SMED Report No 134 2012

Development of the inventory of heavy metals, dioxins, PAHs, HCB and PCBs for Sweden's reporting to CLRTAP

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September 2012

Agreement: 309 1131

Commissioned by the Swedish Environmental Protection Agency

Published at: www.smed.se
Publisher: Swedish Meteorological and Hydrological Institute
Address: SE-601 76 Norrköping, Sweden
Start year: 2006
ISSN: 1653-8102

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Preface

This study has been commissioned by the Swedish Environmental Protection Agency and carried out by the Swedish Environmental Emissions Data (SMED) in 2012. It is part of the annual process to improve and strengthen the Swedish inventories of emissions to air for reporting and monitoring of international regulations and conventions.

This study report is written by Tomas Gustafsson and Tina Skårman, IVL Swedish Environmental Institute.

Göteborg, September 2012

Tomas Gustafsson Tina Skårman

Abbreviations/Glossary

1 A 1 a	1 A 1 a Public electricity and heat production
1 A 1 b	1 A 1 b Petroleum refining
1 A 1 c	1 A 1 c Manufacture of solid fuels and other energy industries
1 A 2 a	1 A 2 a Stationary combustion in manufacturing industries and construction: Iron and steel
1 A 2 b	1 A 2 b Stationary Combustion in manufacturing industries and construction: Non-ferrous metals
1 A 2 c	1 A 2 c Stationary combustion in manufacturing industries and construction: Chemicals
1 A 2 d	1 A 2 d Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print
1 A 2 e	1 A 2 e Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco
1 A 2 f i	1 A 2 f i Stationary combustion in manufacturing industries and construction: Other
1 A 2 f ii	1 A 2 f ii Mobile Combustion in manufacturing industries and construction
1 A 3 a ii (i)	1 A 3 a ii (i) Civil aviation (Domestic, LTO)
1 A 3 a i (i)	1 A 3 a i (i) International aviation (LTO)
1 A 3 b i	1 A 3 b i Road transport: Passenger cars
1 A 3 b ii	1 A 3 b ii Road transport: Light duty vehicles
1 A 3 b iii	1 A 3 b iii Road transport:, Heavy duty vehicles
1 A 3 b iv	1 A 3 b iv Road transport: Mopeds & motorcycles
1 A 3 b v	1 A 3 b v Road transport: Gasoline evaporation
1 A 3 b vi	1 A 3 b vi Road transport: Automobile tyre and brake wear
1 A 3 b vii	1 A 3 b vii Road transport: Automobile road abrasion
1 A 3 c	1 A 3 c Railways
1 A 3 d i (ii)	1 A 3 d i (ii) International inland waterways
1 A 3 d ii	1 A 3 d ii National navigation (Shipping)
1 A 3 e	1 A 3 e Pipeline compressors
1 A 4 a i	1 A 4 a i Commercial / institutional: Stationary
1 A 4 a ii	1 A 4 a ii Commercial / institutional: Mobile
1 A 4 b i	1 A 4 b i Residential: Stationary plants
1 A 4 b ii	1 A 4 b ii Residential: Household and gardening (mobile)
1 A 4 c i	1 A 4 c i Agriculture/Forestry/Fishing: Stationary
1 A 4 c ii	1 A 4 c ii Agriculture/Forestry/Fishing: Off-road vehicles and other machinery
1A 4 c iii	1A 4 c iii Agriculture/Forestry/Fishing: National fishing
1 A 5 a	1 A 5 a Other stationary (including military)
1 A 5 b	1 A 5 b Other, Mobile (including military, land based and recreational boats)
1 B 1 a	1 B 1 a Fugitive emission from solid fuels: Coal mining and handling
1 B 1 b	1 B 1 b Fugitive emission from solid fuels: Solid fuel transformation
1 B 1 c	1 B 1 c Other fugitive emissions from solid fuels
1 B 2 a i	1 B 2 a i Exploration, production, transport
1 B 2 a iv	1 B 2 a iv Refining / storage
1 B 2 a v	1 B 2 a v Distribution of oil products
1 B 2 b	1 B 2 b Natural gas

1 B 2 c	1 B 2 c Venting and flaring
1 B 3	1 B 3 Other fugitive emissions from geothermal energy production , peat and other energy extraction not included in 1 B 2
2 A 1	2 A 1 Cement production
2 A 2	2 A 2 Lime production
2 A 3	2 A 3 Limestone and dolomite use
2 A 4	2 A 4 Soda ash production and use
2 A 5	2 A 5 Asphalt roofing
2 A 6	2 A 6 Road paving with asphalt
2 A 7 a	2 A 7 a Quarrying and mining of minerals other than coal
2 A 7 b	2 A 7 b Construction and demolition
2 A 7 c	2A 7 c Storage, handling and transport of mineral products
2 A 7 d	2 A 7 d Other Mineral products
2 B 1	2 B 1 Ammonia production
2 B 2	2 B 2 Nitric acid production
2 B 3	2 B 3 Adipic acid production
2 B 4	2 B 4 Carbide production
2 B 5 a	2 B 5 a Other chemical industry
2 B 5 b	2 B 5 b Storage, handling and transport of chemical products
2 C 1	2 C 1 Iron and steel production
2 C 1.1	2 C 1.1 Secondary iron and steel production
2 C 1.2	2 C 1.2 Primary iron and steel production
2 C 1.3	2 C 1.3 Iron pellets and sinter production
2 C 2	2 C 2 Ferroalloys production
2 C 3	2 C 3 Aluminum production
2 C 5 a	2 C 5 a Copper production
2 C 5 b	2 C 5 b Lead production
2 C 5 c	2 C 5 c Nickel production
2 C 5 d	2 C 5 d Zinc production
2 C 5 e	2 C 5 e Other metal production
2 C 5 f	2 C 5 f Storage, handling and transport of metal products
2 D 1	2 D 1 Pulp and paper
2 D 2	2 D 2 Food and drink
2 D 3	2 D 3 Wood processing
2 E	2 E Production of POPs
2 F	2 F Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)
2 G	2 G Other production, consumption, storage, transportation or handling of bulk products
3 A 1	3 A 1 Decorative coating application
3 A 2	3 A 2 Industrial coating application
3 A 3	3 A 3 Other coating application
3 B 1	3 B 1 Degreasing
3 B 2	3 B 2 Dry cleaning
3 C	3 C Chemical products

3 D 1	3 D 1 Printing
3 D 2	3 D 2 Domestic solvent use including fungicides
3 D 3	3 D 3 Other product use
4 B 1 a	4 B 1 a Cattle dairy
4 B 1 b	4 B 1 b Cattle non-dairy
4 B 2	4 B 2 Buffalo
4 B 3	4 B 3 Sheep
4 B 4	4 B 4 Goats
4 B 6	4 B 6 Horses
4 B 7	4 B 7 Mules and asses
4 B 8	4 B 8 Swine
4 B 9 a	4 B 9 a Laying hens
4 B 9 b	4 B 9 b Broilers
4 B 9 c	4 B 9 c Turkeys
4 B 9 d	4 B 9 d Other poultry
4 B 13	4 B 13 Other
4 D 1 a	4 D 1 a Synthetic N-fertilizers
4 D 2 a	4 D 2 a Farm-level agricultural operations including storage, handling and transport of agricultural products
4 D 2 b	4 D 2 b Off-farm storage, handling and transport of bulk agricultural products
4 D 2 c	4 D 2 c N-excretion on pasture range and paddock unspecified
4 F	4 F Field burning of agricultural wastes
4 G	4 G Agriculture other
6 A	6 A Solid waste disposal on land
6 B	6 B Waste-water handling
6 C a	6 C a Clinical wasteincineration
6 C b	6 C b Industrial waste incineration
6 C c	6 C c Municipal waste incineration
6 C d	6 C d Cremation
6 C e	6 C e Small scale waste burning
6 D	6 D Other waste
As	Arsenic
B(a)p	Benzo(a)pyrene
B(b)f	Benzo(b)flouranthene
B(k)f	Benzo(k)flouranthene
Cd	Cadmium
CLRTAP	Convention on Long-range Transboundary Air Pollution
Cr	Chromium
CRF	Common reporting format
Cu	Copper
EEA	European Environment Agency
EMEP	European Monitoring and Evaluation Programme
HCB	Hexachlorobenzene

Hg	Mercury
I(1,2,3-cd)p	Indo(1,2,3-cd)pyrene
I-Teq	International Toxic Equivalent
NFR	Nomenclature for reporting
Ni	Nickel
PAHs	Polycyclic Aromatic Hydrocarbons
Pb	Lead
PCB	Polychlorinated Biphenyl
PCDD/PCDF	Dioxins/Furans
POPs	Persistent Organic Pollutants
PRTR	Pollutant Release and Transfer Register
Se	Selenium
SNAP	Selected Nomenclature for sources of Air Pollution
Zn	Zinc

Contents

Summary

Sweden annually reports emissions to air to the UNECE Convention of Long-Range Transboundary Air Pollution (CLRTAP). As Party to the Convention, in 2000 Sweden ratified the Aarhus Protocols on Heavy Metal and on Persistent Organic Pollutants (POPs), committing to reduce its protocol emissions below the 1990 level. However, the Swedish emission inventories on HM and POPs are incomplete and associated with large uncertainties. The aim of this study was to assess the need for updating and improving the Swedish inventory reporting of heavy metals and POPs emissions to air. As information from industrial plants for some sectors are scarce, in this study information from the EEA/EMEP Guidebook and other Nordic countries have been scrutinized to enable good coverage of emission sources.

Based on the results of this study there are several indications that the heavy metals and POPs inventories are in need of improvement. Especially for HCB and PCB the need is substantial due to the lack of reported emission sources in the Swedish inventories. Based on information from annual plant-specific environmental reports, information on process-related heavy metals emissions from cement production and metal production are available for implementation or further quality review. Moreover, this study shows that where the inventories are lacking emission sources, information available in the Guidebook or in other Nordic countries' emission inventories could be used as a complement. Several recommendations on improvements are presented in this study.

Introduction

Background

Sweden annually reports emissions to air to the UNECE Convention of Long-Range Transboundary Air Pollution (CLRTAP). In addition to acidic and eutrophying substances and particles, heavy metals and persistent organic pollutants (POPs)[1] are included in the convention. In 2000 Sweden ratified the Aarhus Protocols on Heavy Metal and on Persistent Organic Pollutants (POPs), committing to reduce its protocol emissions below the 1990 level. In the last decade, Sweden has made efforts in improving the emission inventories of the acidic and eutrophying substances and particles, leaving emission inventories of heavy metals and POPs less complete and associated with larger uncertainties. Thus, there is a call for improvements of the national emission inventories. However, information on emissions or emission measurements of heavy metals and POPs from Swedish industries is scarce and there are few up-to-date national studies available.

In 2006 SMED[2] made a number of recommendations on improving the inventories on mercury, dioxins/furans and HCB (Danielsson & Hansson, 2006). These recommendations have not yet been implemented. In 2009, European Monitoring and Evaluation Programme (EMEP) and European Environment Agency (EEA) published the guidebook for emission inventories for reporting to the CLRTAP[3]. The guidebook includes suggestions on default methodologies and emission factors for use if national estimates are lacking or are of poor quality. The default emission factors are based on data derived from international studies and reports.

The other Nordic countries (Denmark, Finland and Norway) also report emissions annually to the CLRTAP. For some substances and sectors, their reporting is more complete and to use their information for benchmarking could be useful.

The UNECE Protocol on Pollutant Release and Transfer Registers (PRTR) was adopted at an extraordinary meeting of the Parties to the Aarhus Convention on 21 May 2003. The Protocol was signed by 36 states, including Sweden and the EU[4].

1 In CLRTAP, POPs consists of dioxins/furans, PAH (i.e. benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and indeno(1,2,3-cd) pyrene), HCB, HCH and PCB.

2 SMED consists of IVL Swedish Environmental Research Institute, SCB Statistics Sweden, SLU Swedish University of Agricultural Sciences, and SMHI Swedish Meteorological and Hydrological Institute.

3 EMEP/EEA air pollutant emission inventory guidebook – 2009 (formerly referred to as the EMEP CORINAIR emission inventory guidebook)

4 http://www.unece.org/env/pp/prtrhome.html

EU ratified the PRTR Protocol in February 2006 and in order for the European Community to implement the PRTR Protocol, the European Pollutant Release and Transfer Register (E-PRTR) was established through Regulation (EC) No 166/2006. Sweden reports metals and POPs on an annual basis to EU according to the E-PRTR Regulation.

There are on-going negotiations under United Nations Environment Programme (UNEP) to prepare global legally binding instruments on mercury. As part of the preparations of a treaty, UNEP has contracted the Arctic Monitoring and Assessment Programme (AMAP) to develop a global Hg inventory to be reported in late 2012 (AMAP, 2012).

Aim

The aim of the study is to assess the need for updating and improving the Swedish inventory of heavy metal and POPs emissions to air reported to the Convention of Long-Range Transboundary Air Pollution (CLRTAP).

Scope

In the present project, as regards metals and POPs, the following steps are included:

1) Compile relevant activity data per NFR category.
2) Compile emission factors from the EMEP / EEA guidebook. Tier 1 factors will be used in cases tier 2 factors are not applicable.
3) Calculate emissions based on activity data and emission factors from step 1 and 2.
4) In cases where emissions are already reported to CLRTAP, a comparison with calculated emissions in step 3 will be carried out. If applicable, national emission factors will also be compared with default factors.
5) For the most important categories, and where relevant information is available, data that is reported to E-PRTR and information from other Nordic countries' reporting of metals and POPs will be collected and analyzed.
6) Based on the previous steps, list recommendations for possible future revisions.

Method

Estimations based on EMEP/EEA Guidebook 2009 vs CLRTAP

Emissions of 1990 and 2010 are calculated using activity data from the Swedish emission inventory of the 2012 submission to the CLRTAP and default emission factors from the EMEP/EEA Guidebook 2009 (hereafter named as the Guidebook). The Guidebook generally suggests three tier methodologies, tier 1 being the most general and associated with the largest uncertainties. The tier 2 and 3 methodologies are more complex and require more information on national data and national circumstances. Tier 2 includes default emission factors whereas tier 3 generally suggests the use of industry facility measurement data or modelled emissions.

In this study emissions are estimated using default tier 1 and tier 2 emission factors from the Guidebook applied with the national activity data as:

$$Emission = activity\ data * emission\ factor$$

Note that for reporting to CLRTAP emission estimations in most sectors, except the energy sector, are based on models or emission data from industries. National activity data may thus be more or less applicable with default emission factors depending on sector and substance.

Tier 1 default emission factors are general and can be applied for all sectors whereas tier 2 factors to a larger extent are based on technologies and practices (e.g. different abatement technologies). For fuel combustion in energy industries (NFR 1.A.1), the tier 2 default emission factors are based on fuel type and combustion technology (e.g. dry bottom boiler, wet bottom boiler, etc.). National activity data used in the Swedish inventory is split on fuel type but not on combustion technology. Therefore, in this study only tier 1 emission factors are used for estimation of emissions from energy industries. Tier 2 default emission factors for fuel combustion in manufacturing industries (NFR 1.A.2) are mostly available for NO_X, CO and SO_2. An exception is cement production for which clinker production is used as activity data together with tier 2 default EFs.

For emissions of heavy metals and POPs from transportation, the Guidebook default emission factors for tier 2 are scarce. Hence, in this study, only tier 1 default emission factors are used for the emission estimates. Tier 2 default factors for small scale combustion in other sectors (NFR 1.A.4) are applied for biomass burning in the residential sector (NFR 1.A.4.b i).

Default emission factors for incineration of waste with energy recovery are available in the Guidebook section on waste. Neither the tier 1 nor the tier 2 factors are however applicable for Swedish conditions and thus excluded from this study.

Consequently, when comparing emissions with the reported data to the CLRTAP, emissions from waste in the energy sector are deducted.

In order to enable comparison of default emission factors with Swedish emission circumstances, *implied* emission factors are calculated for all sectors except stationary combustion. The implied emission factors are calculated using reported emissions to the CLRTAP and the same activity data used for the emission estimates based on the the Guidebook default factors.

E-PRTR

E-PRTR is regulated by the documents:

- Regulation (EC) No 166/2006 concerning the establishment of a European Pollutant Release and Transfer Register[5]
- Guidance Document for the implementation of the European PRTR[6]

The register covers releases to air, water, land, and off-site transfers of pollutants through the wastewater and off-site transfers of waste. Data represents the total annual emission releases during normal operations as well as accidents for 64 different economic activities given in Annex I to the E-PRTR Regulation. Capacity thresholds are stated for the different activities, grouped into the following nine different sectors:

1. Energy
2. Production and processing of metals
3. Mineral industry
4. Chemical industry
5. Waste and waste water management
6. Paper and wood production and processing
7. Intensive livestock production and aquaculture
8. Animal and vegetable products from the food and beverage sector
9. Other activities

Annex II to the E-PRTR Regulation lists 91 different pollutants and categories of substances. The substances are divided into different categories such as greenhouse gases, ozone-depleting substances, heavy-metals, pesticides, acidification precursors and persistent organic compounds. For each pollutant given in Annex II to the PRTR and waste a threshold is set and if the applicable threshold is exceeded the amount of the pollutant must be reported per facility.

[5] http://eur-lex.europa.eu/LexUriServ/site/en/oj/2006/l_033/l_03320060204en00010017.pdf

[6] http://prtr.ec.europa.eu/docs/EN_E-PRTR_fin.doc

Releases and transfers must be reported only if the emissions of a facility are above the activity and pollutant thresholds set out in the E-PRTR Regulation.

A Finnish team of emission experts has created a mapping table linking categories of different reporting formats (SNAP/NFR/CRF/E-PRTR) that can be found on the CEIP website[7]. The Finnish mapping table have been modified in order to fit Swedish conditions, allowing a more aggregated view (see Table 1). The modified mapping table has been used to perform the comparison between officially reported CLRTAP[8]- and E-PRTR[9]-data for emission year 2010 for metals and POPs.

Table 1. Simplified mapping table between NFR-code and E-PRTR-code on an aggregated level.

NFR-code	E-PRTR-code (aggregated level)	Explanation E-PRTR-code
1A2a, 1A2b, 1B1b, 2C1, 2C2,2C3, 2C5a, 2C5b, 2C5c, 2C5d, 2C5e, 2C5f	2	Production and processing of metals
1 A 2 f i, 2 A 1, 2 A 2, 2 A 3, 2 A 4, 2 A 5, 2 A 6, 2 A 7 a, 2 A 7 b, 2 A 7 b, 2 A 7 c, 2 A 7 d	3	Mineral industry
1 A 2 c, 2 B 1, 2 B 2, 2 B 3, 2 B 4, 2 B 5 a, 2 B 5 b, 3 C	4	Chemical industry
1 A 2 d, 2 D 1, 2 D 3	6	Paper and wood production and processing
4 B 8, 4 B 9 a, 4 B 9 b, 4 B 9 c, 4 B 9 d	7	Intensive livestock production and aquaculture
1 A 2 e, 2 D 2	8	Animal and vegetable products from the food and beverage sector
1 A 1 b, 1 B 2 a iv	1a	Mineral oil and gas refineries
1 A 1 c	1b	Installations for gasification and liquefaction

[7] http://www.ceip.at/reporting-instructions/

[8] http://www.ceip.at/overview-of-submissions-under-clrtap/2012-submissions/

[9] http://cdr.eionet.europa.eu/se/eu/colseypfq/envt3wd3w/EPRTR_2010_Sweden_2012-03-29.xml

1 A 1 a	1c, 5b	Thermal power stations and other combustion installations, Installations for the incineration of non-hazardous waste
6 C b	5a	Installations for the recovery or disposal of hazardous waste
6 D	5c	Installations for the disposal of non-hazardous waste
6 A	5d	Landfills
6 B	5f	Urban waste-water treatment plants
*)	-	

*) The following NFR codes are not included in the reporting requirements under E-PRTR: 1 A 3 a i (i), 1 A 3 b i, 1 A 3 b ii , 1 A 3 b iii, 1 A 3 b iv, 1 A 3 b v, 1 A 3 b vi, 1 A 3 b vii, 1 A 3 c, 1 A 3 d i (ii), 1 A 3 d ii, 1 A 3 e, 1 A 4 a i, 1 A 4 a ii, 1 A 4 b i, 1 A 4 b ii, 1 A 4 c i, 1 A 4 c ii, 1A 4 c iii, 1 A 5 a, 1 A 5 b, 1 B 1 a, 1 B 1 c, 1 B 2 a i, 1 B 2 a v, 1 B 2 b, 1 B 2 c , 1 B 3, 2 E, 2 F, 2 G, 3 A 1, 3 A 2, 3 A 3, 3 B 1, 3 B 2, 3 D 1, 3 D 2, 3 D 3, 4 B 1 a, 4 B 1 b, 4 B 2, 4 B 3, 4 B 4, 4 B 6, 4 B 7, 4 B 13, 4 D 1 a, 4 D 2 a, 4 D 2 b, 4 D 2 c, 4 F, 4 G, 6 C a, 6 C c, 6 C d, 6 C e, 7 A.

Information from other Nordic countries

In this study, information from the most recent national emission inventories (2012 submission to CLRTAP[10]) of Denmark, Finland and Norway are used to identify potential significant gaps or missing emission sources of heavy metals and POPs in the Swedish inventory. As the Nordic countries have different national circumstances, e.g. in terms types of manufacturing industries and the use of fuels, it is important to analyse possible reasons for any major difference.

[10] Located at: http://www.ceip.at/overview-of-submissions-under-clrtap/2012-submissions/

Results and analysis

Comparison of emissions and emission factors based on the Guidebook with information reported to CLRTAP

Table A 1 - Table A 10 in Appendix A present emission estimates for 1990 and 2010 based on the Guidebook and as reported by Sweden to CLRTAP, as well as comparisons between them. The results show large differences between the two approaches depending on substance and NFR sector. For most substances, the Guidebook method generate higher emissions than reported to CLRTAP.

The comparisons between the two approaches do not reflect actual emission differences and the results should be used as indications of where there is information available to improve the Swedish inventory for HM and POPs emissions using the Guidebook. E.g. Table A 5 and Table A 10 in Appendix A indicate where information on emissions are lacking in the Swedish inventory 1990 and 2010, respectively, but EFs are available in the Guidebook. Table 2 indicates missing sources in the Swedish inventory for which the Guidebook method potentially could account for at least ten per cent of the national total emissions 2010. This information could be used to improve the completeness of the Swedish HM and POPs emission inventories.

In the Swedish reporting to CLRTAP emissions of heavy metals and POPs are associated with large uncertainties, besides the fact that the inventories are not complete. Part of the uncertainties stem from known weaknesses in the inventories. E.g. most of the national EFs for heavy metals and POPs from stationary combustion are derived from a study carried out more than eight years ago (Boström et al., 2004) and may thus not fully be representative for 2010 and likely in need of reviewing and updating. In addition, according to the work documentation in the Swedish QA/QC system for reporting to CLRTAP, emissions of heavy metals from several industrial processes, e.g. cement production (2.A.1) and metal production (2.C) are not reported at all or in need of review and revision.

Heavy metals

From Table A 2 and Table A 6 it is obvious that the emissions of heavy metals in the Swedish inventory to CLRTAP have decreased significantly, which mostly is due to improved abatement technologies in the industries, but also is affected by changes in the actual production. The comparison with emissions based on the Guidebook factors show better agreement for 1990 than for 2010. This suggests that the abatement technology in Swedish industries are more efficient than the default factors presented in the Guidebook.

The Hg, Cu, Ni, and Zn emissions 2010 according to the CLRTAP inventory and the Guidebook method show relatively good agreement, i.e. less than 150 per cent difference (Table A 9). There are however reasons for making improvements of these heavy metals, e.g. the importance of Hg in the on-going global negotiations. Emissions of Hg from cremation (6.C.d) reported to CLRTAP significantly exceeds those the estimated emission with Guidebook EFs (the difference accounts for about 23 per cent of total emissions reported to CLRTAP). In Table A 14 it can be seen that the national IEF is about 200 per cent higher than the upper confidence interval of the tier 1 default EFs. Emissions reported to CLRTAP are based on extrapolations of a national Swedish EPA expert judgment from 2003. According to the Swedish federation of Cemeteries and Crematoria[11], Hg emissions for 2010 should about 30 per cent of the actual reported emissions to CLRTAP. There is thus a need for a review and possible revision of Hg emissions from this source.

The largest source of Cu emissions to CLRTAP 2010 is road transport: automobile tyre and brake wear (1.A.3.b vi) for which no tier 1 or tier 2 emission factors are available in the Guidebook, only information for emission modeling. When comparing the Cu emissions with other Nordic countries, however, it is obvious that Sweden reports similar amounts.

In Table A 12 it can be seen that the national EF for Ni from the use diesel oil/domestic heating oil in stationary combustion is very low compared to the ranges given in the Guidebook. It is worth noting that the Ni EF for heavy fuel oil is about 300 times higher and more in range with the Guidebook factors.

For Zn and dioxin/furan emissions 2010 reported to CLRTAP significantly exceed the estimated emissions based on Guidebook EFs (the differences account for about 22 per cent and 28 per cent of total emissions reported to CLRTAP, respectively). The differences are mainly due to higher national EFs for biomass, which are outside the confidence interval of the tier 1 default factors (Table A13).

The overall differences in Pb, Cd, As and Cr emissions between the two estimation methods in 2010 are largely due to differences for primary iron and steel production (2.C.1.2) and other metal production (2.C.5 a-e) (Table A8). It is worth noting that metal production in Sweden consists of several production processes (e.g. primary and secondary production) and is difficult to properly apply the correct default EF and activity data. This is evident when comparing the IEFs with the default EFs (Table A14) as the discrepancy between them vary largely depending on metal and process. Thus there is a need to ensure that the quality of the emission data used in the inventory to CLRTAP is of sufficient quality and that no omission of emissions occur.

[11] http://www.skkf.se/

In Table A 9 it can be seen that for Pb emissions reported to CLRTAP significantly exceed those of the Guidebook method for road transportation 2010 (the difference account for about 29 per cent of total emissions reported to CLRTAP). The main reason for this is the contribution from automobile tyre and brake wear (1.A.3.b vi) which is lacking in the Guidebook.

For As and Se from power and heat production (1.A.1.a) emissions according to the Guidebook method are significantly higher (Table A 8). This is mainly due to much lower EF in the CLRTAP inventory, for As in biomass and for Se in peat and coal (see Table A 11 and Table A 12, respectively).

POPs

In Table A 4 and Table A 9 it can be seen that there are relatively good agreement (below 150 per cent difference) for dioxins/furans and total PAHs 1990 and 2010 between emissions reported to CLRTAP and emissions based on the Guidebook factors. For dioxins/furans the main reasons for the differences 2010 are lower EFs for biomass in the CLRTAP inventories in sectors 1.A.2.D i and 1.A.4.B i. (Table A 13). For total PAHs there are no emissions reported to CLRTAP in secondary metal production (2.C.1.1), whereas it is the largest contributing source in the Guidebook estimates.

For BaP, BbF, BkF and I(1,2,3-cd)P there are large differences between emissions reported to CLRTAP (lower) and emissions based on the Guidebook factors (higher) due to the lack of available emission data in the Swedish inventory for HCB and PCB (e.g. for HCB and PCB only emissions from national navigation and fishing (1.A.3.d ii, 1.A.4.c iii) are reported to CLRTAP) (see Table A 3 and Table A 8).

Table A 5 and Table A 10 indicate that there are several sources for which national activity data and default emission factors in the Guidebook are available. In order to improve the completeness of the POPs inventories, such information could be used if deemed appropriate for Swedish conditions.

Table 2. Indicators (X) for which NFR sector emissions are lacking to CLRTAP, but national activity data together with Guidebook emission factors are available and consist of more than ten per cent of national total reported to CLRTAP for 2010.

NFR Sector	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	Dioxins/ furans	BaP	BbF	BkF	I(1,2,3-cd)P	Total 4 PAHs	HCB	PCB
1.AA.1.A														X		X	X
1.AA.2.A												X	X	X			X
1.AA.2.C												X	X	X		X	X
1.AA.2.D												X	X	X		X	X
1.AA.2.E												X	X	X		X	X
1.AA.2.F i												X	X	X		X	X
1A2fii, 1A4bii, 1A4cii												X					
1A4a												X	X	X		X	X
1A4b												X	X	X		X	X
1A4c												X	X	X		X	X
1B1b	X			X													
1B2a iv		X	X														
2A7d								X									
2C1.1															X		X
2C1.2															X		X
2C1.3								X								X	X
2C3											X	X	X	X			
2C5a-e					X		X										X
2F			X														X
6Cb																X	

Comparison between reported emissions to CLRTAP and E-PRTR

The results of the comparison between reported emissions of metals and POPs to CLRTAP and E-PRTR are presented in Appendix B, Table B 1-Table B 5. It is also indicated in the tables whether the reported emissions according to CLRTAP is less than or exceeds the reported emissions to E-PRTR for a comparable activity. It is important to keep in mind that the reporting according to E-PRTR is based on thresholds both for activities and pollutants and consequently CLRTAP emissions are assumed to exceed E-PRTR emissions. Thus, from a CLRTAP completeness point of view it is of greater interest to identify those activities were the reported emissions according CLRTAP is less than the reported emissions to E-PRTR.

In Table B 1 it can be seen that the reported CLRTAP emissions of As from "Production and processing of metals" is 16 % lower than the reported emissions according to E-PRTR for the same activity. This is due to the fact that in the emission inventory reported to CLRTAP the metal emissions from the three largest iron ore mining producers in Sweden are calculated with emissions factors and not based on the reported emissions in the facilities' annual legal environmental reports. This issue has been identified in the work documentation for NFR code 2.C.1.3 for several years and consequently the CLRTAP reporting needs to be improved by using environmental report data where such data is available. Furthermore it is important to make sure that the whole time series is consistent.

Table B 1 and Table B 2 show that emissions of Cr and Ni is reported for landfills according to E-PRTR whereas for CLRTAP no emissionsare reported. The facility is probably given an incorrect E-PRTR activity since its main activity is steel production. No improvement of CLRTAP-data is therefore suggested in this case.

In Table B 4 it can be seen that the reported emissions of dioxins/furans from Production and processing of metals are 18% lower for CLRTAP compared to E-PRTR. Unfortunately emissions of dioxins/furans from one of the primary iron and steel plants are not included in the CLRTAP reporting for the whole time series 1990-2010, and consequently this needs to be improved.

For the mineral industry it can be seen in Table B 4 that 71 % less dioxins/furans are reported to CLRTAP compared to E-PRTR. This is probably due to error in the reporting of emissions from one lime producing facility. The error has been noted to the facility and the Swedish EPA. No improvement of CLRTAP-data is therefore suggested in this case.

Other Nordic countries' reporting to CLRTAP

Among the Nordic countries (Sweden, Denmark, Finland and Norway) Finland reports the highest amounts of heavy metals (except for Se and Zn), HCB and PCB 2010. Sweden reports the highest emissions of Zn, dioxins/furans and BaP. Besides Sweden, only Denmark reports emissions of BbF, BkF and I(1,2,3-cd)P to CLRTAP. In Table 3 it can be seen that there are a number of NFR sources and substances that contribute significantly to the other Nordic countries national total emissions but are lacking in the Swedish inventory. The following section contains available information and referenced studies in the national Informative Inventory Report's of the Nordic countries.

Denmark

The most important exhaust-related emissions for road transport (1.A.3.b i-iv) in Denmark are Cd, Cr, Hg and Zn based on a national study (Winther and Slentø, 2010). Sweden lacks information on emissions of Cd and Zn from these sources and could investigate the applicability of the Danish factors as a complement.

For BbF, BkF and I(1,2,3-cd)P from 1.A.4.b i in Denmark, EF are derived from the Guidebook. For HCB from 1A1a and 1.A.4.b i in Denmark no reference is given.

Emissions of Se from metal production (2.C.1) are based on specific emissions from steelworks and secondary aluminium manufacturing as well as average emission factors for iron foundries, secondary lead and zinc manufacturing, and allied metal manufacturing. More information would be needed to judge if Se emissions from this source could be adopted to the Swedish inventory. Sweden has production of non-ferrous metals where selenium is extracted as crude selenium in the precious metals plants and should thus have some emissions to report.

Finland

Finland reports emissions of Ni from nickel production (2.C.5.c). Information from the environmental reports of the largest non-ferrous metal plant in Sweden show that measurements of Ni emissions are available and thus should be used for reporting to the CLRTAP.

For the remaining sources different references on emission factors were presented. In this study it has not been possible to investigate the applicability of these factors to be adopted into the Swedish inventories.

- Emissions HCB in 1.A.4.b i are based on wood and coal combustion and an international emission factor of 0.01 mg/t (Joas, A 2006).
- Reported emissions of HCB and PCB from metal production in Finland stem from emission factors based international references (for HCB, Toda 2005 and Pacyna 2003; for PCB, EEA CORINAIR Guidebook 2005).

- Emission factors of HCB and PCB from waste incineration (6.C.b) in Finland stem from different international studies (EEA CORINAIR Guidebook 2005, Joas. A. 2006, Bailey 2001, BiPRO 2006)
- PCB emissions from landfills (6.D) in Finland were calculated using the emission factor for open burning of 2.86 g/t (EEA CORINAIR Guidebook 2005).

Norway

Norway reports emissions Cu from road transport (1.A.3.b) and refers to the Handbook of Emission Factors (HBEFA). In the version of the HBEFA model used in the latest Swedish inventory there is no information available on emission factors for Cu.

Emissions of As and total PAH from aluminium production (2.C.3) in Norway are based on plant-specific data. In Norway, both the prebaked anode and the Soederberg production methods are used. Sweden could explore if information from Norwegian plants are appropriate also for Swedish plants.

Table 3. Indicators (X) for which NFR sector other Nordic countries have significant emissions reported to CLRTAP but Sweden are not reporting emissions 2010.

Nordic country	NFR Sector	Cd	As	Cu	Ni	Se	Zn	B(b)f	B(k)f	I(1,2,3-cd)p	Total 4PAHs	HCB	PCB
Denmark	1A1a											X	
Denmark	1A3b i	X					X						
Denmark	1A4b i							X	X	X		X	
Denmark	2C1					X							
Finland	1A4b i											X	
Finland	2C1												X
Finland	2C5a											X	
Finland	2C5c				X								
Finland	6Cb											X	X
Finland	6D												X
Norway	1A3b i			X									
Norway	2C3		X								X		

B(b)f: Benzo(b)flouranthene. B(k)f: Benzo(k)flouranthene. I(1,2,3-cd)p: Indeno(1,2,3-cd)pyrene.

Conclusions and recommendations

The aim of the study is to assess the need for updating and improving the Swedish inventory of heavy metal and POPs emissions reported to CLRTAP. Based on the results of this study there are several indications that the HM and POPs inventories are in need of improvements. Especially for HCB and PCB the need is substantial due to the lack of reported emission sources in the Swedish inventory.

This study shows that there are emissions reported by some plants in cement production (2.A.1) and metal production (2.C) that are not currently included or only partly included in the inventories reported to the CLRTAP. The plant emissions should be reviewed and if judged to be of sufficient quality, included in the next annual submission to the CLRTAP. For remaining missing sources of heavy metals and POPs available information in the Guidebook or from other Nordic countries' emission inventories could be used as a complement (Table 2 and Table 3). In most cases for HM, there are minor emission sources, but some sectors may account for significant contributions (e.g. As from 1.B.1.b, Cd and Hg from 1.B.2.a iv, Cr from 2C5a-e (see Table 2). The Guidebook could serve as reference material for making the Swedish heavy metals and POPs inventory to the CLRTAP more complete. A general recommendation would be to use the default EFs in the Guidebook if national estimates are not available or of poor quality. However, it is important to make sure that the default factors are appropriate for Sweden's circumstances. As the information in the industries annual environmental reports in most cases is not sufficient to judge the appropriate process technology or combustion abatement, contacts with the most important industries would have to be carried out.

The comparison of Hg emissions between the CLRTAP inventory and the Guidebook method show relatively good agreement (2 per cent in 1990 and 126 per cent in 2010). The CLRTAP inventory may however be missing potentially significant sources of Hg, i.e. refining/storage and consumption of products (1.B.2.a iv and 2.F). This is the same indications as can be seen in the preliminary results from the on-going AMAP study on global mercury releases. Such results should be taken into consideration when making prioritizations of future inventory improvements.

There are indications in this study that some national emission factors may be in need of reviewing and updating. E.g. the EF for Zn and dioxins/furans from biomass in 1A1a could be too high. In addition, some EFs are below the lower confidence interval of the Guidebook factors and should be reviewed, e.g. Ni from diesel oil/domestic heating oil.

For most sources and substances, emissions of heavy metals and POPs reported to CLRTAP exceed those to E-PRTR, as expected. In some cases - As and dioxins/furans from production and processing of metals - E-PRTR data include higher

emissions than reported to CLRTAP. It is recommended that these inconsistences are reviewed and data to CLRTAP is revised.

Recommendations

- Ensure more complete and accurate heavy metals and POPs inventories by reviewing and developing consistent time-series of process-related emissions in cement production (2.A.1) and metal production (2.C) based on information from plant-specific annual environmental reports, e.g.:
    - Several heavy metals from cement production (2.A.1),
    - As from iron ore mining (2.C.1.3),
    - Ni emissions from other metal production (2.C.5.e),
    - Dioxins/furans from production and processing of metals from one plant.
- Where national information on emission factors and emissions are missing (Table 2), develop more complete and accurate emission reporting of heavy metals and POPs to the CLRTAP by applying default EFs from the Guidebook, or investigate the possibility to use information from other Nordic countries (Table 3), especially for BaP, BbF, BkF, I(1,2,3-cd)P, HCB and PCB.
- For emission factors in stationary combustion review and update national factors for heavy metals and POPs, especially for biomass and coal.

References

AMAP/UNEP (2012). Work in progress.

Boström et al. (2004) Emissions of particles, metals, dioxins and PAH in Sweden. SMED report no 7, 2004.

Danielsson & Hansson (2006). Update and improvement of estimated air emissions of mercury, dioxin and HCB in Sweden - a pre-study. SMED report no 8 2007.

Denmark's, Finland's, Norway's and Sweden's 2012 submissions to the CLRTAP: http://www.ceip.at/overview-of-submissions-under-clrtap/2012-submissions/

EMEP/EEA air pollutant emission inventory guidebook — 2009. Technical guidance to prepare national emission inventories. EEA Technical report series: ISSN 1725-2237. Available at: http://www.eea.europa.eu/publications/emep-eea-emission-inventory-guidebook-2009/#

Regulation (EC) No 166/2006 of the European Parliament and of the Council of 18 January 2006 concerning the establishment of a European Pollutant Release and Transfer Register and amending Council Directives 91/689/EEC and 96/61/EC

Appendix A. Emission estimates based on the Guidebook, and comparisons with emissions reported to the CLRTAP 1990 and 2010.

Table A 1. Heavy metals and POPs emissions based on national activity data 1990 and default tier 1 and tier 2 emission factors (Guidebook).

NFR Sector	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	Dioxins/ furans	BaP	BbF	BkF	I(1,2,3-cd)P	Total 4 PAHs	HCB	PCB	Default EF used
	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	g I-Teq	Mg	Mg	Mg	Mg	Mg	kg	kg	Tier
1.AA.1.A	0.821	0.108	0.120	0.633	0.451	0.532	4.204	1.458	4.574	1.151	0.015	0.001	0.000	0.005		0.101	6.174	1
1.AA.1.B	0.062	0.022	0.003	0.022	0.119	0.096	3.496	0.000	0.162	0.008	0.000	0.000	0.000	0.000				1
1.AA.1.C	0.001	0.002	0.000	0.000	0.003	0.002	0.005	0.000	0.062	0.002	0.000	0.000	0.000	0.000				1
1.AA.2.A	0.206	0.006	0.003	0.013	0.156	0.089	3.077	0.000	0.180	0.153	0.067	0.081	0.050	0.028		0.000	0.020	1
1.AA.2.B	0.026	0.001	0.000	0.002	0.020	0.011	0.402	0.000	0.017	0.017	0.008	0.010	0.006	0.004		0.000	0.001	1
1.AA.2.C	0.365	0.008	0.009	0.019	0.204	0.124	3.799	0.002	0.397	0.516	0.141	0.179	0.092	0.061		0.004	0.183	1
1.AA.2.D	1.795	0.088	0.054	0.093	0.612	0.412	6.271	0.026	5.501	14.366	2.107	3.012	1.135	1.032		0.251	2.982	1
1.AA.2.E	0.264	0.007	0.010	0.013	0.120	0.077	2.091	0.002	0.349	0.366	0.097	0.123	0.061	0.041		0.002	0.179	1
1.AA.2.F\ i	2.219	0.085	0.327	0.157	0.801	0.631	9.693	0.082	5.270	9.546	1.536	2.141	0.851	0.728		0.174	2.472	1,2
1A2fii, 1A4bii, 1A4cii		0.009			0.044	1.499	0.062	0.009	0.882		0.027	0.043						1
1A3a																		
1A3b	0.118										0.032	0.077	0.065	0.049				1
1A3c		0.000			0.002	0.056	0.002	0.000	0.033		0.001	0.002						1
1A3dii, 1A4ciii	0.032	0.003	0.006	0.048	0.052	0.220	2.119	0.029	0.269	0.050						0.022	0.097	1
1.AA.4.A\ i	0.541	0.012	0.004	0.034	0.423	0.239	8.477	0.000	0.367	0.562	0.201	0.248	0.147	0.088		0.004	0.043	1
1.AA.4.B\ i	3.154	0.231	0.025	0.147	1.766	1.172	24.197	0.020	7.903	22.489	6.740	8.970	4.663	4.167		0.234	2.341	1,2
1.AA.4.C\ i	0.298	0.005	0.014	0.011	0.075	0.059	1.035	0.003	0.406	0.457	0.108	0.139	0.061	0.045		0.002	0.304	1

NFR Sector	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	Dioxins/ furans	BaP	BbF	BkF	I(1,2,3-cd)P	Total 4 PAHs	HCB	PCB	Default EF used
	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	g I-Teq	Mg	Mg	Mg	Mg	Mg	kg	kg	Tier
1A5b																		
1.B.1.b	1.253	0.031	0.021	0.104			0.313				0.783	0.261	0.261	0.313	0.940			1
1.B.2.a.iv	0.410	0.081	0.090	0.018		0.179	0.781		0.154		0.000	0.000	0.000	0.000	0.166			2
2A7a																		
2A7d	0.286	0.023	0.020	0.043	0.034	0.002	0.267	0.034	0.083									2
2B5a																		
2C1.1	4.531	0.349	0.087	0.026	0.174	0.035	1.220		6.273	1.394					27.882		13.941	2
2C1.2	10.884	0.182	0.004	1.088	12.550	0.095	0.354	0.008	11.082	0.027					6.840		15.266	2
2C1.3	3.902	0.005	0.054	0.198	0.038	0.071	0.204	0.220	0.222	1.961					0.341	34.181	39.516	2
2C2																		
2C3											0.790	1.024	1.024	0.128				2
2C5a-e	61.028	1.939	0.308	5.374	2.045	11.493	1.863		2.776	5.652							634.812	2
2D1																		
2F			0.086														859.063	1
3D3	0.000	0.000	0.000	0.000	0.000	0.000				0.000					0.000			2
6Cb	0.039	0.003	0.002	0.000	0.009	0.090	0.004		0.630	0.011					0.001	0.060		1
6Cd	0.000	0.000	0.000	0.000	0.000	0.000	0.000			0.001	0.000							1
6Ce										0.858					8.582			1
6D	0.000	0.000	0.000	0.000	0.000	0.000				0.000								2
Grand Total	92.232	3.200	1.249	8.043	19.698	17.185	73.936	1.893	47.591	59.588	12.654	16.310	8.417	6.688	44.751	35.035	1577.395	

Note that the value 0.000 equals <0.0005.

Table A 2. Heavy metals and POPs emissions 1990 reported in the 2012 Swedish submission to the CLRTAP.

NFR Sector	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	Dioxins/ furans	BaP	BbF	BkF	I(1,2,3-cd)P	Total 4 PAHs	HCB	PCB
	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	g I-Teq	Mg	Mg	Mg	Mg	Mg	kg	kg
1.AA.1.A	1.578	0.053	0.135	0.196	0.436	0.700	4.110	0.206	7.346	5.852	0.175				0.511		
1.AA.1.B	0.047	0.001	0.000	0.004	0.002	0.016	0.749	0.005	0.038		0.000				0.001		
1.AA.1.C	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000				0.000		
1.AA.2.A	0.070	0.002	0.001	0.006	0.005	0.025	1.020	0.007	0.057	0.012	0.000				0.002		
1.AA.2.B	0.009	0.000	0.000	0.001	0.001	0.003	0.122	0.001	0.007	0.001	0.000				0.000		
1.AA.2.C	0.059	0.002	0.003	0.005	0.012	0.028	0.465	0.007	0.309	0.151	0.004				0.013		
1.AA.2.D	0.874	0.067	0.022	0.051	0.169	0.700	5.054	0.123	18.364	4.453	0.255				0.767		
1.AA.2.E	0.110	0.003	0.003	0.010	0.015	0.043	1.270	0.012	0.196	0.124	0.002				0.008		
1.AA.2.F\ i	0.873	0.051	0.049	0.072	0.229	0.593	3.522	0.116	11.852	3.956	0.164				0.499		
1A2fii, 1A4bii, 1A4cii																	
1A3a																	
1A3b	271.196	0.002			0.002	72.936	0.003		25.251	4.213	0.041	0.071	0.054	0.055	0.220		
1A3c																	
1A3dii, 1A4ciii	0.030	0.001	0.000	0.056	0.082	0.358	2.216	0.001	0.224	0.048	0.001	0.002	0.001	0.002	0.005	0.021	0.090
1.AA.4.A\ i	0.203	0.010	0.003	0.020	0.020	0.095	2.227	0.019	0.431	0.050	0.058				0.192		
1.AA.4.B\ i	0.831	0.134	0.027	0.051	0.158	0.367	1.211	0.105	15.780	2.731	2.906				9.430		
1.AA.4.C\ i	0.071	0.009	0.007	0.008	0.020	0.030	0.346	0.008	0.465	0.186	0.060				0.140		
1A5b	0.761																
1.B.1.b											0.512	0.301	0.157	0.088	1.057		

NFR Sector	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	Dioxins/ furans	BaP	BbF	BkF	I(1,2,3-cd)P	Total 4 PAHs	HCB	PCB
	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	g I-Teq	Mg	Mg	Mg	Mg	Mg	kg	kg
1.B.2.a.iv										0.219	0.001				0.001		
2A7a	0.318	0.003	0.021	0.042		0.096	0.000		1.100								
2A7d	1.455	0.028	0.006	0.106	0.045	0.006	0.055		0.117								
2B5a			0.193														
2C1.1	8.130	0.122	0.258		12.183	1.015	6.972		66.144	17.426							
2C1.2	14.324	0.305	0.043	0.038	0.225	0.706	0.711		11.646	1.386							
2C1.3	0.013	0.001	0.000	0.027	0.195	0.044	0.975		0.310	7.123							
2C2	0.026				8.407				1.213								
2C3											1.051	2.313		0.526	3.889		
2C5a-e	52.051	1.337	0.184	4.712		18.552			33.653	0.845							
2D1	0.401	0.087	0.013	0.132	0.198	0.430	0.467		0.801	0.801					0.015		
2F																	
3D3	0.000	0.000	0.000	0.000	0.000	0.000				0.000					0.000		
6Cb	0.001	0.000			0.000	0.001	0.000			0.004							
6Cd			0.256							0.523	0.000				0.000		
6Ce																	
6D																	
Grand Total	353.430	2.219	1.224	5.537	22.402	96.745	31.497	0.609	195.304	50.104	5.229	2.686	0.211	0.670	16.750	0.021	0.090

Note that the value 0.000 equals <0.0005.

Table A 3. Differences between emissions estimated using default Guidebook EFs and emissions reported to the CLRTAP 1990.

NFR Sector	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	Dioxins/ furans	BaP	BbF	BkF	I(1,2,3-cd)P	Total 4 PAHs	HCB	PCB
	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	g I-Teq	Mg	Mg	Mg	Mg	Mg	kg	kg
1.AA.1.A	-0.757	0.055	-0.014	0.437	0.015	-0.168	0.094	1.251	-2.772	-4.701	-0.160	0.001	0.000	0.005	-0.511	0.101	6.174
1.AA.1.B	0.014	0.021	0.002	0.018	0.117	0.080	2.747	-0.005	0.124	0.008	0.000	0.000	0.000	0.000	-0.001		
1.AA.1.C	0.001	0.002	0.000	0.000	0.003	0.002	0.004	0.000	0.062	0.002	0.000	0.000	0.000	0.000	0.000		
1.AA.2.A	0.136	0.004	0.002	0.007	0.151	0.064	2.057	-0.007	0.122	0.140	0.067	0.081	0.050	0.028	-0.002	0.000	0.020
1.AA.2.B	0.017	0.000	0.000	0.001	0.019	0.008	0.280	-0.001	0.010	0.017	0.008	0.010	0.006	0.004	0.000	0.000	0.001
1.AA.2.C	0.306	0.006	0.006	0.014	0.192	0.096	3.334	-0.005	0.088	0.366	0.137	0.179	0.092	0.061	-0.013	0.004	0.183
1.AA.2.D	0.921	0.021	0.033	0.042	0.443	-0.288	1.216	-0.097	-12.863	9.913	1.852	3.012	1.135	1.032	-0.767	0.251	2.982
1.AA.2.E	0.155	0.004	0.006	0.003	0.105	0.034	0.821	-0.010	0.153	0.242	0.095	0.123	0.061	0.041	-0.008	0.002	0.179
1.AA.2.F\ i	1.345	0.034	0.278	0.085	0.573	0.038	6.171	-0.033	-6.582	5.590	1.372	2.141	0.851	0.728	-0.499	0.174	2.472
1A2fii, 1A4bii, 1A4cii		0.009			0.044	1.499	0.062	0.009	0.882		0.027	0.043					
1A3a																	
1A3b	-271.078	-0.002			-0.002	-72.936	-0.003		-25.251	-4.213	-0.008	0.006	0.011	-0.006	-0.220		
1A3c		0.000			0.002	0.056	0.002	0.000	0.033		0.001	0.002					
1A3dii, 1A4ciii	0.002	0.001	0.006	-0.008	-0.030	-0.137	-0.097	0.028	0.046	0.002	-0.001	-0.002	-0.001	-0.002	-0.005	0.001	0.007
1.AA.4.A\ i	0.338	0.002	0.001	0.013	0.403	0.144	6.250	-0.019	-0.064	0.512	0.143	0.248	0.147	0.088	-0.192	0.004	0.043
1.AA.4.B\ i	2.323	0.097	-0.002	0.096	1.608	0.805	22.987	-0.085	-7.877	19.758	3.835	8.970	4.663	4.167	-9.430	0.234	2.341
1.AA.4.C\ i	0.227	-0.004	0.007	0.003	0.055	0.029	0.689	-0.005	-0.058	0.271	0.048	0.139	0.061	0.045	-0.140	0.002	0.304
1A5b	-0.761																
1.B.1.b	1.253	0.031	0.021	0.104			0.313				0.271	-0.040	0.104	0.225	-0.117		

NFR Sector	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	Dioxins/ furans	BaP	BbF	BkF	I(1,2,3-cd)P	Total 4 PAHs	HCB	PCB
	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	g I-Teq	Mg	Mg	Mg	Mg	Mg	kg	kg
1.B.2.a.iv	0.410	0.081	0.090	0.018		0.179	0.781		0.154	-0.219	-0.001	0.000	0.000	0.000	0.165		
2A7a	-0.318	-0.003	-0.021	-0.042		-0.096	0.000		-1.100								
2A7d	-1.169	-0.004	0.015	-0.064	-0.010	-0.004	0.212	0.034	-0.034								
2B5a			-0.193														
2C1.1	-3.600	0.226	-0.171	0.026	-12.009	-0.981	-5.752		-59.870	-16.032					27.882		13.941
2C1.2	-3.440	-0.123	-0.039	1.051	12.325	-0.611	-0.358	0.008	-0.564	-1.360					6.840		15.266
2C1.3	3.889	0.004	0.054	0.171	-0.157	0.026	-0.771	0.220	-0.088	-5.161					0.341	34.181	39.516
2C2	-0.026				-8.407				-1.213								
2C3											-0.261	-1.289	1.024	-0.398	-3.889		
2C5a-e	8.977	0.601	0.124	0.662	2.045	-7.059	1.863		-30.877	4.807							634.812
2D1	-0.401	-0.087	-0.013	-0.132	-0.198	-0.430	-0.467		-0.801	-0.801					-0.015		
2F			0.086														859.063
3D3																	
6Cb	0.039	0.003	0.002	0.000	0.009	0.089	0.004		0.630	0.007					0.001	0.060	
6Cd	0.000	0.000	-0.256	0.000	0.000	0.000	0.000			-0.522	0.000				0.000		
6Ce										0.858					8.582		
6D	0.000	0.000	0.000	0.000	0.000	0.000				0.000							
Grand Total	-261.197	0.981	0.024	2.505	-2.704	-79.560	42.439	1.284	-147.713	9.484	7.425	13.624	8.206	6.018	28.001	35.014	1577.305

Note that the value 0.000 equals <0.0005.

Table A 4. Differences (per cent) between emissions estimated using default Guidebook EFs and emissions reported to the CLRTAP, in relation to national totals reported the CLRTAP 1990.

NFR Sector	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	Dioxins/ furans	BaP	BbF	BkF	I(1,2,3-cd)P	Total 4 PAHs	HCB	PCB
1.AA.1.A	0%	2%	-1%	8%	0%	0%	0%	206%	-1%	-9%	-3%	0%	0%	1%	-3%	481%	6839%
1.AA.1.B	0%	1%	0%	0%	1%	0%	9%	-1%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1.AA.1.C	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1.AA.2.A	0%	0%	0%	0%	1%	0%	7%	-1%	0%	0%	1%	3%	24%	4%	0%	1%	23%
1.AA.2.B	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	3%	1%	0%	0%	2%
1.AA.2.C	0%	0%	1%	0%	1%	0%	11%	-1%	0%	1%	3%	7%	44%	9%	0%	19%	203%
1.AA.2.D	0%	1%	3%	1%	2%	0%	4%	-16%	-7%	20%	35%	112%	538%	154%	-5%	1193%	3304%
1.AA.2.E	0%	0%	0%	0%	0%	0%	3%	-2%	0%	0%	2%	5%	29%	6%	0%	10%	198%
1.AA.2.F\ i	0%	2%	23%	2%	3%	0%	20%	-5%	-3%	11%	26%	80%	403%	109%	-3%	826%	2739%
1A2fii, 1A4bii, 1A4cii	0%	0%	0%	0%	0%	2%	0%	1%	0%	0%	1%	2%	0%	0%	0%	0%	0%
1A3a	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1A3b	-77%	0%	0%	0%	0%	-75%	0%	0%	-13%	-8%	0%	0%	5%	-1%	-1%	0%	0%
1A3c	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1A3dii, 1A4ciii	0%	0%	0%	0%	0%	0%	0%	5%	0%	0%	0%	0%	0%	0%	0%	3%	7%
1.AA.4.A\ i	0%	0%	0%	0%	2%	0%	20%	-3%	0%	1%	3%	9%	70%	13%	-1%	20%	47%
1.AA.4.B\ i	1%	4%	0%	2%	7%	1%	73%	-14%	-4%	39%	73%	334%	2209%	622%	-56%	1113%	2593%
1.AA.4.C\ i	0%	0%	1%	0%	0%	0%	2%	-1%	0%	1%	1%	5%	29%	7%	-1%	11%	337%
1A5b	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1.B.1.b	0%	1%	2%	2%	0%	0%	1%	0%	0%	0%	5%	-1%	49%	34%	-1%	0%	0%

NFR Sector	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	Dioxins/ furans	BaP	BbF	BkF	I(1,2,3-cd)P	Total 4 PAHs	HCB	PCB
1.B.2.a.iv	0%	4%	7%	0%	0%	0%	2%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%
2A7a	0%	0%	-2%	-1%	0%	0%	0%	0%	-1%	0%	0%	0%	0%	0%	0%	0%	0%
2A7d	0%	0%	1%	-1%	0%	0%	1%	6%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2B5a	0%	0%	-16%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2C1.1	-1%	10%	-14%	0%	-54%	-1%	-18%	0%	-31%	-32%	0%	0%	0%	0%	166%	0%	15443%
2C1.2	-1%	-6%	-3%	19%	55%	-1%	-1%	1%	0%	-3%	0%	0%	0%	0%	41%	0%	16911%
2C1.3	1%	0%	4%	3%	-1%	0%	-2%	36%	0%	-10%	0%	0%	0%	0%	2%	162500%	43775%
2C2	0%	0%	0%	0%	-38%	0%	0%	0%	-1%	0%	0%	0%	0%	0%	0%	0%	0%
2C3	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-5%	-48%	485%	-59%	-23%	0%	0%
2C5a-e	3%	27%	10%	12%	9%	-7%	6%	0%	-16%	10%	0%	0%	0%	0%	0%	0%	703218%
2D1	0%	-4%	-1%	-2%	-1%	0%	-1%	0%	0%	-2%	0%	0%	0%	0%	0%	0%	0%
2F	0%	0%	7%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	951634%
3D3	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
6Cb	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	285%	0%
6Cd	0%	0%	-21%	0%	0%	0%	0%	0%	0%	-1%	0%	0%	0%	0%	0%	0%	0%
6Ce	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%	0%	0%	0%	0%	51%	0%	0%
6D	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Grand Total	-74%	44%	2%	45%	-12%	-82%	135%	211%	-76%	19%	142%	507%	3887%	898%	167%	166463%	1747273%

Table A 5. Indicators (X) where emissions are lacking in the reporting to the CLRTAP but national activity data and default Guidebook emission factors are available for 1990.

NFR Sector	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	Dioxins/ furans	BaP	BbF	BkF	I(1,2,3-cd)P	Total 4 PAHs	HCB	PCB
1.AA.1.A												X	X	X		X	X
1.AA.1.B										X		X	X	X			
1.AA.1.C										X		X	X	X			
1.AA.2.A												X	X	X		X	X
1.AA.2.B												X	X	X		X	X
1.AA.2.C												X	X	X		X	X
1.AA.2.D												X	X	X		X	X
1.AA.2.E												X	X	X		X	X
1.AA.2.F\ i												X	X	X		X	X
1A2fii, 1A4bii, 1A4cii		X			X	X	X	X	X		X	X					
1A3a																	
1A3b																	
1A3c		X			X	X	X	X	X		X	X					
1A3dii, 1A4ciii																	
1.AA.4.A\ i												X	X	X		X	X
1.AA.4.B\ i												X	X	X		X	X
1.AA.4.C\ i												X	X	X		X	X
1A5b																	
1.B.1.b	X	X	X	X			X										

NFR Sector	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	Dioxins/ furans	BaP	BbF	BkF	I(1,2,3-cd)P	Total 4 PAHs	HCB	PCB
1.B.2.a.iv	X	X	X	X		X	X		X			X	X	X			
2A7a																	
2A7d								X									
2B5a																	
2C1.1				X											X		X
2C1.2								X							X		X
2C1.3								X							X	X	X
2C2																	
2C3													X				
2C5a-e					X		X										X
2D1																	
2F			X														X
3D3																	
6Cb			X	X					X						X	X	
6Cd	X	X		X	X	X	X										
6Ce										X					X		
6D	X	X	X	X	X	X				X							

Table A 6. Heavy metals and POPs emissions based on national activity data 2010 and default tier 1 and tier 2 emission factors (Guidebook).

NFR Sector	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	Dioxins/ furans	BaP	BbF	BkF	I(1,2,3-cd)P	Total 4 PAHs	HCB	PCB	Default EF used
	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	g I-Teq	Mg	Mg	Mg	Mg	Mg	kg	kg	Tier
1.AA.1.A	3.432	0.349	0.303	1.758	1.566	3.158	6.548	1.321	27.913	7.389	0.158	0.006	0.003	0.052		0.854	10.501	1
1.AA.1.B	0.070	0.027	0.003	0.019	0.121	0.098	2.013	0.000	0.104	0.005	0.000	0.000	0.000	0.000				1
1.AA.1.C	0.002	0.002	0.001	0.001	0.003	0.002	0.005	0.000	0.063	0.004	0.000	0.000	0.000	0.000		0.000	0.002	1
1.AA.2.A	0.192	0.006	0.003	0.012	0.147	0.084	2.885	0.000	0.183	0.143	0.062	0.075	0.047	0.026		0.000	0.018	1
1.AA.2.B	0.017	0.000	0.000	0.001	0.014	0.008	0.271	0.000	0.013	0.011	0.005	0.006	0.004	0.002				1
1.AA.2.C	0.403	0.011	0.005	0.024	0.287	0.165	5.563	0.001	0.406	0.706	0.181	0.233	0.122	0.081		0.008	0.116	1
1.AA.2.D	1.699	0.106	0.043	0.097	0.592	0.388	4.717	0.028	6.521	18.362	2.585	3.735	1.379	1.284		0.334	3.383	1
1.AA.2.E	0.100	0.006	0.003	0.006	0.056	0.034	0.896	0.001	0.250	0.486	0.080	0.111	0.046	0.038		0.008	0.094	1
1.AA.2.F\ i	1.811	0.069	0.335	0.133	0.536	0.483	5.037	0.082	4.452	7.146	1.143	1.593	0.622	0.537		0.133	2.104	1,2
1A2fii, 1A4bii, 1A4cii		0.011			0.057	1.936	0.080	0.011	1.139		0.036	0.055						1
1A3a																		
1A3b	0.147										0.051	0.100	0.080	0.065				1
1A3c		0.000			0.001	0.035	0.001	0.000	0.021		0.001	0.001						1
1A3dii, 1A4ciii	0.043	0.004	0.007	0.111	0.119	0.295	5.130	0.044	0.323	0.088						0.031	0.132	1
1.AA.4.A\ i	0.172	0.008	0.003	0.011	0.108	0.063	1.867	0.001	0.357	0.782	0.133	0.184	0.079	0.064		0.013	0.129	1

NFR Sector	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	Dioxins/ furans	BaP	BbF	BkF	I(1,2,3-cd)P	Total 4 PAHs	HCB	PCB	Default EF used
	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	g I-Teq	Mg	Mg	Mg	Mg	Mg	kg	kg	Tier
1.AA.4.B\ i	2.310	0.109	0.032	0.094	0.406	0.552	2.835	0.030	9.595	27.734	8.129	10.259	5.535	5.019		0.356	3.562	1,2
1.AA.4.C\ i	0.282	0.016	0.006	0.016	0.117	0.074	1.311	0.004	0.976	2.705	0.389	0.559	0.210	0.193		0.049	0.488	1
1A5b																		
1.B.1.b	1.341	0.034	0.022	0.112			0.335				0.838	0.279	0.279	0.335	1.006			1
1.B.2.a.iv	0.454	0.089	0.099	0.020		0.199	0.866		0.170		0.000	0.000	0.000	0.000	0.195			2
2A7a																		
2A7d	0.510	0.034	0.041	0.072	0.054	0.002	0.401	0.249	0.095									2
2B5a																		
2C1.1	3.944	0.303	0.076	0.023	0.152	0.030	1.062		5.461	1.214					24.272		12.136	2
2C1.2	13.662	0.229	0.005	1.366	15.783	0.120	0.444	0.010	13.911	0.033					8.619		19.189	2
2C1.3	0.443	0.002	0.004	0.398	0.046	0.080	0.243	0.443	0.354	0.126					0.004	0.708	79.678	2
2C2																		
2C3											2.883	3.845	3.845	0.481				2
2C5a-e	78.094	3.462	0.006	10.200	4.000	22.479	3.644		1.478	13.679							1020.621	2
2D1																		
2F			0.094														941.557	1
3D3	0.000	0.000	0.000	0.000	0.000	0.000				0.000					0.000			2
6Cb	0.149	0.011	0.006	0.002	0.034	0.344	0.016		2.410	0.040					0.002	0.230		1
6Cd	0.000	0.000	0.000	0.000	0.000	0.000	0.000			0.001	0.000							1
6Ce										0.366					3.656			1

NFR Sector	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	Dioxins/ furans	BaP	BbF	BkF	I(1,2,3-cd)P	Total 4 PAHs	HCB	PCB	Default EF used
	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	g I-Teq	Mg	Mg	Mg	Mg	Mg	kg	kg	Tier
6D	0.000	0.000	0.000	0.000	0.000	0.000				0.000								2
Grand Total	109.277	4.892	1.099	14.476	24.200	30.627	46.170	2.227	76.196	81.021	16.675	21.042	12.252	8.179	37.754	2.724	2093.711	

Note that the value 0.000 equals <0.0005.

Table A 7. Heavy metals and POPs emissions 2010 reported in the 2012 Swedish submission to the CLRTAP

NFR Sector	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	Dioxins/ furans	BaP	BbF	BkF	I(1,2,3-cd)P	Total 4 PAHs	HCB	PCB
	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	g I-Teq	Mg	Mg	Mg	Mg	Mg	kg	kg
1.AA.1.A	2.880	0.165	0.126	0.216	0.671	1.729	5.179	0.440	66.821	17.845	0.238				0.703		
1.AA.1.B	0.021	0.001	0.000	0.002	0.001	0.008	0.326	0.002	0.017		0.000				0.001		
1.AA.1.C	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.017	0.004	0.000				0.000		
1.AA.2.A	0.059	0.002	0.001	0.005	0.004	0.021	0.887	0.006	0.047	0.012	0.000				0.001		
1.AA.2.B	0.004	0.000	0.000	0.000	0.000	0.002	0.060	0.000	0.003		0.000				0.000		
1.AA.2.C	0.038	0.002	0.001	0.003	0.005	0.018	0.289	0.005	0.448	0.120	0.002				0.008		
1.AA.2.D	0.862	0.055	0.016	0.041	0.175	0.566	3.685	0.130	23.726	5.423	0.051				0.155		
1.AA.2.E	0.039	0.002	0.001	0.003	0.007	0.022	0.269	0.005	0.643	0.153	0.001				0.005		
1.AA.2.F\ i	0.678	0.029	0.044	0.058	0.193	0.362	2.203	0.091	8.956	3.237	0.022				0.067		
1A2fii, 1A4bii, 1A4cii																	
1A3a																	
1A3b	3.910	0.003			0.002	48.823	0.004		29.883	0.590	0.029	0.032	0.014	0.023	0.098		
1A3c																	
1A3dii, 1A4ciii	0.037	0.002	0.000	0.136	0.197	0.466	5.421	0.003	0.309	0.006	0.001	0.002	0.001	0.002	0.007	0.031	0.126
1.AA.4.A\ i	0.041	0.007	0.001	0.002	0.008	0.018	0.008	0.005	0.868	0.151	0.173				0.541		
1.AA.4.B\ i	0.909	0.180	0.030	0.027	0.182	0.312	0.157	0.132	23.759	4.156	3.533				11.532		
1.AA.4.C\ i	0.137	0.025	0.005	0.005	0.027	0.051	0.088	0.019	3.267	0.570	0.651				2.038		
1A5b	0.002																
1.B.1.b											0.548	0.322	0.168	0.094	1.132		

NFR Sector	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	Dioxins/ furans	BaP	BbF	BkF	I(1,2,3-cd)P	Total 4 PAHs	HCB	PCB
	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	g I-Teq	Mg	Mg	Mg	Mg	Mg	kg	kg
1.B.2.a.iv										0.236	0.001				0.001		
2A7a	0.003	0.000	0.000	0.008		0.004	0.002		0.007								
2A7d	0.030	0.005	0.001	0.001	0.004	0.000	0.005		0.011								
2B5a			0.024							0.010							
2C1.1	0.309	0.010	0.067	0.004	1.232	0.174	0.471		7.515	1.780							
2C1.2	0.247	0.005	0.006	0.012	0.105	0.042	0.161		3.031	0.027							
2C1.3	0.003	0.000	0.000	0.001	0.108	0.011	0.384		0.040	0.800							
2C2	0.009				2.000		0.009		0.590								
2C3																	
2C5a-e	2.571	0.028	0.029	0.272		0.801			9.385	0.570							
2D1	0.214	0.046	0.017	0.102	0.108	0.226	0.250		0.428	0.500					0.018		
2F																	
3D3	0.000	0.000	0.000	0.000	0.000	0.000				0.000					0.000		
6Cb	0.002	0.001	0.002	0.001	0.003	0.003	0.014			0.004							
6Cd			0.114							0.628	0.000				0.000		
6Ce											0.013	0.008	0.004	0.005	0.029		
6D			0.001							0.234	0.000	0.000		0.000	0.001		
Grand Total	13.007	0.568	0.487	0.900	5.034	53.660	19.872	0.840	179.773	37.053	5.264	0.364	0.187	0.125	16.336	0.031	0.126

Note that the value 0.000 equals <0.0005.

Table A 8. Differences between emissions estimated using default Guidebook EFs and emissions reported to the CLRTAP 2010.

NFR Sector	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	Dioxins/ furans	BaP	BbF	BkF	I(1,2,3-cd)P	Total 4 PAHs	HCB	PCB
	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	g I-Teq	Mg	Mg	Mg	Mg	Mg	kg	kg
1.AA.1.A	0.552	0.184	0.177	1.542	0.894	1.429	1.369	0.881	-38.907	-10.455	-0.080	0.006	0.003	0.052	-0.703	0.854	10.501
1.AA.1.B	0.049	0.026	0.003	0.017	0.120	0.090	1.687	-0.002	0.087	0.005	0.000	0.000	0.000	0.000	-0.001		
1.AA.1.C	0.001	0.002	0.001	0.001	0.003	0.002	0.004	0.000	0.046	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
1.AA.2.A	0.133	0.004	0.002	0.007	0.143	0.063	1.998	-0.006	0.137	0.131	0.062	0.075	0.047	0.026	-0.001	0.000	0.018
1.AA.2.B	0.013	0.000	0.000	0.001	0.013	0.006	0.210	0.000	0.009	0.011	0.005	0.006	0.004	0.002	0.000		
1.AA.2.C	0.365	0.009	0.004	0.021	0.282	0.147	5.274	-0.004	-0.042	0.586	0.179	0.233	0.122	0.081	-0.008	0.008	0.116
1.AA.2.D	0.837	0.051	0.027	0.056	0.417	-0.178	1.032	-0.102	-17.205	12.939	2.534	3.735	1.379	1.284	-0.155	0.334	3.383
1.AA.2.E	0.061	0.004	0.002	0.003	0.050	0.012	0.627	-0.004	-0.393	0.334	0.079	0.111	0.046	0.038	-0.005	0.008	0.094
1.AA.2.F\ i	1.133	0.040	0.291	0.076	0.343	0.121	2.833	-0.009	-4.504	3.910	1.122	1.593	0.622	0.537	-0.067	0.133	2.104
1A2fii, 1A4bii, 1A4cii		0.011			0.057	1.936	0.080	0.011	1.139		0.036	0.055					
1A3a																	
1A3b	-3.763	-0.003			-0.002	-48.823	-0.004		-29.883	-0.590	0.021	0.068	0.066	0.042	-0.098		
1A3c		0.000			0.001	0.035	0.001	0.000	0.021		0.001	0.001					
1A3dii, 1A4ciii	0.006	0.002	0.006	-0.025	-0.079	-0.171	-0.292	0.041	0.014	0.082	-0.001	-0.002	-0.001	-0.002	-0.007	0.000	0.006
1.AA.4.A\ i	0.131	0.001	0.002	0.008	0.100	0.045	1.859	-0.004	-0.511	0.631	-0.039	0.184	0.079	0.064	-0.541	0.013	0.129
1.AA.4.B\ i	1.401	-0.070	0.002	0.068	0.224	0.239	2.678	-0.102	-14.164	23.579	4.596	10.259	5.535	5.019	-11.532	0.356	3.562
1.AA.4.C\ i	0.145	-0.009	0.002	0.011	0.090	0.022	1.223	-0.015	-2.292	2.135	-0.262	0.559	0.210	0.193	-2.038	0.049	0.488
1A5b	-0.002																
1.B.1.b	1.341	0.034	0.022	0.112			0.335				0.291	-0.042	0.112	0.241	-0.126		

NFR Sector	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	Dioxins/ furans	BaP	BbF	BkF	I(1,2,3-cd)P	Total 4 PAHs	HCB	PCB
	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	g I-Teq	Mg	Mg	Mg	Mg	Mg	kg	kg
1.B.2.a.iv	0.454	0.089	0.099	0.020		0.199	0.866		0.170	-0.236	-0.001	0.000	0.000	0.000	0.193		
2A7a	-0.003	0.000	0.000	-0.008		-0.004	-0.002		-0.007								
2A7d	0.480	0.029	0.041	0.072	0.050	0.002	0.395	0.249	0.084								
2B5a			-0.024							-0.010							
2C1.1	3.635	0.294	0.009	0.019	-1.081	-0.144	0.591		-2.054	-0.566					24.272		12.136
2C1.2	13.415	0.224	0.000	1.354	15.678	0.078	0.283	0.010	10.880	0.007					8.619		19.189
2C1.3	0.440	0.002	0.004	0.397	-0.062	0.069	-0.140	0.443	0.315	-0.674					0.004	0.708	79.678
2C2	-0.009				-2.000		-0.009		-0.590								
2C3											2.883	3.845	3.845	0.481			
2C5a-e	75.522	3.434	-0.023	9.928	4.000	21.678	3.644		-7.907	13.109							1020.621
2D1	-0.214	-0.046	-0.017	-0.102	-0.108	-0.226	-0.250		-0.428	-0.500					-0.018		
2F			0.094														941.557
3D3	0.000																
6Cb	0.147	0.010	0.004	0.001	0.031	0.341	0.002		2.410	0.037					0.002	0.230	
6Cd	0.000	0.000	-0.114	0.000	0.000	0.000	0.000			-0.627	0.000				0.000		
6Ce										0.366	-0.013	-0.008	-0.004	-0.005	3.627		
6D	0.000	0.000	-0.001	0.000	0.000	0.000				-0.234	0.000	0.000		0.000	-0.001		
Grand Total	96.270	4.323	0.612	13.577	19.166	-23.033	26.298	1.387	-103.577	43.968	11.411	20.678	12.065	8.054	21.418	2.694	2093.585

Note that the value 0.000 equals <0.0005.

Table A 9. Differences (per cent) between emissions estimated using default Guidebook EFs and emissions reported to the CLRTAP, in relation to national totals reported the CLRTAP 2010.

NFR Sector	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	Dioxins/ furans	BaP	BbF	BkF	I(1,2,3-cd)P	Total 4 PAHs	HCB	PCB
1.AA.1.A	4%	32%	36%	171%	18%	3%	7%	105%	-22%	-28%	-2%	2%	2%	42%	-4%	2797%	8320%
1.AA.1.B	0%	5%	1%	2%	2%	0%	8%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1.AA.1.C	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	2%
1.AA.2.A	1%	1%	0%	1%	3%	0%	10%	-1%	0%	0%	1%	21%	25%	21%	0%	0%	14%
1.AA.2.B	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	2%	2%	2%	0%	0%	0%
1.AA.2.C	3%	2%	1%	2%	6%	0%	27%	0%	0%	2%	3%	64%	65%	65%	0%	27%	92%
1.AA.2.D	6%	9%	5%	6%	8%	0%	5%	-12%	-10%	35%	48%	1026%	738%	1026%	-1%	1093%	2680%
1.AA.2.E	0%	1%	0%	0%	1%	0%	3%	0%	0%	1%	1%	31%	25%	31%	0%	26%	74%
1.AA.2.F\ i	9%	7%	60%	8%	7%	0%	14%	-1%	-3%	11%	21%	438%	333%	429%	0%	435%	1667%
1A2fii, 1A4bii, 1A4cii	0%	2%	0%	0%	1%	4%	0%	1%	1%	0%	1%	15%	0%	0%	0%	0%	0%
1A3a	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1A3b	-29%	0%	0%	0%	0%	-91%	0%	0%	-17%	-2%	0%	19%	36%	34%	-1%	0%	0%
1A3c	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1A3dii, 1A4ciii	0%	0%	1%	-3%	-2%	0%	-1%	5%	0%	0%	0%	-1%	-1%	-2%	0%	1%	5%
1.AA.4.A\ i	1%	0%	0%	1%	2%	0%	9%	-1%	0%	2%	-1%	51%	42%	51%	-3%	42%	102%
1.AA.4.B\ i	11%	-12%	0%	8%	4%	0%	13%	-12%	-8%	64%	87%	2818%	2964%	4011%	-71%	1166%	2822%
1.AA.4.C\ i	1%	-2%	0%	1%	2%	0%	6%	-2%	-1%	6%	-5%	154%	113%	154%	-12%	160%	387%
1A5b	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1.B.1.b	10%	6%	5%	12%	0%	0%	2%	0%	0%	0%	6%	-12%	60%	193%	-1%	0%	0%

NFR Sector	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	Dioxins/ furans	BaP	BbF	BkF	I(1,2,3-cd)P	Total 4 PAHs	HCB	PCB
1.B.2.a.iv	3%	16%	20%	2%	0%	0%	4%	0%	0%	-1%	0%	0%	0%	0%	1%	0%	0%
2A7a	0%	0%	0%	-1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2A7d	4%	5%	8%	8%	1%	0%	2%	30%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2B5a	0%	0%	-5%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2C1.1	28%	52%	2%	2%	-21%	0%	3%	0%	-1%	-2%	0%	0%	0%	0%	149%	0%	9615%
2C1.2	103%	39%	0%	150%	311%	0%	1%	1%	6%	0%	0%	0%	0%	0%	53%	0%	15202%
2C1.3	3%	0%	1%	44%	-1%	0%	-1%	53%	0%	-2%	0%	0%	0%	0%	0%	2319%	63127%
2C2	0%	0%	0%	0%	-40%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2C3	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	55%	1056%	2059%	384%	0%	0%	0%
2C5a-e	581%	604%	-5%	1104%	79%	40%	18%	0%	-4%	35%	0%	0%	0%	0%	0%	0%	808604%
2D1	-2%	-8%	-3%	-11%	-2%	0%	-1%	0%	0%	-1%	0%	0%	0%	0%	0%	0%	0%
2F	0%	0%	19%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	745965%
3D3	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
6Cb	1%	2%	1%	0%	1%	1%	0%	0%	1%	0%	0%	0%	0%	0%	0%	751%	0%
6Cd	0%	0%	-23%	0%	0%	0%	0%	0%	0%	-2%	0%	0%	0%	0%	0%	0%	0%
6Ce	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	-2%	-2%	-4%	22%	0%	0%
6D	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	0%	0%	0%	0%	0%	0%	0%
Grand Total	740%	761%	126%	1509%	381%	-43%	132%	165%	-58%	119%	217%	5681%	6462%	6437%	131%	8818%	1658678%

Table A 10. Indicators (X) where emissions are lacking in the reporting to the CLRTAP but national activity data and default Guidebook emission factors are available for 2010.

NFR Sector	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	Dioxins/ furans	BaP	BbF	BkF	I(1,2,3-cd)P	Total 4 PAHs	HCB	PCB
1.AA.1.A												X	X	X		X	X
1.AA.1.B										X		X	X	X			
1.AA.1.C												X	X	X		X	X
1.AA.2.A												X	X	X		X	X
1.AA.2.B										X		X	X	X			
1.AA.2.C												X	X	X		X	X
1.AA.2.D												X	X	X		X	X
1.AA.2.E												X	X	X		X	X
1.AA.2.F\ i												X	X	X		X	X
1A2fii, 1A4bii, 1A4cii		X			X	X	X	X	X		X	X					
1A3a																	
1A3b																	
1A3c		X			X	X	X	X	X		X	X					
1A3dii, 1A4ciii																	
1.AA.4.A\ i												X	X	X		X	X
1.AA.4.B\ i												X	X	X		X	X
1.AA.4.C\ i												X	X	X		X	X
1A5b																	
1.B.1.b	X	X	X	X			X										

NFR Sector	Pb	Cd	Hg	As	Cr	Cu	Ni	Se	Zn	Dioxins/ furans	BaP	BbF	BkF	I(1,2,3-cd)P	Total 4 PAHs	HCB	PCB
1.B.2.a.iv	X	X	X	X		X	X		X			X	X	X			
2A7a																	
2A7d								X									
2B5a																	
2C1.1															X		X
2C1.2								X							X		X
2C1.3								X							X	X	X
2C2																	
2C3											X	X	X	X			
2C5a-e					X		X										X
2D1																	
2F			X														X
3D3																	
6Cb									X						X	X	
6Cd	X	X		X	X	X	X										
6Ce										X							
6D	X	X		X	X	X											

Table A 11. Pb, Cd, Hg and As stationary combustion emission factors for 2010 from the 2012 submission to CLRTAP and default emission factors from Guidebook (incl. lower and upper 95% confidence interval).

NFR Sector	Fuel/ technology	Pb (mg/GJ)				Cd (mg/GJ)				Hg (mg/GJ)				As (mg/GJ)				Default EF
		EF	Guidebook 2009			EF	Guidebook 2009			EF	Guidebook 2009			EF	Guidebook 2009			
		Sub 2012	Default EF	Lower	Upper	Sub 2012	Default EF	Lower	Upper	Sub 2012	Default EF	Lower	Upper	Sub 2012	Default EF	Lower	Upper	Tier
1A1a	other biomass	13	21	12	29	1	1.8	1.1	2.5	0.3	1.5	0.9	2.1	0.4	9.5	5.7	13.2	1
1A1a	tall oil													0.4	9.5	5.7	13.2	1
1A1a	wood	13	21	12	29	1	1.8	1.1	2.5	0.3	1.5	0.9	2.1	0.4	9.5	5.7	13.2	1
1A1c	wood	13	21	12	29	1	1.8	1.1	2.5	0.3	1.5	0.9	2.1	0.4	9.5	5.7	13.2	1
1A2	ethanol	13	24.8	5	30	1	1.8	0.1	3	0.3	0.7	0.4	1.5	0.4	1.4	0.25	2	1
1A2	other biomass	13	24.8	5	30	1	1.8	0.1	3	0.3	0.7	0.4	1.5	0.4	1.4	0.25	2	1
1A2	tall oil													0.4	1.4	0.25	2	1
1A2	wood	13	24.8	5	30	1	1.8	0.1	3	0.3	0.7	0.4	1.5	0.4	1.4	0.25	2	1
1A4a,c i	wood	15	24.8	5	30	3	1.8	0.1	3	0.5	0.7	0.4	1.5	0.4	1.4	0.25	2	1
1A1a	peat	40	18	11	25	1	2.1	1.3	3	2	3.5	2.1	4.9	6	17	10	24	1
1A1a	blast furnace gas									3	0.1	0.04	0.4	3	0.09	0.03	0.3	1
1A1a	coke oven gas									3	0.1	0.04	0.4	3	0.09	0.03	0.3	1
1A1c	blast furnace gas									3	0.1	0.04	0.4	3	0.09	0.03	0.3	1
1A1c	coke oven gas									3	0.1	0.04	0.4	3	0.09	0.03	0.3	1
1A2	coke	24	134	50	300	0.5	1.8	0.2	5	3	7.9	5	10	3	4	0.2	8	1
1A2	hard coal	24	134	50	300	0.5	1.8	0.2	5	3	7.9	5	10	3	4	0.2	8	1

NFR Sector	Fuel/ technology	Pb (mg/GJ)				Cd (mg/GJ)				Hg (mg/GJ)				As (mg/GJ)				Default EF
		EF	Guidebook 2009			EF	Guidebook 2009			EF	Guidebook 2009			EF	Guidebook 2009			
		Sub 2012	Default EF	Lower	Upper	Sub 2012	Default EF	Lower	Upper	Sub 2012	Default EF	Lower	Upper	Sub 2012	Default EF	Lower	Upper	Tier
1A2	peat	40	134	50	300	1	1.8	0.2	5	2	7.9	5	10	6	4	0.2	8	1
1A1a	hard coal	24	8.1	4.9	11.4	0.5	1	0.6	1.4	3	1.6	1	2.3	3	8	4.8	11	1
1A	diesel oil	2.4	16	10	20	0.2	0.3	0.15	0.45	0.1	0.1	0.05	0.15	0.4	1	0.5	1.5	1
1A	domestic heating oil	2.4	16	10	20	0.2	0.3	0.15	0.45	0.1	0.1	0.05	0.15	0.4	1	0.5	1.5	1
1A	heavy fuel oils	15	16	10	20	0.4	0.3	0.15	0.45	0.06	0.1	0.05	0.15	1.2	1	0.5	1.5	1
1A	petroleum coke	24	16	10	20	0.5	0.3	0.15	0.45	3	0.1	0.05	0.15	3	1	0.5	1.5	1
1A	refinery oil	15	16	10	20	0.4	0.3	0.15	0.45	0.06	0.1	0.05	0.15	1.2	1	0.5	1.5	1
1A1a	heavy fuel oils	15	4.9	2.4	10	0.4	1.3	0.6	3	0.06	0.4	0.2	1	1.2	4.3	2.1	8.5	1
1A4a,c i	domestic heating oil	2.4	16	10	20	0.2	0.3	0.15	0.45	0.1	0.1	0.05	0.15	0.4	1	0.5	1.5	1
1A4a,c i	heavy fuel oils	15	16	10	20	0.4	0.3	0.15	0.45	0.06	0.1	0.05	0.15	1.2	1	0.5	1.5	1
1A4b i	domestic heating oil	2.4	20	5	24	0.2	2	0.3	2.4	0.1	0.03	0.024	0.036	0.4	1	0.5	1.2	1
1A4b i	heavy fuel oils	15	20	5	24	0.4	2	0.3	2.4	0.06	0.03	0.024	0.036	1.2	1	0.5	1.2	1
1A2	blast furnace gas									3	0.2	0.1	0.7	3	0.09	0.03	0.3	1
1A2	coke oven gas									3	0.2	0.1	0.7	3	0.09	0.03	0.3	1
1A1a	diesel oil	2.4	4.1	0.4	40	0.2	1.4	0.1	15	0.1	1.4	0.1	15	0.4	1.8	0.2	20	1

NFR Sector	Fuel/ technology	Pb (mg/GJ)				Cd (mg/GJ)				Hg (mg/GJ)				As (mg/GJ)				Default EF
		EF	Guidebook 2009			EF	Guidebook 2009			EF	Guidebook 2009			EF	Guidebook 2009			
		Sub 2012	Default EF	Lower	Upper	Sub 2012	Default EF	Lower	Upper	Sub 2012	Default EF	Lower	Upper	Sub 2012	Default EF	Lower	Upper	Tier
1A1a	domestic heating oil	2.4	4.1	0.4	40	0.2	1.4	0.1	15	0.1	1.4	0.1	15	0.4	1.8	0.2	20	1
1A1a	kerosene	2.4	4.1	0.4	40	0.2	1.4	0.1	15	0.1	1.4	0.1	15	0.4	1.8	0.2	20	1
1A1c	domestic heating oil	2.4	4.1	0.4	40	0.2	1.4	0.1	15	0.1	1.4	0.1	15	0.4	1.8	0.2	20	1
1A1b	diesel oil	2.4	4.6	0.9	23	0.2	1.2	0.2	6	0.1	0.11	0.02	0.57	0.4	4	0.8	20	1
1A1b	domestic heating oil	2.4	4.6	0.9	23	0.2	1.2	0.2	6	0.1	0.11	0.02	0.57	0.4	4	0.8	20	1
1A1b	refinery oil	15	4.6	0.9	23	0.4	1.2	0.2	6	0.06	0.11	0.02	0.57	1.2	4	0.8	20	1
1A4b i	wood/small boiler	15	40	24	56	3	2	0.6	2.5	0.5	0.6	0.24	1	0.4	2	0.3	2.5	2
1A4b i	wood/stoves	15	20	10	60	3	0.5	0.1	2.5	0.5	0.4	0.2	0.6	0.4	0.5	0.3	2.5	2
1A4b i	pellet/pellet stoves	15	40	24	56	3	1	0.6	2.5	0.5	0.4	0.24	0.56	0.4	0.5	0.3	2.5	2

Table A 12. Cr, Cu, Ni and Se stationary combustion emission factors for 2010 from the 2012 submission to CLRTAP and default emission factors from Guidebook (incl. lower and upper 95% confidence interval).

NFR Sector	Fuel/ technology	Cr (mg/GJ)				Cu (mg/GJ)				Ni (mg/GJ)				Se (mg/GJ)				Default EF
		EF	Guidebook 2009			EF	Guidebook 2009			EF	Guidebook 2009			EF	Guidebook 2009			
		Sub 2012	Default EF	Lower	Upper	Sub 2012	Default EF	Lower	Upper	Sub 2012	Default EF	Lower	Upper	Sub 2012	Default EF	Lower	Upper	Tier
1A1a	other biomass	3.3	9	5.4	12.6	10	21	13	29	4.5	14	8.5	20	2.2	1.2	0.7	1.7	1
1A1a	tall oil									0.8	14	8.5	20					1
1A1a	wood	3.3	9	5.4	12.6	10	21	13	29	4.5	14	8.5	20	2.2	1.2	0.7	1.7	1
1A1c	wood	3.3	9	5.4	12.6	10	21	13	29	4.5	14	8.5	20	2.2	1.2	0.7	1.7	1
1A2	ethanol	3.3	6.5	1	10	10	4.6	1	5	4.5	2	0.1	300	2.2	0.5	0.1	2	1
1A2	other biomass	3.3	6.5	1	10	10	4.6	1	5	4.5	2	0.1	300	2.2	0.5	0.1	2	1
1A2	tall oil									0.8	2	0.1	300					1
1A2	wood	3.3	6.5	1	10	10	4.6	1	5	4.5	2	0.1	300	2.2	0.5	0.1	2	1
1A4a,c i	wood	3	6.5	1	10	5	4.6	1	5	2.5	2	0.1	300	2.2	0.5	0.1	2	1
1A1a	peat	6	11	6.6	15	10	0.3	0.1	0.8	50	12	7.1	16	5.6	55	33	76	1
1A1a	blast furnace gas																	
1A1a	coke oven gas																	
1A1c	blast furnace gas																	
1A1c	coke oven gas																	
1A2	coke	10	13.5	0.5	20	10	17.5	5	50	8	13	0.5	30	3	1.8	0.2	3	1
1A2	hard coal	10	13.5	0.5	20	10	17.5	5	50	8	13	0.5	30	3	1.8	0.2	3	1

NFR Sector	Fuel/ technology	Cr (mg/GJ)				Cu (mg/GJ)				Ni (mg/GJ)				Se (mg/GJ)				Default EF
		EF	Guidebook 2009			EF	Guidebook 2009			EF	Guidebook 2009			EF	Guidebook 2009			
		Sub 2012	Default EF	Lower	Upper	Sub 2012	Default EF	Lower	Upper	Sub 2012	Default EF	Lower	Upper	Sub 2012	Default EF	Lower	Upper	Tier
1A2	peat	6	13.5	0.5	20	10	17.5	5	50	50	13	0.5	30	5.6	1.8	0.2	3	1
1A1a	hard coal	10	5	3	7.1	10	4.8	0.2	16	8	5.4	3.3	7.6	3	25	15	35	1
1A	diesel oil	0.5	12.8	2	20	2	7.2	3	10	0.8	260	200	300					1
1A	domestic heating oil	0.5	12.8	2	20	2	7.2	3	10	0.8	260	200	300					1
1A	heavy fuel oils	0.7	12.8	2	20	5	7.2	3	10	240	260	200	300					1
1A	petroleum coke	10	12.8	2	20	10	7.2	3	10	8	260	200	300					1
1A	refinery oil	0.7	12.8	2	20	5	7.2	3	10	240	260	200	300					1
1A1a	heavy fuel oils	0.7	2.7	1.4	5.5	5	5.7	2.8	11	240	273	140	550	1.5	2.2	1.1	4.4	1
1A4a,c i	domestic heating oil	0.5	12.8	2	20	2	7.2	3	10	0.8	260	200	300					1
1A4a,c i	heavy fuel oils	0.7	12.8	2	20	5	7.2	3	10	240	260	200	300					1
1A4b i	domestic heating oil	0.5	20	5	24	2	10	3	12	0.8	300	100	350					1
1A4b i	heavy fuel oils	0.7	20	5	24	5	10	3	12	240	300	100	350					1
1A2	blast furnace gas																	
1A2	coke oven gas																	
1A1a	diesel oil	0.5	1.4	0.1	15	2	2.7	0.3	30	0.8	1.4	0.1	15	0.1624	6.8	0.7	70	1

NFR Sector	Fuel/ technology	Cr (mg/GJ)				Cu (mg/GJ)				Ni (mg/GJ)				Se (mg/GJ)				Default EF
		EF	Guidebook 2009			EF	Guidebook 2009			EF	Guidebook 2009			EF	Guidebook 2009			
		Sub 2012	Default EF	Lower	Upper	Sub 2012	Default EF	Lower	Upper	Sub 2012	Default EF	Lower	Upper	Sub 2012	Default EF	Lower	Upper	Tier
1A1a	domestic heating oil	0.5	1.4	0.1	15	2	2.7	0.3	30	0.8	1.4	0.1	15	0.1624	6.8	0.7	70	1
1A1a	kerosene	0.5	1.4	0.1	15	2	2.7	0.3	30	0.8	1.4	0.1	15	0.1624	6.8	0.7	70	1
1A1c	domestic heating oil	0.5	1.4	0.1	15	2	2.7	0.3	30	0.8	1.4	0.1	15	0.1624	6.8	0.7	70	1
1A1b	diesel oil	0.5	15	3	74	2	12	2.4	60	0.8	1030	206	5150					1
1A1b	domestic heating oil	0.5	15	3	74	2	12	2.4	60	0.8	1030	206	5150					1
1A1b	refinery oil	0.7	15	3	74	5	12	2.4	60	240	1030	206	5150					1
1A4b i	wood/small boiler	3	5	1.2	6	5	10	4.8	11.2	2.5	10	1.2	15	2.2	0.5	0.3	0.7	2
1A4b i	wood/stoves	3	3	1	10	5	1	0.5	11.2	2.5	2	1	200	2.2	0.5	0.25	0.75	2
1A4b i	pellet/pellet stoves	3	2	1.2	2.8	5	8	4.8	11.2	2.5	2	1.2	2.8	2.2	0.5	0.3	0.7	2

Table A 13. Zn, Dioxine (PCDD/PCDF) and Benzo(a)pyrene stationary combustion emission factors for 2010 from the 2012 submission to CLRTAP and default emission factors from Guidebook (incl. lower and upper 95% confidence interval).

NFR Sector	Fuel/ technology	Zn (mg/GJ)				Dioxins/furans (ŋg I-Teq/GJ)				Benzo(a)pyrene (µg/GJ)				Default EF
		EF Sub 2012	Guidebook 2009 Default EF	Lower	Upper	EF Sub 2012	Guidebook 2009 Default EF	Lower	Upper	EF Sub 2012	Guidebook 2009 Default EF	Lower	Upper	Tier
1A1a	other biomass	480	181	108	253	110	50	25	75	1	1.12	0.67	1.57	1
1A1a	tall oil	0.8	181	108	253					0.25	1.12	0.67	1.57	1
1A1a	wood	480	181	108	253	110	50	25	75	1	1.12	0.67	1.57	1
1A1c	wood	480	181	108	253	110	50	25	75	1	1.12	0.67	1.57	1
1A2	ethanol	480	113.6	1	150	110	326	30	500	1	44.6	10	100	1
1A2	other biomass	480	113.6	1	150	110	326	30	500	1	44.6	10	100	1
1A2	tall oil	0.8	113.6	1	150					0.25	44.6	10	100	1
1A2	wood	480	113.6	1	150	110	326	30	500	1	44.6	10	100	1
1A4a,c i	wood	400	114	1	150	70	326	30	500	80	44.6	10	100	1
1A1a	peat	30	4.5	0.5	17	110	10	5	15	7	1.6	0.5	4.8	1
1A1a	blast furnace gas													
1A1a	coke oven gas													
1A1c	blast furnace gas													
1A1c	coke oven gas													1
1A2	coke	10	200	50	500	100	203	40	500	0.25	45.5	10	150	1
1A2	hard coal	10	200	50	500	100	203	40	500	0.25	45.5	10	150	1

NFR Sector	Fuel/ technology	Zn (mg/GJ)				Dioxins/furans (ng I-Teq/GJ)				Benzo(a)pyrene (µg/GJ)				Default EF
		EF	Guidebook 2009			EF	Guidebook 2009			EF	Guidebook 2009			
		Sub 2012	Default EF	Lower	Upper	Sub 2012	Default EF	Lower	Upper	Sub 2012	Default EF	Lower	Upper	Tier
1A2	peat	30	200	50	500	110	203	40	500	7	45.5	10	150	1
1A1a	hard coal	10	19	0.39	155	100	10	5	15	0.25	0.7	0.3	2.2	1
1A	diesel oil	1.6	8	5	10					0.03	5.2	1	8	1
1A	domestic heating oil	1.6	8	5	10					0.03	5.2	1	8	1
1A	heavy fuel oils	12	8	5	10					0.015	5.2	1	8	1
1A	petroleum coke	10	8	5	10	100	10	5	15	0.25	5.2	1	8	1
1A	refinery oil	12	8	5	10					0.015	5.2	1	8	1
1A1a	heavy fuel oils	12	94	47	190									1
1A4a,c i	domestic heating oil	1.6	8	5	10					0.03	5.2	1	8	1
1A4a,c i	heavy fuel oils	12	8	5	10					0.015	5.2	1	8	1
1A4b i	domestic heating oil	1.6	10	5	12					0.03	10	5	60	1
1A4b i	heavy fuel oils	12	10	5	12					0.015	10	5	60	1
1A2	blast furnace gas													
1A2	coke oven gas													
1A1a	diesel oil	1.6	1.8	0.2	20									1

NFR Sector	Fuel/ technology	Zn (mg/GJ)				Dioxins/furans (ηg I-Teq/GJ)				Benzo(a)pyrene (µg/GJ)				Default EF
		EF	Guidebook 2009			EF	Guidebook 2009			EF	Guidebook 2009			
		Sub 2012	Default EF	Lower	Upper	Sub 2012	Default EF	Lower	Upper	Sub 2012	Default EF	Lower	Upper	Tier
1A1a	domestic heating oil	1.6	1.8	0.2	20									1
1A1a	kerosene	1.6	1.8	0.2	20									1
1A1c	domestic heating oil	1.6	1.8	0.2	20									1
1A1b	diesel oil	1.6	49	10	247									1
1A1b	domestic heating oil	1.6	49	10	247									1
1A1b	refinery oil	12	49	10	247									1
1A4b i	wood/small boiler	400	200	60	250	70	500	400	1000	80	130	100	300	2
1A4b i	wood/stoves	400	80	60	250	70	50	30	500	1	50	12	100	2
1A4b i	pellet/pellet stoves	400	100	60	250	70	800	500	1000	50	250	150	300	2

Table A 14. Heavy metal and POPs *implied* emission factors (IEF) for all sectors except stationary combustion for 2010 from the 2012 submission to CLRTAP and default emission factors from Guidebook (incl. lower and upper 95% confidence interval).

Pollutant	NFR Sector	NFR Subsector	Fuel/ Technology/ Practice	IEF	Guidebook			Unit	Default EF Tier	Guidebook table	Guidebook reference
					Default Efs	Lower interval	Upper interval				
As	1A3dii, 1A4ciii	National navigation, national fishing	Bunker fuel oil	0.837	0.6562	NA	NA	g/m3 fuel	1	Table 3.1	Average Lloyd's Register, 1995 and Cooper Gustafsson, 2004
As	1A3dii, 1A4ciii	National navigation, national fishing	Marine diesel oil /marine gas oil	1.017	0.0336	NA	NA	g/m3 fuel	1	Table 3.2	Average Lloyd's Register, 1995 and Cooper Gustafsson, 2004
As	2A7d	Flat glass		0.003	0.08	0.01	0.18	g/Mg glass	2	Table 3.2	Rivet (personal communication, 2008)
As	2A7d	Container glass		0.005	0.37	0.02	2.3	g/Mg glass	2	Table 3.2	European Commission (2008)
As	2C1.1	Steel production	Electric furnace steel plant	0.003	0.015	0.007	0.02	g/Mg steel produced	2	Table 3.17	Theloke et al (2008)
As	2C1.2	Steel production	Basic oxygen furnace - LD	0.004	0.4	0.27	0.53	g/Mg steel produced	2	Table 3.15	Theloke et al (2008)
As	2C5a	Copper production	Primary production	1.425	51	35	70	g/Mg copper	2	Table 3.2	Theloke et al (2008)

Pollutant	NFR Sector	NFR Subsector	Fuel/ Technology/ Practice	IEF	Guidebook			Unit	Default EF Tier	Guidebook table	Guidebook reference
					Default Efs	Lower interval	Upper interval				
As	2C5a	Copper production	Primary production	1.425	1.4	0.57	2.1	g/Mg copper	2	Table 3.5	Theloke et al (2008)
As	2C5b	Lead production	Secondary production	4.754	3.5	2.2	5.1	g/Mg lead	2	Table 3.9	Theloke et al (2008)
As	2C5d	Zinc production	Secondary production	7.349	0.48	0.24	0.73	g/Mg zinc	2	Table 3.9	Theloke et al (2008)
As	3D3	Tobacco smoking		0.16	0.16	0.08	0.3	mg/ton tobac-co	2	Table 3.9	Finstad and Rypdal (2003)
As	6Cb	Industrial waste incineration		0.010	0.016	0.01	0.019	g/Mg waste	1	Table 3.1	Theloke et al (2008)
Benzo(a)pyrene	1.B.1.b	Solid fuel transfor-mation		0.49	0.75	0.3	2	g/Mg coke produced	1	Table 3.1	Berdoxski et al. (1995)
Benzo(a)pyrene	1.B.2.a.iv	Refining/storage		9.403	0.71	0.4	1.4	mg/Mg coke burned	2	Table 3.2	CONCAWE (2009)
Benzo(a)pyrene	1A3b	Moped&Motorcycle	Gasoline	0.001	0.0000063	0.00000645	0.00000615	kg/m3 fuel	1	Table 3.8-3.10	COPERT 4
Benzo(a)pyrene	6Cd	Cremation	Human bodies	0.1	0.0103	0.00103	0.103	µg/body	1	Table 3.1	Guidebook 2006
Benzo(b)fluoranthene	1.B.1.b	Solid fuel transfor-mation		0.288	0.25	0.1	1	g/Mg coke produced	1	Table 3.1	Berdoxski et al. (1995)
Benzo(b)fluoranthene	1A3b	Moped&Motorcycle	Gasoline	0.001	0.00000705	0.0000072	0.0000069	kg/m3 fuel	1	Table 3.8-	COPERT 4

Pollutant	NFR Sector	NFR Subsector	Fuel/ Technology/ Practice	IEF	Guidebook			Unit	Default EF Tier	Guidebook table	Guidebook reference
					Default Efs	Lower interval	Upper interval				
										3.10	
Benzo(k)flouranthene	1.B.1.b	Solid fuel transfor-mation		0.15	0.25	0.1	1	g/Mg coke produced	1	Table 3.1	Berdoxski et al. (1995)
Cd	1A3dii, 1A4ciii	National navigation, national fishing	Bunker fuel oil	0.015	0.0193	NA	NA	g/m3 fuel	1	Table 3.1	Average Lloyd's Register, 1995 and Cooper Gus-tafsson, 2004
Cd	1A3dii, 1A4ciii	National navigation, national fishing	Marine diesel oil /marine gas oil	0.019	0.0084	NA	NA	g/m3 fuel	1	Table 3.2	Average Lloyd's Register, 1995 and Cooper Gus-tafsson, 2004
Cd	2A7d	Flat glass		0.019	0.068	0.01	0.25	g/Mg glass	2	Table 3.2	Rivet (personal communication, 2008)
Cd	2A7d	Container glass		0.034	0.12	0.07	0.28	g/Mg glass	2	Table 3.2	European Com-mission (2008)
Cd	2C1.1	Steel production	Electric furnace steel plant	0.006	0.2	0.15	0.29	g/Mg steel produced	2	Table 3.17	Theloke et al (2008)
Cd	2C1.2	Steel production	Basic oxygen furnace - LD	0.001	0.067	0.053	0.08	g/Mg steel produced	2	Table 3.15	Theloke et al (2008)
Cd	2C1.3	Pellet production		0.004	0.1	0.02	0.4	mg/Mg pellet	2	Table 3.3	European Com-

Pollutant	NFR Sector	NFR Subsector	Fuel/ Technology/ Practice	IEF	Guidebook			Unit	Default EF Tier	Guidebook table	Guidebook reference
					Default Efs	Lower interval	Upper interval				
								produced			mission (2001)
Cd	2C5a	Copper production	Primary production	0.146	15	12	23	g/Mg copper	2	Table 3.2	Theloke et al (2008)
Cd	2C5a	Copper production	Primary production	0.146	2.3	1.1	4.6	g/Mg copper	2	Table 3.5	Theloke et al (2008)
Cd	2C5b	Lead production	Secondary production	0.487	1.1	0.73	2.9	g/Mg lead	2	Table 3.9	Theloke et al (2008)
Cd	2C5d	Zinc production	Secondary production	0.753	2.8	1.6	4.1	g/Mg zinc	2	Table 3.9	Theloke et al (2008)
Cd	3D3	Tobacco smoking		0.1	0.1	0.05	0.2	mg/ton tobac-co	2	Table 3.9	Finstad et al. (2001)
Cd	6Cb	Industrial waste incineration		0.009	0.1	0.048	0.15	g/Mg waste	1	Table 3.1	Theloke et al (2008)
Cr	1A3dii, 1A4ciii	National navigation, national fishing	Bunker fuel oil	1.215	0.6948	NA	NA	g/m3 fuel	1	Table 3.1	Average Lloyd's Register, 1995 and Cooper Gus-tafsson, 2004
Cr	1A3dii, 1A4ciii	National navigation, national fishing	Marine diesel oil /marine gas oil	1.476	0.042	NA	NA	g/m3 fuel	1	Table 3.2	Average Lloyd's Register, 1995 and Cooper Gus-tafsson, 2004

Pollutant	NFR Sector	NFR Subsector	Fuel/ Technology/ Practice	IEF	Guidebook			Unit	Default EF Tier	Guidebook table	Guidebook reference
					Default Efs	Lower interval	Upper interval				
Cr	2A7d	Flat glass		0.015	0.08	0.01	0.13	g/Mg glass	2	Table 3.2	Rivet (personal communication, 2008)
Cr	2A7d	Container glass		0.027	0.24	0.02	1	g/Mg glass	2	Table 3.2	European Commission (2008)
Cr	2C1.1	Steel production	Electric furnace steel plant	0.812	0.1	0.008	2.5	g/Mg steel produced	2	Table 3.17	European Commission (2001)
Cr	2C1.2	Pig iron production	Blast furnace charging	0.031	2.3	1.2	3.5	g/Mg pig iron produced	2	Table 3.8	Theloke et al (2008)
Cr	2C1.2	Steel production	Basic oxygen furnace - LD	0.031	2.3	1.5	3.1	g/Mg steel produced	2	Table 3.15	Theloke et al (2008)
Cr	2C1.3	Pellet production		4.884	2.1	1	4.4	mg/Mg pellet produced	2	Table 3.3	European Commission (2001)
Cr	3D3	Tobacco smoking		0.35	0.35	0.2	0.7	mg/ton tobacco	2	Table 3.9	Finstad and Rypdal (2003)
Cr	6Cb	Industrial waste incineration		0.030	0.3	0.03	3	g/Mg waste	1	Table 3.1	Guidebook 2006
Cu	1A3dii, 1A4ciii	National navigation, national fishing	Bunker fuel oil	2.869	1.20625	NA	NA	g/m3 fuel	1	Table 3.1	Average Lloyd's Register, 1995 and Cooper Gustafsson, 2004

Pollutant	NFR Sector	NFR Subsector	Fuel/ Technology/ Practice	IEF	Guidebook			Unit	Default EF Tier	Guidebook table	Guidebook reference
					Default Efs	Lower interval	Upper interval				
Cu	1A3dii, 1A4ciii	National navigation, national fishing	Marine diesel oil /marine gas oil	3.487	0.7392	NA	NA	g/m3 fuel	1	Table 3.2	Average Lloyd's Register, 1995 and Cooper Gustafsson, 2004
Cu	2A7d	Flat glass		0.001	0.007	0.001	0.011	g/Mg glass	2	Table 3.2	Rivet (personal communication, 2008)
Cu	2C1.1	Steel production	Electric furnace steel plant	0.115	0.02	0.001	0.46	g/Mg steel produced	2	Table 3.17	European Commission (2001)
Cu	2C1.2	Pig iron production	Blast furnace charging	0.012	0.015	0.0015	0.15	g/Mg pig iron produced	2	Table 3.8	Guidebook 2006
Cu	2C1.2	Steel production	Basic oxygen furnace - LD	0.012	0.02	0.01	0.04	g/Mg steel produced	2	Table 3.15	European Commission (2001)
Cu	2C1.3	Pellet production		0.482	3.6	1.7	7.5	mg/Mg pellet produced	2	Table 3.3	European Commission (2001)
Cu	2C5a	Copper production	Primary production	4.203	90	30	250	g/Mg copper	2	Table 3.2	European Commission (2001)
Cu	2C5a	Copper production	Primary production	4.203	28	8	100	g/Mg copper	2	Table 3.5	European Commission (2001)
Cu	3D3	Tobacco smoking		0.15	0.15	0.08	0.3	mg/ton tobacco	2	Table 3.9	Finstad and Rypdal (2003)

Pollutant	NFR Sector	NFR Subsector	Fuel/ Technology/ Practice	IEF	Guidebook			Unit	Default EF Tier	Guidebook table	Guidebook reference
					Default Efs	Lower interval	Upper interval				
Cu	6Cb	Industrial waste incineration		0.028	3	0.3	30	g/Mg waste	1	Table 3.1	Guidebook 2006
HCB	1A3dii, 1A4ciii	National navigation, national fishing	Bunker fuel oil	0.188	0.1351	NA	NA	mg/m3 fuel	1	Table 3.1	Cooper 2005
HCB	1A3dii, 1A4ciii	National navigation, national fishing	Marine diesel oil /marine gas oil	0.228	0.0672	NA	NA	mg/m3 fuel	1	Table 3.2	Cooper 2005
Hg	1A3dii, 1A4ciii	National navigation, national fishing	Bunker fuel oil	0.003	0.0193	NA	NA	g/m3 fuel	1	Table 3.1	Average Lloyd's Register, 1995 and Cooper Gus-tafsson, 2004
Hg	1A3dii, 1A4ciii	National navigation, national fishing	Marine diesel oil /marine gas oil	0.004	0.0252	NA	NA	g/m3 fuel	1	Table 3.2	Average Lloyd's Register, 1995 and Cooper Gus-tafsson, 2004
Hg	2A7d	Flat glass		0.002	0.003	0.001	0.039	g/Mg glass	2	Table 3.2	Rivet (personal communication, 2008)
Hg	2A7d	Container glass		0.004	0.29	0.01	1.1	g/Mg glass	2	Table 3.2	European Com-mission (2008)
Hg	2C1.1	Steel production	Electric furnace steel	0.044	0.05	0.038	0.057	g/Mg steel produced	2	Table 3.17	Theloke et al (2008)

Pollutant	NFR Sector	NFR Subsector	Fuel/ Technology/ Practice	IEF	Guidebook			Unit	Default EF Tier	Guidebook table	Guidebook reference
					Default Efs	Lower interval	Upper interval				
			plant								
Hg	2C1.2	Pig iron production	Blast furnace charging	0.002	0.0001	0.00007	0.0002	g/Mg pig iron produced	2	Table 3.8	Theloke et al (2008)
Hg	2C1.2	Steel production	Basic oxygen furnace - LD	0.002	0.0014	0.0007	0.0021	g/Mg steel produced	2	Table 3.15	Theloke et al (2008)
Hg	2C1.3	Pellet production		0.008	0.2	0.1	0.4	mg/Mg pellet produced	2	Table 3.3	European Commission (2001)
Hg	2C5a	Copper production	Primary production	0.152	0.031	0.021	0.052	g/Mg copper	2	Table 3.2	Theloke et al (2008)
Hg	2C5d	Zinc production	Secondary production	0.785	0.0065	0.0032	0.0097	g/Mg zinc	2	Table 3.9	Theloke et al (2008)
Hg	3D3	Tobacco smoking		0.1	0.1	0.05	0.2	mg/ton tobacco	2	Table 3.9	Finstad et al. (2001)
Hg	6Cb	Industrial waste incineration		0.017	0.056	0.04	0.08	g/Mg waste	1	Table 3.1	European Commission (2006)
Hg	6Cd	Cremation	Human bodies	1640.811	0.934	0.00934	93.4	mg/body	1	Table 3.1	Guidebook 2006
Hg	6D	Other waste	Apartment building fire	7693.686	0.26	0.1	0.5	mg/fire	2	Table 3.6	Aasestad (2007)
Indeno(1,2,3-cd)pyrene	1.B.1.b	Solid fuel transformation		0.0843	0.3	0.1	1	g/Mg coke produced	1	Table 3.1	Berdoxski et al. (1995)

Pollutant	NFR Sector	NFR Subsector	Fuel/ Technology/ Practice	IEF	Guidebook			Unit	Default EF Tier	Guidebook table	Guidebook reference
					Default Efs	Lower interval	Upper interval				
Indeno(1,2,3-cd)pyrene	1A3b	Moped&Motorcycle	Gasoline	0.001	0.00000765	0.0000078	0.0000075	kg/m3 fuel	1	Table 3.8-3.10	COPERT 4
Ni	1A3dii, 1A4ciii	National navigation, national fishing	Bunker fuel oil	33.365	30.88	NA	NA	g/m3 fuel	1	Table 3.1	Average Lloyd's Register, 1995 and Cooper Gustafsson, 2004
Ni	1A3dii, 1A4ciii	National navigation, national fishing	Marine diesel oil /marine gas oil	40.550	0.84	NA	NA	g/m3 fuel	1	Table 3.2	Average Lloyd's Register, 1995 and Cooper Gustafsson, 2004
Ni	2A7d	Flat glass		0.020	0.74	0.54	0.97	g/Mg glass	2	Table 3.2	Rivet (personal communication, 2008)
Ni	2A7d	Container glass		0.037	1.5	0.075	8.9	g/Mg glass	2	Table 3.2	European Commission (2008)
Ni	2C1.1	Steel production	Electric furnace steel plant	0.310	0.7	0.2	1.1	g/Mg steel produced	2	Table 3.17	Theloke et al (2008)
Ni	2C1.2	Steel production	Basic oxygen furnace - LD	0.047	0.13	0.067	0.67	g/Mg steel produced	2	Table 3.15	Theloke et al (2008)
Ni	2C1.3	Pellet production		17.332	11	5	25	mg/Mg pellet produced	2	Table 3.3	European Commission (2001)

Pollutant	NFR Sector	NFR Subsector	Fuel/ Technology/ Practice	IEF	Guidebook			Unit	Default EF Tier	Guidebook table	Guidebook reference
					Default Efs	Lower interval	Upper interval				
Ni	6Cb	Industrial waste incineration		0.119	0.14	0.048	0.19	g/Mg waste	1	Table 3.1	Theloke et al (2008)
Pb	1A3b	PC	Gasoline	0.001	0.00001275	4.575E-07	0.00003	kg/m3 fuel	1	Table 3.8-3.10	COPERT 4
Pb	1A3b	PC	Diesel	0.004	0.0000273	4.326E-07	0.0000315	kg/m3 fuel	1	Table 3.8-3.10	COPERT 4
Pb	1A3b	LDV	Gasoline	0.044	0.00001275	4.575E-07	0.00003	kg/m3 fuel	1	Table 3.8-3.10	COPERT 4
Pb	1A3b	LDV	Diesel	0.008	0.0000273	4.326E-07	0.0000315	kg/m3 fuel	1	Table 3.8-3.10	COPERT 4
Pb	1A3b	HDV	Diesel	0.002	0.0000273	4.326E-07	0.0000315	kg/m3 fuel	1	Table 3.8-3.10	COPERT 4
Pb	1A3b	Moped&Motorcycle	Gasoline	0.093	0.00001275	4.575E-07	0.00003	kg/m3 fuel	1	Table 3.8-3.10	COPERT 4
Pb	1A3dii, 1A4ciii	National navigation, national fishing	Bunker fuel oil	0.228	0.1737	NA	NA	g/m3 fuel	1	Table 3.1	Average Lloyd's Register, 1995 and Cooper Gustafsson, 2004
Pb	1A3dii, 1A4ciii	National navigation, national fishing	Marine diesel oil /marine gas oil	0.277	0.1092	NA	NA	g/m3 fuel	1	Table 3.2	Average Lloyd's Register, 1995 and Cooper Gustafsson, 2004

Pollutant	NFR Sector	NFR Subsector	Fuel/ Technology/ Practice	IEF	Guidebook			Unit	Default EF Tier	Guidebook table	Guidebook reference
					Default Efs	Lower interval	Upper interval				
Pb	2A7d	Flat glass		0.115	0.4	0.23	0.68	g/Mg glass	2	Table 3.2	Rivet (personal communication, 2008)
Pb	2A7d	Container glass		0.211	2.9	0.1	15	g/Mg glass	2	Table 3.2	European Commission (2008)
Pb	2C1.1	Steel production	Electric furnace steel plant	0.204	2.6	1.1	4.4	g/Mg steel produced	2	Table 3.17	Theloke et al (2008)
Pb	2C1.2	Pig iron production	Blast furnace charging	0.072	0.0006	0.0003	0.0009	g/Mg pig iron produced	2	Table 3.8	Theloke et al (2008)
Pb	2C1.2	Steel production	Basic oxygen furnace - LD	0.072	4	2.7	6.7	g/Mg steel produced	2	Table 3.15	Theloke et al (2008)
Pb	2C1.3	Pellet production		0.136	20	3	130	mg/Mg pellet produced	2	Table 3.3	European Commission (2001)
Pb	2C5a	Copper production	Primary production	13.499	170	120	290	g/Mg copper	2	Table 3.2	Theloke et al (2008)
Pb	2C5a	Copper production	Primary production	13.499	110	57	230	g/Mg copper	2	Table 3.5	Theloke et al (2008)
Pb	2C5b	Lead production	Secondary production	45.024	430	150	590	g/Mg lead	2	Table 3.9	Theloke et al (2008)
Pb	2C5d	Zinc production	Secondary	69.593	5.3	3.2	8.1	g/Mg zinc	2	Table 3.9	Theloke et al

Pollutant	NFR Sector	NFR Subsector	Fuel/ Technology/ Practice	IEF	Guidebook			Unit	Default EF Tier	Guidebook table	Guidebook reference
					Default Efs	Lower interval	Upper interval				
			production								(2008)
Pb	3D3	Tobacco smoking		0.05	0.05	0.03	0.1	mg/ton tobac-co	2	Table 3.9	Finstad et al. (2001)
Pb	6Cb	Industrial waste incineration		0.018	1.3	0.48	1.9	g/Mg waste	1	Table 3.1	Theloke et al (2008)
Dioxins/furans (PCDD/ PCDF)	1A3dii, 1A4ciii		Bunker fuel oil	0.038	0.074	NA	NA	TEQug/m3 fuel	1	Table 3.2	Cooper 2005
Dioxins/furans (PCDD/ PCDF)	1A3dii, 1A4ciii		Marine diesel oil /marine gas oil	0.046	0.015	NA	NA	TEQug/m3 fuel	1	Table 3.2	Cooper 2005
Dioxins/furans (PCDD/ PCDF)	2C1.1	Steel production	Electric furnace steel plant	1.173	0.8	0.07	9	ug I-teq/Mg steelproduced	2	Table 3.17	European Com-mission (2001)
Dioxins/furans (PCDD/ PCDF)	2C1.2	Pig iron production	Blast furnace charging	0.008	0.002	0.001	0.004	ug I-teq/Mg pig iron produced	2	Table 3.8	European Com-mission (2001)
Dioxins/furans (PCDD/ PCDF)	2C1.2	Steel production	Basic oxygen furnace - LD	0.008	0.00775	0.001	0.06	ug I-teq/Mg steelproduced	2	Table 3.15	European Com-mission (2001)
Dioxins/furans (PCDD/ PCDF)	2C1.3	Pellet production		0.036	0.0057	0.002	0.02	ug I-teq/Mg pellet pro-duced	2	Table 3.3	European Com-mission (2001)

Pollutant	NFR Sector	NFR Subsector	Fuel/ Technology/ Practice	IEF	Guidebook			Unit	Default EF Tier	Guidebook table	Guidebook reference
					Default Efs	Lower interval	Upper interval				
Dioxins/furans (PCDD/ PCDF)	2C5a	Copper production	Primary production	2.990	0.01	0.003	0.03	ug I-teq/Mg copper	2	Table 3.2	UNEP (2005)
Dioxins/furans (PCDD/ PCDF)	2C5a	Copper production	Primary production	2.990	50	0.03	800	ug I-teq/Mg copper	2	Table 3.5	UNEP (2005)
Dioxins/furans (PCDD/ PCDF)	2C5b	Lead production	Secondary production	9.973	8	0.5	80	ug I-teq/Mg lead	2	Table 3.9	UNEP (2005)
Dioxins/furans (PCDD/ PCDF)	2C5d	Zinc production	Secondary production	15.415	100	0.3	1000	ug I-teq/Mg zinc	2	Table 3.9	UNEP (2005)
Dioxins/furans (PCDD/ PCDF)	3D3	Tobacco smoking		1.3	1.3	0.7	3	ng/ton tobacco	2	Table 3.9	Finstad et al. (2001)
Dioxins/furans (PCDD/ PCDF)	6Cb	Industrial waste incineration		0.031	0.35	0	0.4	ug I-teq/Mg waste	1	Table 3.1	UNEP (2005)
Dioxins/furans (PCDD/ PCDF)	6Cd	Cremation	Human bodies	9	0.0168	0.00037	80	µg/body	1	Table 3.1	Guidebook 2006
Dioxins/furans (PCDD/ PCDF)	6D	Other waste	Apartment building fire	1262.612	0.44	0.2	1	µg/fire	2	Table 3.6	Aasestad (2007)
Se	1A3dii, 1A4ciii	National navigation, national fishing	Bunker fuel oil	0.019	0.20265	NA	NA	g/m3 fuel	1	Table 3.1	Average Lloyd's Register, 1995 and Cooper Gus-tafsson, 2004
Se	1A3dii,	National navigation,	Marine diesel	0.023	0.084	NA	NA	g/m3 fuel	1	Table 3.2	Average Lloyd's

Pollutant	NFR Sector	NFR Subsector	Fuel/ Technology/ Practice	IEF	Guidebook			Unit	Default EF Tier	Guidebook table	Guidebook reference
					Default Efs	Lower interval	Upper interval				
	1A4ciii	national fishing	oil /marine gas oil								Register, 1995 and Cooper Gus-tafsson, 2004
Zn	1A3dii, 1A4ciii	National navigation, national fishing	Bunker fuel oil	1.904	1.158	NA	NA	g/m3 fuel	1	Table 3.1	Average Lloyd's Register, 1995 and Cooper Gus-tafsson, 2004
Zn	1A3dii, 1A4ciii	National navigation, national fishing	Marine diesel oil /marine gas oil	2.314	1.008	NA	NA	g/m3 fuel	1	Table 3.2	Average Lloyd's Register, 1995 and Cooper Gus-tafsson, 2004
Zn	2A7d	Flat glass		0.044	0.37	0.13	0.56	g/Mg glass	2	Table 3.2	Rivet (personal communication, 2008)
Zn	2C1.1	Steel production	Electric furnace steel plant	4.954	3.6	0.3	46	g/Mg steel produced	2	Table 3.17	European Com-mission (2001)
Zn	2C1.2	Pig iron production	Blast furnace charging	0.879	0.073	0.0073	0.73	g/Mg pig iron produced	2	Table 3.8	Guidebook 2006
Zn	2C1.2	Steel production	Basic oxygen furnace - LD	0.888	4	0.4	40	g/Mg steel produced	2	Table 3.15	Guidebook 2006
Zn	2C1.3	Pellet production		1.787	16	2.4	110	mg/Mg pellet	2	Table 3.3	European Com-

Pollutant	NFR Sector	NFR Subsector	Fuel/ Technology/ Practice	IEF	Guidebook			Unit	Default EF Tier	Guidebook table	Guidebook reference
					Default Efs	Lower interval	Upper interval				
								produced			mission (2001)
Zn	2C5d	Zinc production	Secondary production	254.000	40	15	110	g/Mg zinc	2	Table 3.9	European Commission (2001)

Appendix B. Comparison of data reported according to CLRTAP and E-PRTR

Table B 1. Comparison of reported emissions of As, Cd and Cr for emission year 2010 for different activities.

NFR-code	E-PRTR-code	Explanation E-PRTR-code	CLRTAP	E-PRTR	Differ-ence	CLRTAP	E-PRTR	Differ-ence	CLRTAP	E-PRTR	Differ-ence
			As	As	As	Cd	Cd	Cd	Cr	Cr	Cr
			Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg
1A2a, 1A2b, 1B1b, 2C1, 2C2,2C3, 2C5a, 2C5b, 2C5c, 2C5d, 2C5e, 2C5f	2	Production and processing of metals	0.294655	0.3524	-16%	0.044457	0.027	65%	3.450091	3.302	4%
1 A 2 f i, 2 A 1, 2 A 2, 2 A 3, 2 A 4, 2 A 5, 2 A 6, 2 A 7 a, 2 A 7 b, 2 A 7 b, 2 A 7 c, 2 A 7 d	3	Mineral industry	0.066543			0.034146			0.196923		
1 A 2 c, 2 B 1, 2 B 2, 2 B 3, 2 B 4, 2 B 5 a, 2 B 5 b, 3 C	4	Chemical industry	0.003395			0.001687			0.005285		
1 A 2 d, 2 D 1, 2 D 3	6	Paper and wood production and processing	0.142346			0.101489	0.0115	783%	0.282787		
4 B 8, 4 B 9 a, 4 B 9 b, 4 B 9 c, 4 B 9 d	7	Intensive livestock production and aquaculture	0			0			0		
1 A 2 e, 2 D 2	8	Animal and vegetable products from the food and beverage sector	0.002621			0.002049			0.006624		
1 A 1 b, 1 B 2 a iv	1a	Mineral oil and gas refineries	0.001818			0.000638			0.001188		

NFR-code	E-PRTR-code	Explanation E-PRTR-code	CLRTAP	E-PRTR	Differ-ence	CLRTAP	E-PRTR	Differ-ence	CLRTAP	E-PRTR	Differ-ence
			As	As	As	Cd	Cd	Cd	Cr	Cr	Cr
			Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg	Mg
1 A 1 c	1b	Installations for gasification and liquefaction	3.21E-05			4.45E-05			0.00014		
1 A 1 a	1c, 5b	Thermal power stations and other combustion installations, Installa-tions for the incineration of non-hazardous waste	0.273693			0.179672			0.747639		
6 C b	5a	Installations for the recovery or disposal of hazardous waste	0.0012			0.001			0.0034		
6 D	5c	Installations for the disposal of non-hazardous waste	0			0			0		
6 A	5d	Landfills								0.114	-100%
6 B	5f	Urban waste-water treatment plants	0			0			0		
*)	-		0.170544			0.21756			0.416726		
Total reported emissions according to CLRTAP and E-PRTR			**0.956849**	**0.3524**		**0.582743**	**0.0385**		**5.110802**	**3.416**	
Comparable reported emissions according to CLRTAP and E-PRTR			**0.786304**	**0.3524**	**123%**	**0.365183**	**0.0385**	**849%**	**4.694077**	**3.416**	**37%**

*) The following NFR codes are not included in the reporting requirements under E-PRTR: 1 A 3 a i (i), 1 A 3 b i, 1 A 3 b ii , 1 A 3 b iii, 1 A 3 b iv, 1 A 3 b v, 1 A 3 b vi, 1 A 3 b vii, 1 A 3 c, 1 A 3 d i (ii), 1 A 3 d ii, 1 A 3 e, 1 A 4 a i, 1 A 4 a ii, 1 A 4 b i, 1 A 4 b ii, 1 A 4 c i, 1 A 4 c ii, 1A 4 c iii, 1 A 5 a, 1 A 5 b, 1 B 1 a, 1 B 1 c, 1 B 2 a i, 1 B 2 a v, 1 B 2 b, 1 B 2 c , 1 B 3, 2 E, 2 F, 2 G, 3 A 1, 3 A 2, 3 A 3, 3 B 1, 3 B 2, 3 D 1, 3 D 2, 3 D 3, 4 B 1 a, 4 B 1 b, 4 B 2, 4 B 3, 4 B 4, 4 B 6, 4 B 7, 4 B 13, 4 D 1 a, 4 D 2 a, 4 D 2 b, 4 D 2 c, 4 F, 4 G, 6 C a, 6 C c, 6 C d, 6 C e, 7 A.

Table B 2. Comparison of reported emissions of Cu, Hg and Ni for emission year 2010 for different activities.

NFR-code	E-PRTR-code	Explanation E-PRTR-code	CLRTAP Cu Mg	E-PRTR Cu Mg	Differ-ence Cu Mg	CLRTAP Hg Mg	E-PRTR Hg Mg	Differ-ence Hg Mg	CLRTAP Ni Mg	E-PRTR Ni Mg	Differ-ence Ni Mg
1A2a, 1A2b, 1B1b, 2C1, 2C2,2C3, 2C5a, 2C5b, 2C5c, 2C5d, 2C5e, 2C5f	2	Production and processing of metals	1.049711	0.739	42%	0.102686	0.0908	13%	1.972157	0.4979	296%
1 A 2 f i, 2 A 1, 2 A 2, 2 A 3, 2 A 4, 2 A 5, 2 A 6, 2 A 7 a, 2 A 7 b, 2 A 7 b, 2 A 7 c, 2 A 7 d	3	Mineral industry	0.366821			0.044584			2.210165		
1 A 2 c, 2 B 1, 2 B 2, 2 B 3, 2 B 4, 2 B 5 a, 2 B 5 b, 3 C	4	Chemical industry	0.018015			0.024964	0.0158	58%	0.289022		
1 A 2 d, 2 D 1, 2 D 3	6	Paper and wood production and processing	0.792251			0.033112			3.934516	1.7797	121%
4 B 8, 4 B 9 a, 4 B 9 b, 4 B 9 c, 4 B 9 d	7	Intensive livestock production and aquaculture									
1 A 2 e, 2 D 2	8	Animal and vegetable products from the food and beverage sector	0.022025			0.000857			0.269113		
1 A 1 b, 1 B 2 a iv	1a	Mineral oil and gas refineries	0.007735			0.000129			0.325797	0.173	88%

NFR-code	E-PRTR-code	Explanation E-PRTR-code	CLRTAP Cu Mg	E-PRTR Cu Mg	Differ-ence Cu Mg	CLRTAP Hg Mg	E-PRTR Hg Mg	Differ-ence Hg Mg	CLRTAP Ni Mg	E-PRTR Ni Mg	Differ-ence Ni Mg
1 A 1 c	1b	Installations for gasification and liquefaction	0.000445			1.51E-05			0.000196		
1 A 1 a	1c, 5b	Thermal power stations and other combustion installations, Installa-tions for the incineration of non-hazardous waste	1.805333			0.192849	0.0286	574%	5.202831	0.132	3842%
6 C b	5a	Installations for the recovery or disposal of hazardous waste	0.0032			0.002			0.0136		
6 D	5c	Installations for the disposal of non-hazardous waste				0.001423					
6 A	5d	Landfills								0.174	-100%
6 B	5f	Urban waste-water treatment plants									
*)	-		49.67062			0.151405			5.678746		
Total reported emissions according to CLRTAP and E-PRTR			**53.73615**	**0.739**		**0.554025**	**0.1352**		**19.89614**	**2.7566**	
Comparable reported emissions according to CLRTAP and E-PRTR			**4.065536**	**0.739**	**450%**	**0.40262**	**0.1352**	**198%**	**14.2174**	**2.7566**	**416%**

*) The following NFR codes are not included in the reporting requirements under E-PRTR: 1 A 3 a i (i), 1 A 3 b i, 1 A 3 b ii , 1 A 3 b iii, 1 A 3 b iv, 1 A 3 b v, 1 A 3 b vi, 1 A 3 b vii, 1 A 3 c, 1 A 3 d i (ii), 1 A 3 d ii, 1 A 3 e, 1 A 4 a i, 1 A 4 a ii, 1 A 4 b i, 1 A 4 b ii, 1 A 4 c i, 1 A 4 c ii, 1A 4 c iii, 1 A 5 a, 1 A 5 b, 1 B 1 a, 1 B 1 c, 1 B 2 a i, 1 B 2 a v, 1 B 2 b, 1 B 2 c , 1 B 3, 2 E, 2 F, 2 G, 3 A 1, 3 A 2, 3 A 3, 3 B 1, 3 B 2, 3 D 1, 3 D 2, 3 D 3, 4 B 1 a, 4 B 1 b, 4 B 2, 4 B 3, 4 B 4, 4 B 6, 4 B 7, 4 B 13, 4 D 1 a, 4 D 2 a, 4 D 2 b, 4 D 2 c, 4 F, 4 G, 6 C a, 6 C c, 6 C d, 6 C e, 7 A.

Table B 3. Comparison of reported emissions of Pb and Zn for emission year 2010 for different activities.

NFR-code	E-PRTR-code	Explanation E-PRTR-code	CLRTAP	E-PRTR	Differ-ence	CLRTAP	E-PRTR	Differ-ence
			Pb	Pb	Pb	Zn	Zn	Zn
			Mg	Mg	Mg	Mg	Mg	Mg
1A2a, 1A2b, 1B1b, 2C1, 2C2,2C3, 2C5a, 2C5b, 2C5c, 2C5d, 2C5e, 2C5f	2	Production and processing of metals	3.202915	2.45	31%	20.61069	20.649	0%
1 A 2 f i, 2 A 1, 2 A 2, 2 A 3, 2 A 4, 2 A 5, 2 A 6, 2 A 7 a, 2 A 7 b, 2 A 7 b, 2 A 7 c, 2 A 7 d	3	Mineral industry	0.710478			8.9751	1	798%
1 A 2 c, 2 B 1, 2 B 2, 2 B 3, 2 B 4, 2 B 5 a, 2 B 5 b, 3 C	4	Chemical industry	0.038363			0.448459		
1 A 2 d, 2 D 1, 2 D 3	6	Paper and wood production and processing	1.076175			24.15487	3.521	586%
4 B 8, 4 B 9 a, 4 B 9 b, 4 B 9 c, 4 B 9 d	7	Intensive livestock production and aquaculture						
1 A 2 e, 2 D 2	8	Animal and vegetable products from the food and beverage sector	0.038616			0.643329		
1 A 1 b, 1 B 2 a iv	1a	Mineral oil and gas refineries	0.021485			0.017035		

NFR-code	E-PRTR-code	Explanation E-PRTR-code	CLRTAP Pb Mg	E-PRTR Pb Mg	Differ-ence Pb Mg	CLRTAP Zn Mg	E-PRTR Zn Mg	Differ-ence Zn Mg
1 A 1 c	1b	Installations for gasification and liquefaction	0.00057			0.017153		
1 A 1 a	1c, 5b	Thermal power stations and other combustion installations, Installa-tions for the incineration of non-hazardous waste	2.947111			66.84461	0.263	25316%
6 C b	5a	Installations for the recovery or disposal of hazardous waste	0.0021					
6 D	5c	Installations for the disposal of non-hazardous waste						
6 A	5d	Landfills						
6 B	5f	Urban waste-water treatment plants						
*)	-		5.036253			58.08581		
Total reported emissions according to CLRTAP and E-PRTR			**13.07407**	**2.45**		**179.7971**	**25.433**	
Comparable reported emissions according to CLRTAP and E-PRTR			**8.037813**	**2.45**	**228%**	**121.7112**	**25.433**	**379%**

*) The following NFR codes are not included in the reporting requirements under E-PRTR: 1 A 3 a i (i), 1 A 3 b i, 1 A 3 b ii , 1 A 3 b iii, 1 A 3 b iv, 1 A 3 b v, 1 A 3 b vi, 1 A 3 b vii, 1 A 3 c, 1 A 3 d i (ii), 1 A 3 d ii, 1 A 3 e, 1 A 4 a i, 1 A 4 a ii, 1 A 4 b i, 1 A 4 b ii, 1 A 4 c i, 1 A 4 c ii, 1A 4 c iii, 1 A 5 a, 1 A 5 b, 1 B 1 a, 1 B 1 c, 1 B 2 a i, 1 B 2 a v, 1 B 2 b, 1 B 2 c , 1 B 3, 2 E, 2 F, 2 G, 3 A 1, 3 A 2, 3 A 3, 3 B 1, 3 B 2, 3 D 1, 3 D 2, 3 D 3, 4 B 1 a, 4 B 1 b, 4 B 2, 4 B 3, 4 B 4, 4 B 6, 4 B 7, 4 B 13, 4 D 1 a, 4 D 2 a, 4 D 2 b, 4 D 2 c, 4 F, 4 G, 6 C a, 6 C c, 6 C d, 6 C e, 7 A.

Table B 4. Comparison of reported emissions of PCDD+PCDF and PAH-4 for emission year 2010 for different activities.

NFR-code	E-PRTR-code	Explanation E-PRTR-code	CLRTAP	E-PRTR	Difference	CLRTAP	E-PRTR	Difference
			PCDD+PCDF (DIOXINS+ FURANS)	PCDD+PCDF (DIOXINS+ FURANS)	PCDD+PCDF (DIOXINS+ FURANS)	Sum of PAHTotal 1-4	Sum of PAHTotal 1-4	Sum of PAHTotal 1-4
			g	g	g	Mg	Mg	Mg
1A2a, 1A2b, 1B1b, 2C1, 2C2,2C3, 2C5a, 2C5b, 2C5c, 2C5d, 2C5e, 2C5f	2	Production and processing of metals	3.188655	3.892	-18%	1.13293	0.623	82%
1 A 2 f i, 2 A 1, 2 A 2, 2 A 3, 2 A 4, 2 A 5, 2 A 6, 2 A 7 a, 2 A 7 b, 2 A 7 b, 2 A 7 c, 2 A 7 d	3	Mineral industry	3.236532	11.28	-71%	0.067281		
1 A 2 c, 2 B 1, 2 B 2, 2 B 3, 2 B 4, 2 B 5 a, 2 B 5 b, 3 C	4	Chemical industry	0.129821			0.007531		
1 A 2 d, 2 D 1, 2 D 3	6	Paper and wood production and processing	5.923284	0.1	5823%	0.173181		
4 B 8, 4 B 9 a, 4 B 9 b, 4 B 9 c, 4 B 9 d	7	Intensive livestock production and aquaculture						
1 A 2 e, 2 D 2	8	Animal and vegetable products from the food and beverage sector	0.152701			0.004891		

NFR-code	E-PRTR-code	Explanation E-PRTR-code	CLRTAP	E-PRTR	Difference	CLRTAP	E-PRTR	Difference
			PCDD+PCDF (DIOXINS+ FURANS)	PCDD+PCDF (DIOXINS+ FURANS)	PCDD+PCDF (DIOXINS+ FURANS)	Sum of PAHTotal 1-4	Sum of PAHTotal 1-4	Sum of PAHTotal 1-4
			g	g	g	Mg	Mg	Mg
1 A 1 b, 1 B 2 a iv	1a	Mineral oil and gas refineries	0.235793			0.001757		
1 A 1 c	1b	Installations for gasification and liquefaction	0.003915			0.000129		
1 A 1 a	1c, 5b	Thermal power stations and other combustion installations, Installations for the incineration of non-hazardous waste	23.66964	0.563	4104%	0.750391		
6 C b	5a	Installations for the recovery or disposal of hazardous waste	0.0036					
6 D	5c	Installations for the disposal of non-hazardous waste	0.233583			0.000504		
6 A	5d	Landfills						
6 B	5f	Urban waste-water treatment plants						
*)	-		6.100633			14.24556		
Total reported emissions according to CLRTAP and E-PRTR			**42.87815**	**15.835**		**16.38415**	**0.623**	
Comparable reported emissions according to CLRTAP and E-PRTR			**36.77752**	**15.835**	**132%**	**2.138594**	**0.623**	**243%**

*) The following NFR codes are not included in the reporting requirements under E-PRTR: 1 A 3 a i (i), 1 A 3 b i, 1 A 3 b ii , 1 A 3 b iii, 1 A 3 b iv, 1 A 3 b v, 1 A 3 b vi, 1 A 3 b vii, 1 A 3 c, 1 A 3 d i (ii), 1 A 3 d ii, 1 A 3 e, 1 A 4 a i, 1 A 4 a ii, 1 A 4 b i, 1 A 4 b ii, 1 A 4 c i, 1 A 4 c ii, 1A 4 c iii, 1 A 5 a, 1 A 5 b, 1 B 1 a, 1 B 1 c, 1 B 2 a i, 1 B 2 a v, 1 B 2 b, 1 B 2 c , 1 B 3, 2 E, 2 F, 2 G, 3 A 1, 3 A 2, 3 A 3, 3 B 1, 3 B 2, 3 D 1, 3 D 2, 3 D 3, 4 B 1 a, 4 B 1 b, 4 B 2, 4 B 3, 4 B 4, 4 B 6, 4 B 7, 4 B 13, 4 D 1 a, 4 D 2 a, 4 D 2 b, 4 D 2 c, 4 F, 4 G, 6 C a, 6 C c, 6 C d, 6 C e, 7 A.

Table B 5. Comparison of reported emissions of HCB, HCH and PCB for emission year 2010 for different activities.

NFR-code	E-PRTR-code	Explanation E-PRTR-code	CLRTAP	E-PRTR	Differ-ence	CLRTAP	E-PRTR	Differ-ence	CLRTAP	E-PRTR	Differ-ence
			HCB	HCB	HCB	HCH	HCH	HCH	PCBs	PCBs	PCBs
			kg	kg	kg	kg	kg	kg	kg	kg	kg
1A2a, 1A2b, 1B1b, 2C1, 2C2,2C3, 2C5a, 2C5b, 2C5c, 2C5d, 2C5e, 2C5f	2	Production and processing of metals									
1 A 2 f i, 2 A 1, 2 A 2, 2 A 3, 2 A 4, 2 A 5, 2 A 6, 2 A 7 a, 2 A 7 b, 2 A 7 b, 2 A 7 c, 2 A 7 d	3	Mineral industry									
1 A 2 c, 2 B 1, 2 B 2, 2 B 3, 2 B 4, 2 B 5 a, 2 B 5 b, 3 C	4	Chemical industry									
1 A 2 d, 2 D 1, 2 D 3	6	Paper and wood production and processing									
4 B 8, 4 B 9 a, 4 B 9 b, 4 B 9 c, 4 B 9 d	7	Intensive livestock production and aquaculture									
1 A 2 e, 2 D 2	8	Animal and vegetable products from the food and beverage sector									
1 A 1 b, 1 B 2 a iv	1a	Mineral oil and gas refineries									

NFR-code	E-PRTR-code	Explanation E-PRTR-code	CLRTAP	E-PRTR	Differ-ence	CLRTAP	E-PRTR	Differ-ence	CLRTAP	E-PRTR	Differ-ence
			HCB	HCB	HCB	HCH	HCH	HCH	PCBs	PCBs	PCBs
			kg	kg	kg	kg	kg	kg	kg	kg	kg
1 A 1 c	1b	Installations for gasification and liquefaction									
1 A 1 a	1c, 5b	Thermal power stations and other combustion installations, Installa-tions for the incineration of non-hazardous waste									
6 C b	5a	Installations for the recovery or disposal of hazardous waste									
6 D	5c	Installations for the disposal of non-hazardous waste									
6 A	5d	Landfills									
6 B	5f	Urban waste-water treatment plants									
*)	-		0.030548						0.12622		
Total reported emissions according to CLRTAP and E-PRTR			**0.030548**						**0.12622**		
Comparable reported emissions according to CLRTAP and E-PRTR											

*) The following NFR codes are not included in the reporting requirements under E-PRTR: 1 A 3 a i (i), 1 A 3 b i, 1 A 3 b ii , 1 A 3 b iii, 1 A 3 b iv, 1 A 3 b v, 1 A 3 b vi, 1 A 3 b vii, 1 A 3 c, 1 A 3 d i (ii), 1 A 3 d ii, 1 A 3 e, 1 A 4 a i, 1 A 4 a ii, 1 A 4 b i, 1 A 4 b ii, 1 A 4 c i, 1 A 4 c ii, 1A 4 c iii, 1 A 5 a, 1 A 5 b, 1 B 1 a, 1 B 1 c, 1 B 2 a i, 1 B 2 a v, 1 B 2 b, 1 B 2 c , 1 B 3, 2 E, 2 F, 2 G, 3 A 1, 3 A 2, 3 A 3, 3 B 1, 3 B 2, 3 D 1, 3 D 2, 3 D 3, 4 B 1 a, 4 B 1 b, 4 B 2, 4 B 3, 4 B 4, 4 B 6, 4 B 7, 4 B 13, 4 D 1 a, 4 D 2 a, 4 D 2 b, 4 D 2 c, 4 F, 4 G, 6 C a, 6 C c, 6 C d, 6 C e, 7 A.