇		∇					▼	▼	▼	▼			Δ	▼	▼
Netherlands			▼	▼		∇	Δ	Δ	▼			▼			▼	Δ		▼	▼	▼
Norway	∇			▼	Δ			Δ			∇	▼				▼	▼	▼	▼	▼
Ireland		∇	▼	▼	∇	∇	∇		▼		∇		∇				▼			▼
Portugal			▼	▼		Δ	∇		▼		∇				▼					▼
Belgium				▼	Δ		Δ					∇		Δ	▼			▼	∇	▼
Finland		∇	▼	▼			∇			∇	∇		Δ		▼	∇			∇	▼
Sweden	∇		▼	▼		∇	∇	∇			∇	∇	Δ			∇	▼	∇	∇	▼
Austria			▼	▼							∇	Δ	Δ					∇		▼
Spain			▼	▼							∇	∇			▼			Δ		
Germany				▼					∇	∇		Δ								
Italy				▼				∇				Δ				∇				
UK			Δ						∇	∇		∇	∇	∇				Δ	∇	▼
France			∇						Δ	Δ								∇	Δ	

Conclusions

- Reports have been issued from all source categories of Annex-I activities, except for activity 3.2: Production of asbestos.
- Three activities are reported by all countries (Metals, Cement klinker, lime, minerals and Hazardous-/municipal waste).
- A number of activities are not reported by all countries. This will partly be due to the variety in economic structure, partly due to gaps in the information for this first data delivery as indicated under the constraint for this analysis.
- For some activities the number of emission reports is limited. Such a low level will be a constraint for a deeper comparative analysis between activities as well.

4.6.1.2 Emission reports per pollutant type

For the EPER reporting, the pollutants of existing international inventories of CLRTAP/EMEP (Long Range Transboundary Air Pollution), UNFCCC (United Nations Framework Convention on Climate Change), CORINAIR (European air emission programme of the EEA), the Water Framework Directive (proposed list of priority substances), and the OSPARCOM and HELCOM lists of hazardous substances have been taken into consideration.
This enhances harmonisation of international reporting requirements for the Member States and benefits the comparability of emission data in different national inventories. As a result the pollutants likely to be reported by activity have been identified. (See EPER Guidance document: Table 4 for emissions to air; Table 5 for emissions to water). Consequently, pollutants can be classified under 3 groups, respectively:

Table 25 Pollutants emitted to air and water

Emissions, solely to air
Methane, (CH_4)
Carbon monoxide, (CO)
Carbon dioxide, (CO_2)
Hydrofluorocarbons (HFCs)
Dinitrogenoxide (N_2O)
Ammonia, (NH_3)
Non methane volatile organic compounds (NMVOC)
Nitrogen oxides, (NO_X)
Perfluorocarbons (PFCs)
Sulphur hexafluoride (SF_6)
Sulphur oxides (SO_X)
Dioxines and furans (PCDDs and PCDFs)
Pentachlorophenol (PCP)
Tetrachloroethylene (PER)
Tetrachloromethane (TCM)
Trichlorobenzenes (TCBs)
Trichloroethane-1,1,1 (TCE)
Trichloroethylene (TRI)
Trichloromethane (Chloroform)
Benzene
Chlorine and inorganic compounds
Fluorine and inorganic compounds
Hydrogencyanid (HCN)
PM10s (Particulates<10 μm)

Emissions, solely to water (direct / indirect)
Benzene, toluene, ethylbenzene, xylenes
Brominated diphenylethers
Chlorides
Chloro-alkanes(C10-13)
Cyanides , total CN
Fluorides
Halogenated Organic Compounds (AOX)
Hexachlorobutadiene (HCBD)
Hexachlorocyclohexane (HCH)
Nitrogen,total
Organotin compounds
Phenols
Phosphorus, total
Total Organic Carbon (TOC)

Emissions to air and water
Name
Arsenic and its compounds
Cadmium and its compounds
Chromium and its compounds
Copper and its compounds
Mercury and its compounds
Nickel and its compounds
Lead and its compounds
Zinc and its compounds
Dichloroethane-1,2 (DCE)
Dichloromethane (DCM)
Hexachlorobenzene (HCB)
Hexachlorocyclohexane (HCH)
Polycyclic Aromatic Hydrocarbons (PAH)

The Guidance Document for EPER implementation provides ”Sector-specific sub-lists” (tables 4 and 5 in the Guidance Document) with pollutants to air and water to check which pollutants will likely be emitted from a specific source category of Annex I activities. As a completeness check, the specifically reported pollutants are analysed and presented in comparison to these tables 4 and 5 of the EPER Guidance Document.

4.6.1.3 Pollutants to air

Table 27 shows, amongst the pollutants likely to be reported, those not reported in this first data delivery:

Table 27 Pollutants, not-reported (○) in the likely to be reported pollutants by activity (●)

Activity	CH_4	CO	CO_2	HFCs	N_2O	NH_3	NMVOC	NO_x	PFCs	SF_6	SO_x	As and compounds	Cd and compounds	Cr and compounds	Cu and compounds	Hg and compounds	Ni and compounds	Pb and compounds	Zn and compounds	Dichloroethane-1,2 (DCE)	Dichloromethane (DCM)	Hexachlorobenzene (HCB)	Hexachlorocyclohexane(HCH)	PCDD+PCDF (dioxins+furans)	Pentachlorophenol (PCP)	Tetrachloroethylene (PER)	Tetrachloromethane (TCM)	Trichlorobenzenes (TCB)	Trichloroethane-1,1,1 (TCE)	Trichloroethylene (TRI)	Trichloromethane	Benzene	Polycyclic Aromatic Hydrocarbons	Chlorine and inorganic compounds	Fluorine and inorganic compounds	HCN	PM10	Total likely to report
Combustion		●	●		●			●			●	●	●	●			●	●						●									●	●	●		●	16
Refineries		●	●				●	●			●	●	●	●	●	●	●	●	●													●	●	●	○		●	18
Coke ovens	●	●	●			●	●	●			●	●	●	●	○	○	●	●														●	●			●	●	18
Coal plants		●						●			○																										○	4
Metals		●	●			●	●	●	●	●	●	●	●	●	●	●	●	●	●			●		●								●	●	●	●	●	●	24
Cement klinker, lime, mineral		●	●	●		●	●	●			●	●	●	●	●	●	●	●	●					●								●	●	●	●		●	21
Asbestos																																					○	1
Organic chemicals		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	○	○	●	○	●	●	●	●	●	●	●	●	●			●	34
Inorganic chemicals		●	●		●	●	●	●			●					●				●	●	○	○	●	○	●	●	●	●	●	●			●			●	22
Biocides and explosives						○	●	●																													○	4
Pharmaceuticals						●	●	●													●					○	○			●							○	8
Hazard.- / municipal waste		●	●			●	●	●			●	●	●	●	●	●	●	●	●			○		●									●	●	●		●	20
Nonhazard. waste / landfills	●		●		●			●			●											○		●			○		○									9
Pulp and paper		●	●				●	●			●																										●	6
Textiles			●			●	●	●			●																										○	6
Tanning			○					○																														2
Slaughterhouse, milk prod.	●		●	●		●		●																													●	6
Animal waste			○			●		●			○													○									○				○	7
Poultry and pigs	●				●	●																															●	4
Surface treatment							●					●	●	●	○	●	●	●	●	○	●	○	○	●	○	●	○	○	○	●	○	●					●	23
Carbon							●	●			●																						●		○		●	6
Total likely to report	4	10	14	3	5	12	13	18	2	2	14	8	8	8	7	8	8	8	6	3	4	6	3	9	3	4	5	3	4	4	3	6	9	7	6	2	19	

The reported pollutants by activity are not fully matching with the pollutants likely to be reported as indicated in the table 4 of the EPER Guidance Document.
For each pollutant, a number of activities is likely expected to be reported and for each activity, a number of specific pollutants are likely expected to be reported. The totals for each cross-section are indicated in table 4 of the EPER Guidance Document.
The actual cross sections for pollutants and activities in this review have been compared to these totals. In Table 28 below, the results of this comparison are summarized, respectively for:

– the share of missing pollutants in reporting compared to the total number of likely reported pollutants in a specific activity, (left side of the table); (e.g. for activity 1.4: Coal plants only 2 of the likely to be expected 4 pollutants (50 %) were reported)
– the share of missing pollutants in reporting compared to the total number of expected activities for a specific pollutant (right side of the table). (e.g. only 1 of the 9 likely to be expected activities (11,1 %) were not reporting PAH's).

Table 28 Pollutants to air - reporting level

Activity	Share of missing [%]	out of a likely expected # of	Pollutant	Share of missing [%]	out of a likely expected # of
Tanning	100,0	2	Hexachlorocyclohexane (HCH)	100,0	3
Asbestos	100,0	1	Pentachlorophenol (PCP)	100,0	3
Animal waste	71,4	7	Hexachlorobenzene (HCB)	83,3	6
Coal plants	50,0	4	Tetrachloromethane (TCM)	60,0	5
Surface treatment	39,1	23	Trichloroethane-1,1,1 (TCE)	50,0	4
Pharmaceuticals	37,5	8	Dichloroethane-1,2 (DCE)	33,3	3
Nonhazardous waste/landfills	33,3	9	Trichlorobenzenes (TCB)	33,3	3
Biocides and explosives	25,0	4	Trichloromethane	33,3	3
Carbon	16,7	6	Fluorine and inorganic compounds	33,3	6
Textiles	16,7	6	PM10	31,6	19
Inorganic chemicals	13,6	22	Cu and compounds	28,6	7
Coke overns	11,1	18	Tetrachloroethylene (PER)	25,0	4
Organic chemicals	8,8	34	CO_2	14,3	14
Refineries	5,6	18	SO_X	14,3	14

Table 28 Pollutants to air - reporting level (Cont.)

Activity	Share of missing [%]	out of a likely expected # of	Pollutant	Share of missing [%]	out of a likely expected # of
Hazardous-/municipal waste	5,0	20	Hg and compounds	12,5	8
			PCDD+PCDF (dioxins+furans)	11,1	9
			Polycyclic Aromatic Hydrocarbons	11,1	9
			NH_3	8,3	12
			NO_X	5,6	18

From this overview it can be concluded that:

– All likely expected pollutants are reported for the activities:

1.1	Combustion
2.1 - 2.6	Metals industry
3.1, 3.3 - 3.5	Cement klinker, lime, minerals
6.1	Pulp and paper
6.4	Slaughterhouses, milk production.
6.6	Poultry and pigs

– Hexachlorocyclohexane (HCH) and Pentachlorophenol (PCP) are not reported at all under the activities likely to be expected.
– Activities 6.3 (Tanning) and 3.2 (Asbestos production) do not provide likely reported emissions.

Not all pollutants of the likely to be reported are represented to a similar level. Table 29 represent the level of reporting of pollutants likely to be reported (referencing to table 4 of the EPER Guidance Document).

Table 29 Reporting intensity of likely expected pollutants to air

Activity	CH_4	CO	CO_2	HFCs	N_2O	NH_3	NMVOC	NO_X	PFCs	SF_6	SO_X	As and compounds	Cd and compounds	Cr and compounds	Cu and compounds	Hg and compounds	Ni and compounds	Pb and compounds	Zn and compounds	Dichloroethane-1,2 (DCE)	Dichloromethane (DCM)	Hexachlorobenzene (HCB)	Hexachlorocyclohexane(HCH)	PCDD+PCDF (dioxins+furans)	Pentachlorophenol (PCP)	Tetrachloroethylene (PER)	Tetrachloromethane (TCM)	Trichlorobenzenes (TCB)	Trichloroethane-1,1,1 (TCE)	Trichloroethylene (TRI)	Trichloromethane	Benzene	Polycyclic Aromatic Hydrocarbons	Chlorine and inorganic compounds	Fluorine and inorganic compounds	HCN	PM10
Combustion			■		■			■			■						■	♦						▼									▼	■			■
Refineries		▼	■				■	■			■	▼	▼	▼	●	▼		●	▼														▼	▼	○		♦
Coke ovens	●	●	●			●	●	▼			▼	●	●	●	○	○	●	●													●	●			●	●
Coal plants		●						●			○																										○
Metals		■	■			▼		■	▼	●	■	♦						■	■			●		♦								♦	♦	♦	♦	▼	
Cement klinker, lime, mineral		■	■	●			▼	■			■	♦	♦	▼	▼				▼					●								♦	▼				■
Asbestos																																					○
Organic chemicals		♦		♦	▼	♦	■	■	●	●		●	●	●	●	▼	▼	●	●	♦		○	○	●	○	●	▼	●	●	●	▼	♦	●	▼			●
Inorganic chemicals		♦			♦		▼									♦				●	▼	○	○	●	○	●	●	●	●	▼	●			▼			▼
Biocides and explosives						○	●	●																													○
Pharmaceuticals						●	▼	●													♦					○	○			●							○
Hazard.- / municipal waste		●				●	●	■			▼	●	♦	●	●	♦	▼	▼	▼			○		♦									●	♦	●		●
Nonhazard. waste / landfills	■		●		●			▼			●											○		●			○		○								
Pulp and paper		♦					♦	■			■																										
Textiles			●			●	●	●			●																										○
Tanning			○					○																													
Slaughterhouse, milk prod.	●		♦	●		●																															▼
Animal waste			○			●		●			○													○									○				○
Poultry and pigs	■				♦	■																															●
Surface treatment							■					●	●	●	○	●	●	●	●	○	▼	○	○	●	○	▼	○	○	○	♦	○	●					●
Carbon																																					

(● : 1 – 10 reports; ▼ 11- 25 reports; ♦ 25 – 50 reports; 50 – 100 reports; ■ 100 reports; ○: likely expected but not reported)

For a number of activities the expected pattern in pollutant reporting is hardly represented. This applies for:

activity 1.3:	Coke ovens
activity 1.4:	Coal plants
activity 4.4 – 4. 6:	Biocides and explosives
activity 6.2:	Textiles
activity 6.5:	Animal waste
activity 6.8:	Carbon

But also pollutants were reported additionally to the pollutants likely to be reported which is represented in the following Table 30.

Table 30 Number of pollutants reported additionally (50 or > 50) to the likely to be reported (●) and the likely but not reported (○) pollutants

Activity	CH_4	CO	CO_2	HFCs	N_2O	NH_3	NMVOC	NO_X	PFCs	SF_6	SO_X	As and compounds	Cd and compounds	Cr and compounds	Cu and compounds	Hg and compounds	Ni and compounds	Pb and compounds	Zn and compounds	Dichloroethane-1,2 (DCE)	Dichloromethane (DCM)	Hexachlorobenzene (HCB)	PCDD+PCDF (dioxins+furans)	Pentachlorophenol (PCP)	Tetrachloroethylene (PER)	Tetrachloromethane (TCM)	Trichlorobenzenes (TCB)	Trichloroethane-1,1,1 (TCE)	Trichloroethylene (TRI)	Trichloromethane	Benzene	Polycyclic Aromatic Hydrocarbons	Chlorine and inorganic compounds	Fluorine and inorganic compounds	HCN	PM10
Combustion	●	●	●	9	●	18	39	●		6	●	●	●	●	50	112	●	●	55				●						1		3	●	●	●		●
Refineries	33	●	●	1	28	12	●	●			●	●	●	●	●	●	●	●	●	3	3				1	1				1	●	●	●	○	1	●
Coke ovens	●	●	●			●	●	●			●	●	●	●	○	○	●	●	5											●	●			●	●
Coal plants	9	●	3		3		4	●			○																			3					○
Metals	18	●	●	9	26	●	●	●	●	●	●	●	●	●	●	●	●	●	●		8	●	●	1	5		1		31		●	●	●	●	●	●
Cement klinker, lime, mineral	4	●	●	●	8	●	●	●			●	●	●	●	●	●	●	●	●		3		●						1		●	●	●	●		●
Asbestos																																				○
Organic chemicals	9	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	○	●	○	●	●	●	●	●	●	●	●	●	1	8	●
Inorganic chemicals	7	●	●	13	●	●	●	●	3	4	●	5	6	7	6	I	11	10	17	●	●	○	●	○	●	●	●	●	●	●			●			●
Biocides and explosives			1		1	○	●	●			3				1				2	2	4								3				1	1		○
Pharmaceuticals			4	5	2	●	●	●			3									3	●		1		○	○			●	9					1	○
Hazard.- / municipal waste	291	●	●	10	26	●	●	●		1	●	●	●	●	●	●	●	●	●	1	4	○	●		1				2		4	●	●	●		●
Nonhazard. waste / landfills	●	1	●		●	1	2	●		1	●	2	3	1	1	3	2		1			○	●			○		○					4			2
Pulp and paper	2	●	●	4	21	21	●	●			●	18	9	1	2	3	20	5	8				1							2			18	1		●
Textiles		1	●			●	●	●			●															1			2					1	○
Tanning			○			1	2	○													1					1									
Slaughterhouse, milk prod.	●	8	●	●	2	●	27	●	1		88	2	1			1	28				1		1										4			●
Animal waste	1		○	2		●		●			○												○									○				○
Poultry and pigs	●				●	●																														●
Surface treatment		1	2	7	2	1	●	10	4	6	9	●	●	●	○	●	●	●	●	○	●	○	●	○	●	○	○	○	●	○	●	3	2			●
Carbon		4					●	●			●				1	1		1													5	●		○		●

Most striking additional reporting of pollutants is for:
– Hg and compounds under activity 1.1: Combustion;
– CH_4 under activity 5.1,5.2: Hazardous- / municipal waste;
– SO_x under activity 6.4: Slaughterhouses, milk production.

In general, more pollutants than likely to be expected were reported under:
activity 1.1: Combustion;
activity 6.1: Pulp and paper;
activity 6.4: Slaughterhouse, milk production.

Conclusions for emissions to air

Compared to the expected pollutants to air as presented in the Guidance Document for EPER implementation

- Emission reports for Hexachlorocyclohexane (HCH) and Pentachlorophenol (PCP) were not included in the data delivery
- All other pollutants were reported once or more frequently in the first data delivery however, the number of reports for specific pollutants is limited.
- For a number of activities, reporting of pollutants is fully covering the likely emitted pollutants of Table 4 of the EPER Guidance Document. Basically, this is the case for:

activity 1.1	Combustion installations;
activity 2.1 - 2.6	Metals;
activity 3.1, 3.3 - 3.5	Production of cement, lime, glass, minerals;
activity 6.1	Pre-treatment of fibres or textiles plants;
activity 6.4	Disposal or recycling of animal carcasses and animal waste;
activity 6.6	Surface treatment or products using organic solvents;

- For a number of pollutants all activities as expected to report are covered: Basically, this is the case for:

CH_4	SF_6	As and compounds
CO	Dichloromethane (DCM)	Cd and compounds
HFCs	Tetrachloroethylene (PER)	Cr and compounds
N_2O	Benzene	Ni and compounds
NMVOC	HCN	Pb and compounds
PFCs	Chlorine and inorganic compounds	Zn and compounds

- On the one hand, the reported pollutants by activity are not fully covering the likely emitted pollutants to air as presented in table 4 of EPER Guidance Document. On the other hand, pollutant reporting exceeds the markings in table 4 of the Guidance Document.
- Pollution of PM10 from the Asbestos production (activity 3.2) is not included. This activity was not represented in the data set.
- Missing information in the activity reporting is:
  activity 6.3: All pollutants likely to be reported are missing,
  Under this activity, limited additional reporting took place.

Conclusions for emissions to air (Cont.)

- Most remarkable additional reporting is for
  Hg and compounds under activity 1.1;
  CH_4 under activity 5.1/5.2 and
  SO_x under activity 6.4.
- The expected pollutants per activity, as indicated in table 4 of the EPER Guidance Document are covering a substantial part of the emissions reported. Some markings could be added in these tables, based on the findings above.

4.6.1.4 Pollutants to water

Like for the emissions to air, an analysis was made of the presence of pollutants compared to the likely reported ones for water. The following tables represent the situation for the first data delivery.

Table 31 gives an overview of the not reported but likely expected pollutants to water.
Table 32 shows the (level of) number of additionally reported pollutants to water.
Table 33 shows the pollutant reports addressing pollution direct to water.
Table 34 shows the pollutant reports addressing pollution indirect to water.
The results are presented per activity, referring to Table 5 of the Guidance Document for EPER implementation.
The number of reports and the number of pollutants to water is less compared to the number of reports to air. Consequently, the presentation of level of reporting has been limited to 2 classes (1 – 50, > 50).
This also applies to Table 33 and Table 34.

Table 31 Not reported pollutants (○) under the likely expected pollutants to water (●)

Activity	Total - Nitrogen	Total - Phosphorus	As and compounds	Cd and compounds	Cr and compounds	Cu and compounds	Hg and compounds	Ni and compounds	Pb and compounds	Zn and compounds	Dichloroethane-1,2 (DCE)	Dichloromethane (DCM)	Chloroalkanes (C10-13)	Hexachlorobenzene (HCB)	Hexachlorobutadiene (HCBD)	Hexachlorocyclohexane (HCH)	Halogenated organic compounds	Benzene, toluene, ethylbenzene, xylenes	Brominated diphenylether	Organotin - compounds	Polycyclic Aromatic Hydrocarbons	Phenols	Total organic carbon (TOC)	Chlorides	Cyanides	Fluorides	Total likely
Combustion	●	●		●	●	●	●	●	●	●								●			●		●	●		●	14
Refineries	●		●	●	●	●	●	●	●	●							●	●			●	●	●	●	●	●	17
Coke ovens	●	○																			●	●	●		●		6
Coal plants	○																				○	○	●				4
Metals	●	●	●	●	●	●	●	●	●	●							●			●	●	●	●	●	●	●	18
Cement klinker, lime, mineral	●	●	●	●	●	●	●	●	●	●								○					●			●	13
Asbestos					○												○						○				3
Organic chemicals	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	○	●	●	●	●		●	●	25
Inorganic chemicals	●	●		●	●	●	●	●	●	●							●	●					●		●	●	14
Biocides and explosives	●	●	●	○	○	●	●	●	●	●						○	●	●		○		●	●				16
Pharmaceuticals	●	●								●							●	●				●	●				7
Hazard.- / municipal waste	●	●	●	●	●	●	●	●	●	●							●				●		●	●	●	●	16
Nonhazard. waste / landfills	●	●	●	●	●	●	●	●	●	●							●						●	●	●		14
Pulp and paper	●	●				●	●	●	●	●							●			○			●				10
Textiles	●	●		●	●	●	●	●	●	●							○	●	○		●	●	●	●			16
Tanning	●	●	○		●	○											○						●	●			8
Slaughterhouse, milk prod.	●	●																					●	●			4
Animal waste	●	●			○	○				○							○						●				7
Poultry and pigs	●	●				●				●													○				5
Surface treatment	●	●	●	●	●	●		●	●	●		○	○				○			●	●	●	●		○	●	18
Carbon																					●		○				2
Total likely	19	17	9	11	14	15	11	12	12	15	1	2	2	1	1	2	14	8	2	5	10	9	21	8	8	8	

Table 32 Number of reported pollutants to water by activity, including those additionally to the likely expected of Table 5 of EPER Guidance Document. (50) or (> 50)

Activity	Total – Nitrogen	Total - Phosphorus	As and compounds	Cd and compounds	Cr and compounds	Cu and compounds	Hg and compounds	Ni and compounds	Pb and compounds	Zn and compounds	Dichloroethane-1,2 (DCE)	Dichloromethane (DCM)	Chloroalkanes (C10-13)	Hexachlorobenzene (HCB)	Hexachlorobutadiene (HCBD)	Hexachlorocyclohexane (HCH)	Halogenated organic compounds	Benzene, toluene, ethylbenzene, xylenes	Brominated diphenylether	Organotin - compounds	Polycyclic Aromatic Hydrocarbons	Phenols	Total organic carbon (TOC)	Chlorides	Cyanides	Fluorides	Total
Combustion	14	8	33	17	15	57	16	44	27	47	1		1				1	4			5	5	26	14		14	349
Refineries	26	8	24	6	11	16	14	26	13	39	2	2	1	1	1	1	4	16	1	1	10	67	49	10	9	15	373
Coke ovens	2	○	2				1		1									1			1	4	2	1	3	1	19
Coal plants	○				1		2		1	1								1			○	○	2	1			9
Metals	37	23	53	49	119	92	21	253	99	167	1	1					2	3		4	24	32	53	15	37	57	1142
Cement klinker, lime, mineral	2	4	14	5	5	2	3	10	15	13								○				7	5	1	1	4	91
Asbestos					○												○						○				0
Organic chemicals	81	69	4	18	45	76	37	96	45	135	28	25	5	3	5	1	48	36	○	2	8	99	283	78	31	37	1340
Inorganic chemicals	66	38	30	26	26	37	47	57	43	57	9	7	1			2	15	7			3	14	52	48	12	36	633
Biocides and explosives	4	4	1	○	○	3	2	2	2	2	2	1				○	4	3		○		5	9	4	1	4	53
Pharmaceuticals	14	17	6	5	7	10	4	17	8	22	7	20					14	6		1	2	19	46	4	2	2	233
Hazard.- / municipal waste	14	12	27	22	15	22	21	40	37	27	4	8					2	4		1	10	33	32	14	5	11	361
Nonhazard. waste / landfills	42	18	24	14	18	17	7	36	18	32		1					3					14	22	9	1	6	282
Pulp and paper	59	82	29	38	48	55	25	79	54	85							67			○	1	12	285	14	2	1	936
Textiles	1	13	2	7	21	28	4	20	10	19							○	1	○		4	15	83	1			229
Tanning	7	2	○		23	○											○					3	9	1			45
Slaughterhouse, milk prod.	74	270	4	6	2	5	3	6	7	19											2	5	433	12	1	1	850
Animal waste	2	3			○	○				○							○						10				15
Poultry and pigs	2	4		2		32				26													○				66
Surface treatment	6	9	7	4	17	17		65	18	37		○	○				○	2	1	1	1	14	21	1	○	11	232
Carbon								1													1	1	○				3
Total	453	584	305	220	372	469	207	752	398	728	54	65	8	4	6	4	160	84	2	10	72	349	1422	228	105	200	7261

Table 33 Number of reported pollutants direct to water by activity including those additional to the likely reported (50) or (> 50)

Activity	Total - Nitrogen	Total - Phosphorus	As and compounds	Cd and compounds	Cr and compounds	Cu and compounds	Hg and compounds	Ni and compounds	Pb and compounds	Zn and compounds	Dichloroethane-1,2 (DCE)	Dichloromethane (DCM)	Chloroalkanes (C10-13)	Hexachlorobenzene (HCB)	Hexachlorobutadiene (HCBD)	Hexachlorocyclohexane (HCH)	Halogenated organic compounds	Benzene, toluene, ethylbenzene, xylenes	Brominated diphenylether	Organotin - compounds	Polycyclic Aromatic Hydrocarbons	Phenols	Total organic carbon (TOC)	Chlorides	Cyanides	Fluorides	Total
Combustion	9	3	31	15	14	52	15	40	25	43	1						1	2			4	5	17	13		12	302
Refineries	23	6	23	6	11	15	13	24	12	37	2	1	1	1	1	1	4	15	1	1	9	61	43	9	8	15	343
Coke ovens	1	○	1						1									1			○	3	1		2		10
Coal plants	○			1			2		1	1								1			○	○	1	1			8
Metals	28	15	45	41	64	68	18	105	79	123	1						○	2		4	18	25	36	14	26	51	763
Cement klinker, lime, mineral	1	1	12	5	5	2	3	10	10	8								○				3	1	1	1	4	67
Asbestos					○												○						○				0
Organic chemicals	54	40	37	14	32	46	30	69	35	99	19	16	2	3	4	1	35	17	○	2	7	52	131	55	20	31	851
Inorganic chemicals	59	31	24	25	24	32	39	45	37	48	8	7	1			2	15	7			2	9	35	45	10	32	537
Biocides and explosives	4	3	1	○	○	3	2	2	2	2	2	1				○	2	2		○		1	5	3	1	3	39
Pharmaceuticals	10	10	4	3	4	6	2	11	3	10	3	7					7	2			1	9	19	2	1	1	115
Hazard.- / municipal waste	7	3	11	9	6	11	12	21	14	10	3	3					2	2		1	6	9	8	11	2	8	159
Nonhazard. waste / landfills	21	14	14	9	9	13	5	20	12	24		1					1					7	11	8	1	5	175
Pulp and paper	58	77	27	36	43	46	20	73	47	72							61			○	1	8	227	14	2	1	813
Textiles	○	5		3	8	9	2	8	6	6							○	○	○		2	2	16	○			67
Tanning	1	○	○		5	○											○						1	○			7
Slaughterhouse, milk prod.	18	56	3	3	1	3	1	4	3	9											1	2	61	9	1		175
Animal waste		3			○	○				○							○						2				5
Poultry and pigs	2	1		2		32				26													○				63
Surface treatment	5	4	2	3	10	9		36	7	19		○	○				○			○	○	4	2	1	○	7	109
Carbon								1													1	1	○				3
Total	301	272	253	175	236	347	164	469	294	537	39	36	4	4	5	4	128	51	1	8	52	201	617	186	75	170	4611

Table 34 Number of reported pollutants indirect to water by activity, including those additional to the likely reported. (< 50) or (> 50)

Activity	Total - Nitrogen	Total - Phosphorus	As and compounds	Cd and compounds	Cr and compounds	Cu and compounds	Hg and compounds	Ni and compounds	Pb and compounds	Zn and compounds	Dichloroethane-1,2 (DCE)	Dichloromethane (DCM)	Chloroalkanes (C10-13)	Hexachlorobenzene (HCB)	Hexachlorobutadiene (HCBD)	Hexachlorocyclohexane (HCH)	Halogenated organic compounds	Benzene, toluene, ethylbenzene, xylenes	Brominated diphenylether	Organotin - compounds	Polycyclic Aromatic Hydrocarbons	Phenols	Total organic carbon (TOC)	Chlorides	Cyanides	Fluorides	Total
Combustion	5	5	2	2	1	5	1	4	2	4			1					24			15		9	1		2	47
Refineries	3	2	1	○	○	1	1	2	1	2		1					○	1	1	1	10	67	49	10	9	15	373
Coke ovens	2	○	2				1		1									1			1	4	2	1	3	1	19
Coal plants	○				1		2		1	1								1			○	○	2	1			9
Metals	37	23	53	49	119	92	21	253	99	167	1	1					2	3		4	24	32	53	15	37	57	1142
Cement klinker, lime, mineral	2	4	14	5	5	2	3	10	15	13								○				7	5	1	1	4	91
Asbestos					○												○						○				0
Organic chemicals	81	69	4	18	45	76	37	96	45	135	28	25	5	3	5	1	48	36	○	2	8	99	283	78	31	37	1340
Inorganic chemicals	66	38	30	26	26	37	47	57	43	57	9	7	1			2	15	7			3	14	52	48	12	36	633
Biocides and explosives	4	4	1	○	○	3	2	2	2	2	2	1				○	4	3		○		5	9	4	1	4	53
Pharmaceuticals	14	17	6	5	7	10	4	17	8	22	7	20					14	6		1	2	19	46	4	2	2	233
Hazard.- / municipal waste	14	12	27	22	15	22	21	40	37	27	4	8					2	4		1	10	33	32	14	5	11	361
Nonhazard. waste / landfills	42	18	24	14	18	17	7	36	18	32		1					3					14	22	9	1	6	282
Pulp and paper	59	82	29	38	48	55	25	79	54	85							67			○	1	12	285	14	2	1	936
Textiles	1	13	2	7	21	28	4	20	10	19							○	1	○		4	15	83	1			229
Tanning	7	2	○		23	○											○					3	9	1			45
Slaughterhouse, milk prod.	74	270	4	6	2	5	3	6	7	19											2	5	433	12	1	1	850
Animal waste	2	3			○	○				○							○						10				15
Poultry and pigs	2	4		2		32				26													○				66
Surface treatment	6	9	7	4	17	17		65	18	37		○	○				○	2	1	1	1	14	21	1	○	11	232
Carbon								1													1	1	○				3
Total	152	312	70	45	136	122	43	283	104	191	15	29	4	0	1	0	32	33	1	2	20	148	805	42	30	30	6959

In the table below, the results from the table of not-reported pollutants addressing emissions to water are summarized for:

– the share of missing reported pollutants compared to the total number of likely reported pollutants for a specific activity, (left 2 columns);
– the share of missing reported pollutants compared to the number of pollutants likely to report. (right 2 columns).

Table 35 Pollutants to water - reporting level

Activity	Share missing [%]	Out of a likely expected # of	Pollutant	Share missing [%]	Out of a likely expected # of
Asbestos	100,0	3	Brominated diphenylether	100,0	2
Coal plants	75,0	4	Hexachlorocyclohexane(HCH)	50,0	2
Animal waste	57,1	7	Chloroalkanes (C10-13)	50,0	2
Carbon	50,0	2	Dichloromethane (DCM)	50,0	2
Tanning	50,0	8	Organotin - compounds	40,0	5
Biocides and explosives	25,0	16	Halogenated organic compounds	35,7	14
Surface treatment	22,2	18	Cr and compounds	21,4	14
Poultry and pigs	20,0	5	Total organic carbon (TOC)	14,3	21
Coke ovens	16,7	6	Cu and compounds	13,3	15
Textiles	12,5	16	Cyanides	12,5	8
Pulp and paper	10,0	10	Benzene, toluene, ethylbenzene, xylenes	12,5	8
Cement klinker, lime, minerals	7,7	13	Polycyclic Aromatic Hydrocarbons	11,1	9
Organic chemicals	4,0	25	As and compounds	11,1	9
			Phenols	10,0	10
			Cd and compounds	9,1	11
			Zn and compounds	6,7	15
			Total - Phosphorus	5,9	17
			Total - Nitrogen	5,3	19

Conclusions

Compared to the expected pollutants to water as presented in table 5 of the Guidance Document for EPER implementation the following can be concluded:

- Regarding the various pollutants, all reports are represented in the data delivery.
- For a number of activities, the reporting of pollutants is fully covering the likely emitted pollutants This is the case for:

activity 1.1:	Combustion installations
activity 1.2:	Mineral oil and gas refineries
activity 2.1 - 2.6:	Metals
activity 4.2/4.3:	Basic inorganic chemicals or fertilisers
activity 4.5:	Pharmaceutical products
activity 5.1/5.2	Installations for the disposal or recovery of hazardous waste or municipal waste
5.3/5.4	Installation for the disposal of non hazardous waste and landfills
6.4	Disposal or recycling of animal carcasses and animal waste

- A number of pollutants as expected to report were covering all their indicated activities: Basically, this is the case for:

Hg and compounds	Hexachlorobenzene (HCB)
Ni and compounds	Hexachlorobutadiene (HCBD)
Pb and compounds	Chlorides
Dichloroethane-1,2 (DCE)	Fluorides

- On the one hand, the reported pollutants by activity are not fully covering the likely emitted pollutants to water as indicated in the table 5 of the Guidance Document for EPER implementation. On the other hand, activity pollutant reporting exceeds the markings in this table.

Most remarkable missing information is:

Activity	3.2 Asbestos	All pollutants likely to be reported are missing since there is no reporting on this activity
Pollutant	Brominated diphenylether	Not present for all likely to be reported annex 1 activities, but additionally reported in other activities

- Most remarkable additionally reported pollutants are:

Chlorides	under activities 4.1 Organic chemicals and 4.2, 4.3: Inorganic chemicals

- The expected pollutants per activity, as indicated in table 5 of the EPER Guidance Document are covering a substantial part of the emissions reported. Some markings could be added in these tables, based on the findings above.

Final conclusions on completeness

General information

- The mandatory identification items are not provided completely
- In order to get a uniform approach, it would be recommendable to request for the visiting address of the facilities.
- The voluntary information was provided to a moderate level
- All reporting facilities were linked to an Annex-I activity as main activity. Approximately 15% of facilities identified other activities apart from their main activity:
- Basically, all reporting information as provided in this first delivery was valid referring to the time period as set for the origin of EPER emission data.

Facilities

- The total number of reporting facilities (9377) is unevenly spread over the various countries. The large countries did provide information about more facilities than the smaller ones.
- Activity 3.2: Asbestos production was not present in the reviewed data set.
- A number of activities is substantially represented in the data delivery. For 6 activities, the number of facilities was limited. This applies to:

1.3	Coke ovens
1.4	Coal gasification and liquefaction plants
4.4 – 4. 6	Biocides and explosives
6.1	Tanning
6.5	Disposal or recycling of animal carcasses and animal waste
6.8	Production of carbon or graphite

- The activity Poultry and pigs is dominantly represented
- UK, Germany, Spain and France reported for more than 1200 facilities

Distribution of emission reports

- All participating countries have delivered emission reports;
- Five countries, respectively UK, Germany, France, Spain and Italy did report more than 2000 emissions each. Luxembourg delivered the minimum of 36 reports
- As for the number of facilities, the number of reports is reasonably proportional to the country size as characterised by the number of inhabitants.
- The number of reports compared to the number of facilities per country shows a more general and consistent pattern
- The average number of emission reports per activity is 2,5
- Emissions for all Annex-I activities have been reported, except for activity 3.2: Asbestos production.
- Some activities are strongly represented and responsible for around 15% of the number of emission reports (Combustion, Poultry & pigs and Metal industry).

Distribution of emission reports (Cont.)

- Another group of 6 activities is represented by only a limited (around 100 or less) number of facilities. (Coke ovens, Coal plants, Biocides and explosives, Tanning, Animal waste and Carbon).
- A limited number of emission reports for a specific cross section will be a constraint for comparative analysis.
- Reports have been issued from all source categories of Annex-I activities, except for activity 3.2 : Asbestos.
- Three activity categories are reported by all countries. (Metal industry, Cement klinker, lime & mineral and Hazardous-/municipal waste)
- A number of activities are not reported by all countries. This will partly be due to the variety in economic structure, partly due to gaps in the information for this first data delivery as indicated under the constraint for this analysis..
- For some activities the number of emission reports is limited. Such a low level will be a constraint for a deeper comparative analysis between activities as well.
- All emission type reports are represented in the data delivery.
- The number of pollutant reports to air is dominant in the total number of reports.
- The split between number of reports to air and reports to water is highly variable depending on the activity. The activities Combustion, Poultry & pigs, Metals and Cement klinker, lime & mineral represent approximately two third of the reports to air. The number of reports on direct water pollution is dominant to the number of reports on indirect water pollution.
- The share of direct water reports compared to indirect water reports is highly variable depending on the activity.
- The activities Metal, Organic chemicals, Pulp and paper and Slaughterhouses, milk production represent more than half of the water reports..
- The share of reports by the various origin of emission type is fairly consistent over the reporting countries
- UK and Germany provide the highest number of reports to air.
- For emissions to water, France and the UK delivered the highest number of reports.
- Regarding emissions to water, the share of emission reports between direct and indirect emissions to water is highly variable over the countries
- Some activities reflect only a very small number of reports.The limited share of specific report types (the emission reports to water) is a barrier for a meaningful deeper analysis.

Pollutants to air

Compared to the expected pollutants to air as presented in the Guidance Document for EPER implementation:

- Emission reports for Hexachlorocyclohexane (HCH) and Pentachlorophenol (PCP) were not included in the data delivery
- All other pollutants were reported once or more frequently in the first data delivery however, the number of reports for specific pollutants is limited.
- For a number of activities, reporting of pollutants is fully covering the likely emitted pollutants of Table 4 of the EPER Guidance Document. Basically, this is the case for activities:

1.1	Combustion installations
2.1 - 2.6	Metal industry
3.1, 3.3 - 3.5	Production of cement, lime, glass, mineral substances, ceramic products
6.1	Pre-treatment of fibres or textiles plants
6.4	Disposal or recycling of animal carcasses and animal waste
6.6	Surface treatment or products using organic solvents

- For a number of pollutants all activities as expected to report are covered: Basically this is the case for:

CH_4	SF_6	As and compounds
CO	Dichloromethane (DCM)	Cd and compounds
HFCs	Tetrachloroethylene (PER)	Cr and compounds
N_2O	Benzene	Ni and compounds
NMVOC	HCN	Pb and compounds
PFCs	Chlorine and inorganic compounds	Zn and compounds

- On the one hand, the reported pollutants by activity are not fully covering the likely emitted pollutants to air as presented in the table 4 of EPER Guidance Document. On the other hand, pollutant reporting exceeds the table markings.
- Missing information in the activity reporting is:

Activity 3.2:	The pollutant likely to be reported (PM-10) is missing. No reports were delivered for activity 3.2: Asbestos
Activity 6.3:	All pollutants likely to be reported are missing, Under this activity, limited additional reporting took place.

- Most remarkable additional reporting is for

Hg and compounds	under activity 1.1,
CH_4	under activity 5.1/5.2
and	
SO_X	under activity 6.4.

Pollutants to water

Compared to the expected pollutants to water as presented in the Guidance Document for EPER implementation

- Regarding the various emission groups, all reports are represented in the data delivery.
- For a number of activities, reporting of pollutants is fully covering the likely emitted pollutants This is the case for activities:

1.1	Combustion
1.2	Refineries
2.1 - 2.6	Metal industry
4.2/4.3	Inorganic chemicals
4.5	Pharmaceutical
5.1/5.2	Hazardous / municipal waste
5.3/5.4	Non hazardous waste / landfills
6.4	Animal waste

- A number of pollutants as expected to report were covering all activities: This is the case for:

Hg and compounds	Hexachlorobenzene (HCB)
Ni and compounds	Hexachlorobutadiene (HCBD)
Pb and compounds	Chlorides
Dichloroethane-1,2 (DCE)	Fluorides

- On the one hand, the reported pollutants by activity are not fully covering the likely emitted pollutants to water as indicated in the table 5 of the Guidance Document for EPER implementation. On the other hand, activity pollutant reporting exceeds the markings of this table.
- Most remarkable missing information is:

Activity	3.2 Asbestos	All pollutants likely to be reported are missing. No reports were delivered for activity 3.2: Asbestos
Pollutant	Brominated diphenylether	Not present for all likely to be reported annex 1 activities, but additionally reported in other activities

Recommendations

The expected pollutants per activity, as indicated in the tables 4 and 5 of the EPER Guidance Document are covering a substantial part of the emissions reported.

Some markings of pollutants could be added to these tables, based on the findings above.

5. Review of emissions

In this chapter, the evaluation of emission **levels** is the central topic.
The evaluation is carried out for the various pollutants to air and to water (direct and indirect), considering the origin by countries and activities.

Presenting the pollutant emission levels by country and by activity will first of all give insight in the most dominant contributions to the total emission of pollutants. By sorting them in descending order a distribution pattern of the emissions will appear. When such a pattern will change rather smoothly towards the lower values, they can be clarified assuming a similar and smooth distribution of activities over the countries.

On the other hand some extreme shares or sudden breaks in the descending trend for a specific country or a specific activity can be observed. This might be due to a real source of emissions but also due to erroneous data or missing information. A critical view on the order and level of the values is needed. The figures will have to be put in the perspective of activities represented in the respective countries, as elaborated in chapter 4.

5.1 Emissions to air

5.1.1 Emissions by country

In order to see the contribution to the total emission to air for a certain pollutant by each country, its share of the total emission is determined.

In the Table 36 until Table 39 these contributions are presented up to a maximum of 10 countries. Besides, the share of the total emission for these countries is reported as well as the total emission for all countries in this review. Apart from these tables, all results are represented in pie charts as well.

Evaluation of these tables gives the following result:
- The total emission of a pollutant is covered for at least more than 92% (average for 98 %) by the 10 most emitting countries.
- For many pollutants to air, the distribution over the various countries shows a rather clear pattern. Most emission levels for specific pollutants are dominated by 5 large countries.(UK, FR, IT, DE and ES). Each of them is frequently represented in the top-3.

- There are some remarkable contributions for a specific country. This applies to the contribution of:
  - GR to the total emission of PFC's;
  - ES to the total emission of Hexachlorobenzene (HCB); (only a few reports available)
  - FR to the total emission of Pentachlorophenol (PCP); (only reporting country)
  - FR to the total emissions of Tetrachloromethane (TCM), Trichlorobenzenes (TCB), Trichloroethane-1.1.1.(TCE)

It should be noted that the distribution over countries is strongly depending on the structure of the industry. To make a final judgment, the reported activities, the intensity of reporting, the information gaps and background information like production level is needed.

Table 36 Main contributions to emissions for various pollutants to <u>air</u> by countries

	Country	CH_4	Country	CO	Country	CO_2	Country	HFCs	Country	N_2O	Country	NH_3	Country	NMVOC	Country	NO_X	Country	PFCs	Country	SF_6	Country	SO_X
	IT	35.8	DE	24.2	DE	28.4	ES	28.3	FR	22.3	UK	40.3	UK	24.8	ES	27.1	GR	75.6	UK	51.4	ES	25.2
	UK	29.4	IT	14.3	UK	16.9	UK	21.6	IT	22.2	ES	21.6	FR	23.0	UK	18.1	FR	11.8	IT	27.4	UK	20.7
	DE	21.8	UK	14.1	IT	14.0	GR	18.6	NL	14.6	DE	20.2	ES	11.2	DE	13.4	IT	2.6	FR	11.0	IT	11.2
	ES	3.5	FR	13.7	ES	10.3	FR	18.4	UK	11.2	FR	5.5	IT	8.7	IT	11.6	SE	2.4	DE	9.3	GR	8.9
	IE	3.0	BE	9.4	FR	5.4	IT	7.1	BE	9.9	SE	2.1	BE	7.8	FR	8.2	DE	2.2	SE	0.7	DE	8.1
	FR	2.2	ES	6.1	GR	4.4	DK	3.1	DE	6.4	IE	1.8	DE	7.5	GR	4.1	UK	1.9	PT	0.2	FR	8.0
	AT	1.5	SE	4.8	NL	4.4	DE	1.6	ES	4.2	DK	1.7	NO	5.4	BE	3.6	ES	1.9			HU	6.2
	FI	0.8	AT	4.0	BE	3.6	SE	1.0	NO	3.9	NL	1.7	SE	4.4	PT	2.6	HU	1.5			PT	3.6
	PT	0.8	NL	3.2	FI	2.4	BE	0.4	AT	1.8	PT	1.1	NL	2.3	FI	2.3					BE	2.3
	BE	0.6	PT	3.2	PT	2.0	PT	0.1	SE	1.4	IT	1.1	FI	1.5	NL	2.1					IE	2.0
Share [%]		99.3		97.0		91.7		100		98.0		97.1		96.6		93.1		100		100		96.2
Total emission [tonne]		2277828		3983349		1513039000		975		146425		111270		567161		2958836		1575		63		4590383

Table 37 Main contributions to emissions for various pollutants to air by countries

	Country	As and compounds	Country	Cd and compounds	Country	Cr and compounds	Country	Cu and compounds	Country	Hg and compounds
	ES	18.0	FR	34.7	ES	36.0	ES	20.9	DE	29.6
	DE	16.0	ES	20.6	DE	11.5	DE	19.1	UK	15.1
	IT	15.1	UK	9.4	IT	9.9	FR	12.1	FR	12.4
	FI	10.0	DE	8.6	UK	9.8	PT	11.9	IT	11.8
	FR	9.6	PT	6.5	BE	7.1	UK	10.0	ES	11.3
	BE	9.5	IT	5.9	FR	7.0	IT	7.6	BE	6.7
	SE	5.5	NL	5.3	FI	5.3	FI	7.5	AT	2.9
	UK	4.2	BE	3.5	PT	4.9	BE	5.4	GR	2.4
	PT	4.0	FI	3.3	GR	2.7	SE	1.6	NL	1.2
	NO	3.2	SE	0.9	SE	2.5	NO	1.4	FI	1.1
Share [%]		95.1		98.6		96.7		97.4		94.5
Total emission [tonne]		31		24		223		138		25

	Country	Ni and compounds	Country	Pb and compounds	Country	Zn and compounds	Country	Dichloroethane-1.2 (DCE)	Country	Dichloromethane (DCM)	Country	Hexachlorobenzene (HCB)
	ES	34.7	FR	22.3	ES	36.5	UK	34.3	UK	45.4	NO	58.5
	IT	23.7	DE	17.4	FR	14.7	FR	33.3	FR	35.8	ES	41.5
	PT	8.9	ES	15.9	DE	9.4	HU	24.9	BE	10.1		
	DE	7.0	UK	14.2	IT	8.6	BE	2.0	IT	3.2		
	BE	5.1	IT	13.5	PT	7.7	NL	1.9	HU	1.6		
	FR	4.9	BE	6.5	BE	7.0	DE	1.5	DE	1.1		
	UK	4.4	NL	4.3	UK	6.5	SE	1.0	ES	1.0		
	NL	4.4	PT	2.0	FI	2.4	IT	0.6	NL	0.8		
	FI	2.6	FI	1.5	NL	1.5	NO	0.3	FI	0.4		
	HU	1.6	SE	0.9	AT	1.5	ES	0.1	IE	0.4		
Share [%]		97.3		98.5		95.7		99.9		99.7		100.0
Total emission [tonne]		493		630		1792		3077		6026		0

Table 38 Main contributions to emissions for various pollutants to air by countries

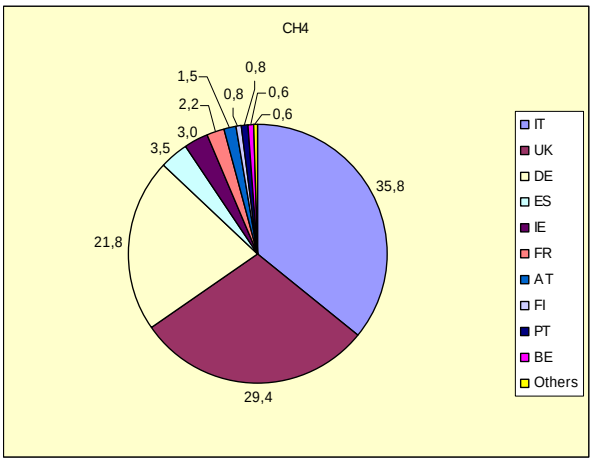
	Country	PCDD+PCDF (dioxins+furans)	Country	Pentachlorophenol (PCP)	Country	Tetrachloroethylene (PER)	Country	Tetrachloromethane (TCM)	Country	Trichlorobenzenes (TCB)	Country	Trichloroethane-1.1.1 (TCE)	Country	Trichloroethylene (TRI)	Country	Trichloromethane	Country	Benzene	Country	Polycyclic Aromatic Hydrocarbons	Country	Chlorine and inorganic compounds
	IT	28.6	FR	100.0	FR	63.5	FR	86.0	DE	100.0	NO	76.2	FR	76.6	FR	46.2	UK	44.7	FR	51.7	UK	37.0
	FR	23.6			UK	18.2	UK	4.8			FR	23.8	UK	15.3	UK	31.2	FR	13.5	NO	22.2	DE	19.5
	ES	23.4			ES	9.5	NL	4.0					ES	3.0	ES	9.9	IT	13.0	IT	8.7	FR	15.6
	DE	10.9			IT	4.4	BE	3.1					PT	2.2	DE	5.3	DE	8.6	ES	6.1	IT	7.0
	BE	7.1			PT	3.3	DE	1.4					BE	1.8	SE	1.9	ES	5.0	UK	3.2	BE	6.4
	UK	4.8			BE	1.2	ES	0.5					FI	0.4	BE	1.6	SE	4.6	BE	2.8	ES	5.9
	NO	0.5					IT	0.1					SE	0.3	NL	1.5	PT	3.2	DE	2.4	PT	2.6
	PT	0.4											IT	0.2	IE	1.2	BE	3.1	SE	1.9	SE	2.1
	NL	0.3											DK	0.1	HU	1.1	NL	1.9	HU	0.4	DK	0.8
	SE	0.2															FI	1.8	FI	0.3	FI	0.7
Share [%]		99.8		100.0		100.0		100.0		100.0		100.0		100.0		100.0		99.4		99.7		97.5
Total emission [tonne]		0		0		754		104		0		1		2704		236		3969		342		37575

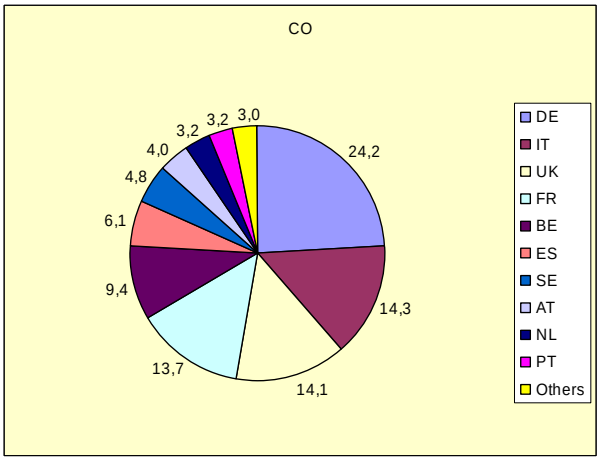
Table 39 Main contributions to emissions for various pollutants to air by countries

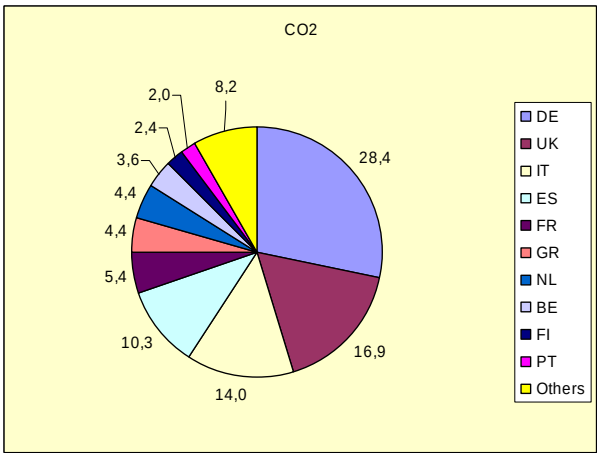
	Country	Fluorine and inorganic compounds	Country	HCN	Country	PM10
	ES	20.3	UK	76.0	ES	29.1
	UK	16.4	DE	9.0	DE	14.6
	DE	15.3	IT	4.8	UK	12.5
	IT	12.1	FR	3.2	BE	8.5
	FR	12.0	ES	2.7	PT	6.4
	NL	7.8	AT	2.3	FI	5.5
	BE	6.0	BE	1.9	NO	5.3
	HU	3.2			FR	4.0
	PT	2.8			IT	3.4
	SE	2.1			NL	3.2
Share [%]		98.0		100.0		92.5
Total emission [tonne]		10290		137		149509

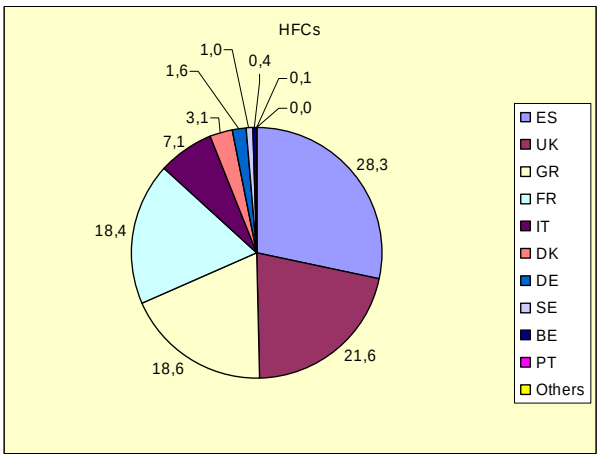
The results above are presented in pie-charts hereafter.

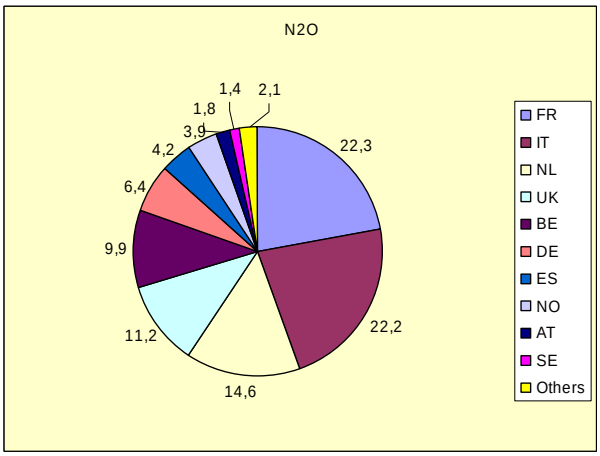
Pie-charts – Emissions to air per countries

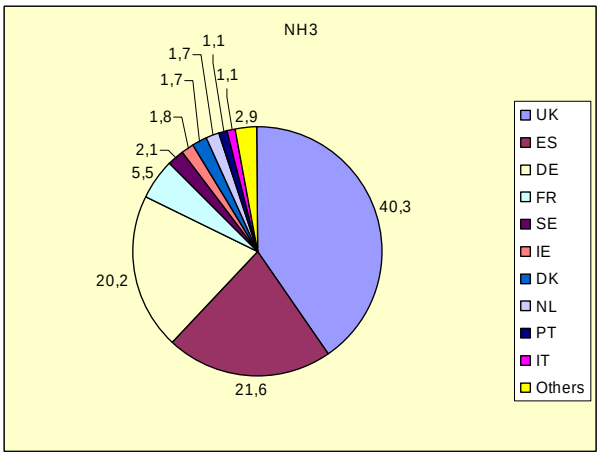


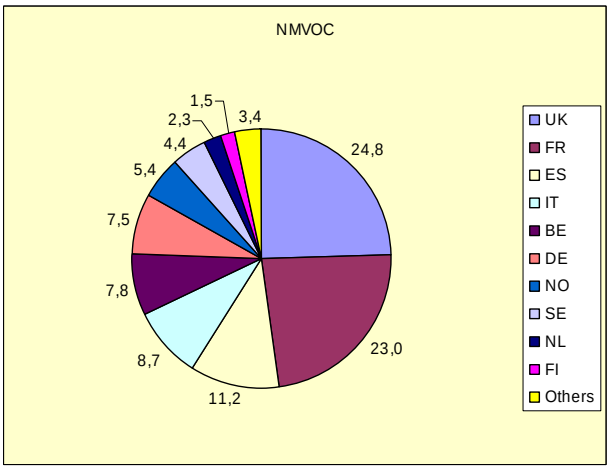








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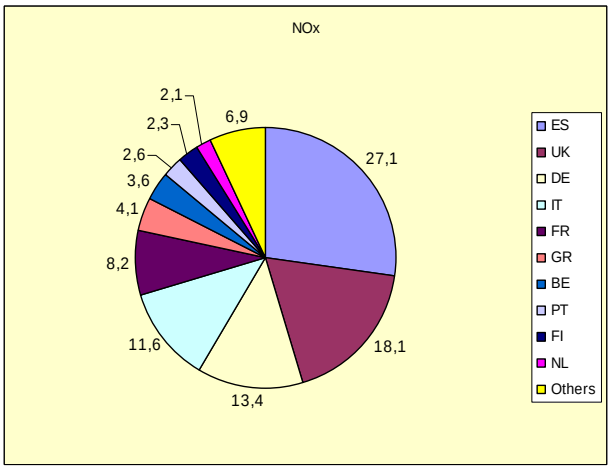
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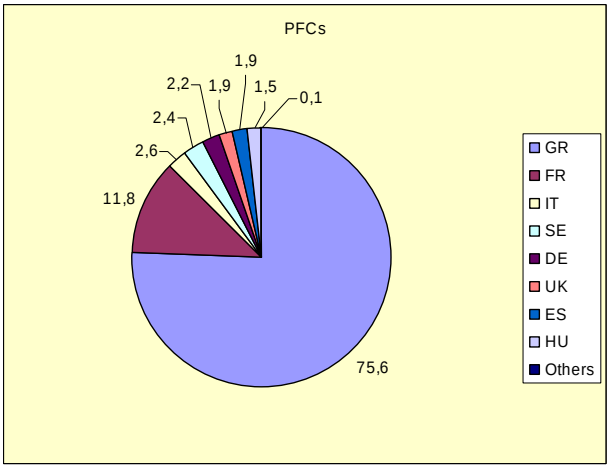
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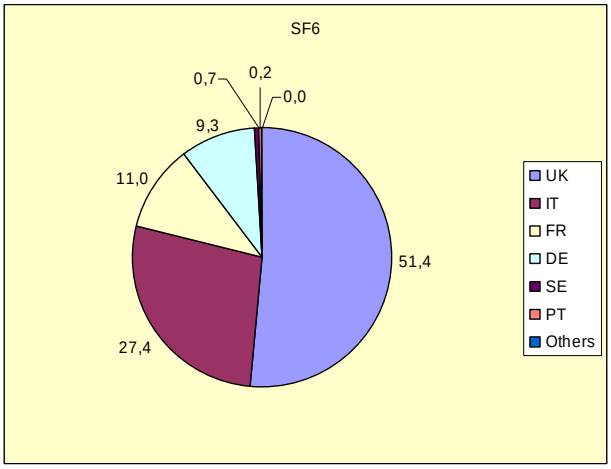
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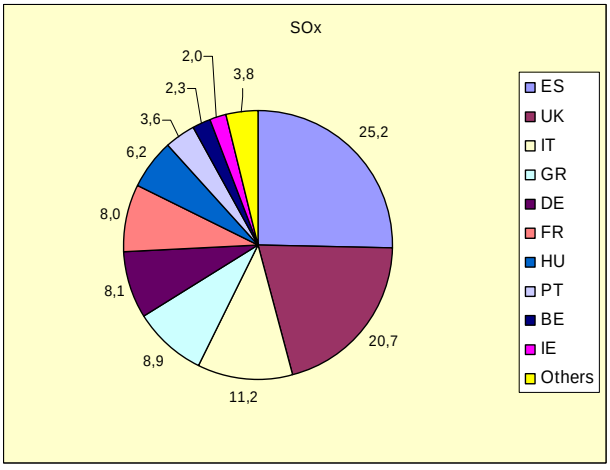
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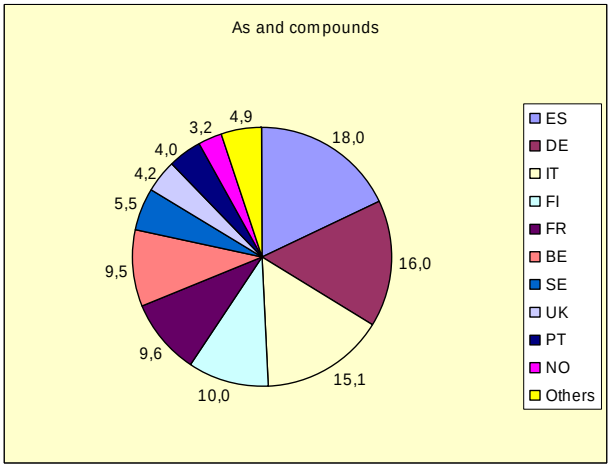
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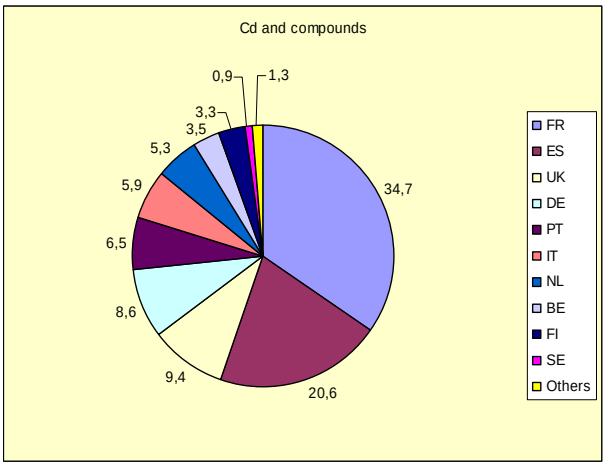
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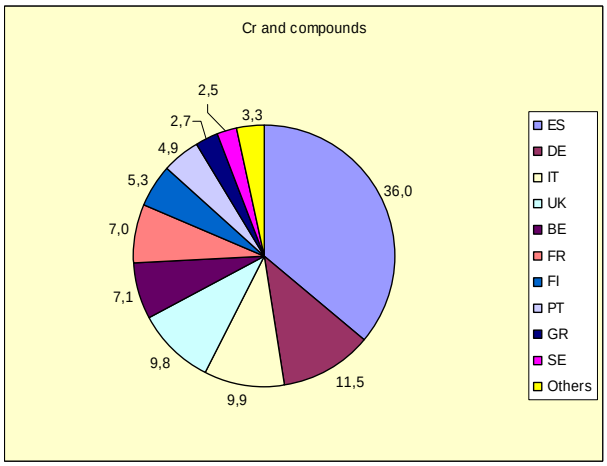
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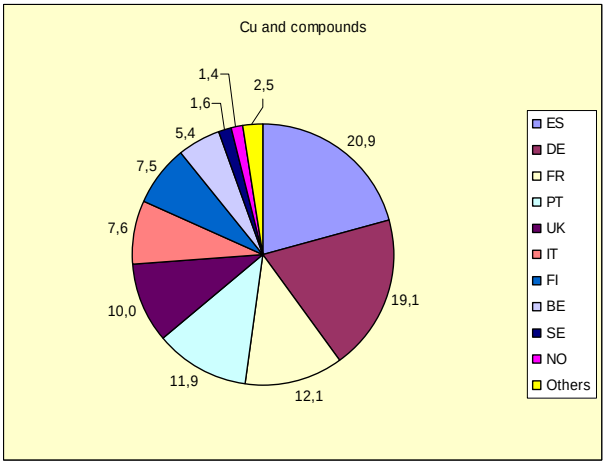
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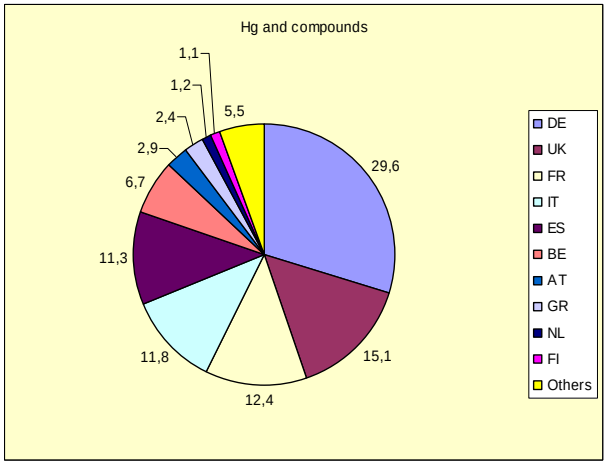
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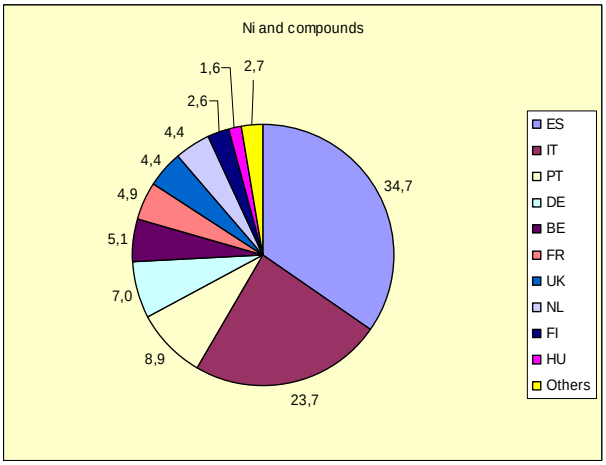
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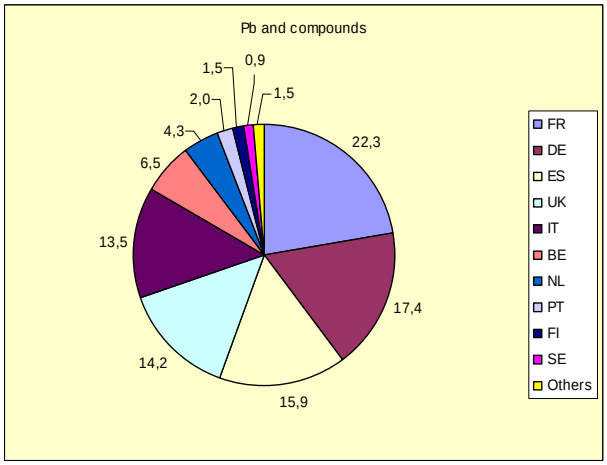
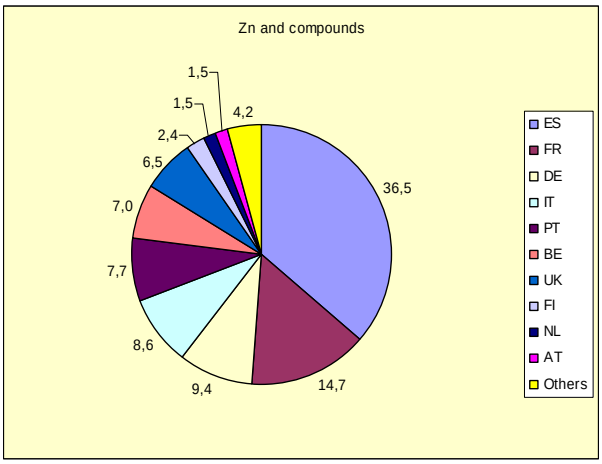
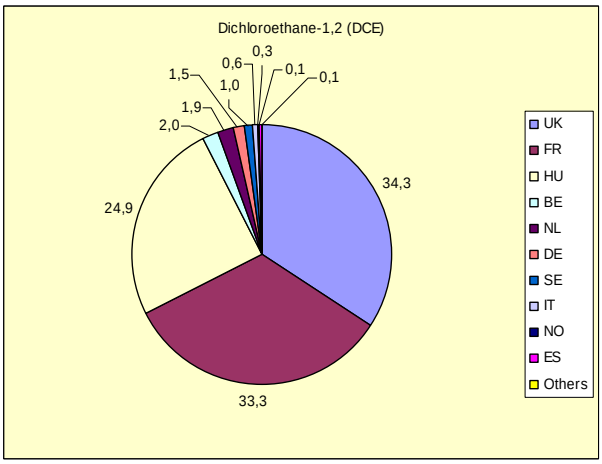
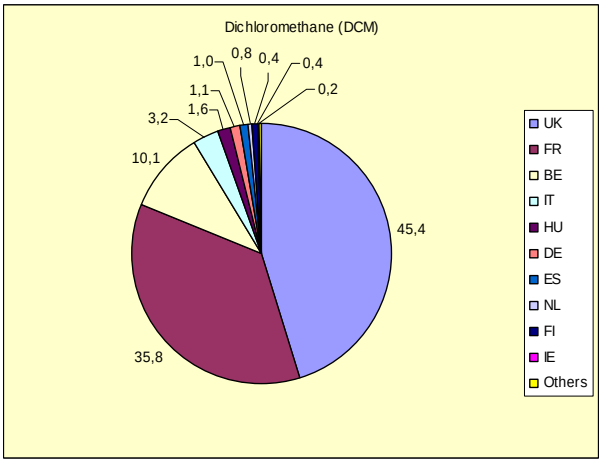
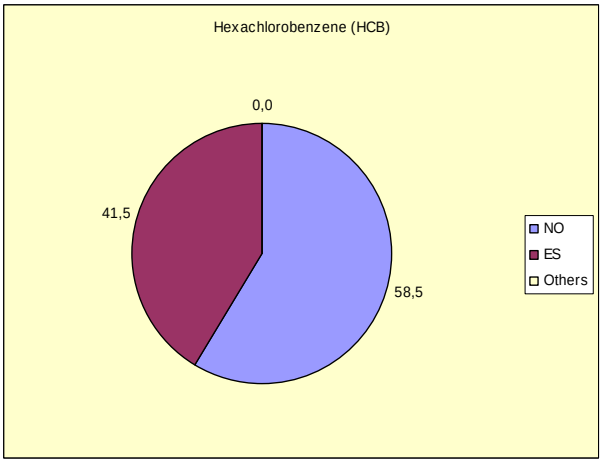
HU
Others

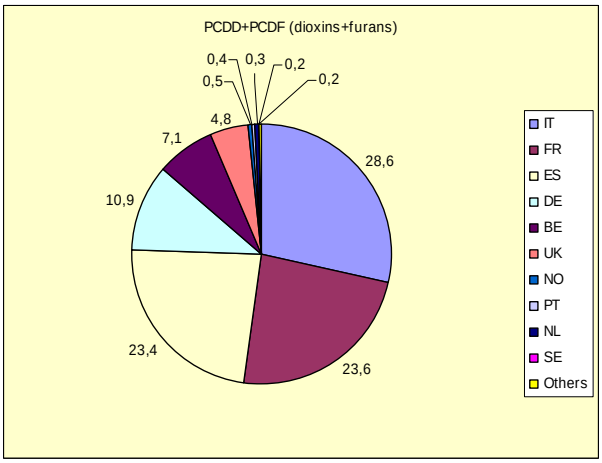

Pb and compounds
22,3
17,4
15,9
14,2
13,5
6,5
4,3
2,0
1,5
1,5
0,9
1,5
FR
DE
ES
UK
IT
BE
NL
PT
FI
SE
Others

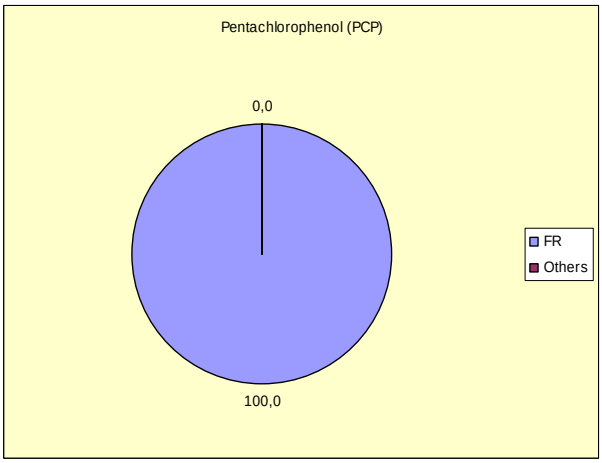

Zn and compounds
36,5
14,7
9,4
8,6
7,7
7,0
6,5
2,4
1,5
1,5
4,2
ES
FR
DE
IT
PT
BE
UK
FI
NL
AT
Others

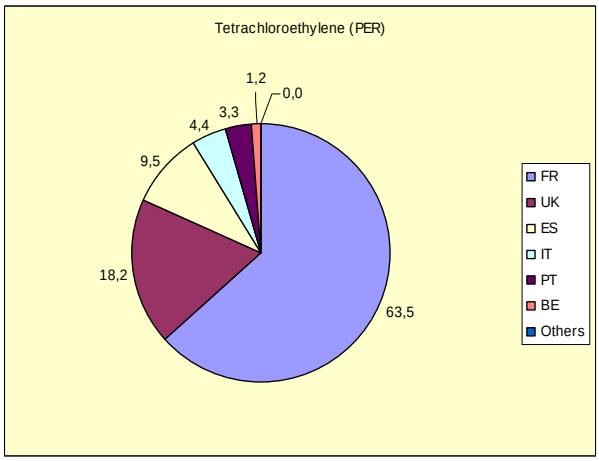

Dichloroethane-1,2 (DCE)
34,3
33,3
24,9
2,0
1,9
1,5
1,0
0,6
0,3
0,1
0,1
UK
FR
HU
BE
NL
DE
SE
IT
NO
ES
Others

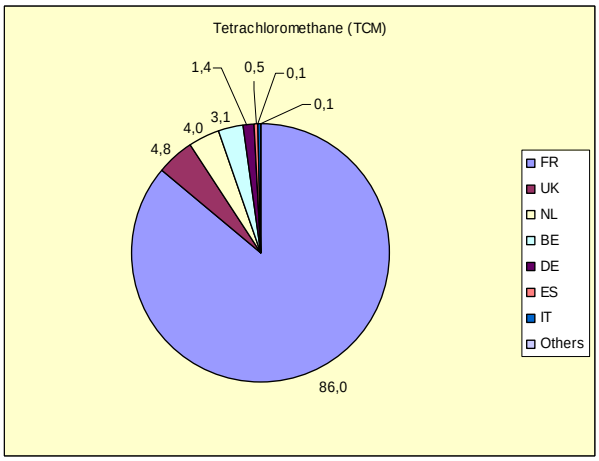

Dichloromethane (DCM)
45,4
35,8
10,1
3,2
1,6
1,1
1,0
0,8
0,4
0,4
0,2
UK
FR
BE
IT
HU
DE
ES
NL
FI
IE
Others

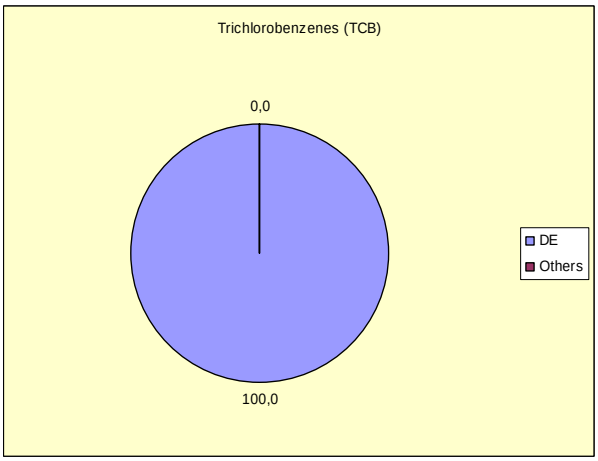

Hexachlorobenzene (HCB)
58,5
41,5
0,0
NO
ES
Others

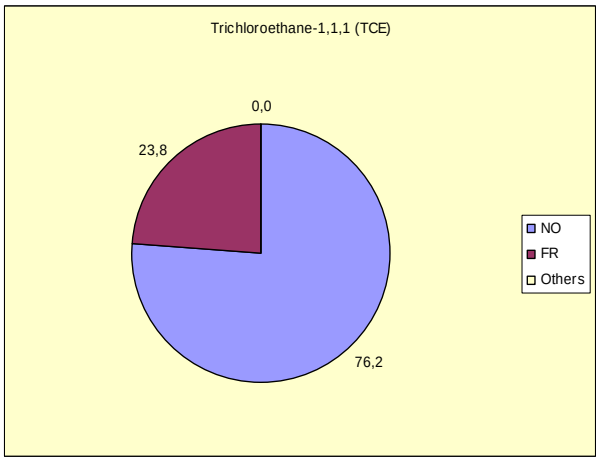

PCDD+PCDF (dioxins+furans)
28,6
23,6
23,4
10,9
7,1
4,8
0,5
0,4
0,3
0,2
0,2
IT
FR
ES
DE
BE
UK
NO
PT
NL
SE
Others

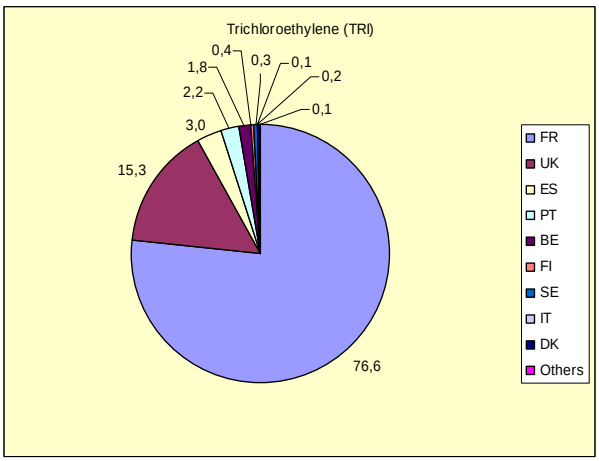

Pentachlorophenol (PCP)
100,0
0,0
FR
Others

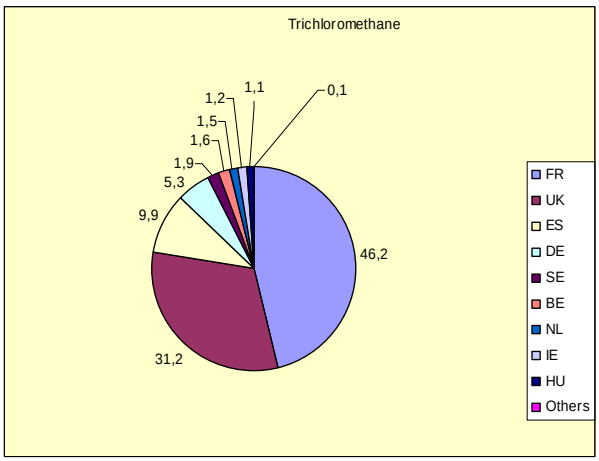

Tetrachloroethylene (PER)
1,2
0,0
3,3
4,4
9,5
18,2
63,5
FR
UK
ES
IT
PT
BE
Others

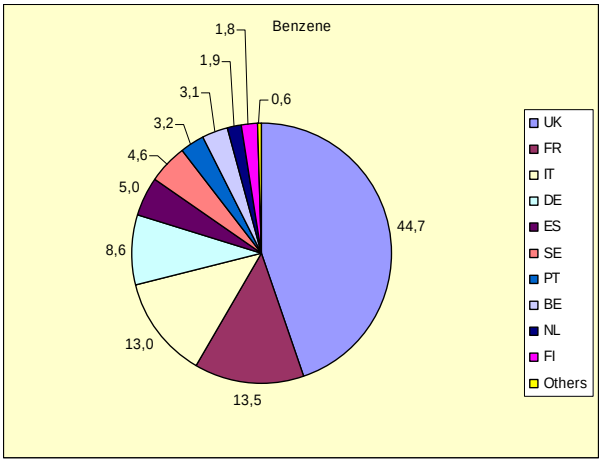

Tetrachloromethane (TCM)
1,4
0,5
0,1
0,1
3,1
4,0
4,8
86,0
FR
UK
NL
BE
DE
ES
IT
Others

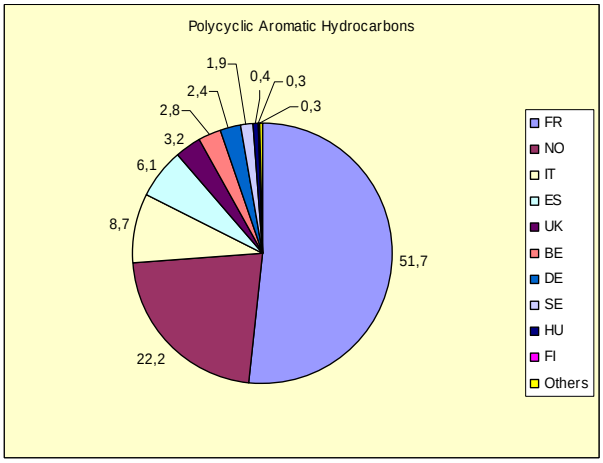

Trichlorobenzenes (TCB)
0,0
100,0
DE
Others

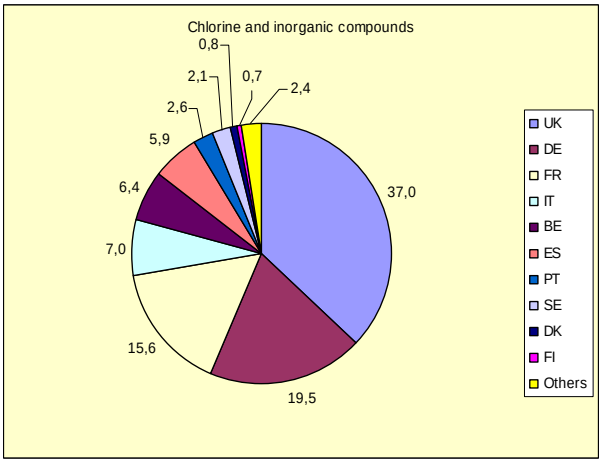

Trichloroethane-1,1,1 (TCE)
0,0
23,8
76,2
NO
FR
Others

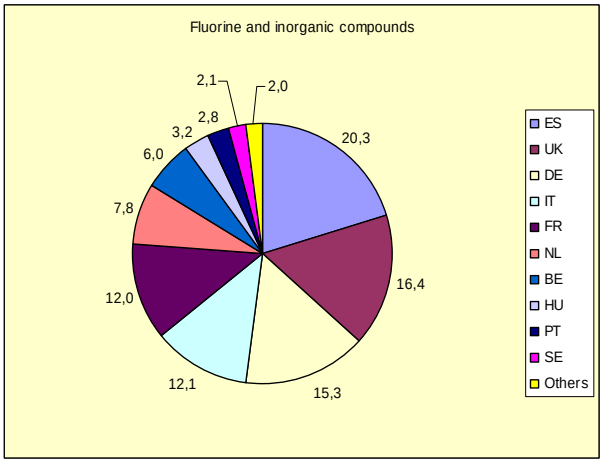

Trichloroethylene (TRI)
0,4
1,8
0,3
0,1
0,2
2,2
0,1
3,0
15,3
76,6
FR
UK
ES
PT
BE
FI
SE
IT
DK
Others

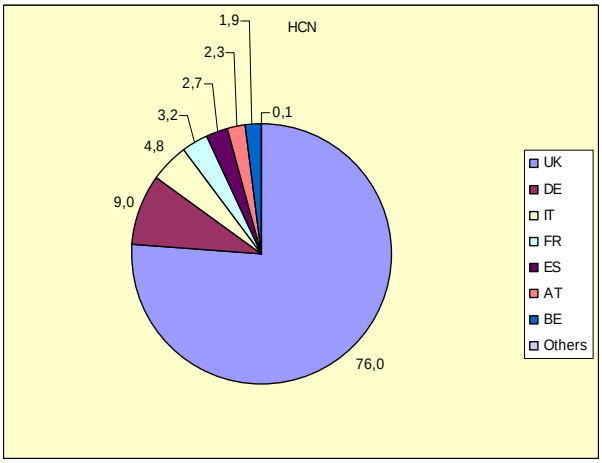

Trichloromethane
1,1
0,1
1,2
1,5
1,6
1,9
5,3
9,9
46,2
31,2
FR
UK
ES
DE
SE
BE
NL
IE
HU
Others

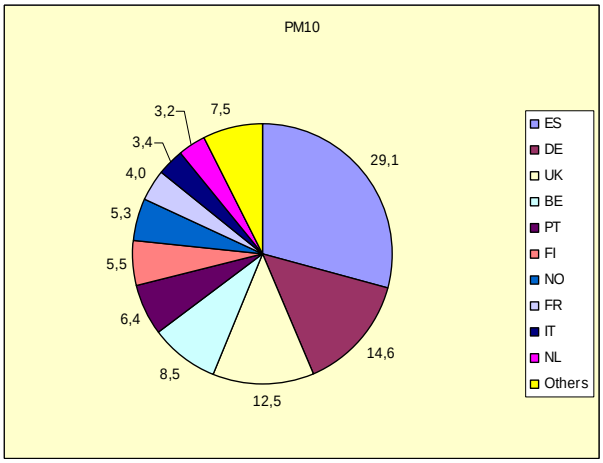

Benzene
1,8
1,9
3,1
0,6
3,2
4,6
5,0
8,6
44,7
13,0
13,5
UK
FR
IT
DE
ES
SE
PT
BE
NL
FI
Others


Polycyclic Aromatic Hydrocarbons
1,9
0,4
0,3
2,4
0,3
2,8
3,2
6,1
8,7
51,7
22,2
FR
NO
IT
ES
UK
BE
DE
SE
HU
FI
Others


Chlorine and inorganic compounds
0,8
2,1
0,7
2,4
2,6
5,9
6,4
37,0
7,0
15,6
19,5
UK
DE
FR
IT
BE
ES
PT
SE
DK
FI
Others


Fluorine and inorganic compounds
2,1
2,0
2,8
3,2
20,3
6,0
7,8
12,0
16,4
12,1
15,3
ES
UK
DE
IT
FR
NL
BE
HU
PT
SE
Others


HCN
1,9
2,3
2,7
3,2
0,1
4,8
9,0
76,0
UK
DE
IT
FR
ES
AT
BE
Others


PM10
3,2
7,5
3,4
4,0
29,1
5,3
5,5
6,4
14,6
8,5
12,5
ES
DE
UK
BE
PT
FI
NO
FR
IT
NL
Others

5.1.2 Emissions by activity

In Table 40 to Table 47, the contributions from the various activities of the total emission are presented up to a maximum of 10.
Besides, the total share of emission for these activities is reported as well as the total emission for all activities in this review.
Apart from these tables, all results are represented in pie charts as well.

Evaluating these tables and graphs gives the following results:

- The total emission of a pollutant is covered for over 97 % by the 10 most emitting activities.
- Basically, the distribution of pollutants emissions over the various industrial activities is matching the likely to be expected.
- In general, the Metal industry is dominantly represented in the ranking of all pollutants
- There are some extreme shares or sudden breaks in the descending trend for a specific activity.
  - HCB for the metal industry was only reported twice respectively by ES and NO. This pollutant was likely to be reported.
  - TCB for the metal industry

To make a final judgment, the reported activities, the intensity of reporting the information gaps and background information like production volume is needed.

Table 40 Main contributions to emissions for various pollutants to air by activities

	Activity	CH_4	Activity	CO	Activity	CO_2	Activity	HFCs	Activity	N2O
	Nonhazardous waste / landfills	88.1	Metal industry	70.7	Combustion	64.9	Inorganic chemicals	48.0	Inorganic chemicals	40.9
	Hazardous- /municipal waste	6.5	Combustion	7.5	Cement klinker. lime. minerals	9.5	Organic chemicals	41.1	Combustion	27.9
	Poultry and pigs	2.3	Cement klinker. lime. minerals	7.2	Refineries	8.7	Combustion	3.4	Organic chemicals	25.7
	Combustion	0.8	Inorganic chemicals	3.7	Metal industry	7.6	Pharmaceuticals	2.2	Refineries	1.6
	Metal industry	0.7	Hazardous- /municipal waste	3.0	Organic chemicals	4.0	Hazardous- /municipal waste	1.9	Metal industry	1.5
	Refineries	0.7	Organic chemicals	2.4	Inorganic chemicals	1.8	Surface treatment	1.8	Poultry and pigs	0.8
	Coal plants	0.3	Pulp and paper	1.6	Pulp and paper	1.3	Slaughterhouses. milk production	0.7	Hazardous- /municipal waste	0.5
	Pulp and paper	0.3	Coal plants	1.6	Hazardous- /municipal waste	1.3	Metal industry	0.7	Pulp and paper	0.3
	Organic chemicals	0.1	Refineries	0.6	Slaughterhouses. milk production	0.4	Pulp and paper	0.1	Nonhazardous waste / landfills	0.3
	Inorganic chemicals	0.1	Surface treatment	0.5	Nonhazardous waste / landfills	0.1	Refineries	0.0	Coal plants	0.2
Share [%]		99.9		98.8		99.7		100.0		99.7
Total emission [tonne]		2277828		3983349		1513039000		975		146425

Table 41 Main contributions to emissions for various pollutants to air by activities

	Activity	NH_3	Activity	NMVOC	Activity	NO_x	Activity	PFCs	Activity	SF_6
	Poultry and pigs	76.0	Refineries	42.8	Combustion	63.9	Metal industry	95.7	Metal industry	80.9
	Inorganic chemicals	12.2	Organic chemicals	20.4	Cement klinker etc.	14.8	Surface treatment	2.2	Inorganic chemicals	10.4
	Cement klinker etc.	3.3	Surface treatment	16.5	Metal industry	6.1	Inorganic chemicals	1.4	Surface treatment	6.4
	Organic chemicals	2.9	Metal industry	6.2	Refineries	6.1	Organic chemicals	0.7	Combustion	1.5
	Pulp and paper	1.6	Textiles	3.6	Pulp and paper	2.4			Hazardous-/ municipal waste	0.4
	Metal industry	1.2	Pulp and paper	2.4	Organic chemicals	2.3			Nonhazardous waste/ landfills	0.2
	Refineries	1.1	Pharmaceuticals	1.6	Inorganic chemicals	1.5			Slaughterhouses. milk prod.	0.2
	Combustion	0.5	Combustion	1.6	Hazard.-/ municipal waste	1.4			Organic chemicals	0.1
	Surface treatment	0.3	Slaughterhouses. milk prod.	1.4	Slaughterhouses. milk prod.	0.5				
	Slaughterhouses. milk prod.	0.3	Inorganic chemicals	1.3	Coke ovens	0.3				
Share [%]		99.3		96.8		99.3		100.0		100.0
Total emission [tonne]		111270		567161		2958836		1575		63.0

Table 42 Main contributions to emissions for various pollutants to <u>air</u> by activities

	Activity	SO_x	Activity	As and compounds	Activity	Cd and compounds	Activity	Cr and compounds	Activity	Cu and compounds
	Combustion	70.8	Metal industry	32.0	Metal industry	58.1	Metal industry	57.7	Metal industry	63.8
	Refineries	14.0	Combustion	30.0	Cement klinker etc.	14.9	Combustion	21.4	Hazardous-/ municipal waste	11.9
	Metal industry	6.7	Cement klinker etc.	16.2	Combustion	11.8	Cement klinker etc.	5.3	Combustion	8.8
	Cement klinker etc.	3.2	Refineries	8.0	Refineries	5.9	Refineries	4.9	Organic chemicals	6.9
	Inorganic chemicals	1.6	Pulp and paper	3.9	Hazardous-/ municipal waste	3.6	Inorganic chemicals	4.2	Cement klinker etc.	4.3
	Organic chemicals	1.2	Inorganic chemicals	3.6	Inorganic chemicals	2.3	Organic chemicals	2.7	Inorganic chemicals	2.0
	Pulp and paper	1.2	Hazardous-/ municipal waste	2.6	Organic chemicals	1.7	Hazard.-/ municipal waste	2.3	Refineries	1.6
	Slaughterhouses. milk prod.	0.7	Organic chemicals	2.0	Pulp and paper	1.1	Surface treatment	0.8	Carbon	0.3
	Coke ovens	0.3	Coke ovens	0.5	Nonhazard.waste/ landfills	0.4	Coke ovens	0.6	Pulp and paper	0.2
	Hazardous-/ municipal waste	0.1	Surface treatment	0.4	Coke ovens	0.1	Pulp and paper	0.1	Biocides and explosives	0.2
Share [%]		99.7		99.4		99.9		100.0		99.9
Total emission [tonne]		4590383		31		24		223		138

Table 43 Main contributions to emissions for various pollutants to <u>air</u> by activities

	Activity	Hg and compounds	Activity	Ni and compounds	Activity	Pb and compounds	Activity	Zn and compounds
	Combustion	31.2	Combustion	41.2	Metal industry	82.3	Metal industry	85.4
	Metal industry	20.3	Refineries	36.3	Cement klinker. lime. minerals	7.0	Hazardous- /municipal waste	6.0
	Inorganic chemicals	16.9	Metal industry	12.6	Combustion	5.0	Combustion	3.4
	Cement klinker. lime. minerals	12.2	Cement klinker. lime. minerals	2.9	Hazardous- /municipal waste	1.5	Cement klinker. lime. minerals	2.0
	Organic chemicals	9.5	Organic chemicals	2.8	Organic chemicals	1.4	Inorganic chemicals	1.7
	Refineries	4.5	Slaughterhouses. milk production	1.2	Inorganic chemicals	0.9	Refineries	0.9
	Hazardous- /municipal waste	4.4	Hazardous- /municipal waste	0.9	Refineries	0.9	Pulp and paper	0.3
	Surface treatment	0.3	Surface treatment	0.8	Coke ovens	0.4	Coke ovens	0.1
	Pulp and paper	0.3	Pulp and paper	0.6	Surface treatment	0.2	Organic chemicals	0.1
	Nonhazardous waste / landfills	0.2	Inorganic chemicals	0.5	Pulp and paper	0.2	Surface treatment	0.1
Share [%]		99.9		99.8		99.9		100.0
Total emission [tonne]		25		493		630		1792

Table 44 Main contributions to emissions for various pollutants to <u>air</u> by activities

	Activity	Dichloroethane-1.2 (DCE)	Activity	Dichloromethane (DCM)	Activity	Hexachlorobenzene (HCB)	Activity	PCDD+PCDF (dioxins+furans)	Activity	Pentachlorophenol (PCP)
	Organic chemicals	56.4	Organic chemicals	56.4	Metal industry	100.0	Metal industry	41.1	Metal industry	####
	Inorganic chemicals	26.6	Pharmaceuticals	21.4			Combustion	19.3		
	Pharmaceuticals	10.9	Hazardous- /municipal waste	8.7			Organic chemicals	16.9		
	Refineries	5.9	Metal industry	3.7			Hazardous- /municipal waste	15.9		
	Biocides and explosives	0.2	Inorganic chemicals	3.1			Cement klinker. lime. minerals	4.0		
	Hazardous- /municipal waste	0.1	Cement klinker. lime. minerals	2.6			Pharmaceuticals	1.1		
			Slaughterhouses. milk production	1.3			Nonhazardous waste / landfills	0.7		
			Surface treatment	1.1			Slaughterhouses. milk production	0.4		
			Refineries	0.9			Pulp and paper	0.4		
			Biocides and explosives	0.7			Surface treatment	0.1		
Share [%]		100.0		99.8		100.0		99.9		100.0
Total emission [tonne]		3077		6026		0		0		0

Table 45 Main contributions to emissions for various pollutants to <u>air</u> by activities

	Activity	Tetrachloroethylene (PER)	Activity	Tetrachloromethane (TCM)	Activity	Trichlorobenzenes (TCB)	Activity	Trichloroethane-1.1.1 (TCE)	Activity	Trichloroethylene (TRI)
	Surface treatment	42.7	Organic chemicals	92.6	Organic chemicals	55.6	Organic chemicals	76.2	Organic chemicals	31.0
	Metal industry	26.5	Inorganic chemicals	5.3	Inorganic chemicals	44.4	Inorganic chemicals	23.8	Metal industry	30.5
	Inorganic chemicals	11.8	Refineries	1.4					Surface treatment	24.2
	Organic chemicals	11.8	Textiles	0.8					Inorganic chemicals	8.2
	Tanning	5.1							Biocides and explosives	2.3
	Refineries	1.3							Textiles	1.4
	Hazardous- /municipal waste	0.7							Hazardous- /municipal waste	1.3
									Pharmaceuticals	0.7
									Combustion	0.3
									Cement klinker. lime. minerals	0.1
Share [%]		100.0		100.0		100.0		100.0		100.0
Total emission [tonne]		754		104		0		1		2704

Table 46 Main contributions to emissions for various pollutants to <u>air</u> by activities

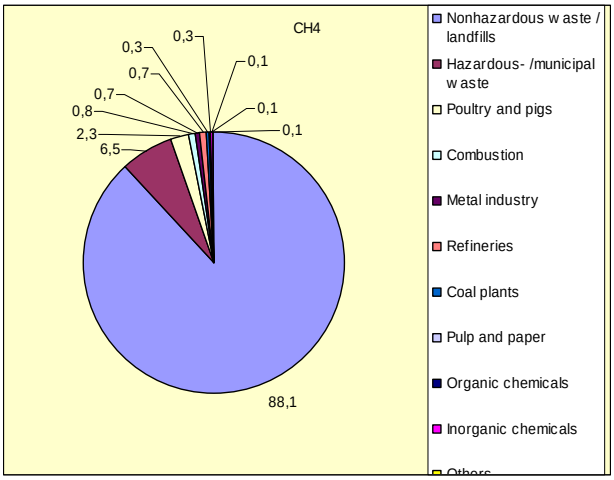
	Activity	Trichloromethane	Activity	Benzene	Activity	Polycyclic Aromatic Hydrocarbons	Activity	Chlorine and inorganic compounds	Activity	Fluorine and inorganic compounds
	Organic chemicals	42.9	Refineries	52.7	Metal industry	35.5	Combustion	73.1	Combustion	48.3
	Inorganic chemicals	38.8	Organic chemicals	24.9	Surface treatment	24.9	Metal industry	9.4	Metal industry	33.2
	Pharmaceuticals	16.4	Metal industry	13.2	Refineries	20.2	Hazardous- /municipal waste	5.5	Cement klinker. lime. minerals	15.2
	Refineries	1.9	Cement klinker. lime. minerals	3.3	Organic chemicals	9.8	Cement klinker. lime. minerals	5.2	Inorganic chemicals	2.9
			Coke ovens	2.2	Coke ovens	3.0	Organic chemicals	1.7	Hazardous- /municipal waste	0.3
			Coal plants	1.4	Carbon	2.7	Pulp and paper	1.6	Organic chemicals	0.1
			Hazardous- /municipal waste	0.7	Cement klinker. lime. minerals	2.3	Refineries	1.4	Pulp and paper	0.1
			Carbon	0.6	Combustion	0.7	Inorganic chemicals	1.2		
			Inorganic chemicals	0.5	Inorganic chemicals	0.7	Slaughterhouses. milk production	0.5		
			Combustion	0.2	Hazardous- /municipal waste	0.3	Nonhazardous waste / landfills	0.2		
Share [%]		100.0		99.7		100.0		99.9		100.0
Total emission [tonne]		236		3969		342		37575		10290

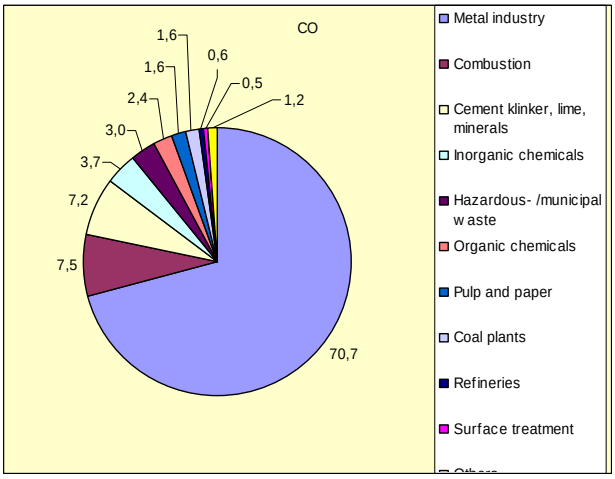
Table 47 Main contributions to emissions for various pollutants to <u>air</u> by activities

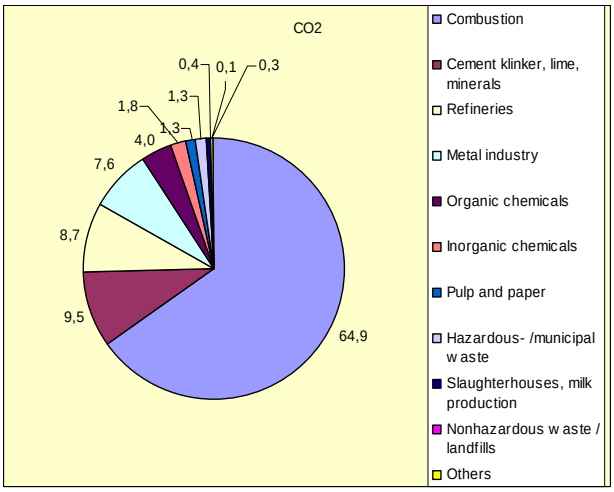
	Activity	HCN	Activity	PM-10
	Organic chemicals	44.0	Combustion	38.8
	Coke ovens	36.6	Metal industry	26.2
	Metal industry	14.6	Cement klinker. lime. minerals	13.0
	Inorganic chemicals	3.1	Pulp and paper	7.6
	Refineries	0.9	Refineries	6.8
	Textiles	0.4	Slaughterhouses. milk production	2.9
	Pharmaceuticals	0.3	Inorganic chemicals	2.3
			Organic chemicals	1.1
			Nonhazardous waste / landfills	0.4
			Hazardous- /municipal waste	0.2
Share [%]		100.0		99.4
Total emission [tonne]		137		149509

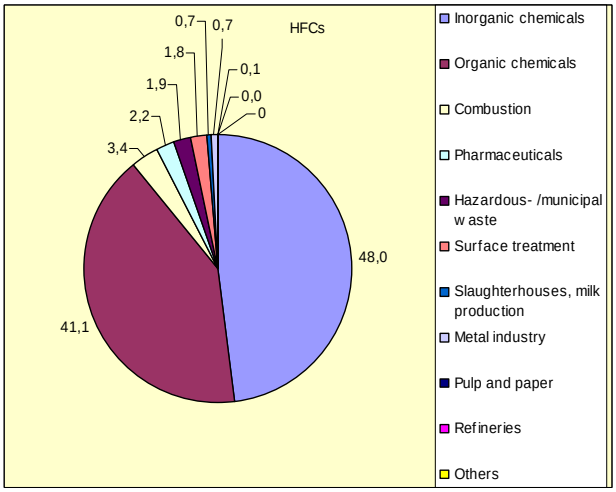
Hereafter. the results above are presented in pie-charts as well.

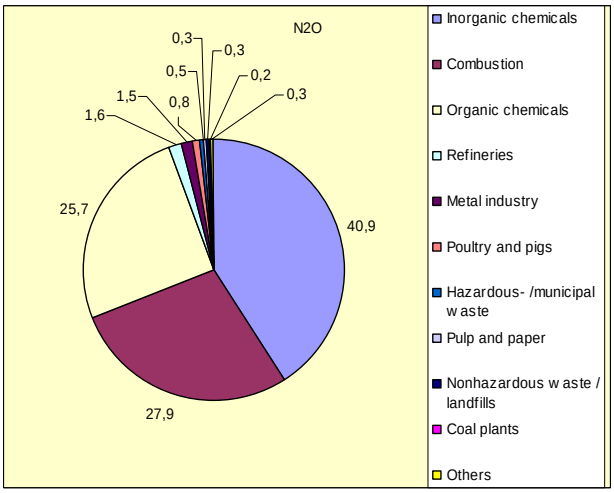
Pie-charts – Emissions to air over activities

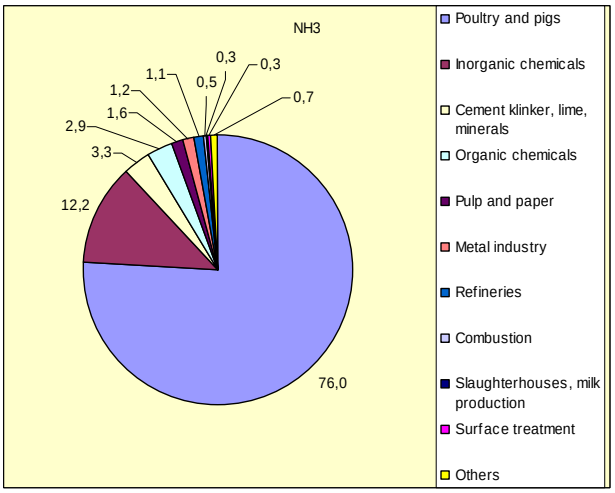


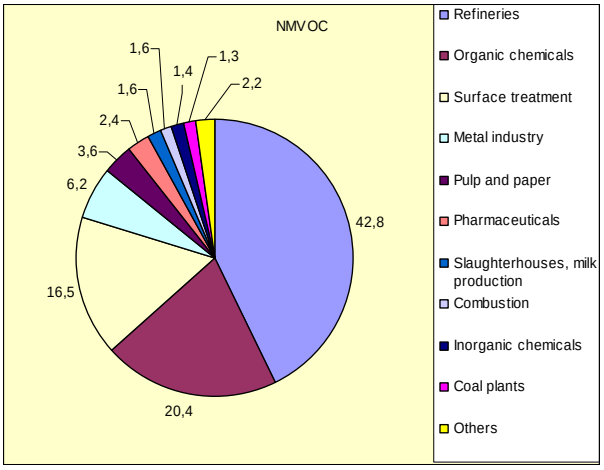


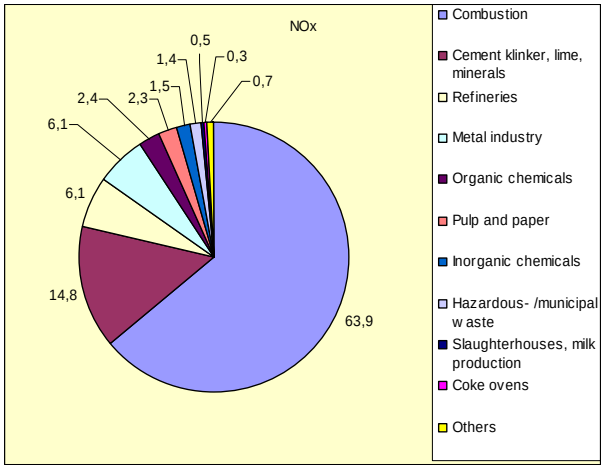


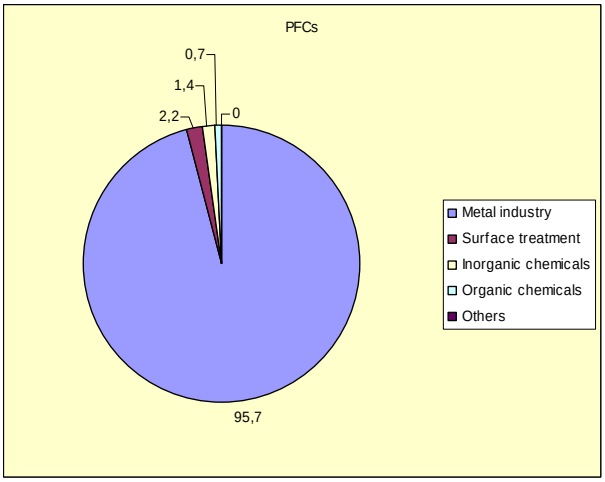


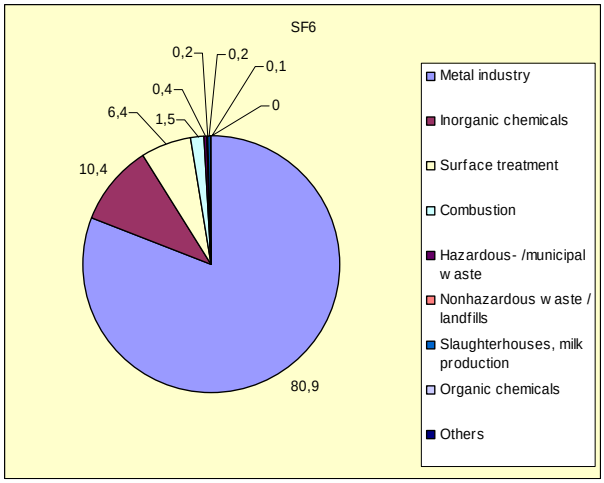


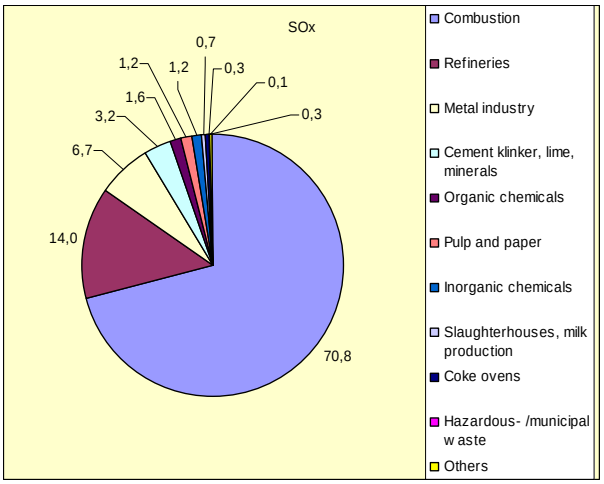


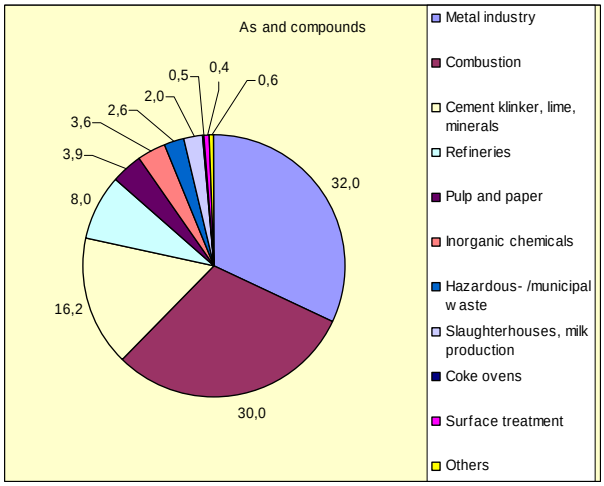

NMVOC
42,8
20,4
16,5
6,2
3,6
2,4
1,6
1,6
1,4
1,3
2,2
Refineries
Organic chemicals
Surface treatment
Metal industry
Pulp and paper
Pharmaceuticals
Slaughterhouses, milk production
Combustion
Inorganic chemicals
Coal plants
Others

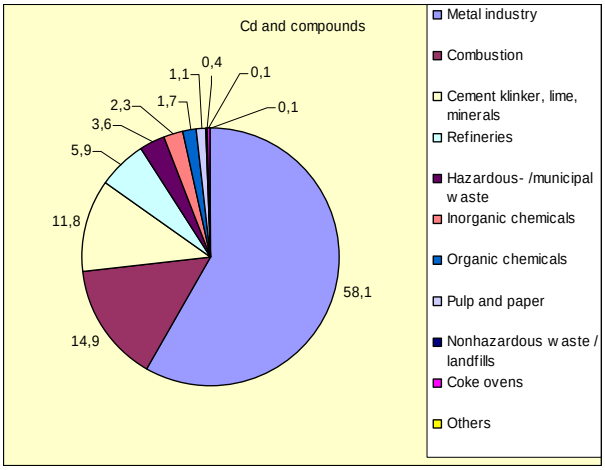

NOx
63,9
14,8
6,1
6,1
2,4
2,3
1,5
1,4
0,5
0,3
0,7
Combustion
Cement klinker, lime, minerals
Refineries
Metal industry
Organic chemicals
Pulp and paper
Inorganic chemicals
Hazardous- /municipal w aste
Slaughterhouses, milk production
Coke ovens
Others

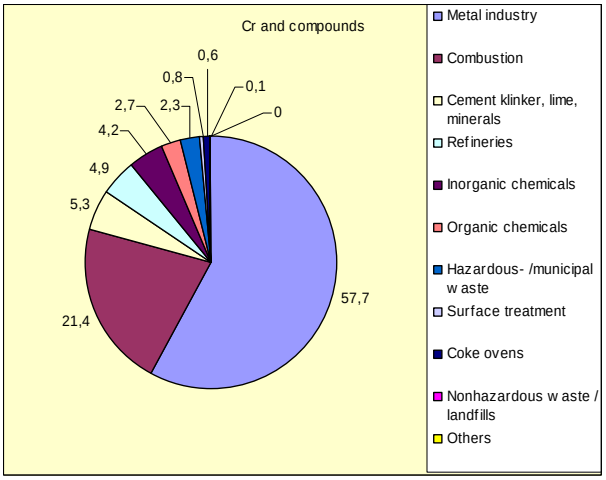

PFCs
95,7
2,2
1,4
0,7
0
Metal industry
Surface treatment
Inorganic chemicals
Organic chemicals
Others

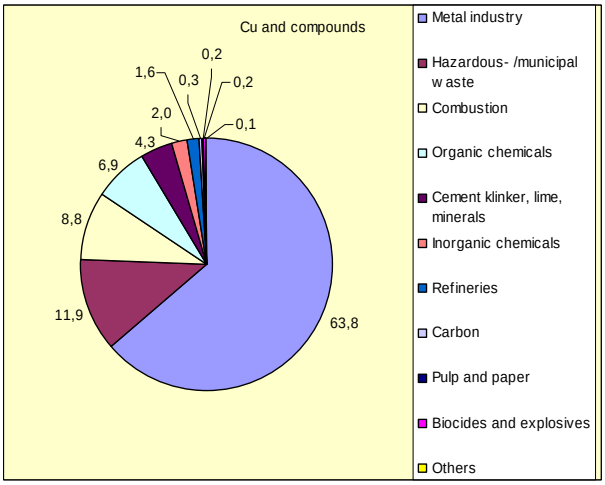

SF6
80,9
10,4
6,4
0,4
1,5
0,2
0,2
0,1
0
Metal industry
Inorganic chemicals
Surface treatment
Combustion
Hazardous- /municipal w aste
Nonhazardous w aste / landfills
Slaughterhouses, milk production
Organic chemicals
Others

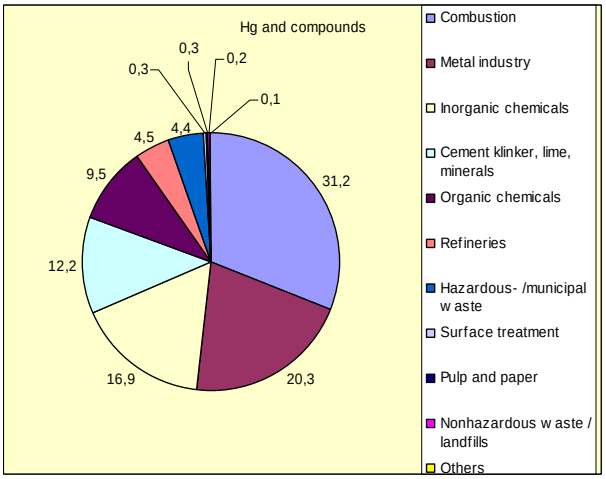

SOx
70,8
14,0
6,7
3,2
1,6
1,2
1,2
0,7
0,3
0,1
0,3
Combustion
Refineries
Metal industry
Cement klinker, lime, minerals
Organic chemicals
Pulp and paper
Inorganic chemicals
Slaughterhouses, milk production
Coke ovens
Hazardous- /municipal w aste
Others

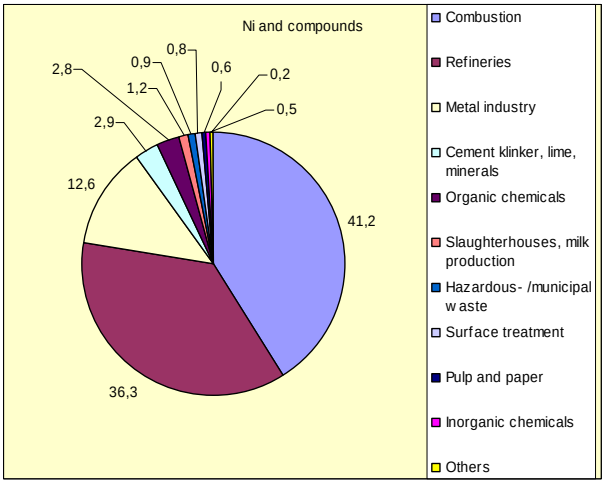

As and compounds
32,0
30,0
16,2
8,0
3,9
3,6
2,6
2,0
0,5
0,4
0,6
Metal industry
Combustion
Cement klinker, lime, minerals
Refineries
Pulp and paper
Inorganic chemicals
Hazardous- /municipal w aste
Slaughterhouses, milk production
Coke ovens
Surface treatment
Others

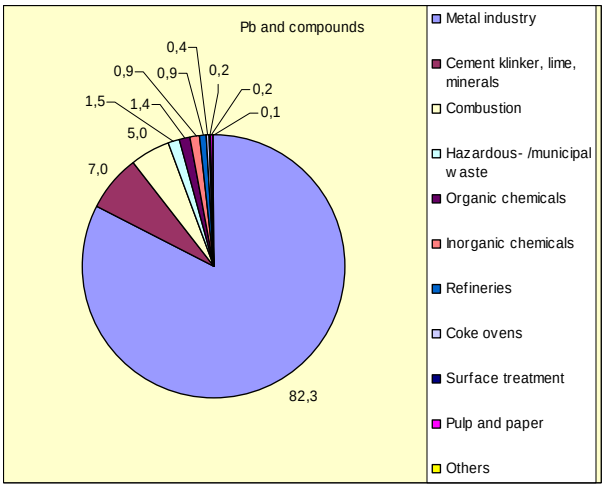

Cd and compounds
58,1
14,9
11,8
5,9
3,6
2,3
1,7
1,1
0,4
0,1
0,1
Metal industry
Combustion
Cement klinker, lime, minerals
Refineries
Hazardous- /municipal w aste
Inorganic chemicals
Organic chemicals
Pulp and paper
Nonhazardous w aste / landfills
Coke ovens
Others

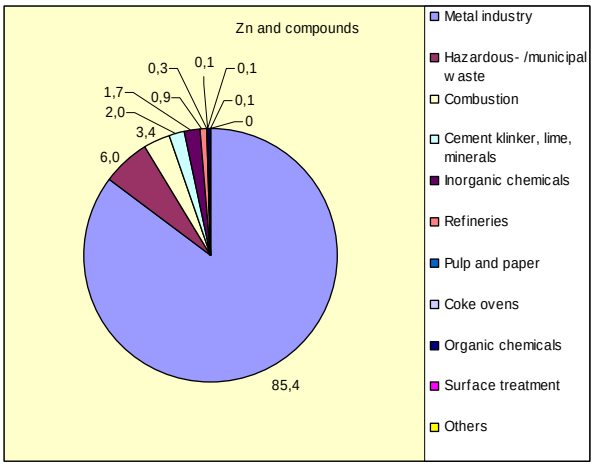

Cr and compounds
57,7
21,4
5,3
4,9
4,2
2,7
2,3
0,8
0,6
0,1
0
Metal industry
Combustion
Cement klinker, lime, minerals
Refineries
Inorganic chemicals
Organic chemicals
Hazardous- /municipal w aste
Surface treatment
Coke ovens
Nonhazardous w aste / landfills
Others

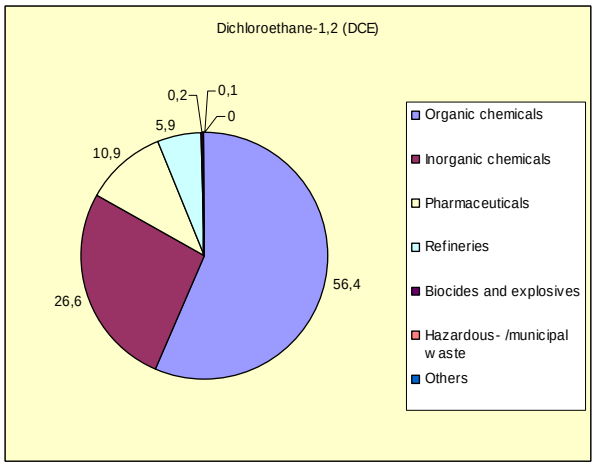

Cu and compounds
63,8
11,9
8,8
6,9
4,3
2,0
1,6
0,3
0,2
0,2
0,1
Metal industry
Hazardous- /municipal w aste
Combustion
Organic chemicals
Cement klinker, lime, minerals
Inorganic chemicals
Refineries
Carbon
Pulp and paper
Biocides and explosives
Others

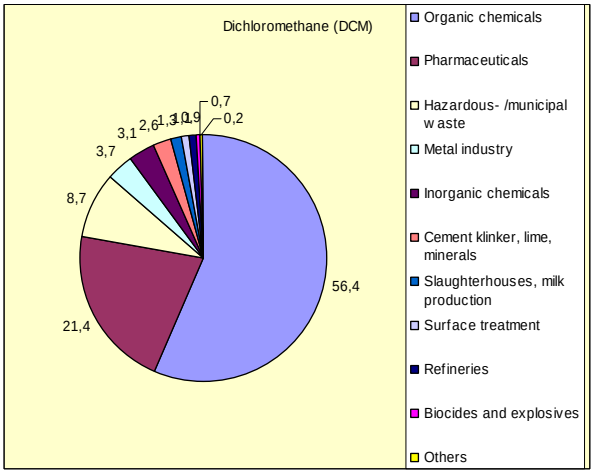

Hg and compounds
31,2
20,3
16,9
12,2
9,5
4,5
4,4
0,3
0,3
0,2
0,1
Combustion
Metal industry
Inorganic chemicals
Cement klinker, lime, minerals
Organic chemicals
Refineries
Hazardous- /municipal w aste
Surface treatment
Pulp and paper
Nonhazardous w aste / landfills
Others

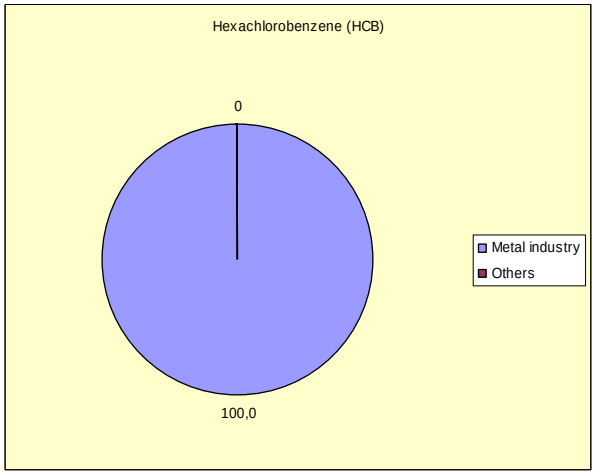

Ni and compounds
41,2
36,3
12,6
2,9
2,8
1,2
0,9
0,8
0,6
0,2
0,5
Combustion
Refineries
Metal industry
Cement klinker, lime, minerals
Organic chemicals
Slaughterhouses, milk production
Hazardous- /municipal w aste
Surface treatment
Pulp and paper
Inorganic chemicals
Others

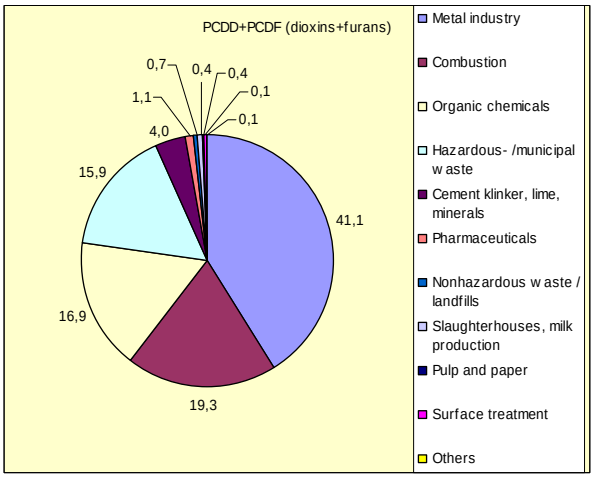

Pb and compounds
82,3
7,0
5,0
1,5
1,4
0,9
0,9
0,4
0,2
0,2
0,1
Metal industry
Cement klinker, lime, minerals
Combustion
Hazardous- /municipal w aste
Organic chemicals
Inorganic chemicals
Refineries
Coke ovens
Surface treatment
Pulp and paper
Others

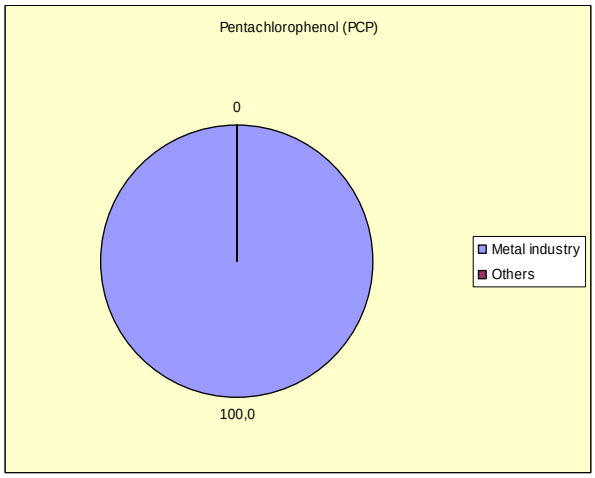

Zn and compounds
0,3
0,1
0,1
1,7
0,9
0,1
2,0
0
3,4
6,0
85,4
Metal industry
Hazardous- /municipal w aste
Combustion
Cement klinker, lime, minerals
Inorganic chemicals
Refineries
Pulp and paper
Coke ovens
Organic chemicals
Surface treatment
Others

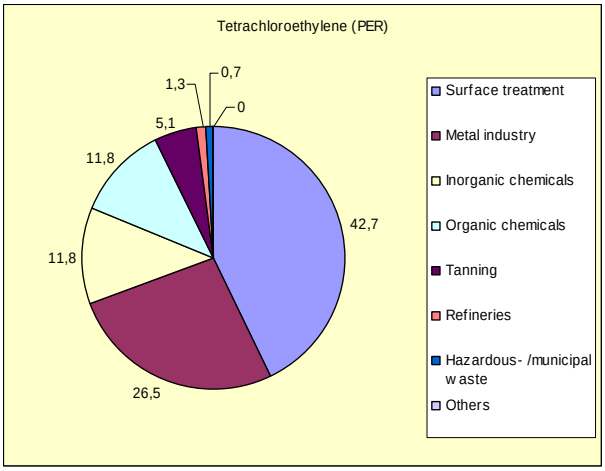

Dichloroethane-1,2 (DCE)
0,2
0,1
0
5,9
10,9
26,6
56,4
Organic chemicals
Inorganic chemicals
Pharmaceuticals
Refineries
Biocides and explosives
Hazardous- /municipal w aste
Others

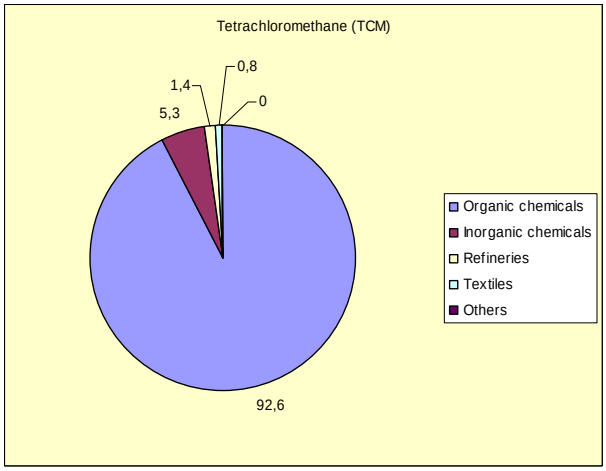

Dichloromethane (DCM)
0,7
0,2
3,1
2,6
1,3
1,1
0,9
3,7
8,7
56,4
21,4
Organic chemicals
Pharmaceuticals
Hazardous- /municipal w aste
Metal industry
Inorganic chemicals
Cement klinker, lime, minerals
Slaughterhouses, milk production
Surface treatment
Refineries
Biocides and explosives
Others

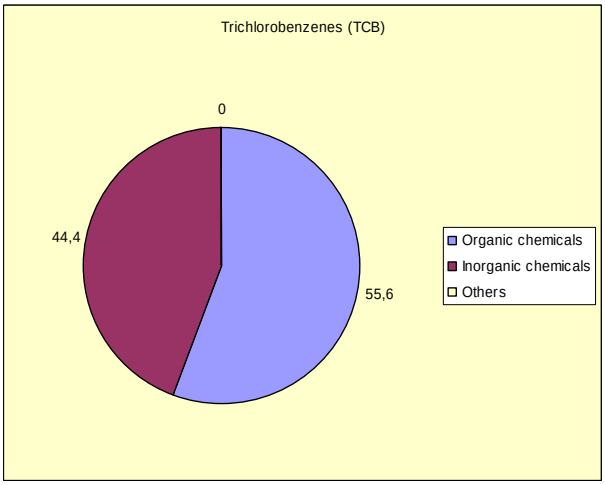

Hexachlorobenzene (HCB)
0
100,0
Metal industry
Others

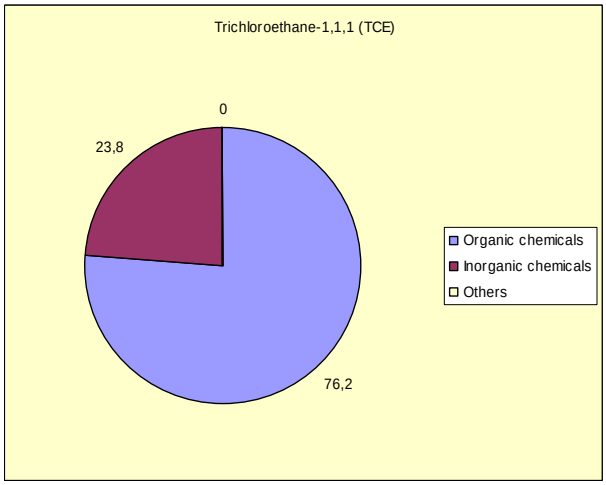

PCDD+PCDF (dioxins+furans)
0,7
0,4
0,4
1,1
0,1
0,1
4,0
15,9
41,1
16,9
19,3
Metal industry
Combustion
Organic chemicals
Hazardous- /municipal w aste
Cement klinker, lime, minerals
Pharmaceuticals
Nonhazardous w aste / landfills
Slaughterhouses, milk production
Pulp and paper
Surface treatment
Others

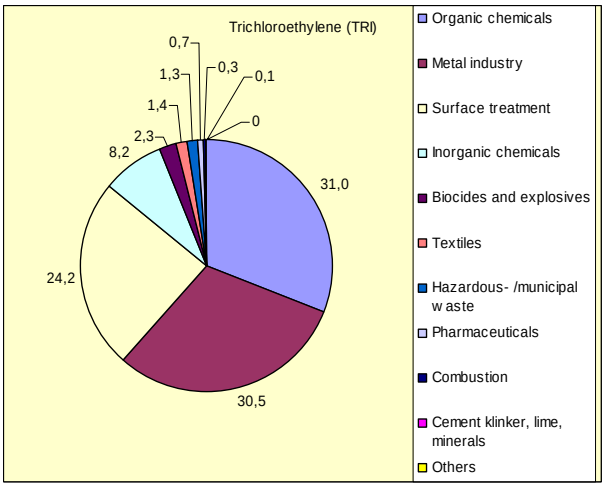

Pentachlorophenol (PCP)
0
100,0
Metal industry
Others

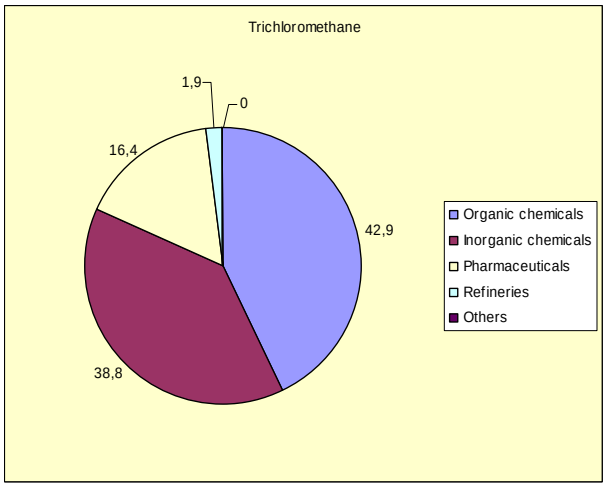

Tetrachloroethylene (PER)
42,7
26,5
11,8
11,8
5,1
1,3
0,7
0
Surface treatment
Metal industry
Inorganic chemicals
Organic chemicals
Tanning
Refineries
Hazardous- /municipal w aste
Others

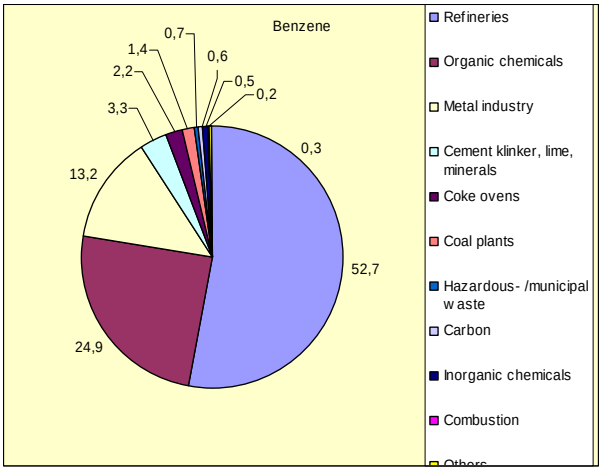

Tetrachloromethane (TCM)
92,6
5,3
1,4
0,8
0
Organic chemicals
Inorganic chemicals
Refineries
Textiles
Others

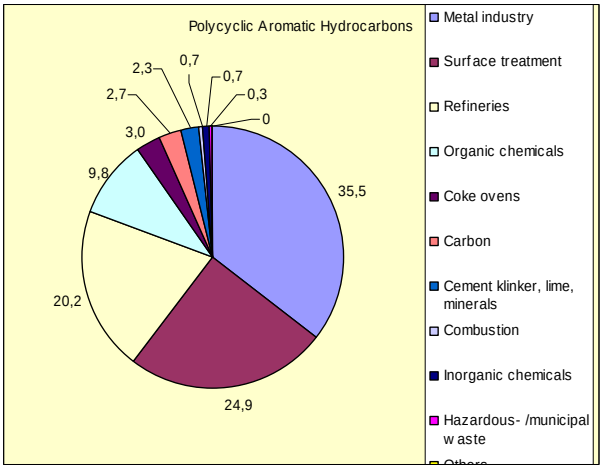

Trichlorobenzenes (TCB)
55,6
44,4
0
Organic chemicals
Inorganic chemicals
Others

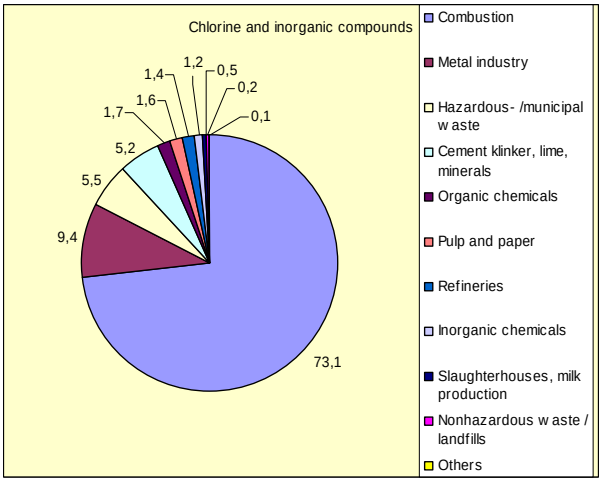

Trichloroethane-1,1,1 (TCE)
76,2
23,8
0
Organic chemicals
Inorganic chemicals
Others

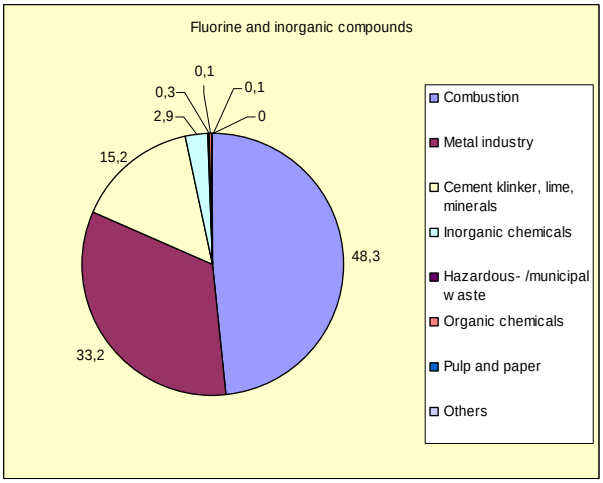

Trichloroethylene (TRI)
31,0
30,5
24,2
8,2
2,3
1,4
1,3
0,7
0,3
0,1
0
Organic chemicals
Metal industry
Surface treatment
Inorganic chemicals
Biocides and explosives
Textiles
Hazardous- /municipal w aste
Pharmaceuticals
Combustion
Cement klinker, lime, minerals
Others

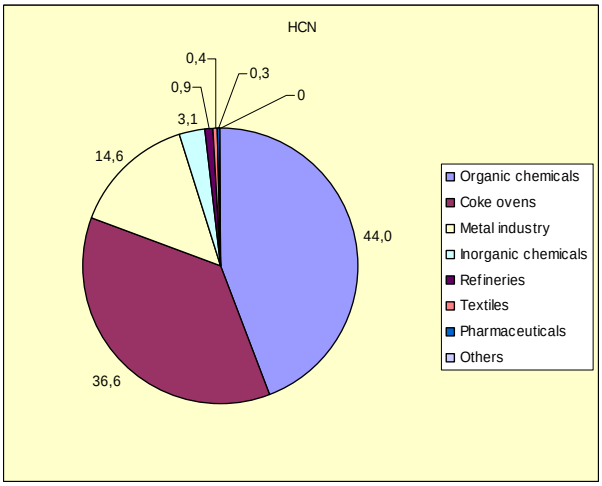

Trichloromethane
42,9
38,8
16,4
1,9
0
Organic chemicals
Inorganic chemicals
Pharmaceuticals
Refineries
Others

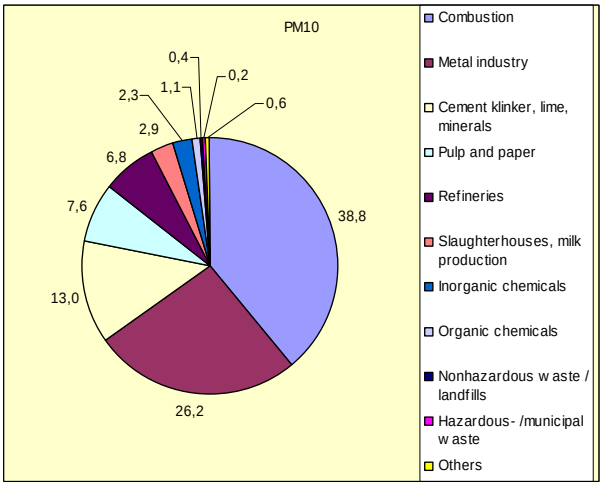

Benzene
0,7
1,4
0,6
2,2
0,5
3,3
0,2
0,3
13,2
52,7
24,9
Refineries
Organic chemicals
Metal industry
Cement klinker, lime, minerals
Coke ovens
Coal plants
Hazardous- /municipal waste
Carbon
Inorganic chemicals
Combustion


Polycyclic Aromatic Hydrocarbons
2,3
0,7
0,7
2,7
0,3
3,0
0
9,8
35,5
20,2
24,9
Metal industry
Surface treatment
Refineries
Organic chemicals
Coke ovens
Carbon
Cement klinker, lime, minerals
Combustion
Inorganic chemicals
Hazardous- /municipal waste


Chlorine and inorganic compounds
1,4
1,2
0,5
0,2
1,6
1,7
0,1
5,2
5,5
9,4
73,1
Combustion
Metal industry
Hazardous- /municipal waste
Cement klinker, lime, minerals
Organic chemicals
Pulp and paper
Refineries
Inorganic chemicals
Slaughterhouses, milk production
Nonhazardous waste / landfills


Fluorine and inorganic compounds
0,1
0,3
0,1
2,9
0
15,2
48,3
33,2
Combustion
Metal industry
Cement klinker, lime, minerals
Inorganic chemicals
Hazardous- /municipal waste
Organic chemicals
Pulp and paper
Others


HCN
0,4
0,3
0,9
0
3,1
14,6
44,0
36,6
Organic chemicals
Coke ovens
Metal industry
Inorganic chemicals
Refineries
Textiles
Pharmaceuticals
Others


PM10
0,4
0,2
2,3
1,1
0,6
2,9
6,8
7,6
38,8
13,0
26,2
Combustion
Metal industry
Cement klinker, lime, minerals
Pulp and paper
Refineries
Slaughterhouses, milk production
Inorganic chemicals
Organic chemicals
Nonhazardous waste / landfills
Hazardous- /municipal waste
Others

5.1.3 Emissions to air by facilities

In Table 48 below all reporting facilities are presented, contributing to more than 5 % of the total emission to air for a specific pollutant.

Table 48 Facilities emitting to air over 5 % of total emissions by pollutant

Pollutant	Company name	Country	Share of total emissions in Europe [%]	Number of facilities reporting the pollutant
CH4	DISCARICA DI 1°CATEGORIA DI RIFIUTI URBANI E SPECIALI NON PERICOLOSI	Italy	21,9%	1287
CO	ILVA S.P.A. Stabilimento di Taranto	Italy	10,2%	495
HFCs	Solvay Flúor Ibérica	Spain	19,7%	97
HFCs	PHOSPHORIC FERTILIZERS INDUSTRY S.A. THESSALONIKI FACTORY	Greece	18,6%	
HFCs	RHODIA ORGANIQUE FINE LTD	United Kingdom	12,2%	
HFCs	ATOFINA ESPAÑA, S.A. - ALONSOTEGI	Spain	8,4%	
HFCs	ATOFINA	France	8,4%	
N2O	RADICI CHIMICA SPA	Italy	17,6%	418
N2O	RHODIA P.I. CHALAMPE	France	8,8%	
N2O	HYDRO AGRI SLUISKIL BV	Netherlands	6,5%	
N2O	BASF Antwerpen nv	Belgium	6,5%	
N2O	DSM LIMBURG BV	Netherlands	5,9%	
NOx	Central Térmica Besós	Spain	12,2%	2161
PFCs	ALUMINIUM DE GRECE S.A.	Greece	75,6%	30
PFCs	Aluminium Pechiney Lannemezan	France	5,4%	
SF6	MAGNESIUM ELEKTRON LTD	United Kingdom	50,1%	23
SF6	Magnesium Products of Italy S.r.l.	Italy	25,5%	
SF6	Solvay Fluor u. Derivate GmbH	Germany	9,3%	
SF6	ALSTOM T&D SA	France	5,2%	
SOx	CENTRAL TERMICA AS PONTES	Spain	6,9%	1321
As and compounds	Outokumpu Harjavalta Metals Oy Harjavallan tehtaat	Finland	5,1%	238
Cd and compounds	UGINE SA	France	5,6%	269
Cd and compounds	UGINE SAVOIE IMPHY	France	5,6%	
Cr and compounds	ACEROS INOXIDABLES OLARRA	Spain	15,8%	222
Cr and compounds	CENTRAL TERMICA PUENTE NUEVO	Spain	9,3%	
Cu and compounds	SOMINCOR - Sociedade Mineira de Neves-Corvo, S.A. - Mina de Neves Corvo	Portugal	8,8%	183
Cu and compounds	Norddeutsche Affinerie AG	Germany	6,4%	
Cu and compounds	ATLANTIC COPPER	Spain	6,4%	
Cu and compounds	Outokumpu Harjavalta Metals Oy Harjavallan tehtaat	Finland	5,4%	
Ni and compounds	Centrale Termoelettrica di San Filippo del Mela	Italy	6,8%	480
Pb and compounds	ILVA S.P.A. Stabilimento di Taranto	Italy	9,0%	288
Zn and compounds	Global Steel Wire, S.A.	Spain	6,7%	360
Zn and compounds	ACERÍA COMPACTA DE BIZKAIA	Spain	5,4%	
Dichloroethane-1,2 (DCE)	INEOS CHLOR LTD	United Kingdom	23,2%	46
Dichloroethane-1,2 (DCE)	Borsodchem Rt	Hungary	14,7%	
Dichloroethane-1,2 (DCE)	Egis Rt. Központi Telep	Hungary	10,1%	
Dichloroethane-1,2 (DCE)	ATOFINA	France	10,0%	
Dichloroethane-1,2 (DCE)	ATOFINA LAVERA	France	6,6%	
Dichloroethane-1,2 (DCE)	VINYLFOS	France	6,1%	
Dichloroethane-1,2 (DCE)	INEOS CHLOR LTD	United Kingdom	5,5%	
Dichloroethane-1,2 (DCE)	ALBEMARLE CHEMICALS SAS	France	5,4%	
Dichloroethane-1,2 (DCE)	EUROPEAN VINYLS CORPORATION (UK) LTD	United Kingdom	5,3%	
Dichloromethane (DCM)	CARPENTER LTD	United Kingdom	8,5%	151
Dichloromethane (DCM)	Scotoil Services Ltd	United Kingdom	8,5%	
Dichloromethane (DCM)	GLAXO OPERATIONS UK LTD	United Kingdom	7,6%	
Dichloromethane (DCM)	ACETATE PRODUCTS LTD	United Kingdom	5,2%	
Hexachlorobenzene (HCB)	NORSK HYDRO PRODUKSJON. Porsgrunn Ind - Magnesiumfabrikken	Norway	58,5%	3
Hexachlorobenzene (HCB)	A.G.SIDERURGICA BALBOA, S.A.	Spain	25,2%	
Hexachlorobenzene (HCB)	Siderúrgica Sevillana, S.A.	Spain	16,3%	
PCDD+PCDF (dioxins+furans)	Stabilimento Syndial di Porto Torres	Italy	14,3%	89
PCDD+PCDF (dioxins+furans)	ILVA S.P.A. Stabilimento di Taranto	Italy	8,8%	
PCDD+PCDF (dioxins+furans)	CT PASAJES	Spain	7,4%	
PCDD+PCDF (dioxins+furans)	CT SANTURCE	Spain	5,3%	
PCDD+PCDF (dioxins+furans)	Thyssen Krupp Stahl AG Werk Schwelgern	Germany	5,2%	
Pentachlorophenol (PCP)	AUBERT & DUVAL	France	100,0%	1
Tetrachloroethylene (PER)	BOXAL FRANCE SA	France	12,6%	34
Tetrachloroethylene (PER)	INEOS CHLOR LTD	United Kingdom	10,7%	
Tetrachloroethylene (PER)	BEHR France	France	10,1%	
Tetrachloroethylene (PER)	GRAPHOCOLOR SA	France	9,5%	
Tetrachloroethylene (PER)	OUTOKUMPU COPPER TUBES	Spain	9,5%	
Tetrachloroethylene (PER)	REVETEMENT INDUSTRIEL	France	6,0%	
Tetrachloroethylene (PER)	CIPEL (ex HOLLANDER)	France	5,1%	
Tetrachloromethane (TCM)	ATOFINA	France	74,8%	20
Trichlorobenzenes (TCB)	Clariant GmbH Werk Griesheim	Germany	55,6%	2
Trichlorobenzenes (TCB)	BASF AG	Germany	44,4%	
Trichloroethane-1,1,1 (TCE)	Hydro Polymers as Rafnes	Norway	76,2%	2
Trichloroethane-1,1,1 (TCE)	ATOFINA	France	23,8%	
Trichloroethylene (TRI)	VALEO	France	25,8%	106
Trichloroethylene (TRI)	INEOS CHLOR LTD	United Kingdom	5,1%	
Trichloromethane	INEOS CHLOR LTD	United Kingdom	17,8%	37
Trichloromethane	ATOFINA	France	9,4%	
Trichloromethane	DSM DERETIL	Spain	7,5%	
Trichloromethane	ATOFINA	France	6,6%	
Trichloromethane	Roche Vitamins (UK) Ltd, Dalry	United Kingdom	6,6%	
Trichloromethane	ATOFINA LAVERA	France	5,9%	
Trichloromethane	SOLVAY ELECTROLYSE France	France	5,7%	
Trichloromethane	INEOS CHLOR LTD	United Kingdom	5,1%	
Benzene	Talisman Energy UK Ltd	United Kingdom	7,4%	220
Polycyclic Aromatic Hydrocarbons	SAFET	France	19,0%	116
Polycyclic Aromatic Hydrocarbons	USINE CHIMIQUE DE L'AUBETTE	France	17,3%	
Polycyclic Aromatic Hydrocarbons	HYDRO ALUMINIUM AS KARMoY	Norway	8,8%	
Polycyclic Aromatic Hydrocarbons	ILVA S.P.A. Stabilimento di Taranto	Italy	7,6%	
Polycyclic Aromatic Hydrocarbons	PPG-SIPSY	France	7,3%	
Polycyclic Aromatic Hydrocarbons	TESTOUTIL	France	5,8%	
Chlorine and inorganic compounds	EDF ENERGY (WEST BURTON POWER) LTD	United Kingdom	11,5%	403
Chlorine and inorganic compounds	TXU EUROPE POWER LTD	United Kingdom	7,3%	
Chlorine and inorganic compounds	RWE INNOGY PLC	United Kingdom	6,4%	
Chlorine and inorganic compounds	Scottish Power Generation uk	United Kingdom	6,2%	
HCN	SEVALCO LTD	United Kingdom	36,6%	34
HCN	LUCITE INTERNATIONAL UK LTD	United Kingdom	23,4%	
HCN	BASF PLC	United Kingdom	15,0%	

5.2 Emissions to water

5.2.1 Emissions to water by country

Similar as for emissions to air, the contribution to the total emission for a certain pollutant to water is presented up to a maximum of 10 countries.
In Table 49 up to Table 54 this is done for the direct emissions to water and for the indirect emissions to water.
Besides, the share of the total emission for this list is given and also the total emission for all countries.
Apart from these tables the results are presented in pie-charts as well.

Evaluating these tables gives the following results:

- The total emission of a pollutant is covered for at least more than 95% (average for 98 %) by the 10 most emitting countries.
- For many pollutants to water (both direct and indirect) the distribution over the various countries shows a rather clear pattern. Most emission levels for specific pollutants are dominated by 5 large countries.(UK, FR, IT, DE and ES). Each of them is frequently represented in the top-3.
- There are some extreme shares or sudden breaks in the descending trend for a specific country.
  - IT with a high share for HCB, HCDB and for Chlorides;
  - PT with high shares for Ni, Pb and Zn and their compounds.

To make a final judgement, the reported activities, the intensity of reporting the information gaps and background information like production volume is needed.

Table 49 Main contributing countries (top-10) to <u>direct</u> emissions to <u>water</u> for various pollutants.

	Country	Total - Nitrogen	Country	Total - Phosphorus	Country	As and compounds	Country	Cd and compounds	Country	Cr and compounds	Country	Cu and compounds	Country	Hg and compounds	Country	Ni and compounds	Country	Pb and compounds	Country	Zn and compounds
	IT	33.4	FR	22.4	FR	22.6	IT	30.3	FR	79.3	FR	27.6	IT	26.7	IT	31.2	FR	31.8	IT	28.7
	FR	15.8	UK	20.0	UK	18.7	FR	28.6	IT	14.2	UK	15.8	HU	19.2	FR	25.5	IT	20.3	FR	14.7
	UK	14.6	IT	17.7	IT	18.3	ES	11.8	DE	1.8	DE	15.5	FR	13.9	DE	9.2	UK	14.7	ES	11.8
	DE	11.8	BE	7.5	DE	9.6	UK	5.8	UK	1.1	PT	10.3	ES	11.4	UK	7.3	DE	11.4	DE	9.4
	ES	5.1	ES	6.7	SE	5.9	HU	5.5	ES	0.7	IT	9.5	UK	8.5	FI	5.5	NO	7.3	SE	8.9
	SE	3.3	SE	5.4	BE	5.5	BE	4.2	GR	0.7	FI	4.3	BE	4.9	ES	5.3	BE	4.1	BE	6.4
	FI	3.1	DE	4.8	PT	5.3	SE	3.7	FI	0.5	ES	4.2	DE	4.3	BE	4.8	ES	2.9	UK	5.7
	NO	3.0	PT	3.8	FI	4.8	NO	2.5	PT	0.4	SE	3.8	AT	4.0	NO	3.5	SE	2.4	PT	4.2
	HU	2.0	NL	3.0	NL	4.6	PT	2.5	NL	0.3	NO	3.4	FI	2.6	SE	2.7	NL	1.7	AT	2.6
	BE	1.9	HU	2.4	ES	1.7	DE	2.3	SE	0.3	AT	1.6	SE	2.2	NL	2.1	AT	1.4	NO	2.6
Share [%]		93.8		93.7		96.9		97.2		99.3		96.1		97.8		97.2		98.1		95.0
Total emission [tonne]		103283		7961		24		14		998		206		2		171		116		1160

Table 50 Main contributing countries (top-10) to direct emissions to water for various pollutants

	Country	Dichloroethane-1.2 (DCE)	Country	Dichloromethane (DCM)	Country	Chloroalkanes (C10-13)	Country	Hexachlorobenzene (HCB)	Country	Hexachlorobutadiene (HCBD)	Country	Hexachlorocyclohexane(HCH)	Country	Halogenated organic compounds	Country	Benzene. toluene. ethylbenzene. xylenes	Country	Organotin - compounds	Country	Polycyclic Aromatic Hydrocarbons
	FR	48.2	UK	71.3	ES	94.9	DE	44.1	FR	58.8	FR	91.8	FI	29.9	UK	46.7	PT	36.7	PT	36.4
	IT	18.5	FR	22.4	DE	5.1	BE	41.2	IT	25.1	DE	8.2	FR	20.3	ES	32.9	IT	33.4	NO	21.0
	NL	12.4	IT	3.4			FR	14.7	BE	11.4			SE	18.0	FR	13.8	GR	16.0	IT	18.7
	UK	11.2	DE	1.5					ES	4.8			ES	9.0	IT	4.4	DE	11.5	ES	17.2
	DE	5.2	IE	0.7									PT	6.6	NL	0.8	UK	2.5	FR	5.6
	BE	2.5	BE	0.5									NO	6.2	DE	0.6			UK	0.5
	ES	1.8	FI	0.1									DE	5.2	BE	0.4			DE	0.4
	SE	0.1	NL	0.0									AT	2.4	AT	0.4			NL	0.1
	NO	0.1											UK	1.1					BE	0.1
													BE	1.1					SE	0.0
Share [%]		100.0		100.0		100.0		100.0		100.0		100.0		99.8		100.0		100.0		100.0
Total emission [tonne]		19		100		0		0		0		0		3558		194		3		43

Table 51 Main contributing countries (top-10) to direct emissions to water for various pollutants

	Country	Phenols	Country	Total organic carbon (TOC)	Country	Chlorides	Country	Cyanides	Country	Fluorides
	UK	62.5	IT	24.4	ES	44.8	ES	50.2	FR	24.1
	FR	12.9	NO	17.9	DE	21.6	NO	15.0	BE	23.3
	IT	10.4	SE	15.8	FR	10.4	IT	10.8	NL	18.0
	ES	6.5	FI	10.6	UK	8.0	FR	6.7	DE	8.7
	DE	3.5	UK	7.3	IT	5.8	DE	5.7	NO	8.1
	NL	0.9	DE	6.2	NL	3.9	NL	4.1	IT	6.5
	NO	0.8	ES	5.4	BE	2.5	UK	3.5	UK	4.3
	BE	0.7	FR	5.3	PT	1.6	BE	2.3	SE	3.2
	GR	0.5	PT	2.7	AT	1.0	AT	1.1	ES	1.3
	HU	0.4	AT	1.6	SE	0.3	SE	0.4	GR	1.3
Share [%]		99.1		97.1		99.9		99.9		98.9
Total emission [tonne]		370		576242		17160682		305		11146

Table 52 Main contributing countries to indirect emissions to water for various pollutants.

	Country	Total - Nitrogen	Country	Total - Phosphorus	Country	As and compounds	Country	Cd and compounds	Country	Cr and compounds
	IT	20.8	ES	23.5	DE	37.3	IT	86.4	IT	46.9
	UK	18.5	UK	19.1	UK	34.9	ES	7.7	UK	40.0
	FR	17.5	FR	17.2	IT	9.5	FR	2.0	FR	7.2
	DE	16.9	IT	14.0	ES	5.7	HU	1.1	ES	2.0
	ES	14.4	DE	11.2	FR	5.2	DE	1.1	DE	1.9
	DK	3.5	NL	7.6	NL	4.6	BE	0.9	HU	1.4
	AT	2.8	DK	3.0	BE	1.6	UK	0.5	BE	0.4
	HU	2.3	AT	1.4	HU	1.1	AT	0.3	PT	0.1
	NL	1.7	BE	0.8	PT	0.0			AT	0.1
	GR	0.5	FI	0.8					GR	0.0
Share [%]		99.8		98.6		100.0		100.0		100.0
Total emission [tonne]		45706		7987		3		5		252

	Country	Cu and components	Country	Hg and compounds	Country	Ni and compounds	Country	Pb and compounds	Country	Zn and compounds
	IT	32.7	IT	44.2	IT	34.1	IT	49.1	IT	30.9
	DE	17.1	HU	34.1	DE	19.6	FR	12.2	DE	25.5
	UK	16.3	ES	8.2	ES	19.4	HU	11.2	FR	12.6
	FR	13.0	DE	5.0	UK	13.5	DE	8.4	ES	10.7
	ES	7.6	FR	4.8	FR	5.3	ES	7.5	UK	8.2
	NL	3.7	UK	1.7	BE	3.8	UK	7.2	PT	4.7
	HU	2.4	NL	1.0	AT	1.3	PT	2.2	NL	3.1
	BE	2.3	GR	0.4	HU	0.8	BE	1.3	BE	1.6
	PT	2.1	BE	0.3	NL	0.7	AT	0.5	HU	1.5
	AT	1.9	SE	0.2	PT	0.7	NL	0.2	AT	0.9
Share [%]		99.1		100.0		99.2		99.9		99.5
Total emission [tonne]		53		1		41		28		173

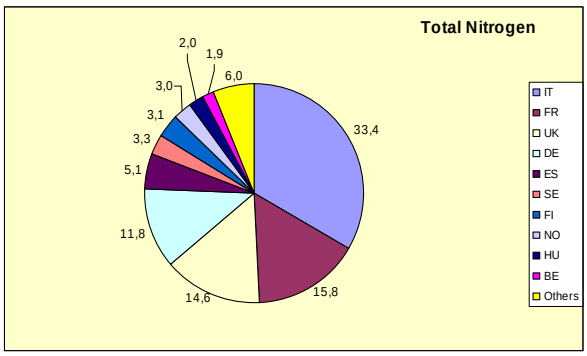
Table 53 Main contributing countries to indirect emissions to water for various pollutants.

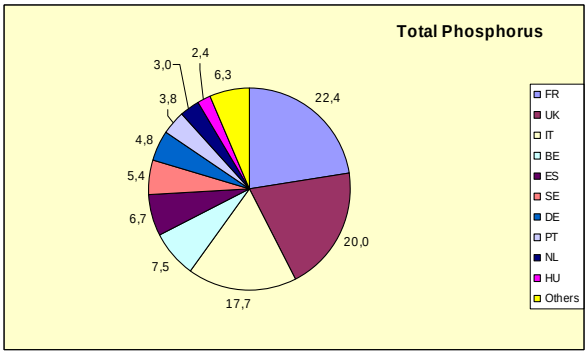
	Country	Dichloroethane-1.2 (DCE)	Country	Dichloromethane (DCM)	Country	Chloroalkanes (C10-13)	Country	Hexachlorobenzene (HCB)	Country	Hexachlorobutadiene (HCBD)	Country	Hexachlorocyclohexane(HCH)	Country	Halogenated organic compounds	Country	Benzene. toluene. ethylbenzene. xylenes	Country	Brominated diphenylether	Country	Organotin - compounds	Country	Polycyclic Aromatic Hydrocarbons
	FR	79.1	FR	61.1	ES	87.8	IT	####	ES	37.9	IT	56.6	UK	####	DE	44.5	PT	63.2	FR	79.1	FR	61.1
	IT	14.9	IT	16.0	IT	12.2			FR	18.6	NL	24.0			ES	29.6	ES	30.4	IT	14.9	IT	16.0
	UK	4.3	UK	9.5					UK	15.1	FR	7.0			IT	25.9	FR	2.9	UK	4.3	UK	9.5
	DE	1.3	IE	9.1					DE	12.2	ES	6.6					NL	2.6	DE	1.3	IE	9.1
	ES	0.4	DE	2.2					IT	8.3	DE	5.3					DE	0.8	ES	0.4	DE	2.2
			ES	1.6					AT	6.5	AT	0.4					IT	0.1			ES	1.6
			BE	0.3					BE	1.4											BE	0.3
			AT	0.2																	AT	0.2
			NL	0.0																	NL	0.0
Share [%]		100.0		100.0		100.0				100.0				100.0		100.0		100.0		100.0		100.0
Total emission [tonne]		5		13		0		0		229		153		1		1		6		5		13

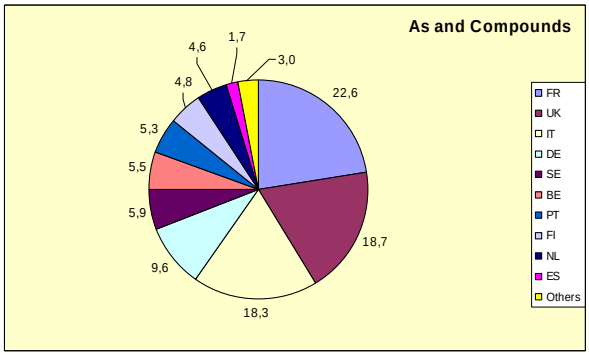
Table 54 Main contributing countries to indirect emissions to water for various pollutants.

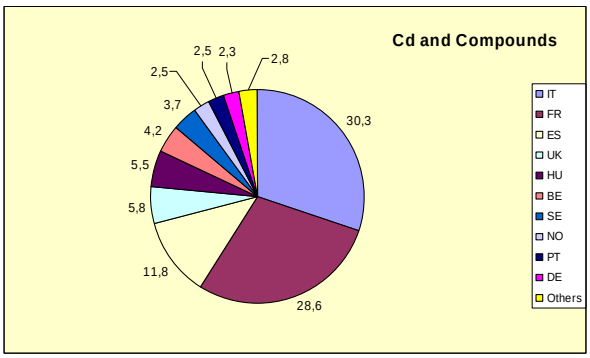
	Country	Phenols	Country	Total organic carbon (TOC)	Country	Chlorides	Country	Cyanides	Country	Fluorides
	DE	46.8	UK	22.3	ES	37.8	DE	54.8	UK	40.4
	AT	23.8	IT	20.2	PT	37.4	AT	29.2	DE	21.3
	IT	9.1	ES	16.0	FR	10.8	ES	5.3	FR	11.9
	PT	8.4	DE	15.9	UK	5.2	UK	4.7	IT	8.3
	UK	7.0	FR	14.0	DE	3.2	IT	4.1	ES	7.1
	FR	3.6	DK	2.5	DK	2.7	FR	1.5	DK	3.9
	ES	0.4	AT	2.2	IT	1.0	BE	0.4	NL	3.0
	DK	0.4	NL	2.0	NL	0.8			AT	2.5
	BE	0.3	HU	1.7	AT	0.8			HU	1.6
	NL	0.1	BE	1.4	BE	0.3				
Share [%]		100.0		98.2		100.0		100.0		100.0
Total emission [tonne]		958		333953		971470		83		424

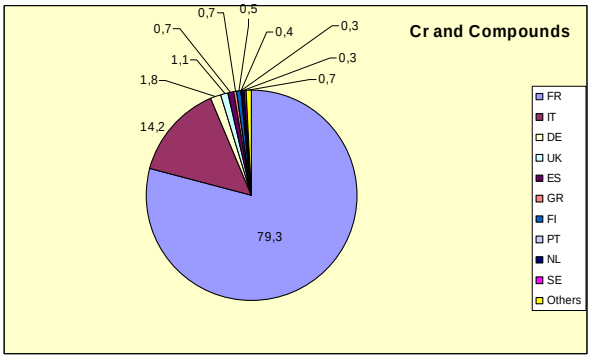
Pie-charts – Emission to water direct over countries

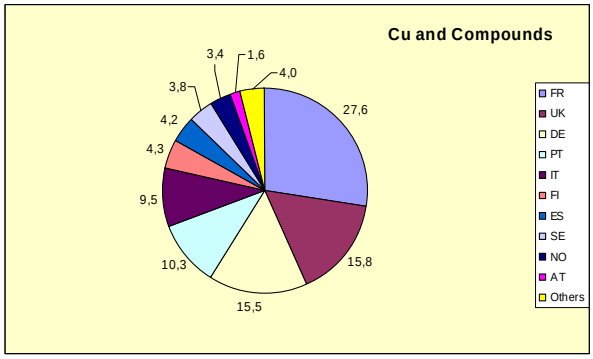


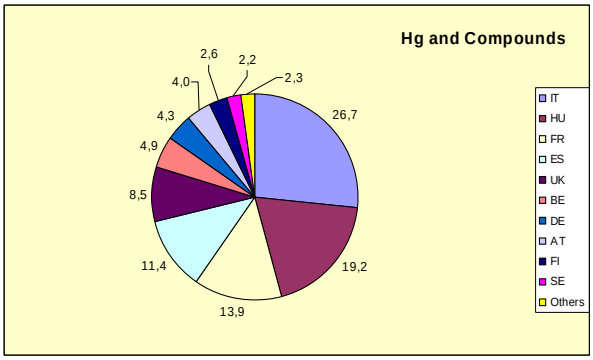


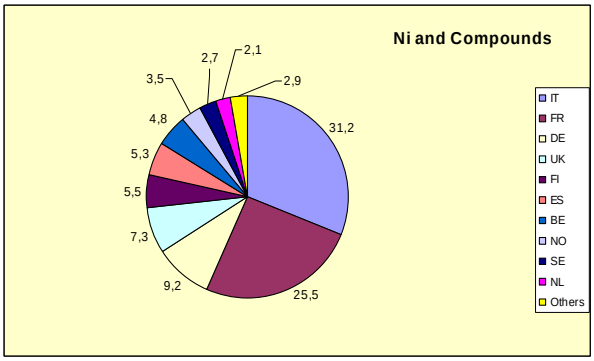


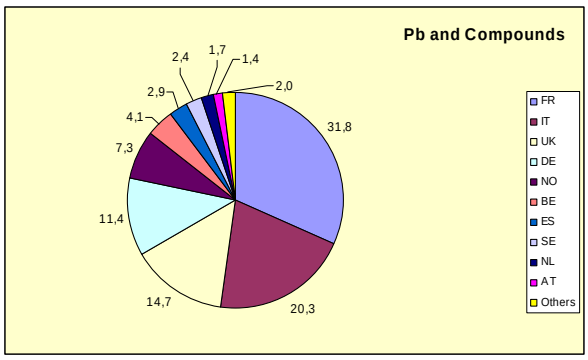











Pb and Compounds
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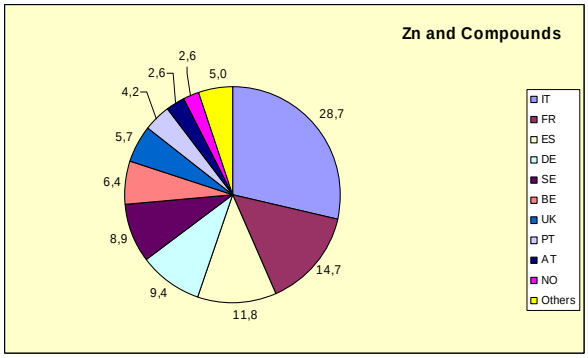
FR
IT
UK
DE
NO
BE
ES
SE
NL
AT
Others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8,9
6,4
5,7
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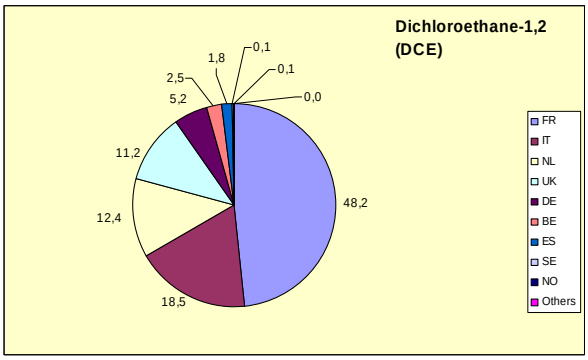
BE
UK
PT
AT
NO
Others


Dichloroethane-1,2 (DCE)
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18,5
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FR
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NL
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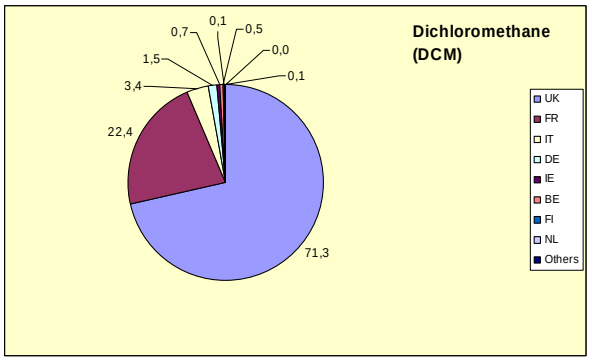
DE
BE
ES
SE
NO
Others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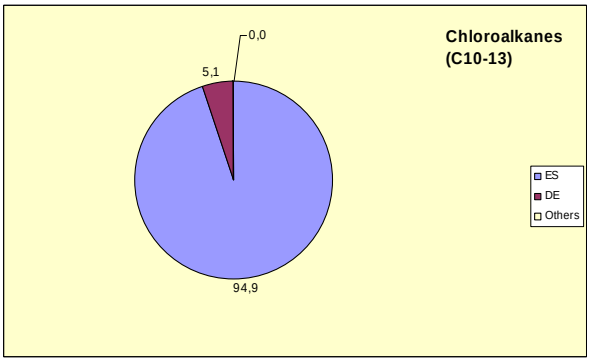
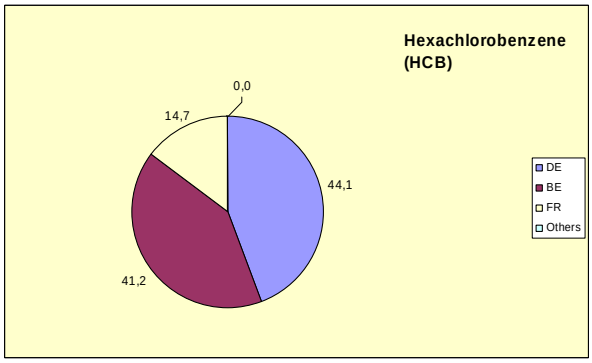
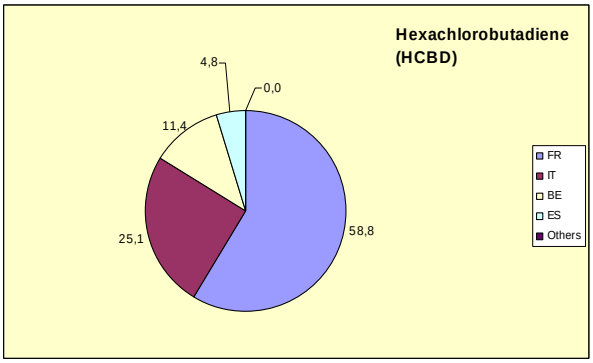
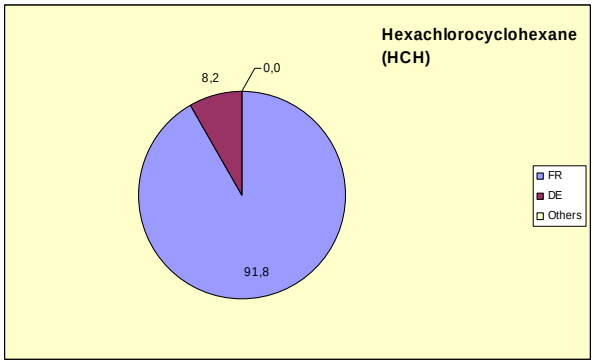
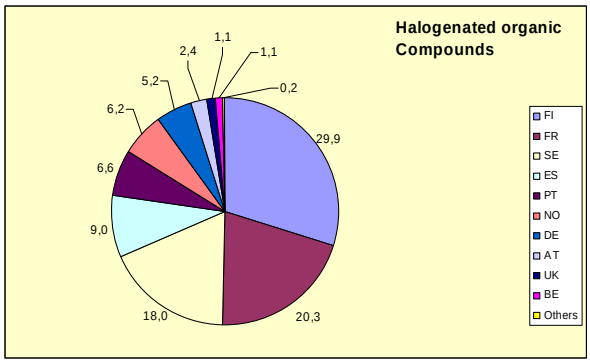
0,1
UK
FR
IT
DE
IE
BE
FI
NL
Others

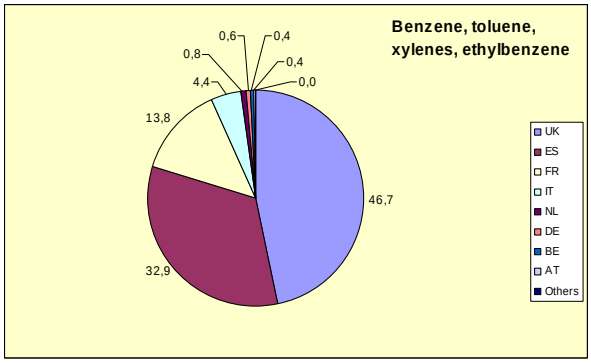

Chloroalkanes (C10-13)
94,9
5,1
0,0
ES
DE
Others

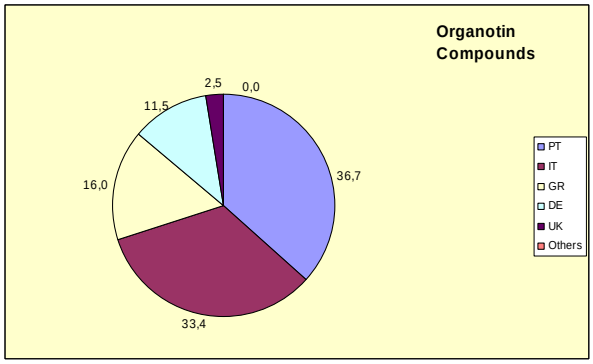

Hexachlorobenzene (HCB)
44,1
41,2
14,7
0,0
DE
BE
FR
Others

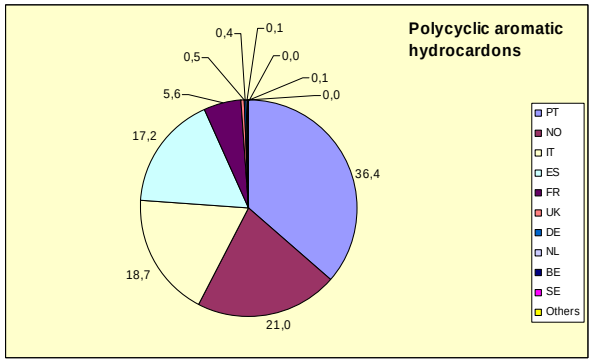

Hexachlorobutadiene (HCBD)
58,8
25,1
11,4
4,8
0,0
FR
IT
BE
ES
Others

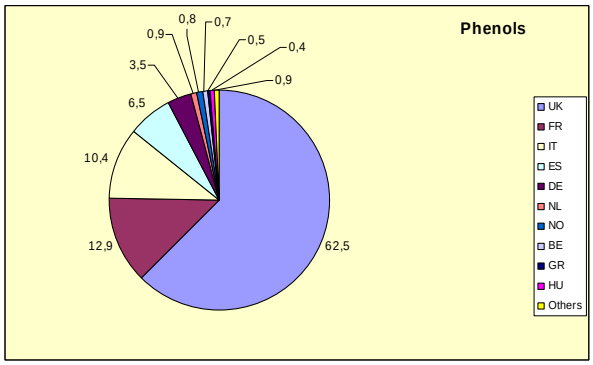

Hexachlorocyclohexane (HCH)
91,8
8,2
0,0
FR
DE
Others

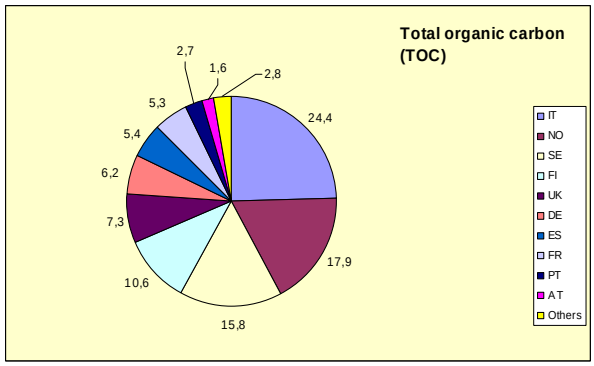

Halogenated organic Compounds
29,9
20,3
18,0
9,0
6,6
6,2
5,2
2,4
1,1
1,1
0,2
FI
FR
SE
ES
PT
NO
DE
AT
UK
BE
Others

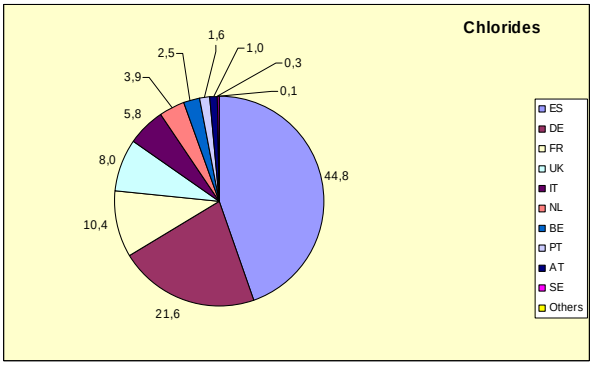

Benzene, toluene, xylenes, ethylbenzene
46,7
32,9
13,8
4,4
0,8
0,6
0,4
0,4
0,0
UK
ES
FR
IT
NL
DE
BE
AT
Others

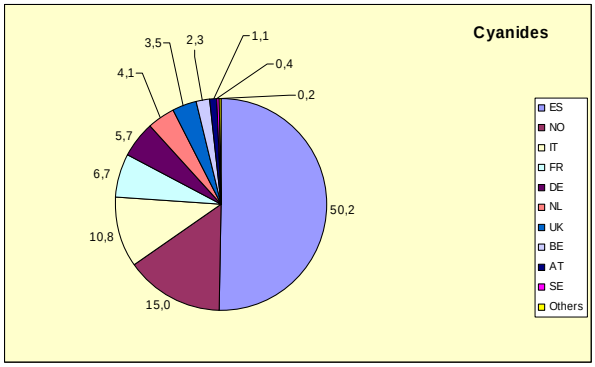

Organotin Compounds
36,7
33,4
16,0
11,5
2,5
0,0
PT
IT
GR
DE
UK
Others

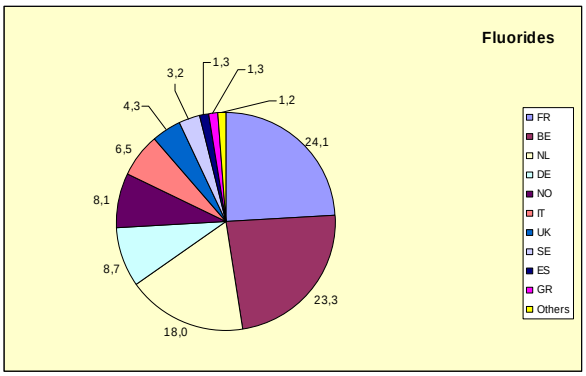

Polycyclic aromatic hydrocardons
36,4
21,0
18,7
17,2
5,6
0,5
0,4
0,1
0,0
0,1
0,0
PT
NO
IT
ES
FR
UK
DE
NL
BE
SE
Others


Phenols
62,5
12,9
10,4
6,5
3,5
0,9
0,8
0,7
0,5
0,4
0,9
UK
FR
IT
ES
DE
NL
NO
BE
GR
HU
Others

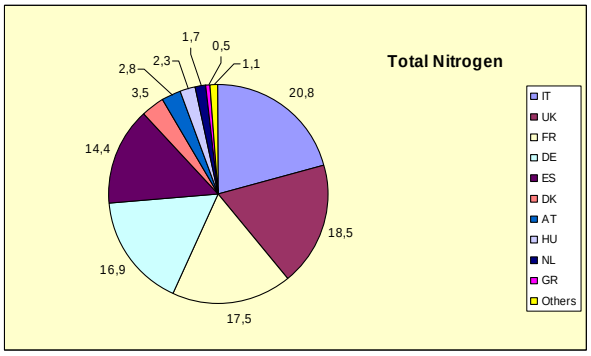

Total organic carbon (TOC)
24,4
17,9
15,8
10,6
7,3
6,2
5,4
5,3
2,7
1,6
2,8
IT
NO
SE
FI
UK
DE
ES
FR
PT
AT
Others

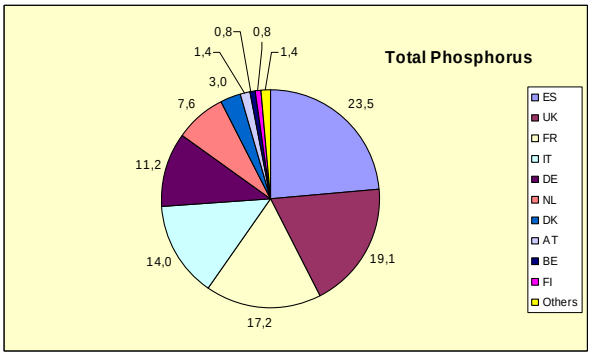

Chlorides
44,8
21,6
10,4
8,0
5,8
3,9
2,5
1,6
1,0
0,3
0,1
ES
DE
FR
UK
IT
NL
BE
PT
AT
SE
Others

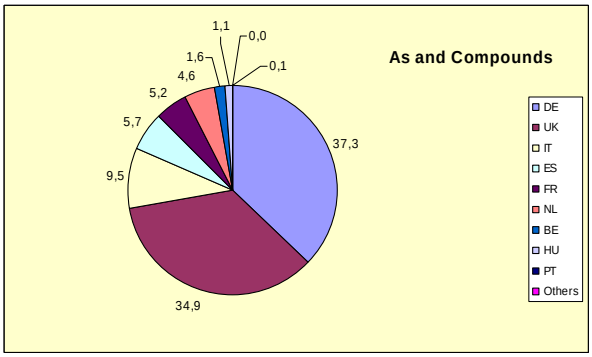

Cyanides
50,2
15,0
10,8
6,7
5,7
4,1
3,5
2,3
1,1
0,4
0,2
ES
NO
IT
FR
DE
NL
UK
BE
AT
SE
Others

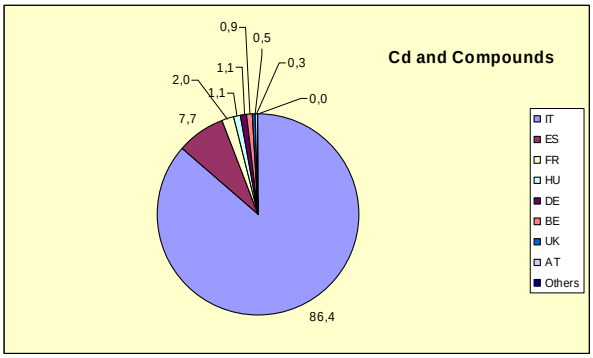


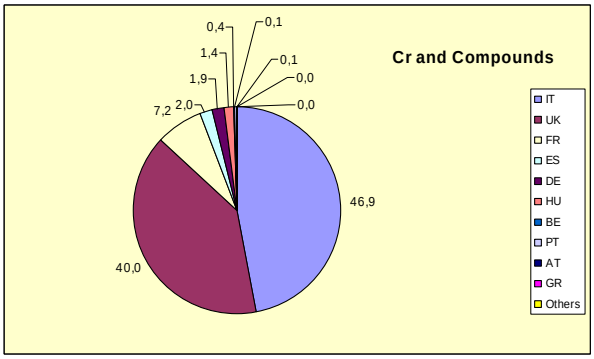
Pie-charts – Emissions to water indirect over countries

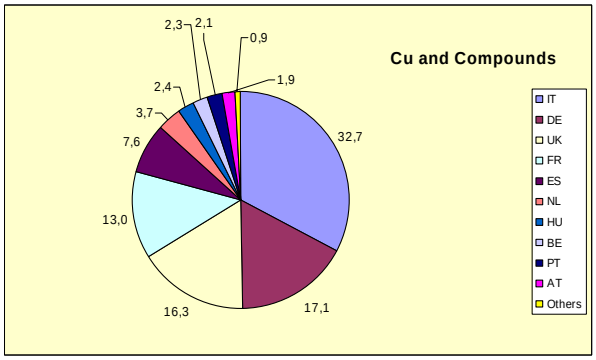


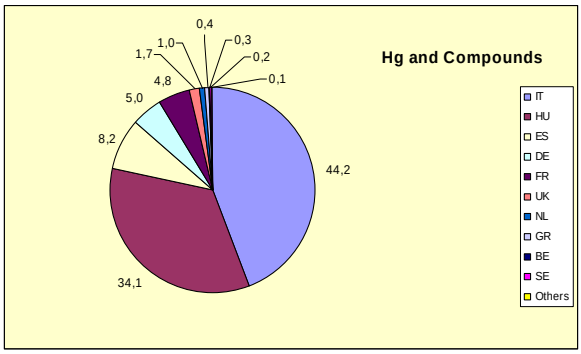


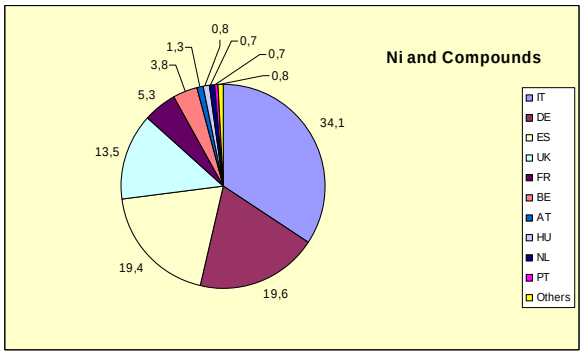


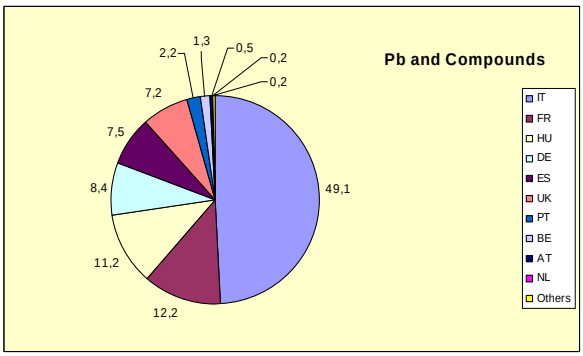


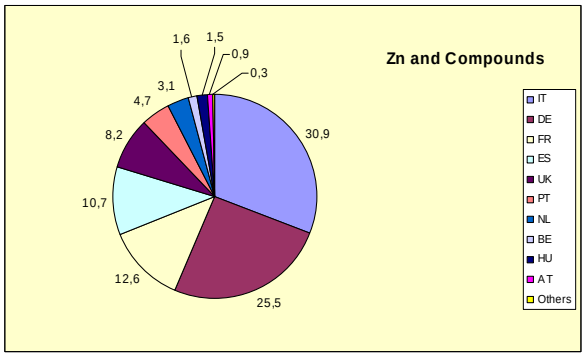


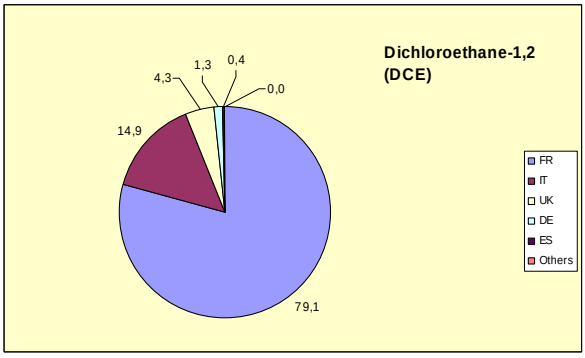


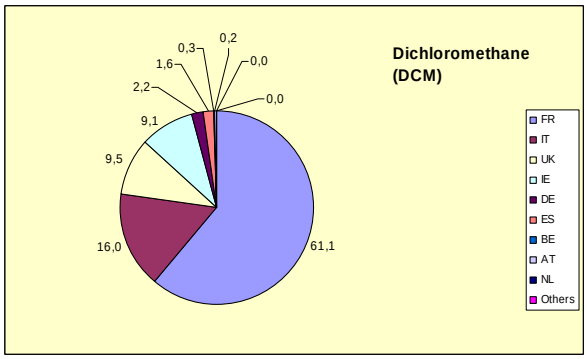

Hg and Compounds
0,4
0,3
1,0
0,2
1,7
0,1
4,8
5,0
8,2
44,2
34,1
IT
HU
ES
DE
FR
UK
NL
GR
BE
SE
Others

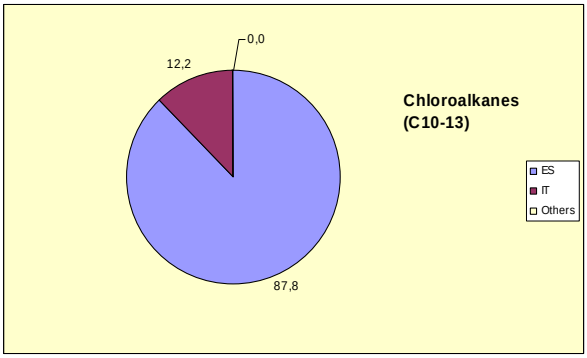

Ni and Compounds
0,8
1,3
0,7
3,8
0,7
5,3
0,8
34,1
13,5
19,4
19,6
IT
DE
ES
UK
FR
BE
AT
HU
NL
PT
Others

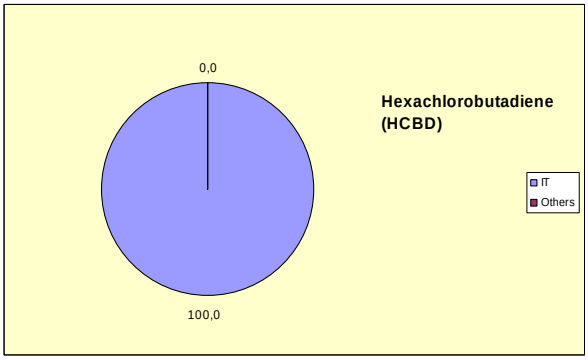

Pb and Compounds
2,2
1,3
0,5
0,2
0,2
7,2
7,5
49,1
8,4
11,2
12,2
IT
FR
HU
DE
ES
UK
PT
BE
AT
NL
Others

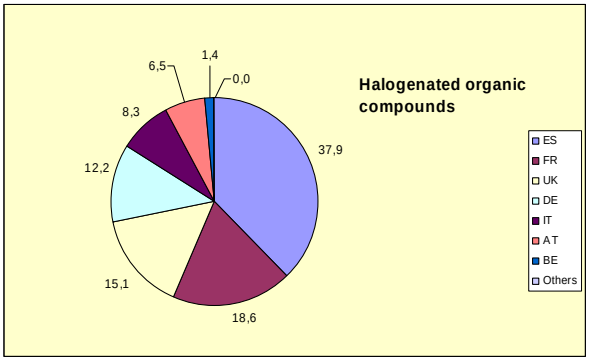

Zn and Compounds
1,6
1,5
0,9
0,3
3,1
4,7
8,2
30,9
10,7
12,6
25,5
IT
DE
FR
ES
UK
PT
NL
BE
HU
AT
Others

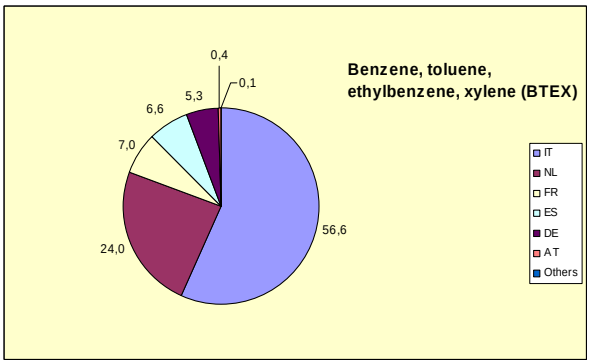

Dichloroethane-1,2
(DCE)
4,3
1,3
0,4
0,0
14,9
79,1
FR
IT
UK
DE
ES
Others

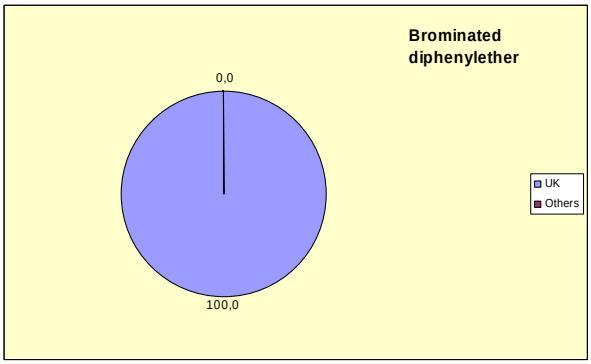

Dichloromethane
(DCM)
0,3
0,2
1,6
0,0
2,2
0,0
9,1
9,5
16,0
61,1
FR
IT
UK
IE
DE
ES
BE
AT
NL
Others

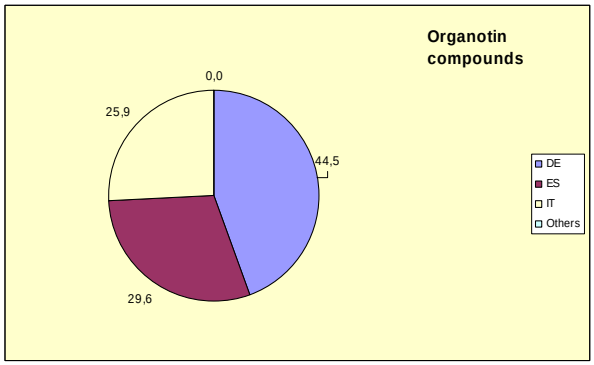

Chloroalkanes
(C10-13)
0,0
12,2
87,8
ES
IT
Others

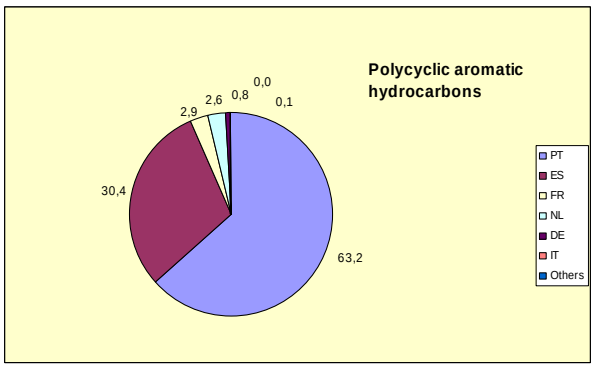

Hexachlorobutadiene
(HCBD)
0,0
100,0
IT
Others

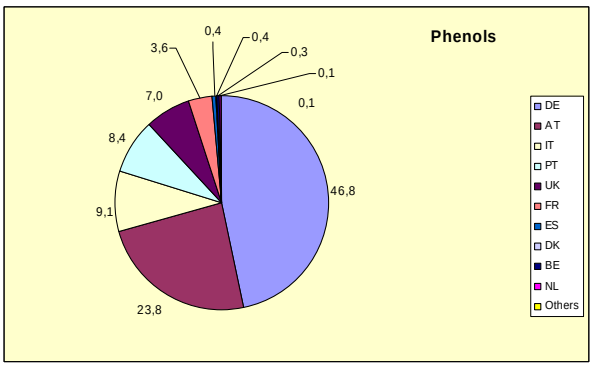

Halogenated organic compounds
37,9
18,6
15,1
12,2
8,3
6,5
1,4
0,0
ES
FR
UK
DE
IT
AT
BE
Others

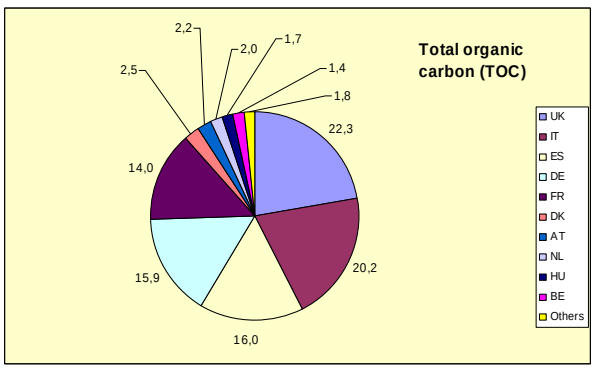

Benzene, toluene, ethylbenzene, xylene (BTEX)
56,6
24,0
7,0
6,6
5,3
0,4
0,1
IT
NL
FR
ES
DE
AT
Others

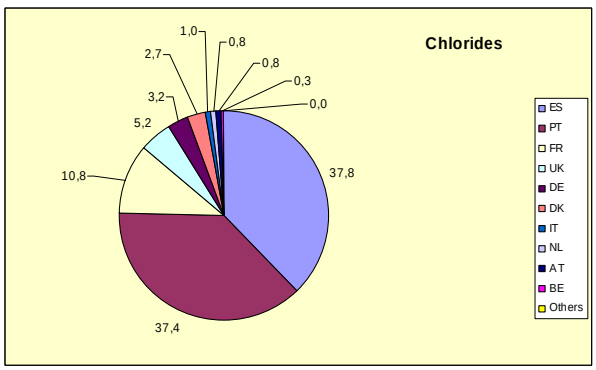

Brominated diphenylether
100,0
0,0
UK
Others

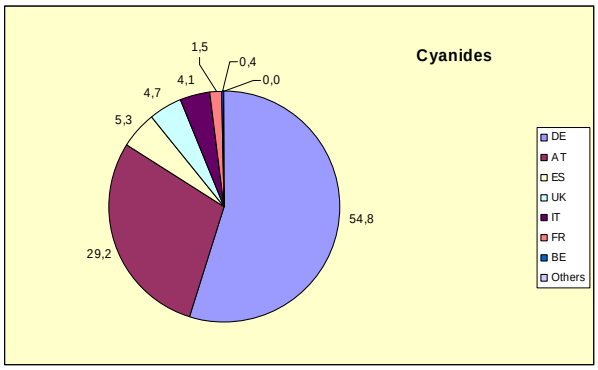

Organotin compounds
44,5
29,6
25,9
0,0
DE
ES
IT
Others

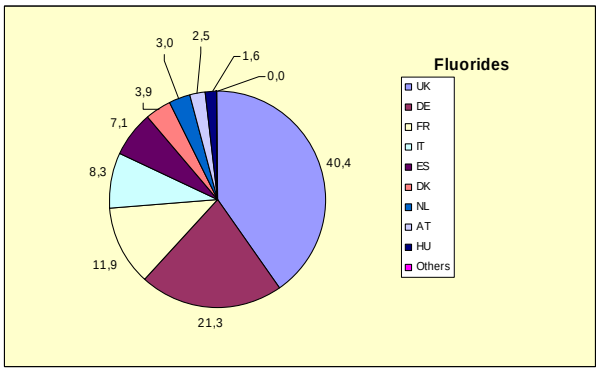

Polycyclic aromatic hydrocarbons
63,2
30,4
2,9
2,6
0,8
0,0
0,1
PT
ES
FR
NL
DE
IT
Others


Phenols
46,8
23,8
9,1
8,4
7,0
3,6
0,4
0,4
0,3
0,1
0,1
DE
AT
IT
PT
UK
FR
ES
DK
BE
NL
Others


Total organic carbon (TOC)
22,3
20,2
16,0
15,9
14,0
2,5
2,2
2,0
1,7
1,4
1,8
UK
IT
ES
DE
FR
DK
AT
NL
HU
BE
Others


Chlorides
37,8
37,4
10,8
5,2
3,2
2,7
1,0
0,8
0,8
0,3
0,0
ES
PT
FR
UK
DE
DK
IT
NL
AT
BE
Others





5.2.2 Emissions to water by activity

The contribution to the total emission for a certain pollutant to water is presented up to a maximum of 10 activities.
In Table 55 up to Table 64 this is done for respectively the direct emissions to water and for the indirect emissions to water.
Besides, the share of the total emission for this list is given and the total emission for the activity.
Apart from these tables the results are presented in pie-charts as well.

From the evaluation of the results, the following conclusions can be drawn:

- The total emission of a pollutant is covered for at least more than 96 % by the 10 most emitting activities.
- For many pollutants to water (both direct and indirect) the distribution over the various activities is variable, ranging from one activity emitting a pollutant to many.
- The emissions to water are dominated by 5 activities, often represented in the top-3 of activities, respectively:
  - Refineries;
  - Organic chemicals;
  - Inorganic chemicals;
  - Metals industry and
  - Pulp and paper.
- There is an extreme share of Chlorides from Non-hazardous waste / landfills

Table 55 Main contributing activities in direct emissions to water for various pollutants.

	Activity	Total - Nitrogen	Activity	Total - Phosphorus	Activity	As and compounds	Activity	Cd and compounds	Activity	Cr and compounds
	Inorganic chemicals	24.8	Inorganic chemicals	22.9	Metal industry	21.4	Metal industry	59.1	Metal industry	86.7
	Nonhazardous waste / landfills	22.6	Organic chemicals	20.2	Inorganic chemicals	19.0	Inorganic chemicals	10.0	Inorganic chemicals	6.3
	Organic chemicals	16.0	Pulp and paper	15.6	Cement klinker. lime. minerals	17.2	Pulp and paper	7.0	Organic chemicals	2.1
	Metal industry	12.7	Nonhazardous waste / landfills	12.6	Nonhazardous waste / landfills	10.0	Poultry and pigs	5.4	Nonhazardous waste / landfills	1.3
	Pulp and paper	7.4	Slaughterhouses. milk production	11.6	Combustion	8.7	Combustion	4.5	Pulp and paper	1.1
	Slaughterhouses. milk production	4.6	Pharmaceuticals	7.0	Refineries	8.6	Hazardous- /municipal waste	3.9	Cement klinker. lime. minerals	0.8
	Refineries	4.2	Metal industry	4.9	Organic chemicals	8.1	Organic chemicals	3.6	Combustion	0.6
	Pharmaceuticals	3.2	Combustion	1.5	Pulp and paper	4.0	Cement klinker. lime. minerals	2.0	Refineries	0.4
	Hazardous- /municipal waste	1.3	Surface treatment	0.9	Hazardous- /municipal waste	2.5	Refineries	1.2	Surface treatment	0.2
	Combustion	1.0	Refineries	0.6	Pharmaceuticals	0.3	Nonhazardous waste / landfills	1.2	Tanning	0.2
Share [%]		97.7		97.7		99.7		97.9		99.7
Total emission [tonne]		103283		7961		24		14		998

Table 56 Main contributing activities in direct emissions to water for various pollutants.

	Activity	Cu and components	Activity	Hg and compounds	Activity	Ni and compounds	Activity	Pb and compounds	Activity	Zn and compounds
	Metal industry	22.9	Inorganic chemicals	25.4	Metal industry	44.9	Metal industry	40.2	Metal industry	30.8
	Inorganic chemicals	18.3	Organic chemicals	23.7	Inorganic chemicals	14.1	Inorganic chemicals	13.4	Organic chemicals	19.8
	Organic chemicals	12.0	Metal industry	18.7	Organic chemicals	13.2	Organic chemicals	11.2	Combustion	15.5
	Combustion	11.1	Hazardous- /municipal waste	10.0	Pulp and paper	5.3	Refineries	10.6	Inorganic chemicals	13.1
	Refineries	8.7	Pulp and paper	6.3	Combustion	5.1	Pulp and paper	6.0	Pulp and paper	8.7
	Pulp and paper	8.6	Nonhazardous waste / landfills	5.1	Cement klinker etc.	4.5	Cement klinker etc.	5.6	Nonhazard. waste/ landfills	4.8
	Poultry and pigs	7.5	Combustion	4.9	Surface treatment	3.5	Combustion	4.3	Refineries	1.7
	Nonhazardous waste / landfills	3.4	Cement klinker. lime. minerals	3.1	Refineries	3.1	Surface treatment	3.9	Coal plants	1.0
	Textiles	2.3	Refineries	1.8	Nonhazard. waste/ landfills	2.4	Hazard.-/ municipal waste	1.9	Poultry and pigs	0.9
	Hazardous- /municipal waste	1.5	Textiles	0.4	Hazard.-/ municipal waste	1.5	Nonhazard. waste/ landfills	1.1	Hazard.-/ municipal waste	0.9
Share [%]		96.4		99.3		97.8		98.2		97.1
Total emission [tonne]		206		2		171		116		1160

Table 57 Main contributing activities in <u>direct</u> emissions to <u>water</u> for various pollutants.

	Activity	Dichloroethane-1.2 (DCE)	Activity	Dichloromethane (DCM)	Activity	Chloroalkanes (C10-13)	Activity	Hexachlorobenzene (HCB)	Activity	Hexachlorobutadiene (HCBD)
	Organic chemicals	47.0	Organic chemicals	76.8	Surface treatment	82.4	Organic chemicals	100.0	Organic chemicals	100.0
	Inorganic chemicals	23.6	Pharmaceuticals	11.1	Organic chemicals	12.5				
	Hazardous- /municipal waste	15.0	Inorganic chemicals	10.8	Inorganic chemicals	5.1				
	Pharmaceuticals	9.1	Biocides and explosives	1.2						
	Biocides and explosives	4.3	Hazardous- /municipal waste	0.1						
	Metal industry	0.6	Nonhazardous waste / landfills	0.0						
	Refineries	0.4								
	Combustion	0.1								
Share [%]		100.0		100.0		100.0		100.0		100.0
Total emission [tonne]		19		100		0		0		0

Table 58 Main contributing activities indirect emissions to water for various pollutants.

	Activity	Halogenated organic compounds	Activity	Benzene. toluene. ethylbenzene. xylenes	Activity	Organotin - compounds	Activity	Polycyclic Aromatic Hydrocarbons	Activity	Phenols
	Pulp and paper	86.1	Refineries	34.8	Metal industry	86.1	Metal industry	38.4	Organic chemicals	45.0
	Organic chemicals	7.7	Inorganic chemicals	29.9	Organic chemicals	11.5	Textiles	19.2	Refineries	25.7
	Inorganic chemicals	3.8	Organic chemicals	20.8	Nonhazardous waste / landfills	2.5	Pharmaceuticals	16.5	Inorganic chemicals	9.9
	Pharmaceuticals	0.9	Metal industry	8.3			Inorganic chemicals	14.9	Metal industry	8.8
	Refineries	0.5	Biocides and explosives	3.2			Organic chemicals	3.2	Pulp and paper	2.6
	Biocides and explosives	0.4	Hazardous- /municipal waste	1.2			Coke ovens	2.6	Combustion	2.5
	Hazardous- /municipal waste	0.3	Pharmaceuticals	0.7			Combustion	2.4	Coke ovens	2.4
	Combustion	0.2	Coal plants	0.5			Refineries	1.3	Pharmaceuticals	1.2
	Nonhazardous waste / landfills	0.1	Combustion	0.5			Hazardous- /municipal waste	0.8	Nonhazardous waste / landfills	0.9
			Coke ovens	0.2			Slaughterhouses. milk production	0.6	Hazardous- /municipal waste	0.5
Share [%]		100.0		100.0		100.0		99.9		99.4
Total emission [tonne]		3558		194		3		43		370

Table 59 Main contributing activities to direct emissions to water for various pollutants.

	Activity	Total organic carbon (TOC)	Activity	Chlorides	Activity	Cyanides	Activity	Fluorides
	Pulp and paper	57.7	Combustion	38.3	Metal industry	67.2	Inorganic chemicals	49.9
	Nonhazardous waste / landfills	21.5	Inorganic chemicals	29.5	Inorganic chemicals	21.7	Metal industry	28.2
	Organic chemicals	9.5	Organic chemicals	18.9	Organic chemicals	8.0	Organic chemicals	16.1
	Slaughterhouses. milk production	3.3	Cement klinker. lime. minerals	4.6	Refineries	1.5	Combustion	2.3
	Metal industry	2.1	Nonhazardous waste / landfills	3.5	Slaughterhouses. milk production	0.8	Refineries	1.7
	Inorganic chemicals	1.7	Metal industry	2.7	Pulp and paper	0.5	Surface treatment	0.7
	Refineries	1.4	Refineries	1.4	Hazardous- /municipal waste	0.2	Hazardous- /municipal waste	0.5
	Pharmaceuticals	1.3	Pulp and paper	0.3	Coke ovens	0.1	Nonhazardous waste / landfills	0.2
	Combustion	0.5	Slaughterhouses. milk production	0.3	Cement klinker. lime. minerals	0.1	Pharmaceuticals	0.1
	Textiles	0.3	Coal plants	0.2	Pharmaceuticals	0.0	Cement klinker. lime. minerals	0.1
Share [%]		99.3		99.7		100.0		99.9
Total emission [tonne]		576242		17160682		305		11146

Table 60 Main contributing activities to indirect emissions to water for various pollutants.

	Activity	Total - Nitrogen	Activity	Total - Phosphorus	Activity	As and compounds	Activity	Cd and compounds	Activity	Cr and compounds
	Slaughterhouses. milk production	28.2	Slaughterhouses. milk production	67.5	Hazardous- /municipal waste	34.5	Nonhazardous waste / landfills	63.7	Tanning	72.4
	Hazardous- /municipal waste	18.0	Nonhazardous waste / landfills	12.4	Metal industry	24.0	Metal industry	25.3	Nonhazardous waste / landfills	12.3
	Organic chemicals	17.0	Organic chemicals	6.4	Nonhazardous waste / landfills	13.6	Hazardous- /municipal waste	4.5	Metal industry	6.7
	Metal industry	7.8	Metal industry	3.6	Organic chemicals	8.1	Organic chemicals	1.6	Organic chemicals	3.7
	Nonhazardous waste / landfills	7.8	Inorganic chemicals	3.0	Surface treatment	6.6	Surface treatment	1.3	Hazardous- /municipal waste	2.6
	Inorganic chemicals	6.8	Pharmaceuticals	2.0	Inorganic chemicals	5.1	Textiles	1.0	Textiles	0.5
	Pharmaceuticals	4.2	Hazardous- /municipal waste	1.0	Combustion	4.1	Slaughterhouses. milk production	0.8	Surface treatment	0.4
	Refineries	4.0	Combustion	0.8	Textiles	1.2	Pharmaceuticals	0.6	Pulp and paper	0.4
	Tanning	2.0	Textiles	0.7	Pulp and paper	0.9	Combustion	0.6	Slaughterhouses. milk production	0.4
	Combustion	1.8	Surface treatment	0.7	Slaughterhouses. milk production	0.8	Pulp and paper	0.4	Pharmaceuticals	0.4
Share [%]		97.6		98.0		98.8		99.9		99.9
Total emission [tonne]		45706		7987		3		5		252

Table 61 Main contributing activities to indirect emissions to water for various pollutants.

	Activity	Cu and compounds	Activity	Hg and compounds	Activity	Ni and compounds	Activity	Pb and compounds	Activity	Zn and compounds
	Metal industry	23.8	Nonhazardous waste / landfills	40.9	Metal industry	41.9	Metal industry	41.6	Organic chemicals	31.7
	Organic chemicals	22.7	Organic chemicals	34.2	Nonhazardous waste / landfills	25.9	Nonhazardous waste / landfills	32.1	Metal industry	27.9
	Nonhazardous waste / landfills	22.1	Hazardous- /municipal waste	6.3	Organic chemicals	13.0	Hazardous- /municipal waste	6.9	Nonhazardous waste / landfills	13.5
	Surface treatment	7.6	Inorganic chemicals	6.0	Surface treatment	7.6	Organic chemicals	4.5	Surface treatment	5.2
	Hazardous- /municipal waste	7.4	Pulp and paper	4.2	Hazardous- /municipal waste	5.0	Slaughterhouses. milk production	3.5	Hazardous- /municipal waste	5.1
	Textiles	4.8	Pharmaceuticals	3.3	Textiles	2.2	Surface treatment	3.5	Pharmaceuticals	4.2
	Combustion	4.3	Slaughterhouses. milk production	2.7	Pharmaceuticals	1.3	Inorganic chemicals	3.2	Combustion	3.0
	Pulp and paper	3.6	Metal industry	0.9	Inorganic chemicals	1.2	Combustion	1.6	Slaughterhouses. milk production	2.9
	Pharmaceuticals	1.5	Textiles	0.8	Combustion	0.8	Pharmaceuticals	0.9	Pulp and paper	2.7
	Slaughterhouses. milk production	1.2	Combustion	0.2	Slaughterhouses. milk production	0.5	Cement klinker. lime. minerals	0.8	Cement klinker. lime. minerals	1.4
Share [%]		99.0		99.6		99.4		98.7		97.5
Total emission [tonne]		53		1		41		28		173

Table 62 Main contributing activities to indirect emissions to water for various pollutants.

	Activity	Dichloroethane-1.2 (DCE)	Activity	Dichloromethane (DCM)	Activity	Chloroalkanes (C10-13)	Activity	Hexachlorobutadiene (HCBD)	Activity	Halogenated organic compounds
	Pharmaceuticals	64.6	Pharmaceuticals	76.8	Organic chemicals	87.8	Organic chemicals	####	Pulp and paper	39.6
	Organic chemicals	31.8	Organic chemicals	13.3	Combustion	12.2			Organic chemicals	31.4
	Hazardous- /municipal waste	3.3	Hazardous- /municipal waste	6.9					Pharmaceuticals	22.3
	Inorganic chemicals	0.2	Metal industry	1.6					Biocides and explosives	3.1
			Refineries	1.3					Nonhazardous waste / landfills	2.6
									Metal industry	1.1
Share [%]		100.0		100.0		100.0		100.0		100.0
Total emission [tonne]		5		13		0		0		229

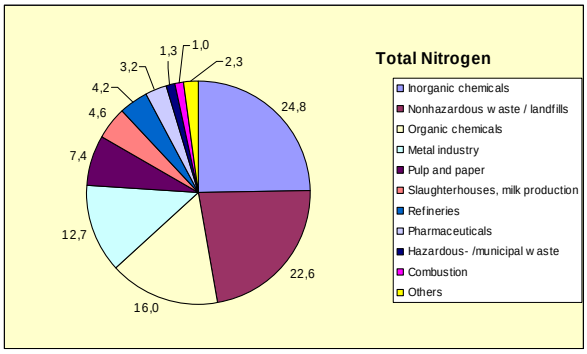
Table 63 Main contributing activities to indirect emissions to water for various pollutants.

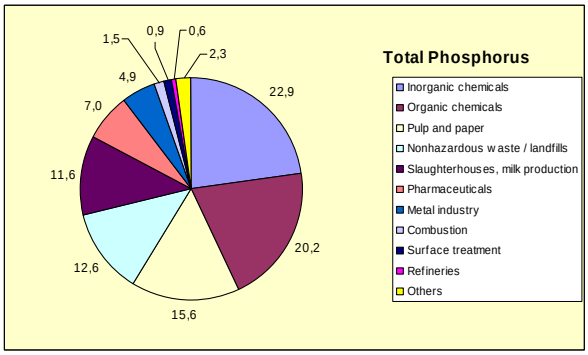
	Activity	Benzene. toluene. ethylbenzene. xylenes	Activity	Brominated diphenylether	Activity	Organotin - compounds	Activity	Polycyclic Aromatic Hydrocarbons	Activity	Phenols
	Organic chemicals	82.9	Surface treatment	100.0	Pharmaceuticals	44.5	Textiles	66.4	Metal industry	39.4
	Metal industry	5.3			Pulp and paper	29.6	Surface treatment	21.3	Organic chemicals	15.7
	Pharmaceuticals	4.9			Surface treatment	25.9	Metal industry	5.8	Coke ovens	11.3
	Surface treatment	2.5					Refineries	2.5	Refineries	9.7
	Combustion	1.8					Hazardous- /municipal waste	1.3	Hazardous- /municipal waste	9.6
	Hazardous- /municipal waste	1.4					Slaughterhouses. milk production	1.3	Textiles	8.3
	Refineries	0.6					Pharmaceuticals	0.6	Inorganic chemicals	2.0
	Textiles	0.5					Coke ovens	0.4	Pulp and paper	1.7
	Biocides and explosives	0.2					Inorganic chemicals	0.2	Pharmaceuticals	1.1
							Combustion	0.1	Nonhazardous waste / landfills	0.5
Share [%]		100.0		100.0		100.0		99.9		99.2
Total emission [tonne]		153		1		1		6		958

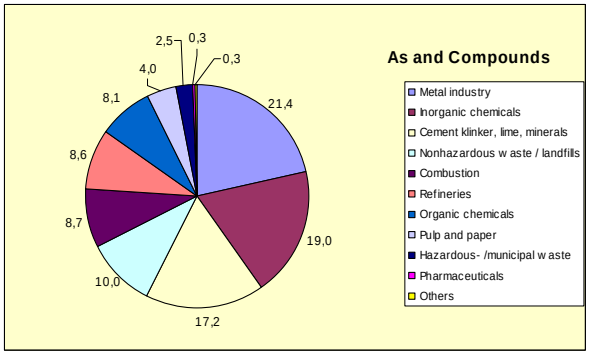
Table 64 Main contributing activities to indirect emissions to water for various pollutants.

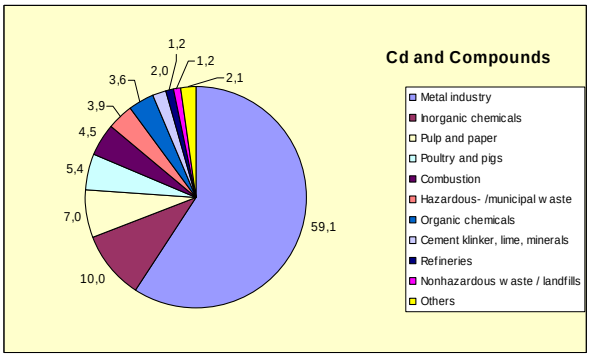
	Activity	Total organic carbon (TOC)	Activity	Chlorides	Activity	Cyanides	Activity	Fluorides
	Slaughterhouses. milk production	44.6	Textiles	37.4	Metal industry	43.5	Organic chemicals	30.2
	Organic chemicals	17.2	Slaughterhouses. milk production	32.6	Coke ovens	42.7	Inorganic chemicals	21.4
	Hazardous- /municipal waste	16.2	Organic chemicals	17.4	Organic chemicals	7.1	Metal industry	15.5
	Pulp and paper	8.8	Inorganic chemicals	6.0	Inorganic chemicals	4.1	Surface treatment	13.1
	Textiles	3.0	Refineries	2.3	Refineries	1.6	Coke ovens	11.3
	Pharmaceuticals	2.5	Hazardous- /municipal waste	1.5	Hazardous- /municipal waste	0.5	Hazardous- /municipal waste	2.6
	Combustion	1.3	Pharmaceuticals	1.0	Pharmaceuticals	0.5	Pharmaceuticals	1.2
	Surface treatment	1.2	Metal industry	0.7			Cement klinker. lime. minerals	1.1
	Tanning	1.1	Combustion	0.3			Nonhazardous waste / landfills	1.1
	Inorganic chemicals	1.0	Biocides and explosives	0.3			Combustion	1.0
Share [%]		96.9		99.5		100.0		98.7
Total emission [tonne]		333953		971470		83		424

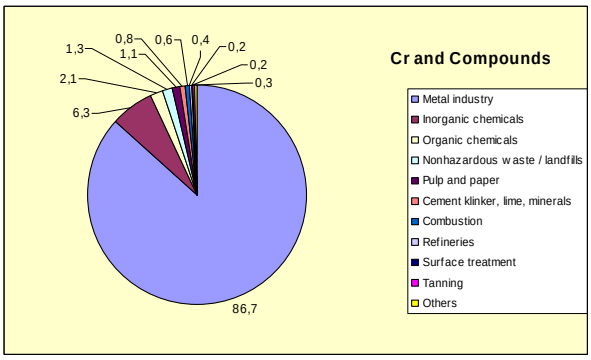
Pie-charts – Emissions to water direct over activities

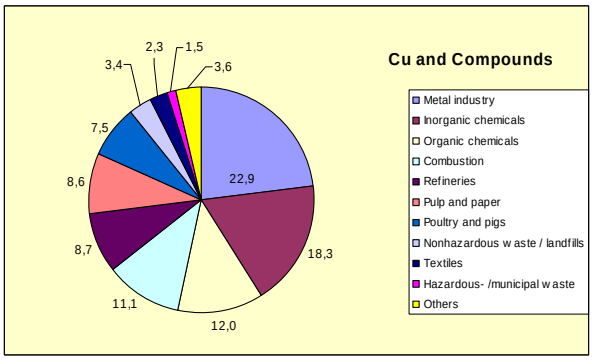


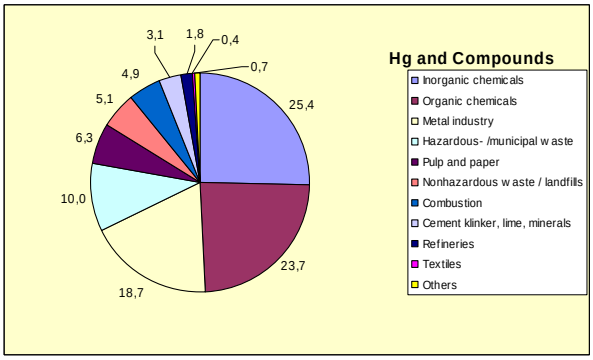


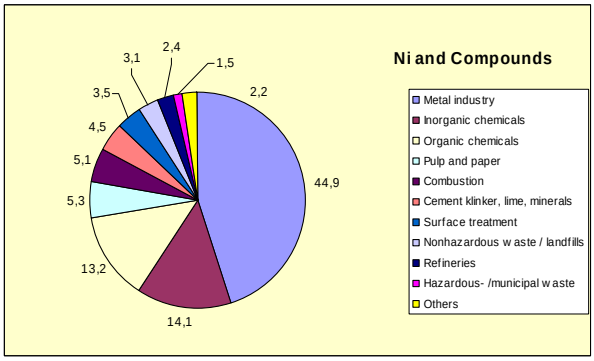


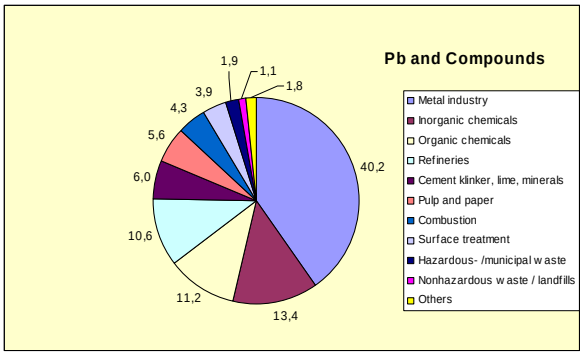


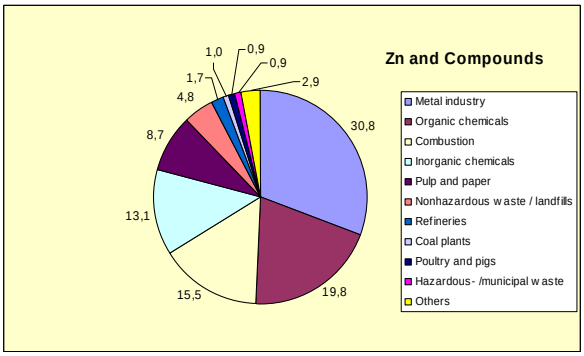


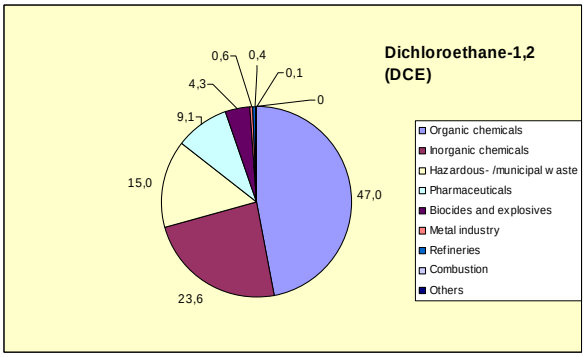


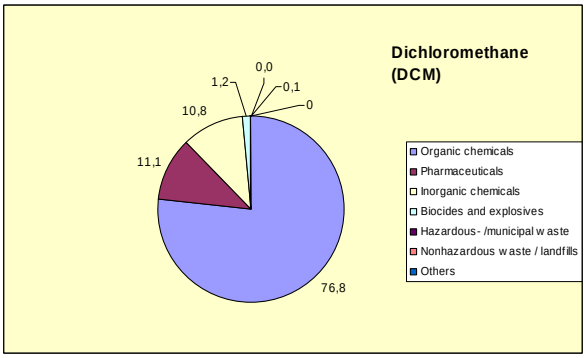


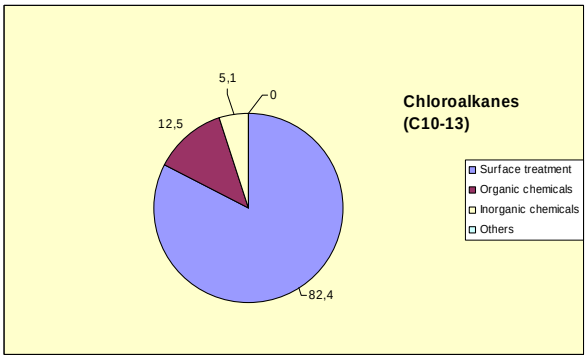


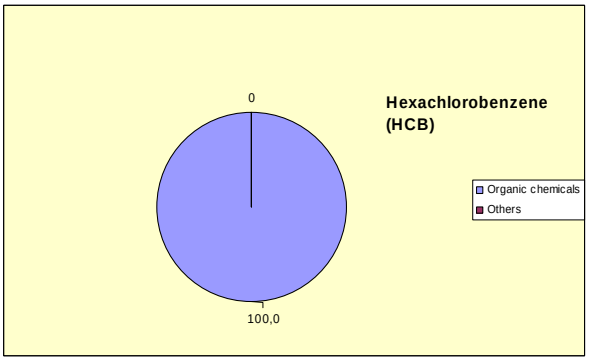

Pb and Compounds
40,2
13,4
11,2
10,6
6,0
5,6
4,3
3,9
1,9
1,1
1,8
Metal industry
Inorganic chemicals
Organic chemicals
Refineries
Cement klinker, lime, minerals
Pulp and paper
Combustion
Surface treatment
Hazardous- /municipal waste
Nonhazardous waste / landfills
Others

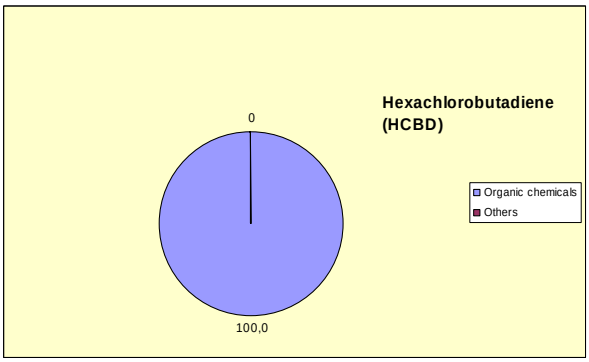

Zn and Compounds
30,8
19,8
15,5
13,1
8,7
4,8
2,9
1,7
1,0
0,9
0,9
Metal industry
Organic chemicals
Combustion
Inorganic chemicals
Pulp and paper
Nonhazardous waste / landfills
Refineries
Coal plants
Poultry and pigs
Hazardous- /municipal waste
Others

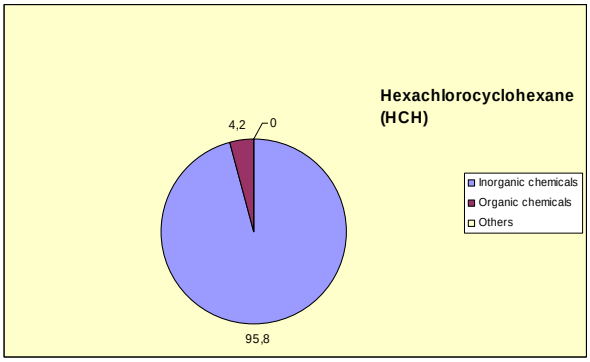

Dichloroethane-1,2 (DCE)
47,0
23,6
15,0
9,1
4,3
0,6
0,4
0,1
0
Organic chemicals
Inorganic chemicals
Hazardous- /municipal waste
Pharmaceuticals
Biocides and explosives
Metal industry
Refineries
Combustion
Others

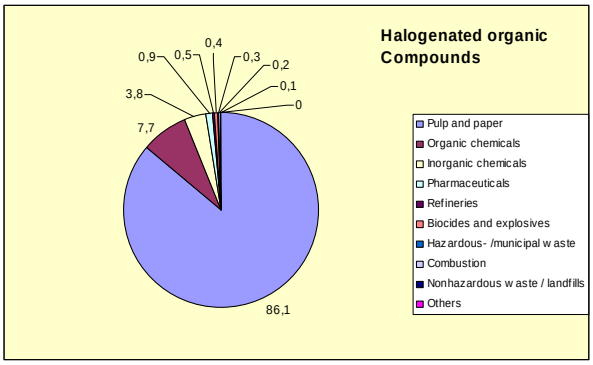

Dichloromethane (DCM)
76,8
11,1
10,8
1,2
0,0
0,1
0
Organic chemicals
Pharmaceuticals
Inorganic chemicals
Biocides and explosives
Hazardous- /municipal waste
Nonhazardous waste / landfills
Others

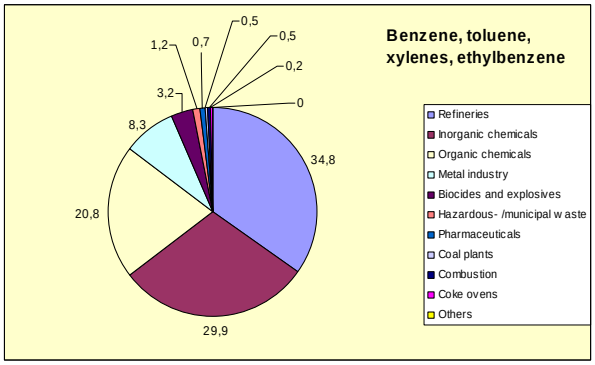

Chloroalkanes (C10-13)
82,4
12,5
5,1
0
Surface treatment
Organic chemicals
Inorganic chemicals
Others

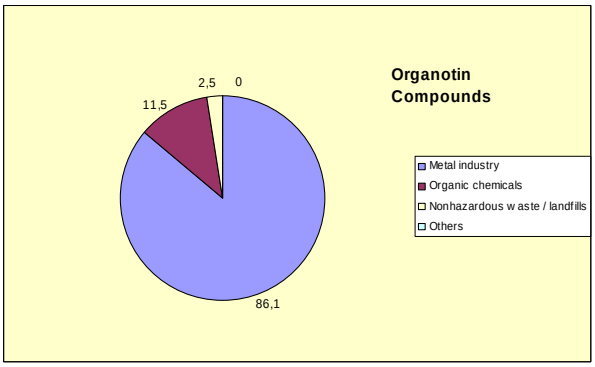

Hexachlorobenzene (HCB)
100,0
0
Organic chemicals
Others

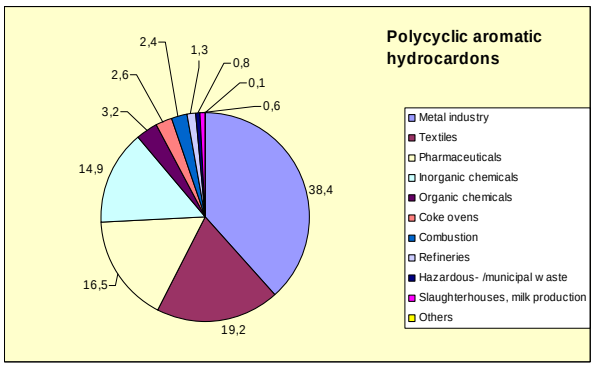

Hexachlorobutadiene (HCBD)
100,0
0
Organic chemicals
Others

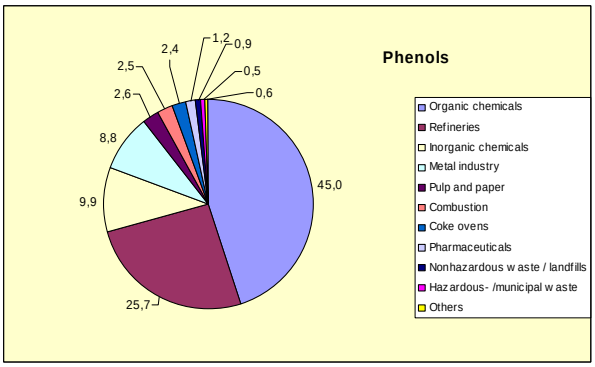

Hexachlorocyclohexane (HCH)
95,8
4,2
0
Inorganic chemicals
Organic chemicals
Others

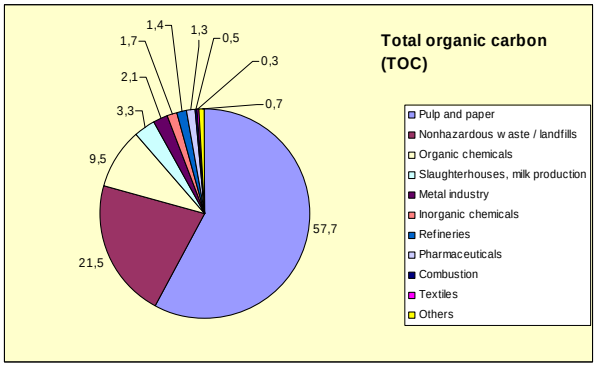

Halogenated organic Compounds
0,9
0,5
0,4
0,3
0,2
0,1
0
3,8
7,7
86,1
Pulp and paper
Organic chemicals
Inorganic chemicals
Pharmaceuticals
Refineries
Biocides and explosives
Hazardous- /municipal waste
Combustion
Nonhazardous waste / landfills
Others

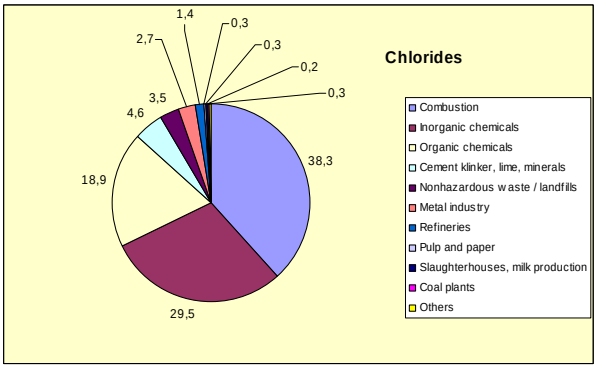

Benzene, toluene, xylenes, ethylbenzene
1,2
0,7
0,5
0,5
0,2
3,2
0
8,3
34,8
20,8
29,9
Refineries
Inorganic chemicals
Organic chemicals
Metal industry
Biocides and explosives
Hazardous- /municipal waste
Pharmaceuticals
Coal plants
Combustion
Coke ovens
Others

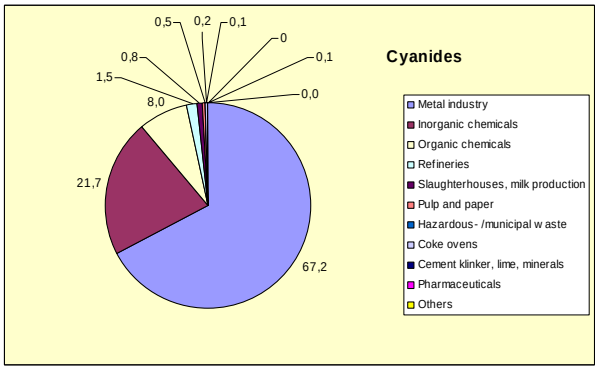

Organotin Compounds
2,5
0
11,5
86,1
Metal industry
Organic chemicals
Nonhazardous waste / landfills
Others

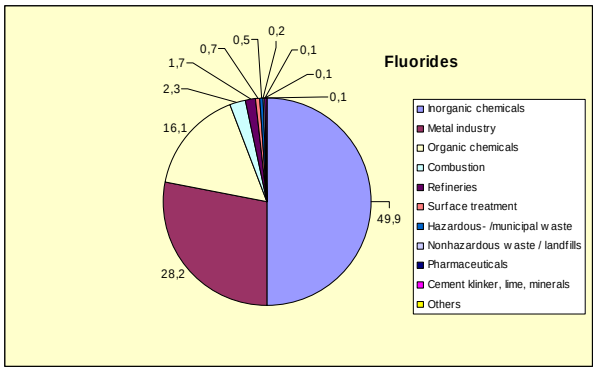

Polycyclic aromatic hydrocardons
2,4
1,3
2,6
0,8
0,1
3,2
0,6
14,9
38,4
16,5
19,2
Metal industry
Textiles
Pharmaceuticals
Inorganic chemicals
Organic chemicals
Coke ovens
Combustion
Refineries
Hazardous- /municipal waste
Slaughterhouses, milk production
Others


Phenols
2,4
1,2
0,9
2,5
0,5
2,6
0,6
8,8
45,0
9,9
25,7
Organic chemicals
Refineries
Inorganic chemicals
Metal industry
Pulp and paper
Combustion
Coke ovens
Pharmaceuticals
Nonhazardous waste / landfills
Hazardous- /municipal waste
Others

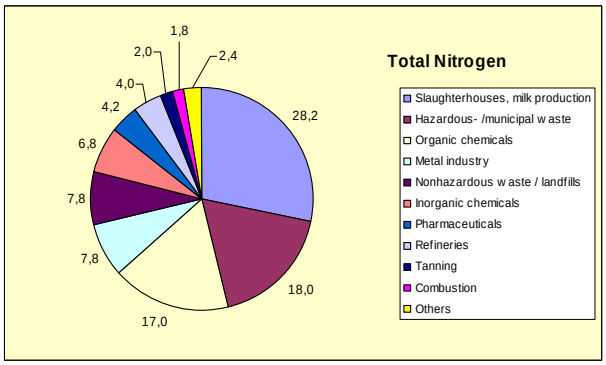

Total organic carbon (TOC)
1,4
1,7
1,3
0,5
0,3
2,1
0,7
3,3
9,5
57,7
21,5
Pulp and paper
Nonhazardous waste / landfills
Organic chemicals
Slaughterhouses, milk production
Metal industry
Inorganic chemicals
Refineries
Pharmaceuticals
Combustion
Textiles
Others

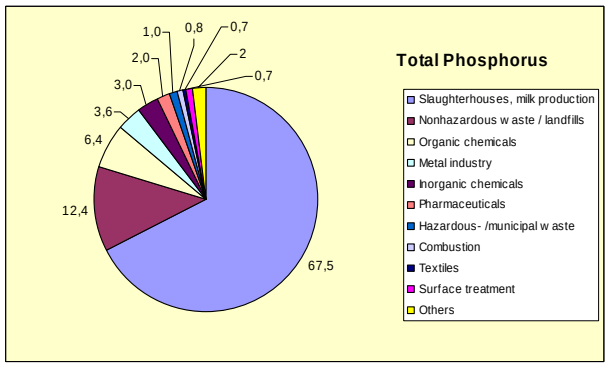

Chlorides
1,4
0,3
2,7
0,3
0,2
0,3
3,5
4,6
38,3
18,9
29,5
Combustion
Inorganic chemicals
Organic chemicals
Cement klinker, lime, minerals
Nonhazardous waste / landfills
Metal industry
Refineries
Pulp and paper
Slaughterhouses, milk production
Coal plants
Others

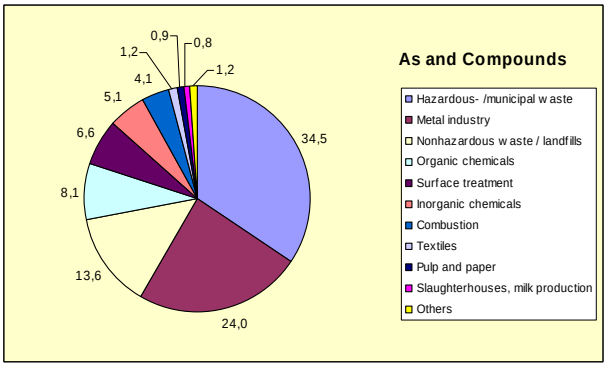

Cyanides
0,5
0,2
0,1
0
0,8
0,1
1,5
0,0
8,0
21,7
67,2
Metal industry
Inorganic chemicals
Organic chemicals
Refineries
Slaughterhouses, milk production
Pulp and paper
Hazardous- /municipal waste
Coke ovens
Cement klinker, lime, minerals
Pharmaceuticals
Others

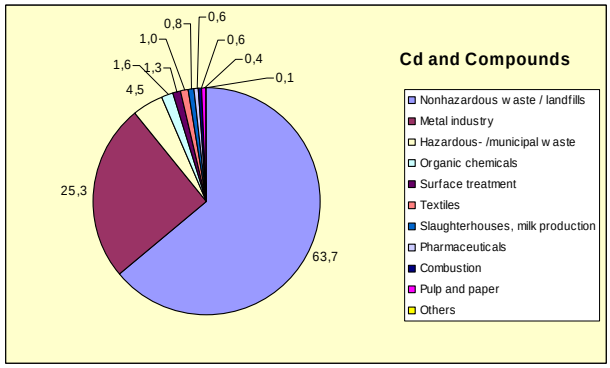


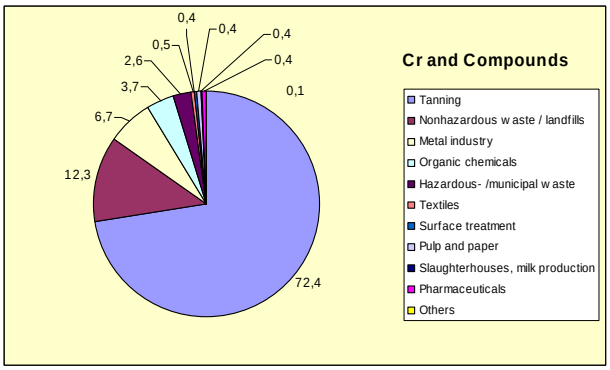
Pie-charts – Emissions to water indirect over activities

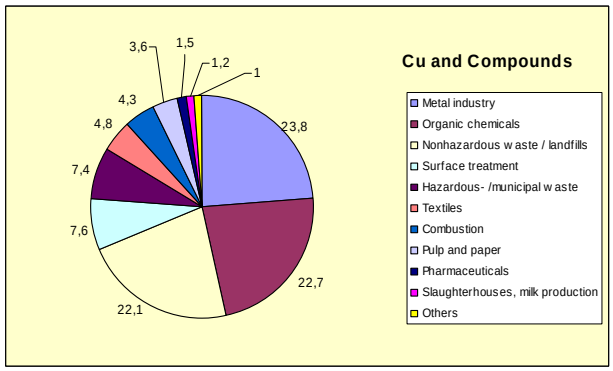


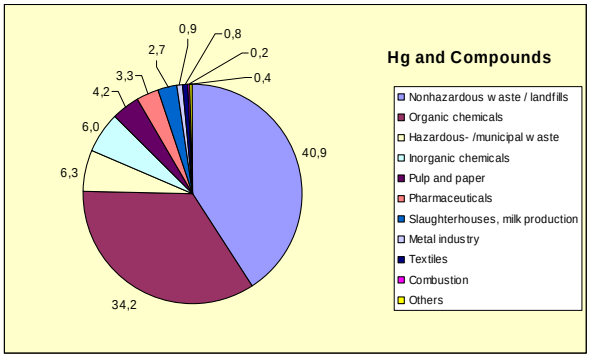


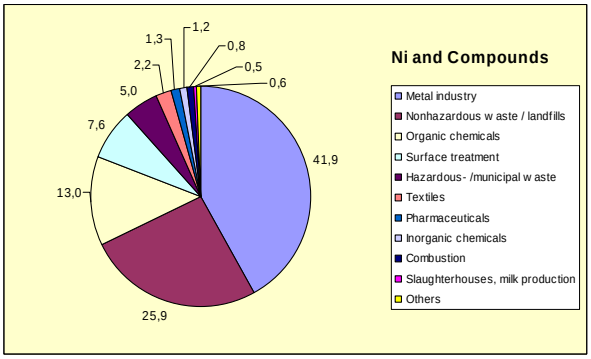


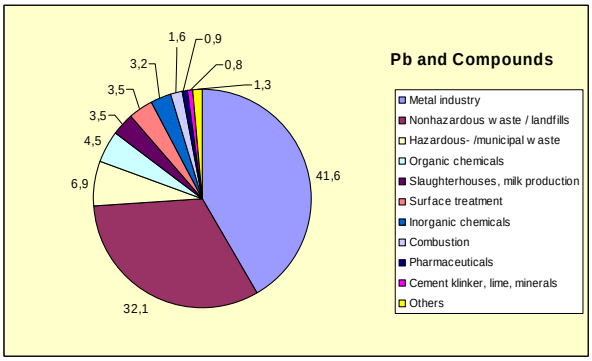


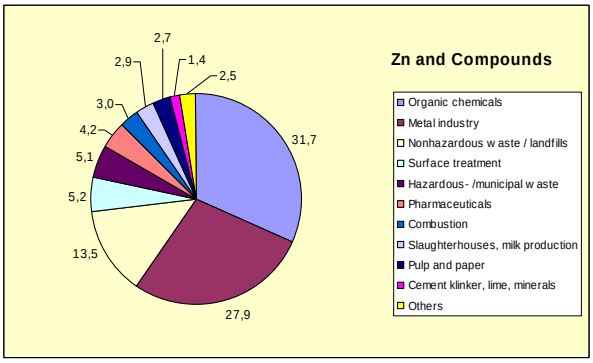


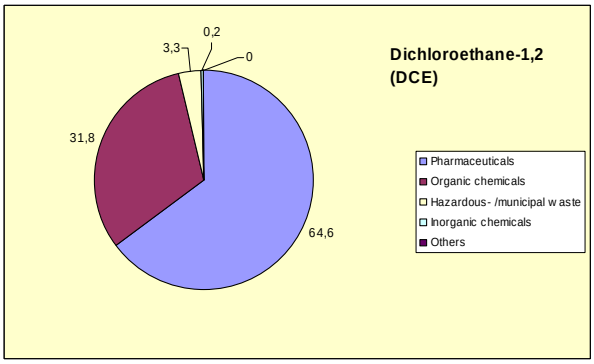


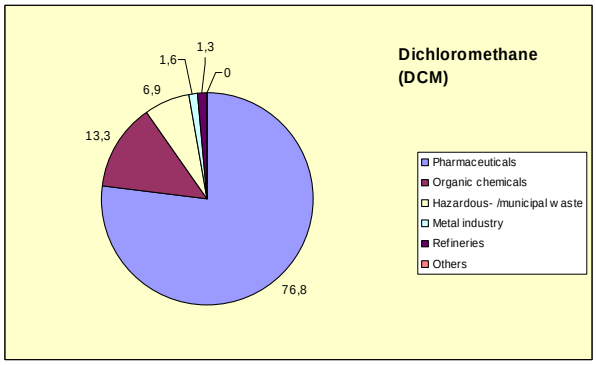

Hg and Compounds
40,9
34,2
6,3
6,0
4,2
3,3
2,7
0,9
0,8
0,2
0,4
Nonhazardous w aste / landfills
Organic chemicals
Hazardous- /municipal w aste
Inorganic chemicals
Pulp and paper
Pharmaceuticals
Slaughterhouses, milk production
Metal industry
Textiles
Combustion
Others

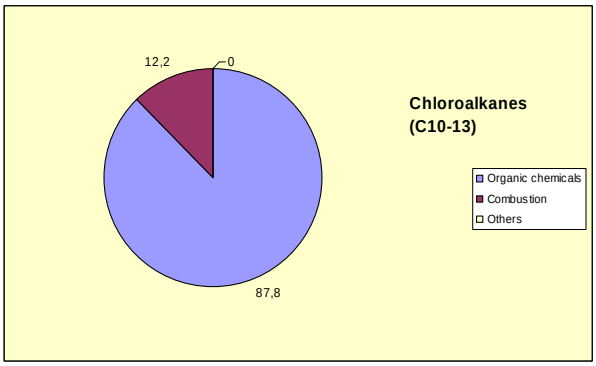

Ni and Compounds
41,9
25,9
13,0
7,6
5,0
2,2
1,3
1,2
0,8
0,5
0,6
Metal industry
Nonhazardous w aste / landfills
Organic chemicals
Surface treatment
Hazardous- /municipal w aste
Textiles
Pharmaceuticals
Inorganic chemicals
Combustion
Slaughterhouses, milk production
Others

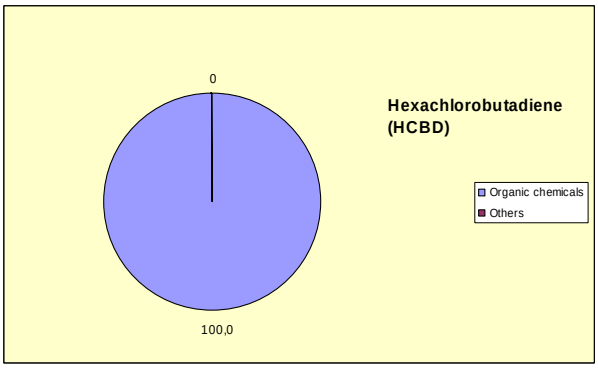

Pb and Compounds
41,6
32,1
6,9
4,5
3,5
3,5
3,2
1,6
0,9
0,8
1,3
Metal industry
Nonhazardous w aste / landfills
Hazardous- /municipal w aste
Organic chemicals
Slaughterhouses, milk production
Surface treatment
Inorganic chemicals
Combustion
Pharmaceuticals
Cement klinker, lime, minerals
Others

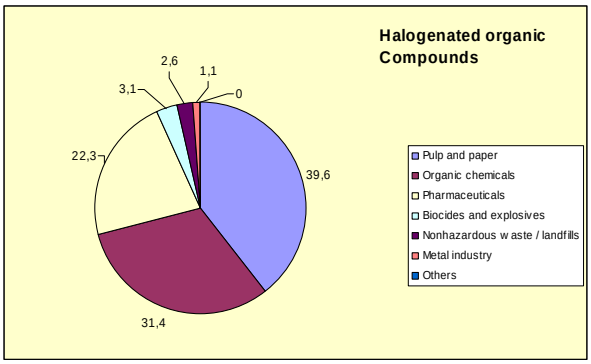

Zn and Compounds
31,7
27,9
13,5
5,2
5,1
4,2
3,0
2,9
2,7
1,4
2,5
Organic chemicals
Metal industry
Nonhazardous w aste / landfills
Surface treatment
Hazardous- /municipal w aste
Pharmaceuticals
Combustion
Slaughterhouses, milk production
Pulp and paper
Cement klinker, lime, minerals
Others

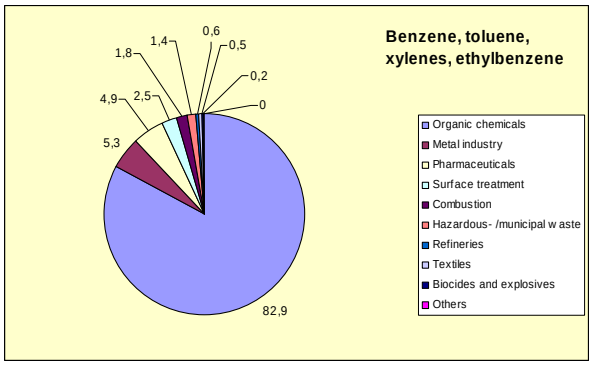

Dichloroethane-1,2
(DCE)
64,6
31,8
3,3
0,2
0
Pharmaceuticals
Organic chemicals
Hazardous- /municipal w aste
Inorganic chemicals
Others

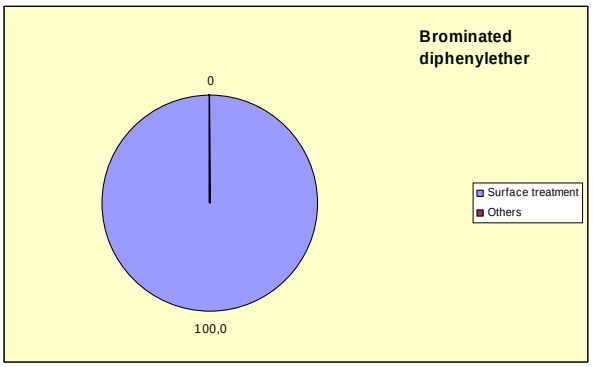

Dichloromethane
(DCM)
76,8
13,3
6,9
1,6
1,3
0
Pharmaceuticals
Organic chemicals
Hazardous- /municipal w aste
Metal industry
Refineries
Others

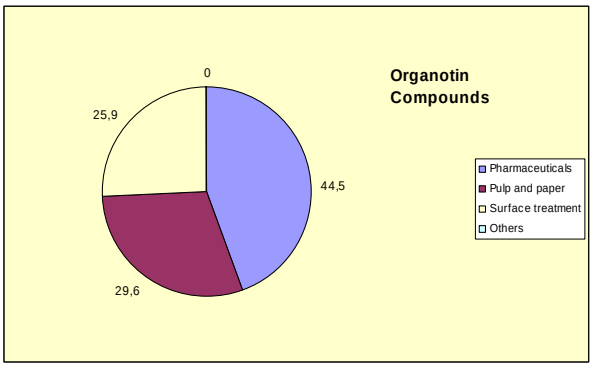

Chloroalkanes
(C10-13)
87,8
12,2
0
Organic chemicals
Combustion
Others

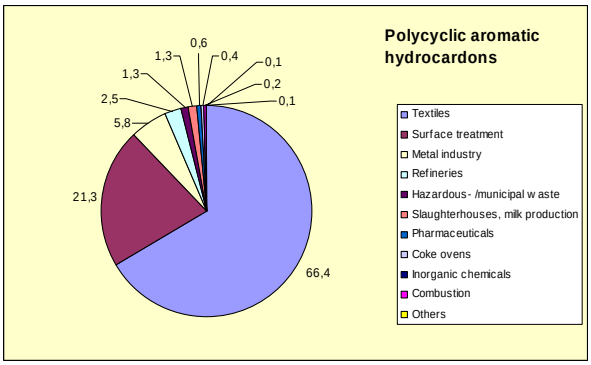

Hexachlorobutadiene
(HCBD)
100,0
0
Organic chemicals
Others

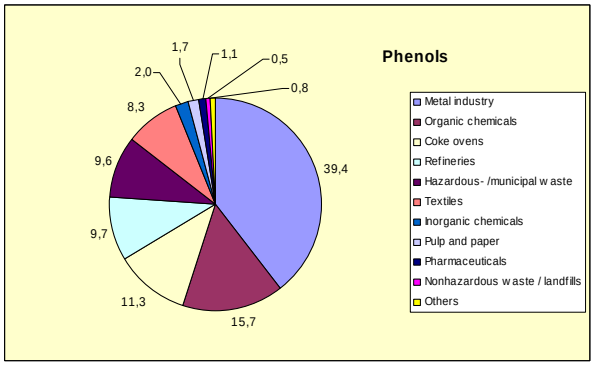

Halogenated organic Compounds
2,6
1,1
3,1
0
22,3
39,6
31,4
Pulp and paper
Organic chemicals
Pharmaceuticals
Biocides and explosives
Nonhazardous w aste / landfills
Metal industry
Others

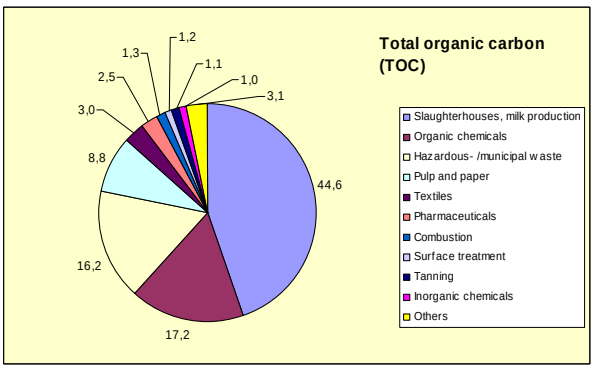

Benzene, toluene, xylenes, ethylbenzene
0,6
1,4
1,8
0,5
0,2
4,9
2,5
0
5,3
82,9
Organic chemicals
Metal industry
Pharmaceuticals
Surface treatment
Combustion
Hazardous- /municipal w aste
Refineries
Textiles
Biocides and explosives
Others

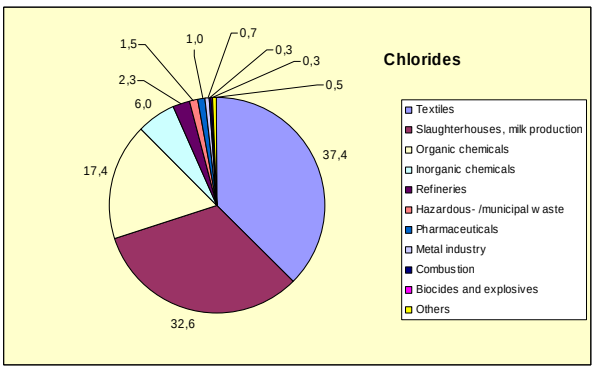

Brominated diphenylether
0
100,0
Surface treatment
Others

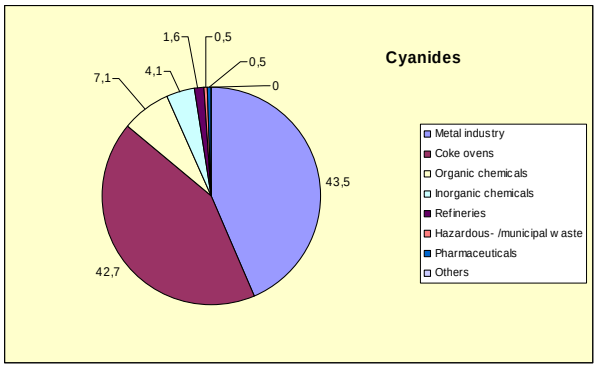

Organotin Compounds
0
25,9
44,5
29,6
Pharmaceuticals
Pulp and paper
Surface treatment
Others

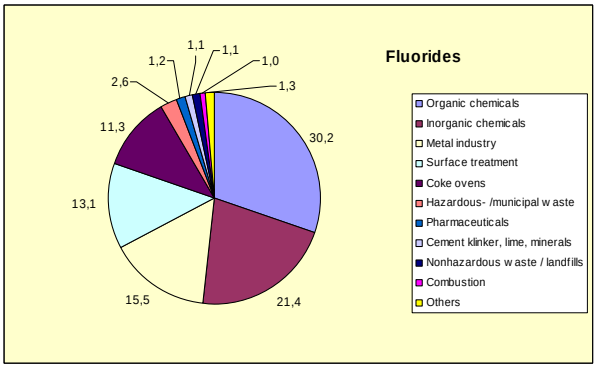

Polycyclic aromatic hydrocardons
0,6
1,3
0,4
1,3
0,1
0,2
2,5
0,1
5,8
21,3
66,4
Textiles
Surface treatment
Metal industry
Refineries
Hazardous- /municipal w aste
Slaughterhouses, milk production
Pharmaceuticals
Coke ovens
Inorganic chemicals
Combustion
Others


Phenols
1,7
1,1
2,0
0,5
0,8
8,3
9,6
39,4
9,7
11,3
15,7
Metal industry
Organic chemicals
Coke ovens
Refineries
Hazardous- /municipal w aste
Textiles
Inorganic chemicals
Pulp and paper
Pharmaceuticals
Nonhazardous w aste / landfills
Others


Total organic carbon (TOC)
1,2
1,3
2,5
1,1
1,0
3,1
3,0
8,8
44,6
16,2
17,2
Slaughterhouses, milk production
Organic chemicals
Hazardous- /municipal w aste
Pulp and paper
Textiles
Pharmaceuticals
Combustion
Surface treatment
Tanning
Inorganic chemicals
Others


Chlorides
1,5
1,0
0,7
0,3
0,3
2,3
0,5
6,0
17,4
37,4
32,6
Textiles
Slaughterhouses, milk production
Organic chemicals
Inorganic chemicals
Refineries
Hazardous- /municipal w aste
Pharmaceuticals
Metal industry
Combustion
Biocides and explosives
Others





5.2.3 Emissions to water by facilities

All facilities that contribute more than 5% of the total emission direct to water for a specific pollutant is given in the table below.

The table also shows the facilities emitting more than 10% of the total emissions indirect to water. It must be noted that these emissions are treated by waste water treatment plants and hece only a (very) small part of these pollutants will enter the aquatic environment.

Table 65a Facilities reporting emissions to water by pollutant above 5% of total emission direct to water.

Pollutant	Company name	Country	Share of total emissions in Europe [%]	Number of facilities reporting the pollutant
Total - Nitrogen	IMPIANTO TRATTAMENTO CHIMICO FISICO BIOLOGICO RIFIUTI	Italy	12,0%	315
Total - Nitrogen	DEPURATORE CONSORTILE	Italy	7,6%	
Total - Phosphorus	DEPURATORE CONSORTILE	Italy	10,1%	284
Total - Phosphorus	PRAYON SA	Belgium	5,2%	
As and compounds	MDPA Mines de potasse d'Alsace	France	13,5%	238
As and compounds	SOLVAY CHIMICA ITALIA S.p.A.	Italy	7,9%	
Cd and compounds	Metaleurop Nord	France	15,8%	181
Cd and compounds	ILVA LAMIERE E TUBI S.R.L. Stabilimento di Taranto	Italy	8,3%	
Cd and compounds	ILVA S.P.A. Stabilimento di Taranto	Italy	8,3%	
Cd and compounds	Umicore	France	6,5%	
Cd and compounds	ILVA S.P.A. STABILIMENTO DI GENOVA CORNIGLIANO	Italy	5,5%	
Cr and compounds	ALUMINIUM PECHINEY USINE DE GARDANNE	France	72,0%	242
Cr and compounds	ILVA LAMIERE E TUBI S.R.L. Stabilimento di Taranto	Italy	5,9%	
Cr and compounds	ILVA S.P.A. Stabilimento di Taranto	Italy	5,9%	
Cu and compounds	BP OIL (UK) LTD	United Kingdom	7,5%	356
Cu and compounds	BASF AG	Germany	7,0%	
Cu and compounds	SUIGRANJA - Sociedade Agrícola, S.A. - Instalação Suinícola da Herdade do Barroso	Portugal	5,6%	
Cu and compounds	OSIRIS GIE	France	5,4%	
Hg and compounds	Borsodchem Rt	Hungary	12,3%	167
Hg and compounds	Nitrokémia Rt. Központi 2. Telephely	Hungary	6,4%	
Ni and compounds	THYSSENKRUPP ACCIAI SPECIALI TERNI S.P.A. - stabilimento di TERNI	Italy	8,6%	480
Ni and compounds	ILVA S.P.A. STABILIMENTO DI GENOVA CORNIGLIANO	Italy	8,5%	
Pb and compounds	ALUMINIUM PECHINEY USINE DE GARDANNE	France	16,4%	305
Pb and compounds	RAFFINERIA DI GELA SPA	Italy	9,2%	
Pb and compounds	ASSOCIATED OCTEL CO LTD	United Kingdom	8,8%	
Pb and compounds	Solvay Soda Deutschland GmbH	Germany	7,0%	
Zn and compounds	ENIPOWER S.P.A. - Stabil. di Brindisi	Italy	13,7%	547
Zn and compounds	Viscocel	Spain	8,0%	
Dichloroethane-1,2 (DCE)	ATOFINA	France	15,1%	39
Dichloroethane-1,2 (DCE)	Centro Ecologico di Ravenna	Italy	14,4%	
Dichloroethane-1,2 (DCE)	ATOFINA	France	12,1%	
Dichloroethane-1,2 (DCE)	ASSOCIATED OCTEL CO LTD	United Kingdom	9,9%	
Dichloroethane-1,2 (DCE)	AKZO NOBEL BASE CHEMICALS BV BOTLEK	Netherlands	7,9%	
Dichloroethane-1,2 (DCE)	Interor	France	7,3%	
Dichloromethane (DCM)	GLAXO OPERATIONS UK LTD	United Kingdom	64,6%	34
Dichloromethane (DCM)	RHODIA INTERMEDIAIRES	France	9,0%	
Dichloromethane (DCM)	OSIRIS GIE	France	8,4%	
Dichloromethane (DCM)	Glaxo Operations	United Kingdom	6,1%	
Chloroalkanes (C10-13)	ASPLA-PLASTICOS ESPAÑOLES, S.A.	Spain	82,4%	3
Chloroalkanes (C10-13)	TRANSFORMADORA DE PROPILENO AIE	Spain	12,5%	
Chloroalkanes (C10-13)	BASF AG	Germany	5,1%	
Hexachlorobenzene (HCB)	Dow Deutschland GmbH & Co. OHG	Germany	44,1%	3
Hexachlorobenzene (HCB)	SOLVIC SA	Belgium	41,2%	
Hexachlorobenzene (HCB)	ATOFINA	France	14,7%	
Hexachlorobutadiene (HCBD)	ATOFINA	France	58,8%	4
Hexachlorobutadiene (HCBD)	STABILIMENTO DI PORTO MARGHERA	Italy	25,1%	
Hexachlorobutadiene (HCBD)	SOLVIC SA	Belgium	11,4%	
Hexachlorocyclohexane(HCH)	SPIRAL GIE	France	87,6%	3
Hexachlorocyclohexane(HCH)	E. Merck, Werk Gernsheim	Germany	8,2%	
Halogenated organic compounds	Ahlstrom labelpack	France	6,1%	133
Halogenated organic compounds	M-Real Sverige AB, Husums fabrik	Sweden	5,1%	
Benzene, toluene, ethylbenzene, xylenes	Solvay Química (Fábrica de Torrelavega)	Spain	24,2%	52
Benzene, toluene, ethylbenzene, xylenes	HUNTSMAN PETROCHEMICALS (UK) LTD	United Kingdom	18,9%	
Benzene, toluene, ethylbenzene, xylenes	BP Chemicals Limited	United Kingdom	11,6%	
Benzene, toluene, ethylbenzene, xylenes	Aceralia Avilés	Spain	7,1%	
Organotin - compounds	LUSOSIDER AÇOS PLANOS S.A.	Portugal	36,7%	7
Organotin - compounds	SITINDUSTRIE INTERNATIONAL S.P.A.	Italy	25,9%	
Organotin - compounds	HELLENIC STEEL CO - RIVA GROUP	Greece	16,0%	
Organotin - compounds	ILVA S.P.A. STABILIMENTO DI GENOVA CORNIGLIANO	Italy	7,5%	
Organotin - compounds	Infraserv GmbH & Co. Höchst KG - Industriepark Höchst, Zentrale Abwasserreinigung	Germany	6,6%	
Polycyclic Aromatic Hydrocarbons	Lameirinho Indústria Têxtil, S.A.	Portugal	19,2%	62
Polycyclic Aromatic Hydrocarbons	CIPAN-Companhia Industrial Produtora de Antibióticos, S.A.	Portugal	16,5%	
Polycyclic Aromatic Hydrocarbons	Solvay Química (Fábrica de Torrelavega)	Spain	10,6%	
Polycyclic Aromatic Hydrocarbons	ELKEM ALUMINIUM ANS. Mosjoen	Norway	6,3%	
Polycyclic Aromatic Hydrocarbons	ILVA LAMIERE E TUBI S.R.L. Stabilimento di Taranto	Italy	6,2%	
Polycyclic Aromatic Hydrocarbons	ILVA S.P.A. Stabilimento di Taranto	Italy	6,2%	
Polycyclic Aromatic Hydrocarbons	Aceralia Avilés	Spain	5,1%	
Phenols	SOLUTIA UK LTD	United Kingdom	29,2%	211
Phenols	ESSO PETROLEUM CO LTD	United Kingdom	6,3%	
Total organic carbon (TOC)	DEPURATORE CONSORTILE	Italy	18,4%	653
Total organic carbon (TOC)	Borregaard Ind. Ltd.. Cellulosesektor	Norway	5,0%	
Chlorides	CT SANTURCE	Spain	37,9%	189
Chlorides	Dow Deutschland GmbH & Co. OHG	Germany	6,8%	
Chlorides	SOLVAY QUIMICA (Fábrica de Torrelavega)	Spain	5,9%	
Cyanides	Aceralia Avilés	Spain	49,5%	77
Cyanides	Odda Smelteverk A.S	Norway	14,8%	
Fluorides	PRAYON SA	Belgium	20,5%	178
Fluorides	GRANDE PAROISSE SA	France	12,4%	
Fluorides	ATOFINA	France	8,8%	
Fluorides	DU PONT DE NEMOURS NED. BV	Netherlands	7,6%	

Table 65b Facilities reporting emissions to water by pollutant above 10% of total emission indirect to water.

Pollutant	Company name	Country	Share of total emissions in Europe [%]	Number of facilities reporting the pollutant
Total - Nitrogen	COMPLESSO IMPIANTISTICO SS 309 KM 2,6	Italy	14,7%	159
Total - Phosphorus	Planta de Málaga	Spain	15,0%	308
Total - Phosphorus	discarica di 1° categoria per Rifiuti Solidi Urbani e Assimilabili	Italy	10,4%	
As and compounds	Oberholz & Söhne Schlossfab	Germany	20,8%	69
As and compounds	Biffa Waste Services Ltd	United Kingdom	12,5%	
Cd and compounds	discarica di 1° categoria per Rifiuti Solidi Urbani e Assimilabili	Italy	55,0%	49
Cd and compounds	Stabilimento di Portovesme	Italy	20,6%	
Cr and compounds	Shoe and Leathergoods Division	United Kingdom	36,5%	136
Cr and compounds	RINO MASTROTTO GROUP S.p.A. - Divisione CALBE	Italy	19,7%	
Cr and compounds	discarica di 1° categoria per Rifiuti Solidi Urbani e Assimilabili	Italy	10,2%	
Cu and compounds	discarica di 1° categoria per Rifiuti Solidi Urbani e Assimilabili	Italy	20,5%	127
Cu and compounds	Franz Viegener II	Germany	11,8%	
Hg and compounds	discarica di 1° categoria per Rifiuti Solidi Urbani e Assimilabili	Italy	40,2%	44
Ni and compounds	Franz Viegener II	Germany	10,1%	284
Pb and compounds	discarica di 1° categoria per Rifiuti Solidi Urbani e Assimilabili	Italy	27,7%	107
Pb and compounds	HCA Holland Colours Hungaria Kft	Hungary	10,7%	
Pb and compounds	Stabilimento di Portovesme	Italy	10,1%	
Zn and compounds	ENKA GmbH Co & KG Werk Elsterberg	Germany	13,1%	197
Dichloroethane-1,2 (DCE)	AVENTIS PHARMA	France	35,3%	14
Dichloroethane-1,2 (DCE)	ORGAMOL FRANCE	France	17,6%	
Dichloroethane-1,2 (DCE)	ATOFINA LAVERA	France	15,8%	
Dichloroethane-1,2 (DCE)	Calaire Chimie	France	10,5%	
Dichloromethane (DCM)	FINORGA	France	40,6%	29
Chloroalkanes (C10-13)	Derivado y Polimeros SA (DERYPOL, SA)	Spain	80,4%	3
Chloroalkanes (C10-13)	STABILIMENTO DI TORVISCOSA	Italy	12,2%	
Hexachlorobutadiene (HCBD)	STABILIMENTO DI PORTO MARGHERA	Italy	100,0%	1
Halogenated organic compounds	PAPELERA GUIPUZCOANA DE ZICUÑAGA	Spain	16,7%	33
Halogenated organic compounds	PASTGUREN	Spain	14,1%	
Benzene, toluene, ethylbenzene, xylenes	Stabilimento di P.to Marghera	Italy	36,2%	33
Benzene, toluene, ethylbenzene, xylenes	KOSA NETHERLANDS BV	Netherlands	13,7%	
Brominated diphenylether	PW GREENHALGH AND CO LTD	United Kingdom	100,0%	1
Organotin - compounds	Schering AG	Germany	44,5%	3
Organotin - compounds	SMURFIT-STONE CONTAINER ESPAÑA,	Spain	29,6%	
Organotin - compounds	IVECO S.p.A. Stabilimento di brescia	Italy	25,9%	
Polycyclic Aromatic Hydrocarbons	ASA - Indústria Têxtil, S.A.	Portugal	63,2%	19
Polycyclic Aromatic Hydrocarbons	NISSAN MOTOR IBÉRICA, S.A.	Spain	21,4%	
Phenols	voestalpine Stahl GmbH	Austria	23,7%	150
Phenols	Thyssen Krupp Stahl AG	Germany	15,2%	
Phenols	RB AG Kokerei Prosper	Germany	11,3%	
Total organic carbon (TOC)	COMPLESSO IMPIANTISTICO SS 309 KM 2,6	Italy	10,4%	815
Chlorides	ASA - Indústria Têxtil, S.A.	Portugal	37,4%	42
Chlorides	Planta de Málaga	Spain	23,3%	
Cyanides	RB AG Kokerei Prosper	Germany	42,7%	30
Cyanides	voestalpine Stahl GmbH	Austria	29,2%	
Fluorides	BAYER CROPSCIENCE LTD	United Kingdom	20,3%	34
Fluorides	Motorola Ltd	United Kingdom	13,5%	
Fluorides	RB AG Kokerei Prosper	Germany	11,3%	

Conclusions on emissions

- The total emission for a pollutant is covered for at least more than 92% (average for 98 %) by the 10 most emitting countries. For water the lowest share is 95 %
- The total emission to air for a pollutant is covered for over 97 % by the 10 most emitting activities.
- The total emission to water for a pollutant is covered for at least more than 96 % by the 10 most emitting activities.
- For many pollutants, the distribution over the various countries shows a rather clear pattern. Most emission levels for specific pollutants (both to air and water) are dominated by 5 large countries.(UK, FR, IT, DE and ES). Each of them is frequently represented in the top-3.
- For emissions to air there are some remarkable contributions for a specific country. This applies to the contribution by:
  - GR to the total emission of PFC's;
  - ES to the total emission of Hexachlorobenzene (HCB). (only a few reports available);
  - FR to the total emission of Pentachlorophenol (PCP). (only reporting country);
  - FR to the total emissions of Tetrachloromethane (TCM), Trichlorobenzene (TCB),Trichloroethane-1.1.1.(TCE).
- For emissions to water there are some remarkable contributions for a specific country. This applies to the contribution by:
  - IT with a high share for HCB, HCDB and for Chlorides;
  - PT with high shares for Ni, Pb and Zn and their compounds.
- Basically, the distribution of pollutants emissions over the various industrial activities is matching the likely to be expected.
- In general, the Metal industry is dominantly represented in the ranking of all pollutants to air
- There is an extreme share for TCB and for HCB in the emission to air from the metal industry but HCB was only reported twice (respectively by ES and NO). This pollutant was likely to be reported.
- A number of 30 facilities were reporting more than 10 % of the total emission to air for one of 19 pollutants. 7 facilities were reporting more than 50% of the total for a pollutant
- For many pollutants to water (both direct and indirect) the distribution over the various activities is variable, ranging from one activity emitting a pollutant to many.
- The emissions to water are dominated by 5 activities, often represented in the top-3 of activities, respectively:
  - Refineries;
  - Organic chemicals;
  - Inorganic chemicals;
  - Metals industry and
  - Pulp and paper.
- There is an extreme share of Chlorides as a pollutant to water from Non-hazardous waste / landfills
- In total 42 facilities were reporting more than 10 % of the total emission to water for one of 26 pollutants. 10 of them were reporting more than 50% of the total for a pollutant.

6. Review of emission determination methodology

The Guidance Document for EPER implementation gives reference to the applicable emission determination methods. Each of the emission data must be accompanied by a code, referring to the methodology of emission determination.
As stated in the EPER Guidance Document

- "M" stands for data based on measurements,
- "C" for data based on calculations and
- "E" for data based on non-standardised estimates.

In order to get more insight in the transparency of emission data, the finally applied determination method for the emission data in this delivery is investigated.
It should be mentioned that the determination codes neither do refer to accuracy nor to preference for a methodology.

6.1 General

All reported pollutants were marked by one of the applicable prescribed methods (Measured, Calculated or Estimated) as already concluded in chapter 4.
The following table gives some key figures related to methodology aspects.

Table 66 Number of reports by determination methodology

Emission type - conditions	Determination methodology		
	Calculated	Estimated	Measured
All reports - All countries	8889	3721	10503
All reports - EU-15	8808	3654	10001
Air reports - All countries	7678	2942	5043
Air reports - EU-15	7616	2907	4743
Water reports - All countries	1211	779	5460
Water reports - EU-15	1192	747	5258
Water direct reports - All countries	549	509	3705
Water direct reports - EU-15	537	491	3541
Water indirect reports - All countries	662	270	1755
Water indirect reports - EU-15	655	256	1717

Table 67 Share of reports by determination methodology

Emission type - conditions	Determination methodology		
	Calculated [%]	Estimated [%]	Measured [%]
All reports - All countries	38,5	16,1	45,4
All reports - EU-15 countries	39,2	16,3	44,5
Emission to air - All countries	49,0	18,8	32,2
Emission to air - EU-15 countries	49,9	19,0	31,1
Emission to water - All countries	16,3	10,5	73,3
Emission to water - EU-15 countries	16,6	10,4	73,1

The applied determination methodologies have been analysed more in depth

- by country;
- by activity;
- by emission type;
- by pollutant.

6.2 Determination methods for air emissions

6.2.1 Determination methodologies by country

Table 68 Number of reports to air by determination methodology and by country

Country	Determination methodology		
	Calculated	Estimated	Measured
AT	80	8	103
BE	231	72	353
DE	1439	603	1061
DK	99	96	14
ES	1321	267	608
FI	0	44	402
FR	500	731	755
GR	89	36	65
IE	165	6	25
IT	545	359	527
NL	0	286	0
SE	197	81	142
UK	2869	260	434
PT	75	55	231
LU	6	3	23
HU	62	33	65
NO	0	2	235

The results are shown in the graphs below.

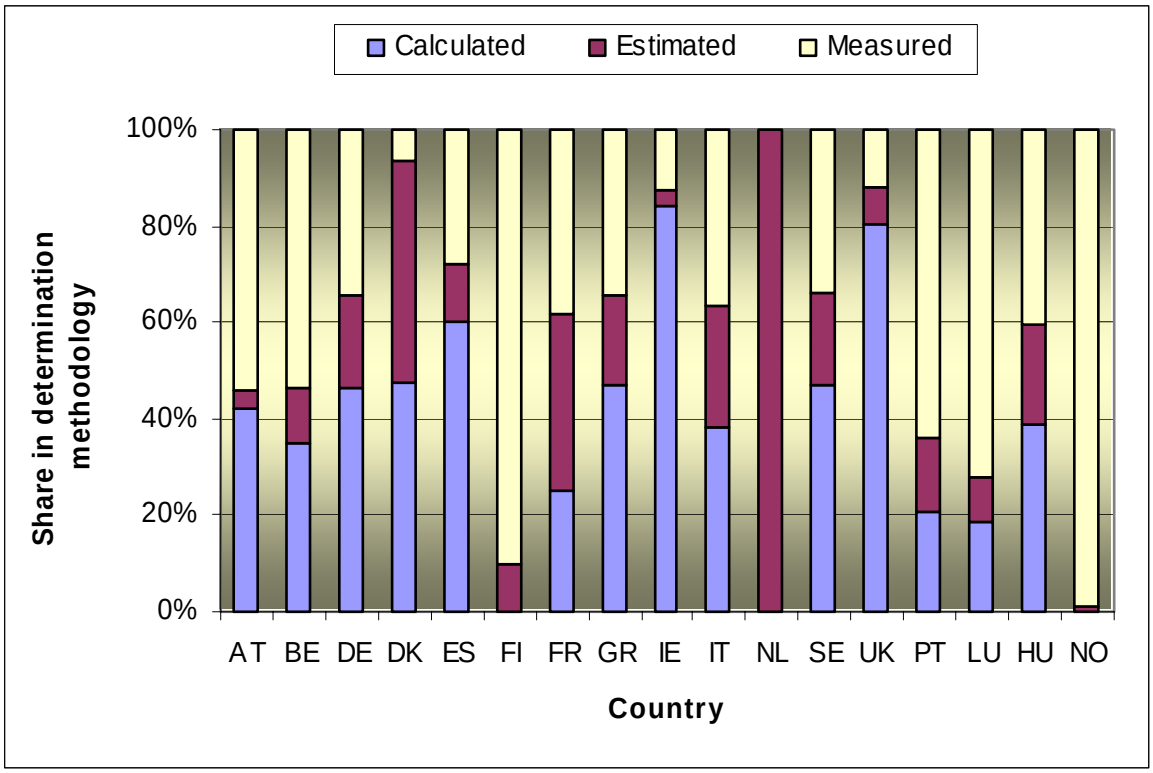


Figure 26 Share of applied determination methods by country

Conclusions

- There is a broad variety in the applied determination methodologies for emissions to air.
- Calculation is the dominantly applied methodology. Actually, it is dominated due to the number of reports for the activity Poultry and pigs (See next paragraph).
- Calculation was not identified at all as applied methodology for reporting in FI, NL and NO.
- Estimation was applied as the only methodology in the reporting of facilities in NL and NO. This might be due to the interpretation of the Guidance Document.

6.2.2 Determination methodologies by activity

The distribution over the various activities is shown in the table below.

The share of the various determination methodologies for reports to air are presented in the graph below.

Activity code	Activity name	Determination methodology		
		Calculated	Estimated	Measured
1.1	Combustion	1604	556	1210
1.2	Refineries	434	169	226
1.3	Coke ovens	35	31	23
1.4	Coal plants	21	4	7
2.1-2.6	Metals	549	534	815
3.1/3.3-3.5	Cement klinker	487	292	1162
4.1	Organic	309	270	348
4.2/4.3	Inorganic	121	148	299
4.4/4.6	Biocides	7	12	9
4.5	Pharmaceuticals	34	47	32
5.1/5.2	Hazardous waste	97	116	310
5.3/5.4	Non-hazardous waste	552	278	64
6.1	Pulp and paper	202	90	320
6.2	Textiles	3	3	16
6.3	Tanning	3	1	1
6.4	Slaughterhouses	115	69	125
6.5	Animal waste	2	7	3
6.6	Poultry and pigs	2930	203	3
6.7	Surface treatment	170	106	51
6.8	Carbon	3	6	19

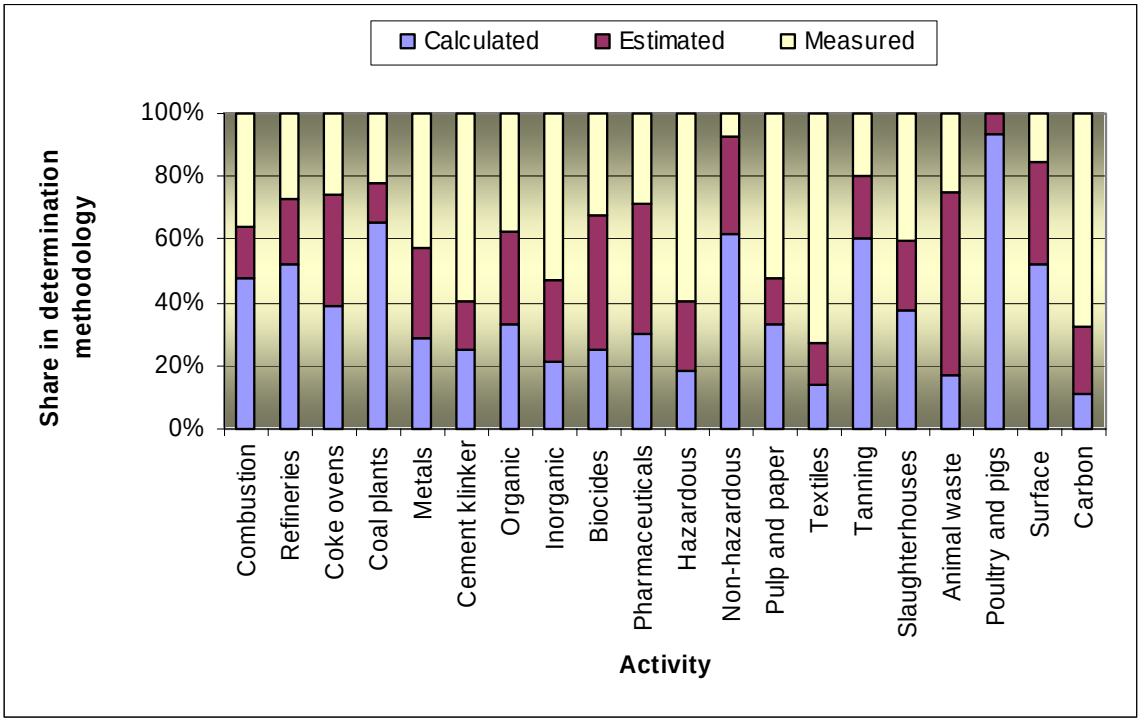


Figure 27 Share of applied determination methods by activity

Conclusions

- The various methodologies are applied over all activities with a high variability.
- For activity 6.6: Poultry and pigs the determination method of “Calculation” as applied determination methodology is dominant. This is also the only activity where “Measuring” was not applied for reports to air.

6.2.3 Determination methodologies by pollutant

The distribution of the determination methodology as applied for the various pollutants to air can be seen in the table and graphs below.

Table 69 Share in determination methodology by pollutants to air

	Calculated [%]	Estimated [%]	Measured [%]
CH4	72,6	23,2	4,3
CO	19,2	27,1	53,7
CO2	72,7	12,4	14,9
HFCs	25,8	37,1	37,1
N2O	55,7	27,8	16,5
NH3	87,2	9,2	3,6
NMVOC	59,5	18,3	22,2
NOX	18,7	13,2	68,1
PFCs	46,7	46,7	6,7
SF6	17,4	60,9	21,7
SOX	22,9	12,1	65,0
As and compounds	42,9	19,3	37,8
Cd and compounds	28,6	25,7	45,7
Cr and compounds	35,1	27,0	37,8
Cu and compounds	32,8	24,6	42,6
Hg and compounds	25,7	24,3	50,0
Ni and compounds	45,8	20,4	33,8
Pb and compounds	27,4	29,2	43,4
Zn and compounds	31,1	30,6	38,3
Dichloroethane-1,2 (DCE)	15,2	60,9	23,9
Dichloromethane (DCM)	26,5	45,7	27,8
Hexachlorobenzene (HCB)	0,0	66,7	33,3
PCDD+PCDF (dioxins+furans)	20,2	24,7	55,1
Pentachlorophenol (PCP)	0,0	100,0	0,0
Tetrachloroethylene (PER)	26,5	58,8	14,7
Tetrachloromethane (TCM)	20,0	45,0	35,0
Trichlorobenzenes (TCB)	50,0	0,0	50,0
Trichloroethane-1,1,1 (TCE)	0,0	50,0	50,0
Trichloroethylene (TRI)	26,4	60,4	13,2
Trichloromethane	24,3	48,6	27,0
Benzene	35,0	35,5	29,5
Polycyclic Aromatic Hydrocarbons	24,1	26,7	49,1
Chlorine and inorganic compounds	20,1	27,8	52,1
Fluorine and inorganic compounds	30,5	25,4	44,1
HCN	35,3	32,4	32,4
PM10	39,5	25,8	34,7

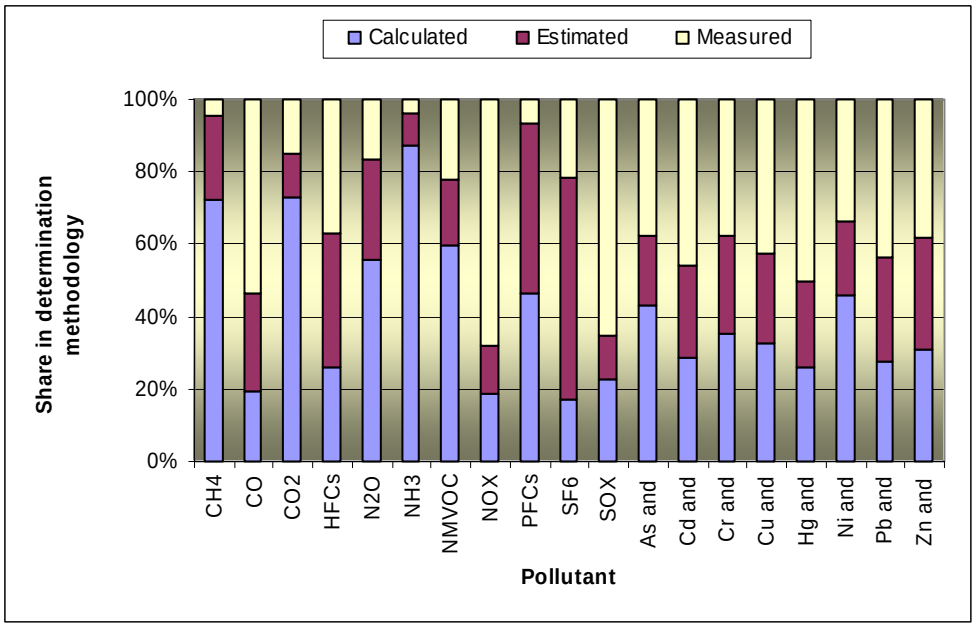


Figure 28 Share of determination methodology by pollutants to air

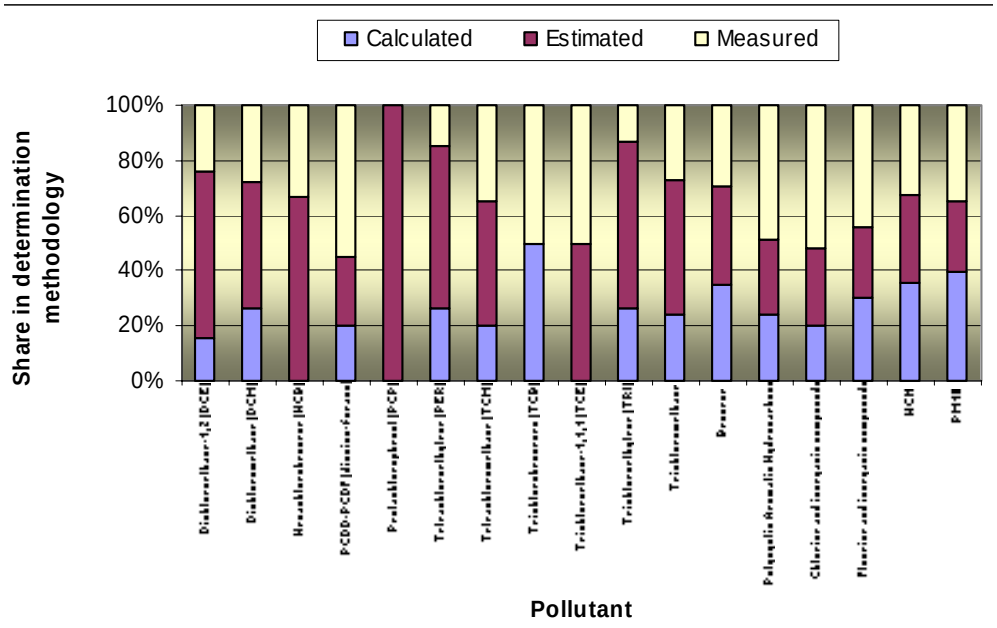


Figure 29 Share of determination methodology by pollutants to air

Conclusions

- The share of methodology is highly variable applied over the various pollutants.
- High shares (more than 50%) of "Calculation" are indicated for CO_2, NH_3, NMVOC and PFC's.
- High shares (more than 50%) of "Measuring" are indicated for NO_X, SF_6, SO_X, Cu, PCDD-PCDF and for Chlorine and inorganic compounds.
- Finally, for CH_4, DCE, HCB, PE, TCE and TRI "Estimation" is indicated for more than 50% of the reports.
- HCB and PCP are only indicated as "Estimated" while for TCE only has been reported indicating "Estimation" and "Measuring" as the applied methodologies.

Apart from the number of reports, the level of emissions covered by these reports is playing a role in the evaluation of the applied method. Comparing the determination methodology by emission levels instead of number of reports is shown in the following table and appropriate graphs.
In the table below, the change in contribution to the various determination methodologies is presented.
The distribution over methods can be calculated both on the number of reports (table 69) and on the value of the emission. The following table 70 shows the distribution of the emission values over the three determination methods.
The red figures indicate an increased share compared to the share in number of emission reports, the blue figures indicate a reduced share compared to the share in number of reports.

Table 70 Share in determination methodology for emission level for pollutants to air

		Calculated [%]	Estimated [%]	Measured [%}
[1] CH_4	[1]	[1] 48,5	[1] 49,2	[1] 2,3
[2] CO	[2]	[2] 19,9	[2] 40,8	[2] 39,2
[3] CO_2	[3]	[3] 79,2	[3] 12,8	[3] 8,0
[4] HFCs	[4]	[4] 25,4	[4] 27,0	[4] 47,7
[5] N_2O	[5]	[5] 37,4	[5] 43,3	[5] 19,3
[6] NH_3	[6]	[6] 76,6	[6] 13,8	[6] 9,6
[7] NMVOC	[7]	[7] 61,3	[7] 28,9	[7] 9,7
[8] NO_X	[8]	[8] 23,0	[8] 11,8	[8] 65,3
[9] PFCs	[9]	[9] 83,0	[9] 16,3	[9] 0,7
[10] SF_6	[10]	[10] 35,7	[10] 13,5	[10] 50,8
[11] SO_X	[11]	[11] 30,9	[11] 6,9	[11] 62,2
[12] As and compounds	[12]	[12] 30,2	[12] 23,6	[12] 46,1
[13] Cd and compounds	[13]	[13] 16,6	[13] 42,8	[13] 40,6
[14] Cr and compounds	[14]	[14] 32,9	[14] 31,6	[14] 35,5
[15] Cu and compounds	[15]	[15] 19,4	[15] 29,4	[15] 51,3
[16] Hg and compounds	[16]	[16] 28,0	[16] 33,2	[16] 38,8
[17] Ni and compounds	[17]	[17] 46,6	[17] 21,6	[17] 31,8
[18] Pb and compounds	[18]	[18] 25,3	[18] 44,6	[18] 30,1
[19] Zn and compounds	[19]	[19] 26,9	[19] 43,7	[19] 29,5
[20] Dichloroethane-1,2 (DCE)	[20]	[20] 8,5	[20] 50,7	[20] 40,8
[21] Dichloromethane (DCM)	[21]	[21] 32,0	[21] 41,0	[21] 27,0
[22] Hexachlorobenzene (HCB)	[22]	[22] 0,0	[22] 100,0	[22] 0,0
[23] PCDD+PCDF (dioxins+furans)	[23]	[23] 12,9	[23] 53,2	[23] 33,9
[24] Pentachlorophenol (PCP)	[24]	[24] 0,0	[24] 100,0	[24] 0,0
[25] Tetrachloroethylene (PER)	[25]	[25] 30,2	[25] 47,9	[25] 21,9
[26] Tetrachloromethane (TCM)	[26]	[26] 3,1	[26] 90,9	[26] 6,0
[27] Trichlorobenzenes (TCB)	[27]	[27] 0,1	[27] 99,8	[27] 0,1
[28] Trichloroethane-1,1,1 (TCE)	[28]	[28] 0,0	[28] 99,6	[28] 0,4
[29] Trichloroethylene (TRI)	[29]	[29] 22,5	[29] 64,6	[29] 13,0
[30] Trichloromethane	[30]	[30] 10,4	[30] 51,1	[30] 38,5
[31] Benzene	[31]	[31] 35,7	[31] 50,2	[31] 14,0
[32] Polycyclic Aromatic Hydrocarbons	[32]	[32] 10,6	[32] 82,4	[32] 7,0
[33] Chlorine and inorganic compounds	[33]	[33] 46,7	[33] 20,8	[33] 32,5
[34] Fluorine and inorganic compounds	[34]	[34] 25,2	[34] 30,4	[34] 44,4
[35] HCN	[35]	[35] 18,0	[35] 56,2	[35] 25,8
[36] PM10	[36]	[36] 42,3	[36] 27,3	[36] 30,4

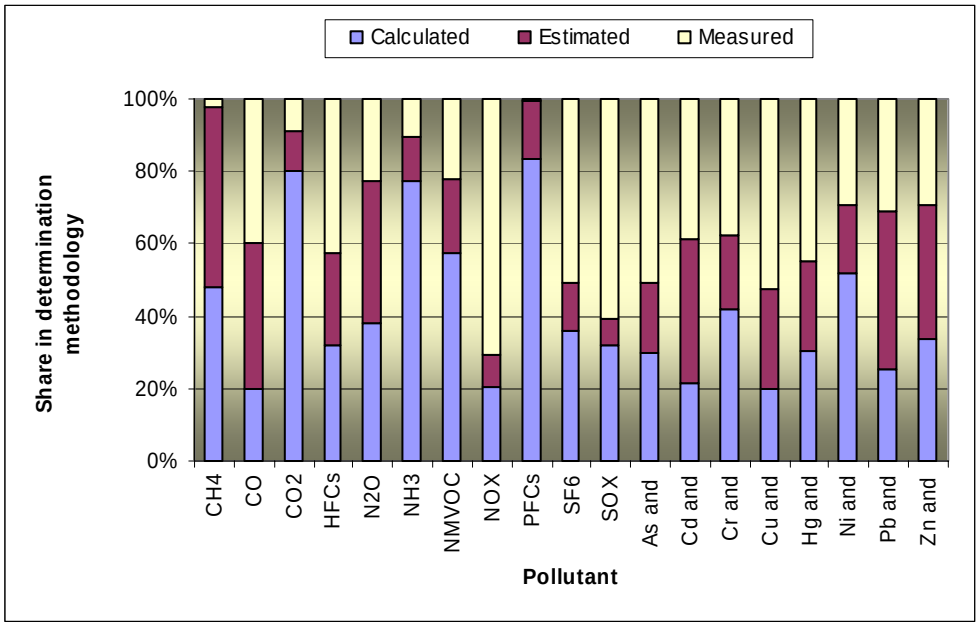


Figure 30 Share of determination methodology for pollutant emission levels (air)

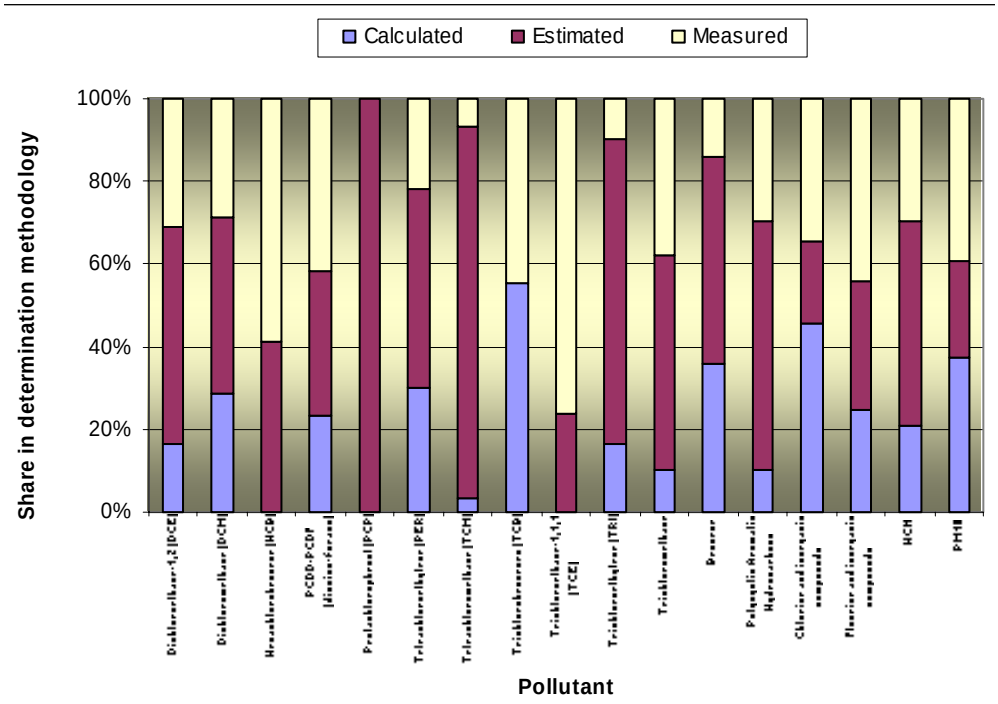


Figure 31 Share of determination methodology for pollutant emission levels (air)

Covering the level of emissions instead of the number of emission reports the applied methodology is tending more to “Estimated”.

Conclusions regarding determination methods for emissions to air:

- Regarding determination methods used for air emissions, a high variability exists as well between countries as also between activities, pollutants or emission types.
- Calculation is the dominantly applied methodology. Actually, it is dominated due to the number of reports for the activity Poultry and pigs. This activity is also the only one where "Measuring" was not applied for reports to air
- Calculation was not identified at all as applied methodology for reporting in FI, NL and NO.
- Estimation was applied as the only methodology in the reporting of facilities in NL and NO.This might be due to the interpretation of the Guidance Document.
- High shares (more than 50%) of "Calculation" are indicated for CO_2, NH_3, NMVOC and PFC's.
- High shares (more than 50%) of "Measuring" are indicated for NO_X, SF_6, SO_X, Cu, PCDD-PCDF and for Chlorine and inorganic compounds.
- High shares (more than 50%) for "Estimation" are indicated for CH_4, DCE, HCB, PE, TCE and TRI.
- HCB and PCP are only indicated as "Estimated" while for TCE only has been reported indicating "Estimation" and "Measuring" as the applied methodologies.
- Covering the level of emissions instead of the number of emission reports the applied methodology is tending more from "Measured" to "Estimated".

6.3 Determination methods for water emissions

6.3.1 Determination methodologies by country

Table 71 Number of applied determination methodology by country

Country	Determination methodology		
	Calculated	Estimated	Measured
AT	41	20	98
BE	1	1	415
DE	221	65	770
DK	0	63	6
ES	34	80	548
FI	0	0	209
FR	14	27	1331
GR	26	8	25
IE	4	0	27
IT	129	276	663
NL	0	0	313
SE	65	58	252
UK	585	137	477
PT	72	12	120
LU	0	0	4
HU	19	32	62
NO	0	0	140

The share of each determination methodology is presented in the graph below.

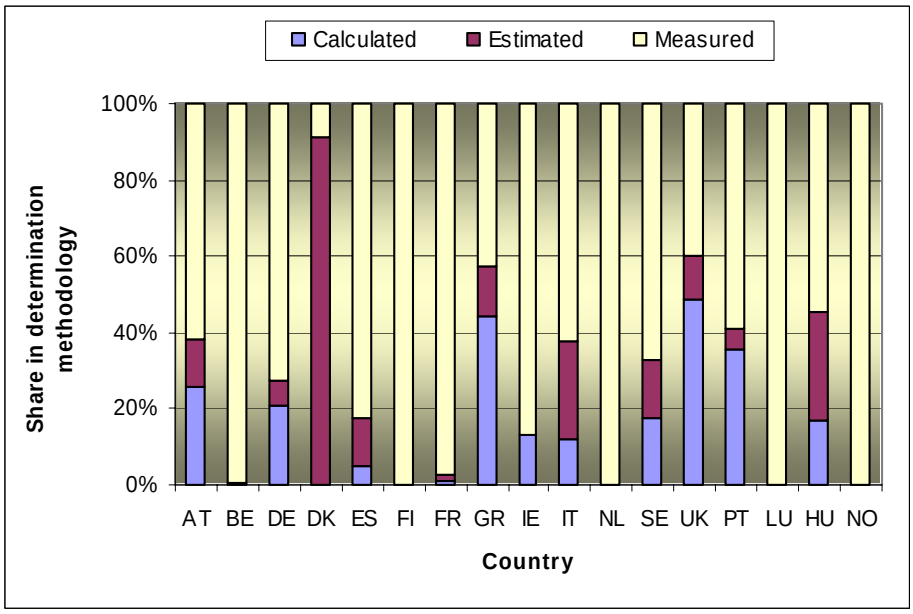


Figure 32 Share of determination methodology by country

Conclusions

- For water emission reports, the determination methodology is dominated by "measured" reporting.
- Emissions to water as reported by Netherlands, Luxembourg, Finland and Norway are solely "Measured".
- For Belgium and France, the contribution of measured reports is high. UK delivers a relatively high contribution to the calculated emissions. In Denmark a very high part of the emissions to water has been determined by "Estimation".

6.3.2 Determination methodologies by activity

The number of reports to water, referring to their determination methodology is provided in the table below.

Table 72 Number of applied determination methodologies by activity

Activity code	Activity name	Determination methodology		
		Calculated	Estimated	Measured
1.1	Combustion	64	71	214
1.2	Refineries	53	47	260
1.3	Coke ovens	2	1	20
1.4	Coal plants	5	2	2
2.1-2.6	Metals	202	133	858
3.1/3.3-3.5	Cement klinker, lime, mineral	7	6	82
4.1	Organic chemicals	172	145	1057
4.2/4.3	Inorganic chemicals	68	57	531
4.4/4.6	Biocides and explosives	7	6	37
4.5	Pharmaceuticals	12	32	213
5.1/5.2	Hazard.- / municipal waste	47	14	292
5.3/5.4	Nonhazard. waste / landfills	38	47	233
6.1	Pulp and paper	128	91	746
6.2	Textiles	35	24	158
6.3	Tanning	16	0	32
6.4	Slaughterhouse, milk prod.	265	85	513
6.5	Animal waste	2	2	11
6.6	Poultry and pigs	60	4	4
6.7	Surface treatment	28	12	194
6.8	Carbon	0	0	3

The share of the various determination methodologies for reports to water are represented in the graph below.

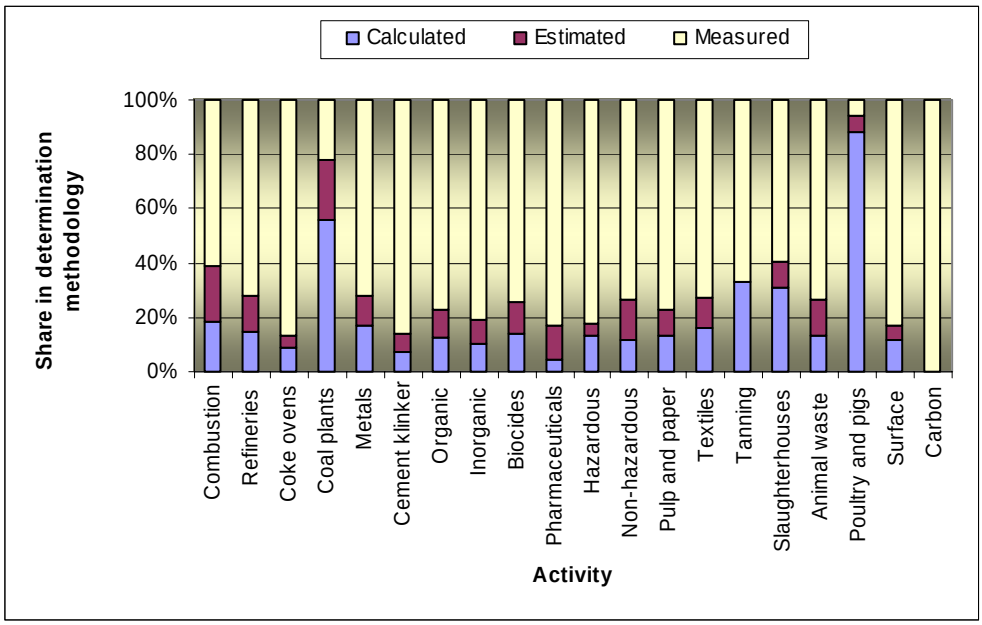


Figure 33 Applied determination methodology by activity

Conclusion

- The reports to water referring to their activity are also dominated by the determination methodology “Measured”. Only for activity 6.4: Poultry and pigs and for activity 1.4 Coal plants, the “Calculated” share is dominant.

6.3.3 Determination methods by pollutant

The number of reports to water, referring to their determination methodology is provided for all pollutants in the table below.

Table 73 Number of applied determination methodologies by pollutant to water

Pollutant name	Determination methodology		
	Calculated	Estimated	Measured
Total - Nitrogen	12,7	12,9	74,5
Total - Phosphorus	20,8	9,6	69,6
As and compounds	10,1	11,1	78,8
Cd and compounds	10,0	18,3	71,7
Cr and compounds	19,8	7,9	72,2
Cu and compounds	17,6	9,9	72,5
Hg and compounds	13,3	12,3	74,4
Ni and compounds	19,6	9,7	70,7
Pb and compounds	10,2	12,9	76,9
Zn and compounds	16,1	10,2	73,7
Dichloroethane-1,2 (DCE)	7,5	7,5	84,9
Dichloromethane (DCM)	6,3	9,5	84,1
Chloroalkanes (C10-13)	0,0	16,7	83,3
Hexachlorobenzene (HCB)	0,0	0,0	100,0
Hexachlorobutadiene (HCBD)	0,0	0,0	100,0
Hexachlorocyclohexane(HCH)	0,0	0,0	100,0
Halogenated organic compounds	6,0	4,8	89,2
Benzene, toluene, ethylbenzene, xylenes	8,2	27,1	64,7
Brominated diphenylether	0,0	100,0	0,0
Organotin - compounds	10,0	10,0	80,0
Polycyclic Aromatic Hydrocarbons	4,9	11,1	84,0
Phenols	11,4	11,4	77,3
Total organic carbon (TOC)	22,4	9,3	68,3
Chlorides	16,0	5,2	78,8
Cyanides	12,1	15,0	72,9
Fluorides	11,3	9,0	79,7

For all pollutants, except brominated diphenylether, the number of measured reports is dominating the two other methodologies.
The relative contribution for each pollutant is reflected in the graph below.

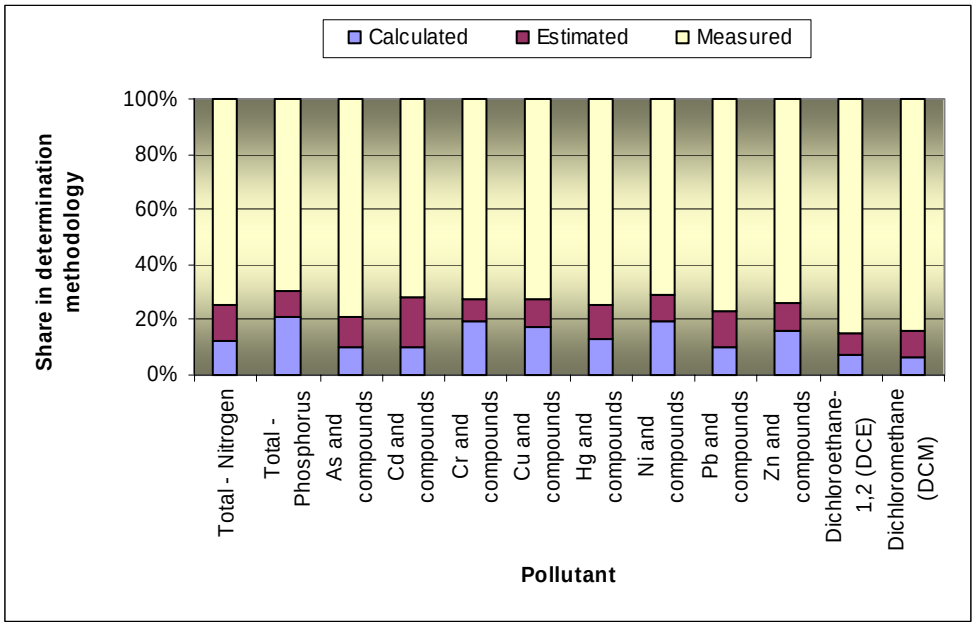


Figure 34 Share of applied determination methodology by pollutant to water

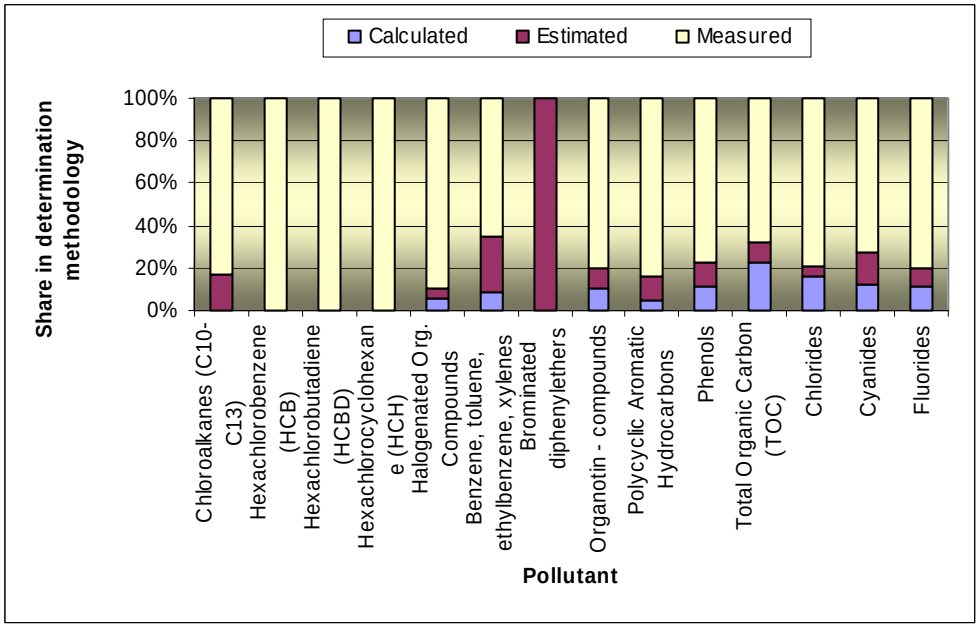


Figure 35 Share of applied determination methodology by pollutant to water

Apart from the number of reports, the level of emissions covered by these reports is playing a role in the evaluation of the applied method. Comparing the determination methodology by emission levels instead of number of reports is shown in the following table and appropriate graphs.

In the table below, the change in contribution to the various determination methodologies is presented.

The distribution over methods can be calculated both on the number of reports (table 73) and on the value of the emission. The following table 74 shows the distribution of the emission values over the three determination methods.
The red figures indicate an increased share compared to the share in number of emission report, the blue figures indicate a reduced share compared to the share in number of reports.

Table 74 Change in contribution of determination methodologies per pollutant

	Share of determination methodology		
Pollutant	**Calculated [%]**	**Estimated [%]**	**Measured [%]**
Total - Nitrogen	**11,5**	**25,0**	**63,5**
Total - Phosphorus	**10,6**	**6,4**	**83,0**
As and compounds	**12,4**	**15,6**	**72,0**
Cd and compounds	**3,4**	**30,4**	**66,2**
Cr and compounds	**7,4**	**15,2**	**77,4**
Cu and compounds	**7,3**	**55,1**	**37,6**
Hg and compounds	**3,9**	**20,7**	**75,4**
Ni and compounds	**2,3**	**66,7**	**31,0**
Pb and compounds	**1,0**	**69,3**	**29,7**
Zn and compounds	**8,8**	**41,1**	**50,1**
Dichloroethane-1,2 (DCE)	**2,1**	**2,8**	**95,1**
Dichloromethane (DCM)	**57,8**	**10,1**	**32,1**
Chloroalkanes (C10-13)	**0,0**	**24,4**	**75,6**
Hexachlorobenzene (HCB)	**0,0**	**87,9**	**12,1**
Hexachlorobutadiene (HCBD)	**0,0**	**79,5**	**20,5**
Hexachlorocyclohexane(HCH)	**0,0**	**37,3**	**62,7**
Halogenated organic compounds	**1,9**	**6,2**	**92,0**
Benzene, toluene, ethylbenzene, xylenes	**13,3**	**27,8**	**58,9**
Brominated diphenylether	**0,0**	**100,0**	**0,0**
Organotin - compounds	**10,8**	**28,8**	**60,4**
Polycyclic Aromatic Hydrocarbons	**0,0**	**99,9**	**0,1**
Phenols	**4,8**	**18,2**	**77,1**
Total organic carbon (TOC)	**17,6**	**10,0**	**72,4**
Chlorides	**1,7**	**0,4**	**97,8**
Cyanides	**1,5**	**48,0**	**50,5**
Fluorides	**6,7**	**7,2**	**86,1**

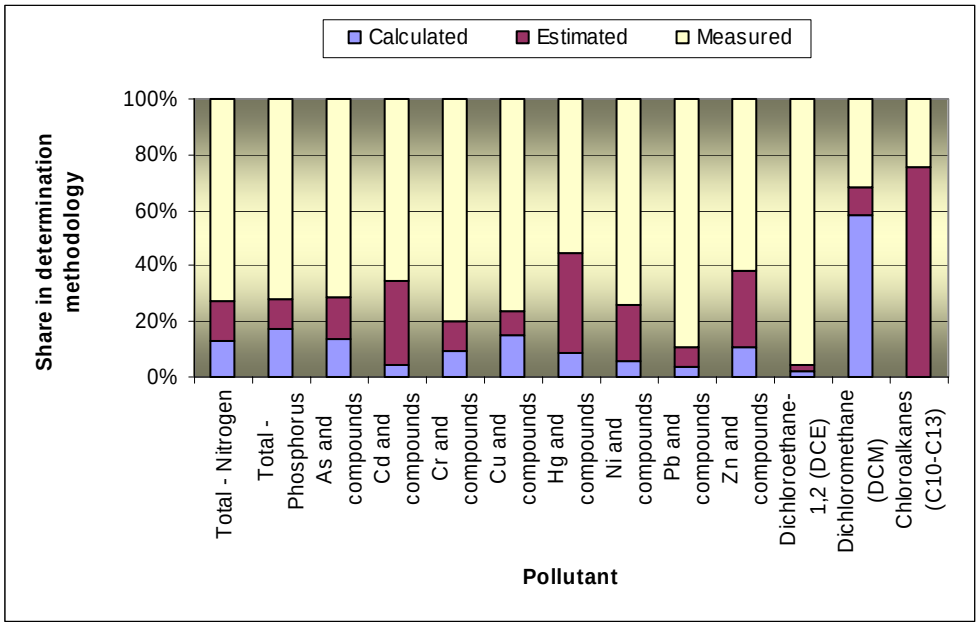


Figure 36 Share of determination methodology for pollutant emission levels (water)

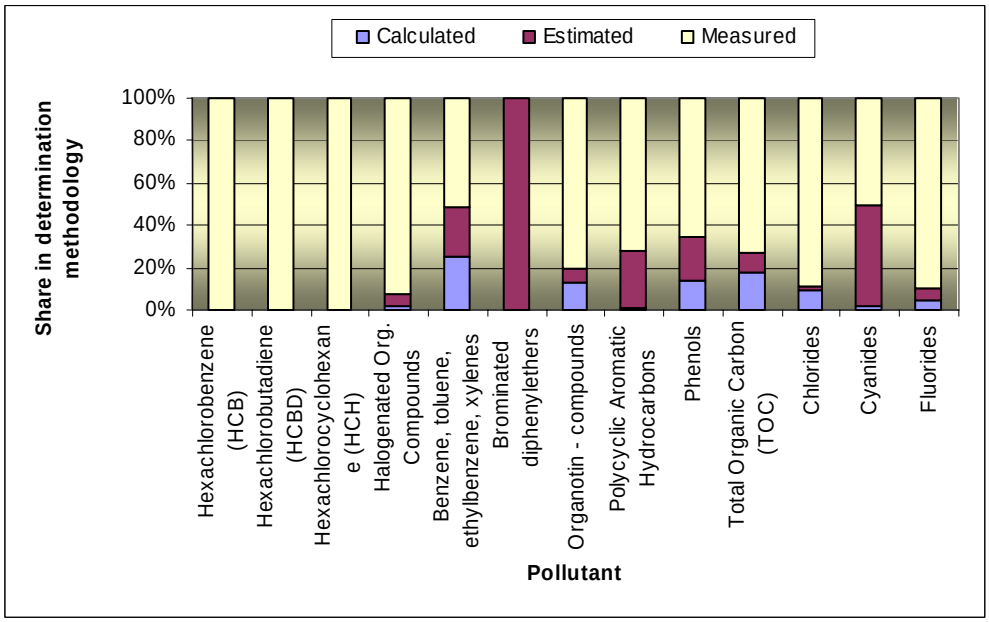


Figure 37 Share of determination methodology for pollutant emission levels (water)

Covering the level of emissions instead of the number of emission reports the applied methodology is tending more to “Estimated”.

Conclusions

- "Measuring" reports are for almost all pollutants the most applied determination methodology.
- The few reports on Brominated diphenylether are all "Estimated".
- Calculation is not applied for this pollutant neither for the relatively limited number of reports for the pollutants:
  - Chloroalkanes (C10-13);
  - Hexachlorobenzene (HCB);
  - Hexachlorobutadiene (HCBD) and
  - Hexachlorocyclohexane(HCH).

Conclusions regarding determination methods to water:

- Regarding determination methods used for water emissions, a high variability exists as well between countries as also between sectors, pollutants or emission types.
- "Measuring" reports are for almost all pollutants the most applied determination methodology.
- Emissions to water as reported by Netherlands, Luxembourg, Finland and Norway are solely "Measured".
- For Belgium and France, the contribution of measured reports is high. UK delivers a relatively high contribution to the calculated emissions. In Denmark a very high part of the emissions to water has been determined by "Estimation".
- The few reports on Brominated diphenylether are all "Estimated".
- Calculation is not applied for the pollutants:
  – Brominated diphenylether
  – Chloroalkanes (C10-13);
  – Hexachlorobenzene (HCB);
  – Hexachlorobutadiene (HCBD) and
  – Hexachlorocyclohexane(HCH).
- Emissions for sector 6.6 Poultry and pigs and for activity 1.4 Coal plants are mainly calculated.

Conclusions regarding determination methods to water:

- Emissions for sector 6.6 Poultry and pigs and for activity 1.4 Coal plants are mainly calculated.

Overall conclusions with respect to determination methodology

- When analysing the applied determination methodologies for the first EPER data, the following conclusions can be drawn:

General

- Regarding determination methodologies indicated for the first EPER data delivery, a high variability exists between countries as well as between activities, pollutants or emission types.

Air

- For air emissions "Calculation" (with nearly 50%) is the dominantly applied determination methodology. This was mainly due to the number of reports for the activity 6.6: Poultry and pigs.
- "Calculation" was not applied for facilities in FI, NL and NO.
- "Estimation" was the only applied methodology for facilities in NL and NO.
- "Measuring" was not applied for reports of activity 6.4: Poultry and pigs.
- High shares (more than 50%) of "Calculation" are indicated for CO_2, NH_3, NMVOC and PFC's.
- High shares (more than 50%) of "Measuring" are indicated for NO_X, SF_6, SO_X, Cu, PCDD-PCDF and for Chlorine and inorganic compounds.
- High shares (more than 50%) for "Estimation" are indicated for CH_4, DCE, HCB, PE, TCE and TRI.
- HCB and PCP are only indicated as "Estimated" while for TCE only has been reported indicating "Estimation" and "Measuring" as the applied methodologies.

Water

- Measuring is the dominantly applied methodology for emissions to water. Only for activity 6.4: Poultry and pigs and for activity 1.4 Coal plants, the "Calculated" share is dominant.
- Emissions to water as reported by Netherlands, Luxembourg, Finland and Norway are solely "Measured".
- For Belgium and France, the contribution of measured reports is high. UK delivers a relatively high contribution to the calculated emissions. In Denmark a very high part of the emissions to water has been determined by "Estimation".
- Emissions for sector 6.6 Poultry and pigs and for activity 1.4 Coal plants are

mainly calculated.

- From pollutants to water the few reports on Brominated diphenylether are all "Estimated".
- Calculation is not applied for this pollutant neither for the relatively limited number of reports for the pollutants:
  - Chloroalkanes (C10-13);
  - Hexachlorobenzene (HCB);
  - Hexachlorobutadiene (HCBD) and
  - Hexachlorocyclohexane(HCH)

Recommendations

- The Commission could consider to further clarify the use of the "Determination method" indicators "M", "C" and "E".

7. Other data quality aspects

Evaluation of data as described in chapter 5 was focussing on the completeness of data. In chapter 6, a first impression of reliability of data was provided. It will be of importance to verify the quality of the data to avoid misjudgement, especially when stepping into the comparison of data.

7.1 Threshold values for emission reporting

EPER aims at compiling emissions from larger facilities to such an extent that about 90 % of the emissions in Europe are covered. To minimise the burden of reporting, the EPER system has defined threshold values for each of the pollutants. If the emissions of one pollutant from a facility exceed the pollutant specific threshold, this emission must be reported. If emissions for other pollutants from the same facility are below the threshold, such emissions may, but do not need to be, reported.

Whether or not the threshold values are set on such a level that indeed about 90 % of the emissions is reported, is very difficult to assess, since emissions below the threshold are not reported and hence not known. Some indication might be obtained from statistical analyses as given in Figure 38. This figure shows the frequency distributions for both the number of data records and the total emission as a function of emission level. A clear different behaviour is shown for NO_x as compared to NH_3.

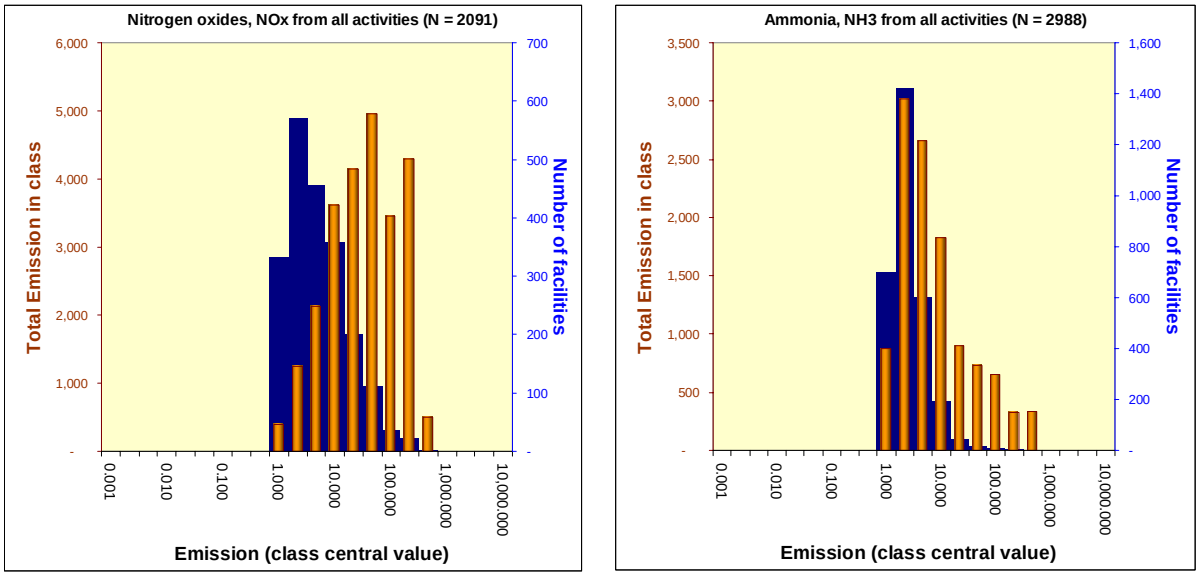


Figure 38 Preliminary analyses on threshold; frequency distributions of number of records (blue bars) and total emissions (brown columns) in the EPER database for NO_x and for NH_3; the emissions are relative to the threshold

For NO_x a relatively large number of records around the threshold level is present in the database. At the same time the total emission as a function of emission level drops quite rapidly at emission levels below 10 times the threshold. For NH_3 this is not the case. This might be an indication that a considerable fraction of NH_3 is emitted by facilities at or below the threshold level, whereas for NO_x this might not be the case.

Further statistical analysis however is needed to draw clear conclusions.

7.2 Data review

Within the framework of this report it was not possible to review the accuracy of the emission data in the EPER database. Such a review would require additional information and efforts, whereas methods for such a review are not readily available. The UNFCCC and LRTAP Conventions are developing methods to review emission data reported by the parties. The applicability of such methods to the EPER data could be investigated.

8. Comparing EPER data with national totals for selected greenhouse gases and air pollutants

This chapter[3] aims to:

- Compare EPER data with total national air emissions data for some key greenhouse gases and air pollutants: CO_2, CH_4, N_2O, SO_x, NO_x, NMVOC, with the aim of assessing the share of emissions covered by EPER.
- Provide an indicative comparison between EPER and EC totals on sectoral level.

8.1 Sources of comparative data

The EC Member States report air emissions data parallel for several purposes under the NEC Directive, CLRTAP and UNFCCC. There are therefore three data sources available that can be used putting EPER data into context. The reporting formats are different for each reporting obligation. The reporting obligations and data for comparisons are listed below:

Table 75 Overview of air emission reporting obligations in the European Community.

Organisation	Legal obligation	Reporting requirements	Reporting format	Most recent report
CLRTAP	1979 Convention on Long-range Transboundary Air Pollution	Emission of SO_x (as SO_2), NO_x (as NO_2), NH_3, NMVOCs, CO, heavy metals (HMs), persistent organic pollutants (POPs), and particulate matter (PM)	Nomenclature for reporting - NFR	EEA (2003): Annual European Community CLRTAP emission inventory 1990-2001, EEA Technical report, in preparation.
EC	Directive 2001/81/EC on national emission ceilings for certain atmospheric pollutants – 'NEC Directive'	Emission of SO_2, NO_x, NMVOCs, NH_3	Nomenclature for reporting - NFR	EEA (2003): Annual European Community CLRTAP emission inventory 1990-2001, EEA Technical report, in preparation.
UNFCCC	Council Decision 280/2004/EC concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol.	Emission of CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, NO_x, CO, NMVOC, SO_2	Common reporting format - CRF	EEA (2003): Annual European Community greenhouse gas inventory 1990-2001 and inventory report 2003, EEA Technical report No. 95.

[3] This chapter was written by Kati Huttunen (ETC-ACC), Andreas Barkman (EEA) and Tinus Pulles (ETC-ACC) as part of the work programme of the European Topic Centre on Air and Climate Change (ETC-ACC) of the European Environment Agency (EEA).

The comparison is based on emission data for 2001 - being the nominal reporting year for the first EPER reporting cycle published on the internet in February 2004. Data on national totals are based on the 2003 submissions to UNFCCC, CLRTAP and NEC for the year 2001. The comparisons were carried out using the following sources of data:

- For the gases CO_2, CH_4 and N_2O the source was the EC UNFCCC submission 2003 (CRF classification).
- For the gases NO_x, NMVOC and SO_x the source was the EC CLRTAP/NEC submission 2003 (NFR classification).
- In the comparisons, these sources are referred to as 'EC total' or 'national inventory data'.

The reason for using the 2003 submission rather than the 2004 submission is that complete EC data sets were not available at the time of writing. Due to potential revisions of national emission, data for 2001 may be revised between 2003 and 2004. However, we expect differences to be small.

The table below shows which relation between the sector classification of EPER (Annex 1) and the CRF/NFR of the UNFCCC/CLRTAP has been used. Five main sector categories are addressed: energy industries, industry, agriculture, waste and other.

Table 76 Conversion used between the EPER and CRF/NFR classification.

EPER classification	CRF/NFR classification
1.1 Combustion installations > 50 MW	Energy
1.2 Mineral oil and gas refineries	Energy
1.3 Coke ovens	Energy
1.4 Coal gasification and liquefaction plants	Energy
2.1/2.2/2.3/2.4/2.5/2.6 Metal industry and metal or roasting or sintering installations; Installations for the production of ferrous and non-ferrous metals	Industry
3.1/3.3/3.4/3.5 Installations for the production of cement klinker (>500t/d), lime (>50t/d), glass (>20t/d), mineral substances (>20t/d) or ceramic products (>75t/d)	Industry
4.1 Basic organic chemicals	Industry
4.2/4.3 Basic inorganic chemicals or fertilisers	Industry
4.4/4.6 Biocides and explosives	Industry
4.5 Pharmaceutical products	Industry
5.1/5.2 Installations for the disposal or recovery of hazardous waste (>10t/d) or municipal waste (>3t/h)	Waste
5.3/5.4 Installations for the disposal of nonhazardous waste (>50t/d) and landfills (>10t/d)	Waste

EPER classification	CRF/NFR classification
6.1 Industrial plants for pulp from timber or other fibrous materials and paper or board production (>20t/d)	Industry
6.2 Plants for the pre-treatment of fibres or textiles (>10t/d)	Industry
6.3 Plants for tanning of hides and skins (>12t/d)	Industry
6.4 Slaughterhouses (>50t/d), plants for the production of milk (>200t/d), other animal raw materials (>75t/d) or vegetable raw materials (>300t/d)	Industry
6.5 Installations for the disposal or recycling of animal carcasses and animal waste (>10t/d)	Waste
6.6 Installations for poultry (>40000), pigs (>2000) or sows (>750)	Agriculture
6.7 Installations for surface treatment or products using organic solvents (>200t/y)	Other
6.8 Installations for the production of carbon or graphite	Industry

Table 77 Conversion used to create main sectors from CRF and NFR classifications.

Main sector	CRF classification	NFR classification
Energy	= 1A1 (Energy industries)	= 1A1
Industry	= 1A2 + 2 (Manufacturing industries and construction, industrial processes)	= 1A2 + 2A + 2B + 2C + 2D + 2G (Manufacturing industries and construction, mineral products, chemical industry, metal production, other production, other
Agriculture	= 4 (Enteric fermentation, manure management, rice cultivation, agricultural soils, prescribed burning of savannas, field burning of agricultural residues, other)	= 4B + 4C + 4D + 4F + 4G + 4E (Manure management, rice cultivation, agricultural soils, prescribed burning of savannas)
Waste	= 6 (Solid waste disposal on land, wastewater handling, waste incineration, other)	= 6A + 6B + 6C + 6D (Solid waste disposal on land, waste-water handling, waste incineration, other waste)
Other	= 1A4 + 1A5 + 1B + 3 + 5 + 7 (Small combustion, other combustion, fugitive emissions from fuels, solvent and other product use, land use change and forestry, other emissions)	= 1B1 + 1B2 + 5B + 7 + 1A4 + 1A5 + 3 (Fugitive emissions from solid fuels, oil and natural gas, forest and grassland conversion, other, other energy sectors, transport, solvent and other product use)

The comparison of EPER data with the other reporting obligations is hampered by the fact that EPER data are stored at the level of facilities, where each facility might have more than one activity. Each facility is given a «Main Activity», to characterise the facility. In UNFCCC and in LRTAP/NEC submissions, data are aggregated at the level of activities. Therefore, when emissions in the EPER database are aggregated to a «Main Activity» total, these might include emissions connected to other activities than the «Main Activity», whereas in UNFCCC and LRTAP/NEC submissions these emissions are separately reported. In the following this issue will be referred to as the «Main Activity issue».

8.2 Assessment of completeness of the EPER data at EC level

8.2.1 CO_2 emissions

The EPER data cover 42 % of the total CO_2 emissions in the EC in 2001. The highest share was within the energy industries, while the lowest was within the sectors agriculture and 'others'. The EPER data on waste provide significantly higher values than the national inventory data.

The reason for the overall 42 % share on the total emissions can be explained by the absence of the transport emissions. In 2001, transport was responsible for 25 % of EC's total CO_2 emissions. Their absence in EPER data influences EPER's share on the total CO_2 emissions. Similarly, there is only one activity in the sector 'other' whereas several sources from the CRF classification were lumped into the sector 'other' in this comparison.

A high coverage within the energy industries is plausible as this sector generally consists of large point sources.

CO_2 emissions from agriculture were not reported under EPER as emission from pig and poultry facilities are below the threshold of 100000 tonnes.

Only less than one percent of the total EC CO_2 emissions come from waste in the official submission under UNFCCC. The very large over-representation of CO_2 from waste cannot at this stage be explained by one factor alone but are probably due to differences in definitions, inclusion/exclusion of biomass, Main Activity issue etc.

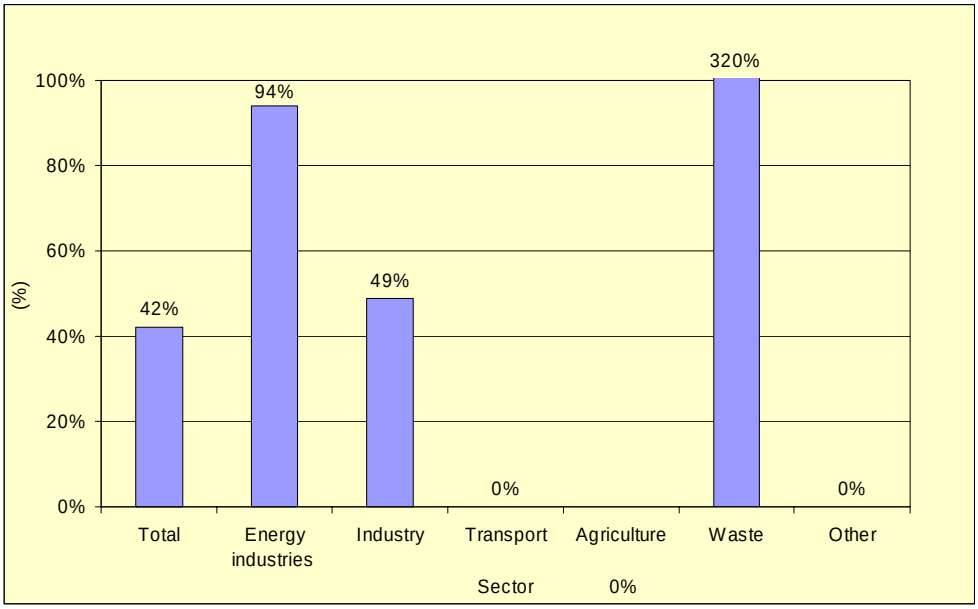


Figure 38 Share of CO_2 emissions reported under EPER compared with national inventory submissions to UNFCCC for the data year 2001

8.2.2 CH_4 emissions

The total coverage of the EPER data is 15 % compared to total EC emissions in 2001. Agriculture is the major source of CH_4 emissions in the EC and in 2001 the agricultural CH_4 emissions were 55 % of the total CH_4 emissions. As EPER only includes large pig and poultry farms the share covered by EPER is as expected relatively small. The second largest source, waste, was responsible for 27 % of the total EC emissions and the sources under 'other' for 16 %. All Member States reported CH_4 emissions from the agriculture sector in their national inventories while under EPER (activity 6.6) there were only three Member States reporting emissions. For waste, all Member States reported CH_4 emissions in their national inventories, but eleven countries did not report any data under EPER. Both the scope in term of source sectors covered and thresholds used in EPER may explain these rather large qualitative differences in reporting.

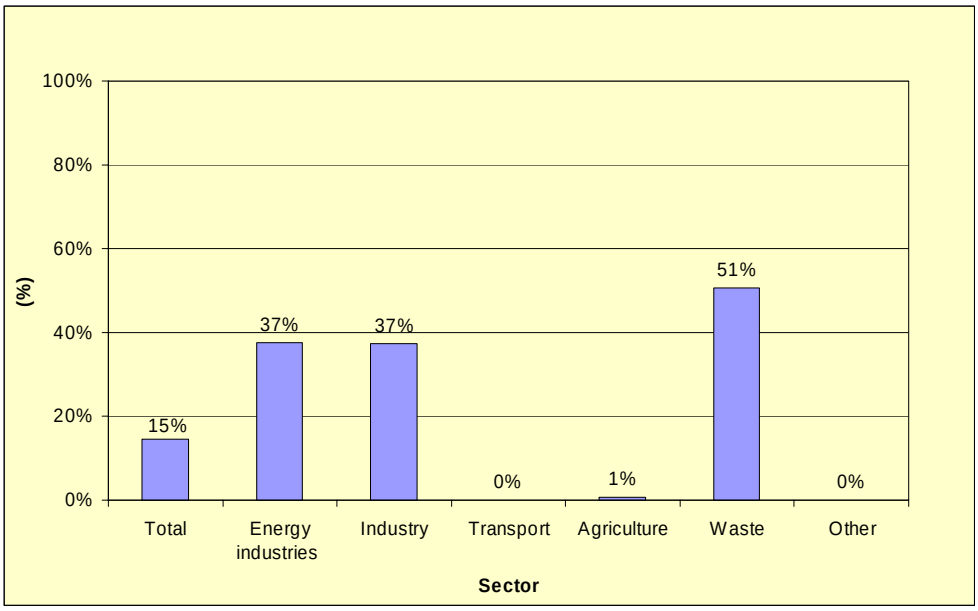


Figure 39 Share of CH_4 emissions reported under EPER on national inventory submissions for the year 2001.

8.2.3 N_2O emissions

N_2O emissions reported under EPER covered 13 % of the total emissions in the EC in 2001. The agriculture sector was responsible for 64 % of the total N_2O emissions in the EC. The low share covered by EPER can be explained by the fact that other emission sources than pig and poultry farms are not covered by EPER and that the emissions from pig and poultry farms generally do not exceed the threshold value and are therefore not included in EPER.

Energy industries and industry have the highest shares on sectoral emissions in EPER, but their shares on total EC emissions are significantly lower: 5 % and 17 %, respectively.

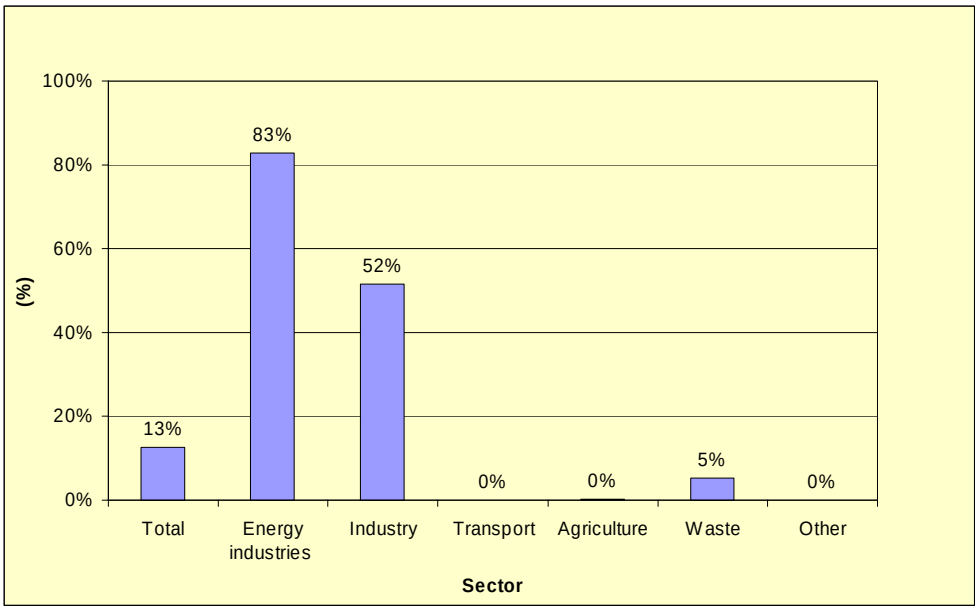


Figure 40 Share of N_2O emissions reported under EPER on national inventory submissions for the year 2001.

8.2.4 NOx emissions

The EPER data cover 26 % of the total NO_x emissions in EC in 2001. The main emitting sector based on national inventory data is transport (53 %) and its absence in the EPER data affects the total share.

The waste sector's share in the EC inventory data is below 1 %. The waste sector in EPER is over-represented compared to the national total data. Similar reasons as for the over-representation of CO_2 emissions from waste (allocation of these emissions to other sources in national inventories or otherwise differential reporting) could be related also to these emissions.

Energy industries and industry are better represented than other sectors as these sectors consist mainly of large point sources.

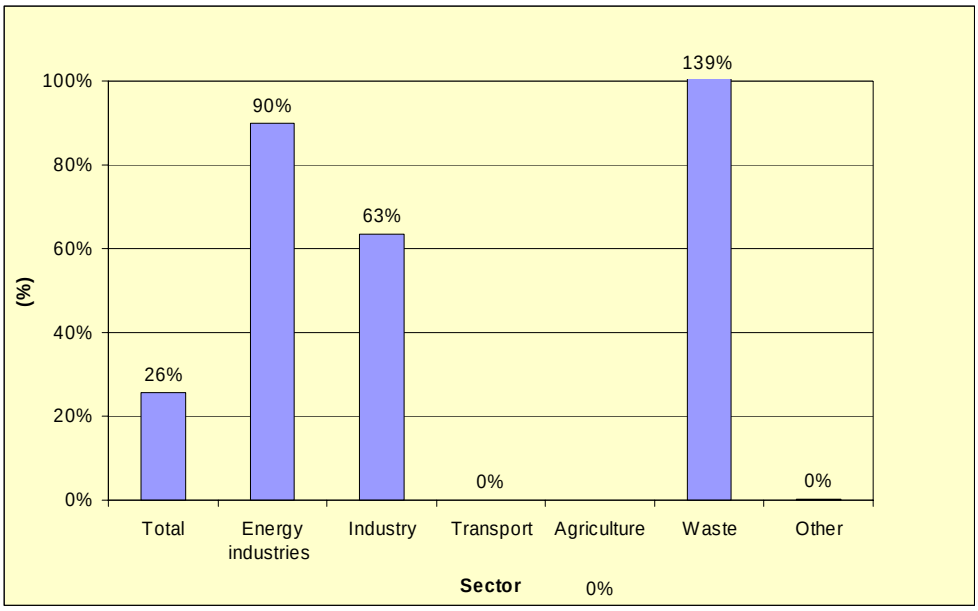


Figure 41 Share of NO_x emissions reported under EPER on national inventory submissions for the year 2001

8.2.5 NMVOC emissions

The EPER data's share of EC total is 6 %. In the national inventory data, the largest sources of NMVOC are under the sectors 'other' (50 %) and transport (30 %). The absence of transport emissions and especially the poor coverage of the sector 'other' causes a low total share.

The energy industries' share is 379 % and industry is 24 % of national totals. According to national inventory data, the energy industries have a share of total NMVOC emissions of less than 1 % and industry 10 %. The 'Main Activity issue' could partly explain the very large NMVOC emissions from energy industries in EPER. Other reasons include that this source is generally not very important in national inventories and therefore less addressed by countries but also that the NMVOCs included are different in EPER compared to the national inventory.

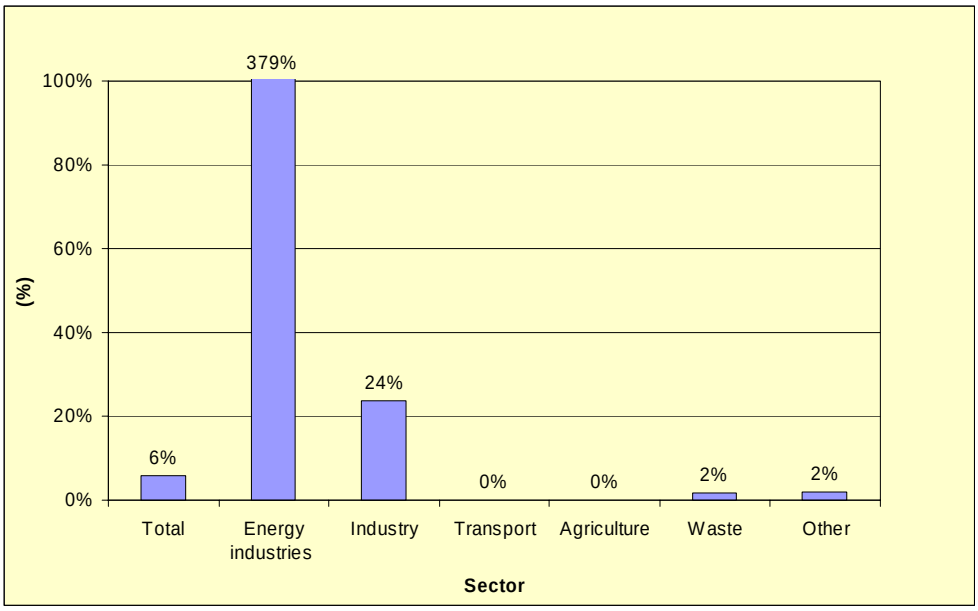


Figure 42 Share of NMVOC emissions reported under EPER on national inventory submissions for the year 2001

8.2.6 SOx emissions

The EPER data cover 70 % of the total EC SO_x emissions in 2001. High shares exist for the waste, energy industries and industry sectors. In the EC inventory, energy industries are responsible for 62 % and industry for 22 % of the total SO_x emissions. Waste is a minor source and is responsible for less than 1 % of the emissions. The main source of SO_x emissions from waste is the waste incineration and similar reasons for its high representation might be present as in the case of CO_2 and NO_x.

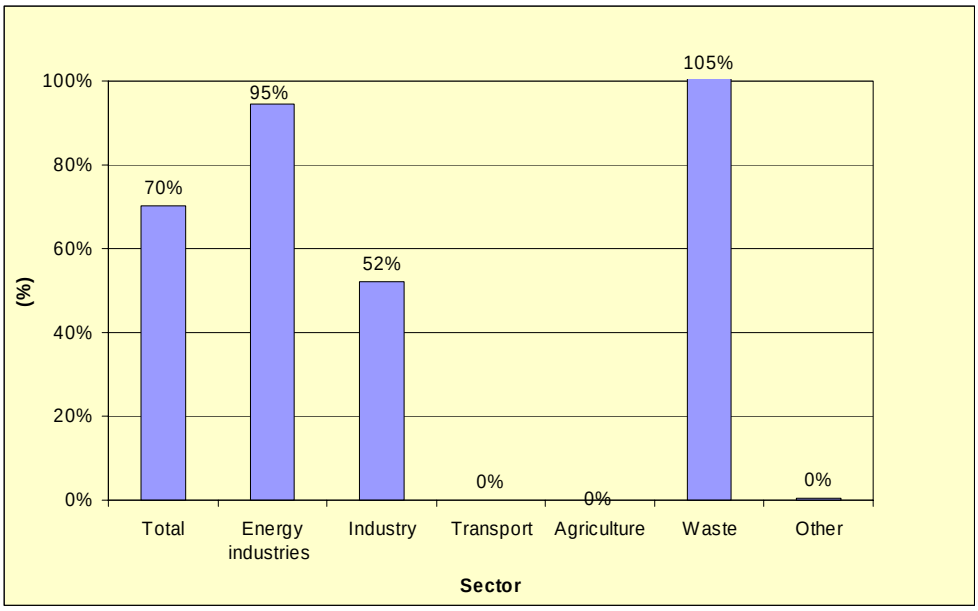


Figure 43 Share of SO_x emissions reported under EPER on national inventory submissions for the year 2001

8.3 Conclusions

- For EC, the share of emissions covered by EPER is generally lower than the total of the national inventories. This is plausible as the EPER data do not include the complete emissions data from each country – e.g. EPER excludes the emissions from the transport sector and from most agricultural sources that are included in the national inventory data. The data include only the emissions from facilities exceeding the emission and capacity thresholds defined in Annex I of the EPER Decision.
- The share of total EPER emissions on the EC total is the only indicator independent from sectoral definitions. The share of emissions covered by EPER varies among the pollutants addressed. The highest coverage is for SO_x (70 %) and CO_2 (42 %) emissions, while EPER data for NO_x and NMVOC are covered by 26% and 6%, respectively. Generally, for the gases for which large point sources are important emitters, the EPER data have automatically a higher coverage than for the gases where diffuse emissions play a major role. The calculation of the share of total EPER emission as compared with total EC emission is much more robust than the shares calculated for each main sector category.
- The differences between EPER and CLRTAP/NEC Directive and UNFCCC, on sectoral level provide only a general indication of completeness and should therefore be interpreted with care. The sectoral comparison shows that EPER data for waste are exceeding total EC emissions for the gases CO_2, NO_x and SO_x as well as emission for NMVOC emissions from energy industries. These results may be due to several reasons: 1) Emission from a facility is aggregated to the main activity of that facility whereas under UNFCCC and

CLRTAP/NEC these emissions are reported separately 2) national inventories do not take account of detailed point source information covered by EPER, and/or 3) methods employed in point source level are not the same as used for national inventories which to a large extent are based on national statistics and sectoral emission factors, and/or 4) EPER data are reported for the first time and the links with national inventories have not been fully established yet. Further analysis is needed to fully assess the importance of these factors, but also to propose ways of improving consistency and comparability of emission data stemming from EPER and national inventories for air pollutants and greenhouse gas emissions.

- Differences in sector definitions, emission determination and aggregation methods may reduce the possibilities to fully harvest mutual benefits in terms of improved quality of both EPER data and data originating form national inventories.

9. Glossary

Abbreviations

Acronym	Explanation
CRF	Common Reporting Format of UNFCCC
EC	European Commission
EEA	European Environment Agency
EPER	European Pollutant Emission Register
ETC-ACC	European Topic Center Air and Climate Change
EU	European Union
GDP	Gross Domestic Product
IPCC	Intergovernmental Panel on Climate Change
IPPC	Integrated Pollution Prevention and Control
LCP	Large Combustion Plant
NEC	National Emission Ceilings Directive
NFR	Nomenclature For Reporting of UN/CLRTAP
NMVOC	Non-Methane Volatile Organic Compounds
PRTR	Pollutant Release and Transfer Register
QA/QC	Quality Assurance/Quality Control
TNO	The Netherlands Organisation for Applied Scientific Research
TNO-MEP	TNO-Environment, Energy and Process Innovation
UN/CLRTAP	United Nations / Convention on Long Range Transboundary Air Pollution

Definitions used

Concept	Definition
Activity code	Code, identifying an activity according to Annex I of the IPPC Directive.
Annex I activity	Activity listed in Annex I to the IPPC Directive 96/61/EC as aggregated and specified in Annex A3 of EPER.
Emission	Direct release of a pollutant to air or water as well as the indirect release by transfer to an off-site waste water treatment plant.
Emission type	Identification of emission by media (Air, water (direct) or water (indirect)
Facility	An industrial complex with one or more installations on the same site, where one operator carries out one or more Annex I activities. This individual entity is reporting emissions of pollutants.
Installation	Stationary technical unit, where one or more activities listed in Annex I to the IPPC Directive are carried out, and any other directly associated activities, which have a technical connection with the activities carried out on that site and which could have an effect on emissions and pollution.
IPPC	Council Directive 96/61/EC on Integrated Pollution Prevention and Control.
NACE code	Standard nomenclature for economic activities.
NOSE-P code	Standard nomenclature for sources of emissions.
Operator	Any natural or legal person, who operates or controls an installation or to whom decisive economic power over the technical functioning of the installation has been delegated.
Pollutant	Individual substance or group of substances as listed in Annex A 1 of the EPER Decision
Report	Reported level of emission of a specific pollutant by one facility, including the emission type, the coordinates and other administrative data.
Reporting cycle	Cycle of the total reporting process, consisting of the collection, validation, submission, management and dissemination of the reported data.
Site	Geographical location of the facility.
Substance	Any chemical element and its compounds, with the exception of radioactive substances

Nomenclature for activities and short names

Main Sector	Sub sector	Description	Short name
1		**Energy industries**	***Energy***
	1.1	Combustion installations > 50 MW	*Combustion*
	1.2	Mineral oil and gas refineries	*Refineries*
	1.3	Coke ovens	*Coke ovens*
	1.4	Coal gasification and liquefaction plants	*Coal plants*
2		**Production and processing of metals**	***Metals***
	2.1 - 2.6	Metal industry and metal ore roasting or sintering installations; Installations for the production of ferrous and non-ferrous metals	*Metals*
3		**Mineral Industry**	***Minerals***
	3.1 / 3.3 / 3.4 / 3.5	Installations for the production of cement klinker (>500t/d), lime (>50t/d), glass (>20t/d), mineral substances (>20t/d) or ceramic products (>75t/d)	*Cement klinker, lime, mineral*
	3.2	Installations for the production of asbestos or asbestos-based products	*Asbestos*
4		**Chemical industry and chemical installations for the production of**	***Chemistry***
	4.1	Basic organic chemicals	*Organic chemicals*
	4.2 / 4.3	Basic inorganic chemicals or fertilisers	*Inorganic chemicals*
	4.4 / 4.6	Biocides and explosives	*Biocides and explosives*
	4.5	Pharmaceutical products	*Pharmaceuticals*
5		**Waste management**	***Waste***
	5.1/5.2	Installations for the disposal or recovery of hazardous waste (>10t/d) or municipal waste (>3t/h)	*Hazardous / municipal waste*
	5.3/5.4	Installations for the disposal of nonhazardous waste (>50t/d) and landfills (>10t/d)	*Nonhazardous waste / landfills*
6		**Other Annex I activities**	***Other***
	6.1	Industrial plants for pulp from timber or other fibrous materials and paper or board production (>20t/d)	*Pulp and paper*
	6.2	Plants for the pre-treatment of fibres or textiles (>10t/d)	*Textiles*
	6.3	Plants for tanning of hides and skins (>12t/d)	*Tanning*
	6.4	Slaughterhouses (>50t/d), plants for the production of milk (>200t/d), other animal raw materials (>75t/d) or vegetable raw materials (>300t/d)	*Slaughterhouse, milk production*
	6.5	Installations for the disposal or recycling of animal carcasses and animal waste (>10t/d)	*Animal waste*
	6.6	Installations for poultry (>40000), pigs (>2000) or sows (>750)	*Poultry and pigs*
	6.7	Installations for surface treatment or products using organic solvents (>200t/y)	*Surface treatment*
	6.8	Installations for the production of carbon or graphite	*Carbon*

Country name abbreviations

Country name	Abbreviation
Austria	AT
Belgium	BE
Denmark	DK
Finland	FI
France	FR
Germany	DE
Greece	GR
Hungary	HU
Ireland	IE
Italy	IT
Luxembourg	LU
Netherlands	NL
Norway	NO
Portugal	PT
Spain	ES
Sweden	SE
United Kingdom	UK

10. Authentication

Name and address of the principal:
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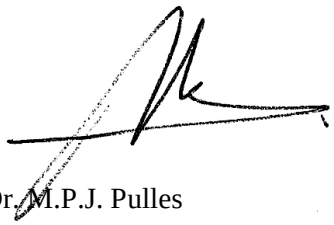
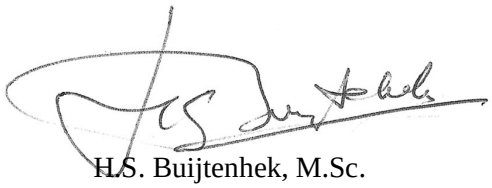
Date upon which, or period in which, the research took place:
October 2003 - June 2004

Signature: Approved by:





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